INTERNATIONAL PACIFIC HALIBUT COMMISSION

IPHC–2019–IM095–00

95th Session of the IPHC Interim Meeting (IM095) – *Compendium of meeting documents*

25 – 26 November 2019, Seattle, WA, USA

Commissioners

Canada	United States of America
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Peter DeGreef	Richard Yamada

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David T. Wilson, Ph.D.

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INTERNATIONAL PACIFIC
HALIBUT COMMISSION

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INTERNATIONAL PACIFIC HALIBUT COMMISSION

IPHC-2019-IM095-01

Last updated: 25 October 2019

DRAFT: AGENDA & SCHEDULE FOR THE 95th SESSION OF THE IPHC INTERIM MEETING (IM095)

Date: 25-26 November 2019
Location: Seattle, Washington, USA
Venue: Grand Hyatt Seattle
Time: 09:00-17:00 daily
Chairperson: Mr Chris Oliver (USA)
Vice-Chairperson: Mr Paul Ryall (Canada)

Notes:

- *All sessions are open to Observers and the general public*
- *All sessions will be webcast. Webcast sessions will also take audience comments and questions as directed by the Chairperson of the Commission.*

DRAFT: AGENDA FOR THE 95th SESSION OF THE IPHC INTERIM MEETING (IM095)

1. **OPENING OF THE SESSION** (Chairperson)

2. **ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION** (Chairperson)
   - **IPHC-2019-IM095-01**: Agenda & Schedule for the 95th Session of the IPHC Interim Meeting (IM095)
   - **IPHC-2019-IM095-02**: List of Documents for the 95th Session of the IPHC Interim Meeting (IM095)

3. **UPDATE ON ACTIONS ARISING FROM THE 95th SESSION OF THE IPHC ANNUAL MEETING (AM095)** (D. Wilson)
   - **IPHC-2019-IM095-03**: Update on actions arising from the 95th Session of the IPHC Annual Meeting (AM095) (D. Wilson)

4. **REPORT OF THE IPHC SECRETARIAT (2019): Draft** (D. Wilson)
   - **IPHC-2019-IM095-04**: Report of the IPHC Secretariat (2019): Draft (D. Wilson)

5. **FISHERY STATISTICS (2019)** (L. Erikson)
   - **IPHC-2019-IM095-05**: Fishery statistics (2019): Draft (L. Erikson)

6. **STOCK STATUS OF PACIFIC HALIBUT (2019) AND HARVEST DECISION TABLE**
   6.1 Fishery Independent Setline Survey (FISS) design and implementation in 2019 (L. Erikson)
   - **IPHC-2019-IM095-06**: Fishery Independent Setline Survey (FISS) design and implementation in 2019 (L. Erikson)

6.2 Space-time modelling of survey data (WPUE; FISS expansion results, etc.) (R. Webster)

- **IPHC-2019-IM095-07**: Space-time modelling of IPHC fishery-independent setline survey data (R. Webster)

6.3 Independent peer review of the IPHC stock assessment (D. Wilson for K. Stokes)

- **IPHC-2019-IM095-08:** Stock Assessment: Independent peer review of the Pacific halibut stock assessment (K. Stokes)

6.4 Data overview and preliminary stock assessment (2019), and draft harvest decision table (2019) (I. Stewart)

- **IPHC-2019-IM095-09**: Summary of the data, stock assessment, and harvest decision table for Pacific halibut (*Hippoglossus stenolepis*) at the end of 2019 (I. Stewart, A. Hicks, R. Webster & D. Wilson)
- **IPHC-2019-IM095-10**: Options for the treatment of U26 discard mortality from non-directed fisheries (bycatch) within a total mortality limit (I. Stewart)
- **IPHC-2019-IM095-11**: Effects of historical (1991-2018) discard mortality in non-directed fisheries (I. Stewart)
- **IPHC-2019-IM095-12**: Alternative projections for 2019 (last year) adjusted for the effects of U26 Pacific halibut discard mortality in non-directed fisheries ('bycatch') (I. Stewart)

7. IPHC SCIENCE AND RESEARCH

7.1 Report of the 20th Session of the IPHC Research Advisory Board (RAB020) (D. Wilson)

- **IPHC-2019-RAB020-R**: Report of the 20th Session of the IPHC Research Advisory Board (SRB020)

7.2 Report of the 14th and 15th Sessions of the IPHC Scientific Review Board (SRB014 and SRB015) (SRB Chairperson)

- **IPHC-2019-SRB014-R**: Report of the 14th Session of the IPHC Scientific Review Board (SRB014)
- **IPHC-2019-SRB015-R**: Report of the 15th Session of the IPHC Scientific Review Board (SRB015)

7.3 IPHC 5-year Biological and Ecosystem Science Research Plan: update (J. Planas)

- **IPHC-2019-IM095-13**: IPHC 5-year Biological and Ecosystem Science Research Plan: update (J. Planas)

8. MANAGEMENT STRATEGY EVALUATION

8.1 IPHC Management Strategy Evaluation: update (A. Hicks & P. Carpi)

- **IPHC-2019-IM095-14:** IPHC Management Strategy Evaluation (MSE): update (A. Hicks, P. Carpi, S. Berukoff, & I. Stewart)

8.2 Report of the 13th and 14th Sessions of the IPHC Management Strategy Advisory Board (MSAB013 and MSAB014) (MASB Co-Chairpersons)

- **IPHC-2019-MSAB013-R**: Report of the 13th Session of the IPHC Management Strategy Advisory Board (MSAB013)
- **IPHC-2019-MSAB014-R**: Report of the 14th Session of the IPHC Management Strategy Advisory Board (MSAB014)

9. CONTRACTING PARTY UPDATES (BY AGENCY)

9.1 Canada

9.1.1 Fisheries and Oceans Canada (DFO)

9.2 United States of America

9.2.1 National Oceanic and Atmospheric Administration (NOAA) – Fisheries
a) National Marine Fisheries Service (NOAA-Fisheries)
b) North Pacific Fishery Management Council (NPFMC)
c) Pacific Fishery Management Council (PFMC)

10. REGULATORY PROPOSALS FOR THE 2019-20 PROCESS

10.1 IPHC Secretariat regulatory proposals (S. Keith)

- **IPHC-2019-IM095-PropA1**: Fishery Limits (Sect. 4) (IPHC Secretariat)
- **IPHC-2019-IM095-PropA2**: Fishing Periods (Sect. 9) (IPHC Secretariat)
- **IPHC-2019-IM095-PropA3**: IPHC Fishery Regulations: minor amendments (IPHC Secretariat)
- **IPHC-2019-IM095-PropA4**: Observer/EM and clearances (Sect. 16) (IPHC Secretariat)
- **IPHC-2019-IM095-15:** Regulatory Proposal implementation notes (IPHC Secretariat)

10.2 Contracting Party (agency) regulatory proposals (Agency staff)
10.3 Stakeholder regulatory proposals (S. Keith)
10.4 Stakeholder statements (S. Keith)

11. IPHC PERFORMANCE REVIEW

11.1 Report of the 2nd IPHC Performance Review (PRIPHC02) (D. Wilson for Terje Løbach)

- **IPHC-2019-IM095-16**: Report of the 2nd IPHC Performance Review (PRIPHC02) (D. Wilson for Terje Løbach)

12. FINANCE AND ADMINISTRATION

- **IPHC-2019-IM095-17**: Finance and Administration - update (D. Wilson, K. Jernigan)

13. OTHER BUSINESS

13.1 Preparation for 96th Session of the IPHC Annual Meeting (AM096) (S. Keith)

- **IPHC-2019-IM095-18**: Preparation for the 96th Session of the IPHC Annual Meeting (AM096) (S. Keith)

13.2 IPHC 3-year meetings calendar (2020-22) (S. Keith)

- **IPHC-2019-IM095-19**: Draft: IPHC 3-year meetings calendar (2020-22) (IPHC Secretariat)

14. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 95th SESSION OF THE IPHC INTERIM MEETING (IM095) (Chairperson & Executive Director)

DRAFT: SCHEDULE FOR THE 95th SESSION OF THE IPHC INTERIM MEETING (IM095)

Monday, 25 November 2019		
Time	**Agenda item**	**Lead**
09:00-09:10	1. Opening of the Session	Chairperson
09:10-09:20	2. Adoption of the agenda and arrangements for the Session	Chairperson
09:20-09:30	3. Update on actions arising from the 95th Session of the IPHC Annual Meeting (AM095)	D. Wilson
09:30-09:45	4. Report of the IPHC Secretariat (2019): Draft	D. Wilson
09:45-10:00	5. Fishery statistics (2019)	L. Erikson
10:00-10:30	6. Stock status of Pacific halibut (2019) and harvest decision table 6.1 Fishery Independent Setline Survey (FISS) design and implementation in 2019 6.2 Space-time modelling of survey data (WPUE; FISS expansion results; etc.)	L. Erikson R. Webster
10:30-10:45	Break	
10:45-11:00	6.3 Independent peer review of the IPHC stock assessment	D. Wilson for K. Stokes
11:00-12:30	6.4 Data overview and preliminary stock assessment (2019), and draft harvest decision table (2019) *Public comment and questions (Agenda Items 5-6)*	I. Stewart
12:30-13:30	Lunch	
13:30-15:30	7. IPHC science and research 7.1 Report of the 20th Session of the IPHC Research Advisory Board (RAB020) 7.2 Reports of the 14th and 15th Sessions of the IPHC Scientific Review Board (SRB014 and SRB015) 7.3 IPHC 5-year Biological and Ecosystem Science Research Plan: update *Public comment and questions (Agenda Item 7)*	D. Wilson SRB J. Planas
15:30-15:45	Break	
15:45-17:00	8. Management strategy evaluation 8.1 IPHC Management Strategy Evaluation: update 8.2 Reports of the 13th and 14th Sessions of the IPHC Management Strategy Advisory Board (MSAB013 and MSAB014) *Public comment and questions (Agenda Item 8)*	A. Hicks MSAB Co-Chairpersons

Tuesday, 26 November 2019		
09:00-09:30	9. Contracting Party (Agency) updates 9.1 Fisheries and Oceans Canada (DFO) 9.2 National Oceanic and Atmospheric Administration (NOAA) – Fisheries • National Marine Fisheries Service (NMFS) • North Pacific Fishery Management Council (NPFMC) • Pacific Fishery Management Council (PFMC) *Public comment and questions (Agenda Item 9)*	TBD TBD TBD TBD TBD
09:30-10:30	10. Regulatory proposals for the 2019-20 process 10.1 IPHC Secretariat regulatory proposals 10.2 Contracting Party (Agency) regulatory proposals 10.3 Stakeholder regulatory proposals 10.4 Stakeholder statements *Public comment and questions (Agenda Item 10)*	S. Keith Agency staff S. Keith S. Keith
10:30-10:45	Break	
11:00-12:00	11. Performance review 11.1 Report of the 2nd IPHC Performance Review (PRIPHC02) *Public comment and questions (Agenda item 11)*	D. Wilson for T. Løbach
12:15-12:30	12. Finance and administration	D. Wilson
12:30-13:30	Lunch	
13:30-14:00	13. Other business 13.1 Preparation for 96th Session of the IPHC Annual Meeting (AM096) 13.2 IPHC meetings calendar (2020-22)	S. Keith S. Keith
14:00-15:30	Report drafting Session	IPHC Secretariat
15:30-15:45	Break	
15:45-17:00	14. Review of the draft and adoption of the Report of the 95th Session of the IPHC Interim Meeting (IM095)	Chairperson & D. Wilson

INTERNATIONAL PACIFIC HALIBUT COMMISSION

DRAFT: LIST OF DOCUMENTS FOR THE 95th SESSION OF THE IPHC INTERIM MEETING (IM095)

Last updated: 22 November 2019

Document	Title	Availability
IPHC-2019-IM095-01	Agenda & Schedule for the 95th Session of the IPHC Interim Meeting (IM095)	✓ 27 Aug 2019 ✓ 23 Sept 2019 ✓ 25 Oct 2019
IPHC-2019-IM095-02	List of Documents for the 95th Session of the IPHC Interim Meeting (IM095)	✓ 27 Aug 2019 ✓ 26 Oct 2019 ✓ 22 Nov 2019
IPHC-2019-IM095-03 Rev_1	Update on actions arising from the 95th Session of the IPHC Annual Meeting (AM095) (D. Wilson)	✓ 23 Oct 2019 ✓ 19 Nov 2019
IPHC-2019-IM095-04	Report of the IPHC Secretariat (2019): Draft (D. Wilson)	✓ 23 Oct 2019
IPHC-2019-IM095-05 Rev_1	Fishery statistics (2019) (L. Erikson, H. Tran & T. Kong)	✓ 26 Oct 2019 ✓ 20 Nov 2019
IPHC-2019-IM095-06	IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2019 (L. Erikson, R. Webster)	✓ 26 Oct 2019
IPHC-2019-IM095-07 Rev_1	Space-time modelling of IPHC fishery-independent setline survey data (R. Webster)	✓ 23 Oct 2019 ✓ 22 Nov 2019
IPHC-2019-IM095-08	Stock Assessment: Independent peer review of the Pacific halibut stock assessment (K. Stokes)	✓ 23 Oct 2019
IPHC-2019-IM095-09 Rev_1	Summary of the data, stock assessment, and harvest decision table for Pacific halibut (*Hippoglossus stenolepis*) at the end of 2019 (I. Stewart, A. Hicks, R. Webster & D. Wilson)	✓ 23 Oct 2019 ✓ 22 Nov 2019
IPHC-2019-IM095-10	Options for the treatment of U26 discard mortality from non-directed fisheries (bycatch) within a total mortality limit (I. Stewart)	✓ 23 Oct 2019
IPHC-2019-IM095-11	Effects of historical (1991-2018) discard mortality in non-directed fisheries (I. Stewart)	✓ 24 Oct 2019
IPHC-2019-IM095-12	Alternative projections for 2019 (last year) adjusted for the effects of U26 Pacific halibut discard mortality in non-directed fisheries ('bycatch') (I. Stewart)	✓ 24 Oct 2019
IPHC-2019-IM095-13	IPHC 5-year Biological and Ecosystem Science Research Plan: update (J. Planas)	✓ 23 Oct 2019

IPHC-2019-IM095-14	IPHC Management Strategy Evaluation (MSE): update (A. Hicks, P. Carpi, S. Berukoff, & I. Stewart)	✓ 25 Oct 2019
IPHC-2019-IM095-15	Regulatory Proposal implementation notes (IPHC Secretariat)	✓ 25 Oct 2019
IPHC-2019-IM095-16	Report of the 2nd IPHC Performance Review (PRIPHC02) (D. Wilson for Terje Løbach)	✓ 24 Oct 2019
IPHC-2019-IM095-17	Finance and Administration - update (D. Wilson, K. Jernigan)	✓ 25 Oct 2019
IPHC-2019-IM095-18	Preparation for the 96th Session of the IPHC Annual Meeting (AM096) (S. Keith)	✓ 23 Oct 2019
IPHC-2019-IM095-19	Draft: IPHC 3-year meetings calendar (2020-22) (IPHC Secretariat)	✓ 23 Oct 2019
Contracting Party updates		
IPHC-2019-IM095-NR01	**Canada**: Fisheries and Oceans Canada (DFO)	none provided
IPHC-2019-IM095-NR02	**United States of America**: NOAA – National Marine Fisheries Service (NMFS); North Pacific Fishery Management Council (NPFMC); Pacific Fishery Management Council (PFMC)	none provided
Regulatory proposals for 2020		
IPHC Secretariat regulatory proposals for 2020		
IPHC-2019-IM095-PropA1	Fishery Limits (Sect. 4) (IPHC Secretariat)	✓ 07 Oct 2019
IPHC-2019-IM095-PropA2	Fishing Periods (Sect. 9) (IPHC Secretariat)	✓ 07 Oct 2019
IPHC-2019-IM095-PropA3	IPHC Fishery Regulations: minor amendments (IPHC Secretariat)	✓ 07 Oct 2019
IPHC-2019-IM095-PropA4	Observer/EM and clearances (Sect. 16) (IPHC Secretariat)	✓ 25 Oct 2019
Contracting Party regulatory proposals for 2020		
IPHC-2019-IM095-PropB1	None provided	none provided
Other Stakeholder regulatory proposals for 2020		
IPHC-2019-IM095-PropC1	None provided	none provided
Reports from IPHC subsidiary bodies		
IPHC-2019-RAB020-R	Report of the 20th Session of the IPHC Research Advisory Board (RAB020)	✓ 6 Mar 2019
IPHC-2019-SRB014-R	Report of the 14th Session of the IPHC Scientific Review Board (SRB014)	✓ 28 Jun 2019
IPHC-2019-SRB015-R	Report of the 15th Session of the IPHC Scientific Review Board (SRB015)	✓ 27 Sep 2019

IPHC-2019-MSAB013-R	Report of the 13th Session of the IPHC Management Strategy Advisory Board (MSAB013)	✓ 10 May 2019
IPHC-2019-MSAB014-R	Report of the 14th Session of the IPHC Management Strategy Advisory Board (MSAB014)	✓ 25 Oct 2019
IPHC-2019-PAB024-R	Report of the 24th Session of the IPHC Processor Advisory Board (PAB024)	✓ 11 Feb 2019
IPHC-2019-CB089-R	Report of the 89th Session of the IPHC Conference Board (CB089)	✓ 7 Feb 2019
Information papers		
IPHC-2019-IM095-INF01	Stakeholder Statements on regulatory proposals	✓ 22 Nov 2019
IPHC-2019-IM095-INF02	Review of the use of pot gear in the Gulf of Alaska 2017-19 (IPHC Secretariat)	✓ 23 Oct 2019
IPHC-2019-IM095-INF03	Options for FISS mortality accounting in projections (I. Stewart, L. Erikson)	✓ 23 Oct 2019

Update on actions arising from the 95th Annual Meeting (AM095)

PREPARED BY: IPHC SECRETARIAT (D. WILSON; 23 OCTOBER; 19 NOVEMBER 2019)

PURPOSE

To provide the Commission with an opportunity to consider the progress made during the inter-sessional period in relation to the direct requests for action by the Commission during the 95th Session of the IPHC Annual Meeting (AM095, January 2019).

BACKGROUND

At the 95th Session of the IPHC Annual Meeting (AM095), Contracting Parties agreed on a series of actions to be taken by Commissioners, subsidiary bodies, and the IPHC Secretariat on a range of issues as detailed in Appendix A.

DISCUSSION

Noting that best practice governance requires the prompt delivery of core tasks assigned to the IPHC Secretariat by the Commission, at each subsequent session of the Commission and its subsidiary bodies, attempts will be made to ensure that any recommendations for action are carefully constructed so that each contains the following elements:

1) a specific action to be undertaken (deliverable);
2) clear responsibility for the action to be undertaken (i.e. a specific Contracting Party, the IPHC Secretariat staff, a subsidiary body of the Commission, or the Commission itself);
3) a desired time frame for delivery of the action (i.e. by the next session of a subsidiary body, or other date).

This involves numbering and tracking all action items (see Appendix A) from the Commission, as well as including clear progress updates and document reference numbers.

RECOMMENDATION/S

That the Commission:

1) **NOTE** paper IPHC-2019-IM095-03 Rev_1, which provided the Commission with an opportunity to consider the progress made during the inter-sessional period, in relation to the direct requests for action by the Commission during its 95th Annual Meeting (AM095, January 2019).

APPENDICES

Appendix A: Update on actions arising from the 95th Annual Meeting (AM095: January 2019).

APPENDIX A

Update on actions arising from the 95th Annual Meeting (AM095: January 2019)

95th Session of the IPHC Annual Meeting (AM095)		
Action No.	**Description**	**Update**
	RECOMMENDATIONS	
AM095–Rec.01 (para. 59c)	***IPHC Management Strategy Evaluation*** The Commission **RECOMMENDED** the MSAB develop the following additional objective, as well as prioritize this objective in the evaluation of management procedures, for the Commission's consideration. i. A conservation objective that meets a spawning biomass target.	**Lead**: Allan Hicks **Status/Plan**: In progress. The MSAB discussed this objective at MSAB013 and MSAB014 and the objective recommended at MSAB014 will be presented to the Commission.
AM095–Rec.02 (para. 62)	***Report of the 12th Session of the IPHC Management Strategy Advisory Board (MSAB012)*** The Commission **RECOMMENDED** that the MSAB and IPHC Secretariat continue its program of work on the Management Procedure for the Scale portion of the harvest strategy, **NOTING** that Scale and Distribution components will be evaluated and presented no later than at AM097 in 2021, for potential adoption and subsequent implementation as a harvest strategy. The management procedure that best meets the primary objectives for coastwide scale is: a) A target SPR of 40% with a fishery trigger of 30% and a fishery limit of 20% in the control rule; b) An annual constraint of 15% from the previous year's mortality limit.	**Lead**: Allan Hicks **Status/Plan**: In progress. Additional results from simulations for coastwide fishing intensity (Scale) were presented and discussed at MSAB013, with similar outcomes as presented at AM095. Work is now focused on defining objectives related to distribution, identifying management procedures for scale and distribution components, and developing a simulation framework that allows for the evaluation of management procedures with both scale and distribution components.
AM095–Rec.03 (para. 65)	***Fishery Limits (Sect. 4)*** The Commission **RECOMMENDED** that Contracting Parties undertake a detailed review of the amendments to the IPHC Fishery Regulations contained in IPHC-2019-AM095-PropA1, and to provide initial feedback at the 95th Session of the IPHC Interim Meeting (IM095) on whether agreement could be reached to adopt the amendments at the subsequent 96th Session of the IPHC Annual Meeting (AM096) in January 2020.	**Lead**: Steve Keith **Status/Plan**: In progress. Updated version published 7 Oct 2019 in order complete review before IM095. The intention is for the Commission to tentatively endorse the proposal at IM095 for adoption at AM096. See paper **IPHC-2019-IM095-PropA1**

95th Session of the IPHC Annual Meeting (AM095)		
Action No.	**Description**	**Update**
AM095–Rec.04 (para. 66)	The Commission **RECOMMENDED** evaluating and redefining TCEY to include the U26 component of discard mortalities, including bycatch, as steps towards more comprehensive and responsible management of the resource, in coordination with the IPHC Secretariat and Contracting Parties. The intent is that each Contracting Party to the Treaty would be responsible for counting its U26 mortalities against its collective TCEY. This change would be intended to take effect for TCEYs established at the 2020 Annual Meeting.	**Lead**: Ian Stewart **Status/Plan**: Completed. Discussion paper comparing several alternatives for the treatment of U26 within a total mortality limit prepared for WM2019: **IPHC-2019-WM2019-13** See paper **IPHC-2019-IM095-10**
AM095–Rec.05 (para. 67)	The Commission **RECOMMENDED** that the IPHC Secretariat expand upon the analysis completed in IPHC-2019-AM095-INF08 "*Treatment and effects of Pacific halibut discard mortality (bycatch) in non-directed fisheries projected for 2019*", to be reviewed by the SRB at its next meeting. The objective of this work is to estimate lost yield from bycatch of Pacific halibut in non-directed fisheries for the years of 1991-2018.	**Lead**: Ian Stewart **Status/Plan**: Completed. Discussion paper describing methods and results reviewed at SRB015 (**IPHC-2019-SRB015-12**), and presented for IM095: See paper **IPHC-2019-IM095-11**
AM095–Rec.06 (para. 71)	The Commission **RECOMMENDED** that the IPHC Secretariat continue to report out annually on Regulatory Area mortality against the TCEY adopted for each Regulatory Area.	**Lead**: Lara Erikson **Status/Plan**: Completed. Incorporated into regular reporting on the fishery provided to the Commission and stakeholders via the Landing Report which is updated bi-monthly: https://www.iphc.int/data/landings-2019
AM095–Rec.07 (para. 72)	The Commission **RECOMMENDED** that the IPHC Secretariat develop options for accounting for Pacific halibut mortalities associated with the FISS and their other research projects in the definition of the coastwide TCEY.	**Lead**: Ian Stewart & L. Erikson **Status/Plan**: Completed. Discussion paper comparing several accounting alternatives prepared for WM2019 and also for IM095. See paper **IPHC-2019-IM095-INF03**
AM095–Rec.08 (para. 78)	***IPHC Regulatory Area 2A Non-Tribal Directed Commercial Fishery*** **NOTING** the indication made to the PFMC in a letter dated 25 January 2019, that the IPHC Secretariat would welcome the opportunity to further address the safety concerns in the fishery, and to examine other potential management options for the fishery such as an IFQ or limited entry, as well as its management responsibilities, the Commission **RECOMMENDED** that this workshop take place, given the desire for the IPHC to move full management of the fishery from the IPHC (an international fisheries management body) to the relevant domestic agencies.	**Lead**: Steve Keith **Status/Plan**: In progress. Coordinating with relevant Contracting Party domestic agencies regarding shifting management of all Pacific halibut fisheries in IPHC Regulatory Area 2A from the IPHC to the relevant domestic agencies. The Pacific Fishery Management Council (PFMC) affirmed its willingness to pursue domestic management at its June 2019 meeting, and has initiated

95th Session of the IPHC Annual Meeting (AM095)		
Action No.	**Description**	**Update**
		the necessary regulatory process with NOAA Fisheries. The workshop described in the January 2019 PFMC letter has been postponed, as the current focus is to transfer management of the fishery in its current form. The PFMC may then later investigate other potential management options for the fishery.
AM095–Rec.09 (para. 82)	***IPHC Fishery Regulations: minor amendments*** The Commission **RECOMMENDED** that Contracting Parties undertake a detailed review of the amendments to the IPHC Fishery Regulations contained in IPHC-2019-AM095-PropA3 Rev_1, and to provide initial feedback at the 95th Session of the IPHC Interim Meeting (IM095) on whether agreement could be reached to adopt the amendments at the subsequent 96th Session of the IPHC Annual Meeting (AM096) in January 2020.	**Lead**: Steve Keith **Status/Plan**: In progress. Updated version of published 7 Oct 2019 in order complete review before IM095. See paper **IPHC-2019-IM095-PropA3**
AM095–Rec.10 (para. 129)	***Peer review process for IPHC science products*** The Commission **RECOMMENDED** that the IPHC Secretariat develop terms of reference for a consultant to undertake a peer review of the IPHC Pacific halibut stock assessment, for implementation in early 2019. The terms of reference and budget shall be endorsed by the Commission inter-sessionally.	**Lead**: David Wilson & Ian Stewart **Status/Plan**: Completed. TORs drafted, sent and reviewed by SRB, sent to Commissioners for formal decision via Circular 2019-007. Approved by consensus. Contract awarded, peer review undertaken by Dr Kevin Stokes. Final report/review circulated to Commission on 2 Aug 2019 via IPHC Circular 2019-015.
AM095–Rec.11 (para. 130)	The Commission **RECOMMENDED** that the IPHC Secretariat finalise terms of reference for an expert/consultant to undertake a peer review of the IPHC Pacific halibut MSE, for implementation in early November 2019 and July 2020. The terms of reference and budget shall be endorsed by the Commission inter-sessionally.	**Lead**: David Wilson & Allan Hicks **Status/Plan**: In progress. TORs in development. Plan is for the review to occur in 2020, not 2019.
	REQUESTS	
AM095–Req.01 (para. 06)	***Report of the IPHC Secretariat (2018)*** The Commission **NOTED** the new functionality added to the IPHC website in 2018, and **REQUESTED** that these initiatives continue to be enhanced, with the overall aim of further improving the transparency of the IPHC's operations and data collected (http://iphc.int/): a) Fishery-Independent Setline Survey (FISS) data interactive b) Regulations portal, including the online regulatory proposal submission form c) Landings Report	**Lead**: All Branch Managers **Status/Plan**: In progress. See webpages for updates.

95th Session of the IPHC Annual Meeting (AM095)		
Action No.	**Description**	**Update**
	d) Mortality projection tool e) Commercial Fisheries data interactive (in development)	
AM095–Req.02 (para. 12)	***Fishery statistics (2018)*** **NOTING** the uncertainty associated with various estimates of removals, as listed below, the Commission **REQUESTED** each Contracting Party address these uncertainties in a report to the Commission at its next Session. The intention is to provide greater detail on how each removal category is quantified, and verified: ***Canada*** a) self-reporting of lodges for recreational estimates in Canada; b) subsistence estimates in Canada; ***United States of America*** c) self-reporting of lodges for recreational estimates in the U.S.A. (Alaska); d) recreational discard mortality estimates for U.S.A. (IPHC Regulatory Area 2A); e) subsistence estimates in the U.S.A.; f) estimates for the Pacific halibut commercial fishery discard mortality in U.S.A. (Alaska) due to the estimates calculated by the IPHC Secretariat differing from those provided by NMFS, due primarily to the way coverage is measured (by fish weight caught, versus fishing trip); g) the estimates for Pacific halibut bycatch mortality in other fisheries in the U.S.A., for the same reasons identified in the previous point.	**Lead**: Lara Erikson **Status/Plan**: In progress. Report in development for IM095. Clarity around what sort of things are needed. Template needed once agencies consulted.
AM095–Req.03 (para. 23)	***Space-time modelling of survey data (WPUE; FISS expansion results, etc.)*** **NOTING** that more FISS stations in the disputed area between Regulatory Areas 2B and 2C appear to be assigned to Regulatory Area 2C, and that the IPHC Secretariat indicated that this assignment is based on a ‘compromise’ boundary line previously developed, the Commission **REQUESTED** that this separation line be clarified and clearly marked on any future IPHC map to avoid confusion. The IPHC Secretariat shall develop such maps and distribute to the Commission in the coming weeks.	**Lead**: Ray Webster **Status/Plan**: Completed. Following discussions with Commissioners, all FISS stations within the overlap of Canadian and USA maritime claims are included in both Regulatory Areas 2B and 2C’s WPUE and NPUE indices. Use of a “compromise” boundary line has been discontinued.

95th Session of the IPHC Annual Meeting (AM095)		
Action No.	**Description**	**Update**
AM095–Req.04 (para. 91)	***Contracting Party (by Agency) reports - Regulatory Area 2A (U.S.A.: West coast)*** **NOTING** a lack of clarity regarding the accounting for Pacific halibut caught recreationally in British Columbia waters (Canada) and landed in Washington ports (U.S.A.), the Commission **REQUESTED** continued liaison between the Washington Department of Fish and Wildlife and Fisheries and Oceans Canada on the subject.	**Lead**: Steve Keith **Status/Plan**: In progress. Working with both Contracting Party agencies to promote clear accounting for all recreational removals, aiming to having both agencies report results of their liaison via the Contracting Party reports at AM096.
AM095–Req.05 (para. 117)	***Budget estimates for FY2020 (for approval), and tentatively for FY2021*** The Commission **REQUESTED** that the IPHC Secretariat continue to develop a proposal for a potential Life History Modeller to join the IPHC Secretariat and for this to be provided to the Commission for consideration inter-sessionally.	**Lead**: Josep Planas **Status/Plan**: In progress. The position description was provided to the Commissioners inter-sessionally via IPHC Circular 2019-022 and will be discussed informally prior to the AM096 in February 2020 where the Commission may choose to appropriate funds for the position.
AM095–Req.06 (para. 120)	***IPHC Financial Regulations (2019)*** The Commission **ADOPTED** the revised IPHC Financial Regulations (2019) by consensus, and **REQUESTED** that the IPHC Secretariat finalise and publish them accordingly.	**Lead**: David Wilson **Status/Plan**: Completed. **IPHC Financial Regulations 2019** were published to the IPHC website on 4 February 2019.
AM095–Req.07 (para. 124)	***IPHC Rules of Procedure (2019)*** The Commission **ADOPTED** the revised IPHC Rules of Procedure (2019) by consensus, and **REQUESTED** that the IPHC Secretariat finalise and publish them accordingly.	**Lead**: David Wilson **Status/Plan**: Completed, **IPHC Rules of Procedure 2019** were published to the IPHC website on 4 February 2019.
AM095–Req.08 (para. 150)	***Review of the draft and adoption of the report of the 95th Session of the IPHC Annual Meeting (AM095)*** The Commission **REQUESTED** that the IPHC Secretariat finalise and publish the IPHC *Pacific Halibut Fishery Regulations (2019)* no later than 28 February 2019, **NOTING** that only minor editorial and formatting changes are permitted beyond the decisions made by the Commission at the AM095.	**Lead**: Steve Keith **Status/Plan**: Completed, **IPHC Pacific Halibut Fishery Regulations 2019** were published to the IPHC website on 19 February 2019.

Report of the IPHC Secretariat (2019): Draft

PREPARED BY: IPHC SECRETARIAT (D. WILSON, S. KEITH; 23 OCTOBER 2019)

Contents

1. PURPOSE

To provide the Commission with an update on the activities of the IPHC Secretariat in 2019 (as of 23 October 2019).

2. STAFFING IMPROVEMENTS DURING 2019

2.1. REGULAR FULL-TIME POSITIONS

FT Arrivals	**Type**	**Hire Date**	**Status**	**Position Title**
Ms Kamala Carroll	Regular full-time	8 Aug 2019	Active	Fisheries Data Manager (Field Staff Supervisor)
Ms Kimberly Sawyer	Regular full-time	22 Jul 2019	Active	Fisheries Data Specialist
FT Change				
Nil	Nil	Nil	Nil	Nil
FT Departure				
Mr E. Soderlund	Regular full-time	17 Mar 2003	Departed 24 Oct 2019	Setline Survey Specialist
Ms A. Tesfatsion	Regular full-time	2 Aug 1999	Departed 7 Jul 2019	Fisheries Data Specialist
Ms T. Geernaert	Regular full-time	5 May 1986	Departed 14 Jun 2019	Setline Survey Advisor

2.2. TEMPORARY FULL-TIME POSITIONS

Temporary full-time positons				
Temp/contract	**Type**	**Hire Date**	**Status**	**Position Title**
Dr Barbara Hutniczak	Temporary full-time 2-yr contract ending 31 October 2021	1 Nov 2019	Active	Fisheries Economist
Mr Andy Jasonowicz	Temporary full-time 1-yr contract ending in Aug 2020	26 Aug 2019	Active	Research Biologist (Genetics)
Ms Abby Carrigan	Temporary full-time 6-mo contract ending in Jan 2020	15 Jul 2019	Active	Data Entry Specialist
Dr Piera Carpi	Temporary full-time 2-yr contract ending in March 2021	1 Apr 2019	Active	MSE Researcher
Mr Colin Jones	Temporary full-time 2-yr contract ending in January 2021	14 Jan 2019	Active	Setline Survey Specialist (Gear and Bait)

3. IPHC MERIT SCHOLARSHIP FOR 2019

The IPHC funds several Merit Scholarships to support university, technical college, and other post-secondary education for students from Canada and the USA who are connected to the Pacific halibut fishery. Generally, a single new scholarship valued at US$4000 per year is awarded every two years. The scholarships are renewable annually for the normal four-year period of undergraduate education, subject to maintenance of satisfactory academic performance. A Scholarship Committee of industry and Commission representatives reviews applications and determines recipients based on academic qualifications, career goals, and relationship to the Pacific halibut industry.

No scholarships were awarded in 2019, as the next announcement will occur in early 2020.

The list of current recipients and their expected years of receipt are provided below. Note that in 2016 the IPHC Merit Scholarship shifted from an award of US$2000 per year for four years, with a new recipient selected each year, to an award of US$4000 per year for four years, with a new recipient selected every other year.

Name	2015	2016	2017	2018	2019	2020	2021
Shalie Dahl (Petersburg, AK, USA)	$2000	$2000	$2000	$2000	-	-	-
Ysabel Echeverio (Stevensville, MT, USA)	-	$4000	$4000	$4000	$4000	-	-
Kaia Dahl (Petersburg, AK, USA)	-	-	-	$4000	$4000	$4000	$4000

4. MEETINGS OF THE COMMISSION AND SUBSIDIARY BODIES DURING 2019

Meeting	No.	Date	Location
Finance and Administration Committee (FAC)	95th	28 Jan	Victoria, Canada
Annual Meeting (AM)	**95th**	**28 Jan-1 Feb**	**Victoria, Canada**
Conference Board (CB)	89th	29-30 Jan	Victoria, Canada
Processor Advisory Board (PAB)	24th	29-30 Jan	Victoria, Canada
Research Advisory Board (RAB)	20th	27 Feb	Seattle, USA
Management Strategy Advisory Board (MSAB)	13th	6-9 May	Sitka, USA
	14th	21-24 Oct	Seattle, USA
Scientific Review Board (SRB)	14th	26-28 June	Seattle, USA
	15th	24-26 Sept	Seattle, USA
Work Meeting (WM)	--	18-19 Sept	Bellingham, USA
Interim Meeting (IM)	**95th**	**25-26 Nov**	**Seattle, USA**

5. IPHC Fishery Regulations (2019)

5.1. Fishery Regulations adopted in 2019

In 2019, the Commission adopted **three (3)** fishery regulations in accordance with Article III of the Convention, as follows:

1) ***IPHC Pacific halibut fishery regulations, Section 4. Fishery Limits***

IPHC-2019-AM095-R, para. 70: The Commission **ADOPTED** the mortality limits for each Contracting Party, by IPHC Regulatory Area, (Table 5) and sector, as provided in Appendix IV.

Table 5. Adopted TCEY mortality limits for 2019

IPHC Regulatory Area	Mortality limit (TCEY) (mlbs)	Mortality limit (TCEY) (metric tonnes)
2A	1.65	748.42
2B	6.83	3,098.04
2C	6.34	2,875.78
3A	13.50	6,123.50
3B	2.90	1,315.42
4A	1.94	879.97
4B	1.45	657.71
4CDE	4.00	1,814.37
Total (IPHC Convention Area)	**38.61**	**17,513.20**

Appendix IV (of IPHC-2019-AM095-R)
Mortality table projected for the 2019 mortality limits by IPHC Regulatory Area
(All values reported in millions of net pounds)

Sector	**IPHC Regulatory Area**								
	2A	**2B**	**2C**	**3A**	**3B**	**4A**	**4B**	**4CDE**	**Total**
Commercial discard mortality	0.02	0.13	NA	NA	0.19	0.09	0.02	0.04	0.50
O26 Bycatch	0.13	0.27	0.03	1.28	0.36	0.18	0.22	1.87	4.33
Non-CSP Recreational (+ discards)	NA	0.08	1.38	1.74	0.00	0.01	0.00	0.00	3.21
Subsistence	NA	0.41	0.44	0.22	0.01	0.01	0.00	0.06	1.14
Total Non-FCEY	0.15	0.88	1.85	3.24	0.57	0.29	0.24	1.96	9.18
Commercial discard mortality	NA	NA	0.06	0.31	NA	NA	NA	NA	0.37
CSP Recreational (+ discards)	0.60	0.84	0.82	1.89	NA	NA	NA	NA	4.16
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial Landings	0.86	5.10	3.61	8.06	2.33	1.65	1.21	2.04	24.88
Total FCEY	1.50	5.95	4.49	10.26	2.33	1.65	1.21	2.04	29.43
TCEY	1.65	6.83	6.34	13.50	2.90	1.94	1.45	4.00	38.61
U26 Bycatch	0.00	0.02	0.00	0.37	0.11	0.10	0.01	1.12	1.73
Total Mortality	**1.65**	**6.85**	**6.34**	**13.87**	**3.01**	**2.04**	**1.46**	**5.12**	**40.34**

2) ***IPHC Pacific halibut fishery regulations, Section 9. Commercial fishing periods***

IPHC-2019-AM095-R, para. 80: The Commission **ADOPTED** fishing periods for 2019 as provided below, thereby superseding Section 9 of the IPHC Pacific halibut fishery regulations: (para. 80)

a) All commercial fishing for Pacific halibut in all IPHC Regulatory Areas may begin no earlier than 15 March and must cease on 14 November.

b) IPHC Regulatory Area 2A (Non-Treaty Directed Commercial): Retain the 10-hour derby fishery for 2019, 26 June, 10 July, 24 July, 7 August, 21 August, 4 September, 18 September, with additional openings and fishing period limits (vessel quota) to be determined and communicated by the IPHC Secretariat.

3) ***Charter management measures in IPHC Regulatory Areas 2C and 3A***

IPHC-2019-AM095-R, para. 83: The Commission **NOTED** and **ADOPTED** regulatory proposal IPHC-2019-AM095-PropB1, which proposed IPHC Regulation changes for charter Pacific halibut fisheries in IPHC Regulatory Areas 2C and 3A, in order to achieve the charter Pacific halibut allocation under the North Pacific Fisheries Management Council's (NPFMC) Pacific halibut Catch Sharing Plan. (para. 83)

5.2. DEFERRED REGULATORY PROPOSALS

At the 95th Session of the IPHC Annual Meeting (AM095), the Commission deferred action on a number of IPHC Secretariat and stakeholder regulatory proposals and tasked the IPHC Secretariat as follows:

Fishery Limits (Sect. 4)

Para. 63. The Commission **NOTED** regulatory proposal IPHC-2019-AM095-PropA1, which aimed to improve clarity and transparency of fishery limits in the IPHC Fishery Regulations, and to provide the framework for mortality limits adopted by the Commission.

Para 64. The Commission **DEFERRED** modifications to the fishery regulations at this time, due to administrative concerns raised by NOAA-Fisheries, and indication that they would be unable to make modifications to the IPHC's Fishery Regulations outside of absolutely essential edits.

IPHC Fishery Regulations: minor amendments

Para. 81. The Commission **NOTED** and **DEFERRED** regulatory proposal IPHC-2019-AM095-PropA3 Rev_1, which proposed amendments to ensure clarity and consistency in the IPHC Fishery Regulations.

IPHC Regulatory Area 2A Quota Proposal

Para. 87. The Commission **NOTED** and **DEFERRED** action on regulatory proposal IPHC-2019-AM095-PropC2, which proposed an individual quota system for IPHC Regulatory Area 2A (reference paragraphs 75-79).

Progress: Updated versions of IPHC-2019-AM095-PropA1 and IPHC-2019-AM095-PropA3 were published 7 October 2019 in order complete review before IM095. No further action on

IPHC-2019-AM95-PropC2 is contemplated, given the ongoing discussion regarding management of the Pacific halibut fisheries in IPHC Regulatory Area 2A (see paragraph 6.3.2b below).

6. INTERACTIONS WITH CONTRACTING PARTIES

6.1. *CONTRACTING PARTY REPORTS*

At AM095, the Commission agreed to pursue a modified format for annual Contracting Party reports to the IPHC:

> IPHC-2019-AM095-R, para. 100: The Commission **NOTED** paper IPHC-2019-AM095-INF02 which provided a revised draft template for use by Contracting Parties (and/or domestic agencies) in their annual reports to the Commission.

> IPHC-2019-AM095-R, para. 101: **NOTING** that efficiencies are likely to be gained by modifying the format and content for Contracting Parties reports to the Commission, the Commission **AGREED** that the Contracting Parties, via Commissioners, would work with the IPHC Secretariat intersessionally to improve the process, including the possibility for reports from Contracting Party agencies to be aggregated and presented as a consolidated Contracting Party report to the Commission. The IPHC Secretariat will share this work with the governments of both Contracting Parties to facilitate this effort throughout 2019.

The IPHC Secretariat is discussing the new reporting format at the staff level with Contracting Party agencies and has provided them the new template for reports. The Commission may wish to provide further input to the Contracting Parties regarding aggregation of reports.

6.2. *CANADA*

6.2.1. *Fisheries and Oceans Canada (DFO)*

a) **Areas of conservation concern**

The IPHC Secretariat followed up with Fisheries and Oceans Canada on incursions into Marine Protected Areas (MPAs) by the 2018 IPHC fishery-independent setline survey (FISS). In response, the IPHC Secretariat improved its FISS protocols, operations monitoring, and training. The two vessels involved also received letters of warning from Fisheries and Oceans Canada.

6.2.2. *Halibut Advisory Board (HAB)*

a) The Executive Director participates as a HAB member, with other Secretariat staff in support. This relationship is expected to continue into the future given the HAB's contributions to the Canadian decision-making process.

b) IPHC Secretariat attended HAB meetings on 25 September and 12 November 2019 via webinar, and will attend the 10 December 2019 meeting in person (Vancouver, Canada).

6.3. *UNITED STATES OF AMERICA*

6.3.1. *NORTH Pacific Fishery Management Council (NPFMC)*

a) **Abundance-Based Management of Pacific halibut bycatch (ABM)**

The NPFMC's Abundance-Based Management Working Group (ABMWG) continued its work, with participation of the IPHC Secretariat. The Commission has supported the development of ABM due to its potential effect on the directed Pacific halibut fisheries.

At its February 2019 meeting, the NPFMC received a report from the ABM Stakeholder Committee and revised alternatives for the forthcoming halibut ABM PSC limit analysis. The Council then agreed to a revised set of alternatives for analysis: Council Motion D3.

At the April 2019 NPFMC meeting, the Scientific and Statistical Committee (SSC) reviewed the operating model and additional analytical considerations to be employed in the initial ABM review analysis.

The Commission provided comments to the NPFMC on the analysis to date in its letter of 30 September 2019, and encouraged the NPFMC to address the Commission's concerns prior to making any final decisions on this issue.

At its October 2019 meeting, the NPFMC reviewed the current analysis and the preliminary draft environmental impact statement (EIS). The NPFMC requested particular revisions to the operating model and the preliminary draft EIS, as suggested by its SSC, and requested that the preliminary draft EIS should come back to the NPFMC for another initial review before publishing, likely in June 2020.

The Commission may wish to provide further input to the NPFMC regarding the process during 2020.

6.3.2. *PACIFIC Fishery Management Council (PFMC)*

a) **IPHC Regulatory Area 2A Catch Sharing Plans and in-season management**

The IPHC Secretariat collaborated with NOAA Fisheries and State agencies to conduct in-season management of the various fisheries identified in the IPHC Regulatory Area 2A Catch Sharing Plan. Date and possession restrictions were adjusted in season among the various fisheries to meet identified fishery needs while attaining and remaining within the applicable catch limits. Estimates of removals for 2019 will be presented during the IPHC Annual Meeting Agenda Item 5 on fishery statistics.

b) **IPHC Regulatory Area 2A non-tribal directed commercial fishery**

In 2017, the IPHC Secretariat initiated discussion with the PFMC, as well as with NOAA Fisheries and the relevant State agencies, regarding the management of the non-tribal directed commercial Pacific halibut fishery in IPHC Regulatory Area 2A, with the goal of moving away from its current derby-style management. The IPHC Secretariat noted concerns over safety and discards, as well as limitations on fishers' and processors' flexibility.

Discussion continued during 2018, focused on the IPHC's proposal to change the length of the fishing period for this fishery, presented in IPHC-2019-AM095-PropA2. At AM095, the Commission continued the 10-hour fishing period for 2019, but indicated its desire to move away from the current derby format:

> IPHC-2019-AM095-R, para. 75: *The Commission **AGREED** that for IPHC Regulatory Area 2A, fishing periods for the non-tribal directed commercial fishery should be longer than the current 10-hour derby fishing periods, primarily for safety reasons.*
>
> IPHC-2019-AM095-R, para. 79: ***NOTING** the concerns expressed by Canada about the safety issues related to the current management of this derby fishery, the Commission **EXPRESSED** its hope that there will be a proposal for an alternative management approach that addresses safety concerns by the time the Commission reconvenes at next year's annual meeting. If no resolution is in hand by then, the IPHC expects to re-examine what steps it can take to address the issue, including moving to longer fishing periods.*

During 2019, in response to letters exchanged between the Commission and the PFMC, and the Commission's desires expressed at AM095, the discussion broadened to include shifting responsibility for management of Pacific halibut fisheries in IPHC Regulatory Area 2A from the IPHC to domestic agencies, as is the case in all other IPHC Regulatory Areas.

> IPHC-2019-AM095-R, para. 77: *The Commission **NOTED** the suggestion from the PFMC and the NOAA Fisheries West Coast Region office for a workshop to consider future changes to the IPHC Regulatory Area 2A Pacific halibut fishery management structure in a more holistic way, to include all management partners and to take place as early as spring 2019.*
>
> IPHC-2019-AM095-R, para. 78: ***NOTING** the indication made to the PFMC in a letter dated 25 January 2019, that the IPHC Secretariat would welcome the opportunity to further address the safety concerns in the fishery, and to examine other potential management options for the fishery such as an IFQ or limited entry, as well as its management responsibilities, the Commission **RECOMMENDED** that this workshop take place, given the desire for the IPHC to move full management of the fishery from the IPHC (an international fisheries management body) to the relevant domestic agencies.*

At its June 2019 meeting, the PFMC affirmed its commitment to pursue domestic management of the Pacific halibut fisheries in IPHC Regulatory Area 2A. The workshop described in the paragraphs above has been postponed, as the current focus is to transfer management of the fishery before the 2021 fishing period. The PFMC may then later investigate other potential management options for the fishery. Further discussion of the way ahead is expected at the PFMC's November 2019 meeting.

The PFMC noted its commitment to the transition of management in its letter to the IPHC of 6 September 2019. The Commission responded in its letter to the PFMC of October 2019, offering to support the transition process and expressing its desire to complete the transition as expeditiously as possible.

7. IPHC Communications and Outreach

7.1. *IPHC Website*

The IPHC Secretariat continues to develop different ways to publish data and statistics for our stakeholders, focusing particularly on the addition of timely and useful visual displays such as our interactive maps and our online fishery-independent setline survey (FISS) data query. New developments to be presented at the IM095, including commercial fishery data pages and catch tables.

7.2. *Annual Report*

The 2018 Annual Report is available for download from the IPHC website at the following link: https://www.iphc.int/library/documents/annual-reports/iphc-2019-ar2018-iphc-annual-report-2018. We are now using an accelerated production timeline for the IPHC Annual Report, thereby ensuring users of the report receive the summary information as close to the relevant year as possible. Continued feedback on the content, format and presentation of the Annual Report is welcome.

The 2019 Annual Report is on track for publication at the end of February 2020.

7.3. *IPHC Circulars and Media Releases*

IPHC Circulars, introduced in late 2016, continue to serve as the formal inter-sessional communication mechanism for the Commission. Circulars are used to announce meetings of the Commission and its subsidiary bodies, as well as inter-sessional decisions made by the Commission.

IPHC Media Releases, are now the primary informal communication with all stakeholders. In some cases these will duplicate the formal communications provided in IPHC Circulars. IPHC Media Releases replace IPHC News Releases and other informal communication formats used previously.

Effective 1 August 2019, the IPHC Secretariat moved to fully electronic information distribution, after a two (2) year transition period. IPHC Circulars, Media releases, and similar information are posted on the IPHC website and distributed via email links only.

Stakeholders are encouraged to request that their email addresses be added to IPHC distribution lists at the following link: https://www.iphc.int/form/media-and-news.

8. IPHC Publications in 2019

8.1. *Published peer-reviewed journal papers*

Kuriyama PT, Branch TA, **Hicks AC**, Harms JH & Hamel OS (2019) Investigating three sources of bias in hook-and-line surveys: survey design, gear saturation, and multispecies interactions. *Can. J. Fish. Aquat. Sci. 76: 192–207 (2019) dx.doi.org/10.1139/cjfas-2017-0286.*

Nielsen JK, Mueter FJ, Adkinson MD, **Loher T**, McDermott SF & Seitz AC (2019) Effect of study area bathymetric heterogeneity on parameterization and performance of a depth-based geolocation model for demersal fish. Ecological Modelling 402(2019):1-34. doi: 10.1016/ecolmodel.2019.03.023

8.2. *In press peer-reviewed journal papers*

Monnahan, CC, Branch, TA, Thorson, JT, **Stewart, IJ**, and Szuwalski, C. (*In press*). Overcoming long Bayesian run times in integrated fisheries stock assessments. ICES J. Mar. Sci. doi:10.1093/icesjms/fsz059/5475859.

Rose CS, Nielsen JK, Gauvin J, Loher T, Sethi S, Seitz AC, Courtney MB & Drobny P (*In press*) Pacific halibut (*Hippoglossus stenolepis*) survivals after release from trawl catches through expedited sorting: deploying advanced tags in quantity (160) reveals patterns in survival outcomes. Canadian Journal of Fisheries and Aquatic Sciences. doi: 10.1139/cjfas-2018.0350

8.3. *Submitted peer-review journal papers – In revision*

Webster, R. A., Soderlund, E., Dykstra, C. L. and Stewart, I. J. (*in review*) Monitoring change in a dynamic environment: spatio-temporal modelling of calibrated data from different types of fisheries surveys of Pacific halibut. Canadian Journal of Fisheries and Aquatic Sciences.

9. RECOMMENDATION

That the Commission:

1) **NOTE** paper IPHC-2019-IM095-04 which provides the Commission with a draft update on activities of the IPHC Secretariat in 2019 not detailed in other papers before the Commission.

APPENDICES

Nil.

Fishery statistics (2019)

PREPARED BY: IPHC SECRETARIAT (L. ERIKSON, H. TRAN AND T. KONG; 26 OCTOBER & 20 NOVEMBER 2019)

PURPOSE

To provide an overview of the key fishery statistics from fisheries catching Pacific halibut during 2019, including the status of landings compared to fishery limits implemented by the Contracting Parties of the Commission.

BACKGROUND

The International Pacific Halibut Commission (IPHC) estimates all Pacific halibut (*Hippoglossus stenolepis*) removals taken in the IPHC Convention Area and uses this information in its yearly stock assessment (see IPHC-2019-IM095-09) and other analyses. The data are compiled by the IPHC Secretariat and include data from Federal and State agencies of each Contracting Party. All 2019 data are in net weight (head-off, dressed, ice and slime deducted) and are considered preliminary at this time.

This paper includes Pacific halibut removals for:

- Directed commercial fisheries, including landings and discard mortality
- Recreational fisheries, including landings and discard mortality
- Subsistence fisheries
- Non-directed commercial discard mortality (e.g. trawl, pot, longline, previously bycatch)
- IPHC Fishery-Independent Setline Survey (FISS) and other research

Figure 1 shows the distribution of Pacific halibut removals (mortality) by these fishery sources in 2019. Table 1 provides estimates of total removals by IPHC Regulatory Area (Figure 2).

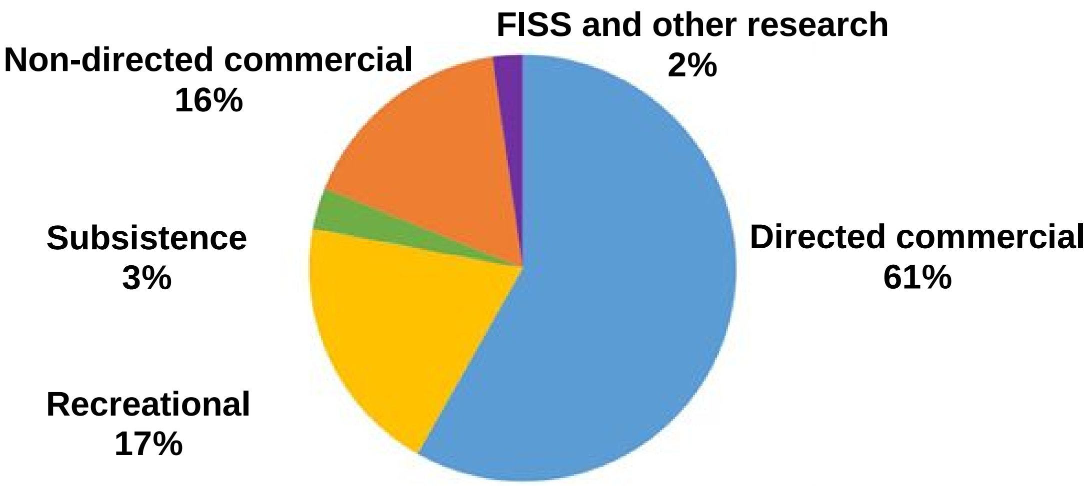

Figure 1. Distribution of Pacific halibut mortality by source in 2019.

Table 1. 2019 estimates of total removals (net weight), including fishery limits and landings of Pacific halibut by IPHC Regulatory Area. Preliminary as of 19 November 2019. Totals have been rounded.

IPHC Regulatory Area	Fishery limits (net weight)		Landings (net weight)		Percent
	Tonnes (t)	Pounds (lb)	Tonnes (t)	Pounds (lb)	%
Area 2A (California, Oregon, and Washington)	750.24	1,654,000	693.63	1,526,992	92
Non-treaty directed commercial (south of Pt. Chehalis)	115.41	254,426	114.65	252,761	99
Non-treaty incidental catch in salmon troll fishery	20.37	44,899	19.69	43,417	97
Non-treaty incidental catch in sablefish fishery (north of Pt. Chehalis)	31.75	70,000	36.00	79,360	113
Treaty Indian commercial	225.44	497,000	224.33	494,568	100
Discard mortality (directed commercial)[1]	9.07	20,000	13.15	29,000	145
Recreational – Washington	125.69	277,100	122.48	270,024	97
Recreational – Oregon	131.35	289,575	72.71	160,306	55
Recreational – California	17.69	39,000	8.15	17,968	46
Recreational discard mortality	1.81	4,000	2.59	5,706	143
Treaty Indian ceremonial and subsistence	12.70	28,000	12.70	28,000	100
Discard mortality (non-directed commercial)[1]	58.97	130,000	57.15	126,000	97
IPHC fishery-independent setline survey and research	none	none	9.02	19,882	n/a
Area 2B (British Columbia)	3,095.77	6,825,000	3,072.05	6,772,713	99
Commercial fishery	2,313.32	5,100,000	2,285.39	5,038,414	99
Discard mortality (directed commercial)[1]	58.97	130,000	63.50	140,000	108
Recreational fishery	381.02	840,000	364.40	803,367	96
Recreational discard mortality[1]	36.29	80,000	18.97	41,816	52
Recreational fishery (XRQ)	n/a	n/a	8.16	18,000	n/a
Subsistence[1]	183.70	405,000	183.70	405,000	100
Discard mortality (non-directed commercial)[1]	122.47	270,000	108.41	239,000	89
IPHC fishery-independent setline survey and research	none	none	39.52	87,116	n/a
Area 2C (southeastern Alaska)	2,874.19	6,336,500	2,781.44	6,132,024	97
Commercial fishery	1,637.47	3,610,000	1,523.21	3,358,103	95
Discard mortality (directed commercial)[1]	27.22	60,000	36.29	80,000	133
Metlakatla (Annette Island Reserve)	n/a	n/a	12.90	28,435	n/a
Guided recreational fishery	371.95	820,000	287.58	634,000	81[3]
Guided recreational discard mortality[2]	n/a	n/a	14.97	33,000	n/a
Guided recreational fishery (GAF)[1]	n/a	n/a	34.04	75,039	n/a
Unguided recreational fishery[1]	625.96	1,380,000	515.28	1,136,000	83[3]
Unguided recreational discard mortality[2]	n/a	n/a	6.80	15,000	n/a
Subsistence[1]	197.99	436,500	166.11	366,214	84
Discard mortality (non-directed commercial)[1]	13.61	30,000	40.37	89,000	297
IPHC fishery-independent setline survey and research	none	none	143.89	317,233	n/a
Area 3A (central Gulf of Alaska)	6,124.63	13,502,500	6,299.21	13,887,386	103
Commercial fishery	3,655.95	8,060,000	3,579.36	7,891,137	98
Discard mortality (directed commercial)[1]	140.61	310,000	160.12	353,000	114
Guided recreational fishery	857.29	1,890,000	907.18	2,000,000	107[3]
Guided recreational discard mortality[2]	n/a	n/a	8.62	19,000	n/a
Guided recreational fishery (GAF)	n/a	n/a	4.83	10,652	n/a
Unguided recreational fishery[1]	789.25	1,740,000	742.08	1,636,000	96[3]
Unguided recreational discard mortality[2]	n/a	n/a	12.70	28,000	n/a
Subsistence[1]	100.92	222,500	85.14	187,698	84
Discard mortality (non-directed commercial)[1]	580.60	1,280,000	661.34	1,458,000	114
IPHC fishery-independent setline survey and research	none	none	137.85	303,899	n/a

Table 1 continued. 2019 estimates of total removals (net weight), including fishery limits and landings of Pacific halibut by IPHC Regulatory Area. Preliminary as of 19 November 2019. Totals have been rounded.

IPHC Regulatory Area	Fishery limits (net weight)		Landings (net weight)		Percent
	Tonnes (t)	Pounds (lb)	Tonnes (t)	Pounds (lb)	%
Area 3B (western Gulf of Alaska)	1,317.32	2,904,200	1,325.50	2,922,222	101
Commercial fishery	1,056.87	2,330,000	977.58	2,155,192	92
Discard mortality (directed commercial)[1]	86.18	190,000	73.94	163,000	86
Recreational fishery[1]	4.54	10,000	1.81	4,000	40
Recreational discard mortality	0.00	0	0	0	0
Subsistence[1]	6.44	14,200	7.55	16,644	117
Discard mortality (non-directed commercial)[1]	163.29	360,000	208.20	459,000	128
IPHC fishery-independent setline survey and research	none	none	56.42	124,386	n/a
Area 4A (eastern Aleutians)	879.11	1,938,100	846.13	1,865,390	96
Commercial fishery	748.43	1,650,000	621.03	1,369,148	83
Discard mortality (directed commercial)[1]	40.82	90,000	47.17	104,000	116
Recreational fishery[1]	4.54	10,000	6.35	14,000	140
Recreational discard mortality	0.00	0	0	0	0
Subsistence[1]	3.67	8,100	6.00	13,237	163
Discard mortality (non-directed commercial)[1]	81.65	180,000	149.23	329,000	183
IPHC fishery-independent setline survey and research	none	none	16.33	36,005	n/a
Area 4B (central/western Aleutians)	657.84	1,450,300	551.89	1,216,718	84
Commercial fishery	548.85	1,210,000	443.50	977,742	81
Discard mortality (directed commercial)[1]	9.07	20,000	17.24	38,000	190
Recreational fishery[1]	0.00	0	0	0	0
Recreational discard mortality	0.00	0	0	0	0
Subsistence[1]	0.14	300	0.76	1,684	561
Discard mortality (non-directed commercial)[1]	99.79	220,000	76.66	169,000	77
IPHC fishery-independent setline survey and research	none	none	13.74	30,292	n/a
Area 4CDE (Bering Sea)[4]	1,815.77	4,003,080	2,419.77	5,334,682	133
Commercial fishery	925.33	2,040,000	741.02	1,633,659	80
Discard mortality (directed commercial)[1]	18.14	40,000	34.02	75,000	188
Recreational fishery[1]	0.00	0	0.00	0	0
Recreational discard mortality	0.00	0	0.00	0	0
Subsistence[1]	24.08	53,080	17.04	37,564	71
Discard mortality (non-directed commercial)[1]	848.22	1,870,000	1,617.96	3,567,000	191
IPHC fishery-independent setline survey and research	none	none	9.73	21,459	n/a
Totals	17,514.87	38,613,680	17,988.62	39,658,127	103
Commercial fishery	11,279.17	24,866,325	10,578.65	23,321,936	94
Discard mortality (directed commercial)[1]	390.09	860,000	445.43	982,000	114
Recreational fishery	3,309.26	7,295,675	3,118.15	6,874,356	94
Recreational discard mortality[5]	20.76	45,760	21.56	47,522	104
Subsistence[1]	529.65	1,167,680	479.01	1,056,041	90
Discard mortality (non-directed commercial)[1]	1,968.59	4,340,000	2,919.32	6,436,000	148
IPHC fishery-independent setline survey and research	none	none	426.50	940,272	n/a

[1] 'Limit' is value from 2018 estimates which were used in setting the TCEY for each IPHC Regulatory Area.
[2] Limit included in limit listed above.
[3] Includes recreational discard mortality.
[4] Landings in IPHC Regulatory Area 4CDE are combined to meet confidentiality requirements.
[5] Limit for IPHC Regulatory Areas 2A and 2B only. Recreational discard mortality limits included with recreational fishery limits for all other IPHC Regulatory Areas.
n/a = not available and XRQ = Experimental Quota and GAF = Guided Angler Fish (XRQ and GAF leased from commercial quota).

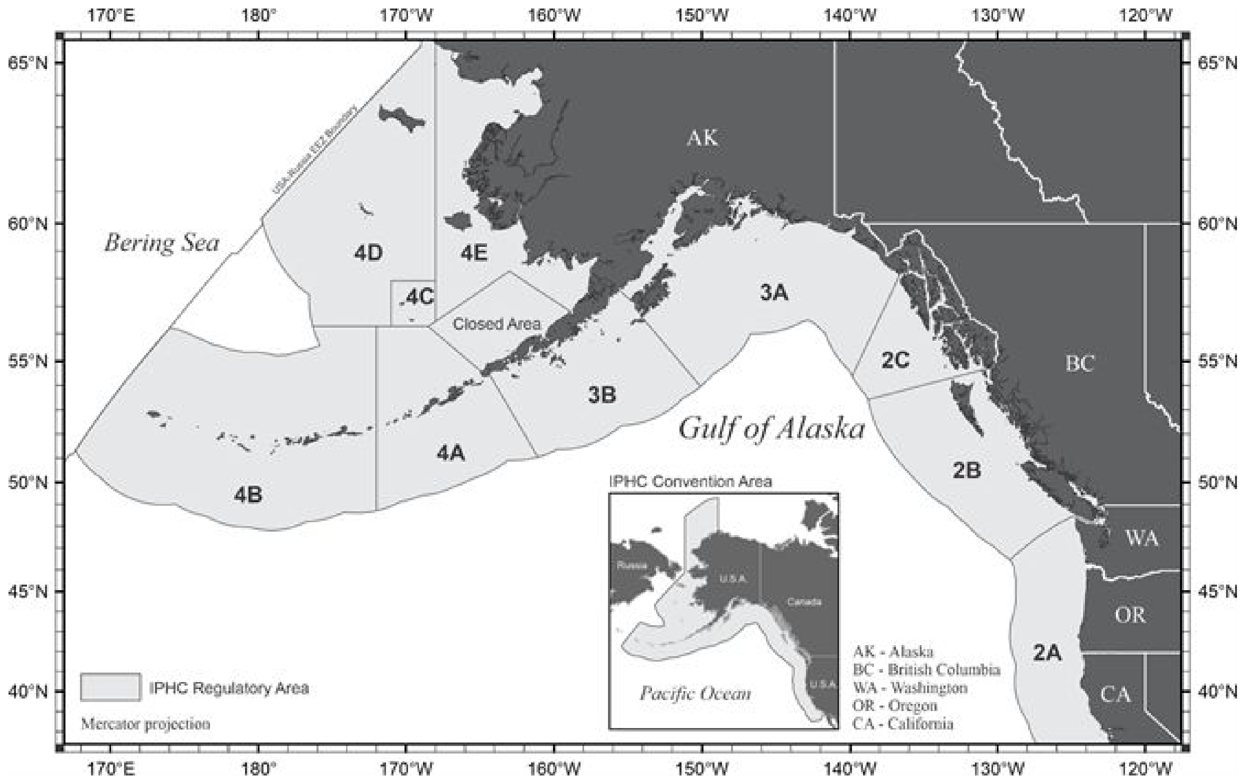

Figure 2. Map of the IPHC Convention Area (insert) and IPHC Regulatory Areas.

DEFINITIONS

Commercial fisheries: include commercial landings and directed commercial discard mortality. Commercial discard mortality continues to include estimates of sub-legal Pacific halibut (under 81.3 cm (32 inches), also called U32), fish that die on lost or abandoned fishing gear, and fish discarded for regulatory compliance reasons.

Recreational fisheries: include recreational landings (including landings from commercial leasing) and discard mortality.

Subsistence fisheries (formerly called personal use/subsistence): are non-commercial, customary, and traditional use of Pacific halibut for direct personal, family, or community consumption or sharing as food, or customary trade. Subsistence fisheries include:

i) ceremonial and subsistence (C&S) removals in the IPHC Regulatory Area 2A treaty Indian fishery,
ii) the sanctioned First Nations Food, Social, and Ceremonial (FSC) fishery conducted in British Columbia,
iii) federal subsistence fishery in Alaska, USA that uses Alaska Subsistence Halibut Registration Certificate (SHARC), and
iv) U32 Pacific halibut retained in IPHC Regulatory Areas 4D and 4E by the CDQ fishery for personal use.

Discard mortality (non-directed commercial): incidentally caught Pacific halibut by fisheries targeting other species and that cannot legally be retained, e.g. by the trawl fleet. Refers only to those Pacific halibut that subsequently die due to capture.

IPHC FISS and Research: includes Pacific halibut landings and removals as a result of the IPHC fishery-independent setline survey and other research.

DIRECTED COMMERCIAL FISHERIES

The IPHC's commercial fisheries span from northern California through to northern and western Alaska in USA and Canada waters of the northeastern Pacific Ocean. The IPHC sets annual limits for the catch of Pacific halibut in each IPHC Regulatory Area. Participants in these commercial fisheries use longline and pot gear to catch Pacific halibut for sale. The commercial Pacific halibut fisheries in IPHC Regulatory Area 2A consisted of the directed commercial fishery with fishing period limits, the incidental Pacific halibut catch during the salmon troll and limited-entry sablefish (*Anoplopoma fimbria*) fisheries, and the treaty Indian fisheries. Farther north, the commercial fisheries consisted of the Individual Vessel Quota (IVQ) fishery in IPHC Regulatory Area 2B in British Columbia, Canada; the Individual Fishing Quota (IFQ) system in Alaska, USA, the Community Development Quota (CDQ) fisheries in IPHC Regulatory Areas 4B and 4CDE, and the Metlakatla fishery in IPHC Regulatory Area 2C. All 2018 landing and discard mortality data presented in this document are preliminary.

Commercial Fishing Periods

The Canadian IVQ fishery in IPHC Regulatory Area 2B and the USA IFQ and CDQ fisheries in IPHC Regulatory Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, and 4E commenced at 12 noon local time on 15 March and closed at 12 noon local time on 14 November 2019 (Table 2). The IPHC Regulatory Area 2A commercial fisheries, including the treaty Indian commercial fisheries, occurred during the same calendar period (15 March to 14 November 2018). For IPHC Regulatory Area 2A, eight potential 10-hour fishing periods for the non-treaty directed commercial fishery were adopted: 26 June, 27 June, 10 July, 24 July, 7 August, 21 August, 4 September, and 18 September 2019. All fishing periods began at 0800 and ended at 1800 local time, were further restricted by fishing period limits, and closed for the remainder of the year after the third opening on 24 July (no opening was observed on 27 June) when the IPHC Regulatory Area 2A directed commercial fishery allocation was estimated to have been reached.

Table 2. Fishing periods for commercial Pacific halibut fisheries by IPHC Regulatory Area, 2010-19.

IPHC Regulatory Area	Year									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
2A Treaty Indian	6 Mar–20 Mar (14) 6 Mar-8 Apr	20-22 Mar (2) 1-2 May (19 h) 12-19 Mar 24-28 Mar (13)	24-26 Mar (2) 1 May (13 hrs) 17-19 Mar (55 hrs)	23-25 Mar (48 hrs) 2-4 Apr, 15-16 Apr, 8 May, 6 Jun, 13 Jul 20 Jul 3 Aug	11-13 Mar (48 hrs) 20-21Mar, 8May 8 May	16-18 Mar (48 hrs) 1-2 Apr	19-21 Mar,20-21 Mar, 21-23 Mar 1-2 Apr 1-2,11-12 May, 18 May-15 Aug, 25 Jul-2 Aug, 12 Sep-7 Nov	20 Mar, 15-16 Apr 1-2 May 19-20 May, 22-23 May 18-19 Jun 21-22 Jul	24 Mar – 28 Apr (36 hrs) 24 Mar – 28 Apr (37 hrs) 4 May – 23 May (30 hrs)	15 Mar-15 May (55 hrs) (Unrestricted) 15 Mar-15 May (84 hrs) and 20 May-15 Jun (72 hrs) (Restricted) 11 Jun-24 Jul(~327 lbs per tribe)
2A Commercial Directed	30 Jun (10 hrs)	29 Jun (10 hrs) 13 Jul (10 hrs)	27 Jun (10 hrs) 11 Jul (10 hrs)	26 Jun (10 hrs) 10 Jul (10 hrs)	25 Jun (10 hrs) 9 Jul (10 hrs)	24 Jun (10 hrs) 8 Jul (10 hrs)	22 Jun (10 hrs) 6 Jul (10 hrs) 20 Jul (10 hrs)	28 Jun (10 hrs) 12 Jul (10 hrs) 26 Jul (10 hrs)	27 Jun (10 hrs) 11 Jul (10 hrs) 25 Jul (10 hrs)	26 June (10 hrs) 10 July (10 hrs) 24 July (10 hrs)
2A Commercial Incidental	Salmon 1 May– 16 Jun (45) Sablefish No fishery	Salmon 1 May–28May (28) 29 Jul-31 Oct (94) Sablefish No fishery	Salmon 1 May – 3 Jul (64) Sablefish 1 May– 31 Oct (184)	Salmon 1 May–10 Aug (101) Sablefish 1 May– 31 Oct (184)	Salmon 1 Apr–11 Sep (163) Sablefish 1 Apr– 31 Oct (213)	Salmon 1 Apr–21 Aug (142) Sablefish 1 Apr– 31 Aug (152)	Salmon 1 Apr – 31 Oct (213) Sablefish 1 Apr – 31 Oct (213)	Salmon 1 Apr–3 Aug (124) Sablefish 1 Apr– 31 Oct (213)	Salmon 24 Mar - 8 Aug (137) Sablefish 24 Mar – 7 Nov (228)	Salmon 20 Apr - 30 Sept (WA, CA - 163) 20 Apr - 31 Oct (OR - 194) Sablefish 1 April- 31 Oct (213)
2B	6 Mar–15 Nov (255)	12 Mar–18 Nov (252)	17 Mar–7 Nov (236)	23 Mar–7 Nov (230)	8 Mar–7 Nov (244)	14 Mar–7 Nov (238)	19 Mar–7 Nov (233)	11 Mar–7 Nov (241)	24 Mar–7 Nov (228)	15 Mar-14 Nov (244)
Alaska, USA (2C, 3A, 3B, 4A, 4B, 4CDE)	6 Mar–15 Nov (255)	12 Mar–18 Nov (252)	17 Mar–7 Nov (236)	23 Mar–7 Nov (230)	8 Mar–7 Nov (244)	14 Mar–7 Nov (238)	19 Mar–7 Nov (233)	11 Mar–7 Nov (241)	24 Mar–7 Nov (228)	15 Mar-14 Nov (244)

Directed Commercial Landings

Commercial landings and fishery limits by IPHC Regulatory Area for the 2019 fishing season are shown in Table 3. Commercial fishery limit, as referred to here, is the IPHC commercial fishery limit set by the Contracting Parties following the Annual Meeting. The fishery limits with adjustments from the underage and overage programs from the previous year's quota share programs, and in IPHC Regulatory Area 2B, it also includes relinquishment of quota and quota leasing programs among sectors and the Use of Fish allocation are not presented. Historical landings and fishery limits from 2010 through 2019 are shown in Table 3.

The 2019 commercial fishery landings were spread over nine months of the year (Table 4). On a month-to-month comparison, July took the lead as the busiest month for total poundage (18%) landed from IPHC Regulatory Area 2B. On a month-to-month comparison, May was the busiest month for total poundage (17%) from Alaska, USA.

Table 3. Pacific halibut directed commercial landings, discard mortality, fishery limits and percent of fishery limit attained (tonnes, net weight) by IPHC Regulatory Area, 2010-19.

IPHC Regulatory Area	Directed Commercial Landings									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
2A	185	238	252	239	231	250	291	337	298	400
2B	2,997	2,999	2,664	2,700	2,620	2,669	2,742	2,781	2,380	2,285
2C[1]	1,991	1,072	1,168	1,321	1,486	1,634	1,759	1,859	1,557	1,536
3A	9,156	6,522	5,323	4,922	3,349	3,503	3,315	3,478	3,259	3,579
3B	4,517	3,274	2,237	1,818	1,277	1,168	1,183	1,359	1,098	978
4A	1,027	1,051	700	547	378	606	611	572	554	621
4B	810	917	778	555	495	490	492	476	471	444
4CDE	1,491	1,549	1,056	797	564	532	664	735	641	741
Total	22,174	7,620	14,178	12,900	10,400	10,851	11,056	11,598	9,595	10,606
IPHC Regulatory Area	Directed Commercial Discard Mortality									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
2A	12	11	12	12	10	14	17	9	10	13
2B	139	133	104	97	114	114	108	81	64	64
2C[1]	124	43	55	59	62	61	65	49	35	36
3A	692	438	292	265	224	254	194	171	145	160
3B	411	352	239	179	148	100	109	109	98	74
4A	65	77	43	37	17	38	24	29	33	47
4B	23	26	20	15	26	17	26	15	11	17
4CDE	43	83	36	26	24	24	32	13	14	34
Total	1,507	1,163	801	690	625	622	575	475	410	445
IPHC Regulatory Area	Directed Commercial Total Removals									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
2A	197	249	264	251	241	264	308	346	308	413
2B	3,136	3,132	2,768	2,797	2,734	2,783	2,850	2,862	2,444	2,349
2C[1]	2,115	1,115	1,223	1,380	1,548	1,695	1,824	1,908	1,592	1,572
3A	9,848	6,960	5,615	5,187	3,573	3,757	3,509	3,649	3,404	3,739
3B	4,928	3,626	2,476	1,997	1,425	1,268	1,292	1,468	1,196	1,052
4A	1,092	1,128	743	584	395	644	635	601	587	668
4B	833	943	798	570	521	507	518	491	482	461
4CDE	1,534	1,632	1,092	823	588	556	696	748	655	775
Total	23,681	18,785	14,979	13,589	11,025	11,474	11,632	12,072	10,668	11,051
IPHC Regulatory Area	Directed Commercial Fishery Limits									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
2A	191	218	248	245	236	232	291	350	307	393
2B	2,993	3,040	2,700	2,703	2,628	2,710	2,812	2,845	2,402	2,313
2C	1,996	1,057	1,190	1,347	1,505	1,669	1,780	1,911	1,619	1,637
3A	9,067	6,514	5,406	5,003	3,319	3,533	3,328	3,510	3,334	3,656
3B	4,491	3,406	2,300	1,946	1,288	1,202	1,229	1,424	1,188	1,057
4A	1,057	1,093	711	603	386	630	630	630	621	748
4B	980	989	848	658	517	517	517	517	476	549
4CDE	1,624	1,687	1,118	875	583	583	753	771	717	925
Total	22,398	18,004	14,520	13,380	10,462	11,077	11,340	11,959	10,665	11,279
IPHC Regulatory Area	Directed Commercial Limits – Percent Attained									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
2A	97	109	102	98	98	108	100	96	97	102
2B	100	99	99	100	100	98	98	98	99	100
2C[1]	100	101	98	98	99	98	99	97	96	94
3A	101	100	98	98	101	99	100	99	98	98
3B	101	96	97	93	99	97	96	95	92	93
4A	97	96	98	91	98	96	97	91	89	83
4B	83	93	92	84	96	95	95	92	99	81
4CDE	92	92	94	91	97	91	88	95	89	80
Total	99	42	98	96	99	98	97	97	90	94

[1] In Area 2C, includes the Metlakatla fishery landed catch.

Table 4. 2019 commercial landings (tonnes, net weight, preliminary) of Pacific halibut for Alaska, USA and British Columbia, Canada by IPHC Regulatory Area and month. Preliminary as of 25 October 2019.

IPHC Regulatory Area	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Total
2B[1]	283	309	265	258	393	285	207	140	n/a	2,140
2C[2]	189	312	332	143	102	171	139	92	n/a	1,480
3A[2]	232	616	694	475	268	468	397	231	n/a	3,380
3B[2]	30	125	101	169	92	150	159	78	n/a	904
4A[2]	-	38[3]	56	68	76	114	174	63	n/a	589
4B[2]	-	61[3]	108	53	79	67	37	21	n/a	425
4CDE[2]	-	-	15[3]	112	159	279	103	54	n/a	721
Alaska, USA Total	451	1,151	1,305	1,020	776	1,249	1,009	538	n/a	7,499
Grand Total	734	1,460	1,570	1,278	1,169	1,534	1,216	678	n/a	9,639

[1] Based on landings from DFO Fishery Operations System (FOS).
[2] Based on landings from NOAA Fisheries Restricted Access Management (RAM) Division.
[3] Weight combined with the previous months for confidentiality purposes.
n/a = not available

IPHC Regulatory Area 2A (USA: Washington, Oregon, California)

The 2019 IPHC Regulatory Area 2A fisheries and respective fishery limits are listed in Table 1. The total directed commercial landings of 114.65 t (253,000 pounds) were 1% under the fishery limit of 115.41 t (254,426 pounds) after three 10-hour openers. The fishing period limits by vessel size class for each opening in 2019 are listed in Table 5.

At the start of the salmon troll fishery season on 20 April, the allowable incidental landing ratio was one Pacific halibut per three Chinook (*Oncorhynchus tshawytscha*), plus an "extra" Pacific halibut per landing, and a vessel trip limit of 10 fish. The allowable incidental landing ratio was changed to one Pacific halibut per two Chinook, plus an "extra" Pacific halibut per landing, and a vessel trip limit of 15 fish on 1 May. The allowable incidental landing ratio was changed to one Pacific halibut per two Chinook, plus an "extra" Pacific halibut per landing, and a vessel trip limit of 15 fish on 1 July. The allowable incidental landing ratio was changed to one Pacific halibut per two Chinook, plus an "extra" Pacific halibut per landing, and a vessel trip limit of 4 fish on 19 July. The allowable incidental landing ratio was changed to one Pacific halibut per two Chinook, plus an "extra" Pacific halibut per landing, and a vessel trip limit of 2 fish on 29 July. The incidental Pacific halibut retention in Washington and California was open through 30 September with Oregon remaining open through the month of October. Total landings of 19.69 tonnes (43,417 pounds) was 3% under the fishery limit (20.37 tonnes (44,899 pounds)). Incidental Pacific halibut retention during the limited-entry sablefish fishery remained open from 1 April to noon on 31 October. Beginning 1 April, the allowable landing ratio was 0.09 tonnes (200 pounds) (net weight) of Pacific halibut to 0.45 tonnes (1,000 pounds) (net weight) of sablefish, and up to two additional Pacific halibut in excess of the ratio limit. Effective 2 August, the landing ratio was modified to 0.11 tonnes (250 pounds) (net weight) of Pacific halibut to 0.45 tonnes (1,000 pounds) (net weight) of sablefish, and up to two additional Pacific halibut in excess of the ratio limit. The total landings of 36.00 tonnes (79,360 pounds) were 13% over the fishery limit (31.75 t (70,000 pounds)).

In IPHC Regulatory Area 2A, north of Point Chehalis, the treaty Indian tribes manage the commercial landings by allocating 75% to an open access fishery and 25% to a restricted fishery with daily and vessel limits. There were one unrestricted, open access fishery 15 March to 15 May and two restricted fisheries, including a vessel per day limit of 0.23 tonnes (500 pounds) for 15 March to 15 May and 20 May to 5 June openings. The 2019 tribal commercial season closed to all parties following a late fishery 11 June to 24 July with each tribe fishing a share of approximately 0.15 tonnes (327 pounds) with total landings of 224 tonnes (494,568 pounds), 0.5% under the fishery limit (225 t (497,000 pounds)).

Table 5. The fishing periods and limits (tonnes, dressed, head-on with ice/slime) by vessel class used in the 2019 directed commercial fishery in IPHC Regulatory Area 2A.

Vessel Class		**Fishing Period (dates) & Limits (t)**	
Letter	**Feet**	**26 June and 10 July**	**24 July**
A	≤25	2.05	1.04
B	26-30	2.05	1.04
C	31-35	2.05	1.04
D	36-40	3.09	1.04
E	41-45	3.09	1.04
F	46-50	4.12	1.04
G	51-55	4.12	1.04
H	56+	4.64	1.04

IPHC Regulatory Area 2B (British Columbia, Canada)

Under the IVQ fishery in British Columbia, Canada, the number of active Pacific halibut licences (L licences), and First Nations communal commercial licences (FL licences) was 152 in 2019. In addition, Pacific halibut can be landed as incidental catch in other licensed groundfish fisheries. Therefore, Pacific halibut was landed from a total of 223 active licences in 2019, with 71 of these licences from other fisheries. The 2019 directed commercial landings of 2,285 tonnes (5,038,000 pounds) were 1% under the fishery limit (2,313 tonnes (5,100,000 pounds)) (Table 3).

Directed commercial trips from IPHC Regulatory Area 2B were delivered into 14 different ports in 2019. The ports of Port Hardy (including Coal Harbour and Port McNeill) and Prince Rupert/Port Edward were the major landing locations, receiving 90% of the commercial landings. Port Hardy received 40% while Prince Rupert received 50% (848 and 1,072 tonnes (1,870,000 and 2,363,000 pounds), respectively) of the commercial landings. All of the IVQ landings were landed in IPHC Regulatory Area 2B.

IPHC Regulatory Areas 2C, 3, and 4 (USA: Alaska)

In Alaska, USA, the National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) Restricted Access Management (RAM) allocated Pacific halibut quota share (QS) to recipients by IPHC Regulatory Area. Quota share transfers were permitted with restrictions on the amount of QS a person could hold and the amount that could be fished per vessel. In 2018, RAM reported that 2,257 persons held QS.

The total 2019 landings from the IFQ/CDQ Pacific halibut fishery for the waters off Alaska, USA were 7,886 tonnes (17,385,000 pounds), less than 8% under the fishery limit (Table 3). By IPHC Regulatory Area, the landings were under the fishery limit by 5% for Area 2C, 2% for Area 3A, 8% for Area 3B, 17% for Area 4A, and 19% for Area 4B. The total combined IPHC Regulatory Area 4CDE commercial landings of 741 tonnes (1,634,000 pounds) were 20% under the combined Area 4CDE fishery limit (925 tonnes (2,040,000 pounds)). The North Pacific Fishery Management Council's Catch Sharing Plan allowed IPHC Regulatory Area 4D CDQ to be harvested in IPHC Regulatory Areas 4D or 4E and Area 4C IFQ and CDQ to be fished in Areas 4C or 4D.

Homer received approximately 15% (1,103 tonnes (2,432,000 pounds)) of the commercial landings of Alaskan catch making it the port that received the greatest number of pounds in 2019. Seward received the second and Kodiak the third largest landing volume at 11% (864 tonnes (1,880,000 pounds)) and 11% (838 tonnes (1,847,000 pounds)) of the Alaskan commercial landings, respectively. In Southeast Alaska, the two largest landing volumes were received in Juneau (529 tonnes (1,166,000 pounds)) and Sitka (523 tonnes (1,154,000 pounds)), and their combined landings represented 14% of the commercial Alaskan landings. The Alaskan QS catch that was landed outside of Alaska, USA was 2%.

The Metlakatla Indian Community (within IPHC Regulatory Area 2C) was authorized by the United States government to conduct a commercial Pacific halibut fishery within the Annette Islands Reserve. There were 13 two-day openings between 29 March and 15 September for total landings of 12.90 tonnes (28,435 pounds) (Table 6).

Table 6. Metlakatla community fishing periods, number of vessels, and preliminary Pacific halibut landings (net weight) in IPHC Regulatory Area 2C, 2019.

Fishing Period Dates	Landings		Number of Vessels
	(Tonnes)	(Pounds)	
29 – 31 March	0.8	1,661	7
12 – 14 April	0.8	1,767	8
26 – 28 April	0.9	1,992	6
10 – 12 May	1.2	2,568	9
24 – 26 May	0.8	1,649	8
07 – 9 June	0.9	1,992	5
21 – 23 June	0.7	1,513	7
05 – 07 July	1.7	3,684	7
19 – 21 July	1.2	2,694	6
02 – 04 August	0.7	1,599	5
16 – 18 August	1.2	2,716	7
30 August – 01 September	0.9	1,904	5
13 – 15 September	0.9	1,901	8
27 – 29 September	0.4	795	3
Total	12.9	28,435	14 Openings

Directed Commercial Discard Mortality

Incidental mortality of Pacific halibut in the directed commercial Pacific halibut fishery is the mortality of all Pacific halibut that do not become part of the landed catch. The three main sources of discard mortality estimate include: 1) fish that are captured and discarded because they are below the legal size limit of 81.3 cm (32 inches), 2) fish that are estimated to die on lost or abandoned fishing gear, and 3) fish that are discarded for regulatory reasons (e.g. the vessels trip limit has been exceeded). The methods that are applied to produce each of these estimates differ due to the amount and quality of information available. Information on lost gear and regulatory discards is collected through logbook interviews and fishing logs received by mail. The ratio of U32 to O32 Pacific halibut (>81.3 cm or 32 inches in length) is determined from the IPHC fisheries-independent setline survey in most areas and by direct observation in the IPHC Regulatory Area 2B fishery. Different mortality rates are applied to each category: released Pacific halibut have a 16% mortality rate and Pacific halibut mortality from lost gear is 100%.

Pacific halibut discard mortality estimates from the commercial Pacific halibut fishery are summarized by IPHC Regulatory Area in Table 1 and over a series of years in Table 3.

RECREATIONAL FISHERIES

The 2019 recreational removals of Pacific halibut, including discard mortality, was estimated at 3,140 tonnes (6,922,000 pounds), a decrease of the recreational harvest in 2018 by 57 tonnes. Changes in harvests varied across areas; in some cases, in response to changes in size restrictions. Recreational fishery limits and landings are detailed by IPHC Regulatory Area in Table 7, and summarized in Table 1.

Table 7. Recreational removals and limits of Pacific halibut (tonnes, net weight) by IPHC Regulatory Area, 2013-19.

IPHC Regulatory Area	Recreational Retained						
	2013	2014	2015	2016	2017	2018	2019
2A	227	216	202	229	234	211	203
2B – XRQ Leased	4	2	2	3	4	8	8
2B	369	414	445	463	516	364	364
2B	373	416	447	466	520	371	373
2C – GAF Leased	-	24	13	18	19	29	34
2C – Charter	346	355	348	358	409	298	288
2C – Noncharter	617	531	602	565	552	552	515
2C	963	911	963	941	962	878	837
3A – GAF Leased	-	5	2	4	3	4	5
3A – Charter	1140	923	938	909	942	850	907
3A – Noncharter	659	695	733	698	694	705	742
3A	1,799	1,622	1,673	1,611	1,636	1,555	1,654
3B	7	3	2	4	0	2	2
4A	4	4	3	7	3	6	6
4B and 4CDE	-	-	-	-	-	-	-
Total	3,369	3,142	3,273	3,232	3,587	2,995	3,075
IPHC Regulatory Area	Recreational Discard Mortality						
	2013	2014	2015	2016	2017	2018	2019
2A	2	2	2	2	2	2	3
2B	20	15	28	30	24	34	19
2C – Charter	19	21	21	23	19	28	15
2C – Noncharter	13	7	8	9	7	7	7
2C	32	28	29	32	25	34	22
3A – Charter	22	20	16	13	10	8	9
3A – Noncharter	14	12	17	12	10	9	13
3A	36	31	33	25	20	18	21
3B and 4	-	-	-	-	-	-	-
Total	90	76	92	89	71	88	64
IPHC Regulatory Area	Recreational Total Removals						
	2013	2014	2015	2016	2017	2018	2019
2A	229	218	204	230	235	213	206
2B	393	431	475	496	543	397	392
2C	995	939	992	973	1005	913	859
3A	1,835	1,654	1,706	1,636	1,659	1,573	1,675
3B	7	3	2	4	0	2	2
4A	4	4	3	7	3	6	6
4B and 4CDE	-	-	-	-	-	-	-
Total	3,462	3,259	3,382	3,346	3,686	3,083	3,140
IPHC Regulatory Area	Recreational Limits						
	2013	2014	2015	2016	2017	2018	2019
2A	190	187	194	210	240	220	277
2B	490	479	483	499	507	421	381
2C	357	345	386	411	415	367	372
3A	1240	808	857	823	857	812	857
3B and 4	-	-	-	-	-	-	-
Total	2,277	1,820	1,920	1,944	2,019	1,821	1,887
IPHC Regulatory Area	Recreational Limit Percent Attained						
	2013	2014	2015	2016	2017	2018	2019
2A	121	117	105	109	98	94	74
2B	75	86	92	93	102	94	96
2C	102	109	96	93	103	90	81
3A	94	117	111	112	111	104	107
3B and 4	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-

Recreational Landings

IPHC Regulatory Area 2A (USA: Washington, Oregon, California)

The 2019 IPHC Regulatory Area 2A recreational allocation was 274.7 tonnes (605,674 pounds) net weight and based on the Pacific Fishery Management Council's Catch Sharing Plan formula, which divides the overall fishery fishery limit among all sectors. The recreational allocation was further subdivided to seven subareas, after 31.8 tonnes (70,000 pounds) were allocated to the incidental Pacific halibut catch in the commercial sablefish fishery in Washington. This subdivision resulted in 121.8 tonnes (268,633 pounds) being allocated to Washington subareas, 128.3 tonnes (282,914 pounds) to Oregon subareas. In addition, California received an allocation of 17.7 tonnes (39,000 pounds). The IPHC Regulatory Area 2A recreational harvest totaled 203 tonnes (448,298 pounds), 26% under the recreational allocation (Table 7).

Recreational fishery harvest seasons by subareas varied and were managed inseason with fisheries opening on 1 May.

IPHC Regulatory Area 2B (Canada: British Columbia)

IPHC Regulatory Area 2B operated under a 115 cm (45.3 inch) maximum size limit, and one Pacific halibut had to be less than 83 cm (32.7 inch) when attaining the two fish possession limit with an annual limit of six per licence holder. The IPHC Regulatory Area 2B fishery remains open.

British Columbia, Canada and Alaska, USA both have programs that allow recreational harvesters to land fish that is leased from commercial fishery quota share holders for the current season. In Canada, an estimated 8.16 tonnes (18,000 pounds) were leased from the commercial quota fishery and landed as recreational harvest.

IPHC Regulatory Areas 2C, 3, and 4 (USA: Alaska)

A reverse slot limit allowing for the retention of Pacific halibut, if ≤ 97 cm (38 inches) or ≥ 203 cm (80 inches) in total length, was continued by the IPHC for the charter fishery in IPHC Regulatory Area 2C. In IPHC Regulatory Area 3A, charter anglers were allowed to retain two fish, but only one could exceed 71.1 cm (28 inches) in length, a four fish annual limit with a recording requirement, one trip per calendar day per charter permit, with no charter retention of Pacific halibut on Wednesdays throughout the season and 9 July, 16 July, 23 July, 30 July, 6 August and 13 August.

Similar to British Columbia (Canada), Alaska (USA) has programs that allow recreational harvesters to land fish that is leased from commercial fishery quota share holders for the current season. In IPHC Regulatory Areas 2C and 3A, 34.0 tonnes (75,039 pounds) and 4.8 tonnes (10,652 pounds), respectively, were leased from the commercial quota fisheries in those areas and landed as recreational harvest.

Recreational Discard Mortality

Pacific halibut discarded for any reason suffer some degree of discard mortality, and impacts more of the stock with the increasing use of size restrictions, such as reverse slot limits. Current year estimates from Contracting Parties' agencies of recreational discard mortality have been received from Alaska and Oregon in the USA, and British Columbia, Canada and are provided in Table 7.

Subsistence Fisheries

Pacific halibut is taken throughout its range as subsistence harvest by several fisheries. Subsistence fisheries are non-commercial, customary, and traditional use of Pacific halibut for direct personal, family, or community consumption or sharing as food, or customary trade. The primary subsistence fisheries are the treaty Indian Ceremonial and Subsistence fishery in IPHC Regulatory Area 2A off northwest Washington State (USA), the First Nations Food, Social, and Ceremonial (FSC) fishery in British Columbia (Canada), and the subsistence fishery by rural residents and federally-recognized native tribes in Alaska (USA) documented via Subsistence Halibut Registration Certificates (SHARC).

The coastwide subsistence estimate for 2019 is 479.0 tonnes (1,056,041 pounds). Subsistence harvest by IPHC Regulatory Areas from 2010 through 2019 is available in Table 8.

Table 8. Subsistence Pacific halibut fisheries removals (tonnes, net weight) by IPHC Regulatory Area, 2010-19.

IPHC Regulatory Area	Subsistence Fishery									
	2010	2011	2012	2013[1]	2014	2015[1]	2016	2017[1]	2018[1]	2019[1]
2A	11	11	15	13	14	15	13	13	13	13
2B	184	184	184	184	184	184	184	184	184	184
2C	193	176	180	180	192	192	198	198	166	166
3A	142	121	115	115	109	109	101	101	85	85
3B	10	10	7	7	6	6	6	6	7	8
4A	7	6	4	4	3	3	4	4	6	6
4B	0	0	1	1	0	0	0	0	1	1
4C	5	1	1	1	2	2	2	2	2	2
4D	1	0	0	0	0	0	0	0	0	0
4E	5	3	4	4	32	32	19	19	11	11
4D/4E (CDQ U32)	4	8	9	5	2	2	2	3	5	3
Total	561	519	519	513	546	546	530	530	480	479

[1] Alaska, USA estimates were carried over for the 2013 estimates from 2012, for the 2015 estimates from 2014, for the 2017 estimates from 2016, and for the 2019 estimates from 2018, with the exception that 4D/4E subsistence harvest in the CDQ fishery were updated.

Estimated subsistence harvests by area

In the commercial Pacific halibut fisheries coastwide, the state and federal regulations require that take-home Pacific halibut caught during commercial fishing be recorded as part of the commercial fishery on the landing records (i.e. State fish tickets or Canadian validation records). This is consistent across areas, including the quota share fisheries in Canada and USA, and as part of fishing period limits and Pacific halibut ratios in the incidental fisheries in IPHC Regulatory Area 2A. Therefore, personal use fish or take-home fish within the commercial fisheries are accounted for as commercial catch and are not included here.

IPHC Regulatory Area 2A (USA: Washington, Oregon, California)

The Pacific Fishery Management Council's Catch Sharing Plan allocates the Pacific halibut fishery limit to commercial, recreational, and treaty Indian users in IPHC Regulatory Area 2A. The treaty tribal fishery limit is further sub-divided into commercial and ceremonial and subsistence (C&S) fisheries. The 2018 final estimate of C&S was 12.7 tonnes (28,000 pounds) and this catch estimate became the 2019 C&S allocation. The estimate of the 2019 removals is not available so it is assumed the treaty tribal C&S allocation was fully harvested.

IPHC Regulatory Area 2B (Canada: British Columbia)

The source of Pacific halibut subsistence harvest in British Columbia is the First Nations FSC fishery. The IPHC receives some logbook and landing data for this harvest from the DFO but those data have not been adequate for the IPHC to make an independent estimate of the FSC fishery harvest. DFO estimated the First Nations FSC harvest to be 136.1 tonnes (300,000 pounds) annually until 2006, and since 2007, the yearly estimate has been provided as 183.7 tonnes (405,000 pounds).

IPHC Regulatory Areas 2C, 3, and 4 (USA: Alaska)

In 2003, the subsistence Pacific halibut fishery off Alaska was formally recognized by the North Pacific Fishery Management Council, and implemented by IPHC and NOAA Fisheries regulations. The fishery allows the customary and traditional use of Pacific halibut by rural residents and members of federally-recognized Alaska, USA native tribes who can retain Pacific halibut for non-commercial use, food, or customary trade. The NOAA Fisheries regulations define legal gear, number of hooks, and daily bag limits, and IPHC regulations set the fishing season. Prior to subsistence fishing, eligible persons registered with NOAA Fisheries Restricted Access Management to obtain a SHARC. The Division of Subsistence at ADF&G was contracted by NOAA Fisheries to estimate the subsistence harvest in Alaska, USA through a data collection program. Yearly reports are available at http://www.fakr.noaa.gov/ram/ subsistence/halibut.htm. Each year, the data collection program included an annual voluntary survey of fishers conducted by mail or phone, with some onsite visits. The 2012 estimate has been carried forward for the 2013 estimate and the 2014 estimate has been used for 2014 through 2015; a 2016 estimate was used for 2016 through 2017 and a new 2018 estimate is used for 2018 through 2019. The 2014 estimates are about 10% higher than in 2012, and are noticeably higher in IPHC Regulatory Area 4E. To collect the 2014 harvest estimates, the ADF&G staff conducted face to face interviews in two of the major subsistence harvesting communities within IPHC Regulatory Area 4E rather than relying on mailed returns. Face to face interviews likely resulted in more realistic harvest estimates than the mail survey alone, so it is likely that the IPHC Regulatory Area 4E harvest estimates between 2009 through 2013 were low.

In addition to the SHARC harvest, IPHC regulations allow Pacific halibut less than 81.3 cm or 32 inches in fork length (also called U32) to be retained in the IPHC Regulatory Area 4D and 4E commercial Pacific halibut CDQ fishery, under an exemption requested by the North Pacific Fishery Management Council, as long as the fish are not sold or bartered. The exemption originally applied only to CDQ fisheries in IPHC Regulatory Area 4E in 1998 but was expanded in 2002 to also include IPHC Regulatory Area 4D. The CDQ organizations are required to report to the IPHC the amounts retained during their commercial fishing operations. This harvest is not included in the SHARC program estimate and is reported separately.

Reports for 2019 were received from three organizations: Bristol Bay Economic Development Corporation (BBEDC), Coastal Villages Regional Fund (CVRF), and Norton Sound Economic Development Corporation (NSEDC). The reports are summarized below, and the reported amounts of retained U32 Pacific halibut are shown in Table 9. A total of 3.3 tonnes (7,252 pounds) of retained U32 Pacific halibut was reported by CDQ organizations. Generally, annual changes are a reflection of the amount of effort by the local small boat fleets and the availability of fish in their nearshore fisheries.

Table 9. Reported annual amount (tonnes, net weight) of U32 (<32 inches in fork length) Pacific halibut retained by Community Development Quota harvesters fishing in IPHC Regulatory Areas 4D and 4E.

Organization	U32 CDQ Landings									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
BBEDC	1.0	1.2	2.3	1.6	1.6	1.1	1.6	2.4	3.9	1.5
CVRF	1.8	4.5	4.7	2.4	0.4	0.0	0.0	0.0	0.0	0.0
NSEDC	1.6	1.9	2.1	0.6	0.5	1.0	0.9	1.0	0.7	1.8
Total	4.3	7.7	9.2	4.6	2.5	2.1	2.5	3.3	4.5	3.3

CDQ - Bristol Bay Economic Development Corporation (BBEDC)

BBEDC requires their fishers to record the lengths of retained U32 Pacific halibut in a separate log, which are tabulated by BBEDC at the conclusion of the season. The lengths were converted to weights using the IPHC length/weight relationship and summed to estimate the total retained U32 weight. Pacific halibut were landed by BBEDC vessels equally at Togiak and Dillingham, with a small amount landed in Naknek and a minor amount landed in Egegik. BBEDC reported 25 harvesters landed 317 U32 Pacific halibut (1.5 tonnes; 3,349 pounds).

CDQ - Coastal Villages Regional Fund (CVRF)

CVRF reported that no Pacific halibut were landed by their fishers or received by their facilities.

CDQ - Norton Sound Economic Development Corporation (NSEDC)

NSEDC required their fishers to offload the U32 Pacific halibut for weighing. Ice was removed but the fish were not washed nor the heads removed. The U32 Pacific halibut were then returned to the harvester. NSEDC reported 390 U32 Pacific halibut weighing 1.8 tonnes (3,903 pounds) were caught in the local CDQ fishery and landed at the Nome plant.

NON-DIRECTED COMMERCIAL DISCARD MORTALITY

The IPHC accounts for non-directed commercial discard mortality by IPHC Regulatory Area and sector. Table 10 provides these estimates from 2010 through 2019.

Table 10. Non-directed commercial discard mortality estimates of Pacific halibut (tonnes, net weight) by year, IPHC Regulatory Area, and fishery, for 2010-19. Estimates for 2019 are preliminary.[1]

IPHC Regulatory Area and Gear	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AREA 2A										
Groundfish Trawl	136									
IFQ Bottom Trawl		23	27	24	20	25	25	26	23	32
Other Groundfish Trawl	1	1	1	2	1	1	1	1	2	0
Groundfish Pot		0	0	0	0	0	0	1	0	0
Hook & Line	97	16	24	4	24	10	18	33	24	24
Shrimp Trawl	0	0	0	0	0	0	0	0	0	0
Total	157	41	53	30	45	36	44	61	49	57
AREA 2B										
Groundfish Bottom Trawl	82	105	86	102	111	148	123	114	136	108
Total	82	105	86	102	111	148	123	114	136	108
AREA 2C										
Crab Pot	8	5	10	6	0	0	0	0	0	0
Groundfish Trawl	0	0	0	0	0	0	0	0	0	0
Hook & Line (non-IFQ)	2	1	3	4	3	5	7	2	2	2
Hook & Line (IFQ)	1	1	5	6	4	3	6	6	18	23
Chatham Str. Sablefish	4	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Clarence Str. Sablefish	11	11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total	26	22	19	16	8	8	13	8	21	25
AREA 3A										
Scallop Dredge	6	5	4	6	11	11	11	11	11	11
Groundfish Trawl	921	1,012	645	606	762	813	677	558	679	615
Hook & Line (non-IFQ)	50	42	108	98	70	101	95	58	28	20
Hook & Line (IFQ)	54	54	11	14	7	15	12	16	32	10
Groundfish Pot	5	10	13	15	5	11	18	4	1	0
Pr Wm Sd Sablefish	5	5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total	1,042	1,128	782	739	856	951	813	647	751	657
AREA 3B										
Crab Pot	23	23	23	23	23	23	23	23	23	23
Scallop Dredge	0	2	2	4	6	6	6	6	6	6
Groundfish Trawl	307	365	449	332	367	244	321	348	188	131
Hook & Line (non-IFQ)	122	78	48	40	52	43	56	42	6	5
Hook & Line (IFQ)	53	53	11	6	8	7	4	7	7	42
Groundfish Pot	16	10	9	20	8	5	14	6	1	1
Total	520	531	541	425	464	328	424	433	231	208

continued…

Table 10 continued. Non-directed commercial discard mortality estimates of Pacific halibut (tonnes, net weight) by year, IPHC Regulatory Area, and fishery, for 2010-19. Estimates for 2019 are preliminary.[1]

IPHC Regulatory Area and Gear	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AREA 4A										
Scallop Dredge	0	0	0	0	0	0	0	0	0	0
Crab Pot	10	7	6	12	12	12	12	12	12	12
Groundfish Trawl	363	358	596	275	279	219	211	138	123	118
Hook & Line (non-IFQ)	97	66	59	93	73	67	45	40	13	15
Hook & Line (IFQ)	7	7	2	2	1	2	1	1	1	3
Groundfish Pot	3	4	5	15	12	3	2	2	1	1
Total	480	441	668	396	377	303	272	194	150	149
AREA 4B										
Crab Pot	0	1	0	1	1	1	1	1	1	1
Groundfish Trawl	168	182	98	53	46	91	62	88	57	69
Hook & Line (non-IFQ)	29	15	12	3	11	9	2	6	5	5
Hook & Line (IFQ)	18	18	5	5	2	1	1	0	0	0
Groundfish Pot	0	0	0	2	1	0	0	0	1	1
Total	217	216	116	63	61	103	67	95	65	77
AREA 4CDE+CA										
Scallop Dredge	0	0	0	0	0	0	0	0	0	0
Crab Pot	28	22	13	13	13	17	17	17	17	17
Groundfish Trawl	1,555	1,132	1,569	1,864	1,907	1,362	1,313	1,107	1,282	1,545
Hook & Line (non-IFQ)	310	214	348	303	244	174	141	121	51	55
Hook & Line (IFQ)	2	2	0	68	5	0	0	0	0	0
Groundfish Pot	0	1	2	8	6	1	1	1	0	1
Total	1,897	1,372	1,932	2,257	2,176	1,554	1,472	1,246	1,350	1,618
AREA 4 Subtotal										
Scallop Dredge	0	0	0	0	0	0	0	0	0	0
Crab Pot	39	29	19	27	27	30	30	30	30	30
Groundfish Trawl	2,087	1,672	2,262	2,192	2,232	1,672	1,587	1,333	1,462	1,732
Hook & Line (non-IFQ)	436	294	420	398	327	250	188	168	69	76
Hook & Line (IFQ)	27	27	8	75	9	2	1	1	1	3
Groundfish Pot	4	5	7	25	19	4	3	3	2	3
Total	2,593	2,028	2,716	2,717	2,614	1,959	1,810	1,535	1,564	1,844
GRAND TOTAL	**4,420**	**3,856**	**4,215**	**4,048**	**4,119**	**3,450**	**3,427**	**2,818**	**2,771**	**2,919**

[1]Note that some totals may not sum precisely due to rounding.

Estimating Non-Directed Commercial Discard Mortality

Non-directed commercial discard mortality of Pacific halibut is estimated because not all fisheries have 100% monitoring and not all Pacific halibut that are discarded are assumed to die. Agencies estimate the amount of non-directed commercial discard that will not survive, called non-directed commercial discard mortality.

The IPHC relies upon information supplied by observer programs run by domestic agencies for non-directed commercial discard mortality estimates in most fisheries. Non-IPHC research survey information is used to generate estimates of non-directed commercial discard mortality in the few cases where fishery observations are unavailable. The NOAA-Fisheries operates observer programs off the USA West Coast and Alaska, which monitor the major groundfish fisheries. Data collected by those programs are used to estimate non-directed commercial discard mortality. Trawl fisheries off British Columbia (BC: Canada) are comprehensively monitored and non-directed commercial discard mortality information is provided to IPHC by DFO.

Off the USA West Coast, an individual quota (IQ) program was implemented in 2011 for the domestic groundfish trawl fisheries. The program is quite similar to the program for the BC trawl fishery, in that it contains an individual non-directed commercial discard mortality quota component for managing and reducing Pacific halibut non-directed commercial discard mortality. Fishery monitoring is required at 100% coverage levels, so all vessels carry an observer to record the vessel’s catch. Non-directed commercial discard mortality is reported to IPHC by NOAA Fisheries (Jannot et al. 2018). Non-directed commercial discard mortality estimates for the shrimp trawl fishery have been provided by Oregon Department of Fish and Wildlife (ODFW) staff from examinations of Pacific halibut non-directed commercial catch during gear experiments. Updated estimates were provided by ODFW in 2011.

The amount of information varies for fisheries conducted off BC, Canada. For the trawl fishery, non-directed commercial discard mortality is managed with an individual non-directed commercial discard mortality quota program implemented by DFO in 1996. Fishery observers sample the catch on each bottom trawler, collecting data to estimate catch and non-directed commercial discard mortality. Non-directed commercial discard mortality in other fisheries, such as the shrimp trawl, sablefish pot, and rockfish hook-and-line fisheries, was largely unknown until the inception of the Integrated Fisheries Management Program in 2006. The program has requirements for full accounting and accountability of all non-directed commercial discard mortality, and includes 100% at-sea monitoring, either by human observers or electronic monitoring. Estimates of trawl non-directed commercial discard mortality were provided by DFO staff at the Pacific Biological Station, based on data collected by observers. Reporting of non-directed commercial discard mortality from the non-trawl programs is being developed with DFO staff and will be provided in future reports.

Estimates of non-directed commercial discard mortality off Alaska, USA in federally managed fisheries were provided by the NOAA Fisheries Alaska Region. Several fishery programs have a mandatory 100% monitoring requirement, including the CGOARP, the BSAI CDQ fisheries, the AFA pollock cooperatives, and the BSAI A80 fishery cooperatives. NOAA Fisheries Alaska Fisheries Science Center’s Annual Deployment Plan (ADP) provides the scientific guidelines which determine how vessels not involved in these full coverage programs are chosen for monitoring, including vessels in the directed Pacific halibut IFQ fishery. Additional details about the ADP can be found in NOAA Fisheries (2017). The NOAA Fisheries projections were provided in metric tons, round weight, and were converted to net weight using net weight = round weight x 0.75.

Estimates of Pacific halibut non-directed commercial discard mortality in scallop dredge and crab fisheries are obtained from the ADF&G, but not on an annual basis. The catch estimates are based on fishery data collected by on-board observers. The most recent estimates of 2016 were rolled forward for 2017 and 2018. Work is underway to develop an annual approach to updating these data.

Non-directed Commercial Discard Mortality by Area

IPHC Regulatory Area 2A (USA: Washington, Oregon, California)

Groundfish fisheries off Washington, Oregon, and California are managed by the NOAA Fisheries, following advice and recommendations developed by the Pacific Fishery Management Council.

IPHC Regulatory Area 2B (Canada: British Columbia)

In Canada, Pacific halibut non-directed commercial discard mortality in trawl fisheries are capped at 453.6 tonnes round weight by DFO. Non-trawl non-directed commercial discard mortality is handled under an IFQ system within the directed Pacific halibut fishery cap.

IPHC Regulatory Areas 2C, 3, and 4 (USA: Alaska)

Groundfish fisheries in Alaska, USA are managed by the NOAA Fisheries, following advice and recommendations developed by the North Pacific Fishery Management Council. The North Pacific Fishery Management Council sets limits on the amount of Pacific halibut non-directed commercial discard mortality which is allowed to occur annually in the groundfish fisheries, known as the Prohibited Species Catch (PSC) limits. These PSC limits are published in metric tons (t) (round weight) and are shown in Table 11, with their equivalent net weight. If a fishery's PSC limit is reached, the fishery is closed. Certain gear types, e.g., pots or jigs, are exempted from closures due to their low non-directed commercial discard mortality properties and to encourage their use. Non-directed commercial discard mortality projected estimates for Alaskan areas in the USA in Table 10 were provided by NOAA Fisheries.

Table 11. Pacific halibut non-directed commercial discard mortality limits in the Alaska, USA groundfish fishery 2010-19.

Geographical Area	**Sector**	**Non-directed Commercial Discard Mortality Limits** (tonnes, round weight)									
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gulf of Alaska	Trawl	2,000	2,000	2,000	1,973	1,848	1,759	1,706	1,706	1,706	1,706
	Fixed Gears	300	300	300	300	279	270	266	266	266	266
Bering Sea/ Aleutian Islands	Trawl	3,625	3,575	3,525	3,525	3,525	3,525	2,805	2,805	2,805	2,805
	Fixed Gears	900	900	900	900	900	900	710	710	710	710
Geographical Area	**Sector**	**Non-directed Commercial Discard Mortality Limits** (tonnes, net weight)									
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gulf of Alaska	Trawl	1,500	1,500	1,500	1,480	1,386	1,319	1,280	1,280	1,280	1,280
	Fixed Gears	225	225	225	225	209	203	200	200	200	200
Bering Sea/ Aleutian Islands	Trawl	2,719	2,681	2,644	2,644	2,644	2644	2104	2104	2104	2104
	Fixed Gears	675	675	675	675	675	675	533	533	533	533

IPHC Regulatory Area 2C (USA: Southeast Alaska)

For the federal waters of IPHC Regulatory Area 2C, only non-directed commercial discard mortality by hook-and-line vessels fishing in the outside waters were reported by NOAA Fisheries. These vessels are primarily targeting Pacific cod and rockfish (*Sebastes* spp.) in open access fisheries, and sablefish in the IFQ fishery.

Fisheries occurring within state waters and resulting in Pacific halibut non-directed commercial discard mortality include pot fisheries for red and golden king crab, and tanner crab. Information is provided periodically by ADF&G, and the estimate was again rolled forward.

IPHC Regulatory Area 3 (USA: Eastern, Central and Western Gulf of Alaska)

IPHC Regulatory Area 3 is comprised of Areas 3A and 3B. IPHC tracks non-directed commercial discard mortality for each IPHC Regulatory Area due to assessment and stock management needs, while groundfish fisheries operate throughout both areas. Trawl fisheries are responsible for the majority of the non-directed commercial discard mortality in these IPHC Regulatory Areas, with hook-and-line fisheries a distant second (Table 10). State-managed crab and scallop fisheries are also known to take Pacific halibut as non-directed commercial discard mortality, but at low levels.

IPHC Regulatory Area 3 remains the area where non-directed commercial discard mortality mortality is estimated most poorly. Observer coverage for most fisheries is relatively low. Tendering, loopholes in trip cancelling, and safety considerations likely result in observed trips not being representative of all trips (observed and unobserved) in many regards (e.g. duration, species composition, etc.. This, plus low coverage, lead to increased uncertainty in these **non-**directed commercial discard mortality estimates and to potential for bias.

IPHC Regulatory Area 4 (USA: Bering Sea and Aleutian Islands)

Pacific cod is the major fishery in this IPHC Regulatory Area with Pacific halibut non-directed commercial discard mortality, which is conducted in the late winter/early spring and late summer. Almost all of the vessels are required to have 100% observer coverage because of the vessel's size and requirements of their fishery cooperative; very few small vessels fish Pacific cod in this IPHC Regulatory Area. Because of this high level of observer coverage, non-directed commercial discard mortality estimates for this and other IPHC Regulatory Area 4 fisheries are considered reliable.

Pots are used to fish for Pacific cod and sablefish and fish very selectively. Non-directed commercial discard mortality rates are quite low and survival is relatively high. Annual non-directed commercial discard mortality mortality estimates are typically low, usually less than 7 tonnes.

Within the Bering Sea, non-directed commercial discard mortality mortality estimates have typically been the highest in IPHC Regulatory Area 4CDE (Table 10). This is due to the groundfish fisheries which operate in the area, i.e., those for flatfish.

IPHC FISHERY-INDEPENDENT SETLINE SURVEY AND OTHER RESEARCH

The IPHC's FISS provides catch information and biological data on Pacific halibut (*Hippoglossus stenolepis)* that are independently collected from the commercial fishery. Approximately 393 tonnes (866,000 pounds) of Pacific halibut were landed from the FISS in 2019 with the amount landed from each IPHC Regulatory Area documented IPHC-2019-IM095-06.

RECOMMENDATION/S

That the Commission:

1) **NOTE** paper IPHC-2019-IM095-05 Rev_1 which provides preliminary fishery statistics from fisheries catching Pacific halibut during 2019, including the status of removals compared to fishery limits implemented by the Contracting Parties.

REFERENCES

Jannot, J.E., Somers, K., Riley, N.B., Tuttle, V., and McVeigh, J. 2018. Pacific Halibut Bycatch in the US West Coast Fisheries (2002-2017). NOAA Fisheries, NWFSC Observer Program, 2725 Montlake Blvd E., Seattle, WA 98112. 134 p. Available online at: https://www.pcouncil.org/wp-content/uploads/2018/08/I1b_NMFS_NWFSC_Rpt2_E-Only_Pacific_Halibut_Bycatch_2002_2017_SEPT2018BB.pdf

NOAA Fisheries. 2016. 2017 Annual Deployment Plan for Observers in the Groundfish and Halibut Fisheries off Alaska. National Oceanic and Atmospheric Administration, 709 West 9th Street. Juneau, Alaska 99802. Published December 2016. 30 p. Available online at: https://alaskafisheries.noaa.gov/sites/default/files/2017finaladp.pdf

APPENDICES

Nil

IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2019

PREPARED BY: IPHC SECRETARIAT (L. ERIKSON AND R. WEBSTER; 26 OCTOBER 2019)

PURPOSE

To provide preliminary results of the IPHC Fishery-Independent Setline Survey (FISS) expansions in IPHC Regulatory Areas 3A and 3B in 2019, a general overview of FISS results, and a discussion of the Pacific halibut weight sampling undertaken on the FISS in 2019.

BACKGROUND

The annual IPHC Fishery-Independent Setline Survey (FISS) of the Pacific halibut stock has been augmented each year since 2014 with expansion stations that fill in gaps in coverage in the annual FISS. Typically, expansions have taken place in one or two IPHC Regulatory Areas each year, with IPHC Regulatory Areas 2A and 4A undertaken in 2014, the eastern Bering Sea flats in 2015, the IPHC Regulatory Area 4CDE shelf edge in 2016, IPHC Regulatory Areas 2A and 4B in 2017, IPHC Regulatory Areas in 2B and 2C in 2018 and IPHC Regulatory Areas in 3A and 3B in 2019.

Prior to 2019, only fixed gear was used to fish FISS sets. With increasing use of snap gear in the commercial fishery, this restriction has limited the number of vessels available for the FISS. Further, any differences between snap and fixed gears (including catch rate differences and differences in fishing locations) may affect our understanding of trends in commercial fishery indices. This has motivated the need for a study comparing the two gear types.

Data from IPHC collections from commercial landings and other sources have provided evidence that the current standard length-net weight curve used for estimating Pacific halibut weights on the FISS may be over-estimating weights on average in most IPHC Regulatory Areas, and that the relationship between weight and length may vary spatially. Prior to 2019, the FISS depended on the standard curve for estimation of all Pacific halibut weights, and therefore questions have arisen regarding the accuracy of estimates that depend on these weights, including weight per unit effort (WPUE) indices of density.

Interactive views of some of the FISS results were provided via the IPHC website and can be found here:

https://www.iphc.int/data/setline-survey-catch-per-unit-effort

INTRODUCTION

In most IPHC Regulatory Areas, the standard, annual FISS grid is fished in waters within the 37-503 m (20-275 fm) depth range. Information from commercial fishery data and other fishery-independent sources showed the presence of Pacific halibut down to depths of 732 m (400 fm) and in waters shallower than 37 m. Further, most IPHC Regulatory Areas had significant gaps in coverage within the standard 37-503 m depth range. The incomplete coverage of Pacific halibut habitat by the FISS had the potential to create bias in estimates of the weight per unit effort and numbers per unit effort (NPUE) density indices used in the stock assessment modelling and for stock distribution estimation. For this reason, the IPHC has been undertaking a sequence of FISS expansions since 2014 (following a 2011 pilot), with stations added to the standard grid to cover habitat not previously sampled on the FISS. The expansions involve adding stations to one or two IPHC Regulatory Areas each year, and reverting to the standard annual grid for those areas in subsequent years. In 2019, FISS expansions took place in IPHC Regulatory Areas 3A and 3B.

In addition, a comparison of the use of snap gear to the use of fixed gear on the FISS was conducted in IPHC Regulatory Area 2C. The design featured each station being fished twice, once with fixed gear and once with snap gear, with randomisation of the order of the two gear types for each station. The comparison will provide data on any differences between catch (e.g. Pacific halibut catch rates, age and size distribution, bycatch species) on the two gears.

In 2019, weighing of Pacific halibut at sea throughout the FISS was introduced in order to improve the quality of estimates based on Pacific halibut weight. The use of direct weight measurements will lead to more accurate estimates of WPUE and other quantities based on weights, allow estimation of length-weight curves based on all sizes available to longline gear (whereas collections from commercial landings only measure fish greater than or equal to 81.3 cm in length) and provide additional information on biases in the standard curve and spatial differences in the length-weight relationship.

