INTERNATIONAL PACIFIC HALIBUT COMMISSION

IPHC–2021–IM097–00
Last Update: 1 December 2021

97th Session of the IPHC Interim Meeting (IM097) – *Compendium of meeting documents*

30 November - 1 December 2021, Seattle, WA, USA

Commissioners

Canada	United States of America
Paul Ryall	Glenn Merrill
Neil Davis	Robert Alverson
Peter DeGreef	Richard Yamada

Executive Director

David T. Wilson, Ph.D.

DISTRIBUTION: IPHC WEBSITE
LAST UPDATE: 1 DECEMBER 2021

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INTERNATIONAL PACIFIC HALIBUT COMMISSION

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AGENDA & SCHEDULE FOR THE 97th SESSION OF THE IPHC INTERIM MEETING (IM097)

Date: 30 November – 1 December 2021
Location: Electronic
Venue: Adobe Connect
Time: 09:00-17:00 daily
Chairperson: Mr Glenn Merrill (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.*

AGENDA FOR THE 97th SESSION OF THE IPHC INTERIM MEETING (IM097)

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

2. **ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION** (Chairperson & Executive Director)

3. **IPHC PROCESS** (D. Wilson)
   - 3.1 Update on actions arising from the 97th Session of the IPHC Annual Meeting (AM097), and 2021 Special Sessions (D. Wilson)
   - 3.2 Report of the IPHC Secretariat (2021): Draft (D. Wilson)
   - 3.3 2nd IPHC Performance Review (PRIPHC02): Implementation of recommendations (D. Wilson)
   - 3.4 Report of the 22nd Session of the IPHC Research Advisory Board (RAB022) (D. Wilson)
   - 3.5 Reports of the IPHC Scientific Review Board (SRB Chairperson)

4. **FISHERY DATA OVERVIEW (2021): Preliminary** (L. Erikson, H. Tran, T. Kong & C. Prem)

5. **STOCK STATUS OF PACIFIC HALIBUT (2021) AND HARVEST DECISION TABLE 2022**
   - 5.1 IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2021 (K. Ualesi & D. Wilson)
   - 5.2 Space-time modelling of survey data (R. Webster)
   - 5.3 2022-24 FISS design evaluation (R. Webster)
   - 5.4 Data overview and preliminary stock assessment (2021), and draft harvest decision table (2022) (I. Stewart, A. Hicks, R. Webster, D. Wilson, & B. Hutniczak)

6. IPHC SCIENCE AND RESEARCH

6.1 IPHC 5-year Biological and Ecosystem Science Research Plan (2017-21): update (J. Planas)

6.2 International Pacific Halibut Commission 5-Year program of integrated research and monitoring (2022-26) (D. Wilson, J. Planas, I. Stewart, A. Hicks, R. Webster, B. Hutniczak)

7. MANAGEMENT STRATEGY EVALUATION

7.1 IPHC Management Strategy Evaluation: update (A. Hicks)

8. CONTRACTING PARTY NATIONAL REPORTS (Contracting Parties)

8.1 Canada

8.1.1 Fisheries and Oceans Canada (DFO)

8.2 United States of America

8.2.1 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)

9. PACIFIC HALIBUT FISHERY ECONOMICS UPDATE (B. Hutniczak)

10. IPHC FISHERY REGULATIONS: PROPOSALS FOR THE 2021-22 PROCESS (B. Hutniczak & D. Wilson)

10.1 IPHC Secretariat fishery regulation proposals (B. Hutniczak)

10.2 Contracting Party fishery regulation proposals (Contracting Parties)

10.3 Stakeholder fishery regulation proposals (Stakeholders)

10.4 Stakeholder statements (B. Hutniczak)

11. FINANCE AND ADMINISTRATION

11.1 IPHC Rules of Procedure (2022): Draft (D. Wilson)

11.2 FY2021 Independent auditing process (D. Wilson)

11.3 FY2022 Budget update (D. Wilson)

12. OTHER BUSINESS

12.1 Preparation for the 98th Session of the IPHC Annual Meeting (AM098) and associated subsidiary bodies (D. Wilson)

13. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 97th SESSION OF THE IPHC INTERIM MEETING (IM097) (Chairperson & Executive Director)

SCHEDULE FOR THE 97th SESSION OF THE IPHC INTERIM MEETING (IM097)

Tuesday, 30 November 2021		
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
09:20-10:25	3. IPHC Process 3.1 Update on actions arising from the 97th Session of the IPHC Annual Meeting (AM097), and 2021 Special Sessions 3.2 Report of the IPHC Secretariat (2021): Draft 3.3 2nd IPHC Performance Review (PRIPHC02): Implementation of recommendations 3.4 Report of the 22nd Session of the IPHC Research Advisory Board (RAB022) 3.5 Reports of the IPHC Scientific Review Board (SRB Chairperson)	D. Wilson SRB Chairperson
10:15-10:30	4. Fishery data update (2021): Preliminary	L. Erikson
10:30-10:45	Break	
10:45-11:30	5. Stock status of Pacific halibut (2021) and harvest decision table (2022) 5.1 IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2021 5.2 Space-time modelling of survey data 5.3 2022-24 FISS design evaluation	K. Ualesi R. Webster R. Webster
11:30-12:30	5.4 Data overview and preliminary stock assessment (2021), and draft harvest decision table (2022) *Public comment and questions (Agenda Items 3-5)*	I. Stewart
12:30-13:30	Lunch	
13:30-14:30	6. IPHC Research 6.1 IPHC 5-year Biological and Ecosystem Science Research Plan (2017-21): update 6.2 International Pacific Halibut Commission 5-Year program of integrated research and monitoring (2022-26) *Public comment and questions (Agenda Item 6)*	J. Planas D. Wilson
14:30-15:30	7. Management strategy evaluation 7.1 IPHC Management Strategy Evaluation: update *Public comment and questions (Agenda Item 7)*	A. Hicks
15:30-15:45	Break	
15:45-17:00	*Open time slot - TBA*	Chairperson

Wednesday, 1 December 2021		
09:00-09:30	8. Contracting Party National Reports 8.1 Canada 8.2 United States of America *Public comment and questions (Agenda Item 8)*	 TBD TBD
09:30-10:30	9. Pacific halibut fishery economics update *Public comment and questions (Agenda item 9)*	B. Hutniczak
10:30-10:45	Break	
10:45-11:15	10. IPHC Fishery Regulations: Proposals for the 2021-22 process 10.1 IPHC Secretariat fishery regulation proposals 10.2 Contracting Party fishery regulation proposals) 10.3 Stakeholder fishery regulation proposals 10.4 Stakeholder statements *Public comment and questions (Agenda Item 10)*	 B. Hutniczak Contracting Parties Stakeholders B. Hutniczak
11:15-12:30	11. Finance and Administration 11.1 IPHC Rules of Procedure (2022): Draft 11.2 FY2021 Independent auditing process 11.3 FY2022 Budget update	D. Wilson
	12. Other business 12.1 Preparation for the 98th Session of the IPHC Annual Meeting (AM098) and associated subsidiary bodies	D. Wilson
12:30-13:30	Lunch	
13:30-15:30	Report drafting Session	IPHC Secretariat
15:30-15:45	Break	
15:45-17:00	13. Review of the draft and adoption of the Report of the 97th Session of the IPHC Interim Meeting (IM097)	Chairperson & D. Wilson

LIST OF DOCUMENTS FOR THE 97th SESSION OF THE IPHC INTERIM MEETING (IM097)

Last updated: 30 November 2021

Document	Title	Availability
IPHC-2021-IM097-01	Agenda & Schedule for the 97th Session of the IPHC Interim Meeting (IM097)	✓ 1 Sept 2021 ✓ 12 Oct 2021 ✓ 25 Oct 2021
IPHC-2021-IM097-02	List of Documents for the 97th Session of the IPHC Interim Meeting (IM097)	✓ 12 Oct 2021 ✓ 29 Oct 2021 ✓ 29 Nov 2021
IPHC-2021-IM097-03	Update on actions arising from the 97th Session of the IPHC Annual Meeting (AM097), and 2021 Special Sessions (D. Wilson)	✓ 25 Oct 2021
IPHC-2021-IM097-04	Report of the IPHC Secretariat (2021): Draft (D. Wilson)	✓ 25 Oct 2021
IPHC-2021-IM097-05	Implementation of the Recommendations from the 2nd IPHC Performance Review (PRIPHC02) (D. Wilson)	✓ 25 Oct 2021
IPHC-2021-IM097-06	Fishery data overview (2021): Preliminary (L. Erikson, H. Tran, T. Kong & C. Prem)	✓ 29 Oct 2021
IPHC-2021-IM097-07	IPHC Fishery-independent setline survey (FISS) design and implementation in 2021 (K. Ualesi, D. Wilson, C. Jones & R. Rillera)	✓ 28 Oct 2021
IPHC-2021-IM097-08 Rev_1	Space-time modelling of survey data (R. Webster)	✓ 28 Oct 2021 ✓ 12 Nov 2021
IPHC-2021-IM097-09	2022-24 FISS Design evaluation (R. Webster)	✓ 29 Oct 2021
IPHC-2021-IM097-10 Rev_1	Summary of the data, stock assessment, and harvest decision table for Pacific halibut (*Hippoglossus stenolepis*) at the end of 2021 (I. Stewart, A. Hicks, R. Webster, D. Wilson, & B. Hutniczak)	✓ 13 Oct 2021 ✓ 23 Nov 2021
IPHC-2021-IM097-11	IPHC 5-year Biological and Ecosystem Science Research Plan (2017-21): Update (J. Planas)	✓ 13 Oct 2021
IPHC-2021-IM097-12	International Pacific Halibut Commission 5-Year program of integrated research and monitoring (2022-26) (D. Wilson, J. Planas, I. Stewart, A. Hicks, R. Webster, & B. Hutniczak)	✓ 29 Oct 2021
IPHC-2021-IM097-13	Update on the IPHC Secretariat MSE Program of Work (2021-23) (A. Hicks & I. Stewart)	✓ 22 Oct 2021

IPHC-2021-IM097-14 Rev_1	Pacific Halibut Multiregional Economic Impact Assessment (PHMEIA): summary of progress (B. Hutniczak)	✓ 29 Oct 2021 ✓ 19 Nov 2021
IPHC-2021-IM097-15	IPHC Fishery Regulations: Proposals for the 2021-22 process (B. Hutniczak & D. Wilson)	✓ 29 Oct 2021
IPHC-2021-IM097-16	Draft: IPHC Rules of Procedure (2022) (D. Wilson & L. Erikson)	✓ 28 Oct 2021
IPHC-2021-IM097-17	FY2021 Independent auditing process (D. Wilson)	✓ 25 Oct 2021
IPHC-2021-IM097-18	FY2022 Budget - update (D. Wilson)	✓ 28 Oct 2021
Contracting Party updates		
IPHC-2021-IM097-NR01	**Canada**: Fisheries and Oceans Canada (DFO)	Deferred to AM098
IPHC-2021-IM097-NR02	**United States of America**: NOAA – National Marine Fisheries Service (NMFS); North Pacific Fishery Management Council (NPFMC); Pacific Fishery Management Council (PFMC)	Deferred to AM098
IPHC Fishery Regulation proposals for 2022		
IPHC Secretariat Fishery Regulation proposals for 2022		
IPHC-2021-IM097-PropA1	Mortality and Fishery Limits (Sect. 5) (IPHC Secretariat)	✓ 12 Oct 2021
IPHC-2021-IM097-PropA2	Commercial Fishing Periods (Sect. 9) (IPHC Secretariat)	✓ 12 Oct 2021
IPHC-2021-IM097-PropA3	IPHC Fishery Regulations: minor amendments (IPHC Secretariat)	✓ 22 Oct 2021
Contracting Party Fishery Regulation proposals for 2022		
IPHC-2021-IM097-PropB1	Recreational (sport) fishing for Pacific halibut—IPHC Regulatory Areas 2c, 3a, 3b, 4a, 4b, 4c, 4d, 4e (Sect. 29) - *Recordkeeping for charter Pacific halibut annual limits* (USA: NOAA-Fisheries)	✓ 29 Oct 2021
IPHC-2021-IM097-PropB2	Recreational (sport) fishing for Pacific halibut—IPHC Regulatory Areas 2c, 3a, 3b, 4a, 4b, 4c, 4d, 4e (Sect. 29) - *Charter Management Measures in IPHC Regulatory Areas 2C and 3A* (USA: NOAA-Fisheries)	Deferred to AM098
Other Stakeholder Fishery Regulation proposals for 2022		
IPHC-2021-IM097-PropC1	-	-
Reports from IPHC subsidiary bodies		
IPHC-2021-RAB022-R	Report of the 22nd Session of the IPHC Research Advisory Board (RAB022)	Expected: 29 Nov 2021

IPHC-2021-SRB018-R	Report of the 18th Session of the IPHC Scientific Review Board (SRB018)	✓ 17 Jun 2021
IPHC-2021-SRB019-R	Report of the 19th Session of the IPHC Scientific Review Board (SRB019)	✓ 23 Sept 2021
IPHC-2021-FAC097-R	Report of the 97th Session of the IPHC Finance and Administration Committee (FAC097)	✓ 28 Jan 2021
IPHC-2021-PAB026-R	Report of the 26th Session of the IPHC Processor Advisory Board (PAB026)	✓ 28 Jan 2021
IPHC-2021-CB091-R	Report of the 91st Session of the IPHC Conference Board (CB091)	✓ 28 Jan 2021
Information papers		
IPHC-2021-IM097-INF01	Stakeholder Statements on IPHC Fishery Regulation proposals (B. Hutniczak)	✓ 29 Oct 2021
IPHC-2021-IM097-INF02	The IPHC mortality projection tool for 2022 mortality limits (I. Stewart)	✓ 12 Oct 2021
IPHC-2021-IM097-INF03	Bio-socioeconomic conditions index for Pacific halibut fisheries (B. Hutniczak)	✓ 29 Oct 2021
IPHC-2021-IM097-INF04	Pacific halibut market profile (B. Hutniczak)	✓ 29 Oct 2021
IPHC-2021-IM097-INF05	A description of the IPHC fishery-independent setline survey (FISS) abundance-based management (ABM) index (IPHC Secretariat)	✓ 29 Nov 2021

INTERNATIONAL PACIFIC HALIBUT COMMISSION

IPHC-2021-IM097-03

Update on actions arising from the 97th Session of the IPHC Annual Meeting (AM097), and 2021 Special Sessions

PREPARED BY: IPHC SECRETARIAT (D. WILSON; 25 OCTOBER 2021)

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 97th Session of the IPHC Annual Meeting (AM097), and 2021 Special Sessions.