MATERIALS AND METHODS

The IPHC's FISS design encompasses nearshore and offshore waters of the IPHC Convention Area (Figure 1). The current FISS station layout has been in place since 1998 (with some additions in 2006 (Bering Sea), and in 2011 (IPHC Regulatory Area 2A).

The IPHC Regulatory Areas are divided into 31 regions, each requiring between 10 and 46 charter days to survey. FISS stations were located at the intersections of a 10 nmi by 10 nmi square grid within the depth range occupied by Pacific halibut during summer months (20-275 fm [37-503 m] in most areas). Figure 2 depicts the 2019 FISS station positions (including expansion stations), charter region divisions, and IPHC Regulatory Areas surveyed.

Thirteen extra stations in southeast Alaska and eight rockfish (*Sebastes spp*.) index stations in the Washington charter region are fished on a different layout than the FISS and are included in the IPHC stock assessment dataset.

Fishing vessels are chosen through a competitive bid process each year where up to 3 regions per vessel are awarded and typically 10-15 vessels are chosen.

The 2019 FISS chartered eighteen (18) commercial longline vessels (eight Canadian and ten USA) during a combined 97 trips and 939 charter days. Of the 1,439 FISS stations planned for the 2019 FISS season, 1,369 (95%) were effectively completed. Twenty-three expansion stations were not fished because they were either too deep or too shallow once prospected. The remaining 54 stations were rated ineffective because of whale depredation (n=41), sand flea damage (n=7), gear soak time exceeded 24 hours (n=2), shark depredation (n=1), and setting and gear issues (n=4). Otoliths were removed from 18,210 fish coastwide. Approximately 390 tonnes (860,000 pounds) of Pacific halibut, 70 tonnes (130,000 pounds) of Pacific cod, and 34 tonnes (75,000 pounds) of rockfish were landed from the FISS stations.

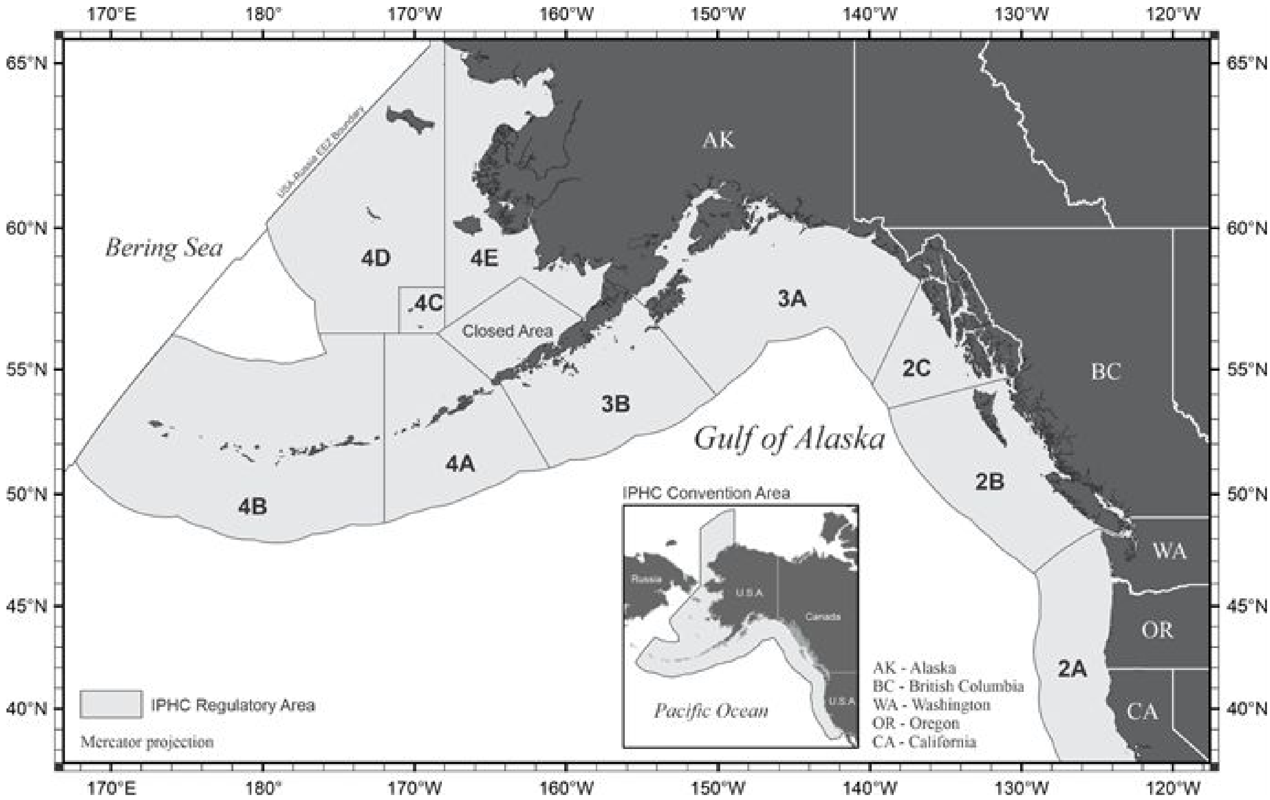

Figure 1. Map of the IPHC Convention Area (insert) and IPHC Regulatory Areas.

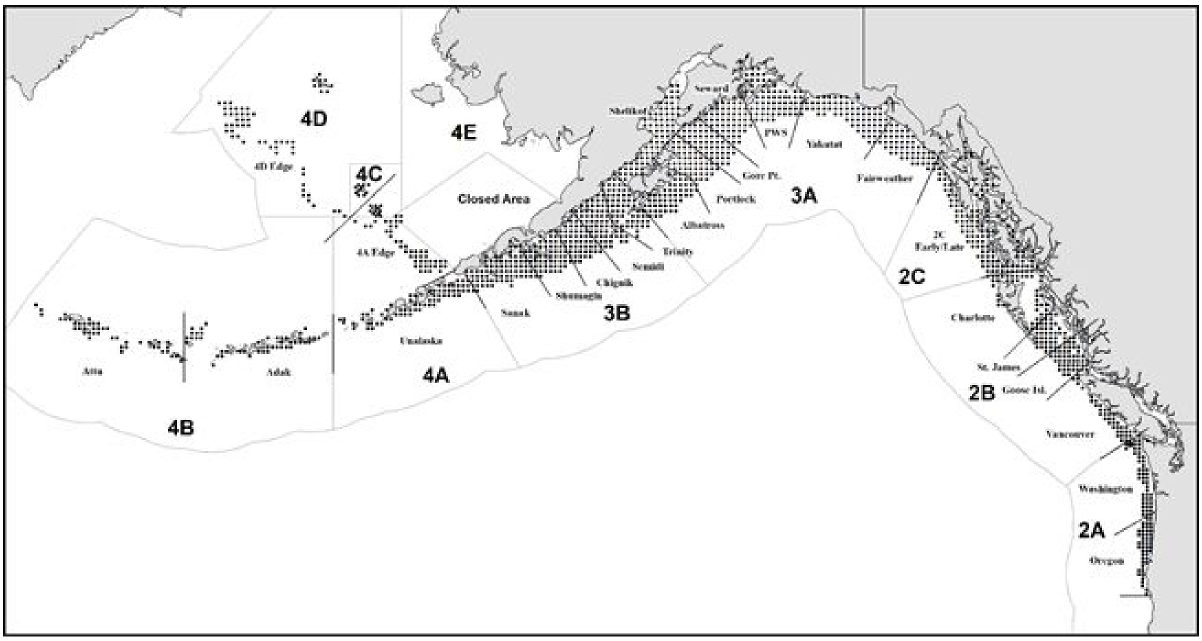

Figure 2. 2019 FISS station positions, charter region divisions, and IPHC Regulatory Areas.

Expansion stations

Since 2014, the IPHC has been sampling expansion FISS stations in one or two IPHC Regulatory Areas each year (Figure 3). Commercial fishery data and other sources have shown the presence of Pacific halibut down to depths of 732 m (400 fm) and in waters shallower than 37 m (20 fm). The IPHC has been undertaking a sequence of expansions since 2014 (following a 2011 pilot), with FISS stations added to the standard grid to cover habitat not previously sampled.

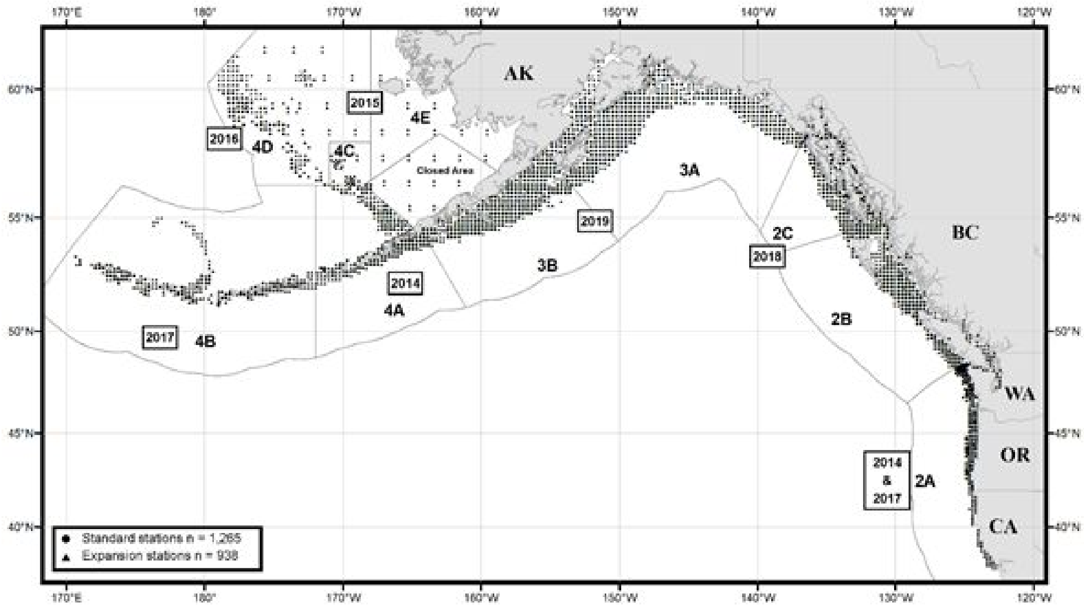

Figure 3. FISS expansion stations planned for 2014-19.

2019 Expansion in IPHC Regulatory Area 3A

The FISS expansion in IPHC Regulatory Area 3A included an additional 89 stations that were added to the existing 374 FISS stations (standard) in IPHC Regulatory Area 3A. These included stations as shallow as 9 fathoms (17 m) and as deep as 399 fathoms (732 m) (Figure 4).

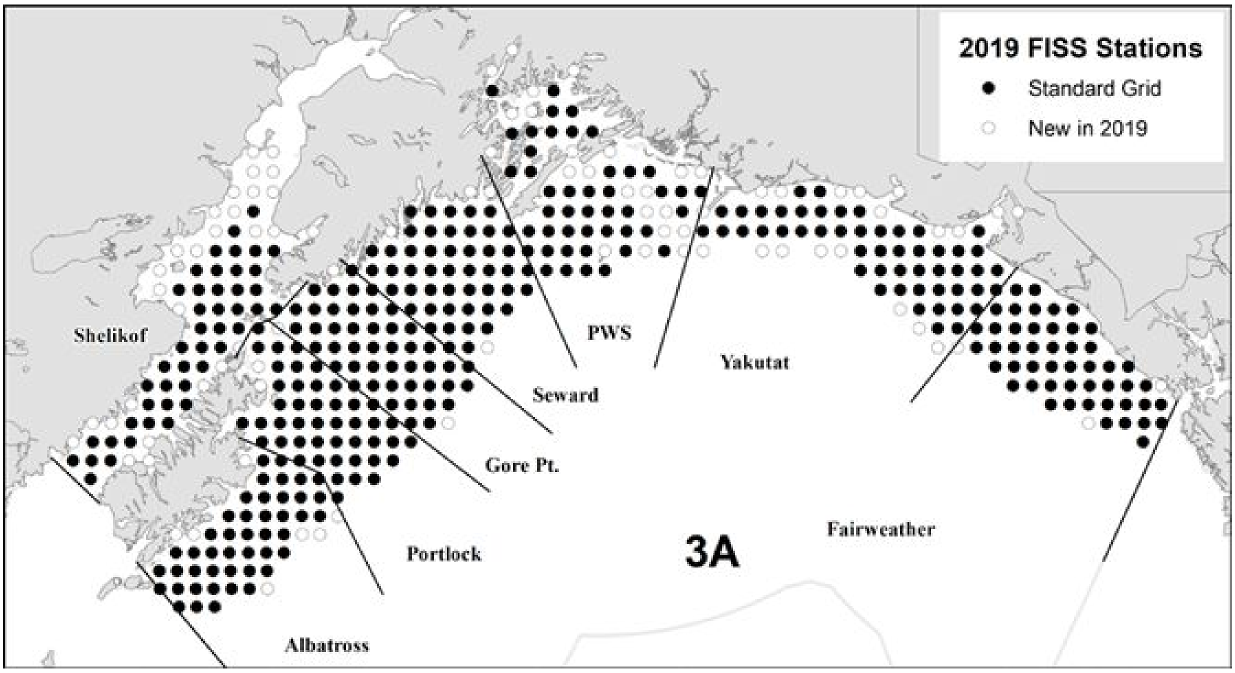

Figure 4. 2019 IPHC FISS stations in IPHC Regulatory Area 3A by charter region.

2019 Expansion in IPHC Regulatory Area 3B (USA)

The FISS expansion in IPHC Regulatory Area 3B included 231 of the existing FISS stations (standard) with an additional 66 stations, including stations as shallow as 9 fathoms (17 m) and as deep as 399 fathoms (732 m) (Figure 5).

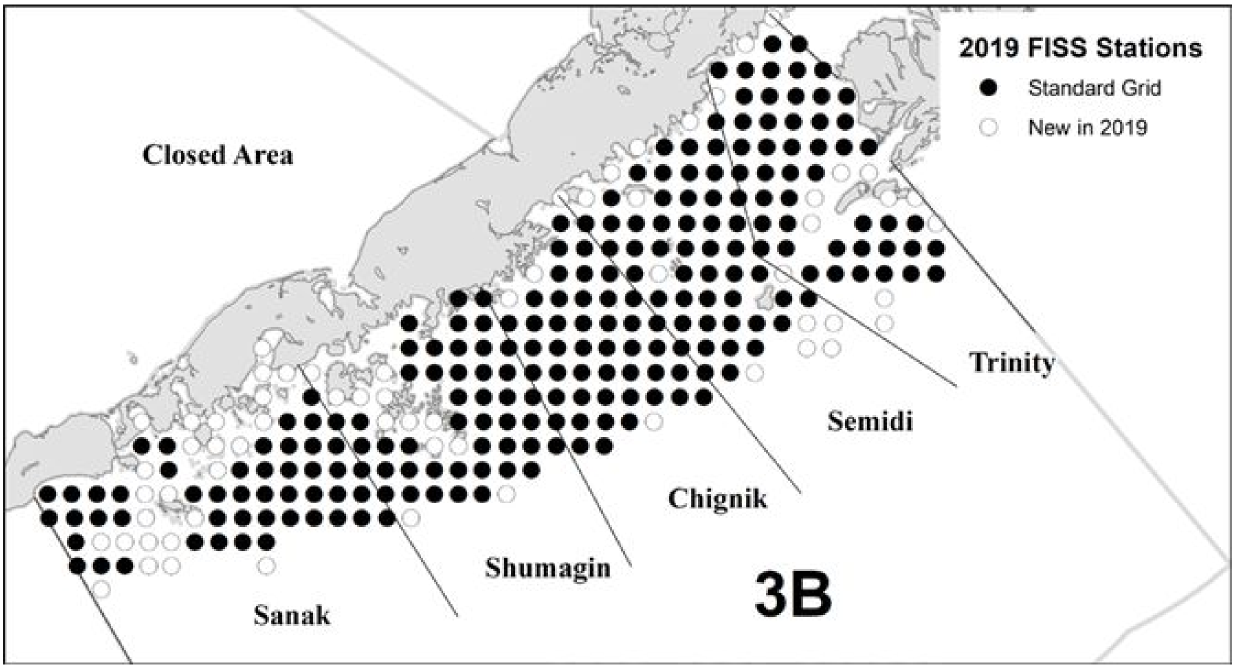

Figure 5. 2019 FISS stations in IPHC Regulatory Area 3B by charter region.

Sampling protocols

Setline Survey Specialists collected data according to protocols established in the 2019 FISS Manual.

Bait purchase

The minimum quality requirement for FISS bait is No. 2 semi-bright (Alaska Seafood Marketing Institute grades A through E), headed and gutted, and individually quick-frozen chum salmon. The IPHC secures most of the bait needed to supply FISS operations at the end of the previous salmon season. In August 2018, staff began arranging bait purchases for the 2019 FISS. Approximately 185 tonnes of chum salmon were utilized from three suppliers in the United States of America. Bait usage is based on 0.17 kilograms per hook resulting in approximately 117 kilograms per 7 skate station. Bait quality was monitored and documented throughout the season and found to meet the standard as described above.

RESULTS AND REVENUE

Beginning in 2017, interactive views of some of the FISS results were provided via the IPHC website and can be found here: https://www.iphc.int/data/setline-survey-catch-per-unit-effort.

As in previous years, legal-sized Pacific halibut that were caught on FISS stations and sacrificed in order to obtain biological data were retained and sold. This helps to offset costs of the FISS program. FISS vessels also retained for sale incidentally captured rockfish (*Sebastes spp*.) and Pacific cod (*Gadus macrocephalus*). These species were retained because they rarely survive the barotrauma resulting from capture. Most vessel contracts provided the vessel a lump sum payment, along with a 10% share of the Pacific halibut proceeds and a 50% share of the incidental catch proceeds. The *R/V Pacific Surveyor* received no share of Pacific halibut or bycatch proceeds. The IPHC does not retain proceeds from the sale of incidentally captured rockfish and Pacific cod. Instead, for retained bycatch captured in USA waters, proceeds are divided equally between the vessel (for handling expenses) and the state management agency. In Canada, Fisheries and Oceans Canada (DFO) receives all proceeds from sales of retained bycatch captured in Canadian waters, subsequent to abovementioned deduction of the predetermined vessel bycatch processing fees.

Vessels chartered by the IPHC delivered fish to 23 different ports (Table 1). Fish sales were awarded based on the objectives of obtaining a fair market price and distributing sales among buyers and ports. When awarding sales, the Commission considered the price offered, the number of years that a buyer had been buying and marketing Pacific halibut, how fish were graded at the dock (including the determination of No. 2 and chalky Pacific halibut), and the promptness of settlements following deliveries. Obtaining fair market value was the main consideration in awarding fish sales. However, sales were sometimes awarded to buyers not offering the highest prices, thereby meeting the goal of distributing sales among qualified buyers. Individual sales were evaluated after each event to ensure that the buyer was meeting IPHC standards. Average prices decreased from $12.65/kg in 2018 to $12.31/kg in 2019.

Table 1. FISS Pacific halibut landings by port, 2019[1,2].

Offload Port	Trips	Tonnes	Pounds	Total USD	Average Price (USD/kg)	Average Price (USD/lb)
Adak	5	13	28,345	$126,197	$9.82	$4.45
Astoria	1	1	1,801	$13,984	$17.12	$7.76
Charleston	1	1	2,362	$18,318	$17.10	$7.76
Cordova	1	6	12,173	$73,655	$13.34	$6.05
Dutch / Unalaska	7	17	38,232	$168,012	$9.69	$4.39
Homer	5	22	48,007	$299,517	$13.75	$6.24
Juneau/Auke Bay	2	9	19,092	$115,496	$13.34	$6.05
Ketchikan	3	15	33,464	$185,351	$12.21	$5.54
Kodiak	13	51	113,278	$608,893	$11.85	$5.38
Neah Bay	1	2	4,619	$24,566	$11.73	$5.32
Newport	3	3	5,639	$43,701	$17.09	$7.75
Petersburg	1	8	18,468	$104,657	$12.49	$5.67
PHardy/Beaver C/Coal	3	13	29,390	$244,968	$13.92	$6.31
Prince Rupert	12	67	148,448	$1,215,468	$13.68	$6.20
Sand Point	8	26	56,388	$243,258	$9.51	$4.31
Seward	8	44	97,571	$587,082	$13.27	$6.02
Sitka	8	47	103,494	$557,735	$11.88	$5.39
St Paul	4	9	19,736	$75,105	$8.39	$3.81
Steveston	1	3	5,584	$54,050	$16.17	$7.33
Ucluelet/Barkley Sd	1	4	9,011	$84,158	$15.60	$7.08
Valdez	1	8	17,201	$84,191	$10.79	$4.89
Westport/Grayland	1	1	2,764	$14,607	$11.65	$5.28
Yakutat	7	21	45,672	$250,504	$12.09	$5.48
Grand Total	**97**	**390**	**860,739**	**$ 4,805,923**	**$12.31**	**$5.58**

[1] Net weight (head-off, dressed, washed).
[2] Prices based on net weight.

FISS timing

Each year, the months of June, July, and August are targeted for FISS fishing. On a coastwide basis, FISS vessel activity was highest in intensity at the beginning of the FISS season and declined early in August as boats finished their charter regions (Figure 6). All FISS activity was completed by late-September.

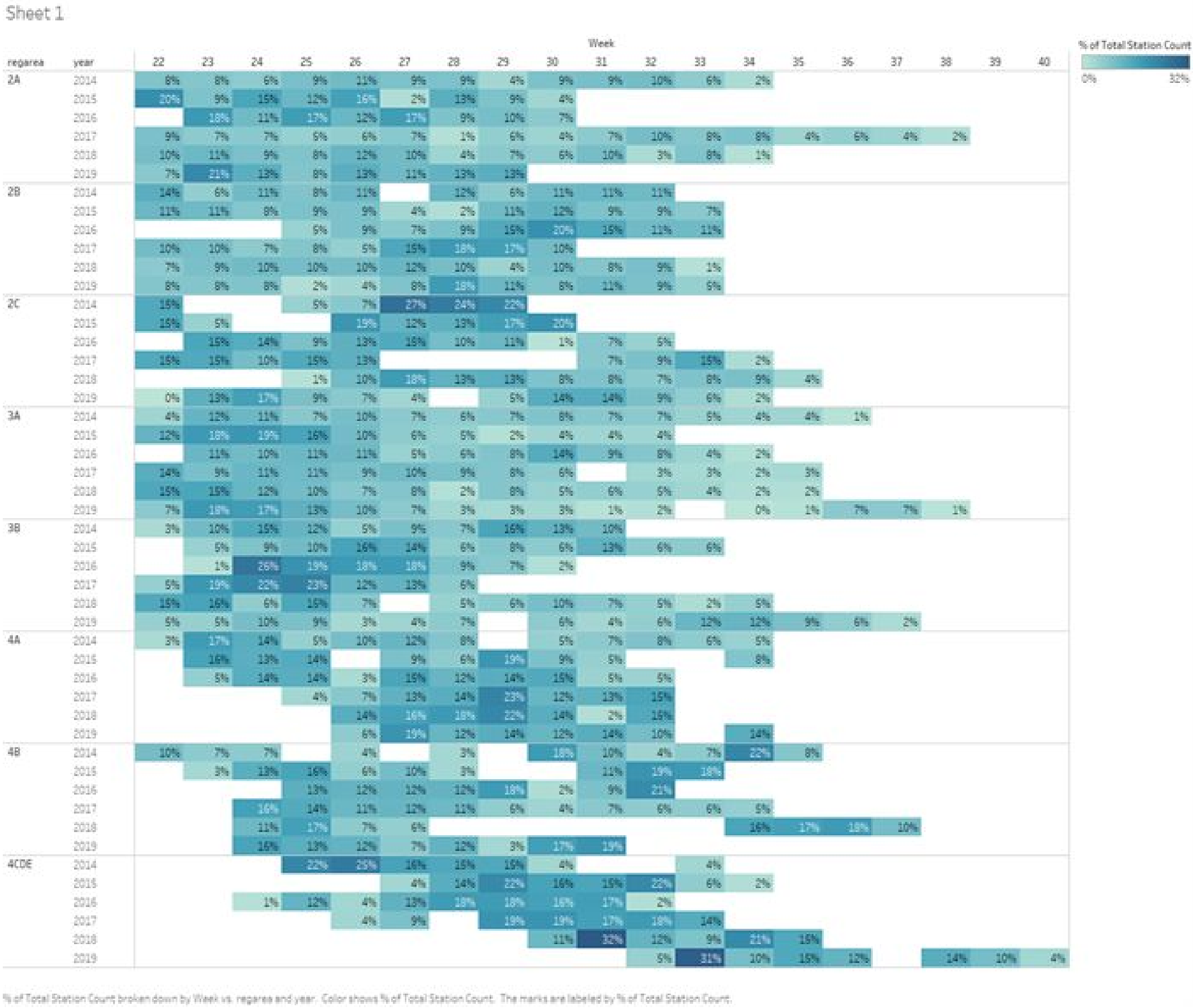

Figure 6. Percent of the total FISS stations completed by IPHC Regulatory Area during each week of the year. Week 22 begins in late May or early June depending on the year.

RECOMMENDATION/S

That the Commission **NOTE** paper IPHC-2019-IM095-06 which provided an overview of the IPHC's FISS design and implementation in 2019, including current and future expansions.

APPENDICES

Nil

INTERNATIONAL PACIFIC HALIBUT COMMISSION

Space-time modelling of IPHC Fishery-Independent Setline Survey (FISS) data

PREPARED BY: IPHC SECRETARIAT (R. WEBSTER; 23 OCTOBER; 22 NOVEMBER 2019)

PURPOSE

To provide the Commission with a summary of the results of the 2019 space-time modelling of Pacific halibut survey data (which includes data from other fishery-independent surveys), as well as results of the IPHC fishery-independent setline survey (FISS) expansions in IPHC Regulatory Areas 3A and 3B, and modelling results from fixed and snap gear comparison in Regulatory 2C. Also presented are methods for rationalising the FISS following completion of the final set of expansions in 2019.

BACKGROUND/INTRODUCTION

The IPHC has completed a series of FISS expansions, beginning with a 2011 pilot in IPHC Regulatory Area 2A, and continuing from 2014-19 as follows:

- 2014: Regulatory Areas 2A and 4A
- 2015: Regulatory Area 4CDE eastern Bering Sea flats
- 2016: Regulatory Area 4CDE shelf edge
- 2017: Regulatory Areas 2A and 4B
- 2018: Regulatory Areas 2B and 2C
- 2019: Regulatory Areas 3A and 3B

The purpose of the expansion program has been to fill in the often large gaps in the annually-fished FISS to build a complete picture of Pacific halibut density throughout its range, and thereby reduce bias and improve precision in density indices and other quantities computed from the FISS data.

With the expansions completed in 2019, the intention is to use our improved understanding of the Pacific halibut distribution to re-design the annual FISS. As a result, it is likely that stations that were previously fished annually may require less frequent fishing, and it may be efficient to annually fish some expansion stations that have been surveyed just once to date. This report proposes criteria and methods for evaluating such a FISS rationalisation, and uses Regulatory Area 4B as an example to demonstrate the application of our proposed approach. We envision the rationalisation as an ongoing process: as new data become available each year and relative costs change with time, future designs choices will be re-evaluated and modified to adapt to changing data needs.

Snap gear is increasingly used in the commercial fishery, and allowing vessels using snap gear to participate in the FISS (previously fixed-gear only) increases the number of available vessels. Using a study design that fished each FISS station in Regulatory 2C twice, once with each gear type, provided data for comparing snap and fixed gears, including examining the effect of gear type on weight and numbers per unit effort indices through space-time modelling.

Space-time modelling results for 2019

Revisions to the data inputs for space-time modelling of survey data include: the addition of expansion stations in Regulatory Areas 3A and 3B; the use of direct individual weight measurements of FISS Pacific halibut in computing 2019 station-level WPUE; the application of revised effectiveness criteria for whale depredation for FISS sets; the inclusion of snap-gear data in Regulatory Area 2C modelling; and the inclusion of FISS stations within the area of overlap of US and Canadian maritime claims in Dixon entrance in the estimation of WPUE and NPUE indices in both Regulatory Areas.

Figures 1-2 show time series estimates of O32 WPUE (most comparable to fishery catch-rates) and all sizes NPUE over the 1993-2019 period included in the 2019 space-time modelling. Declines of 4-5% were estimated in all three indices from 2018-19, largely driven by 8-10% declines in Biological Region 3. Equivalent figures for Regulatory Areas are in Appendix A.

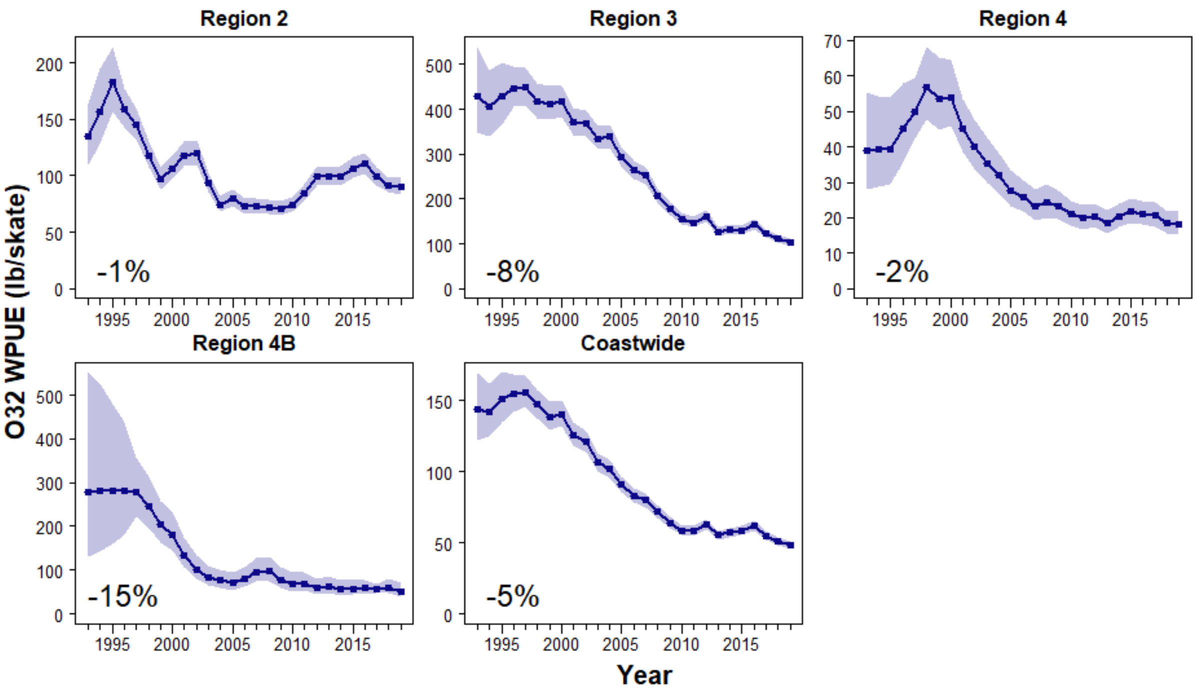

Figure 1. Space-time model output for O32 WPUE for 1993-2019 for Biological Regions. Filled circles denote the posterior means of O32 WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean O32 WPUE from 2018 to 2019.

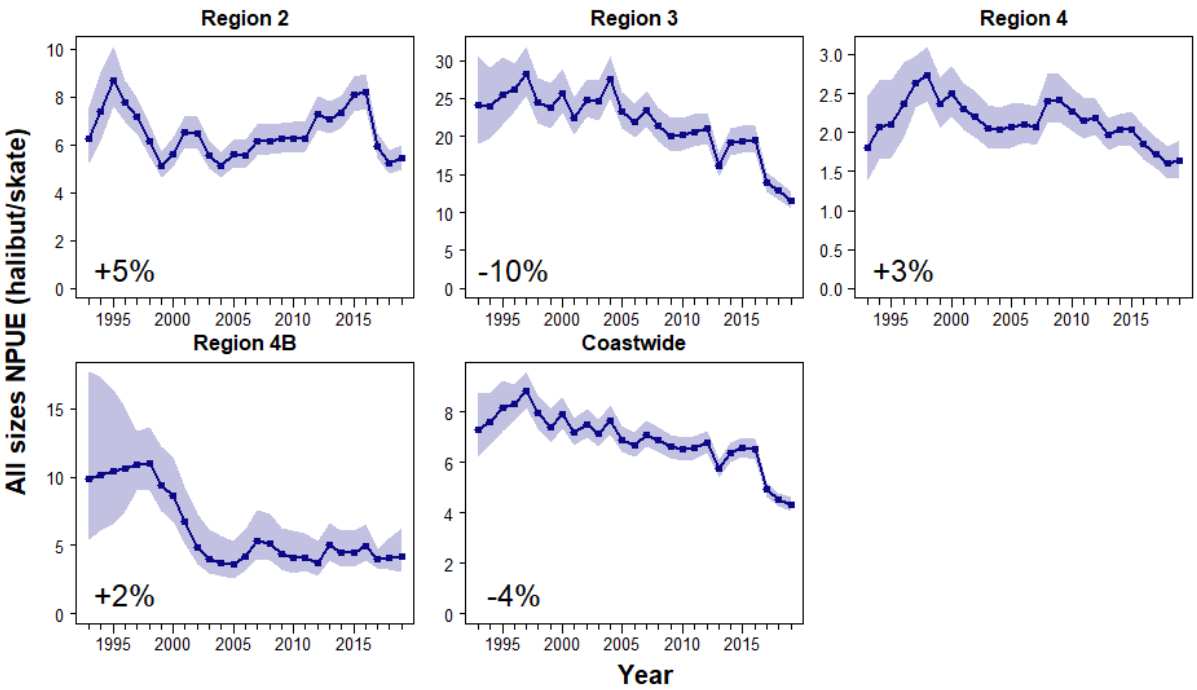

Figure 2. Space-time model output for all sizes NPUE for 1993-2019 for Biological Regions. Filled circles denote the posterior means of all sizes NPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean all sizes NPUE from 2018 to 2019.

In Regulatory Area 2C, data from both fixed and snap gears were used in the modelling. Parameters allowing for different catch rates of the two gears were included in the models, and estimates of WPUE and NPUE series were based on model predictions assuming fixed gear to ensure consistency with other Regulatory Areas. Comparisons of estimates based on data with and without the snap gear data show no meaningful effect of including the snap gear data on either means or uncertainty (Appendix B). Note that these figures do not imply there were no gear differences in catch rates, since we have standardized for gear type by predicting at fixed gear only. Indeed, parameter estimates of gear type differences showed some evidence that snap gear catch rates were lower on average (Table 1), with estimated catch rate ratios of 0.86 for all three indices modelled in 2019 (i.e., we estimate snap gear had 86% of the catch of fixed gear on average). Posterior 95% credible intervals all had an upper limit of 1.00, i.e., no difference in catch rate, so evidence for a difference in gear types was not strong. Although there is no impediment to using these data in generating estimates of indices, with the calibration estimated within the space-time model, the results imply the need to collect additional data comparing fixed and snap gears in order to better understand the relative efficiency of the gears and potential variability over time and space.

Table 1. Posterior estimates of the ratio of snap to fixed gear catch rates for O32 and all sizes WPUE, and all sizes NPUE, from space-time modelling of data from Regulatory Area 2C in 2019.

Variable	Ratio of snap to fixed catch rate	
	Posterior mean	**95% credible interval**
O32 WPUE	0.86	0.74 – 1.00
All sizes WPUE	0.86	0.75 – 1.00
All sizes NPUE	0.86	0.75 – 1.00

The 2019 FISS expansions in Regulatory Areas 3A and 3B led to improvements in precision and reductions in bias (Appendix C). This was particularly true for Regulatory Area 3A, where the addition of expansion stations to previously very poorly-predicted locations in places like Cook Inlet and Prince William Sound greatly reduced uncertainty (Figures C.1 and C.2).

Methods for FISS rationalisation

The overall goal of the FISS rationalisation is to maintain or enhance data quality (precision and bias), while minimizing the annual scope of the survey, subject to the cost constraints of the FISS budget. Here we propose some precision targets, discuss an approach for reducing the chance of large biases, and note the importance of considering costs in any redesign.

Precision targets

Previously, the IPHC Secretariat had an informal goal of maintaining a coefficient of variation (CV) of no more than 15% for mean WPUE for each IPHC Regulatory Area. Including all expansion data to date, this goal has been achieved in all areas from 2011, the year of the first pilot expansion (Table 2), except Regulatory Area 4B in 2011-14 and 2019 for O32 WPUE and 2011-12 and 2019 for all sizes WPUE, and Regulatory Area 4A in 2016-19 (O32 and all sizes WPUE).

Table 2. Range of coefficients of variation for O32 and all sizes WPUE from 2011-18 by Regulatory Area.

Reg Area	O32 WPUE (2011-19)				All sizes WPUE (2011-18)			
	Lowest CV (%)	Year	Highest CV (%)	Year	Lowest CV (%)	Year	Highest CV (%)	Year
2A	10	2014*	13	2019	10	2014*	13	2019
2B	5	2018*	7	2019	5	2018*	7	2012
2C	5	2018*	6	2012	5	2018*	6	2011
3A	4	2017	5	2011	5	2019	5	2011
3B	7	2019*	8	2015	9	2018	10	2015
4A	12	2014*	18	2019	10	2014*	19	2019
4B	10	2017*	16	2012	10	2017*	16	2012
4CDE	10	2017#	11	2013	5	2015*	6	2019

* Year of FISS expansion in Reg. Area. # Year of NMFS trawl expansion in Reg. Area 4CDE.

Considering Biological Regions, CVs for WPUE in Region 2 and Region 3 were at or below 5% in all years from 2011 (Table 3). Region 4 CVs for WPUE were below 10%, while the smallest region, Region 4B, has some years with CVs above 15% as noted previously. For all sizes NPUE (Table 4), CVs were above 10% in all Regions except Region 4B. Based on this information, constraining the FISS design to produce CVs of 10% or less for Regions 2-4 and 15% for Region 4B should allow for some reduced FISS effort in the former regions, while maintaining low uncertainty in Region 4B.

Table 3. Range of coefficients of variation for O32 and all sizes WPUE from 2011-19 by Biological Region.

Region	WPUE (2011-19)				All sizes WPUE (2011-19)			
	Lowest CV (%)	Year	Highest CV (%)	Year	Lowest CV (%)	Year	Highest CV (%)	Year
2	4	2018*	4	2012	4	2018*	4	2012
3	4	2019*	4	2011	4	2018	5	2011
4	8	2014*	9	2019	5	2014*	9	2019
4B	10	2017*	16	2012	10	2017*	16	2012

* Year of FISS expansion in at least part of the Region.

Table 4. Range of coefficients of variation for all sizes NPUE from 2011-19 by Biological Region.

Region	All sizes NPUE (2011-19)			
	Lowest CV (%)	Year	Highest CV (%)	Year
2	4	2018*	5	2011
3	4	2018*	5	2011
4	5	2014*	8	2019
4B	9	2017*	20	2019

* Year of FISS expansion in at least part of the Region.

Finally, the CV of coastwide, all sizes NPUE (used in the stock assessment) is estimated to be from 3-9% for all years of estimation from 1993 to 2019 (3-4% for 2011-19). This suggests a target of 10% for the CV of this index will ensure that uncertainty is maintained at a low level for this key stock assessment input.

In summary, in order to maintain the quality of the estimates used for the assessment, and for estimating stock distribution, we propose that a rationalised FISS should be designed to meet the following precision targets:

- CVs below 15% for O32 and all sizes WPUE for all Regulatory Areas
- CVs below 10% for O32 WPUE, all sizes WPUE, and all sizes NPUE for Regions 2, 3 and 4
- CVs below 15% for O32 WPUE, all sizes WPUE, and all sizes NPUE for Region 4B
- CVs below 10% for the coastwide, all sizes NPUE index

Reducing the potential for bias

With these targets set, we can proceed to using the space-time modelling to evaluate different FISS designs by IPHC Regulatory Area and Biological Region. However, sampling a subset of stations in any area or region brings with it the potential for bias, when trends in the unsurveyed portion of a management unit (Regulatory Area or Region) differ from the surveyed portion. To reduce the potential for bias, we also looked at how frequently part of an area or region (called a “subarea” here) should be surveyed in order to reduce the likelihood of appreciable bias. For this, we propose a threshold of a 10% absolute change in biomass percentage: how quickly can a subarea’s percent of the biomass of a Regulatory Area or Region’s change by at least 10%? By sampling each subarea frequently enough to keep down the chance of its percentage changing by more than 10% between successive surveys of the subarea, we reduce the potential for appreciable bias in the Regulatory Area or Region’s indices as a whole.

Cost constraints
While there are financial benefits to sampling low-density waters less frequently, reduced sampling frequency in high-density waters will result in a loss of income generated from fish sales. Thus, there are constraints on the how the FISS design can be modified in a given year. Consideration of the effect of FISS operating costs and cost recovery will be part of the final analysis, and is likely to constrain options for reducing annual effort in high-density Regulatory Areas and limit the frequency of surveys in remote, low density regions. Any decisions on future survey designs must account for the relative costs of design options, and be subject to overall budget limitations.

Analytical methods
We propose examining the effect of subsampling a management unit on precision as follows:

- Identify subareas within each management unit and select priorities for future sampling
- Generate simulated data for all FISS stations based on the output from the most recent space-time modelling
- Fit space-time models to the 1993-2018 observed data augmented with 1 to 3 additional years of data, where the design over those three years reflects the sampling priorities identified above

Extending the modelling beyond three years is not considered worthwhile, as we expect further evaluation undertaken following collection of data during the 1-3 year time period to influence design choice to subsequent years.

Ideally, a full simulation study with many replicate data sets would be used, but this is impractical for the computationally time-consuming spatio-temporal modelling. Instead, “simulated” sample data sets for the future years will be taken from the 2000 posterior samples from the most recent year’s modelling. Each year’s simulated data will have to be added and modelled sequentially, as subsequent data can improve the precision of prior years’ estimates, meaning the terminal year is often the least precise (given a consistent design). If time allows, the process can be repeated with several simulated data sets to ensure consistency in results, although with large enough sample sizes (number of stations) in each year, we would expect even a single fit to be informative.

Example: IPHC Regulatory Area 4B

Regulatory Area 4B was chosen as an example for discussion as it is a relatively small area (and so models are quite quick to run), can be divided into fairly distinct subareas based on the 2017 expansion results, and is likely to benefit from a redesign as it has a high potential for exceeding CV targets and is costly to survey. We began by dividing Regulatory Area 4B into three subareas based on the results of the 2017 expanded FISS (Figure 2):

1. West of Kiska Is. At present, a relatively low density subarea, but one that previously had much higher densities of Pacific halibut. (57 stations)
2. East of Kiska Is, and west of Amchitka Pass, including Bowers Ridge. Also at present a low density subarea, but one largely unsurveyed before 2017. (73 stations)
3. East of Amchitka Pass. Currently, a subarea of relatively high density and stability, although with higher density in the past. (73 stations)

In recent years, the bulk of the 4B stock (70-80%, Figure 3) is estimated to have been in Subarea 3. With standard deviations typically increasing with the mean for this type of data, focusing FISS effort on this subarea in future surveys may succeed in maintaining target CVs, while reducing net cost. However, Subarea 1's percentage of the biomass can also change by relatively large amounts over short time frames, with absolute changes of over 10% over as little as 3-4 years (Table 4). This also should be accounted for in a three-year design plan.

We augmented the 1993-2018 data with simulated data sets for 2019-22. For 2019, the planned FISS design was used, while the following designs were considered for subsequent years:

- 2019: Planned FISS fished (standard 89-station 4B FISS)
- 2020: Only Subarea 3 fished (73 stations)
- 2021: Only Subarea 3 fished (73 stations)
- 2022a: Only Subarea 3 fished (73 stations)
- 2022b: Only Subarea 1 fished (57 stations)
- 2022c: Subareas 1 and 2 fished (130 stations)

The three options for 2022 allow either a continuation of Subarea 3 only (2022a), Subarea 1 only to reduce the chance of bias due to changes in density in Subarea 1 over the three years since 2019 (2022b), and a third option (2022c) in case 2022b leads to CVs above the 15% target. The third option is also precautionary in that while there is apparent stability in Subarea 2's biomass percentage (Figure 3 and Table 5), most of Subarea 2 has been surveyed just once, in the 2017 expansion. Therefore, this stability can be at least partly attributed to a lack of data reducing the potential for rapid change in its biomass percentage. As a precautionary approach, a more frequent FISS for Subarea 2 than implied by the estimates in Table 5 could be implemented initially, with further evaluation once more data are available.

Table 5. For each year, the number of years until at least a 10% absolute change in estimated biomass percentage is observed.

Subarea	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
1	9	8	7	4	3	4	3	13	12	7	5	4	4
2	17	21	20	19	18	19	≥ 19	16	16	14	13	12	11
3	6	5	4	3	2	4	11	10	11	11	10	9	8
Subarea	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
1	7	6	4	3	4	3	≥ 7	≥ 6	≥ 5	≥ 4	≥ 3	≥ 2	≥ 1
2	≥ 13	≥ 12	≥ 11	≥ 10	≥ 9	≥ 8	≥ 7	≥ 6	≥ 5	≥ 4	≥ 3	≥ 2	≥ 1
3	6	6	4	3	4	3	3	≥ 6	≥ 5	≥ 4	≥ 3	≥ 2	≥ 1

Table 6 presents the estimated CVs for each of the space-time model inputs listed above for 2020-22, along with those from the 2018 model fit to observed 1993-2018 data only. The three fits based on surveying only Subarea 3 in 2020-22 (rows 3, 4 and 5 of Table 6) all lead to CVs below the 15% target. However, surveying only Subarea 1 instead of Subarea 3 in 2022 was insufficient to meet the target, with a CV of 17% estimated in 2022. Adding Subarea 2 brought the 2022 CV down to 14%, now below the target.

Table 6. Estimated coefficients of variation (%) by data input for Regulatory Area 4B. Proposed target CV is 15%.

Data input	2017	2018	2019	2020	2021	2022
1993-2018 data	9	14				
+ 2019-20 simulated data	9	13	12	10		
+ 2019-21 simulated data	10	13	13	11	12	
+ 2019-22a simulated data	9	12	12	10	12	14
+ 2019-22b simulated data	9	12	12	10	11	*17*
+ 2019-22c simulated data	9	11	11	9	9	14

The next step would be to calculate the relative costs of each option. Fishing both Subareas 1 and 2 in 2022 would be expensive, with likely high vessel charter costs together with low catches offsetting those costs. It may be desirable to explore other options for 2022, such as pairing Subareas 1 and 3, and fishing Subarea 2 (probably together with Subarea 3) in a later year.

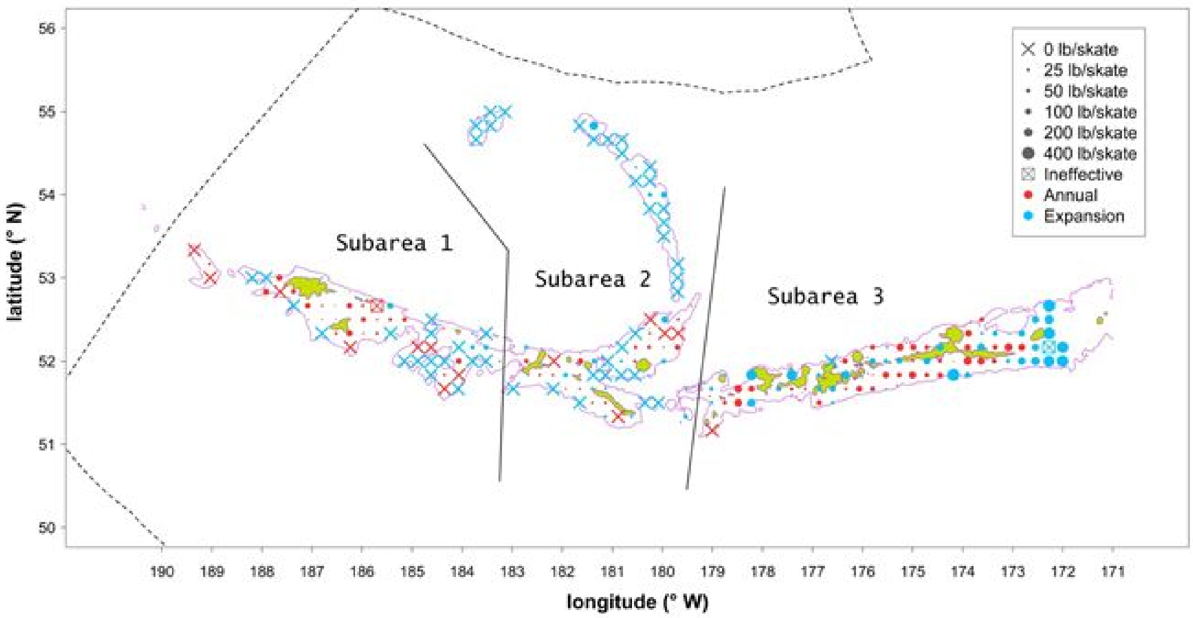

Figure 2. Map of 2017 the FISS expansion design in IPHC Regulatory Area 4B showing the subareas used in the analysis.

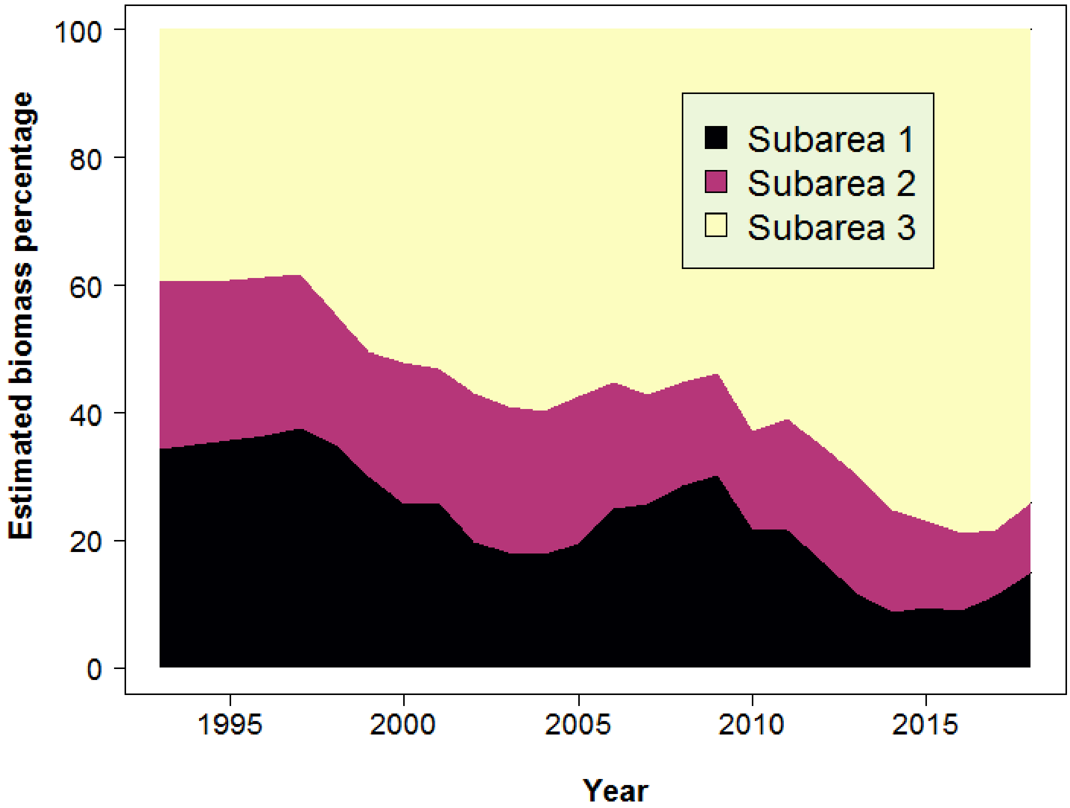

Figure 3. Estimated Regulatory Area 4B biomass % by subarea and year.

Other Regulatory Areas

Like Regulatory Area 4B, we identified subareas in Regulatory Areas 2A and 4A based largely on geographic biomass distribution and developed priorities using the precision and bias criteria described above. Regulatory Areas 2B, 2C, 3A and 3B represent the core of the Pacific halibut stock, with generally high density throughout. It was therefore more difficult to identify subareas based on density, geographic regions, or biological differences. Instead, IPHC FISS regions were considered as subareas, and sampling priorities were based on the density and temporal variability of these. Specifically, we considered designs in which two FISS region per year were omitted from the six regions in Regulatory 2B, the eight regions in Regulatory 3A and the five regions in Regulatory 3B, and where two of the three FISS regions in Regulatory 2C were fished. Those regions with either the highest densities in recent years, or (in the case of Regulatory Area 3B), with densities that varied greatly over short time periods, were prioritized for annual sampling, while other FISS regions can be sampled on a rotating basis. As described above, the proposed designs for each Regulatory Area in 2020 were evaluated to ensure that precision and bias criteria were met. The full proposal for 2020 is shown in Figure 4. This represents a minimum design that will meet the data quality criteria for analytical purposes, and comprises approximately 1150 stations, fewer than in recent years. Other stations can be added to the design if there are specific needs beyond those criteria, such as for sampling efficiency, cost recovery, biological sampling, and environmental monitoring.

Figure 4 includes a proposal for fishing the full 10 nmi grid along the Regulatory Area 4CDE edge in 2020 (last fished in 2016). While it may be possible to reduce FISS sampling and still meet precision/bias targets, we note that ecosystem conditions have been anomalous in the Bering Sea for several years, making the Pacific halibut distribution more difficult to predict in unsurveyed habitat. Indeed, recent NMFS trawl surveys in the northern Bering Sea have shown a generally increasing trend in that region, but over the last three years, deeper waters in the north covered by the FISS grid have been unsampled. The IPHC is interested in better understanding density trends and possible links with Pacific halibut in Russian waters in the Bering Sea, and the data obtained from sampling the full FISS grid in 2020 would help greatly in achieving these goals.

RECOMMENDATION/S

That the Commission:

1) **NOTE** paper IPHC-2019-IM095-07 Rev_1, which provided the Commission with a summary of the results of the 2019 space-time modelling of Pacific halibut survey data (which includes data from other fishery-independent surveys), as well as results of the IPHC fishery-independent setline survey (FISS) expansions in IPHC Regulatory Areas 3A and 3B, and modelling results from fixed and snap gear comparison in Regulatory 2C. Also presented were methods for rationalising the FISS following completion of the final set of expansions in 2019.

2) **ENDORSE** the proposed minimum FISS design for 2020 (provided in Figure 4), while recognizing that it will be subject to potential modification (addition of FISS stations) to meet the Commissions general objective of revenue neutrality.

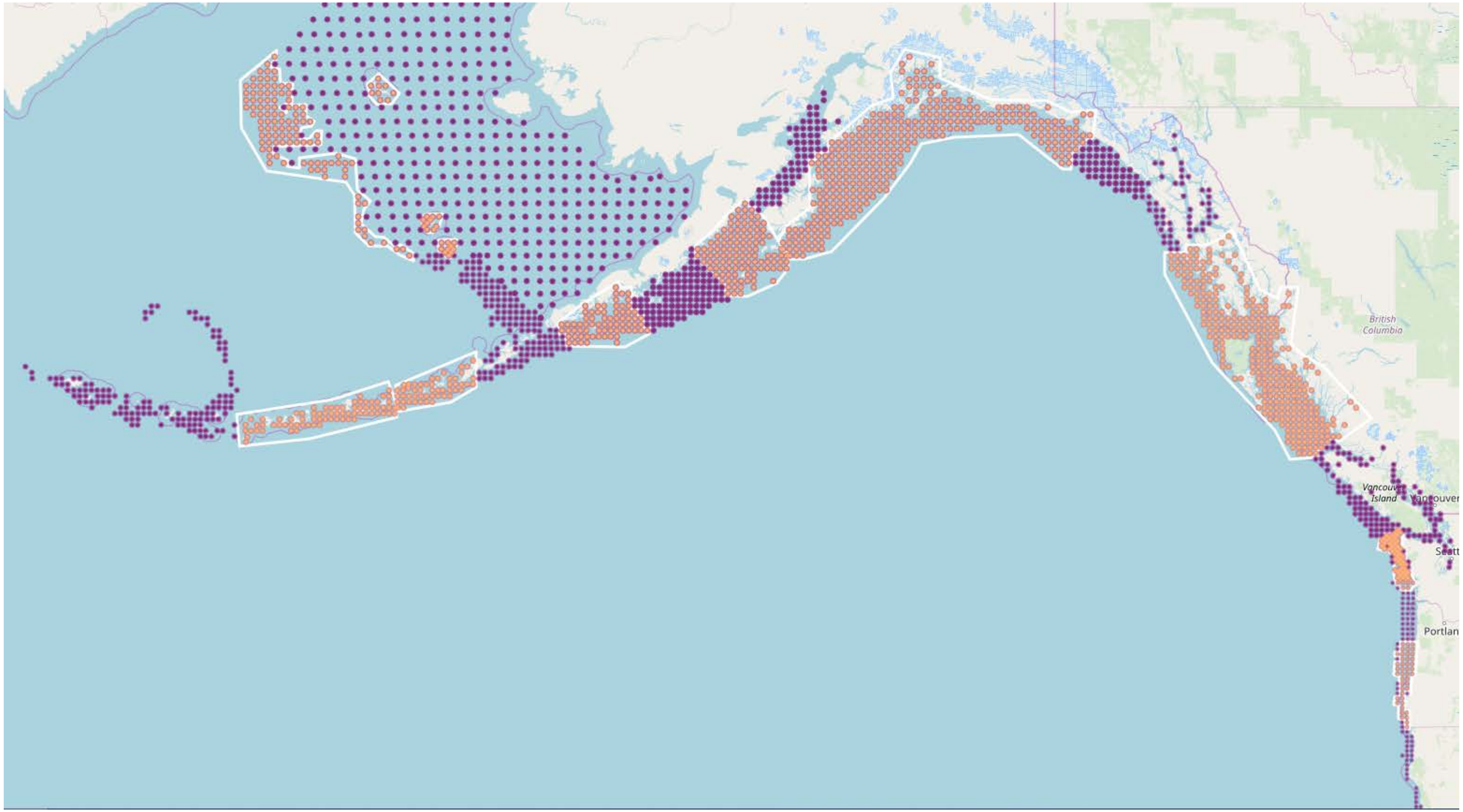

Figure 4. Proposed minimum FISS design in 2020 (orange circles). Purple circles on the 10 nmi FISS grid are optional for meeting data quality criteria, while purple circles on a 20 nmi grid in the Bering Sea will be sampled by the 2020 NMFS trawl survey used for indexing Pacific halibut density in Regulatory Area 4CDE.

APPENDIX A

Space-time modelling results by IPHC Regulatory Area

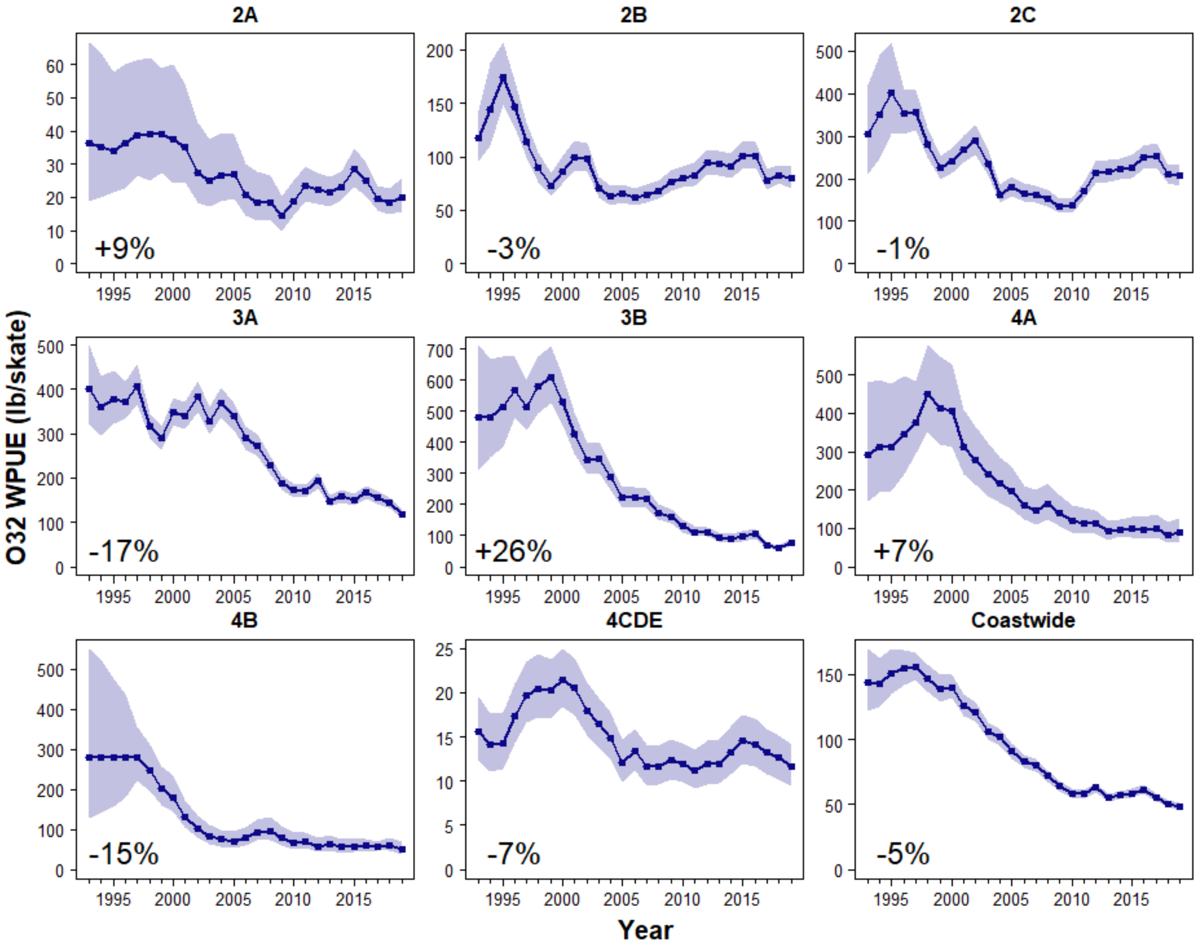

Figure A.1. Space-time model output for O32 WPUE for 1993-2019. Filled circles denote the posterior means of O32 WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean O32 WPUE from 2018 to 2019.

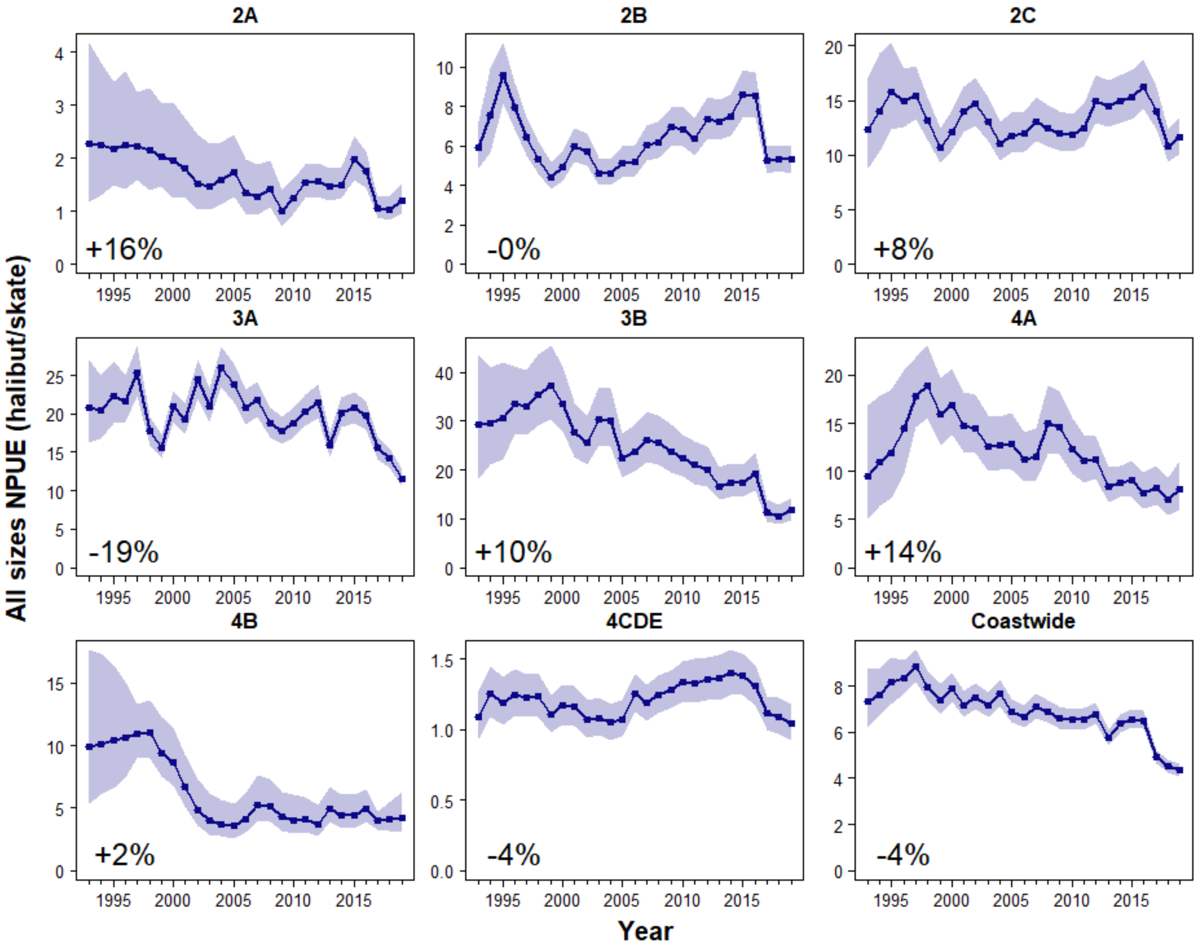

Figure A.2. Space-time model output for total NPUE for 1993-2019. Filled circles denote the posterior means of total NPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean total NPUE from 2018 to 2019.

APPENDIX B

Space-time modelling results for Regulatory Area 2C with and without snap gear data.

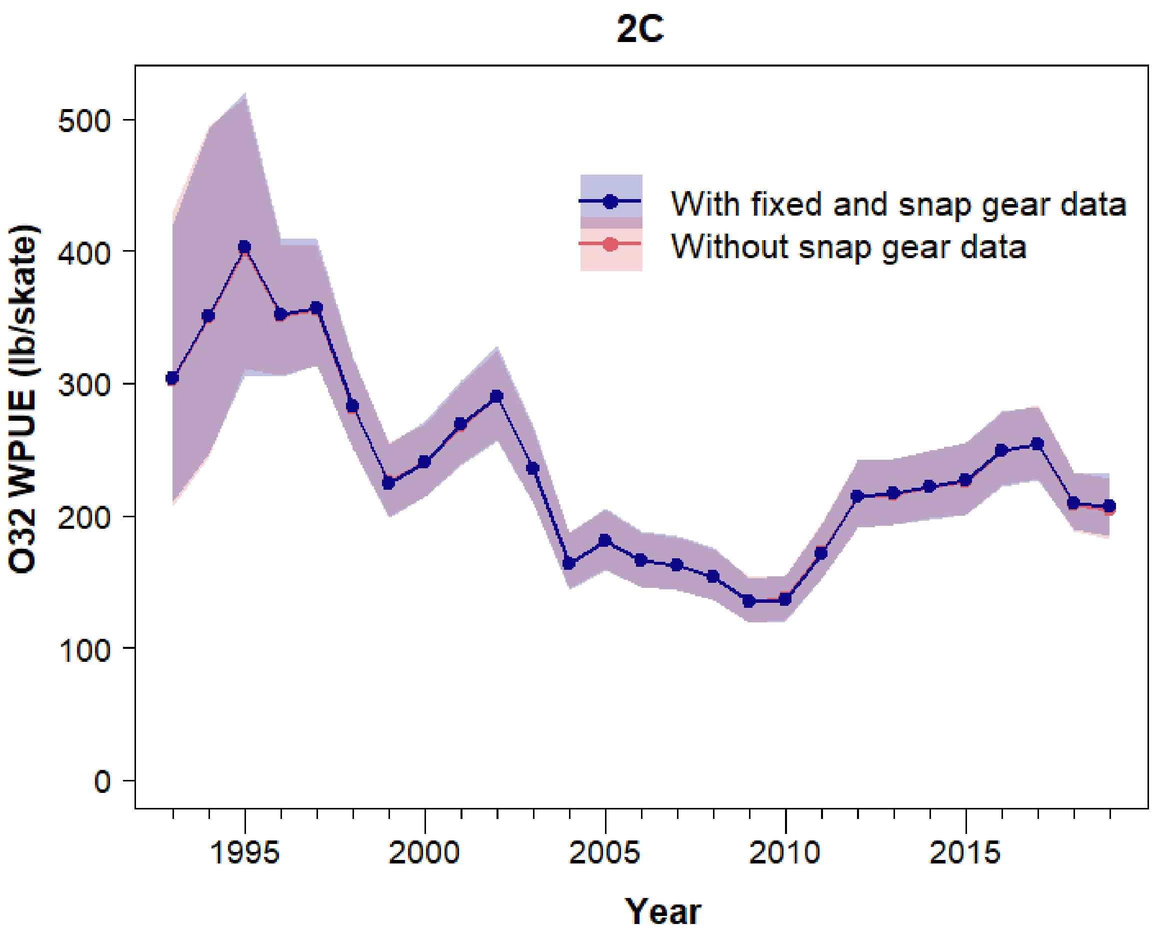

Figure B.1. Space-time model output for O32 WPUE for 1993-2019 for Regulatory Area 2C, comparing output from models with and without snap gear data. Filled circles denote the posterior means of O32 WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate.

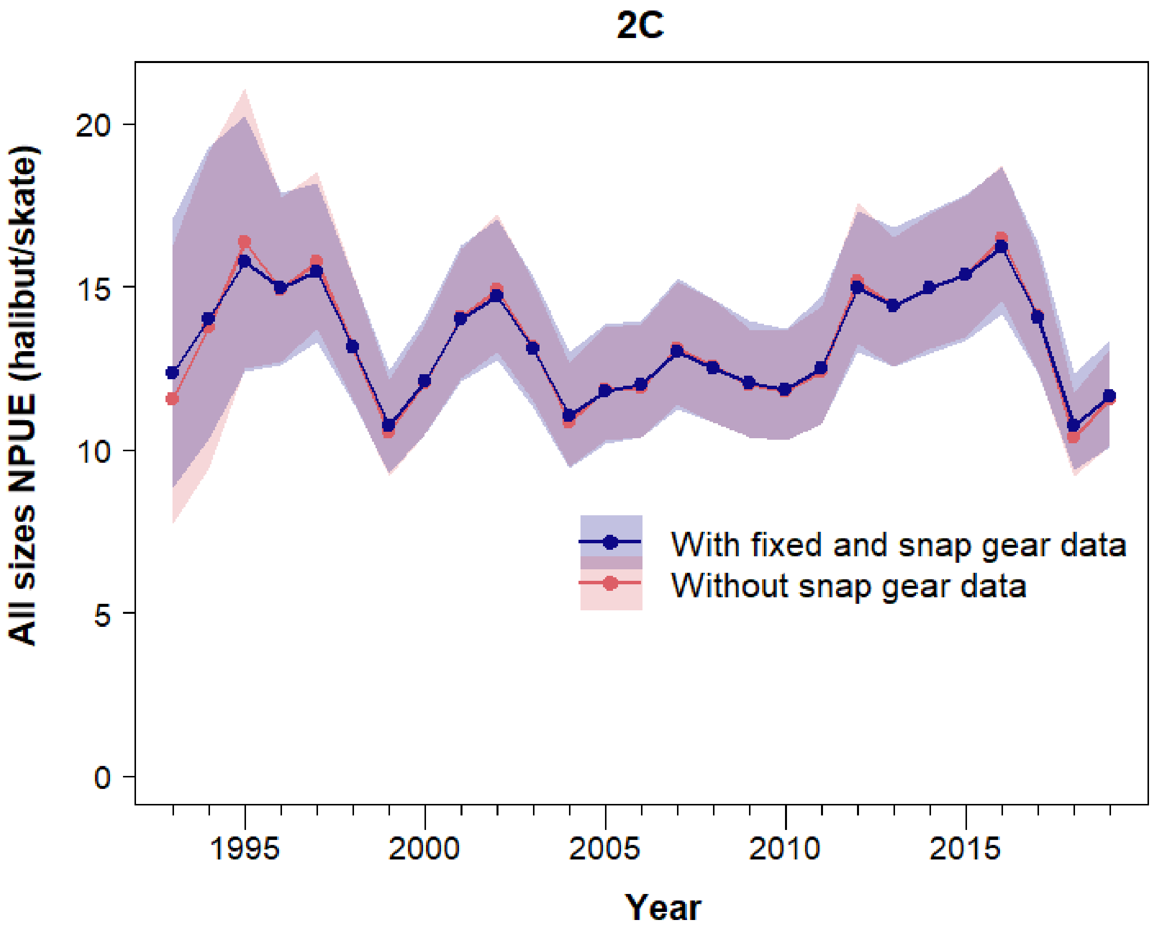

Figure B.2. Space-time model output for all sizes NPUE for 1993-2019 for Regulatory Area 2C, comparing output from models with and without snap gear data. Filled circles denote the posterior means of all sizes NPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate.

APPENDIX C
The effect of 2019 FISS expansions on space-time modelling results by IPHC Regulatory Area

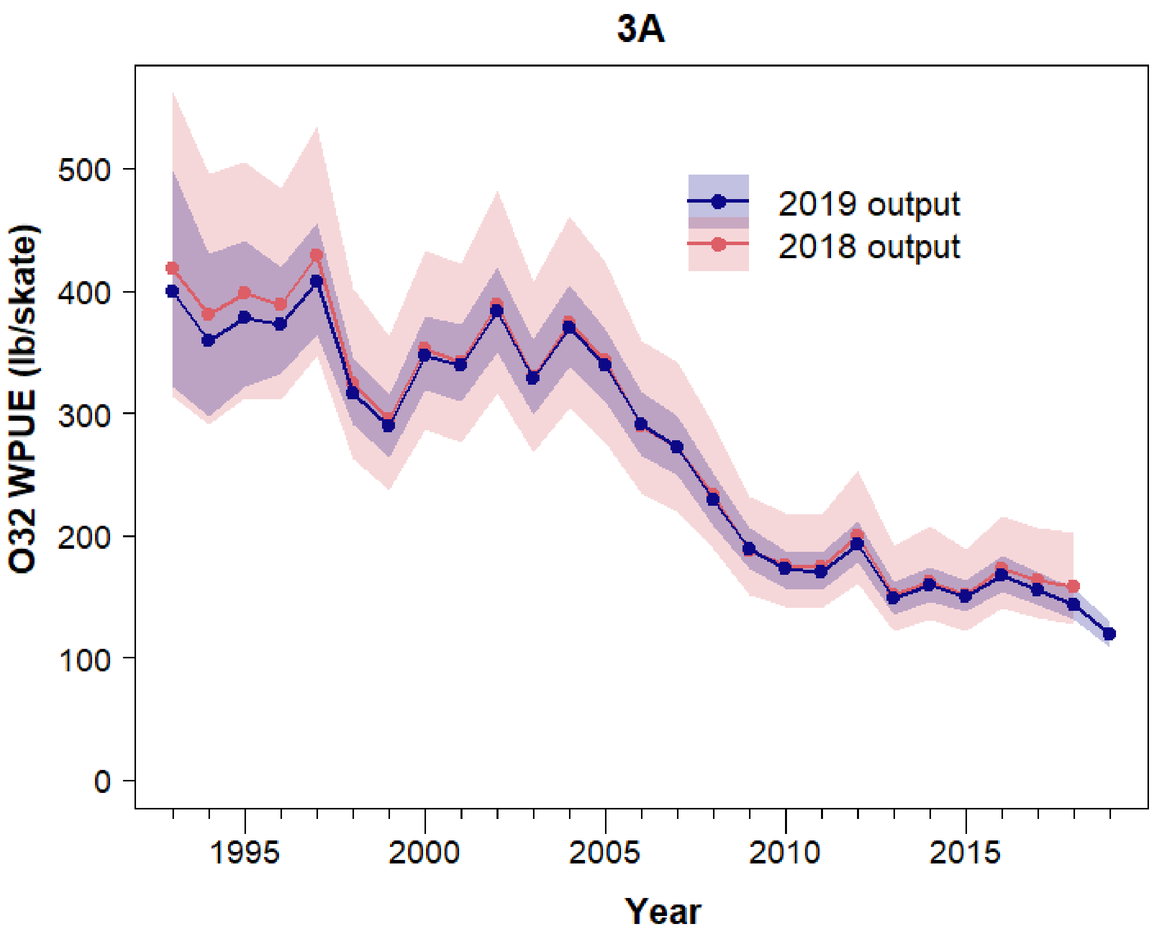

Figure C.1. Time series of posterior means of average O32 WPUE in Regulatory Area 3A from space-time modelling undertaken in 2019, compared with model output from 2018 modelling. The shaded regions show 95% posterior credible intervals.

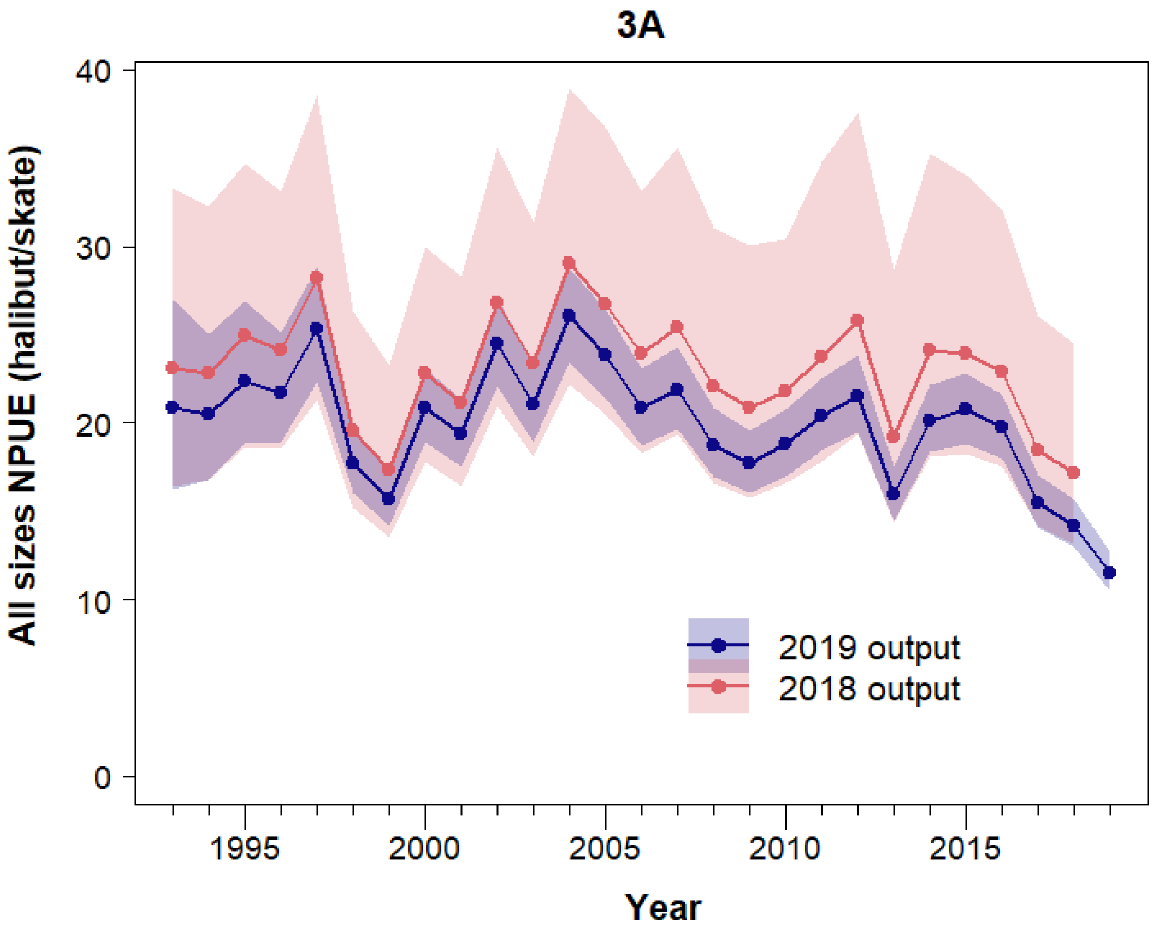

Figure C.2. Time series of posterior means of average all sizes NPUE in Regulatory Area 3A from space-time modelling undertaken in 2019, compared with model output from 2018 modelling. The shaded regions show 95% posterior credible intervals.

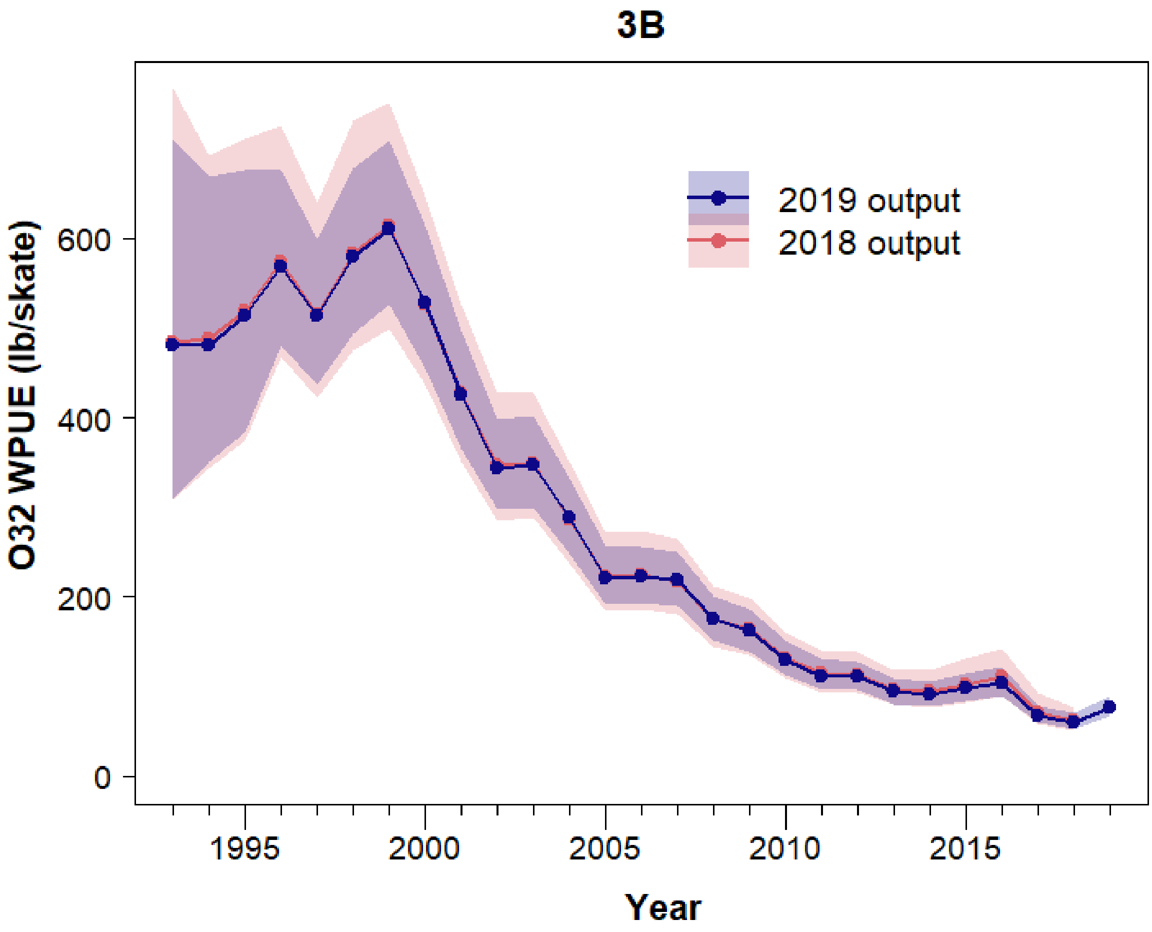

Figure C.3. Time series of posterior means of average O32 WPUE in Regulatory Area 3B from space-time modelling undertaken in 2019, compared with model output from 2018 modelling. The shaded regions show 95% posterior credible intervals.

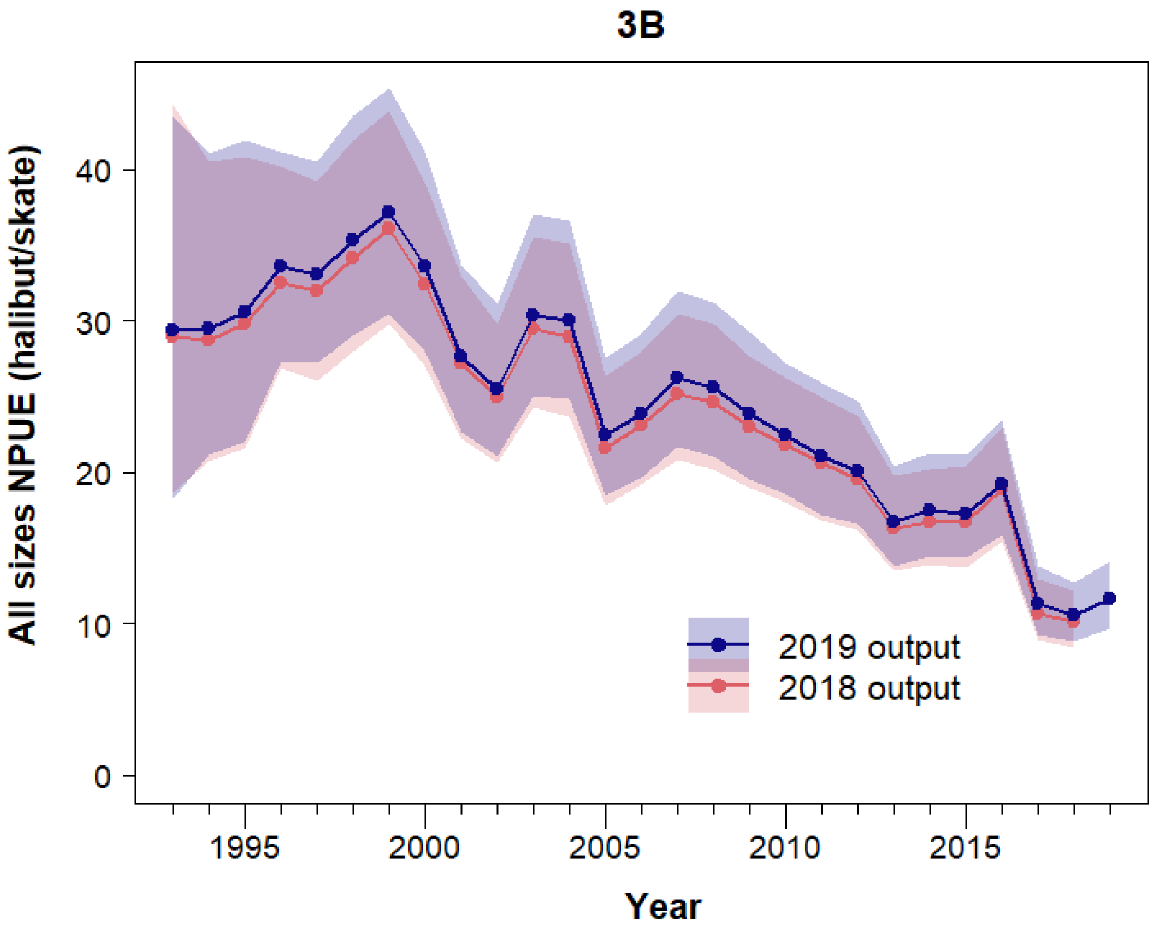

Figure C.4. Time series of posterior means of average all sizes NPUE in Regulatory Area 3B from space-time modelling undertaken in 2019, compared with model output from 2018 modelling. The shaded regions show 95% posterior credible intervals.

INTERNATIONAL PACIFIC HALIBUT COMMISSION

IPHC-2019-IM095-08

Stock Assessment: Independent peer review of the Pacific halibut stock assessment

PREPARED BY: IPHC SECRETARIAT (D. WILSON, 23 OCTOBER 2019)

PURPOSE

To provide the Commission with an opportunity to further consider the independent peer review report of the IPHC Stock Assessment for Pacific halibut.

BACKGROUND

The Commission directed the IPHC Secretariat via Commission decisions **AM095-Rec.10** and **IPHC-2019-ID001** (shown below) to:

> **95th Session of the IPHC Annual Meeting (AM095) – 1 February 2019**
> **AM095–Rec.10 (para. 129)** "*The Commission **RECOMMENDED** that the IPHC Secretariat develop terms of reference for a consultant to undertake a peer review of the IPHC Pacific halibut stock assessment, for implementation in early 2019. The terms of reference and budget shall be endorsed by the Commission inter-sessionally.*"
>
> **2019 Inter-sessional decision – 17 April 2019**
> **IPHC-2019-ID001**: The Commission **ENDORSED** the "*Open call for expressions of interest: Independent peer reviewer for the IPHC stock assessment*"

The report by the independent consultant was provided to the Commission on 2 August 2019, via IPHC Circular 2019-16.

DISCUSSION

The report by the independent peer reviewer, Dr Kevin Stokes, is provided at **Appendix I**, and is also available on the Stock Assessment page of the IPHC website under the 'Peer Review' tab for transparency and accountability purposes: https://www.iphc.int/management/science-and-research/stock-assessment. A direct link to the pdf is also provided below:

https://www.iphc.int/uploads/pdf/sa/2019/stokes_2019-independent_peer_review_for_the_2019_iphc_stock_assessment.pdf

The review will be considered at the Commission's upcoming Work Meeting (18-19 September 2019), and also by the IPHC's Scientific Review Board at its 15th Session from the 24-26 September 2019.

RECOMMENDATION/S

That the Commission **NOTE** paper IPHC-2019-IM095-08 which provided the Commission with an opportunity to further consider the independent peer review of the IPHC Stock Assessment for Pacific halibut.

APPENDICES

Appendix A: Independent peer review of the Pacific halibut stock assessment (K. Stokes)

APPENDIX I

Independent Peer Review for the 2019 IPHC Stock Assessment

Prepared by Kevin Stokes
August 2019

Summary

This report reviews the in-development 2019 full stock assessment of Pacific Halibut being conducted by the Secretariat of the International Pacific Halibut Commission (IPHC). The stock assessment is updated annually and undergoes full assessment every 5 years. The last full assessment was in 2014. The basis for the full stock assessment should be completed by September 2019 for final review by the IPHC Scientific Review Board (SPB) before its application to all updated data in December 2019 and provision of science-based risk assessments to the IPHC for decision-making in early 2020.

This review covers the full spectrum of stock assessment related matters and is guided by the terms of reference set out by the IPHC. The potential scope is large and the review attempts to focus on key matters, based on the terms of reference and discussion with the IPHC Secretariat. The review included a site visit to the IPHC in Seattle which overlapped with an SRB meeting. The SRB has separately provided feedback to the Secretariat on the in-development stock assessment.

Pacific halibut has been exploited for over a century along the North American west coast by IPHC members (USA and Canada). Commercial fisheries started in the 19th century along the west coast but even before 1920 had expanded to the Gulf of Alaska. The majority of the stock is distributed in Alaskan waters and over time the commercial fisheries in Alaska have come to dominate mortalities. Since the 1960s, bycatch in commercial Alaskan trawl fisheries has grown. Pafiic halibut provides important subsistence catches and has also been increasingly taken by guided and non-guided recreational fisheries since the late 1970s. Despite the wide array of fishery sectors, data on mortalities and catch rates are generally of a high quality to inform stock assessment. Some minor areas of concern are noted in this review, including the section on research priorities.

Biological data from commercial fisheries are generally sound though as fish are landed dressed, sampling at ports is critical. A key issue is determination of commercial catch sex ratios. Work by the IPHC to determine sex ratios using port sampling and genetic analyses is in hand and new data have already been considered in the in-development stock assessment. This work is important and may need to continue beyond the initial 2 year program.

The IPHC operates a dedicated and extensive annual setline survey which provides the stock assessment with critical information on Pacific halibut abundance and distribution as well as with biological data. Exploratory work to improve the survey has been in progress since 2014 and should come to fruition in late 2019/early 2020 to inform the 2020 design. The survey, which uses a large number of member country commercial vessels annually, is outstanding by any measure and provides not just critical inputs to the stock assessment but also an important platform for ongoing and agile research to understand Pacific halibut biology and ecology. State of the art approaches are used to analyse survey data and provide high quality indices and

other data to the stock assessment. The survey is critical in that provides information on fish that will enter the fishery three or four years later.

The stock assessment is conducted using the Stock Synthesis framework and is carried out by world class analysts, supported within the IPHC by statistics and biology teams and by the independent SRB, and embedded in the fertile Seattle stock assessment and methods community. The quality of analysis if excellent and aimed purposefully at providing science-based risk assessment to support IPHC decision-making.

Individual stock assessment models have been developed iteratively over many years but have settled since the last full assessment to include four structurally different models that are fitted in a two-way cross to Long (i.e., full history) or Short (i.e., since 1992) data series and to Coastwide (i.e., as a single area) or AAF (i.e., Areas-as-Fleets). The models use different approaches to fixing or estimating natural mortality, selectivity, and environmental factors. The rationales provided for the model development are credible and robust based on historical analyses, data availability, and utility. All models are individually fit using state of the art manual, iterative tuning techniques which are well explained. As an in-development assessment, final tuning will be required once the assessment approach is agreed and final 2019 data become available. The in-development assessment considers addition or replacement of models for the final assessment. This review finds the four models a good basis for providing a consistent, robust and credible risk assessment to the IPHC in early 2020. Especially given the progress being made on Management Strategy Evaluation by the IPHC Secretariat, for possible implementation of agreed mortality-setting rules by 2021, major changes to the existing set of stock assessment models is not encouraged.

The provision of risk assessment advice to the IPHC uses all four, structurally different models, in a way which is slightly unconventional. Most stock assessment-based advice is based on a single assessment and associated sensitivity runs to portray uncertainty. While that approach may provide risk assessments that include uncertainty associated with data and model fitting to data, it does not address uncertainty due to the structural differences between models - all of which are valid. Selecting a single model as a basis for risk assessment puts a key part of the risk decision in to the science process rather than the IPHC Annual Meeting process. In order to separate risk decisions in science and policy to the greatest extent possible, the IPHC approach is to assess risks associated with any decisions on future mortalities using an ensemble of all four models. Selection of the four models is rational and science-based and use of all four removes the necessity to focus on any one model.

Of course, different models could be selected and risk assessments could be affected. The rationales for model development are, however, science based and credible. In order to provide a consistent basis for advice this review concludes that continued use of the four individual models is appropriate. This leaves open the issue of whether the four models might be weighted equally, as in recent years, or differentially. There is no right way to weight the models and even equal weighting is arbitrary. Equal weighting also makes models with lower biomass scales influential in assessing risks. The issue of weighting is considered in the review and at this stage it is advised to maintain equal weighting.

The IPHC is conducting Management Strategy Evaluation which is likely to result in adoption of rules for setting mortalities in 20121. Once implemented, it is possible the need for annual stock assessment updates will be removed. This would provide time to analysts to explore more fully a range of important issues such as automated tuning of individual models, alternative individual models to account for structural uncertainty, weighting of models within the ensemble, use of Bayesian approaches (also impacting on ensemble weighting options). All of these are considered in the review as well as all other research priorities outlined in IPHC stock assessment and data update papers.

Background: ToR, Process, and relationship to IPHC Performance Review

Terms of Reference (ToR) for this stock assessment (SA) review are intentionally wide, providing scope for discussion and focus as deemed appropriate on the *stock assessment process, methods and reporting*. Nevertheless, *specific topics that should be addressed* fall in the following categories:

1) Aspects of data collection and analysis.
2) Aspects of individual model development. [Aspects of developing individual models to consider for including in the ensemble.]
3) The collection of models contributing to the ensemble, and the methods for combining/weighting the results.
4) Comments on research priorities or avenues for data, model or management advice development as appropriate.
5) Comments on the document and background material provided for the review.

The review is also required to *clearly delineate between tactical changes to be considered for the current (2019) stock assessment and research avenues for future work.*

The review was carried out remotely but benefited from an informal site visit from 17-20 June 2019 to meet IPHC staff, discuss a range of SA issues, identify key SA documents, and understand the IPHC website structure and content. The site visit also provided an opportunity to discuss science processes, to be reported on separately as input to the 2nd Performance Review (PR) of the IPHC (PRIPHC02). The site visit was not initially planned and I am grateful to the IPHC staff who made time and contributed to it.

The IPHC SA is undertaken within the Secretariat by dedicated science staff. The primary focus of this review is the SA *per se*, conducted by the *Quantitative Sciences Branch*. Inputs to the SA and aspects of research planning and prioritisation, however, also require consideration of work carried out by the *Biological & Ecosystem Sciences Branch* and the *Fisheries Statistics &*

Services Branch. During the site visit, four presentations were provided by the three IPHC Branches as background and to aid discussion. The presentations used were the same as given to the 1st session of PRIPHC02; they are available online at: https://www.iphc.int/venues/details/2nd-performance-review-of-the-iphc-priphc02-1st-session.

The last full SA of Pacific halibut was in 2015 with updates in 2016, 2017 and 2018. The in-development SA now being reviewed (the 2019 assessment) is the first weigh point in the first full assessment since 2015. Expectations about the SA are provided in the report of the 13th Session of the Scientific Review Board (SRB; IPHC, 2018): *A full assessment analysis and review is planned for 2019, which will allow more in-depth investigation and model-based evaluation of the new and/or revised data. Progress continues on the reevaluation of whale depredation accounting in the Fishery Independent Setline Survey time-series, as well as the sex-ratio of the commercial catch in 2017; both products are anticipated in February 2019. That analysis will also allow for an in-depth exploration of data weighting, parameterization of time-varying processes and other modelling approaches implemented in the four Pacific halibut models comprising the stock assessment ensemble.*

The key SA document for the review is Stewart and Hicks (2019). As a first weigh point in the 2019 process, the paper describes and reports on preliminary analyses conducted during the development of the 2019 SA. It includes consideration of new data; bridging from the previous assessment, including consideration of issues noted by the SRB; initial individual model weighting; and initial ensemble modelling. While it superficially provides indications for status in 2019, these should be treated cautiously given the imminent addition of full 2019 survey, fishery and other data, and potentially any changes in models used.

The IPHC SA process includes two SRB meetings annually; the preliminary SA report is presented and considered in June each year and feedback from the SRB is used in development of the final SA that is presented to the SRB in mid-late September. Completed current year data are then used in final model runs and development of decision tables to be used by the Commission. This review is timed to allow any findings to be considered alongside comments made by the SRB in the report of its 14th session. Stewart and Hicks (2019) has in fact already been considered by the 14th Session of the SRB which met from 24-26 June 2019 (IPHC, 2019a). The SRB made just three requests of the SA team: one regarding the IPHC setline survey and two regarding the SA modelling. These are commented on below.

ToR bullet 5 (*Comments on the document and background material provided for the review*) can be dealt with quickly and simply at the outset. The SA paper by Stewart and Hicks (2019) is notable for its careful and logical elaboration of the in-development SA. It is unusually and exceptionally clear with a focus on explaining why as well as how models have been developed - from an historical perspective, given data, and in the IPHC decision-making context. While many SA documents focus on model fitting, Stewart and Hicks (2019) is about modelling but with full consideration of model fitting nested appropriately, comprehensively and clearly. It is an excellent document but for review needs to be read in conjunction with Stewart and Webster

(2019) which elaborates on data available for the SA. It also needs to be considered in the context of its purpose which is to provide a scientifically rigorous, but value-free, risk assessment to aid the Commission in its annual deliberations.

In addition to the in-development SA document, a wide range of papers and materials were made available for the review in electronic form, either in advance, during the informal site visit, or through the IPHC website. In advance, these included detailed input and output files for the individual models (see ToR bullet 2) used in the ensemble (see ToR bullet 3); the excellent, annually updated, overview of data sources up to November 2018 (Stewart and Webster, 2019; ToR bullet 1); previous model documentation; and relevant papers/manuscripts on the assessment, most notably as relevant to ToR bullets 2 and 3. The overall quality of documentation from all IPHC sources is of the highest quality with exceptional care taken in preparation.

Data Collection and Analysis

ToR bullet 1: Aspects of data collection and analysis.

Stewart and Webster (2019) provides an annual update of data as of November 2018. The paper is clear and comprehensive in scope as of November 2018, identifying data changes and additions but not repeating methods as outlined in previous documents. Data as relevant to the SA development, including bridging and weighting, have also been summarised in Stewart and Hicks (2019). During the site visit for the SA review, a number of relevant presentations were made (as also made to the PRIPHC02, see above).

Full review of all data sources is beyond the scope of this review. Review, for example, of fisheries statistics collection or the Fisheries Independent Setline Survey (FISS) could be standalone. Only key aspects of data collection and analysis are commented upon here. Stewart and Webster (2019) note a number of data sources for potential future analyses and relevant research projects. All of these are also included in a wider list of research priorities outlined by Stewart and Hicks (2019). These are all commented on in the section below on *Research priorities, Biological understanding* or *Research priorities, Data related research*.

The data available for Pacific halibut SA are unusual in that they span a long period of time and comprise both high quality fishery dependent and independent sources which are well documented and understood. The fishery dependent and independent sources are remarkably coherent. For example, the comparison between the FISS over-32” WPUE and commercial WPUE from 1995 onwards can be seen clearly in slides 10 and 11 of IPHC (2019b) and between FISS indices and commercial WPUE reported in Stewart and Webster (2019). While the sex ratios of the FISS and commercial catch are different, the trends and scales are neverthless suggestive of a high degree of consistency between the indices, reflected also in the good fits to all indices in the individual models reported in Stewart and Hicks (2019). Comparisons of compositional data from different sources also appear consistent. Of course, the SA needs to balance compositional and other data with indices and to fit complex selectivities, estimate mortality, etc, but the coherence overall gives reassurance that the final SA should be able to provide i) a robust view of the Pacific halibut stock status, and ii) a sound basis for risk assessment related to future mortalities. It is usual in SA to need to make hard decisions about data weighting in individual models which go beyond rigorous statistical considerations. With such coherent data there is a reasonable *a priori* expectation that weighting choices might be less important than is often the case. Also, with such coherent data it is reasonable *a priori* to expect between-models correlation of trends and estimates of variance on status metrics and forecasts (see below on ensemble modelling).

Pacific halibut is caught by an array of sectors across a wide geographic range and in two national jurisdictions. Even with the majority of the catches being taken in directed setline fisheries, fisheries data collection and preparation is therefore complex.The IPHC has its own observers but relies necessarily on its member states' national data collection programs for fisheries-dependent data that feed into the SA. In discussion with IPHC staff, this seemed to be regarded as a weakness, but it is normal for cross-boundary stocks managed by RFMOs and the overall quality of mortality data does seem to be good. The IPHC clearly works directly with fisheries and has good relationships that enhance data collection and understanding of issues. IPHC staff visit ports and vessels and the annual use of multiple commercial fishers for the FISS is a means not just to collect high quality data but also to develop relationships that underpin confidence in wider data collection. Ongoing access at ports, e.g for fin clipping to determine sex ratios in commercial catches, is a good example. Confidence in following regulations and reporting is also created in, e.g., USA complete lack of head-off landings in 2017 and 2018 following regulatory change in early 2017 (IPHC, 2017 para 48).

IPHC (2019b) and Stewart and Webster (2019) provide a summary of the multiple fishery components by sector and area. My overall impression is that while the data collection systems could always be better specifically for halibut, they of course are designed for multiple species with a wide range of constraints. Given those constraints, there seems in the main documentation to be general satisfaction that the nature and extent of mortality is reasonably captured. The lack of sensitivity testing in historic and current SA suggests it is not regarded as a major uncertainty. However, some concerns are implied at *Research priorities, Data related research* items 10 and 11 which propose (10) reanalysis of historical bycatch mortalities and age frequencies, and (11) investigation of variances and errors in the scale of mortality estimates; these concerns are commented on below. IPHC (2019c) notes a number of concerns related to recreational, subsistence and bycatch fisheries. Considering concerns expressed by both IPHC (2019c) and Stewart and Webster (2019), only one common issue seems to emerge - the low level of observer coverage in directed fisheries in Alaska, with none for vessels less than 40', leading to inaccurate fish weights and age-distributions for discarded fish. The Alaska commercial fishery mortality is a large percentage of the total (circa 50%) and of the Alaska fishery the discard percentage is of the order of 5%. While 5% of 50% may seem small, information on fish below the MLS is important in determining selectivities and providing information on recruitment to the SA. It is beyond the scope of this review to recommend improving observer coverage by a member state but this is clearly one aspect of mortality estimation where improved information would be useful and could improve credibility of the SA.

One potential unaccounted mortality component is whale depradation in the commercial fisheries, as has been observed, quantified and explored for the FISS (see below). This is not mentioned in Stewart and Hicks (2019), even under *Research priorities*, or other documents but was raised in discussion during the site visit. The possible scale and nature is unclear, as is whether it might (or not) be important in the risk assessments provided for decision-making. While discarding could create an unaccounted mortality of smaller fish that might impact estimated future risks, depradation by whales of the same scale as discarding might be important to estimated status and/or future risks depending on its nature (i.e., size of fish taken or trends). Generally, for all stock assessments, consistent biases in unaccounted mortalities should “come out in the wash” if fishing practices remain consistent. Where unaccounted mortalities trend, however, and if they are of sufficient scale, problems can occur. If depradation is greater in specific areas and mortalities are allocated by area, as is the case for Pacific halibut, then the unaccounted mortality could become very important. Given experience from the FISS, working with commercial fishers in areas susceptible to whale depradation to quantify possible losses would appear to be feasible. Some simple ‘what if’ model runs with assumed trends in the scale and nature of depradation could be made quite quickly as part of the 2019 SA or, more pertinently, Management Strategy Evaluation (MSE) processes to gauge what level of depradation might be important (see *Research priorities, Data related* research item 9).

Pacific halibut are landed gutted and the sex ratio of the commercial catch has therefore not been monitored historically. As the fishery is highly size selective and males and females have different growth schedules, the commercial sex ratio is not expected to be 50:50 and could vary spatially and/or temporally. As reported in Stewart and Hicks (2019), this has been a cause for concern in the SA for some years. The current IPHC 5-year Biological and Ecosystem Science Research Plan for 2017-2021 recognises the need for accurate sex identification of commercial landings both for SA and MSE work (see: https://www.iphc.int/uploads/pdf/besrp/2019/iphc-2019-besrp-5yp.pdf). In line with the plan, port-based fin clip processing was carried out during 2017 and 2018 with genotyping of samples to determine sex also conducted. The work has yet to be published but is outlined briefly in https://www.iphc.int/uploads/pdf/priphc/priphc02/ppt/iphc-2019-priphc02-05c-p.pdf. To date, the 2017 samples have been genotyped and results made available for the 2019 SA development work. The results are briefly outlined in Stewart and Hicks (2019) and are used in the 2019 individual model bridging exercise (see below). The 2017 data became available in February 2019 and it is unclear if the 2018 sex ratio results will be available for the final 2019 SA or only in 2020 for the 2021 update.

Including coastwide and regional sex ratio information in the SA is clearly important given the nature of the fishery and potential implications for model fitting (see below) and management. The willingness of IPHC to pursue important data collection and use new data in analyses is commendable. The research plan currently only includes fin clip collection in 2017 and 2018. It may be necessary to update the plan to monitor in future years as well in case of temporal or spatial changes in sex ratios, with potentially serious implications for SA modelling. If the 2018 results are similar to the 2017 ones then the final 2019 SA may remain appropriate and credible but if the 2018 results become available in early 2020 and show different patterns, it could undermine confidence in the2019 SA and any decisions made by the Commission in January 2020. Ideally, the 2018 results would be available for the final 2019 SA.

Fishery independent information is available through the IPHC FISS and the NMFS trawl survey in Alaska. It is unusual for SA purposes to have access to even one high quality fishery-independent index and the IPHC is fortunate to have two, with the dedicated IPHC FISS being exceptional by any standard. Its duration, scope and fine-scale provide a fishery independent index (coastwide or by region or area), composition data, and biological information, including annual estimates of stock distribution by area. The FISS provides the primary index for the SA. As an IPHC-run annual survey it also provides a platform for other research (see, e.g.: https://www.iphc.int/uploads/pdf/priphc/priphc02/ppt/iphc-2019-priphc02-05b-p.pdf). The use of multiple commercial vessels further provides an opportunity for industry and Secretariat interaction and for building credibility in any outputs from the survey as used in SA. Expansion work in the FISS from 2014 through 2019 demonstrates both a flexibility seldom seen in more general surveys and a desire to improve information and credible science support for decision-making. Critically, the FISS provides information to the SA on fish below the commercial MLS of 32”. Together with the NMFS survey which samples still smaller/younger fish, the FISS is a key component of the SA and provides the ability to provide probabilistic forecasts of the impacts of future catches on stock status.

The FISS is simply but well described in Webster (2019). Since 1998, it has been *undertaken annually using a 10 nmi fixed grid design, within depths of 37-503 m (20-275 ftm). This design ensures that, on average, all habitat types within the area covered by the setline survey are sampled in proportion to their occurrence, while fishing the same fixed stations each year reduces uncertainty in any estimates of trends in density indices derived from the setline survey data.* As reported in Webster (2019), the FISS has been analysed using a space-time modelling approach since 2016 but, as commented on by the SRB (IPHC, 2018): *NOTING that this is the sixth review of the spacetime modelling approach, the SRB reiterated its ENDORSEMENT of the approach as cutting-edge and could be widely used. Thus there is a pressing need to publish the space-time modelling approach used for the fishery-independent setline survey data in a peer-reviewed scientific journal.* I have been unable to find even a source grey paper on the IPHC space-time modelling, only on results and discussions such as Webster (2019), but agree with the SRB as to the general utility of the approach which is now becoming commonplace as a replacement for design-based modelling and is well understood (see, e.g.: http://www.capamresearch.org/Spatio-Temporal-Modelling-Mini-Workshop/presentations). The approach allows not just surface fitting for integration of indices but a deeper exploration of covariates and time-dependencies than more traditional approaches, as well, potentially, of estimating biological data such as age compositions. This is commented on under *Research priorities, Data relates issues* item 12.

The SRB (IPHC, 2019a) has requested: *analysis of past prediction patterns (a type of cross-validation analysis) to help assess the proposed methods' ability to meet precision targets while maintaining low bias. This should include an examination of spatio-temporal residual patterns for the appropriateness of estimated autocorrelation*. SRB reports are summary documents and do not provide documentation of discussions leading to request (though full audio recording is available). I am therefore unclear as to the reason for the SRB request. As I understand it, it is not requesting cross-validation *per se* but the requested work is regarded as conceptually related to cross-validation. Clearly, it relates to estimates from the space-time modelling and their use in the SA. I have what might be a related comment motivated by use of the space-time modelling to understand fundamentally how the distribution of fish is more or less stable through time and how complex, and the factors that influence variation. Fixed station design will generally reduce variance but at the possible expense of bias, especially if the complex distribution of fish changes through time. The space-time modelling approach used for FISS analysis can account for variations in distribution but bias will still depend on survey coverage compared to stock distribution. The expansion work since 2014 (one area *per* year) is clearly aimed at re-design to reduce bias in estimates by area and also further reducing the variance of estimates. Any re-design of the FISS following completion of the expansion series should be beneficial.

Consideration of covariates (e.g., Dissolved oxygen) in the space-time analyses appears to be ongoing and discussion between the Secretariat science staff and the SRB is guiding inclusion or otherwise. I see no need to add further comment other than the process is working, discussions taking place, and results being produced as required for the SA.

Primary and even grey literature on the FISS and application of space-time models is scarce; it would be good to see a publication not just on methods applied to the FISS and utility in SA, but also on fundamental understanding of halibut.

One issue of note regarding FISS indices is as outlined by the SRB (IPHC, 2018) - the need for re-evaluation of whale depredation accounting in the FISS time-series. This is effectively handled in the bridging exercise (see below) using revised FISS indices estimated using data revised due to redefined and reviewed criteria for determining when a FISS station has experienced whale depradation and should therefore be deemed ineffective. The details of the revised FISS indices are not given in Webster (2019) or Stewart and Webster (2019) as the work was only completed in February 2019. Presumably they will be included in the update paper dated 2020. The issue is briefly described in Stewart and Hicks (2019). This is mentioned here primarily to emphasise that the IPHC is responsive to concerns and through iteration with the SRB is careful to address issues - in this case, requiring a revision of data usage in analyses of the FISS, re-running of the FISS and consideration within the SA development phase.

While the commercial fishery samples fish from 32” upwards, mostly age 8 upwards, the FISS samples fish from 4-5 years old and the NMFS trawl survey samples fish from 2 years old. Sampling from all sources is clearly variable but IPHC samplers are involved in both surveys as well as at ports. Age composition data are available from all sources and information on cohort structures appears coherent between sources and informative in the SA. Work on age-determination has been ongoing and current ageing appears to be robust.

The overwhelming issue that stands out from biological sampling in the FISS, NMFS Alaska survey, and commercial landings is the strong trends in weight-at-age. While not discussed in Stewart and Hicks (2019) or Stewart and Webster (2019) the issue is included under *Research priorities, Biological understanding* item 4 and PHC-besrp, 2019 already (Appendices II and III) includes a number of growth-related studies due to feed in to the SA and MSE. It is unclear at this proposed item what additional work, if any, is envisaged. As a general comment, distinguishing between the range of factors listed (*competition, density dependence, environmental effects, size-selective fishing and other factors*) is likely to be extremely difficult in practice, even with the extensive and high quality data available on Pacific halibut, other stocks, and the environment from the USA and Canada NW and USA Alaska regions. Also, while understanding historic variations in growth in relation to a number of factors might be possible, prediction is only possible if the processes are understood. As reference points are defined as spawning biomass relative to dynamic, unfished spawning biomass, changes in weight-at-age are masked in advice on Stock Status but do, of course, flow through to Decision Tables as absolute values of Total Mortality used, as well as to Trend assessments. In the case of advice on Stock and Fishery Trends apparent risks are potentially confounded and probabilities poorly determined in weight-at-age trends are not appropriately predicted. For the 3 year forecasts used this may not be problematic but is something that might be considered in the MSE.

Individual Model Development

ToR bullet 2: Aspects of individual model development. [Aspects of developing individual models to consider for including in the ensemble.]

Stewart and Hicks (2019) describes clearly the historical development of individual models given the history of fisheries, data, survey developments, problems with previous models, etc. The rationales for model development and current selection within the ensemble are well-made and I see little need to revise these core models which have been used to provide advice for a number of years. The issue of whether they might be considered separately in providing multi-model advice or using an ensemble is a separate issue considered below. Each individual model is structurally distinct and is fitted to different data, allowing an exploration of model uncertainty.The models use either the long or short time-series and for each use more (AAF) or less (CW) disaggregated abundance and composition data. Models also differ in assumptions about selectivity, natural mortality, and other factors, with time-varying selectivity in the AAF models a major feature. The Long models also incorporate a simple environmental regime factor, coded as a binary PDO productivity regime parameter in the stock-recruit relationship and consistent with Pacific halibut SA practice over more than a decade. Further comment on the PDO is made at *Research priorities, Technical development* item 9. As noted above, the information between data sets is reasonably coherent - abundance indices are apparently correlated, despite even sex ratio differences between surveys and commercial fisheries, and, as modeled, composition data provide reasonable information on selectivity and natural mortality sufficient to allow coherent interpretations within models. I note the use of direct weight-at-age data coupled with time-varying selectivity in the AAF models; while highly parameterised it is not statistically over-parameterised. The rationale provided that the approach deals effectively with historic retrospective patterns is reasonably convincing, though there do appear to be recalcitrant retrospective patterns still associated with male selectivity estimation.

While the abundance indices provide a robust definition of scale, the greatest uncertainty is of course due to process misspecification of natural mortality, selectivity, and recruitment but the 4 models capture a wide range of that misspecification. Despite the rigorous approach to tuning, Stewart and Hicks also downweight composition data relative to abundance data which provide information on scale critical to the risk assessment.

For the current tuning approach, clearly described in Stewart and Hicks (2019; pp. 27-29) it would be useful diagnostically, even with a simple 2x2 ensemble, to track the weights applied to each of the data sources for individual models, from assessment to assessment. It is noticeable, for example, in Stewart and Hicks (2019, Fig 13) that the AAF Long tuned model estimates of trend are markedly different to the 2018 corresponding model (at least pre-1995), perhaps implying different weighting, though other individual models within the ensemble are all similar. With no simple comparison of outputs through time (e.g., such as a 2018 equivalent of Stewart and Hicks, 2019, Fig. 62) or of final tunings (Table 11), it is hard to determine the degree to which tuning per se might be an issue. This links below to *Research priorities, Technical development* item 2. Of course, as decision-making is determined by post-1995 estimates and as trigger reference points are approached increasingly by ensemble lower/mid tail estimation, the AAF Long model may not in any case be as important as either coastwide model which have lower spawning biomass scales. With the full 2019 data yet to be used in the assessment and final tuning still to be carried out, this will all change and it is not necessary to dig too deeply at this stage.

While not made explicit in Stewart and Hicks (2019), for each model, the bridging analyses presented suggest a consistent weighting and tuning of data with past corresponding model implementations, except perhaps in the case of the AAF Long model. From the report, it is unclear to what extent individual model relative weights and tuned effective weights may have changed between years. In discussion, however, it has been clarified that within-model data weighting has been kept constant year-to-year to reduce/avoid changes to model structure during annual updates. The explanation for the clear difference in estimated trends for the 2019 AAF Long model is thus that the re-tuned weighting "*was 'catching up' with all the new information added since 2015*". This is sensible practice, consistent with the approach of annual updates. Annual updating of data includes not just newly acquired data but also re-worked data and it could be argued that even annual updates should involve complete re-weighting and re-tuning; however, re-weighting would hide effective changes in model structure. Nevertheless, for the final SA, it might be useful to see how relative weights within individual model fits might have changed through time.

There are still axes of uncertainty such as steepness which is fixed in all individual models though has already been explored to a degree. The SRB (2019a) has requested a coarse profile of steepness. Comment is made on this in the section below on the ensemble as well as in *Research priorities, Technical development* item 2. Overall, given the historical rationale and data availability, the 4 models as structured, provide a sound basis for the risk assessment provided as advice to the Commission. None of the models is regarded as right or good enough to provide advice in isolation but the set appears to capture wide structural uncertainty and the models jointly have utility. Stewart and Hicks (2019) reports on attempts to estimate steepness. There appears to be little information to allow estimation of steepness which is, of course, confounded with natural mortality and influenced in fitting by other parameter choices. Likelihood profiling on steepness will be interesting but models that can trade steepness for other parameters generally will have little impact on probabilistic advice. However, the CW Long model is the lowest scaled of the 4 models and the one for which steepness estimation to date does have an apparent impact. Any profiling will need careful tuning but should it lead to use of a steepness axis for any or all of the 4 models in the ensemble, perhaps nested weighting could be applied such that while the four structurally different models are each weighted equally, weighting within models across the additional axes (steepness) might rely on standard approaches such as AICc (Suguira, 1978).

There is one area of potential concern. The issue of stock structure and migrations is clearly recognised by the IPHC science teams, both within the existing stock boundaries of the SA but also, potentially, as pertains to connection to the western Pacific. I note in Stewart and Hicks (2019) there is just one passing reference, in *Other Uncertainty Considerations,* to the possibility of linkage to Russian waters. It receives no mention in Stewart and Webster (2019), nor in either the presentations given to the 1st session of PRIPHC02 or the current 5-year research plan. In discussion, however, the issue was raised by IPHC staff. In contrast, migration and distribution within existing stock boundaries is well-covered in the current 5-year research plan, with dedicated projects and collaborations that explore larval and early juvenile dispersal modelling, late juvenile migration using wire tags, and tail pattern recognition to follow fish through time. Stock structure and migration issues are always important and work to understand the issues is warranted. However, the existing ensemble of models includes AAF models which allow annually varying selectivity estimation. Arguably, while modelling different processes, these models should capture some of the uncertainty that might be due to migration or stock structure. The final research priority in Stewart and Hicks' list (*Research priorities, Technical development* item 9) also touches on this general issue and comment is made below. In summary here, while the issues of stock structure and migration are recognised as important to understand, they are not regarded as critical with respect to current individual and SA modelling and the provision of robust risk assessment and advice to the Commission.

While the SA might remain focused on the 4 individual models during the full assessment and perhaps some exploration of alternatives or nesting of axes of uncertainty within models (see section on the ensemble below), the ongoing MSE work provides an opportunity for wider investigation of structural uncertainty and could be used to guide research and SA efforts in the context of what matters to decision-making.

While supporting the continued use of the 4 individual models for the 2019 full assessment, I note that Stewart and Hicks (2019) is a weigh point and that fitting to data in November 2019 could reveal issues that warrant further investigation. The initial bridging work has utilised the most recent data to address issues raised by the SRB (IPHC, 2018) regarding whale depradation in the fishery independent setline survey (FISS) and sex ratio of the commercial catch (using fin clip sampling). It is important to note that the final 2019 SA will use data up to late 2019, including from the 2019 FISS (possibly including Region 3 expansion), mortality estimates, age compositions, weights at age, and a second year of sex ratio data. Working from the weigh point, however, and the careful bridging work carried out, it appears that issues considered have either nil effect (change in software version, and consideration of whale depradation in the survey) or result in changes as expected (use of new sex ratio data).

The explanation in Stewart and Hicks (2019) of manual, iterative tuning methods used in the SA is clear and informative; far more so than most stock assessment reports. It describes well both philosophy and, to the extent possible, practice. As described and discussed during the site visit, the Pacific halibut tuning process is rigorous. Like all manual, iterative fisheries model tuning, however, it is highly time consuming, difficult to describe in complete detail, difficult to replicate, and hard to review externally given the highly detailed process.