BACKGROUND

At the 97th Session of the IPHC Annual Meeting (AM097), 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.

In addition, the Commission made a number of decisions during Specials Sessions in 2021, as detailed in Appendix B.

DISCUSSION

Noting that best practice governance requires the prompt delivery of core tasks assigned to the IPHC Secretariat by the Commission, at each session of the Commission and its subsidiary bodies, 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 from the Commission, as well as including clear progress updates and document reference numbers.

RECOMMENDATION/S

That the Commission:

1) **NOTE** paper IPHC-2021-IM097-03, 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 the 97th Session of the IPHC Annual Meeting (AM097), and 2021 Special Sessions.

APPENDICES

Appendix A: Update on actions arising from the 97th Session of the IPHC Annual Meeting (AM097: January 2021)

Appendix B: 2021 Special Session decisions

APPENDIX A

Update on actions arising from the 97th Session of the IPHC Annual Meeting (AM097: January 2021)

97th Session of the IPHC Annual Meeting (AM097)		
Action No.	**Description**	**Update**
	RECOMMENDATIONS	
AM097–Rec.01 (para. 87)	***Commercial Fishing Period*** The Commission **RECOMMENDED** that further consultations between Contracting Parties and fishery stakeholders on the administrative and policy implications of a year round fishery would support the decision process for the 98th Session of the IPHC Annual Meeting (AM098; January 2022) on potential further extensions of the direct commercial fishing period.	**Lead**: Contracting Party Heads of Delegation **Status/Plan**: Pending updates from CPs
	REQUESTS	
AM097–Req.01 (para. 27)	***IPHC Fishery-Independent Setline Survey (FISS)*** The Commission **REQUESTED** that the IPHC Secretariat coordinate with Contracting Parties to develop a Memorandum of Understanding (MOU) to promote data sharing among the IPHC Secretariat and Contracting Parties at no additional cost to the Contracting Parties.	**Lead**: IPHC Secretariat **Status/Plan**: In progress Current and Expired Memoranda of Understanding and Agreements are being reviewed. See paper **IPHC-2021-IM097-04** All are available on the IPHC website: https://www.iphc.int/the-commission/cooperation-with-other-organisations The Secretariat also makes ALL data collected on the FISS available via the IPHC website. An example are the rockfish and other species data collected at a fine scale in Reg. Area 2B, which are now accessed directly by DFO, thus ensuring no additional costs to either Party.
AM097–Req.02 (para. 70)	***Management Strategy Evaluation*** The Commission **REQUESTED** that the IPHC Secretariat consider and develop a draft MSE Program of Work for review by the Commission. The MSE Program of Work should describe technical versus policy-oriented issues, linkages between/among specific work products, and sequencing considerations between/among items. The MSE Program of Work should describe the resources required to complete items.	**Lead**: IPHC Secretariat (A. Hicks) **Status/Plan**: Completed See paper **IPHC-2021-IM097-13** Further refinements were made and presented to the Commission at the 11th Special Session (SS011). See Special Session in Appendix B below.

97th Session of the IPHC Annual Meeting (AM097)		
Action No.	**Description**	**Update**
AM097–Req.03 (para. 75)	***IPHC Fishery Regulations: Mortality and Fishery Limits (Sect. 5)*** The Commission **REQUESTED** additional information on the management and data collection procedures used in the unguided recreational fishery in IPHC Regulatory Areas 2C and 3A, and for these to be presented to the Commission no later than the next Interim Meeting of the Commission.	**Lead**: USA **Status/Plan**: Pending update from USA
AM097–Req.04 (para. 94)	***Pacific halibut fishery economics update*** The Commission **REQUESTED** that the IPHC Secretariat develop and distribute a Media Release on the Fishery economic project and the associated economic survey for industry to complete.	**Lead**: IPHC Secretariat **Status/Plan**: Completed Media release published 16 Feb 2021. See IPHC Media Release 2021-008
AM097–Req.05 (para. 104)	***IPHC Financial Regulations (2021)*** The Commission **ENDORSED** and **ADOPTED** the IPHC Financial Regulations (2021) as provided in paper IPHC-2021-AM097-INF04 Rev_3 by consensus, and **REQUESTED** that the IPHC Secretariat finalise and publish them accordingly.	**Lead**: IPHC Secretariat (D. Wilson) **Status/Plan**: Completed Published 29 February 2021 IPHC-2021-FR21
AM097–Req.06 (para. 105)	The Commission **REQUESTED** that the IPHC Secretariat will undertake an inter-sessional review and recommend further improvements to the Financial Regulations of the Commission, including the basis of accounting to better align with GAAP standards while maintaining regulatory compliance.	**Lead**: IPHC Secretariat (with Sommerville and Associates LLC) **Status/Plan**: In Progress These will be provided at the FAC098 in January 2022 if identified as necessary for this year.
AM097–Req.07 (para. 106)	***IPHC Rules of Procedure (2021)*** The Commission **ADOPTED** the IPHC Rules of Procedure (2021), as provided in IPHC-2021-FAC097-09 by consensus, and **REQUESTED** that the IPHC Secretariat finalise and publish them accordingly.	**Lead**: D. Wilson **Status/Plan**: Completed Published 29 February 2021 IPHC-2021-ROP21
AM097–Req.08 (para. 107)	The Commission **REQUESTED** that the IPHC Secretariat undertake an inter-sessional review and recommend further improvements to the IPHC Rules of Procedure to the Commission, noting the CB's recommendation (to change when Chairs are elected in their rule), PAB noting the conflicting text in the Rules, and roles of the Commissions Secretariat.	**Lead**: D. Wilson **Status/Plan**: In progress See paper **IPHC-2021-IM097-16** Includes amendments to the CB and PAB terms of reference.
AM097–Req.09 (para. 122)	***Review of the draft and adoption of the report of the 97th Session of the IPHC Annual Meeting (AM097)*** The Commission **REQUESTED** that the IPHC Secretariat finalise and publish the IPHC *Pacific Halibut Fishery Regulations (2021)* as soon as possible, **NOTING** that only minor editorial and formatting changes are permitted beyond the decisions made by the Commission at the AM097.	**Lead**: D. Wilson **Status/Plan**: Completed Published on 3 February 2021 (note SS009 additional amendment below)

APPENDIX B

2021 Special Sessions of the Commission

Action No.	Description	Update
10th Special Session of the IPHC (SS010) (8 January 2021)		
SS010–Req.01 (para. 8)	The Commission **REQUESTED** that the IPHC Secretariat make the adopted amendments to Section 28, paragraph (c) of the IPHC Fishery Regulations (2021), and for these to be submitted to the Contracting Parties after the current amendments (from AM097) are confirmed by both Parties. The expectation is that the amendments to Section 28, paragraph (c) would be in place prior to 1 April 2021.	**Lead**: D. Wilson **Status/Plan**: Completed The IPHC Fishery Regulations (2021) were circulated, approved, and then published on 22 February 2021.
11th Special Session of the IPHC (SS011) (22 June 2021)		
SS011-Rec.01 (para. 7)	The Commission **RECOMMENDED** that the IPHC Secretariat: a) prioritize tasks F1, F.2, F.3 and F.5 to support the development of a robust framework, and E.3 to work with stakeholders and the Commission to improve the methods of presenting MSE results. b) continue to work on task M.3 to understand the trade-offs with multi-year stock assessments. c) continue investigation of size limits (M.1) to understand the long-term effects of a change in the size limit, including under different realizations of population dynamics such as size-at-age.	**Lead**: A. Hicks **Status/Plan**: In progress See paper **IPHC-2021-IM097-13** The recommended Program of Work for the IPHC Secretariat (2021-23) is available on the IPHC website and will be implemented accordingly. https://www.iphc.int/uploads/pdf/msab/tech/iphc-2021-mse-02.pdf
SS011-(Para.11)	The Commission **ADOPTED** the FY2022 budget (1 October 2021 to 30 September 2022), as detailed in Appendix IV, including the Contracting Party contributions to the General Fund as follows: • Canada: Contribution to the General Fund: US$900,407 • U.S.A.: Contribution to the General Fund: US$4,157,760	**Lead**: D. Wilson **Status/Plan**: In progress Both Contracting Parties were invoiced for FY2022 contributions on 21 September 2021. Contributions fell due on 1 October 2021. No contributions have yet been received as of the date of this paper.

INTERNATIONAL PACIFIC HALIBUT COMMISSION

Report of the IPHC Secretariat (2021): Draft

PREPARED BY: IPHC SECRETARIAT (D. WILSON, 25 OCTOBER 2021)

Contents

Purpose

To provide the Commission with a draft update on the activities of the IPHC Secretariat in 2021, not already contained within other papers before the Commission.

1. Arrivals

FT Arrivals	Type	Hire Date	Status	Branch and Position Title
Rachel **Rillera**	Regular full-time	1 June 2021	Active	FSSB: Setline Survey Specialist
Ola **Wietecha**	Regular full-time	26 Jul 2021	Active	FPSB: Administrative Specialist
Tina **Wisnowski**	Regular full-time	2 Aug 2021	Active	FPSB: Staff Accountant
Crystal **Simchick**	Temporary full-time	23 Aug 2021	Active	BESB: Biological Science Laboratory Technician
Tyler Jack-**McCollough**	Regular full-time	16 Sept 2021	Active	FSSB: Setline Survey Specialist

2. Departures

FT Departures	Type	Branch and Position Title
Nicholas Wilson	Regular full-time	FPSB: Staff Accountant
Monica Thom	Regular full-time	FSSB: Setline Survey Specialist
Dana Rudy	Regular full-time	FSSB: Otolith technician
Keith Jernigan	Regular full-time	Assistant Director
Anna Simeon	Temporary full-time	BESB: Biological Science Laboratory Technician

3. IPHC Internship program: 2021

The IPHC funds full-time internships each summer. In 2021 the IPHC hosted two undergraduate interns, Ms Maya **Stock** from Oregon State University (Corvallis, OR), and Ms Eva **Sukphon-Devita** from Western Washington University (Bellingham, WA).

Maya and Eva have participated in two activities of the Biological and Ecosystem Sciences Branch. Firstly, Maya and Eva have contributed to the generation of sex ratio information from the 2020 commercial samples by participating in all components of this important monitoring effort: from DNA extraction from fin clips to conducting the genotyping assays. Secondly, Maya and Eva have participated in the processing of blood samples and in the determination of stress indicators from Pacific halibut captured and released in the recently conducted DMR Recreational Study. The internship period runs from 21 June through 10 September 2021.

4. IPHC Merit Scholarship for 2020-23

The IPHC funds several Merit Scholarships to support university, technical college, and other post-secondary education for students from Canada and the United States of America who are connected to the Pacific halibut fishery. Generally, a single new scholarship valued at US$4,000 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 four (4) person IPHC Merit Scholarship Panel reviews applications and determines recipients based on academic qualifications, career goals, and relationship to the Pacific halibut industry.

In 2020, the IPHC Merit Scholarship was awarded to Mr Hahlen **Behnken-Barkhau** (Whitman College).

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$2,000 per year for four years, with a new recipient selected each year, to an award of US$4,000 per year for four years, with a new recipient selected every other year.

Name	2018	2019	2020	2021	2022	2023
Kaia Dahl (Petersburg, AK, USA)	$4,000	$4,000	$4,000	$4,000	-	-
Hahlen Behnken-Barkhau (Sitka, AK, USA)	-	-	$4,000	$4,000	$4,000	$4,000

5. MEETINGS OF THE COMMISSION AND SUBSIDIARY BODIES DURING 2021

Meeting	No.	Date	Location
Finance and Administration Committee (FAC)	97th	25 Jan	Electronic
Annual Meeting (AM)	**97th**	**25-29 Jan**	Electronic
Conference Board (CB)	91st	26-27 Jan	Electronic
Processor Advisory Board (PAB)	26th	26-27 Jan	Electronic
Scientific Review Board (SRB)	18th	15-17 June	Electronic
	19th	21-23 Sept	Electronic
Work Meeting (WM)	2021	15-16 Sept	Electronic
Research Advisory Board (RAB)	22nd	29 Nov	Electronic
Interim Meeting (IM)	**97th**	**30 Nov – 1 Dec**	Electronic

6. IPHC PACIFIC HALIBUT FISHERY REGULATIONS (2021)

6.1. IPHC FISHERY REGULATIONS ADOPTED IN 2021

In 2021, the Commission adopted **six (6)** fishery regulations/amendments in accordance with Article III of the Convention, as follows:

IPHC Fishery Regulations: Morality and Fishery Limits (Sect. 5)

(para. 72) The Commission **NOTED** and **ADOPTED** fishery regulation proposal IPHC-2021-AM097-PropA1, which provides the mortality and fishery limits framework for population at AM097 (Appendix IV).

(para. 73) The Commission **ADOPTED** the distributed mortality limits for each Contracting Party, by IPHC Regulatory Area, (Table 6) and sector, as provided in Appendix IV. [**Canada**: In favour=3, Against=0][**USA**: In favour=3, Against=0]

Table 6. Adopted TCEY mortality limits for 2021

Contracting Party IPHC Regulatory Area	Mortality limit (TCEY) (metric tonnes)	Mortality limit (TCEY) (mlbs)
Canada Total: 2B	**3,175**	**7.00**
USA: 2A	748	1.65
USA: 2C	2,631	5.80
USA: 3A	6,350	14.00
USA: 3B	1,415	3.12
USA: 4A	930	2.05
USA: 4B	635	1.40
USA: 4CDE	1,805	3.98
United States of America Total	**14,515**	**32.00**
Total (IPHC Convention Area)	**17,690**	**39.00**

IPHC Fishery Regulations: Commercial fishing periods (Sect. 9)

(para. 77) The Commission **ADOPTED** fishing periods for 2021 as provided below, thereby superseding the relevant portions of Section 9 of the IPHC Pacific halibut fishery regulations (Appendix V) by specifying that commercial fishing for Pacific halibut in all IPHC Regulatory Areas may begin no earlier than 6 March and must cease on 7 December.