Stewart and Hicks note the possibility of estimating observation and process error (Thorson, 2018) rather than iterative, manual tuning. Thorson outlines how recent advances in parameter estimation involving random effects could be used to replace manual tuning in fisheries assessment models. While restricting discussion to three areas of parameter tuning that might be replaced by estimation variance parameters directly, Thorson argues that the techniques are likely extendable to the case of multiple variance parameters (as required in fisheries SA such as for Paciifc halibut). It is not clear if the Pacific halibut SA could be implemented using random effects models to estimate parameter variances (in place of manual tuning) in the 2019 SA round, but it seems unlikely given the SA is currently implemented using Stock Synthesis ("SS"; Methot *et al*, 2013)) which does not yet include the option. It is well beyond the scope of this review to suggest SS might be converted to implement random effects models but Thorson notes two modelling tools that do use random effects (STAN and TMB; references in Thorson, 2018) are already available and used for stock assessment modelling. Coding the individual Pacific halibut models using STAN or TMB is a major task and unlikely within the 2019 SA round but could be explored in 2020, perhaps for comparison with updated models using manual tuning. This is an exciting area of development that could result in a major step forward in undertaking fisheries assessment. While estimating variance parameters will be computationally time-consuming it should be much faster and ‘safer’ that manual, iterative tuning. Potentially, it could also be incorporated in to grid-based operating models used in MSE/MPE.

While the approach advocated by Thorson has clear advantages, it potentially has some disadvantages. One potential disadvantage is the opportunity to press a button rather than explore. The Pacific halibut SA is an excellent example of where dedicated analysts with sufficient time to focus on a stock assessment have dug deeply into data and model variants and understand individual fits. Further, a deep understanding of information content of data allows some subjective decisions to be taken; the obvious example in this (and many) cases being the priority given to abundance indices over composition data.

Stewart and Hicks (2019) point to the potential to move to Bayesian integration of the stock assessment. Advantages of using Bayesian integration are outlined in the main document: i) better characterisation of uncertainty with ii) direct interpretation of probabilities, and iii) avoiding the potential for MLE fits to mis-estimate key quantities of interest in complex models with skewed distributions. A Bayesian analysis of the CW Short model is reported in Stewart and Hicks (2019). The time taken to run the simplest of the individual models, with slightly simplified selectivity parameterisation, is of the order of two weeks. The results from the Bayesian run as only briefly reported suggest little difference to median estimates from the standard MLE run and little skewness in the Bayesian posteriors - though a hint of right skewness in male natural mortality. It is unclear if full bayesian integration of the AAF models might lead to greater differences to MLE equivalent runs but it is clear that the computing time requirements will increase and that perhaps, further simplifications will be required. From a purely practical perspective, therefore, while moving to Bayesian analyses could be done, it does not seem to be a high priority in the context of providing robust and credible decision-support. Even with the current 2x2 ensemble, Bayesian integration would be computer intensive and time consuming and could require additional time to simplify models to run efficiently. The time taken would increase as more models were potentially added to the ensemble (*Research priorities, Technical development* item 2). As indicated in the proposal, however, using Bayesian integration could provide a more natural approach for combining models in the ensemble. The current 4 individual models are all structurally different and fit to four different, though overlapping, data sets. As such, standard model weighting (AIC and BIC variants) cannot be applied regardless of MLE or Bayesian approaches being used. Alternative approaches such as Leave-One-Out cross-validation (LOO) and the Widely Applicable Information Criterion (WAIC) (see, e.g., Vehtari et al, 2017) might be applicable but would add substantially to computing time. There is no need in the current round of SA development during 2019 to investigate further Bayesian approaches but if time permits, and perhaps when the MSE work progresses and the Commission adopts simple annual catch updating mechanisms that free up SA time, further work could (as noted by Stewart and Hicks, 2019, p91) be undertaken on individual model Bayesian integration and potentially on weighting of Bayesian models in the ensemble.

Ensemble/Weighting

ToR bullet 3: The collection of models contributing to the ensemble, and the methods for combining/weighting the results.

Consideration of the ensemble needs to include i) the general methods used, including weighting of models within the ensemble; ii) preliminary results for the 2019 SA *cf* the 2018 final results; and iii) options for development.

With regard to methods (i), the approach has been developed over the past 4-5 years and is carefully explained in Stewart and Hicks (2019). Assumptions (notably the correlation between spawning biomass and the dynamic unfished spawning biomass) have been tested for impacts on key estimates used in decision-making. Provision for flexible weighting is included in the general methods. To date, individual models have received equal weighting in the ensemble as used to generate decision tables for use by the Commission though it is clear that alternatives have been explored and considered by the Secretariat and discussed with the SRB. These are noted in the section below on possible development. The approach in use is pragmatic and reasonable; it has provided the basis for a single stream of science-based risk assessment. Importantly, by using the selected ensemble of structurally different models, and not focusing on a specific model run, the Secretariat has managed largely to separate science from policy in the support materials provided to the Commission for annual decision-making. Continued use of the 2x2 ensemble as is, with equal model weighting, would continue to provide a robust and consistent approach if used in the final 2019 SA.

Stewart and Hicks (209) provide preliminary results for 2019 and compare quantities of interest estimated using the in-development SA with those made in the final 2018 SA. Usefully, Stewart and Hicks distinguish the sources of any changes in estimates. The final 2019 SA will use fully updated fishery dependent and fishery independent data sets and all individual models will be carefully re-tuned. Preliminary results therefore need to be treated with care and only potentially as aids in thinking about model development.

The preliminary SPR estimates of interest reported in Stewart and Hicks on page 87 are given in the text only and not in preliminary decision tables or any presentation I can find. This is sensible in a development document and is noted here not as a criticism but as an indication of good process; it would be dangerous to put these figures in to any other form until the final SA is completed and final decision-support material is provided. The estimates are included at this stage to enable a deconstruction of why there are changes in the estimated status compared to the 2018 SA. Understanding this is important in providing advice in a continuous decision-making context and is critical to building credibility and trust in the advice, especially if the new estimate in the final 2019 SA remains well below the 2018 estimate and close to the trigger point for the IPHC control rule. A similar deconstruction in the final SA document is encouraged.

Individual models differ in how much flexibility they assume/allow in a variety of features and only the longer time-series models use PDO data in fitting the stock-recruitment relationship. However, while the individual models are structurally different, all are fit to the same later period fishery dependent and fishery independent data in a more or less aggregated form. It is to be expected, therefore, that they will estimate the same general late period trends and with similar uncertainty, though with different assumptions or estimates of productivity translating in to different scales of spawning biomass and recruitment and hence potential yield. This appears to be the case (e.g., Stewart and Hicks, 2019; Figs. 62-64).

The change in apparent status in the 2019 preliminary SA compared to the final 2018 SA is attributed to a change in reference points, which are estimated annually as dynamic unfished SPR, updated data and "*updating of the individual models*". Changes in dynamic reference points are natural and apparently within the range of estimation as seen through Table 14 of stewart and Hicks (2019). The majority of change is attributed jointly to new data and model updates.

The key comment at this stage is that the approach to disentangling sources of change is important and useful. However, from the preliminary analyses, it is unclear to what extent individual model effective and relative weights may have changed between years using standardised approaches requiring iterative tuning. For the current tuning approach, clearly described in Stewart and Hicks (2019; pp. 27-29) it would be useful diagnostically, even with a simple 2x2 ensemble, to track the relative weights applied to each of the data sources for individual models. It is noticeable, for example, in Stewart and Hicks (2019, Fig 13) that the AAF Long tuned model estimates of trend are markedly different to the 2018 corresponding model (at least pre-1995), perhaps implying different weighting, though other individual models within the ensemble are all similar. With no simple comparison of outputs through time (e.g., such as a 2018 equivalent of Stewart and Hicks, 2019, Fig. 62) or of final tunings (Table 11), it is hard to determine the degree to which tuning *per se* might be an issue. This links below to *Research priorities, Technical development* item 2. Of course, as decision-making is determined by post-1995 estimates and as trigger reference points are approached increasingly by ensemble lower/mid tail estimation, the AAF Long model may not in any case be as important as either coastwide model. With the full 2019 data yet to be used in the assessment and final tuning still to be carried out, this will all change and it is not necessary to dig too deeply at this stage. For the final SA, it might be useful to see how relative weights within individual model fits might have changed through time.

With regard to future development (iii), the models are currently equally weighted but there is a clear concern that this might not be the most appropriate approach. Consideration needs to be given to a) weighting of the existing 2x2 ensemble, either pragmatically or formally; and b) adoption of more and/or alternative models within the ensemble. It is important to distinguish academic issues related to model weighting from weighting as it affects the quality of risk assessment provided for decision-making; i.e., Decision Tables.

The current 4 individual models in the 2x2 ensemble are all structurally different and fit to four different, though overlapping, data sets. As such, standard model weighting such as AIC and BIC variants cannot be applied regardless of the use of MLE or Bayesian approaches in individual model fitting. If Bayesian integration is progressed then alternative approaches such as Leave-one-out cross-validation (LOO) and the widely applicable information criterion (WAIC) (see, e.g., Vehtari et al, 2017) are available but would require considerable increases in both individual model computation time and in the time required for combination of those models. They are possible means of weighting that could be explored for future use if the SA adopts a Bayesian approach.

Generally, a weighted average ensemble (as used currently in the SA) is an approach that allows multiple models to contribute to a prediction in proportion to their trust or estimated performance. In the language of machine learning and neural networks this is commonly referred to as “skill”. Stewart and Hicks (2019) reports on a number of suggested weighting approaches that have been discussed in recent years with the SRB, but not progressed for reasons that are not explicit. These are to weight models in the ensemble according to i) fit to the survey index of abundance; ii) retrospective performance (using Mohn’s rho); and iii) predictive performance (i.e., skill in predicting the terminal survey index value). Ensemble weighting based on (i) places weight on models which are already likely to be more weighted to the survey in the individual model tuning phase. Weighting using retrospective performance (ii) may favour models less influenced by the treatment of male selectivity - presumably by effectively weighting to abundance *cf* composition data. Weighting based on predictive skill for the terminal survey indice (iii) is an effective, additional weight on the survey and arguably akin to selecting, or at least prioritising,composition data over indices; in that case, a more traditional approach of using different individual models separately to reveal uncertainty might be more ‘honest’. All approaches have clear rationales but the third, notwithstanding the comment above, using “skill” arguably has the best academic foundation, borrowing in concept from machine learning and neural networks. All, however, are in fact arbitrary and as individual model tunings vary through time it is likely weighting through re-tuning of models in the ensemble may also vary, hiding relative contributions to risk-based advice. Perhaps most importantly, however, all suggestions place value on fitting specific data or achieving SA stability. It would be equally plausible to suggest, for example, that in the absence of a model with explicit stock structure and movement, the AAF models should be afforded greater weight because they provide a proxy mechanism and allow for spatial and temporal variation in distribution. While all models are caricatures and our interest in them is primarily in their predictive capabilities, given the knowledge on spatial differentiation are the CW models even admissible regardless of fit diagnostics?

The IPHC has gone to great lengths to separate science from policy advice. Arguably, rather than model weighting based on fitting criteria or *a priori* “best” model consideration, weighting might instead be focused on how robust is the advice using models combined in the ensemble. All current individual models display similar trends and variances which largely affect stock status estimates equally, but they differ in estimated scale of SB and therefore potential yield and forecasts. In decision-making that attends to probabilities of bad things happening given absolute values of catch, it is the mid lower tails of the ensemble distributions that generally might become important. The CW models have lower SB and presumably therefore lower potential yield than AAF models (e.g., Stewart and Hicks, 2019; Table 13 and Fig. 62). Therefore, even though the 4 models are currently equally weighted, for any absolute catch assumption in the decision tables based on all 4 models the estimated probability of being below stock status trigger reference points will depend on how much the CW models (with lower SB estimates) are weighted. As decision-making is concerned with the mid lower tails, the CW models have more influence on decision outcomes than the AAF models.

One easy way to evaluate the robustness of advice to weighting would be a simple, manual leave one out approach using equal weights for each combination of three models - *a priori* it might make little difference in the stock trends part of the Decision Tables though presumably would impact more on stock status 'probabilities'. Similarly, various *ad hoc* arbitrary re-weighting of the 4 models could be considered as a sensitivity test on advice.

A consistently applied and academically defensible weighting process would be ideal but the current equal weighting approach has the merit of apparent consistency and simplicity, and therefore of credibility with users. Continuing to use the approach with equal weighting is sufficient to support consistent decision-making by the Commission but investigating the robustness of the advice to different weighting, which can be done informally, would be a good first step. In the future, if SA time is freed up following use of MSE, use of a Bayesian approach, or perhaps 'automated' tuning as suggested by Thorson (2018; see also *Research priorities, Technical developments* item 3), then more formal weighting methods might be considered, explored, and used.

The use of additional or alternative individual models in the ensemble has been mooted. The SRB (IPHC, 2019a) has requested: … *Evaluate a profile (coarse) over steepness, e.g. 0.65 and 0.85, and check the impact on recruitment estimates and RSB values…* It is not clear from the SRB summary report if this request is simply aimed at further investigation of the use of a fixed value of 0.75 for steepness, or whether it is aimed possibly at *Research priorities, Technical developmen*t, item 2 and the possibility of including additional axes of uncertainty in the ensemble. Stewart and Hicks (2019) reports on attempts to estimate steepness. There appears to be little information to allow estimation of steepness which is, of course, confounded *inter alia* with natural mortality and influenced in fitting by other parameter choices. Likelihood profiling on steepness will be interesting but models that can trade steepness for other parameters generally will have little impact on probabilistic advice. However, the CW Long model is the lowest scaled of the 4 models and the one for which steepness estimation to date does have an apparent impact. Any profiling will need careful tuning but should it lead to use of a steepness axis for any or all of the 4 models in the ensemble, perhaps nested weighting could be applied such that while the four structurally different models are each weighted equally, weighting within models across the additional axes (steepness) might rely on standard approaches such as AICc (Suguira, 1978).

The ensemble has been stable for a full SA cycle (between full assessments) and provides a consistent basis for robust decision-support. While a full assessment is an opportunity to adjust individual models and the composition and/or weighting of the ensemble, any change needs to be well justified and tested for robustness. Investigating axes of uncertainty is a key part of SA but the provision of consistent, robust and credible risk assessment as a basis for regular decision-making must be considered. With MSE work currently being carried out by the IPHC and due for presentation and possible implementation in 2021, it might be prudent to minimise or even avoid any changes to the composition of the ensemble at this time.

Research Priorities

ToR bullet 4: Comments on research priorities or avenues for data, model or management advice development as appropriate.

Stewart and Hicks (2019) provide an extensive list of '*Research priorities*', spanning improvements in basic biological understanding, investigation of existing data series and collection of new information, and technical development of models and modelling approaches. The list subsumes all potential data-related future analyses highlighted by Stewart and Webster (2019). For simplicity, the complete list from Stewart and Hicks (2019) is included here as numbered items, together with comments. The text from Stewart and Hicks is in *blue italics*. Comments are in black. Potential recommendations on prioritisation are underlined and **possible priorities are in bold case**. Note that Stewart and Hicks (2019) is a complete list and does not suggest potential costs and benefits or prioritisation, nor does it distinguish work already started from work that is proposed. In the final SA report due in September 2019, it would be helpful to separate in progress from suggested future work and for suggested work to provide priority rankings with justification, ideally linked to the text of the main report. This would assist reading but would also integrate better with development and updating of 5-year plans.

NOTE: The 5-year research plan reported in Planas (2019) seems now to be replaced by https://www.iphc.int/uploads/pdf/besrp/2019/iphc-2019-besrp-5yp.pdf. I can find no formal reference to this document and it is referred to in this report as IPHC-besrp, 2019.

Biological understanding

During the last several years, the IPHC Secretariat has developed a comprehensive five-year research program (Planas 2019). The development of the research priorities has been closely tied to the needs of the stock assessment and harvest strategy policy analyses, such that the IPHC's research projects will provide data, and hopefully knowledge, about key biological and ecosystem processes that can then be incorporated directly into analyses supporting the management of Pacific halibut. Key areas for improvement in biological understanding include:

1. *The current functional maturity schedule for Pacific halibut, including fecundity-weight relationships and the presence and/or rate of skip spawning.* This is already in progress

as reported in Planas (2019), IPHC-besrp, (2019), and Stewart and Webster (2019); no further comment.

2. *The stock structure of the Pacific halibut population. Specifically, whether any geographical components (e.g., Region 4B) are isolated to a degree that modelling approximations would be improved by treating those components separately in the demographic equations and management decision-making process.* See also item 3, below.
3. *Movement rates among Biological Regions remain uncertain and likely variable over time. Long-term research to inform these rates could lead to a spatially explicit stock assessment model for future inclusion into the ensemble.* The issue of stock structure and migrations is clearly recognised by the IPHC science teams, both within the existing stock boundaries of the SA but also, potentially, as pertains to connection to the western Pacific. I note in Stewart and Hicks (2019) there is just one passing reference, in *Other Uncertainty Considerations,* to the possibility of linkage to Russian waters. It receives no mention in Stewart and Webster (2019), nor in any of the presentations given to the 1st session of PRIPHC02 or the current 5-year research plan. In discussion, however, the issue was raised by IPHC staff, consistent with general descriptions on the IPHC website (https://iphc.int/management/science-and-research/pacific-halibut-stock-status-and-biology). In contrast, migration and distribution within existing stock boundaries is well-covered in the current 5-year research plan, with dedicated projects and collaborations that explore larval and early juvenile dispersal modelling, late juvenile migration using wire tags, and tail pattern recognition to follow fish through time. Stock structure and migration issues are always important and work to understand the issues is warranted. However, the existing ensemble of models includes AAF models which allow annually varying selectivity estimation. Arguably, while modelling different processes, these models should capture some of the uncertainty that might be due to migration or stock structure. The final research priority in Stewart and Hicks' list (*Technical development*, item 9) also touches on this general issue and comment is made there. In summary here: i) while the issues of stock structure and migration are recognised as important to understand, they are not regarded as critical with respect to current individual and SA modelling and the provision of robust risk-based advice to the Commission; ii) spatial distribution and migration are already incorporated into the 5-year work program; and iii) the issue of connection between eastern and western Pacific stocks is not currently covered in IPHC-besrp, 2019, but warrants investigation and reporting in the full SA report **(Medium priority)**
4. *The relative role of potential factors underlying changes in size-at-age is not currently understood. Delineating between competition, density dependence, environmental effects, size-selective fishing and other factors could allow improved prediction of size-at age under future conditions.* IPHC-besrp, 2019 already (Appendices II and III) includes a number of growth-related studies due to feed in to the SA and MSE. it is unclear at this proposed item what additional work, if any, is envisaged. As a general comment, distinguishing between the range of factors listed is likely to be extremely difficult in practice, even with the extensive and high quality data available on Pacific halibut, other

stocks, and the environment from the USA and Canada NW and USA Alaska regions. Also, while understanding historic variations in growth in relation to a number of factors might be possible, prediction is only possible if the processes are understood. **(Unclear priority)**

5. *Improved understanding of recruitment processes and larval dynamics could lead to covariates explaining more or the residual variability about the stock-recruit relationship than is currently accounted for via the binary indicator used for the Pacific Decadal Oscillation.*This appears to be subsumed under *Technical development*, item 8.
6. *Improved understanding of discard mortality rates and the factors contributing to them may reduce potential biases in mortality estimates used for stock assessment.*This appears to be subsumed under *Data related research*, item 11.

Data related research

This section represents a list of potential projects relating specifically to existing and new data sources that could benefit the Pacific halibut stock assessment.

1. *Continued collection of sex-ratio from the commercial landings will provide valuable information for determining relative selectivity of males and females, and therefore the scale of the estimated spawning biomass, and the level of fishing intensity as measured by SPR. Potential methods for estimating historical sex-ratios from archived scales, otoliths or other samples should be pursued if possible.* Estimates of historic and future catch sex ratios are critical to credible usage of SPR in the management context. Fin clipping of fish in the ports, together with genetic analysis, has already provided a sex ratio estimate for 2017, with a 2018 estimate imminent. This is covered in the 5-year research plan. However. The plan does not explicitly include continued fin clipping/genetic work after 2018. Nor is there any provision for estimating historic sex ratios. The potential project noted by Stewart and Hicks seems to presuppose future monitoring - this might be clarified in the 5-year research plan and the final SA report. The suggestion for methods to estimate historical sex ratios, at this stage just to explore what is possible using archived samples, is important. Consideration should be given to including at least exploration of archived samples and potential for sex ratio estimation in the 5-year plan **(Exploration - high priority)**
2. *The work of Monnahan and Stewart (2015) modelling commercial fishery catch rates has been extended to include spatial effects. This could be used to provide a standardized fishery index for the recent time-series.* The reference is not alluded to in the main text of Stewart and Hicks (2019) and is not included in the reference list. It is referenced in Stewart and Webster (2019) where it is noted that: ...*A detailed exploratory analysis of the logbook standardization data and methods was completed during 2014 (Monnahan and Stewart 2015), which suggested future analyses may be able to include all logbook records in all Regulatory Areas regardless of gear type if a model-based estimator were used. However, discussions with the IPHC's Scientific Review Board did not result in a recommendation to change the simple method employed historically*...and from which the proposal appears to carry over. Without further discussion and information it is not possible to comment or suggest priority.

3. *A revised hook spacing relationship (Monnahan and Stewart 2017) will be investigated for inclusion into IPHC database processing algorithms.* This is noted as important but, as stated, seems to be a given rather than a proposal.
4. *Reevaluation of the historical length-weight relationship to determine whether recent changes in length-at-age are also accompanied by changes in weight-at-length and how this may change estimates of removals over time is ongoing.*This is noted as important but already in progress.
5. *A historical investigation on the factors influencing observed size-at-age, and ageing of additional samples from key periods and areas to support this analysis is ongoing at the IPHC.*This is noted as important but already in progress.
6. *There is the potential that trawl surveys, particularly the Bering Sea trawl survey, could provide information on recruitment strengths for Pacific halibut several years prior to currently available sources of data. Geostatistical modelling and renewed investigation of the lack of historical correlation between trawl survey abundance and subsequent abundance of Pacific halibut in the FISS and directed fisheries may be helpful for this effort.* Early indications of recruitment are clearly key to forecasting three years ahead, as done for the decision tables provided annually. Given fishery selectivity and regulations (MLS) the FISS currently contains information 3-4 years ahead of recruitment to the fishery. The NMFS survey could in principle extend this lead in by a further 2-3 years. With annual decision-making, 3-year forecasts are likely sufficient, and if MSE leads to implementation of control rules or management procedures then FISS-derived indices are likely to dominate in informing annual mortality changes. While this proposed work would be interesting and potentially useful in developing understanding of ontogenetic or environmentally-related changes in distribution of halibut, and may be worthwhile in its own right, it is not a clear priority for SA or MSE.
7. *There is a vast quantity of archived historical data that is currently inaccessible until organized, electronically entered, and formatted into the IPHC's database with appropriate meta-data. Information on historical fishery landings, effort, and age samples would provide a much clearer (and more reproducible) perception of the historical period.* No detail on historical data (as specified in this research item) or archived materials is given in Stewart and Hicks (2019) or Stewart and Webster (2019) though Stewart and Hicks does report briefly on, e.g., re-ageing of archived otolith samples. The listed avenue of research is a general comment about inaccessible, archived data and is difficult to comment on except to provide in principle support for careful cataloguing, reanalysis and use of historical data and materials (e.g., for sex ratio estimation as at *Data related research* item 1). The re-ageing reported by Forsberg and Stewart (2015) is a good example of why such materials and data are important. It is noted that the suggestion for this item is consistent with various annual reports of assessment and research activities (e.g., IPHC, 2014).
8. *Additional efforts could be made to reconstruct estimates of subsistence harvest prior to 1991.* It is unclear from Stewart and Webster (2019), from which this item carries over, what if any sources of existing data might be used to reconstruct subsistence estimates, or if the proposal is to use e.g. structured interviewing techniques to gather information.

The scale of post-1991 subsistence estimates, however, is very small compared to other sources of mortality and it is not obvious that this work should be afforded great priority from a technical perspective.

9. *NMFS observer data from the directed Pacific halibut fleet in Alaska could be evaluated for use in updating DMRs and the age-distributions for discard mortality. This may be more feasible if observer coverage is increased and if smaller vessels (< 40 feet LOA, 12.2 m) are observed in the future. Post-stratification and investigation of observed vs. unobserved fishing behavior may be required.* Discard mortality in the directed fishery is clearly an important component to quantify and age-composition data of discards potentially provides key information on recruitment and potential yields. Increased observer coverage generally and extension to smaller vessels is clearly desirable but as commented above, while improved information would be useful and could improve credibility of the SA, it is beyond the scope of this review to recommend increasing observer coverage by a member state. This research proposal is one of a number about improving or acquiring basic data but is different in that it implies a change in monitoring. As such, with considerable cost implication, clear justification with costs and benefits to support prioritisation is required. <u>NOTE based on the main text above: One other potential unaccounted mortality in the commercial fishery is that due to whale depradation. An exploration of potential importance in risks assessments that might be caused by trends in scale and nature of this could be undertaken quickly to determine what priority might be placed on estimating depradation in commercial fisheries. Exploration using MSE that includes how unaccounted trends impact the assessment-decision-implementation loop would be preferable.</u> **(Medium priority)**
10. *Historical bycatch length frequencies and mortality estimates need to be reanalyzed accounting for sampling rates in target fisheries and evaluating data quality over the historical period.* It is unclear if this relates also to item 7 on inaccessible data or to accessible data sets requiring new analysis; I presume the latter. IPHC (2019c) indicates recent bycatch mortality is about 15% of total mortality but visually from Stewart and Hicks (2019; Fig. 3) historical bycatch mortality may have been as much as 25% in the 1960s and approaching 50% in the late 1970s and 1980. Older fish are well represented in the early (i.e., pre-1992) bycatch compositions. It is unclear from the main Stewart and Hicks (2019) text why this specific reanalysis is 'needed' and what priority it should receive; there is no suggestion that the data as used currently in the assessment are flawed except also by implication at *Research proposal, Technical Development* item 5. Improving these data to the greatest extent possible would be welcome and might impact on historical perspectives but it is unclear how it might flow through to impact on current advice. **(Medium priority?)**
11. *There are currently no comprehensive variance estimates for the sources of mortality used in the assessment models. In some cases, variance due to sampling and perhaps even non-sampling sources could be quantified and used as inputs to the models via scaling parameters or even alternative models in the ensemble.* (See also *Biological understanding*, item 6.) It is not uncommon to use gross sensitivity tests to account for potential misspecification of mortality components, particularly of scale, and, perhaps

more importantly, trend. This could be done as part of SA sensitivity testing and/or might be incorporated into MSE robustness testing. However, it does need to be informed by data and analysis to be credible. It is unclear from the core documents available for review what precisely is envisaged under this proposal item or if priorities would be assigned by sector. Presumably, data and information on observer coverage, etc, exist and could be used to estimate variances but issues of scale and trend may often require less formal information. Issues affecting estimates will vary by sector and information on changing practices within sectors will require careful consideration. The directed fishery is the largest proportion of mortality but likely the best sampled, though issues such as conversion factors and changing practices might be relevant. Changes through time due to regulatory change and low observer coverage might be relevant in the bycatch fishery. Over more recent times, growth in variable recreational fisheries might be of importance. It would be useful to consider this proposed item in light of perceived problems and to set priorities accordingly **(Medium priority?)**.

12. *A space-time model could be used to calculate weighted FISS age-composition data. This might alleviate some of the lack of fit to existing data sets that is occurring not because of model misspecification but because of incomplete spatial coverage in the annual FISS sampling which is accounted for in the generation of the index, but not in the standardization of the composition information.* Fitting weighted age-composition data using a space-time model would be interesting and for fisheries with less extensive sampling could be highly beneficial. However, it is not clear from Stewart and Hicks (2019) reports of individual model fits why this proposed work would be of high priority for the SA. While there is incomplete spatial coverage in the FISS age sampling, it is nevertheless extensive and fits to FISS age composition data appear generally good for all models, though I note Fig. 35 and residual patterns in the AAF Short model. The expansion work should also lead to improved age compositions. I note the comments by Thorson (http://www.capamresearch.org/sites/default/files/Thorson2.pdf; slides 46 onwards) concluding i) the feasibility of estimating age compositions using space-time models; but ii) perhaps with little benefit. However, Thorson's conclusion *re* little benefit is somewhat countered by the example used that shows stock assessment outcomes when using either design or model-based age composition data; relative spawning biomass appears little affected but in the example case the absolute spawning biomass levels are very different. Given the lack of information on scale in composition data this seems strange. Exploration of a space-time model as suggested could lead to standardised composition data as suggested and is worthy of exploration, also as an alternative/backup should future sampling or ageing be compromised. **(Not essential for the SA so Low to medium priority?)**

Technical development

There are a variety of technical explorations and improvements that could benefit the stock assessment models and ensemble framework. Although larger changes, such as the new data sets and refinements to the models presented in this document, naturally fit into the period full *assessment analyses, incremental changes may be possible during updated assessments when and if new data or methods become available. Specifically, development is intended to occur in time for initial SRB review (generally in June), with only refinements made for final review (October), such that untested approaches are not being implemented during the annual stock assessment itself. Technical research priorities include:* This preamble suggests the list contains technical developments that '*could*' benefit the individual SA and ensemble but the final sentence uses the word '*priorities*'. <u>If the intention is to prioritise then further justification is required at each item with respect to the SA and perhaps MSE but especially in the context of providing robust, consistently-based, and credible decision-support.</u>

1. *Maintaining consistency and coordination between MSE, and stock assessment data, modelling and methodology.* Noted and supported; presumably this is ongoing and standard operating procedure. It is unclear why that this needs to be given specific mention as a "*technical exploration and improvement*".
2. *Continued refinement of the ensemble of models used in the stock assessment. This may include investigation of alternative approaches to modelling selectivity that would reduce relative downweighting of certain data sources (see section above), evaluation of additional axis of uncertainty (e.g., steepness, as explored above), or others.* Stewart and Hicks (2019) reports on attempts to estimate steepness. There appears to be little information to allow estimation of steepness which is, of course, confounded with natural mortality and influenced in fitting by other parameter choices. Likelihood profiling on steepness will be interesting but models that can trade steepness for other parameters generally will have little impact on probabilistic advice. However, the CW Long model is the lowest scaled of the 4 models and the one for which steepness estimation to date does have an apparent impact. Any profiling will need careful tuning but should it lead to use of a steepness axis for any or all of the 4 models in the ensemble, perhaps nested weighting could be applied such that while the four structurally different models are each weighted equally, weighting within models across the additional axes (steepness) might rely on standard approaches such as AICc (Suguira, 1978). // The ensemble has been stable for a full SA cycle (between full assessments) and provides a consistent basis for robust decision-support. While a full assessment is an opportunity to adjust individual models and the composition and/or weighting of the ensemble, any change needs to be well justified and tested for robustness. Investigating axes of uncertainty is a key part of SA but the provision of consistent, robust and credible risk assessment as a basis for regular decision-making must be considered. <u>With MSE work currently being carried out by the IPHC and due for presentation and possible implementation in 2021, it might be prudent to minimise or even avoid any changes to the composition of the ensemble at this time.</u>
3. *Evaluation of estimating (Thorson 2018) rather than tuning (Francis 2011; Francis 2016) the level of observation and process error in order to achieve internal consistency and better propagate uncertainty within each individual assessment model. This could include the 2d Autoregressive smoother for selectivity, the Dirichlet multinomial, and other features now implemented in stock synthesis (Methot et al. 2019).*The explanation in Stewart and Hicks (2019) of manual tuning methods/approaches used in the SA is

clear and informative; far more so than most stock assessment reports. As described and discussed during the site visit the Pacific halibut tuning process is rigorous. Like all fisheries model tuning, however, it is highly time consuming, difficult to describe in detail, difficult to replicate, and very hard to review. Stewart and Hicks note the possibility of estimating observation and process error (Thorson, 2018) rather than iterative, manual tuning. Thorson outlines how recent advances in parameter estimation involving random effects could be used to replace manual tuning in fisheries assessment models. While restricting discussion to three areas of parameter tuning that might be replaced by estimation variance parameters directly, Thorson argues that the techniques are likely extendable to the case of multiple variance parameters (as required in fisheries SA such as Paciifc halibut). It is not clear if the Pacific halibut SA could be implemented using random effects models to estimate parameter variances (in place of manual tuning) in the 2019 SA round, but it seems unlikely given the SA is currently implemented using Stock Synthesis (Methot *et al*, 2013)) which does not yet include the option. It is well beyond the scope of this review to suggest SS might be converted to implement random effects models but Thorson notes two modelling tools that do use random effects (STAN and TMB; references in Thorson, 2018) already available and used for stock assessment modelling. **Coding the individual Pacific halibut models using STAN or TMB is a major task and unlikely within the 2019 SA round but could be explored in 2020, perhaps for comparison with updated models using manual tuning.** This is an exciting area of development that could result in a major step forward in undertaking fisheries assessment. While estimating variance parameters will be computationally time-consuming it should be much faster and 'safer' that manual, iterative tuning. Potentially, it could also be incorporated into grid-based operating models used in MSE/MPE.

4. *Continued development of weighting approaches for models included in the ensemble, potentially including fit to the survey index of abundance, retrospective, and predictive performance (see section above).* As noted at item 6, below, the current 4 individual models are all structurally different and fit to four different, though overlapping, data sets. As such, standard model weighting (AIC and BIC variants) cannot be applied regardless of MLE or Bayesian approaches being used. Alternative (effectively cross-validation) approaches are available for Bayesian models (see, e.g. Vehtari et al, 2017) but would require considerable increases in both individual model computation time and in the combination of those models. They are possible means of weighting that could be explored for future use if the SA adopts a Bayesian approach. Generally, A weighted average ensemble is an approach that allows multiple models to contribute to a prediction in proportion to their trust or estimated performance. Stewart and Hicks (2019) reports on a number of suggested weighting approaches that have been discussed with the SRB but not progressed. These are to weight models in the ensemble according to i) fit to the survey index of abundance; ii) retrospective performance (using Mohn's rho); and iii) predictive performance (i.e., skill in predicting the terminal survey index value). Ensemble weighting based on (i) places weight on models which are already likely to be more weighted to the survey in the individual model tuning phase. Weighting using

retrospective performance (ii) may favour models less influenced by the treatment of male selectivity - presumably by effectively weighting to abundance *cf* composition data. Weighting based on predictive skill for the terminal survey indice (iii) is an effective, additional weight on the survey and arguably akin to selecting, or at least prioritising composition data over indices; in that case, a more traditional approach of using different individual models separately to reveal uncertainty might be more 'honest'. All approaches have clear rationales but the third, notwithstanding the comment above, using "skill" arguably has the best academic foundation, borrowing in concept from machine learning and neural networks. All, however, are in fact arbitrary and as individual model tunings vary through time it is likely weighting through re-tuning of models in the ensemble may also vary, hiding relative contributions to risk-based advice. The IPHC has gone to great lengths to separate science from policy advice; care is needed in investigating any *ad hoc* weighting to focus not on which models make a difference but on how robust is the advice using those four models. All models display similar trends and variances which affect status determination and forecasts but they differ in estimated scale of SB and therefore potential yield. In decision-making that attends to probabilities of bad things happening, it is the mid lower tails of the distributions of absolute values that generally might become important, with the CW models having lower SB and presumably therefore potential yield than AAF models (e.g., Stewart and Hicks, 2019; Table 13 and Fig. 62). One simple way to evaluating the robustness of advice to weighting would be a simple, manual leave one out approach using equal weights for each combination of three models - *a priori* it might make little difference in the status trends part and perhaps stock trends part of the Decision Tables though presumably would impact more fishery trend 'probabilities'. Similarly, an ad hoc arbitrary re-weighting of the 4 models could be considered as a sensitivity test on advice. A consistently applied and academically defensible weighting process would be ideal but the current approach has the merit of consistency and simplicity. Continuing to use the approach with equal weighting is sufficient to support decision-making by the Commission but investigating the robustness of the advice to different weighting, which can be done informally, would be a useful step in the 2019 SA **(SA 2019; Medium priority).** In time, if SA time is freed up following use of MSE, and if the SA adopts a Bayesian approach, more formal weighting methods might be used **(Post MSE)**

5. *Exploration of methods for better including uncertainty in discard mortality and bycatch estimates in the assessment (now evaluated only via alternative mortality projection tables or model sensitivity tests) in order to better include these sources uncertainty in the decision table. These could include explicit discard/retention relationships, including uncertainty in discard mortality rates, and allow for some uncertainty directly in the magnitude of mortality for these sources.* See also *Research proposals, Data related research* item 10. Work under the data related research needs to proceed first to identify uncertainties in the mortality estimates. Depending on estimates, SA and MSE focus can then be directed appropriately if warranted. The standard approach of conducting sensitivity tests on the individual models and perhaps decision tables is the obvious first approach within the SA. Including discard/retention relationships in the SA would need to

be informed by data, potentially from compliance authorities. MSE can be used to test the implications of different relationships in combination with management. If biases are consistent then the implications for decision-making are likely to be small or insignificant. If biases are variable but reasonably symmetric then the effectiveness of any control rule or management procedure will depend on its inputs (likely from the FISS) and their ability to track changes in recruited biomass. If, however, there is a discard/retention relationship related, e.g., to regulatory 'bite' (such as reducing catch limits) then unless control rules or management procedures react quickly to informative inputs, there is potential for unseen stock decline. If analyses suggest biases and especially any discard/retention relationships then the MSE rather than the SA would be an appropriate mechanism to investigate implications and to develop robust management responses as part of control rules or management procedures. **(Priority in MSE depends on analyses to identify potential issues)**

6. *Bayesian methods for fully integrating parameter uncertainty may provide improved uncertainty estimates within the models contributing to the assessment, and a more natural approach for combining the individual models in the ensemble (see section above).* Advantages of using Bayesian integration are outlined in the main document: i) better characterisation of uncertainty with ii) direct interpretation of probabilities, and iii) avoiding the potential for MLE fits to mis-estimate key quantities of interest in complex models with skewed distributions. A Bayesian analysis of the CW Short model is reported in Stewart and Hicks (2019). The time taken to run the simplest of the individual models, with slightly simplified selectivity parameterisation, is of the order of two weeks. The results from the Bayesian run as only briefly reported suggest little difference to median estimates from the standard MLE run and little skewness in the Bayesian posteriors - though a hint of right skewness in male natural mortality. It is unclear if full Bayesian integration of the AAF models might lead to greater differences to MLE equivalent runs but it is clear that the computing time requirements will increase and that, perhaps, further simplifications will be required. From a purely practical perspective, therefore, while moving to Bayesian analyses could be done, it does not seem to be a high priority in the context of providing robust and credible decision-support. Even with the current 2x2 ensemble, Bayesian integration would be computer intensive and time consuming and could require additional time to simplify models to run efficiently. The time taken would increase as more models were potentially added to the ensemble (Technical development, item 2). As indicated in the proposal, however, using Bayesian integration could provide a more natural approach for combining models in the ensemble. The current 4 individual models are all structurally different and fit to four different, though overlapping, data sets. As such, standard model weighting (AIC and BIC variants) cannot be applied regardless of MLE or Bayesian approaches being used. Alternative approaches such as Leave-one-out cross-validation (LOO) and the widely applicable information criterion (WAIC) (see, e.g., Vehtari et al, 2017) might be applicable but would add substantially to computing time. There is no need in the current round of SA development during 2019 to investigate further Bayesian approaches but if time permits, and perhaps when the MSE work progresses and the Commission adopts

simple annual catch updating mechanisms that free up SA time, further work could (as noted by Stewart and Hicks, 2019, p91) be undertaken on individual model Bayesian integration and potentially on weighting of Bayesian models in the ensemble. **(Post MSE)**

7. *Exploration of stock synthesis features previously unavailable or unevaluated including: timing of fishery and survey observations, the fishing mortality approximation used (i.e., estimated parameters, 'hybrid' or Pope's approximations).* Stewart and Hicks (2019) describe the standard population structuring adopted for all models in the SA, using mid year removals and Pope's approximation.For Pacific halibut, while exploration of alternatives may be interesting it would seem a low priority given the approximations are robust except at high fishing mortality - which is not the case. It is unclear why the proposal is made.
8. *An analysis of model sensitivity and statistical performance of treating the environmental relationship between recruitment and the PDO as annual deviates (+/-), a running mean, or annual values (actual PDO), or other methods that differ from the binary indicator variable currently employed.*The current binary indicator approach requires only a single parameter estimate (of β) in each of the Long models, and is informed primarily for the later part of the time series for which good composition data are available. It effectively assumes an unspecified linkage between general environmental state and Pacific halibut recruitment. Any alternative using e.g. a running mean or actual values in essence assumes a more direct link between PDO state and the scale of Pacific halibut recruitment resulting from the within-species contest competition implied by the Beverton-Holt S-R function. Pacific halibut recruitment, however, derives from complex and stochastic environmental processes and from complex single and multi species biological and ecological processes, also subject to stochasticity. Any direct link between PDO and recruitment will therefore have high process error, as well as observation error in the composition data informing recruitment estimation. Tuning will need to pay attention directly to recruitment but also to aliasing estimates of natural mortality in particular, but also selectivity. This would be compounded if steepness were also estimated or alternative steepness values assumed. While exploring alternative PDO linkage functions would be an interesting research area and might potentially result in apparently improved stock assessment(s) at any point in time, it is not at all clear that this would benefit risk assessments derived using stock assessments because without understanding the complex processes linking the PDO specifically to Pacific halibut recruitment, forecasting utility would not necessarily be enhanced. The MSE might again be the best place to explore how changes in environment (in a wide sense, to include not just e.g. PDO but also e.g. other species stock distribution and abundance) might affect recruitment and how alternative control rules or management procedures might be more or less robust. **(SA: Low priority; MSE: Medium priority?)**
9. *Alternative model structures, including a growth-explicit statistical catch-at-age approach and a spatially explicit approach may provide avenues for future exploration. Efforts to develop these approaches thus far have been challenging due to the technical complexity and data requirements of both. Previous reviews have indicated that such*

efforts may be more tractable in the context of operating models for the MSE, where conditioning to historical data may be much more easily achieved than fully fitting an assessment model to all data sources for use in tactical management decision making. (See also *Research priorities, Biological Understanding* items 2 and 3). The SA and MSE “philosophies” are different with more care typically taken in development of individual SA models. Conditioning, however, still requires fitting, though it is impractical to fit with the rigour used, e.g., in the individual IPHC stock assessments, especially when grid approaches with wide parameter spaces are used and specific parameter combinations may be infeasible or not well supported. Nevertheless, development of spatially explicit models for MSE purposes needs to start with careful model development and fitting as used for the tactical SA, even if final generating (operating) models are less rigorously fit. Regardless, so long as the tactical SA ensemble approach reasonably captures uncertainties through proxies for explicit spatial models (e.g. AAF with annual variation in selectivity) then specific consideration of spatially explicit models is best left to MSE where assessment and management robustness can be explored more thoroughly.

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Summary of the data, stock assessment, and harvest decision table for Pacific halibut (*Hippoglossus stenolepis*) at the end of 2019

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PURPOSE

To provide the Commission with a summary of the data, stock assessment, and harvest decision table at the end of 2019.

INTRODUCTION

In 2019 the International Pacific Halibut Commission (IPHC) undertook its annual coastwide stock assessment of Pacific halibut (*Hippoglossus stenolepis*), which included a full re-evaluation of all data sources and models contributing to the assessment. The assessment was conducted in two phases: first, a preliminary assessment underwent an external independent peer review, and a two-part review by the IPHC's Scientific Review Board (SRB; IPHC-2019-SRB014-R, IPHC-2019-SRB015-R), second the preliminary assessment was updated to include all data through 2019. This process included five steps to update from the 2018 stock assessment to the preliminary results for 2019 (Stewart and Hicks 2019) and the final estimates reported here:

1) Add the newly available sex-ratio data from the 2017 commercial fishery landings and estimate male selectivity scale parameters.
2) Extend the time series (for the two short models) from 1996 to 1992 and add a stock-recruitment function to these models.
3) Replace the modelled FISS time-series with the series corrected for whale depredation.
4) Regularize and tune each model to be reliable and internally consistent given all the changes that had been made.
5) Add the 2018 sex-ratio data, estimates of 2019 mortality and extend all data sources through 2019 for the final assessment.

Overall, the inclusion of the 2017 sex-ratio data resulted in higher spawning biomass for all models, and the updated whale depredation data made little difference to the results. Extending the time-series back to 1992 in the two short models resulted in higher estimates of recruitment for 1994 and 1995. Regularizing and tuning the series had different effects on each model. The 2019 data revised the estimates of the 2012 year-class upward slightly, but had little effect on the overall time-series, and the 2018 sex-ratio data was very similar to the 2017 information included in the preliminary analysis and therefore produced little additional change. In aggregate, the historical female spawning biomass estimated from the stock assessment ensemble was slightly larger than that estimated in previous assessments at the end of the time series, and considerably larger prior to the early 2000s, although the trend remains very similar in recent years using these updated data sources.

This document provides an overview of the final data sources available for the 2019 Pacific halibut stock assessment including the population trends and distribution among Regulatory Areas based on the modelled IPHC fishery-independent setline survey (FISS), directed commercial fishery data, and results of the stock assessment including all data available through 2019.

STOCK AND MANAGEMENT

The stock assessment reports the status of the Pacific halibut resource in the IPHC Convention Area. As in recent stock assessments, the resource is modelled as a single stock extending from northern California to the Aleutian Islands and Bering Sea, including all inside waters of the Strait of Georgia and Puget Sound, but excludes known extremities in the western Bering Sea within the Russian Exclusive Economic Zone (Figure 1).

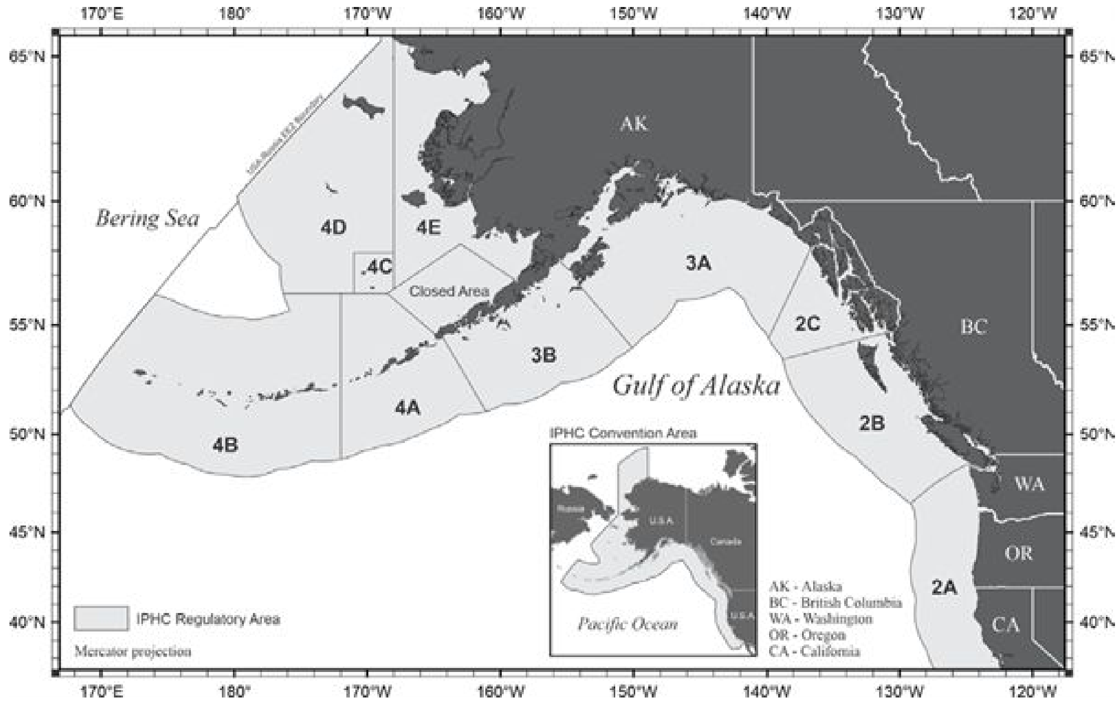

FIGURE 1. IPHC Convention Area (insert) and IPHC Regulatory Areas.

The Pacific halibut fishery has been managed by the IPHC since 1923. Catch limits for each of eight IPHC Regulatory Areas[1] are set each year by the Commission. The stock assessment provides a summary of recently collected data, and model estimates of stock size and trend. Specific management information is summarized via a decision table reporting the estimated risks associated with alternative management actions and catch tables projecting the level of mortality for fisheries in each Regulatory Area indicated by the IPHC's interim management procedure, as well as other alternatives.

DATA

Historical mortality

Known Pacific halibut mortality consists of target commercial fishery landings and discard mortality (including research), recreational fisheries, subsistence, and discard mortality in fisheries targeting other species ('non-directed' fisheries where Pacific halibut retention is prohibited). Over the period 1920-2019 mortality has totaled 7.2 billion pounds (~3.3 million metric tons, t), ranging annually from 34 to 100 million pounds (16,000-45,000 t) with an annual average of 63 million pounds (~29,000 t; Figure 2). Annual mortality was above this long-term

[1] The IPHC recognizes sub-Areas 4C, 4D, 4E and the Closed Area for use in domestic catch agreements but manages the combined Area 4CDE.

average from 1985 through 2010, and has averaged 41 million pounds (~18,500 t) from 2016-19.

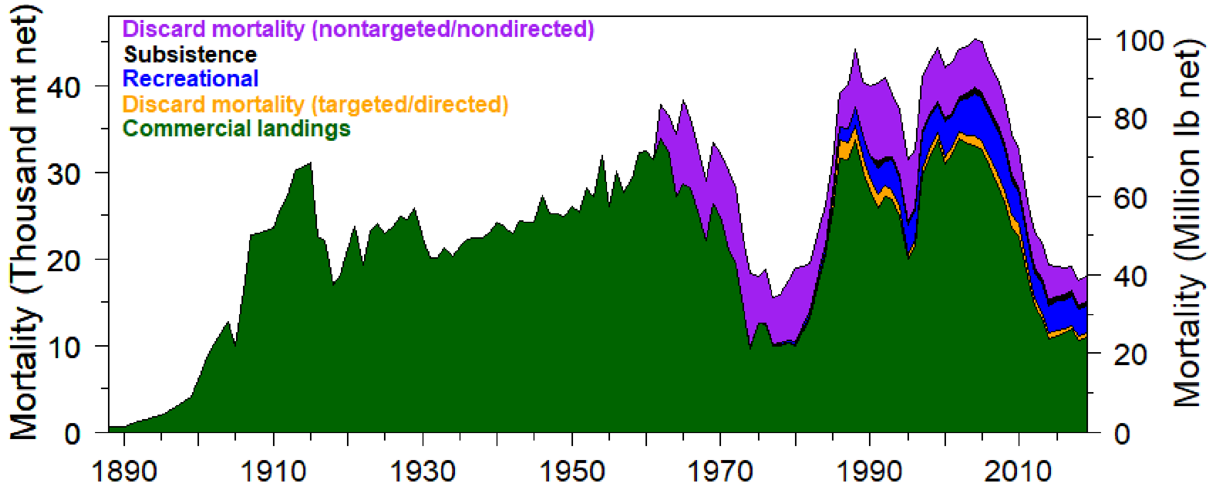

FIGURE 2. Summary of estimated historical mortality by source (colors), 1888-2019.

2019 Fishery and IPHC fishery-independent setline survey (FISS) statistics

Coastwide commercial Pacific halibut fishery landings (including research landings) in 2019 were approximately 24.3 million pounds (~11,000 t), up 3% from 2018. Discard mortality in non-directed fisheries was estimated to be 6.4 million pounds in 2019 (~2,900 t)[2], up 5% from 2018. The total recreational mortality (including estimates of discard mortality) was estimated to be 6.9 million pounds (~3,100 t), very close to the final estimate for 2018. Mortality from all sources increased by 3% to an estimated 39.7 million pounds (~18,000 t) in 2019 based on preliminary information available through 31 October 2019.

Data for stock assessment use are initially compiled by IPHC Regulatory Area, and then aggregated to four Biological Regions: Region 2 (Areas 2A, 2B, and 2C), Region 3 (Areas 3A, 3B), Region 4 (4A, 4CDE) and Region 4B and then coastwide (Figure 1). In addition to the aggregate mortality (including all sizes of Pacific halibut), the assessment includes data from both fishery dependent and fishery independent sources as well as auxiliary biological information, with the most spatially complete data available since the late-1990s. Primary sources of information for this assessment include modelled indices of abundance (IPHC-2019-IM095-07; based on the IPHC's annual fishery-independent setline survey (FISS; in numbers and weight) and other surveys), commercial Catch-Per-Unit-Effort (weight), and biological summaries from both sources (length-, weight-, and age-composition data).

All data sources are reprocessed each year to include new information from the terminal year, as well as any additional information for or changes made to the entire time-series. For 2019, there were two important improvements to the existing data sources: 1) sex-ratios at age based on genetic assays of port sampled Pacific halibut were available for commercial fishery landings made in 2017 and 2018, and 2) a revised modelled index of abundance reflecting the 2019 FISS

[2] The IPHC receives preliminary estimates of the current year's bycatch mortality in from the NOAA-Fisheries National Marine Fisheries Service Alaska Regional Office, Northwest Fisheries Science Center, and Fisheries and Oceans Canada in late October. Where necessary, projections are added to approximate the total mortality through the end of the calendar year.

sampling and expansions (in IPHC Regulatory Areas 3A and 3B). Routine updates of logbook records from the 2017-18 directed commercial fishery, as well as age-frequency observations from both commercial fishery and survey catches were also included. Since 2015, individual Pacific halibut weights collected during port sampling of commercial fishery landings are used to describe the commercial fishery. For 2019, individual weights were also collected during FISS operations such that use of the historical weight-length relationship was not necessary to calculate WPUE and stock distribution estimates. All mortality estimates (including changes to the existing time-series where new estimates have become available) were extended to include 2019. All available information was finalized on 31 October 2019 in order to provide adequate time for analysis and modeling. As has been the case in all years, some data are incomplete (i.e. commercial fishery logbook and age information), or include projections for the remainder of the year (i.e. mortality estimates for ongoing fisheries or for fisheries where final estimation is still pending).

The 2019 FISS detailed a coastwide aggregate NPUE (modelled via the space-time methodology) which showed a second consecutive year of decrease, down 4% from 2018 with 2017-19 each representing the lowest in the time-series (Figure 3). Biological Region 3 declined by 10% to the lowest estimate in the time-series while Biological Regions 2, 4, and 4B all increased slightly, but remain near historical lows. The 2019 modelled coastwide WPUE of legal (O32) Pacific halibut, the most comparable metric to observed commercial fishery catch rates, was lower (5%) than 2018, down for the third consecutive year and at the lowest value in the time series. Individual IPHC Regulatory Areas varied from a 26% increase (Regulatory Area 3B) to a 17% decrease (Regulatory Area 3A; Figure 4). The FISS sampling associated with the expansion in Biological Region 3 resulted in lower estimated catch-rates in this Region compared to the rest of the coast, and reduced the uncertainty in the index both for Region 3 and coastwide.

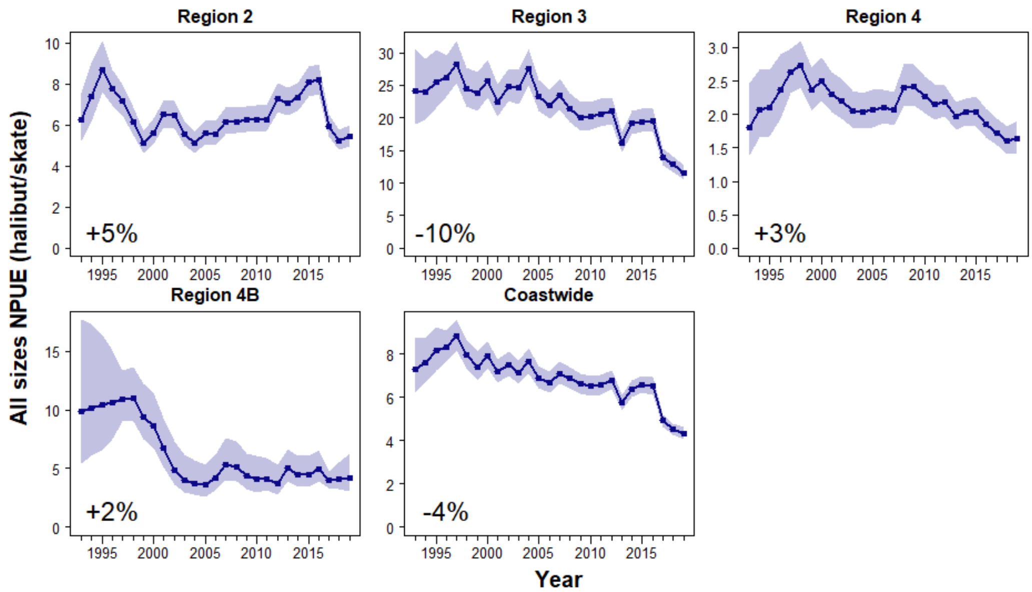

FIGURE 3. Trends in modelled FISS NPUE by Biological Region, 1993-2019. Percentages indicate the change from 2018 to 2019. Shaded zones indicate approximate 95% credible intervals.

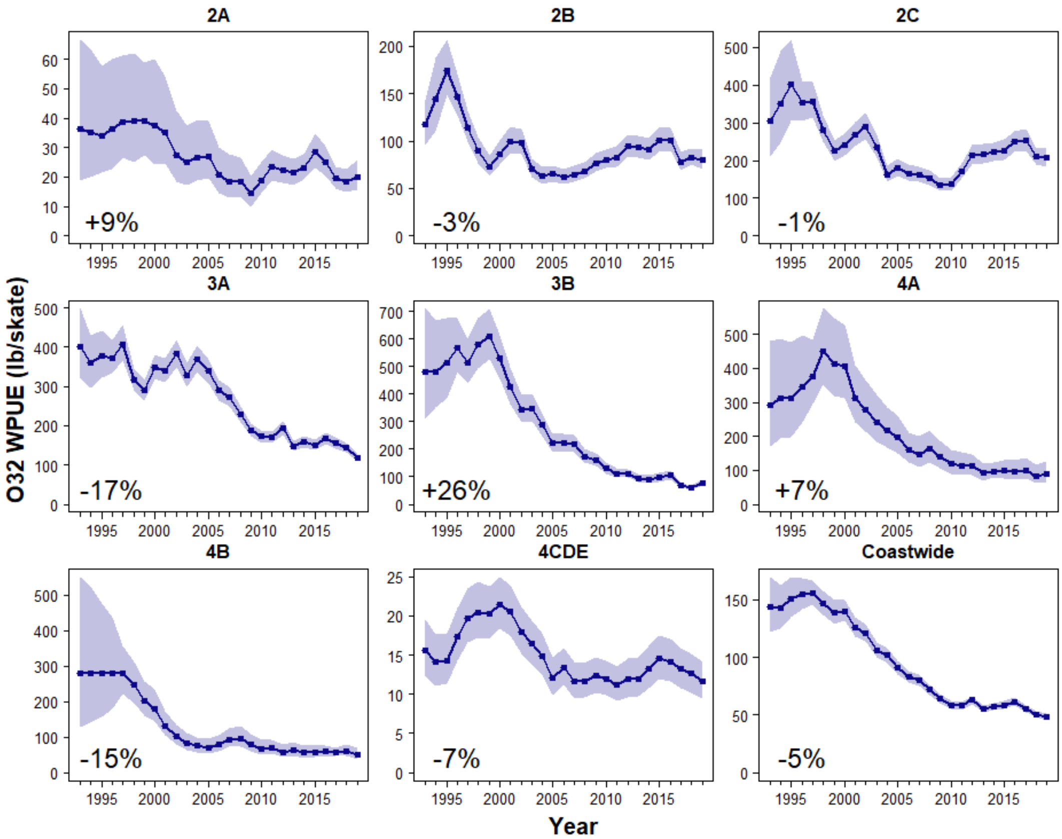

FIGURE 4. Trends in modelled FISS legal (O32) WPUE by IPHC Regulatory Area, 1993-2019. Percentages indicate the change from 2018 to 2019. Shaded zones indicate approximate 95% credible intervals.

Commercial fishery WPUE (based on extensive, but incomplete logbook records available for this assessment) increased 4% coastwide, with mixed performance across IPHC Regulatory Areas (Figure 5). A bias correction (to account for additional logbooks compiled after the fishing season, standard practice in recent years) resulted in an estimate of a 1% increase coastwide. As in 2018, fisheries and gear types are reported separately to allow more detailed evaluation of fishery performance (Figure 5).

Biological information (ages and lengths) from the commercial fishery continue to show the 2005 year-class as the largest contributor (in number) to the fish encountered. In the FISS age-frequency data, 2011 and 2012 cohorts (7 and 8 years old, following a series of weak cohorts from 2006-10) represented the largest proportions in some IPHC Regulatory Areas for the total catch, and the largest proportions coastwide for sublegal female Pacific halibut. At the coastwide level, individual size-at-age continues to be very low relative to the rest of the time-series and there has been no clear trend across ages over the last several years. For the first time, direct estimates of the sex-ratio at age for the directed commercial fishery were available for the IPHC's stock assessment. Data from sampled Pacific halibut in 2017 indicated a very high proportion female coastwide (82%), and a range from 65% in Biological Region 4B to 92% in Biological Region 4. Data from 2018 reflected very similar patterns, with females comprising 80% of the coastwide commercial landings (by number).

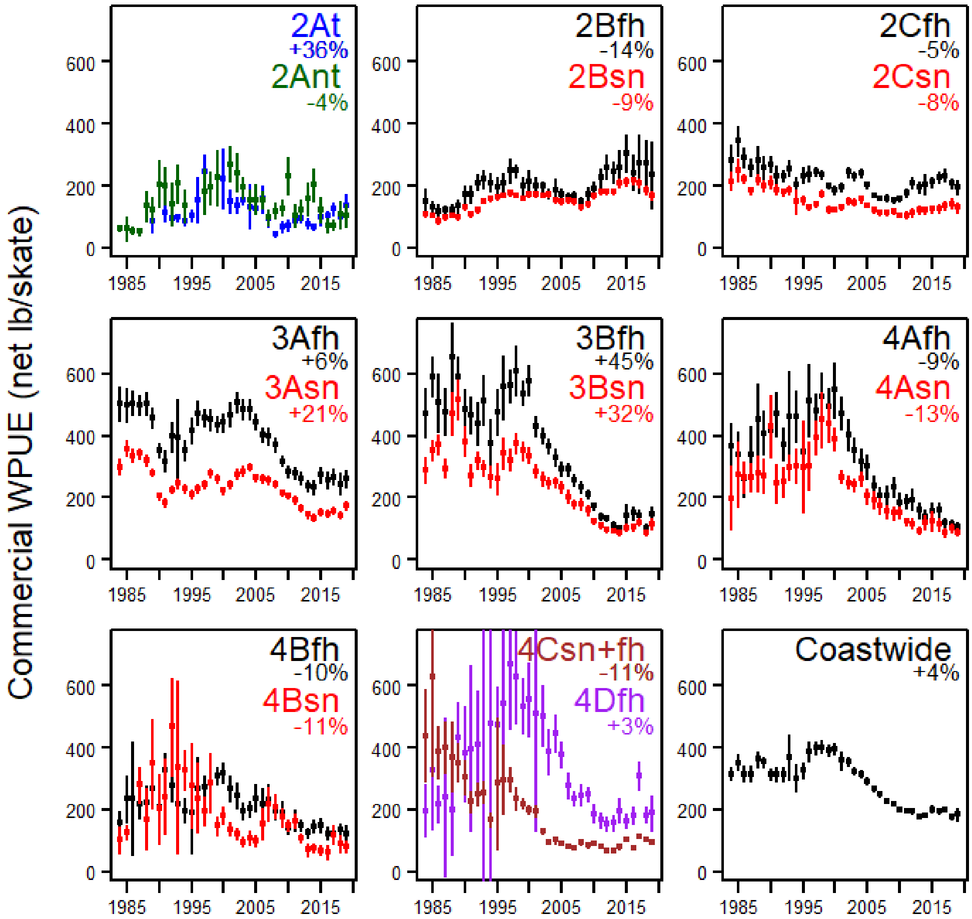

FIGURE 5. Trends in commercial fishery WPUE by IPHC Regulatory Area and fishery or gear, 1984-2019. The tribal fishery in 2A is denoted by "2At", nontribal by "2Ant", fixed hook catch rates by "fh" and snap gear catch rates by "sn" for IPHC Regulatory Areas 2B-4D. Percentages indicate the change from 2018 to 2019 uncorrected for bias due to incomplete logbooks (see text above). Vertical lines indicate approximate 95% confidence intervals.

Biological stock distribution

Updated trends indicate that population distribution (measured via the modelled FISS catch in weight of all Pacific halibut) has been decreasing in Biological Region 3 since 2004, and increasing in Biological Regions 2 and 4 (Figure 6; recent years in Table 1). Survey data are insufficient to estimate stock distribution prior to 1993. It is therefore unknown how historical distributions, and the average distribution likely to occur in the absence of fishing mortality may compare with recent observations.

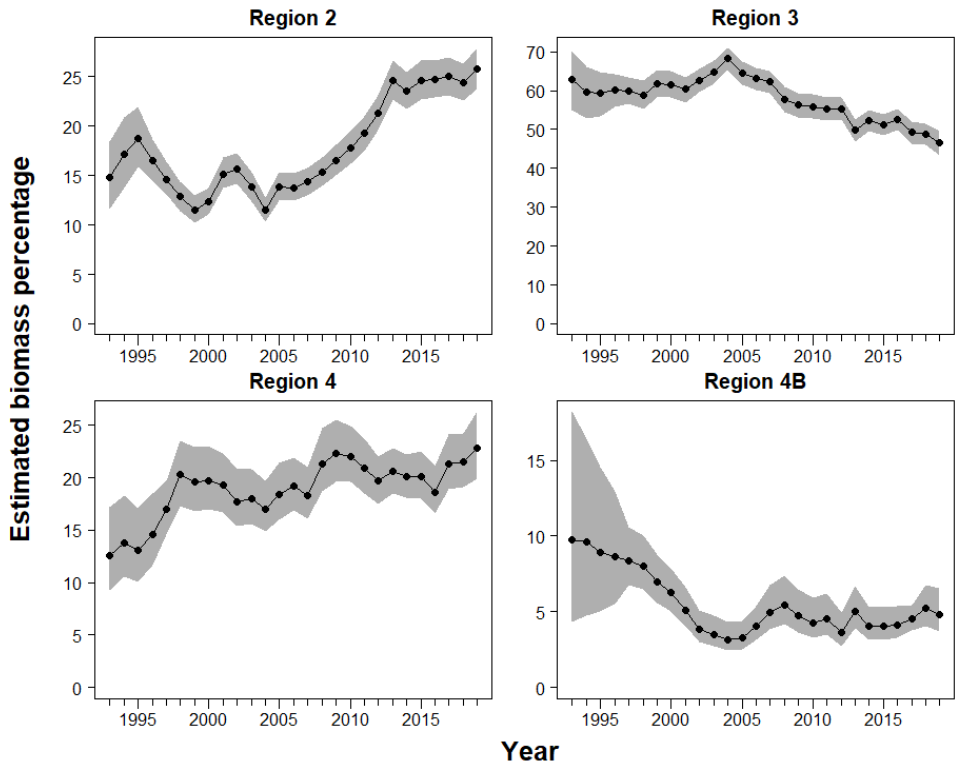

FIGURE 6. Estimated stock distribution (1993-2019) based on modelled survey catch of all sizes of Pacific halibut. Shaded zones indicate approximate 95% credible intervals.

TABLE 1. Recent stock distribution estimates by Biological Region based on modelling of all Pacific halibut captured by the FISS.

Year	Region 2 (2A, 2B, 2C)	Region 3 (3A, 3B)	Region 4 (4A, 4CDE)	Region 4B
2015	24.6%	51.3%	20.1%	4.0%
2016	24.7%	52.5%	18.7%	4.1%
2017	25.0%	49.2%	21.3%	4.5%
2018	24.4%	48.9%	21.5%	5.2%
2019	25.8%	46.5%	22.8%	4.8%

STOCK ASSESSMENT

This stock assessment continues to be implemented using the generalized software stock synthesis (Methot and Wetzel 2013). The analysis consists of an ensemble of four equally weighted models: two long time-series models, reconstructing historical dynamics back to the beginning of the modern fishery, and two short time-series models incorporating data only from 1992 to the present, a time-period for which estimates of all sources of mortality and survey indices are available for all regions. For each time-series length, there are two models: one fitting to coastwide aggregate data, and one fitting to data disaggregated into the four geographic regions. This combination of models includes uncertainty in the form of alternative hypotheses about several important axes of uncertainty, including: natural mortality rates (estimated in the long time-series models, fixed in the short time-series models), environmental effects on recruitment (estimated in the long time-series models), and other model parameters.

The 2019 stock assessment included a complete re-evaluation of all data sources and modelling choices. Although the basic ensemble approach and four structural models remain consistent with previous analyses, several key improvements were made including: extending the short time-series models back to 1992 to utilize the full modelled FISS index (beginning in 1993), additional flexibility in modelling fishery selectivity enabled by newly available sex-ratio at age data, and re-weighting the contributions of each type of data to the stock assessments based on the goodness of fit to index and age frequencies. The sex-ratio data were critically important to this assessment, as they allowed for direct estimation of parameters describing the scale of male selectivity in each of the individual models.

As has been the case since 2012, the results of this stock assessment are based on the approximate probability distributions derived from the ensemble of models, thereby incorporating the uncertainty within each model (parameter or estimation uncertainty) as well as the uncertainty among models (structural uncertainty). This approach reduces the potential for abrupt changes in management quantities as improvements and additional data are added to individual models, and provides a more realistic perception of uncertainty than any single model, and therefore a stronger basis for risk assessment. For 2019, the four models were again equally weighted. Within-model uncertainty from each model was propagated through to the ensemble results via the maximum likelihood estimates and an asymptotic approximation to their variance. Point estimates in this stock assessment correspond to median values from the ensemble: with the simple probabilistic interpretation that there is an equal probability above or below the reported value.

BIOMASS AND RECRUITMENT TRENDS

The results of the 2019 stock assessment indicate that the Pacific halibut stock declined continuously from the late 1990s to around 2012 (Figure 7). That trend is estimated to have been largely a result of decreasing size-at-age, as well as somewhat weaker recruitment strengths than those observed during the 1980s. The spawning biomass (SB) is estimated to have increased gradually to 2016, and then decreased to an estimated 194 million pounds (~87,850 t) at the beginning of 2020, with an approximate 95% confidence interval ranging from 133 to 248 million pounds (~60,500-112,500 t; Figure 8). Comparison with previous stock assessments indicates that over the last decade the 2019 results are very close to estimates from the 2012 through 2018 assessments. Prior to that period, the current 2019 assessment indicates a high probability of larger biomass than estimated in previous assessments (Figure 9); this is largely the result of the new sex-ratio information for the directed commercial landings indicating more females than in past analyses. All assessments since 2015 have indicated a decreasing spawning biomass in the terminal year.

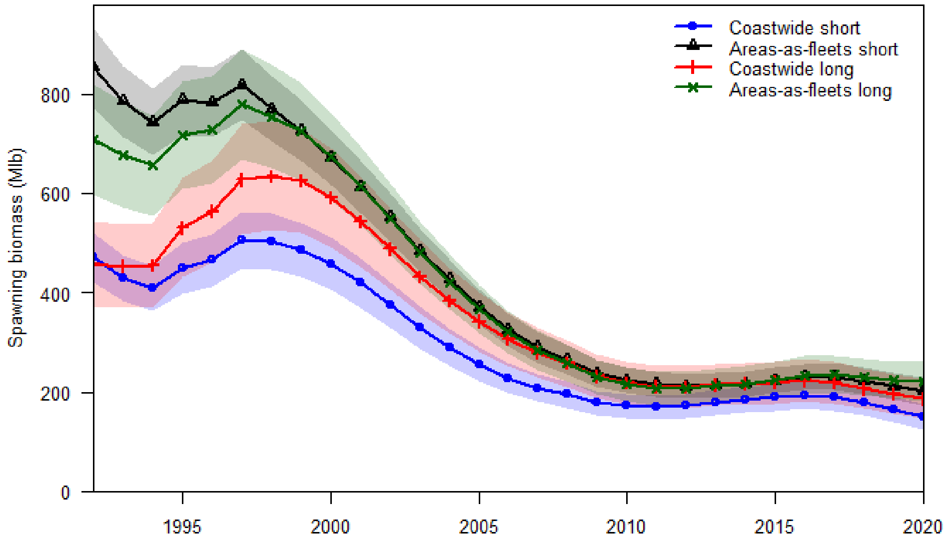

FIGURE 7. Estimated spawning biomass trends (1992-2020) based on the four individual models included in the 2019 stock assessment ensemble. Series indicate the maximum likelihood estimates; shaded intervals indicate approximate 95% credible intervals.

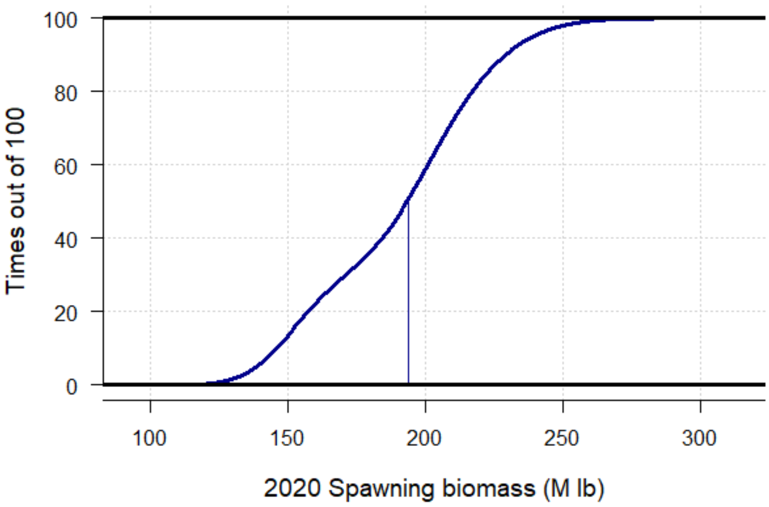

FIGURE 8. Cumulative distribution of the estimated spawning biomass at the beginning of 2020. Curve represents the estimated probability that the biomass is less than or equal to the value on the x-axis; vertical line represents the median (194 million pounds, ~87,850 t).

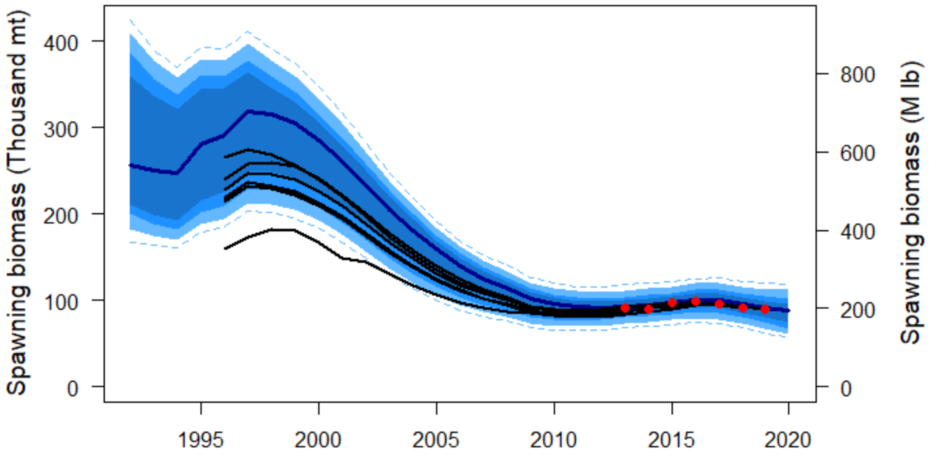

FIGURE 9. Retrospective comparison among recent IPHC stock assessments. Black lines indicate estimates of spawning biomass estimated by assessments conducted from 2012-2018 with the terminal estimate shown as a point, the shaded distribution denotes the 2019 ensemble: the dark blue line indicates the median (or “50:50 line”) with an equal probability of the estimate falling above or below that level; colored bands moving away from the median indicate the intervals containing 50/100, 75/100, and 95/100 estimates; dashed lines indicating the 99/100 interval.

Average Pacific halibut recruitment is estimated to be higher (69 and 76% for the coastwide and AAF models respectively) during favorable Pacific Decadal Oscillation (PDO) regimes, a widely used indicator of productivity in the north Pacific. Historically, these regimes included positive conditions prior to 1947, poor conditions from 1947-77, positive conditions from 1978-2006, and poor conditions from 2007-13. Annual averages from 2014 through September 2019 have been positive; however, over this period many other environmental indicators, current and temperature patterns have been anomalous. Therefore, historical patterns of productivity related to the PDO may not be relevant to the most recent few years, and it will be years or decades before this can be verified via observed recruitment strengths. Pacific halibut recruitment estimates show the largest recent cohorts in 1999 and 2005 (Figure 10). Cohorts from 2006 through 2010 are estimated to be much smaller than those from 1999-2005 which results in a high probability of decline in both the stock and fishery yield as these low recruitments become increasingly important to the age range over which much of the harvest and spawning takes place. Based on age data from the 2019 survey, this assessment estimated the 2011 and 2012 year-classes to be similar to those in 2000-04. This is consistent with the appearance of these cohorts in the 2018 assessment, although they remain below the level of the 1999 and 2005 year-classes even with second year of observation. The projected spawning biomass over the next 2-4 years includes the effects of these year classes maturing at ages 8-13.

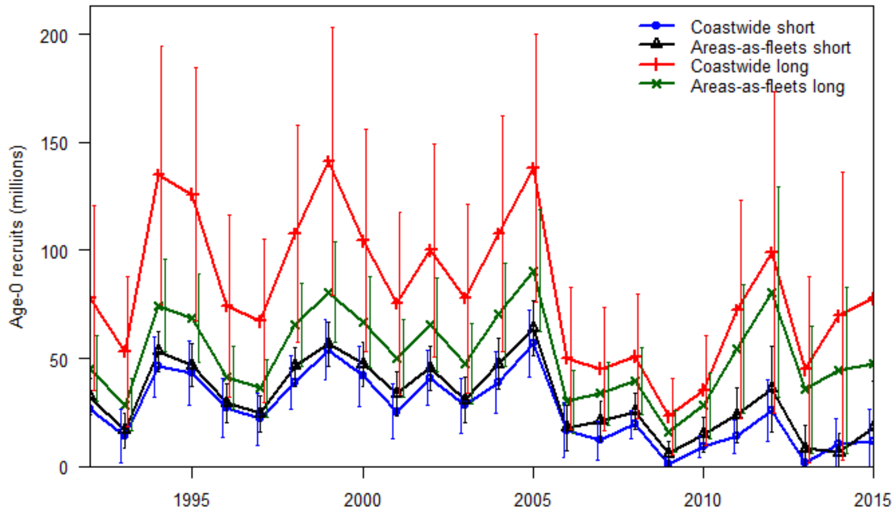

FIGURE 10. Estimated age-0 recruitment trends (1992-2015) based on the four individual models included in the 2019 stock assessment ensemble. Series indicate the maximum likelihood estimates; vertical lines indicate approximate 95% credible intervals.

The IPHC's interim management procedure uses a relative spawning biomass of 30% as a trigger, to begin reducing the target fishing intensity to a limit at 20%, where directed fishing is halted due to the critically low biomass condition. The relative spawning biomass has historically been calculated based on an arbitrary choice of 'good' weight-at-age and 'poor' recruitment levels estimated decades ago. The 2019 assessment, after Scientific Review Board and external review, and following the developments in the IPHC's Management Strategy Evaluation (MSE) process, has updated this calculation to include recent biological conditions. By using current weight-at-age and estimated recruitments influencing the current stock only, the 'dynamic' calculation measures the effect of fishing on the spawning biomass. This avoids the potential situation where environmental and biological conditions could be conflated with fishing effects. The 'historical' static relative spawning biomass was declining rapidly (although estimated to be higher in the 2018 assessment), where the dynamic calculation has been lower (estimated to be 32% in 2020; approximate credible interval: 22-46%) but more stable (Table 2). This result reflects the greater effects of reduced recruitment, rather than fishing in the last few years. The probability that the stock is below the $SB_{30\%}$ level is estimated to be 46% at the beginning of 2020, with less than a 1% chance that the stock is below $SB_{20\%}$. The two long time-series models provide a comparison with spawning biomass levels estimated to have occurred during the low stock sizes estimated for the 1970s: the AAF model suggests that recent stock sizes are at 61% of those levels, and the coastwide model at 207%. The large relative differences among models reflect both the uncertainty in historical dynamics as well as the importance of spatial patterns in the data and population processes, for which all of the models represent only simple approximations.

TABLE 2. Comparison of ‘historical’ and ‘dynamic’ relative spawning biomass estimates from the 2018 and current 2019 stock assessments. Percentage indicates the relative spawning biomass estimated for that year with approximate 95% credible intervals in parentheses; $P(SB<SB_{XX\%})$ indicates the probability that the relative spawning biomass in that year is below the reference point (either 20 or 30%).

Year	**2018 Assessment** (‘Historical’ relative *SB*)	**2019 Assessment** (‘Dynamic’ relative *SB*)
2019	43% (27-63%) *P(SB<SB30%)* = 11% *P(SB<SB20%)* = <1%	32% (23-46%) *P(SB<SB30%)* = 44% *P(SB<SB20%)* = <1%
2020	38% (22-51%) *P(SB<SB30%)* = 25% *P(SB<SB20%)* = <1%	32% (22-46%) *P(SB<SB30%)* = 46% *P(SB<SB20%)* = <1%

The IPHC’s Interim management procedure specifies a target level of fishing intensity of a Spawning Potential Ratio (SPR) corresponding to an $F_{46\%}$; this equates to the level of fishing that would reduce the lifetime spawning output per recruit to 46% of the unfished level given current biology, fishery characteristics and demographics. Based on the 2019 assessment, and including the higher proportion of females in the directed commercial landings than previously understood, the 2019 fishing intensity is estimated to correspond to an $F_{42\%}$ (credible interval: 29-57%; Table 3). Comparing the relative spawning biomass and fishing intensity over the recent historical period provides for an evaluation of trends conditioned on the currently defined reference points; this type of comparison is commonly called a ‘phase’ plot. The phase plot for Pacific halibut shows that the relative spawning biomass decreased as fishing intensity increased through 2010, then increased as the fishing intensity decreased through 2016, and has been relatively stable since then (Figure 11).

TABLE 3. Status summary of Pacific halibut in the IPHC Convention Area at the end of 2019.

Indicators	Values	Trends	Status
Total mortality 2019: Retained catch 2019: Average removals 2015–19:	39.67 Mlbs, 17,996 t[1] 32.21 Mlbs, 14,608 t 40.93 Mlbs, 18,567 t	Mortality increased from 2018 to 2019	**2019 mortality near 100-year Low**
SPR_{2019}: P(SPR<46%): P(SPR<limit):	42% (29-57%)[2] 59% Limit not specified	Fishing intensity Increased from 2018 to 2019	**Fishing intensity ABOVE reference level[3]**
SB_{2020} (Mlb): SB_{2020}/SB_0: $P(SB_{2020}<SB_{30})$: $P(SB_{2020}<SB_{20})$:	194 Mlbs (133–248) 32% (22-46%) 46% <1%	SB decreased from 2016 to 2020	**Not overfished[4]**
Biological stock distribution:	See Tables and Figures	Region 3 Decreasing	**Region 2 and 4 at historical highs**

[1] Weights in this document are reported as 'net' weights, head and guts removed; this is approximately 75% of the round (wet) weight.
[2] Ranges denote approximate 95% credible intervals from the stock assessment ensemble.
[3] Status determined relative to the IPHC's interim reference Spawning Potential Ratio level of 46%.
[4] Status determined relative to the IPHC's interim management procedure biomass limit of $SB_{20\%}$.

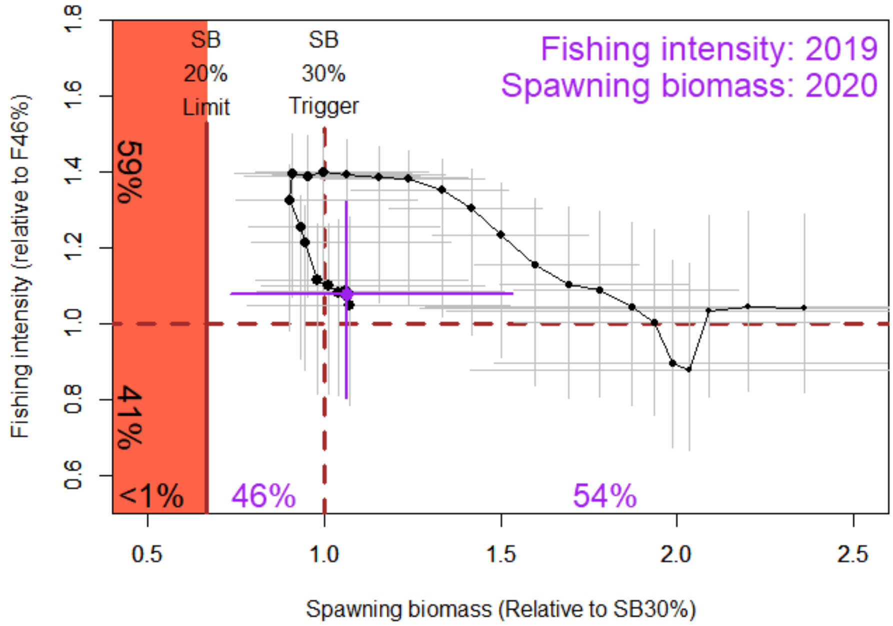

FIGURE 11. Phase plot showing the time-series (1992-2020) of estimated spawning biomass and fishing intensity relative to the reference points specified in the IPHC's interim management procedure. Dashed lines indicate the $F_{46\%}$ (horizontal) and $SB_{30\%}$ (vertical) values, red area indicates relative spawning biomass levels below the $SB_{20\%}$ threshold. Each year of the time series is denoted by a solid point (credible intervals by horizontal and vertical whiskers), with the relative fishing intensity in 2019 and spawning biomass at the beginning of 2020 shown as the largest point (purple). Percentages along the y-axis indicate the probability of being above and

below $F_{46\%}$ in 2019; percentages on the x-axis the probabilities of being below $SB_{20\%}$, between $SB_{20\%}$ and $SB_{30\%}$ and above $SB_{30\%}$ at the beginning of 2020.

MAJOR SOURCES OF UNCERTAINTY

This stock assessment includes uncertainty associated with estimation of model parameters, treatment of the data sources (e.g. short and long time-series), natural mortality (fixed vs. estimated), approach to spatial structure in the data, and other differences among the models included in the ensemble. Although this is an improvement over the use of a single assessment model, there are important sources of uncertainty that are not included.

The 2019 assessment utilizes two years (2017-18) of sex-ratio information from the directed commercial fishery landings. However, uncertainty in historical ratios, and the degree of variability likely present in those and future fisheries remains unknown. Additional years of data are likely to further inform selectivity parameters and cumulatively reduce uncertainty in stock size in the future. The treatment of spatial dynamics and movement rates among Biological Regions, which are represented via the coastwide and AAF approaches, has large implications for the current stock trend, as evidenced by the different results among the four models comprising the stock assessment ensemble. Further, movement rates for adult and younger Pacific halibut (roughly ages 2-6, which were not well-represented in the PIT-tagging study), particularly to and from Biological Region 4 (and especially to and from the Eastern Bering Sea), are important and uncertain components in understanding and delineating between the distribution of recruitment among biological Regions, and other factors influencing stock distribution and productivity. This assessment also does not include mortality, trends or explicit demographic linkages with Russian waters, although such linkages may be increasingly important as warming waters in the Bering Sea allow for potentially important exchange across the international border.

Additional important contributors to assessment uncertainty (and potential bias) include factors influencing recruitment, size-at-age, and some estimated components of the fishery removals. The link between Pacific halibut recruitment strengths and environmental conditions remains poorly understood, and although correlation with the Pacific Decadal Oscillation is currently useful, it may not remain so in the future. Therefore, recruitment variability remains a substantial source of uncertainty in current stock estimates due to the lack of mechanistic understanding and the lag between birth year and direct observation in the fishery and survey data (6-10 years). Reduced size-at-age relative to levels observed in the 1970s has been the most important driver of recent decade's stock trends, but its cause also remains unknown. Like most stock assessments, mortality estimates are assumed to be accurate. Therefore, uncertainty due to discard mortality estimation (observer sampling and representativeness), discard mortality rates, and any other unreported sources of removals in either directed or non-directed fisheries (e.g., whale depredation) could create bias in this assessment.

Maturation schedules are currently under renewed investigation by the IPHC. Currently used historical values are based on visual field assessments, and the simple assumption that fecundity is proportional to spawning biomass and that Pacific halibut do not experience appreciable skip-spawning (physiologically mature fish which do not actually spawn due to environmental or other conditions). To the degree that maturity, fecundity or skip spawning may be temporally variable, the current approach could result in bias in the stock assessment trends and reference points. New information will be incorporated as it becomes available; however, it may take years to better understand these biological processes.

Due to the many remaining uncertainties in Pacific halibut biology and population dynamics, a high degree of uncertainty in both stock scale and trend will continue to be an integral part of an annual management process. Potential solutions include management procedures that utilize multi-year management approaches, which are being tested with the MSE framework.

OUTLOOK

Stock projections were conducted using the integrated results from the stock assessment ensemble in tandem with summaries of the 2019 directed fisheries and other sources of mortality. The harvest decision table (Table 4) provides a comparison of the relative risk (in times out of 100), using stock and fishery metrics (rows), against a range of alternative harvest levels for 2020 (columns). The block of rows entitled "Stock Trend" provides for evaluation of the risks to short-term trend in spawning biomass, independent of all harvest policy calculations. The remaining rows portray risks relative to the spawning biomass reference points ("Stock Status") and fishery performance relative to the approach identified in the interim management procedure. The alternatives (columns) provided include several coarsely spaced levels of mortality intended for evaluation of stock dynamics including:

- No mortality (useful to evaluate the stock trend due solely to population processes),
- A 10 million pound (~4,500 t) 2020 Total Constant Exploitation Yield (TCEY[3])
- A 50 million pound (~22,700 t) 2020 TCEY
- A 60 million pound (~27,200 t) 2020 TCEY
- The mortality at which there is a 50% chance that the spawning biomass will be smaller in three years than in 2020 ("*3-year surplus*")
- The mortality consistent with the "Reference" SPR ($F_{46\%}$) level.
- The mortality consistent with repeating the TCEYs set for 2019 (*"status quo"*).

A grid of alternative TCEY values corresponding to SPR values from 40% to 58% is also provided. For each row of the decision table, the mortality (including all sizes and sources), the coastwide TCEY and the associated level of fishing intensity projected for 2020 (median value with the 95% credible interval below) are reported.

The stock is projected to decrease with at least a 51% chance over the period from 2021-23 for all TCEYs greater than the "3-year surplus" of 18.4 million pounds (~8,350 t), corresponding to a projected SPR of 63% (credible interval 44-75%; Table 4, Figure 12). At the reference level (a projected SPR of 46%) the probability of spawning biomass decline to 2021 is 89%, decreasing to 75% in three years, as the 2011 and 2012 cohorts mature. At the *status quo* TCEYs (38.61 million lb, (~17,500 t), the probability of spawning biomass declines is 97 and 87% for one and three years respectively. The one-year risk of the stock dropping below $SB_{30\%}$ ranges from 43% (at the 3-year surplus level) to 49% at the *status quo* TCEYs. Over three years these probabilities range from 37% to 50% depending on the level of mortality.

[3] The TCEY corresponds approximately to all mortality of Pacific halibut, except non-directed discard mortality of fish less than 26 inches (66 cm) in length.

TABLE 4. Harvest decision table for 2020 mortality limits. Columns correspond to yield alternatives and rows to risk metrics. Values in the table represent the probability, in "times out of 100" (or percent chance) of a particular risk.

		2020 Alternative			3-Year Surplus				Reference SPR=46%						Status quo		
		Total mortality (M lb)	0.0	11.6	20.0	23.6	27.6	32.3	33.5	34.6	35.7	36.8	37.8	38.9	40.2	61.6	
		TCEY (M lb)	0.0	10.0	18.4	22.0	26.0	30.7	31.9	33.0	34.1	35.2	36.2	37.3	38.6	60.0	
		2020 fishing intensity	$F_{100\%}$	$F_{78\%}$	$F_{63\%}$	$F_{58\%}$	$F_{53\%}$	$F_{47\%}$	$F_{46\%}$	$F_{45\%}$	$F_{44\%}$	$F_{43\%}$	$F_{42\%}$	$F_{41\%}$	$F_{40\%}$	$F_{27\%}$	
		Fishing intensity interval	--	59-87%	44-75%	39-71%	35-67%	31-62%	30-61%	29-60%	28-59%	28-58%	27-57%	26-56%	25-56%	17-43%	
Stock Trend (spawning biomass)	In 2021	Is less than 2020	1	29	61	71	79	87	89	91	93	94	95	96	97	>99	a
		Is 5% less than 2020	<1	<1	11	23	30	42	46	50	54	58	61	64	67	98	b
	In 2022	Is less than 2020	<1	16	50	60	68	77	79	81	83	85	87	89	90	>99	c
		Is 5% less than 2020	<1	1	23	33	45	59	61	64	66	68	69	71	74	99	d
	In 2023	Is less than 2020	1	22	50	58	65	73	75	77	79	81	83	85	87	>99	e
		Is 5% less than 2020	<1	6	33	43	53	62	64	66	67	69	71	73	75	99	f
Stock Status (Spawning biomass)	In 2021	Is less than 30%	35	39	43	44	46	47	48	48	48	48	48	49	49	51	g
		Is less than 20%	<1	<1	<1	<1	<1	1	1	1	2	2	2	3	3	16	h
	In 2022	Is less than 30%	26	31	40	43	46	48	48	49	49	49	49	50	50	54	i
		Is less than 20%	<1	<1	<1	1	2	6	7	8	9	11	12	14	15	27	j
	In 2023	Is less than 30%	18	27	37	41	45	48	49	49	49	49	50	50	50	60	k
		Is less than 20%	<1	<1	<1	2	6	13	15	17	18	20	21	22	23	40	l
Fishery Trend (TCEY)	In 2021	Is less than 2020	0	<1	11	24	36	50	51	52	54	57	59	63	67	>99	m
		Is 10% less than 2020	0	<1	1	12	25	40	44	46	48	50	51	52	53	>99	n
	In 2022	Is less than 2020	0	<1	11	25	39	50	51	52	54	56	59	62	66	>99	o
		Is 10% less than 2020	0	<1	2	14	27	43	46	48	49	50	51	52	54	>99	p
	In 2023	Is less than 2020	0	<1	13	27	41	50	51	52	54	56	58	61	65	>99	q
		Is 10% less than 2020	0	<1	4	16	30	45	47	48	49	50	51	52	54	>99	r
Fishery Status (Fishing intensity)	In 2020	Is above $F_{46\%}$	0	<1	7	22	31	48	50	51	53	55	57	60	64	>99	s

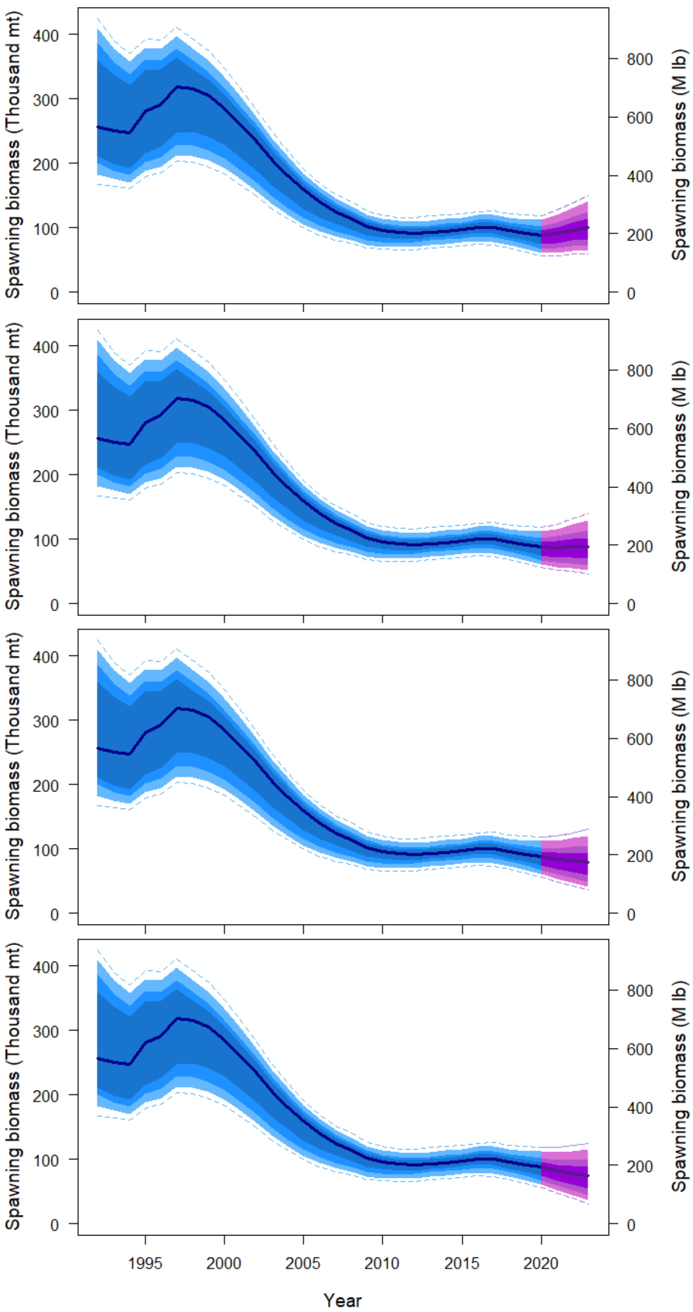

FIGURE 12. Three-year projections of stock trend under alternative levels of mortality: no fishing mortality (upper panel), the 3-year surplus (18.4 million pounds, ~8,350 t; second panel), the TCEY projected for the IPHC's Interim management procedure (31.9 million pounds, 14,500 t; third panel) and a TCEY of 38.61 million pounds (~17,500 t, the *status quo* TCEYs from 2019; lower panel).

SCIENTIFIC ADVICE

Sources of mortality: In 2019, total Pacific mortality due to fishing was up slightly to 39.67 million pounds (17,996 t) from 38.5 million pounds (17,461 t) in 2018 (updated for this assessment). Of that total, 81% comprised the retained catch, down from 82% in 2018 (Table 3).

Fishing intensity: The 2019 mortality corresponded to a point estimate of SPR = 42%; there is a 59% chance that fishing intensity exceeded the IPHC's reference level of 46% (Table 3). The Commission does not currently have a coastwide fishing intensity limit reference point.

Stock status (spawning biomass): Current female spawning biomass is estimated to be 194 million pounds (87,856 t), which corresponds to an 46% chance of being below the IPHC threshold (trigger) reference point of $SB_{30\%}$, and less than a 1% chance of being below the IPHC limit reference point of $SB_{20\%}$. The stock is estimated to have been declining since 2016 and is currently at 32% of the unfished state. Therefore, the stock is considered to be '**not overfished**'. Projections indicate that mortality consistent with the Interim management procedure reference fishing intensity ($F_{46\%}$) is likely to result in further declining biomass levels in the near future.

Stock distribution: The proportion of the coastwide stock represented by Biological Region 3 has been decreasing since 2004 (Figure 6), with Biological Regions 2 and 4 increasing. Although comprising 46.5% of the coastwide surveyed biomass in 2019, the decreasing trend suggests that surplus production has likely been exceeded in Biological Region 3 over the last 15 years to a greater degree than in other Biological Regions.

RESEARCH PRIORITIES

Research priorities for the stock assessment and related analyses have been consolidated with those for the IPHC's MSE and the Biological Research program. These ranked and categorized priorities will soon be available on the IPHC's website.

ADDITIONAL INFORMATION

Detailed information for AM096 will include any revisions to this document (IPHC-2020-AM096-08), a description of the data sources (IPHC-2020-AM096-09), and the stock assessment (IPHC-2020-AM096-10). The IPHC's website contains many new interactive tools and historical data series that allow for detailed evaluation and will replace historical static summaries.

An updated mortality projection tool will be developed prior to AM096 for use in evaluating 2020 mortality limits. This tool will be finalized in early January 2020 in order to make use of revised end-of-year 2019 discard mortality estimates in non-directed fisheries.

RECOMMENDATION/S

That the Commission:

a) **NOTE** paper IPHC-2019-IM095-09 Rev_1 which provides a summary of data, the 2019 stock assessment and the harvest decision table for 2020.

REFERENCES

IPHC. 2019a. Report of the 14th session of the IPHC Scientific Review Board (SRB014). Seattle, Washington, U.S.A., 26-28 June 2019. IPHC-2019-SRB014-R. 16 p.

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Stewart, I., and Hicks, A. 2019. 2019 Pacific halibut (*Hippoglossus stenolepis*) stock assessment: development. IPHC-2019-SRB014-07. 100 p.

Stokes, K. 2019. Independent peer review for the 2019 IPHC stock assessment. August 2019. 31 p. https://www.iphc.int/uploads/pdf/sa/2019/stokes_2019-independent_peer_review_for_the_2019_iphc_stock_assessment.pdf.

Options for the treatment of U26 discard mortality from non-directed fisheries (*bycatch*) within a total mortality limit

PREPARED BY: IPHC SECRETARIAT (I. STEWART, 23 OCTOBER 2019)

PURPOSE

To provide the Commission with a set of options and a discussion of those options in response to:

> *"AM095–Rec.04 (para. 66) The Commission **RECOMMENDED** evaluating and redefining TCEY to include the U26 component of discard mortalities, including bycatch, as steps towards more comprehensive and responsible management of the resource, in coordination with the IPHC Secretariat and Contracting Parties. The intent is that each Contracting Party to the Treaty would be responsible for counting its U26 mortalities against its collective TCEY. This change would be intended to take effect for TCEYs established at the 2020 Annual Meeting."*

BACKGROUND

The IPHC's process for setting annual mortality limits has changed appreciably over its history. Historically, the IPHC set limits called Fishery Constant Exploitation Yields[1] (FCEYs) which constrained the retained catch of the directed commercial Pacific halibut fishery. Due to the 32 inch (81.3 cm) minimum size limit (MSL), in place since 1973 (Myhre 1973), the FCEY only applied to mortality above the MSL. In only IPHC Regulatory Areas 2A and 2B recreational mortality was also included in the FCEY. Harvest strategy calculations consisted of calculating the Total Constant Exploitation Yield (TCEY), then subtracting off the projected levels of "other removals" consisting of all recreational and subsistence mortality, as well as discard mortality from non-directed fisheries (bycatch) and directed commercial Pacific halibut fishery discard mortality estimates of fish over 32" to get the FCEY. Discussion of 'regularizing' the treatment of discard mortality from non-directed fisheries (bycatch) and directed commercial discard mortality to be consistent with the treatment of recreational and subsistence mortality began in 2006 (Hare and Clark 2007). In 2011 the mortality represented by 'other removals' was extended to add fish over 26 inches (66 cm) in length (O26), thereby adding to the deductions made from the TCEY to get to the FCEY (Hare 2011a, 2011b). Prior to the 2012 stock assessment, projections of the total mortality from all sources and sizes of Pacific halibut, and TCEYs associated with the mortality limits (FCEYs) adopted by the Commission each year were not routinely reported. In 2014, Catch Sharing Plans (CSPs) were adopted in IPHC Regulatory Areas 2C and 3A which resulted in the inclusion of the charter recreational mortality in the FCEY rather than the 'other removals'.

More recently, the Commission directed the IPHC Secretariat to provide for setting mortality limits based on the TCEY for 2018:

> *"AM093–Rec.05 (para. 30) NOTING that the Commission has indicated its interest in clearer accounting for all mortality, and that Canada has put forward catch limit allocation principles proposing that catch limits include all sources of mortality for each regulatory area, the Commission RECOMMENDED that the presentation of harvest advice be changed to be based on the TCEY, which includes all O26 commercial, sport, personal*

[1] Definitions: https://www.iphc.int/the-commission/glossary-of-terms-and-abbreviations

use/subsistence, bycatch and wastage removals, for the 2018 Annual Meeting cycle, as a step towards more comprehensive and responsible management of the resource that will result in the negotiation of Regulatory Area-specific catch limits based on TCEYs."

This change clarified the components included in the adopted mortality limits and standardized these components across all IPHC Regulatory Areas regardless of the CSPs in place for Pacific halibut. As of 2019, all sources of Pacific halibut mortality except for discard mortality from non-directed fisheries (bycatch) of U26 fish were included in the adopted mortality limits (TCEYs).

At the 95th Session of the IPHC Annual Meeting (AM095) the Commission provided further direction on setting mortality limits on all sizes:

AM095–Rec.04 (para. 66) *"The Commission RECOMMENDED evaluating and redefining TCEY to include the U26 component of discard mortalities, including bycatch, as steps towards more comprehensive and responsible management of the resource, in coordination with the IPHC Secretariat and Contracting Parties. The intent is that each Contracting Party to the Treaty would be responsible for counting its U26 mortalities against its collective TCEY. This change would be intended to take effect for TCEYs established at the 2020 Annual Meeting."*

This paper provides a set of options for addressing limits on U26 discard mortality from non-directed fisheries (bycatch) and a discussion of those options.

IMPORTANCE OF THE U26 DELINEATION

The historical choice of U26 (and earlier U32) on which to delineate the accounting of mortality was based on three primary considerations:

1) These young fish are highly mobile and much less likely than older fish to be found in the same IPHC Regulatory Area (or Biological Region) in the upcoming year in which mortality limits would apply. Therefore, the effects of U26 mortality on potential O26 yield are likely to be distributed broadly across the stock in subsequent years.
2) The IPHC's Fishery Independent Setline Survey (FISS) captures Pacific halibut that are approximately O26, providing an annually updated scientifically-based measure of the stock distribution across the IPHC Convention Area. There is currently no reliable tool for describing the annual distribution of U26 fish across the Convention Area.
3) Mortality of U26 fish has a different effect on the Spawning Potential Ratio (SPR; a measure of the fishing intensity describing the effect on the lifetime spawning output per recruit) than that of older fish. Although this is the case for any category of size/age delineation, previous work suggests that the effects change most rapidly around this size. This concept is further illustrated as part of the options provided below.

All three of these factors suggest that addressing U26 mortality separately from O26 mortality may in some way be warranted when setting catch limits. Therefore, the options provided below allow for consideration of both separate and partitioned limits for U26 and O26 within a total mortality limit.

USE OF THE TERMS FCEY AND TCEY

The Contracting Party CSPs (and in some cases other regulations) currently in place in many IPHC Regulatory Areas are based on the terms FCEY and TCEY. In order to provide for the time needed to adjust the wording of CSPs to match the IPHC's mortality limit setting process (noting that none have yet caught up to the change to the Commission setting TCEYs beginning in 2018), it could be beneficial to temporarily retain the calculation of FCEYs and TCEYs, and enhance these terms with a total, partitioned total or separate U26 limit per the options below.

DESCRIPTION OF OPTIONS

There are two key aspects to both the IPHC's interim management procedure and the Management Strategy Evaluation (MSE) process:

1) the scale of mortality limits is done at the coastwide level, and;
2) the distribution of those mortality limits occurs among Biological Regions and IPHC Regulatory Areas.

The options for managing U26 mortality provided below are therefore divided into those two aspects; one option will need to be selected to determine the coastwide scale of U26 mortality, and one to determine the distribution of U26 mortality.

Scale

For this initial discussion paper, three U26 mortality scale options are provided:

Scale Option 1. The *status quo* (no change to the current approach of setting TCEYs):

> Predicted U26 discard mortality from non-directed fisheries (bycatch) is currently based on the previous year's estimate (https://www.iphc.int/data/projection-tool). At the request of the Commission, in some years differing levels of projected discard mortality from non-directed fisheries (bycatch) have been used to construct alternative mortality tables for use in decision-making (Stewart 2018). This option allows for a direct evaluation of the projected effects of discard mortality from non-directed fisheries (bycatch), but offers the Commission no explicit accounting method for comparing predicted and observed U26 mortality after the limits have been set. It is important to note that O26 mortality for all fisheries (directed and non-directed) is already part of the TCEY, and therefore changes in the overall magnitude of O26 discard mortality from non-directed fisheries (bycatch) will be evident in comparisons of mortality limits with the previous year's estimates (e.g. Table 1 in https://www.iphc.int/uploads/pdf/am/2019am/iphc-2019-am095-05.pdf).

Scale Option 2. Setting a total mortality limit

> The Commission could set a single mortality limit including all sources and sizes of Pacific halibut. This approach has a potentially important shortcoming in that there will be differences in the SPR resulting from a single catch limit given varying levels/proportion of U26 discard mortality from non-directed fisheries (bycatch). To illustrate these potential effects within a single catch limit, the 2019 projected mortality levels were evaluated using the preliminary 2019 stock assessment (IPHC-2019-SRB014-07). Holding the total mortality constant at the projected magnitude, the SPR was compared under three scenarios:
>
> 1) 2019 discard mortality from non-directed fisheries (bycatch) mortality with the O26:U26 ratio exactly matching the projections;
> 2) all projected discard mortality from non-directed fisheries (bycatch) mortality taken as U26;
> 3) all projected discard mortality from non-directed fisheries (bycatch) taken as O26 (see Appendix A for a description of how this was conducted).
>
> The results of these alternative projections indicted that the change in SPR could range from –4% to 0% under current conditions (Table 1). This range represents extreme

values, as actual discard mortality from non-directed fisheries (bycatch) is unlikely to comprise all or no U26; however, discard mortality from non-directed fisheries (bycatch) is currently at a historical low which reduces the magnitude of the effect on SPR. This source of variability in projected SPR would be in addition to the considerable annual variability in realized vs. projected SPR caused by revised estimates of model parameters (biomass levels and recruitment), and differences between the projected and actual magnitude of mortality.

TABLE 1. Percent change in SPR with different treatments of recent discard mortality from non-directed fisheries (bycatch) mortality of Pacific halibut.

Discard mortality from non-directed fisheries (bycatch) scenario for 2019	Change in SPR
All mortality as U26	-4%
U26:O26 ratio as projected	0%
All mortality as O26	0%

Scale Option 3. Separate TCEY and U26 discard mortality from non-directed fisheries (bycatch) limits summing to a total mortality limit, or via a partitioned total mortality limit:

This option allows for the Commission to set limits that fully describe all sizes and sources of Pacific halibut mortality and also increases the predictability of the SPR resulting from these limits. It could consist of two limits: one for the TCEY and one for the U26 discard mortality from non-directed fisheries (bycatch), or a combined limit with an explicit partition (percentage) assigned to either the U26 discard mortality from non-directed fisheries (bycatch) or TCEY components.

It is important to note that even though these options treat the management of U26 discard mortality from non-directed fisheries (bycatch) differently, the stock assessment projections provided for management will be conducted in the same way regardless of the option chosen. For all three options, the decision-making tables presented as part of the stock assessment (decision table and mortality limits table) will have the same structure as in 2019:

- For the *status quo* option, the previous year's U26 mortality amount is predicted.
- For option 2 (total mortality limit), the percentage of U26 mortality will be predicted.
- For option 3 (separate limits) the management decision for U26 mortality will be projected.
- For all options, alternative predictions (such as full Prohibited Species Catch limit usage) can also be considered.

Distribution

For this initial discussion paper, four U26 mortality distribution options are provided:

Distribution Option 1. The *status quo* (no change to the current approach – most recent year):

Predicted U26 discard mortality from non-directed fisheries (bycatch) mortality by IPHC Regulatory Area (distributed) is currently based on the most recent year's estimates (https://www.iphc.int/data/projection-tool). This approach implicitly assumes that the effects of U26 discard mortality from non-directed fisheries (bycatch) on the Pacific halibut stock are accounted for in the coastwide SPR, and that the most recent estimates of stock distribution reflect the most likely distribution of the U26 fish comprising the mortality in future years.

Distribution Option 2. Recent use (several years):

This option would use additional information prior to the most recent year to distribute U26 discard mortality from non-directed fisheries (bycatch) mortality. Specifically, the average U26 mortality observed over a recent period (e.g., 3- 5- or 10-years; Table 2) could be used to distribute the U26 limit among IPHC Regulatory Areas.

TABLE 2. Recent discard mortality from non-directed fisheries (fisheries that cannot legally retain Pacific halibut; bycatch) of Pacific halibut <26 inches in length (U26; million net pounds).

Year	2A	2B	2C	3A	3B	4A	4B	4CDE	Canada	U.S.	Coastwide
2009	0.04	0.02	0.01	0.87	0.37	0.67	0.14	1.56	0.02	3.65	3.67
2010	0.00	0.01	0.01	0.81	0.33	0.45	0.14	1.63	0.01	3.36	3.38
2011	0.00	0.02	0.01	0.87	0.33	0.42	0.14	1.18	0.02	2.95	2.96
2012	0.01	0.03	0.01	0.61	0.34	0.63	0.08	1.66	0.03	3.32	3.35
2013	0.00	0.02	0.00	0.48	0.33	0.38	0.02	1.81	0.02	3.01	3.03
2014	0.00	0.02	0.00	0.58	0.27	0.23	0.02	1.60	0.02	2.71	2.73
2015	0.00	0.03	0.00	0.73	0.22	0.26	0.01	1.34	0.03	2.56	2.58
2016	0.00	0.02	0.00	0.53	0.43	0.16	0.01	0.93	0.02	2.05	2.07
2017	0.00	0.02	0.00	0.32	0.21	0.14	0.01	1.03	0.02	1.71	1.73
2018	0.00	0.02	0.00	0.37	0.11	0.10	0.01	1.12	0.02	1.71	1.73
3-year average	0.00	0.02	0.00	0.41	0.25	0.13	0.01	1.03	0.02	1.82	1.84
5-year average	0.00	0.02	0.00	0.51	0.25	0.18	0.01	1.20	0.02	2.15	2.17
10-year average	0.01	0.02	0.00	0.62	0.29	0.34	0.06	1.38	0.02	2.70	2.72

Distribution Option 3. Proportions of the total mortality by IPHC Regulatory Area (set proportions):

This option would distribute the U26 discard mortality from non-directed fisheries (bycatch) limit as a set proportion of the total mortality in each IPHC Regulatory Area (Table 3). The proportions could be determined from the recent year's U26 estimate (similar to Distribution Option 1), or from the recent history of U26 mortality estimates (similar to Distribution Option 2; Table 4).

TABLE 3. Recent mortality of Pacific halibut from all sources by IPHC Regulatory Area (million net pounds).

Year	2A	2B	2C	3A	3B	4A	4B	4CDE	Canada	U.S.	Coastwide
2009	1.58	8.71	8.15	30.50	12.88	4.30	2.07	7.45	8.71	66.92	75.63
2010	1.22	8.77	7.20	28.85	12.16	3.55	2.34	7.62	8.77	62.95	71.72
2011	1.09	8.83	4.00	22.76	9.26	3.50	2.57	6.67	8.83	49.85	58.68
2012	1.22	7.85	4.81	18.23	6.75	3.19	2.03	6.71	7.85	42.93	50.79
2013	1.17	7.75	5.77	17.53	5.41	2.20	1.43	6.82	7.75	40.32	48.07
2014	1.16	7.75	6.05	13.88	4.24	1.76	1.31	6.16	7.75	34.56	42.31
2015	1.17	8.01	6.52	14.59	3.59	2.11	1.37	4.75	8.01	34.09	42.10
2016	1.32	8.13	6.73	13.57	3.84	2.03	1.32	4.84	8.13	33.66	41.79
2017	1.46	8.27	6.98	13.47	4.24	1.77	1.33	4.47	8.27	33.73	41.99
2018	1.36	7.20	6.31	13.30	3.18	1.61	1.31	4.48	7.20	31.54	38.74
3-year average	1.38	7.87	6.68	13.45	3.76	1.80	1.32	4.60	7.87	32.98	40.84
5-year average	1.29	7.87	6.52	13.76	3.82	1.85	1.33	4.94	7.87	33.52	41.39
10-year average	1.27	8.13	6.25	18.67	6.56	2.60	1.71	6.00	8.13	43.05	51.18

TABLE 4. Recent percentage of discard mortality from non-directed fisheries (fisheries that cannot legally retain Pacific halibut; bycatch) of Pacific halibut <26 inches in length (U26; million net pounds) relative to mortality of Pacific halibut from all sources.

Year	2A	2B	2C	3A	3B	4A	4B	4CDE	Canada	U.S.	Coastwide
2009	2.6%	0.2%	0.1%	2.9%	2.9%	15.6%	6.5%	21.0%	0.2%	5.5%	4.9%
2010	0.3%	0.2%	0.1%	2.8%	2.7%	12.8%	6.0%	21.3%	0.2%	5.3%	4.7%
2011	0.2%	0.2%	0.1%	3.8%	3.6%	11.9%	5.4%	17.6%	0.2%	5.9%	5.1%
2012	0.4%	0.4%	0.1%	3.3%	5.0%	19.8%	3.7%	24.7%	0.4%	7.7%	6.6%
2013	0.1%	0.3%	0.0%	2.7%	6.1%	17.1%	1.3%	26.5%	0.3%	7.5%	6.3%
2014	0.2%	0.3%	0.0%	4.2%	6.3%	13.2%	1.7%	26.0%	0.3%	7.8%	6.5%
2015	0.2%	0.3%	0.0%	5.0%	6.2%	12.3%	0.8%	28.1%	0.3%	7.5%	6.1%
2016	0.1%	0.3%	0.0%	3.9%	11.2%	7.9%	0.5%	19.1%	0.3%	6.1%	5.0%
2017	0.1%	0.2%	0.0%	2.4%	4.9%	7.9%	0.6%	23.0%	0.2%	5.1%	4.1%
2018	0.1%	0.3%	0.0%	2.8%	3.4%	6.0%	0.7%	25.0%	0.3%	5.4%	4.5%
3-year average	0.1%	0.3%	0.0%	3.0%	6.6%	7.3%	0.6%	22.3%	0.3%	5.5%	4.5%
5-year average	0.1%	0.3%	0.0%	3.7%	6.5%	9.6%	0.9%	24.4%	0.3%	6.4%	5.2%
10-year average	0.5%	0.3%	0.0%	3.3%	4.5%	13.2%	3.3%	23.1%	0.3%	6.3%	5.3%

Distribution Option 4. Management-based limits (Negotiated):

There is no currently available information to inform the relative value of U26 Pacific halibut occurring in one IPHC Regulatory Area over another (but see below for research avenues). Therefore, at present, the distribution of U26 discard mortality from non-directed fisheries (bycatch) represents a management decision. As long as a formulaic approach was taken, or specific distribution scenarios were provided, the IPHC Secretariat could provide mortality projections for any such decision or distribution rule. The policy implications between and within the domestic agencies of such a decision that differed appreciably from the *status quo* are beyond the scope of this technical analysis.

POTENTIAL FUTURE RESEARCH

Additional research would be needed to provide a scientifically-based U26 stock distribution estimate (analogous to that for the O26 biomass based on the modelled FISS). Several avenues could be explored including habitat-based methods, oceanographic models linking spawning areas to settlement and areas occupied at early life-stages, as well as trawl survey-based modelling. Some previous work has investigated survey-based estimates of younger age-classes from trawl data and geostatistical models (e.g., Ono et al. 2018). However, although moderately correlated with subsequently observed recruitment, this type of approach has not proven to be a good indicator of the scale of strong year-classes (i.e., the size of the 2005 cohort is grossly overestimated by the Bering Sea trawl survey; Stewart and Webster 2019; Stewart and Hicks 2019), and therefore also may not be a good indicator of distribution. Further development consolidating all available trawl data including the Bering Sea, Aleutian Islands, Gulf of Alaska, B.C. and U.S.A. West Coast and conducting the analysis by age (rather than size, which may miss-assign strong cohorts) could be pursued. One shortcoming of these data is that comprehensive trawl data (all portions of the stock range) is not available on an annual basis.

MANAGEMENT PERFORMANCE

The IPHC's current management procedure accounts for U26 mortality, but does not actively manage its magnitude or distribution. These components could be included in the set of potential management procedures under development via the IPHC's Management Strategy Evaluation (MSE) process. MSE is the most appropriate tool for more extensive evaluation of downstream effects, specific biological implications, and effects on management performance (relative to objectives) of the scale of U26 mortality and the distribution of U26 mortality.

RECOMMENDATION/S

That the Commission:

a) **NOTE** paper IPHC-2019-IM095-10 which provides a summary of options for setting annual mortality limits.

b) **REQUEST** any modifications or additions necessary to provide for further consideration of this topic during the 96th Session of the IPHC Annual Meeting (AM096).

c) **REQUEST** which of these options (one each for scale and distribution) the IPHC Secretariat should use as the basis for the default mortality projection tool for AM096.

d) **REQUEST** that the IPHC MSE process:

   i. continue to evaluate status quo management related to discard mortality for non-directed fisheries (bycatch) under the current program of work for delivery of full MSE results at AM097 in 2021, noting that this source of mortality is currently modelled as a fixed component of the total (with variability), ***OR***

   ii. explicitly consider one or more of the options described here when evaluating management procedures.

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APPENDICES

Appendix A: Description of projections under alternative U26:O26 discard mortality in non-directed fisheries (bycatch) proportions.

APPENDIX A

Description of projections under alternative U26:O26 discard mortality in non-directed fisheries (bycatch) proportions.

In order to estimate the variability in SPR that may arise due to differences in the relative magnitude of U26 and O26 mortality, this analysis used the preliminary 2019 stock assessment models (IPHC-2019-SRB014-07). Specifically, alternative projections of the 2019 mortality from all sources were constructed under two scenarios replacing the U26 and O26 mortality projected based on the 2018 estimates: 1) all projected discard mortality in non-directed fisheries (bycatch; with the same scale and distribution) would occur as U26, and 2) all projected discard mortality in non-directed fisheries (bycatch; with the same scale and distribution) would occur as O26. In order to estimate the resulting SPR values from each of the two alternative 2019 projections the following steps were taken:

1) Approximate the U26 to O26 delineation in age at age-5.
2) For scenario 1 (all projected discard mortality in non-directed fisheries (bycatch) as U26), the selectivity for 2019 discard mortality in non-directed fisheries (bycatch) was forced to decay immediately after age-5 by setting the descending width and final selectivity parameters to extremely small values (-10 on a log scale). For scenario 2 (all projected discard mortality in non-directed fisheries (bycatch) as O26), the selectivity for all ages less than 5 was set to a value of zero directly in the model parameterization.
3) Each of the four stock assessment models was then used to project the 2019 SPR under the two alternative discard mortality in non-directed fisheries (bycatch) scenarios without changing the parameter estimates (using a .par file).
4) The results of the four models were integrated, as in the standard assessment projections to obtain a median SPR for each scenario.
5) The median projected SPR under each scenario was compared to the standard projection and the difference reported for this working paper.