IPHC Fishery Regulations: minor amendments

(para. 78) The Commission **NOTED** and **ADOPTED** fishery regulation proposal IPHC-2021-AM097-PropA3, which proposed amendments to ensure IPHC Secretariat were formally regulated to allow them to sample Pacific halibut at the point of landing, with minor modification as identified during AM097 (Appendix VI).

Contracting Party fishery regulation proposals

IPHC Fishery Regulations: Charter management measures in IPHC Regulatory Areas 2C and 3A (Sect. 29)

(para. 79) The Commission **NOTED** and **ADOPTED** fishery regulation proposal IPHC-2021-AM097-PropB1, which proposed IPHC Regulation changes for charter recreational Pacific halibut fisheries in IPHC Regulatory Areas 2C and 3A (Appendix VII), in order to achieve the charter Pacific halibut allocation under the North Pacific Fisheries Management Council's (NPFMC) Pacific halibut Catch Sharing Plan:

a) IPHC Regulatory Area 2C – one-fish bag limit with size limit of less than or equal to 50 inches or greater than or equal to 72 inches;

b) IPHC Regulatory Area 3A – two-fish bag limit with one fish of any size and a second fish less than or equal to 32 inches, Wednesdays closed to retention of Pacific halibut, one trip per vessel and one trip per permit per day (no annual limit). See IPHC-2021-AM097-PropB1 for additional detail.

IPHC Fishery Regulations: Commercial fishing periods (Sect. 9)

(para. 83) The Commission **ADOPTED** fishery regulation changes contained within IPHC-2021-AM097-INF05, which revises the derby season structure from openings Monday through Wednesday, to openings Tuesday through Thursday (Appendix VIII).

7. INTERACTIONS WITH CONTRACTING PARTIES

7.1. *CONTRACTING PARTY REPORTS*

In 2021, the IPHC Secretariat has engaged agency representatives from both Contracting Parties regarding more comprehensive and timely reporting of all forms of Pacific halibut removals and directed commercial fishery revenue data. The IPHC Secretariat is working to identify and address data gaps in reporting.

In addition, the IPHC Secretariat continues to actively collaborate with domestic agencies from both Contracting Parties through existing and new Collective Agreements, and MoUs. These are detailed in the section below.

7.2. *CANADA*

7.2.1. *Fisheries and Oceans Canada (DFO)*

Memorandum of Understanding/Collective Agreement – Rockfish

The objective of the Memorandum of Understanding (MOU) / Collective Agreement with DFO and the PHMA is to 1) collect and utilize catch and biological sample data from species caught during the IPHC's annual fishery-independent setline survey (FISS); 2) lay forth the financial obligations associated with (1) hook by hook species identification data on the total catch and (2) biological data on rockfish species caught during FISS operations, as requested by DFO to survey rockfish populations off the British Columbia coastline. The activities covered under the MoU/CA are 100% cost recovered from the PHMA.

In early 2021, PHMA indicated to DFO and the IPHC that is had insufficient funds to provide for this sampling during the 2021 FISS.

Discussions are ongoing in developing an MoU for 2022.

Areas of conservation concern

The IPHC Secretariat continues to work with Fisheries and Oceans representatives to address gaps in coverage for the IPHC Fishery-Independent Setline Survey (FISS) in the IPHC Convention Area. An application was submitted again in 2021 to fish the FISS stations within the Marine Protected Areas in Canadian waters, which was denied.

Halibut Advisory Board (HAB)

The Executive Director participates as a HAB member, with Dr Basia Hutniczak as the IPHC alternate. This relationship is expected to continue into the future given the HAB's contributions to the Canadian decision-making process.

7.3. *United States of America*

7.3.1. *NOAA Alaska Port Sampling Grant:*

Incremental cost to the International Pacific Halibut Commission sampling program due to IFQ/CDQ programs (2019-2023)

The IPHC Port Sampling Program runs annually in Alaskan ports. The USA, via NOAA provide funds directly to the IPHC to pay for some of our Port Sampling costs (this is in addition to the annual USA Contributions to the IPHC General Budget). For background understanding, the IPHC is one of those who receive funds each year to cover off on partial costs for our Pacific halibut Fisheries Data program which had to be expanded in 1995 when the US implemented the IFQ program in Alaska. This change extended the length of the commercial season in Southeast Alaska (IPHC Regulatory Area 2C) and the Gulf of Alaska (IPHC Regulatory Areas 3A, 3B, 4A) from two days to 260 days. In the Bering Sea and Aleutian Islands, the season length went from 1-22 days to 260 days (season length varied by IPHC Regulatory Area). Prior to the implementation of the IFQ program in Alaska, the Commission's catch effort data collection was accomplished through the use of one or multiple personnel stationed temporarily in Pacific halibut landing ports for up to a week following the directed commercial fishing period, to collect the necessary data throughout the intensive landing period that existed with the 'Derby'-style pre-IFQ fishery. With the implementation of the IFQ program and the associated longer fishing season, it became necessary to alter the catch effort personnel deployment patterns to accomplish similar scientific protocols for representative sampling of the fishery landings. These sampling protocols require both biological and logbook targets specific to each IPHC Regulatory Area with both spatial and temporal requirements.

To meet these targets, it was necessary to station personnel in major ports for the extended, nine-month fishery season with employees on call to collect the necessary data (12 hours a day and six days a week). It also provides some funds that are meant to cover the costs of the sablefish data collection and reporting program as a service for NOAA.

The current Grant agreement was set up for 5 years and will end at the close of the 2023 fishing period, and is budgeted to cover 81% of our expenses for the Port Program. The IPHC is currently in discussions with NOAA personnel to update, improve, and extend the current arrangement past 2023. We expect to bring the new agreement to the Commission for consideration in the first half of 2022.

7.3.2. *NOAA Pacific cod and Pacific spiny dogfish sampling agreement*

NOAA-Fisheries, through the Alaska Fisheries Science Center (AFSC) requested sex and length data from Pacific spiny dogfish and length data from Pacific cod from all surveyed stations in 2021. The IPHC has been collecting this requested data from a subsample of Pacific spiny dogfish since 2011, and for Pacific cod in the Bering Sea since 2007 and in the Gulf of Alaska (GOA) since 2017. This remains a valuable collaboration and one which the IPHC will continue.

In 2021, the IPHC FISS team collected lengths of Pacific Cod and Pacific spiny dogfish at the request of NOAA-Fisheries.

IPHC Regulatory Area	Pacific spiny dogfish lengths/sex
2A	143
2B	516
2C	332
3A	807
3B	227
4A	3
4B	1
TOTAL	**2,029**
IPHC Regulatory Area	**Pacific cod lengths**
2B	500
2C	1380
3A	944
3B	497
4A	317
4B	217
4C	99
4D	160
IPHC Closed Area	15
TOTAL	**4,129**

7.3.3. *Memorandum of Understanding – Rockfish – Washington Department of Fish and Wildlife*

The objective of the Memorandum of Understanding (MoU) with WDFW is to 1) collect and utilize catch and biological sample data from species caught during the IPHC's annual fishery-independent setline survey (FISS); 2) agree on how proceeds from the sale of Pacific halibut (*Hippoglossus stenolepis*), rockfish (*Sebastes* spp.) and Pacific cod (*Gadus microcephalus*) will be disbursed; and 3) lay forth the financial obligations associated with undertaking additional FISS stations, as requested by the WDFW to survey rockfish populations off the Washington coastline.

In 2021, the IPHC sampled the eight (8) additional stations at the request of the WDFW. The IPHC tagged 187 rockfish at sea, which were then sampled by WDFW staff during the offloads in Westport, WA. The costs incurred by these activities are 100% cost-recovered from the WDFW.

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

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 January/February 2020 meeting, the NPFMC revised the ABM motion (Council D4 Motion AM80) to focus solely on the Amendment 80 sector for the forthcoming Pacific halibut ABM PSC limit analysis and added a second motion (Council D4 Motion PSC Limits) containing additional options to consider in a discussion paper.

ABM was a priority agenda at the NPFMC October 2020 meeting. The Scientific and Statistical Committee (SSC) discussed the operating model and results from the simulation analysis. However, a misspecification in the simulation model left little time to review the updated results before the end of the SSC meeting, and the SSC unanimously decided to not review the results at that time. The Council discussed the outcomes extensively and moved to a new approach in Council C6 Motion as well as updating the purpose and need. The motion specifies four alternatives for analysis with one being status quo and the other three variations of a lookup table incorporating the two indices calculated from the FISS data and the EBS trawl survey data. Four options were specified that would reduce variability in the annual PSC limits and introduce performance standards that may increase or decrease the PSC limit depending on percent usage of the limit.

Following an initial review of a preliminary draft environmental impact statement (DEIS) in April 2020, the NPFMC modified the specified options, removed the option annual roll-overs, and requested the draft DEIS be revised in response to SSC requests before publishing it for a public comment period (Council C2 Motion ABM). The National Marine Fisheries Service (NMFS) will provide an analysis of comments at the November 2021 NPFMC meeting followed in December 2021 with the NPFMC taking final action to recommend a preferred alternative. Given this timeline, implementation could occur in January 2023.

7.3.5. *PACIFIC FISHERY Management Council (PFMC)*

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 2021 will be presented during Agenda Item 5.

IPHC Regulatory Area 2A fishery management handover to the USA

The Council took final action in November 2020, and adopted the following:

- The Council will consider the directed fishery framework during the Catch Sharing Plan process in September and November; include any guidance for vessel limits and inseason changes for NMFS implementation.
- NMFS will issue permits for all Area 2A halibut fisheries: commercial-directed, incidental salmon troll, incidental sablefish, and recreational charter halibut fisheries.
- NMFS will determine the appropriate application deadlines for all commercial halibut applications, set to accommodate Council meetings and NMFS processing time.
- Proof of permit will be required to be onboard the fishing vessel and made readily available upon request, regardless of the type of permit (e.g., paper or electronic). NMFS will provide access to permits in a printable format or send paper copies directly to the participant.

As for the status of implementation, NMFS is anticipating the following schedule:

- A proposed rule will be published this fall with the expectation that the rule will be finalized by June/July 2022
- Collect information necessary to issue permits in June/July 2022

- Consider management alternatives through the Council process in September and November 2023
- Issue Permits by early 2023
- NMFS will manage the non-Indian directed commercial fishery beginning in 2023

8. IPHC Communications and Outreach

8.1. *IPHC Website*

The IPHC Secretariat continues to develop new ways to display data and statistics for our stakeholders and other interested parties, focusing particularly on the addition of timely and useful visual displays such as interactive maps for the IPHC Fishery-Independent Setline Survey (FISS) data, and commercial fishery data pages and catch tables. https://www.iphc.int/www.iphc.int/data

8.2. *Annual Report*

The 2020 Annual Report (1 January to 31 December 2020) was published on 2 April 2021 and is available for download from the IPHC website at the following link: https://www.iphc.int/uploads/pdf/ar/iphc-2021-ar2020-r.pdf

We continue to implement 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.

8.3. *IPHC Circulars and Media Releases*

IPHC Circulars 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.

https://www.iphc.int/library/documents/category/circulars

IPHC Media Releases are the primary informal communication with all stakeholders. In some cases, these will duplicate the formal communications provided in IPHC Circulars.

https://www.iphc.int/library/documents/category/media-releases

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

8.4. *IPHC External engagement*

There is a considerable amount of effort put into public outreach, attending conferences and meetings that enhance knowledge, contributing expertise to the broader scientific community through participation on boards and committees, and seeking further education and training. In 2021, much of this engagement took place electronically due to the COVID-19 pandemic.

Committees and external organisation appointments

North America:

1) *Technical Subcommittee (TSC) of the Canada-United States Groundfish Committee* - Dr. Josep Planas & Ms. Lara Erikson

Canada:

1) *Halibut Advisory Board* (Canada) - Dr. David Wilson (Dr. Basia Hutniczak – Alternate)

United States of America:

1) *Bering Sea/Aleutian Islands Plan Team* - Dr. Allan Hicks
2) *Bering Sea Fishery Ecosystem Plan Team* - Dr. Ian Stewart
3) *North Pacific Fishery Management Council (NPFMC) Abundance-based Management Working Group* – Dr. Allan Hicks
4) *NPFMC Scientific and Statistical Committee* - Dr. Ian Stewart
5) *NPFMC Trawl Electronic Monitoring Committee* – Ms. Huyen Tran
6) *North Pacific Research Board Science Panel* - Dr. Josep Planas
7) *Fisheries Monitoring Science Committee (NOAA-Alaska)* – Dr. Ray Webster
8) *Interagency electronic reporting system for commercial fishery landings in Alaska (eLandings) Steering Committee – Ms. Kamala Carroll and Ms. Huyen Tran*
9) *Interagency electronic reporting system for commercial fishery landings in Alaska (eLandings) IT Steering Committee – Ms. Huyen Tran and Mr. Afshin Taheri*
10) *Interagency electronic reporting system for commercial fishery landings in Alaska (eLandings) Interagency Coordination Committee (ICC) – Ms. Huyen Tran*
11) *Stock Assessment Review (STAR) of Vermilion and Sunset Rockfishes (PFMC) – Dr. Allan Hicks*

Conferences and symposia (chronological order)

1) Participation (remote) in the North American Association of Fisheries Economists biannual meeting - Dr. Basia Hutniczak
2) World Fisheries Congress, Adelaide, SA, Australia – remote participation – Dr David T. Wilson, Dr Josep Planas, Mr Andy Jasonowicz, Mr Colin Jones.

Academic affiliations 2021

Affiliate Faculty:

1) Dr. Allan Hicks - University of Washington School of Aquatic and Fishery Sciences, Seattle, WA, USA
2) Dr. Ian Stewart - University of Washington School of Aquatic and Fishery Sciences, Seattle, WA, USA
3) Dr. Josep Planas - Alaska Pacific University, Anchorage, AK, USA

Graduate student committee member:

1) Dr. Allan Hicks - University of Massachusetts School for Marine Science & Technology, Dartmouth, MA, USA
2) Dr. Allan Hicks - University of Washington School of Aquatic & Fishery Sciences, Seattle, WA, USA
3) Dr. Ian Stewart - Alaska Pacific University, Anchorage, AK, USA
4) Dr. Ian Stewart - University of Washington School of Aquatic & Fishery Sciences, Seattle, WA, USA
5) Dr. Josep Planas - Alaska Pacific University, Anchorage, AK, USA

9. IPHC Publications in 2021

***Published* peer-reviewed journal papers**

Carpi, P., Loher, T., Sadorus, L.L., Forsberg, J.E., Webster, R.A., Planas, J.V., Jasonowicz, A., Stewart, I.J., and Hicks, A.C. (2021) Ontogenetic and spawning migration of Pacific halibut: a review. Reviews in Fish Biology and Fisheries. https://doi.org/10.1007/s11160-021-09672-w

Kroska, A.C., Wolf, N., **Planas, J.V.**, Baker, M.R., Smeltz, T.S., and Harris, B.P. (2021) Controlled experiments to explore the use of a multi-tissue approach to characterizing stress in wild-caught Pacific halibut (*Hippoglossus stenolepis*). Cons. Physiol. Vol. 9(1): coab001. doi.org/10.1093/conphys/coab001

Loher, T., Bath, G.E., and Wischniowski, S. (2021). The potential utility of otolith microchemistry as an indicator of nursery origins in Pacific halibut (*Hippoglossus stenolepis*). Fish. Res. 243: 106072. doi.org/10.1016/j.fishres.2021.106072.

Lomeli, M.J.M., Wakefield, W.W., Herrmann, B., **Dykstra, C.L., Simeon, A., Rudy, D.M., Planas, J.V.** (2021) Use of Artificial Illumination to Reduce Pacific Halibut Bycatch in a U.S. West Coast Groundfish Bottom Trawl. Fish. Res. 233:105737. doi.org/10.1016/j.fishres.2020.105737

Sadorus, L.L., Goldstein, E.D., **Webster, R.A.,** Stockhausen, W.T., **Planas, J.V.,** Duffy-Anderson, J.T. (2021) Multiple life-stage connectivity of Pacific halibut (*Hippoglossus stenolepis*) across the Bering Sea and Gulf of Alaska. Fish. Oceanogr. Vol. 30(2):174-193. doi.org/10.1111/fog.12512

Stewart, I.J., Hicks, A.C., and P. Carpi 2021. Fully subscribed: Evaluating yield trade-offs among fishery sectors utilizing the Pacific halibut resource. Fisheries Research 234. doi:10.1016/j.fishres.2020.105800

Stewart, I.J., Scordino, J. J., Petersen, J.R., Wise, A.W., Svec, C.I., Buttram, R.H., Monette, J.L., Gonzales, M.R., Svec, R., Scordino, J. Butterfield, K., Parker, W., Buzzell, L.A. (2021) Out with the new and in with the old: Reviving a traditional Makah halibut hook for modern fisheries management challenges. Fisheries Magazine: American Fisheries Society (early view). doi.org/10.1002/fsh.10603

Taylor, I.G., Doering, K.L., Johnson, K.F., Wetzel, C.R., and **Stewart, I.J.** (2021). Beyond visualizing catch-at-age models: Lessons learned from the r4ss package about software to support stock assessments. Fish. Res. Vol. 439:105924. doi.org/10.1016/j.fishres.2021.105924

***In press* peer-reviewed journal papers**

Loher, T., Dykstra, C.L., Hicks, A., Stewart, I.J., Wolf, N., Harris, B.P., **Planas, J.V.** Estimation of post-release longline mortality in Pacific halibut (*Hippoglossus stenolepis*) using acceleration-logging tags. North American Journal of Fisheries Management (In Press).

***Submitted* peer-review journal papers – In review**

Hutniczak, B. Method for Efficient Updating of Regional Supply and Use Tables, Journal of Economic Structures (In Review).

Loher, T., Dykstra, C.L., Hicks, A., Stewart, I.J., Wolf, N., Harris, B.P., **Planas, J.V.** Estimation of post-release longline mortality in Pacific halibut (*Hippoglossus stenolepis*) using acceleration-logging tags. North American Journal of Fisheries Management (In Review).

***Submitted* peer-review journal papers – In review**

Hutniczak, B. Method for Efficient Updating of Regional Supply and Use Tables, Journal of Economic Structures (In Review).

Loher, T., McCarthy, O., **Sadorus, L.L., Erikson, L.M., Simeon, A.,** Drinan, D.P., Hauser, L., **Planas, J.V., Stewart, I.J**. A test of deriving sex-composition data for the North American Pacific halibut (*Hippoglossus stenolepis*) directed commercial fishery via an at-sea marking program. Fish. Res. (In Review).

10. Recommendation

That the Commission **NOTE** paper IPHC-2021-IM097-04 which provides the Commission with an update on activities of the IPHC Secretariat in 2021 not detailed in other papers before the Commission.

Appendices

Nil.

Implementation of the Recommendations from the 2nd IPHC Performance Review (PRIPHC02)

PREPARED BY: IPHC SECRETARIAT (D. WILSON; 25 OCTOBER 2021)

To provide the Commission with an update on the implementation of the recommendations arising from the 2nd Performance Review of the IPHC (PRIPHC02).

BACKGROUND

The Report of the 2nd Performance Review of the IPHC (PRIPHC02), IPHC-2019-PRIPHC02-R (adopted on 11 October 2019) is available for download from the IPHC website: https://www.iphc.int/library/documents/post/iphc-2019-priphc02-r-report-of-the-2nd-performance-review-of-the-international-pacific-halibut-commission-priphc02

At the 96th Session of the IPHC Annual Meeting (AM096), the Commission:

> *(para. 137) "The Commission **NOTED** that 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."*
>
> *(para 138) "The Commission **NOTED** para. 22 of the report which stated:*
>
> > *(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."*
>
> *(para. 139) "The Commission **REQUESTED** that paper IPHC-2020-AM096-14 be reviewed intersessionally by each Contracting Party, with the intention of providing edits/additions, for endorsement. The IPHC Secretariat will facilitate this request by proposing intersessional meeting dates."*

During the 6th Special Session of the IPHC (SS06) held on 3 March 2020, the Commission:

> (para. 6) "*The Commission **ENDORSED** the recommendations, priorities, responsibilities, timelines and updates provided at Appendix B, and **AGREED** that these would be reported on at each IPHC meeting.*" (IPHC-2020-SS06-R)

RECOMMENDATION

That the Commission **NOTE** paper IPHC-2021-IM097-05 that provides the Commission with an update on the implementation of the recommendations arising from the 2nd Performance Review of the IPHC (PRIPHC02).

APPENDICES

Appendix A: Table of recommendations arising from the PRIPHC02, including 1) responsibilities, 2) timeline, 3) priorities; and 4) any initial comments of relevance.

Appendix A
RECOMMENDATIONS OF THE 2ND PERFORMANCE REVIEW OF THE INTERNATIONAL PACIFIC HALIBUT COMMISSION (PRIPHC02)

REF#	RECOMMENDATION	PRIORITY	RESPONSIBILITY	TIMELINE	UPDATE/STATUS
PRIPHC02 –Rec.01 (para. 32)	***Legal analysis of the IPHC Convention*** 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) – z)	N/A	N/A	N/A	**N/A:** At this time, the Contracting Parties do not wish to commence the process of updating 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. Commission directive: The Commission **RECOMMENDED** the exploration and implementation of alternate mechanisms to implement international best practices, such as revisions to the IPHC Rules of Procedure, IPHC Financial Regulations and IPHC Fishery Regulations.	N/A High	N/A Commission	N/A 2020-24	**N/A** **In progress/Ongoing**: The IPHC Rules of Procedure (ROP) and the IPHC Financial Regulations (FR) will be periodically updated (at least once every 2 years) and where possible, should accommodate applicable improvements as recommended in the legal review of the IPHC Convention. Revised ROPs and FRs will be submitted to the annual **Finance and Administration Committee (FAC)** for consideration and potential recommendation to the Commission.

REF#	RECOMMENDATION	PRIORITY	RESPONSIBILITY	TIMELINE	UPDATE/STATUS
PRIPHC02 –Rec.03 (para. 44)	***Science: Status of living marine resources*** 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.	High	IPHC Secretariat	2020-24	**In progress/Ongoing**: There are three non-Contracting Parties who exploit Pacific halibut: Russia, Rep. of Korea and Japan. Most recently we have engaged Russian scientists working on Pacific halibut through PICES (https://meetings.pices.int/). We will continue to explore this avenue via PICES, noting that COVID-19 has hindered/delayed some interactions
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.	Medium	IPHC Secretariat	2020-24	**In progress**: The IPHC's work in this area has been limited to date. However, some efforts to incorporate ecosystem considerations into the MSE work has commenced.
PRIPHC02 –Rec.05 (para. 63)	***Science: Quality and provision of scientific advice*** The PRIPHC02 **RECOMMENDED** that simplified materials be developed for RAB and especially MSAB use, including training/induction materials.	High	IPHC Secretariat	2020-24	**In progress**: The IPHC Secretariat continues to seek ways to ensure broad stakeholder understanding of our work. For the MSAB and associated MSE work, an interactive web-based tool has been developed to provide a user friendly means to explore and understand the utility of MSE and the simulation results arising. See paper **IPHC-2021-AM097-11** for the latest iteration. Additionally, an information paper describing how to use the IPHC MSE Explorer tool (IPHC-2021-AM097-inf03) was provided at the 97th Annual Meeting. MSE Explorer. https://www.iphc.int/management/science-and-research/management-strategy-evaluation

REF#	RECOMMENDATION	PRIORITY	RESPONSIBILITY	TIMELINE	UPDATE/STATUS
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.	Medium	Commission; IPHC Secretariat	2020	**Completed**: The IPHC Secretariat provided the Commission with revised Rules of Procedure for consideration at AM096, which included a two-term limit. This was adopted by the Commission and is now in force. See **IPHC Rules of Procedure (2020)**
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.	High	Commission; IPHC Secretariat	2020-24	**In progress**: The Commission has approved peer review of the IPHC stock assessment which was **concluded** in 2019, the IPHC MSE which was concluded on 25 September 2020. See **IPHC-2020-CR-022**. The Commission has indicated its strong support topic based peer review moving forward.
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.	High	IPHC Secretariat	2020	**Completed**: The IPHC Secretariat now includes both time-series' and phase plots of management-related quantities See paper **IPHC-2021-AM097-08**.
PRIPHC02 –Rec.09 (para. 73)	***Conservation and Management: Data collection and sharing*** The PRIPHC02 **RECOMMENDED** that observer coverage be adjusted to be commensurate with the level of fishing intensity in each IPHC Regulatory Area. Commission directive: The Commission **RECOMMENDED** that the IPHC Secretariat, in consultation with the Commission, develop minimum data collection standards for Pacific halibut by scientific observer programs. The intention would be for the Commission to review and approve the minimum standards, and recommend them for implementation by domestic agencies.	N/A High	N/A Contracting Parties	N/A 2020-24	**N/A** **Pending**:

REF#	RECOMMENDATION	PRIORITY	RESPONSIBILITY	TIMELINE	UPDATE/STATUS
PRIPHC02 –Rec.10 (para. 82)	***Conservation and Management: Consistency between scientific advice and fishery Regulations adopted*** 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.	High	IPHC Secretariat	2021-24	**In progress**: To be considered once update MSE products, including multi-year management procedures, are delivered at AM098 in January 2022, and updated complete results are presented at AM099 in January 2023. Evaluating multi-year stock assessments is a priority task in the MSE program of work for 2021-2023.
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.	High	IPHC Secretariat	2020-21	**In progress**: See paper **IPHC-2021-AM097-11** for the latest iteration and https://www.iphc.int/uploads/pdf/msab/tech/iphc-2021-mse-02.pdf for the most recent MSE program of work.
PRIPHC02 –Rec.12 (para. 88)	***Fishing allocations and opportunities*** The PRIPHC02 **STRONGLY URGED** the Commission to conclude its MSE process and **RECOMMENDED** it meet its 2021 deadline to adopt a harvest strategy.	High	IPHC Secretariat	2020-21	**In progress**: See paper **IPHC-2021-AM097-11** for the latest iteration.
PRIPHC02 –Rec.13 (para. 96)	***Compliance and enforcement: Port State measures*** The PRIPHC02 **RECOMMENDED** that Contracting Party enforcement agencies adopt common standards for assessment of implementation of the principles of port State measures.	Medium	Contracting Parties	2020-24	**Pending**: Potentially to be incorporated into the Contracting Party National Reports at each Annual Meeting. The Secretariat will work with each Contracting Party.
PRIPHC02 –Rec.14 (para. 105)	***Compliance and enforcement: Monitoring, control and surveillance (MCS)*** 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.	Medium	Contracting Parties	2021-24	**Pending**: Potentially to be incorporated into the Contracting Party National Reports at each Annual Meeting.

REF#	RECOMMENDATION	PRIORITY	RESPONSIBILITY	TIMELINE	UPDATE/STATUS
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.	High	IPHC Secretariat; Commission	2020	**In progress**: The IPHC Secretariat is 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. At IM095, the Commission requested: IM095 (para. 89) *The Commission **WELCOMED** the PFMC's commitment to transition management of Pacific halibut fisheries in IPHC Regulatory Area 2A from the IPHC to domestic agencies and **REQUESTED** that the IPHC Secretariat continue to support this process in the short-term, with the aim of transitioning management of the fishery to the domestic agencies at the earliest opportunity.* NOAA-Fisheries continues to deliberate this topic.
PRIPHC02 –Rec.16 (para. 108)	***Compliance and enforcement: Follow-up on infringements*** 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.	High	IPHC Secretariat; Commission	2020	**In progress**: The IPHC Secretariat has requested this information be provided by domestic agencies via the Contracting Party National Reports to the Commission.
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.	Medium	IPHC Secretariat; Contracting Parties	2020	**In progress**: The IPHC Secretariat has requested this information be provided by domestic agencies via a consolidated Contracting Party National Report to the Commission. This will likely take several years to become an efficient process of reporting.
PRIPHC02 –Rec.18 (para. 124)	***Governance: Decision-making*** 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.	Low	IPHC Secretariat	2020-21	**Completed**: IPHC Rules of Procedure (2020) published on 7 February 2020.