INTERNATIONAL PACIFIC HALIBUT COMMISSION

Analysis of the effects of historical discard mortality in non-directed fisheries ('bycatch')

PREPARED BY: IPHC SECRETARIAT (I. STEWART, A. HICKS , P. CARPI; 24 OCTOBER 2019)

PURPOSE

To provide the Commission with a response to the Commission's request:

> "*AM095–Rec.05 (para. 67) The Commission* ***RECOMMENDED*** *that the IPHC Secretariat expand upon the analysis completed in IPHC-2019-AM095-INF08 "Treatment and effects of Pacific halibut discard mortality (bycatch) in non-directed fisheries projected for 2019", to be reviewed by the SRB at its next meeting. The objective of this work is to estimate lost yield from bycatch of Pacific halibut in non-directed fisheries for the years of 1991-2018.*"

INTRODUCTION

There has been a long-standing interest in understanding the trade-off between yield in the directed Pacific halibut fisheries, stock or spawning biomass and mortality of Pacific halibut due to discards in non-directed fisheries ('bycatch'). Summary and analysis historically focused on accounting for 'lost' spawning output (Salveson et al. 1992) as well as direct estimates of 'yield loss' including both immediate and delayed effects throughout the potential life-span of a fish experiencing this mortality (Adlerstein 1993; Adlerstein 1994). Yield loss has been defined differently among studies, but all included at least the directed commercial fishery landings. Yield loss was generally found to be very sensitive to the specific non-directed fleet being investigated, as well as the year, location and season of the comparison. Specific gear by area and season components ranged from values less than 1.0 to as high as 3.3 pounds of yield gained in the directed commercial fishery per pound of discard mortality in non-directed fisheries (Adlerstein 1993; Adlerstein 1994). An early estimate of aggregate yield loss including all non-directed fisheries indicated a rate of 1.7 pounds per pound (Sullivan et al. 1994). Another analysis indicated lower values around 1.12 (for 1995 specifically; calculated from the results in Clark and Hare 1998). Clark and Hare (1998) also attempted to estimate the distribution of the yield loss under varying hypotheses regarding movement rates. They found that much of the lost yield was estimated to occur in the IPHC Regulatory Area in which the mortality from non-directed fisheries had been realized. Hare and Clark (2007) reported historical yield loss values of 1.40 and 1.58 from the early and late 1980s respectively. More recently, yield loss was estimated to be 1.14 (Hare and Williams 2013).

Many of the early analyses made simple assumptions regarding the selectivity of both the mortality in non-directed fisheries and in the directed commercial Pacific halibut fishery. Specifically these models often did not explicitly include dynamics for fish less than 6 or 8 years of age, and did not always account for sub-legal mortality (fish below the current 32 inch (82 cm) minimum size limit). The trade-off between yield and economic value in the directed fisheries and discard mortality in non-directed fisheries has been found to be quite sensitive to the discard mortality rates in the directed fisheries (Martell et al. 2015).

In 2018, the IPHC Secretariat evaluated alternative projections for 2019-21 under alternative scenarios of no discard mortality in non-directed fisheries (bycatch) and no discard mortality in non-directed fisheries for Pacific halibut less than 26 inches (66 cm) in length (U26; IPHC-2019-AM095-INF07, IPHC-2019-AM095-INF08). That analysis rephrased the metric for comparison as potential 'yield gain', as the focus was to describe the change in the directed fisheries (a 'gain') as mortality in non-directed fisheries was reduced; however, even though the term has changed, the values can be interpreted in the same manner as estimates from historical analysis. The results indicated that over short-term projections (2019-2021) the current Catch Sharing Plans (CSPs), selectivity and biology (weight-at-age) led to a potential yield gain of 1.25-1.29 pounds of FCEY yield for every pound of discard mortality in non-directed fisheries (bycatch) removed from the projections. The methods used to create these estimates were based on maintaining a constant Spawning Potential Ratio (SPR; Goodyear 1993) while shifting yield from non-directed fisheries mortality to the directed fisheries. That approach is consistent with the concept of the 'fisheries footprint' introduced in 2016 (Martell et al. 2016). Briefly, the fisheries footprint accounts for the simultaneous nature of multiple sources of mortality to describe the relative contribution of each to the SPR of the population. This type of approach is necessary where fishing and natural mortality is simultaneous rather than sequential (e.g. 'adult equivalents' used for Pacific salmon analyses) because some of the fish that survive one source succumb to another prior to contribution to the long-term spawning output of the population.

METHODS

This analysis used the preliminary 2019 stock assessment (four models; IPHC-2019-SRB014-07) to evaluate the hypothetical yield gained by the directed Pacific halibut fisheries in the absence of annual historical discard mortality in non-directed fisheries (bycatch). Although the Commission request specified a starting year of 1991, current short time-series stock assessment models (two of the four) extend only as far back as 1992, so the analysis includes only 1992-2018.

The methods follow the conceptual approach that produced the 2018 analysis (IPHC-2019-AM095-INF07, IPHC-2019-AM095-INF08). This approach is purely numerical (iteratively solving for the solution) in order to most accurately represent the conditions estimated in the stock assessment for each year. It differs importantly in application from the analysis performed in 2018 in that this analysis is retrospective (rather than a projection), which requires a slightly different set of procedures to maintain consistency with assessment results (described below).

The steps to conduct this analysis were as follows:

a) Set all model parameters in each of the four stock assessment models to initialize at the maximum likelihood estimates from the preliminary 2019 stock assessment.
b) Set stock synthesis (the software used to implement the individual stock assessment models) input controls to calculate the time-series of population and fishery quantities without solving for new parameter values (maximum phase = 0; Methot et al. 2019).
c) For the target year (each year from 1992 through 2018 was analyzed independently), set discard mortality from non-directed fisheries (bycatch) equal to a value of zero.
d) Increase the directed commercial fishery mortality in the target year (including both landings and discard mortality) by a scaling factor, α (an arbitrary starting point of 1.0 was used for the first target year analyzed, subsequent years used the previous target year's starting point to speed convergence).
e) Recalculate the time-series of population and fishery quantities for each model.
f) Because the variance for the estimate SPR from each model is not available (the parameters are not re-estimated), the original variance from each of the preliminary 2019 stock assessment models was used to integrate the results of the four models and to calculate the median ensemble SPR for that year.
g) Compare the median ensemble SPR for the target year to the original estimate from the preliminary 2019 stock assessment. If it does not match (to the third decimal place), repeat steps d-f by adjusting α up or down accordingly.

h) Calculate the difference between the directed commercial fishery mortality after step g and the original directed commercial fishery mortality to determine the raw potential yield gained.

The raw potential yield gained was then divided by the discard mortality in non-directed fisheries that had been removed in order to determine the potential yield gain rate. In order to evaluate the hypothetical spatial distribution of yield gained by the directed Pacific halibut fisheries, basic properties of the IPHC's interim management strategy were applied as a simple approximation to historical decision-making. These properties included:

1) All discard mortality in non-directed fisheries (bycatch) of Pacific halibut greater than 26 inches (66 cm) in length (O26) was transferred to the directed commercial fishery within the IPHC Regulatory Area in which it occurred. This step is consistent with the IPHC's interim management strategy of directly transferring O26 non-directed fishery discard mortality to the directed fisheries based on projected levels.
2) The directed commercial fishery in all IPHC Regulatory Areas were then scaled up or down in proportion to the distribution of the directed commercial fishery mortality across IPHC Regulatory Areas in that year to match the overall hypothetical yield gain. This step implicitly assumes that the decision making leading to the distribution of mortality for the directed commercial fishery would have been maintained and applied to the additional (or reduced) hypothetical yield available in each year.

As a secondary analysis, a more general comparison was made using tools created for evaluation of reference points for the ongoing Management Strategy Evaluation. The underlying model and equations are documented in IPHC-2019-SRB015-11. Briefly, a simplified population dynamics model was created with options to partition fishing mortality (*F*) between a directed Pacific halibut fleet (not including discard mortality) and a fleet representing discard mortality in non-directed fisheries. The population and fleet dynamics (selectivity) parameters were based on relatively recent (2018) estimates from the stock assessment (IPHC-2019-AM095-09). A specific case of the general reference point evaluation was created to provide some comparability with the methods described above. Importantly, SPR was held constant at a value of 0.46, weight-at-age was set to resemble recent conditions (low weight-at-age scenario), and a comparison was made between the aggregate yield estimated for four scenarios: 1) 100% directed fishery, 2) 80% directed and 20% non-directed discard mortality, 3) 40% directed and 60% non-directed discard mortality, and 4) 100% non-directed discard mortality.

RESULTS

Historical discard mortality in non-directed fisheries (bycatch) has decreased almost monotonically from a high of just over 20 million pounds in 1992 to a low of 6.06 million pounds in 2018 (Table 1). This decrease was concurrent, but not in exact proportion to decreases in the estimated spawning biomass of Pacific halibut over much of this time-period (IPHC-2019-SRB014-07). The effects of discard mortality in non-directed fisheries on hypothetical yield to directed commercial Pacific halibut fishery have differed over time (Figure 1, Table 2). Specifically, during the mid-1990s, a period of very abundant young Pacific halibut and a relatively low level of fishing intensity (IPHC-2019-SRB014-07) moving yield from non-directed fisheries to the directed commercial fishery is estimated to have a larger effect on the stock (and thus a yield gain rate < 100%) as measured via SPR. In later years and over most of the time series the hypothetical yield gain rate was estimated to be larger than 100%, ranging up to 139% in 2010 (Table 2) and averaging 115% over the entire time-series.

Based on the distribution of O26 non-directed fishery discard mortality and the actual distribution of commercial fishery catch (both landings and estimated discard mortality), the hypothetical yield gain is distributed differently in each year as both sources changed over time (Table 3). Although similar to the spatial distribution of discard mortality in non-target fisheries, the aggregate yield gain over the entire time-series is greater than the observed mortality in IPHC Regulatory Areas 2B-3B and smaller than the observed mortality in IPHC Regulatory Areas 4A-4CDE (Table 4).

TABLE 1. Discard mortality in non-directed fisheries (bycatch) of all sizes 1992-2018 (million net pounds).

Year	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
1992	0.44	1.75	0.74	4.67	1.98	2.49	1.17	7.06	20.29
1993	0.44	1.66	0.74	4.29	1.06	1.80	0.85	5.11	15.96
1994	0.44	1.22	0.53	3.91	1.39	2.20	1.04	6.24	16.95
1995	0.61	1.52	0.35	2.96	1.76	2.02	0.96	5.75	15.93
1996	0.61	0.30	0.35	2.74	1.96	1.97	0.93	5.60	14.46
1997	0.61	0.22	0.40	2.97	1.44	1.83	0.86	5.19	13.51
1998	1.08	0.21	0.09	2.66	1.39	1.79	0.85	5.09	13.16
1999	0.99	0.19	0.06	2.89	1.74	1.78	0.84	5.06	13.54
2000	0.82	0.23	0.13	2.89	1.51	1.73	0.81	4.90	13.02
2001	0.84	0.18	0.06	3.01	1.68	1.65	0.78	4.69	12.88
2002	0.64	0.24	0.06	1.95	1.92	1.69	0.80	4.79	12.09
2003	0.26	0.24	0.07	2.94	1.73	1.58	0.75	4.49	12.07
2004	0.29	0.25	0.07	3.43	1.27	1.56	0.74	4.44	12.05
2005	0.54	0.35	0.05	2.98	1.13	1.78	0.84	5.07	12.74
2006	0.58	0.29	0.05	2.73	1.35	1.74	0.82	4.94	12.50
2007	0.39	0.32	0.06	2.60	1.07	1.59	0.48	4.81	11.31
2008	0.43	0.14	0.06	2.82	1.30	1.23	0.36	4.51	10.86
2009	0.51	0.21	0.05	2.48	1.25	1.56	0.46	4.02	10.54
2010	0.35	0.18	0.06	2.30	1.10	1.06	0.48	4.18	9.70
2011	0.09	0.23	0.05	2.49	1.12	0.97	0.48	3.02	8.45
2012	0.12	0.19	0.04	1.72	1.14	1.47	0.26	4.26	9.20
2013	0.07	0.23	0.03	1.63	0.89	0.87	0.14	4.98	8.83
2014	0.10	0.25	0.02	1.89	0.97	0.81	0.13	4.77	8.93
2015	0.08	0.33	0.02	2.10	0.66	0.64	0.22	3.43	7.47
2016	0.10	0.27	0.03	1.79	0.87	0.57	0.14	3.25	7.02
2017	0.13	0.25	0.02	1.43	0.89	0.40	0.21	2.75	6.07
2018	0.13	0.29	0.03	1.65	0.46	0.28	0.23	2.99	6.06

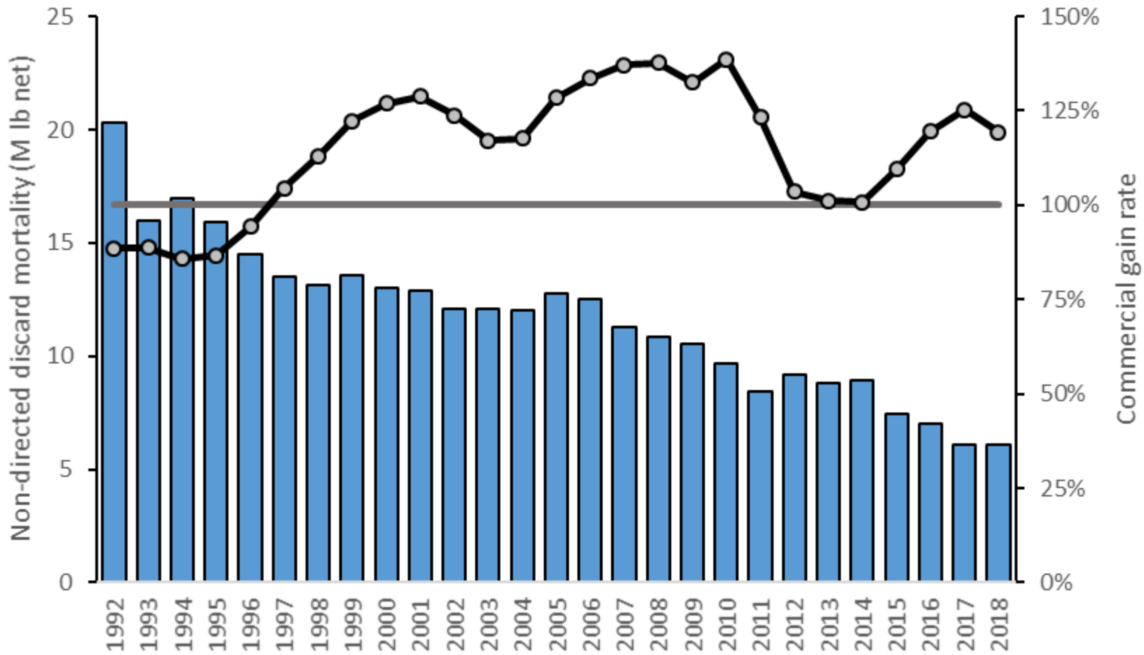

FIGURE 1. Summary of annual discard mortality in non-directed fisheries (bycatch; millions net pounds; bars) and hypothetical yield gain rate (yield gained per weight of discard mortality in non-directed fisheries removed; connected points) to directed commercial in the absence of annual discard mortality in non-directed fisheries. Horizontal line indicates a gain rate of 100%, or exact equivalency in trading yield between sectors.

TABLE 2. Summary of annual discard mortality in non-directed fisheries (bycatch; millions net pounds) by size category and hypothetical yield gain to the directed commercial fishery *including discard mortality* (millions net pounds) in the absence of annual discard mortality in non-directed fisheries (bycatch). The rate represents the hypothetical yield gained per weight of discard mortality in non-directed fisheries (bycatch) removed.

	Discard mortality from non-directed fisheries (bycatch)			Directed commercial fishery yield gain	
Year	O26	U26	Total	yield	rate
1992	13.11	7.18	20.29	17.97	89%
1993	9.20	6.76	15.96	14.17	89%
1994	12.4	4.55	16.95	14.54	86%
1995	11.78	4.16	15.93	13.80	87%
1996	11.50	2.96	14.46	13.63	94%
1997	10.85	2.66	13.51	14.13	105%
1998	10.84	2.32	13.16	14.87	113%
1999	10.33	3.21	13.54	16.56	122%
2000	9.90	3.13	13.02	16.53	127%
2001	10.04	2.83	12.88	16.58	129%
2002	8.55	3.54	12.09	14.97	124%
2003	8.18	3.89	12.07	14.14	117%
2004	8.20	3.86	12.05	14.18	118%
2005	8.65	4.09	12.74	16.36	128%
2006	8.08	4.42	12.50	16.70	134%
2007	7.28	4.03	11.31	15.52	137%
2008	7.05	3.81	10.86	14.96	138%
2009	6.87	3.67	10.54	13.97	133%
2010	6.32	3.38	9.70	13.44	139%
2011	5.49	2.96	8.45	10.41	123%
2012	5.85	3.35	9.20	9.52	104%
2013	5.80	3.03	8.83	8.93	101%
2014	6.19	2.73	8.93	9.00	101%
2015	4.89	2.58	7.47	8.18	109%
2016	4.95	2.07	7.02	8.39	120%
2017	4.34	1.73	6.07	7.61	125%
2018	4.33	1.73	6.06	7.22	119%

TABLE 3. Distribution of hypothetical yield gain (millions net pounds) to directed commercial fisheries in the absence of annual discard mortality in non-directed fisheries (bycatch).

Year	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
1992	0.48	2.09	1.41	5.82	2.28	1.21	1.29	3.39	17.97
1993	0.49	2.01	1.39	4.82	1.35	0.54	0.89	2.68	14.17
1994	0.44	1.40	0.84	4.16	1.33	1.46	1.04	3.86	14.54
1995	0.61	1.71	0.61	3.02	1.48	1.13	0.92	4.33	13.80
1996	0.64	0.63	0.65	2.95	1.69	1.40	0.98	4.68	13.63
1997	0.65	0.74	0.80	3.50	1.54	1.33	0.98	4.59	14.13
1998	1.15	0.86	0.59	3.64	1.76	1.61	0.95	4.31	14.87
1999	1.08	1.13	0.80	4.39	2.56	1.42	1.10	4.06	16.56
2000	0.92	1.15	0.84	4.21	2.67	1.60	1.23	3.91	16.53
2001	0.95	1.02	0.73	4.23	2.57	1.70	1.14	4.24	16.58
2002	0.65	1.17	0.71	3.30	2.72	1.25	1.12	4.07	14.97
2003	0.31	1.10	0.67	3.90	2.50	1.25	1.05	3.36	14.14
2004	0.33	1.14	0.81	4.46	2.06	1.13	0.96	3.30	14.18
2005	0.54	1.52	1.07	4.81	2.09	1.34	1.07	3.93	16.36
2006	0.60	1.68	1.26	4.87	2.29	1.48	0.82	3.71	16.70
2007	0.45	1.50	1.07	4.98	1.93	1.35	0.54	3.71	15.52
2008	0.53	1.09	0.82	4.99	2.35	1.15	0.50	3.54	14.96
2009	0.59	1.02	0.65	4.43	2.31	1.30	0.54	3.13	13.97
2010	0.43	1.04	0.63	4.31	2.19	0.97	0.61	3.28	13.44
2011	0.16	0.96	0.31	3.40	1.71	0.87	0.59	2.42	10.41
2012	0.18	0.75	0.30	2.40	1.39	1.07	0.36	3.08	9.53
2013	0.12	0.76	0.30	2.25	0.99	0.66	0.24	3.60	8.93
2014	0.16	0.79	0.34	2.14	1.06	0.71	0.23	3.57	9.00
2015	0.15	1.00	0.44	2.42	0.80	0.57	0.35	2.45	8.18
2016	0.19	0.98	0.49	2.29	0.81	0.61	0.28	2.75	8.39
2017	0.22	0.91	0.47	2.07	1.10	0.43	0.34	2.07	7.61
2018	0.21	0.86	0.40	2.19	0.67	0.33	0.35	2.21	7.22

TABLE 4. Distribution of aggregate total time-series discard mortality in non-directed fisheries (1992-2018; Table 1) and hypothetical yield gain in the directed commercial fishery (Table 3).

	2A	2B	2C	3A	3B	4A	4B	4CDE
Non-directed discard mortality	3.7%	3.7%	1.3%	22.8%	11.1%	12.4%	5.3%	39.7%
Yield gain	3.7%	8.7%	5.4%	28.0%	13.5%	8.4%	5.7%	26.4%

The auxiliary analysis based on the non-time series specific model built for evaluation of reference points for Pacific halibut produced similar results to those from the time-series. Specifically, yield gain rates under equilibrium conditions (conceptually equivalent to the average over a very long time series) were estimated to range from 121-144%, between an 80:20 partition of directed:non-directed fishing mortality and a 0:100 partition (Table 5).

TABLE 5. Distribution of hypothetical yield gain to directed commercial fisheries in the absence of annual discard mortality in non-directed fisheries (bycatch).

Scenario	Directed fishery *F*	Non-directed *F*	Relative yield	Gain rate
1	100%	0%	1.00	--
2	80%	20%	0.83	121%
3	40%	60%	0.73	137%
4	0%	100%	0.69	144%

Discussion

The yield gain rate between directed fisheries and non-directed fisheries depends on a large number of temporally varying biological factors including: the population age structure, the relative population biomass, the maturity schedule as well as the weight-at-age. In addition, fishery and management factors including the aggregate level of fishing intensity exerted on the stock (SPR), the selectivity specific to each of the directed and non-directed fisheries, and also the relative allocation among components within the directed (i.e., commercial, recreational, subsistence) and non-directed (trawl, pot, hook-and-line) fisheries. A change in any of these factors will lead to a change in the yield gain rate, as evidenced by the variability over time observed even in this simple analysis.

The individual models comprising the stock assessment do not currently allow for time-varying selectivity for discard mortality in non-target fisheries (bycatch; IPHC-2019-SRB014-07); doing so would affect the results. To the degree that the size and age structure of the discard mortality reflects that of the Pacific halibut population, time-varying selectivity may dampen the variability in yield gain rates, as the more abundant demographic components (with a reduced effect on SPR) would be more heavily selected.

This analysis does **not** represent a 'replay' of history with alternative management decisions. The SPR is held constant at the actual estimate from each year, therefore the approach uses the 'fishery footprint' concept to replace one source of mortality (discard mortality in non-directed fisheries; bycatch) with another (directed Pacific halibut fisheries). Because the relative 'footprint' of each source of mortality depends on the overall fishing intensity (SPR), the effects of discard mortality in non-directed fisheries (bycatch) would have differed under alternative harvest strategies. Further, such differences would compound over the time-series: differences from the actual history beginning in 1992 would have changed the stock and fishery interactions both in 1992 and in all subsequent years. Therefore, this analysis only represents one potential measurement tool with which to gauge the relationships between yields to the directed and non-directed Pacific halibut fisheries.

In aggregate, the results of this analysis are generally consistent with those from historical analyses and those based on alternative methods. Mortality reduced in non-directed fisheries, because it has a larger effect on smaller/younger Pacific halibut, generally corresponds to a larger yield in directed fisheries, in this case an average of 115% over the period 1992-2018. The spatial distribution of this hypothetical yield is largely reflective of the distribution of mortality in non-directed fisheries; however, the actual distribution of directed fishery mortality indicates that more of this hypothetical yield may have been taken historically in the eastern IPHC Regulatory Areas of the stock. The trade-off in yield among fisheries is only one part of the IPHC's long-term harvest strategy. Considering this topic in tandem with other management decisions may be best pursued through the ongoing Management Strategy Evaluation.

Recommendation/s

That the Commission:

a) **NOTE** paper IPHC-2019-IM095-11 which provides an analysis of the effects of historical discard mortality in non-directed fisheries (bycatch) on yields to the directed fisheries

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Alternative projections for 2019 (last year) adjusted for the effects of U26 Pacific halibut discard mortality in non-directed fisheries ('bycatch')

PREPARED BY: IPHC SECRETARIAT (I. STEWART, 24 OCTOBER 2019)

PURPOSE

To provide the Commissioners with alternative projections for 2019 (last year) for comparison with adopted mortality limits from AM095.

INTRODUCTION

Discussions during the 2019 IPHC Work Meeting (WM2019) related to the treatment of discard mortality in non-directed fisheries ('bycatch') of fish less than 26 inches in length (U26) resulted in an informal request that the IPHC Secretariat provide alternative projections for 2019 (last year) in order to evaluate the effects of U26 discard mortality in non-directed fisheries on the coastwide and IPHC Regulatory Area-specific TCEYs.

These calculations are based on the results presented in IPHC-2019-AM095-INF07[1], which found that there were 3.24 million pounds of additional TCEY associated with a 2019 projection that did not include any U26 discard mortality in non-directed fisheries. The potential yield gain (IPHC-2019-IM095-11) due to reductions in discard mortality from non-directed fisheries will vary year-to-year, so these projections will need to be recalculated for 2020 if this approach is to be evaluated again, and the results may differ based on changes in the fisheries as well as the demographics and biology of the stock.

METHODS

Projected alternative 2019 TCEYS are calculated based on the following starting conditions (TABLE 1):

- The adopted 2019 limit establishing a fixed TCEY of 1.65 Mlb for IPHC Regulatory Area 2A.
- The adopted 2019 limit for IPHC Regulatory Area 2B, which represented a weighted average of the historical allocation (20%) to IPHC Regulatory Area 2B (weighted 70%) and the allocation (12.3%) based on the interim management procedure (weighted 30%). The interim management procedure TCEY distribution is itself based on the product of the estimated O32 stock distribution and the relative harvest rates of 1.0 for IPHC Regulatory Areas 2A-3A and 0.75 for 3B-4CDE. The result of this calculation for 2B was 17.7% for 2019.
- The adopted 2019 TCEYs for IPHC Regulatory Areas 2C-4CDE.

From these starting conditions, three steps were taken to derive the final TCEYs:

1) The TCEY for each IPHC Regulatory Area is first proportionally increased to include the potential yield available if no U26 discard mortality in non-directed fisheries was projected.
2) The increased TCEY for IPHC Regulatory Area 2B is fixed, and the TCEY for IPHC Regulatory Area 2A is fixed at the original value (1.65).

[1] There was a small amount (0.02 million pounds) of U26 discard mortality in non-directed fisheries prosecuted in IPHC Regulatory Area 2B in 2018. This would be excluded from future calculations, but is not here to retain consistency with the results reported in IPHC-2019-AM095-INF07.

3) Finally, all TCEYs for Alaska (IPHC Regulatory Areas 2C-4CDE) are reduced in proportion to the original allocation such that the original total coastwide TCEY is achieved.

RESULTS

This alternative approach to accounting for U26 discard mortality in non-directed fisheries results in an additional 0.57 million pounds allocated to IPHC Regulatory Area 2B under the distribution of the 2019 adopted catch limits (TABLE 1). The reductions to IPHC Regulatory Areas 2C-4CDE range from 0.03 million pounds in 4B to 0.26 million pounds for 3A under the distribution of the 2019 adopted catch limits (TABLE 1).

TABLE 1. Summary of TCEY calculations (millions of pounds) corresponding to the 2019 adopted limits and adjusted to account for the effects of U26 discard mortality in non-directed fisheries.

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
2019 Adopted TCEYs	1.65	6.83	6.34	13.50	2.90	1.94	1.45	4.00	38.61
2019 adopted TCEY distribution	4.3%	17.7%	16.4%	35.0%	7.5%	5.0%	3.8%	10.4%	100%
2019 adopted TCEYs adjusted as if there were no U26 non-directed discard mortality	1.79	7.40	6.87	14.63	3.14	2.10	1.57	4.34	41.85
Difference	0.14	0.57	0.53	1.13	0.24	0.16	0.12	0.34	3.24
2019 adopted TCEYs with 2B and Alaska adjusted to account for U26 non-directed discard mortality	1.65	7.40	6.22	13.24	2.84	1.90	1.42	3.92	38.61

DISCUSSION

This analysis provides an example, using the 2019 projections (last year), of one possible approach for accounting for the effects of U26 discard mortality in non-directed fisheries on directed fishery limits across all IPHC Regulatory Areas. The approach is consistent with the options outlined in IPHC-2019-IM095-10 for determining the coastwide scale of U26 discard mortality in non-directed fisheries based on either the *status quo* approach (setting TCEYs), or setting a combined total mortality limit based on the previous year's estimates. It is also consistent with determining the distribution of U26 within a total mortality limit based on the previous year's estimates of U26 distribution.

This approach consists of proportionally adjusting (decreasing) the projected TCEYs in Alaskan waters to account for the effects of U26 discard mortality in non-directed fisheries while simultaneously adjusting (increasing) the TCEY in IPHC Regulatory Area 2B. The calculation accounts for the effects of U26 discard mortality in non-directed fisheries on the coastwide SPR, and distributes those effects based on where they occur.

RECOMMENDATION/S

That the Commission:

a) **NOTE** paper IPHC-2019-IM095-12 which provides an alternative approach for accounting for U26 discard mortality in non-directed fisheries, as requested by the Commission.

b) **REQUEST** this or another method to be applied as a basis for the mortality projection tool for use in the decision making processes at AM096.

REFERENCES

IPHC Secretariat. 2019. Treatment and effects of Pacific halibut discard mortality (bycatch) in non-directed fisheries projected for 2019. IPHC-2019-AM095-INF07. 10 p.

IPHC 5-year Biological and Ecosystem Science Research Plan: Update (J. Planas)

PREPARED BY: IPHC SECRETARIAT (J. PLANAS, 23 OCTOBER 2019)

PURPOSE

To provide the Commission with a description of progress on Biological and Ecosystem Science Research by the IPHC Secretariat.

BACKGROUND

The main objectives of Biological and Ecosystem Science Research at IPHC are to:

1) identify and assess critical knowledge gaps in the biology of the Pacific halibut;
2) understand the influence of environmental conditions; and
3) apply the resulting knowledge to reduce uncertainty in current stock assessment models.

The primary biological research activities at IPHC that follow Commission objectives are identified and described in the Five-Year Research Plan for the period 2017-21. These activities are summarized in five broad research areas designed to provide inputs into stock assessment and the management strategy evaluation processes (Appendix I), as follows:

1) Migration. Studies are aimed at further understanding reproductive migration and identification of spawning times and locations as well as larval and juvenile dispersal.
2) Reproduction. Studies are aimed at providing information on the sex ratio of the commercial catch and to improve current estimates of maturity.
3) Growth and Physiological Condition. Studies are aimed at describing the role of some of the factors responsible for the observed changes in size-at-age and to provide tools for measuring growth and physiological condition in Pacific halibut.
4) Discard Mortality Rates (DMRs) and Survival. Studies are aimed at providing updated estimates of DMRs in both the longline and the trawl fisheries.
5) Genetics and Genomics. Studies are aimed at describing the genetic structure of the Pacific halibut population and at providing the means to investigate rapid adaptive changes in response to fishery-dependent and fishery-independent influences.

UPDATE ON PROGRESS ON THE MAIN RESEARCH ACTIVITIES

1. Migration.

Knowledge of Pacific halibut migration throughout all life stages is necessary in order to gain a complete understanding of stock distribution and the factors that influence it.

1.1. Larval distribution and connectivity between the Gulf of Alaska and Bering Sea. A manuscript resulting from work on the cooperative project between NOAA EcoFoci and the IPHC has been drafted and is being edited for submission to a peer-reviewed journal. Two year classes, 2005 and 2009, were chosen as the primary focus of this project based on the fact that these represented relatively large and weak year classes, and "warm" and "cold" environmental regimes in the Bering Sea, respectively. Additional "warm" and "cold" years were added to the larval advection modeling component to study the environmental linkage. Larval advection modeling produced information about dispersal pathways and degree of connectivity between spawning and settlement grounds both within and between the Bering Sea and Gulf of Alaska. Results suggest that up to half of the larvae spawned in the western Gulf of Alaska have the potential to be advected into the Bering Sea through Unimak Pass, AK. While Bering Sea environmental regime did not appear to strongly correlate to region of larval delivery in the Bering Sea, there was annual variation. Application of the IPHC-developed space-time model was used to assess distribution of young fish from 2-6 years old as they move away from the settlement grounds. Dispersal is widespread with young Pacific halibut moving further offshore and to deeper depths as they age. A portion of the young fish, especially evident when modeling the 2009 cohort due to higher densities, appeared to move out of Bristol Bay southward along the Alaska Peninsula, arriving at Unimak Pass within 2-3 years. Results from this project provide a new understanding of linkages between spawning grounds, eventual settlement, and subsequent migration of young fish, as well as variability in these pathways under different environmental scenarios. This work fills a gap in knowledge of early life history dispersal and ontogenetic migration utilized by young Pacific halibut.

1.2. <u>Wire tagging of U32 Pacific halibut</u>. Wire tagging of Pacific halibut caught in the NOAA/NMFS trawl surveys, which began in 2015, was continued in 2019. In 2019, 963 and 811 Pacific halibut were tagged in the Bering Sea and Gulf of Alaska, respectively. The wire tagging effort of U32 Pacific halibut that has taken place during the IPHC's Fishery Independent Setline Survey (FISS) in recent years was not implemented in 2019 due to work load commitments on the surveys. However, through 2019, a total of 10,770 U32 Pacific halibut had been wire tagged and 110 of those have been recovered to date.

1.3. <u>Electronic archival tagging</u>. In 2019, as part of a collaborative research project with the Norton Sound Economic Development Corporation (NSEDC) and the University of Alaska Fairbanks, Pacific halibut were tagged in the eastern Bering Sea shelf with pop-up archival satellite (PAT) tags. Pacific halibut (U32 and O32) were tagged in the Norton Sound and St. Lawrence Island regions (n = 56). The PAT tags were programmed to release from their host fish and report their location and archived data during three periods: January 2020 (representing the spawning season); summer of 2020 (investigating site fidelity versus emigration); and summer of 2021 (examining longer-term dispersal). Tags provided by the IPHC were used to tag relative small fish (i.e., 70-90 cm) and were accompanied by tagging of large (>100 cm) Pacific halibut using tags that were purchased by NSEDC. This is designed to produce data that are comparable to the IPHC's prior PAT-tagging research that was conducted to examine adult connectivity and spawning stock structure throughout the managed range, while expanding the work to examine considerably broader stock demographics than any prior electronic archival tagging experiment. Of particular interest is anecdotal information that suggest that the northeastern Bering Sea Pacific halibut population may be composed of two functional components: one that moves seasonally between this region and the continental shelf edge in US waters (e.g. Middle and Pervenets Canyons in Area 4D), and another that may spawn in Russian waters (e.g. Navarin Canyon) be largely derived of individuals that are reared in Russian nurseries.

2. Reproduction.

Efforts at IPHC are currently underway to address two critical issues in stock assessment for estimating the female spawning biomass: the sex ratio of the commercial landings and maturity estimations.

2.1. Sex ratio of the commercial landings. For the first time, the IPHC has generated sex information of the entire set of age commercial landings in 2017 and 2018. Genetic assays developed in collaboration with the University of Washington have been conducted at the IPHC biological laboratory using a QuantStudio6 instrument. Fin clips from over 10,000 aged Pacific halibut collected coastwide by IPHC port samplers in 2017 and a similar number of tissues from commercial landings collected in 2018 have been genotyped. The sex ratio data of the commercial landings are currently being used in stock assessment.

2.2. Maturity estimations. In order to characterize the gonadal maturation schedule, the IPHC is conducting a full characterization of the annual reproductive cycle in female and male Pacific halibut. Biological samples (gonads, blood, pituitary, otolith, fat content) were collected at monthly intervals from female (N=30) and male (N=30) Pacific halibut captured from the Portlock region in the central Gulf of Alaska throughout an entire calendar year, from September 2017 until August 2018 (Figure 1). Formalin-fixed gonadal samples were processed for histology in early 2019 and duplicate histological slides for each sampled Pacific halibut gonad (N = 360 per sex) were stained with Hematoxylin and Eosin and are now available for staging. An MSc student from Alaska Pacific University, with funding from IPHC, was trained for this purpose in March 2019 and began staging the entire collection of ovarian histological samples in June 2019. The revision of maturity schedules and the comparison of macroscopic and microscopic ovarian staging will constitute the basis of her MSc dissertation.

We have completed the analysis of the temporal progression of the four maturity classification stages (macroscopic) used for staging females in the IPHC FISS (Figure 1) and of the gonadosomatic index (gonad weight/round weight x 100; GSI) as well as the hepatosomatic index (liver weight/round weight x 100; HSI) for both females and males (Figure 2). In addition, we have described the four maturity classification stages in relation to the GSH and the HISI (Figure 3) and established criteria for the classification of the different oocyte developmental stages that is critical for accurate staging.

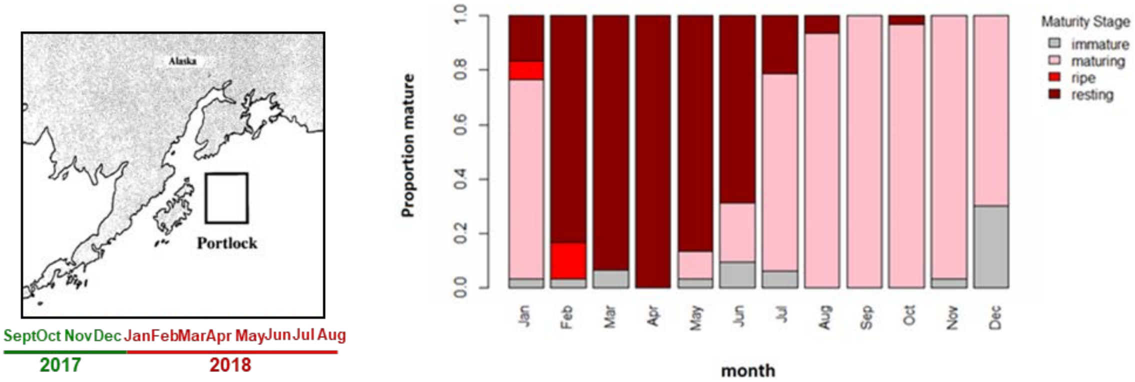


Figure 1. *Left.* Monthly sampling schedule in the Portlock area (Central Gulf of Alaska). *Right*. Temporal changes in the proportion of female Pacific halibut staged macroscopically according to the maturity classification criteria used in the FISS throughout an entire calendar year.

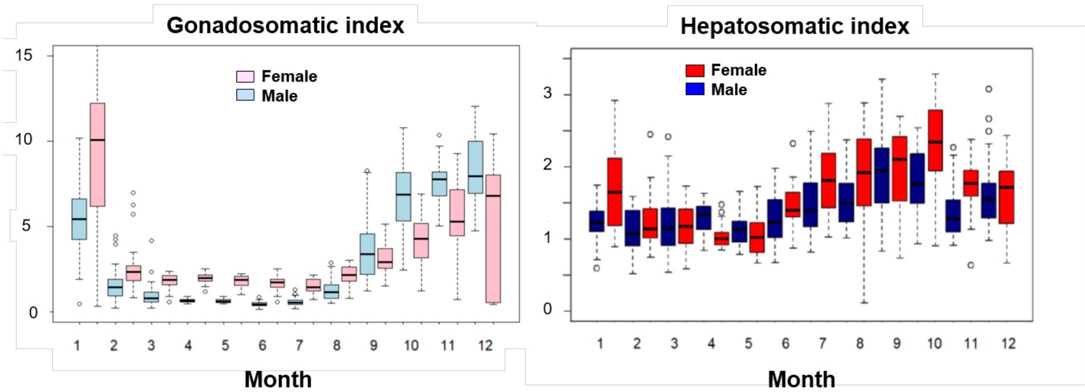


Figure 2. Temporal changes in the gonadosomatic (left) and hepatosomatic (right) indices in female and male Pacific halibut.

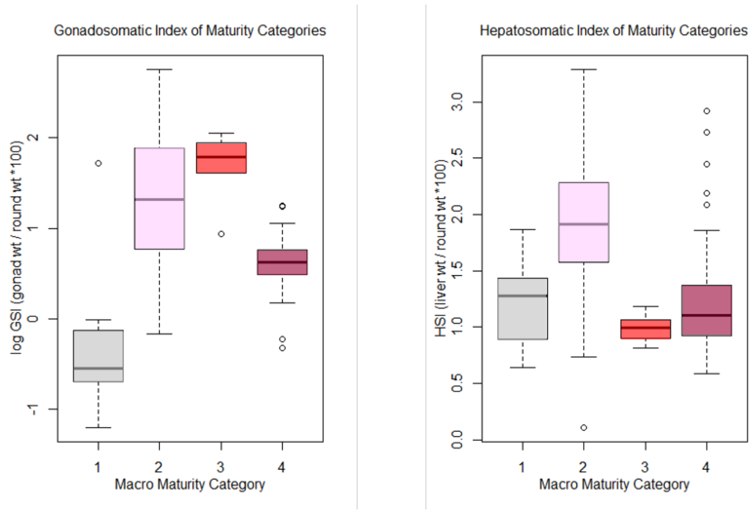


Figure 3. Macroscopic maturity categories in relation to the gonadosomatic (left) and hepatosomatic (right) indices in female Pacific halibut.

Future plans include: 1) analysis of the entire collection of testicular histological samples and 2) the temporal characterization of reproductive hormones in the blood and the gene expression profiles of gonadotropic hormones (follicle-stimulating hormone and luteinizing hormone), known key markers of the reproductive process, in the pituitary of female and male Pacific halibut. In addition to characterizing the progression of reproductive development throughout an entire annual reproductive cycle (intraseasonal) reproductive samples, the IPHC collected samples in June 2019 in the Portlock region to compare with those collected in the same location in June 2018 and June 2017 in order to evaluate possible differences in interseasonal variation in maturity schedules. Ovarian samples from these three years have been processed for histology and are in the process of being analyzed.

3. Growth.

In order to improve our understanding of the possible role of growth alterations in the observed historical changes in size-at-age in Pacific halibut, the IPHC Secretariat is conducting studies aimed at: 1) the identification and validation of physiological markers for growth; and 2) the use of growth markers for evaluating growth patterns in the Pacific halibut population and the effects of environmental influences. The IPHC Secretariat is conducting investigations on the effects of temperature variation on growth performance, as well as on the effects of density, hierarchical dominance and handling stress on growth in juvenile Pacific halibut in captivity (Figure 4). These studies are partially funded by a grant from the North Pacific Research Board to the IPHC (Appendix II) and the results on the effects of temperature on growth physiological indicators are being prepared for publication in a peer-reviewed journal.

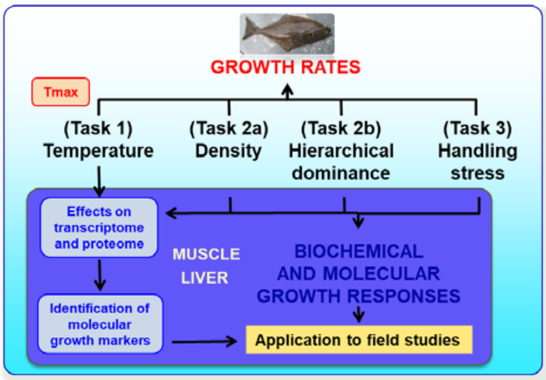


Figure 4. Diagram of the objectives of the NPRB-funded project with indication of the different tasks.

4. Discard Mortality Rates (DMRs) and Survival Assessment. In order to better estimate post-release survival of Pacific halibut caught incidentally in the directed longline fishery, the IPHC Secretariat is conducting investigations to understand the relationship between fish handling practices and fish physical and physiological condition and survival post-capture as assessed by tagging. These studies are partially funded by a grant from the Saltonstall-Kennedy Grant Program NOAA to IPHC (Appendix II).

4.1. Evaluation of the effects of **hook release techniques** on injury levels and association with the physiological condition of captured Pacific halibut. The IPHC has evaluated the effects of different release techniques on injury levels (Figure 5) and the results indicate that a majority (more than 70%) of Pacific halibut released by careful shake and by gangion cutting are classified in the excellent injury category. In contrast, Pacific halibut that encounter the hook stripper are primarily classified in the medium and poor injury categories.

The physiological condition of Pacific halibut subjected to the different hook release techniques is currently being assessed by relating the injury category assigned to each fish with the condition factor, fat levels and levels of blood stress indicators.

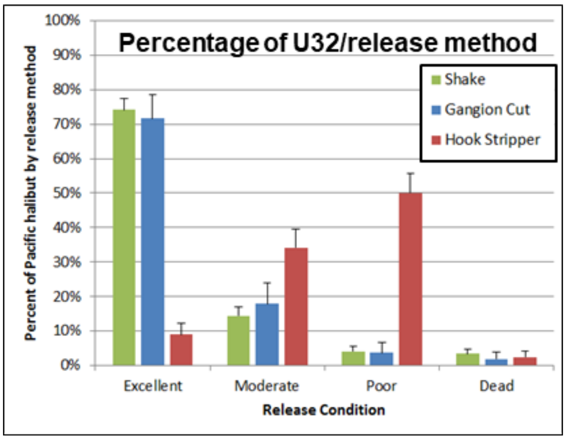


Figure 5. *Left***.** Schematic diagram of workflow. *Right***.** Prevalence of types of injuries (as indicated by injury classification or release condition) in U32 fish released by different hook release techniques (careful shake, gangion cut and hook stripper).

4.2. <u>Post-release survival estimations</u>. In order to evaluate the survival of discarded fish, two types of tagging approaches were used. 1) Classical mark-and-recapture of released fish with wire tags: 1,027 fish (under 33 inches in length) were tagged. 2) Biotelemetric monitoring of released fish with the use of satellite-transmitting electronic archival tags equipped with accelerometers: results from a total of 79 Pacific halibut ranging from 53-81 cm FL allowed us to estimate that the DMR of U32 Pacific halibut that were categorized as being in excellent-condition at the time of their release was approximately 4%.

4.3. <u>Application of electronic monitoring (EM) for capturing the hook release methods</u>. Evaluation of EM data whereby reviewers recorded the release method and condition of released fish evidenced a high degree (95%-100%) of agreement between the actual release method used and that captured by EM. Therefore, once the survival estimates of fish released by the different hook release techniques are determined, these results strongly suggest that mortality rates could be deduced from EM-captured hook release techniques.

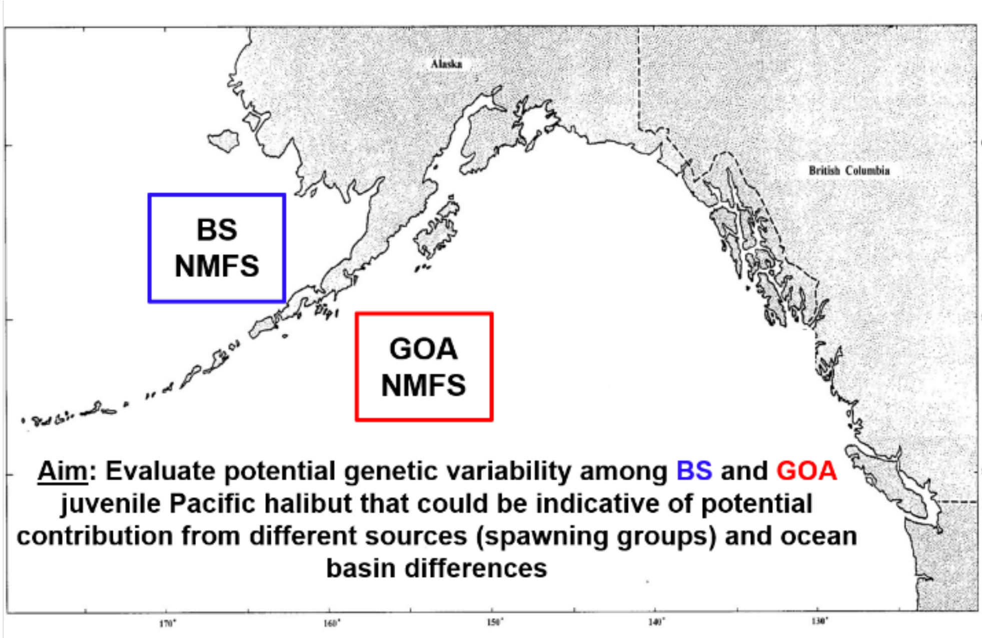
4.4. <u>Discard mortality rates of Pacific halibut in the charter recreational fishery</u>. The IPHC has initiated in 2019 a research project aimed at experimentally deriving DMRs from the charter recreational fishery for the first time. This project has received funding from the National Fish and Wildlife foundation (Appendix II). As an initial step in this project, information from the charter fleet on types of gear and fish handling practices used was collected through stakeholder meetings and on dock interviews with charter captains and operators. This information will inform the design of the experimental test fishing that will take place in 2020 and in which fish mortality will be estimated as described in 4.2.

5. Genetics and genomics. The IPHC Secretariat is exploring avenues for incorporating genetic approaches for a better understanding of population structure and distribution and is also building genomic resources to assist in genetics and molecular studies on Pacific halibut.

   5.1. Genetics. The main purpose of the proposed studies is to incorporate genetic analyses into migration-related research in order to improve our understanding of Pacific halibut movement and dispersal and of the genetic structure of the Pacific halibut population. Three specific topics will be investigated:

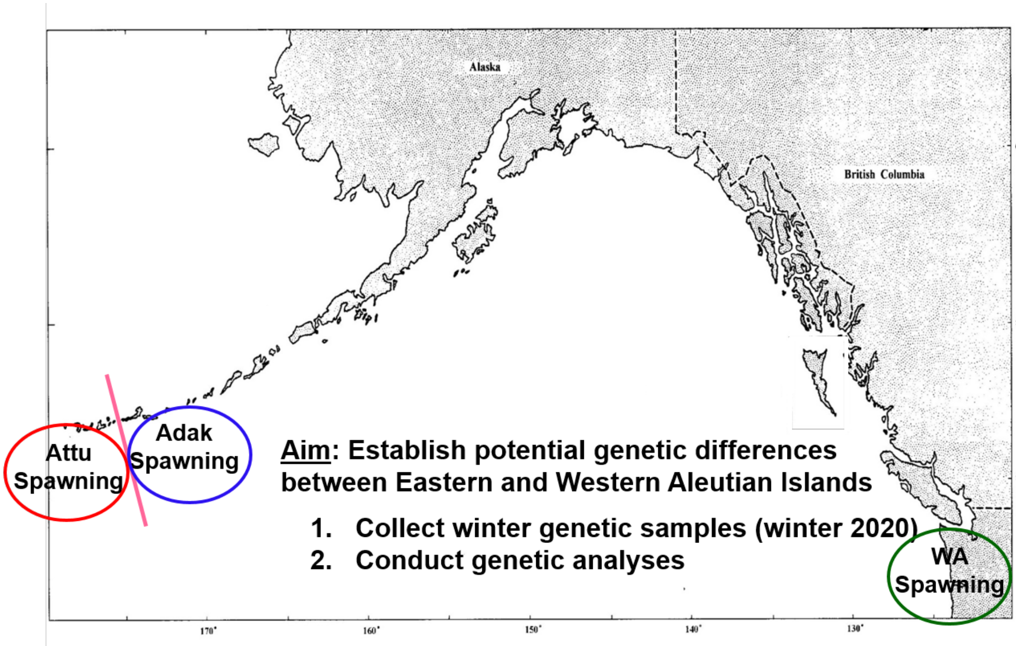
      5.1.1. *Analysis of genetic variability among juvenile Pacific halibut in the Bering Sea and the Gulf of Alaska*. The aim of this study is to evaluate the genetic variability among juvenile Pacific halibut in a given ocean basin in order to infer information on the potential contribution from fish spawned in different areas to that particular ocean basin. We hypothesize that genetic variability among juvenile Pacific halibut captured in one particular ocean basin (e.g. eastern Bering Sea) may be indicative of mixing of individuals originating in different spawning grounds and, therefore, of movement. By comparing the genetic variability of fish between two ocean basins (i.e. eastern Bering Sea and Gulf of Alaska), we will be able to evaluate the extent of the potential contribution from different sources (e.g. spawning groups) in each of the ocean basins and provide indications of relative movement of fish to these two different ocean basins. The use of genetic samples from juvenile Pacific halibut collected in the NMFS trawl survey in the eastern Bering Sea and in the Gulf of Alaska, aged directly or indirectly through the length-age key, will allow us to provide genetic information from fish that are at or near their settlement or nursery grounds.

      Fin clips from 150 fish from the eastern Bering Sea and from 150 fish from the Gulf of Alaska, all between 2 and 3 years of age, will be used for DNA extraction and purification. A pooled-sequencing approach will be used to obtain genome-wide data resulting from the sequencing of two libraries, each composed of all the individuals from each of the two areas. Pooled heterozygosity will be estimated for each of the two ocean basins as well as the mean difference in pooled heterozygosity between the two sample groups (i.e. ocean basins). For fish of unknown sex, genetic sex will be determined using SNPs to two sex-linked loci previously developed and used to determine the genetic sex of the commercial Pacific halibut landings.



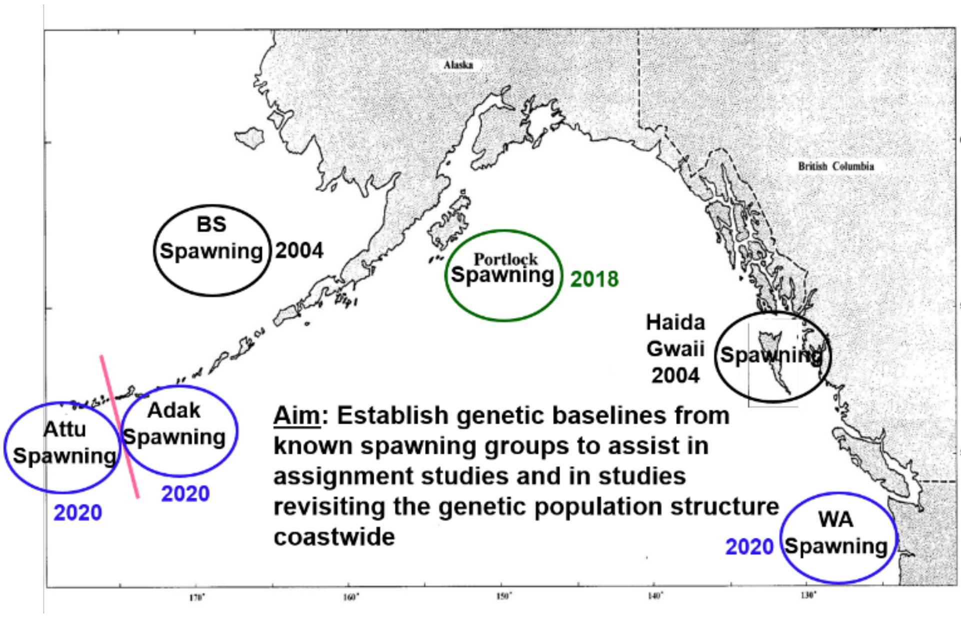
5.1.2. *Analysis of genetic population structure in IPHC Regulatory Area 4B*. Understanding population structure is imperative for sound management and conservation of natural resources. Pacific halibut in US and Canadian waters are managed as a single, panmictic population on the basis of tagging studies and historical (i.e., pre-2010) analyses of genetic population structure that failed to demonstrate significant differentiation in the eastern Pacific. However, recent studies have reported significant genetic population on the basis of microsatellites that suggest that Pacific halibut residing in the Aleutian Islands may be genetically distinct from other regions. In particular, differentiation of the population on either side of Amchitka Pass is indicated, suggesting a possible basis for separating IPHC Regulatory Area 4B into two management subareas. However, in order to evaluate that possibility, it would be advisable to re-assess those conclusions using samples specifically collected to evaluate the implied stock delineation. In particular, the existing analyses employed summer-collected (i.e. non-spawning season) samples west of Amchitka Pass and may or may not be representative of the local spawning population. Although unlikely, one cannot exclude the possibility that the observed differentiation in the Aleutian Islands may be representative of differentiation caused by dilution of the west Aleutian sample by individuals from some other region. The proposed work would sample the local population on either side of Amchitka Pass during the spawning season so as to best-characterize spawning structure and provide management advice regarding the relative justifiability for considering the western Aleutians as a genetically-distinct substock. Subsequently, genetic analyses will be conducted to evaluate the level of genetic differentiation between the two sampled areas. In addition, migration analyses have suggested that spawning occurs off the Washington coast, which would represent a component of the spawning population that has never before been studied. In a number of northern fish populations it has been shown that fish at the southern edge of the range display unique genetic composition.

Sample collection will take place west and east of Amchitka Pass, and off the Washington coast, during the winter of 2020 in order to collect fish during the spawning season. Commercial fishing vessels will be chartered specifically for the purpose of collecting approximately 50 adult fish from each area and those samples will be subjected to DNA extraction and purification. A pooled-sequencing approach will be used to obtain genome-wide data resulting from the sequencing of three libraries, one from each area sampled.



5.1.3. *Identification of potential genetic signatures of origin or spawning groups to revise population structure*. In order to expand our proposed studies evaluating the Pacific halibut population genetic structure to the entire northeast Pacific Ocean covering the IPHC Convention Area, a broader genetic study is proposed that aims at establishing genetic baselines from known spawning groups throughout the geographic area in question. With the genetic samples that are planned to be collected in the winter of 202, together with winter samples collected in the Portlock area (i.e. central Gulf of Alaska) in 2018 and in Haida Gwaii in 2004 and in the Bering Sea (i.e. Pribilof Canyon) in 2004, we plan on establishing genetic signatures of these spawning groups to revise the genetic population structure with up-to-date genetic techniques.

Fin clips from 50 fish from each of the six sampled geographic areas will be used for DNA extraction and purification. A pooled-sequencing approach will be used to obtain genome-wide data resulting from the sequencing of 6 libraries, each composed of all the individuals from each of the six areas sampled.



5.2. Genomics. The IPHC Secretariat is currently conducting a project aimed at generating a first draft sequence of the Pacific halibut genome. This study is being conducted in collaboration with the National Institute of Agrogenomic Research (INRA, Rennes, France) and the University of Washington. An initial sequencing effort using genomic DNA from one Pacific halibut female in half an Illumina lane in 2 x 250 pair end mode resulted in a total size of assembled scaffolds of 700 Mb, likely corresponding to the size of the Pacific halibut genome. This non-contiguous genomic sequence is currently being complemented by long read sequencing using the Nanopore technology (i.e. PromethION) combined with Hi-C sequencing for chromosome-scale scaffolding of the genome assembly. The sequencing effort is expected to be completed by the end of 2019. Plans to establish a collaboration with Canadian scientists to establish a genomic comparison between Pacific and Atlantic halibut genomes are being discussed, including the possibility of a joint publication highlighting the comparative genomics approach. In addition to genome sequencing, the IPHC Secretariat has completed transcriptome sequencing of a wide variety of tissues (12) in Pacific halibut including white and red skeletal muscle, liver, heart, ovary, testis, head kidney, brain, gill, pituitary, spleen and retina. Current plans regarding this extensive transcriptomic dataset include generating a reference transcriptome for the species and to create a user-friendly, searchable database to be made public in the IPHC website.

RECOMMENDATIONS

That the Commission **NOTE** paper IPHC-2019-IM095-13 which outlines progress on Biological and Ecosystem Science Research by the IPHC Secretariat.

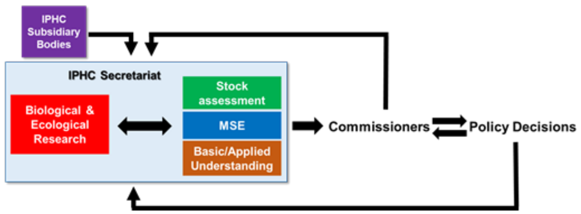
APPENDICES

Appendix I: Integration of biological research, stock assessment and harvest strategy policy

Appendix II: Summary of external research projects awarded for funding

APPENDIX I

Integration of biological research, stock assessment and harvest strategy policy



Biological research | Stock assessment | Stock assessment MSE

Research areas	*Research outcomes*	*Relevance for stock assessment*	*Inputs to stock assessment and MSE development*
Migration	Larval distribution Juvenile and adult migratory behavior and distribution	Geographical selectivity Stock distribution	Information for structural choices Recruitment indices Migration pathways and rates Timing of migration
Reproduction	Sex ratio Spawning output Age at maturity	Spawning biomass scale and trend Stock productivity Recruitment variability	Sex ratio Maturity schedule Fecundity
Growth	Identification of growth patterns Environmental effects on growth Growth influence in size-at-age variation	Temporal and spatial variation in growth Yield calculations Effects of ecosystem conditions Effects of fishing	Predicted weight-at-age Mechanisms for changes in weight-at-age
Discard Survival	Bycatch survival estimates Discard mortality rate estimates	Scale and trend in mortality Scale and trend in productivity	Bycatch and discard mortality estimates Variability in bycatch and uncertainty in discard mortality estimates
Genetics and Genomics	Genetic structure of the population Sequencing of the Pacific halibut genome	Spatial dynamics Management units	Information for structural choices

APPENDIX II

Summary of current awarded research grants

Project #	Grant agency	Project name	PI	Partners	IPHC Budget ($US)	Management implications	Grant period
1	**Saltonstall-Kennedy NOAA**	Improving discard mortality rate estimates in the Pacific halibut by integrating handling practices, physiological condition and post-release survival (Award No. NA17NMF4270240)	IPHC	Alaska Pacific University	$286,121	Bycatch estimates	September 2017 – August 2019 (no cost extension requested)
2	**North Pacific Research Board**	Somatic growth processes in the Pacific halibut (*Hippoglossus stenolepis*) and their response to temperature, density and stress manipulation effects (NPRB Award No. 1704)	IPHC	AFSC-NOAA-Newport, OR	$131,891	Changes in biomass/size-at-age	September 2017 – February 2020
3	**Bycatch Reduction Engineering Program - NOAA**	Adapting Towed Array Hydrophones to Support Information Sharing Networks to Reduce Interactions Between Sperm Whales and Longline Gear in Alaska	Alaska Longline Fishing Association	IPHC, University of Alaska Southeast, AFSC-NOAA	-	Whale Depredation	September 2018 – August 2019
4	**Bycatch Reduction Engineering Program - NOAA**	Use of LEDs to reduce Pacific halibut catches before trawl entrainment	Pacific States Marine Fisheries Commission	IPHC, NMFS	-	Bycatch reduction	September 2018 – August 2019
5	**National Fish & Wildlife Foundation**	Improving the characterization of discard mortality of Pacific halibut in the recreational fisheries	IPHC	Alaska Pacific University, U of A Fairbanks, charter industry	$98,902	Bycatch estimates	January 2019 – December 2019
				Total awarded ($)	**$516,914**		

INTERNATIONAL PACIFIC HALIBUT COMMISSION

IPHC Management Strategy Evaluation (MSE): update

PREPARED BY: IPHC SECRETARIAT (A. HICKS, P. CARPI, S. BERUKOFF & I. STEWART; 25 OCTOBER 2019)

PURPOSE

To provide an update of International Pacific Halibut Commission (IPHC) Management Strategy Evaluation (MSE) activities including definition of scale and distribution objectives, development of a framework to evaluate management procedures for distributing the TCEY, identification of management procedures to evaluate, and a summary of the MSE program of work.

1 INTRODUCTION

The Management Strategy Evaluation (MSE) at the International Pacific Halibut Commission (IPHC) completed an initial phase of evaluating management procedures relative to the coastwide scale of the Pacific halibut stock and fishery. Results of the MSE simulations were presented at the 95th Session of the IPHC Annual Meeting (AM095), the 13th Session of the IPHC Management Strategy Advisory Board (MSAB013), and the 14th Session of the IPHC Management Strategy Advisory Board (MSAB014). The next phase investigates management procedures related to the distribution of the Total Constant Exploitation Yield (TCEY). The TCEY is the mortality limit composed of mortality from all sources except under- 26-inch (66.0 cm, U26) non-directed discard mortality, and is determined by the Commission at each Annual Meeting for each IPHC Regulatory Area.

This document first presents the objectives that the MSAB and Commission are using to evaluate management procedures. It then summarizes the results of the simulations investigating the coastwide scale portion of the management procedure, followed by the identification of management procedures incorporating scale and distribution components for evaluation at MSAB meetings in 2020. The progress on developing a framework to investigate distributing the TCEY follows, and the program of work for the next year is discussed.

2 GOALS AND OBJECTIVES

The MSAB currently has four goals, each with multiple objectives related to scale and distribution. The four goals and their primary general objectives are

1. Biological Sustainability (also referred to as a conservation goal)
    1.1. Keep female spawning biomass above a limit to avoid critical stock sizes and conserve spatial population structure
2. Optimise directed fishing opportunities (also referred to as a fishery goal)
    2.1. Maintain spawning biomass around a level that optimises fishing activities
    2.2. Limit catch variability
    2.3. Provide directed fishing yield
3. Minimize discard mortality in directed fisheries
4. Minimize discards and discard mortality in non-directed fisheries (bycatch)

The biological sustainability goal is also referred to as a conservation goal, and the goal "optimise directed fishing opportunities" is often referred to as a fishery goal. The fishery goal stresses optimising fishery yield with respect to stability and sustainability and optimising the fishing opportunities to ensure access. Goals related to discard mortality in directed fisheries and non-directed fisheries have not yet been specifically considered in the MSE but have been identified as important to consider after 2021.

There are two major components of the harvest strategy: coastwide scale and TCEY distribution (Figure 1). The MSE has recently focused on coastwide scale with an input fishing mortality rate (F_{SPR}) and 30:20 control rule determining the total coastwide mortality, and thus objectives have been focused at the coastwide level. The MSE program of work is now focusing on both components with the intent to refine coastwide objectives and define regional- and area-specific distributional objectives.

In this section, we first present the MSAB-defined objectives related to coastwide scale and performance metrics linked to those objectives. We then present the distribution objectives defined at MSAB014.

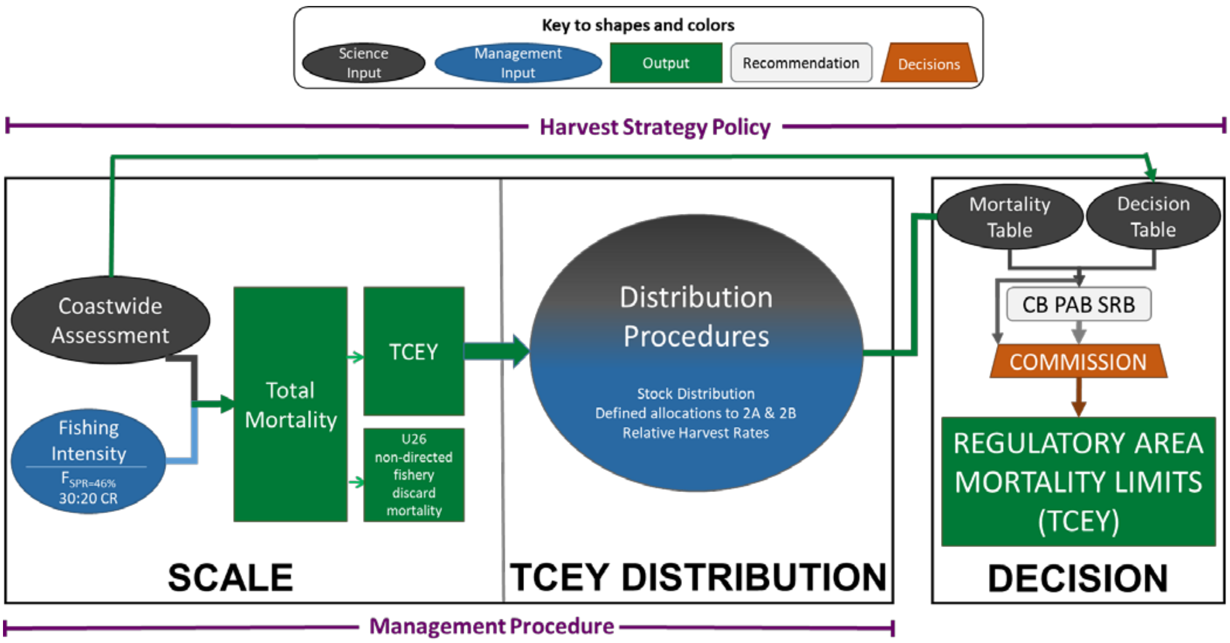


Figure 1: Illustration of the Commission interim IPHC harvest strategy policy (as revised for 2019-2022) process showing the coastwide scale and TCEY distribution components that comprise the management procedure. The decision component is the Commission decision-making procedure, which considers inputs from many sources.

2.1 Objectives related to coastwide scale

Primary general objectives were previously identified by the MSAB and the Commission for evaluating MSE results related to coastwide fishing intensity as presented at AM095. At that time, the biological sustainability objective (maintain the biomass above a limit) was prioritized to be met before evaluating the fishery stability objective (limit catch variability), which must be met before evaluating the fishery yield objective (maximize the TCEY). Performance metrics were developed from these objectives by defining a measurable outcome, a tolerance (i.e., level of risk), and a timeframe over which it is desired to achieve that outcome. Many more objectives and performance metrics were identified (IPHC-2019-MSAB013-07 Appendix I) which were used to further evaluate the MSE results. Objectives that did not have a tolerance defined can still be reported as performance metrics, and metrics not specifically associated with an objective were labeled as "statistics of interest."

A directive from the Commission agreed with the three primary objectives, except that an objective to maintain a minimum catch was identified without a defined minimum or level or tolerance. Without these specifications, it was not possible to use this objective in the evaluation of the MSE results. Instead, the third primary objective was to maximize the yield subject to satisfying the other two primary objectives.

Subsequent to the presentation of coastwide objectives and MSE results at the 95th Annual Meeting (AM095), the following paragraphs from the Report of the 95th Annual Meeting (IPHC-2019-AM095-R) have guided further refinement of coastwide objectives.

> **AM095-R, para 59a.** *The Commission* ***ENDORSED*** *the primary objectives and associated performance metrics used to evaluate management procedures in the MSE process (as detailed in paper IPHC-2019-AM095-12)*

> **AM095-R, para 59c.** *The Commission* ***RECOMMENDED*** *the MSAB develop the following additional objective, as well as prioritize this objective in the evaluation of management procedures, for the Commission's consideration.*
> *i. A conservation objective that meets a spawning biomass target.*

The MSAB reconsidered the biological sustainability objective to maintain the spawning biomass above a limit to avoid critical stock sizes. A review of the policies and MSE objectives of other processes around the world revealed various proxies for a biomass limit and tolerances for falling below that limit. For example, the U.S. Pacific Fishery Management Council defines a default minimum stock size threshold (MSST) as 25% of unfished spawning biomass, the status below which a stock is defined overfished, although the MSST for flatfish stocks is 12.5% (PFMC 2016). In the U.S. North Pacific Fishery Management Council Fishery Management Plan (NPFMC 2018) the MSST is dependent on the tier that the stock assessment is classified as, but one definition is one-half of B_{MSY}. Fisheries and Oceans Canada defines a limit reference point as 40% of B_{MSY} in their fisheries policy document (DFO 2009). Lastly, the Marine Stewardship Council (MSC) fisheries standard V2.01 defines proxies for the point at which recruitment would be impaired (PRI) as one-half B_{MSY} or 20% of unfished spawning biomass for stocks with average productivity (MSC 2018). Furthermore, the certainty that the stock is greater than the

PRI must be greater than 95% to reach the highest category of the MSC scoring criteria. To remain consistent with other fisheries management approaches, the MSAB retained the spawning biomass limit at 20% of unfished spawning biomass for the biological sustainability objective and updated the tolerance to 5% (Table 1).

The development of a spawning biomass target (i.e., a biomass level with a 50% probability of being above or below) was discussed extensively by the MSAB. Noting that the current IPHC harvest strategy policy (https://iphc.int/the-commission/harvest-strategy-policy) suggests using a proxy for Maximum Economic Yield (MEY), which is related to Maximum Sustainable Yield (MSY), much of the discussion focused around these quantities and what appropriate proxies may be.

The need to maximise economic benefit rather than maximising only yield has been widely recognized. However, the estimation of MEY and related quantities (SB_{MEY} and F_{MEY}) for specific fisheries remains challenging and requires a deep understanding of the economic variables relevant to the fishery. In the absence of this information and of a bio-economic model of the fishery, a proxy for MEY may be obtained from MSY. For example, the Australian government's harvest strategy policy uses the relationship: $SB_{MEY} = 1.2 \times SB_{MSY}$ (Rayns, 2007), and Pascoe *et al*. (2014) suggested that $SB_{MEY} = 1.45 \times SB_{MSY}$ may be appropriate for data-poor single-species fisheries.

Four dynamic equilibrium reference points were estimated for the Pacific halibut stock: 1) unfished equilibrium dynamic spawning biomass (SB_0), 2) MSY, 3) B_{MSY} as a percentage of SB_0 (RSB_{MSY}), and 4) the equilibrium fishing intensity to achieve MSY using spawning potential ratio (SPR_{MSY}) using three different methods to determine appropriate proxy reference points (IPHC-2019-SRB015-11 Rev_1). First, we used a simple equilibrium model. Second, estimates of B_{MSY} from the most recent assessment (IPHC-2019-AM095-09) were determined. Lastly, the coastwide MSE operating model was used to provide a range of SB_{MSY} estimates given the uncertainty and scenarios assumed in the closed-loop simulations. Two approaches were used to characterize variability in the reference points: 1) different scenarios to represent various states of weight-at-age (low, medium, and high relative to the historical observations), environmental regimes (explicitly defined as positive/negative), and values of other parameters, or 2) variability in parameters and weight-at-age were integrated into the simulations and the estimated reference points. Document IPHC-2019-SRB015-11 Rev_1 describes the methods and results from this analysis, with estimates of the dynamic equilibrium RSB_{MSY} for Pacific halibut to likely be in the range of 20% to 30% and SPR_{MSY} to likely be between 30% and 35%. A reasonable RSB_{MSY} proxy, including a precautionary allowance for unexplored sources of uncertainty, would be 30%, and would put a proxy for SB_{MEY} between 36% and 44% given the recommendations of Rayns (2007) and Pascoe *et al.* (2014). The MSAB determined that an appropriate target spawning biomass is 36% of unfished spawning biomass, which addresses uncertainty in estimating MSY and also offers benefits of catch stability and conservation (paragraph 34 of IPHC-2019-MSAB014-R), but at the cost of some foregone yield.

The objective of maintaining the spawning biomass around a target or above a level that optimises fishing activities can be viewed as a fishery objective (e.g., maximise yield) as well as a biological sustainability objective (e.g., maintain a sustainable biomass). However, sustainability of the Pacific halibut stock would be satisfied by meeting the objective of avoiding low stock sizes that may result in an impairment to recruitment. Therefore, the primary biological sustainability objective is to avoid a minimum stock size threshold (i.e. SB_{Lim}) with a high probability (Table 1). The fishery objective to maintain the biomass around a target of $SB_{36\%}$ (Table 1) would be prioritised after meeting this single conservation objective.

The MSAB discussed the coastwide objective to limit annual changes in the TCEY. Up to now, the performance metric for this objective was the average annual variability (AAV), which is an average taken over a ten-year period. Using this performance metric means that even when meeting the objective (a defined threshold of 15% with a tolerance of 0.25) some of those annual changes in the TCEY will exceed the defined threshold. Instead, MSAB members were more interested in the actual annual change from year to year and to limit it to a threshold that is never exceeded more than three times in a ten-year period. A new statistic called Annual Change (AC) was defined to represent actual annual change in the TCEY and used with the stability objective along with AAV since they both provide different interpretations of variability in the TCEY (paragraph 35 of IPHC-2019-MSAB014-R).

The different interpretation of the results when looking at AC or AAV can be seen in Table 2. The probability that the Total Mortality changes by more than 15% in at least one year of the ten-year period is high (0.61 to 0.76) for the slow-up fast-down constraint, and low for the maxChangeBoth15 constraint (0.10 to 0.12, which is a result of mortality that is not "constrained" under the management procedure). However, the median absolute value of the change in the Total Mortality (changes in both directions) is 15% for the maxChangeBoth15 constraint and near 7% for the slow-up fast-down constraint. Furthermore, the probability that the percent change in the TM is greater than 15% in two or more years nearly halves for the slow-up fast-down approach. This shows that the maxChangeBoth15 constraint rarely exceeds a 15% annual change in TM but is often at 15%. In contrast, the slow-up fast-down constraint often results in an annual change less than 15%, but at least one year in a ten-year period is likely to be greater than 15%. On average, the maxChangeBoth15 is more variable than the slow-up fast-down constraint, as seen in the median AAV. Therefore, to evaluate management procedures with respect to stability, it may be beneficial to examine multiple performance metrics. Additionally, the tolerance for the stability objective was removed so that the evaluation would be examining trade-offs between yield and variability.

Table 1: Primary measurable objectives, evaluated over a simulated ten-year period, revised at MSAB013 and by the *ad hoc* working group that met in July 2019. Objective 1.1 is a biological sustainability (conservation) objective and objectives 2.1, 2.2, and 2.3 are fishery objectives.

General Objective	Measurable Objective	Measurable Outcome	Time-frame	Tolerance	Performance Metric
1.1. Keep female spawning biomass above a limit to avoid critical stock sizes and conserve spatial population structure	Maintain a female spawning stock biomass above a biomass limit reference point at least 95% of the time	*SB* < Spawning Biomass Limit (SB_{Lim}) SB_{Lim}=20% unfished spawning biomass	Long-term	0.05	$P(SB < SB_{Lim})$
	Maintain a defined minimum proportion of female spawning biomass in each Biological Region	$p_{SB,2} > 5\%$ $p_{SB,3} > 33\%$ $p_{SB,2} > 10\%$ $p_{SB,2} > 2\%$	Long-term	0.05	$P(p_{SB,R} < p_{SB,R,min})$
2.1 Maintain spawning biomass around a level that optimises fishing activities	Maintain the coastwide female spawning biomass above a biomass target reference point at least 50% of the time	*SB*<Spawning Biomass Target (SB_{Targ}) SB_{Targ}=$SB_{36\%}$ unfished spawning biomass	Long-term	0.50	$P(SB < SB_{Targ})$
2.2. Limit Catch Variability	Limit annual changes in the coastwide TCEY	Annual Change (*AC*) > 15% in any 3 years	Short-term		$P(AC_3 > 15\%)$
		Median coastwide Average Annual Variability (AAV)	Short-term		*Median AAV*
	Limit annual changes in the Regulatory Area TCEY	Annual Change (*AC*) > 15% in any 3 years	Short-term		$P(AC_3 > 15\%)$
		Average AAV by Regulatory Area (AAV_A)	Short-term		*Median* AAV_A
2.3. Provide Directed Fishing Yield	Optimize average coastwide TCEY	Median coastwide TCEY	Short-term		*Median* $\overline{TCEY}$
	Optimize TCEY among Regulatory Areas	Median $TCEY_A$	Short-term		*Median* $\overline{TCEY_A}$
	Optimize the percentage of the coastwide TCEY among Regulatory Areas	Median $\%TCEY_A$	Short-term		*Median* $\overline{\left(\frac{TCEY_A}{TCEY}\right)}$
	Maintain a minimum TCEY for each Regulatory Area	Minimum $TCEY_A$	Short-term		*Median Min(TCEY)*
	Maintain a percentage of the coastwide TCEY for each Regulatory Area	Minimum $\%TCEY_A$	Short-term		*Median Min(%TCEY)*

Table 2: MSE coastwide results for primary objectives with management procedures using the 30:20 control rule with SPR values of 0.38, 0.42, and 0.46 for unconstrained annual changes in the Total Mortality (TM) and three constraint options. The term “any” denotes a threshold exceeded at least one year in the ten-year period and a number after “any” (e.g., “any2”) refers the threshold being exceeded in at least that number of years in the ten-year period. Non-primary objectives are shown in grey.

Input Control Rule	**30:20**											
Constraint	**No Constraint**			**maxChangeBoth15**			**slowUpFastDown**			**Multi-year (3)**		
Input SPR	**0.46**	**0.42**	**0.38**	**0.46**	**0.42**	**0.38**	**0.46**	**0.42**	**0.38**	**0.46**	**0.42**	**0.38**
Biological Sustainability												
P(any RSB_y<20%)	<0.01	<0.01	<0.01	0.02	0.02	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Fishery Sustainability												
P(all RSB<36%)	0.29	0.47	0.68	0.28	0.46	0.63	0.26	0.43	0.60	0.32	0.50	0.67
Median absolute change TM	15.6%	16.9%	19.1%	15.0%	15.0%	15.0%	6.5%	7.1%	7.7%	0.0%	0.0%	0.0%
P(any1 AC TM > 15%)	1	1	1	0.11	0.11	0.10	0.61	0.68	0.76	0.94	0.96	0.96
P(any2 AC TM > 15%)	0.97	0.98	0.99	0.09	0.08	0.08	0.32	0.41	0.52	0.7	0.72	0.77
P(any3 AC TM > 15%)	0.89	0.91	0.94	0.06	0.06	0.06	0.19	0.26	0.35	0.30	0.32	0.40
P(all AAV > 15%)	0.69	0.76	0.84	0.04	0.05	0.06	0.07	0.11	0.15	0.14	0.19	0.3
Median AAV TM	17.9%	19.7%	23.1%	11.2%	11.3%	11.7%	7.0%	7.7%	8.8%	8.0%	8.8%	10.8%
Median average TM (Mlbs)	46.76	49.51	51.78	46.13	48.55	50.88	44.99	48.17	51.11	46.53	48.88	51.18

2.2 Objectives related to the distribution of the TCEY

2.2.1 Biological sustainability

In paragraph 31 of IPHC-2018-SRB012-R, "*the SRB AGREED that the defined Bioregions (i.e. 2,3,4, and 4b described in paper IPHC-2018-SRB012-08) are presently the best option for implementing a precautionary approach given uncertainty about spatial population structure and dynamics of Pacific halibut.*" Therefore, objectives related to conserving some level of spatial population structure should be included under the Biological Sustainability goal. The *ad hoc* working group that met in July 2019 discussed spatial biomass objectives which is reported in IPHC-2019-MSAB014-INF01.

Conserving spatial population structure may imply several meanings, such as maintaining the current biomass distribution across regions, maintaining the proportion of spawning biomass in each Biological Region (Figure 2) within a specified range, or maintaining a minimum spawning biomass or proportion of spawning biomass in each Biological Region. The *ad hoc* working group proposed objectives to maintain a defined minimum proportion of spawning biomass in each Biological Region, which will complement the coastwide biological sustainability objective of maintaining the coastwide spawning biomass above a limit. The IPHC Secretariat proposed minimum proportions of 5%, 33%, 10%, and 2% for Biological Regions 2, 3, 4, and 4B, respectively after qualitatively investigating the modelled survey proportions of O32 stock distribution in each Biological Region since 1993 (the earliest period for which this information is available). Recognizing the short time-series, these minimum proportions were selected to be less than the lowest proportions observed, but no less than 40% of those values.

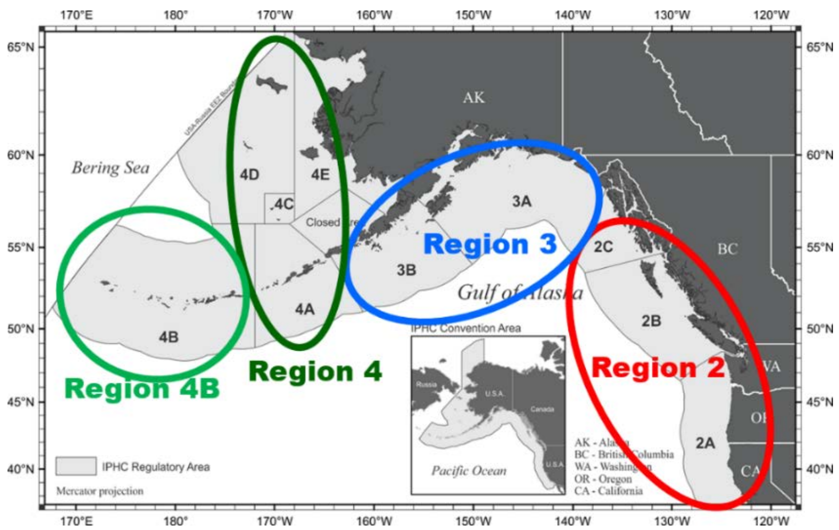


Figure 2. Biological Regions overlaid on IPHC Regulatory Areas with Region 2 comprised of 2A, 2B, and 2C, Region 3 comprised of 3A and 3B, Region 4 comprised of 4A and 4CDE, and Region 4B comprised solely of 4B.

2.2.2 Optimise Directed Fishing Opportunities

Three general objectives are currently defined for the fishery goal: 1) maintain the spawning biomass around a level that optimises fishing activities, 2) limit catch variability, and 3) provide directed fishing yield. Under each general objective, there are coastwide TCEY measurable objectives, but distribution objectives are only defined for the latter two. While Biological Regions are the spatial scale for the biological sustainability goal, fishery objectives are related to IPHC Regulatory Areas and Management Zones (the aggregation of IPHC Regulatory Areas that does not match Biological Regions) because quotas are defined within these areas and are therefore of interest to a quota holder. A finer spatial scale than IPHC Regulatory Areas may be important to individual fishers and may be considered in future evaluations.

2.2.2.1 Maintain the spawning biomass around a level that optimises fishing activities

There are no primary distribution objectives defined for this general objective, but secondary objectives will likely be defined at future meetings.

2.2.2.2 Limit catch variability

The MSAB discussed the coastwide objective to limit annual changes in the TCEY and proposed that the same objective be defined for IPHC Regulatory Areas with both the AC and AAV reported. This objective would capture the objective for stability in a stakeholder's area of interest as well as recognize that there is uncertainty in the distribution procedure that will likely result in variability in IPHC Regulatory Area catch limits. The MSAB decided to define both coastwide and distribution objectives for the time being, and to evaluate potential redundancy when results become available.

2.2.2.3 Maximize fishery yield

Two different types of objectives related to fishery yield in an IPHC Regulatory Area were defined. These were related to an actual TCEY and a proportion of the coastwide TCEY. Both types are useful to report since they suggest separate concepts. Use of the actual TCEY value is an objective specific to a desired mortality limit within an IPHC Regulatory Area, while the using proportion of coastwide TCEY captures its distribution sharing among IPHC Regulatory Areas. The median of the average TCEY and the proportion of the TCEY over a ten-year period were reported along with the median minimum TCEY and minimum proportion of the TCEY over a ten-year period.

The catch variability and yield objectives did not have a tolerance defined, thus simple performance metrics will be reported and used to evaluate the management procedures against each of the objectives as well as examine the trade-offs between the objectives and IPHC Regulatory Areas.

3 INVESTIGATIONS OF COASTWIDE FISHING INTENSITY

Simulation results presented at MSAB012 (IPHC-2018-MSAB012-07) showed that no management procedure met the primary stability objective (average annual variability of the mortality limit less than 15% at least 75% of the time) when lacking a constraint on the change in annual mortality limit, as noted in paragraph 59,e in IPHC-2019-AM095-R. Therefore, various constraints on the change in the annual mortality limit were introduced into the management procedure for evaluation (as was also recommended by the SRB in document IPHC-2018-SRB013-R, para. 29). Appendix I of this document summarises the results documented in IPHC-2019-AM095-12 and additional results pertaining to a constraint on the annual mortality limit that were presented at MSAB013 (IPHC-2019-MSAB013-08). Details of the coastwide closed-loop simulations can be found in IPHC-2018-MSAB012-07.

It is worth noting that, despite defining a specific procedural (input) SPR[1] (Figure I-1 and horizontal axis of the upper left plot in Figure 3), the fishing intensity typically realized in a specific year would differ due to various sources of variability. There is the applied SPR that is a result of applying the control rule (points in the upper left plot of Figure 3), which will often be equal to the procedural SPR. However, when the stock status is estimated to be below the fishery trigger, which results in a reduction in fishing intensity, the applied SPR will be greater than the procedural SPR. Furthermore, the realized SPR for a specific year (error bars in the upper left plot of Figure 3) results from applying the control rule, accounting for estimation error, and determining implementation variability (e.g., not catching the entire mortality limit). For example, with an input SPR of 46% and a 30:20 control rule, the median average SPR is 47% (slightly greater than the procedural SPR) and the realized SPR ranges from approximately 43% to 54%. This variability has been observed in recent IPHC stock assessments which estimated a confidence interval for SPR and produced estimates of past (realized) SPR values that were not equal to the procedural SPR chosen by the Commission for that year.

To summarise the results from the coastwide investigation of fishing intensity (Appendix I), long-term performance metrics showed little risk of falling below the 20% biomass limit for nearly all management procedures evaluated. In the medium-term, variability in catches increased with higher fishing intensities (i.e., lower SPR), and median total mortality (TM) limits increased slightly with greater fishing intensity. Therefore, all procedural SPR's greater than 30% met the biological sustainability objective, but the unconstrained management procedure showed high variability in mortality limits, mainly due to estimation error. Constrained management procedures were able to meet biological and stability objectives and maxChangeBoth15%, slowUpFastDown, and multiYear performed the best. Management procedures with an SPR greater than 40% met the fishery objective of maintaining the biomass around a target of $SB_{36\%}$. Additionally, at fishing intensities greater than those associated with an SPR of 40% (i.e., SPR values less than 40%) the variability in total mortality increased rapidly while the median total mortality made minimal gains. If a constraint is to be implemented, it may be useful to introduce a precaution, such as defining a procedure that the constraint should not be applied if the estimated stock status is nearing or is below the biomass limit. Vice versa, a measure may be applied that allows for increased harvest if the stock status is highly likely to be much greater than the target biomass.

[1] The procedural SPR is the SPR that is defined by the management procedure. In practice, this SPR may be modified by a control rule, and is unlikely to be exactly achieved due to implementation variability and estimation uncertainty.

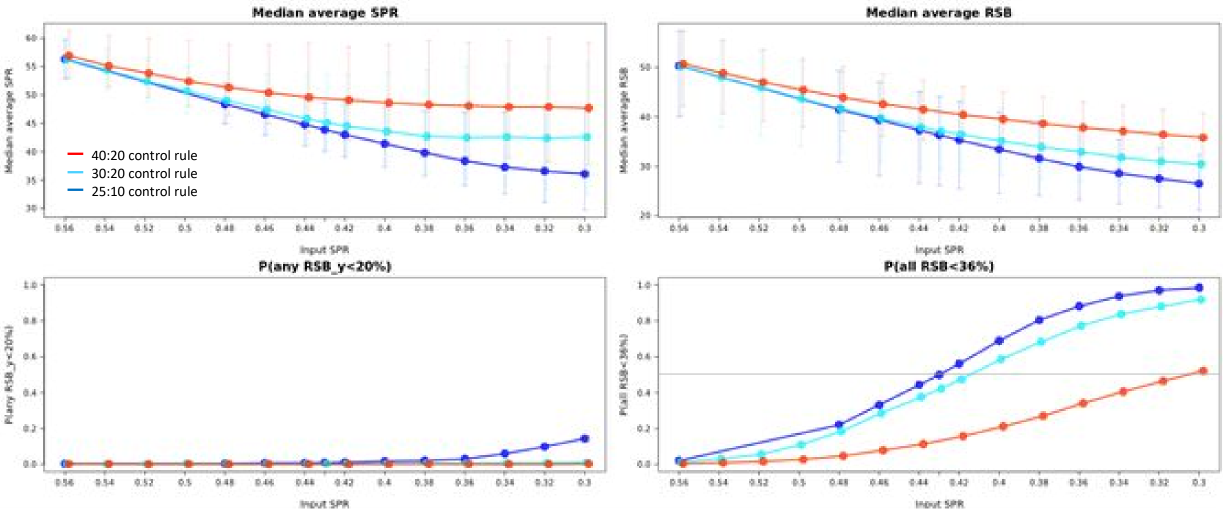


Figure 3: Performance metrics for the MSE simulation results when using 40:20, 30:20, and 25:10 control rules. Vertical lines represent the 5th and 95th percentiles of the simulation results. The horizontal line in the top-right plot indicates the 30% limit for RSB and the one in the bottom right indicates the 20% tolerance level. P(all RSB<30%) represents the probability that the event may occur in a single year. P(any RSB<30%) represents the probability that the event may occur in at least one out of ten years.

4 MANAGEMENT PROCEDURES FOR COASTWIDE SCALE AND DISTRIBUTION OF THE TCEY

The report from the 95th Session of the IPHC Annual Meeting (AM095) contained one paragraph that noted the TCEY distribution component of the IPHC harvest strategy policy (IPHC-2019-AM095-R):

> *62. The Commission* ***RECOMMENDED*** *that the MSAB and IPHC Secretariat continue its program of work on the Management Procedure for the Scale portion of the harvest strategy, NOTING that Scale and Distribution components will be evaluated and presented no later than at AM097 in 2021, for potential adoption and subsequent implementation as a harvest strategy.*

There are many notes, requests, and recommendations from past Annual Meetings and MSAB meetings that pertain to distributing the TCEY (see Appendix I of IPHC-2019-MSAB013-09). Some important themes from these paragraphs are

- Distributing the TCEY to IPHC Regulatory Areas may result in a change to the coastwide total mortality or to the coastwide SPR.
- Science-based and management-derived elements exist for distributing the TCEY. A framework has been proposed that incorporates these elements.
- The IPHC Secretariat has described four Biological Regions (consistent with IPHC Regulatory Area boundaries) based on the best available science.
- The MSAB has identified many potentials tools for use in distribution procedures.

In 2017, the Commission agreed to move to an SPR-based management procedure to account for the mortality of all sizes and from all fisheries (Figure 1). The procedure uses a coastwide fishing intensity based on the spawning potential ratio (SPR), which defines the “scale” of the coastwide catch. The current interim management procedure for distributing the TCEY among IPHC Regulatory Areas contains two inputs: 1) the current estimated stock distribution and 2) relative target harvest rates.

4.1 COMMISSION INTERIM MANAGEMENT PROCEDURE TO DISTRIBUTE THE TCEY

4.1.1 Stock distribution

The IPHC uses a space-time model to estimate annual Weight-Per-Unit-Effort (WPUE) for use in estimating the annual stock distribution of Pacific halibut (IPHC-2019-AM095-07). Briefly, the observed WPUE for Pacific halibut is fitted with a model that accounts for correlation between setline survey stations over time (years) and space (within Regulatory Areas). Competition for hooks by Pacific halibut and other species, the timing of the setline survey relative to annual fishery mortality, and observations from other fishery-independent surveys are also accounted for in the approach. This fitted model is then used to predict WPUE (a measure of relative density) of Pacific halibut for every setline survey station in the design, including all setline survey expansion stations, regardless of whether it was fished in a particular year. These predictions are then averaged within each IPHC Regulatory Area, and combined among IPHC Regulatory Areas, weighting by the “geographic extent” (calculated area within the survey design depth range) of each IPHC Regulatory Area. It is important to note that this produces relative indices of abundance and biomass but does not produce an absolute measure of abundance or biomass because it is weight-per-unit-effort scaled by the geographic extent of each IPHC Regulatory Area. These indices are useful for determining trends in stock numbers and biomass and are also useful in estimating the geographic distribution of the stock. The proportion of estimated over-32-inch (81.3 cm; O32) biomass in each IPHC Regulatory Area is used in the current interim management procedure to determine stock distribution.

4.1.2 Relative Harvest Rates

The target distribution of the TCEY is shifted from the estimated stock distribution based on relative harvest rates of 1.00 for IPHC Regulatory Areas 2A–3A and 0.75 for IPHC Regulatory Areas 3B–4CDE (Table 3).

Table 3. IPHC Regulatory Area stock distribution estimated from the 2018 space-time model O32 WPUE, IPHC Regulatory Area-specific relative target harvest rates, and resulting 2019 target TCEY distribution based on the IPHC’s 2019 interim management procedure (reproduced from the mortality projection tool https://iphc.int/data/projection-tool).

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
O32 stock distribution	1.8%	11.2%	14.3%	37.2%	9.0%	6.7%	5.9%	13.9%	100%
Relative harvest rates	1.00	1.00	1.00	1.00	0.75	0.75	0.75	0.75	--
Target TCEY Distribution	1.9%	12.3%	15.6%	40.9%	7.4%	5.5%	4.9%	11.5%	100%

The lower harvest rates in IPHC Regulatory Areas 3B, 4A, 4CDE, and 4B, compared to IPHC Regulatory Areas 2 and 3A, were first implemented over a number of years starting at least in 2004 (Clark & Hare 2005, Hare 2005, Hare 2006, Hare 2009). The reductions in harvest rates were partly described as 'precautionary' based on declining trends in spawning biomass and CPUE, the presence of small fish, differences in yield-per-recruit, differences in emigration and immigration, and greater uncertainty in the data and analyses available at the time (Hare 2009). For example, the reduction in the harvest rate in IPHC Regulatory Area 3B was described as a precautionary decision after observing steady declines in catch rates, sharp declines in survey WPUE, an increase in effort expended to take the mortality limit, a contracted age distribution, indication that emigration is greater than immigration, and observed results of reduced harvest rates in IPHC Regulatory Areas 4A, 4B, and 4CDE (Hare 2009).

Recently, the modelled survey numbers-per-unit-effort (NPUE) have shown a decline coastwide since the early 2000's (Figure 4). Most IPHC Regulatory Areas have shown both increases and decreases in NPUE since the early 2000's, but IPHC Regulatory Areas 3B and 4A have shown the largest and most consistent declines. Relative to surplus production (the harvest that stabilizes the biomass) harvest rates in IPHC Regulatory Areas 3B and 4A have been above the surplus as they resulted in declines. Higher harvest rates in the eastern areas (3A and 2) did not lead to declines over the same period. Movement among areas, interacting with actual patterns of harvest, can lead to a confounding of the actual surplus production by area. Such patterns are not able to be considered in a simple look at observed time-series. The full MSE will evaluate management procedures with different harvest rates and distribution components that will account for these and other factors simultaneously.

4.1.3 Defined shares

Two different concepts of implementing defined shares for IPHC Regulatory Areas 2A and 2B were defined at AM095 (IPHC-2019-AM095-R paragraphs 69 b and c).

> *b) a share-based allocation for IPHC Regulatory Area 2B. The share will be defined based on a weighted average that assigns 30% weight to the current interim management procedure's target TCEY distribution and 70% on 2B's recent historical average share of 20%. This formula for defining IPHC Regulatory Areas 2B's annual allocation is intended to apply for a period of 2019 to 2022. For 2019, this equates to a share of 17.7%; and*
>
> *c) a fixed TCEY for IPHC Regulatory Area 2A of 1.65 mlbs is intended to apply for a period from 2019-2022, subject to any substantive conservation concerns.*

The values are used first to define the TCEY in 2A and 2B, after which the estimated stock distribution and relative harvest rates relative to these values distribute the TCEY to the other IPHC Regulatory Areas.

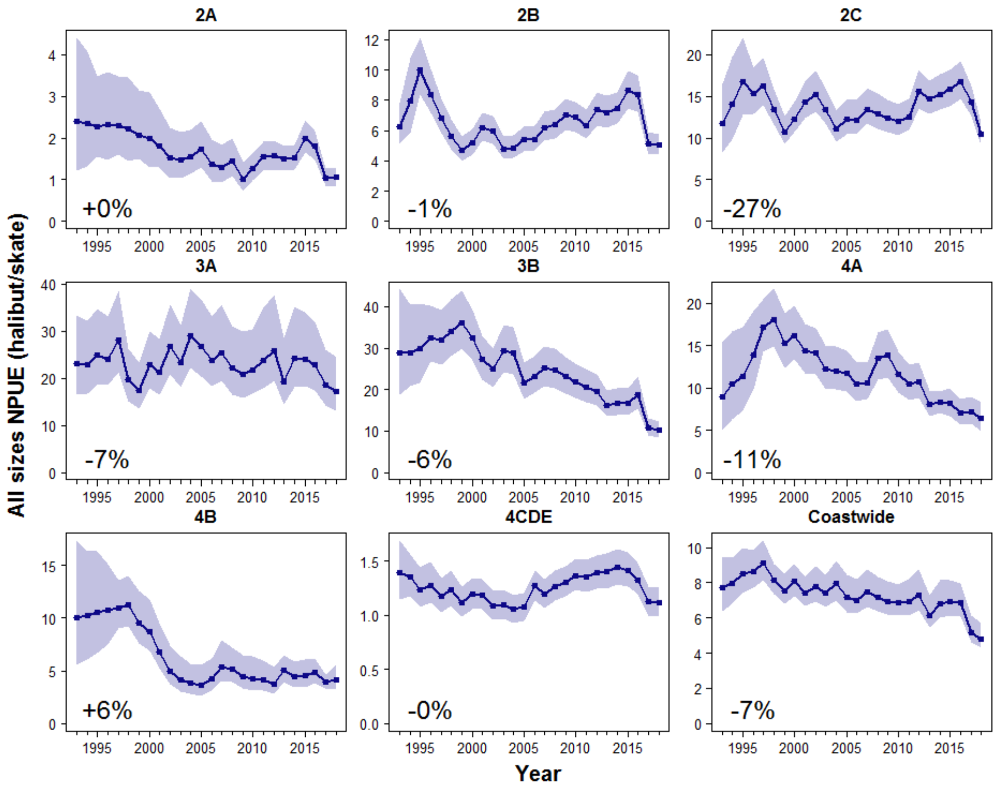


Figure 4: Trends in modelled survey NPUE by IPHC Regulatory Area, 1993-2018 (reproduced from IPHC-2019-AM095-08). Percentages indicate the change from 2017 to 2018. Shaded zones indicate 95% credible intervals.

4.2 Alternative approaches to the distribution of the TCEY

Distributing the TCEY can be made up of multiple components such as those described above in Section 4.1. Below, alternative approaches to stock distribution and relative harvest rates are described.

4.2.1 Stock Distribution

The overarching conservation goal for Pacific halibut is to maintain a healthy coastwide stock, which implies an objective to retain viable spawning activity in geographic components of the stock. This requires defining the scale of spawning components from which distribution is to be conserved and balancing the removals to protect against depletion of spatial and demographic components of the stock that may produce differential recruitment success under changing environmental and ecological conditions. Splitting the coast into many small areas to satisfy conservation objectives can result in complications, including i) making it cumbersome to determine if conservation objectives are met, ii) making it difficult to accurately determine the proportion of the stock in that area resulting in inter-annual variability in estimates of the proportion, iii) forcing arbitrary delineation among areas despite evidence of strong stock mixing, and iv) not representing biological importance. Emerging understanding of Pacific halibut diversity across the geographic range of the Pacific halibut stock indicates that IPHC Regulatory Areas should only be considered as management units and do not represent sub-populations (Seitz et al. 2017). Biological Regions, defined earlier and shown in Figure 2, are considered by the IPHC Secretariat, and supported by the SRB (paragraph 31 IPHC-2018-SRB012-R), to be the best current option for biologically-based areas to meet management needs and conserve spatial population structure. Biological Regions are also the most logical scale over which to consider conservation objectives related to distribution of the fishing mortality.

In addition to using Biological Regions for stock distribution, the “all sizes” WPUE from the space-time model, which is largely composed of O26 Pacific halibut due to the selectivity of the setline gear, is more congruent with the TCEY (O26 catch levels) than O32 WPUE. Therefore, when distributing the TCEY to Biological Regions, the estimated proportion of “all sizes” WPUE from the space-time model should be used for consistency.

4.2.2 Additional distribution procedures

Distribution procedures in addition to stock distribution may be used to make further modification to the distribution of the TCEY among Biological Regions and subsequent distribution among IPHC Regulatory Areas within Biological Regions. Modifications at the level of Biological Regions or IPHC Regulatory Areas may be based on differences in productivity between areas, observations in each area relative to other areas (e.g., fishery-dependent WPUE), uncertainty of data or mortality in each area, defined allocations, national shares, or other methods.

4.2.2.1 Yield-per-recruit analysis

A yield-per-recruit analysis by Biological Region was completed to examine differences in productivity between the four Biological Regions (Figure 2). A yield-per-recruit analysis provides the harvest rate at which the yield would be maximized, given natural mortality, fishery selectivity, and weight-at-age. A common reference point used in fisheries management is the harvest rate at which the slope in the yield-per-recruit curve is 10% of the steepest slope (the steepest slope occurs at the origin when the harvest rate increases from zero). This reference point, $F_{0.1}$, is preferred over the harvest rate that maximizes yield-per-recruit because it is precautionary, and some yield-per-recruit curves do not peak until very high harvest rates are reached due to the biology of the fish stock. This occurs for Pacific halibut because the weight-at-age continues to increase almost linearly at older ages meaning that growth is still occurring at a significant rate that may outweigh the mortality at older ages. The actual harvest rate is not of interest for this analysis, but relative $F_{0.1}$ across Biological Regions provides information on relative per-recruit harvest rates among regions. This method does not account for recruitment dynamics or movement rates.

The yield-per-recruit at various harvest rates and the reference point $F_{0.1}$ relative to the estimated $F_{0.1}$ in Biological Region 3 were estimated for each Biological Region at three different points in time: 1985, 1999, and 2018 (Figure 5). The year 1985 was used because weight-at-age was then very high in Biological Regions 2 and 3. The year 1999 was used because it is representative of data from a period that would have informed previous yield-per-recruit analyses performed to justify reductions in harvest rates in western IPHC Regulatory Areas (e.g., Hare 2009), and because annual changes in selectivity curves were estimated from 1997 to 2018 in the stock assessment for Biological Regions 4 and 4B. The year 2018 represents the current state. Weight-at-age and selectivity for each year and Biological Region were used in the yield-per-recruit analysis.

During the 1980s and the 1990s, the relative estimates of $F_{0.1}$ show similar harvest rates for Biological Regions 2 and 3, a relative harvest rate near 0.8 for Biological Region 4, and a relative harvest rate of 0.5 for Biological Region 4B (Table 4). However, using weight-at-age and selectivity from 2018 showed a relative harvest rate of 1.0 for Biological Region 4. This supports the application of a lower relative harvest rate in western areas in the historical harvest strategy, but also shows changes in productivity over time that may affect the appropriate current application of relative harvest rates. An MSE is the appropriate tool to evaluate management procedures with static or annual adjustments (based on data and observations to reflect changing conditions) to relative harvest rates. An MSE also accounts for other factors such as movement, recruitment dynamics, and the effects of harvest levels in other areas.

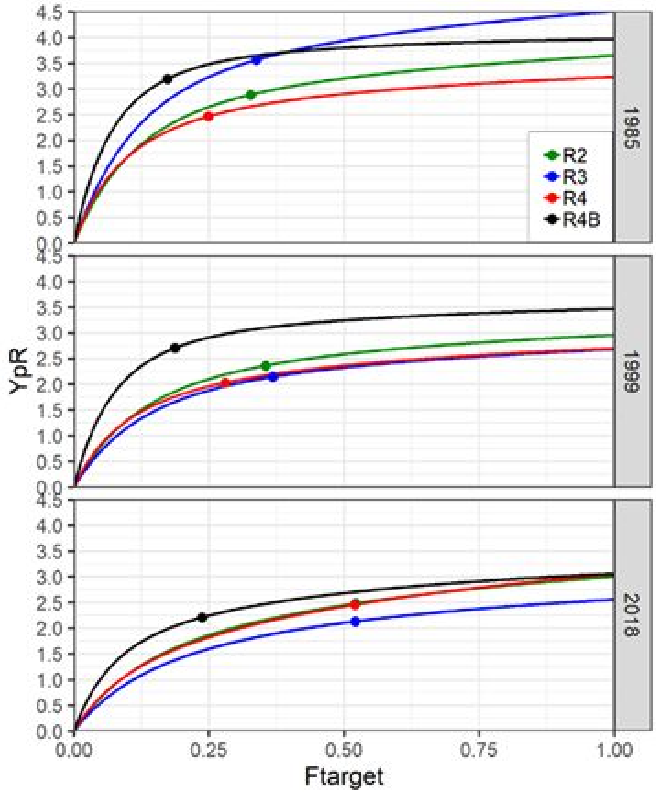


Figure 5: Yield-per-recruit at different harvest rates (Ftarget as an exploitation rate) estimated for each Biological Region (2, 3, 4, and 4B; Figure 2) using weight-at-age and selectivity (as estimated in the long areas-as-fleets stock assessment model) from 1985 (top panel), 1999 (middle panel), and 2018 (bottom panel). The colored points on each curve correspond to the reference point $F_{0.1}$ for each Biological Region.

Table 4: Reference point $F_{0.1}$ from the yield-per-recruit analysis in each Biological Region relative to the $F_{0.1}$ in Region 3.

		Biological Region			
Weight-at-age	**Selectivity**	**2**	**3**	**4**	**4B**
1985	1985	1.0	1.0	0.7	0.5
1999	1999	1.0	1.0	0.8	0.5
2018	2018	1.0	1.0	1.0	0.5

4.2.2.2 Net movement in and out of Biological Regions

The net movement of Pacific halibut in and out of Biological Regions is an important factor to consider when determining appropriate relative harvest rates in Biological Regions. It is generally understood that the net movement of Pacific halibut is from west to east and the net movement out of Biological Region 4 is likely greater than movement of adults into it. The connection of Biological Region 4B to the other Biological Regions is not well understood and there is a possibility that 4B is the most demographically distinct of the four. Considerable movement of older Pacific halibut is estimated to occur between Biological Regions 2 and 3. The section on movement rates among Biological Regions in IPHC-2019-AM095-08 provides a summary of the current understanding of Pacific halibut movement.

4.2.2.3 Uncertainty of productivity and harvest levels in Biological Regions

Additional justification, other than yield-per-recruit, for reducing harvest rates in IPHC Regulatory Areas 3B, 4A, 4B, and 4CDE was provided in the past (e.g., Hare 2009). These included varying levels of uncertainty in each area. For example, the historical harvest in Biological Regions 4 and 4B developed after the fisheries in Biological Regions 2 and 3, and a shorter time-series of observations is available from 4 and 4B. This results in an increased historical uncertainty about productivity and optimal harvest levels in these Biological Regions. However, recent modelled survey information is of roughly equal and adequate precision for all Biological Regions (IPHC-2019-AM095-08).

Overall, science (e.g., analysing data and understanding the life-history of Pacific halibut) and policy (e.g., examining observations and uncertainty) in each Biological Region will help inform the construction of management procedures related to distributing the TCEY among Biological Regions and IPHC Regulatory Areas. It is currently understood that Pacific halibut have move considerably within (and, to some extent among) Biological Regions within a year, and the scale of IPHC Regulatory Areas is likely too small to make conclusions regarding differences in productivity. However, other tools, such as fishery-dependent WPUE, may be used to develop distribution procedures to distribute the TCEY to IPHC Regulatory Areas, and the MSE will evaluate the different procedures with respect to defined objectives.

The MSAB013 report (IPHC-2019-MSAB013-R, paragraph 60) listed eleven potential tools for use in developing distribution procedures (both at a regional and at a regulatory area level), which will have been discussed at MSAB014. Also, the Commission adopted two tools (minimum catch limit and a percent share) for IPHC Regulatory Areas 2A and 2B (IPHC-2019-AM095-R, paragraph 69) that could easily be incorporated into a management procedure (or objectives as noted in Section 2.2.2.3).

Incorporating these tools in a management procedure can be done by defining specific steps, as in the example framework below (Section 4.3). For example, one management procedure may be to simply assign a fixed proportion of the TCEY to each IPHC Regulatory Area, or calculate the proportions based on recent landings. Another management procedure may be to determine the stock distribution, shift the proportion of the TCEY to eastern regions, further modify the distribution across regions based on the sizes of Pacific halibut in each region, distribute the TCEY to IPHC Regulatory Areas within each Region using trends in the survey abundance, and modify that distribution to match a define minimum proportions in each IPHC Regulatory Area. The point is that Management Procedures can be built by piecing together different tools that are designed to meet different objectives.

The steps in the Distribution Procedures may consider conservation objectives, but the steps will mainly be developed with respect to fishery objectives, which will likely be diverse and in conflict across IPHC Regulatory Areas. Pacific halibut mortality limits are defined for each IPHC Regulatory Area and quota is accounted for by those IPHC Regulatory Areas. Therefore, IPHC Regulatory Areas are the appropriate scale at which to consider fishery objectives. Once a reasonable set of management procedures is defined, it can be modelled in the simulation framework and evaluated against the objectives. A possible framework to populate with various tools is described below.

4.3 A Framework for Distributing the TCEY among IPHC Regulatory Areas

The harvest strategy policy begins with the coastwide TCEY determined from the stock assessment and fishing intensity determined from a target SPR (Figure 1). To distribute the TCEY among regions, stock distribution (Section 4.2.1) between biological regions may occur first to satisfy conservation objectives. This is followed by adjustments across Biological Regions and IPHC Regulatory Areas based on distribution procedures to further encompass conservation objectives and consider fishery objectives. A constraint could be enforced such that given relative adjustments, the overall fishing intensity (i.e. target SPR) is maintained (i.e. a zero-sum game relative to fishing intensity). This is consistent with many management procedures for fisheries around the world. If a target SPR is not maintained, the minimum SPR value in the range produced by the distribution procedure would be considered the “worst-case scenario” target, although after many years of application, an analysis of the chosen SPR could reflect the realized target.

A general framework for a management procedure encompassing conservation and fishery objectives that ends with a TCEY for each IPHC Regulatory Area is described below. Only steps 1 and 5 are essential; steps 2 to 4 are optional.

1. **Coastwide Assessment (science-based) and Target Fishing Intensity (management-derived):** Determine the coastwide total mortality using a target SPR that is most consistent with IPHC coastwide objectives defined by the Commission, removing the U26 non-directed fishing discard mortality from the Total Mortality to determine the coastwide TCEY.
2. **Regional Stock Distribution (science-based):** Distribute the coastwide TCEY to four (4) biologically-based Regions (Figure 2) using the proportion of the stock estimated in each Biological Region for all sizes of Pacific halibut using information from the IPHC space-time model. “All sizes” WPUE is the most appropriate metric to distribute the TCEY at this scale.
3. **Regional Relative Fishing Intensity (science-based):** Adjust the distribution of the TCEY among Biological Regions to account for migration, productivity, and other biological characteristics of the Pacific halibut observed in each Biological Region.
4. **Regional Allocation Adjustment (management derived):** Adjust the distribution of the TCEY among Biological Regions to account for other factors. Further adjustments are part of a management/policy decision may include evaluation of recent trends in estimated quantities (such as fishery-independent WPUE), inspection of historical trends in fishing intensity, and recent or historical fishery performance. Regional relative harvest rates may also be determined through negotiation, leading to an allocation agreement for further regional adjustment of the TCEY.
5. **Regulatory Area Allocation (management derived):** Apply IPHC Regulatory Area allocation percentages within each Biological Region (or from coastwide if steps 2-4 are omitted) to distribute the coastwide or Region-specific TCEY to Regulatory Areas. This management or policy decision may be informed by data or defined by an allocation agreement. For example, recent trends in estimated all sizes WPUE from the modelled survey or fishery data, age composition, or size composition may be used to distribute the TCEY to IPHC Regulatory Areas. Inspection of historical trends in fishing intensity or catches by IPHC Regulatory Area may also be used. Finally, predetermined fixed percentages are also an option. This allocation to IPHC Regulatory Areas may be a procedure with multiple adjustments using different information or agreements.

The five steps described above would be contained within the IPHC Harvest Strategy Policy as part of the Management Procedure and are predetermined steps with a predictable outcome. The decision-making process would then occur (Figure 1).

6. **Annual Regulatory Area Adjustment (policy)**: Adjust individual Regulatory Area TCEY limits to account for other factors as needed. This is the policy component of the harvest strategy policy and occurs as a final step where other objectives are considered (e.g., economic, social, etc.). A departure from the target SPR may be a desired outcome for a particular year (short-term, tactical decision making based on current trends estimated in the stock assessment) but would deviate from the management procedure and the long-term management objectives. Departures from the management procedure could take advantage of current situations but may result in unpredictable longer-term outcomes.

4.4 Management procedures to evaluate

At MSAB014, the MSAB recommended management procedures to evaluate that include both scale and distribution components (IPHC-2019-MSAB014-R).

> MSAB014–Rec.04 (para. 49): *The MSAB **RECOMMENDED** that SPR values of 0.3, 0.34, 0.38, 0.40, 0.42, 0.46, and 0.50 with a 30:20 control rule be evaluated at MSAB015 along with constraints defined by a maximum change in the TCEY of 15%, a slow-up fast-down approach, and/or setting quotas every third year*

> MSAB014–Rec.05 (para. 56): *The MSAB **RECOMMENDED** that the management procedures listed in Table 2 in Appendix VI be evaluated at MSAB015.*

4.4.1.1 Scale elements of management procedures.

The coastwide MSE investigated only the scale component of the management procedure and identified a range of procedural SPR values associated with control rules and constraints that satisfied the coastwide objectives. The investigation of management procedures incorporating scale and distribution components will focus on the scale elements that satisfied the coastwide objectives (Table 5).

Table 5: Elements of the coastwide componenet of the management procedures that will be evaluated at MSAB015.

Procedural SPR	Control Rule	Constraints
30%, 34%, 38%, 42%, 46%, 50%	30:20	• maxChange15% • Slow-up/Fast-down • Multi-year • maxChange15% combined with either of above

4.4.1.2 Distribution elements of management procedures

Table 6 presents the management procedures recommended at MSAB014 for evaluation at MSAB015. These ten management procedures contain various scale and distribution elements, as identified in paragraph 55 of IPHC-2019-MSAB014-R.

> MSAB014-R, para. 55: *The MSAB **REQUESTED** that a number of elements in distribution management procedures be included for evaluation at MSAB015:*
>
> a) *A coastwide constraint using a slow-up, fast-down approach with a maximum change in the TCEY of 15%;*
>
> b) *evaluating different relative harvest rates across IPHC Regulatory Areas or Biological Regions;*
>
> c) *distributing the TCEY directly to IPHC Regulatory Area;*
>
> d) *A fixed shares concept for all or some IPHC Regulatory Areas, Biological Regions, or Management Zones with options to distribute the TCEY to the areas without a fixed share. The determination of these shares may be fixed or varying over time; and*

e) *A maximum fishing intensity defined by an SPR of 36% to act as a buffer when distributing the TCEY to IPHC Regulatory Areas.*

The concept of a buffer allows the fishing intensity to increase from the reference fishing intensity due to constraints on the TCEY and other elements that may result in a change to the coastwide SPR. However, the management procedure fishing intensity cannot exceed the defined maximum fishing intensity.

Table 6: Recommended management procedures from MSAB014 for evaluation at MSAB015.

MP	Coastwide	Regional	IPHC Regulatory Area
MP A	SPR 30:20		• O32 stock distribution • Proportional Relative harvest rates (starting with 1.0 for 2-3A, 0.75 for 3B-4) relative to below • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)
MP B	SPR 30:20 Slow-up, fast-down MaxChange15%		• O32 stock distribution • Proportional Relative harvest rates (starting with 1.0 for 2-3A, 0.75 for 3B-4) relative to below • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)
MP C	SPR 30:20		• O32 stock distribution • Relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4)
MP D	SPR 30:20 Slow-up, fast-down MaxChange15%		• O32 stock distribution • Relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4)
MP E	SPR 30:20		• O32 stock distribution • Relative harvest rates (0.75 for 4B, 1 for others) •

Table 6 (continued)

MP	Coastwide	Regional	IPHC Regulatory Area
MP F	SPR 30:20	Biological Regions, O32 stock distribution Rel HRs: R2=1, R3=1, R4=0.75, R4B=0.75	• O32 stock distribution • Relative harvest rates not applied • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)
MP G	SPR 30:20	Biological Regions, O32 stock distribution Rel HRs: R2=1, R3=1, R4=1, R4B=0.75	• O32 stock distribution • Relative harvest rates not applied • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)
MP H	SPR 30:20 Max FI (36%)		First • O32 stock distribution • Relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4) Second within buffer • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)
MP I	SPR 30:20		• 5-year shares determined from 5-year O32 stock distribution (vary over time)
MP J	SPR 30:20	National Shares: 20% to 2B, 80% to other	• O32 stock distribution

5 DEVELOPMENT OF THE CLOSED-LOOP SIMULATION FRAMEWORK

The MSE at IPHC has completed an initial phase of evaluating management procedures relative to the coastwide scale of the Pacific halibut stock and fishery. Results of the MSE simulations were presented at the 95th Session of the IPHC Annual Meeting (AM095) and at MSAB013. The next phase, which is underway, investigates management procedures related to the distribution of the TCEY.

The development of an MSE framework aims to support the scientific, forecast-driven study of the trade-offs between fisheries management scenarios. Crafting this tooling requires

- the definition and specification of a multi-area operating model;
- an ability to condition model parameters using historical catch and survey data and other observations;
- integration with, use of, or comparison against stock assessment tools or data;
- identification and development of management procedures with closed-loop feedback into the operating model;
- definition and validation of performance metrics to evaluate the efficacy of applied management procedures.

Updates on the recent efforts in these areas are outlined in Section 5.1. Likewise, a significant effort developing the software underpinning these simulations is underway, which is outlined in section 5.2.

5.1 Framework Elements

The MSE framework includes elements that simulate the Pacific halibut population and fishery (Operating Model, OM) and management procedures with a closed-loop feedback (Figure 6). Specifications of some elements are described below, with additional technical details in document IPHC-2019-MSAB014-INF02, which is a living document that is being updated as development occurs.

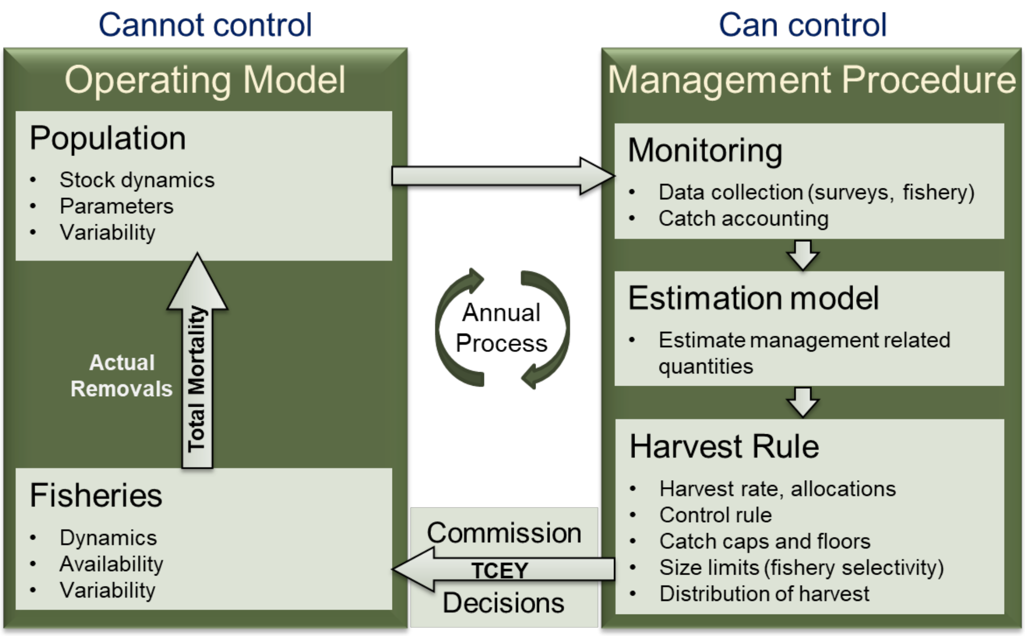


Figure 6: Illustration of the closed-loop simulation framework with the operating model (OM) and the Management Procedure (MP). This is the annual process on a yearly timescale.

5.1.1 Multi-area operating model

The generalized operating model will be able to model multiple spatial components, which is necessary because Pacific halibut migrate considerable distances and mortality limits are set at the IPHC Regulatory Area level and some objectives are defined at that level.

5.1.1.1 Population and fishery spatial specification

As mentioned above, emerging understanding of Pacific halibut diversity across the geographic range of its stock indicates that IPHC Regulatory Areas should be only considered as management units and do not represent relevant sub-populations (Seitz et al. 2017). The structures of two of the four current Pacific halibut stock assessment models was developed around identifying portions of the data (fishery-independent and fishery-dependent data) that correspond to differing biological and population processes within the larger Pacific halibut stock. Biological Regions (Figure 2) were therefore defined with boundaries that matched some of the IPHC Regulatory Area boundaries. Tagging studies have indicated that within a year, larger Pacific halibut tend to undertake feeding and spawning migrations within a Biological Region, and movement between Biological Regions typically occurs between years (Loher & Seitz 2006; Seitz et al. 2007; Webster et al. 2013). It is unlikely that there is a set of regions that accurately delineates the stock biologically since different aspects of the stock differ over varying scales, but Biological Regions are the best approximation that also satisfy management needs (paragraph 31 IPHC-2018-SRB012-R). They also offer an appropriate and parsimonious spatial separation for modeling inter-annual population dynamics.

However, as mentioned earlier, mortality limits are set for IPHC Regulatory Areas and thus directed fisheries operate at that spatial scale. Furthermore, since some fishery objectives have been defined at the IPHC Regulatory Area level, the TCEY will need to be distributed at that scale. Even though the population is modelled at the Biological Region scale, fisheries can be modelled at the IPHC Regulatory Area scale by using an areas-as-fleets approach (Waterhouse et al. 2014) within Biological Regions. This requires modelling each fleet with separate selectivities and harvest rates that operate on the exploitable biomass in the entire Biological Region.

Additionally, calculating statistics specific to IPHC Regulatory Areas may be difficult. For example, simulating the proportion of biomass in each IPHC Regulatory Area (e.g., to mimic the current interim management procedure) requires simulating a survey biomass for each IPHC Regulatory Area, and likewise determining some objectives related to IPHC Regulatory Area may be difficult to calculate (such as the proportion of O26 fish in each IPHC Regulatory Area). The distribution of the population within a Biological Region would have to be approximated, which could be done assuming a probability density function based on past observations with some variability (e.g., a Beta distribution with different shapes). This concept is currently under development.

5.1.1.2 Movement

Many data sources are available to inform Pacific halibut movement. Decades of tagging studies and observations have shown that important migrations characterize both the juvenile and adult stages and apply across all Regulatory Areas. A conceptual model of halibut ontogenetic and seasonal migration, including main spawning and nursery grounds, as per the most current knowledge, is presented in Figure 7 and detailed below. Figure 7 is a live map and will be updated as new information becomes available.

The Pacific halibut spawning season spans from November to March. Spawning has been reported to occur on grounds located along the continental slope and in depressions on the continental shelf, concentrated mainly in the central part of the Gulf of Alaska and Eastern Bering Sea (St-Pierre 1984). In early spring, adults undertake a migration to the feeding areas they occupied before the spawning migration, while eggs and larvae are dispersed to the north and west (Skud 1977; Valero & Webster 2011).

Larval stages are found in deep waters and exploit the deepwater circulation pattern to move inshore (Thompson & van Cleve 1936; Skud 1977; Bailey et al. 2008; Sohn et al. 2016). Some larvae may enter the Alaskan gyre and be carried offshore, far from the common nursery grounds, where they eventually die (Skud 1977). Between the larval stages and the settlement of juveniles, individuals move to shallow waters undertaking abrupt vertical ontogenetic migrations (Sohn et al. 2016). Halibut juveniles settle on sand substrata mixed with mud and granule in shallow waters, or near or outside mouths of bays (Norcross et al. 1997; Moles et al. 1995; Bailey et al. 2008). In the Bering Sea, juveniles are found over the shelf, along the west side of the Alaskan Peninsula and close to Pribilof Island, while in the Gulf of Alaska they are most abundant around Kodiak Island and along the western and central Gulf. Almost no individuals zero to three years old are found in Southeast Alaska and British Columbia, where the population is characterized by individuals 4 years of age and older (IPHC 1998). Young Pacific halibut in the Gulf of Alaska between 2 and 5 years old undertake a backward southerly and easterly migration (Hilborn et al. 1995). More recent tagging results have also shown that adults continue to migrate throughout their life, even though the percentage of migrating fish decreases as they age (Valero & Webster 2011, Webster et al. 2013).

Despite evidence of a fully mixed stock, genetic studies and additional tagging experiments have suggested a degree of basin-scale segregation among spawning groups (Seitz et al. 2017; Seitz et al. 2011). In particular, older Pacific halibut spend the summer feeding season around the Aleutian Islands and in the Bering Sea and appear to also spawn there, indicating a high retention rate for these older Pacific halibut in the region (Seitz et al. 2011). Also, results from an ocean circulation model suggest that the contribution of Gulf of Alaska spawners to Eastern Bering Sea juveniles is small (Vestfals et al. 2014). Genetic studies have also identified a different genetic structure of the population in the western Aleutian Islands compared to the rest of the stock, suggesting a low migration rate to (and possibly from) this region (Drinan et al. 2016).

In light of this, a framework was developed in 2015 to represent the IPHC working hypothesis concerning movement-at-age among Biological Regions (IPHC-2019-AM095-08). Each

Biological Region spans multiple Regulatory Areas (Figure 7). Within a year, halibut move from one Regulatory Area to another but tend to remain within the same Biological Region. The definition of Biological Regions is supported by several lines of evidence. Genetic studies have separated components of the Pacific halibut population in the Aleutian islands west of Samalga Pass (Drinan et al. 2016). Additionally, environmental conditions in the Northeast Pacific suggest a loose division into three main oceanographic regions, the west coast of US and Canada, the Gulf of Alaska, and the Bering Sea (Sadorus et al. 2016). Further, analysis of size-at-age and growth parameters by region have shown differences that maybe explained by different environmental conditions, e.g., habitat quality, prey availability, or water temperature (Martell et al. 2012; Sullivan et al. 2016). Finally, a study on the zoogeography of halibut parasites in the Northeast Pacific has shown breakpoints between the parasites' species composition between fish in Region 3 (Gulf of Alaska) and in southern areas (Blaylock et al. 1998).

This conceptual model will inform the development of the MSE operating model framework and will be used as a starting point to incorporate variability and alternative movement hypotheses in Pacific halibut movement dynamics. Movement will be modelled as the proportion of individuals that move from one region to another. For this purpose, a transition matrix for each age class or group of ages and sex will be used. The matrix dimension will correspond to the number of regions considered. In the case of halibut, a 4x4 matrix (for four Biological Regions) will be used, with each matrix cell *jk* corresponding to the proportion of fish moving from Region *j* to Region *k*. Tagging data will be used to inform the values in the transition matrix, and different hypothesis will be tested. Also, all hypotheses will be compared to similar approaches used in the past (i.e., Quinn et al. 1990; Hilborn 1995). It will be important to include a range of transition probabilities that encompass both historical and future potential movement patterns.

5.1.2 Management Procedure

The management procedure consists of three elements. Monitoring (data generation) is the code that simulates the data from the operating model and is used by the estimation model. It simulates the data collection and sampling process and can introduce variability, bias, and any other properties that are desired. The Estimation Model (EM) is analogous to the stock assessment and simulates estimation error in the process. Using the data generated, it produces an annual estimate of stock size and status and provides the advice for setting the catch levels for the next time step. Simplifications may be necessary to keep simulation times within a reasonable time. The Harvest Rule is the application of the estimation model output along with the scale and distribution management procedures (Figure 6) to produce the catch limit for that year. Simulated management procedures must be clearly specified so that they can be implemented by computer code within the framework.

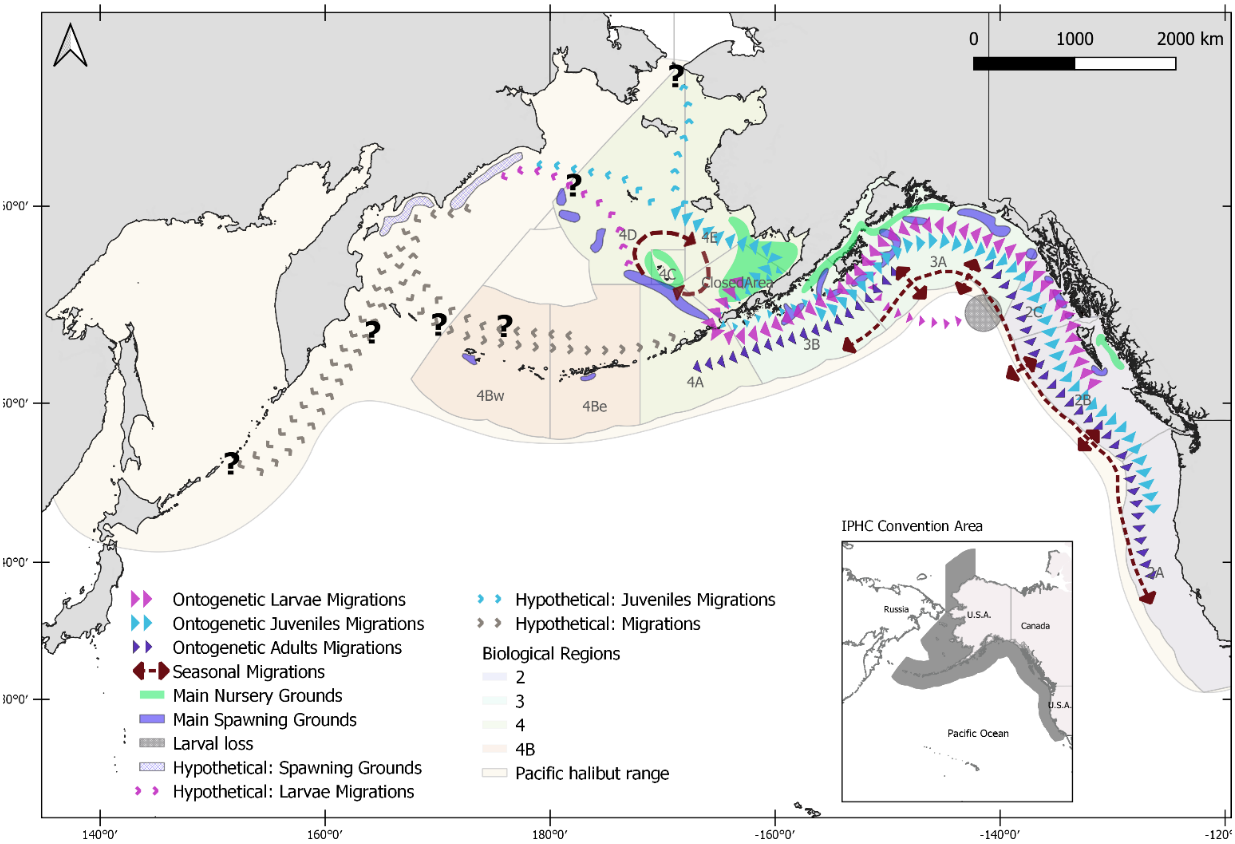


Figure 7: Conceptual model of halibut movement and migration. Broken arrows indicate main seasonal movements (to spawning and to feeding grounds). Arrow-shaped lines indicate ontogenetic movements and the possibility to stop anywhere along the lines. Round polygons indicate main settlement areas for juveniles and main spawning grounds. The grey circle represents the possibility of larvae loss when these enter the Alaskan Gyre. Biological Regions are represented by the four large irregular shaded polygons.

5.2 Technical Development

In concert with the ongoing scientific and procedural elaboration of the MSE framework, the initial development of computer software to simulate the population and offer input to analysis and management strategy is underway. Generally, the software underpinning the MSE simulations and analysis and reporting tools must be robust, return reproducible results, and be easy to use and well-documented so that the MSE scientific staff can focus on analysis rather than technical issues. From an engineering perspective, the software must be performant to reduce lengthy run times and extensible to ease the addition of new features, and therefore written with standard software development and testing processes and tools. Structurally, the software will resemble the MSE process, highlighting the interplay between forecast models conditioned on historical data that characterize the stock, and a management procedure to be evaluated against conservation and fishery objectives.

To date, several areas have begun development, including

- Implementation of an operating model in the C++ programming language;
- Integration of the Automatic Differentiation Model Builder (ADMB) for conditioning the initial model to the present day;
- Creation of flexible templates for management procedures, for fast prototyping and analysis;
- Development of user-friendly configuration tools to ease and parallelize model runs and analysis;
- Use of flexible, open-source libraries to ease data analysis and processing;
- Visualization and reporting tools written in R and related packages.

Later stages of development will focus on robust testing of the implemented algorithms, comparison of its outputs with other implementations to validate accuracy, and, ultimately, ongoing performance optimization (through code restructuring or various forms of parallelization) to reduce runtimes.

6 MSE PROGRAM OF WORK

The presentation of results for the MSE investigating the full harvest strategy policy is scheduled to occur at the 97th Annual Meeting in early 2021. The tasks to be delivered at each MSAB, SRB, and Annual meeting before then are listed in Table 7 and Figure 8. An independent peer review is schedule to occur in Spring of 2020 with a follow-up in late Summer of 2020.

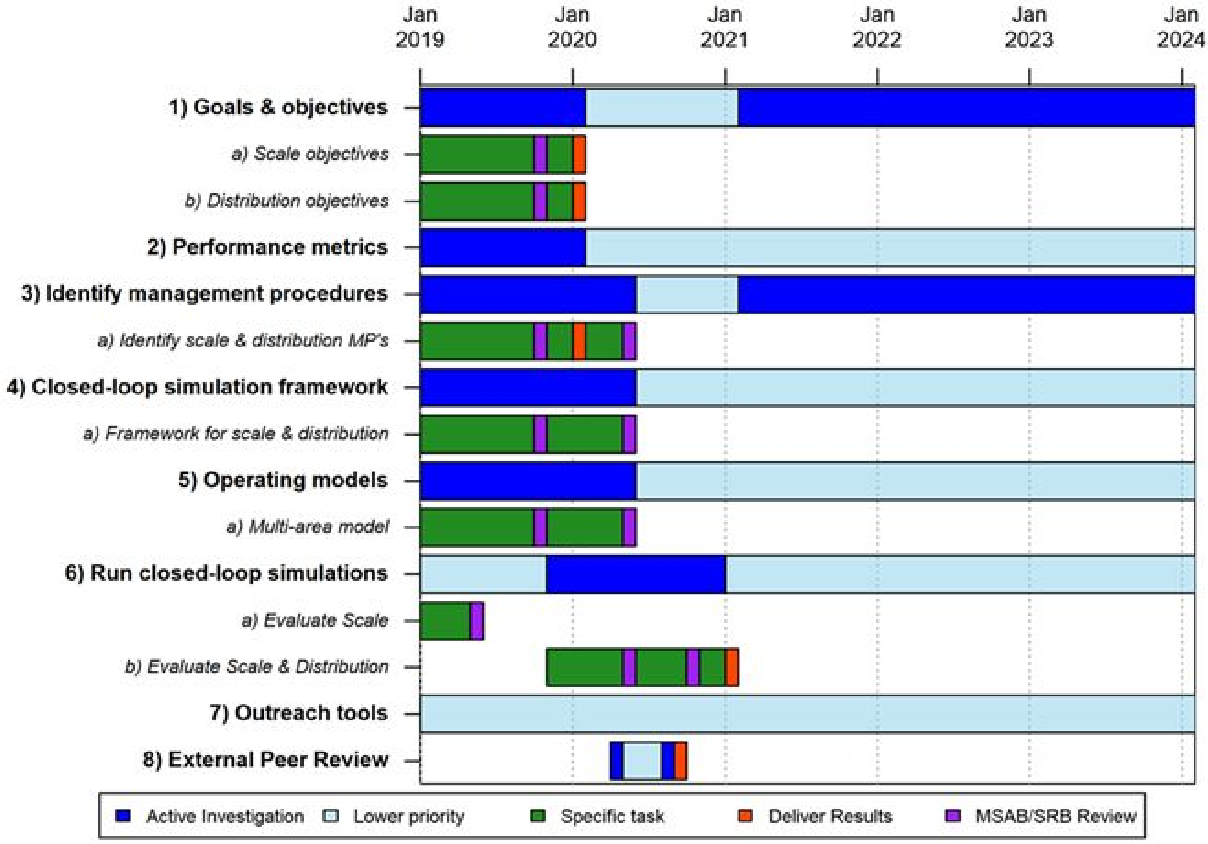


Figure 8: Five-year program of work shown as a Gantt chart format showing tasks down the right side and time along the horizontal axis.

Table 7: Program of work and tasks for 2020 leading up to the delivery of the full MSE results at the 97th Annual Meeting in early 2021.

13th Session of the IPHC MSAB (MSAB013) - May 2019	**Status**
Evaluate additional Scale management procedures	Completed
Review goals and objectives	Completed
Spatial model complexity	Completed
Identify management procedures (Scale & Distribution)	Completed
Review Framework	Completed
14th Session of the IPHC MSAB (MSAB014) - October 2019	
Review Framework	Completed
Review multi-area model development	Completed
Spatial Model Complexity	Completed
Define Goals and Objectives (Scale & Distribution)	Completed
Identify management procedures (Scale & Distribution)	Completed
96th Session of the IPHC Annual Meeting (AM096) – January 2020	
Update on progress	
15th Session of the IPHC MSAB (MSAB015) - May 2020	
Review goals and objectives (Scale & Distribution)	
Review simulation framework	
Review multi-area model	
Review preliminary results	
Identify management procedures (Scale & Distribution)	
16th Session of the IPHC MSAB (MSAB016) - October 2020	
Review final results	
Provide recommendations on management procedures	
97th Session of the IPHC Annual Meeting (AM097) – January 2021	
Presentation of complete MSE product to the Commission Recommendations on Scale and Distribution management procedures	

7 RECOMMENDATIONS

That the Commission:

a) **NOTE** paper IPHC-2019-IM095-14 which provides the Commission with an update on the IPHC MSE process including defining objectives, developing management procedures for scale and distribution, a framework for distributing the TCEY, and a program of work.

b) **NOTE** the priority coastwide biological sustainability objective of maintaining the female spawning biomass above a biomass limit.

c) **NOTE** the priority coastwide fishery objectives to be used to evaluate management procedures, including
   a. maintaining the female spawning biomass around a proxy target biomass of 36%;
   b. limit annual changes in the TCEY; and
   c. optimise directed fishing yield.

d) **NOTE** the priority biological sustainability objective of conserving spatial population structure across Biological Regions to be used to evaluate management procedures.

e) **NOTE** the priority fishery objectives at the IPHC Regulatory Area scale to evaluate management procedures, including
   a. limit annual changes in the TCEY for each IPHC Regulatory Area;
   b. optimise the TCEY among IPHC Regulatory Areas;
   c. optimise a percentage of the coastwide TCEY among IPHC Regulatory Areas;
   d. maintain the TCEY above a minimum absolute level within each IPHC Regulatory Area; and
   e. maintain a percentage of the coastwide TCEY above a minimum level within each IPHC Regulatory Area;

f) **NOTE** that given the results from the coastwide MSE, the following elements from the scale (coastwide) component of the management procedure meet the coastwide objectives
   a. SPR values greater than 40%
   b. A control rule of 30:20,
   c. Constraints on the annual change in the TCEY that limit it to 15%, use a slow-up, fast-down approach, and fix the mortality limits for three-year periods.

g) **NOTE** the various elements of the scale and distribution components of the management procedure, including those listed in Tables 5 and 6 will be evaluated for consideration at AM097 in 2021.

h) **NOTE** that the operating model for the MSE will model movement of Pacific halibut across Biological Regions and fisheries within IPHC Regulatory Areas.

i) **NOTE** that an independent peer review of the MSE will take place in April 2020 and August 2020 with a report supplied to the SRB, MSAB, and Commission.

j) **NOTE** that the SRB will review MSE results in September 2020, and these results including scale and distribution management procedures will be presented to the Commission at AM097 in 2021.

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9 APPENDICES

Appendix I: Results from the investigation of coastwide fishing intensity

Appendix I   Results from the investigation of coastwide fishing intensity

I.1 Management Procedure

The elements of the management procedure include data generation, an estimation model, and a harvest rule, where the harvest rule consists of a coastwide Scale portion and a distribution portion to distribute the mortality limits to IPHC Regulatory Areas. The focus of these simulations was on the coastwide Scale portion of the general management procedure (Figure 1). Data generation and the estimation model were combined into simulated estimation error for efficiency (IPHC-2018-MSAB012-07). The coastwide harvest rule portion of the management procedure is discussed below.

I.1.1 Harvest Rule

The coastwide component of the management procedure being evaluated is a harvest control rule (Figure I-1) that is responsive to stock status and consists of i) a procedural SPR determining fishing intensity, ii) a fishery trigger based on stock status that determines when the fishing intensity begins to be linearly reduced, and iii) a fishery limit that determines when there is theoretically no fishing intensity (which may differ from the biological limit defined in Table 1). For these simulations, two coastwide models were used and mortality was distributed to five coastwide sources of mortality (directed commercial, directed fishery discard, non-directed fishery discard (bycatch), recreational, and subsistence). Simulations used a range of SPR values from 30% to 56% and fishery trigger:limit points of 40:20, 30:20, and 25:10.

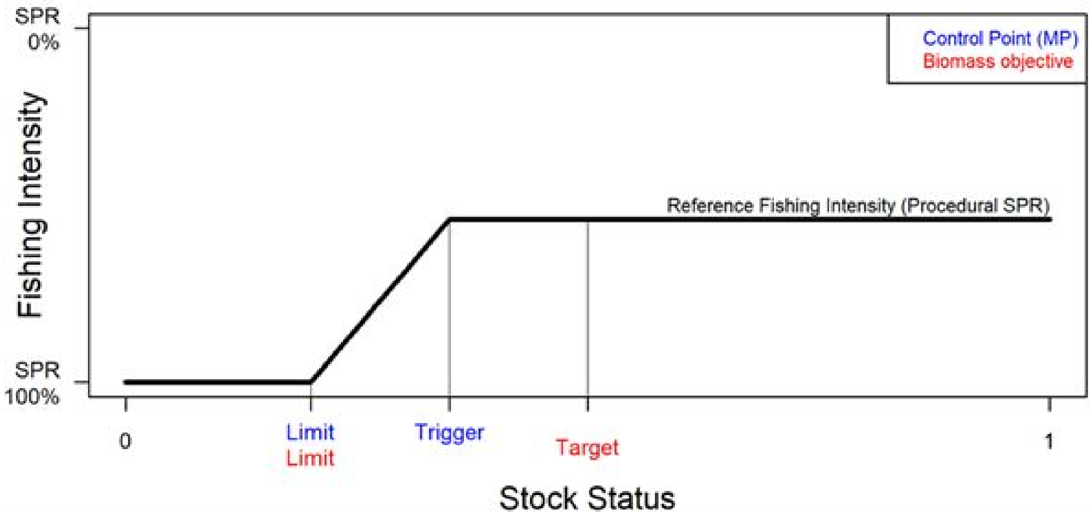

Figure I-1: Example harvest control rule responsive to stock status based on Spawning Potential Ratio (SPR) to determine fishing intensity, a fishery trigger level of stock status that determines when the fishing intensity begins to be linearly reduced, and a fishery limit based on stock status that determines when there is theoretically no fishing intensity (SPR=100%). The Procedural SPR, the Fishery Trigger, and the Fishery Limit are the elements that were evaluated by assigning a range of values for each.

I.1.2 Constraints on the change in the annual mortality limit

Some management procedures in the simulated set included an annual constraint on the change in the annual mortality limit. Eight different combinations of methods and parameterizations were tested. These included to simply constrain the maximum amount of change in the mortality limit from one year to the next, to enforce a maximum mortality limit, or to set a constant limit for three years before updating it. The eight methods are described below and a hypothetical comparison is shown in Figure I-2.

- **MaxChangeBoth15%:** Not allow the mortality limit to change by more than 15% up or down, even if the harvest rule suggests a larger change. When the change in the mortality limit would be more than 15%, the mortality limit is set at the limit corresponding to a 15% change.
- **MaxChangeBoth20%**: Not allow the mortality limit to change by more than 20% up or down, even if the harvest rule suggests a larger change. When the change in the mortality limit would be more than 20%, the mortality limit is set at the limit corresponding to a 20% change.
- **MaxChangeUp15%**: Not allow the mortality limit to increase by more than 15%, even if the assessment suggests a larger change, but allow the mortality limit to decrease by any amount (as determined by the harvest rule). When the increase in the mortality limit would be more than 15%, the mortality limit is set at the limit corresponding to a 15% change.
- **SlowUpFastDown**: Increase the mortality limit by one-third of the change suggested by the harvest rule and decrease the mortality limit by one-half of the change suggested by the harvest rule. Therefore, the mortality limit from the harvest rule is never implemented in a given year, but potential inter-annual variability is dampened.
- **SlowUpFullDown**: Increase the mortality limit by one-third of the change suggested by the harvest rule and decrease the mortality limit fully to the value suggested by the harvest rule. Therefore, an increase in the mortality limit from the harvest rule is never implemented in a given year, but a decrease is fully implemented.
- **Cap60**: Not allow the total mortality limit to exceed 60 million pounds. When below 60 million pounds, the harvest rule is unconstrained.
- **Cap80**: Not allow the total mortality limit to exceed 80 million pounds. When below 80 million pounds, the harvest rule is unconstrained.
- **MultiYear**: Set a single mortality limit every third year to apply to a period of three years. Therefore, the mortality limit is constant for a three-year period, but the harvest rule results in an unconstrained change every third year.

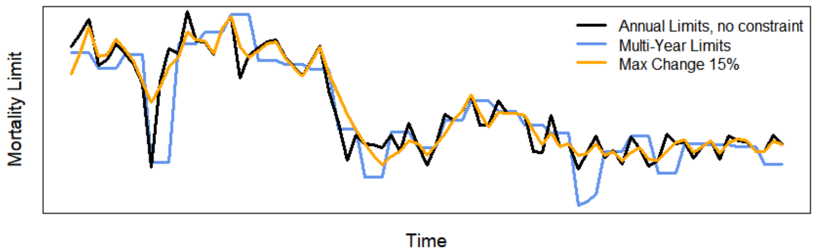

Figure I-2: Hypothetical example of the difference between unconstrained and constrained management procedures when determining the total mortality limit. The multi-year limit (blue) is set every third year, but due to allocation to other sectors, the limit may be adjusted in years when the total mortality limit is small. A maximum change of 15% is applied to “Max Change 15%”, shown in orange, and compared to the unconstrained mortality limit shown in black.

I.2 Simulation Results

Table I-1 and Table I-2 show the long-term primary biological performance metric and the medium-term (14-23 years) fishery sustainability performance metrics for the main management procedures requested at MSAB011 (IPHC-2018-MSAB011-R). Table I-3 shows the same long-term performance metrics for a control rule of 25:10. Short-term performance metrics were similar for these management procedures because the current spawning biomass is likely to be above the fishery trigger (e.g., 30%), thus are not shown. For long-term results with a control rule, the probability that the stock is below 20% of the dynamic unfished equilibrium biomass is less than 0.01 (<1/100) for all cases using control rules 30:20 or 40:20. This is a result of the control rule limiting the fishing intensity as the stock approaches the 20% threshold even with estimation error present, and since dynamic relative spawning biomass is a measure of the effect of fishing, reducing the fishing intensity reduces the risk of dropping below this threshold. It is rare that positive estimation error persists for a long enough period that fishing intensity remains high and the stock falls below the 20% threshold. The outcome of this reduction in fishing intensity can be seen in the performance metrics associated with the stability objective (i.e. Annual Change (AC) and Average Annual Variability (AAV)). The AC is a measure of the change in the mortality limit from one year to the next, while the AAV is measure of the average change in the TCEY over a ten-year period. At any fishing intensity and for all control rules tested, the probability of an AC in any 3 years greater than 15% is more than 85%. The AAV ranges between 16–46% for different SPR values and the 3 control rules. The 40:20 control rule resulted in higher variability for the AAV and higher probabilities for the AC, because the reduction in fishing intensity occurs more often given the 40% fishery trigger value and the range of SPR values evaluated. The top ranked management procedure was the 30:20 control rule with a SPR of 42% given the current primary objectives (Table 1). The absolute value of the Total Mortality limit was highly variable for a given SPR.

The use of SPR values without a control rule (results not shown) also did not meet the stability objective for any SPR considered, implying that estimation error formed a large part of the variability in the total mortality limits. Therefore, to meet the stability objective, additional elements of a management procedure need to be included to stabilize the limits (or, alternatively, the objective can be updated such that a management procedure will meet the objective). Eight different general options for constraining the limit were simulated to evaluate their potential to meet the primary objectives (see Section I.1.2). With the 30:20 control rule and SPR values of 38%, 40%, 42%, and 46%, the biological sustainability goal was met for all constraint options (Table I-4 and Table I-5). However, only the maxChangeBoth15%, slowUpFastDown, slowUpFullDown, and multiYear constraints had SPR options that significantly limited variability in the total mortality according to both performance metrics. The best management procedures used the constraints slowUpFastDown, maxChangeBoth15%, and multiYear constraints. The probability of AC greater than 15% in any 3 years is below 10% for all SPR values tested when using the maxChangeBoth15 constraint, while is greater than 10% for the slowUpFastDown and the MultiYear constraints. However, the maxChangeBoth15% results in the higher AAV among the three rules, with values greater than 10% for all SPRs tested. Setting the limit every third year (multiYear) resulted in high probability of an AC in total mortality greater than 15% (30%-

40%) in any 3 years, which is because it sets the mortality limit every third year. The median yield across the three rules ranged from 45 Mlbs to 51.2 Mlbs.

The full set of simulated management procedures and performance metrics are available for interactively viewing in a table or on plots at http://shiny.westus.cloudapp.azure.com/shiny/sample-apps/MSE-Explorer/.

Table I-1: Primary performance metrics for a 30:20 control rule, and a range of input SPRs from 0.3 to 0.56. P(all …) is the probability of that the event occurs in a given year, and P(any …) is the probability that the event occurs in at least one year out of a ten-year period. Long-term is a ten-year period after simulating 90 annual cycles and is used for the biomass objectives (i.e., RSB). Medium-term is a ten-year period after simulating 13 annual cycles (i.e., simulated years 14-23) and is used for the stability and yield fishery objectives.

Input Control Rule	30:20	30:20	30:20	30:20	30:20	30:20	30:20	30:20	30:20	30:20	30:20
Input SPR	56%	48%	46%	44%	42%	40%	38%	36%	34%	32%	30%
Biological Sustainability											
P(any RSB_y<20%)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Fishery Sustainability											
P(all RSB<36%)	0.01	0.18	0.29	0.38	0.47	0.59	0.68	0.77	0.84	0.88	0.92
P(any3 AC > 15%)	0.86	0.88	0.89	0.90	0.91	0.92	0.94	0.96	0.97	0.99	>0.99
Median AAV	16.5%	17.5%	17.9%	18.7%	19.7%	20.9%	23.1%	26.2%	29.7%	33.5%	37.3%
Median average TM	39.4	45.5	46.8	48.0	49.5	50.6	51.8	52.1	52.4	53.2	52.8
	Rankings (lower is better) over all management procedures without a constraint (Table I-1, Table I-2, and Table I-3)										
Meet biological objective?[1]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Meet target objective?[2]	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
Minimize P(AC_3>15%)	1	6	7	8	9						
Minimize AAV	2	6	7	9	10						
Maximum yield (TM)	17	14	11	8	1	—	—	—	—	—	—
Average of Ranks[3]	9.25	8.75	7.5	6.5	3.25	—	—	—	—	—	—

[1] This is determined using P(any RSB < 20%) for the objective to maintain RSB above 20% at least 95% of the time.

[2] This is determined using P(all RSB >36%) for the objective to maintain RSB above a target of 36% at least 50% of the time.

[3] The overall ranking applies to all management procedures without a constraint (Table I-1, Table I-2, and Table I-3)

Table I-2: Primary performance metrics for a 40:20 control rule, and a range of input SPRs from 0.3 to 0.56. P(all …) is the probability of that the event occurs in a given year, and P(any …) is the probability that the event occurs in at least one year out of a ten-year period. Long-term is a ten-year period after simulating 90 annual cycles and is used for the biomass objectives (i.e., RSB). Medium-term is a ten-year period after simulating 13 annual cycles (i.e., simulated years 14-23) and is used for the stability and yield fishery objectives.

Input Control Rule	40:20	40:20	40:20	40:20	40:20	40:20	40:20	40:20	40:20	40:20	40:20
Input SPR	56%	48%	46%	44%	42%	40%	38%	36%	34%	32%	30%
Biological Sustainability											
P(any RSB<20%)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fishery Sustainability											
P(all RSB<36%)	<0.01	0.05	0.08	0.11	0.16	0.21	0.27	0.34	0.41	0.46	0.52
P(any3 AC > 15%)	0.91	0.94	0.96	0.97	0.99	>0.99	>0.99	>0.99	>0.99	>0.99	>0.99
Median AAV	18.6%	22.3%	24.2%	26.1%	28.5%	31.0%	33.5%	36.3%	39.2%	42.2%	45.6%
Median average TM	39.2	44.4	45.5	46.4	47.6	48.3	48.8	48.9	49.4	49.5	49.8
	Rankings (lower is better) over all management procedures without a constraint (Table I-1, Table I-2, and Table I-3)										
Meet biological objective?[1]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Meet target objective?[2]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Minimize P(AC_3>15%)	9	11	12	13	14	15	15	15	15	15	
Minimize AAV	8	11	12	13	14	15	16	17	18	19	
Maximum yield (TM)	19	16	14	12	9	7	5	4	3	1	—
Average of Ranks[4]	11.75	11	10.25	9.5	8.25	7.5	6.75	6.5	6.25	5.5	—

[1] This is determined using P(any RSB < 20%) for the objective to maintain RSB above 20% at least 95% of the time.

[2] This is determined using P(all RSB >36%) for the objective to maintain RSB above a target of 36% at least 50% of the time.

[3] The overall ranking applies to all management procedures without a constraint (Table I-1, Table I-2, and Table I-3)

Table I-3: Primary performance metrics for a 25:10 control rule, and a range of input SPRs from 0.3 to 0.56. P(all …) is the probability of that the event occurs in a given year, and P(any …) is the probability that the event occurs in at least one year out of a ten-year period. Long-term is a ten-year period after simulating 90 annual cycles and is used for the biomass objectives (i.e., RSB). Medium-term is a ten-year period after simulating 13 annual cycles (i.e., simulated years 14-23) and is used for the stability and yield fishery objectives.

Input Control Rule	25:10	25:10	25:10	25:10	25:10	25:10	25:10	25:10	25:10	25:10	25:10
Input SPR	56%	48%	46%	44%	42%	40%	38%	36%	34%	32%	30%
Biological Sustainability											
P(any RSB<20%)	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.02	0.03	0.06	0.10	0.14
Fishery Sustainability											
P(all RSB<36%)	0.0207	0.2209	0.3316	0.4425	0.5609	0.6888	0.8040	0.8813	0.9378	0.9701	0.9843
P(any3 AC > 15%)	0.86	0.87	0.87	0.87	0.87	0.88	0.88	0.90	0.92	0.94	0.95
Median AAV	16.0%	16.5%	16.7%	16.8%	17.0%	17.4%	18.0%	18.7%	19.7%	21.4%	23.9%
Median average TM	39.4	45.9	47.1	48.5	49.9	51.2	52.6	54.0	55.0	55.3	55.3
	Rankings (lower is better) over all management procedures without a constraint (Table I-1, Table I-2, and Table I-3)										
Meet biological objective?[1]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Meet target objective?[2]	Yes	Yes	Yes	Yes	No	No	No	No	—	—	—
Minimize P(AC_3>15%)	1	3	3	3							
Minimize AAV	1	2	4	5							
Maximum yield (TM)	17	13	10	6	—	—	—	—	—	—	—
Average of Ranks[4]	9	7.25	6.25	4.5	—	—	—	—	—	—	—

[1] This is determined using P(any RSB < 20%) for the objective to maintain RSB above 20% at least 95% of the time.

[2] This is determined using P(all RSB >36%) for the objective to maintain RSB above a target of 36% at least 50% of the time.

[3] The overall ranking applies to all management procedures without a constraint (Table I-1, Table I-2, and Table I-3)

Table I-4: Primary performance metrics and ranking of management procedures for a 30:20 control rule, input SPRs, and various constraints on the annual change in the total mortality (see Section I.1.2). P(all …) is the probability of that the event occurs in a given year, and P(any …) is the probability that the event occurs in at least one year out of a ten-year period. Long-term is a ten-year period after simulating 90 annual cycles. Medium-term is a ten-year period after simulating 13 annual cycles (i.e., simulated years 14-23).

Input Control Rule	**30:20**											
Constraint	**maxChangeBoth15%**				**slowUp FastDown**				**multiYear**			
Input SPR	**46%**	**42%**	**40%**	**38%**	**46%**	**42%**	**40%**	**38%**	**46%**	**42%**	**40%**	**38%**
Biological Sustainability												
P(any RSB<20%)	0.02	0.02	0.02	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Fishery Sustainability												
P(all RSB<36%)	0.28	0.46	0.55	0.63	0.26	0.43	0.51	0.60	0.32	0.50	0.59	0.67
P(any3 AC > 15%)	0.06	0.06	0.07	0.06	0.19	0.26	0.31	0.35	0.30	0.32	0.36	0.40
Median AAV	11.2%	11.3%	11.6%	11.7%	7.0%	7.7%	8.1%	8.8%	8.0%	8.8%	9.8%	10.8%
Median average TM	46.1	48.6	49.5	50.9	45.0	48.2	49.5	51.1	46.5	48.9	50.5	51.2

Table I-5: Primary performance metrics and ranking of management procedures for a 30:20 control rule, input SPRs, and various constraints on the annual change in the total mortality (see Section I.1.2). P(all …) is the probability of that the event occurs in a given year, and P(any …) is the probability that the event occurs in at least one year out of a ten-year period. Long-term is a ten-year period after simulating 90 annual cycles. Medium-term is a ten-year period after simulating 13 annual cycles (i.e., simulated years 14-23).

Input Control Rule	**30:20**												
Constraint	**maxChangeBoth20%**				**maxChangeUp**		**slowUp FullDown**			**Cap80**		**Cap60**	
Input SPR	**46%**	**42%**	**40%**	**38%**	**46%**	**40%**	**46%**	**42%**	**40%**	**46%**	**40%**	**46%**	**40%**
Biological Sustainability													
P(any dRSB_y<20%)	0.01	0.01	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fishery Sustainability													
P(all RSB > 36%)	0.26	0.45	0.55	0.63	0.10	0.23	0.16	0.32	0.40	0.26	0.50	0.24	0.44
P(any3 AC > 15%)	0.88	0.91	0.92	0.93	0.22	0.27	0.34	0.42	0.48	0.78	0.76	0.60	0.57
Median AAV	13.2%	13.5%	13.8%	14.1%	12.7%	13.1%	9.2%	9.9%	10.3%	16.1%	18.2%	13.3%	13.9%
Median average TM3	46.5	49.1	49.9	51.1	44.0	45.3	44.7	47.5	49.3	46.4	50.7	46.1	50.0

INTERNATIONAL PACIFIC HALIBUT COMMISSION

IPHC-2019-IM095-15

Implementation Notes: 2020 Regulatory proposals

PREPARED BY: IPHC SECRETARIAT (25 OCTOBER 2019)

PURPOSE

To provide the Commission with the required '*Implementation Notes*' for regulatory proposals received by the IPHC Secretariat for preliminary consideration at the 95th Session of the IPHC Interim Meeting (IM095).

BACKGROUND

On behalf of the Commission, the IPHC Secretariat receives regulatory proposals for preliminary consideration at the IPHC Interim Meeting, and in accordance with the process established for handling regulatory proposals, the IPHC Secretariat develops *Implementation Notes* for each proposal to aid Commissioners in their deliberations.

DISCUSSION

To date, no regulatory proposals from Contracting Parties or other stakeholders have been received for the Commission's consideration at 95th Session of the IPHC Interim Meeting (IM095).

The IPHC Secretariat anticipates that there will be regulatory proposals submitted for the Commission's consideration at the 96th Session of the IPHC Annual Meeting (IM096).

2nd IPHC Performance Review (PRIPHC02): Update

PREPARED BY: IPHC SECRETARIAT (D. WILSON; 24 OCTOBER 2019)

PURPOSE

To provide the Commission with an opportunity to consider the Report of the 2nd Performance Review of the IPHC (PRIPHC02), and direct the IPHC Secretariat accordingly.

BACKGROUND

2018

At the 94th Session of the IPHC Annual Meeting (AM094 in January 2018, the Commission adopted Terms of Reference, criteria, process and budget to conduct the 2nd Performance Review of the IPHC:

> Terms of Reference, criteria, process, and budget to conduct the 2nd Performance review of the IPHC (Adopted 26 January 2018)

Also at the AM094, the Commission agreed to defer the 2nd IPHC Performance Review until FY2019 (1 Oct. 2018 to 30 Sept. 2019), due to budget limitations in the current financial year (para. 94 of IPHC-2018-AM094-R).

The "*Terms of Reference and Criteria to Conduct the 2nd Performance Review of the IPHC*," includes six specific criteria for the review. Criteria 1, "*Legal analysis of the Convention to ensure its adequacy relative to current global best practice principles of fisheries management*," is the foundation element, upon which the rest of the review will rest.

2017

At the 93rd Session of the IPHC Annual Meeting (AM093) in January 2017, the Commission noted paper IPHC-2017-AM093-18, which outlined planning for the 2nd IPHC Performance Review, and provided the following direction to the IPHC Secretariat:

> AM093–Rec.13 (para. 153) *The Commission **RECOMMENDED** that the IPHC Secretariat finalise the draft performance review terms of reference and criteria to conduct the review, and implement the 2nd Performance Review throughout 2017, for presentation to the Commission at its 94th Annual Meeting in 2018.*

2014

In January 2014, the Commission issued a Progress Report, documenting the Commission's response to the 1st IPHC Performance Review (PERFORMANCE REVIEW 2012: A Progress Report). At Interim and Annual Meetings since then, Contracting Parties have noted the status of implementation of each of the recommendations arising from the report of the 1st IPHC Performance Review.

2011-12

In response to calls from the international community for a review of the performance of Regional Fisheries Management Organizations (RFMOs), the International Pacific Halibut Commission (IPHC) agreed in 2011 to implement a process of Performance Review. The IPHC contracted with CONCUR, Inc., a U.S.-based firm, to undertake the review. CONCUR performed its work independently of IPHC Commissioners and staff, and concluded its report to the Commission in April 2012. In undertaking the Performance Review, the contractor relied on the following approaches to assess the Commission's work and practices, track effectiveness, and gauge the need for revised approaches:

1) Conducting a set of 43 in-depth interviews with a representative and diverse set of stakeholders;
2) Observing the 2011 Interim and 2012 Annual Meetings and reviewing Commission background materials;
3) Reviewing practices at other regional fishery management organizations; and
4) Drawing on its professional judgment and experience.

In 2012, the contractor published a report outlining 12 recommendations (containing 39 parts) to improve the functioning of the IPHC (McCreary & Brooks, CONCUR, Inc. 2012).

DISCUSSION

In accordance with Rule 15 (Reports and Records) of the IPHC Rules of Procedure (2019), the final Report of the 2nd Performance Review of the IPHC (PRIPHC02), IPHC-2019-PRIPHC02-R (adopted on 11 October 2019), was provided to the Commission via IPHC Circular 2019-21 on 15 October 2019.

The report is available for download from the IPHC website: https://www.iphc.int/ or directly at the following link:

https://www.iphc.int/library/documents/post/iphc-2019-priphc02-r-report-of-the-2nd-performance-review-of-the-international-pacific-halibut-commission-priphc02

The Panel for the 2nd Performance Review of the IPHC is as follows:

a) Chairperson: **Mr Terje Løbach** (Norway).
b) Contracting Parties: **Mr Robert Day** (Canada); **Ms Staci MacCorkle** (U.S.A.).
c) Science Advisor: **Dr Kevin Stokes** (New Zealand).
d) Regional Fishery Management Organisations: **Mr Peter Flewwelling** (North Pacific Fisheries Commission);
e) Regional Fishery Management Organisations: **Mr Jeongseok Park** (North Pacific Anadromous Fish Commission).
f) Non-Governmental Organisations: **Ms Amanda Nickson** (The PEW Charitable Trusts).
g) IPHC Secretariat: **Dr David T. Wilson** (Facilitator)

RECOMMENDATION

That the Commission **NOTE** paper IPHC-2019-IM095-16 which provides the Commission with an opportunity to consider the Report of the 2nd Performance Review of the IPHC (PRIPHC02), and direct the IPHC Secretariat accordingly.

APPENDICES

Nil

Financial and Administration - update

PREPARED BY: IPHC SECRETARIAT (D. WILSON, K. JERNIGAN; 25 OCTOBER 2019)

PURPOSE

To provide the Commission with a status update on IPHC finance and accounting processes leading up to the next meeting of the IPHC Finance and Administration Committee (FAC), scheduled for 3 February 2020.

FY2019 – ACTUALS

The FY2019 budget closed on 31 September 2019. Actuals will be prepared for auditing commencing on 28 October 2019 and are scheduled to be completed by 15 December 2019.

Thus, the end of year financial statement for FY2019 (financial period: 1 October 2018 to 30 September 2019) will be presented to the IPHC Finance and Administration Committee (FAC) on 3 February 2020 (next scheduled meeting).

FY2020 – ADOPTED

At the 95th Session of the IPHC Annual Meeting (AM095), the Commission **adopted** the FY2020 budget, a summary of which is provided at Appendix VI of the AM095 report. At this time, no substantive changes are envisioned.

FY2021 - PROPOSED

At AM095 the Commission **noted** the preliminary budget estimates for FY2021, a summary of which is provided at Appendix VII of the AM095 report. At this time, no substantive changes are envisioned.

In accordance with the IPHC Financial Regulations (2019) and IPHC Rules of Procedure (2019), the FY2021 proposed budget will be presented to the IPHC Finance and Administration Committee (FAC) on 3 February 2020.

FY2022 - TENTATIVE

In accordance with the IPHC Financial Regulations (2019) and IPHC Rules of Procedure (2019), a tentative FY2022 budget will be presented to the IPHC Finance and Administration Committee (FAC) on 3 February 2020.

AUDITS FY2018 & FY2019

A draft of the FY2018 audited financial statements will be completed by 01 December 2019. A consultant has worked to prepare the FY2018 financial books and records for the audit. This included, but was not limited to, comparisons to bank records and internal reporting statements, reconciliation of various accounts, and team inquiries of activity. The consultant will be the IPHC lead to work with the auditors.

Final issuance of the FY2018 audited financial statements will occur when FY2019 actuals are current, which is anticipated to be by 15 December 2019. We anticipate the audit of FY2019 to be completed no later than 31 January 2020.

RECOMMENDATION/S

That the Commission **NOTE** paper IPHC-2019-IM095-17 which provides the Commission with a status update on IPHC finance and accounting processes leading up to the next meeting of the IPHC Finance and Administration Committee (FAC), scheduled for 3 February 2020.

APPENDICES

Nil.

Preparation for the 96th Session of the IPHC Annual Meeting (2020)

PREPARED BY: IPHC SECRETARIAT (S. KEITH; 23 OCTOBER 2019)

PURPOSE

To provide the Commission with the opportunity to direct preparations for the 96th Session of the IPHC Annual Meeting (AM096), to take place in Anchorage, Alaska, USA, from 3 to 7 February 2020.

BACKGROUND

The IPHC will hold the 96th Session of its Annual Meeting (AM096) in Anchorage, Alaska, USA, from 03 to 07 February 2020. At the preceding Interim Meeting (IM095), the Commission customarily reviews the preparations for the Annual Meeting, noting in particular the draft agenda and schedule, and directs the IPHC Secretariat regarding any changes it desires.

DISCUSSION

The 96th Session of the IPHC Annual Meeting (AM096) will be held at the Hotel Captain Cook in Anchorage, which has meeting rooms adequate to the needs of the meeting.

The provisional agenda, schedule, and list of documents for the meeting are available on the AM096 meeting page:

https://www.iphc.int/venues/details/96th-session-of-the-iphc-annual-meeting-am096.

RECOMMENDATIONS

That the Commission:

1) **NOTE** paper IPHC-2019-IM095-18, which outlines the preparations for the 96th Session of the IPHC Annual Meeting (03-07 February 2020).
2) **DIRECT** the IPHC Secretariat regarding improvements that the Commission would like to make to the agenda and schedule, as well as to any other meeting preparations, for the 96th Session of the IPHC Annual Meeting (03-07 February 2020).

APPENDICES

Nil

DRAFT: IPHC meetings calendar (2020-22)

PREPARED BY: IPHC SECRETARIAT (23 OCTOBER 2019)

PURPOSE

To provide the Commission with an opportunity to consider the draft IPHC meetings calendar (2020-22) (Appendix I).

BACKGROUND

Commission: The Commission's annual cycle of meetings is built around the management needs of the Pacific halibut fishery. The IPHC Interim Meeting (IM) follows the completion of the commercial fishing period, and is timed to allow the IPHC Secretariat to incorporate data from that fishing period into the stock assessment and harvest decision support for the coming season. The IPHC Annual Meeting (AM) is scheduled to allow harvest and regulation decisions to be made by the Commission and implemented by the Contracting Parties in time for the opening of the next commercial fishing period.

Subsidiary bodies: The Finance and Administration Committee (FAC), Conference Board (CB) and Processor Advisory Board (PAB) meet adjacent to or during the course of the Annual Meeting. The Scientific Review Board (SRB) and Management Strategy Advisory Board (MSAB) each meet at least twice during the course of the year, in a sequence that supports both their mutual collaboration and the timing of their advice for the Commission. The Research Advisory Board (RAB) meets in late February, when its members are best able to convene and consider the IPHC's scientific program of work.

DISCUSSION

Meetings of the Commission and its subsidiary bodies are of interest to the Pacific halibut stakeholder community and the general public, and the publication of their schedule as far in advance as possible enhances meeting preparation and collaboration among stakeholders and Contracting Party agencies.

The draft IPHC calendar provided in Appendix I includes the dates and locations for meetings in 2020 and 2021 approved by the Commission at its 95th Annual Meeting (AM095). The following changes, or potential changes, to the approved calendar have arisen since then:

- The dates of the 96th Annual Meeting (AM096) were shifted from 27-31 January to 3-7 February 2020 to resolve a conflict with the North Pacific Fishery Management Council meeting dates. (See IPHC Circular 2019-008.)
- At the 20th Session of the Research Advisory Board (RAB020) in February 2019, the board requested consideration of new dates for RAB021 and RAB022.

From IPHC-2019-RAB020-R:

58. The RAB REQUESTED that the IPHC Secretariat consider dates earlier in February for RAB021 and RAB022 in order to enable better participation by current or potential RAB members.

The date for RAB021 (2020) could not be changed, but in response to the RAB's request earlier dates for RAB022 (2021) and RAB 023 (2022) are proposed in the draft calendar provided in Appendix I.

- At the 2019 Work Meeting, the Commission discussed possible locations for MSAB015. The intention is to hold the meeting at a location in British Columbia readily accessible to stakeholders. A decision regarding the location for MSAB015 should be made not later than IM095 in order to allow adequate time for meeting planning.

Dates for IPHC meetings in 2022 are proposed in the draft calendar for the Commission's consideration. Note that the location for the 98th Session of the IPHC Annual Meeting (AM098) in 2022, hosted by the USA, should be decided at AM096 in order to plan for the meeting and contract for the necessary meeting venue.

RECOMMENDATIONS

That the Commission:

1) **NOTE** paper IPHC-2019-IM095-19, which provides the Commission with an opportunity to consider the draft IPHC Meetings Calendar (2020-22).
2) **DIRECT** the IPHC Secretariat regarding any changes to the draft IPHC Meetings Calendar (2020-22), with a view toward approving it at the 96th Annual Meeting (AM096) in February 2020.

APPENDICES

Appendix I: DRAFT: IPHC Meetings Calendar (2020-22)

APPENDIX I

DRAFT: IPHC Meetings Calendar (2020-22)

Meeting	2020			2021			2022		
	No.	Date	Location	No.	Date	Location	No.	Proposed Dates	Location
Annual Meeting (AM)	**96th**	**3-7 Feb**	**Anchorage, USA**	**97th**	**25-29 Jan**	**Victoria, Canada**	**98th**	**24-28 Jan**	**TBD, USA**
Finance and Administration Committee (FAC)	96th	3 Feb	Anchorage, USA	97th	25 Jan	Victoria, Canada	98th	24 Jan	TBD, USA
Conference Board (CB)	90th	4-5 Feb	Anchorage, USA	91st	26-27 Jan	Victoria, Canada	92nd	25-26 Jan	TBD, USA
Processor Advisory Board (PAB)	25th	4-5 Feb	Anchorage, USA	26th	26-27 Jan	Victoria, Canada	27th	25-26 Jan	TBD, USA
Research Advisory Board (RAB)	21st	26 Feb	Seattle, USA	22nd	TBD	Seattle, USA	23rd	9 Feb	Seattle, USA
Management Strategy Advisory Board (MSAB)	15th	11-14 May	TBD, Canada	-		-	-		-
	16th	19-22 Oct	Seattle, USA	-		-	-		-
Scientific Review Board (SRB)	16th	23-25 June	Seattle, USA	18th	22-24 June	Seattle, USA	20th	21-23 June	Seattle, USA
	17th	22-24 Sept	Seattle, USA	19th	21-23 Sept	Seattle, USA	21st	20-22 Sept	Seattle, USA
Work Meeting (WM)	--	16-17 Sept	Bellingham, USA	--	15-16 Sept	Bellingham, USA	--	14-15 Sept	Bellingham, USA
Interim Meeting (IM)	**96th**	**1-2 Dec**	**Seattle, USA**	**97th**	**30 Nov-1 Dec**	**Seattle, USA**	**98th**	**29-30 Nov**	**Seattle, USA**

IPHC Pacific Halibut Fishery Regulations:

Fishery Limits (Sect. 4)

PREPARED BY: IPHC SECRETARIAT (07 OCTOBER 2019)

PURPOSE

To improve clarity and transparency of fishery limits in the IPHC Fishery Regulations.

BACKGROUND

The Commission considers new and revised IPHC Fishery Regulations, including proposed changes to fishery limits, and makes changes as deemed necessary at each Annual Meeting. In the absence of changes being deemed necessary, the existing IPHC Fishery Regulations remain in effect.

In accordance with the IPHC Convention[1], the Contracting Parties may also implement fishery regulations that are more restrictive than those adopted by the IPHC.

This proposal suggests improvements to IPHC Pacific Halibut Fishery Regulations Section 4, '*Limits,*' to reflect TCEY values adopted by the IPHC and the applicable fishery sector limits resulting from those TCEY values according to existing Contracting Party catch sharing arrangements.

DISCUSSION

IPHC Pacific Halibut Fishery Regulations Section 4, '*Limits,*' was adopted in 2018 in order to provide clear documentation of the limits for fishery sectors within defined Contracting Party catch sharing arrangements, which are themselves tied to the mortality distribution (TCEY) decisions of the Commission. This proposal retitles the section as *'Fishery Limits'* and adds a table of the TCEY values adopted by the Commission, for clarity and to emphasize the role of the TCEY values as the basis for the subsequent setting of sector allocations through the operation of the Contracting Parties' existing catch sharing arrangements. Both the TCEY and the fishery sector allocation table will be populated as TCEY decisions are made for each IPHC Regulatory Area by the Commission during the 96th Session of the IPHC Annual Meeting (AM096) in February 2020.

Benefits/Drawbacks: The benefit is clear identification of fishery limits resulting from Commission decisions on distributed mortality (TCEY) values for each IPHC Regulatory Area. The potential drawback is a misconception that the resulting catch sharing arrangements and associated fishery limits are within the Commission's mandate, when in fact they are the responsibility of the Contracting Parties. This change is intended to reinforce that distinction by

[1] The Convention between Canada and the United States of America for the Preservation of the [Pacific] Halibut Fishery of the Northern Pacific Ocean and Bering Sea

clarifying which decisions are made by the Commission.

Sectors Affected: This proposal affects all sectors of the Pacific halibut fishery.

ADDITIONAL DOCUMENTATION / REFERENCES

None

SUGGESTED REGULATORY LANGUAGE

4. Fishery Limits

(1) The Commission has adopted the following distributed mortality (TCEY) values:

IPHC Regulatory Area	*Distributed mortality limits (TCEY) (net weight)*	
	Metric tons (t)	**Pounds (lb)**
Area 2A (California, Oregon, and Washington)		
Area 2B (British Columbia)		
Area 2C (southeastern Alaska)		
Area 3A (central Gulf of Alaska)		
Area 3B (western Gulf of Alaska)		
Area 4A (eastern Aleutians)		
Area 4B (central/western Aleutians)		
Areas 4CDE (Bering Sea)		

(2) The fishery limits resulting from the IPHC-adopted distributed mortality (TCEY) values and the existing Contracting Party catch sharing arrangements are as follows, recognizing that each Contracting Party may implement more restrictive limits:

IPHC Regulatory Area	*Fishery limits (net weight)*	
	Metric tons (t)	**Pounds (lb)**
Area 2A (California, Oregon, and Washington)		
Non-treaty directed commercial (south of Pt. Chehalis)		
Non-treaty incidental catch in salmon troll fishery		
Non-treaty incidental catch in sablefish fishery (north of Pt. Chehalis)		
Treaty Indian commercial		
Treaty Indian ceremonial and subsistence (year-round)		
Recreational – Washington		
Recreational – Oregon		
Recreational – California		
Area 2B (British Columbia) (combined commercial/recreational)		
Commercial fishery		
Recreational fishery		
Area 2C (southeastern Alaska) (combined commercial/guided recreational)		
Commercial fishery (catch)		
Commercial fishery (incidental mortality)		
Guided recreational fishery (includes catch and incidental mortality)		

Area 3A (central Gulf of Alaska) (combined commercial/guided recreational)		
Commercial fishery catch)		
Commercial fishery (incidental mortality)		
Guided recreational fishery (includes catch and incidental mortality)		
Area 3B (western Gulf of Alaska)		
Area 4A (eastern Aleutians)		
Area 4B (central/western Aleutians)		
Areas 4CDE (Bering Sea)		
Area 4C (Pribilof Islands)		
Area 4D (northwestern Bering Sea)		
Area 4E (Bering Sea flats)		
Total		

IPHC Pacific Halibut Fishery Regulations:

Commercial Fishing Periods (Sect. 9)

PREPARED BY: IPHC SECRETARIAT (07 OCTOBER 2019)

PURPOSE

To specify fishing periods for the commercial Pacific halibut fisheries.

BACKGROUND

Each year the International Pacific Halibut Commission (IPHC) selects fishing period dates for the commercial Pacific halibut fisheries in each of the IPHC Regulatory Areas. Historically, the first management measures implemented by the IPHC were to limit periods when fishing was allowed. Biological factors considered in the past when setting fishing period dates included migration and spawning considerations, neither of which is now used as a basis for determining fishing periods. Weather patterns, predicted tides in some fishing areas, whale activity, and business considerations for both fishers and processors have also been factors in the discussions surrounding the setting of fishing period dates.

Overall commercial fishing period

The IPHC's practice is to use the same overall commercial fishing period dates for all IPHC Regulatory Areas. These dates vary from year to year, and in recent years have allowed commercial fishing to begin sometime in March and end sometime in November for all IPHC Regulatory Areas.

IPHC Regulatory Area 2A: Non-tribal directed commercial fishery (Derby fishery)

Additionally restrictive fishing periods are established by the IPHC for the IPHC Regulatory Area 2A non-tribal directed commercial fishery, currently managed as a 10-hr derby fishery.

DISCUSSION

Overall commercial fishing period:

The IPHC Secretariat proposes that the overall commercial fishing period for all IPHC Regulatory Areas be fixed from **DD April** to **DD October/November**. Fixing the season will allow stakeholders to more efficiently develop business plans and will allow the IPHC Secretariat to more effectively monitor and manage the fishery.

IPHC Regulatory Area 2A: Non-tribal directed commercial fishery (Derby fishery)

For IPHC Regulatory Area 2A, the IPHC Secretariat proposes fishing periods for the non-tribal directed commercial fishery longer than the current 10-hour derby fishing periods. Specifically, the IPHC Secretariat proposes a **2-day fishing period**, and suggests that any version of a longer fishing period, from two to three days, would be preferable to the 10-hour derby fishing period currently in use. This change can be made now, in the interest of safety and within the current management structure of this fishery, ahead of and apart from any consideration of more extensive modifications to the management of this fishery as it transitions from the IPHC to Contracting Party domestic management.

Reasons for longer fishing periods

The IPHC Secretariat sees no compelling reason to retain the current “derby-style” form of the directed commercial Pacific halibut fishery, with its 10-hour fishing periods, but a number of advantages in reducing the concentration of fishing effort and eliminating or reducing the “race to fish” under potentially dangerous conditions. Potential advantages include:

1. Safety. This is the primary reason. The current system offers no flexibility as to when fishing takes place, creating pressure to attempt fishing even in poor weather and dangerous conditions. The U.S. Coast Guard has frequently commented at IPHC meetings in support of moving away from the derby-style fishery for this reason. Based on the experience of other fisheries in both Canada and the USA, we believe that a system offering more flexible fishing opportunities is inherently safer for everyone on the water. **This justification alone should be enough for the Commission to extend the fishing period for 2020.**
2. Reduced discards. The current derby system is essentially a “race to fish,” where fishers have an incentive to set as much gear as possible during the short time available for fishing. This leads to more discards as fishing period limits are reached than would be the case under a system where the fishers had time to more carefully calibrate their effort to applicable limits. This discard mortality represents an unnecessary loss to the Pacific halibut resource.

Other than maintaining access to the resource by the commercial Pacific halibut fishery, the IPHC Secretariat does not recommend a particular management system to replace the current form of the IPHC Regulatory Area 2A non-tribal directed commercial Pacific halibut fishery as it transitions to domestic management. The IPHC Secretariat supports a reduction in the concentration of fishing effort, eliminating the race to fish, and improving safety as guiding principles for any initial changes.

Implications of longer fishing periods

Longer fishing periods are expected to allow greater participation of license holders and greater attainment of individual fishing period limits by participating vessels. The primary implication of longer fishing periods is that fewer fishing periods and/or lower fishing period limits may be required in order to maintain the fishery within its allocation under the Pacific Fishery Management Council’s (PFMC) catch sharing plan (CSP).

Along with announcing open dates for the directed commercial fishery, the IPHC announces what the per-vessel fishing period limits will be, by vessel class, in accordance with the Pacific Halibut Fishery Regulations Section 13 (Fishing Period Limits). The IPHC determines the fishing period limits before each fishing period opens, based on the number of vessels in each length class, the average performance of vessels in that length class, and the amount of catch allocated to (or remaining for) the directed commercial fishery for that year. The IPHC vessel length classes range from A to H, with A being the smallest vessels (25 ft and under) and H being the largest (56 ft and over). The method of scaling fishing period limits among the vessel size classes can be adjusted to include a minimum, or floor, value for the smallest vessels in order to maintain an economically viable fishing opportunity.

In recent years the IPHC set fishing period limits for the first 10-hour fishing period of the year that ranged from 4.64 t (10,225 lb) landed weight[1] for the largest, H-class vessels to less than 0.45 t (1000 lb) for the smallest, A-class vessels. Dependent upon the sector allocation for 2020, the IPHC Secretariat expects that fishing period limits for a first fishing period of either two or three days for 2020 would be similar to those used in 2019, which ranged from 4.64 t (10,225 lb) for larger vessels to 2.05 t (4,525 lb) for smaller vessels.

Discussion and feedback on this issue to date

1. The IPHC initiated the current sequence of discussions regarding fishing periods in IPHC Regulatory Area 2A with a letter to the PMFC in May 2017. The PFMC and its advisory bodies engaged in discussion of the issue at their June, September, and November 2017 meetings, including a request for more information from IPHC and the inter-agency production of a matrix of management options for the fishery.

    a. This discussion and its attendant information and analyses were considered by the Commission at the 94th Annual Meeting (AM094) in January 2018 (IPHC-2018-AM094-INF02).

    b. No recommendations were made by the Commission for the 2018 fishery other than status quo. The PFMC and other parties indicated a willingness to continue discussing potential changes to the management of the fishery.

2. The focus of attention during 2018 was on the possibility of changing the length of the fishing period, and on the IPHC Secretariat's specific proposal for either a 5-day or a 10-day fishing period (IPHC-2019-AM095-PropA2). Such a change is within the IPHC's mandate and addresses the IPHC's primary concern with the current 10-hour fishing period, the safety of participants in the fishery. It could be undertaken by the IPHC on its own, without requiring changes in the aspects of the fishery managed by the PFMC and the state and federal agencies.

    a. The IPHC identified its proposal to change the fishing period in letters to the PFMC, which the PFMC discussed extensively at its September and November 2018 meetings. The PFMC then provided its feedback in a letter to the IPHC in November 2018, identifying concerns with the proposal and requesting engagement with the IPHC to work through the concerns or otherwise delay action to modify the management parameters of the fishery until its concerns were addressed.

    b. In response, the IPHC Secretariat noted that the concerns raised by the PFMC were worthy of continued discussion and coordination, but that they did not preclude the implementation of longer fishing periods. In particular, input from stakeholders and agencies regarding economic viability, enforcement concerns, and the timing of the fishery would continue to be useful considerations for future

[1] "Landed weight" is defined as the weight without gills and entrails, head-on, with ice and slime.

modifications to the fishery. The IPHC welcomed the proposal by the PFMC for a workshop to consider additional changes to the IPHC Regulatory Area 2A fishery management structure.

c. In response to suggestions by the IPHC Commissioners, and the PFMC and its Groundfish Advisory Panel, the IPHC Secretariat sought input from its Regulatory Area 2A license holders on the possibility of a longer fishing period. All 171 license holders from 2016 to 2018 were surveyed, the results of which are provided in the following table:

	All license holders 2016-2018	**%**
Total license holders (2016-18)	**171**	
Total respondents	137	80.12
Longer Season?		
Yes	118	86.13
No	19	13.87
Season length?		
Shorter than five days	26	18.98
Five days	35	25.55
10 days	48	35.04
Longer than ten days	28	20.44

Of survey respondents, totaling 80.12% of all license holders over the period 2016-18, there was a clear preference for a longer fishing period (86.13%).

3. Discussion continued during 2019, beginning with an extensive review of IPHC-2019-AM095-PropA2 at the 95th Annual Meeting (AM095).

a. At the 95th Annual Meeting (AM095), the Commission made no changes to the 10-hour fishing period for 2019, but indicated its desire to move to longer fishing periods. The Commission also responded to the PFMC's input and expressed its desire for changes in the management of the fishery, as detailed in the following paragraphs from the AM095 Report:

IPHC-2019-AM095-R, paragraphs 75-80:

*75. "The Commission **AGREED** that for IPHC Regulatory Area 2A, fishing periods for the non-tribal directed commercial fishery should be longer than the current 10-hour derby fishing periods, primarily for safety reasons.*

*76. "The Commission **NOTED** that of the 171 license holders in this fishery from 2016 to 2018, a clear majority (86% of the 80% who responded to the IPHC Secretariat's survey) favoured a longer fishing period with lower individual vessel quotas for each opening. Of those surveyed respondents who participated in the fishery (delivered fish) during those years, 76% favoured one of the longer fishing periods proposed.*

77. *"The Commission **NOTED** the suggestion from the PFMC and the NOAA Fisheries West Coast Region office for a workshop to consider future changes to the IPHC Regulatory Area 2A Pacific halibut fishery management structure in a more holistic way, to include all management partners and to take place as early as spring 2019.*

78. *"**NOTING** the indication made to the PFMC in a letter dated 25 January 2019, that the IPHC Secretariat would welcome the opportunity to further address the safety concerns in the fishery, and to examine other potential management options for the fishery such as an IFQ or limited entry, as well as its management responsibilities, the Commission **RECOMMENDED** that this workshop take place, given the desire for the IPHC to move full management of the fishery from the IPHC (an international fisheries management body) to the relevant domestic agencies.*

79. *"**NOTING** the concerns expressed by Canada about the safety issues related to the current management of this derby fishery, the Commission **EXPRESSED** its hope that there will be a proposal for an alternative management approach that addresses safety concerns by the time the Commission reconvenes at next year's annual meeting. If no resolution is in hand by then, the IPHC expects to re-examine what steps it can take to address the issue, including moving to longer fishing periods.*

80. *"The Commission **ADOPTED** fishing periods for 2019 as provided below, thereby superseding Section 9 of the IPHC Pacific halibut fishery regulations:*

    a. *"All commercial fishing for Pacific halibut in all IPHC Regulatory Areas may begin no earlier than 15 March and must cease on 14 November.*

    b. *"IPHC Regulatory Area 2A (Non-Treaty Directed Commercial): Retain the 10-hour derby fishery for 2019, 26 June, 10 July, 24 July, 7 August, 21 August, 4 September, 18 September, with additional openings and fishing period limits (vessel quota) to be determined and communicated by the IPHC Secretariat."*

b. In response to the Commission's direction (paragraph 80b above), an additional possible opening date of 27 June 2019, immediately following the first fishing period on 26 June, was included in the Pacific Halibut Fishery Regulations (2019). The possibility of sequential 10-hour fishing periods engendered significant discussion, and, in order to gather the direct feedback of fishery participants, the IPHC Secretariat conducted a survey of license holders during April 2019. The response was 73% in favor of scheduling the first two fishing periods for 26 June and 10 July 2019 (two weeks apart), instead of 26 and 27 June 2019. Informed by the survey response, the IPHC did not establish fishing period limits for the 27 June 2019 fishing period and the fishery was not open that day (see IPHC News Release 2019-009).

c. The PFMC continued its discussion of the management of the fishery at its April and June 2019 meetings, noting in particular in its June 2019 Decision Summary Document:

> *"The Council committed to working closely with the International Pacific Halibut Commission (IPHC) and stakeholders on transitioning the management of the non-Indian commercial directed halibut fishery from the IPHC to the Council and outlined intentions for the management and structure of the fishery in the near future…"*

d. Further progress on the transition of the IPHC Regulatory Area 2A fisheries to domestic management is expected to be made at the September and November 2019 PFMC meetings, but the process is not expected to reach implementation before the coming fishing year. Therefore, the IPHC will continue to manage the fishery for 2020.

4. Noting the Commission's expressed desire to move to a longer fishing period (paragraphs 75 and 79 above), the IPHC Secretariat proposes 2-day fishing periods for 2020. This action can be taken now in the interest of safety, while the fishery management transition process proceeds during 2020.

Expected outcomes

Should the Commission approve a longer fishing period for 2020, the IPHC Secretariat expects that its implementation will immediately enhance safety for fishery participants, as well as provide valuable feedback and potentially lead to further refinements for subsequent years. For instance, we may find that the dates or the duration of the fishing periods require adjustment in order to stay within allocation or to better meet stakeholder needs.

Sectors Affected: Commercial Pacific halibut fisheries in each IPHC Regulatory Area.

ADDITIONAL DOCUMENTATION / REFERENCES

IPHC-2019-AM095-PropA2

APPENDICES

None

SUGGESTED REGULATORY LANGUAGE

9. Commercial Fishing Periods

(1) The fishing periods for each IPHC Regulatory Area apply where the catch limits specified in Section 12 have not been taken.

(2) Unless the Commission specifies otherwise, commercial fishing for Pacific halibut in all IPHC Regulatory Areas may begin no earlier in the year than 12:00 local time on DD April.

(3) All commercial fishing for Pacific halibut in all IPHC Regulatory Areas shall cease for the year at 12:00 local time on DD October/November.

(4) The first fishing period in the IPHC Regulatory Area 2A non-tribal directed commercial fishery shall begin at 08:00 on the fourth Wednesday in June and terminate at 18:00 local time the next day, unless the Commission specifies otherwise. If the Commission determines that the catch limit specified for IPHC Regulatory Area 2A in Section 12 has not been exceeded, it may announce a second fishing period of up to two fishing days to begin on the second Wednesday in July, and, if necessary, a third fishing period of up to two fishing days to begin on the fourth Wednesday in July.

(5) Notwithstanding paragraph (7) of section 12, an incidental catch fishery is authorized during the sablefish seasons in IPHC Regulatory Area 2A in accordance with regulations promulgated by NOAA Fisheries. This fishery will occur between the dates and times listed in paragraphs 2 and 3 of this section.

(6) Notwithstanding paragraph (2), and paragraph (7) of section 12, an incidental catch fishery is authorized during salmon troll seasons in IPHC Regulatory Area 2A in accordance with regulations promulgated by NOAA Fisheries. This fishery will occur between the dates and times listed in paragraphs 2 and 3 of this section.

12. Commercial Catch Limits

(1) …

(6) If the Commission determines that the catch limit specified for IPHC Regulatory Area 2A in paragraph (1) would be exceeded in an additional directed commercial fishing period as specified in paragraph (4) of section 9…

IPHC Fishery Regulations: minor amendments

PREPARED BY: IPHC SECRETARIAT (07 OCTOBER 2019)

PURPOSE

To improve clarity and consistency in the IPHC Fishery Regulations.

BACKGROUND

This proposal would make minor amendments to the IPHC Regulations. These revisions to the regulations would include:

- Updating and clarifying existing fishery regulations;
- Reordering regulations for clarity and emphasis.

DISCUSSION

Periodically, regulations should be reviewed to ensure they are clear, concise, consistent, and current. These proposed revisions to the IPHC Fishery Regulations are a result of a holistic review. The primary revisions resulting from this review are described below, and will be provided for the 96th Session of the IPHC Annual Meeting (AM096) in detail:

- Updating and clarifying fishery regulations
    1. Section 1, Short Title, would be removed as it is no longer necessary.
    2. The current Section 4, Limits, would be re-titled Fishery Limits. [This section would also be amended in accordance with IPHC-2019-IM095-PropA1, as approved.]
    3. Section 5, Licensing Vessels for IPHC Regulatory Area 2A, would be amended to make it clear that vessels in IPHC Regulatory Area 2A may hold both a license for directed commercial fishing *and* a license for the incidental catch during the sablefish fishery.
    4. Section 7, Regulatory Areas, would be amended to specify that the definition of IPHC Regulatory Areas applies within the IPHC Convention Area.
    5. The table of commercial catch limits would be removed from the current Section 12, Commercial Catch Limits, as this information is available in Section 4, [*Fishery*] Limits and is therefore redundant. Section 12 would be retitled Application of Commercial Fishery Limits.
    6. Section 15, Careful Release, would be amended to include the application of both minimum and maximum size limits, in order to make the section applicable to all fisheries.
    7. Section 18, Receipt and Possession of Pacific Halibut, would be revised to make it clear that IPHC Regulatory Area 2A is included in Paragraph 6 as intended.
    8. Section 20, Fishing Gear, would be amended to allow pots capable of catching Pacific halibut.

9. Section 22, Retention of Tagged Pacific Halibut, would be revised to make it clear that tagged fish do not count against commercial or recreational individual limits.
10. Section 23, Fishing by United States Treaty Indian Tribes, would be amended to remove references to specific fishery sector allocations, as this information is available in Section 4, [*Fishery*] Limits and is therefore redundant, and to include the Metkalatka fishery in Alaska.
11. References to specific fishery sector allocations would be removed from Sections 27, Sport Fishing for Pacific Halibut—IPHC Regulatory Area 2A and 29, Sport Fishing for Pacific Halibut—IPHC Regulatory Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, 4E, as this information is available in Section 4, [*Fishery*] Limits and is therefore redundant.
12. Minor edits would be made throughout for stylistic consistency among Sections.

- Reordering fishery regulations for clarity and emphasis
    1. The sequence of sections would be revised as indicated in the following table, and all sections would be edited as necessary to reflect the new sequence:

Previous Section No.	***New Section No.***	***New Section title***
		Applicable to all fisheries
2.	*1*	Application
3.	*2*	Definitions
7.	*3*	IPHC Regulatory Areas
4.	*4*	Fishery Limits
6.	*5*	In-Season Actions
15.	*6*	Careful Release of Pacific Halibut
22.	*7*	Retention of Tagged Pacific Halibut
		Applicable to commercial fisheries
9.	*8*	Fishing Periods
11.	*9*	Closed Area
10.	*10*	Closed Periods
12.	*11*	Application of Commercial Fishery Limits
8.	*12*	Fishing in IPHC Regulatory Areas 4D and 4E
13.	*13*	Fishing Period Limits
5.	*14*	Licensing Vessels for IPHC Regulatory Area 2A
16.	*15*	Vessel Clearance in IPHC Regulatory Area 4
19.	*16*	Fishing Multiple IPHC Regulatory Areas
20.	*17*	Fishing Gear
14.	*18*	Size Limits
17.	*19*	Logs
18.	*20*	Receipt and Possession of Pacific Halibut
21.	*21*	Supervision of Unloading and Weighing
23.	*22*	Fishing by United States Treaty Indian Tribes
		Applicable to Indigenous fisheries
25.	*23*	Aboriginal Groups Fishing for Food, Social and Ceremonial Purposes in British Columbia

24.	*24*	Customary and Traditional Fishing in Alaska
		Applicable to recreational fisheries
26.	*25*	Sport Fishing for Pacific Halibut—General
27.	*26*	Sport Fishing for Pacific Halibut—IPHC Regulatory Area 2A
28.	*27*	Sport Fishing for Pacific Halibut—IPHC Regulatory Area 2B
29.	*28*	Sport Fishing for Pacific Halibut—IPHC Regulatory Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, 4E
		General provisions
30.	*29*	General provisions – Superseding Fishery Regulations

Benefits/Drawbacks: The benefit is clearer and more consistent regulations that are easier to use. No known drawback.

Sectors Affected: This proposal affects all sectors of the Pacific halibut fishery.

ADDITIONAL DOCUMENTATION / REFERENCES

None

SUGGESTED REGULATORY LANGUAGE

1. Section 1, Short Title, deleted and other sections re-numbered accordingly.
2. Section 4 re-titled Fishery Limits (to be combined with other changes from IPHC-2019-IM095-PropA1, as approved):

4. Fishery Limits

3. Section 5 re-numbered and revised to read:

14. Licensing Vessels for IPHC Regulatory Area 2A

(1) No person shall fish for Pacific halibut from a vessel, nor possess Pacific halibut on board a vessel, used either for commercial fishing or as a charter vessel in IPHC Regulatory Area 2A, unless the Commission has issued a license valid for fishing in IPHC Regulatory Area 2A in respect of that vessel.

(2) A license issued for a vessel operating in IPHC Regulatory Area 2A shall be valid only for operating either as a charter vessel or a commercial vessel, but not both.

(3) A vessel with a valid IPHC Regulatory Area 2A commercial license cannot be used to recreationally fish for Pacific halibut in IPHC Regulatory Area 2A.

(4) A license issued for a vessel operating in the commercial fishery in Area 2A shall be valid for one of the following:

(a) the directed commercial fishery during the fishing periods specified in paragraph (2) of section 9;

(b) the incidental catch fishery during the sablefish fishery specified in paragraph (3) of section 9; or

(c) the incidental catch fishery during the salmon troll fishery specified in paragraph (4) of section 9.

(5) A vessel with a valid license for the IPHC Regulatory Area 2A incidental catch fishery during the sablefish fishery described in paragraph (4)(b) may also apply for or be issued a license for the directed commercial fishery described in paragraph (4)(a)..

(6) …

4. Section 7, Regulatory Areas, re-numbered, re-titled, and amended to specify that the definition of IPHC Regulatory Areas applies within the IPHC Convention Area:

3. IPHC Regulatory Areas

The following areas within the IPHC Convention Area shall be defined as IPHC Regulatory Areas for the purposes of the Convention (see Figure 1):

(1) …

5. The table of commercial catch limits removed from Section 12 (along with sub-paragraph [1]), and Section 12 re-numbered, re-titled, and revised:

11. Application of Commercial Fishery Limits

(1) Notwithstanding the fishery limits described in Section 4, regulations pertaining…

(2) …

(3) Notwithstanding the fishery limits described in Section 4, the commercial fishing in IPHC Regulatory Area 2B…

(4) Notwithstanding the fishery limits described in Section 4, the commercial fishing in IPHC Regulatory Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, and 4E…

(5) If the Commission determines that the catch limit specified for IPHC Regulatory Area 2A in Section 4 would be exceeded…

(6) When under paragraphs (1), (2), and (5) the Commission has announced a date…

(7) Notwithstanding the fishery limits described in Section 4, the total allowable catch of Pacific halibut that may be taken in the IPHC Regulatory Area 4E directed commercial fishery…

(8) Notwithstanding the fishery limits described in Section 4, the total allowable catch of Pacific halibut that may be taken in the IPHC Regulatory Area 4D directed commercial fishery…

6. Section 15 renumbered and revised to read:

6. Careful Release of Pacific Halibut

(1) …

(2) Except that paragraph (1) shall not prohibit the possession of Pacific halibut on board a vessel that has been brought aboard to be measured to determine if the applicable size limit of the Pacific halibut is met and, if not legal-sized, is promptly returned to the sea with a minimum of injury.

7. Section 18 re-numbered and revised to make it clear that IPHC Regulatory Area 2A is included in Paragraph 6 as intended:

20. Receipt and Possession of Pacific Halibut

(1) …

(6) The first recipient, commercial fish processor, or buyer in the United States of America who purchases or receives Pacific halibut directly from the vessel operator that harvested such Pacific halibut must weigh and record all Pacific halibut received and record the following information on State fish tickets: the date of offload; vessel number (State or Federal) or Tribal ID number; total weight obtained at the time of offload including the weight (in pounds) of Pacific halibut purchased; the weight (in pounds) of Pacific halibut offloaded in excess of the IFQ, CDQ, or fishing period limits; the weight of Pacific halibut (in pounds) retained for personal use or for future sale; and the weight (in pounds) of halibut discarded as unfit for human consumption. All Pacific halibut harvested fisheries in IPHC Regulatory Areas 2A, 2C, 3A, 3B, 4A, 4B, 4C, 4D, and 4E, must be weighed with the head on and the head-on weight must be recorded on State fish tickets as specified in this paragraph, unless the Pacific halibut is frozen at sea and exempt from the head-on landing requirement at Section 14(2).

(7) …

8. Section 20, Fishing Gear, re-numbered and amended to allow pots capable of catching Pacific halibut where applicable:

17. Fishing Gear

(1) …,
- (a) …
- (b) …

(2) …
- (a) …
- (b) …

(3) No person shall possess Pacific halibut while on board a vessel carrying any trawl nets capable of catching Pacific halibut.

(4) …
- (a) …
- (b) …

(5) …

(6) …
- (a) …
- (b) …

(7) …
- (a) …
- (b) …

(8) …
- (a) …
- (b) …

(9) No person on board a vessel used to fish for any species of fish…
- (a) …
- (b) …

(10) No vessel used to fish for any species of fish…

(11) …

9. Section 22 renumbered and revised to read:

7. Retention of Tagged Pacific Halibut

(1) …

(2) …

(3) Any Pacific halibut that bears a Commission external tag will not count against commercial fishing period limits, Individual Vessel Quotas (IVQ), Community Development Quotas (CDQ), or Individual Fishing Quotas (IFQ), and are not subject to size limits in these regulations.

(4) Any Pacific halibut that bears a Commission external tag will not count against recreational (sport) daily bag limits or possession limits, may be retained outside of recreational (sport) fishing seasons, and are not subject to size limits in these regulations.

10. Section 23, Fishing by United States Treaty Indian Tribes, re-numbered and amended to remove references to specific fishery sector allocations and to include the Metkalatka fishery in Alaska:

22. Fishing by United States Treaty Indian Tribes

(1) Pacific halibut fishing in IPHC Regulatory Area Subarea 2A-1 by members of 'United States treaty Indian' tribes located in the State of Washington shall be regulated under regulations promulgated by NOAA Fisheries and published in the <u>Federal Register</u>.

  (a) Subarea 2A-1 includes…

  (b) Section 14 (size limits)…

  (c) Regulations in sub paragraph (b) of this section that apply to State fish tickets…

  (d) Section 4 (Licensing Vessels for IPHC Regulatory Area 2A)…

  (e) Commercial fishing for Pacific halibut in Subarea 2A-1 is permitted with hook and line gear from *[date to be determined separately]* through *[date to be determined separately]*, or until the limit specified in Section 4 is taken, whichever occurs first.

  (f) Ceremonial and subsistence fishing for Pacific halibut in Subarea 2A-1 is permitted with hook and line gear from January 1 through December 31.

(2) In IPHC Regulatory Area 2C, the Metlakatla Indian Community has been authorized by the United States Government to conduct a commercial Pacific halibut fishery within the Annette Islands Reserve. Fishing periods for this fishery are announced by the Metlakatla Indian Community and the Bureau of Indian Affairs. Landings in this fishery are accounted with the commercial landings for IPHC Regulatory Area 2C.

11. Sections re-numbered and references to specific fishery sector allocations removed from Sections 27, Sport Fishing for Pacific Halibut—IPHC Regulatory Area 2A and 29, Sport Fishing for Pacific Halibut—IPHC Regulatory Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, 4E:

26. Sport Fishing for Pacific Halibut—IPHC Regulatory Area 2A

(1) The Commission shall determine and announce closing dates to the public for any area in which the catch limits promulgated by NOAA Fisheries are estimated to have been taken.

(2) When the Commission has determined that a…

28. Sport Fishing for Pacific Halibut—IPHC Regulatory Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, 4E

(1) …

(2) For guided sport fishing (as referred to in 50 CFR 300.65) in IPHC Regulatory Area 2C:

(a) No person on board a charter vessel (as referred to in 50 CFR 300.65) shall catch and retain more than one Pacific halibut per calendar day.

(b)…

(3) For guided sport fishing (as referred to in 50 CFR 300.65) in IPHC Regulatory Area 3A:

(a) No person on board a charter vessel (as referred to in 50 CFR 300.65) shall catch and retain more than two Pacific halibut per calendar day.

(b)…

12. Minor edits throughout for stylistic consistency among Sections.

APPENDICES

None

IPHC Pacific Halibut Fishery Regulations:

Clearances and Observers or Electronic Monitoring (Sect. 16)

PREPARED BY: IPHC SECRETARIAT (25 OCTOBER 2019)

PURPOSE

To address the need for clearances when a National Oceanic and Atmospheric Administration (NOAA) Fisheries observer or electronic monitoring device is present.

BACKGROUND

The International Pacific Halibut Commission (IPHC) requires vessels to obtain clearances to fish in IPHC Regulatory Area 4 and to offload fish from IPHC Regulatory Area 4 when the vessel is used to fish in another IPHC Regulatory Area during the same fishing season.

DISCUSSION

In 2003, IPHC regulations were modified to allow for a clearance exemption when a vessel has a NOAA Fisheries approved Vessel Monitoring System (VMS) on board and follows prescribed protocols.

The IPHC Secretariat proposes that the Commission expand this clearance exemption to include when a NOAA Fisheries observer or electronic monitoring (EM) device is present,

Benefits/Drawbacks: The benefit is that the exemption will allow for greater flexibility in meeting the clearance requirement for vessels fishing in IPHC Regulatory Area 4 and other IPHC Regulatory Areas, while encouraging additional observer coverage. There are no apparent drawbacks.

Sectors Affected: This proposal affects the directed commercial sectors of the Pacific halibut fishery fishing in IPHC Regulatory Area 4 and other IPHC Regulatory Areas during the same season.

ADDITIONAL DOCUMENTATION / REFERENCES

None

SUGGESTED REGULATORY LANGUAGE

16. Vessel Clearance in IPHC Regulatory Area 4

(1) ….

(16) Any vessel that carries a NOAA Fisheries observer, a NOAA Fisheries electronic monitoring system, or a transmitting VMS transmitter while fishing for Pacific halibut in IPHC Regulatory Areas 4A, 4B, 4C, or 4D and until all Pacific halibut caught in any of these IPHC Regulatory Areas is landed, is exempt from the clearance requirements of paragraph (1) of this section, provided that:

(a) the operator of the vessel complies with NOAA Fisheries' observer, electronic monitoring or vessel monitoring system regulations published at 50 CFR 679.28(f)(3), (4) and (5); and

(b) the operator of the vessel notifies NOAA Fisheries Office for Law Enforcement at 800-304-4846 (select option 1 to speak to an Enforcement Data Clerk) between the hours of 06:00 hours and 00:00 hours (midnight) local time within 72 hours before fishing for Pacific halibut in IPHC Regulatory Areas 4A, 4B, 4C, or 4D and receives a VMS confirmation number.

Report of the 20th Session of the IPHC Research Advisory Board (RAB020)

Seattle, Washington, United States of America, 27 February 2019

Commissioners

Canada	United States of America
Paul Ryall	Chris Oliver
Neil Davis	Robert Alverson
Peter DeGreef	Richard Yamada

Executive Director

David T. Wilson, Ph.D.

DISTRIBUTION:
Participants in the Session
Members of the Commission
IPHC Secretariat

BIBLIOGRAPHIC ENTRY
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ACRONYMS

CPUE	Catch per Unit Effort
IPHC	International Pacific Halibut Commission
NOAA	National Oceanic and Atmospheric Administration (NOAA-Fisheries)
PAT	Pop-up Archival Transmitting (tag)
RAB	Research Advisory Board
WPUE	Weight per Unit Effort

DEFINITIONS

A set of working definitions are provided in the IPHC Glossary of Terms and abbreviations: https://iphc.int/the-commission/glossary-of-terms-and-abbreviations

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

This report has been written using the following terms and associated definitions so as to remove ambiguity surrounding how particular paragraphs should be interpreted.

Level 1: **RECOMMENDED**; **RECOMMENDATION; ADOPTED** (formal); **REQUESTED; ENDORSED** (informal): A conclusion for an action to be undertaken, by a Contracting Party, a subsidiary (advisory) body of the Commission and/or the IPHC Secretariat.

Level 2: **AGREED**: Any point of discussion from a meeting which the Commission considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 above; a general point of agreement among delegations/participants of a meeting which does not need to be elevated in the Commission's reporting structure.

Level 3: **NOTED/NOTING**; **CONSIDERED**; **URGED**; **ACKNOWLEDGED**: General terms to be used for consistency. Any point of discussion from a meeting which the Commission considers to be important enough to record in a meeting report for future reference. Any other term may be used to highlight to the reader of an IPHC report, the importance of the relevant paragraph. Other terms may be used but will be considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The 20th Session of the Research Advisory Board (RAB020) of the International Pacific Halibut Commission (IPHC) was held in Seattle, Washington, U.S.A. on 27 February 2019. The meeting was opened by the Vice-Chairperson Dr Josep Planas.

The following are a subset of the complete recommendations and requests for action from the RAB020 to the Commission, which are provided within Appendix IV.

RECOMMENDATIONS

IPHC Closed Area

RAB020-Rec.01 (para. 10) The RAB **AGREED** that the IPHC Closed Area (Pacific Halibut Fishery Regulations 2019, Sect. 11) is not currently meeting its intended objective of protecting juvenile Pacific halibut when it is open to non-directed fisheries, and **RECOMMENDED**, in coordination with the NPMFC, that the IPHC Secretariat examine alternative management regimes for the Closed Area, and for these to be presented at the 96th Session of the IPHC Annual Meeting (AM096) in 2020.

REQUESTS

Effects of long-line gear on benthic habitats, lost gear, and spatial patterns in fishing

RAB020-Req.01 (para. 21) The RAB **NOTED** the limitations imposed on the fishing industry by the growing number of marine conservation areas that restrict particular fishing activities, and **REQUESTED** that the IPHC consider research examining the following aspects of the longline fishery:

a. The impact of longline gear on the ocean bottom, including how much habitat disturbance is created by setting and retrieving the gear;

b. The magnitude and impact of lost and abandoned longline gear over time; and

c. The extent of the geographic footprint (the bottom area directly affected) of longline gear.

Black cod pot fishing

RAB020-Req.02 (para. 24) The RAB **NOTED** the increasing use of pot gear to fish for sablefish in Alaska, and **REQUESTED** the IPHC gather data on the effect of this shift, including potentially:

a. How this change affects the catch of Pacific halibut in the sablefish fishery;

b. How the gear shift in the sablefish fishery might drive whale predation toward the Pacific halibut fishery; and

c. The change in these effects over time.

Impact of recreational fishery releases

RAB020-Req.03 (para. 29) The RAB **NOTED** the possibility of engaging recreational fishers in data collection efforts in order to better characterize the population of Pacific halibut released in the fishery, and **REQUESTED** that the IPHC Secretariat begin to explore such research possibilities, including guidance and best practices that might be required.

RAB020-Req.04 (para. 30) The RAB **NOTED** that recreational fishing logs may be left incomplete, in particular with regard to numbers of fish caught and released, and **REQUESTED** that the IPHC Secretariat work with relevant Contracting Party agencies to encourage and enforce complete data collection.

1. Opening of the Session

1. The 20th Session of the Research Advisory Board (RAB020) of the International Pacific Halibut Commission (IPHC) was held in Seattle, Washington, U.S.A. on 27 February 2019. A total of seven (7) members attended the Session from the two (2) Contracting Parties, as well as two (2) observers and 19 IPHC Secretariat staff as observers or officers. Six (6) RAB Members were absent (apologies received from Art Davidson, Stephen Rhoads, Brad Mirau, and Richie Shaw). The list of participants is provided at Appendix I. The meeting was opened by the Vice-Chairperson, Dr Josep Planas, who welcomed participants to Seattle.
2. The RAB **EXPRESSED** its condolences for the recent departure of Mr Bruce Gabrys, who passed away at the end of January 2019.

2. Adoption of the Agenda and Arrangements for the Session

3. The RAB **ADOPTED** the Agenda as provided at Appendix II. The documents provided to the RAB are listed in Appendix III.

3. IPHC Process

3.1 IPHC Rules of Procedure (2019)

4. The RAB **RECALLED** its mandate as stated in the IPHC Rules of Procedure (2019) as follows:

   Appendix VII, I.1-3 *"The Research Advisory Board (RAB) is composed of members of the Pacific halibut community that shall a) suggest research ideas, b) review IPHC research proposals, and c) provide the IPHC Secretariat staff (who participate in Sessions of the RAB as Observers) with direct input and advice from industry during the development of research plans. The RAB may also make recommendations to the Scientific Review Board concerning research plans and priorities for its consideration. The Executive Director shall Chair the RAB's meetings, as well as communication with the Commission and the other IPHC subsidiary bodies on the RAB's behalf."*

5. The RAB **NOTED** the revisions to the IPHC Rules of Procedure adopted by the Commission at its 95th Session of the Annual Meeting (AM095): *IPHC Rules of Procedure (2019)*.

3.2 Update on the actions arising from the 19th Session of the RAB (RAB019)

6. The RAB **NOTED** paper IPHC-2019-RAB020-03 which provided the RAB with an opportunity to consider the progress made during the inter-sessional period, in relation to the recommendations and requests of the 19th Session of the IPHC Research Advisory Board (RAB019).
7. The RAB **AGREED** to consider and revise as necessary, the actions, and for these to be combined with any new actions arising from the RAB020.

3.2.1 Bycatch handling practices on all fleets catching Pacific halibut

8. **NOTING** that the IPHC Secretariat is currently conducting a research project evaluating handling practices associated with physiological condition and survival of discarded Pacific halibut in the directed longline fishery that will produce, as deliverables, best practice handling guidelines for the reduction or control of discard mortality rates by late 2019, the RAB reiterated its previous **RECOMMENDATION** that the IPHC Secretariat develop '*Best practice handling guidelines*' for each of the primary gear types (fixed-hook, snap gear, auto-longline, pots and trawl) which catch Pacific halibut, both directed and non-directed.

3.2.2 IPHC Closed Area

9. The RAB **AGREED** that retaining the IPHC Closed Area in its current form, whereby the directed fishery is prohibited from fishing within the area, and with the intent of protecting juvenile Pacific halibut from extraction by the longline fleet, will continue to be ineffectual if other fisheries which are known to catch and have a high mortality of juveniles, such as bottom trawl, continue to be permitted access.
10. The RAB **AGREED** that the IPHC Closed Area (Pacific Halibut Fishery Regulations 2019, Sect. 11) is not currently meeting its intended objective of protecting juvenile Pacific halibut when it is open to non-

directed fisheries, and **RECOMMENDED**, in coordination with the NPMFC, that the IPHC Secretariat examine alternative management regimes for the Closed Area, and for these to be presented at the 96th Session of the IPHC Annual Meeting (AM096) in 2020.

3.2.3 Chalky Pacific halibut

11. See discussion at item 6.3.2 below.

3.2.4 Benthic habitat mapping

12. The RAB **NOTED** that the IPHC has begun collecting bathymetric data during all IPHC fishery-independent setline survey (FISS), and that this was a requirement for all contracted vessels in 2019.

3.2.5 Calibration of snap versus fixed gear

13. See discussion at item 5.2 below.

3.2.6 Whale depredation

14. See discussion at item 6.3.1 below.

3.3 Outcomes of the 95th Session of the IPHC Annual Meeting (AM095)

15. The RAB **NOTED** paper IPHC-2019-RAB020-04 which provided the outcomes of the 95th Session of the IPHC Annual Meeting (AM095) relevant to the mandate of the RAB.

3.3.1 Total mortality accounting

16. The RAB **NOTED** that, at the AM095, the Commission recommended evaluating and redefining TCEY, and that the IPHC Secretariat will evaluate this question during the year leading up to AM096;

> AM095–Rec.04 (para. 66) *The Commission **RECOMMENDED** evaluating and redefining TCEY to include the U26 component of discard mortalities, including bycatch, as steps towards more comprehensive and responsible management of the resource, in coordination with the IPHC Secretariat and Contracting Parties. The intent is that each Contracting Party to the Treaty would be responsible for counting its U26 mortalities against its collective TCEY. This change would be intended to take effect for TCEYs established at the 2020 Annual Meeting*.

3.3.2 Empirical mortality limit-setting methodology

17. The RAB **NOTED** that the Commission discussed an empirical (survey-based) mortality limit-setting methodology at AM095, and that the IPHC Management Strategy Advisory Board is considering including such approaches in the IPHC Management Strategy Evaluation program of work, and **AGREED** that such an approach was worth considering:

> AM095 (para. 52) *The Commission **NOTED** the potential benefits in terms of transparency and simplicity, of a management procedure setting mortality limits directly from modelled survey results, particularly for long-lived species where year-to-year demographic change will be relatively minor*.

4. SEASON OVERVIEW

18. The RAB **NOTED** the following key 2018 fishing updates provided by RAB members.

4.1 Effect of yelloweye rockfish abundance on spatial distribution of Pacific halibut harvest

19. The RAB **NOTED** that an abundance of yelloweye rockfish (*Sebastes ruberrimus*) in IPHC Regulatory Area 2B in the vicinity of Haida Gwaii, in conjunction with relatively low bycatch limits, is resulting in an elimination of the Pacific halibut fishery from these areas and a shift in the spatial distribution of the fishery to other grounds in the Convention Area.

4.2 Marine mammal interactions

20. The RAB **NOTED** continuing interaction of the Pacific halibut longline fishery with marine mammals in IPHC Regulatory Areas 2B and 4D; additionally noting that the inshore grounds on 2B remain relatively

unaffected while both orca (*Orcinus orca*) and sperm whales (*Physeter macrocephalus*) were encountered along the continental shelf break; and that high rates of orca along the 4D continental shelf edge appear to be causing a marked shift in eastern Bering Sea fishing effort to the grounds adjacent to St. Matthew Island.

4.3 Effects of long-line gear on benthic habitats, lost gear, and spatial patterns in fishing

21. The RAB **NOTED** the limitations imposed on the fishing industry by the growing number of marine conservation areas that restrict particular fishing activities, and **REQUESTED** that the IPHC consider research examining the following aspects of the longline fishery:
    a. The impact of longline gear on the ocean bottom, including how much habitat disturbance is created by setting and retrieving the gear;
    b. The magnitude and impact of lost and abandoned longline gear over time; and
    c. The extent of the geographic footprint (the bottom area directly affected) of longline gear.
22. The RAB **NOTED** that the IPHC has recently provided data on lost gear in response to a request from the Pacific Halibut Management Association (PHMA), and intends to make such data publicly available on the website.
23. The RAB **NOTED** that the IPHC is currently engaged in a cooperative study with DFO to examine the footprint of the Pacific halibut fishery in Canada before and after rationalization of the fishery.

4.4 Black cod pot fishing

24. The RAB **NOTED** the increasing use of pot gear to fish for sablefish in Alaska, and **REQUESTED** the IPHC gather data on the effect of this shift, including potentially:
    a. How this change affects the catch of Pacific halibut in the sablefish fishery;
    b. How the gear shift in the sablefish fishery might drive whale predation toward the Pacific halibut fishery; and
    c. The change in these effects over time.
25. The RAB **NOTED** that the IPHC currently samples landings of Pacific halibut caught in pot gear in the same manner as Pacific halibut caught with longline gear.

4.5 Environmental effects in IPHC Regulatory Area 2A

26. The RAB **DISCUSSED** the potential effect of hypoxic zones on catch in the IPHC fishery-independent setline survey (FISS) as well as in the commercial fishery in IPHC Regulatory Area 2A, and **NOTED** that IPHC analysis to date has shown no meaningful effect on space-time modelling of survey data results over time.
27. The RAB **NOTED** the importance of monitoring domoic acid levels as part of oceanographic monitoring efforts and **SUGGESTED** that the IPHC consider the possibility of collecting domoic acid level information during the oceanographic monitoring conducted as part of the FISS.

4.6 Impact of recreational fishery releases

28. The RAB **NOTED** that large numbers of fish are handled in the recreational fisheries that may not be accounted for because they are discarded at unknown rates; that fishers may not employ careful release methods; that the range and relative distribution of handling practices and prior-hooking injuries is currently undocumented; and that the IPHC will initiate research in 2019 to investigate discard mortality rates (DMR) in the recreational fisheries.
29. The RAB **NOTED** the possibility of engaging recreational fishers in data collection efforts in order to better characterize the population of Pacific halibut released in the fishery, and **REQUESTED** that the IPHC Secretariat begin to explore such research possibilities, including guidance and best practices that might be required.

30. The RAB **NOTED** that recreational fishing logs may be left incomplete, in particular with regard to numbers of fish caught and released, and **REQUESTED** that the IPHC Secretariat work with relevant Contracting Party agencies to encourage and enforce complete data collection.

4.7 Animal handling practices in fisheries

31. The RAB **NOTED** the attention that animal handling and kill practices in other food industries have attracted, and **SUGGESTED** that documentation of best animal handling and kill practices in fisheries might be useful to the fishing industry.

4.8 Hook standardization

32. The RAB **NOTED** an impromptu presentation on the variation in hooks available to fishers, posing the question of whether such variation could affect CPUE in the commercial fishery and the IPHC FISS, or public perception of IPHC FISS results. The RAB **CONSIDERED** several options regarding this question, including:
    a. Continue with present FISS practice and note new developments in hook design as they take place, noting that the current FISS practice already incorporates a degree of variability in equipment among vessels participating in the FISS;
    b. Standardise the FISS to use a particular make and model hook, noting that there is no international standard for hook sizes;
    c. Conduct a study of catch using different hook designs, noting that differences in catchability could be difficult to detect among potentially confounding variables.
33. The RAB **RECOMMENDED** that the IPHC consider standardising the FISS to use a particular model hook and to encourage each vessel to begin its FISS contract work each year with all new hooks.

5. IPHC FISHERY-INDEPENDENT SETLINE SURVEY

5.1 2019 FISS season: Expansion in IPHC Regulatory Areas 3A and 3B

34. The RAB **NOTED** paper IPHC-2019-RAB020-06 which provided an overview of the International Pacific Halibut Commission's (IPHC) fishery-independent setline survey (FISS) design and implementation in 2019, including the last year of the expansion series in IPHC Regulatory Areas 3A and 3B.

5.2 2019 FISS gear comparison: Fixed versus snap gear in IPHC Regulatory Area 2C

35. The RAB **NOTED** that the IPHC Secretariat will be undertaking a gear comparison during the 2019 FISS to compare the catch-rates of fixed-hook and snap gear. The comparison will evaluate whether data from both gear types can be used in the calculation of indices, and how data collected on the FISS compare to that obtained from the snap and fixed-hook gear used by the commercial fishery. All stations in IPHC Regulatory Area 2C will be fished twice, once by the FISS standard of fixed-hook gear and once by snap gear (with the order of fishing by each gear assigned randomly).

5.3 Utility of the IPHC FISS as a research platform

36. The RAB **NOTED** that the FISS might be able to provide a research platform to help close data gaps in other oceanographic and marine biological research, for example, the density and extent of domoic acid-producing organisms.

6. DESCRIPTION OF IPHC RESEARCH ACTIVITIES

6.1 Overview: IPHC 5-year Biological and Ecosystem Sciences Research Program (2017-21)

37. The RAB **NOTED** paper IPHC-2019-RAB020-05 which outlined the research projects proposed to, and endorsed by, the Commission, and provided an overview of the IPHC's 5-year Biological and Ecosystem Sciences Research Program (2017-21).
38. The RAB **NOTED** that some of the proposed research elements are paired with the IPHC fishery-independent setline survey (FISS) each year.

39. The RAB **ENDORSED** the general approach to research detailed in paper IPHC-2019-RAB020-05 and encouraged the IPHC Secretariat to further engage with industry to determine if more hands-on research could be undertaken in collaboration with the fleet.

6.2 Core research streams: Updates for key ongoing research activities

6.2.1 Migration

6.2.1.1 Migratory behavior and distribution of Pacific halibut

40. The RAB **NOTED** paper IPHC-2018-RAB019-11, which outlined the research projects describing studies designed to improve our knowledge on Pacific halibut distribution and migration at all life stages, including the connectivity of Pacific halibut between the Gulf of Alaska and Bering Sea.
41. The RAB **NOTED** the ongoing IPHC research into Pacific halibut migration, and **REQUESTED** that the IPHC Secretariat incorporate into its research the question of how changing ocean conditions might affect both migration rates and stock distribution over time.

6.2.2 Reproduction

6.2.2.1 Reproductive assessment of the Pacific halibut population

42. The RAB **NOTED** paper IPHC-2019-RAB020-07, which outlined the research project describing studies designed to improve our knowledge on reproductive development in female and male Pacific halibut.

6.2.2.2 Sex-marking at sea and applications of genetics to determine the sex ratio of the commercial catch

43. The RAB **NOTED** paper IPHC-2019-RAB020-08, which outlined the completion of the at-sea sex marking project and the application of genetic assays for sex identification in the commercial landings.

6.2.3 Growth

6.2.3.1 Factors affecting somatic growth in Pacific halibut

44. The RAB **NOTED** paper IPHC-2019-RAB020-09, which outlined the studies on growth in juvenile Pacific halibut by the IPHC Secretariat.
45. The RAB **NOTED** that biological data on Pacific halibut caught in the FISS are now displayed in the interactive tools on the IPHC website.

6.2.4 Discard mortality rates

6.2.4.1 Discard mortality rates and post-release survival in the Pacific halibut fisheries

46. The RAB **NOTED** paper IPHC-2018-RAB019-10, which outlined the research project describing studies designed to improve our estimates of discard mortality rates in the directed Pacific halibut longline fishery.
47. The RAB **NOTED** that the IPHC Secretariat is working with the longline fleet to determine if there are improved ways to assess condition/injury classification relative to release methods, thereby providing improved data accuracy. This requires an ability to observe releases without influencing the handling of the fish.

6.2.5 Genetics and Genomics

6.2.5.1 Application of genetics and genomics to improve our knowledge on population structure and distribution

48. The RAB **NOTED** that current IPHC Project 2019-01 ("*Integrating migration and genetics research to refine Pacific halibut population structure, distribution and movement*") proposes studies to improve our understanding of spawning site contributions to nursery areas in relation to year-class and recruit survival and strength, as well as of the relationship between nursery origin and adult distribution and abundance over temporal and spatial scales through the application of genetic approaches to address management-

relevant questions on population structure, distribution and movement, and that this project includes collecting genetic samples from spawning fish in western IPHC Regulatory Area 4B to fill a lack of data from that area.

6.3 IPHC research topics selected for 2019

49. The RAB **CONSIDERED** the degree which the selection of IPHC-funded research projects is weighed against the economic value of problems to be studied and **NOTED** that the perceived importance of a particular issue, such as chalkiness, to either the fishery or the public may be a factor in deciding where to allocate research resources, notwithstanding the economic impact of the topic of scientific inquiry. Issues that have a bearing upon specific constituencies or harvest sectors may have economic impacts that are locally important but regionally less important.

6.3.1 Whale depredation

50. The RAB **NOTED** that the IPHC Secretariat had proposed a research project on whale detection methods to commence in 2018, though the Commission deferred the project's commencement to 2019 for budgetary reasons. Thus, the following project will be implemented during the 2019 fishing period: Project 2019-02 ("Whale detection methods") proposes testing electronic monitoring-based methods to detect whale presence in the directed longline Pacific halibut fishery.
51. The RAB **NOTED** that the IPHC Secretariat is engaged in research with other partners to evaluate the effectiveness of whale detection techniques.
52. The RAB **REQUESTED** that the IPHC Secretariat evaluate possible gear solutions for avoiding whale depredation, such as pot gear.

6.3.2 Alterations of flesh characteristics: chalky Pacific halibut

53. The RAB **NOTED** that the IPHC Secretariat is undertaking a survey in 2019 gather information that would assist in answering the following questions.
    a. What causes chalky flesh in Pacific halibut and to what degree? Are there particular environmental signatures (temperature, dissolved oxygen, etc.) that characterize areas with incidence of chalky flesh?
    b. Why does the occurrence of chalky flesh in Pacific halibut appear to be variable, i.e. high incidence until about 2010 and then reappearing after a period of limited occurrence in Regulatory Areas 3A and 3B in 2016, and again in 3A during the 2017 fishing period?
    c. Are there differences in the occurrence of chalky flesh in males and females, as well as fish of different sizes?
54. The RAB **NOTED** that offer from some RAB members to assist in development of the survey questionnaire to gather data on the incidence of chalky Pacific halibut, and that it would be useful when conducting the survey to recruit fishers and processors ahead of time so that they would be better prepared to provide useful data.

6.3.3 Bycatch reduction

55. The RAB **NOTED** the IPHC Secretariat is participating in Project 2019-04 ("*Use of LEDs to reduce Pacific halibut catches before trawl entrainment*"), which proposes evaluating whether artificial illumination (e.g. LEDs) in trawl gear can reduce Pacific halibut bycatch before trawl entrainment in relation to the physiological condition of the fish. This study will be performed in the framework of a Bycatch Reduction Engineering Program (BREP-NOAA)-funded study led by Pacific States Marine Fisheries Commission, in which the IPHC is a collaborating partner.

7. GUIDANCE ON, AND DISCUSSION OF, OTHER POTENTIAL APPLIED RESEARCH PROJECTS

56. The RAB **NOTED** a request from the IPHC Secretariat to consider acceptable levels of aggregation and/or elapsed time for making commercial logbook data public, noting that this might make it easier to use the data in support of public presentation and discussion within the IPHC process, as well as making more

historical data available to the public than is now the case under the IPHC's current data confidentiality practices.

8. OTHER BUSINESS

8.1 Date and place of the 21st and 22nd Sessions of the IPHC Research Advisory Board

57. The RAB **NOTED** the IPHC meetings calendar (2019-21) adopted by the Commission at its 95th Session included the next two Sessions of the RAB.

58. The RAB **REQUESTED** that the IPHC Secretariat consider dates earlier in February for RAB021 and RAB022 in order to enable better participation by current or potential RAB members.

9. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 20TH SESSION OF THE IPHC RESEARCH ADVISORY BOARD (RAB020)

59. The report of the 20th Session of the Research Advisory Board (IPHC-2019-RAB020-R) was **ADOPTED** via correspondence on 5 March 2019, including the consolidated set of recommendation and requests arising from the RAB020, provided at Appendix IV.

APPENDIX I
LIST OF PARTICIPANTS

RAB Officers

Chairperson	Vice-Chairperson
Dr David T. **Wilson** *(apologies)* Executive Director, International Pacific Halibut Commission Email: david.wilson@iphc.int	Dr Josep **Planas** Branch Head: Biological and Ecosystem Sciences Branch, International Pacific Halibut Commission Email: josep.planas@iphc.int

RAB Members

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Mr Dave **Boyes** Email: mcboyes@icloud.com	Mr Steve **Daniels** Email: sdindigo@gmail.com
	Mr Lando **Echevario** Email: lechevario@yahoo.com
	Mr Jim **Hubbard** Email: kruzof@ak.net
	Mr Scott **Mazzone** Email: smazzone@quinault.org
	Mr Charles **McEldowney** Email: charlesM@icicleseafoods.com
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Absent	
Mr Art **Davidson** Email: artdavidson@telus.net	Mr Stephen **Rhoads** Email: deep_pow@hotmail.com
Mr Brad **Mirau** Email: brad@aerotrading.ca	Mr Lu **Dochtermann** Email: DochtermannLudger@gmail.com
Mr Richie **Shaw** Email: SOIpow@recn.ca	Mr Jay **Hebert** Email: jjpeche@comcast.net

Observers

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Mr Jahn Hoel	Mustad Autoline	jnh@mustadautoline.com

IPHC Secretariat

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Ms Dana Rudy	Age Lab Technician	dana.rudy@iphc.int

APPENDIX II
AGENDA FOR THE 20TH SESSION OF THE IPHC RESEARCH ADVISORY BOARD (RAB020)

Date: 27 February 2019
Location: Seattle, Washington, U.S.A.
Venue: IPHC Training Room, Salmon Bay
Time: 09:00-17:30
Chairperson: Dr David T. Wilson (IPHC Executive Director)
Vice-Chairperson: Dr Josep Planas (IPHC Biological & Ecosystem Sciences Branch Manager)

1. **OPENING OF THE SESSION** (Chairperson)

2. **ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION** (Chairperson)

3. **IPHC PROCESS**
   - 3.1 IPHC Rules of Procedure (2019)
   - 3.2 Update on the actions arising from the 19th Session of the RAB (RAB019)
   - 3.3 Outcomes of the 95th Session of the IPHC Annual Meeting (AM095)

4. **SEASON OVERVIEW: RAB MEMBERS**

5. **IPHC FISHERY-INDEPENDENT SETLINE SURVEY (FISS)**
   - 5.1 2019 FISS season: Expansion in IPHC Regulatory Areas 3A and 3B (R. Webster)
   - 5.2 2019 FISS gear comparison: Fixed versus snap gear in IPHC Regulatory Area 2C (I. Stewart)

6. **DESCRIPTION OF IPHC RESEARCH ACTIVITIES** (J. Planas & Project leaders)
   - 6.1 Overview: IPHC 5-year Biological and Ecosystem Sciences Research Plan (2017-21) (J. Planas)
   - 6.2 Core research streams: Updates for key ongoing research activities (Project leaders)
     - **6.2.1 Migration**
       - 6.2.1.1 Migratory behaviour and distribution of Pacific halibut (T. Loher, L. Sadorus)
     - **6.2.2 Reproduction**
       - 6.2.2.1 Reproductive assessment of the Pacific halibut population (J. Planas)
       - 6.2.2.2 Sex-marking at sea and applications of genetics to determine the sex ratio of the commercial catch (T. Loher, J. Planas)
     - **6.2.3 Growth**
       - 6.2.3.1 Factors affecting somatic growth in Pacific halibut (J. Planas)
     - **6.2.4 Discard mortality rates**
       - 6.2.4.1 Discard mortality rates and post-release survival in the Pacific halibut fisheries (C. Dykstra)
     - **6.2.5 Genetic and Genomics**
       - 6.2.5.1 Application of genetics and genomics to improve our knowledge on population structure and distribution (J. Planas)
   - 6.3 IPHC research topics selected for 2019 (J. Planas)
     - Whale depredation
     - Alterations of flesh characteristics: chalky Pacific halibut

7. GUIDANCE ON, AND DISCUSSION OF, OTHER POTENTIAL APPLIED RESEARCH PROJECTS (Chairperson)

8. OTHER BUSINESS

8.1 Date and place of the 21st and 22nd Sessions of the IPHC Research Advisory Board (Chairperson)

9. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 20th SESSION OF THE IPHC RESEARCH ADVISORY BOARD (RAB020) (Chairperson)

APPENDIX III
LIST OF DOCUMENTS FOR THE 20TH SESSION OF THE IPHC RESEARCH ADVISORY BOARD (RAB020)

Document	Title	Availability
IPHC-2019-RAB020-01	Agenda & Schedule for the 20th Session of the IPHC Research Advisory Board (RAB020)	✓ 14 Nov 2018 ✓ 17 Jan 2019
IPHC-2019-RAB020-02	List of Documents for the 20th Session of the IPHC Research Advisory Board (RAB020)	✓ 22 Jan 2019 ✓ 11 Feb 2019
IPHC-2019-RAB020-03	Update on the actions arising from the 19th Session of the RAB (RAB019) (D. Wilson & J. Planas)	✓ 17 Jan 2019
IPHC-2019-RAB020-04	Outcomes of the 95th Session of the IPHC Annual Meeting (AM095) (IPHC Secretariat)	✓ 11 Feb 2019
IPHC-2019-RAB020-05	Overview: IPHC 5-year biological and ecosystem sciences research program (2017-21) (J. Planas)	✓ 17 Jan 2019
IPHC-2019-RAB020-06	IPHC fishery-independent setline survey (FISS) design and implementation in 2019 (R. Webster & I. Stewart)	✓ 23 Jan 2019
IPHC-2019-RAB020-07	Reproductive assessment of the Pacific halibut population (J. Planas)	✓ 22 Jan 2019
IPHC-2019-RAB020-08	Sex identification of commercial landings (J. Planas)	✓ 23 Jan 2019
IPHC-2019-RAB020-09	Factors affecting somatic growth in juvenile Pacific halibut (J. Planas)	✓ 22 Jan 2019
IPHC-2019-RAB020-10	Discard mortality rates and post-release survival in the directed Pacific halibut fishery (C. Dykstra)	✓ 22 Jan 2019
IPHC-2019-RAB020-11	Migratory behavior and distribution of Pacific halibut (T. Loher, J. Forsberg & L. Sadorus)	✓ 23 Jan 2019
IPHC-2019-RAB020-12	IPHC research topics selected for 2019 (J. Planas)	✓ 22 Jan 2019

APPENDIX IV

CONSOLIDATED SET OF RECOMMENDATIONS OF THE 20TH SESSION OF THE IPHC RESEARCH ADVISORY BOARD (RAB020) TO THE COMMISSION

RECOMMENDATIONS

IPHC Closed Area

RAB020-Rec.01 (para. 10) The RAB **AGREED** that the IPHC Closed Area (Pacific Halibut Fishery Regulations 2019, Sect. 11) is not currently meeting its intended objective of protecting juvenile Pacific halibut when it is open to non-directed fisheries, and **RECOMMENDED**, in coordination with the NPMFC, that the IPHC Secretariat examine alternative management regimes for the Closed Area, and for these to be presented at the 96th Session of the IPHC Annual Meeting (AM096) in 2020.

Hook standardization

RAB020-Rec.02 (para. 33) The RAB **RECOMMENDED** that the IPHC consider standardising the FISS to use a particular model hook and to encourage each vessel to begin its FISS contract work each year with all new hooks.

REQUESTS

Effects of long-line gear on benthic habitats, lost gear, and spatial patterns in fishing

RAB020-Req.01 (para. 21) The RAB **NOTED** the limitations imposed on the fishing industry by the growing number of marine conservation areas that restrict particular fishing activities, and **REQUESTED** that the IPHC consider research examining the following aspects of the longline fishery:

a. The impact of longline gear on the ocean bottom, including how much habitat disturbance is created by setting and retrieving the gear;
b. The magnitude and impact of lost and abandoned longline gear over time; and
c. The extent of the geographic footprint (the bottom area directly affected) of longline gear.

Black cod pot fishing

RAB020-Req.02 (para. 24) The RAB **NOTED** the increasing use of pot gear to fish for sablefish in Alaska, and **REQUESTED** the IPHC gather data on the effect of this shift, including potentially:

a. How this change affects the catch of Pacific halibut in the sablefish fishery;
b. How the gear shift in the sablefish fishery might drive whale predation toward the Pacific halibut fishery; and
c. The change in these effects over time.

Impact of recreational fishery releases

RAB020-Req.03 (para. 29) The RAB **NOTED** the possibility of engaging recreational fishers in data collection efforts in order to better characterize the population of Pacific halibut released in the fishery, and **REQUESTED** that the IPHC Secretariat begin to explore such research possibilities, including guidance and best practices that might be required.

RAB020-Req.04 (para. 30) The RAB **NOTED** that recreational fishing logs may be left incomplete, in particular with regard to numbers of fish caught and released, and **REQUESTED** that the IPHC Secretariat work with relevant Contracting Party agencies to encourage and enforce complete data collection.

Migration

RAB020-Req.05 (para. 41) The RAB **NOTED** the ongoing IPHC research into Pacific halibut migration, and **REQUESTED** that the IPHC Secretariat incorporate into its research the question of how changing ocean conditions might affect both migration rates and stock distribution over time.

Whale depredation

RAB020-Req.06 (para. 52) The RAB **REQUESTED** that the IPHC Secretariat evaluate possible gear solutions for avoiding whale depredation, such as pot gear.

Date and place of the 21st and 22nd Sessions of the IPHC Research Advisory Board

RAB020-Req.07 (para. 58) The RAB **REQUESTED** that the IPHC Secretariat consider dates earlier in February for RAB021 and RAB022 in order to enable better participation by current or potential RAB members.