REF#	RECOMMENDATION	PRIORITY	RESPONSIBILITY	TIMELINE	UPDATE/STATUS
PRIPHC02 –Rec.19 (para. 128)	***Governance: Dispute settlement*** The PRIPHC02 **RECOMMENDED** updating the rules of procedure to reflect intersessional decision making approaches.	Medium	IPHC Secretariat	2020-21	**Completed**: IPHC Rules of Procedure (2020) published on 7 February 2020. Further amendments will be presented at FAC097 for recommendation to the Commission. **97th Session of the IPHC Finance and Administration Committee (FAC097)**
PRIPHC02 –Rec.20 (para. 137)	***Governance: Transparency*** The PRIPHC02 **RECOMMENDED** that the significant level of transparency achieved across Commission business continue to be improved.	High	Commission; IPHC Secretariat;	2020-24	**In progress**: Monitor progress through the IPHC meeting cycle.
PRIPHC02 –Rec.21 (para. 146)	***International cooperation: Relationship to non-Contracting Parties*** The PRIPHC02 **RECOMMENDED** that the Commission prioritise scientific work to confirm the full range of the Pacific halibut stock.	High	IPHC Secretariat;	2020-24	**In progress**: There are three non-Contracting Parties who exploit Pacific halibut: Russia, Rep. of Korea and Japan. Most recently we have engaged Russian scientists working on Pacific halibut through PICES (https://meetings.pices.int/).
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.	Low/ Medium	IPHC Secretariat	2020-24	**In progress**: The IPHC Secretariat is engaging with other countries harvesting Pacific halibut via PICES as a first step.
PRIPHC02 –Rec.23 (para. 156)	***Efficiency and transparency of financial and administrative management: Availability of resources for IPHC activities*** 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.	High	IPHC Secretariat; FAC	2020	**In progress**: The IPHC Secretariat has developed a BCP for the Finance and Administrative Services Branch (financial and administrative BCP) over the past months, and will move to consolidate with other Branches of the organization throughout 2020.

REF#	RECOMMENDATION	PRIORITY	RESPONSIBILITY	TIMELINE	UPDATE/STATUS
PRIPHC02 –Rec.24 (para. 162)	***Efficiency and transparency of financial and administrative management: Efficiency and cost-effectiveness*** 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.	High	FAC; IPHC Secretariat	2020-24	**Completed**: The first report of the IPHC Finance and Administration Committee (FAC) was adopted on 4 February 2020, and presented to the Commission at its 96th Session for consideration.
PRIPHC02 –Rec.25 (para. 165)	***Efficiency and transparency of financial and administrative management: Advisory structure*** 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.	N/A	Commission	N/A	**Completed**: The Commission agreed to keep the two subsidiary bodies separate moving forward.
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.	High	Commission; IPHC Secretariat	2020-24	**Completed**: The Commission agreed to keep the two subsidiary bodies separate moving forward, and for them to be enhanced wherever feasible.

Fisheries Data Overview (2021): Preliminary

PREPARED BY: IPHC SECRETARIAT (L. ERIKSON, H. TRAN, T. KONG & C. PREM; 19 NOVEMBER 2021)

PURPOSE

To provide an overview of the key fisheries data regarding Pacific halibut removals from fisheries catching Pacific halibut during 2021, including the status of landings compared to fishery limits implemented by the Contracting Parties to 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-2021-IM097-10) and other analyses. The data are compiled by the IPHC Secretariat and include data from Federal and State agencies of each Contracting Party. All 2021 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)
- IPHC Fishery-Independent Setline Survey (FISS) and other research

Figure 1 shows the distribution of Pacific halibut removals (mortality) by these fishery sources in 2021. Table 1 and Table 2 provide estimates of total removals by IPHC Regulatory Area (Figure 2).

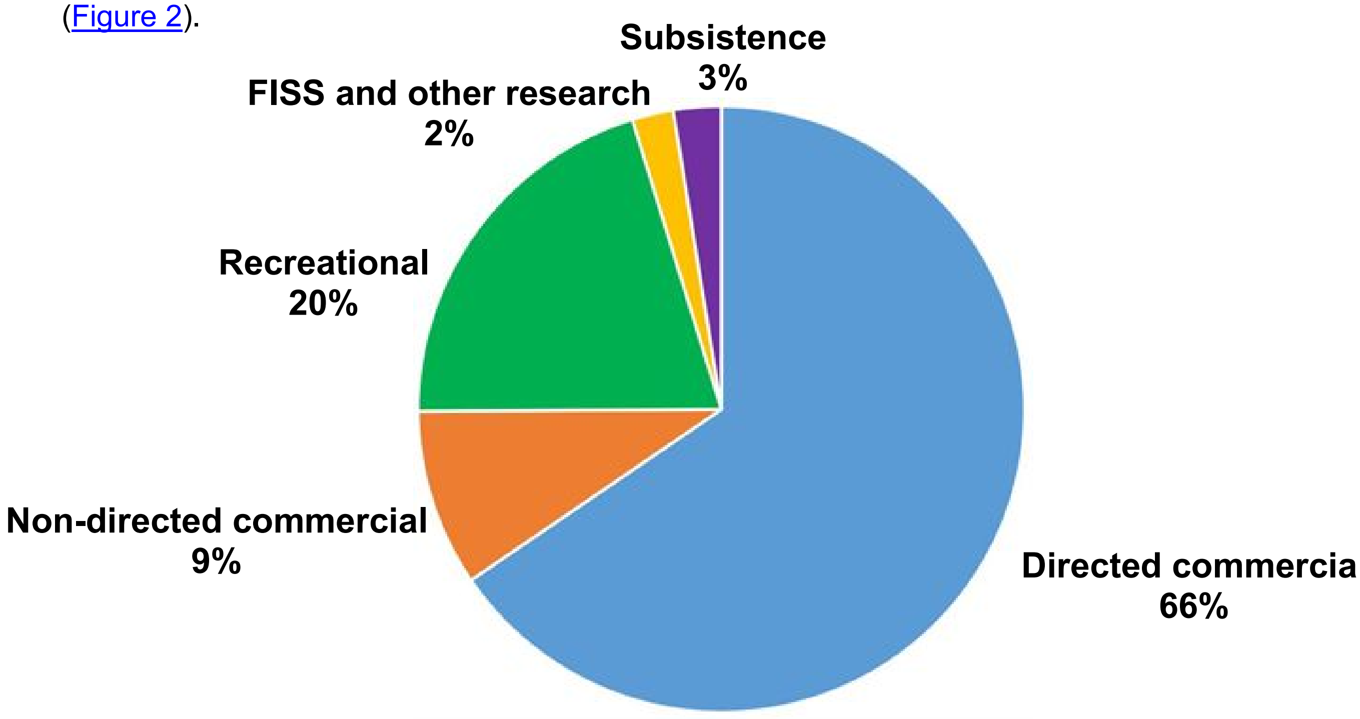

Figure 1. Distribution of Pacific halibut mortality by source in 2021.

Table 1. 2021 Mortality limits (TCEYs) and estimates (TCEYs and U26) by Contracting Party.

Contracting Party	Mortality limits (net weight)		Mortality (net weight)		Percent
	Tonnes (t)	Pounds (lb)	Tonnes (t)	Pounds (lb)	%
Canada	**3,175**	**7,000,000**	**3,018**	**6,653,325**	**95**
United States of America	**14,515**	**32,000,000**	**13,659**	**30,113,762**	**94**
IPHC Regulatory Area 2A	748	1,650,000	651	1,435,845	87
IPHC Regulatory Area 2C	2,631	5,800,000	2,859	6,302,386	109
IPHC Regulatory Area 3A	6,350	14,000,000	6,314	13,920,562	99
IPHC Regulatory Area 3B	1,415	3,120,000	1,332	2,936,818	94
IPHC Regulatory Area 4A	930	2,050,000	747	1,646,075	80
IPHC Regulatory Area 4B	635	1,400,000	441	972,624	69
IPHC Regulatory Area 4CDE and Closed Area	1,805	3,980,000	1,315	2,899,452	73
Subtotal (TCEY)	**17,690**	**39,000,000**	**16,677**	**36,767,087**	**94**
Non-directed commercial discard mortality (U26)	567	1,250,000	426	940,000	75
Total	**18,257**	**40,250,000**	**17,104**	**37,707,087**	**94**

Table 2. 2021 estimates of total removals (net weight), including fishery limits and mortality projections of Pacific halibut by IPHC Regulatory Area.

IPHC Regulatory Area	Fishery limit or Mortality projection		Mortality (net weight)		Percent
	Tonnes (t)	Pounds (lb)	Tonnes (t)	Pounds (lb)	%
Canada – Area 2B (British Columbia)	3,175	7,000,000	3,018	6,653,325	95
Directed commercial fishery landings	2,372	5,230,000	2,191	4,830,396	92
Directed commercial discard mortality	77	170,000	82	181,000	106
Recreational fishery	417	920,000	372	820,000	89
Recreational discard mortality[1]	18	40,000	12	25,459	64
Recreational - XRQ	n/a	n/a	7	15,000	n/a
Subsistence[1]	186	410,000	184	405,000	99
Non-directed commercial discard mortality (O26)[1]	104	230,000	106	233,000	101
IPHC fishery-independent setline survey and research[2]	n/a	n/a	65	143,470	n/a
Non-directed commercial discard mortality (U26)	14	30,000	65	143,470	110
USA – 2A (California, Oregon, and Washington)	748	1,650,000	651	1,435,845	87
Non-treaty directed commercial	116	256,122	110	242,997	95
Non-treaty incidental to salmon troll fishery	21	45,198	8	18,562	41
Non-treaty incidental to sablefish fishery	32	70,000	29	63,656	91
Treaty Indian directed commercial	225	496,300	220	485,896	98
Directed commercial discard mortality	14	30,000	32	71,000	237
Recreational – Washington	127	279,414	114	250,286	90
Recreational – Oregon	132	291,506	59	129,560	44
Recreational – California	18	39,260	14	30,494	78
Recreational discard mortality	n/a	n/a	3	5,891	n/a
Subsistence[1]	15	32,200	15	32,200	100
Non-directed commercial discard mortality (O26)[1]	45	100,000	42	93,000	93
IPHC fishery-independent setline survey and research[2]	n/a	n/a	6	12,303	n/a
Non-directed commercial discard mortality (U26)	0	0	2	4,000	n/a

continued….

Table 2 continued. 2021 estimates of total removals (net weight), including fishery limits and mortality projections of Pacific halibut by IPHC Regulatory Area.

IPHC Regulatory Area	Fishery limit or Mortality projection		Mortality (net weight)		Percent
	Tonnes (t)	Pounds (lb)	Tonnes (t)	Pounds (lb)	%
USA – Area 2C (southeastern Alaska)	2,631	5,800,000	2,859	6,302,386	109
Directed commercial fishery landings	1,601	3,530,000	1,511	3,331,367	94
Directed commercial discard mortality	32	70,000	61	135,000	193
Metlakatla (Annette Island Reserve)	n/a	n/a	12	27,391	n/a
Guided recreational fishery	367	810,000	508	1,119,116	142
Guided recreational discard mortality[3]	n/a	n/a	16	34,746	n/a
Guided recreational fishery (GAF) [1]	n/a	n/a	35	76,529	n/a
Unguided recreational fishery[1]	426	940,000	486	1,071,000	116
Unguided recreational discard mortality[3]	n/a	n/a	8	17,653	n/a
Subsistence[1]	168	370,000	132	290,137	78
Non-directed commercial discard mortality (O26)[1]	41	90,000	26	58,000	64
IPHC fishery-independent setline survey and research[2]	n/a	n/a	64	141,447	n/a
Non-directed commercial discard mortality (U26)	0	0	0	0	n/a
USA – Area 3A (central Gulf of Alaska)	6,350	14,000,000	6,314	13,920,562	99
Directed commercial fishery landings	4,060	8,950,000	3,946	8,700,063	97
Directed commercial discard mortality	109	240,000	176	387,000	161
Guided recreational fishery	885	1,950,000	1,105	2,436,437	126
Guided recreational discard mortality[3]	n/a	n/a	8	17,608	n/a
Guided recreational fishery (GAF)	n/a	n/a	2	3,377	n/a
Unguided recreational fishery[1]	694	1,530,000	704	1,552,032	103
Unguided recreational discard mortality[3]	n/a	n/a	11	25,061	n/a
Subsistence[1]	86	190,000	80	176,993	93
Non-directed commercial discard mortality (O26)[1]	517	1,140,000	114	251,000	22
IPHC fishery-independent setline survey and research[2]	n/a	n/a	168	370,991	n/a
Non-directed commercial discard mortality (U26)	132	290,000	65	144,000	50
USA – Area 3B (western Gulf of Alaska)	1,415	3,120,000	1,332	2,936,818	94
Directed commercial fishery landings	1,161	2,560,000	1,101	2,426,380	95
Directed commercial discard mortality[1]	50	110,000	63	139,000	126
Recreational fishery[1]	5	10,000	3	6,432	64
Recreational discard mortality	n/a	n/a	0	0	n/a
Subsistence[1]	9	20,000	6	13,861	69
Non-directed commercial discard mortality (O26)[1]	191	420,000	117	258,000	61
IPHC fishery-independent setline survey and research[2]	n/a	n/a	42	93,145	n/a
Non-directed commercial discard mortality (U26)	27	60,000	30	67,000	112
USA – Area 4A (eastern Aleutians)	930	2,050,000	747	1,646,075	80
Directed commercial fishery landings	753	1,660,000	617	1,359,871	82
Directed commercial discard mortality[1]	54	120,000	24	53,000	44
Recreational fishery[1]	9	20,000	5	10,829	54
Recreational discard mortality	n/a	n/a	0	0	n/a
Subsistence[1]	5	10,000	5	12,118	121
Non-directed commercial discard mortality (O26)[1]	109	240,000	82	180,000	75
IPHC fishery-independent setline survey and research[2]	n/a	n/a	14	30,257	n/a
Non-directed commercial discard mortality (U26)	36	80,000	34	74,000	93

continued….

Table 2 continued. 2021 estimates of total removals (net weight), including fishery limits and mortality projections of Pacific halibut by IPHC Regulatory Area.