Report of the 14th Session of the IPHC Scientific Review Board (SRB014)

Seattle, Washington, U.S.A., 26-28 June 2019

Commissioners

Canada	United States of America
Paul Ryall	Chris Oliver
Neil Davis	Robert Alverson
Peter DeGreef	Richard Yamada

Executive Director
David T. Wilson, Ph.D.

DISTRIBUTION:
Participants in the Session
Members of the Commission
IPHC Secretariat

BIBLIOGRAPHIC ENTRY
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ACRONYMS

AM	Annual Meeting
CDN	Canada
IPHC	International Pacific Halibut Commission
MSAB	Management Strategy Advisory Board
MSE	Management Strategy Evaluation
NPUE	Number-Per-Unit-Effort
PDO	Pacific Decadal Oscillation
SB	Spawning Biomass
SRB	Scientific Review Board
TCEY	Total Constant Exploitable Yield
U.S.A.	United States of America
WPUE	Weight-Per-Unit-Effort

DEFINITIONS

A set of working definitions are provided in the IPHC Glossary of Terms and abbreviations: https://iphc.int/the-commission/glossary-of-terms-and-abbreviations

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

This report has been written using the following terms and associated definitions so as to remove ambiguity surrounding how particular paragraphs should be interpreted.

Level 1: **RECOMMENDED**; **RECOMMENDATION; ADOPTED** (formal); **REQUESTED; ENDORSED** (informal): A conclusion for an action to be undertaken, by a Contracting Party, a subsidiary (advisory) body of the Commission and/or the IPHC Secretariat.

Level 2: **AGREED**: Any point of discussion from a meeting which the Commission considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 above; a general point of agreement among delegations/participants of a meeting which does not need to be elevated in the Commission's reporting structure.

Level 3: **NOTED/NOTING**; **CONSIDERED**; **URGED**; **ACKNOWLEDGED**: General terms to be used for consistency. Any point of discussion from a meeting which the Commission considers to be important enough to record in a meeting report for future reference. Any other term may be used to highlight to the reader of an IPHC report, the importance of the relevant paragraph. Other terms may be used but will be considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3.

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EXECUTIVE SUMMARY

The 14th Session of the International Pacific Halibut Commission (IPHC) Scientific Advisory Board (SRB014) was held in Seattle, WA, U.S.A. from 26-28 June 2019. The SRB consists of five (5) board members, required to be independent of the Contracting Parties. Two (2) individuals attended the Session as Observers. The meeting was opened by the Chairperson, Dr Sean Cox (Canada), and the Executive Director, Dr David Wilson, who welcomed participants to Seattle.

The following are a subset of the complete recommendations/requests for action from the MSAB013, which are provided in full at Appendix IV.

RECOMMENDATIONS

NOTING that the core purpose of the SRB014 is to review progress on the IPHC science program, and to provide guidance for the delivery of products to the SRB015 in September 2019, the SRB RECALLED that formal recommendations to the Commission would not be developed at the present meeting, but rather, these would be developed at the SRB015.

REQUESTS

Methods for spatial setline survey modelling – Program of work for 2019

SRB014–Req.01 (para. 14) The SRB **REQUESTED** analysis of past prediction patterns (a type of cross-validation analysis) to help assess the proposed methods' ability to meet precision targets while maintaining low bias. This should include an examination of spatio-temporal residual patterns for the appropriateness of estimated autocorrelation.

Pacific halibut stock assessment: 2019 - Modelling updates

SRB014–Req.01 (para. 27) The SRB **REQUESTED** the following additional analyses for evaluation in September:

a) The Pacific Decadal Oscillation (PDO) index affects results that correspond with the presence and absence of FISS age data. As a check, perhaps evaluate models with the selectivity for the FISS fixed at the current estimates but then do a run which completely down-weights the FISS age data. This is intended as a check for the PDO coefficient.

b) Evaluate a profile (coarse) over steepness, e.g. 0.65 and 0.85, and check the impact on recruitment estimates and RSB values.

Management Strategy Evaluation: update

SRB014–Req.01 (para. 32) The SRB **REQUESTED** that the new operating model be used to generate simulated input data sets for simulation testing estimation performance of the current assessment ensemble. The SRB looks forward to reviewing these results as part of the full review of the assessment in 2022 or thereafter.

Research integration

SRB014–Req.01 (para. 48) The SRB **REQUESTED** clarification on how the juvenile spatial distribution analyses and simulations will be used/incorporated into operating models. The SRB can only assume that these will be used to develop an age-dependent transition matrix for < 100 cm fish.

SRB014–Req.01 (para. 52) The SRB **REQUESTED** preliminary results for steps (a)-(c) (paragraph 51) for the September 2019 meeting.

1. Opening of the Session

1. The 14th Session of the International Pacific Halibut Commission (IPHC) Scientific Review Board (SRB014) was held in Seattle, Washington, U.S.A. from 26 to 28 June 2019. The list of participants is provided at Appendix I. The meeting was opened by the Chairperson, Dr Sean Cox (Canada), and the Executive Director, Dr David Wilson, who welcomed participants to Seattle.

2. The SRB **RECALLED** its mandate, as detailed in Appendix VIII, Sect. I, para. 1-3 of the IPHC Rules of Procedure (2019):

   1. *The Scientific Review Board (SRB) shall provide an independent scientific peer review of Commission science/research proposals, programs, and products, including but not limited to:*
      a. *Stock assessment;*
      b. *Management Strategy Evaluation;*
      c. *Migration;*
      d. *Reproduction;*
      e. *Growth;*
      f. *Discard survival;*
      g. *Genetics and Genomics;*
   2. *Undertake periodic reviews of science/research strategy, progress, and overall performance.*
   3. *Review the recommendations arising from the MSAB and the RAB.*

2. Adoption of the Agenda and Arrangements for the Session

3. The SRB **ADOPTED** the Agenda as provided at Appendix II. The documents provided to the SRB are listed in Appendix III. Participants were reminded that all documents for the meeting were published on the IPHC website, 30 days prior to the Session: https://www.iphc.int/venues/details/14th-session-of-the-iphc-scientific-review-board-srb014.

3. IPHC process

3.1 SRB annual workflow

4. **NOTING** that the core purpose of the SRB014 is to review progress on the IPHC science program, and to provide guidance for the delivery of products to the SRB015 in September 2019, the SRB **RECALLED** that formal recommendations to the Commission would not be developed at the present meeting, but rather, these would be developed at the SRB015.

3.2 Update on the actions arising from the 13th Session of the SRB (SRB013)

5. The SRB **NOTED** paper IPHC-2019-SRB014-03, which provided the SRB with an opportunity to consider the progress made during the inter-sessional period, in relation to the consolidated list of recommendations/requests arising from the previous SRB meeting (SRB013).

6. The SRB **AGREED** to consider and revise the actions as necessary, and to combine them with any new actions arising from SRB014 into a consolidated list for future reporting.

3.3 Outcomes of the 95th Session of the IPHC Annual Meeting (AM095)

7. The SRB **NOTED** paper IPHC-2019-SRB014-04 which detailed the outcomes of the 95th Session of the IPHC Annual Meeting (AM095), relevant to the mandate of the SRB, and **AGREED** to consider how best to provide the Commission with the information it has requested, throughout the course of the current SRB meeting.

3.4 Observer updates

8. The SRB **NOTED** updates from the two science advisors, who provided brief overviews of some of the points of clarification being sought from the present SRB meeting. These included, but were not limited to: 1) explanations of FISS trends in comparison to fishery trends; 2) degrees of spatial and temporal connectivity among areas/regions; 3) consideration of MSY-based reference points; 4) the current intention of the IPHC to move from a coastwise stock assessment to an area-based model; 5) juvenile (pre-reproductive) Pacific halibut population changes; 6) options for distributing the TCEY spatially; and 7) justifications for using biological regions in comparison to IPHC Regulatory areas.

4. INDEPENDENT EXTERNAL PEER REVIEW OF THE IPHC STOCK ASSESSMENT: UPDATE ON THE PROCESS

9. The SRB **RECALLED** that at the 95th Session of the IPHC Annual Meeting (AM095), the Commission made the following recommendation regarding a peer review of the IPHC stock assessment:

> ***Peer review process for IPHC science products***
> AM095–Rec.10 (para. 129) *The Commission **RECOMMENDED** that the IPHC Secretariat develop terms of reference for a consultant to undertake a peer review of the IPHC Pacific halibut stock assessment, for implementation in early 2019. The terms of reference and budget shall be endorsed by the Commission inter-sessionally.*

10. The SRB **NOTED** that:

    a) the IPHC Secretariat provided the SRB with draft terms of reference for the peer review on 1 April 2019;

    b) comments/endorsement were provided by all SRB members through 5 April 2019;

    c) in accordance with AM095-Rec.10, on 5 April 2019 the IPHC Secretariat circulated IPHC Circular 2019-005 which contained the Draft "*Open call for expressions of interest: Independent peer reviewer for the IPHC stock assessment*", for Contracting Party review and endorsement;

    d) the Commission endorsed the open call for expressions of interest on 17 April 2019, via IPHC Circular 2019-010;

    e) following the expression of interest period, and under a mandate from the lead Commissioners, the IPHC Secretariat recruited Dr Kevin Stokes to undertake the Independent peer review;

    f) expected delivery of the independent peer review: 1) draft report 15 August 2019; 2) final report 31 August 2019; 3) electronic presentation at SRB015 (24-26 September 2019).

5. IPHC FISHERY-INDEPENDENT SETLINE SURVEY (FISS)

5.1 Methods for spatial setline survey modelling – Program of work for 2019

11. The SRB **NOTED** paper IPHC-2019-SRB014-05 Rev_1, which proposed methods for assessing options for a rationalised IPHC fishery-independent setline survey (FISS) following completion of the planned FISS expansions in 2019.

12. The SRB **NOTED** that the proposed precision targets for WPUE and NPUE indices for management units (IPHC Regulatory Areas, biological regions, and the coastwide stock), along with the use of estimates of past changes to stock distribution within management units, provided a balanced approach for determining sampling priorities for future setline survey designs.

13. The SRB **NOTED** the use of space-time modelling with simulated data to project uncertainty for potential future FISS designs.

14. The SRB **REQUESTED** analysis of past prediction patterns (a type of cross-validation analysis) to help assess the proposed methods' ability to meet precision targets while maintaining low bias. This should include an examination of spatio-temporal residual patterns for the appropriateness of estimated autocorrelation.
15. The SRB **AGREED** that for future presentations, all Coefficient of Variation's (CV) should be rounded to whole percentages.
16. The SRB **NOTED** that the "middle ground" for selecting criteria for survey stations (i.e. sub-areas) as it sits between over-reliance on optimisation at one end versus random FISS station selection at the other. The treatment of whale depredation seems appropriate.
17. The SRB **NOTED** that the analysts could examine the covariance over years (for the FISS index data) to evaluate the potential correlation among years. This should help determine whether further steps are needed to include such covariance in the assessment model.

6. PACIFIC HALIBUT STOCK ASSESSMENT: 2019

18. The SRB **NOTED** paper IPHC-2019-SRB014-07, which provided a preliminary analysis in development of the 2019 Pacific halibut stock assessment.
19. The SRB **NOTED** that following the review of the preliminary assessment, requested revisions will be considered and presented for final review in September 2019 (SRB015). Updated data sources, including the results of the 2019 Fishery-Independent Setline Survey (FISS), logbook and biological data from the 2019 commercial fishery, and (potentially) sex-ratio information from the 2018 commercial landings-at-age will be included for the final 2019 analysis.

6.1 Data source development

20. The SRB **NOTED** that the most current summary of data (2018) used for stock assessment and MSE analyses are provided in paper IPHC-2019-AM095-08, titled "*Overview of data sources for the Pacific halibut stock assessment, harvest policy, and related analyses*".
21. The SRB **NOTED** that two new or revised sources of data were included in the preliminary 2019 stock assessment:
    a) Sex-ratio at age information from the 2017 commercial fishery landings;
    b) A revised time-series of Numbers-Per-Unit-Effort from the space-time model including revised criteria for determining a station to be ineffective based on observed or suspected whale depredation (more strict relative to historical analyses).

6.2 Modelling updates

22. The SRB **NOTED** the 2018 stock assessment (IPHC-2019-AM095-09) provides a summary of stock assessment results through the beginning of 2019, serving as a starting point for the preliminary 2019 stock assessment.
23. The SRB **NOTED** that the same approach of using an ensemble of four (4) models to estimate management quantities has been employed since 2015, with only minor changes and updates to data sources as available.
24. The SRB **NOTED** that the preliminary 2019 assessment provided a 'bridging' analysis, showing the incremental changes made for several steps in model development. These steps included:
    a) Updating to the newest software available (stock synthesis version 3.30);
    b) Adding the 2017 sex-ratio data;
    c) Extending the time-series of the two short models to include 1992+, allowing for the use of all available years of the space-time model estimated survey indices (1993+);

d) Replacing the previous survey index of abundance with the series corrected for improved whale depredation criteria;

e) Regularizing and tuning each model to ensure convergence and internal consistency among process error (recruitment, selectivity, and catchability variation), and observation error (input sample sizes).

25. The SRB **NOTED** that overall the changes made in the preliminary assessment, particularly the effects of adding the commercial sex-ratio data and removing the link between fishery and survey selectivity had the result of increasing the estimates of spawning biomass. Extending the time-series and adding the survey index using revised whale depredation criteria had little effect on the results, and the tuning process had mixed results across models.

26. The SRB **NOTED** the sensitivity and retrospective analyses, including comparison of Bayesian results for the coastwide short model and the evaluation of the sources of uncertainty.

27. The SRB **REQUESTED** the following additional analyses for evaluation in September:

a) The Pacific Decadal Oscillation (PDO) index affects results that correspond with the presence and absence of FISS age data. As a check, perhaps evaluate models with the selectivity for the FISS fixed at the current estimates but then do a run which completely down-weights the FISS age data. This is intended as a check for the PDO coefficient.

b) Evaluate a profile (coarse) over steepness, e.g. 0.65 and 0.85, and check the impact on recruitment estimates and RSB values.

28. The SRB **NOTED** the discussion of ensemble methods and the transition to dynamic relative spawning biomass for consistency with the results of the MSE process and to eliminate the use of arbitrary historical constants in the calculations.

29. The SRB **NOTED** the discussion of research priorities, highlighting the ongoing activities of the Biological and Ecosystem Sciences Research Program as well as a large number of data-related and technical avenues for development.

30. The SRB **NOTED** a brief discussion regarding paper IPHC-2019-AM095-INF08, presented at the 95th Session of the IPHC Annual Meeting (AM095) in January 2019, and **AGREED** to consider the need for further discussion at SRB015, inter-sessionally.

7. MANAGEMENT STRATEGY EVALUATION: UPDATE

31. The SRB **NOTED** paper IPHC-2019-SRB014-08 which provided the SRB with an update on the IPHC MSE process including defining objectives, results for management procedures related to coastwide fishing intensity, a framework for distributing the TCEY, and a program of work.

32. The SRB **REQUESTED** that the new operating model be used to generate simulated input data sets for simulation testing estimation performance of the current assessment ensemble. The SRB looks forward to reviewing these results as part of the full review of the assessment in 2022 or thereafter.

7.1 Outcomes of MSAB013

33. The SRB **NOTED** the report of the 13th Session of the IPHC Management Strategy Advisory Board (MSAB013) (IPHC-2019-MSAB013-R).

34. The SRB **NOTED** that following request arising from MSAB013:

Goals, objectives, and performance metrics

MSAB013–Req.02 (para. 38) *The MSAB **REQUESTED** that the Scientific Review Board (SRB) and the IPHC Secretariat consider the draft objectives contained within Table 1 and to provide advice to the MSAB on potential MSY and MEY proxy target reference points for objective 2.1B.*

35. The SRB **NOTED** that:

    a) the primary objectives used to evaluate management procedures related to coastwide scale and the additional primary objectives related to a target biomass;

    b) three methods will be used to investigate BMSY for Pacific halibut;

    c) no coast-wide management procedure without constraints met the stability objective;

    d) three different constraints were ranked in the top 5 management procedures (a slow-up fast-down approach, a maximum change of 15%, and a multi-year limit).

36. The SRB **AGREED** that objective 2.1B is sensible because unlike 2.1A (from Appendix V of MSAB013 report: IPHC-2019-MSAB013-R) does not conflate the objective and the management procedure.

37. The SRB **NOTED** that the choice of SB target in 2.1B (from Appendix V of MSAB013 report: IPHC-2019-MSAB013-R) will have implications for the SPR target in the management procedure. Ultimately, the specific value of the SB target is a management choice, involving a range of trade-offs with other objectives.

7.2 Updates to MSE framework and closed-loop simulations

38. The SRB **ACKNOWLEDGED** and appreciated the important investment in staff and resources allocated to the MSE work.

39. The SRB **NOTED** that:

    a) the distribution framework consisting of a coastwide TCEY distributed to Biological Regions based on stock distribution, relative fishing intensities and other regional allocation adjustments, and then distribution to IPHC Regulatory Areas based other data, observations, or agreement.

    b) the development of a closed-loop simulation framework to evaluate management procedures related to coastwide scale and distribution of the TCEY.

40. The SRB **NOTED** the development of online tools that MSAB can use to explore the implications and trade-offs between Objectives.

7.3 MSAB Program of Work and delivery of timeline for 2019-21

41. The SRB **NOTED** the MSE Program of Work, including the presentation of results for the MSE investigating the full harvest strategy policy that is scheduled to occur at the 97th Annual Meeting in early 2021. The SRB will review the technical details of the framework and operating model in September 2019, see preliminary results in June 2020, and review the full MSE in September 2020.

8. BIOLOGICAL AND ECOSYSTEM SCIENCE PROGRAM RESEARCH UPDATES

8.1 Five-year research plan and management implications: update

42. The SRB **NOTED** paper IPHC-2019-SRB014-09 which provided the SRB with an update on current progress on research projects conducted and planned within the IPHC's five-year research plan (2017-21).

43. The SRB **NOTED** the temporal link of listed detailed outputs from the IPHC's five-year research plan (2017-21) with specific inputs into the Stock Assessment and Management Strategy Evaluation process.

8.2 Progress on ongoing research projects

44. The SRB **NOTED** the progress on ongoing research projects contemplated within the IPHC's five year research plan (2017-2021) involving

a) Discard mortality rates, which have been estimated in the longline fishery and that the relationship between capture or handling conditions and injuries and physiological stress levels sustained are being investigated;

b) Progress on the identification of physiological markers in skeletal muscle of temperature-induced growth manipulations in juvenile Pacific halibut;

c) Initial results on the annual progression of ovarian growth, as assessed by the gonadosomatic index, and of field maturity stages, as assessed macroscopically, in female Pacific halibut during an entire reproductive cycle;

d) Continuing efforts to generate a first complete draft of the Pacific halibut genome.

45. The SRB **NOTED** future research (2020) aimed at improving understanding of population structure by collecting samples from spawning grounds.

8.3 Focus on population genetics and migration studies

8.3.1 Summary of past studies

46. **RECALLING** the request from SRB013 (below), the SRB **NOTED** presentation IPHC-2019-SRB014-09 ppt, titled "Migration and population genetics research at IPHC".

SRB013–Req.03 (para. 41) *Biological research updates:*
The SRB REQUESTED that specific research topics, analysis and results be addressed in depth at subsequent SRB meetings, and that at SRB014, a presentation focused on population genetics and migration as they relate to the stock assessment and MSE work be provided. For example, how does this work identify alternative hypotheses for movement and population structure that can be considered in the MSE process and the stock assessment.

9. RESEARCH INTEGRATION

47. The SRB **NOTED** improved interaction, collaboration, and iteration between biological and modelling research programs, although some of the migration research seems to be bottom-up, driven mainly by data collection and ecological hypotheses rather than by precisely defined questions related to assessment and harvest policy development.

48. The SRB **REQUESTED** clarification on how the juvenile spatial distribution analyses and simulations will be used/incorporated into operating models. The SRB can only assume that these will be used to develop an age-dependent transition matrix for < 100 cm fish.

49. The SRB **NOTED** that empirical data and models (e.g. space-time models for juvenile density in Bering Sea (BS) trawl survey) continue to be generated, but it is not clear (i) how the quality of the models is being assessed and (ii) how the model outputs will link to assessments and operating models. For example, there was no presentation of model fits and diagnostics for the juvenile BS space-time distribution model. This is needed to ensure that model outputs produce relevant information for <100 cm fish in operating models, if that is the ultimate intent.

50. The SRB **URGED** the IPHC Secretariat take a more formal approach to developing research priorities, integrating research programs among biological, assessment, and MSE programs. For example, assessment results showing potential sensitivity to new demographic information (e.g. sex ratio in catch) was noted and subsequently identified as a high research priority. There are other aspects of demography that should also be jointly investigated for sensitivity. For example, size/age-at-maturation and frequency of reproduction could have serious consequences for assessments and MSE if these traits change over age, space, time, etc.

51. The SRB **NOTED** that maturity involves an ideal set of topics where the biological and modelling programs could work iteratively to:

a) develop plausible hypotheses for these traits

b) construct models to incorporate these hypotheses into the assessment model (and also operating models)

c) explore sensitivity of assessment model outputs to alternative hypotheses. At this point, a new iteration could proceed to determine whether new empirical data are needed and subsequently designing research. Also, the programs could jointly determine whether to expand the ensemble to incorporate these models.

52. The SRB **REQUESTED** preliminary results for steps (a)-(c) (paragraph 51) for the September 2019 meeting.

9.1 Research priorities

53. The SRB **REQUESTED** that an integrated set of future research priorities be presented jointly after the conclusion of the stock assessment, MSE, and biological program presentations. Integrated, in this context, means that priorities are co-developed by the program leads of the three groups. For example, a Table of Research Priorities could include the following columns: Rank, Topic, Justification, Lead Responsibility. Such a table will allow the SRB and Secretariat to effectively fill-in details and assess viability of the research.

10. Review of the draft and adoption of the report of the 14th Session of the IPHC Scientific Review Board (SRB014)

54. The report of the 14th Session of the IPHC Scientific Review Board (IPHC-2019-SRB014-R) was **ADOPTED** on 28 June 2019, including the consolidated set of recommendations and/or requests arising from SRB014, provided at Appendix IV.

APPENDIX I
LIST OF PARTICIPANTS FOR THE 14TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB014)

SRB Members

Dr Sean **Cox**:	spcox@sfu.ca; Associate Professor, School of Resource and Environmental Management, Simon Fraser University, 8888 University Dr., Burnaby, B.C., Canada V5A 1S6
Dr James **Ianelli**:	jim.ianelli@noaa.gov; Research Scientist, National Marine Fisheries Service-NOAA, 7600 Sand Pt Way NE, Seattle, WA, U.S.A., 98115
Dr Sven **Kupschus**:	sven.kupschus@cefas.co.uk; Principal Fisheries Research Scientist, CEFAS, Pakefield Road, Lowestoft NR33 0HT, UK
Dr Marc **Mangel**:	msmangel@ucsc.edu; Distinguished Research Professor and Director, Center for Stock Assessment Research, University of California, Santa Cruz, CA, U.S.A., 95064
Dr Kim **Scribner**:	scribne3@msu.edu; Professor, Department of Fisheries and Wildlife, Michigan State University, 2E Natural Resources Building, East Lansing, MI, U.S.A., 48824

Observers

Canada	United States of America
Ms Ann-Marie **Huang**: Ann-Marie.Huang@dfo-mpo.gc.ca	Dr Carey **McGilliard**: carey.mcgillard@noaa.gov

IPHC Secretariat

Name	Position and email
Dr David **Wilson**	Executive Director, david.wilson@iphc.int
Dr Piera **Carpi**	MSE Researcher, piera.carpi@iphc.int
Dr Allan **Hicks**	Quantitative Scientist, allan.hicks@iphc.int
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Dr Josep **Planas**	Biological and Ecosystem Sciences Branch Manager, josep.planas@iphc.int
Ms Lauri **Sadorus**	Research Biologist, lauri.sadorus@iphc.int
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Dr Ray **Webster**	Quantitative Scientist, ray.webster@iphc.int

APPENDIX II
AGENDA FOR THE 14TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB014)

Date: 26-28 June 2019
Location: Seattle, Washington, U.S.A.
Venue: IPHC Board Room, Salmon Bay
Time: 12:00-17:00 (26th), 09:00-17:00 (27th), 09:00-17:00 (28th)
Chairperson: Dr Sean Cox (Simon Fraser University)
Vice-Chairperson: Nil

1. OPENING OF THE SESSION

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

3. IPHC PROCESS
- 3.1. SRB annual workflow (D. Wilson)
- 3.2. Update on the actions arising from the 13th Session of the SRB (SRB013) (D. Wilson)
- 3.3. Outcomes of the 95th Session of the IPHC Annual Meeting (AM095) (D. Wilson)
- 3.4. Observer updates (e.g. Science Advisors)

4. INDEPENDENT EXTERNAL PEER REVIEW OF THE IPHC STOCK ASSESSMENT: UPDATE ON THE PROCESS

5. IPHC FISHERY-INDEPENDENT SETLINE SURVEY (FISS)
- 5.1. Methods for spatial setline survey modelling – Program of work for 2019 (R. Webster)

6. PACIFIC HALIBUT STOCK ASSESSMENT: 2019
- 6.1. Data source development (I. Stewart)
- 6.2. Modelling updates (I. Stewart)

7. MANAGEMENT STRATEGY EVALUATION: UPDATE
- 7.1. Outcomes of the MSAB013 (A. Hicks)
- 7.2. Updates to MSE framework and closed-loop simulations (A. Hicks)
- 7.3. MSAB Program of Work and delivery timeline for 2019-21 (A. Hicks)

8. BIOLOGICAL AND ECOSYSTEM SCIENCE RESEARCH UPDATES
- 8.1. Five-year research plan and management implications: Update (J. Planas)
- 8.2. Progress on ongoing research projects (J. Planas)
  - 8.2.1. Discard Mortality Rates
  - 8.2.2. Juvenile growth studies
  - 8.2.3. Reproductive assessment
  - 8.2.4. Genomics
- 8.3. Focus on population genetics and migration studies (J. Planas, T. Loher, L. Sadorus)
  - 8.3.1. Summary of past studies
  - 8.3.2. Proposed future studies

9. RESEARCH INTEGRATION

10. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 14TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB014)

APPENDIX III
LIST OF DOCUMENTS FOR THE 14TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB014)

Document	Title	Availability
IPHC-2019-SRB014-01	DRAFT: Agenda & Schedule for the 14th Session of the Scientific Review Board (SRB014)	✓ 28 Mar 2019 ✓ 21 May 2019
IPHC-2019-SRB014-02	List of Documents for the 14th Session of the Scientific Review Board (SRB014)	✓ 21 May 2019 ✓ 24 May 2019
IPHC-2019-SRB014-03	Update on the actions arising from the 13th Session of the SRB (SRB013) (IPHC Secretariat)	✓ 21 May 2019
IPHC-2019-SRB014-04	Outcomes of the 95th Session of the IPHC Annual Meeting (AM095) (D. Wilson)	✓ 21 May 2019
IPHC-2019-SRB014-05 Rev_1	Methods for spatial survey modelling – program of work for 2019 (R. Webster)	✓ 24 May 2019 ✓ 20 Jun 2019
IPHC-2019-SRB014-06	Withdrawn	
IPHC-2019-SRB014-07	2019 Pacific halibut (*Hippoglossus stenolepis*) stock assessment: Development (I. Stewart, A. Hicks)	✓ 23 May 2019
IPHC-2019-SRB014-08	An update on the IPHC Management Strategy Evaluation (MSE) process for SRB014 (A. Hicks, P. Carpi, S. Berukoff, & I. Stewart)	✓ 23 May 2019
IPHC-2019-SRB014-09	Report on current and future biological research activities (J. Planas, T. Loher, L. Sadorus, C. Dykstra, J. Forsberg)	✓ 24 May 2019
Information papers		
IPHC-2019-SRB014-INF01	Nil	

APPENDIX IV
CONSOLIDATED SET OF RECOMMENDATIONS AND REQUESTS OF THE 14TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB014)

RECOMMENDATIONS

(para. 4) **NOTING** that the core purpose of the SRB014 is to review progress on the IPHC science program, and to provide guidance for the delivery of products to the SRB015 in September 2019, the SRB **RECALLED** that formal recommendations to the Commission would not be developed at the present meeting, but rather, these would be developed at the SRB015.

REQUESTS

Methods for spatial setline survey modelling – Program of work for 2019

SRB014–Req.01 (para. 14) The SRB **REQUESTED** analysis of past prediction patterns (a type of cross-validation analysis) to help assess the proposed methods' ability to meet precision targets while maintaining low bias. This should include an examination of spatio-temporal residual patterns for the appropriateness of estimated autocorrelation.

Pacific halibut stock assessment: 2019 - Modelling updates

SRB014–Req.02 (para. 27) The SRB **REQUESTED** the following additional analyses for evaluation in September:

a) The Pacific Decadal Oscillation (PDO) index affects results that correspond with the presence and absence of FISS age data. As a check, perhaps evaluate models with the selectivity for the FISS fixed at the current estimates but then do a run which completely down-weights the FISS age data. This is intended as a check for the PDO coefficient.

b) Evaluate a profile (coarse) over steepness, e.g. 0.65 and 0.85, and check the impact on recruitment estimates and RSB values.

Management Strategy Evaluation: update

SRB014–Req.03 (para. 32) The SRB **REQUESTED** that the new operating model be used to generate simulated input data sets for simulation testing estimation performance of the current assessment ensemble. The SRB looks forward to reviewing these results as part of the full review of the assessment in 2022 or thereafter.

Research integration

SRB014–Req.04 (para. 48) The SRB **REQUESTED** clarification on how the juvenile spatial distribution analyses and simulations will be used/incorporated into operating models. The SRB can only assume that these will be used to develop an age-dependent transition matrix for < 100 cm fish.

SRB014–Req.05 (para. 52) The SRB **REQUESTED** preliminary results for steps (a)-(c) (paragraph 51) for the September 2019 meeting.

Research priorities

SRB014–Req.06 (para. 53) The SRB **REQUESTED** that an integrated set of future research priorities be presented jointly after the conclusion of the stock assessment, MSE, and biological program presentations. Integrated, in this context, means that priorities are co-developed by the program leads of the three groups. For example, a Table of Research Priorities could include the following columns: Rank, Topic, Justification, Lead Responsibility. Such a table will allow the SRB and Secretariat to effectively fill-in details and assess viability of the research.

INTERNATIONAL PACIFIC HALIBUT COMMISSION

IPHC–2019–SRB015–R

Report of the 15th Session of the IPHC Scientific Review Board (SRB015)

Seattle, Washington, U.S.A., 24-26 September 2019

Commissioners

Canada	United States of America
Paul Ryall	Chris Oliver
Neil Davis	Robert Alverson
Peter DeGreef	Richard Yamada

Executive Director
David T. Wilson, Ph.D.

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Participants in the Session
Members of the Commission
IPHC Secretariat

BIBLIOGRAPHIC ENTRY
IPHC 2019. Report of the 15th Session of the IPHC Scientific Review Board (SRB015). Seattle, Washington, U.S.A., 24-26 September 2019.
IPHC–2019–SRB015–R, 18 pp.

INTERNATIONAL PACIFIC HALIBUT COMMISSION

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ACRONYMS

AM	Annual Meeting
CDN	Canada
IPHC	International Pacific Halibut Commission
MSAB	Management Strategy Advisory Board
MSE	Management Strategy Evaluation
SB	Spawning Biomass
SRB	Scientific Review Board
TCEY	Total Constant Exploitable Yield
U.S.A.	United States of America

DEFINITIONS

A set of working definitions are provided in the IPHC Glossary of Terms and abbreviations: https://www.iphc.int/the-commission/glossary-of-terms-and-abbreviations

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

This report has been written using the following terms and associated definitions so as to remove ambiguity surrounding how particular paragraphs should be interpreted.

Level 1: **RECOMMENDED**; **RECOMMENDATION; ADOPTED** (formal); **REQUESTED; ENDORSED** (informal): A conclusion for an action to be undertaken, by a Contracting Party, a subsidiary (advisory) body of the Commission and/or the IPHC Secretariat.

Level 2: **AGREED**: Any point of discussion from a meeting which the Commission considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 above; a general point of agreement among delegations/participants of a meeting which does not need to be elevated in the Commission's reporting structure.

Level 3: **NOTED/NOTING**; **CONSIDERED**; **URGED**; **ACKNOWLEDGED**: General terms to be used for consistency. Any point of discussion from a meeting which the Commission considers to be important enough to record in a meeting report for future reference. Any other term may be used to highlight to the reader of an IPHC report, the importance of the relevant paragraph. Other terms may be used but will be considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3.

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EXECUTIVE SUMMARY

The 15th Session of the International Pacific Halibut Commission (IPHC) Scientific Advisory Board (SRB015) was held in Seattle, WA, U.S.A. from 24-26 September 2019. The SRB consists of five (5) board members, required to be independent of the Contracting Parties. Two (2) individuals attended the Session as Observers. The meeting was opened by the Chairperson, Dr Sean Cox (Canada), and the Executive Director, Dr David Wilson, who welcomed participants to Seattle.

The following are a subset of the complete recommendations/requests for action from the SRB015, which are provided in full at Appendix IV.

RECOMMENDATIONS

Discard mortality in non-directed fisheries

SRB015–Rec.01 (para. 10) The SRB **RECOMMENDED** that the analysis of the effects of historical discard mortality in non-directed fisheries ('bycatch'), be interpreted with caution, as there are multiple methods for evaluating how bycatch in non-directed fisheries impact stock productivity and biomass over time. The estimated rates of bycatch impact on directed fishery changed over time in part due to the variability in recruitment and/or sublegal abundance relative to the vulnerable stock. The choice of the appropriate method will depend on how the results feed into management advice.

SRB015–Rec.02 (para. 11) The SRB **RECOMMENDED** that, if a bycatch management strategy is a priority for the Commission, then the MSE process would be a more appropriate venue for evaluating methods of bycatch accounting for reasons outlined at SRB012:

> "*NOTING the request for "replay" analyses, the SRB AGREED that "what if" questions about past behaviour are not appropriate for stock assessment models because those analyses do not adequately reflect the information available at the time or information feedbacks to future decision over time. An MSE analysis, on the other hand is specifically designed to answer "what if" questions under particular future scenarios while properly accounting for stock assessment errors in response to changing information.*" (IPHC-2018-SRB012-R, para. 23)

Pacific halibut stock assessment: 2019

SRB015–Rec.04 (para. 34) **NOTING** the discussion of recommendations arising from the external peer review of the IPHC stock assessment (Section 4), the SRB **RECOMMENDED** that the IPHC Secretariat:

a) Update data weighting for the 2019 assessment;

b) For SRB016:

   i. evaluate the types of weightings (e.g., Dirichlet-multinomial) for compositional data;

   ii. advise on the impact of data re-weighting as new information arises. This could be more sensitive as new sex-composition data are included;

   iii. keep apprised of new software developments (e.g. CAPAM meeting in NZ) and report on potential future directions (e.g. if alternatives provide improved Bayesian integration or adaptations for simulation testing etc.).

Management Strategy Evaluation: Goals, Objectives and Performance Metrics

SRB015–Rec.05 (para. 41) The SRB **RECOMMENDED** that if the original objective to have annual mortality limits related to local abundances was of broad interest to the Commission, then candidate management procedures be developed and tested in which regional mortality limits are set annually in proportion to modelled survey abundance trends by IPHC Regulatory Area (noting that splitting regions into Regulatory Areas would require assumptions about within-region abundance proportions).

Management Strategy Evaluation: Dynamic reference points

SRB015–Rec.06 (para. 45) The SRB **RECOMMENDED** that the MSAB define objectives independently of the management procedures used to achieve them and, instead, focus on the outcomes/consequences they wish to avoid (e.g. low catch, fishery closures, large drops in TCEY, public perceptions of poor stock status).

Management Strategy Evaluation: Updates to MSE framework and closed-loop simulations

SRB015–Rec.07 (para. 51) The SRB **RECOMMENDED** that the Commission develop a standard criterion for achieving a limited set of (or one over-arching) objectives. This would ensure that any candidate management procedure achieves common goals with differences in trade-offs between risks and benefits. Doing so will improve the efficiency of the iterative approach that is required for MSE.

1. OPENING OF THE SESSION

1. The 15th Session of the International Pacific Halibut Commission (IPHC) Scientific Review Board (SRB015) was held in Seattle, Washington, U.S.A. from 24 to 26 September 2019. The list of participants is provided at Appendix I. The meeting was opened by the Chairperson, Dr Sean Cox (Canada), and the Executive Director, Dr David Wilson, who welcomed participants to Seattle.

2. The SRB **RECALLED** its mandate, as detailed in Appendix VIII, Sect. I, para. 1-3 of the IPHC Rules of Procedure (2019):

   1. *The Scientific Review Board (SRB) shall provide an independent scientific peer review of Commission science/research proposals, programs, and products, including but not limited to:*
      a. *Stock assessment;*
      b. *Management Strategy Evaluation;*
      c. *Migration;*
      d. *Reproduction;*
      e. *Growth;*
      f. *Discard survival;*
      g. *Genetics and Genomics;*
   2. *Undertake periodic reviews of science/research strategy, progress, and overall performance.*
   3. *Review the recommendations arising from the MSAB and the RAB.*

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

3. The SRB **ADOPTED** the Agenda as provided at Appendix II. The documents provided to the SRB are listed in Appendix III. Participants were reminded that all documents for the meeting were published on the IPHC website, 30 days prior to the Session: https://www.iphc.int/venues/details/15th-session-of-the-iphc-scientific-review-board-srb015.

3. IPHC PROCESS

3.1 SRB annual workflow

4. The SRB **RECALLED** that the core purpose of the SRB015 is to review progress on the IPHC science program, including specific products, and to provide guidance for the delivery of products to the Commission at its Interim Meeting in November 2019, and Annual Meeting in February 2020.

3.2 Update on the actions arising from the 14th Session of the SRB (SRB014)

5. The SRB **NOTED** paper IPHC-2019-SRB015-03, which provided the SRB with an opportunity to consider the progress made during the inter-sessional period, in relation to the consolidated list of recommendations/requests arising from the previous SRB meeting (SRB014).

6. The SRB **AGREED** to consider and revise the actions as necessary, and to combine them with any new actions arising from SRB015 into a consolidated list for future reporting.

3.3 Outcomes of the 95th Session of the IPHC Annual Meeting (AM095)

7. The SRB **NOTED** paper IPHC-2019-SRB015-04 which detailed the outcomes of the 95th Session of the IPHC Annual Meeting (AM095), relevant to the mandate of the SRB, and **AGREED** to consider how best to provide the Commission with the information it has requested, throughout the course of the current SRB meeting.

3.3.1 Discard mortality in non-directed fisheries

8. The SRB **NOTED** paper IPHC-2019-SRB015-12, which provided an analysis of the effects of historical discard mortality in non-directed fisheries ('bycatch').
9. The SRB **NOTED** that the estimates of the effects of discard mortality in non-directed fisheries have varied among historical analyses, and that the results of the current analysis are generally on a consistent scale.
10. The SRB **RECOMMENDED** that the analysis of the effects of historical discard mortality in non-directed fisheries ('bycatch'), be interpreted with caution, as there are multiple methods for evaluating how bycatch in non-directed fisheries impact stock productivity and biomass over time. The estimated rates of bycatch impact on directed fishery changed over time in part due to the variability in recruitment and/or sublegal abundance relative to the vulnerable stock. The choice of the appropriate method will depend on how the results feed into management advice.
11. The SRB **RECOMMENDED** that, if a bycatch management strategy is a priority for the Commission, then the MSE process would be a more appropriate venue for evaluating methods of bycatch accounting for reasons outlined at SRB012:

    "*NOTING the request for "replay" analyses, the SRB AGREED that "what if" questions about past behaviour are not appropriate for stock assessment models because those analyses do not adequately reflect the information available at the time or information feedbacks to future decision over time. An MSE analysis, on the other hand is specifically designed to answer "what if" questions under particular future scenarios while properly accounting for stock assessment errors in response to changing information*." (IPHC-2018-SRB012-R, para. 23)

3.4 Observer updates

12. The SRB **NOTED** updates from the two Contracting Party science advisors, who provided brief overviews of some of the points of clarification being sought from the present SRB meeting. These included, but were not limited to: 1) explanations of FISS trends in comparison to fishery trends; 2) degrees of spatial and temporal connectivity among areas/regions; 3) consideration of MSY-based and MEY-based reference points; 4) juvenile (pre-reproductive) Pacific halibut population changes; 5) options for distributing the TCEY spatially; 6) consideration of Kobe-style status plots; 7) Accountability and responsibilities for mortalities; 8) FISS rationalisation; 9) climate change; and 10) justifications for using biological regions in comparison to IPHC Regulatory Areas.
13. The SRB **NOTED** the valuable contributions of the science advisors to the process, especially given they attend most IPHC meetings.

4. INDEPENDENT EXTERNAL PEER REVIEW OF THE IPHC STOCK ASSESSMENT

14. The SRB **NOTED** paper IPHC-2019-SRB015-13, which provided the SRB with an opportunity to further consider the independent peer review of the IPHC Stock Assessment for Pacific halibut.
15. The SRB **RECALLED** that at the 95th Session of the IPHC Annual Meeting (AM095), the Commission made the following recommendation regarding a peer review of the IPHC stock assessment:

    Peer review process for IPHC science products
    AM095–Rec.10 (para. 129) *The Commission **RECOMMENDED** that the IPHC Secretariat develop terms of reference for a consultant to undertake a peer review of the IPHC Pacific halibut stock assessment, for implementation in early 2019. The terms of reference and budget shall be endorsed by the Commission inter-sessionally.*

16. The SRB **NOTED** that the Commission directed the IPHC Secretariat via Commission decisions **AM095-Rec.10** and **IPHC-2019-ID001** (shown below) to:

    a) ***95th Session of the IPHC Annual Meeting (AM095) – 1 February 2019***

    AM095–Rec.10 (**para. 129**) "The Commission **RECOMMENDED** that the IPHC Secretariat develop terms of reference for a consultant to undertake a peer review of the IPHC Pacific halibut stock assessment, for implementation in early 2019. The terms of reference and budget shall be endorsed by the Commission inter-sessionally."

    b) ***2019 Inter-sessional decision – 17 April 2019***

    IPHC-2019-ID001: The Commission **ENDORSED** the "Open call for expressions of interest: Independent peer reviewer for the IPHC stock assessment"

17. The SRB **NOTED** that the report by the independent consultant was provided to the Commission and SRB on 2 August 2019, via IPHC Circular 2019-16.

18. The SRB **AGREED** that the external peer review (IPHC-2019-SRB015-13) was of a high quality and appreciated the completeness of the document.

19. The SRB **RECOMMENDED** that as was the case in the 2019 external peer review, any future external review would also benefit from an in-person review component. The biannual peer review that the SRB undertakes should continue as a complimentary element, thereby providing ongoing verification for the Commission.

20. The SRB **AGREED** that in light of scientific advances in the field, the SRB continue to be involved in developing the terms of reference for future stock assessment, scientific, and other technical reviews.

5. IPHC FISHERY-INDEPENDENT SETLINE SURVEY (FISS)

5.1 Methods for spatial setline survey modelling – Program of work for 2019

21. The SRB **NOTED** paper IPHC-2019-SRB015-05, which provided an update on the inputs to the survey modelling approach for 2019.

22. The SRB **NOTED** paper IPHC-2019-SRB015-06, which provided a response to SRB requests from SRB014 (IPHC-2019-SRB014-R) regarding methods for a rationalised IPHC fishery-independent setline survey (FISS).

23. The SRB **NOTED** that this research topic is focused on developing criteria to determine when it is appropriate to revisit areas that are not sampled every year. The space-time model was used to project Coefficient of Variation (CV) forward to aid in this study.

24. The SRB **NOTED** the presentation and was encouraged by the innovative approach taken to develop statistics for evaluating the efficiency of the FISS.

25. The SRB **REQUESTED** that the IPHC Secretariat further develop the approach in collaboration with the SRB to specifically address the issue of potential bias in the indices caused by areas that are unsampled in some years. A draft manuscript was made available, which provided details on aspects of this research, and the SRB looks forward to reviewing this prior to the SRB016, in 2020.

6. PACIFIC HALIBUT STOCK ASSESSMENT: 2019

26. The SRB **NOTED** paper IPHC-2019-SRB015-07, which provided a response to requests made during SRB014 (IPHC-2019-SRB014-R), held in June 2019, and to provide the SRB with an update of the 2019 assessment development and preliminary results.

6.1 Data source development

27. The SRB **NOTED** that two new or revised sources of data were already included in the 2019 stock assessment:
    a) Sex-ratio at age information from the 2017 commercial fishery landings;
    b) A revised time-series of Numbers-Per-Unit-Effort from the space-time model including revised criteria for determining a station to be ineffective based on observed or suspected whale depredation (more strict relative to historical analyses).

28. The SRB **NOTED** that the final 2019 stock assessment would contain:
    a) The 2018 estimated sex-ratio at age for the directed commercial fishery landings;
    b) Updated information for 2018 data sources, where available;
    c) Standard data inputs for 2019 including:
        i. Mortality estimates from all sources;
        ii. the FISS modelled index, age composition information, and mean weight data;
        iii. Commercial fishery catch-per-unit-effort and age data.

6.2 Modelling updates

29. The SRB **NOTED** that there had been no changes to the preliminary assessment since SRB014.

30. The SRB **NOTED** the results of the evaluation of FISS age data in informing the estimated link coefficients for the Pacific Decadal Oscillation in the two long time series models, which suggested the parameter estimates were not driven exclusively by the modelled survey information.

31. The SRB **NOTED** the profiles describing the effect of alternative values for steepness in each of the four models comprising the ensemble. The coastwide long times series model showed the greatest sensitivity in spawning biomass, with little difference in the likelihood over the range from 0.75 to 1.0. The short time series models showed no difference in SSB, but estimates of recent recruitment varied as a function of steepness.

32. The SRB **NOTED** the sensitivity analysis of steepness and saw no need to include an additional nested steepness component in the ensemble for the coastwide long time series model.

33. The SRB **REQUESTED** that for SRB016 (2020), the IPHC Secretariat:
    a) provide a more detailed evaluation and profile of steepness values. Specifically, this should show the different data and model components that inform the steepness parameter, and also the interaction with sigmaR. This should also help inform the SRR relationship to be used in the operating model for MSE work;
    b) consider examining the relative impact of different fleets (sources of mortality) on historical SSB (e.g. set fleet x F = 0, replay, then fleet x and y, etc.).

34. **NOTING** the discussion of recommendations arising from the external peer review of the IPHC stock assessment (Section 4), the SRB **RECOMMENDED** that the IPHC Secretariat:
    a) Update data weighting for the 2019 assessment;
    b) For SRB016:
        i. evaluate the types of weightings (e.g., Dirichlet-multinomial) for compositional data;
        ii. advise on the impact of data re-weighting as new information arises. This could be more sensitive as new sex-composition data are included;
        iii. keep apprised of new software developments (e.g. CAPAM meeting in NZ) and report on potential future directions (e.g. if alternatives provide improved Bayesian integration or adaptations for simulation testing etc.).

35. The SRB **NOTED** the presentation of alternative methods for reporting stock status with regard to fishing intensity and relative biomass (phase plots) and their utility in summarising results recognising that the Commission's current management strategy and should not be interpreted in the context of other management strategies.

36. The SRB **REQUESTED** that values related to stock status from the assessment be distinguished from MSE presentations (e.g. probabilities of avoiding a threshold based on operating model simulations).

7. MANAGEMENT STRATEGY EVALUATION: UPDATE

37. The SRB **NOTED** paper IPHC-2019-SRB015-09 which provided the SRB with an update on the IPHC MSE process including defining objectives, results for management procedures related to coastwide fishing intensity, a framework for distributing the TCEY, and a program of work.

Goals, Objectives and Performance Metrics

38. The SRB **NOTED** paper IPHC-2019-SRB015-INF01, which provided the outcomes of the Ad-hoc Working Group on ideas to Refine Goals, Objectives, and Performance Metrics for the IPHC Management Strategy Evaluation (MSE).

39. **NOTING** the new objectives provided in paper IPHC-2019-SRB015-09, and that objectives for minimum catch levels by IPHC Regulatory Area may be useful for evaluating management procedures, the SRB **AGREED** that proportional shares are a different concept and should also be defined for each IPHC Regulatory Area to examine trade-offs.

40. The SRB **NOTED** the proposed objective to have annual mortality limits related to local abundances. While this could provide transparency from a policy perspective, it ignores the biological realities of movement and other processes that remain poorly understood at both coastwide and Regulatory Area scales.

41. The SRB **RECOMMENDED** that if the original objective to have annual mortality limits related to local abundances was of broad interest to the Commission, then candidate management procedures be developed and tested in which regional mortality limits are set annually in proportion to modelled survey abundance trends by IPHC Regulatory Area (noting that splitting regions into Regulatory Areas would require assumptions about within-region abundance proportions).

Dynamic reference points

42. The SRB **NOTED** paper IPHC-2019-SRB015-11 Rev_1, which provided an evaluation of dynamic reference points for Pacific halibut.

43. The SRB **NOTED** that a precautionary RSB_{MSY} proxy of 30% of unfished spawning biomass, putting a proxy for RSB_{MEY} between 36% and 44%, could provide a reasonable range of values for the coastwide objective to maintain the spawning biomass around a target (objective 2.1B).

44. The SRB **NOTED** that candidate control rule development is an iterative process, and that:

    a) use of the trigger from the control rule in coastwide objective 2.1A (*Maintain the female spawning biomass above a trigger reference point at least 80% of the time*) conflates the objective and management procedure;

    b) avoiding a spawning biomass limit of 20% unfished with a tolerance of 0.05 is a potential conservation objective based on the analysis of MSY-related reference points and is consistent with some international standards;

    c) SPR values between 38% and 48% could satisfy the coastwide conservation objective and the biomass target objective based on a proxy for SB_{MEY} between 36% and 44%, and the stability objective may be met by applying one of two constraints: a maximum annual change in the mortality limit of 15% or a slow-up fast-down approach.

45. The SRB **RECOMMENDED** that the MSAB define objectives independently of the management procedures used to achieve them and, instead, focus on the outcomes/consequences they wish to avoid (e.g. low catch, fishery closures, large drops in TCEY, public perceptions of poor stock status).

7.1 Updates to MSE framework and closed-loop simulations

46. The SRB **NOTED** paper IPHC-2019-SRB015-10 Rev_1, which provided technical details of the IPHC MSE framework.
47. The SRB **AGREED** on the valuable contribution provided by the conceptual model and mapping reviewing the different life-history phases and putative movement and settlement patterns, and **ENCOURAGED** presenting this more broadly, linking to existing IPHC data archives, and also highlighting specific gaps in knowledge. In particular, this is useful for guiding operating model specifications.
48. The SRB **NOTED** the yield-per-recruit analysis and the changes in relative estimated $F_{0.1}$ among Biological Regions in the recent year compared to the past three decades and that this analysis along with a general understanding of the life-history of Pacific halibut in each Biological Region suggests that eastern areas may be able to sustain higher harvest rates than western areas, at least in some years.
49. The SRB **NOTED** that the distribution framework consisting of a coastwide TCEY distributed to Biological Regions based on stock distribution, relative fishing intensities, and other allocation adjustments, and then distributed to IPHC Regulatory Areas based on other data, observations, or agreement is a useful starting point for developing management procedures to distribute the TCEY.
50. The SRB **REQUESTED** that the initial performance of the above proposals for candidate management procedures be evaluated and presented at the SRB016 in 2020. At that time the appropriateness of different performance measures and objectives could be more carefully evaluated.
51. The SRB **RECOMMENDED** that the Commission develop a standard criterion for achieving a limited set of (or one over-arching) objectives. This would ensure that any candidate management procedure achieves common goals with differences in trade-offs between risks and benefits. Doing so will improve the efficiency of the iterative approach that is required for MSE.

7.2 MSAB Program of Work and delivery of timeline for 2019-21

52. The SRB **NOTED** that the full MSE results will be provided to the SRB for review no later than at the 17th Session of the SRB in September 2020 (SRB017), and that these results, including scale and distribution management procedures, will be presented to the Commission at the 97th Session of the Annual Meeting (AM097), in January 2021.

8. BIOLOGICAL AND ECOSYSTEM SCIENCE PROGRAM RESEARCH UPDATES

8.1 Five-year research plan and management implications: update

53. The SRB **NOTED** paper IPHC-2019-SRB015-08 which provided the SRB with an update on current progress on research projects conducted and planned within the IPHC's 5-year Biological and Ecosystem Science Research Plan (2017-21).

8.2 Progress on ongoing research projects

54. The SRB **NOTED** the progress on ongoing research projects contemplated within the IPHC's five year research plan (2017-21) involving:
    a) The use of life-stage, age-specific distribution data, and modelling approaches to examine pelagic larval dispersal and connectivity between in the Gulf of Alaska and the Bering Sea using an individual-based biophysical model and to track the movement of Pacific halibut up to 6-years of age using annual age-based distributions and a spatio-temporal modeling approach;

b) Progress on the characterisation of the annual progression of ovarian development and of field maturity stages in female Pacific halibut and plans to investigate maturity in a spatial scale;

c) Progress on the development of useful growth physiological markers for monitoring real-time growth patterns in Pacific halibut;

d) Progress on investigating the relationship between capture or handling conditions and injuries and physiological stress levels sustained in Pacific halibut caught by longline gear;

e) Continuing efforts to generate a first complete draft of the Pacific halibut genome.

55. The SRB **NOTED** future research (2020) aimed at improving understanding of population structure by collecting samples from spawning grounds with which to conduct studies to investigate the genetic structure of the Pacific halibut population.

56. **NOTING** paper IPHC-2019-SRB015-08 "*Report on Current and Future Biological Research Activities*" and presentations made by the IPHC Secretariat regarding current and plans for future research, the SRB **COMMENDED** the IPHC Secretariat for communicating their vision pertaining to relationships among ongoing and proposed research and IPHC stock assessment and management objectives. The SRB also **NOTED** the timeline on research projects and that more constructive and direct guidance could be provided on biological research if detailed study designs, methods, and results were the focus of future SRB presentations and supporting documents; and that an inventory of available data (including from NMFS and DFO) be compiled to guide biological research.

9. OTHER BUSINESS

9.1 Life history modeler

57. The SRB **NOTED** the draft terms of reference and position description for a Life history modeller position at the IPHC Secretariat, and **AGREED** to provide additional comments inter-sessionally, so that the final version could be considered by the Commission at its 95^{th} Session of the Interim Meeting (IM095), in November 2019.

9.2 MSE external peer review

58. The SRB **NOTED** the draft terms of reference and position description for an external MSE peer reviewer, and **AGREED** to provide additional comments inter-sessionally, so that the final version could be considered by the Commission at its 95^{th} Session of the Interim Meeting (IM095), in November 2019.

9.3 SRB meeting calendar

59. The SRB **NOTED** the dates for meetings of the SRB as follows:

Meeting	No.	2020 Dates	No.	2021 Dates	No.	2022 Proposed Dates
Scientific Review Board (SRB)	16^{th}	23-25 June	18^{th}	22-24 June	20^{th}	21-23 Jun
	17^{th}	22-24 Sept	19^{th}	21-23 Sept	21^{st}	20-22 Sep

10. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 15^{TH} SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB015)

60. The SRB **ACKNOWLEDEGED** the outstanding service and contribution of Dr Marc Mangel to the SRB and wished him well in his retirement.

61. The report of the 15^{th} Session of the IPHC Scientific Review Board (IPHC-2019-SRB015-R) was **ADOPTED** on 26 September 2019, including the consolidated set of recommendations and/or requests arising from SRB015, provided at Appendix IV.

APPENDIX I
LIST OF PARTICIPANTS FOR THE 15TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB015)

SRB Members

Dr Sean **Cox**:	spcox@sfu.ca; Associate Professor, School of Resource and Environmental Management, Simon Fraser University, 8888 University Dr., Burnaby, B.C., Canada V5A 1S6
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Dr Marc **Mangel**:	msmangel@ucsc.edu; Distinguished Research Professor and Director, Center for Stock Assessment Research, University of California, Santa Cruz, CA, U.S.A., 95064
Dr Kim **Scribner**:	scribne3@msu.edu; Professor, Department of Fisheries and Wildlife, Michigan State University, 2E Natural Resources Building, East Lansing, MI, U.S.A., 48824

Observers

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IPHC Secretariat

Name	Position and email
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APPENDIX II
AGENDA FOR THE 15TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB015)

Date: 24-26 September 2019
Location: Seattle, Washington, U.S.A.
Venue: IPHC Board Room, Salmon Bay
Time: 12:00-17:00 (24th), 09:00-17:00 (25th), 09:00-17:00 (26th)
Chairperson: Dr Sean Cox (Simon Fraser University)
Vice-Chairperson: Nil

1. OPENING OF THE SESSION

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

3. IPHC PROCESS
- 3.1. SRB annual workflow (D. Wilson)
- 3.2. Update on the actions arising from the 14th Session of the SRB (SRB014) (D. Wilson)
- 3.3. Outcomes of the 95th Session of the IPHC Annual Meeting (AM095) (D. Wilson)
- 3.4. Observer updates (e.g. Science Advisors)

4. INDEPENDENT EXTERNAL PEER REVIEW OF THE IPHC STOCK ASSESSMENT

5. IPHC FISHERY-INDEPENDENT SETLINE SURVEY (FISS)
- 5.1. Methods for spatial setline survey modelling – results to date for 2019 (R. Webster)

6. PACIFIC HALIBUT STOCK ASSESSMENT: 2019
- 6.1. Data source development (I. Stewart)
- 6.2. Modelling updates (I. Stewart)

7. MANAGEMENT STRATEGY EVALUATION: UPDATE
- 7.1. Updates to MSE framework and closed-loop simulations (A. Hicks)
- 7.2. MSAB Program of Work and delivery timeline for 2019-21 (A. Hicks)

8. BIOLOGICAL AND ECOSYSTEM SCIENCES RESEARCH UPDATES
- 8.1. Five-year research plan and management implications: Update (J. Planas)
- 8.2. Progress on ongoing research projects (J. Planas)

9. OTHER BUSINESS
- 9.1. Life history modeler
- 9.2. MSE external peer review
- 9.3. SRB meeting calendar

10. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 15TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB015)

APPENDIX III
LIST OF DOCUMENTS FOR THE 15TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB015)

Document	Title	Availability
IPHC-2019-SRB015-01	Agenda & Schedule for the 15th Session of the Scientific Review Board (SRB015)	✓ 26 Jun 2019 ✓ 16 Aug 2019
IPHC-2019-SRB015-02	DRAFT: List of Documents for the 15th Session of the Scientific Review Board (SRB015)	✓ 16 Aug 2019 ✓ 25 Aug 2019 ✓ 10 Sep 2019
IPHC-2019-SRB015-03	Update on the actions arising from the 14th Session of the SRB (SRB014) (IPHC Secretariat)	✓ 20 Aug 2019
IPHC-2019-SRB015-04	Outcomes of the 95th Session of the IPHC Annual Meeting (AM095) (D. Wilson)	✓ 16 Aug 2019
IPHC-2019-SRB015-05	Update on inputs to space-time modelling of survey data for 2019 (R. Webster)	✓ 24 Aug 2019
IPHC-2019-SRB015-06	Methods for spatial survey modelling – program of work for 2019 (R. Webster)	✓ 24 Aug 2019
IPHC-2019-SRB015-07	Updates on the development of the 2019 stock assessment (I. Stewart, A. Hicks)	✓ 24 Aug 2019
IPHC-2019-SRB015-08	Report on current and future biological research activities (J. Planas, T. Loher, L. Sadorus, C. Dykstra, J. Forsberg)	✓ 16 Aug 2019
IPHC-2019-SRB015-09	An update on the IPHC Management Strategy Evaluation (MSE) process for SRB015 (A. Hicks, P. Carpi, S. Berukoff, I. Stewart)	✓ 24 Aug 2019
IPHC-2019-SRB015-10 Rev_1	Technical details of the IPHC MSE framework (A. Hicks, P. Carpi, S. Berukoff)	✓ 25 Aug 2019 ✓ 10 Sep 2019
IPHC-2019-SRB015-11 Rev_1	An evaluation of dynamic reference points for Pacific halibut, *Hippoglossus stenolepis* (A. Hicks, P. Carpi, I. Stewart)	✓ 21 Aug 2019 ✓ 10 Sep 2019
IPHC-2019-SRB015-12	Analysis of the effects of historical discard mortality in non-directed fisheries ('bycatch') (I. Stewart, A. Hicks, P. Carpi)	✓ 20 Aug 2019
IPHC-2019-SRB015-13	Stock Assessment: Independent peer review of the Pacific halibut stock assessment (D. Wilson for K. Stokes)	✓ 16 Aug 2019
Information papers		
IPHC-2019-SRB015-INF01	Ad-hoc Working Group ideas to Refine Goals, Objectives, and Performance Metrics for the IPHC Management Strategy Evaluation (MSE) (A. Hicks, P. Carpi, MSAB Ad-Hoc Working Group)	✓ 24 Aug 2019

APPENDIX IV
CONSOLIDATED SET OF RECOMMENDATIONS AND REQUESTS OF THE 15TH SESSION OF THE IPHC SCIENTIFIC REVIEW BOARD (SRB015)

RECOMMENDATIONS

Discard mortality in non-directed fisheries

SRB015–Rec.01 (para. 10) The SRB **RECOMMENDED** that the analysis of the effects of historical discard mortality in non-directed fisheries ('bycatch'), be interpreted with caution, as there are multiple methods for evaluating how bycatch in non-directed fisheries impact stock productivity and biomass over time. The estimated rates of bycatch impact on directed fishery changed over time in part due to the variability in recruitment and/or sublegal abundance relative to the vulnerable stock. The choice of the appropriate method will depend on how the results feed into management advice.

SRB015–Rec.02 (para. 11) The SRB **RECOMMENDED** that, if a bycatch management strategy is a priority for the Commission, then the MSE process would be a more appropriate venue for evaluating methods of bycatch accounting for reasons outlined at SRB012:

> "*NOTING the request for "replay" analyses, the SRB AGREED that "what if" questions about past behaviour are not appropriate for stock assessment models because those analyses do not adequately reflect the information available at the time or information feedbacks to future decision over time. An MSE analysis, on the other hand is specifically designed to answer "what if" questions under particular future scenarios while properly accounting for stock assessment errors in response to changing information.*" (IPHC-2018-SRB012-R, para. 23)

Independent external peer review of the IPHC stock assessment

SRB015–Rec.03 (para. 19) The SRB **RECOMMENDED** that as was the case in the 2019 external peer review, any future external review would also benefit from an in-person review component. The biannual peer review that the SRB undertakes should continue as a complimentary element, thereby providing ongoing verification for the Commission.

Pacific halibut stock assessment: 2019

SRB015–Rec.04 (para. 34) **NOTING** the discussion of recommendations arising from the external peer review of the IPHC stock assessment (Section 4), the SRB **RECOMMENDED** that the IPHC Secretariat:

a) Update data weighting for the 2019 assessment;

b) For SRB016:

   i. evaluate the types of weightings (e.g., Dirichlet-multinomial) for compositional data;

   ii. advise on the impact of data re-weighting as new information arises. This could be more sensitive as new sex-composition data are included;

   iii. keep apprised of new software developments (e.g. CAPAM meeting in NZ) and report on potential future directions (e.g. if alternatives provide improved Bayesian integration or adaptations for simulation testing etc.).

Management Strategy Evaluation: Goals, Objectives and Performance Metrics

SRB015–Rec.05 (para. 41) The SRB **RECOMMENDED** that if the original objective to have annual mortality limits related to local abundances was of broad interest to the Commission, then candidate management procedures be developed and tested in which regional mortality limits are set annually in proportion to modelled survey abundance trends by IPHC Regulatory Area (noting that splitting regions into Regulatory Areas would require assumptions about within-region abundance proportions).

Management Strategy Evaluation: Dynamic reference points

SRB015–Rec.06 (para. 45) The SRB **RECOMMENDED** that the MSAB define objectives independently of the management procedures used to achieve them and, instead, focus on the outcomes/consequences they wish to avoid (e.g. low catch, fishery closures, large drops in TCEY, public perceptions of poor stock status).

Management Strategy Evaluation: Updates to MSE framework and closed-loop simulations

SRB015–Rec.07 (para. 51) The SRB **RECOMMENDED** that the Commission develop a standard criterion for achieving a limited set of (or one over-arching) objectives. This would ensure that any candidate management procedure achieves common goals with differences in trade-offs between risks and benefits. Doing so will improve the efficiency of the iterative approach that is required for MSE.

REQUESTS

IPHC Fishery-independent setline survey (FISS)

SRB015–Req.01 (para. 25) The SRB **REQUESTED** that the IPHC Secretariat further develop the approach in collaboration with the SRB to specifically address the issue of potential bias in the indices caused by areas that are unsampled in some years. A draft manuscript was made available, which provided details on aspects of this research, and the SRB looks forward to reviewing this prior to the SRB016, in 2020.

Pacific halibut stock assessment: 2019

SRB015–Req.02 (para. 33) The SRB **REQUESTED** that for SRB016 (2020), the IPHC Secretariat:

a) provide a more detailed evaluation and profile of steepness values. Specifically, this should show the different data and model components that inform the steepness parameter, and also the interaction with sigmaR. This should also help inform the SRR relationship to be used in the operating model for MSE work;

b) consider examining the relative impact of different fleets (sources of mortality) on historical SSB (e.g. set fleet x F = 0, replay, then fleet x and y, etc.).

SRB015–Req.03 (para. 36) The SRB **REQUESTED** that values related to stock status from the assessment be distinguished from MSE presentations (e.g. probabilities of avoiding a threshold based on operating model simulations).

Updates to MSE framework and closed-loop simulations

SRB015–Req.04 (para. 50) The SRB **REQUESTED** that the initial performance of the above proposals for candidate management procedures be evaluated and presented at the SRB016 in 2020. At that time the appropriateness of different performance measures and objectives could be more carefully evaluated.

Report of the 13th Session of the IPHC Management Strategy Advisory Board (MSAB013)

Sitka, Alaska, U.S.A., 6-9 May 2019

Commissioners

Canada	United States of America
Paul Ryall	Chris Oliver
Neil Davis	Robert Alverson
Peter DeGreef	Richard Yamada

Executive Director
David T. Wilson, Ph.D.

DISTRIBUTION:
Participants in the Session
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IPHC Secretariat

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IPHC–2019–MSAB013–R, 23 pp.

INTERNATIONAL PACIFIC
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ACRONYMS

AAV	Average Annual Variability
RSB	Relative Spawning Biomass
FCEY	Fishery Constant Exploitation Yield
F_{SPR}	The Fishing Intensity that results in an equilibrium Spawning Potential Ratio
HCR	Harvest Control Rule
IPHC	International Pacific Halibut Commission
MP	Management Procedure
MEY	Maximum Economic Yield
MSAB	Management Strategy Advisory Board
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
NPUE	Numbers-Per-Unit-Effort
RSB	Relative Spawning Biomass
SB	Spawning Biomass
SRB	Scientific Review Board
SPR	Spawning Potential Ratio
TCEY	Total Constant Exploitation Yield
U.S.A.	United States of America
WPUE	Weight-Per-Unit-Effort

DEFINITIONS

A set of working definitions are provided in the IPHC Glossary of Terms and abbreviations: https://iphc.int/the-commission/glossary-of-terms-and-abbreviations

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

This report has been written using the following terms and associated definitions so as to remove ambiguity surrounding how particular paragraphs should be interpreted.

Level 1: **RECOMMENDED**; **RECOMMENDATION; ADOPTED** (formal); **REQUESTED; ENDORSED** (informal): A conclusion for an action to be undertaken, by a Contracting Party, a subsidiary (advisory) body of the Commission and/or the IPHC Secretariat.

Level 2: **AGREED**: Any point of discussion from a meeting which the Commission considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 above; a general point of agreement among delegations/participants of a meeting which does not need to be elevated in the Commission's reporting structure.

Level 3: **NOTED/NOTING**; **CONSIDERED**; **URGED**; **ACKNOWLEDGED**: General terms to be used for consistency. Any point of discussion from a meeting which the Commission considers to be important enough to record in a meeting report for future reference. Any other term may be used to highlight to the reader of an IPHC report, the importance of the relevant paragraph. Other terms may be used but will be considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3.

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EXECUTIVE SUMMARY

The 13th Session of the International Pacific Halibut Commission (IPHC) Management Strategy Advisory Board (MSAB013) was held in Sitka, Alaska, U.S.A. from 6-9 May 2019. The MSAB consists of 23 board members, 20 of which attended the Session from the two (2) Contracting Parties. A total of ten (10) individuals attended the Session as Observers. In addition, one (1) IPHC Commissioner was in attendance, Mr Richard Yamada (USA). The list of participants is provided at Appendix I.

The following are a subset of the complete recommendations/requests for action from the MSAB013, which are provided in full at Appendix VII.

RECOMMENDATIONS

NOTING that the core purpose of the MSAB013 is to review progress on the MSE Program of Work, and to provide guidance for the delivery of products to the MSAB014 in October 2019, the MSAB RECALLED that formal recommendations to the Commission would not be developed at the present meeting, but rather, these would be developed at the MSAB014.

REQUESTS

Update on the actions arising from the 12th Session of the MSAB (MSAB012)

MSAB013–Req.01 (para. 12) The MSAB **REQUESTED** that the IPHC Secretariat provide a report of IPHC research and other relevant research (to the extent possible) activities related to relationships between population dynamics and environmental conditions, noting that the IPHC 5-year research plan is available on the IPHC website, to aid in the discussion of hypotheses that are plausible to include in the MSE process. In particular, the MSAB would like to hear about research on the following topics:

a) Migration patterns, stock structure, and consequences to area productivity;
b) Productivity by region;
c) Climate drivers of Pacific halibut ecology and movement (e.g. hypoxia events).

Goals, objectives, and performance metrics

MSAB013–Req.02 (para. 38) The MSAB **REQUESTED** that the Scientific Review Board (SRB) and the IPHC Secretariat consider the draft objectives contained within Table 1 and to provide advice to the MSAB on potential MSY and MEY proxy target reference points for objective 2.1B.

Other business

68. The MSAB **ENDORSED** the importance of scheduling time and providing opportunities to allow for Commissioner engagement in the evaluation of management procedures prior to reporting the final result at AM097.

1. Opening of the Session

1. The 13th Session of the International Pacific Halibut Commission (IPHC) Management Strategy Advisory Board (MSAB013) was held in Sitka, Alaska, U.S.A. from 6-9 May 2019. The MSAB consists of 23 board members, 20 of which attended the Session from the two (2) Contracting Parties. A total of ten (10) individuals attended the Session as Observers. In addition, one (1) IPHC Commissioner was in attendance, Mr Richard Yamada (USA). The list of participants is provided at Appendix I.

2. The MSAB **NOTED** apologies received from the following board members: Mr Jeff Kaufmann (USA Commercial harvester representative), and Mr Joe Morelli (USA Processor representative). Additional apologies were received from Glenn Merrill (USA Government agency representative) and Angel Drobnica (USA Processor representative) for Tuesday through Thursday.

3. The MSAB **RECALLED** that the primary role of the MSAB is to advise the Commission on the Management Strategy Evaluation (MSE) process. To meet this advisory role, the Commission has articulated the following specific objectives for the MSAB, as described in Appendix V, para. 2 of the IPHC Rules of Procedure (2019):

   a) *define clear measurable objectives and performance measures for the fishery;*

   b) *define candidate management strategies, which include aspects of the fishery that can be managed (e.g. regulatory requirements); and*

   c) *advise the IPHC Secretariat about plausible scenarios for investigation, which include aspects of the fishery that cannot be managed by the IPHC (e.g. environmental conditions and removals under the management authority of a domestic management agency).*

   d) *Gather and clearly articulate the interests and concerns of constituents and incorporate them into the MSAB's discussions;*

   e) *encourage and allow members to test tentative ideas and exploratory suggestions without prejudice to future discussions;*

   f) *represent information, views, and outcomes of the MSAB discussions to external parties accurately and appropriately;*

   g) *encourage the understanding and support of their constituencies for the MSAB process and for consensus positions developed by MSAB.*

4. **NOTING** paragraph 3, the MSAB **RECALLED** that the Management Strategy Evaluation process is a stakeholder informed, scientifically driven process.

2. Adoption of the Agenda and Arrangements for the Session

5. The MSAB **ADOPTED** the Agenda as provided at Appendix II. The documents provided to the MSAB013 are listed at Appendix III.

3. IPHC process

3.1 MSAB Membership

6. The MSAB **NOTED** paper IPHC-2019-MSAB013-03 which provided the current membership list and term expirations for the MSAB. The full membership list is provided at Appendix IV.

7. The MSAB **NOTED** that Mr Craig Cross (NPFMC representative) resigned on 29 Apr 2019. No replacement has yet been nominated by the NPFMC.

8. The MSAB **WELCOMED** the following new MSAB members appointed by the Commission on 17 April 2019 (terms: 17 April 2019 to 16 April 2023):
   a) Mr. Chuck Ashcroft - Recreational/Sport fisheries (Canada)
   b) Mr. Forrest Braden - Recreational/Sport fisheries - Alaska recreational (USA)
   c) Mr. James Johnson - Commercial Harvester (USA)
   d) Ms. Angel Drobnica - Processor (USA)

9. The MSAB **NOTED** that the Commission re-appointed the following members for a further four (4) years on 17 April 2019 (terms: 9 May 2019 to 8 May 2023):
    a) Mr. Jeff Kauffman (USA Commercial)
    b) Mr. Scott Mazzone (USA Treaty Tribes)
    c) Ms. Peggy Parker (USA/CDN Processing)
    d) Mr. Brad Mirau (CDN Processing)
    e) Mr. Tom Marking (USA Sportfishing)
    f) Mr. Adam Keizer (DFO) – Direct Canadian government appointment

3.2 Update on the actions arising from the 12th Session of the MSAB (MSAB012)

10. The MSAB **NOTED** paper IPHC-2019-MSAB013-04 which provided an opportunity to consider the progress made during the inter-sessional period in relation to the recommendations and requests of the 12th Session of the IPHC Management Strategy Advisory Board (MSAB012).

11. The MSAB **AGREED** to consider and revise as necessary, the actions arising from the MSAB012, and for these to be combined with any new actions arising from the MSAB013.

12. The MSAB **REQUESTED** that the IPHC Secretariat provide a report of IPHC research and other relevant research (to the extent possible) activities related to relationships between population dynamics and environmental conditions, noting that the IPHC 5-year research plan is available on the IPHC website, to aid in the discussion of hypotheses that are plausible to include in the MSE process. In particular, the MSAB would like to hear about research on the following topics:
    a) Migration patterns, stock structure, and consequences to area productivity;
    b) Productivity by region;
    c) Climate drivers of Pacific halibut ecology and movement (e.g. hypoxia events).

3.3 Review of the outcomes of the 13th Session of the IPHC Scientific Review Board (SRB013)

13. The MSAB **NOTED** paper IPHC-2019-MSAB013-05, which provided the outcomes of the 13th Session of the IPHC Scientific Review Board (SRB013) relevant to the mandate of the MSAB, which were provided for reference.

3.4 Outcomes of the 95th Session of the IPHC Annual Meeting (AM095)

14. The MSAB **NOTED** paper IPHC-2019-MSAB013-06, which detailed the outcomes of the 95th Session of the IPHC Annual Meeting (AM095) relevant to the mandate of the MSAB.

15. The MSAB **RECALLED** para. 61 of AM095-R,

    "The Commission AGREED with the MSAB recommendation that the harvest strategy policy consist of a coast wide fishing intensity SPR should not be lower than 40% nor higher than 46%, with a target SPR of 42%-43% and with a 30:20 HCR."

16. The MSAB **RECALLED** the following two recommendations from the Commission:

    AM095–Rec.01 (<u>para. 59c</u>) *The Commission **RECOMMENDED** the MSAB develop the following additional objective, as well as prioritize this objective in the evaluation of management procedures, for the Commission's consideration.*

    a) A conservation objective that meets a spawning biomass target.

    AM095–Rec.02 (<u>para. 62</u>) *The Commission **RECOMMENDED** that the MSAB and IPHC Secretariat continue its program of work on the Management Procedure for the Scale portion of the harvest strategy, **NOTING** that Scale and Distribution components will be evaluated and presented no later than at AM097 in 2021, for potential adoption and subsequent implementation as a harvest strategy. The management procedure that best meets the primary objectives for coastwide scale is:*

    a) A target SPR of 40% with a fishery trigger of 30% and a fishery limit of 20% in the control rule;

    b) An annual constraint of 15% from the previous year's mortality limit.

17. The MSAB **NOTED** that the Commission considered a management procedure that best met the primary objectives that were defined at the time, as detailed in document IPHC-2019-AM095-12, and this management procedure was not evaluated at MSAB012, but was evaluated at the MSAB013.

18. The MSAB **NOTED** the revised IPHC Rules of Procedure (2019) adopted by the Commission, which includes updates to the MSAB terms of reference and rules of procedure. There remain some inconsistencies in terminology, such as '*recreational*' versus '*sport*' fisheries.

3.5 Update on two-year Program of Work

19. The MSAB **NOTED** that the full MSE is scheduled for delivery at the 97th Session of the IPHC Annual Meeting (AM097) in January of 2021 and that the agendas for MSAB013 and MSAB014 include clearly defining objectives, identifying management procedures, and reviewing the multi-area operating model. Results of the simulations will be evaluated at the MSAB meetings in 2020.

3.6 A review of MSE (MSE 101)

20. The MSAB **NOTED** paper IPHC-2019-MSAB013-INF01 describing the MSE process in general, and included a brief history of the IPHC harvest policy and management strategy (harvest strategy) at IPHC, a discussion of sources of uncertainty in fisheries modelling, an example of an MSE, and that MSE is a process not a product.

4. GOALS, OBJECTIVES, AND PERFORMANCE METRICS

21. The MSAB **NOTED** paper IPHC-2019-MSAB013-07 which provided the goals and objectives used in the Management Strategy Evaluation (MSE) related to overall scale and preliminary goals and objectives related to distributing the TCEY. The paper links goals and objectives with performance metrics, and defines a set of performance metrics to use for evaluating and ranking management procedures.

22. The MSAB **NOTED** a description by the IPHC Secretariat of the IPHC harvest strategy policy document. This is a draft framework developed by the IPHC Secretariat to guide the MSE process but not constrain the MSAB recommendations. The following paragraph is noted in the harvest strategy policy document: https://www.iphc.int/the-commission/harvest-strategy-policy

    "*The following is a Draft document based on an amalgamation of current IPHC practices and best practices in harvest strategy policy. It is not intended to be a definitive policy, noting that the IPHC is yet to adopt a formal harvest strategy for Pacific halibut. It is expected that over the coming two years, the IPHC will develop and implement a harvest strategy, and that this policy document will then be updated accordingly*."

4.1 A review of the goals and objectives of the IPHC MSE process

23. The MSAB **NOTED** that the Commission endorsed the three primary objectives and associated performance metrics used to evaluate management procedures in the MSE process at MSAB012 (as detailed in paper IPHC-2019-AM095-12) (AM095-R para. 59a).

24. The MSAB **NOTED** that:

    a) a management procedure to constrain the AAV at the coastwide level may not constrain AAV within regulatory areas to the same extent;

    b) the Commission made an inter-sessional request of the MSAB on 4 October 2018 as follows:

        "While it is recognized that the MSAB has spent considerable time and effort in developing objectives for evaluating management procedures, for the purpose of expediting a recommendation on the level of the coast-wide fishing intensity, and noting SRB11–Rec.02 to develop an objectives hierarchy, the MSAB is requested to evaluate management procedure performance against objectives that prioritize long-term conservation over short-/medium-term (e.g. 3-8 years) catch performance. Where helpful in accelerating progress on scale, the MSAB is requested to constrain objectives

to (1) maintain biomass above a limit to avoid critical stock sizes, (2) maintain a minimum average catch, and (3) limit catch variability."

25. The MSAB **AGREED** that an objective of a coastwide minimum average catch may be better considered at the IPHC Regulatory Area level and will be explored in discussions about objectives for distribution.
26. The MSAB **AGREED** to maintain objective 2.2, leaving the threshold level of the AAV measurable outcome at 15% (Table 1).
27. The MSAB **NOTED** Fig. 1, which illustrates a harvest control rule as part of a harvest strategy. A set of working definitions are provided in the IPHC Glossary of Terms and abbreviations: https://iphc.int/the-commission/glossary-of-terms-and-abbreviations.

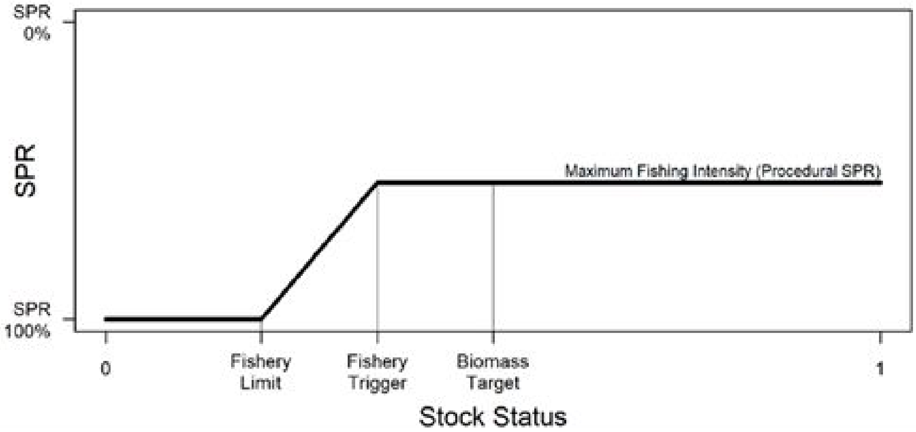

Fig. 1. An illustration of a harvest control rule as part of a harvest strategy.

28. The MSAB **NOTED** information from the IPHC Secretariat that 30% of unfished spawning biomass is currently a lower bound estimate of SB_{MSY}, and 41% is a high median estimate. The estimates of SB_{MSY} may be updated after further analysis.
29. The MSAB **NOTED** that avoiding low stocks sizes (below a fishery trigger as shown in Fig. 1) may be a useful means to optimise fishing activities by avoiding additional management action from the harvest control rule and potentially keeping the biomass in a range incorporating B_{MSY}.
30. The MSAB **AGREED** that additional consistent and accessible language describing stock status and control rules would be useful for communication and outreach.
31. The MSAB **NOTED** that a tolerance of 10% on the biological sustainability objective, as defined previously, implies a one in ten chance of being below that limit.
32. The MSAB **AGREED** that:
    a) **SB_{Lim}**: the biological sustainability objective to keep the biomass above a limit should be updated to include a tolerance of 0.05 (5%) with the rationale that an SB_{Lim} of 0.20 (20%) is an appropriate biomass limit for Pacific halibut and a tolerance of 0.05 is an acceptable level of risk based on constituent input as reported by individual MSAB members. These values are also consistent with harvest policies and MSE's from many other fishery management bodies globally. The spawning biomass limit reference point relates to a dynamic unfished spawning biomass.
    b) **SB_{Trig}**: a fishery objective to maintain the biomass above a fishery trigger (trigger reference point) in the harvest control rule be incorporated as a primary objective. This objective should include a measurable outcome of being above $SB_{30\%}$ with a tolerance defined as 0.80 (0.75 and 0.90 were also considered), and would be considered over the long-term.
33. The MSAB **NOTED** a spawning biomass target reference point that is greater than the trigger reference point is consistent with many fishery management bodies globally.

34. The MSAB **NOTED** a presentation by the IPHC Secretariat on potential target reference points including maximum sustainable yield (MSY) and maximum economic yield (MEY), as well as commonly applied proxies to represent those quantities. An $SB_{36\text{-}45\%}$ may be a proxy for MEY, assuming that SB_{MSY} is approximately $SB_{30\text{-}41\%}$ based on simulations to date (and taking into account the 30:20 control rule and past assessment models).

35. The MSAB **CONSIDERED** a draft fishery objective to maintain the spawning biomass around a target reference point that optimises fishing activities based on MEY.

36. The MSAB **AGREED** that MEY is an amalgamation of sector-specific values and has not yet been accurately estimated and requires further refinement before use as an objective.

37. The MSAB **NOTED** that the IPHC Secretariat is in the process of hiring a fishery economist to work on tasks including a fishery-wide MEY estimate.

38. The MSAB **REQUESTED** that the Scientific Review Board (SRB) and the IPHC Secretariat consider the draft objectives contained within Table 1 and to provide advice to the MSAB on potential MSY and MEY proxy target reference points for objective 2.1B.

39. The MSAB **NOTED** that a fishery objective to maintain the biomass around a target (SB_{Targ}) may be a useful means to optimise fishing activities. This objective could include a measurable outcome which may be a proxy for SB_{MEY}. A biomass target that is greater than the fishery trigger reference point is consistent with many fishery management bodies globally. The tolerance would be defined as 0.50, and considered in the long-term.

40. The MSAB **AGREED** to the draft objectives detailed in Table 1.

Table 1. DRAFT: Primary measurable objectives used for evaluation of MSE results for coastwide fishing intensity revised at MSAB013. **Items in development*.

GENERAL OBJECTIVE	MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE	PERFORMANCE METRIC
1.1. KEEP SPAWNING BIOMASS ABOVE A LIMIT TO AVOID CRITICAL STOCK SIZES Biomass Limit	Maintain a minimum female spawning stock biomass above a biomass limit reference point at least 95% of the time	*SB* < Spawning Biomass Limit (SB_{Lim}) SB_{Lim}=20% unfished spawning biomass	Long-term	0.05	$P(SB < SB_{Lim})$
*2.1 MAINTAIN SPAWNING BIOMASS AROUND A LEVEL THAT OPTIMISES FISHING ACTIVITIES	2.1A SPAWNING BIOMASS TRIGGER Maintain the female spawning biomass above a trigger reference point at least 80% of the time	SB<Spawning Biomass Trigger (SB_{Trig}) SB_{Trig}=$SB_{30\%}$ unfished spawning biomass	Long-term	0.20	$P(SB < SB_{Trig})$
	*2.1B SPAWNING BIOMASS TARGET Maintain the female spawning biomass above a biomass target reference point at least 50% of the time	SB<Spawning Biomass Target (SB_{Targ}) SB_{Targ}=$SB_{36\text{-}45\%}$ unfished spawning biomass	Long-term	0.50	$P(SB < SB_{Targ})$
2.2. LIMIT CATCH VARIABILITY	Limit annual changes in the coastwide TCEY	Average Annual Variability (*AAV*) > 15%	Short-term	0.25	$P(AAV > 15\%)$
2.3. MAXIMIZE DIRECTED FISHING YIELD	*Maximize average TCEY coastwide*	*Median coastwide TCEY*	Short-term	*STATISTIC OF INTEREST*	Median $\overline{TCEY}$

4.2 Identification of goals and objectives related to distributing the TCEY

41. The MSAB **NOTED** four general objectives related to distributing the TCEY:
    a) Conserve spatial population structure;
    b) Limit catch variability within a biological region;
    c) Maximize directed fishing yield within a biological region;
    d) Minimize potential of no catch for the directed fishery within a biological region.
42. The MSAB **NOTED** the IPHC Secretariat presentation explaining that the objective to conserve spatial population structure should be described as the proportion of spawning biomass in each biological region since a coastwide limit has been defined and biological regions are the appropriate scale for biological sustainability objectives.
43. The MSAB **NOTED** the draft objectives related to distributing the TCEY provided in Appendix V.
44. The MSAB **NOTED** that the proportion of O26 Pacific halibut biomass in each IPHC Regulatory Area is an option for an objective and would be classified as a fishery objective rather than a conservation objective because it relates to biomass available to the directed fisheries.

4.3 Performance metrics for evaluation

45. **NOTING** that performance metrics are developed from the measurable objectives, the MSAB **AGREED** to use the performance metrics defined in Table 1.
46. The MSAB **AGREED** to develop an additional performance metric related to catch stability to capture the non-averaged magnitude of change from the previous year. For example, the proportion of time that the inter-annual change is greater than 10%, 15%, and 30%.
47. The MSAB **AGREED** that an ad-hoc working group meet prior to the MSAB014 to review and suggest revisions to the draft objectives and performance metrics related to distributing the TCEY provided in Appendix V. The ad-hoc working group will also refine objectives related to catch limit variability on a coastwide scale. The ad-hoc working group will consist of James Hasbrouck, Michele Culver, Scott Mazzone, Matt Damiano, Dan Falvey, Chris Sporer, Adam Keizer, Carey McGilliard, Peggy Parker, Jim Lane, and Glenn Merrill.

5. A REVIEW OF THE EVALUATION OF COASTWISE FISHING INTENSITY

48. The MSAB **NOTED** paper IPHC-2019-MSAB013-08 which provided additional results of the closed-loop simulations on investigation of coastwide fishing intensity. Results presented at MSAB012 were compared to results with an annual constraint on the TCEY.

5.1 Closed-loop simulation results to investigate coastwide fishing intensity and constraints on the TCEY

49. The MSAB **NOTED** that no management procedure without constraints met the stability objective of the AAV exceeding 15% no more than 25% of the time.
50. The MSAB **NOTED** that:
    a) only management procedures with constraints on change in mortality limits satisfied the catch stability objective;
    b) management procedures that utilized a slow-up fast-down approach, a maximum change of 15% (up or down), and a multi-year limit were ranked highly among management procedures;
    c) management procedures with a maximum change (up or down) between 15 and 20% were not evaluated but may be highly ranked;
    d) some constrained management procedures with a 30:20 control rule and an SPR of 43% met objectives for biological sustainability, catch stability, and maintaining the biomass, at least 80% of the time, above the fishery trigger of $SB_{30\%}$.

51. The MSAB **NOTED** that management procedures could be modified to incorporate additional variables, e.g. environmental variables, bycatch, and age structure, particularly by considering scale and distribution together.
52. The MSAB **AGREED** that:
    a) a coastwide fishing intensity SPR of 43%, with a 30:20 HCR, and with one of two constraints 1) +/-15% maximum change in total mortality, or 2) slow up, fast down, be used in harvest strategy development process; and
    b) a range of management procedures including fishing intensity SPR of 40-46% be considered in light of implementation variability within the closed-loop simulations when investigating distribution.
53. The MSAB **NOTED** that future decisions made by the Commission (e.g. AM095-R Rec.04, para. 66) can be incorporated into the MSE process as time allows.

6. DEVELOPMENT OF A FRAMEWORK TO INVESTIGATE FISHING INTENSITY AND DISTRIBUTING THE TOTAL CONSTANT EXPLOITATION YIELD (TCEY) FOR PACIFIC HALIBUT FISHERIES

54. The MSAB **NOTED** paper IPHC-2019-MSAB013-08 which provided an update on discussions and ideas related to science inputs and management procedures for distributing the Total Constant Exploitation Yield (TCEY) across the IPHC Convention Area, as well as the development of simulation framework to evaluate these management procedures.
55. The MSAB **NOTED** that aspects of TCEY distribution can be considered as an objective and/or as a management procedure.

6.1 Review the framework to investigate distributing the TCEY among IPHC Regulatory Areas

56. The MSAB **NOTED** the distribution framework and the separation of scientific and management elements of distribution procedures.
57. The MSAB **NOTED** the design of a simulation framework to conduct the closed-loop simulations and report results. The design goals include performance, fidelity, ease of use, modularity, and being maintainable over the long-term.

6.2 Development of a multi-area operating model

58. The MSAB **NOTED** the development of a multi-area operating model that will be generalized and able to accommodate a wide range of specifications.
59. The MSAB **NOTED** that the operating will be parameterized using historical and current knowledge, will be conditioned to available data and informed assumptions, and be reviewed by the SRB.

6.3 Identify management procedures related to distribution

60. The MSAB **NOTED** the following potential elements of management procedures for the distribution of the TCEY:
    a) IPHC fishery-independent setline survey estimates by IPHC Regulatory Area, biological regions, or multi-area management zones;
    b) relative harvest rates;
    c) O32:O26 ratios or other proxies to represent discard mortality in directed fisheries;
    d) trends in the IPHC fishery-independent setline survey WPUE/NPUE by IPHC Regulatory Area, biological regions, or multi-area management zones;
    e) Trends in fishery CPUE by IPHC Regulatory Area, biological regions, or multi-area management zones;
    f) Smoothing algorithms on area-specific catch limits;

g) Percentage allocation to an IPHC Regulatory Area (e.g., a method to calculate a proportion of the TCEY for IPHC Regulatory Area 2B);

h) a floor on the TCEY (e.g. a minimum of 1.65 Mlbs in IPHC Regulatory Area 2A);

i) A maximum SPR with catch distribution by IPHC Regulatory Area determined from the IPHC fishery-independent setline survey WPUE;

j) Coastwide TCEY target and maximum calculated; distribution by target, but with ability to adjust TCEY up to the maximum;

k) Stair-steps to modify the TCEY at specific trigger reference points.

61. The MSAB **ENCOURAGED** the IPHC Secretariat to identify potential starting points and baselines for management procedure elements that incorporate trends or compare a current metric to a historical value.

62. The MSAB **NOTED** that the use of multi-area management zones (e.g., 2A/2B and 2C/3A) may be applied to any of the tools in paragraph 60.

63. The MSAB **NOTED** that components of a management procedure could include the decisions made at AM095 in AM095-R para. 69 with respect to IPHC Regulatory Areas 2A and 2B.

64. The MSAB **NOTED** that management procedures may be developed to incorporate elements in various ways and at various scales. For example,

a) determining area-specific mortality limits using survey results;

b) distributing the coastwide TCEY directly to IPHC Regulatory Areas, or to biological regions or management zones as an intermediate step;

c) determine the coastwide TCEY using survey results instead of a stock assessment model (AM095-R para. 52).

7. MSAB PROGRAM OF WORK (2019-23)

65. The MSAB **NOTED** paper IPHC-2019-MSAB013-10 which provided an update on the 5-year MSE Program of Work (2019-23), given current Commission directives.

66. The MSAB **NOTED** the delivery dates of January 2019 for coastwide results and January 2021 for the MSE results, including Scale and Distribution components of the management procedure for potential adoption by the Commission and subsequent implementation.

67. The MSAB **NOTED** the Program of Work provided at Appendix VI.

8. OTHER BUSINESS

68. The MSAB **ENDORSED** the importance of scheduling time and providing opportunities to allow for Commissioner engagement in the evaluation of management procedures prior to reporting the final result at AM097.

9. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 13TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB013)

69. The report of the 13th Session of the IPHC Management Strategy Advisory Board (IPHC-2019-MSAB013–R) was **ADOPTED** on 9 May 2019, including the consolidated set of recommendations and/or requests arising from MSAB013, provided at Appendix VII.

APPENDIX I
LIST OF PARTICIPANTS FOR THE 13TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB013)

Officers

Co-Chairperson (Canada)	**Co-Chairperson (United States of America)**
Mr Adam **Keizer**: adam.keizer@dfo-mpo.gc.ca	Dr Carey **McGilliard**: Carey.McGilliard@noaa.gov

MSAB Members

Canada	**United States of America**
Mr Chuck **Ashcroft**: chuckashcroft@telus.net	Mr Forrest **Braden**: forrest@seagoalaska.org
Mr Robert **Hauknes**: robert_hauknes@hotmail.com	Ms Michele **Culver**: Michele.Culver@dfw.wa.gov
Ms Ann-Marie **Huang:** Ann-Marie.Huang@dfo-mpo.gc.ca	Mr Matt **Damiano**: mdamiano@nwifc.org
Mr Adam **Keizer**: adam.keizer@dfo-mpo.gc.ca	Ms Angel **Drobnica**: adrobnica@apicda.com
Mr Jim **Lane**: jim.lane@nuuchahnulth.org	Mr Dan **Falvey**: myriadfisheries@gmail.com
Mr Brad **Mirau**: brad@aerotrading.ca	Dr James **Hasbrouck**: james.hasbrouck@alaska.gov
Mr Chris **Sporer**: chris.sporer@phma.ca	Mr James **Johnson**: JimJ@glacierfish.com
	Mr Tom **Marking**: tmmarking@gmail.com
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	Dr Carey **McGilliard**: Carey.McGilliard@noaa.gov
	Mr Glenn **Merrill**: glenn.merrill@noaa.gov
	Mr Per **Odegaard**: vanseeodegaard@hotmail.com
	Ms Peggy **Parker**: peggyparker616@gmail.com
Absentees	**Absentees**
	Mr Jeff **Kauffman**: jeff@spfishco.com
	Mr Joseph **Morelli**: jmorelli@spcsales.com

Commissioners

Canada	**United States of America**
	Mr Richard **Yamada**: richard@alaskareel.com

Observers

Canada	**United States of America**
	Ms Wendy **Alderson**, ALFA: wendyalderson@gci.net
	Ms Linda **Behnken**, ALFA: alfafish@acsalaska.net
	Mr Charlie **Clement**, ALFA: AKfork89@gmail.com
	Mr Tad **Fujioka**, ALFA: Tadsitka@gmail.com
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	Mr Mike **Mayo**, FV Coral Lee: michaelmayo@hotmail.com
	Mr Terry **Peransowich**, ALFA: terry_joanna@yahoo.com
	Mr Stephen **Rhoads**, SPC: SRhoades@SpcSales.com
	Ms Diana **Stram**, NPFMC: diana.stram@noaa.gov
	Ms Sarah **Webster**, ADFG: sarah.webster@alaska.gov

IPHC Secretariat

Name	Position and email
Dr David **Wilson**	Executive Director, david.wilson@iphc.int
Dr Steven **Berukoff**	MSE Programmer, steven.berukoff@iphc.int
Dr Piera **Carpi**	MSE Researcher, piera.carpi@iphc.int
Mr Ed **Henry**	Fisheries Data Specialist, Edward.henry@iphc.int
Dr Allan **Hicks**	Quantitative Scientist, allan.hicks@iphc.int
Mr Keith **Jernigan**	Branch Manager (IT&DB), CIO, keith.jernigan@iphc.int
Dr Ian **Stewart**	Quantitative Scientist, ian.stewart@iphc.int

APPENDIX II
AGENDA FOR THE 13TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB013)

Date: 6-9 May 2019
Location: Sitka, Alaska, U.S.A.
Venue: Harrigan Centennial Hall (HCH)
Time: 09:00-17:00 daily
Co-Chairpersons: Mr. Adam Keizer (Canada) and Dr. Carey McGilliard (U.S.A.)

1. **OPENING OF THE SESSION**

2. **ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION**

3. **IPHC PROCESS**
   - 3.1. MSAB Membership
   - 3.2. Update on the actions arising from the 12th Session of the MSAB (MSAB012)
   - 3.3. Review of the outcomes of the 13th Session of the Scientific Review Board (SRB013)
   - 3.4. Outcomes of the 95th Session of the IPHC Annual Meeting (AM095)
     - 3.4.1. IPHC Rules of Procedure (2019)
   - 3.5. Update on two-year Program of Work
   - 3.6. A review of MSE (MSE 101)

4. **GOALS, OBJECTIVES, AND PERFORMANCE METRICS**
   - 4.1. A review of the coastwide goals and objectives of the IPHC MSE process
   - 4.2. Identification of goals and objectives related to distributing the TCEY
   - 4.3. Performance metrics for evaluation

5. **A REVIEW OF THE EVALUATION OF COASTWIDE FISHING INTENSITY**
   - 5.1. Closed-loop simulation results to investigate coastwide fishing intensity and constraints on the TCEY

6. **DEVELOPMENT OF A FRAMEWORK TO INVESTIGATE FISHING INTENSITY AND DISTRIBUTING THE TOTAL CONSTANT EXPLOITATION YIELD (TCEY) FOR PACIFIC HALIBUT FISHERIES**
   - 6.1. Review the framework to investigate distributing the TCEY among IPHC Regulatory Areas
   - 6.2. Development of a multi-area operating model
   - 6.3. Identify management procedures related to distribution

7. **MSAB PROGRAM OF WORK (2019-23)**

8. **OTHER BUSINESS**

9. **REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 13th SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB013)**

APPENDIX III
LIST OF DOCUMENTS FOR THE 13TH SESSION OF THE MANAGEMENT STRATEGY ADVISORY BOARD (MSAB013)

Document	Title	Availability
IPHC-2019-MSAB013-01	Draft: Agenda & Schedule for the 13th Session of the IPHC Management Strategy Advisory Board (MSAB013)	✓ 04 February 2019 ✓ 05 April 2019
IPHC-2019-MSAB013-02	Draft: List of Documents for the 13th Session of the IPHC Management Strategy Advisory Board (MSAB013)	✓ 04 February 2019 ✓ 05 April 2019 ✓ 06 May 2019
IPHC-2019-MSAB013-03	MSAB Membership (IPHC Secretariat)	✓ 04 April 2019
IPHC-2019-MSAB013-04	Update on the actions arising from the 12th Session of the MSAB (MSAB012) (A Hicks)	✓ 05 April 2019
IPHC-2019-MSAB013-05	Outcomes of the 13th Session of the IPHC Scientific Review Board (SRB013) (D Wilson)	✓ 05 April 2019
IPHC-2019-MSAB013-06	Outcomes of the 95th Session of the IPHC Annual meeting (AM095) (D Wilson & A. Hicks)	✓ 05 April 2019
IPHC-2019-MSAB013-07	Goals, objectives, and performance metrics for the IPHC Management Strategy Evaluation (MSE) (A. Hicks)	✓ 05 April 2019
IPHC-2019-MSAB013-08	Further investigation of management procedures related to coastwide fishing intensity (A. Hicks & I. Stewart)	✓ 05 April 2019
IPHC-2019-MSAB013-09	Development of a framework to investigate fishing intensity and distributing the total constant exploitation yield (TCEY) for Pacific halibut fisheries (A. Hicks, S. Berukoff & I. Stewart)	✓ 05 April 2019
IPHC-2019-MSAB013-10	IPHC Secretariat Program of Work for MSAB Related Activities 2019-23 (A. Hicks)	✓ 05 April 2019
Information papers		
IPHC-2019-MSAB013-INF01	A brief overview of Management Strategy Evaluation (MSE)	✓ 06 May 2019

APPENDIX IV
MSAB MEMBERSHIP

Membership category	Member	Canada	U.S.A.	Current Term commence-ment	Current Term expiration
Commercial harvesters (6-8)					
1	Sporer, Chris	CDN Commercial		9-May-17	08-May-21
2	Hauknes, Robert	CDN Commercial		9-May-17	08-May-21
3	Vacant	CDN Commercial			
4	Vacant	CDN Commercial			
5	Johnson, James		USA Commercial	17-Apr-19	16-Apr-23
6	Kauffman, Jeff		USA Commercial	9-May-19	08-May-23
7	Odegaard, Per		USA Commercial	9-May-17	08-May-21
8	Falvey, Dan		USA Commercial	9-May-17	08-May-21
First Nations/ Tribal fisheries (2-4)					
1	Lane, Jim	CDN First Nations		9-May-17	08-May-21
2	Vacant	CDN First Nations			
3	Mazzone, Scott		USA Treaty Tribes	9-May-19	08-May-23
4	Damiano, Matt		USA Treaty Tribes	20-Jun-18	19-Jun-22
Government Agencies (4-8)					
1	Keizer, Adam	DFO		9-May-19	08-May-23
2	Huang, Ann-Marie	CDN Science Advisor		10-May-18	09-May-22
3	Vacant	DFO			
4	Merrill, Glenn		NOAA-Fisheries	7-May-18	06-May-22
5	McGilliard, Carey		USA Science Advisor	9-May-17	08-May-21
6	Culver, Michele		PFMC	9-May-17	08-May-21
7	Vacant		NPFMC		
8	Hasbrouck, James		ADFG	12-Oct-18	11-Oct-22
Processors (2-4)					
1	Parker, Peggy	US/CDN Processing	US/CDN Processing	9-May-19	08-May-23
2	Mirau, Brad	CDN Processing		9-May-19	08-May-23
3	Morelli, Joseph		USA Processing	29-Aug-18	28-Aug-22
4	Drobnica, Angel		USA Processing	17-Apr-19	16-Apr-23
Recreational/ Sport fisheries (2-4)					
1	Ashcroft, Chuck	CDN Sport Fishing Advisory Board		17-Apr-19	16-Apr-23
2	Vacant	CDN Sportfishing			

Membership category	Member	Canada	U.S.A.	Current Term commence-ment	Current Term expiration
3	Marking, Tom		USA Sportfishing (CA)	9-May-19	08-May-23
4	Braden, Forrest		USA sportfishing (AK)	17-Apr-19	16-Apr-23

APPENDIX V
PRIMARY OBJECTIVES AND ASSOCIATED PERFORMANCE METRICS

General Objective	Measurable Objective	Measurable Outcome	Time-frame	Tolerance	Performance Metric
1.1A CONSERVE SPATIAL POPULATION STRUCTURE	Maintain a defined minimum proportion of spawning biomass in each Biological Region	$p_{SB,R} < p_{SB,R,min}$	Med-term Long-term		$P(\ldots)$
	Proportion of Pacific halibut spawning biomass in each Biological Region	Proportion of O26 Pacific halibut biomass in each Biological Region	Long-term	STATISTIC OF INTEREST	$\frac{SB_A}{SB}$
2.1A MAINTAIN BIOMASS AROUND A TARGET THAT OPTIMISES FISHING ACTIVITIES	Maintain a proportion of O26 Pacific halibut in each area within the range observed by the IPHC fishery-independent setline survey (FISS)	$p_{B_{O26},A,min} < p_{B_{O26},A} < p_{B_{O26},A,max}$	Long-term Short-term		$P(\ldots)$
	Proportion of O26 Pacific halibut biomass in each area	Proportion of O26 Pacific halibut biomass in each area	Long-term Short-term	STATISTIC OF INTEREST	$\frac{B_{O26,\ A}}{BO26}$
2.2A LIMIT CATCH VARIABILITY	Limit annual changes in the TCEY for each Regulatory Area	Average Annual Variability by Regulatory Area (AAVA) > 15%	Long-term Short-term	0.25	$P(AAV > 15\%)$
		AAV_A	Long-term Short-term	STATISTIC OF INTEREST	AAV and variability
		Change in TCEY by Regulatory Area > 15% in any year	Long-term Short-term	STATISTIC OF INTEREST	$\frac{TCEY_{i+1} - TCEY_i}{TCEY_i}$
2.3A MAXIMIZE DIRECTED FISHING YIELD	Maximize average TCEY by Regulatory Area	Median Reg Area TCEY	Long-term Short-term	STATISTIC OF INTEREST	Median $\overline{TCEY}$

	Maintain TCEY above a minimum level by Regulatory Area	$TCEY_A < TCEY_{A,min}$	Long-term Short-term	?? ??	$P(TCEY < TCEY_{A,min})$
	Maximize high yield (TCEY) opportunities by Regulatory Area	$TCEY_A >$?? Mlbs	Long-term Short-term	STATISTIC OF INTEREST	$P(TCEY <??\ Mlbs)$
	Present the range of TCEY by Regulatory Area that would be expected	Range of TCEY by Regulatory Area	Long-term Short-term	STATISTIC OF INTEREST	5th and 75th percentiles of TCEY
2.4A MINIMIZE POTENTIAL OF NO CATCH LIMIT FOR DIRECTED FISHERY	Maintain catch limit for directed fishery in each Regulatory Area above zero	$DirectedYield_A = 0$	Long-term Short-term	?? ??	$P(DirY_A = 0)$

APPENDIX VI
MSE PROGRAM OF WORK (2019-23)

May 2019 MSAB Meeting
Evaluate additional Scale MP’s
Review Goals
Spatial Model Complexity
Identify MP's (Distn Scale)
Review Framework
October 2019 MSAB Meeting
Review Goals
Spatial Model Complexity
Identify MP's (Distn Scale)
Review Framework
Review multi-area model development
Annual Meeting 2020
Update on progress
May 2020 MSAB Meeting
Review Goals
Review multi-area model
Review final results to be presented at AM097
October 2020 MSAB Meeting
Review Goals
Review final results
Annual Meeting 2021
Presentation of first complete MSE product to the Commission Recommendations on Scale and Distribution MP

APPENDIX VII

CONSOLIDATED SET OF RECOMMENDATIONS AND REQUESTS OF THE 13TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB013)

RECOMMENDATIONS

NOTING that the core purpose of the MSAB013 is to review progress on the MSE Program of Work, and to provide guidance for the delivery of products to the MSAB014 in October 2019, the MSAB RECALLED that formal recommendations to the Commission would not be developed at the present meeting, but rather, these would be developed at the MSAB014.

REQUESTS

Update on the actions arising from the 12th Session of the MSAB (MSAB012)

MSAB013–Req.01 (para. 12) The MSAB **REQUESTED** that the IPHC Secretariat provide a report of IPHC research and other relevant research (to the extent possible) activities related to relationships between population dynamics and environmental conditions, noting that the IPHC 5-year research plan is available on the IPHC website, to aid in the discussion of hypotheses that are plausible to include in the MSE process. In particular, the MSAB would like to hear about research on the following topics:

a) Migration patterns, stock structure, and consequences to area productivity;
b) Productivity by region;
c) Climate drivers of Pacific halibut ecology and movement (e.g. hypoxia events).

Goals, objectives, and performance metrics

MSAB013–Req.02 (para. 38) The MSAB **REQUESTED** that the Scientific Review Board (SRB) and the IPHC Secretariat consider the draft objectives contained within Table 1 and to provide advice to the MSAB on potential MSY and MEY proxy target reference points for objective 2.1B.

Report of the 14th Session of the IPHC Management Strategy Advisory Board (MSAB014)

Seattle, WA, USA, 21-24 October 2019

Commissioners

Canada	United States of America
Paul Ryall	Chris Oliver
Neil Davis	Robert Alverson
Peter DeGreef	Richard Yamada

Executive Director

David T. Wilson, Ph.D.

DISTRIBUTION:
Participants in the Session
Members of the Commission
IPHC Secretariat

BIBLIOGRAPHIC ENTRY
IPHC 2019. Report of the 14th Session of the IPHC Management Strategy Advisory Board (MSAB014). Seattle, WA, USA, 21-24 October 2019.
IPHC–2019–MSAB014–R, 27 pp.

INTERNATIONAL PACIFIC HALIBUT COMMISSION

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ACRONYMS

AAV	Average Annual Variability
AC	Annual Change
RSB	Relative Spawning Biomass
FCEY	Fishery Constant Exploitation Yield
F_{SPR}	The Fishing Intensity that results in an equilibrium Spawning Potential Ratio
HCR	Harvest Control Rule
IPHC	International Pacific Halibut Commission
MP	Management Procedure
MEY	Maximum Economic Yield
MSAB	Management Strategy Advisory Board
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
RSB	Relative Spawning Biomass
SB	Spawning Biomass
SRB	Scientific Review Board
SPR	Spawning Potential Ratio
TCEY	Total Constant Exploitation Yield
USA	United States of America

DEFINITIONS

A set of working definitions are provided in the IPHC Glossary of Terms and abbreviations: https://www.iphc.int/the-commission/glossary-of-terms-and-abbreviations

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

This report has been written using the following terms and associated definitions so as to remove ambiguity surrounding how particular paragraphs should be interpreted.

Level 1: **RECOMMENDED**; **RECOMMENDATION; ADOPTED** (formal); **REQUESTED; ENDORSED** (informal): A conclusion for an action to be undertaken, by a Contracting Party, a subsidiary (advisory) body of the Commission and/or the IPHC Secretariat.

Level 2: **AGREED**: Any point of discussion from a meeting which the Commission considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 above; a general point of agreement among delegations/participants of a meeting which does not need to be elevated in the Commission's reporting structure.

Level 3: **NOTED/NOTING**; **CONSIDERED**; **URGED**; **ACKNOWLEDGED**: General terms to be used for consistency. Any point of discussion from a meeting which the Commission considers to be important enough to record in a meeting report for future reference. Any other term may be used to highlight to the reader of an IPHC report, the importance of the relevant paragraph. Other terms may be used but will be considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3.

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EXECUTIVE SUMMARY

The 14th Session of the International Pacific Halibut Commission (IPHC) Management Strategy Advisory Board (MSAB014) was held in Seattle, WA, USA from 21-24 October 2019. The MSAB consists of 22 board members, 17 of which attended the Session from the two (2) Contracting Parties. A total of 2 individuals attended the Session as Observers. In addition, 2 IPHC Commissioners were in attendance, Mr Peter DeGreef (Canada) and Mr Bob Alverson (USA).

The following are a subset of the complete recommendations/requests for action from the MSAB014, which are provided in full at Appendix VIII.

RECOMMENDATIONS

A review of the coastwide goals and objectives of the IPHC MSE process

MSAB014–Rec.01 (para. 34) The MSAB **RECOMMENDED** a coastwide fishery objective, in response to a request from the Commissioners, to maintain the spawning biomass above a target reference point of $RSB_{36\%}$, 50% of the time over the long-term.

Identification of goals and objectives related to distributing the TCEY

MSAB014–Rec.02 (para. 41) The MSAB **RECOMMENDED** the primary objectives and associated performance metrics detailed in Appendix V to be used for the evaluation of management procedures at MSAB015.

Performance metrics for evaluation

MSAB014–Rec.03 (para. 46) **NOTING** the current progress on evaluating coastwide fishing intensity, the MSAB **RECOMMENDED** that:

a) a coastwide fishing intensity SPR of 43%, with a 30:20 HCR, and with one of two constraints 1) +/-15% maximum change in total mortality, and/or 2) slow up, fast down, be used in harvest strategy development process; and

b) a range of management procedures including fishing intensity SPR of 40-46% be considered in light of implementation variability within the closed-loop simulations when investigating distribution.

Management procedures for coastwide scale

MSAB014–Rec.04 (para. 49) The MSAB **RECOMMENDED** that SPR values of 0.3, 0.34, 0.38, 0.40, 0.42, 0.46, and 0.50 with a 30:20 control rule be evaluated at MSAB015 along with constraints defined by a maximum change in the TCEY of 15%, a slow-up fast-down approach, and/or setting quotas every third year.

Management procedures for distributing the TCEY

MSAB014–Rec.05 (para. 56) The MSAB **RECOMMENDED** that the management procedures listed in Table 2 in Appendix VI be evaluated at MSAB015.

1. Opening of the Session

1. The 14th Session of the International Pacific Halibut Commission (IPHC) Management Strategy Advisory Board (MSAB014) was held in Seattle, WA, USA from 21-24 October 2019. The MSAB consists of 22 board members, 17 of which attended the Session from the two (2) Contracting Parties. A total of 2 individuals attended the Session as Observers. In addition, 2 IPHC Commissioners were in attendance, Mr Peter DeGreef (Canada) and Mr Bob Alverson (USA). The list of participants is provided at Appendix I.

2. The MSAB **NOTED** apologies were received by the IPHC Secretariat and/or the Co-Chairpersons from the following three (3) board members: Mr Robert Hauknes, Mr Brad Mirau, and Ms Peggy Parker.

3. The MSAB **RECALLED** that the primary role of the MSAB is to advise the Commission on the Management Strategy Evaluation (MSE) process. To meet this advisory role, the Commission has articulated the following specific objectives for the MSAB, as described in Appendix V, para. 2 of the IPHC Rules of Procedure (2019):

    a) *define clear measurable objectives and performance measures for the fishery;*

    b) *define candidate management strategies, which include aspects of the fishery that can be managed (e.g. regulatory requirements); and*

    c) *advise the IPHC Secretariat about plausible scenarios for investigation, which include aspects of the fishery that cannot be managed by the IPHC (e.g. environmental conditions and removals under the management authority of a domestic management agency).*

    d) *Gather and clearly articulate the interests and concerns of constituents and incorporate them into the MSAB's discussions;*

    e) *encourage and allow members to test tentative ideas and exploratory suggestions without prejudice to future discussions;*

    f) *represent information, views, and outcomes of the MSAB discussions to external parties accurately and appropriately;*

    g) *encourage the understanding and support of their constituencies for the MSAB process and for consensus positions developed by MSAB.*

4. **NOTING** paragraph 3, the MSAB **RECALLED** that the Management Strategy Evaluation process is a stakeholder informed, scientifically driven process.

2. Adoption of the Agenda and Arrangements for the Session

5. The MSAB **ADOPTED** the Agenda as provided at Appendix II. The documents provided to the MSAB014 are listed at Appendix III.

3. IPHC process

3.1 MSAB Membership

6. The MSAB **NOTED** paper IPHC-2019-MSAB014-03 which provided the current membership list and term expirations for the MSAB. The current full membership list is provided at Appendix IV.

7. The MSAB **NOTED** that Mr Matt Damiano (USA Treaty Tribes representative) resigned on 26 June 2019. No replacement has yet been formally nominated by the US Treaty Tribes to the IPHC to-date.

8. The MSAB **NOTED** that Ms Rachel Baker was nominated and appointed by the NPFMC on 23 October 2019 to fill the vacant NPFMC position.

9. The MSAB **NOTED** that in accordance with Appendix V, Sect III.5 of the IPHC Rules of Procedure (2019), Mr Adam Keizer (Canada) was nominated and re-elected as Co-Chairperson of the MSAB for a two-year period (ending 23 October 2021).

10. The MSAB **NOTED** that Dr Carey McGilliard (USA) appointment as Co-Chairperson of the MSAB will expire on 10 May 2020.

3.2 Update on the actions arising from the 13th Session of the MSAB (MSAB013)

11. The MSAB **NOTED** paper IPHC-2019-MSAB014-04 which provided the MSAB with an opportunity to consider the progress made during the inter-sessional period in relation to the recommendations and requests of the 13th Session of the IPHC Management Strategy Advisory Board (MSAB013).

12. The MSAB **RECALLED** paragraph 52 of IPHC-2019-MSAB013-R:

    a) *a coastwide fishing intensity SPR of 43%, with a 30:20 HCR, and with one of two constraints 1) +/-15% maximum change in total mortality, or 2) slow up, fast down, be used in harvest strategy development process; and*

    b) *a range of management procedures including fishing intensity SPR of 40-46% be considered in light of implementation variability within the closed-loop simulations when investigating distribution.*

3.3 Review of the outcomes of the 14th Session of the IPHC Scientific Review Board (SRB014)

13. The MSAB **NOTED** paper IPHC-2019-MSAB014-05, which provided the outcomes of the 15th Session of the IPHC Scientific Review Board (SRB015) relevant to the mandate of the MSAB, which were provided for reference.

14. The MSAB **REQUESTED** further clarification from the SRB on paragraphs 40–41 of IPHC-2019-SRB015-R:

    SRB015 (para. 40) *"The SRB NOTED the proposed objective to have annual mortality limits related to local abundances. While this could provide transparency from a policy perspective, it ignores the biological realities of movement and other processes that remain poorly understood at both coastwide and Regulatory Area scales."*

    SRB015–Rec.05 (para. 41) "*The SRB RECOMMENDED that if the original objective to have annual mortality limits related to local abundances was of broad interest to the Commission, then candidate management procedures be developed and tested in which regional mortality limits are set annually in proportion to modelled survey abundance trends by IPHC Regulatory Area (noting that splitting regions into Regulatory Areas would require assumptions about within-region abundance proportions)."*

3.4 Outcomes of the 95th Session of the IPHC Annual Meeting (AM095)

15. The MSAB **NOTED** paper IPHC-2019-MSAB014-06, which detailed the outcomes of the 95th Session of the IPHC Annual Meeting (AM095) relevant to the mandate of the MSAB.

16. The MSAB **RECALLED** para. 61 of IPHC-2019-AM095-R:

    "The Commission AGREED with the MSAB recommendation that the harvest strategy policy consist of a coast wide fishing intensity SPR should not be lower than 40% nor higher than 46%, with a target SPR of 42%-43% and with a 30:20 HCR."

17. The MSAB **RECALLED** the following three (3) recommendations from the Commission:

    AM095–Rec.01 (para. 59c) "*The Commission RECOMMENDED the MSAB develop the following additional objective, as well as prioritize this objective in the evaluation of management procedures, for the Commission's consideration.*

a) A conservation objective that meets a spawning biomass target."

AM095–Rec.02 (para. 62) "*The Commission RECOMMENDED that the MSAB and IPHC Secretariat continue its program of work on the Management Procedure for the Scale portion of the harvest strategy, NOTING that Scale and Distribution components will be evaluated and presented no later than at AM097 in 2021, for potential adoption and subsequent implementation as a harvest strategy. The management procedure that best meets the primary objectives for coastwide scale is:*

a) A target SPR of 40% with a fishery trigger of 30% and a fishery limit of 20% in the control rule;

b) An annual constraint of 15% from the previous year's mortality limit."

AM095–Rec.04 (para. 66) "*The Commission RECOMMENDED evaluating and redefining TCEY to include the U26 component of discard mortalities, including bycatch, as steps towards more comprehensive and responsible management of the resource, in coordination with the IPHC Secretariat and Contracting Parties. The intent is that each Contracting Party to the Treaty would be responsible for counting its U26 mortalities against its collective TCEY. This change would be intended to take effect for TCEYs established at the 2020 Annual Meeting."*

18. The MSAB **NOTED** that future Commission decisions may include all sources of mortality (e.g. TCEY and U26 non-directed fishing discard mortality) and that Management Procedures will accommodate the Commission decisions.

3.5 Brief review of the two-year Program of Work

19. The MSAB **NOTED** that the full MSE is scheduled for delivery at the 97th Session of the IPHC Annual Meeting (AM097) in January of 2021 and that the agenda for MSAB014 will include clearly defining objectives, identifying management procedures, and reviewing the multi-area operating model. Results of the simulations will be evaluated during the MSAB meetings in 2020.

20. The MSAB **NOTED** that an independent external peer review of the MSE process will likely occur in 2020 as noted in the presentation associated with document IPHC-2019-MSAB014-09.

4. REVIEW THE FRAMEWORK TO INVESTIGATE DISTRIBUTING THE TCEY AMONG IPHC REGULATORY AREAS

4.1 Review the framework

21. The MSAB **NOTED** paper IPHC-2019-MSAB014-08 which provided the MSAB with an overview of the development of the MSE framework and the multi-area Operating Model ("OM").

4.2 Development of a multi-area operating model

22. The MSAB **NOTED** that the OM will be tuned to the stock assessment to be presented at AM096 which includes updated and new data.

23. The MSAB **NOTED** that the OM will be spatially specified by Biological Region with movement modelled between Biological Regions. Fishery sectors will be modelled at the IPHC Regulatory Area level with approximations of how those fisheries operate within a Biological Region. Additionally, performance metrics will be available by IPHC Regulatory Area. The methods for determining metrics by IPHC Regulatory Area are under development and may be done by modelling the proportion of biomass in each IPHC Regulatory Area within a Biological Region in some way. This means that population and fishery dynamics at the IPHC Regulatory Area level may not be fully captured.