IPHC Regulatory Area	Fishery limit or Mortality projection		Mortality (net weight)		Percent
	Tonnes (t)	Pounds (lb)	Tonnes (t)	Pounds (lb)	%
USA – Area 4B (central/western Aleutians)	635	1,400,000	441	972,624	69
Directed commercial fishery landings	558	1,230,000	363	799,516	65
Directed commercial discard mortality[1]	23	50,000	15	32,000	64
Recreational fishery[1]	0	0	0	0	n/a
Recreational discard mortality	0	0	0	0	n/a
Subsistence[1]	0	0	<1	987	n/a
Non-directed commercial discard mortality (O26)[1]	54	120,000	53	116,000	97
IPHC fishery-independent setline survey and research[2]	n/a	n/a	11	24,121	n/a
Non-directed commercial discard mortality (U26)	5	10,000	5	12,000	120
USA – Area 4CDE and Closed (Bering Sea)	1,805	3,980,000	1,315	2,899,452	73
Directed commercial fishery landings	758	1,670,000	647	1,425,440	85
Directed commercial discard mortality[1]	36	80,000	11	25,000	31
Recreational fishery[1]	0	0	0	0	n/a
Recreational discard mortality	0	0	0	0	n/a
Subsistence[1]	14	30,000	18	38,830	129
Non-directed commercial discard mortality (O26)[1]	998	2,200,000	636	1,403,000	64
IPHC fishery-independent setline survey and research[2]	n/a	n/a	3	7,182	n/a
Non-directed commercial discard mortality (U26)	354	780,000	275	606,000	78
Totals	17,690	39,000,000	17,104	37,707,087	97
Directed commercial fishery landings	12,052	26,570,000	11,219	24,734,535	93
Recreational fishery	3,098	6,830,000	3,469	7,647,510	112
Subsistence[1]	476	1,050,000	440	970,126	92
Non-directed commercial discard mortality (O26)[1]	2,059	4,540,000	1,176	2,592,000	57
IPHC fishery-independent setline survey and research[2]	n/a	n/a	373	822,916	n/a
Non-directed commercial discard mortality (U26)	567	1,250,000	426	940,000	75

[1] 'Fishery projection' is value from 2020 estimates which were used in setting the TCEY for each IPHC Regulatory Area.

[2] Includes U32 Pacific halibut landed during FISS.

[3] Limit included in limit listed above.

n/a = not available
XRQ = Experimental Quota leased from commercial quota.
GAF = Guided Angler Fish leased from commercial quota.

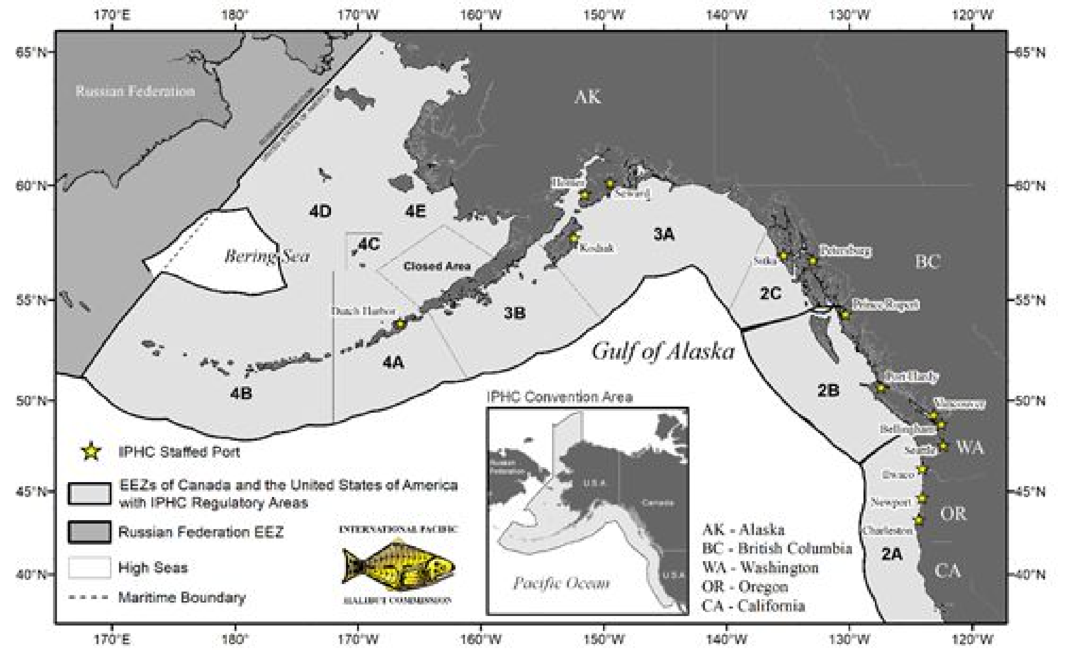

Figure 2. Map of the IPHC Convention Area (insert) and IPHC Regulatory Areas.

DEFINITIONS

Directed commercial fisheries: include commercial landings and discard mortality. Directed 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.

Non-directed commercial discard mortality: 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 directed commercial fisheries span from northern California through to northern and western Alaska in USA and Canadian waters of the northeastern Pacific Ocean. The IPHC sets annual limits for the retention 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 directed 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 directed 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 2021 landing and discard mortality data presented in this document are preliminary.

Directed 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 6 March and will close at 12 noon local time on 7 December (Table 3). The IPHC Regulatory Area 2A directed commercial fisheries, including the treaty Indian commercial fisheries, occurred during the same calendar period (6 March to 7 December 2021). For IPHC Regulatory Area 2A, the potential of 58-hour fishing periods every two weeks beginning on the fourth Tuesday in June for the non-treaty directed commercial fishery were adopted. Fishing periods began on the Tuesday at 0800 and ended on the Thursday at 1800 local time (58-hours), were further restricted by fishing period limits, and closed for the remainder of the year after the third opening on 22 July when the IPHC Regulatory Area 2A directed commercial non-treaty fishery allocation was estimated to have been reached.

Table 3. Fishing periods for directed commercial Pacific halibut fisheries by IPHC Regulatory Area, 2012-21.

IPHC Regulatory Area	Year									
	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012
Canada: 2B	6 Mar– 7 Dec (276)	14 Mar- 7 Dec (268)	15 Mar- 14 Nov (244)	24 Mar– 7 Nov (228)	11 Mar– 7 Nov (241)	19 Mar– 7 Nov (233)	14 Mar–7 Nov (238)	8 Mar–7 Nov (244)	23 Mar–7 Nov (230)	17 Mar–7 Nov (236)
USA: 2A Treaty Indian	6 Mar-16 May (55 h) (Unrestricted) 6 Mar-16 May (102 h) (Restricted) 16 May-20 Jun (24 h)	14 Mar-30 Sept (55 h) (Unrestricted) 14 Mar-30 Sep (222 h) (Restricted) 5 Oct -18 Oct (800 lb per calendar day per vessel)	15 Mar-15 May (55 h) (Unrestricted) 15 Mar-15 May (84 h) 20 May-15 Jun (72 h) (Restricted) 11 Jun-24 Jul (~327 lb per tribe)	24 Mar – 28 Apr (36 h) 24 Mar – 28 Apr (37 h) 4 May – 23 May (30 h)	20 Mar, 15-16 Apr 1-2 May 19-20 May, 22-23 May 18-19 Jun 21-22 Jul	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	16-18 Mar (48 h) 1-2 Apr	11-13 Mar (48 h) 20-21Mar, 8May 8 May	23-25 Mar (48 h) 2-4 Apr, 15-16 Apr, 8 May, 6 Jun, 13 Jul, 20 Jul, 3 Aug	24-26 Mar (2) 1 May (13 h) 17-19 Mar (55 h)
USA: 2A Commercial Directed	22-24 Jun 6-8 Jul 20-22 Jul (58 h each)	22-24 Jun 6-8 Jul 20-22 Jul 3-5 Aug 17-19 Aug (58 h each)	26 Jun 10 Jul 24 Jul (10 h each)	27 Jun 11 Jul 25 Jul (10 h each)	28 Jun 12 Jul 26 Jul (10 h each)	22 Jun 6 Jul 20 Jul (10 h each)	24 Jun 8 Jul (10 h each)	25 Jun 9 Jul (10 h each)	26 Jun 10 Jul (10 h each)	27 Jun 11 Jul (10 h each)
USA: 2A Commercial Incidental	Salmon 1 Apr – 7 Dec (251) Sablefish 1 Apr – 7 Dec (213)	Salmon 15 Apr–30 Sep (WA – 168) 15 Apr–31 Oct (OR - 199) 1 Aug–30 Sep (CA - 60) Sablefish 1 Apr – 15 Nov (228)	Salmon 20 Apr - 30 Sep (WA, CA - 163) 20 Apr - 31 Oct (OR - 194) Sablefish 1 Apr- 31 Oct (213)	Salmon 24 Mar - 8 Aug (137) Sablefish 24 Mar – 7 Nov (228)	Salmon 1 Apr–3 Aug (124) Sablefish 1 Apr– 31 Oct (213)	Salmon 1 Apr – 31 Oct (213) Sablefish 1 Apr – 31 Oct (213)	Salmon 1 Apr–21 Aug (142) Sablefish 1 Apr– 31 Aug (152)	Salmon 1 Apr–11 Sep (163) Sablefish 1 Apr– 31 Oct (213)	Salmon 1 May–10 Aug (101) Sablefish 1 May– 31 Oct (184)	Salmon 1 May – 3 Jul (64) Sablefish 1 May– 31 Oct (184)
USA: Alaska (2C, 3A, 3B, 4A, 4B, 4CDE)	6 Mar– 7 Dec (276)	14 Mar- 15 Nov (246)	15 Mar- 14 Nov (244)	24 Mar– 7 Nov (228)	11 Mar– 7 Nov (241)	19 Mar–7 Nov (233)	14 Mar–7 Nov (238)	8 Mar–7 Nov (244)	23 Mar–7 Nov (230)	17 Mar–7 Nov (236)

Directed Commercial Landings

Directed commercial landings and fishery limits by IPHC Regulatory Area for the 2021 fishing season are shown in Table 2. Directed commercial fishery limit, as referred to here, is the IPHC commercial fishery limit set by the Contracting Parties following the IPHC 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, the Use of Fish allocation are not presented. Historical landings and fishery limits are available on the IPHC website (https://www.iphc.int/data).

The 2021 directed commercial fishery landings were spread over ten months of the year in Canada and the USA (Table 4). On a month-to-month comparison, April 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 (16%) from Alaska, USA. A year-to-date visualization is also available on the IPHC website: https://www.iphc.int/data/year-to-date-directed-commercial-landing-patterns-ak-and-bc

Table 4. 2021 directed commercial landings (tonnes, net weight, preliminary) of Pacific halibut for Alaska, USA and British Columbia, Canada by IQ fisheries,IPHC Regulatory Area and month.

IPHC Regulatory Area	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov/Dec	Total
2B[1]	345	384	258	235	338	226	189	111	106	2,191
2C[2]	155	222	250	196	105	155	202	115	110	1,511
3A[2]	216	425	766	518	387	472	470	444	249	3,946
3B[2]	17	61	133	196	115	167	154	161	96	1,101
4A[2]		-	31[3]	26	107	169	146	81	57	617
4B[2]		-	93[3]	-	108[3]	-	-	132[3]	29	363
4CDE[2]		-	6	15	93	210	167	118	38	647
Alaska, USA Total	388	708	1,280	950	915	1,174	1,140	1,051	579	8,184
Grand Total	733	1,091	1,537	1,185	1,253	1,400	1,329	1,163	684	10,375

[1] Based on landings from DFO Fishery Operations System (FOS).
[2] Based on landings from NOAA Fisheries Restricted Access Management (RAM) Program.
[3] Weight combined with the previous month(s) for confidentiality purposes.

Canada – IPHC Regulatory Area 2B (British Columbia)

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 144 in 2021. In addition, Pacific halibut can be landed as incidental catch in other licensed groundfish fisheries. Therefore, Pacific halibut was landed from a total of 206 active licences in 2021, with 62 of these licences from other fisheries. The 2021 directed commercial landings represented 2,191 tonnes (4,830,396 pounds) of Pacific halibut (Table 2).

Directed commercial trips from IPHC Regulatory Area 2B were delivered into 11 different ports in 2021. The ports of Port Hardy (including Coal Harbour and Port McNeill) and Prince Rupert/Port Edward were the major landing locations, receiving 94% of the commercial landings. Port Hardy received 46% while Prince Rupert received 48% of the directed commercial landings. All of the IVQ landings were landed in IPHC Regulatory Area 2B. Only Canadian vessels landed frozen, head-off Pacific halibut in 2021: 41 landings (23 tonnes; 51,373 net lb) reported frozen-at-sea head-off product from 18 vessels.

According to logbook data, less than 0.03% by weight of Pacific halibut were caught with pot gear and landed within the directed commercial fishery in IPHC Regulatory Area 2B.

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

The 2021 IPHC Regulatory Area 2A fisheries and respective fishery limits are listed in Table 2. The total IPHC Regulatory Area 2A directed commercial landings of 368 tonnes (811,000 pounds) are 7% below the fishery limit. The total non-treaty directed commercial landings of 110 tonnes (242,997 pounds) were 5% under the fishery limit of 116 tonnes (256,122 pounds) after three 58-hour openers. The fishing period limits by vessel size class for each opening in 2021 are listed in Table 5.

The salmon troll fishery season began on 1 April with an allowable incidental landing ratio of one Pacific halibut per two Chinook (*Oncorhynchus tshawytscha*), plus an "extra" Pacific halibut per landing, and a vessel trip limit of 35 fish. On 1 July, the fishery was extended at the same ratio and landing limit. Total landings of 8 tonnes (18,562 pounds) are 59% under the fishery limit (21 tonnes (45,198 pounds)).

Incidental Pacific halibut retention during the limited-entry sablefish (*Anoplopoma fimbria*) fishery remains open from 1 April to 31 December. Beginning 1 April, the allowable landing ratio was 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. Beginning 1 June, the allowable landing ratio was 0.10 tonnes (225 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 29 tonnes (63,656 pounds) were 9% under the fishery limit (32 tonnes (70,000 pounds)).

In IPHC Regulatory Area 2A, north of Point Chehalis (46°53.30´ N. latitude), the treaty Indian tribes manage the directed commercial landings for three fisheries under a Memorandum of Understanding among the 13 tribes. These consist of an unrestricted fishery, a restricted fishery with trip limits, and a late season fishery. These fisheries are subject to in-season management. There was one unrestricted, open access fishery, not to exceed 55 hours from 6 March to 16 May and one restricted fishery not to exceed 102 hours and 5 total calendar days of fishing, including a vessel per day limit of 0.23 tonnes (500 pounds) from 6 March to 16 May. A final fishery not to exceed 24 hours was open from 19 May to 20 June. Estimated total landings, of 220 tonnes (485,896 pounds), were 2% under the fishery limit (225 tonnes (496,300 pounds)).