24. The MSAB **NOTED** the general understanding about seasonal spawning and ontogenetic movements (i.e. movement related to specific life stages) of Pacific halibut. Several questions remain, for example:

a) degree of mixing between IPHC Regulatory Areas and Biological Regions, including areas outside of the IPHC Convention Area;

b) variability of movement from one year to the next;

c) changes in movement due to environmental variability, including climate change; and

d) relative contribution of spawning grounds to future recruitment.

5. Goals, objectives, and performance metrics for the IPHC MSE process

25. The MSAB **NOTED** paper IPHC-2019-MSAB014-07 which provided an update on scale and distribution objectives, and defining management procedures related to distributing the TCEY for use in the MSE process.

26. The MSAB **NOTED** paper IPHC-2019-MSAB014-INF01 which provided a summary and outcomes of the MSAB *ad hoc* Working Group discussion on coastwide and distribution objectives. In particular:

    a) objectives reflecting biological sustainability and stability in catch limits (e.g. a result of natural variability and assessment uncertainty). These objectives apply to the coastwide or Biological Region level;

    b) interaction objectives (the effect of one area on another). These objectives apply to the Biological Region, Management Zone, or IPHC Regulatory Area level; and

    c) objectives within IPHC Regulatory Areas.

27. The MSAB **NOTED** primary objectives will be used for evaluation of the management procedures and presented to the Commission. Additional performance metrics and statistics of interest will be available for evaluation.

28. The MSAB **NOTED** two types of implementation variability that will be modelled:

    a) variability in the difference between the mortality limit from the management procedure and the implemented mortality limit; and

    b) the difference between the implemented mortality limit and the realized mortality from all fisheries.

29. The MSAB **RECALLED** that the Commission made an informal inter-sessional request of the MSAB on 4 October 2018 (via email to the Co-Chairpersons) which included prioritizing conservation objectives over fishery objectives:

    "While it is recognized that the MSAB has spent considerable time and effort in developing objectives for evaluating management procedures, for the purpose of expediting a recommendation on the level of the coast-wide fishing intensity, and noting SRB11–Rec.02 to develop an objectives hierarchy, the MSAB is requested to evaluate management procedure performance against objectives that prioritize long-term conservation over short-/medium-term (e.g. 3-8 years) catch performance. Where helpful in accelerating progress on scale, the MSAB is requested to constrain objectives to (1) maintain biomass above a limit to avoid critical stock sizes, (2) maintain a minimum average catch, and (3) limit catch variability."

5.1 A review of the coastwide goals and objectives of the IPHC MSE process

30. The MSAB **AGREED** that the coastwide biological sustainability objective to keep the biomass above a limit should be updated to include a tolerance of 0.05 (5%) with the rationale that a spawning biomass limit of 20% is an appropriate biomass limit for Pacific halibut. Additionally, a tolerance of 0.05 is an acceptable level of risk based on constituent input as reported by individual MSAB members. These values are also consistent with harvest policies from other fisheries management bodies and with the

Marine Stewardship Council's scoring guideline 100 to avoid falling below minimum stock sizes 95% of the time.

31. **RECALLING** paragraph 44 of IPHC-2019-SRB015-R, and realizing that a fishery objective using a biomass threshold may be redundant with a fishery objective using a biomass target, the MSAB **AGREED** to remove a biomass threshold from the primary objectives:

    (para 44). *The SRB **NOTED** that candidate control rule development is an iterative process, and that:*

    a) use of the trigger from the control rule in coastwide objective 2.1A (Maintain the female spawning biomass above a trigger reference point at least 80% of the time) conflates the objective and management procedure

32. The MSAB **AGREED** that 30% of unfished spawning biomass is a precautionary proxy for RSB_{MSY} based on an analysis of dynamic reference points using an equilibrium model, the stock assessment ensemble, and the MSE operating model.
33. The MSAB **NOTED** that the consequences of exceeding MSY can introduce a considerable amount of risk to the spawning biomass. Additionally, multiple paradigms in fisheries science suggest that we cannot know MSY exactly for any stock, and that precautionary proxies address this uncertainty and also offer benefits of stability and conservation.
34. The MSAB **RECOMMENDED** a coastwide fishery objective, in response to a request from the Commissioners, to maintain the spawning biomass above a target reference point of $RSB_{36\%}$, 50% of the time over the long-term.
35. The MSAB **NOTED** that stakeholders are interested in both the annual change in catch limits from year to year and an average of the annual percent change over time. Therefore, both Annual Change (AC) and Average Annual Variability (AAV) will be reported as performance metrics for the primary stability objectives.

5.2 An update from the ad hoc working group tasked to refine goal and objectives related to distribution

36. The MSAB **NOTED** paper IPHC-2019-MSAB014-INF01 which provided a starting point for the discussion of objectives related to distributing TCEY.

5.3 Identification of goals and objectives related to distributing the TCEY

37. The MSAB **AGREED** to an objective to conserve spatial population structure that is defined as a minimum proportion of the spawning biomass in each Biological Region as 5% in Region 2, 33% in Region 3, 10% in Region 4, and 2% in Region 4B. These proportions were proposed by the IPHC Secretariat after qualitatively investigating the modelled survey proportion of O32 stock distribution in each Biological Region since 1993 and may be updated following further review.
38. The MSAB **AGREED** that a distribution measurable objective to maintain a proportion of O26 Pacific halibut biomass in each area be classified as a secondary objective.
39. The MSAB **AGREED** that the same catch variability performance metrics listed in paragraph 35 be defined at the IPHC Regulatory Area level.
40. **NOTING** that trade-offs will exist between IPHC Regulatory Areas for the same objective, the MSAB **AGREED** to a general objective to provide directed fishing yield, and to report performance metrics to evaluate variability and yield trade-offs within and between IPHC Regulatory Areas. Four performance metrics related to yield that will be reported are:
    a) median average proportion of TCEY in each IPHC Regulatory Area;
    b) median minimum proportion of TCEY in each IPHC Regulatory Area;

c) median average TCEY in each IPHC Regulatory Area;

d) median minimum TCEY in each IPHC Regulatory Area.

41. The MSAB **RECOMMENDED** the primary objectives and associated performance metrics detailed in Appendix V to be used for the evaluation of management procedures at MSAB015.

42. **NOTING** that objectives will be updated as management procedures are evaluated, the MSAB **AGREED** to pause discussion about primary objectives to facilitate evaluation of management procedures in 2020. New primary objectives will first be proposed in writing to the MSAB Co-Chairpersons and IPHC Secretariat where they will be reviewed for clarity, and potentially presented to the MSAB for inter-sessional comment.

5.4 Performance metrics for evaluation

43. The MSAB **NOTED** that the IPHC Secretariat will report appropriate performance metrics for primary objectives, as well as additional metrics as needed to aid the evaluation of management procedures at MSAB015 and MSAB016.

44. The MSAB **AGREED** that:

a) the type of constraint on the TCEY in the management procedure has different implications for the catch variability objectives. More specifically, a constraint of +/-15% maximum change in total mortality leads to lower probabilities that the annual change in the TCEY will exceed 15%, but a higher average annual change in the TCEY than the slow-up, fast-down constraint; and

b) sustained fishing intensities of SPR=40% will fail to satisfy the biomass target objective for management procedures without a catch constraint and some management procedures with catch constraints. A coastwide fishing of 43% is a precautionary buffer to allow for uncertainty given outcomes of distribution procedures.

45. The MSAB **NOTED** that changing the TCEY every third year (multi-annual setting of catch limits) met the primary objectives. However, this constraint has different properties in that there is no change in the TCEY for a three-year period followed by the possibility of a large change which leads to worse performance for probability that the annual change in any three years exceeds 15%.

46. **NOTING** the current progress on evaluating coastwide fishing intensity, the MSAB **RECOMMENDED** that:

a) a coastwide fishing intensity SPR of 43%, with a 30:20 HCR, and with one of two constraints 1) +/-15% maximum change in total mortality, and/or 2) slow up, fast down, be used in harvest strategy development process; and

b) a range of management procedures including fishing intensity SPR of 40-46% be considered in light of implementation variability within the closed-loop simulations when investigating distribution.

6. MANAGEMENT PROCEDURES TO DETERMINE THE TOTAL CONSTANT EXPLOITATION YIELD (TCEY) BY IPHC REGULATORY AREAS FOR PACIFIC HALIBUT FISHERIES

47. The MSAB **NOTED** paper IPHC-2019-MSAB014-07 which describes the coastwide scale and distribution components of the harvest strategy policy (Fig. 1), a framework for developing management procedures, and example management procedures.

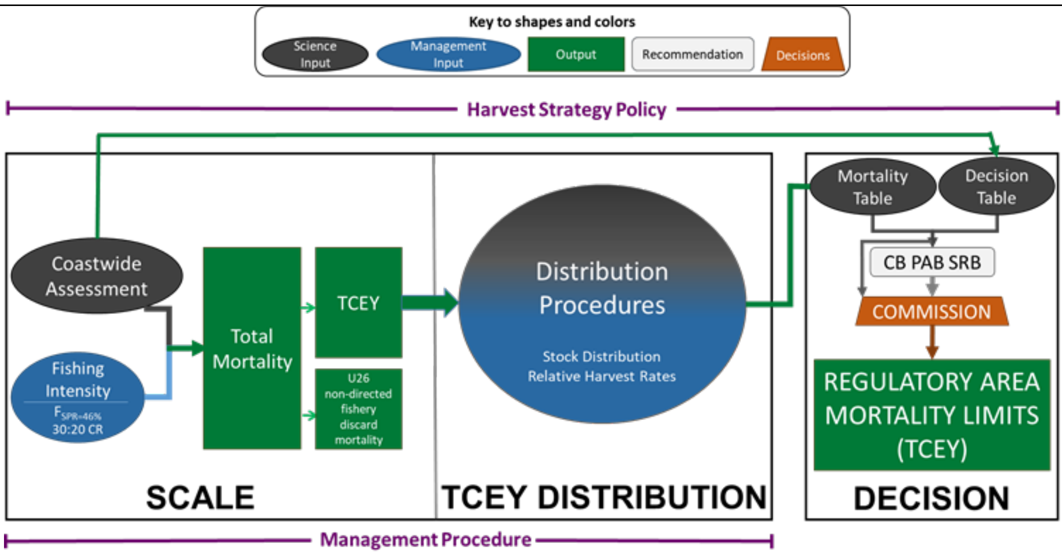

Figure 1. An illustration of the current interim IPHC harvest strategy policy process showing the coastwide scale and TCEY distribution components that comprise the management procedure. The decision component is the Commission decision-making procedure, which considers inputs from many sources.

48. The MSAB **NOTED** that there is a difference between operational control points in the harvest control rule (Fig. 2) and biomass reference points used to define objectives, although they may be defined as the same value.

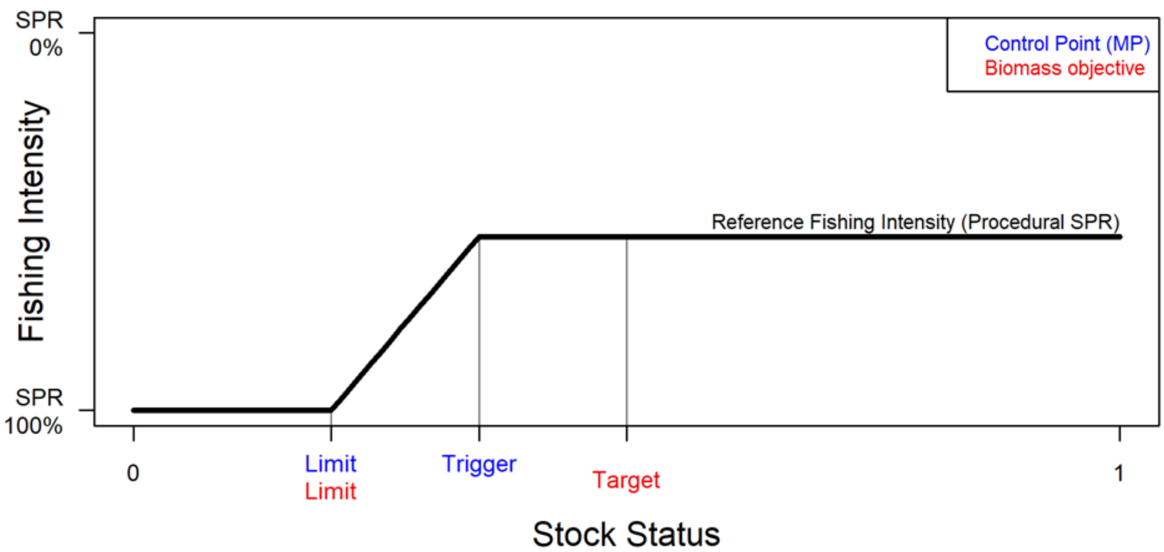

Figure 2. The harvest control rule showing the how the reference fishing intensity is adjusted, operational control points in the management procedure and how they related to reference points used in defining objectives.

6.1 Management procedures for coastwide scale

49. The MSAB **RECOMMENDED** that SPR values of 0.3, 0.34, 0.38, 0.40, 0.42, 0.46, and 0.50 with a 30:20 control rule be evaluated at MSAB015 along with constraints defined by a maximum change in the TCEY of 15%, a slow-up fast-down approach, and/or setting quotas every third year.

6.2 Management procedures for distributing the TCEY

50. The MSAB **AGREED** that the distribution framework with the steps listed below is a useful method for developing management procedures to distribute the TCEY.
    a) determine a coastwide TCEY;
    b) (optional) distribute the TCEY to Biological Regions or Management Zones;
    c) distribute the TCEY to IPHC Regulatory Areas based on stock distribution, relative fishing intensities, allocation agreements, data, or other observations.
51. The MSAB **NOTED** that historical productivity differences between IPHC Regulatory Areas is one rationale for different relative harvest rates between IPHC Regulatory Areas.
52. The MSAB **NOTED** a presentation by the IPHC Secretariat to update estimates of productivity for each Biological Region (using a Yield-Per-Recruit analysis), which showed that productivity in 2018 appears to be similar among Biological Regions, except in 4B where the productivity was lower, suggesting a lower harvest rate for IPHC Regulatory Area 4B.
53. The MSAB **AGREED** on a number of candidate management procedures (Table 1 in Appendix VI) to be considered for evaluation. Various elements for distributing the TCEY to Biological Regions Management Zones, and/or IPHC Regulatory Areas, including relative harvest rates, abundance-based allocations, and minimum allocations. Management Zones are aggregated IPHC Regulatory Areas that do not necessarily align with Biological Regions.
54. The MSAB **NOTED** that some distribution procedures may change the coastwide TCEY associated with a particular reference fishing intensity (F_{SPR}). In response, the IPHC Secretariat presented the idea of defining a buffer in the harvest control rule which would periodically allow for higher fishing intensities than the reference SPR. A potential limit of the buffer could be defined as the SPR_{MSY}.
55. The MSAB **REQUESTED** that a number of elements in distribution management procedures be included for evaluation at MSAB015:
    a) A coastwide constraint using a slow-up, fast-down approach with a maximum change in the TCEY of 15%;
    b) evaluating different relative harvest rates across IPHC Regulatory Areas or Biological Regions;
    c) distributing the TCEY directly to IPHC Regulatory Area;
    d) A fixed shares concept for all or some IPHC Regulatory Areas, Biological Regions, or Management Zones with options to distribute the TCEY to the areas without a fixed share. The determination of these shares may be fixed or varying over time; and
    e) A maximum fishing intensity defined by an SPR of 36% to act as a buffer when distributing the TCEY to IPHC Regulatory Areas.
56. The MSAB **RECOMMENDED** that the management procedures listed in Table 2 in Appendix VI be evaluated at MSAB015.
57. The MSAB **NOTED** additional elements for distribution procedures to consider as sensitivities when developing management procedures for evaluation at MSAB015 as follows:
    a) a constraint applied to the TCEY for each IPHC Regulatory Area using a slow-up, fast-down approach with a maximum change in the TCEY of 15%;
    b) using O32 estimates of stock distribution or "all sizes" estimates of stock distribution from the modelled survey results;
    c) evaluating different relative harvest rates across IPHC Regulatory Areas or Biological Regions (e.g. harvest rates for Biological Region 2, IPHC Regulatory Areas 2A and/or 4CDE);

d) calculating shares across Biological Regions, Management Zones, or IPHC Regulatory Areas using approaches that blend multiple sources of information (e.g., using historical TCEYs and stock distribution results for all IPHC Regulatory Area, a 5-year window of estimated stock distribution, etc.);

e) the importance the order of applying elements in the distribution procedure when limiting the maximum SPR (i.e. using a buffer).

58. The MSAB **NOTED** additional elements for distribution procedures to consider when developing management procedures for evaluation at MSAB016 as follows:

a) a constraint applied to the TCEY for each IPHC Regulatory Area using a slow-up, fast-down approach;

b) a constraint applied to the TCEY for each IPHC Regulatory Area implementing a maximum change in the TCEY of 15%;

c) a maximum fishing intensity defined by an SPR of 40% to act as a buffer when distributing the TCEY to IPHC Regulatory Areas;

d) adjusting relative harvest rates to reflect current stock productivity (note that this will be explored before MSAB015);

e) using trends in fishery CPUE to adjust allocation percentages by IPHC Regulatory Area (note that this will be explored before MSAB015);

f) additional approaches to first distribute the TCEY to Biological Region or Management Zone.

7. MSAB PROGRAM OF WORK (2019-23)

59. The MSAB **NOTED** paper IPHC-2019-MSAB014-09 which provided an update on the 5-year MSE Program of Work (2019-23), given current Commission directives.

60. The MSAB **NOTED** the delivery dates of January 2020 for coastwide results and January 2021 for the MSE results, including Scale and Distribution components of the management procedure for potential adoption by the Commission and subsequent implementation.

61. The MSAB **NOTED** the Program of Work provided at Appendix VII.

8. OTHER BUSINESS

8.1 IPHC meetings calendar (2019-21)

62. The MSAB **NOTED** the current 3-year meeting calendar and that the 15th Session of the MSAB will be held in Courtenay, or Nanaimo, BC, Canada from 11-14 May 2020.

9. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 14TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB014)

63. The report of the 14th Session of the IPHC Management Strategy Advisory Board (IPHC-2019-MSAB014–R) was **ADOPTED** on 24 October 2019, including the consolidated set of recommendations and/or requests arising from MSAB014, provided at Appendix VIII.

APPENDIX I
LIST OF PARTICIPANTS FOR THE 14TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB014)

Officers

Co-Chairperson (Canada)	**Co-Chairperson (United States of America)**
Mr Adam **Keizer**: adam.keizer@dfo-mpo.gc.ca	Dr Carey **McGilliard**: Carey.McGilliard@noaa.gov

MSAB Members

Canada	**United States of America**
Mr Chuck **Ashcroft**: chuckashcroft@telus.net	Mr Forrest **Braden**: forrest@seagoalaska.org
Ms Ann-Marie **Huang:** Ann-Marie.Huang@dfo-mpo.gc.ca	Ms Michele **Culver**: Michele.Culver@dfw.wa.gov
Mr Adam **Keizer**: adam.keizer@dfo-mpo.gc.ca	Ms Angel **Drobnica**: adrobnica@apicda.com
Mr Jim **Lane**: jim.lane@nuuchahnulth.org	Mr Dan **Falvey**: myriadfisheries@gmail.com
Mr Chris **Sporer**: chris.sporer@phma.ca	Mr James **Johnson**: JimJ@glacierfish.com
	Mr Jeff **Kauffman**: jeff@spfishco.com
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	Mr Scott **Mazzone**: smazzone@quinault.org
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	Ms Sarah **Webster**: sarah.webster@alaska.gov
Absentees	**Absentees**
Mr Robert **Hauknes**: robert_hauknes@hotmail.com	Mr Glenn **Merrill**: glenn.merrill@noaa.gov
Mr Brad **Mirau**: brad@aerotrading.ca	Ms Peggy **Parker**: peggyparker616@gmail.com

Commissioners

Canada	**United States of America**
Mr Peter **DeGreef**: peter.degreef@iphc.int	Mr Bob **Alverson**: Robert.alverson@iphc.int

Observers

Canada	**United States of America**
Dr Luke **Rogers** (DFO)	Ms Maia **Sosa-Kapur** (UW)

IPHC Secretariat

Name	**Position and email**
Dr David **Wilson**	Executive Director, david.wilson@iphc.int
Mr Stephen **Keith**	Assistant Director, stephen.keith@iphc.int
Dr Piera **Carpi**	MSE Researcher, piera.carpi@iphc.int
Dr Allan **Hicks**	Quantitative Scientist, allan.hicks@iphc.int
Dr Ian **Stewart**	Quantitative Scientist, ian.stewart@iphc.int

APPENDIX II

AGENDA FOR THE 14TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB014)

Date: 21-24 October 2019
Location: Seattle, Washington, U.S.A.
Venue: IPHC Seattle Office
Time: 21st: 12:00-17:00; 22nd-24th 09:00-17:00 daily
Co-Chairpersons: Mr Adam Keizer (Canada) and Dr Carey McGilliard (U.S.A.)

1. **OPENING OF THE SESSION**

2. **ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION**

3. **IPHC PROCESS**
   - 3.1. MSAB Membership
   - 3.2. Update on the actions arising from the 13th Session of the MSAB (MSAB013)
   - 3.3. Review of the outcomes of the 15th Session of the Scientific Review Board (SRB015)
   - 3.4. Brief review of the two-year Program of Work

4. **DEVELOPMENT OF A FRAMEWORK TO INVESTIGATE FISHING INTENSITY AND DISTRIBUTING THE TOTAL CONSTANT EXPLOITATION YIELD (TCEY) FOR PACIFIC HALIBUT FISHERIES**
   - 4.1. Review the framework to investigate distributing the TCEY among IPHC Regulatory Areas
   - 4.2. Development of a multi-area operating model

5. **GOALS, OBJECTIVES, AND PERFORMANCE METRICS FOR THE IPHC MSE PROCESS**
   - 5.1. A review of the coastwide goals and objectives of the IPHC MSE process
   - 5.2. An update from the ad hoc working group tasked to refine goal and objectives related to distribution
   - 5.3. Identification of goals and objectives related to distributing the TCEY
   - 5.4. Performance metrics for evaluation

6. **MANAGEMENT PROCEDURES TO DETERMINE THE TOTAL CONSTANT EXPLOITATION YIELD (TCEY) BY IPHC REGULATORY AREAS FOR PACIFIC HALIBUT FISHERIES**
   - 6.1. Management procedures for coastwide scale
   - 6.2. Management procedures for distributing the TCEY

7. **MSAB PROGRAM OF WORK (2019-23)**

8. **OTHER BUSINESS**
   - 8.1. IPHC meetings calendar (2019-21)

9. **REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 14th SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB014)**

APPENDIX III
LIST OF DOCUMENTS FOR THE 14TH SESSION OF THE MANAGEMENT STRATEGY ADVISORY BOARD (MSAB014)

Document	Title	Availability
IPHC-2019-MSAB014-01	Draft: Agenda & Schedule for the 14th Session of the IPHC Management Strategy Advisory Board (MSAB014)	✓ 22 Jul 2019
IPHC-2019-MSAB014-02	List of Documents for the 14th Session of the IPHC Management Strategy Advisory Board (MSAB014)	✓ 04 Sept 2019 ✓ 20 Sept 2019 ✓ 15 Oct 2019
IPHC-2019-MSAB014-03	MSAB Membership (D. Wilson)	✓ 20 Sept 2019
IPHC-2019-MSAB014-04	Update on the actions arising from the 13th Session of the MSAB (MSAB013) (A. Hicks)	✓ 20 Sept 2019
IPHC-2019-MSAB014-05	Outcomes of the 15th Session of the IPHC Scientific Review Board (SRB015) (IPHC Secretariat)	✓ 15 Oct 2019
IPHC-2019-MSAB014-06	Outcomes of the 95th Session of the IPHC Annual meeting (AM095) (D. Wilson & A. Hicks)	✓ 20 Sept 2019
IPHC-2019-MSAB014-07	Objectives and management procedures for the IPHC Management Strategy Evaluation (MSE) (A. Hicks, P. Carpi, & I. Stewart)	✓ 20 Sept 2019
IPHC-2019-MSAB014-08	Development of a framework to investigate fishing intensity and distributing the total constant exploitation yield (TCEY) for Pacific halibut fisheries (A. Hicks, S. Berukoff, P. Carpi)	✓ 20 Sept 2019
IPHC-2019-MSAB014-09	IPHC Secretariat Program of Work for MSAB Related Activities 2019-23 (A. Hicks, P. Carpi, S. Berukoff)	✓ 20 Sept 2019
Information papers		
IPHC-2019-MSAB014-INF01	Ad-hoc Working Group ideas to Refine Goals, Objectives, and Performance Metrics for the IPHC Management Strategy Evaluation (MSE) (A. Hicks, P. Carpi, MSAB Ad-Hoc Working Group)	✓ 20 Sept 2019
IPHC-2019-MSAB014-INF02	Technical details of the IPHC MSE framework (A. Hicks, P. Carpi, S. Berukoff)	✓ 20 Sept 2019

APPENDIX IV
MSAB MEMBERSHIP

Membership category	Member	Canada	U.S.A.	Current Term commence-ment	Current Term expiration
Commercial harvesters (6-8)					
1	Sporer, Chris	CDN Commercial		9-May-17	08-May-21
2	Hauknes, Robert	CDN Commercial		9-May-17	08-May-21
3	Vacant	CDN Commercial			
4	Vacant	CDN Commercial			
5	Johnson, James		USA Commercial	17-Apr-19	16-Apr-23
6	Kauffman, Jeff		USA Commercial	9-May-19	08-May-23
7	Odegaard, Per		USA Commercial	9-May-17	08-May-21
8	Falvey, Dan		USA Commercial	9-May-17	08-May-21
First Nations/ Tribal fisheries (2-4)					
1	Lane, Jim	CDN First Nations		9-May-17	08-May-21
2	Vacant	CDN First Nations			
3	Mazzone, Scott		USA Treaty Tribes	9-May-19	08-May-23
4	Vacant		USA Treaty Tribes		
Government Agencies (4-8)					
1	Keizer, Adam	DFO		9-May-19	08-May-23
2	Huang, Ann-Marie	CDN Science Advisor		10-May-18	09-May-22
3	Vacant	DFO			
4	Merrill, Glenn		NOAA-Fisheries	7-May-18	06-May-22
5	McGilliard, Carey		USA Science Advisor	9-May-17	08-May-21
6	Culver, Michele		PFMC	9-May-17	08-May-21
7	Baker, Rachel		NPFMC	23-Oct-19	22-Oct-21
8	Hasbrouck, James		ADFG	12-Oct-18	11-Oct-22
Processors (2-4)					
1	Parker, Peggy	US/CDN Processing	US/CDN Processing	9-May-19	08-May-23
2	Mirau, Brad	CDN Processing		9-May-19	08-May-23
3	Morelli, Joseph		USA Processing	29-Aug-18	28-Aug-22
4	Drobnica, Angel		USA Processing	17-Apr-19	16-Apr-23

Membership category	Member	Canada	U.S.A.	Current Term commence-ment	Current Term expiration
Recreational/ Sport fisheries (2-4)					
1	Ashcroft, Chuck	CDN Sport Fishing Advisory Board		17-Apr-19	16-Apr-23
2	Vacant	CDN Sportfishing			
3	Marking, Tom		USA Sportfishing (CA)	9-May-19	08-May-23
4	Braden, Forrest		USA Sportfishing (AK)	17-Apr-19	16-Apr-23

APPENDIX V
PRIMARY OBJECTIVES AND ASSOCIATED PERFORMANCE METRICS

GENERAL OBJECTIVE	MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE	PERFORMANCE METRIC
1.1. KEEP FEMALE SPAWNING BIOMASS ABOVE A LIMIT TO AVOID CRITICAL STOCK SIZES AND CONSERVE SPATIAL POPULATION STRUCTURE	Maintain a female spawning stock biomass above a biomass limit reference point at least 95% of the time	SB < Spawning Biomass Limit (SB_{Lim}) SB_{Lim}=20% unfished spawning biomass	Long-term	0.05	$P(SB < SB_{Lim})$
	Maintain a defined minimum proportion of female spawning biomass in each Biological Region	$p_{SB,2} > 5\%$ $p_{SB,3} > 33\%$ $p_{SB,2} > 10\%$ $p_{SB,2} > 2\%$	Long-term	0.05	$P(p_{SB,R} < p_{SB,R,min})$
2.1 MAINTAIN SPAWNING BIOMASS AROUND A LEVEL THAT OPTIMISES FISHING ACTIVITIES	Maintain the coastwide female spawning biomass above a biomass target reference point at least 50% of the time	SB<Spawning Biomass Target (SB_{Targ}) SB_{Targ}=$SB_{36\%}$ unfished spawning biomass	Long-term	0.50	$P(SB < SB_{Targ})$
2.2. LIMIT CATCH VARIABILITY	Limit annual changes in the coastwide TCEY	Annual Change (AC) > 15% in any 3 years	Short-term		$P(AC_3 > 15\%)$
		Median coastwide Average Annual Variability (AAV)	Short-term		*Median AAV*
	Limit annual changes in the Regulatory Area TCEY	Annual Change (AC) > 15% in any 3 years	Short-term		$P(AC_3 > 15\%)$
		Average AAV by Regulatory Area (AAV_A)	Short-term		*Median* AAV_A
2.3. PROVIDE DIRECTED FISHING YIELD	Optimize average coastwide TCEY	Median coastwide TCEY	Short-term		*Median* $\overline{TCEY}$
	Optimize TCEY among Regulatory Areas	Median $TCEY_A$	Short-term		*Median* $\overline{TCEY_A}$
	Optimize the percentage of the coastwide TCEY among Regulatory Areas	Median $\%TCEY_A$	Short-term		*Median* $\overline{\left(\frac{TCEY_A}{TCEY}\right)}$
	Maintain a minimum TCEY for each Regulatory Area	Minimum $TCEY_A$	Short-term		*Median Min(TCEY)*
	Maintain a percentage of the coastwide TCEY for each Regulatory Area	Minimum $\%TCEY_A$	Short-term		*Median Min(%TCEY)*

APPENDIX VI
PROPOSED AND RECOMMENDED MANAGEMENT PROCEDURES

Table 1. Management procedures proposed by MSAB members.

Proposed MP	**Coastwide**	**Regional**	**IPHC Regulatory Area**
Commission Interim MP	SPR 30:20		• O32 stock distribution • Proportional Relative harvest rates (starting with 1.0 for 2-3A, 0.75 for 3B-4) relative to below • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)
MP 1	SPR 30:20 Max FI = 36% 15% max change		• 15% maximum change • O32 stock distribution with 3 year weighted average (50:30:20) • Relative HR (1 for 2-3A, 0.75 for 3B-4)
MP 2	SPR 30:20 Max FI = 36% 15% max change		• 15% maximum change • O32 stock distribution with 3 year weighted average (50:30:20) • Relative HR using YPR-type analysis every 5 years
MP 3	SPR 30:20 Max FI =36% 15% max change		• 15% maximum change • O32 stock distribution with 3 year weighted average (50:30:20) • Relative HR (1 for 2-3A, 0.75 for 3B-4) • 3-year average trend in CPUE informs an up to 5% change in allocation percentage if allowed by buffer after above points
MP 4	SPR 30:20 Max FI =36% 15% max change		• 15% maximum change • O32 stock distribution with 3 year weighted average (50:30:20) • Adjust relative harvest rates every 5 years using productivity analyses • 3-year average trend in CPUE informs an up to 5% change in allocation percentage if allowed by buffer after above points
MP 5	SPR 30:20 SUFD 15% max change		• % of TCEY = 70% of 5-year adopted TCEY (moving window starting with 2015–2019) + 30% O32 modelled survey stock distribution
MP 6	SPR 30:20	National Zones (20% to 2B, 80% to other)	• Other Reg Areas distributed using o the modelled O32 stock distribution o Proportional Relative harvest rates (starting with 1.0 for 2-3A, 0.75 for 3B-4) relative to Regional allocation

Proposed MP	**Coastwide**	**Regional**	**IPHC Regulatory Area**
MP 7	SPR 30:20 15% max change	National Zones (20% to 2B, 80% to other)	• Other Reg Areas distributed using o the modelled O32 stock distribution o Proportional Relative harvest rates (starting with 1.0 for 2-3A, 0.75 for 3B-4) relative to Regional allocation
MP 8	SPR 30:20 15% max change	• Trends in the all sizes stock distribution averaged over recent 3 years • Relative harvest rates based on uncertainty in bycatch (TBD)	• Proportion of adopted TCEYs from 2013–2017
MP 9	SPR 30:20 15% max change		• O32 stock distribution • Proportional Relative harvest rates (starting with 1.0 for 2-3A, 0.75 for 3B-4) relative to below • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)
MP 10	SPR 30:20	• Relative harvest rates o Reg 2 = 1.25 o Reg 3 = combine 3AB (TBD) o Reg 4 = 0.75	• All sizes stock distribution
MP 11	SPR 30:20	• Relative harvest rates o Reg 2 = 1.25 o Reg 3 = combine 3AB (TBD) o Reg 4ACDE = 1.0 o Reg 4B = 0.75	• All sizes stock distribution
MP 12	SPR 30:20	• Zone 2AB = status quo 2B formula + 4% • All sizes stock distribution for zones 2C3A, 3B4A, 4B, 4CDE • Relative harvest rates of 1.0, 1.0, 0.75, 0.75, 0.75	• TBD
MP 13	SPR 30:20	• Zone 2AB = status quo 2B formula + 4% • All sizes stock distribution for zones 2C3A, 3B4A, 4B, 4CDE • Relative harvest rates of 1.0, 0.75, 0.75, 0.75, 0.75	• TBD
MP 14	SPR 30:20		• O32 stock distribution • Proportional Relative harvest rates (starting with 1.0 for 2-3A, 0.75 for 3B-4) relative to below • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)

Proposed MP	Coastwide	Regional	IPHC Regulatory Area
MP 15	SPR 30:20		• O32 stock distribution • Relative harvest rates not applied • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)
MP16	SPR 30:20		• O32 stock distribution (fixed from 2015-2019 initially, adjusted every 5 years)
MP17	SPR 30:20	National Zones (2B and Other): O32 stock distribution (over 5 year periods)	• O32 stock distribution (fixed from 2015-2019 initially, adjusted every 5 years)

Table 2. Recommended management procedures for evaluation at MSAB015.

MP	**Coastwide**	**Regional**	**IPHC Regulatory Area**
MP A	SPR 30:20		• O32 stock distribution • Proportional Relative harvest rates (starting with 1.0 for 2-3A, 0.75 for 3B-4) relative to below • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)
MP B	SPR 30:20 Slow-up, fast-down MaxChange15%		• O32 stock distribution • Proportional Relative harvest rates (starting with 1.0 for 2-3A, 0.75 for 3B-4) relative to below • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)
MP C	SPR 30:20		• O32 stock distribution • Relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4)
MP D	SPR 30:20 Slow-up, fast-down MaxChange15%		• O32 stock distribution • Relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4)
MP E	SPR 30:20		• O32 stock distribution • Relative harvest rates (0.75 for 4B, 1 for others) •
MP F	SPR 30:20	Biological Regions, O32 stock distribution Rel HRs: R2=1, R3=1, R4=0.75, R4B=0.75	• O32 stock distribution • Relative harvest rates not applied • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)
MP G	SPR 30:20	Biological Regions, O32 stock distribution Rel HRs: R2=1, R3=1, R4=1, R4B=0.75	• O32 stock distribution • Relative harvest rates not applied • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)
MP H	SPR 30:20 Max FI (36%)		First • O32 stock distribution • Relative harvest rates (1.0 for 2-3A, 0.75 for 3B-4) Second within buffer • 1.65 Mlbs floor in 2A (para 69c AM095-R) • Formula percentage for 2B (para 69b AM095-R)
MP I	SPR 30:20		• 5-year shares determined from 5-year O32 stock distribution (vary over time)
MP J	SPR 30:20	National Shares: 20% to 2B, 80% to other	• O32 stock distribution

APPENDIX VII
MSE PROGRAM OF WORK (2019-21)

13th Session of the IPHC MSAB (MSAB013) - May 2019	**Status**
Evaluate additional Scale management procedures	Completed
Review goals and objectives	Completed
Spatial model complexity	Completed
Identify management procedures (Scale & Distribution)	Completed
Review Framework	Completed
14th Session of the IPHC MSAB (MSAB014) - October 2019	
Review Framework	Completed
Review multi-area model development	Completed
Spatial Model Complexity	Completed
Define Goals and Objectives (Scale & Distribution)	Completed
Identify management procedures (Scale & Distribution)	Completed
96th Session of the IPHC Annual Meeting (AM096) – January 2020	
Update on progress	
15th Session of the IPHC MSAB (MSAB015) - May 2020	
Review goals and objectives (Scale & Distribution)	
Review simulation framework	
Review multi-area model	
Review preliminary results	
Identify management procedures (Scale & Distribution)	
16th Session of the IPHC MSAB (MSAB016) - October 2020	
Review final results	
Provide recommendations on management procedures	
97th Session of the IPHC Annual Meeting (AM097) – January 2021	
Presentation of complete MSE product to the Commission Recommendations on Scale and Distribution management procedures	

APPENDIX VIII
CONSOLIDATED SET OF RECOMMENDATIONS AND REQUESTS OF THE 14TH SESSION OF THE IPHC MANAGEMENT STRATEGY ADVISORY BOARD (MSAB014)

RECOMMENDATIONS

A review of the coastwide goals and objectives of the IPHC MSE process

MSAB014–Rec.01 (para. 34) The MSAB **RECOMMENDED** a coastwide fishery objective, in response to a request from the Commissioners, to maintain the spawning biomass above a target reference point of $RSB_{36\%}$, 50% of the time over the long-term.

Identification of goals and objectives related to distributing the TCEY

MSAB014–Rec.02 (para. 41) The MSAB **RECOMMENDED** the primary objectives and associated performance metrics detailed in Appendix V to be used for the evaluation of management procedures at MSAB015.

Performance metrics for evaluation

MSAB014–Rec.03 (para. 46) **NOTING** the current progress on evaluating coastwide fishing intensity, the MSAB **RECOMMENDED** that:

a) a coastwide fishing intensity SPR of 43%, with a 30:20 HCR, and with one of two constraints 1) +/-15% maximum change in total mortality, and/or 2) slow up, fast down, be used in harvest strategy development process; and

b) a range of management procedures including fishing intensity SPR of 40-46% be considered in light of implementation variability within the closed-loop simulations when investigating distribution.

Management procedures for coastwide scale

MSAB014–Rec.04 (para. 49) The MSAB **RECOMMENDED** that SPR values of 0.3, 0.34, 0.38, 0.40, 0.42, 0.46, and 0.50 with a 30:20 control rule be evaluated at MSAB015 along with constraints defined by a maximum change in the TCEY of 15%, a slow-up fast-down approach, and/or setting quotas every third year.

Management procedures for distributing the TCEY

MSAB014–Rec.05 (para. 56) The MSAB **RECOMMENDED** that the management procedures listed in Table 2 in Appendix VI be evaluated at MSAB015.

REQUESTS

Review of the outcomes of the 14th Session of the IPHC Scientific Review Board (SRB014)

MSAB014–Req.01 (para. 14) The MSAB **REQUESTED** further clarification from the SRB on paragraphs 40–41 of IPHC-2019-SRB015-R:

> SRB015 (para. 40) *"The SRB NOTED the proposed objective to have annual mortality limits related to local abundances. While this could provide transparency from a policy perspective, it ignores the biological realities of movement and other processes that remain poorly understood at both coastwide and Regulatory Area scales."*

SRB015–Rec.05 (para. 41) "*The SRB RECOMMENDED that if the original objective to have annual mortality limits related to local abundances was of broad interest to the Commission, then candidate management procedures be developed and tested in which regional mortality limits are set annually in proportion to modelled survey abundance trends by IPHC Regulatory Area (noting that splitting regions into Regulatory Areas would require assumptions about within-region abundance proportions).*"

Management procedures for distributing the TCEY

MSAB014–Req.02 (para. 55) The MSAB **REQUESTED** that a number of elements in distribution management procedures be included for evaluation at MSAB015:

a) A coastwide constraint using a slow-up, fast-down approach with a maximum change in the TCEY of 15%;

b) evaluating different relative harvest rates across IPHC Regulatory Areas or Biological Regions;

c) distributing the TCEY directly to IPHC Regulatory Area;

d) A fixed shares concept for all or some IPHC Regulatory Areas, Biological Regions, or Management Zones with options to distribute the TCEY to the areas without a fixed share. The determination of these shares may be fixed or varying over time; and

e) A maximum fishing intensity defined by an SPR of 36% to act as a buffer when distributing the TCEY to IPHC Regulatory Areas.

Report of the 24th Session of the IPHC Processor Advisory Board (PAB024)

Victoria, British Columbia, Canada, 29-30 January 2019

DISTRIBUTION:
Participants in the Session
Members of the Commission
IPHC Secretariat

BIBLIOGRAPHIC ENTRY
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IPHC–2019–PAB024–R, 15 pp.

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ACRONYMS

FCEY	Fishery Constant Exploitation Yield
IPHC	International Pacific Halibut Commission
PAB	Processor Advisory Board
SPR	Spawning Potential Ratio
TCEY	Total Constant Exploitation Yield

DEFINITIONS

A set of working definitions are provided in the IPHC Glossary of Terms and abbreviations: https://iphc.int/the-commission/glossary-of-terms-and-abbreviations

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

This report has been written using the following terms and associated definitions so as to remove ambiguity surrounding how particular paragraphs should be interpreted.

Level 1: **RECOMMENDED**; **RECOMMENDATION; ADOPTED** (formal); **REQUESTED; ENDORSED** (informal): A conclusion for an action to be undertaken, by a Contracting Party, a subsidiary (advisory) body of the Commission and/or the IPHC Secretariat.

Level 2: **AGREED**: Any point of discussion from a meeting which the Commission considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 above; a general point of agreement among delegations/participants of a meeting which does not need to be elevated in the Commission's reporting structure.

Level 3: **NOTED/NOTING**; **CONSIDERED**; **URGED**; **ACKNOWLEDGED**: General terms to be used for consistency. Any point of discussion from a meeting which the Commission considers to be important enough to record in a meeting report for future reference. Any other term may be used to highlight to the reader of an IPHC report, the importance of the relevant paragraph. Other terms may be used but will be considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3.

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EXECUTIVE SUMMARY

The 24th Session of the International Pacific Halibut Commission (IPHC) Processor Advisory Board (PAB024) was held in Victoria, Canada, from 29-30 January 2019. A total of 18 (20 in 2018) members attended the Session from the two (2) Contracting Parties, with a total of 33 meeting participants.

The following are a subset of the complete recommendations and requests for action from the PAB024, which are provided at Appendix IV.

RECOMMENDATIONS

Fishing periods: season opening and closing dates

PAB024-Rec.01 (para. 9) The PAB **RECOMMENDED** the following fishing period dates for the 2019:

a) Opening: 23 March at noon local time;

b) Closing: 7 November at noon local time.

Mortality limits

PAB024-Rec.02 (para. 12) The PAB **RECOMMENDED** the following TCEY mortality limits for the 2019 fishing period as provided in Table 1, which translate to the mortality estimates by sector (as provided by the IPHC Secretariat) provided in Appendix III and an SPR of 46%, modified by slow up fast down approach. To comply with the recommendation regarding PropC1, to allocate 1.65 mlbs to IPHC Regulatory Area 2A, taken proportionately from each Alaskan regulatory area.

Table 1. Processor Advisory Board (PAB) recommended TCEY mortality limits for 2019

IPHC Regulatory Area	Mortality limit (TCEY) (mlbs)
2A	1.65
2B	6.01
2C	6.17
3A	13.54
3B	3.06
4A	1.86
4B	1.47
4CDE	3.87
Total (IPHC Convention Area)	**37.63**

PAB024-Rec.08 (para. 27) The PAB **RECOMMENDED**:

a) a 1.65 million lbs TCEY in 2A for 2019, at FSPR46 total removal level be taken using Alaskan regulatory areas (prorated from 2019 TCEY in Alaskan IPHC Regulatory Area 2C-4) and needs to be reviewed annually. The purpose of this is to stay within the total mortality reflected in the F value adopted for coastwide removals.

b) that the Commission look at IPHC Regulatory Area 2A year-to-year in this regard, and not set a five-year term for an elevated allocation.

1. Opening of the Session

1. The 24th Session of the International Pacific Halibut Commission (IPHC) Processor Advisory Board (PAB024) was held in Victoria, Canada, from 29-30 January 2019. A total of 18 (20 in 2018) voting members attended the Session from the two (2) Contracting Parties. Thirty-one (31) participants in total participated over the two day meeting. The list of participants is provided at Appendix I. The meeting was opened by the HANA president Ms. Jessie Keplinger who welcomed participants to Victoria.
2. In accordance with Appendix VI, Section III of the IPHC Rules of Procedure (2017), the PAB **NOTED** the requirement to elect a Chairperson and a Vice-Chairperson of the PAB until the opening of the next PAB meeting in 2020.
3. The PAB **CALLED** for nominations for the position of Chairperson of the PAB until the opening of the next session in 2020. Mr. Blake Tipton (Canada) was nominated, seconded and elected as Chairperson.
4. The PAB **CALLED** for nominations for the position of Vice-Chairperson of the PAB until the opening of the next session in 2020. Ms Jessie Keplinger (USA) was nominated, seconded and elected as Vice-Chairperson.

2. Adoption of the agenda and arrangements for the Session

5. The PAB **ADOPTED** the Agenda as provided at Appendix II. The documents provided to the PAB024 are those submitted for the 95th Session of the IPHC Annual Meeting (AM095).

3. Fishing periods: season opening and closing dates

6. The PAB **AGREED** that a closing date of 7 November is preferable due to the substantial drop in market interest at the end of the season, deterioration of the weather in most areas, increased problems with quality, and the need for the IPHC Secretariat to collect and process data for the stock assessment in a timely manner.
7. The PAB **NOTED** that the relatively late opening date of March 23 reflects concern about another federal government shutdown in the U.S.A. which would delay issuance of permits, and the additional backlog the 35-day shutdown has caused now. The Saturday opening favors market timing, as well as the Boston Seafood Show, and tides. The early November closure is appropriate given weather for the fleets, market timing, and plant schedules.
8. The PAB **ACKNOWLEDGED** extensive discussion over season dates, including substitute motions (Recommendations), friendly amendments, a rescinded motion (Recommendation), and a final motion (Recommendation) with a friendly amendment during the two day session.

Recommendation

9. The PAB **RECOMMENDED** the following fishing period dates for the 2019 [in favour=14; against=2; abstain=2]:
    a) Opening: 23 March at noon local time;
    b) Closing: 7 November at noon local time.

4. Mortality limits

10. The PAB **NOTED** paper IPHC-2019-AM095-11 Rev_1 which provided an introduction and usage guide for the IPHC's web-based mortality projection tool (https://iphc.int/data/projection-tool).
11. The PAB **NOTED** the summary of IPHC Regulatory Area-specific mortality projections for 2019 based on the interim management procedure and other alternatives.

Recommendation

12. The PAB **RECOMMENDED** the following TCEY mortality limits for the 2019 fishing period as provided in Table 1, which translate to the mortality estimates by sector (as provided by the IPHC Secretariat) provided in Appendix III and an SPR of 46%, modified by slow up fast down approach. To

comply with the recommendation regarding PropC1, to allocate 1.65 mlbs to IPHC Regulatory Area 2A, taken proportionately from each Alaskan regulatory area.

Table 1. Processor Advisory Board (PAB) recommended TCEY mortality limits for 2019 [in favour 11; against=7; abstain=0]. (voting along Contracting Party lines)

IPHC Regulatory Area	Mortality limit (TCEY) (mlbs)
2A	1.65
2B	6.01
2C	6.17
3A	13.54
3B	3.06
4A	1.86
4B	1.47
4CDE	3.87
Total (IPHC Convention Area)	**37.63**

13. The PAB **NOTED** that although this motion passed, the Canadian's offered a substitute motion for a total of 37.21 mlbs, with the same shifting of a proportionate share of each IPHC Regulatory Area in Alaska to Regulatory Area 2A to increase their TCEY to 1.65mlb. Under the Canadian motion, prior to the calculations affecting each Alaskan IPHC Regulatory Area, 2A would get 1.32 mbls, 2B = 7.1 mlbs, 2C = 6.34 mbls, 3A 12.54 mlbs, 3B = 3.27 mbls, 4A = 1.74 mlbs, 4B = 1.28 mbls, 4CDE = 3.62 mbls. This motion failed along country lines on a 7 in favor, 11 opposed vote. The rationale in the Canadian motion was to keep a status quo and not increase mortalities in 2019. They also agreed to address IPHC Regulatory Area 2A's concerns in the same way the earlier motion from the U.S.A. did.
14. The PAB **NOTED** the rationale for the U.S. motion concerning catch limits:
    a) Overall Stock status:
        i. USA PAB members note stock is facing a series of incoming weak year classes (recruitment) from 2006 to 2010 that will reduce spawning biomass in the near term, and that FISS WPUE declined in 5 of the 8 IPHC Regulatory Areas.
        ii. USA PAB members also note the significant uncertainty associated with the size of the 2011 and 2012 year classes at this time. This uncertainty is expected to be lessened with one to two years of additional data.
        iii. For these reasons, USA PAB members recommend a precautionary approach to setting 2019 catch limits until additional data can resolve recruitment uncertainty and stronger year classes enter the fishery.
        iv. We are supporting the slow up/fast down management procedure to smooth annual variability in catch limits and account for survey encounter variability and imprecision. Slow up means the catch limit is set 1/3 of the way up from last year's TCEY to this year's TCEY by area; fast down means the catch limit is set half way between last year's TCEY and this year's TCEY.
    b) MSE Process:
        i. USA PAB members support the goals established by the MSAB relating to conservation and fishery performance; and the prioritization of conservation objectives over fishery performance as necessary.
15. The PAB **AGREED** that both the Canada and U.S.A. mortality limit proposals were guided by the principal of conservation when setting catch limits, which using F46 with a SU/FD smoother does. In the end, the two proposals weren't that far apart.

5. Regulatory proposals for 2019

5.1 IPHC Secretariat regulatory proposals

5.1.1 Fishery Limits (Sect. 4)

16. The PAB **NOTED** regulatory proposal IPHC-2019-AM095-PropA1, which aimed to improve clarity and transparency of fishery limits in the IPHC Fishery Regulations.

17. The PAB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropA1, with the addition of the mortality limits for each Contracting Party, by sector, as detailed in Section 4). [in favour=17; against=0; abstain=1]

5.1.2 Commercial fishing periods (Sect. 9)

18. The PAB **NOTED** regulatory proposal IPHC-2019-AM095-PropA2, which specified fishing periods for the commercial Pacific halibut fisheries. See Section 3 for additional summary of discussions.

19. The PAB **RECOMMENDED** that the Commission does not adopt fixed dates for either the opening or closing of the Pacific halibut fishing season. Market conditions change every year, frozen inventory levels are different every year, and each year processor's species mix may change and make conforming to a fixed date impossible. If the quota increases, there may be compelling reasons for opening a longer season, so flexibility is both necessary and efficient when setting annual opening and closing dates. [in favour=18; against = 0; abstain = 0]

5.1.3 IPHC Fishery Regulations: minor amendments

20. The PAB **NOTED** regulatory proposal IPHC-2019-AM095-PropA3 which proposed amendments to ensure clarity and consistency in the IPHC Fishery Regulations. 1

21. The PAB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropA3. [in favour=18 against=0 abstain=0]

5.2 Contracting Party regulatory proposals

5.2.1 Charter management measures in IPHC Regulatory Areas 2C and 3A

22. The PAB **NOTED** regulatory proposal IPHC-2019-AM095-PropB1, which proposed IPHC Regulation changes for charter Pacific halibut fisheries in IPHC Regulatory Areas 2C and 3A, in order to achieve the charter Pacific halibut allocation under the North Pacific Fisheries Management Council's (NPFMC) Pacific halibut Catch Sharing Plan.

23. The PAB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropB1. [in favour=18; against=0; abstain=0]

5.3 Other Stakeholder regulatory proposals

5.3.1 Minimum TCEY in IPHC Regulatory Area 2A

24. The PAB **NOTED** regulatory proposal IPHC-2019-AM095-PropC1, which proposed adopting a TCEY for IPHC Regulatory Area 2A that supports a FCEY no lower than 1.5Mlb. In years when the distribution would indicate a FCEY higher than 1.5Mlb is available, that number would be adopted.

25. The PAB **NOTED** that a separate motion that provides for the request made in PropC1, with some changes. After that motion was made, discussed, and adopted, the PAB took action on Prop C1.

26. The PAB **RECOMMENDED** that the Commission not adopt proposal IPHC-2019-AM095-PropC1. [in favour=16; against=1; abstain=0; -1 member missing].

27. The PAB **RECOMMENDED**: [in favour=18; against=0; abstain=0]

    a) a 1.65 million lbs TCEY in 2A for 2019, at FSPR46 total removal level be taken using Alaskan regulatory areas (prorated from 2019 TCEY in Alaskan IPHC Regulatory Area 2C-4) and needs to be reviewed annually. The purpose of this is to stay within the total mortality reflected in the F value adopted for coastwide removals.

b) that the Commission look at IPHC Regulatory Area 2A year-to-year in this regard, and not set a five-year term for an elevated allocation.

5.3.2 IPHC Regulatory Area 2A Quota Proposal

28. The PAB **NOTED** paper IPHC-2019-AM095-PropC2, which proposed an individual quota system for IPHC Regulatory Area 2A.

29. The PAB **RECOMMENDED** that the Commission take no action on Proposal C2, but **ENCOURAGED** the Commission to request information from the Pacific Council relating to this issue, including the process for changing from the current fishery to an IFQ fishery or other management option, encourage the council to consider a wide range of options, and to keep IPHC informed of their progress. [in favour=18; against=0; abstain=0]

6. ADDITIONAL RECOMMENDATIONS TO THE COMMISSION

30. The PAB **REQUESTED** the Commission arrange to have a publication similar to what has been provided in the past (2017 and earlier), known as the Blue Book, available during the 2020 Annual Meeting. This was characterized as having the highest level of importance for next year, as requested last year. The quality of the PAB's deliberations and its overall productivity is damaged by not having the Blue Book available. [in favour=18; against=0; abstain=0]

31. The PAB **NOTED** the IPHC Secretariat's indication that it continues to publish the blue book each year, as document IPHC-2019-AM095-00, which is a compendium of annual meeting documents (the former bluebook), 30 days prior to the annual meeting, for download and possible printing by users.

7. OTHER BUSINESS

32. The PAB **EXPRESSED** its appreciation for the assistance provided by the IPHC Secretariat, and for in-session presentations by Dr David Wilson, Dr Ian Stewart, Dr Ian Hicks, Ms Lara Erikson, Mr Glenn Merrill, Mr. Mike Pettis, and the Amendment 80 group (Mr. Mark Fina, Mr. Chris Woodley, Ms. Beth Conception).

USA Government shutdown impacts

33. The PAB **NOTED** the comments from Mr Glenn Merrill, USA Scientific and Technical Advisor, who elaborated on the previous and likely future shutdown of the US Government in three weeks' time and the impacts this will have on the opening of the Pacific halibut fishery in the USA, primarily as a function of delays that will occur in quota permit issuance and season opening dates.

34. The PAB **NOTED** Mr Merrill's indication that cost recovery funds may be parsed out to the Pacific halibut fishery to facilitate opening, and that it will depend on funds available from treasury, although they are being depleted.

IPHC Rules of Procedure

35. The PAB **NOTED** paper IPHC-2019-AM095-20 which provided an opportunity to consider proposed amendments to the IPHC Rules of Procedure (2017), as presented by the IPHC Executive Director. No objections to the improvements suggested by the IPHC Secretariat were provided by the PAB.

Trawl bycatch of Pacific halibut

36. The PAB **NOTED** paper IPHC-2019-AM095-INF05, which provided the Alaska Seafood Cooperative Halibut Bycatch Performance Report to the IPHC.

Abundance Based Management by the NPFMC

37. The PAB **RECOMMENDED** that the IPHC Secretariat be involved in the work at the NPFMC on Pacific halibut abundance based management. The IPHC should provide Secretariat staff members as needed and time for staff members to attend meetings and provide advice on the subject of Pacific halibut bycatch management. [in favour=16; against=0; abstain=2]

8. Review of the draft and adoption of the report of the 23rd Session of the IPHC Processor Advisory Board (PAB023)

38. The report of the 24th Session of the IPHC Processor Advisory Board (IPHC-2019-PAB024-R) was **ADOPTED** via correspondence on 11 February 2019, including the consolidated set of recommendations and requests arising from PAB024, provided at Appendix IV.

APPENDIX I

LIST OF PARTICIPANTS FOR THE 24TH SESSION OF THE IPHC PROCESSOR ADVISORY BOARD (PAB024)

Officers

Chairperson	Vice-Chairperson
Mr. Blake **Tipton** (Canada)	Ms Jessica **Keplinger** United States of America

HANA Executive Director

Ms Peggy **Parker**: peggyparker616@gmail.com

PAB Members

Canada		
Member		**Representative**
1.7 Seas Fish	Mr Nick Heras	nheras@7seas.ca
2.French Creek Seafood	Mr Brad McLean Mr. Robbie St. Louis	brad@frenchcreek.ca rob@frenchcreek.ca
3.FAS Seafoods	Mr Pete Hartman Mr. Bruce Hale Mr. Bob Fraumeni	pete@finestatsea.com bruce@fasseafood.com rghf@fasseafood.com
4.Aero Trading Company Ltd	Mr Brad Mirau Mr. Liam Stockwell	brad@aerotrading.ca liam@aerotrading.ca
5.SM Products (BC) Ltd	Mr Carl Nordmann Mr. Cody Smith Blake Tipton	carl@halibut.ca cody@halibut.ca blake@halibut.ca
6.Canadian Fishing Co.	Mr Phil Young	phil.young@canfisco.com
7.Scarlet Point Seafoods	Mr. Arlo Kueber	arlo@scarletpoint.ca

United States of America		
Member	**Representative**	**Email**
1.Icicle Seafoods	Mr John Pettersen Mr. John Woodruff Ms Jessie Keplinger Mr. Don Spigelmyre Mr. Duff Hoyt	johnp@icicleseafoods.com johnw@icicleseafoods.com jessiek@icicleseafoods.com dons@icicleseafoods.com duffh@icicleseafoods.com
2.SPC	Mr Joe Morelli	jmorelli@spcsales.com
3.170 West	Ms Heather McCarty	hdmccarty@gmail.com
4.Golden Harvest	Mr Steve Minor	steve@wafro.com
5.Northport Fisheries	Mr Tyler Goodnight Mr. Keith Goodnight	tyler@northportfisheries.com keith@northportfisheries.com
6.Pacific Seafood	Mr Mike Okoniewski	mokoniewski@pacseafood.com
	Mr Christopher (Kit) Durnil	kdurnil@pacseafood.com
7.International Seafoods of Alaska	Mr. John Sevier	John.sevier@ISA-AK.com
8.Dana F. Besecker Co. Inc.	Mr Miles Smith	miles@fbcompany.com
9.Yakutat Seafoods/EE	Mr. Greg Indreland	Gregyak@yahoo.com
	Mr. Jeff Berger	jeffb@eefoods.com
10.Kachemak Bay	Mr. Bill Sullivan	freshhalibut@gmail.com
11.Bellingham Cold storage	Mr. Joel Harvey	Joel.harvey@bellcold.com

IPHC Secretariat

Participant	Title	Email
Ms Tracee **Geernaert**	Survey Manager	tracee.geernaert@iphc.int
Mr Ed **Henry**	Fisheries Data Specialist	edward.henry@iphc.int

APPENDIX II
AGENDA FOR THE 24TH SESSION OF THE IPHC PROCESSOR ADVISORY BOARD (PAB024)

Date: 29–30 January 2019
Location: Victoria, BC, Canada
Venue: Fairmont Empress, **Room**: Bengal Room
Time: 29th: 13:30-17:30; 30th: 09:00-17:00
Chairperson: Blake Tipton (Canada)
Vice-Chairperson: Jessie Keplinger (United States of America)

Note: *All sessions are open to observers and the general public.*

1. **OPENING OF THE SESSION**
2. **ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION**
3. **FISHING PERIODS: SEASON OPENING AND CLOSING DATES**
4. **MORTALITY LIMITS**
5. **REGULATORY PROPOSALS FOR 2019**
   - 5.1 IPHC Secretariat regulatory proposals
   - 5.2 Contracting Party regulatory proposals
   - 5.3 Other Stakeholder regulatory proposals
6. **ADDITIONAL RECOMMENDATIONS TO THE COMMISSION**
7. **OTHER BUSINESS**
8. **REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 24th SESSION OF THE IPHC PROCESSOR ADVISORY BOARD (PAB024)**

APPENDIX III
PACIFIC HALIBUT MORTALITY PROJECTED FOR 2019 BASED ON THE PAB RECOMMENDED TCEY CATCH LIMITS

Note: All values reported in millions of net pounds. Provided by the IPHC Secretariat based on the PAB 2019 TCEY recommendations.

	2A	**2B**	**2C**	**3A**	**3B**	**4A**	**4B**	**4CDE**	**Total**
Commercial discard mortality	0.02	0.11	NA	NA	0.21	0.09	0.02	0.04	0.49
O26 Bycatch	0.13	0.27	0.03	1.28	0.36	0.18	0.22	1.87	4.33
Non-CSP Recreational (+ discards)	NA	0.07	1.38	1.74	0.00	0.01	0.00	0.00	3.20
Subsistence	NA	0.41	0.44	0.22	0.01	0.01	0.00	0.06	1.14
Total Non-FCEY	0.15	0.85	1.85	3.24	0.58	0.28	0.24	1.96	9.16
Commercial discard mortality	NA	NA	0.06	0.31	NA	NA	NA	NA	0.36
CSP Recreational (+ discards)	0.60	0.73	0.79	1.89	NA	NA	NA	NA	4.02
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial Landings	0.86	4.42	3.48	8.10	2.48	1.58	1.23	1.91	24.06
Total FCEY	**1.50**	**5.15**	**4.32**	**10.30**	**2.48**	**1.58**	**1.23**	**1.91**	**28.47**
TCEY	**1.65**	**6.01**	**6.17**	**13.54**	**3.06**	**1.86**	**1.47**	**3.87**	**37.63**
U26 Bycatch	0.00	0.02	0.00	0.37	0.11	0.10	0.01	1.12	1.73
Total Mortality	1.65	6.03	6.17	13.91	3.17	1.96	1.48	4.99	39.36

APPENDIX IV

CONSOLIDATED SET OF RECOMMENDATIONS AND REQUESTS OF THE 24TH SESSION OF THE IPHC PROCESSOR ADVISORY BOARD (PAB024) (29-30 JANUARY 2019)

RECOMMENDATIONS

Fishing periods: season opening and closing dates

PAB024-Rec.01 (para. 9) The PAB **RECOMMENDED** the following fishing period dates for the 2019:

a) Opening: 23 March at noon local time;

b) Closing: 7 November at noon local time.

Mortality limits

PAB024-Rec.02 (para. 12) The PAB **RECOMMENDED** the following TCEY mortality limits for the 2019 fishing period as provided in Table 1, which translate to the mortality estimates by sector (as provided by the IPHC Secretariat) provided in Appendix III and an SPR of 46%, modified by slow up fast down approach. To comply with the recommendation regarding PropC1, to allocate 1.65 mlbs to IPHC Regulatory Area 2A, taken proportionately from each Alaskan regulatory area.

Table 1. Processor Advisory Board (PAB) recommended TCEY mortality limits for 2019

IPHC Regulatory Area	Mortality limit (TCEY) (mlbs)
2A	1.65
2B	6.01
2C	6.17
3A	13.54
3B	3.06
4A	1.86
4B	1.47
4CDE	3.87
Total (IPHC Convention Area)	**37.63**

Fishery Limits (Sect. 4)

PAB024-Rec.03 (para. 17) The PAB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropA1, with the addition of the mortality limits for each Contracting Party, by sector, as detailed in Section 4).

Commercial fishing periods (Sect. 9)

PAB024-Rec.04 (para. 19) The PAB **RECOMMENDED** that the Commission does not adopt fixed dates for either the opening or closing of the Pacific halibut fishing season. Market conditions change every year, frozen inventory levels are different every year, and each year processor's species mix may change and make conforming to a fixed date impossible. If the quota increases, there may be compelling reasons for opening a longer season, so flexibility is both necessary and efficient when setting annual opening and closing dates.

IPHC Fishery Regulations: minor amendments

PAB024-Rec.05 (para. 21) The PAB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropA3.

Charter management measures in IPHC Regulatory Areas 2C and 3A

PAB024-Rec.06 (para. 23) The PAB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropB1.

Minimum TCEY in IPHC Regulatory Area 2A

PAB024-Rec.07 (para. 26) The PAB **RECOMMENDED** that the Commission not adopt proposal IPHC-2019-AM095-PropC1.

PAB024-Rec.08 (para. 27) The PAB **RECOMMENDED**:

c) a 1.65 million lbs TCEY in 2A for 2019, at FSPR46 total removal level be taken using Alaskan regulatory areas (prorated from 2019 TCEY in Alaskan IPHC Regulatory Area 2C-4) and needs to be reviewed annually. The purpose of this is to stay within the total mortality reflected in the F value adopted for coastwide removals.

d) that the Commission look at IPHC Regulatory Area 2A year-to-year in this regard, and not set a five-year term for an elevated allocation.

IPHC Regulatory Area 2A Quota Proposal

PAB024-Rec.09 (para. 29) The PAB **RECOMMENDED** that the Commission take no action on Proposal C2, but **ENCOURAGED** the Commission to request information from the Pacific Council relating to this issue, including the process for changing from the current fishery to an IFQ fishery or other management option, encourage the council to consider a wide range of options, and to keep IPHC informed of their progress.

Abundance Based Management by the NPFMC

PAB024-Rec.10 (para. 37) The PAB **RECOMMENDED** that the IPHC Secretariat be involved in the work at the NPFMC on Pacific halibut abundance based management. The IPHC should provide Secretariat staff members as needed and time for staff members to attend meetings and provide advice on the subject of Pacific halibut bycatch management.

REQUESTS

Additional recommendations to the Commission

PAB024-Req.01 (para. 30) The PAB **REQUESTED** the Commission arrange to have a publication similar to what has been provided in the past (2017 and earlier), known as the Blue Book, available during the 2020 Annual Meeting. This was characterized as having the highest level of importance for next year, as requested last year. The quality of the PAB's deliberations and its overall productivity is damaged by not having the Blue Book available.

Report of the 89th Session of the IPHC Conference Board (CB089)

Victoria, British Columbia, Canada, 29-30 January 2019

DISTRIBUTION:
Participants in the Session
Members of the Commission
IPHC Secretariat

BIBLIOGRAPHIC ENTRY
IPHC 2019. Report of the 89th Session of the IPHC Conference Board. Victoria, Canada, 29-30 January 2019. *IPHC–2019–CB089–R, 22 pp.*

INTERNATIONAL PACIFIC HALIBUT COMMISSION

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ACRONYMS

AM	Annual Meeting, of the IPHC
CB	Conference Board
CPUE	Catch per unit effort
FCEY	Fishery Constant Exploitation Yield
FISS	Fishery-independent setline survey
IPHC	International Pacific Halibut Commission
MSAB	Management Strategy Advisory Board
NPFMC	North Pacific Fishery Management Council
NPUE	Number Per Unit Effort
SB	Spawning Biomass
SRB	Scientific Review Board
SPR	Spawning Potential Ratio
TCEY	Total Constant Exploitation Yield
WPUE	Weight Per Unit Effort

DEFINITIONS

A set of working definitions are provided in the IPHC Glossary of Terms and abbreviations: https://iphc.int/the-commission/glossary-of-terms-and-abbreviations

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

This report has been written using the following terms and associated definitions so as to remove ambiguity surrounding how particular paragraphs should be interpreted.

Level 1: **RECOMMENDED**; **RECOMMENDATION; ADOPTED** (formal); **REQUESTED; ENDORSED** (informal): A conclusion for an action to be undertaken, by a Contracting Party, a subsidiary (advisory) body of the Commission and/or the IPHC Secretariat.

Level 2: **AGREED**: Any point of discussion from a meeting which the Commission considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 above; a general point of agreement among delegations/participants of a meeting which does not need to be elevated in the Commission's reporting structure.

Level 3: **NOTED/NOTING**; **CONSIDERED**; **URGED**; **ACKNOWLEDGED**: General terms to be used for consistency. Any point of discussion from a meeting which the Commission considers to be important enough to record in a meeting report for future reference. Any other term may be used to highlight to the reader of an IPHC report, the importance of the relevant paragraph. Other terms may be used but will be considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3.

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EXECUTIVE SUMMARY

The 89th Session of the International Pacific Halibut Commission (IPHC) Conference Board (CB089) was held in Victoria, Canada, from 29-30 January 2019. A total of 70 (78 in 2018) members attended the Session from the two (2) Contracting Parties. Canada accredited 2 new members and the USA accredited 5 new members, for participation in the 2019 Conference Board proceedings. The meeting was opened by Mr. Jeff Kaufman (U.S.A.) and Mr. Jim Lane (Canada) (Co-Chairpersons), who welcomed participants to Victoria, Canada.

The following are a subset of the complete recommendations and requests for action from the CB089, which are provided at Appendix IV.

RECOMMENDATIONS

Fishing periods: season opening and closing dates

CB089-Rec.02 (para. 14) The CB **RECOMMENDED** the following fishing period dates for 2019:

a) Opening: 02 March

b) Closing: 30 November

Mortality limits

CB089-Rec.04 (para. 28) The CB **RECOMMENDED** the following TCEY mortality limits for the 2019 fishing period as provided in Table 1, which translate to the mortality estimates by sector (as provided by the IPHC Secretariat) provided in Appendix III and an SPR of 46%.

Table 1. Conference Board (CB) recommended TCEY mortality limits for 2019.

IPHC Regulatory Area	Mortality limit (TCEY) (mlbs)
2A	1.65
2B	7.38
2C	6.30
3A	13.81
3B	3.12
4A	1.90
4B	1.50
4CDE	3.94
Total (IPHC Convention Area)	**39.60**

Fishery Limits (Sect. 4)

CB089-Rec.05 (para. 30) The CB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropA1, with the addition of the mortality limits for each Contracting Party, by sector, as detailed in Section 6).

IPHC Fishery Regulations: minor amendments

CB089-Rec.06 (para. 35) The CB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropA3.

Charter management measures in IPHC Regulatory Areas 2C and 3A

CB089-Rec.07 (para. 38) The CB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropB1.

Minimum TCEY in IPHC Regulatory Area 2A

CB089-Rec.08 (para. 40) The CB **RECOMMENDED** that the Commission does not adopt proposal IPHC-2019-AM095-PropC1.

IPHC Regulatory Area 2A Quota Proposal

CB089-Rec.09 (para. 45) The CB **RECOMMENDED** that the Commission adopt an earlier start date (second half of May) for the IPHC Regulatory Area 2A Non-Treaty directed commercial fishery's initial fishing period.

Bycatch

CB089-Rec.11 (para. 48) The CB **RECOMMENDED** that the Commission communicate these concerns to the North Pacific Fishery Management Council:

a) New work by the IPHC Secretariat indicates that U26 bycatch impacts the spawning potential of the Pacific halibut stock on a ratio of 1:1.8 –i.e., one pound of bycatch results in a 1.8-pound loss of future Pacific halibut yield to the directed fisheries (TCEY), noting that 65% of the U26 Pacific halibut mortality occurs in IPHC Regulatory Area 4CDE, where observer coverage on groundfish vessels is high and bycatch reduction incentive programs are in place. Approximately 28% of the U26 bycatch occurs in Region 3, where observer coverage on trawl vessels is lower.

CB089-Rec.12 (para. 49) The CB **RECOMMENDED** that the Commission strongly recommend that the NPFMC:

a) prioritize Pacific halibut bycatch reduction in the Bering Sea and Gulf of Alaska, and take meaningful action to protect the future potential of the Pacific halibut stock and the directed fisheries.

b) Increase observer coverage on Gulf of Alaska trawl vessels to more accurately account for bycatch and its impacts on the Pacific halibut stock and directed Pacific halibut fisheries.

1. Opening of the Session

1. The 89th Session of the International Pacific Halibut Commission (IPHC) Conference Board (CB089) was held in Victoria, Canada, from 29-30 January 2019. A total of 70 (78 in 2018) members attended the Session from the two (2) Contracting Parties. Canada accredited 2 new members and the USA accredited 7 new members, for participation in the 2019 Conference Board proceedings. The list of participants is provided at Appendix I. The meeting was opened by Mr Jeff Kaufman (U.S.A.) and Mr. Jim Lane (Canada) (Co-Chairpersons), who welcomed participants to Victoria, Canada.
2. In accordance with Appendix IV, Section III of the IPHC Rules of Procedure (2017), the CB **NOTED** the requirement to elect Co-Chairpersons, and the option to elect up to two (2) Vice-Chairpersons, of the CB until the beginning of the next Session in 2020.
3. The CB **CALLED** for nominations for the positions of Co-Chairpersons of the CB until the opening of the next session in 2020. Mr Jim Lane (Canada) and Mr Jeff Kauffman (United States of America) were nominated, seconded and elected as Co-Chairpersons.

2. Adoption of the agenda and arrangements for the Session

4. The CB **ADOPTED** the Agenda as provided at Appendix II, which include an item to discuss the current work by the IPHC on Management Strategy Evaluation. The documents provided to the CB089 are those submitted for the 95th Session of the Annual Meeting (AM095).
5. The CB **ACKNOWLEDGED** the attendance of long-time CB participant, Mr Clem Tillion and his continued and past insightful contributions to the CB.

3. IPHC Secretariat informational session

6. The CB **NOTED** paper IPHC-2019-AM095-11 Rev_1 which provided an introduction and usage guide for the IPHC’s web-based mortality projection tool (https://iphc.int/data/projection-tool).
7. The CB **NOTED** the summary of IPHC Regulatory Area-specific mortality projections for 2019 based on the interim management procedure and other alternatives.

IPHC Rules of Procedure

8. The CB **NOTED** paper IPHC-2019-AM095-20 which provided an opportunity to consider proposed amendments to the IPHC Rules of Procedure (2017).
9. The CB **AGREED** to facilitate inter-sessional communication with the IPHC Secretariat, and among all CB members by providing contact names and email addresses in the CB report list of participants (Appendix I).
10. The CB **NOTED** that an ad-hoc working group would be formed to consider specific topics with five CB members from Canada (Gerry Kristianson, Chris Sporer, Chuck Ashcroft, Bill Shaw and Jim Lane) and six CB members from U.S.A (Kathy Hansen, Duncan Fields, Jim Johnson, Angel Drobnica, Rebecca Skinner and Linda Behnken) to work through the year to develop a set of recommendations on the terms of reference and an accreditation process for CB members in the interim to be brought to CB090 for action.
11. The CB **RECOMMENDED** that the Commission defer the revised IPHC Rules of Procedure (2019) to AM096 for adoption, specifically related to the CB, with respect to the terms of reference as the ad-hoc group that was formed felt that the changes are more than clarifying or technical in nature. [**Canada**: In favour=unanimous][**USA**: In favour=unanimous]

4. Fishing periods: season opening and closing dates

12. The CB **AGREED** that, for both opening and closing, the dates should emphasize the longest fishing period possible. The following reasons were given for this rationale:
    a) Maximize time to catch quota
    b) Longer season for market and bycatch considerations

13. The CB **NOTED** that several members expressed concern regarding the time the USA may require to have fishing permits ready for an early March opening.

Recommendation

14. The CB **RECOMMENDED** the following fishing period dates for 2019:
    a) Opening: 02 March [in favour=56; against=1; abstain=13]
    b) Closing: 30 November [in favour=53; against=1; abstain=16]

5. MANAGEMENT STRATEGY EVALUATION

15. The CB **RECOMMENDED** the Commission does the following: [in favour=68; against=1; abstain=1]
    a) supports the work to date by the MSAB and their identified goals and objectives;
    b) support prioritization of conservation over fishery performance objectives;
    c) support preliminary SPR target of 42-43% and SPR range of 40-46%; and
    d) support goal of restraining annual variability to 15% or less, and encourage MSAB to continue to develop management procedures that control annual variability, such as those presented at this meeting (AM095).

6. MORTALITY LIMITS

16. The CB **NOTED** paper IPHC-2019-AM095-11 Rev_1 which provided an introduction and usage guide for the IPHC's web-based mortality projection tool (https://iphc.int/data/projection-tool).

6.1 Coastwide perspectives

17. The CB **NOTED** that U.S.A. put forth a motion to recommend an SPR of 48% with a Coastwide TCEY of 38.23 million pounds with the following rationale: [**Canada**: In favour=0; against=35; abstain=0; **USA**: In favour=33; against=0; abstain=0]
    a) the goal of establishing a conservative overall number as the first step, to be followed by a decision on distribution, which is the IPHC recommended process under the adopted SPR management approach;
    b) recognition that to a large degree the determination that 2018 fishing intensity is F48 depends on the estimated strength of the incoming 2011 and 2012 year classes, noting the significant uncertainty associated with the size of the 2011 and 2012 year classes at this time, that this uncertainty is expected to be resolved with additional years' data, and recognizing the need to be conservative until the strength of these two years classes is confirmed; and
    c) the overly optimistic estimation of the 2005/06 year classes resulted in fishing intensity over the target rates and a significant retrospective bias to the detriment of the Pacific halibut stock.

18. The CB **NOTED** the following perspectives shared by U.S.A. CB members:
    a) encouraged by improvements in precision the enhanced FISS has achieved, however note stock is facing a series of incoming weak year classes from 2006 to 2010 that will reduce spawning biomass in the near term,
    b) in response to the weak incoming year classes, the FISS NPUE is at a 20-year low and showed continued decline in most management areas and coast wide;
    c) FISS WPUE also declined in five of the eight management areas, and showed an overall 7% decline coast wide;
    d) commercial WPUE are at low levels and showed decline in many areas;
    e) support of the slow up/fast down management procedure to smooth annual variability in catch limits and account for survey encounter variability and imprecision (Slow up means the TCEY is

set 1/3 of the way up from last year's TCEY to this year's TCEY by area; fast down means the TCEY is set half way between last year's TCEY and this year's TCEY); and

f) slow up/fast down adds conservation benefits by dampening potential increases, particularly notable in 2019 for Area 3A, where the SPR46 reference level would have resulted in a 30% TCEY increase in this area instead of the 10% increase included in this motion.

19. The CB **NOTED** the following perspectives shared by U.S.A. CB members:

a) appreciation for the work of the MSAB and the results put forward by the MSE process noting this is ongoing and final recommendation on scale and distribution are expected within one to two years;

b) support for the goals established by the MSAB relating to conservation and fishery performance; and the prioritization of conservation objectives over fishery performance as necessary;

c) support for the MSE process's introduction of management procedures to define coast wide scale and distribution results;

d) belief this process will improve the quality and equity of the annual mortality limit setting process, while preserving the ability of the CB to recommend, and the Commissioners to consider short term tactical changes;

20. The CB **NOTED** that Canada moved to approve a TCEY of 7.38 million pounds for Canada (IPHC Regulatory Area 2B). [**Canada**: In favour=35; against=0; abstain=0; **USA**: In favour=0; against=30; abstain=3]

21. The CB **NOTED** the following perspectives shared by the CB members from Canada:

a) Canada supported the proposed IPHC Regulatory Area 2A TCEY of 1.65 M lbs for 2019; however, as the USA refused to divide their proposal (paragraph 17, above) so that a separate vote was held on the allocation to IPHC Regulatory Area 2A, Canada could not support the motion as proposed to that area that was consistent with the approach Canada was taking because the "apportionment" method for coastwide distribution was unsuitable. Canada noted this inconsistency in the US approach.

b) Support for the work of the MSAB and their recommendations, which call for a target SPR of 42-43 for a long term harvest policy, but also include a range of SPR 40-46 to allow for short term tactical decisions,

c) that a good choice at the coastwide level does not necessarily result in good outcomes given how the harvest is presently allocated and that there are concerns about the TCEY that results from the target SPR of the MSAB recommendation,

d) that there is concern regarding

i. allocating large amounts to the western areas given FISS results and the continued downward trend; and

ii. poor recruitment, and that we should see another year of the 2011/12 year class before relying on it too heavily,

e) comfort with what was being seen and experienced on the IPHC Regulatory Area 2B grounds this year.

22. The CB **NOTED** that Canadian CB members have never agreed with the '*apportionment*' methodology and the following perspectives shared by the CB members from Canada:

a) There is no agreement or (biological justification) on the current distribution procedure (*apportionment*) to allocate to the Regulatory Area level;

b) as a result, Canada initially proposed a 20% share of the coastwide TCEY for Canada (that has been the annual average for Canada for the past five to six years) and based on an SPR 46, which is consistent with the MSAB recommendations and having heard concerns from some Conference Board members about a 20% share, Canada amended its proposal to an 18.5% share, which, at an SPR 46, results in an IPHC Regulatory Area 2B TCEY of 7.38 M lbs;

c) the MSAB has not commented on a Slow Up/Fast Down adjustment mechanism and notes it will be taken to MSAB for evaluation (as noted in the 2008 peer review of the coast wide stock assessment, it was ad hoc and had never been formally evaluated); and

d) The proposed Area 2B TCEY is also responsive to FISS results; it represents a 4% increase in the IPHC Regulatory Area 2B TCEY and the FISS [O32 WPUE] increased by 6% compared to last year.

23. The CB **NOTED** the following perspectives shared by U.S.A. CB members:

a) that the same management procedure adopted and implemented in Alaska should be adopted and implemented in Canada, and that the full rationale from above supports consistent treatment of Canada and Alaska areas;

b) Surveyed distribution provides an objective measure of stock distribution and an equitable basis for TCEY distribution. In recent years, the FISS has found 11-13% of the Pacific halibut stock in IPHC Regulatory Area 2B. The IPHC Regulatory Area 2B TCEY should be proportional to abundance. A TCEY in excess of 13% of total is unfair to other harvesters and unacceptable to the USA;

c) The enhanced FISS conducted in IPHC Regulatory Area 2B in 2018 indicated that there has been a chronic overestimation of abundance in IPHC Regulatory Area 2B by the FISS. Catch levels similar to last year will result in harvest level even farther above reference levels than previously assumed;

d) Canada points to bycatch in Alaska as rationale for harvest above the reference SPR, but recent data supplied by the IPHC Secretariat indicate that the Alaska bycatch impact on IPHC Regulatory Area 2B is in the 400,000 pound range, not the 1-2 million pound extra mortality Canada has imposed on the Pacific halibut stock. In addition, both IPHC Regulatory Area 2A and 2C have addressed and controlled bycatch, with IPHC Regulatory Area 2C eliminating trawling and responsible for the lowest bycatch levels of any area;

e) FISS stations along the border between IPHC Regulatory Area 2B and 2C showed significant decline, which may be associated with excess fishing pressure by lodges and other harvesters in this area. IPHC Regulatory Areas 2A and 2C are concerned overharvest by IPHC Regulatory Area 2B fishermen are negatively impacting Region 2 Pacific halibut abundance;

f) IPHC Regulatory Area 2B FISS WPUE is significantly lower than IPHC Regulatory Area 2C even with the 2018 drop in IPHC Regulatory Area 2C WPUE and the 2018 increase in IPHC Regulatory Area 2B. Allocating a higher percentage of total to IPHC Regulatory 2B than 2C does not reflect relative health of the stock between the two areas;

g) Canada’s request for SPR 46% and 7.38 million pounds can only be achieved with a 6.2% reduction in the US TCEY. This is inequitable to US fishermen; and

h) recognizes Treaty rights of IPHC Regulatory Area 2A Tribes and for 2019 will support 1.65 TCEY.

24. The CB **NOTED** that U.S.A. moved to approve an U.S.A. TCEY of 32.22 million pounds with the following TCEYs for each of the IPHC Regulatory Areas in U.S.A.:

a) IPHC Regulatory Area 2A TCEY of 1.65 million pounds;

b) IPHC Regulatory Area 2C TCEY of 6.30 million pounds;

c) IPHC Regulatory Area 3A TCEY of 13.81 million pounds;

d) IPHC Regulatory Area 3B TCEY of 3.12 million pounds;

e) IPHC Regulatory Area 4A TCEY of 1.90 million pounds;

f) IPHC Regulatory Area 4B TCEY of 1.50 million pounds; and

g) IPHC Regulatory Area 4CDE TCEY of 3.94 million pounds with the resulting votes:

Canada: In favour=0; against=36; abstain=0

USA: In favour=34; against=0; abstain=0

25. The CB **NOTED** the following perspectives shared by U.S.A. CB members:

a) use of O32 WPUE proportion in each IPHC Regulatory Area;

b) use of relative harvest rates by IPHC Regulatory Area (2A-3A=1, 3B-4=0.75);

c) the use of the following management procedures;

   a. initial SPR of F 46 with distribution based default mortality percentage from the IPHC mortality tool;

   b. slow-up, Fast Down smoothing procedure based on 50% down and 33% up on difference between 2018 and 2019 reference F 46 TCEY; and

   c. an IPHC Regulatory Area 2A adjustment of 0.6 million pounds in addition.

d) belief the catch limits recommended by this motion incorporate many of the recommendations of the MSAB by:

   a. Using repeatable management procedures and data sources to consistently and equitably set the scale and distribution of mortality limits;

   b. Starting with a Reference SPR value of F 46, which is the current IPHC reference harvest rate, within the range recommended by the MSAB and appropriately precautionary given the stock status considerations noted above;

   c. Using the existing interim stock distribution inputs of 032 distribution and relative harvest rates among management areas;

   d. Using a smoothing management procedure to reduce annual variability to acceptable levels;

   e. further prioritizing conservation over fishery performance in recommending a final harvest rate of F 48 after slow up/fast down is applied.

6.2 Regulatory Area perspectives

IPHC Regulatory Area 2A

26. The CB **NOTED** the following from IPHC Regulatory Area 2A harvesters:

a) allocation less than this make it extremely difficult to implement the fisheries off the west coast of U.S.A. under the catch share plan among the tribes, recreational and commercial users;

b) average removals over time has been 1.79 million pounds which suggest the area can sustain this level of removals;

c) the Makah unrestricted directed fisheries CPUE is up 200% since 2013;

d) there is trawl rationalisation on the west coast and since its implementation there have been dramatic increases in Pacific halibut abundance along with a dramatic decrease in Pacific halibut bycatch (by 800,000 pounds);

e) That this is a terminal fishery such that other areas do not have to pay for this increase; and

f) the spawning biomass is between 150 and 250 million pounds such that this small increase has no statistical influence on the spawning biomass.

IPHC Regulatory Areas 4B

27. The CB **NOTED** the following from Regulatory Area 4A, 4B and 4CDE harvesters:

a) the burden of conservation in Alaska biological areas has fallen hardest on IPHC Regulatory Area 4B in relative distribution terms with a direct application of a 46 SPR providing a 4.9% distribution while applying the slow up/fast down approach resulted in a 4% distribution; and

b) this is a separate biological area and allowing a higher catch at the full 4.9% distribution level would have been appropriate given the 17% increase in the FISS together with increases in FISS and commercial WPUE's and NPUE's.

Recommendation

28. The CB **RECOMMENDED** the following TCEY mortality limits for the 2019 fishing period as provided in Table 1, which translate to the mortality estimates by sector (as provided by the IPHC Secretariat) provided in Appendix III and an SPR of 46%.

Table 1. Conference Board (CB) recommended TCEY mortality limits for 2019. See previous paragraphs for voting.

IPHC Regulatory Area	Mortality limit (TCEY) (mlbs)
2A	1.65
2B	7.38
2C	6.30
3A	13.81
3B	3.12
4A	1.90
4B	1.50
4CDE	3.94
Total (IPHC Convention Area)	**39.60**

7. REGULATORY PROPOSALS FOR 2018

7.1 IPHC Secretariat regulatory proposals

7.1.1 Fishery Limits (Sect. 4)

29. The CB **NOTED** regulatory proposal IPHC-2019-AM095-PropA1, which aimed to improve clarity and transparency of fishery limits in the IPHC Fishery Regulations.

30. The CB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropA1, with the addition of the mortality limits for each Contracting Party, by sector, as detailed in Section 6). [in favour=unanimous]

7.1.2 Commercial fishing periods (Sect. 9)

31. The CB **NOTED** regulatory proposal IPHC-2019-AM095-PropA2, which specified fishing periods for the commercial Pacific halibut fisheries. See Section 4 for a summary of discussions and recommendations.

32. The CB **NOTED** no action was taken on IPHC-2019-AM095-PropA2, which specified fishing periods for the commercial Pacific halibut fisheries. See Section 4 for a summary of discussions and recommendations.

33. The CB **NOTED** there was a willingness to explore fixed dates to allow for improved business planning. However, the dates in this proposal were not supported.

7.1.3 IPHC Fishery Regulations: minor amendments

34. The CB **NOTED** regulatory proposal IPHC-2019-AM095-PropA3 which proposed amendments to ensure clarity and consistency in the IPHC Fishery Regulations.

35. The CB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropA3. [in favour=unanimous]

36. The CB **NOTED** their support and appreciation for efforts to simplify and clarify existing regulations.

7.2 Contracting Party regulatory proposals

7.2.1 Charter management measures in IPHC Regulatory Areas 2C and 3A

37. The CB **NOTED** regulatory proposal IPHC-2019-AM095-PropB1, which proposed IPHC Regulation changes for charter Pacific halibut fisheries in IPHC Regulatory Areas 2C and 3A, in order to achieve the charter Pacific halibut allocation under the North Pacific Fisheries Management Council's (NPFMC) Pacific halibut Catch Sharing Plan.

38. The CB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropB1.

    Canada: abstain=all

    USA: In favour=32; against=0; abstain=3

7.3 Other Stakeholder regulatory proposals

7.3.1 Minimum TCEY in IPHC Regulatory Area 2A

39. The CB **NOTED** regulatory proposal IPHC-2019-AM095-PropC1, which proposed adopting a TCEY for IPHC Regulatory Area 2A that supports a FCEY no lower than 1.5Mlb. In years when the distribution would indicate a FCEY higher than 1.5Mlb is available, that number would be adopted.

40. The CB **RECOMMENDED** that the Commission does <u>not</u> adopt proposal IPHC-2019-AM095-PropC1.

    Canada: In favour=4; against=17; abstain=8]

    USA: In favour=11; against=14; abstain=7

41. The CB **NOTED** that there was general support for the proposed IPHC Regulatory Area 2A TCEY level, but not within a regulatory framework with both a fixed lower limit and no defined term.

42. The CB **NOTED** the following minority statement:

    "The Regulatory Proposal for a minimum TCEY for the 2A Region was presented by the Makah Tribe at the Conference Board yesterday but was not supported by a majority of either of the Contracting Parties. We find that unfortunate. The item was brought forth at the end of a long and tiring day and followed a contentious discussion of the TCEY allocations between the Alaska and Canadian Representatives. It was apparent that while there was overwhelming support by most members for 2A to be granted the 1.66 mlbs TCEY and 1.5 mlbs FCEY as requested, a multi-year, minimum floor TCEY concept for a 3-5 five year period was lacking support. There was considerable confusion by many over the concept and skepticism of the request. This latter statement is what we wish to address. The Makah Tribe is making this request for the entire 2A Area, consisting of the three Pacific States. The Tribes are not just stakeholders in this process, but are in fact, Co-Mangers, with a long and respected history of fishery Management. They work in conjunction with the three State Governments, the Federal Government and the IPHC for sustainable conservation policies and best practices management goals regarding harvest of pacific halibut. They have developed a short term, responsible, and thoughtful proposal for Management, that was developed with the cooperation of the IPHC Secretariat and included principles suggested by the MSAB. Their concept is to present a short term solution for management in an area that is at the Southern end of the p. halibut range, has no conservation concerns to the stock, stays within the SPR 46% stated goals of the MSAB, and smooths out the annual variation of the FISS data and patchiness of population density that is prevalent in the 2A area. This is "pilot program" of an alternative management concept, proposed for a short duration, under the full review and control of the Commission and Secretariat. This does not affect other Regulatory Areas and is unique in in both situation and location. We in the 2A area support the

concept, and believe it should be give the opportunity to see if it is a successful management scenario for this unique area.
The principle objection at the Conference Board seemed to center around this being a multi-year proposal. The Contracting Parties wanted the opportunity to consider a TCEY request annually, but voiced support for the 1.66 mt TCEY. A secondary issue was the concern that if this short term minimum TCEY proposal was adopted that level would be held in perpetuity, until such time as a Regulatory change was passed to remove the minimum. This is not in the proposal, nor was it stated in the motion on the floor to support this Regulatory Proposal. But, the concern lingered on and confused many and created uncertainty and suspicion.
We in 2A believe this concept justifies consideration by the Commission and a minority of the Conference Board supports adoption, with a time period selected at the discretion of the Commission with Secretariat advice."

7.3.2 IPHC Regulatory Area 2A Quota Proposal

43. The CB **NOTED** paper IPHC-2019-AM095-PropC2, which proposed an individual quota system for IPHC Regulatory Area 2A.
44. The CB **NOTED** that no action was taken on IPHC-2019-AM095-PropC2 at this time as the Chair of the Pacific Fisheries Management Council addressed the CB and stated their recommendation to the IPHC was not adopt any changes until more comprehensive consultations have been completed with all IPHC Regulatory Area 2A stakeholders.
45. The CB **RECOMMENDED** that the Commission adopt an earlier start date (second half of May) for the IPHC Regulatory Area 2A Non-Treaty directed commercial fishery's initial fishing period.

    Canada: abstain=all

    USA: In favour=15; against=0; abstain=9

8. BYCATCH

46. The CB **NOTED** the presentation by the Amendment 80 Group detailing their Bycatch Avoidance measures, including the most recent results of the Experimental Fishing Permit on deck sorting.
47. The CB **NOTED** continued concern regarding bycatch impacts to the Pacific halibut stock.
48. The CB **RECOMMENDED** that the Commission communicate these concerns to the North Pacific Fishery Management Council:
    a) New work by the IPHC Secretariat indicates that U26 bycatch impacts the spawning potential of the Pacific halibut stock on a ratio of 1:1.8 –i.e., one pound of bycatch results in a 1.8-pound loss of future Pacific halibut yield to the directed fisheries (TCEY), noting that 65% of the U26 Pacific halibut mortality occurs in IPHC Regulatory Area 4CDE, where observer coverage on groundfish vessels is high and bycatch reduction incentive programs are in place. Approximately 28% of the U26 bycatch occurs in Region 3, where observer coverage on trawl vessels is lower.
49. The CB **RECOMMENDED** that the Commission strongly recommend that the NPFMC:
    a) prioritize Pacific halibut bycatch reduction in the Bering Sea and Gulf of Alaska, and take meaningful action to protect the future potential of the Pacific halibut stock and the directed fisheries.
    b) Increase observer coverage on Gulf of Alaska trawl vessels to more accurately account for bycatch and its impacts on the Pacific halibut stock and directed Pacific halibut fisheries.

9. OTHER BUSINESS

9.1 Annual Meeting documents

50. The CB **URGED** the Commission to have the IPHC Secretariat provide a printed streamlined paper version of annual meeting documents for CB members that contains relevant documents in regard to TCEY

discussions such as SPR ratios, decision tables, risk tables, WPUE commercial graphs and time series of data by regulatory area, O32 FISS data, NPUES FISS data and FCEY/TCEY conversions for previous years, fishery average fish weight by regulatory area, time series of total removals by regulatory area and recent reference TCEY by regulatory area and adopted TCEY.

51. The CB **NOTED** their request for at least one hard copy of a RARA be available for reference and that the IPHC Secretariat provide a method to produce adequate paper copies of requested documents to CB members in future meetings. This would likely be a 25 page document. If this is a financial hardship, the Commission could, at the time of registration, ask if an individual wanted a copy of this modified document that they agree to purchase at the cost of printing.

52. The CB **NOTED** the IPHC Secretariat's indication that it continues to publish the blue book each year, as document IPHC-2019-AM095-00, which is a compendium of annual meeting documents (the former bluebook), 30 days prior to the annual meeting, for download and possible printing by users.

9.2 MSAB position

53. The CB **URGED** the Commission to consider Angel Drobnica or Forrest Braiden for a seat on the MSAB.

10. Review of the draft and adoption of the report of the 88th Session of the IPHC Conference Board (CB088)

54. The report of the 89th Session of the IPHC Conference Board (IPHC-2019-CB089-R) was **ADOPTED** via correspondence on 07 February 2019, including the consolidated set of recommendations and requests arising from CB089, provided at Appendix IV.

APPENDIX I
LIST OF PARTICIPANTS FOR THE 89TH SESSION OF THE IPHC CONFERENCE BOARD (CB089)

Officers

Co-Chairperson	Co-Chairperson
Mr. Jim Lane (Canada)	Mr. Jeff **Kauffman** (United States of America)

CB Members

Canada		
Member	**Representative**	**Email**
Ahousaht First Nation	Andrew Webster	Bigmack.ahousat@gmail.com
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Area F Troll Association	Esther Sample	esthersample@gmail.com
BC Commercial Integrated Groundfish Society	Bruce Turris	bruceturris@shaw.ca
BC Halibut Longline Fisherman's Assoc.	Loren Iverson	lorneiverson@telus.net
BC Longline Fisherman's Association	Colleen van der Heide	eric@egoodman.ca
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Canadian Sablefish Association	Gary Williamson	riverone@telus.net
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Ditidaht First Nation	Phillip Edgar	mlucas@ditidaht.ca
Esquimalt Anglers Association	Gary Caton	gcaton@shaw.ca
FAS Seafood Producers	William Woodbury	wwoodbury@fasseafood.com
Gulf Trollers Association	Angus Grout	rommel@telus.net
Halibut Advisory Board	David Boyes	mcboyes@telus.net
Hook and Line Groundfish Association	Ken Wing	kwing@dccnet.com
Huu-Ay-Aht First Nation	Edward Johnson	Edjohnson.northstar@gmail.com
IMAWG	Carl Edgar	carledgarjr@gmail.com
Northern Halibut Producer's Assoc.	Alan Carl	porchers@citytel.net
Northern Trollers Association		
North Pac Halibut Fisherman's Assn		
Nuu-Chah-Nulth Tribal Council	Cliff Atleo	c.atleo71@shaw.ca
Pacific Coast Fishing Vessel Owners Guild	Quincy Sample	quintonsample@gmail.com
Pacific Trollers Association		
PHMA	Chris Sporer	phma@telus.net
Sidney Anglers' Association	Grant MacPherson	bigbass@shaw.ca
Sport Fishing Advisory Board – Main	Gerry Kristianson	gerrykr@telus.net
Sport Fishing Advisory Board – South	Chuck Ashcroft	chuckashcroft@telus.net
Sport Fishing Advisory Board – North	Doug Daugert	Kumdis2@haidagwaii.ca
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Sport Fishing Institute of BC	Owen Bird	birdo@sportfishing.bc.ca

South Vancouver Island Anglers Coalition	Chris Bos	chris@anglerscoalition.com
Ucluelet First Nation		
UFAWU	Russell Cameron	russelljcameron@yahoo.ca
Vancouver Island Longline Assoc.	Lyle Pierce	Lyle_p@shaw.ca
West Coast Fishing Guides Association	Bill Shaw	bill@wfms.ca

United States of America		
Member	**Representative**	**Email**
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Alaska Charter Association	Jim Martin	flatland@mcn.org
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Alaska Whitefish Trawlers Association	Rebecca Skinner	execdir@alaskawhitefishtrawlers.org
Aleut Corporation	Clem Tillion	tillionc@xyz.net
Aleutian Pribilof Island Community Development Association	Angel Drobnica	adrobnica@apicda.com
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Humbolt Area Saltwater Anglers	Mary Marking	Ma5marking@gmail.com
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IPHC Secretariat

Participant	Title	Email
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Mr Eric **Soderlund**	Fisheries Data Specialist	eric.soderlund@iphc.int

APPENDIX II
AGENDA FOR THE 89TH SESSION OF THE IPHC CONFERENCE BOARD (CB089)

Date: 29–30 January 2019
Location: Victoria, BC, Canada.
Venue: Fairmont Empress; Room: Crystal Ballroom
Time: 29th: 13:30-17:30; 30th: 09:00-17:00
Co-Chairpersons: Mr. Jim Lane (Canada); Mr. Jeff Kauffman (United States of America)
Vice-Chairpersons: Nil
Note: *All sessions are open to observers and the general public.*

1. OPENING OF THE SESSION
- 1.1 Election of Co-Chairpersons
- 1.2 Accreditation of Membership for CB089

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

3. IPHC SECRETARIAT INFORMATIONAL SESSION

4. FISHING PERIODS: SEASON OPENING AND CLOSING DATES

5. MANAGEMENT STRATEGY EVALUATION

6. MORTALITY LIMITS
- 6.1 Coastwide perspectives
- 6.2 Regulatory Area perspectives

7. REGULATORY PROPOSALS FOR 2019
- 7.1 IPHC Secretariat regulatory proposals
- 7.2 Contracting Party regulatory proposals
- 7.3 Other Stakeholder regulatory proposals

8. BYCATCH

9. OTHER BUSINESS
- 9.1 Annual meeting documents
- 9.2 MSAB position

10. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 89th SESSION OF THE IPHC CONFERENCE BOARD (CB089)

APPENDIX III
PACIFIC HALIBUT MORTALITY PROJECTED FOR 2019 BASED ON THE CB RECOMMENDED TCEY CATCH LIMITS

Note: All values reported in millions of net pounds. Provided by the IPHC Secretariat based on the CB 2019 TCEY recommendations.

	2A	**2B**	**2C**	**3A**	**3B**	**4A**	**4B**	**4CDE**	**Total**
Commercial discard mortality	0.02	0.14	NA	NA	0.21	0.09	0.02	0.04	0.52
O26 Bycatch	0.13	0.27	0.03	1.28	0.36	0.18	0.22	1.87	4.33
Non-CSP Recreational (+ discards)	NA	0.09	1.38	1.74	0.00	0.01	0.00	0.00	3.21
Subsistence	NA	0.41	0.44	0.22	0.01	0.01	0.00	0.06	1.14
Total Non-FCEY	0.15	0.90	1.85	3.24	0.58	0.29	0.24	1.96	9.21
Commercial discard mortality	NA	NA	0.06	0.32	NA	NA	NA	NA	0.38
CSP Recreational (+ discards)	0.60	0.92	0.82	1.89	NA	NA	NA	NA	4.23
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial Landings	0.86	5.56	3.58	8.36	2.54	1.61	1.26	1.98	25.75
Total FCEY	1.50	6.48	4.45	10.57	2.54	1.61	1.26	1.98	30.39
TCEY	1.65	7.38	6.30	13.81	3.12	1.90	1.50	3.94	39.60
U26 Bycatch	0.00	0.02	0.00	0.37	0.11	0.10	0.01	1.12	1.73
Total Mortality	1.65	7.40	6.30	14.18	3.23	2.00	1.51	5.06	41.33

APPENDIX IV

CONSOLIDATED SET OF RECOMMENDATIONS AND REQUESTS OF THE 89TH SESSION OF THE IPHC CONFERENCE BOARD (CB089) (29-30 JANUARY 2019)

RECOMMENDATIONS

IPHC Rules of Procedure

CB089-Rec.01 (para. 11) The CB **RECOMMENDED** that the Commission defer the revised IPHC Rules of Procedure (2019) to AM096 for adoption, specifically related to the CB, with respect to the terms of reference as the ad-hoc group that was formed felt that the changes are more than clarifying or technical in nature.

Fishing periods: season opening and closing dates

CB089-Rec.02 (para. 14) The CB **RECOMMENDED** the following fishing period dates for 2019:

a) Opening: 02 March

b) Closing: 30 November

Management Strategy Evaluation

CB089-Rec.03 (para. 15) The CB **RECOMMENDED** the Commission does the following:

a) supports the work to date by the MSAB and their identified goals and objectives;

b) support prioritization of conservation over fishery performance objectives;

c) support preliminary SPR target of 42-43% and SPR range of 40-46%; and

d) support goal of restraining annual variability to 15% or less, and encourage MSAB to continue to develop management procedures that control annual variability, such as those presented at this meeting (AM095).

Mortality limits

CB089-Rec.04 (para. 28) The CB **RECOMMENDED** the following TCEY mortality limits for the 2019 fishing period as provided in Table 1, which translate to the mortality estimates by sector (as provided by the IPHC Secretariat) provided in Appendix III and an SPR of 46%.

Table 1. Conference Board (CB) recommended TCEY mortality limits for 2019. See previous paragraphs for voting.

IPHC Regulatory Area	Mortality limit (TCEY) (mlbs)
2A	1.65
2B	7.38
2C	6.30
3A	13.81
3B	3.12
4A	1.90
4B	1.50
4CDE	3.94
Total (IPHC Convention Area)	**39.60**

Fishery Limits (Sect. 4)

CB089-Rec.05 (para. 30) The CB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropA1, with the addition of the mortality limits for each Contracting Party, by sector, as detailed in Section 6).

IPHC Fishery Regulations: minor amendments

CB089-Rec.06 (para. 35) The CB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropA3.

Charter management measures in IPHC Regulatory Areas 2C and 3A

CB089-Rec.07 (para. 38) The CB **RECOMMENDED** that the Commission adopt proposal IPHC-2019-AM095-PropB1.

Minimum TCEY in IPHC Regulatory Area 2A

CB089-Rec.08 (para. 40) The CB **RECOMMENDED** that the Commission does not adopt proposal IPHC-2019-AM095-PropC1.

IPHC Regulatory Area 2A Quota Proposal

CB089-Rec.09 (para. 45) The CB **RECOMMENDED** that the Commission adopt an earlier start date (second half of May) for the IPHC Regulatory Area 2A Non-Treaty directed commercial fishery's initial fishing period.

Bycatch

CB089-Rec.11 (para. 48) The CB **RECOMMENDED** that the Commission communicate these concerns to the North Pacific Fishery Management Council:

a) New work by the IPHC Secretariat indicates that U26 bycatch impacts the spawning potential of the Pacific halibut stock on a ratio of 1:1.8 –i.e., one pound of bycatch results in a 1.8-pound loss of future Pacific halibut yield to the directed fisheries (TCEY), noting that 65% of the U26 Pacific halibut mortality occurs in IPHC Regulatory Area 4CDE, where observer coverage on groundfish vessels is high and bycatch reduction incentive programs are in place. Approximately 28% of the U26 bycatch occurs in Region 3, where observer coverage on trawl vessels is lower.

CB089-Rec.12 (para. 49) The CB **RECOMMENDED** that the Commission strongly recommend that the NPFMC:

a) prioritize Pacific halibut bycatch reduction in the Bering Sea and Gulf of Alaska, and take meaningful action to protect the future potential of the Pacific halibut stock and the directed fisheries.

b) Increase observer coverage on Gulf of Alaska trawl vessels to more accurately account for bycatch and its impacts on the Pacific halibut stock and directed Pacific halibut fisheries.

REQUESTS

Nil

Report of the 2nd Performance Review of the International Pacific Halibut Commission (PRIPHC02)

Commissioners

Canada	United States of America
Paul Ryall	Chris Oliver
Neil Davis	Robert Alverson
Peter DeGreef	Richard Yamada

Executive Director

David T. Wilson, Ph.D.

DISTRIBUTION:

Participants in the Session
Members of the Commission
IPHC Secretariat

BIBLIOGRAPHIC ENTRY

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ACRONYMS

AM	Annual Meeting
CB	Conference Board
EEZ	Exclusive Economic Zone
FAC	Finance and Administration Committee
FISS	Fishery-independent setline survey
IPHC	International Pacific Halibut Commission
MCS	Monitoring, control and surveillance
MSAB	Management Strategy Advisory Board
MSE	Management Strategy Evaluation
NGO	Non-governmental organisation
PAB	Processor Advisory Board
PICES	North Pacific Marine Science Organization
PRIPHC01	1st Performance Review of the IPHC
PRIPHC02	2nd Performance Review of the IPHC
PSMA	Port State Measures Agreement
RAB	Research Advisory Board
RFMO	Regional Fisheries Management Organisation
SB	Spawning Biomass
SRB	Scientific Review Board
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNFSA	United Nations Fish Stocks Agreement
USA	United States of America
VME	Vulnerable Marine Ecosystem
VMS	Vessel monitoring system

DEFINITIONS

A set of working definitions are provided in the IPHC Glossary of Terms and abbreviations: https://www.iphc.int/the-commission/glossary-of-terms-and-abbreviations

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

This report has been written using the following terms and associated definitions so as to remove ambiguity surrounding how particular paragraphs should be interpreted.

Level 1: **RECOMMENDED**; **RECOMMENDATION; ADOPTED** (formal); **REQUESTED; ENDORSED** (informal): A conclusion for an action to be undertaken, by a Contracting Party, a subsidiary (advisory) body of the Commission and/or the IPHC Secretariat.

Level 2: **AGREED**: Any point of discussion from a meeting which the Commission considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 above; a general point of agreement among delegations/participants of a meeting which does not need to be elevated in the Commission's reporting structure.

Level 3: **NOTED/NOTING**; **CONSIDERED**; **URGED**; **ACKNOWLEDGED**: General terms to be used for consistency. Any point of discussion from a meeting which the Commission considers to be important enough to record in a meeting report for future reference. Any other term may be used to highlight to the reader of an IPHC report, the importance of the relevant paragraph. Other terms may be used but will be considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3.

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EXECUTIVE SUMMARY

The PRIPHC02 was carried out over the course of 2019 via three face-to-face meetings: one in Seattle, USA (4-6 June 2019), one in New York City, USA (25 August 2019) and one in Ottawa, Canada (7-11 October 2019). The Panel held several additional tele-conferences, both among themselves, and with stakeholders. The meeting was also supported by Independent Legal and Science Experts who each dedicated additional working days to providing technical reviews and reports on specific components of the review criteria relevant to their areas of expertise. The following are a subset of the complete recommendations from the PRIPHC02, which are provided at Appendix III.

(para. 22) The PRIPHC02 **CONGRATULATED** the Commission and Secretariat for the positive strides in response to the first performance review. Through the course of the consultations, document review and interviews, the panel saw consistent and significant improvements in transparency, availability and modernisation of documentation and background information, and heard resounding praise for this increased transparency and the movement away from previously "closed-door" and perceived "secretive" processes and decision-making.

Legal analysis of the IPHC Convention

PRIPHC02–Rec.02 (para. 33) The PRIPHC02 **RECOMMENDED** to update the Convention, while in the interim period seek alternate mechanisms to implement international best practices and legal principles.

Science: Status of living marine resources

PRIPHC02–Rec.03 (para. 44) The PRIPHC02 **RECOMMENDED** that opportunities to engage with western Pacific halibut science and management agencies be sought, to strengthen science links and data exchange. Specifically, consider options to investigate pan-Pacific stock structure and migration of Pacific halibut.

Conservation and Management: Data collection and sharing

PRIPHC02–Rec.09 (para. 73) The PRIPHC02 **RECOMMENDED** that observer coverage be adjusted to be commensurate with the level of fishing intensity in each IPHC Regulatory Area.

Conservation and Management: Consistency between scientific advice and fishery Regulations adopted

PRIPHC02–Rec.10 (para. 82) The PRIPHC02 **RECOMMENDED** that the development of MSE to underpin multi-year (strategic) decision-making be continued, and as multi-year decision making is implemented, current Secretariat capacity usage for annual stock assessments should be refocused on research to investigate MSE operating model development (including consideration of biological and fishery uncertainties) for future MSE iterations and regularised multi-year stock assessments.

PRIPHC02–Rec.11 (para. 83) The PRIPHC02 **RECOMMENDED** that ongoing work on the MSE process be prioritised to ensure there is a management framework/procedure with minimal room for ambiguous interpretation, and robust pre-agreed mortality limit setting frameworks.

Fishing allocations and opportunities

PRIPHC02–Rec.12 (para. 88) The PRIPHC02 **STRONGLY URGED** the Commission to conclude its MSE process and **RECOMMENDED** it meet its 2021 deadline to adopt a harvest strategy.

International cooperation: Relationship to non-Contracting Parties

PRIPHC02–Rec.22 (para. 147) The PRIPHC02 **RECOMMENDED** that if the full range of the Pacific halibut stock extends outside the Convention Area, the Contracting Parties invite collaboration with all parties involved in the harvest of this stock, to ensure science and management includes accurate data regarding all removals from the stock.

1. INTRODUCTION

1. At the 93rd Session of the International Pacific Halibut Commission (IPHC) Annual Meeting (AM093) held in January 2017, the Commission considered how best to move forward with a 2nd Performance Review of the IPHC (PRIPHC02). As a result, the Commission requested that the IPHC Secretariat finalise performance review terms of reference and criteria, as well as provide a proposed process and budget to conduct the review. The Commission subsequently adopted the terms of reference, criteria, process, and budget to conduct the PRIPHC02 at its 94th Session (AM094) in January 2018, with the intention of implementing it in 2018 and 2019.

2. The Terms of Reference, criteria, and process to conduct the PRIPHC02 is provided at Appendix I.

3. The PRIPHC02 **AGREED** to modify the criteria described in Appendix I to provide an improved review by organisational area and structure. The modification is of a technical nature and has no impact on the substance of the criteria. This involved the following modifications that are reflected in the structure of this report:

    a) Separate Criteria 3 into two sections: 1) Science - Status of living marine resources and Quality and provision of scientific advice; 2) Conservation and management - Data collection and sharing; Consistency between scientific advice and fishery regulations adopted; Compatibility of management measures; and Fishing allocations and opportunities; and

    b) Rename Criteria 5 (Decision-making and dispute settlement) to "Governance" and to move "Transparency" from Criteria 6 (International cooperation) to this new Criteria (Governance).

4. The PRIPHC02 **AGREED** that each section should include an introductory paragraph providing context (and noting progress on addressing recommendations from the first review, if relevant) and framing the remaining section. Each sub-section should include the following four points:

    a) Brief background, if required;

    b) Areas for improvement;

    c) Rationale for recommendations; and

    d) Recommendations. Each section will, however, not be split into sub-sections.

5. The PRIPHC02 **NOTED** that some recommendations are repeated as they apply to more than one set of considerations. It is expected that the Commission, in considering this report, would look at the recommendations as an ensemble but remain in each section as pertinent to the understanding and alignment of the recommendations with the PRIPHC02 discussions.

1.1 Composition of the Review Panel

6. The PRIPHC02 Panel consisted of the following seven (7) members. The IPHC Executive Director facilitated the process. A short biography for each are provided at Appendix II:

    - Chairperson: **Mr Terje Løbach** (Norway).
    - Contracting Parties: **Dr Robert Day** (Canada); **Ms Staci MacCorkle** (United States of America).
    - Science Advisor: **Dr Kevin Stokes** (New Zealand).
    - Regional Fishery Management Organisations: **Mr Peter Flewwelling** (North Pacific Fisheries Commission); **Mr Jeongseok Park** (North Pacific Anadromous Fish Commission).
    - Non-Governmental Organisations: **Ms Amanda Nickson** (The Pew Charitable Trusts).
    - IPHC Secretariat: **Dr David T. Wilson** (Facilitator).

1.2 Process for undertaking the 2nd Performance Review of the IPHC

7. The PRIPHC02 was carried out over the course of 2019 via three face-to-face meetings: one in Seattle, USA (4-6 June 2019), one in New York City, USA (25 August 2019) and one in Ottawa, Canada (7-11 October 2019). The Panel held several tele-conferences, both among themselves, and with stakeholders as detailed below. The meeting was also supported by Independent Legal and Science Experts who each dedicated additional working days to providing technical reviews and reports on specific components of the review criteria relevant to their areas of expertise (papers IPHC-2019-PRIPHC02-04 and IPHC-2019-PRIPHC02-10).

8. The PRIPHC02 utilised documentation and presentations provided by the IPHC Secretariat, as well as feedback from Contracting Parties, Commissioners, and officers of the Commission's subsidiary bodies. During each discussion with these various group representatives, the PRIPHC02 pursued three basic themes:

   a) Impressions on progress since the first review in 2012 (or, for those who may not have been engaged in the IPHC then, thoughts on engagement with IPHC to date);

   b) View of the current status of the IPHC and the support/functioning of the IPHC Secretariat;

   c) Thoughts about what is needed for the future of IPHC – from the Secretariat and/or other engagements.

9. The Contracting Parties were represented on the PRIPHC02, and thus, it was deemed to be the responsibility of that member to seek the views of the other stakeholders they represented, and to express those to the all members for consideration.

10. Additionally attempts were made to contact interested civil society organisations for their input on the same questions. This yielded limited success as there are relatively few civil society organisations engaged in Pacific halibut management issues, with the majority seemingly involved at a local level, rather than the national or international level. The limited input collected have been aggregated with other responses to maintain the anonymity of the responder.

2. BACKGROUND AND A BRIEF HISTORY OF THE IPHC

11. The IPHC is an intergovernmental organisation established by a Convention between Canada and the United States of America. The IPHC Convention was concluded in 1923 and entered into force that same year. The Convention has been revised several times since, to extend the Commission's authority and meet new conditions in the fishery (Bell 1969). The most recent change occurred in 1979 and involved an amendment to the *1953 Halibut Convention*. The amendment, termed a "protocol", was precipitated in 1976 by Canada and the United States of America extending their jurisdiction over fisheries resources to 200 miles. The 1979 Protocol along with the U.S. legislation that gave effect to the Protocol (Northern Pacific Halibut Act of 1982) has affected the way the fishery is conducted, and redefined the role of IPHC in the management of the fishery during the 1980s (Note: Canada did not require specific enabling legislation to implement the protocol).

12. In the United States of America, the IPHC is considered a "public international organization" and is entitled to particular privileges, exemptions, and immunities conferred by the International Organizations Immunities Act (22 U.S.C. Sec. 288). In 1987, the IPHC was granted 503(c) status as a not-for-profit organization.

2.1 Species, objective, and Convention Area

13. The IPHC is mandated to undertake research on, and management of, Pacific halibut (*Hippoglossus stenolepis*) occurring within Convention waters. The primary objective of the Commission, as provided in Article I, paragraph 2 of the IPHC Convention, "*is to develop the stocks of [Pacific] halibut in the Convention waters to those levels which will permit the optimum yield from the fishery and to maintain*

the stocks at those levels". The IPHC Convention Area was divided into management units (IPHC Regulatory Areas) (Fig. 1), as prescribed in Annex I of the Convention to facilitate regionally-based management.

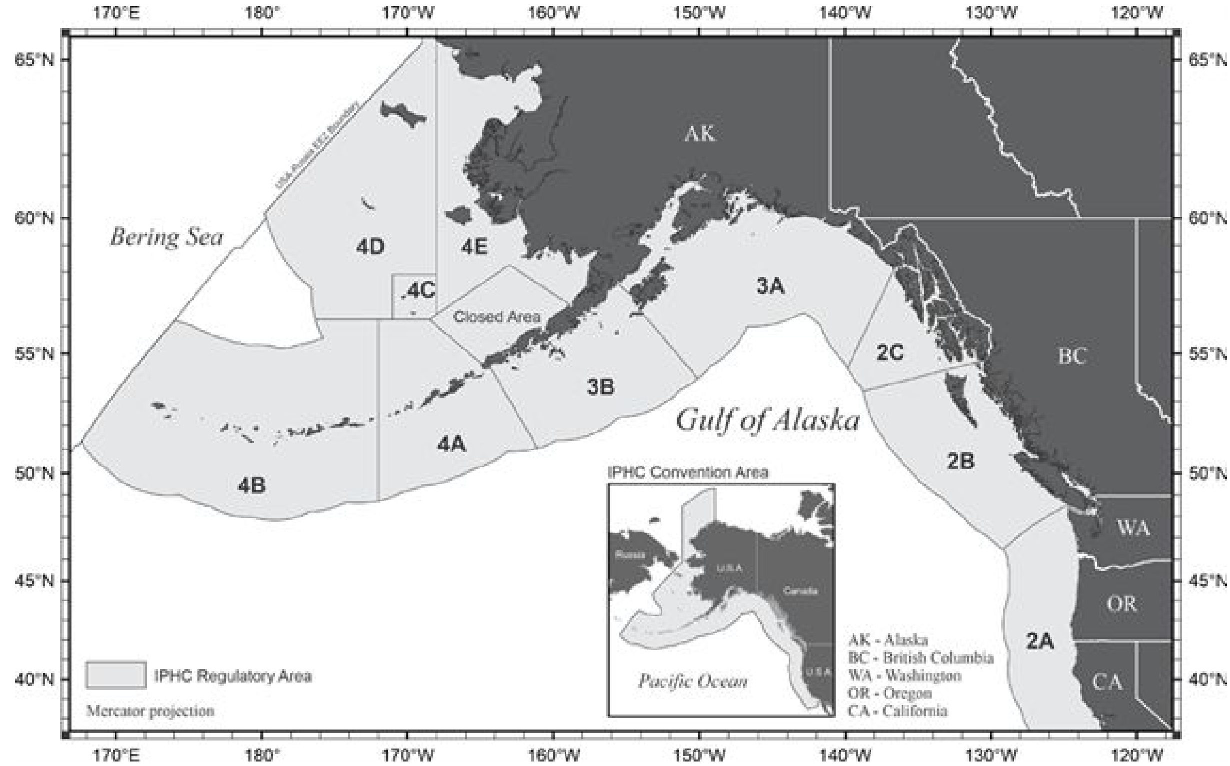


Fig. 1. IPHC Convention Area (insert) and division of IPHC Regulatory Areas.

2.2 Structure of the Commission

14. The Commission currently consists of six members, three appointed by each Contracting Party (the Governor General of Canada and the President of the United States of America), who serve their terms at the pleasure of the Contracting Party. In recent years, one Commissioner from each Contracting Party has been an employee of the federal fisheries agency, and two others involved in the fishery. The Commission has established five (5) Boards (Conference Board (CB); Management Strategy Advisory Board (MSAB); Processor Advisory Board (PAB); Research Advisory Board (RAB); Scientific Review Board (SRB)) and one (1) Committee (Finance and Administration Committee (FAC); Fig. 2)) to provide advice. The Rules of Procedure for the subsidiary bodies are contained within the IPHC Rules of Procedure of the Commission. The Commission, including its Subsidiary Bodies, are supported by an Executive Director and Secretariat staff (Fig. 2).