Table 5. The fishing periods and limits (tonnes, dressed, head-on with ice/slime) by vessel class used in the 2021 directed commercial fishery in IPHC Regulatory Area 2A.

Vessel Class		Fishing Period (dates) & Limits (t)		
Letter	**Feet**	**22-24 June**	**6-8 July**	**20-22 July**
A, B and C	1-35	1.03	1.03	1.03
D and E	36-45	1.55	1.55	1.55
F and G	46-55	2.06	2.06	2.06
H	56+	2.32	2.32	2.32

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

In Alaska, USA, the National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) Restricted Access Management (RAM) Program 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 2021, RAM reported that 2,280 persons/entities held QS.

The total 2021 landings from the IFQ/CDQ Pacific halibut fishery for the waters off Alaska, USA were 8,184 tonnes (18,043,000 pounds), 8% under the fishery limit (Table 2). By IPHC Regulatory Area, the landings were under the fishery limit by 6% for Area 2C, 3% for Area 3A, 5% for Area 3B, 18% for Area 4A, 35% for Area 4B, and 15% for 4CDE/Closed (Table 2).

Homer received approximately 19% (1,522 tonnes (3,355,000 pounds)) of the directed commercial landings of Alaskan catch making it the port that received the greatest number of pounds thus far in 2021. Seward received the second and Kodiak the third largest landing volume at 11% (932 tonnes (2,055,000 pounds)) and 9% (765 tonnes (1,686,000 pounds)) of the Alaskan commercial landings, respectively. In Southeast Alaska, the two largest landing volumes were received in Sitka (579 tonnes (1,276,000 pounds)) and Juneau (569 tonnes (1,254,000 pounds)), and their combined landings represented 14% of the directed commercial Alaskan landings. The Alaskan QS catch that was landed outside of Alaska, USA was 2%.

In Alaska, 37 tonnes (81,797 pounds) of Pacific halibut were caught with pot gear and landed within the directed commercial fishery representing 0.5% of the total Alaska landings.

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 eight two-day openings between 12 March and 26 September for total landings of 12 tonnes (27,391 pounds). The fishery closed on 30 September.

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 fishery-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 2.

RECREATIONAL FISHERIES

The 2021 recreational removals of Pacific halibut, including discard mortality, was estimated at 3,469 tonnes (7,647,510 pounds). 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 2. Historical recreational removals are also available at the IPHC website: https://www.iphc.int/data/datatest/pacific-halibut-recreational-fisheries-data

Recreational Landings

Canada – IPHC Regulatory Area 2B (British Columbia)

IPHC Regulatory Area 2B operated under a 126 cm (49.6 inch) maximum size limit and one Pacific halibut had to be between 90 – 126 cm (35.4 - 49.6 inches) or both under 90 cm (35.4 inch) when attaining the two fish possession limit with an annual limit of six per licence holder. On 1 April, the maximum size limit was increased to 133 cm (53.4 inch) and one Pacific halibut to be between 90 – 133 cm (35.4 – 53.4 inches) or both under 90 cm (35.4 inch) when attaining the two fish possession limit with an annual limit of ten per licence holder. The IPHC Regulatory

Area 2B recreational harvest was 11% under the recreational fishery limit at 372 tonnes (820,000 pounds).

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

The 2021 IPHC Regulatory Area 2A recreational allocation was 277 tonnes (610,180 pounds) net weight and based on the Pacific Fishery Management Council's Catch Sharing Plan formula, which divides the overall fishery limit among all sectors. The recreational allocation was further subdivided to seven subareas, after 32 tonnes (70,000 pounds) were allocated to the incidental Pacific halibut catch in the commercial sablefish fishery in Washington. This subdivision resulted in 127 tonnes (279,414 pounds) being allocated to Washington subareas, 132 tonnes (291,506 pounds) to Oregon subareas. In addition, California received an allocation of 18 tonnes (39,260 pounds). The IPHC Regulatory Area 2A recreational harvest totaled 186 tonnes (410,340 pounds), 33% under the recreational fishery limit. Recreational fishery harvest seasons by subareas varied and were managed inseason with fisheries opening on 1 May.

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

A reverse slot limit allowing for the retention of Pacific halibut, if ≤ 127.0 cm (50 inches) or ≥ 182.9 cm (72 inches) in total length, was in place for the charter fishery in IPHC Regulatory Area 2C. In IPHC Regulatory Area 3A, charter anglers were allowed to retain two fish per day, but only one could exceed 81.3 cm (32 inches) in length, with a recording requirement. A possession limit equaled to 2 daily bag limits with no annual limit. One trip per calendar day per charter permit was allowed, with no charter retention of Pacific halibut on Wednesdays.

The Contracting Party agencies in Alaska (USA) have a program that allow recreational harvesters to land fish that is leased from commercial fishery quota shareholders for the current season.

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 both Contracting Parties and are provided in Table 2.

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 2021 is 440 tonnes (970,126 pounds) (Table 2). Historical subsistence removals are also available at the IPHC website: https://www.iphc.int/datatest/subsistence-fisheries

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. It is estimated that 15 tonnes (32,200 pounds) were retained as C&S. A revised estimate of the 2021 removals will be provided at the end of the year and may be higher than previous years due to an increased usage for food security as a result of the COVID-19 pandemic.

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 tonnes (300,000 pounds) annually until 2006, and since 2007, the yearly estimate has been provided as 184 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. A voluntary survey of fishers is conducted by mail or phone, with some onsite visits. Beginning in 2018, this survey is conducted on a biannual schedule, rather than annually. The 2020 estimate has been carried forward for 2021.

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 2021 removals were received from three CDQ management organizations: Bristol Bay Economic Development Corporation (BBEDC), Norton Sound Economic Development Corporation (NSEDC) and Coastal Villages Regional Fund (CVRF), with CVRF reporting no removals.

<u>CDQ - Bristol Bay Economic Development Corporation (BBEDC)</u>

BBEDC requires their fishers to record the lengths of retained U32 Pacific halibut in a separate log, which are then 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 primarily in Togiak and

Dillingham in a lesser amount. A small amount was landed equally in Naknek and King Salmon. BBEDC reported 13 harvesters landed 158 U32 Pacific halibut (<1 tonne; 1,641 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. The fish were not washed nor were the heads removed. The U32 Pacific halibut were then returned to the harvester. NSEDC reported 54 U32 Pacific halibut weighing <1 tonne (466 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. All removals for 2021 are available in Table 2. Historical data are also available on the IPHC website: https://www.iphc.int/data/datatest/non-directed-commercial-discard-mortality-fisheries

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 Contracting Party 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. Trawl fisheries off British Columbia, Canada are monitored, and non-directed commercial discard mortality information is provided to IPHC by DFO. 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. A breakout of these removals by IPHC Regulatory Area and year is available on the IPHC website: https://www.iphc.int/data/datatest/non-directed-commercial-discard-mortality-fisheries.

Non-directed Commercial Discard Mortality by Area

Canada – IPHC Regulatory Area 2B (British Columbia)

In Canada, Pacific halibut non-directed commercial discard mortality in trawl fisheries are capped at 454 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.

USA – IPHC Regulatory Area 2A (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.

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

Groundfish fisheries in Alaska are managed by NOAA Fisheries, following advice and recommendations developed by the North Pacific Fishery Management Council. Non-directed commercial discard mortality projected estimates for Alaskan areas are provided by NOAA Fisheries.

IPHC Regulatory Area 2C (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 (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. 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 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 (Bering Sea and Aleutian Islands)

The Pacific cod fishery, which is conducted in the late winter/early spring and late summer, is the major contributor to Pacific halibut non-directed commercial discard mortality in IPHC Regulatory Area 4. 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 are very selective. Non-directed commercial discard mortality rates are quite low, and survival is relatively high. Annual non-directed commercial discard mortality estimates are typically low, usually less than 7 tonnes.

Within the Bering Sea, non-directed commercial discard mortality estimates have typically been the highest in IPHC Regulatory Area 4CDE (Table 2). 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

Approximately 373 tonnes (822,916 pounds) of Pacific halibut were landed from the FISS and other research in 2021 with the amount landed from each IPHC Regulatory Area documented in Table 2.

RECOMMENDATION

That the Commission **NOTE** paper IPHC-2021-IM097-06 Rev_1 which provides an overview of the key fisheries data regarding Pacific halibut removals from fisheries catching Pacific halibut during 2021, including the status of landings compared to fishery limits implemented by the Contracting Parties of the Commission.

IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2021

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PURPOSE

To provide Commissioners with a summary of the IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2021.

BACKGROUND

The annual IPHC Fishery-Independent Setline Survey (FISS) of the Pacific halibut stock was augmented from 2014-2019 with expansion stations that filled in gaps in coverage in the annual FISS. Prior to 2020, the standard grid of stations comprised 1,200 stations. Following the completion in 2019, expansion stations were added to the standard grid in all IPHC Regulatory Areas, now totaling 1,890 stations for the full FISS design (Fig. 1), within the prescribed depth range of 18 to 732 metres (10 to 400 fathoms).

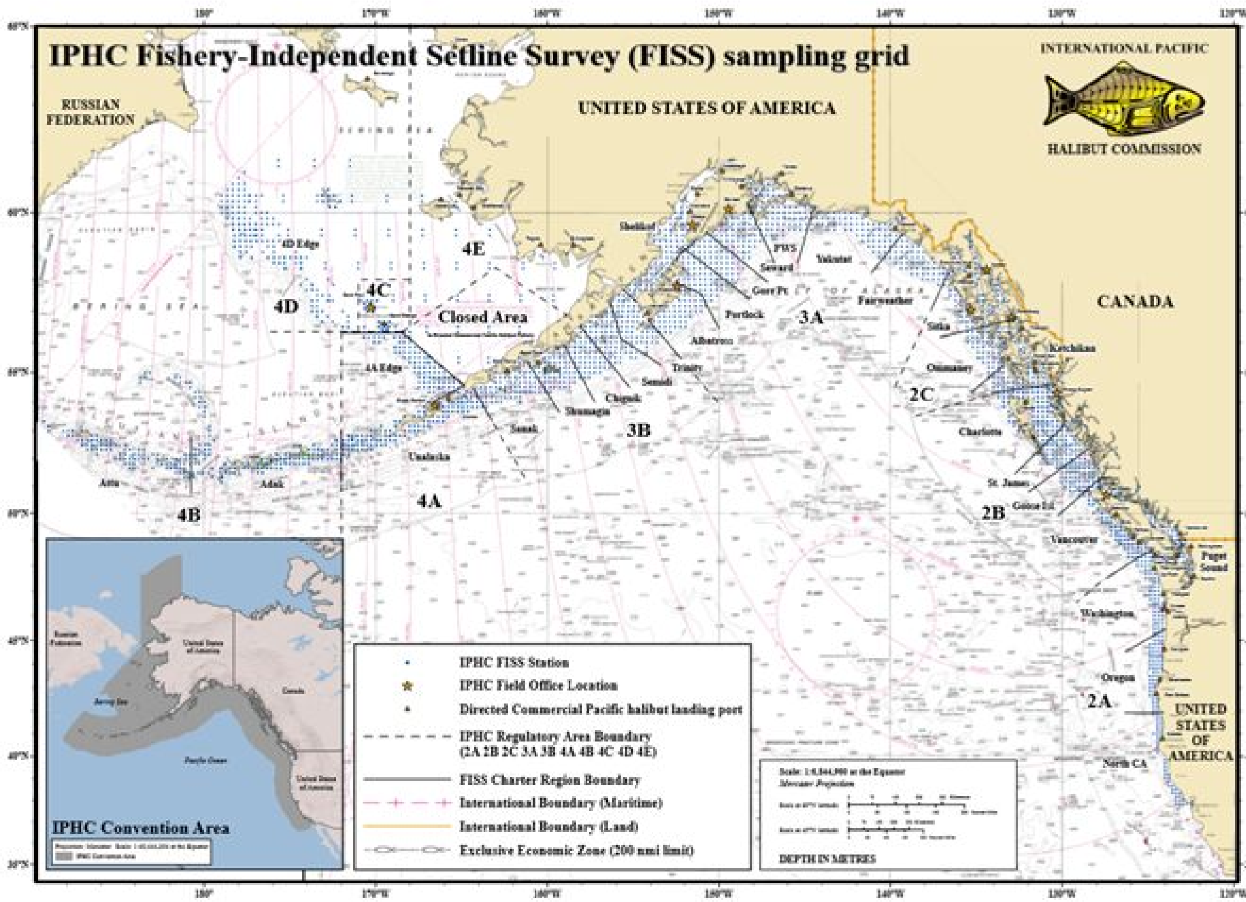

Figure 1. IPHC Fishery-Independent Setline Survey (FISS) with full sampling grid shown.

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 with this work being done in 2019, 2020, and again in 2021.

Beginning in 2019, individual weight data were collected coastwide from Pacific halibut caught on the FISS to eliminate questions that have arisen regarding the accuracy of estimates that depend on these weights, including weight per unit effort (WPUE) indices of density. Data from IPHC collections from commercial landings and other sources had provided evidence that the current standard length-net weight curve used for estimating Pacific halibut weights on the FISS may have been over-estimating weights on average in most IPHC Regulatory Areas, and that the relationship between weight and length may vary spatially.

2021 FISS design

At the 9th Special Session of the Commission (SS09), the Commission recommended a FISS design for 2021 that included 1,346 stations coastwide (Fig. 2). The design comprised sampling of subareas within IPHC Regulatory Areas 2A, 4A, and 4B intended to reduce potential bias (relative to historical observed changes year-to-year) and to achieve a level of precision comparable to or better than recent setline surveys. 2021 sampling in IPHC Regulatory Areas 2B (except inside waters), and 3B included random subsampling from the full design to provide for unbiased estimates, while increasing precision relative to recent setline surveys. Sampling in IPHC Regulatory Area 4CDE included 100% of the full FISS design.