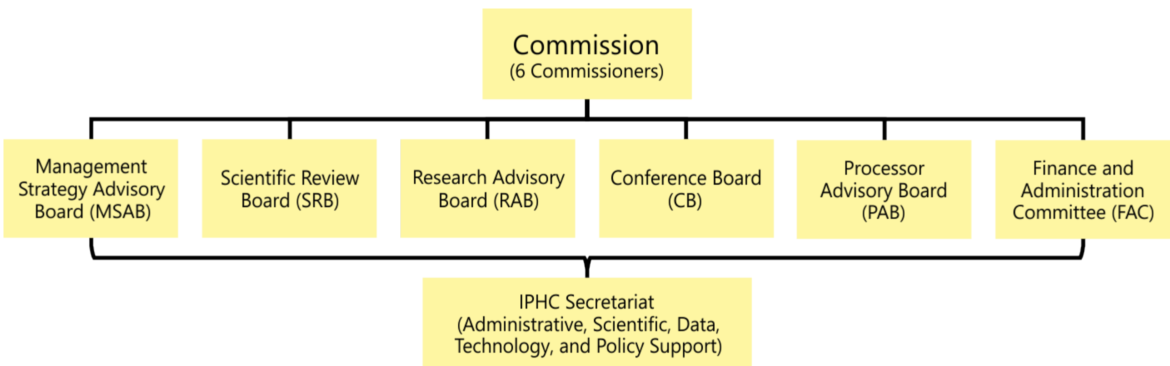


Fig. 2. Overall structure of the IPHC.

2.3 Basic texts of the IPHC

15. The basic texts of the IPHC are available from the IPHC website: https://www.iphc.int/the-commission:

- **Convention (1979) -** The Protocol amending the Convention for the Preservation of the Halibut Fishery of the Northern Pacific Ocean and Bering Sea.
- **Rules of Procedure (2019) -** The Rules of Procedure consist of rules and regulations adopted by the IPHC pursuant to the Convention between Canada and the United States of America.
- **Financial Regulations (2019) -** The Financial Regulations govern the financial administration of the IPHC and were established pursuant to the Commission's Rules of Procedure.
- **Pacific Halibut Fishery Regulations (2019) -** The Pacific halibut fishery Regulations published here are for information purposes only. Official regulations adopted by the Contracting Parties are available at the following web-links:
    - **Canada**: Canada Gazette and on the 'Condition of License';
    - **United States of America**: The Federal Register.

3. 1ST PERFORMANCE REVIEW OF THE IPHC

16. In response to calls from the international community for a review of the performance of Regional Fisheries Management Organisations (RFMOs), the IPHC agreed in 2011 to implement its first process of Performance Review. The IPHC contracted with CONCUR, Inc., a U.S.A.-based firm, to undertake the review. CONCUR performed its work independently of IPHC Commissioners and the IPHC Secretariat, and concluded its report to the Commission in April 2012.

17. In undertaking the Performance Review, the contractor relied on the following approaches to assess the IPHC's work and practices, track effectiveness, and gauge the need for revised approaches:

a) Conducting a set of 43 in-depth interviews with a representative and diverse set of stakeholders;

b) Observing the 2011 Interim and 2012 Annual Meetings and reviewing meeting background materials;

c) Reviewing practices at other RFMOs; and

d) Drawing on its professional judgment and experience.

18. In 2012, the contractor published a report outlining 12 recommendations (containing 39 parts) to improve the functioning of the IPHC (McCreary & Brooks, CONCUR, Inc. 2012).

19. In January 2014, the Commission issued a Progress Report, documenting the Commission's response to the 1st IPHC Performance Review (PERFORMANCE REVIEW 2012: A Progress Report). At Interim and Annual Meetings since then, Contracting Parties have noted the status of implementation of each of the recommendations arising from the report of the 1st Performance Review of the IPHC (PRIPHC01). In the January 2014 progress report, the Commission noted that:

> *"Performance reviews are an important tool to help ensure the Commission continues to fulfil its mission and maintain accountability to its stakeholders and community. The Commission has benefitted significantly from the 2012 performance review and intends to continue the work stemming from that review…"*
>
> *"One fundamental best practice that stands out in the literature is the need to review performance on a regular basis. The Commission intends to make periodic performance reviews a regular feature of its operations. Future reviews may be structured as broad looks or as more focused evaluations, depending on conditions and developments at the time. They may be*

performed by internal or external reviewers. Key to a successful review program is to track all recommendations, actions, and outcomes, so that each review builds on its predecessors."

"The Commission also continues to solicit comment and advice from stakeholders on its ongoing performance review process."

20. The PRIPHC02 **NOTED** paper IPHC-2019-PRIPHC02-03, which included the recommendations arising from the 1st Performance Review of the IPHC (PRIPHC01). The associated responsibilities, timelines for implementation, priorities, and a brief summary of the actions taken in implementing the recommendations are also provided.

21. The PRIPH02 **NOTED** that of the 39 parts of the 12 general recommendations from the first Performance Review, all were considered and only 4 were not addressed further due either to being in the legal mandate of the individual parties, e.g. greater involvement of Tribes and First Nations, or requiring reopening the Convention, e.g. expansion of the number of Commissioners and the Commission composition. One recommendation about the Commission structure was not accepted, that being the one to consolidate CB and PAB subsidiary bodies into one. Re-consideration of the latter decision for a partial merging of subsidiary bodies may have merit.

22. The PRIPHC02 **CONGRATULATED** the Commission and Secretariat for the positive strides in response to the first performance review. Through the course of the consultations, document review and interviews, the panel saw consistent and significant improvements in transparency, availability and modernisation of documentation and background information, and heard resounding praise for this increased transparency and the movement away from previously "closed-door" and perceived "secretive" processes and decision-making.

23. The PRIPHC02 **NOTED** that, following this increased transparency, there could be greater benefit derived from explicit clarity of the roles, responsibilities, and respective authorities of the Commission/Commissioners, the Secretariat, and the various subsidiary bodies.

24. The PRIPHC02 **NOTED** that there is some confusion among stakeholders regarding the authorities and responsibilities of the Commission/Commissioners versus the supporting Secretariat and associated subsidiary bodies. It became apparent that there is a need to further define the process for provision of information to Commissioners, and delineation of decision-making authority resulting from that provision of information. This would be consistent with international best practices reflecting the role of secretariats as the primary support to delivery of bi- and multi-lateral agreements and their decision-making bodies.

25. The PRIPHC02 **NOTED** that many of the structural and operational changes resulting from the first review were well received, however some of the interviewees had not realised the drivers and/or genesis of these changes. This highlights an opportunity and a need for increased information dissemination regarding the reason for changes in the organisation. While the majority of these changes have been welcomed, the pace and scale of the changes have been challenging for many longstanding stakeholders.

26. The PRIPHC02 **NOTED** that while there are continued opportunities for improvement and refinement, as outlined throughout this document, it should not be lost that immense strides have been made in modernising and improving the overall operation of the IPHC with respect to international best practice.

4. Legal analysis of the IPHC Convention

27. The PRIPHC02 **NOTED** paper IPHC-2019-PRIPHC02-04, which provided a legal analysis of the IPHC Convention, prepared by Mr Terje Løbach, against global best practice principles of fisheries management.

28. The PRIPHC02 **NOTED** that the legal review evaluated the IPHC *Convention between Canada and the United States of America for the Preservation of the Halibut Fishery of the Northern Pacific Ocean and Bering Sea*, from an international fisheries legal framework point of view. Specifically, the legal analysis

documented deficiencies in the IPHC Convention in terms of international best practice and principles, as well as the protocols the IPHC follows in implementing its Convention.

29. The PRIPHC02 **NOTED** that while the IPHC was established in 1923 by the *Convention between Canada and the United States of America for the Preservation of the Halibut Fishery of the Northern Pacific Ocean and the Bering Sea*, there have been several amendments, the most recent in 1979. Since then, several global instruments concerning the conservation and management of world fishery resources have been agreed, many of them containing obligations and principles relevant to transboundary fish stocks. The key legally binding instrument is the 1982 United Nations Convention on the Law of the Sea (UNCLOS), which provides the framework for all maritime activities, including conservation and utilisation of living marine resources. Among other treaties related to fishing, and relevant to the IPHC, are the 2005 UN Fish Stocks Agreement (UNFSA) and the 2009 FAO Port State Measures Agreement (PSMA). In addition, a series of soft-law instruments have been adopted. Those relevant in this context include the:
    - 1995 FAO Code of Conduct on Responsible Fisheries (the Code of Conduct);
    - 1999 FAO International Plan of Action for the Management of Capacity (IPOA-Capacity);
    - 1999 FAO International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA-Seabirds);
    - 2001 FAO International Plan of Action to Prevent, Deter and Eliminate IUU Fishing (IPOA-IUU);
    - 2010 FAO Guidelines on Bycatch Management and Reduction of Discards (the Bycatch Guidelines); and
    - 2014 FAO Guidelines for Flag State Performance (the Flag State Guidelines).

30. The PRIPHC02 **NOTED** that:
    a) the UN General Assembly annually addresses fisheries issues, among other things calling upon States, individually or through RFMOs, to address specific topics in order to achieve sustainable fisheries. Likewise, several multilateral declarations, both ministerial and other, have called for specific actions to address conservation and management of fisheries and the ecosystem in which they take place. While UNCLOS, UNFSA and the PSMA entail legally binding obligations on their parties, all these other instruments are voluntary. They serve as guidelines/toolboxes for conservation and management of fisheries, including some specific options for states and RFMOs;
    b) the results of the Legal Analysis emphasised the fact that the IPHC Convention is outdated and not consistent with newer mandatory international legal instruments.

31. The PRIPHC02 **AGREED** that 'best practice' required the IPHC Convention to be updated given its deficiencies. However, it was also recognised that the process for updating the Convention would open additional areas for discussion and may result in a very lengthy process. Thus, the process of updating the Convention should be undertaken in parallel with other mechanisms that could be used to include the principles and components of the international legal instruments in the interim period, e.g. through Commission mechanisms.

Recommendations

32. The PRIPHC02 **RECOMMENDED** that consideration be given to updating the Convention at the next opportunity, to become consistent with newer international legal instruments, and specifically consider including the following elements:
    a) Incorporate a preamble setting forth the purpose of the Convention, and make references to relevant international instruments and principles (e.g. UNCLOS, the Code of Conduct and its action plans, etc.).

b) Incorporate an article for “Definitions,” thereby removing or reducing ambiguity in term usage and meaning.

c) Incorporate an article for “Objective” reflecting international standards for conservation and management of living marine resources.

d) Incorporate an article for “Area of application of the Convention,” including a detailed map, noting that the northern boundary of the Convention area is vague.

e) Include explicit language confirming that the Convention applies to all removals of Pacific halibut in the Convention waters by directed and non-directed fisheries, commercial, recreational, and other.

f) Specify the current species is Pacific halibut (*Hippoglossus stenolepis*)’, though other species of *Hippoglossus* could also be covered under the Convention should they be identified.

g) Incorporate an article for “General principles” to include references to long-term sustainability, science-based decisions, application of the precautionary approach, minimisation of harmful impact on the marine ecosystem, collection and sharing of data, and ensuring effective compliance, etc.

h) Maintain, but in a stand-alone article, the current provisions for continuation of the Commission, with all its assets and liabilities established by the 1923 Convention and subsequent revisions.

i) Consider whether elements of the current Rules of Procedure are better placed in the Convention or a Headquarters Agreement.

j) The functions concerning fishing set out in the Convention to be streamlined in a specific article, and to include the following additional functions:

   i. adopt standards for collection and sharing of data;

   ii. adopt measures for species belonging to the same ecosystem or dependent upon or associated with Pacific halibut;

   iii. adopt measures to avoid, reduce and minimise waste, discards, catch by lost or discarded gear;

   iv. adopt measures to prevent significant adverse impacts on VMEs; and

   v. adopt measures to ensure effective monitoring, control and surveillance, as well as compliance.

k) Consider whether the establishment of the Commission’s subsidiary bodies be moved from the Rules of Procedure to the Convention.

l) Incorporate in the Convention a specific article dealing with administrative issues, such as to appoint a Director, to approve program of work, to approve budget, to adopt or amend rules of procedures, financial regulations and other internal administrative regulations.

m) Harmonise the decision-making provisions of the Convention and the Rules of Procedure, and incorporate those in a specific article of the Convention.

n) Expand the current text to also include obligations to provide national legal provisions related to measures adopted by the Commission, and submit reports on vessel activities at appropriate intervals.

o) Noting the adequate provisions in the Convention, the text should also contain follow-up actions by the flag state that include application of sanctions of sufficient gravity as to be effective in securing compliance, such as depriving offenders of benefits, and refusal, suspension, or withdrawal of authorisations.

p) Consider establishment of a Compliance Committee for reviewing implementation of measures adopted by the Commission.

q) Incorporate in a specific article of the Convention general language concerning transparency.

r) Incorporate in the Convention a specific article, which in general terms states that in order to settle a possible dispute between Contracting Parties, concerning interpretation or implementation of the Convention, the parties shall consult by means they agree upon.

s) Incorporate an article on signature, ratification, acceptance and approval, stating who are entitled to become parties, as well as the timeframe for signature.

t) Incorporate an article stating when it enters into force, and conditions thereto.

u) Incorporate an article stating whether or not reservations or exceptions may be made.

v) Incorporate an article allowing parties to make statements or declarations that do not exclude or modify the legal effect of the provisions.

w) Incorporate an article making references to for example the UNCLOS concerning sovereign rights of coastal States as well as other possible relevant instruments.

x) Incorporate an article describing the amendment mechanisms such as time frames, communication, adoption and entering into force. If annexes or appendices are regarded as an integral part of the treaty, more flexible mechanism for those.

y) Incorporate an article describing possible withdrawal procedures.

z) Incorporate an article stating who will be the depository government as well as its obligations and functions.

33. The PRIPHC02 **RECOMMENDED** to update the Convention, while in the interim period seek alternate mechanisms to implement international best practices and legal principles.

5. SCIENCE

34. The PRIPHC02 **NOTED** paper IPHC-2019-PRIPHC02-05 Rev_1, which provided information regarding the Performance Review Criteria 3: *Conservation and management (status of living marine resources; quality and provision of scientific advice; data collection and sharing; adoption of fishery Regulations, also known in other RFMO's as Conservation and Management Measures, including measures adopted at the national level; compatibility of fishery Regulations).*

35. The PRIPHC02 **NOTED** paper IPHC-2019-PRIPHC02-10, which provided an evaluation of the progress made on the recommendations arising from the first performance review of the IPHC related to science, and also to the criteria set forth with regards to the delivery and management of the science process and scientific advice to the Commission, prepared by Dr Kevin Stokes.

36. The PRIPHC02 **AGREED** that:

a) progress against PRIPHC01 recommendations has been carefully considered and is impressive;

b) when considered across criteria related to peer review, relevance, integrity, objectivity and reliability, plus communication, the IPHC Secretariat science processes generally meet or exceed best practice standards;

c) the IPHC science capability and capacity is strong and trusted with a variety of strengths and few relative weaknesses, but with clear opportunity for improved communication to enable more effective stakeholder engagement.

5.1 Status of living marine resources

37. The PRIPHC02 **NOTED** that:

a) the IPHC has developed a stock status report for Pacific halibut (*Hippoglossus stenolepis*), with the target audience being the general public and stakeholders;

b) Pacific halibut is targeted by the Contracting Parties throughout the Convention Area, from the Bering Sea to the central California coast, as far as San Francisco Bay;

c) In addition, the range extends into the waters of Russia and Japan (see https://www.fishbase.se/summary/Hippoglossus-stenolepis.html);

d) Historically, the IPHC has estimated relatively low density of Pacific halibut in the northern Bering Sea, approaching the Exclusive Economic Zone (EEZ) boundary. This information, along with a modest fraction of the coastwide spawning biomass estimated to occur in the Bering Sea (5.2-13.9%), and no clear information regarding movement of fish across the northern Bering Sea from tagging studies, suggested low demographic exchange. Therefore, the EEZ is currently used as a stock boundary for the purposes of the stock assessment;

e) Catches of Pacific halibut by Russian vessels operating in the Russian EEZ have ranged from 1,430 to 2,555 metric tons over the past 10 years, with an average annual catch of 1,960 mt. The highest catch reported to date was in 2013 (2,555 mt). A Fishery Improvement Plan is currently in development for the Russian fishery (http://longline.ru/index.php/en/) which should lead to greater transparency in landings;

f) The Pacific halibut fishery is comprised of a number of sectors that target (directed fisheries) the species using hook and line and pot gear (demersal longline, traps/pots, recreational/sport, traditional hook and line), as well as incidental catch sectors (non-directed fisheries), that deploy demersal trawl, hook and line (troll, longline, etc.) and pots. Sablefish (*Anoplopoma fimbria*) is a common species caught while fishing Pacific halibut and vice-versa.

g) Incidentally caught species such as rockfish (*Sebastes* spp.) are also caught by demersal longline gear targeting Pacific halibut, among other species listed under the U.S. Endangered Species Act (ESA) or the Canadian Species-at-Risk Act (SARA).

38. The PRIPHC02 **NOTED** that recent aggregate mortality estimates from all sources show that the directed commercial fishery represents the majority of the fishing mortality (Fig. 3). Mortality from all sources in 2018 was estimated to be 38.8 million pounds (~17,590 t), down 8% from 42.0 million pounds in 2017 (~19,050 t). Over the period 1919-2018 mortality has totalled 7.2 billion pounds (~3.2 million t), ranging annually from 34 to 100 million pounds (16,000-45,000 t) with an annual average of 63 million pounds (~29,000 t). Annual mortality was above this long-term average from 1985 through 2010 and was relatively stable near 42 million pounds (~19,000 t) from 2014-2017. Recent mortality estimates from all sources by individual IPHC Regulatory Area reveal that Area 3A has been the largest single source of mortality throughout the last five decades, but that Areas 3A and 3B represent a smaller fraction of the total in recent years than in previous decades. When mortality by source is compared among IPHC Regulatory areas, there are differing patterns in both the magnitude and distribution.

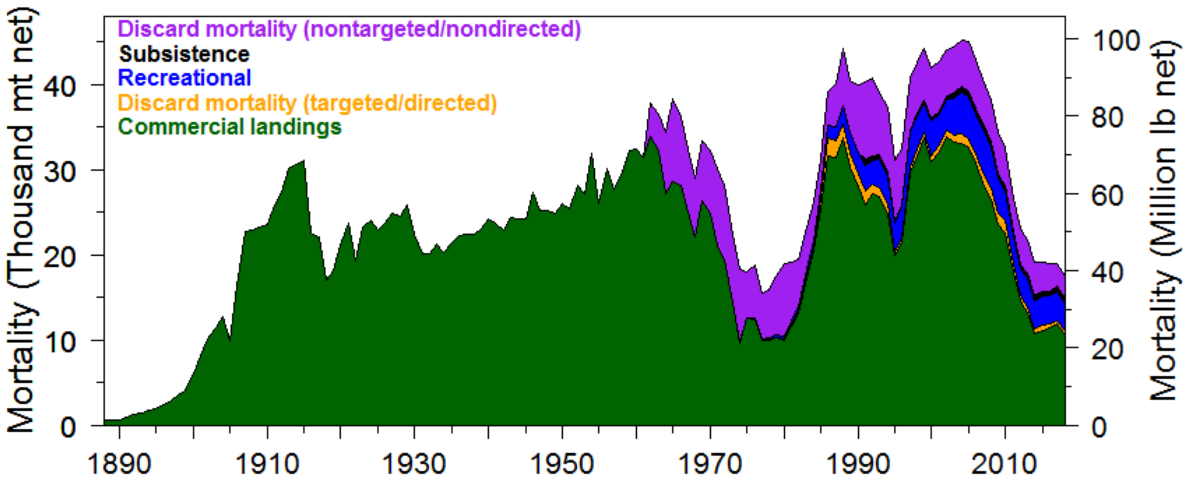


Fig. 3. Summary of estimated historical mortality by source since 1888-2018.

39. The PRIPHC02 **NOTED** that:

a) stock structure of Pacific halibut is not known, and thus, populations are currently considered to constitute a single stock for assessment and management purposes. Investigations are currently underway to verify this assumption;

b) the Commission's harvest strategy directive is to conserve population structure over at least four Biological Regions (2A-2B-2C, 3A-3B, 4A-4CDE, and 4B);

c) in 2018, an ensemble of four (4) equally-weighted models, two long time-series models, and two short time-series models either using data sets by geographical region, or aggregating all data series into coastwide summaries, were applied to the Pacific halibut stock in the IPHC Convention Area, using the stock synthesis software. The results of the 2018 stock assessment indicate that the Pacific halibut stock declined continuously from the late 1990s to around 2011 (Fig. 4);

d) the estimated female spawning biomass (SB) stabilised near 190 million pounds (~86,200 t) in 2011. The SB at the beginning of 2019 is estimated to be 199 million pounds (~90,300 t) (SB_{2019}/SB_0: 43% (27-63)), with an approximate 95% confidence interval ranging from 125 to 287 million pounds (~56,700-130,200 t);

e) the stock is projected to decrease over the period from 2019-21 for all fishing mortality estimates greater than 20 million pounds (~9,070 t). At the 2018 mortality levels (37.2 million lb, ~16,900 t), the probability of at least a 5% decrease in stock size (from 2019 levels) increases from 30% (2020) to 79% (2022). The stock projection merits continued close monitoring under the precautionary approach to fisheries management.

Other species

40. The PRIPHC02 **NOTED** that the IPHC Secretariat works closely with other organisations, and domestic agencies within each Contracting Party on non-target species in Pacific halibut fisheries. This collaboration includes work on marine mammal interactions, seabird interactions and other non-target species, including rockfish, spiny dogfish, sablefish, and Pacific cod. At present, the IPHC does not conduct specific bycatch research, but rather collaborates with domestic organisations by providing them with catches of other species during its annual Fishery-independent setline survey (FISS). The following link provides a data interactive for all species caught during the IPHC's FISS: https://www.iphc.int/data/iphc-secretariat-data.

41. The PRIPHC02 **NOTED** that in the independent review of the IPHC stock assessment (IPHC 2019), opportunities for liaison between the IPHC Secretariat and scientists working on western Pacific halibut should be explored and encouraged.

42. The PRIPHC02 **AGREED** that a lack of historical engagement between the IPHC and western Pacific halibut science and management agencies, may undermine the comprehensiveness of science carried out and advice provided. However, since 2017, efforts have been undertaken to build science relationships, the most notable recent engagement being a dedicated Pacific halibut workshop as part of the annual meetings of the North Pacific Marine Science Organization (PICES): https://meetings.pices.int/meetings/annual/2019/pices/scope.

43. The PRIPHC02 **NOTED** that Pacific halibut are distributed across the coastal North Pacific Ocean from Hokkaido (Japan) to California (United States of America) but life history and genetic studies to date are inconclusive as to distinction between western and eastern North Pacific stocks. More generally, opportunities for liaison between the IPHC Secretariat and scientists working on western Pacific halibut could be explored and encouraged.

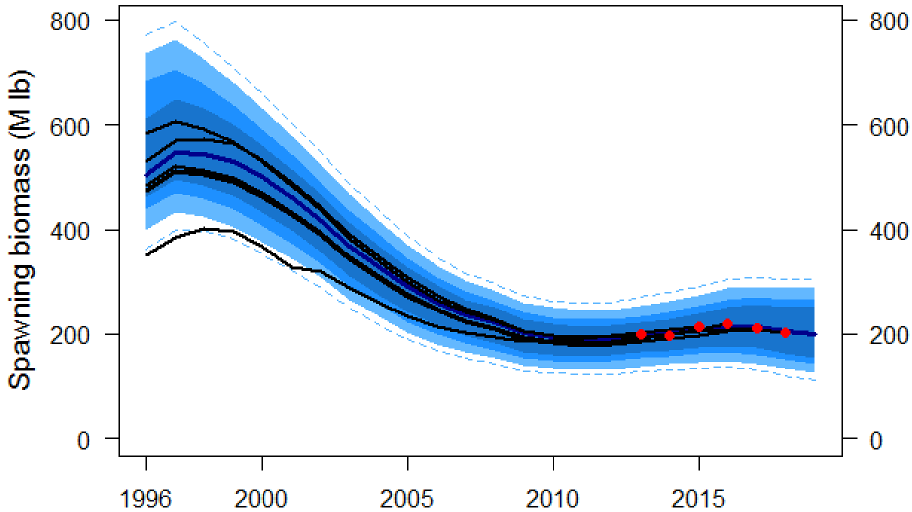


Fig. 4. Retrospective comparison among recent IPHC stock assessments. Black lines indicate estimates of spawning biomass from assessments conducted from 2012-18 with the terminal estimate shown as a point, the shaded distribution denotes the 2018 ensemble: the dark blue line indicates the median (or "50:50 line") with an equal probability of the estimate falling above or below that level; coloured bands moving away from the median indicate the intervals containing 50/100, 75/100, and 95/100 estimates; dashed lines indicating the 99/100 interval.

Recommendations

44. The PRIPHC02 **RECOMMENDED** that opportunities to engage with western Pacific halibut science and management agencies be sought, to strengthen science links and data exchange. Specifically, consider options to investigate pan-Pacific stock structure and migration of Pacific halibut.

45. The PRIPHC02 **RECOMMENDED** that:

a) further efforts be made to lead and collaborate on research to assess the ecosystem impacts of Pacific halibut fisheries on incidentally caught species (retained and/or discarded);

b) where feasible, this research be incorporated within the IPHC's 5-Year Research Plan (https://www.iphc.int/uploads/pdf/besrp/2019/iphc-2019-besrp-5yp.pdf);

c) findings from the IPHC Secretariat research and that of the Contracting Parties be readily accessible via the IPHC website.

5.2 Quality and provision of scientific advice

46. The PRIPHC02 **NOTED** that the science and research activities conducted by the IPHC are directed towards fulfilling the following continuing objectives of the Commission:
    a) improving the annual stock assessment and quota recommendations;
    b) developing information on current management issues (including stock structure, bycatch, and ecosystem impacts/solution); and
    c) contributing to improve the knowledge of the biology and life history of Pacific halibut.
47. The PRIPHC02 **NOTED** that three Secretariat branches (Biological & Ecosystem Sciences Branch, Quantitative Sciences Branch, and Fisheries Statistics & Services Branch) work effectively together to ensure relevant research is conducted to support fundamental understanding of Pacific halibut but with a focus on the needs to inform stock assessment and management strategy evaluation (MSE).

Biological and Ecosystem Sciences Research

48. The PRIPHC02 **NOTED** that since its inception, the IPHC has had a long-standing history of conducting research activities devoted to describing and understanding the biology and ecology of Pacific halibut.
49. The PRIPHC02 **NOTED** that biological research activities at the IPHC are guided by a 5-Year Research Plan, which is available on the IPHC website: https://www.iphc.int/uploads/pdf/besrp/2019/iphc-2019-besrp-5yp.pdf. At the present time, the main objectives of the Biological and Ecosystem Science Research Plan at the IPHC are to:
    a) identify and assess critical knowledge gaps in the biology of the Pacific halibut;
    b) understand the influence of environmental conditions; and
    c) apply the resulting knowledge to provide biological inputs and reduce uncertainty in the current stock assessment and management strategy evaluation models.
50. The PRIPHC02 **NOTED** that the successful pursuit of the objectives detailed in the 5-Year Research Plan is aligned with the Commission's strategic goals to position IPHC as a global leader in scientific excellence in support of science-based decision-making and to foster collaboration (within Contracting Parties and internationally) to enhance IPHC's science and management advice. Individual research projects and results are published in meeting papers of the IPHC's subsidiary bodies, in the scientific literature and on the IPHC website: https://www.iphc.int/management/science-and-research/biological-and-ecosystem-science-research-program-bandesrp.
51. The PRIPHC02 **NOTED** that an overarching goal of the 5-Year Research Plan is to promote integration and synergies among the various management-driven research activities implemented by the IPHC Secretariat in order to improve our knowledge of key biological inputs that feed into the stock assessment and MSE processes, which are directed by management needs. Typically, the IPHC Secretariat responds to the Commission's needs through new and continuing project proposals, designed to address key biological and management-related issues based on the IPHC Secretariat's input as well as input from the IPHC Commissioners, stakeholders and particularly from specific subsidiary bodies of the IPHC, including the SRB and the RAB.
52. The PRIPHC02 **AGREED** that IPHC's 5-Year Research Plan is wide ranging but focused on management needs. Analyses are well focused and are generally supported by sufficient documentation. Presentations to Commission meetings (Interim and Annual Meetings) are for the most part succinct and cover aspects of research pertinent to decision-making.

Stock Assessment

53. The PRIPHC02 **NOTED** that the IPHC conducts an annual stock assessment, using data from the FISS, the commercial Pacific halibut and other fisheries, as well biological information collected under its 5-

yr Research Plan. The assessment includes the Pacific halibut resource in the IPHC Convention Area, covering the waters under national jurisdiction of Canada and the United States of America. Data sources are updated each year to reflect the most recent scientific information available for use in management decision-making. Stock assessment results are used as inputs for harvest strategy calculations, including mortality tables for the upcoming year that reflect the draft IPHC's harvest strategy policy and other considerations, as well as the harvest decision table, which provides a direct tool for the management process. The harvest decision table uses the probability distributions from short-term (three-year) assessment projections to evaluate the trade-offs between alternative levels of potential yield (catch) and the associated risks to the stock and fishery. The most recent stock assessment files are available on each Annual Meeting page, as well as the Stock assessment page on the IPHC website: https://www.iphc.int/management/science-and-research/stock-assessment.

54. The PRIPHC02 **AGREED** that the IPHC Secretariat has strengthened its internal science capacity, and implemented rigorous science peer review processes since the PRIPHC01, and science is largely aimed at delivering relevant decision-support materials. The overall science support provided by the IPHC Secretariat is highly regarded by Commissioners, stakeholders, and internationally.

55. The PRIPHC02 **AGREED** that maintaining the existing, highly credible science capacity and capability of the IPHC Secretariat is crucial, while strengthening it as appropriate to meet specific future interests (e.g. in economics).

Harvest Strategy Policy and Management Strategy Evaluation

56. The PRIPHC02 **NOTED** that the draft IPHC Harvest Strategy Policy provides a framework for applying a science-based approach to setting harvest levels for Pacific halibut within the Convention Area. It defines the biological and economic objectives of the Commission. It also identifies potential reference points for use in the harvest strategy to achieve the Commission's stated objectives. This policy, together with the *Protocol amending the Convention between Canada and the United States of America for the preservation of the [Pacific] halibut fishery of the northern Pacific Ocean and Bering Sea (1979)*, provides the basis to manage the risk to Pacific halibut fisheries and the Pacific halibut population. The full document is available on the IPHC website: https://www.iphc.int/the-commission/harvest-strategy-policy.

57. The PRIPHC02 **NOTED** that at its 89th Annual Meeting in 2013, the Commission endorsed the development of a program of MSE for the Pacific halibut resource occurring within the Convention Area. In doing so, the Commission approved the formation of the MSAB. Appendix V of the IPHC Rules of Procedure (2019) define the role of the MSAB as follows (para. 1):

> "*The primary role of the MSAB is to advise the Commission on the Management Strategy Evaluation (MSE) process*".

58. The PRIPHC02 **NOTED** the latest progress and documents relating to the MSE process are located on the MSAB meeting pages. https://www.iphc.int/library/documents/meeting-documents/iphc-meeting-index. A brief overview of MSE is also provided at the following link: https://www.iphc.int/management/science-and-research/management-strategy-evaluation.

59. The PRIPHC02 **NOTED** that it is clear that considerable progress has been made with advancing the MSE through the MSAB with technical support from the IPHC Secretariat. It is recognised that the process is iterative (between science and management) and that the Commission is encouraged to ensure a coherent process is maintained among managers, scientists and stakeholders. This will help confirm recommendations on objectives and performance measures that need to be adopted by the Commission in order to advance the MSE itself and the consideration of a harvest strategy.

Science peer review and communication

60. The PRIPHC02 **AGREED** that continued high-quality peer review through the SRB mechanism is required. The SRB mechanism is dependent on its membership, and by itself does not guarantee the

quality and credibility of IPHC science, but the current membership of the SRB is of a high calibre with complementary attributes; this standard should be maintained and strengthened as necessary.

61. The PRIPHC02 **AGREED** that the Secretariat scientific staff is highly skilled at communicating complex scientific information to IPHC stakeholders. Additional opportunities include:
   a) assisting subsidiary bodies to understand science and engage effectively in stakeholder processes such as through small planning meetings (onboarding) led by the IPHC Secretariat with participation of subsidiary body chairs, selected Commissioners and selected Secretariat staff; and
   b) providing a simple graphical update of stock status for use by the Commission.
62. The PRIPHC02 **NOTED** that through the MSE process it is expected that reference points would be developed that would allow for a phase plot to be developed. This would allow for easier communication of important science information concerning the status of the stock.

Recommendations

63. The PRIPHC02 **RECOMMENDED** that simplified materials be developed for RAB and especially MSAB use, including training/induction materials.
64. The PRIPHC02 **RECOMMENDED** that consideration be given to amending the Rules of Procedure to include appropriate fixed terms of service to ensure SRB peer review remains independent and fresh; a fixed term of three years seems appropriate, with no more than one renewal.
65. The PRIPHC02 **RECOMMENDED** that the peer review process be strengthened through expanded subject specific independent reviews including data quality and standards, the FISS, MSE, and biological/ecological research; as well as conversion of "grey literature" to primary literature publications. The latter considered important to ongoing information outreach efforts given the cutting-edge nature of the Commission's scientific work.
66. The PRIPHC02 **RECOMMENDED** that the IPHC Secretariat develop options for simple graphical summaries (i.e. phase plot equivalents) of fishing intensity and spawning stock biomass for provision to the Commission.

6. CONSERVATION AND MANAGEMENT

67. The PRIPHC02 **NOTED** paper IPHC-2019-PRIPHC02-05 Rev_1, which provided information regarding the Performance Review Criteria 3: *Conservation and management (status of living marine resources; quality and provision of scientific advice; data collection and sharing; adoption of fishery Regulations, also known in other RFMO's as Conservation and Management Measures, including measures adopted at the national level; compatibility of fishery Regulations).*

6.1 Data collection and sharing

68. The PRIPHC02 **NOTED** the following IPHC webpages that detail current formats, specifications, timelines for data submission, and sharing of data:
   a) IPHC Fishery Regulations: https://www.iphc.int/the-commission/fishery-regulations/
   b) In-season landing reports: https://www.iphc.int/data/landings-2019
   c) Overview of the fisheries: https://www.iphc.int/management/fisheries
   d) Commercial Fisheries: https://www.iphc.int/management/fisheries/commercial-fisheries
   e) Recreational Fisheries: https://www.iphc.int/management/fisheries/recreational-fisheries
   f) Subsistence Fisheries: https://www.iphc.int/management/fisheries/subsistence-fisheries
   g) Bycatch (non-targeted discard mortality): https://www.iphc.int/management/fisheries/bycatch

h) Most recent fisheries summary provided at the annual IPHC meeting: https://www.iphc.int/uploads/pdf/am/2019am/iphc-2019-am095-05.pdf

i) IPHC Data Confidentiality Policy and Procedures: https://www.iphc.int/uploads/pdf/key-policies/iphc-data-use-and-confidentiality-policy.pdf

69. The PRIPHC02 **NOTED** that the IPHC does not currently collect socio-economic data. However the Commission approved the staffing of a fishery economist position to commence in November 2019. This will be the first Fishery Economist position created within an RFMO globally. The primary duties assigned to this position are to:

   a) undertake and guide a broad economic study, including the identification of any knowledge gaps, of the Pacific halibut fishery;

   b) advise on economic principles, compliance with IPHC guidance on economic issues, economic research, or the economic effects of proposed actions; and

   c) prepare written analyses of the costs, benefits, and other impacts of proposed IPHC Fishery Regulations or policies on affected individuals and entities.

70. The PRIPHC02 **NOTED** that underpinning the credibility and utility of any models is trust in the quality of data. The IPHC Secretariat has made recommendations related both to estimates of discard mortality in directed and non-directed fisheries. The independent review of the stock assessment (IPHC 2019) comments on these in the context of the stock assessment and MSE. Further, during discussion with Commissioners, comments were made that reveal concerns about data quality as it relates to adequate observer coverage of non-directed fisheries in areas of higher fishing effort. Concerns have been expressed that this may undermine the integrity of the assessment.

71. The PRIPHC02 **NOTED** that generally all data used in developing advice are subject to scrutiny by Contracting Parties and the IPHC Secretariat. Methods used to analyse data are subject to extensive verification by developers and through collaborative usage. Notable amongst methods and software used is the stock assessment software (i.e. Stock Synthesis), which is subject to continuous and rigorous verification. Other statistical software used is subject to similar ongoing scrutiny through collaborative mechanisms. Verification of correct implementation is through internal collaboration and internal and external peer review. The annual IPHC stock assessment includes careful “bridging” analyses to check on potential influences of software changes.

72. The PRIPHC02 **NOTED** that:

   a) Non-representative scientific monitoring and data collection activities in the non-directed sector of the northern spawning areas and intense fishing in IPHC Regulatory Areas 3A, 3B, and 2C could have a negative impact on fishing opportunities for those participants further down the migration paths in Areas 2A and 2B;

   b) deficiencies were observed in monitoring and data collection, most notably with respect to Pacific halibut discard mortality in non-directed fisheries, especially juveniles in IPHC Regulatory Area 4;

   c) IPHC Regulatory Areas 4 and 3 are areas of lowest observer coverage and hence weakest monitoring, despite the significant Monitoring, Control and Surveillance (MCS) resources applied:

      i. Observer coverage in the Bering Sea at 10%;

      ii. No observer coverage for vessels less than 40 feet; and

      iii. Gulf of Alaska (GOA) observer coverage at 7% in areas with highest fishing pressures.

Recommendations

73. The PRIPHC02 **RECOMMENDED** that observer coverage be adjusted to be commensurate with the level of fishing intensity in each IPHC Regulatory Area.

6.2 Consistency between scientific advice and fishery Regulations adopted

74. The PRIPHC02 **NOTED** that the documents and reports of the IPHC Annual Meetings provide the decision-support materials developed by the IPHC Secretariat, and the subsequent decisions of the Commission based on the advice received, are publically available on the IPHC website. The most recent three (3) years, and the current Fishery Regulations are linked below:
    a) 2019: https://www.iphc.int/venues/details/95th-session-of-the-iphc-annual-meeting-am095
    b) 2018: https://www.iphc.int/venues/details/94th-session-of-the-iphc-annual-meeting-am094
    c) 2017: https://www.iphc.int/venues/details/93rd-session-of-the-iphc-annual-meeting-am093
    d) IPHC Fishery Regulations: https://www.iphc.int/the-commission/fishery-regulations/
75. The PRIPHC02 **NOTED** the draft IPHC Harvest Strategy Policy (https://www.iphc.int/the-commission/harvest-strategy-policy is a draft document based on an amalgamation of current IPHC practices and best practices in harvest strategy policy. It is not intended to be a definitive policy, noting that the IPHC is yet to adopt a formal harvest strategy for Pacific halibut. It is expected that over the coming two years, the IPHC will develop and implement a harvest strategy, and that this policy document will then be updated accordingly.
76. The PRIPHC02 **NOTED** that the draft IPHC Harvest Strategy Policy provides an interim framework for applying a science-based approach to setting harvest levels for Pacific halibut within the Convention Area. In the 96-year history of the IPHC, a rebuilding plan has not been deemed required by the Commission. A process for developing a rebuilding plan has been incorporated in the draft IPHC Harvest Strategy Policy.
77. The PRIPHC02 **NOTED** that because the IPHC Secretariat provides decision-support materials for setting mortality limits rather than definitive advice, it is difficult to assess comprehensively or categorically whether there is consistency between scientific advice and management measures adopted by the Commission.
78. The PRIPHC02 **NOTED** that fishing mortality advice is provided via a risk framework. Under international best practice and application of the precautionary approach, scientific advice would comprise a recommendation toward the lowest risk of the stock falling below an agreed reference point. In the current situation at IPHC, where reference points have not formally been adopted with associated risk tolerance levels, assessment of what may be considered acceptable risk is left to interpretation. This is an area where conflict could arise between Contracting Parties, stakeholders, and partners.
79. The PRIPHC02 **NOTED** that the IPHC currently has high calibre, motivated Secretariat staff working on biological and ecosystem research, stock assessment, and MSE. The Secretariat staff work collaboratively within IPHC and with outside agencies. Comments made as part of the PRIPHC02 process signal high respect for, and trust in Secretariat staff. The current high level of trust is a function of processes per se but also of staff and staff leadership. No signals of staff dissatisfaction have been noted and staff retention and high calibre staff recruitment is critical to continued quality and trust by stakeholders and Commissioners.
80. The PRIPHC02 **NOTED** that the SRB provides a key function of peer review to ensure the relevance, integrity, objectivity and reliability of the science outputs. Ensuring continuity is critical though needs to be balanced against potential perceptions of the SRB as an internal, collegiate science advisory body. The recent strengthening of the SRB is a positive step and signal of Secretariat understanding and oversight of the processes that needs to be maintained. Nevertheless, the lack of a formal means of ensuring a balance between continuity and turnover of SRB membership is a risk that should be mitigated.
81. The PRIPHC02 **NOTED** the full benefit of MSE will be realised if the MSE-derived harvest strategy can be implemented for a reasonable time period, e.g. 7-10 years. This would reduce the demands for

annual decision support tools because annual decision-making, using the harvest strategy, would rely upon the modelled survey abundance indices.

Recommendations

82. The PRIPHC02 **RECOMMENDED** that the development of MSE to underpin multi-year (strategic) decision-making be continued, and as multi-year decision making is implemented, current Secretariat capacity usage for annual stock assessments should be refocused on research to investigate MSE operating model development (including consideration of biological and fishery uncertainties) for future MSE iterations and regularised multi-year stock assessments.

83. The PRIPHC02 **RECOMMENDED** that ongoing work on the MSE process be prioritised to ensure there is a management framework/procedure with minimal room for ambiguous interpretation, and robust pre-agreed mortality limit setting frameworks.

6.3 Compatibility of management measures

84. The PRIPHC02 **NOTED** that UNFSA Article 7 provides that, without prejudice to the sovereign rights of coastal States over resources within areas under national jurisdiction, and the rights of all States to fish on the high seas, coastal States and States fishing on the high seas are required to "seek to agree" on the measures necessary for the conservation of straddling fish stocks in the adjacent high seas areas. These measures must be compatible with and not undermine the effectiveness of conservation and management measures adopted by coastal States within areas of their national jurisdiction "in order to ensure conservation and management of straddling fish stocks in their entirety".

85. The PRIPHC02 **NOTED** that the range of Pacific halibut extends into the waters of Japan and Russia presuming that the highest annual catches are within the waters of Russia. There are no registered catches on the high seas (while acknowledging that there may be catches occurring in the high seas pocket between Russia and the Convention Area), and consequently UNFSA is currently considered not applicable, and the issue will be addressed under the section 'International Cooperation: Relationship to non-Contracting Parties'.

6.4 Fishing allocations and opportunities

86. The PRIPHC02 **NOTED** the previous challenges encountered by the Commission in setting fishing mortality levels and the process that the Commission has taken to agree on an allocation decision for 2019 and the next three years (for IPHC Regulatory Areas 2A and 2B).

87. The PRIPHC02 **NOTED** the substantial resources that the Commission has allocated to the MSE process since 2017.

Recommendation

88. The PRIPHC02 **STRONGLY URGED** the Commission to conclude its MSE process and **RECOMMENDED** it meet its 2021 deadline to adopt a harvest strategy.

7. COMPLIANCE AND ENFORCEMENT

89. The PRIPHC02 **NOTED** paper IPHC-2019-PRIPHC02-06 Rev_1, which provided information regarding the Performance Review Criteria 4: *Compliance and enforcement (flag State duties; monitoring, control and surveillance activities; port State measures; follow-up on infringements; cooperative mechanisms to detect and deter non-compliance; market-related measures).*

7.1 Flag State duties

90. The PRIPHC02 **NOTED** that the IPHC is unlike most RFMOs in that it is comprised of two Contracting Parties, with a focus on management of a single resource, Pacific halibut, which occurs for the most part within their EEZs. The IPHC was established in 1923 and the update of its Convention in 1979 precludes the formal ideas of flag State responsibilities to control fisheries activities on the high seas under

UNCLOS and UNFSA by several years. Noting the age of IPHC, the bilateral arrangement and focus on operations within the two EEZs, the concept of flag State responsibilities to control their flag vessels when operating on the high seas may not be relevant in this situation, however the general principles can be assessed noting the basic responsibilities addressed under UNFSA Article 18 paragraph 3 and in the Code of Conduct for Responsible Fisheries, Article 8.2, and the IPHC actions with respect to use of these principles within the EEZs of each Contracting Party.

91. The PRIPHC02 **NOTED** the relevant principles of flag State duties include:

a) control of such vessels by means of fishing licenses, authorisations or permits with terms and conditions for fishing operations;

b) establishment of regulations requiring carriage of licenses, production on demand, etc.;

c) requirements for marking of fishing vessels and fishing gear;

d) requirements for recording and timely reporting of vessel position, catch of target and non-target species, fishing effort and other relevant fisheries data in accordance with set standards for collection of such data;

e) requirements for verifying the catch of target and non-target species through such means as observer programs, inspection schemes, unloading reports, supervision of transshipment and monitoring of landed catches and market statistics;

f) monitoring, control and surveillance of such vessels, their fishing operations and related activities by, inter alia:

i. the implementation of national inspection schemes;

ii. the implementation of national observer programs; and

iii. the development and implementation of vessel monitoring systems, including, as appropriate, satellite transmitter systems, in accordance with any national programs: and

g) regulation of fishing activities to ensure compliance with set measures.

92. The PRIPHC02 **AGREED** that IPHC Pacific Halibut Fishery Regulations (2019) address all these principles directly or in part, through either the IPHC regulations or through national regulations for individual flag State control of its fishing fleets. Consequently, although the idea of flag State responsibilities is meant for the high seas, the two Contracting Parties making up the Commission do apply the principles in their management regimes. Further, noting the adherence to the principles of flag State control measures, there are no suggestions for improvement and as the current regulatory actions of the Commission are consistent with the principles noted above, no further recommendations are required.

7.2 Port State measures

93. The PRIPHC02 **NOTED** that the PSMA applies to vessels not entitled to fly the flag of the port State (i.e. foreign vessels), with two categories that may be exempted, namely vessels of a neighbouring state engaged in artisanal fishing for subsistence and particular container vessels that are not carrying fish, or if carrying fish, only fish that have been previously landed. It should be noted that application by a port State is not required to vessels chartered by nationals exclusively for fishing in their own zones. Such vessels shall be subject to measures by the Party which are as effective as measures applied in relation to vessels entitled to fly its flag. Further, the UNFSA Article 23 and the Code of Conduct for Responsible Fisheries, Article 8.3 focus on measures related to foreign vessels.

94. The PRIPHC02 **NOTED** that the Pacific halibut fisheries managed by the IPHC occur entirely within the EEZs of the two Contracting Parties, and all Pacific halibut are landed in ports of the two countries. Landings are almost exclusively in ports of the same country as the fishing vessel, the primary exception being the IPHC's own research catch, which may be landed in either country. Thus, although not stated

explicitly, the Convention effectively assigns the equivalent of Port State duties to the Contracting Parties to carry out with respect to their ports. Both Canada and the United States of America are parties to the PSMA.

95. The PRIPHC02 **NOTED** the current bilateral nature of this Commission, limits of its mandate to the activities within its EEZs, authorisation requirements, gear limitations, season limitations, Vessel Monitoring Systems (VMS), log books requirements, inspections and monitoring of landings, plus the plethora of enforcement agencies involved in at-sea and in port MCS activities as noted in their annual reports, it is suggested that the principles of PSMA are generally implemented, noting that the majority of landings are by domestic vessels at their Contracting Party ports.

Recommendation

96. The PRIPHC02 **RECOMMENDED** that Contracting Party enforcement agencies adopt common standards for assessment of implementation of the principles of port State measures.

7.3 Monitoring, control and surveillance (MCS)

97. The PRIPHC02 **NOTED** that MCS measures are the individual responsibility of the IPHC Contracting Parties as part of their management of the fisheries and enforcement of regulations. A number of MCS measures are included in the IPHC Pacific Halibut Fishery Regulations (2019) at the request of the Contracting Parties for purposes of domestic management and enforcement.

98. The PRIPHC02 **NOTED** that the PRIPHC01 did not have any specific recommendations on MCS, although they did have recommendations regarding transparency, stakeholder engagement and the need to strengthen stock assessment processes and development of a long-term strategic plan for the fishery and enhanced involvement of the Commissioners in their leadership roles.

99. The PRIPHC02 **NOTED** the IPHC Fishery Regulations are reviewed and updated annually, including the implementation of mortality limits, partial VMS coverage, observers, data collectors, monitoring of landings, etc. These are all very positive steps to implementation of sustainable, ‘best practice’, management measures recognising that MCS is the implementing arm for fisheries management through two key approaches, ‘voluntary’ compliance strategies and ‘deterrent’ enforcement strategies.

100. The PRIPHC02 **NOTED** that the implementation of the management measures is the responsibility of each of the Contracting Parties. The common indicator of compliance trends for RFMOs to input into future management measures and the Compliance Monitoring Scheme is weak and appears to be segmented through the submission of 15 separate MCS reports (2 for Canada and 13 for the United States of America) with no integration or focus on what the results mean with respect to successful implementation.

101. **NOTING** the plethora of enforcement agency reports, especially from the USA, including significant duplication of data, the PRIPHC02 **AGREED** with the IPHC request for coordination of agency efforts to re-focus on an integration of MCS efforts for sustainable fisheries management, and coordination of efforts amongst MCS partner agencies.

102. The PRIPHC02 **AGREED** that the establishment of common standards and levels for monitoring, observers and data collection could greatly enhance the management process and ensure greater equity or balance in fishing opportunities for all areas and sectors.

103. The PRIPHC02 **NOTED** that some efforts on the ‘educational, voluntary compliance’ mechanisms to involve all participants, however the greater effort and focus appeared to remain on the ‘deterrent’ enforcement activities which are only one part of the MCS regime for sustainable management of the fisheries, and in fact, the last resort to ensure compliance. Earlier efforts on educational involvement and ‘voluntary compliance’ may assist in higher compliance levels, peer pressure for compliance and hence a better balance in the management regime for all participants.

104. The PRIPHC02 **NOTED** the pressures and negative impacts that limited MCS resources can have on monitoring and controlling the 'derby style' of management of the fishery in IPHC Regulatory Area 2A. This type of management scheme encourages fishers to take greater safety risks to participate in the fishery, consequently consideration might be given to alternate management processes.

Recommendation

105. The PRIPHC02 **RECOMMENDED** enhancement of coordination of MCS activities to result in a common, integrated enforcement report for each Contracting Party to facilitate assessment of compliance efforts, trends and input into management decisions.

106. The PRIPHC02 **RECOMMENDED** that the Commission re-assess the 'derby-style' fisheries management concept in operation in IPHC Regulatory Area 2A in terms of available resources, impact on validity of monitoring results, and safety of fishers, and amend the management processes, if and as necessary.

7.4 Follow-up on infringements

107. The PRIPHC02 **NOTED**:

a) the "Contracting Party (by agency) Reports" prepared for the 95th Session of the IPHC Annual Meeting (AM095) for the most recent compliance monitoring and reporting: https://www.iphc.int/venues/details/95th-session-of-the-iphc-annual-meeting-am095;

b) the level of effort on 'voluntary' compliance mechanisms by the Contracting Parties was not reported because most of the compliance reports provided only spatial/time commitments for 'deterrent' enforcement operations;

c) that the Commission has not received any information on follow-up on the infringements reported;

d) that at present, follow-up on infringements is left largely to each Contracting Party, independent of the other. However, there is a benefit in providing more transparency in this regard through consolidated National Reporting to the Commission. The Commission is currently developing a template for reporting in a consistent format annually;

e) that efficiencies are likely to be gained by modifying the format and content for Contracting Parties reports to the Commission.

Recommendations

108. The PRIPHC02 **RECOMMENDED** that the IPHC request information regarding Contracting Party follow-up of infringements, to assist in determining the overall efficacy of MCS and enforcement activities. This would support best practices with respect to transparency.

109. The PRIPHC02 **RECOMMENDED** that the Commission improve the process of Contracting Party reporting to the Commission by aggregating individual agency reports into a consolidated, standardised, Contracting Party report to the Commission.

7.5 Cooperative mechanisms to detect and deter non-compliance

110. The PRIPHC02 **NOTED** that the IPHC relies on its Contracting Parties to detect and deter non-compliance as part of their domestic management of the fishery and enforcement of IPHC Fishery Regulations. This is generally carried out by each of the two Contracting Parties independently of the other because the fisheries they manage take place entirely within waters under their respective national jurisdictions.

7.6 Market-related measures

111. The PRIPHC02 **NOTED** it did not identify any need for consideration under this section.

8. GOVERNANCE

112. The PRIPHC02 **NOTED** paper IPHC-2019-PRIPHC02-07 Rev_1, and paper IPHC-2019-PRIPHC02-08 Rev_1 which provided information regarding the Performance Review Criteria 5: *Decision-making and dispute-settlement*, and an item from Criteria 6: *transparency*, respectively.

8.1 Decision-making

113. The PRIPHC02 **NOTED** that among other things, Article III, paragraph 1 of the IPHC Convention also includes a decision-making clause. All decisions of the Commission shall be made by concurring vote of at least two of the Commissioners of each Party. However, this is modified by Rule 11, paragraph 1 of the Rules of Procedure (2019), which states that as a general rule, decision-making in the Commission should be by consensus, defined to mean the absence of any formal objection made at the time the decision was taken. A voting procedure will be invoked if it appears that all efforts to reach consensus have been exhausted, and the decision will be made by voting as referred to in Article III, paragraph 1 of the Convention.

114. The PRIPHC02 **NOTED** that the IPHC Convention does not make reference to observer participation at IPHC meetings. However, according to Rule 6.2 of the Rules of Procedure 2019 meetings of the Commission may be open to observers and the general public. Rule 12 specifies the IPHC's relationship to observers and the general public, and states that all sessions of the Commission and its subsidiary bodies may be open to observers and the general public, unless the Commission decides otherwise. It may invite States, RFMOs and other relevant governmental and intergovernmental organisations and non-governmental organisations. The current position of the Commission is that all meetings are open to observers and the general public.

115. The PRIPHC02 **NOTED** that since the PRIPHC01, the Commission progressively decided to treat all meetings (Commission and its subsidiary bodies) as open unless specifically closed (sessions pertaining to personnel remain closed). All open sessions are also live webcast to the public and the web broadcast incorporates the ability to receive questions from and respond to the on-line audience. Audio recordings of all open sessions are also published on the website, and YouTube channels for the public record. For example, see the following two links, the first being for the 95th Session of the IPHC Annual Meeting, and the second being a sub-link to the audio recording from the same meeting posted on YouTube. The link is included in the 'Meeting results' of the AM095 page:

a) AM095 meeting page: https://www.iphc.int/venues/details/95th-session-of-the-iphc-annual-meeting-am095

b) YouTube link: https://www.youtube.com/playlist?list=PLww0sbZpeo2dBacOa8qPmBQyOW0LkDvD1

116. The PRIPHC02 **NOTED** that in session, all attendees, including observers and members of the public, as well as the webinar audience, are able to pose questions and have them answered by the Commission in two-way dialogue during the meeting. The Commission also directed the CB and PAB to open their meetings to the public from 2017. Thus, all IPHC subsidiary bodies are open to the public. In addition, meetings of the MSAB are webcast (one-way only), and the meetings of the MSAB, the SRB, and the RAB are recorded.

117. The PRIPHC02 **NOTED** that the Commission's Rules of Procedure have been updated three times since the PRIPHC01.

a) IPHC Rules of Procedure (2014): Minor improvements made to clarify the functions of the Commission;

b) IPHC Rules of Procedure (2017): Substantially updated by incorporating terms of reference and processes for subsidiary bodies. A requirement for review and revision every two (2) years; and

c) IPHC Rules of Procedure (2019): Further revisions to refine the terms of reference and procedures the subsidiary bodies to reduce potential overlaps in mandate. In addition, a 'code of conduct' was added to guide the interactions of the subsidiary bodies. The decision making process in-session and also intersessionally are clearly defined in the IPHC Rules of Procedure (2019), Rule 11 – Decision making. https://www.iphc.int/uploads/pdf/basic-texts/iphc-2019-rules-of-procedure.pdf

118. The PRIPHC02 **NOTED** that from 2017, all documents for Commission and subsidiary body meetings are prepared in a standard format and posted at the IPHC website (https://www.iphc.int/iphc-meetings). Documents prepared for meetings are posted not later than 30 days in advance of the session, and a comprehensive meeting report is posted as efficiently as possible following each session. In addition to posting at the IPHC website, meeting results are published to stakeholders and the public via IPHC Media Releases and Circulars. (See the IPHC Documents webpage at https://www.iphc.int/library/documents for examples).

119. The PRIPHC02 **NOTED** that the IPHC operates on a regular annual meeting cycle, and since 2018, has operated on a three-year calendar of meetings, approved annually by the Commission. The timing of the IPHC annual meeting cycle, with major decisions made by the Commission in January or early February of each year, is geared to support the needs of the domestic regulatory processes for the Pacific halibut fisheries in both Contracting Parties. (see discussion in https://www.iphc.int/uploads/pdf/am/2019am/iphc-2019-am095-22.pdf.).

120. The PRIPHC02 **NOTED** that accessibility to meeting materials and meetings is an area where the IPHC has demonstrated leadership among RFMOs globally.

121. The PRIPHC02 **NOTED** that all observer organisations and the general public are able to register and attend all IPHC meetings, via the meeting webpages. However, a clearer pathway and recognition of Observer organisations is needed.

122. The PRIPHC02 **NOTED** that IPHC decision-making is annual, based on objective and current science. The adoption of a consistent ensemble model approach to providing the scientific basis for decision-making has been welcomed. The move toward strategic decision-making and management based on MSE is an opportunity to strengthen science-based decision-making and to increase capacity for the annual stock assessment process.

123. The PRIPHC02 **NOTED** that the involvement of civil society organisations as contributors, stakeholders and partners at all levels of the management process is welcomed, however the Commission process lacks formal pathways for participation by observer organisations, particularly civil society representatives.

Recommendation

124. The PRIPHC02 **RECOMMENDED** that the IPHC Rules of Procedure be modified to include a clear category and recognition for observer organisations, which would be in addition to the general public.

8.2 Dispute settlement

125. The PRIPHC02 **NOTED** that each Contracting Party actively manages its fisheries in accordance with the IPHC Fishery Regulations (current IPHC Fishery Regulations 2019). However, the published Pacific Halibut Fishery Regulations are for information purposes only. Official regulations are adopted by the Contracting Parties, and are available at the following web-links:

a) Canada: Canada Gazette and on the 'Condition of License': http://www.dfo-mpo.gc.ca/acts-lois/regulations-reglements-eng.htm

b) United States of America: The Federal Register: https://www.federalregister.gov/documents/2019/03/14/2019-04714/pacific-halibut-fisheries-catch-sharing-plan

126. The PRIPHC02 **NOTED** that Contracting Parties may choose to object and thus not enact specific IPHC fishery regulations, and notify the other Party accordingly at the time the decision is made. As the IPHC currently acts in a bilateral context, consent by both parties is required to adopt a new regulatory measure. In instances where agreement is not reached, the parties will enter into an inter-sessional discussion process. Should agreement be reached intersessionally, the intersessional decision must be made by consensus of all 6 Commissions (while the current practice, that is not reflected in the Rules of Procedure). Alternatively, the decision is moved to the next session of the Commission for deliberation (ref. IPHC Rules of Procedure 2019, Rule 11, para. 5-10. At that point, only 2 Commissioners from each Contracting Party (4 in total) are required to be in favour in order for a decision to be adopted. The IPHC Rules of Procedure (2019) describe how the above process works. The Commission receives from each Contracting Party regular reports about management actions they have taken and the ensuing results, including data on removals in the directed and non-directed fisheries. Because they each directly manage the fisheries in their own waters, disputes or disagreements between the Contracting Parties tend to be focused on the annual decision-making process, in particular the setting of mortality limits (catch limits) for each IPHC Regulatory Area.

127. The PRIPHC02 **NOTED** that regulations adopted by the IPHC remain in force until changed or superseded by the Commission. The IPHC Convention requires that in session, "all decisions of the Commission shall be made by a concurring vote of at least two of the [three] Commissioners of each Party." In the absence of such agreement, existing regulations remain in force, thus the operation of the fisheries is not hampered or restricted in the event the Commission fails to update regulations. The Commission strives to avoid this situation and it is rare, occurring only twice in the past 96 years.

Recommendation

128. The PRIPHC02 **RECOMMENDED** updating the rules of procedure to reflect intersessional decision making approaches.

8.3 Transparency

129. The PRIPHC02 **AGREED** that the issue of transparency is two-fold – internal (i.e. whether decisions within IPHC are made in a transparent manner) and external (i.e. its relationship with other organisations and civil society). The first one is addressed under decision-making.

130. The PRIPHC02 **NOTED** that since 2017, all reports from meetings of the Commission and its subsidiary bodies are now required to be published within 15 days of the close of the respective meeting. This rule was included in the 2017 version of the IPHC Rules of Procedure. Since that time, time taken to publish IPHC meeting reports has continuously been reduced, with the most recent Report of the 95th Session of the IPHC Annual Meeting (AM095) being published on the same day that the meeting closed. At each subsequent session, an Actions Arising paper is published, detailing progress made during the inter-sessional period. In 2017, numerical tracking of actions was introduced for the first time, to facilitate tracking and reporting. An example from the recent AM095 meeting of the Commission: https://www.iphc.int/uploads/pdf/am/2019am/iphc-2019-am095-03.pdf. All papers for meetings of the Commission or its subsidiary bodies are required to be published 30 days prior to the commencement of a meeting. This rule has been adhered to for all meetings since it was introduced in the 2017 version of the IPHC Rules of Procedure. See Rule 8 – Order of Business, of the IPHC Rules of Procedure (2019).

131. The PRIPHC02 **NOTED** that the Commission has contracted separate independent peer reviews of the stock assessment, the most recent being in 2019. As for all IPHC reports, the independent stock assessment review is available online. It is debatable whether the Commission should additionally contract independent reviews on other matters. The SRB mechanism is in principle sufficient but while it is independent, it is also internalised and could potentially be perceived as institutionalised. Stakeholder, Commissioner and public trust may be enhanced by judicious contracting of occasional additional external peer reviews.

132. The PRIPHC02 **AGREED** that with respect to the MSE, timely review would be prior to finalisation and decision-making on implementation. Other areas for potential review are the FISS, specific biological and ecological research activities, and catch data quality and standards. Opportunities to publish in the primary literature could also be taken advantage of, providing a highly visible form of peer review.

133. The PRIPHC02 **AGREED** that the SRB could be more responsive and assist in strengthening internal engagement of members. Careful consideration is needed of the SRB role and whether it could be widened to serve such purposes. As mandated through the Rules of Procedure it has an independent, scientific peer review function. Any move to widen that function could undermine it and perceptions of independence. To meet best practice standards, a clear peer review mechanism is required. The current functioning of the SRB and occasional external review meets those standards.

134. The PRIPHC02 **NOTED** that less formally, the IPHC employs world-class analysts and biologists and exists in what might best be termed a fisheries Center of Excellence; Seattle provides a fertile ground for informal scientific peer review and the interactions between permanent IPHC scientists and the wider scientific northwest Pacific fisheries science community further ensure continuous scrutiny.

135. The PRIPHC02 **AGREED** that:

a) IPHC Science processes are robust and implementation as evidenced by transparent documentation and reports is excellent with most improvements occurring after 2016;

b) Transparency is a strong attribute of all IPHC work, particularly since 2017. The scope and quality of science documentation is impressive. However, as is common in fisheries, the science products are generally restricted to "grey literature" documents. There is considerable opportunity for much of the IPHC science to be published in primary literature, providing further peer review and credibility but also motivation for Secretariat staff.

136. The PRIPHC02 **NOTED** the need for a visible and clear pathway for Observer participation, with specific input and feedback points at all key points in the management and governance process. The PRIPHC02 considers Observers to include "civil society" (e.g. those with an interest such as NGOs and other entities without financial stake in the fishery, but for whom input into the management of public resources is a component of their core business).

Recommendations

137. The PRIPHC02 **RECOMMENDED** that the significant level of transparency achieved across Commission business continue to be improved.

9. INTERNATIONAL COOPERATION

138. The PRIPHC02 **NOTED** paper IPHC-2019-PRIPHC02-08 Rev_1, which provided information regarding the Performance Review Criteria 6: *International cooperation (relationship to non-Contracting Parties; cooperation with other RFMOs)*. Note that '*transparency*' has been moved to Governance, above.

9.1 Relationship to non-Contracting Parties

139. The PRIPHC02 **NOTED** that there are three non-Contracting Parties who exploit Pacific halibut, Russia, the Republic of Korea and Japan. Both the Republic of Korea and Japan harvest Pacific halibut as incidental catch. To date the IPHC has been unable to obtain landing figures. Russia has a longline fishery landing Pacific halibut in excess of 2,000 metric tons annually. The IPHC has engaged Russia both on a scientific and management/policy level in the past with mixed engagement success. Most recently it has engaged Russian scientists working on Pacific halibut through PICES. Russian managers and scientists intermittently participate in the IPHC process, an example being the 1993 Annual meeting, among others: https://www.iphc.int/uploads/pdf/am/iphc-1993-am069-r.pdf. The IPHC Secretariat

organised a joint scientific working group meeting on Pacific halibut at the PICES meeting in October 2019, including the participation of Russian and Japanese scientists, in addition to scientists from the Contracting Parties.

140. The PRIPHC02 **NOTED** that there are no vessels from non-Contracting Parties authorised to fish in the IPHC Convention Area. This is enforced by the Contracting Parties. Russia has previously fished in IPHC Convention Area under access agreements, however this arrangement was terminated in the 1980s.

141. The PRIPHC02 **NOTED** that the IPHC management processes currently focus solely on Pacific halibut in the waters under the national jurisdictions of the Contracting Parties, and appear to discount or ignore the harvests of the same Pacific halibut stock in the areas outside the Convention Area, thereby creating a risk in the application of 'best practices' for stock management. A possible ~13% of the annual mortality of Pacific halibut is harvested outside the IPHC Convention Area (i.e. by Russia, Japan, and, possibly, the Republic of Korea) and accurate data on these fisheries is not included in either the stock assessments or management strategies. This lack of attention to fishing outside the Convention Area creates an information gap and may bias any stock assessment exercises or management efforts to an unknown degree.

142. The PRIPHC02 **NOTED** that pursuant to Article 63, paragraph 1 of UNCLOS that where the same stock occurs within the EEZ of two or more coastal States, these States shall seek to agree upon measures necessary to coordinate and ensure that coordination and development of such a stock. As IPHC has in place a management system that implements this obligation for two coastal States, it would seem appropriate that IPHC reaches out to relevant additional coastal States in order to find suitable cooperative arrangements within the obligations set out in UNCLOS.

143. The PRIPHC02 **NOTED** that although catches had been registered by Russia, Japan, and the Republic of Korea, it is a question to whether the magnitude of the catches in all three countries' waters falls within a definition of the word "occurs" referred to in Article 63, paragraph of UNCLOS. The catches in Russian waters show, however, that Pacific halibut occurs in Russian waters.

144. The PRIPHC02 **RECOGNISED** that UNFSA is not applicable for the management of transboundary fish stocks, Article 17 contains a principle that could be noted; i.e. that a non-member of an RFMO, which not otherwise agree to apply the conservation and management measures established by such an RFMO is not discharged from the obligation to cooperate in accordance with UNCLOS.

145. The PRIPHC02 **NOTED** that best practices for sustainable management of fisheries and ecosystems requires access to all information about removals and impacts of such harvesting on the stock and ecosystem over the full geographic range of the stock.

Recommendations

146. The PRIPHC02 **RECOMMENDED** that the Commission prioritise scientific work to confirm the full range of the Pacific halibut stock.

147. The PRIPHC02 **RECOMMENDED** that if the full range of the Pacific halibut stock extends outside the Convention Area, the Contracting Parties invite collaboration with all parties involved in the harvest of this stock, to ensure science and management includes accurate data regarding all removals from the stock.

9.2 Cooperation with other RFMOs (and other international bodies)

148. The PRIPHC02 **NOTED** that the Secretariat regularly interacts with other RFMOs in a number of forms. This includes with the International Fisheries Commissions based in North America via annual joint meetings, and also via meetings of the IPHC Secretariat staff. The IPHC Secretariat also participates in the Regional Fishery Body Secretariats, PICES, and at COFI meetings, and the Executive Director is scheduled to convene a session on RFMO's at the upcoming World Fisheries Congress 2020.

149. The PRIPHC02 **NOTED** that the IPHC works closely with the domestic agencies of the Contracting Parties, both at the Halibut Advisory Board in Canada, and the Fishery Management Councils in the USA.

a) North Pacific Fishery Management Council (NPFMC): https://www.npfmc.org/;

b) Pacific Fishery Management Council (PFMC): https://www.pcouncil.org/;

c) Halibut Advisory Board (HAB): https://www.pac.dfo-mpo.gc.ca/consultation/ground-fond/hab-ccf/index-eng.html.

150. The PRIPHC02 **NOTED** the recent MOU that has been established between IPHC and PICES, as well as the workshop that will be undertaken at PICES on Pacific halibut. This approach is **ENCOURAGED** as it will provide a simplified process to bring together skilled science capacity from the North Pacific, and as with other fisheries management organisations (e.g. North Pacific Fisheries Commission), allows for discussions on broader ecosystem considerations including influence of changing ocean conditions.

9.3 Participation

151. The PRIPHC02 **NOTED** that participation was addressed in sections 8.1, 8.3, and 9.1.

10. EFFICIENCY AND TRANSPARENCY OF FINANCIAL AND ADMINISTRATIVE MANAGEMENT

152. The PRIPHC02 **NOTED** paper IPHC-2019-PRIPHC02-09 Rev_1, which provided information regarding the Performance Review Criteria 7: *Efficiency and transparency of financial and administrative management.*

10.1 Availability of resources for IPHC activities

153. The PRIPHC02 **NOTED** that the documents related to each budget cycle, and the associated decisions of the Commission are provided in the Annual Meeting pages: https://www.iphc.int/library/documents/meeting-documents/iphc-meeting-index. The decisions of the Commission are contained within each Annual Meeting report. Intersessional budget related decisions are recorded in IPHC Circulars: https://www.iphc.int/library/documents/category/circulars. For example, recent intersessional decisions are provided in IPHC Circular 2019-010. Prior to 2017, the record keeping of decisions made and the associated supporting evidence are not well recorded. Since that time however, all documents are available to the public via each meeting page. An example of the most recent (2019) Annual Meeting documents and decisions are provided at: https://www.iphc.int/venues/details/95th-session-of-the-iphc-annual-meeting-am095.

154. The PRIPHC02 **NOTED** that, in addition to the readily available meeting records of financial information, the Secretariat is establishing a Business Continuity Plan in order to ensure memorialised institutional knowledge and capabilities.

155. The PRIPHC02 **NOTED** the importance of maintaining strong financial controls that are regularly audited. These controls would address both the Contracting Parties' assessed contributions and the revenue generated from the sale of fish from the FISS.

Recommendation

156. The PRIPHC02 **RECOMMENDED** the continued establishment of a Business Continuity Plan (BCP), which will serve to strengthen the long-term viability of IPHC Secretariat functioning and accountability, in line with best practices of an organisation of its size and breadth. Prioritising a financial and administrative BCP, with the ultimate goal of establishing a comprehensive BCP for the IPHC Secretariat as a whole.

10.2 Efficiency and cost-effectiveness

157. The PRIPHC02 **NOTED** that the IPHC currently employs 35 regular ongoing staff based in Seattle, WA, USA, and 32-40 seasonal staff. Fig. 5 provides a schematic of the Secretariat's structure.

A directory of IPHC Secretariat, including staff bios, is provided at: https://www.iphc.int/the-commission/secretariat-staff.

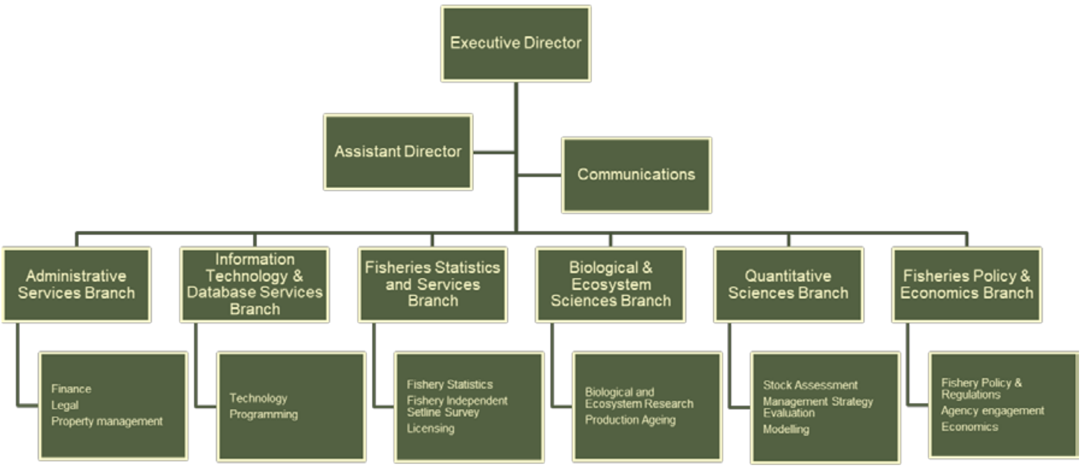


Fig. 5. Schematic of the IPHC Secretariat's structure.

158. The PRIPHC02 **NOTED** that the IPHC undergoes an annual independent audit. The most recent of which is available on the IPHC website, annual meeting documents (linked below). The following text from the report of the 95th Session of the IPHC Annual Meeting (AM095), provides the Commissions current stance on the audits. ***Annual independent auditor's report (2017 & 2018)***

159. The PRIPHC02 **NOTED** the extent to which the IPHC Rules of Procedure and the IPHC Financial Regulations comply with international best practice:

a) IPHC Rules of Procedure (2019): The Rules of Procedure consist of rules and regulations adopted by the IPHC pursuant to the Convention between Canada and the United States of America;

b) IPHC Financial Regulations (2019): The Financial Regulations govern the financial administration of the IPHC and were established pursuant to the Commission's Rules of Procedure.

160. The PRIPHC02 **AGREED** that the FAC by-and-large fulfils the Terms of Reference for the committee with one exception. Terms of Reference for the FAC call for a report to be prepared at the conclusion of each meeting and for the report to be transmitted to the Commission. The practice has been to conclude the meetings without a report because the FAC participants are, in fact, also the members of the Commission. However, there is a risk of incomplete capture of the FAC process.

161. The PRIPHC02 **AGREED** that there is a need to align the FAC process with those of all other subsidiary bodies.

Recommendation

162. The PRIPHC02 **RECOMMENDED** the FAC produce a report detailing the actual FAC meeting and that the presentation of the report be incorporated into the Annual Meeting agenda and report, along with the final decisions of the Commission.

10.3 Advisory structure

163. The PRIPHC02 **NOTED** that the Commission is advised by one (1) committee and five (5) boards, as illustrated in Fig. 2. The IPHC Rules of Procedure (2019) describe the various terms of reference for each subsidiary body, as listed in Rule 14.

164. The PRIPHC02 **NOTED** that from a science process and advisory perspective, the IPHC is unusual in that opportunities are provided for stakeholder engagement during all stages. Informally, Secretariat staff are in frequent contact while sampling or visiting ports and during the extensive annual FISS, which typically contracts 14-18 vessels each year from the Contracting Parties. Formally, both the RAB (see

e.g.: https://www.iphc.int/uploads/pdf/rab/2019/iphc-2019-rab020-r.pdf) and the MSAB (see also Recommendation 8, and e.g.: https://www.iphc.int/uploads/pdf/msab/msab13/iphc-2019-msab013-r.pdf), are standing bodies with multi-sector representation, clear mandates set out by the Commission, and operating under the IPHC Rules of Procedure (see: https://www.iphc.int/the-commission), which include clear terms of reference for each Board. The RAB meets annually and the MSAB meets twice a year. The RAB mandate provides opportunity to make inputs directly to the Secretariat in the development of research plans and also directly to the SRB, itself mandated in the Rules of Procedure, as well as reporting to the Annual Meeting alongside the RAB, MSAB and other subsidiary boards. All RAB, MSAB and SRB activities are transparent. Materials provided to the meetings and meeting reports are all available online. The MSAB provides critical input to the development and testing of management strategies with direct consequences for future harvest strategies and fishing opportunities. The SRB provides independent scientific peer review of all science-related matters including review of recommendations from the RAB and MSAB.

Recommendations

165. The PRIPHC02 **RECOMMENDED** that when revisiting PRIPHC01 Recommendation 3.1 on unifying subsidiary bodies, treat the CB and PAB as non-science process and maintain separated RAB and MSAB at least until the 2021 adoption and implementation of a new management strategy.

166. The PRIPHC02 **RECOMMENDED** that continued support for high quality stakeholder engagement through the science-focused subsidiary bodies (RAB and MSAB) or any future subsidiary bodies be maintained.

11. CONCLUDING COMMENTS

167. In conclusion, the PRIPHC02 reiterates its praise for the progress made since the last review. The recommendations contained herein provide ample opportunity to continue building on and refining this progress. It is noteworthy that, throughout this review and deliberation, the following themes emerged, prompting robust discussions:

a) Roles and responsibilities among the Commission, Secretariat and subsidiary bodies;

b) The importance of the results of the MSE process as a tool for multi-year management;

c) Data from the full geographic range of Pacific halibut, including consideration that the stock may stretch all the way to the Republic of Korea;

d) Concerns about the non-directed fishery mortality data; and

e) Changing ocean dynamics and the impact on future management.

168. The PRIPHC02 members are grateful for the opportunity to participate in this valuable exercise.

169. The PRIPHC02 **ADOPTED** the report of the 2nd Performance Review of the IPHC (IPHC-2019-PRIPHC02-R), including the consolidated set of Recommendations provided in Appendix III, on 11 October 2019.

APPENDIX I
TERMS OF REFERENCE, CRITERIA, AND PROCESS TO CONDUCT THE 2ND PERFORMANCE REVIEW OF THE IPHC

1. Terms of reference for the implementation of the 2nd Performance Review of the International Pacific Halibut Commission (PRIPHC02)

1.1 Scope of the review:

The review will evaluate progress made on the recommendations arising from the 1st performance review of the IPHC. In addition, it will focus on the effectiveness of the Commission to fulfil its mandate, in accordance with the criteria set forth below. In conducting the review, the strengths, weakness, opportunities and risks to the organisation shall also be evaluated.

1.2 Composition of the Review Panel:

Chairperson: An independent Chairperson with legal fisheries background and a good understanding of Regional Fisheries Management Organisations (RFMO). The Chairperson should not be directly affiliated with any IPHC Contracting Party.

Contracting Parties: 1 representative of each IPHC Contracting Party.

Science Advisor: A science expert not affiliated with the IPHC Contracting Parties, and with expertise on groundfish and the ecosystems affected by Pacific halibut fisheries.

RFMOs: At least two members from other Regional Fisheries Management Organisations: e.g. Inter-American Tropical Tuna Commission (IATTC), North Pacific Fisheries Commission (NPFC), North Pacific Anadromous Fish Commission (NPAFC).

NGOs: Two Non-Governmental Organisations: e.g. The Pew Charitable Trusts, Birdlife International (BL)).

IPHC Secretariat: The IPHC Secretariat will not be a part of the Review Panel but it will act as a facilitator of its activities, providing access to information and facilities that the Review Panel will require to conduct its work.

1.3 Meeting locations:

At least two (2) in-person Review Panel meetings will take place, one in the USA (at the seat of the Commission in Seattle or in Alaska) and one in Canada (location to be decided by Canada). Contracting Parties will cover the costs associated with the participation of their representative. However, the attendance of other Panel Members to the Review Panel meetings shall be funded under the Commission's budget. Additional meetings may be required, as determined by the Panel, and will be conducted via electronic means facilitated by the IPHC Secretariat.

1.4 Work schedule

The report of the Review Panel will be completed and made available no later than 30 days prior to the 96th Session of the IPHC Annual Meeting (AM096) in 2020, and published on the IPHC website so as to maximise transparency.

2. Criteria for the 2nd Performance Review of the International Pacific Halibut Commission (PRIPHC02)

Criteria 1: ***1st Performance Review***: to evaluate progress made on the implementation of the recommendations arising from the 1st performance review of the IPHC

Criteria 2: ***Legal analysis of the Convention*** to ensure its adequacy relative to current global best practice principles of fisheries management

Criteria 3: ***Conservation and management*** (status of living marine resources; quality and provision of scientific advice; data collection and sharing; adoption of fishery Regulations, also known in other RFMO's as Conservation and Management Measures, including measures adopted at the national level; compatibility of fishery Regulations)

i. Status of living marine resources
- Status of Pacific halibut stock under the purview of the IPHC in relation to relevant biological standards.
- Trends in the status of the stock.
- Status of species that belong to the same ecosystems as, or are associated with or dependent upon, Pacific halibut (hereinafter "non-target species").
- Trends in the status of non-target species.

ii. Quality and provision of scientific advice
- Extent to which the IPHC receives and/or produces the best scientific advice relevant to the fish stocks and other living marine resources under its purview, as well as to the effects of fishing on the marine environment.
- Extend to which the IPHC obtains and evaluates scientific advice, reviews the status of the stock, promotes the conduct of relevant scientific research and disseminates the results thereof.

iii. Data collection and sharing
- Extent to which the IPHC has agreed formats, specifications and timeframes for data submission, taking into account UNFSA Annex I.
- Extent to which IPHC Contracting Parties, individually or through the IPHC, collect and share complete and accurate fisheries data concerning target stocks and non-target species and other relevant data in a timely manner.
- Extent to which fishing data and fishing vessel data are gathered by the IPHC and shared among Contracting Parties and other relevant bodies.
- Extent to which the IPHC is addressing any gaps in the collection and sharing of data as required.
- Extent to which the IPHC has set standards for the collection of socio-economic data from the fisheries; and extent to which this information is used to inform decisions by the Commission.
- Extent to which the IPHC has set security and confidentiality standards and rules for sharing of sensitive science and operational/compliance data.

iv. Consistency between scientific advice and fishery Regulations adopted;
- Extent to which the IPHC has adopted fishery Regulations for both Pacific halibut, and proposed regulations for non-target species to relevant bodies, that ensure the long-term

sustainability of the ecosystem as well as of such stocks and species and are based on the best scientific evidence available.
- Extent to which the IPHC has applied the precautionary approach as set forth in UNFSA Article 6 and the Code of Conduct for Responsible Fisheries Article 7.5, including the application of precautionary reference points and harvest control rules.
- Extent to which the IPHC has adopted and implemented effective rebuilding plans for depleted or overfished stocks.
- Extent to which the IPHC has taken due account of the need to conserve marine biological diversity and minimise harmful impacts of fisheries on living marine resources and marine ecosystems.
- Extent to which the IPHC has adopted measures to minimise pollution, waste, discards, catch by lost or abandoned gear, catch of non-target species, both fish and non-fish species, and impacts on associated or dependent species, in particular endangered species, through measures including, to the extent practicable, the development and use of selective, environmentally safe and cost-effective fishing gear and techniques.

v. Compatibility of management measures
- Extent to which measures have been adopted as reflected in UNFSA Article 7.

vi. Fishing allocations and opportunities
- Extent to which the IPHC agrees on the allocation of allowable catch or levels of fishing effort, including taking into account requests for participation from new Contracting Parties or participants as reflected in UNFSA Article 11.

Criteria 4: ***Compliance and enforcement*** (flag State duties; monitoring, control and surveillance activities; port State measures; follow-up on infringements; cooperative mechanisms to detect and deter non-compliance; market-related measures)

i. Flag State duties
- Extent to which IPHC Contracting Parties are fulfilling their duties as flag States under the Convention establishing the IPHC, pursuant to measures adopted by the IPHC, and under other international instruments, including, *inter alia*, the 1982 Law of the Sea Convention, and the UNFSA, as applicable.

ii. Port State measures
- Extent to which the IPHC has adopted measures relating to the exercise of the rights and duties of its members as port States, as reflected in UNFSA Article 23 and the Code of Conduct for Responsible Fisheries Article 8.3 and the FAO Port State Agreement.
- Extent to which these measures are effectively implemented.

iii. Monitoring, control and surveillance (MCS)
- Extent to which the IPHC has adopted integrated MCS measures (e.g. required use of VMS, observers, catch documentation and trade tracking schemes, restrictions on transhipment, boarding and inspection schemes).
- Extent to which these measures are effectively implemented.

iv. Follow-up on infringements

- Extent to which the IPHC Contracting Parties follow up on infringements to management measures.

v. Cooperative mechanisms to detect and deter non-compliance
- Extent to which the IPHC has established adequate cooperative mechanisms to both monitor compliance and detect and deter non-compliance (e.g. compliance committees, vessel lists, sharing of information about non-compliance, joint patrols, common Minimum Terms and Conditions for access, harmonised regulatory mechanisms, boarding schemes, regional/compatible VMS equipment and operational criteria, observer schemes, with common training standards for inspectors and observers, intra-regional cooperation, etc.).
- Extent to which these mechanisms are being effectively utilised.
- Extent to which the IPHC has adopted new measures to foster (reward/penalise) compliance within IPHC and effectiveness of such measures.

vi. Market-related measures
- Extent to which the IPHC has adopted measures relating to the exercise of the rights and duties of its Members as market States.
- Extent to which these market-related measures are effectively implemented.

Criteria 5: ***Decision-making and dispute settlement***

i. Decision-making
- Extent to which IPHC has transparent and consistent decision-making procedures that facilitate the adoption of management regulations in a timely and effective manner.

ii. Dispute settlement
- Extent to which the IPHC has established adequate mechanisms for resolving disputes among Contracting Parties.

Criteria 6: ***International cooperation*** (transparency; relationship to non-Contracting Parties; cooperation with other RFMOs)

i. Transparency
- Extent to which the IPHC is operating in a transparent manner, as reflected in UNFSA Article 12 and the Code of Conduct for Responsible Fisheries Article 7.1.9.
- Extent to which IPHC decisions, meeting reports, scientific advice upon which decisions are made, and other relevant materials are made publicly available in a timely fashion.

ii. Relationship to non-Contracting Parties
- Extent to which the IPHC facilitates cooperation among Contracting Parties and non-Contracting Parties which exploit the Pacific halibut stock, including through the adoption and implementation of procedures for granting Cooperating Non-Contracting Party status.
- Extent of fishing activity by vessels of non-Contracting Parties that are not cooperating with the IPHC, as well as measures to deter such activities.

iii. Cooperation with other RFMOs

- Extent to which the IPHC cooperates with other RFMOs, including through the network of Regional Fishery Body Secretariats.
- Extent to which IPHC works intra-regionally to adopt common regulatory principles, standards and operational schemes, and processes where appropriate, e.g. observer coverage, gear management, access rules and appropriate financial mechanisms.

iv. Participation

- Extent to which all fishing entities active in the Convention area, and the stock range, discharge their obligations in line with the UNFSA.

Criteria 7: ***Efficiency and transparency of financial and administrative management***

i. Availability of resources for IPHC activities

- Extent to which financial and other resources are made available to achieve the aims of the IPHC and to implement the Commission's decisions.

ii. Efficiency and cost-effectiveness

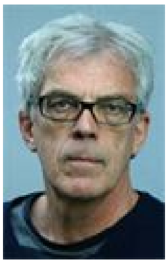
- Extent to which the IPHC is efficiently and effectively managing its human and financial resources.
- Extent to which the IPHC is managing its budget as well as its capacity to monitor and audit annual and multiannual expenditures.
- Extent to which the IPHC Rules of Procedure and the IPHC Financial Regulations comply with international best practice.

iii. Advisory structure

- Extent to which the IPHC has an adequate and effective set of subsidiary bodies which provide it with sound advice, and in accordance with best practice governance processes.

APPENDIX II
COMPOSITION OF THE REVIEW PANEL

Chairperson:
Mr Terje Løbach (Norway)



Terje Løbach is a lawyer, specialising in the law of the sea, in particular concerning marine living resources. He has been employed by the Norwegian fisheries authorities and the Norwegian foreign service. He has also been working at UN DOALOS and at the FAO Legal Office.

He has extensive experience in bilateral and multilateral negotiations, in particular concerning conservation and management of straddling fish stocks, but also general conservation and management issues including monitoring, control and enforcement, and he has been a major contributor to the fight against IUU fishing at regional and global levels. He has been Norway's representative to CCAMLR, FAO, ICCAT, IOC/ABE-LOS, NAFO, NEAFC, SEAFO and to the UN. He had the position as president of NAFO for four years and the chairperson of CCAMLR for two years.

He was the legal adviser and chair of both the first and second performance review panels of the IOTC, he was a member the first SEAFO performance review panel, and he was on the panel for the second NAFO performance review. He has also been selected to many FAO expert consultations, and he has contributed to several publications on the conservation and management of marine living resources and he has been speaker, chairperson, panellist or resource person at numerous conferences, symposia, seminars and workshops.

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Contracting Parties:
Dr Robert Day (Canada)

Dr. Robert Day has worked at Fisheries and Oceans Canada since 2001 in the field of international fisheries and oceans management. He is currently the Director of International Fisheries Management with responsibility for overall support for Canada's fisheries where there is an international management regime. He has supported and been Head of Delegation to a number of RFMOs and also served as Canadian Commissioner to the IPHC in 2018. This includes his current role as Canada's HoD to the North Pacific Fisheries Commission (a new RFMO in 2014) and selection as inaugural chair of its Technical and Compliance Committee. Dr. Day has also led delegations to tuna RFMO meetings and has actively supported the development of management strategy evaluation (MSE) on North Pacific albacore in the Northern Committee of the Western and Central Pacific Fisheries Commission.

He has co-chaired the ecosystem approach to fisheries working group as the fisheries representative in the Northwest Atlantic Fisheries Organization (cochaired with Science rep). This novel approach increased the ability for management and science to work collaboratively in a timely way while respecting individual roles.

Contact details: Director, International Fisheries Management, Department of Fisheries and Oceans Canada, 200 Kent St., Ottawa, On, K1A 0E6, +1-613-668-1907, Email: Robert.Day@dfo-mpo.gc.ca

Ms Staci MacCorkle (United States of America)

Staci MacCorkle is a Foreign Service Officer with the U.S. Department of State. Her current assignment is with the Office of Marine Conservation (OMC) in the Bureau of Oceans and International Environmental and Scientific Affairs (OES). Ms. MacCorkle is the State Department Representative to three important bilateral fisheries agreements with Canada: the International Pacific Halibut Commission, the Pacific Salmon Commission along with the related Yukon River Panel, and the Pacific Hake/Whiting Advisory Panel. She also supports her OMC colleagues with the Department's engagement in the multilateral North Pacific Anadromous Fish Commission, the North Pacific Fisheries Commission, and the Bering Sea "Donut Hole" Convention. Prior to arriving in OES/OMC, Ms. MacCorkle was posted to the U.S. Embassy in Panama City, Panama, where she managed the environment, science, technology, and health ("ESTH") portfolio. Her first diplomatic posting was as a Consular Officer at U.S. Embassy Guatemala City.

Before joining the Department of State, Ms. MacCorkle was an environmental consultant in Portland, Oregon. She managed a variety of projects to determine their potential impacts to natural resources. Much of her project work was in support of federal, state, and local government projects that had the potential to alter the natural environment and/or set long-term management strategies for protected natural areas throughout the U.S. Pacific Northwest. Ms. MacCorkle continues to maintain her Project Management Professional credential.

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Science Advisor:

Dr Kevin Stokes (New Zealand)

Kevin Stokes has worked at senior management levels in both the public and private sectors as a fisheries scientist, manager and advisor. He worked for the UK government for 15 years where he was responsible for all finfish monitoring, assessment and advice and worked extensively in Europe, serving as chair of the EC Scientific, Technical and Economic Committee for Fisheries (STECF) and as UK representative on the International Council for the Exploration of the Sea (ICES) Advisory Committee for Fisheries Management (ACFM), as well as chairing working groups and committees. He served on multiple UK research councils, led the UK scientific delegation to the International Whaling Commission (IWC) and served as UK Alternate IWC Commissioner for many years. Kevin worked as Chief Scientist for the New Zealand Seafood Industry Council (SeafIC) from 2000-2009, with responsibility for science policy and process as well as leading a consulting group drawing on diverse international expertise. Since 2009. He has worked internationally as an independent consultant.

He has worked on a wide range of fish, other marine species, and environmental issues and has provided advice nationally and internationally at senior governmental and ministerial levels, as well as to fishing, processing and retail industries, and to environmental NGOs. For the past ten years, he has worked as a private consultant in the general area of fisheries but extending to governance and wider advisory matters, and chairing and facilitating committees and processes. He is the current independent chair of the Extended Scientific Committee of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT).

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Regional Fishery Management Organisations:

Mr Peter Flewwelling (North Pacific Fisheries Commission)

Peter Flewwelling is a Canadian Fisheries and MCS Practitioner. Career 1 included 11 years in the British and Canadian Navy (Submarine Officer); Career 2 – starting in 1977 as a Canadian Fisheries and ICNAF Officer and 14 years later concluding as Acting Director, Regulations and Enforcement for Canada and Chief, Surveillance and Enforcement; Career 3, has been similarly rewarding with 27 years as an international fisheries advisor. Work experience has been in Asia/Pacific, Africa/Indian and Atlantic Ocean, Central and South Americas for World Bank, Asian Development Bank, UNDP, UNESCO, Norwegian Aid, CIDA, USAID, FAO for Fisheries and Disaster Recovery and Rehabilitation, and work with a few RFMOs: NAFO, IOTC, SWIOFC, WCPFC and now Compliance Manager for NPFC.

Contact details: Compliance Manager, NPFC, 2nd Floor Hakuyo Hall, Tokyo University of Marine Science and Technology, 4-5-7 Konan, Minato-ku, Tokyo, 108-8477 JAPAN, +81-3-5479-8717, Email: pflewwelling@npfc.int

Mr Jeongseok Park (North Pacific Anadromous Fish Commission)

Jeongseok started working for the Korea Maritime Institute (KMI) as a fisheries researcher, where he studied Korean domestic fisheries issues, including socio-economic assessments and evaluations. In 2006, he joined the International Cooperation Division of the Ministry of Oceans and Fisheries (MOF) of the Republic of Korea. Over the last ten years, he represented the Korean government as a Fisheries Negotiator at international fisheries organisations, including the International Commission for the Conservation of Atlantic Tunas (ICCAT), Indian Ocean Tuna Commission (IOTC), North Pacific Fisheries Commission (NPFC), North Pacific Anadromous Fish Commission (NPAFC), International Whaling Commission (IWC), and other regional fisheries management organisations.

Jeongseok served as the Vice-Chairperson of the IOTC from May 2013 to January 2017. At NPAFC, he also served as Chairperson of the Committee on Enforcement from 2011 to 2014, and from 2014 to 2016 he was the Chairperson of the Committee on Finance and Administration. In May 2016, he was elected Vice President of NPAFC, and since February 2017, Jeongseok has joined the NPAFC Secretariat as Deputy Director.

Contact details: Deputy Secretary, NPAFC, Suite 502, 889 West Pender Street, Vancouver, BC, Canada, V6C 3B2, Phone: +1 604 775 5550, Email: jpark@npafc.org

Non-Governmental Organisations:

Ms Amanda Nickson (The Pew Charitable Trusts)

Amanda Nickson directs Pew's international fisheries efforts to conserve important marine species through science-based policy development and advocacy. Her work includes reducing overfishing; minimising the impact of destructive fishing gear; and eliminating illegal, unreported, and unregulated fishing. She also helps lead advocacy efforts with regional fisheries management organisations, the international bodies that govern the treaties regulating commercial fishing on the high seas. Nickson's work also addresses the overfishing of other valuable marine species in international waters and helps to protect the ocean environment.

Before joining Pew, Nickson worked for the World Wildlife Fund, most recently directing international efforts to protect threatened charismatic species such as tigers, pandas, and marine turtles. She also developed and led WWF's Bycatch Initiative, a major policy and field program aimed at reducing the incidental catch of non-target species in fisheries in more than 20 countries throughout the world.

Contact details: Director - International Fisheries, The Pew Charitable Trusts, 901 E Street, N.W., Washington, DC 20004 USA, Phone: +1 202-540-6528, +1 202-674-9829, Email: anickson@pewtrusts.org

IPHC Secretariat:

Dr David T. Wilson (Facilitator)

Dr Wilson joined the IPHC in mid-2016 as its Executive Director. Although originally from Australia, Dr Wilson spent the majority of his professional working life abroad. Most of this time has been spent in fisheries science institutional management and in developing and implementing multilateral arrangements for the conservation and management of highly migratory fish stocks, and shared fish stocks in the Pacific Ocean, Indian Ocean and Caribbean. My experience was largely gained while working at the Indian Ocean Tuna Commission (Deputy and Acting Executive Secretary); Australian Government International Fisheries Science Head (Department of Agriculture, Forestry and Fisheries – Australian Bureau of Agricultural and Resource Economics and Sciences); Northern Fisheries Senior Manager at the Australian Fisheries Management Authority; Director of the Center for Marine Resource Studies in the Turks and Caicos Islands, and Fisheries Biologist with the Department of Marine and Wildlife Resources in American Samoa. Dr Wilson obtained my doctorate from James Cook University, Australia, in tandem with the Australian Institute of Marine Science, and the Smithsonian Tropical Research Institute in Panama.

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APPENDIX III
CONSOLIDATED SET OF RECOMMENDATIONS OF THE 2ND PERFORMANCE REVIEW OF THE INTERNATIONAL PACIFIC HALIBUT COMMISSION (PRIPHC02)

Legal analysis of the IPHC Convention

PRIPHC02–Rec.01 (para. 32) The PRIPHC02 **RECOMMENDED** that consideration be given to updating the Convention at the next opportunity, to become consistent with newer international legal instruments, and specifically consider including the following elements:

a) Incorporate a preamble setting forth the purpose of the Convention, and make references to relevant international instruments and principles (e.g. UNCLOS, the Code of Conduct and its action plans, etc.).
b) Incorporate an article for "Definitions," thereby removing or reducing ambiguity in term usage and meaning.
c) Incorporate an article for "Objective" reflecting international standards for conservation and management of living marine resources.
d) Incorporate an article for "Area of application of the Convention," including a detailed map, noting that the northern boundary of the Convention area is vague.
e) Include explicit language confirming that the Convention applies to all removals of Pacific halibut in the Convention waters by directed and non-directed fisheries, commercial, recreational, and other.
f) Specify the current species is Pacific halibut (*Hippoglossus stenolepis*)', though other species of *Hippoglossus* could also be covered under the Convention should they be identified.
g) Incorporate an article for "General principles" to include references to long-term sustainability, science-based decisions, application of the precautionary approach, minimisation of harmful impact on the marine ecosystem, collection and sharing of data, and ensuring effective compliance, etc.
h) Maintain, but in a stand-alone article, the current provisions for continuation of the Commission, with all its assets and liabilities established by the 1923 Convention and subsequent revisions.
i) Consider whether elements of the current Rules of Procedure are better placed in the Convention or a Headquarters Agreement.
j) The functions concerning fishing set out in the Convention to be streamlined in a specific article, and to include the following additional functions:
    i. adopt standards for collection and sharing of data;
    ii. adopt measures for species belonging to the same ecosystem or dependent upon or associated with Pacific halibut;
    iii. adopt measures to avoid, reduce and minimise waste, discards, catch by lost or discarded gear;
    iv. adopt measures to prevent significant adverse impacts on VMEs; and
    v. adopt measures to ensure effective monitoring, control and surveillance, as well as compliance.
k) Consider whether the establishment of the Commission's subsidiary bodies be moved from the Rules of Procedure to the Convention.
l) Incorporate in the Convention a specific article dealing with administrative issues, such as to appoint a Director, to approve program of work, to approve budget, to adopt or amend rules of procedures, financial regulations and other internal administrative regulations.

m) Harmonise the decision-making provisions of the Convention and the Rules of Procedure, and incorporate those in a specific article of the Convention.
n) Expand the current text to also include obligations to provide national legal provisions related to measures adopted by the Commission, and submit reports on vessel activities at appropriate intervals.
o) Noting the adequate provisions in the Convention, the text should also contain follow-up actions by the flag state that include application of sanctions of sufficient gravity as to be effective in securing compliance, such as depriving offenders of benefits, and refusal, suspension, or withdrawal of authorisations.
p) Consider establishment of a Compliance Committee for reviewing implementation of measures adopted by the Commission.
q) Incorporate in a specific article of the Convention general language concerning transparency.
r) Incorporate in the Convention a specific article, which in general terms states that in order to settle a possible dispute between Contracting Parties, concerning interpretation or implementation of the Convention, the parties shall consult by means they agree upon.
s) Incorporate an article on signature, ratification, acceptance and approval, stating who are entitled to become parties, as well as the timeframe for signature.
t) Incorporate an article stating when it enters into force, and conditions thereto.
u) Incorporate an article stating whether or not reservations or exceptions may be made.
v) Incorporate an article allowing parties to make statements or declarations that do not exclude or modify the legal effect of the provisions.
w) Incorporate an article making references to for example the UNCLOS concerning sovereign rights of coastal States as well as other possible relevant instruments.
x) Incorporate an article describing the amendment mechanisms such as time frames, communication, adoption and entering into force. If annexes or appendices are regarded as an integral part of the treaty, more flexible mechanism for those.
y) Incorporate an article describing possible withdrawal procedures.
z) Incorporate an article stating who will be the depository government as well as its obligations and functions.

PRIPHC02–Rec.02 (para. 33) The PRIPHC02 **RECOMMENDED** to update the Convention, while in the interim period seek alternate mechanisms to implement international best practices and legal principles.

Science: Status of living marine resources

PRIPHC02–Rec.03 (para. 44) The PRIPHC02 **RECOMMENDED** that opportunities to engage with western Pacific halibut science and management agencies be sought, to strengthen science links and data exchange. Specifically, consider options to investigate pan-Pacific stock structure and migration of Pacific halibut.

PRIPHC02–Rec.04 (para. 45) The PRIPHC02 **RECOMMENDED** that:

a) further efforts be made to lead and collaborate on research to assess the ecosystem impacts of Pacific halibut fisheries on incidentally caught species (retained and/or discarded);
b) where feasible, this research be incorporated within the IPHC's 5-Year Research Plan (https://www.iphc.int/uploads/pdf/besrp/2019/iphc-2019-besrp-5yp.pdf);
c) findings from the IPHC Secretariat research and that of the Contracting Parties be readily accessible via the IPHC website.

Science: Quality and provision of scientific advice

PRIPHC02–Rec.05 (para. 63) The PRIPHC02 **RECOMMENDED** that simplified materials be developed for RAB and especially MSAB use, including training/induction materials.

PRIPHC02–Rec.06 (para. 64) The PRIPHC02 **RECOMMENDED** that consideration be given to amending the Rules of Procedure to include appropriate fixed terms of service to ensure SRB peer review remains independent and fresh; a fixed term of three years seems appropriate, with no more than one renewal.

PRIPHC02–Rec.07 (para. 65) The PRIPHC02 **RECOMMENDED** that the peer review process be strengthened through expanded subject specific independent reviews including data quality and standards, the FISS, MSE, and biological/ecological research; as well as conversion of "grey literature" to primary literature publications. The latter considered important to ongoing information outreach efforts given the cutting-edge nature of the Commission's scientific work.

PRIPHC02–Rec.08 (para. 66) The PRIPHC02 **RECOMMENDED** that the IPHC Secretariat develop options for simple graphical summaries (i.e. phase plot equivalents) of fishing intensity and spawning stock biomass for provision to the Commission.

Conservation and Management: Data collection and sharing

PRIPHC02–Rec.09 (para. 73) The PRIPHC02 **RECOMMENDED** that observer coverage be adjusted to be commensurate with the level of fishing intensity in each IPHC Regulatory Area.

Conservation and Management: Consistency between scientific advice and fishery Regulations adopted

PRIPHC02–Rec.10 (para. 82) The PRIPHC02 **RECOMMENDED** that the development of MSE to underpin multi-year (strategic) decision-making be continued, and as multi-year decision making is implemented, current Secretariat capacity usage for annual stock assessments should be refocused on research to investigate MSE operating model development (including consideration of biological and fishery uncertainties) for future MSE iterations and regularised multi-year stock assessments.

PRIPHC02–Rec.11 (para. 83) The PRIPHC02 **RECOMMENDED** that ongoing work on the MSE process be prioritised to ensure there is a management framework/procedure with minimal room for ambiguous interpretation, and robust pre-agreed mortality limit setting frameworks.

Fishing allocations and opportunities

PRIPHC02–Rec.12 (para. 88) The PRIPHC02 **STRONGLY URGED** the Commission to conclude its MSE process and **RECOMMENDED** it meet its 2021 deadline to adopt a harvest strategy.

Compliance and enforcement: Port State measures

PRIPHC02–Rec.13 (para. 96) The PRIPHC02 **RECOMMENDED** that Contracting Party enforcement agencies adopt common standards for assessment of implementation of the principles of port State measures.

Compliance and enforcement: Monitoring, control and surveillance (MCS)

PRIPHC02–Rec.14 (para. 105) The PRIPHC02 **RECOMMENDED** enhancement of coordination of MCS activities to result in a common, integrated enforcement report for each Contracting Party to facilitate assessment of compliance efforts, trends and input into management decisions.

PRIPHC02–Rec.15 (para. 106) The PRIPHC02 **RECOMMENDED** that the Commission re-assess the 'derby-style' fisheries management concept in operation in IPHC Regulatory Area 2A in terms of available resources, impact on validity of monitoring results, and safety of fishers, and amend the management processes, if and as necessary.

Compliance and enforcement: Follow-up on infringements

PRIPHC02–Rec.16 (para. 108) The PRIPHC02 **RECOMMENDED** that the IPHC request information regarding Contracting Party follow-up of infringements, to assist in determining the overall efficacy of MCS and enforcement activities. This would support best practices with respect to transparency.

PRIPHC02–Rec.17 (para. 109) The PRIPHC02 **RECOMMENDED** that the Commission improve the process of Contracting Party reporting to the Commission by aggregating individual agency reports into a consolidated, standardised, Contracting Party report to the Commission.

Governance: Decision-making

PRIPHC02–Rec.18 (para. 124) The PRIPHC02 **RECOMMENDED** that the IPHC Rules of Procedure be modified to include a clear category and recognition for observer organisations, which would be in addition to the general public.

Governance: Dispute settlement

PRIPHC02–Rec.19 (para. 128) The PRIPHC02 **RECOMMENDED** updating the rules of procedure to reflect intersessional decision making approaches.

Governance: Transparency

PRIPHC02–Rec.20 (para. 137) The PRIPHC02 **RECOMMENDED** that the significant level of transparency achieved across Commission business continue to be improved.

International cooperation: Relationship to non-Contracting Parties

PRIPHC02–Rec.21 (para. 146) The PRIPHC02 **RECOMMENDED** that the Commission prioritise scientific work to confirm the full range of the Pacific halibut stock.

PRIPHC02–Rec.22 (para. 147) The PRIPHC02 **RECOMMENDED** that if the full range of the Pacific halibut stock extends outside the Convention Area, the Contracting Parties invite collaboration with all parties involved in the harvest of this stock, to ensure science and management includes accurate data regarding all removals from the stock.

Efficiency and transparency of financial and administrative management: Availability of resources for IPHC activities

PRIPHC02–Rec.23 (para. 156) The PRIPHC02 **RECOMMENDED** the continued establishment of a Business Continuity Plan (BCP), which will serve to strengthen the long-term viability of IPHC Secretariat functioning and accountability, in line with best practices of an organisation of its size and breadth. Prioritising a financial and administrative BCP, with the ultimate goal of establishing a comprehensive BCP for the IPHC Secretariat as a whole.

Efficiency and transparency of financial and administrative management: Efficiency and cost-effectiveness

PRIPHC02–Rec.24 (para. 162) The PRIPHC02 **RECOMMENDED** the FAC produce a report detailing the actual FAC meeting and that the presentation of the report be incorporated into the Annual Meeting agenda and report, along with the final decisions of the Commission.

Efficiency and transparency of financial and administrative management: Advisory structure

PRIPHC02–Rec.25 (para. 165) The PRIPHC02 **RECOMMENDED** that when revisiting PRIPHC01 Recommendation 3.1 on unifying subsidiary bodies, treat the CB and PAB as non-science process and maintain separated RAB and MSAB at least until the 2021 adoption and implementation of a new management strategy.

PRIPHC02–Rec.26 (para. 166) The PRIPHC02 **RECOMMENDED** that continued support for high quality stakeholder engagement through the science-focused subsidiary bodies (RAB and MSAB) or any future subsidiary bodies be maintained.

INTERNATIONAL PACIFIC HALIBUT COMMISSION

IPHC-2019-IM095-INF01

Stakeholder statements on regulatory proposals

PREPARED BY: IPHC SECRETARIAT (22 NOVEMBER 2019)

PURPOSE

To provide the Commission with a consolidated document containing 'Statements' from stakeholders submitted to the Commission for its consideration at the 95th Session of the IPHC Interim Meeting (IM095).

BACKGROUND

During 2018, the IPHC Secretariat made improvements to the Fishery Regulations portal on the IPHC website, which includes instructions for stakeholders to submit statements to the Commission for its consideration. Specifically:

> *"Informal Statements by stakeholders should be submitted as an email to the following address, secretariat@iphc.int, which will then be provided to the Commissioners as Stakeholder Statements at each Session.*

DISCUSSION

No Stakeholder Statements were received by the IPHC Secretariat as of 22 November 2019. This paper will be updated for the 96th Session of the IPHC Annual Meeting (AM096) to include any Stakeholder Statements received before AM096 begins.

APPENDICES

None

Review of the use of pot gear in the Gulf of Alaska 2017-19

PREPARED BY: IPHC SECRETARIAT (23 OCTOBER 2019)

PURPOSE

To provide the Commission with data and observations from three years of experience with the retention of Pacific halibut caught in pot gear incidental to the sablefish fishery in the Gulf of Alaska.

BACKGROUND

In 2016, the IPHC approved the retention of Pacific halibut caught in pot gear incidental to the Individual Fishing Quota (IFQ) sablefish fishery in the Gulf of Alaska. From the minutes of the 2016 Annual Meeting (AM092):

> *8) The IPHC approved longline pot gear as a legal gear for the commercial halibut fishery in Alaska when NMFS* [NOAA Fisheries] *regulations permit the use of this gear in the IFQ sablefish fishery. The IPHC will review the measure in three years.*
>
> *Mr. Alverson noted that the IPHC would like an MRA* [Maximum Retention Allowance] *to ensure that halibut is not targeted in the pots, but instead remains an incidental catch inside this fishery. However, there is not yet any data on which to base a limit. The three year review will include that analysis.*

At the time of the adoption of this regulatory change, the Commission expected the necessary NOAA Fisheries rule to be in place for the 2016 fishing season. It was not implemented until March 2017, however, which was noted by the Commission at the 2017 Annual Meeting (AM093):

From IPHC-2017-AM093-03:

AM92.13	***Sablefish pots:*** Staff to schedule review of retention of halibut in sablefish pots prior to 2018 Interim Meeting.	Pending: Nil progress to date. Suggested action revision: As the new pots regulation go into effect in 2017, this review should be rescheduled for completion in 2020, thereby encompassing three years of data under the new regulation.

The 2019 fishery was the third year of implementation, thus occasioning this report to the Commission.

DISCUSSION

Table 1 lists the landings of Pacific halibut caught in pot gear incidental to the IFQ sablefish fishery in IPHC Regulatory Areas 2C, 3A, and 3B for the three years that this regulation has been in effect.

Table 1. Landings with pot gear in IPHC Regulatory Areas 2C, 3A, and 3B 2017-19

Year	**Landings**		
	tonnes (t)	*pounds (lb)*	*percentage of landings*
2017	12	27,025	0.18
2018	23	49,983	0.38
2019*	28	65,793	0.53

*Preliminary data (through 22 October 2019)

A small fraction of the overall commercial landings in these IPHC Regulatory Areas is taken with pot gear, indicating that fishers do not appear to have shifted to targeting Pacific halibut with pot gear, and that an MRA is not currently necessary to limit retention by this gear type.

Note that landings using pot gear are now being reported by the IPHC Secretariat as part of its regular fishery statistics reporting (see paper IPHC-2019-IM095-05), which will allow the Commission to continue monitoring the relative use of this fishing gear in the commercial fishery.

RECOMMENDATIONS

That the Commission:

1) **NOTE** paper IPHC-2019-IM095-INF03, which provides data and observations from three years of experience with the retention of Pacific halibut caught in pot gear incidental to the sablefish fishery in the Gulf of Alaska.
2) **NOTE** that the IPHC Secretariat now reports landings using pot gear as part of its regular fisheries statistics reporting, which will allow the Commission to continue monitoring the relative use of this fishing gear in the commercial fishery.

APPENDICES

None

Options for FISS mortality accounting in projections

PREPARED BY: IPHC SECRETARIAT (I. STEWART, L. ERIKSON, 23 OCTOBER 2019)

PURPOSE

To provide the Commission with a set of options and a discussion of those options in response to:

> AM095–Rec.07 (para. 72) "*The Commission **RECOMMENDED** that the IPHC Secretariat develop options for accounting for Pacific halibut mortalities associated with the FISS and their other research projects in the definition of the coastwide TCEY*."

BACKGROUND

Prior to 2014, the IPHC's Report of Assessment and Research Activities did not routinely include a clear summary of all sources of mortality estimated to have occurred during the year. Similarly, the annual mortality tables ('catch' or 'removals' tables at the time) contained only the O26 mortality estimates used in the harvest strategy calculations (e.g. Webster and Stewart 2014). Beginning in 2015, mortality tables included all sizes and sources of Pacific halibut mortality (Stewart 2015; Stewart et al. 2015). Beginning with this change, the mortality associated with annual sampling by the IPHC's Fishery Independent Setline Survey (FISS) was explicitly included in mortality summaries and projections as part of the commercial landings (i.e., see footnote to Table 3 in Stewart 2015).

Pacific halibut over 32 inches in length (O32) captured on the FISS are landed to offset the costs of conducting the FISS, accounted for via fish tickets in the same manner as commercial landings, and ultimately enter the market just as commercial Pacific halibut fishery landings do. Actual landings from the FISS may differ from summarized catch rates used for stock and assessment and other analyses (https://www.iphc.int/data/iphc-secretariat-data) due to Pacific halibut landed from ineffective stations, damaged Pacific halibut included in catch rates but not landed, and other factors. The size-and age- sex-structure of the FISS landings are similar to those from the commercial fishery; however, the FISS takes place only during the summer months (late-May through early September; IPHC-2019-AM095-06).

Despite the previous five years of reporting and including FISS mortality in all mortality and projection tables, it is not currently clear how FISS mortality is being used by managers when setting specific fishery limits and applying Catch Sharing Plans/Agreements (CSPs). To address this need for greater transparency, at the 95th Session of the IPHC Annual Meeting (AM095) in 2019, the Commission directed the Secretariat to provide more information on this topic:

> AM095–Rec.07 (para. 72) "*The Commission RECOMMENDED that the IPHC Secretariat develop options for accounting for Pacific halibut mortalities associated with the FISS and their other research projects in the definition of the coastwide TCEY*."

This document provides several options to clarify and improve accounting of FISS mortality for Commission consideration.

SIMILAR CASES

There are other landings (in addition to the FISS mortality) each year that are implicitly included in the projected annual mortality tables but may not be explicitly accounted for in the calculation of specific fishery limits and in the application of Catch Sharing Plans/Agreements (CSPs).

These include the Metlakatla fishery conducted in the Annette Islands reserve in Southeast Alaska, as well as overages and underages[1] from the previous year's commercial fishing in IPHC Regulatory Areas 2B-4CDE (https://www.iphc.int/uploads/pdf/am/2019am/iphc-2019-am095-05.pdf).

DESCRIPTION OF OPTIONS

Given that the FISS mortality is already included in mortality and projection tables, the options below represent avenues for more transparent accounting and no change to the treatment of all sources of mortality in the annual stock assessment and harvest strategy calculations.

For this initial discussion paper, three options are provided:

Option 1. The *status quo* (no change to current accounting):

> Predicted commercial landings in the IPHC's current mortality projection tool include FISS mortality (https://www.iphc.int/data/projection-tool). This leaves the accounting for the mortality associated with the FISS to the managers implementing the applicable quota programs and CSPs. FISS landings have been relatively small in recent years (Table 1), and have represented an average of only 3% of the total fish ticket landings (FISS and commercial combined (Table 2)). It does not appear that in recent year's managers have opted to set aside quota to offset FISS mortality, and the IPHC has not provided explicit projections of FISS landings. However, the magnitude of the actual mortality accruing to the TCEY compared to the adopted TCEY in recent years does not appear to be related to years of higher or lower FISS activity (Table 3). This may suggest that the current approach is not causing actual mortality (FISS and commercial combined) to exceed the adopted mortality limits, although in concept if all other sources were fully harvested this would be the case. The *status quo* approach does not require use of uncertain projections of FISS landings, but as this paper outlines, does not provide for transparent accounting.

TABLE 1. Recent FISS Pacific halibut landings (million net pounds). Note that FISS expansions began in 2014, so all rows in this table represent different FISS designs and numbers of stations.

Year	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
2013	0.02	0.09	0.12	0.23	0.08	0.03	0.03	0.01	0.60
2014	0.02	0.11	0.15	0.28	0.10	0.07	0.03	0.01	0.77
2015	0.02	0.11	0.17	0.25	0.12	0.04	0.03	0.01	0.75
2016	0.02	0.09	0.12	0.27	0.11	0.03	0.03	0.02	0.68
2017	0.02	0.07	0.12	0.20	0.07	0.03	0.04	0.02	0.57
2018	0.02	0.14	0.20	0.30	0.07	0.03	0.03	0.02	0.83
6-year average	0.02	0.10	0.15	0.25	0.09	0.04	0.03	0.02	0.70

[1] The stock assessment is conducted using the best estimates of actual and not predicted mortality each year. Therefore, any overages or underages from the previous year are already included in the results of the annual assessment. Therefore, while overages and underages may be useful to track and distribute quota among participants, they should not change the total mortality relative to that projected.

TABLE 2. Recent directed commercial Pacific halibut landings (million net pounds).

Year	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
2013	0.54	6.04	3.03	11.08	4.09	1.23	1.25	1.77	29.04
2014	0.53	5.88	3.42	7.66	2.92	0.91	1.12	1.26	23.70
2015	0.57	5.99	3.77	7.97	2.70	1.37	1.11	1.19	24.67
2016	0.65	6.14	4.00	7.57	2.72	1.38	1.11	1.48	25.05
2017	0.76	6.24	4.22	7.82	3.10	1.29	1.10	1.65	26.17
2018	0.71	5.47	3.61	7.49	2.50	1.25	1.07	1.41	23.50
6-year average	0.63	5.96	3.68	8.26	3.00	1.24	1.13	1.46	25.36

TABLE 3. Recent actual mortality accruing to the TCEY, not including U26 discard mortality in non-directed fisheries (bycatch), relative to adopted TCEYs (values greater than 100% indicate mortality in excess of the adopted TCEY.

Year	**2A**	**2B**	**2C**	**3A**	**3B**	**4A**	**4B**	**4CDE**	**Total**
2013	105%	99%	115%	100%	87%	75%	73%	117%	99%
2014	105%	101%	111%	110%	106%	98%	86%	127%	108%
2015	110%	101%	105%	107%	91%	94%	89%	80%	100%
2016	105%	98%	103%	102%	100%	96%	96%	96%	100%
2017	99%	99%	99%	101%	101%	90%	99%	90%	99%
2018	103%	101%	100%	103%	94%	87%	102%	93%	99%
6-year average	**104%**	**100%**	**105%**	**104%**	**97%**	**90%**	**91%**	**101%**	**101%**

Option 2. Enhanced accounting, no change to mortality projections:

> This option would retain the current format of the mortality projection tool (i.e. combining commercial and FISS landings) but would add an additional reporting step associated with planned FISS sampling in the upcoming year. Specifically, projected FISS mortality based on design and station counts (which may be variable year-to-year as the FISS is optimized to best meet scientific objectives while addressing logistical, operational and financial needs; IPHC-2019-SRB014-05) would be provided as part of the annual meeting documentation and could be used by managers in setting quotas for the upcoming year and/or the application of CSPs as they see fit. This option would allow for greater flexibility, but less transparency in how each step of the quota program accounting is performed.

Option 3. Adding FISS to mortality projections:

> This option would add an explicit row to the mortality projection tool that would include projected FISS landings for the upcoming year (as would be reported in Option 2). In order for this option to be implemented, each IPHC Regulatory Area with a CSP would need to specify whether the FISS mortality should be included in the FCEY (or not) such that all calculations can be updated accordingly. Option 3 would add some complexity to the current mortality table, and increase the differences in interpretation of each row among IPHC Regulatory Areas.

SUMMARY

This working paper should provide improved clarity regarding the treatment of FISS mortality in annual projections. Given the relatively small magnitude of FISS mortality in recent years (and likely in the near future), no change to the current approach is required. However, both Options

2 and 3 could provide more explicit information for predicting and accounting for mortality associated with the annual FISS sampling.

ADDENDUM

During 2019, initial discussion of these alternatives occurred among the IPHC Secretariat, Commissioners, and Contracting Party agencies. The Secretariat plans to proceed with Option 2 'Enhanced accounting' for 2020 projections as directed by the Commission informally at its Work Meeting 2019 (WM2019). This approach can be revisited, as needed, for future projections.

RECOMMENDATION/S

That the Commission:

a) **NOTE** paper IPHC-2019-IM095-INF03 which provides a summary of options for FISS mortality accounting.
b) ***If Option 2 is not sufficient*, REQUEST** a specific alternative that the Secretariat should use as the basis for reporting and the default mortality projection tool for the upcoming 96th Session of the IPHC Annual Meeting (AM096), or future meetings.

REFERENCES

Stewart, I.J. 2015. Regulatory area harvest policy calculations and catch tables. IPHC Report of Assessment and Research Activities 2014. p. 195-212.

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