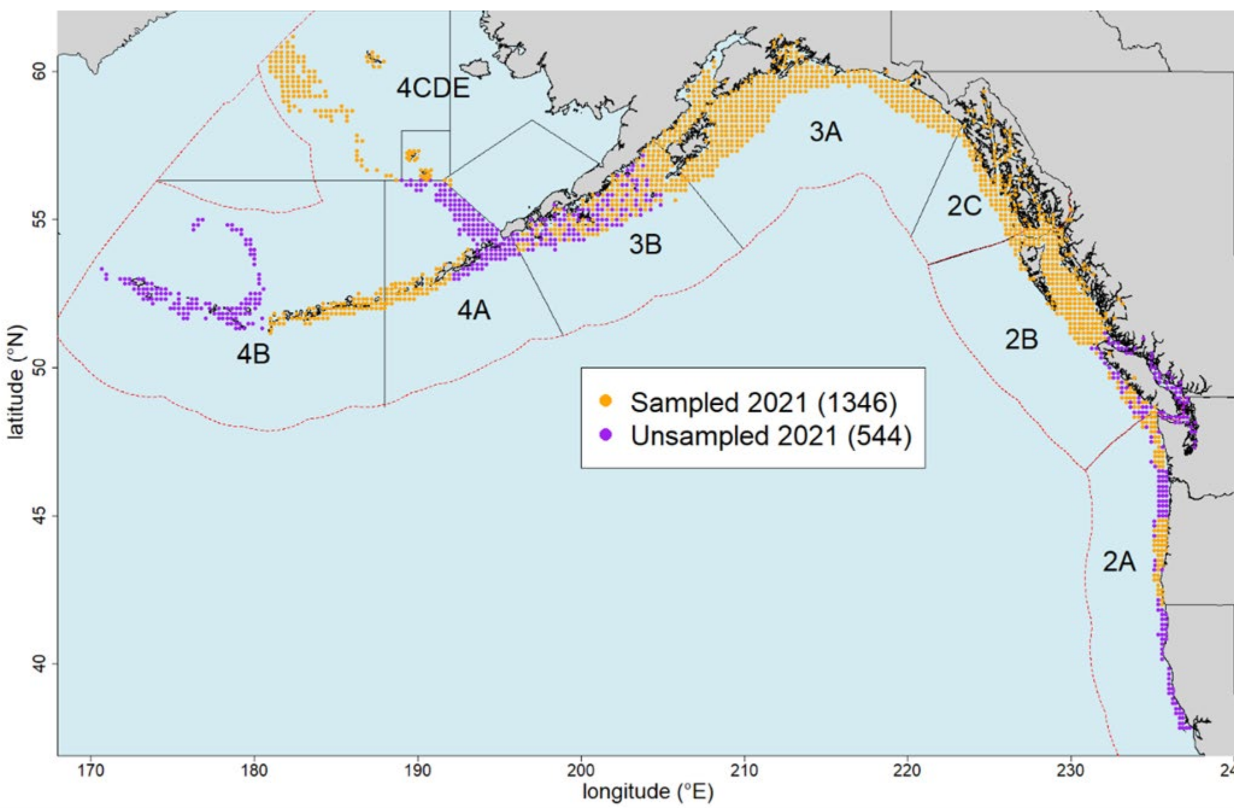

Figure 2. Map of the 2021 FISS design endorsed by the Commission on 8 December 2020 (IPHC-2020-SS09-R). Purple circles were not sampled in 2021.

MATERIALS AND METHODS

The IPHC's FISS design encompasses nearshore and offshore waters of the IPHC Convention Area (Fig. 1). The IPHC Regulatory Areas are divided into 29 charter regions, each requiring between 10 and 46 charter days to complete. FISS stations are located at the intersections of a 10 nmi by 10 nmi square grid within the depth range occupied by Pacific halibut during summer months (18 – 732 m [10 – 400 fm]). Figure 2 depicts the 2021 FISS station positions, and IPHC Regulatory Areas.

Fishing vessels are chosen through a competitive bid process where up to four (4) charter regions per vessel may be awarded and typically 10-15 vessels are chosen. In 2021, the process has been clearly documented on the IPHC website for accountability and transparency purposes: https://www.iphc.int/management/science-and-research/fishery-independent-setline-survey-fiss/62-fiss-vessel-recruiting.

In 2021, 13 vessels were chartered to complete the FISS, as detailed in Media Release 2021-019: Notification of IPHC Fishery-Independent Setline Survey (FISS) 2021 Contract Awards.

Sampling protocols - 2021

IPHC Setline Survey Specialists (Field) collected data according to protocols established in the 2021 FISS Sampling Manual (IPHC-2021-VSM01).

Sampling challenges - 2021

Of the 1,346 FISS stations planned for the 2021 FISS season, 1,167 (87%) were effectively sampled.

Not sampled: A total of 128 planned stations were not sampled in 2021. 75 of the 140 stations planned for Area 4CDE were not completed in 2021 due to mechanical issues and crew challenges aboard the vessel completing this area. In Adak, 36 of the 73 planned stations were not completed due to significant technological issues aboard the vessel. In Unalaska, the vessel faced several instances of lost gear and other logistical challenges at the end of the season, leaving 11 stations not sampled. In Yakutat, the presence of sea ice restricted the vessel's access and resulted in three (3) stations not being sampled and stations located in the Marine Protected Areas of IPHC charter regions St James and Charlotte prevented three (3) stations from being sampled.

Ineffective stations: Coastwide, fifty-nine (59) stations were deemed ineffective due to whale depredation (n=43), pinniped predation (n=1), gear soak time (n=3), shark predation (n=3), sand flea activity (n=2), station moved > 3nmi (n=1), and setting and gear issues (n=6).

Fixed versus Snap Gear comparison

A third comparison of the use of snap gear to the use of fixed gear on the FISS was conducted in IPHC Regulatory Area 3A (Seward charter region) in 2021 (Fig. 3). The design again featured each station being fished twice, once with fixed gear and once with snap gear. 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, and move the FISS closer to accommodating both data sources into its annual design in the near future.

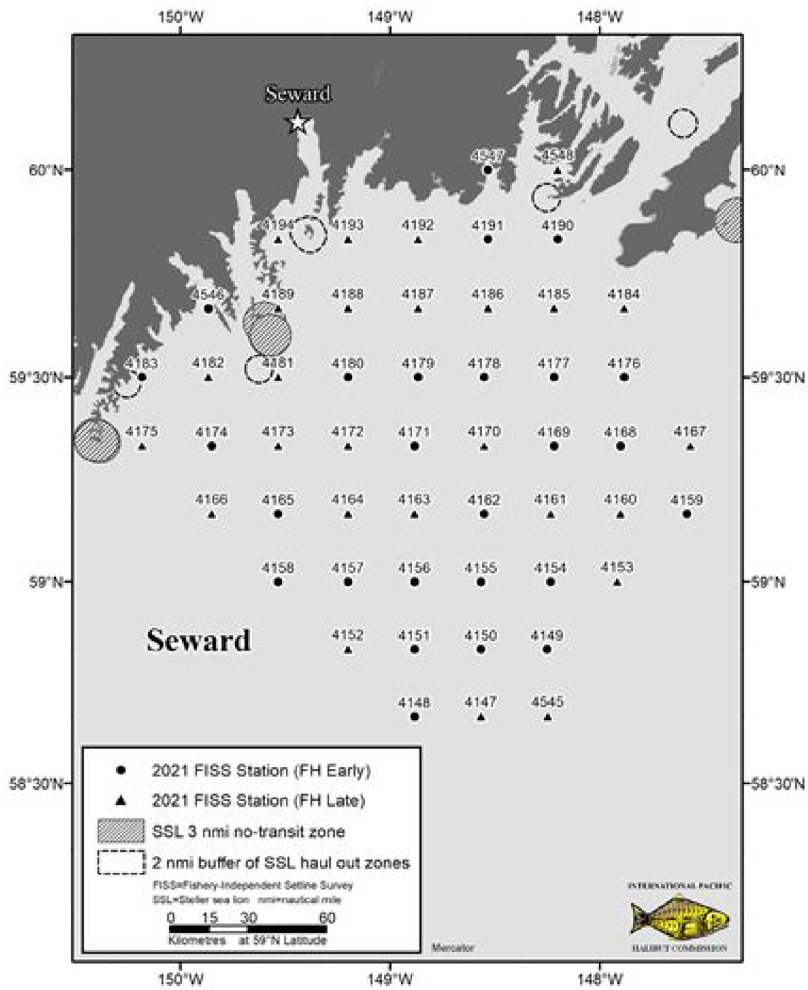

Figure 3. IPHC Fishery-Independent Setline Survey fixed-hook/snap gear comparison stations in the Seward region of IPHC Regulatory Area 3A. Early Fixed Hook stations equate to late Snap Gear stations and late Fixed Hook stations to early Snap Gear stations.

Bait (Chum salmon)

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. Bait usage is based on 0.17 kilograms (0.37 pounds) per hook resulting in approximately 136 kilograms (300 pounds) per eight skate station. Bait quality was monitored and documented throughout the season and found to meet the standard as described above.

Pre-season: In October 2020 (IPHC Media Release 2020-031), the Secretariat made pre-season bait purchases of approximately 90 tonnes (200,000 lbs) to ensure a smooth start to the 2021 FISS, and to take advantage of advance purchase prices.

In-season: In March 2021 the Secretariat made an in-season bait RFT (IPHC Media Release 2021-013) for approximately 77 tonnes (170,000 lbs) of bait, to supplement pre-season purchases and complete the 2021 FISS successfully.

RESULTS

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

https://www.iphc.int/data/setline-survey-catch-per-unit-effort
(published 29 October 2021)

As in previous years, legal-sized (O32) Pacific halibut that were caught on FISS stations and sacrificed in order to obtain biological data were retained and sold. In addition, beginning in 2020, sub-legal (U32) Pacific halibut that were caught and randomly selected for otolith sampling were also retained and sold. This helps to offset costs of the FISS. 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 2021 FISS chartered 13 commercial longline vessels (four Canadian and nine USA) during a combined 82 trips and 801 charter days (Tables 1). Otoliths were removed from 13,258 fish coastwide. Approximately 373 tonnes (823,000 pounds) of Pacific halibut, 33 tonnes (73,600 pounds) of Pacific cod, and 40 tonnes (87,250 pounds) of rockfish were landed from the FISS stations.

Table 1a. Effort and landing summary by FISS charter region and vessel for all 2021 stations and all Pacific halibut (sampled U32 and all O32).

IPHC Regulatory Area	Charter Region	Vessel	Vessel Number[1]	Charter Days[2]	Planned Stations	Effective Stations[3]	Pacific halibut Sold (t) [4]	Pacific halibut Sold (lb)[4]	Average Price USD/kg[5]	Average Price USD/lb[5]
2A	Oregon	*Pacific Surveyor*	947061	25	43	42	2	5,161	$11.94	$5.41
2A	Washington	*Pacific Surveyor*	947061	20	37	34	3	7,142	$11.06	$5.02
2B	Charlotte	*Vanisle*	21912	51	89	86	30	65,460	$18.01	$8.17
2B	Goose Island	*Vanisle*	21912	42	57	56	17	36,725	$17.87	$8.11
2B	St. James	*Pender Isle*	27282	34	60	59	17	37,493	$17.68	$8.02
2B	Vancouver	*Pender isle*	27282	14	29	29	2	3,792	$16.45	$7.46
2C	Ketchikan	*Bold Pursuit*	99997	26	43	43	16	34,885	$15.35	$6.96
2C	Ommaney	*Star Wars II*	99997	31	52	49	24	52,600	$14.41	$6.54
2C	Sitka	*Bold Pursuit*	27282	31	52	49	24	53,962	$14.66	$6.65
3A	Albatross	*Predator*	33133	26	49	46	22	47,980	$13.54	$6.14
3A	Fairweather	*Bold Pursuit*	99997	24	51	40	12	26,632	$14.35	$6.51
3A	Gore Point	*Kema Sue*	41033	26	48	47	13	28,642	$15.04	$6.82
3A	Portlock	*Kema Sue*	41033	33	51	49	19	42,168	$15.72	$7.13
3A	PWS	*Star Wars II*	99997	44	67	65	22	47,709	$16.09	$7.39
3A	Seward	*Kema Sue*	41033	27	52	52	17	38,398	$16.30	$7.39
3A	Seward (Snap)	*Star Wars II*	99997	37	52	49	15	33,907	$16.15	$7.32
3A	Shelikof	*Devotion*	42892	38	64	62	25	54,414	$15.00	$6.80
3A	Yakutat	*Seymour*	17530	35	64	57	23	51,141	$15.85	$7.19
3B	Chignik	*Polaris*	19266	18	31	30	7	16,250	$13.79	$6.25

3B	Sanak	*Allstar*	55922	14	25	24	4	8,052	$11.46	$5.20
3B	Semidi	*Polaris*	19266	18	32	31	5	10,522	$13.84	$6.28
3B	Shumagin	*Allstar*	55922	23	30	30	7	14,502	$12.30	$5.58
3B	Trinity	*Allstar*	55922	32	56	52	20	43,819	$13.63	$6.18
4A	Unalaska	*Devotion*	42892	31	59	33	14	30,257	$11.73	$5.32
4B	Adak	*Norcoaster*	38137	53	73	37	11	24,121	$12.14	$5.51
4C	4CDE	*Grant*	19262	12	57	20	2	5,487	$11.84	$5.37
4D	4CDE	*Norcoaster*	38137	30	80	42	1	1,583	$11.60	$5.26
Closed Area	4CDE	*Grant*	19262	6	3	3	0	112	$11.84	$5.37
Total		**13 Vessels**		**801**	**1,406**	**1,216**	**373**	**822,916**	**$15.13**	**$6.86**

[1] Canada: Vessel Registration Number and USA: ADF&G vessel number.
[2] Days are estimated - some vessels fished two charter regions in one day.
[3] Stations that did not meet setting parameters or deemed ineffective are excluded.
[4] Net weight (head-off, dressed, washed). May not sum to correct total due to rounding.
[5] Ex-vessel price.

Table 1b. Effort and landing summary by FISS charter region and vessel for all 2021 stations and O32 Pacific halibut.

IPHC Regulatory Area	**Charter Region**	**Vessel**	**Vessel Number** [1]	**Charter Days**[2]	**Planned Stations**	**Effective Stations**[3]	**Pacific halibut Sold (t)** [4]	**Pacific halibut Sold (lb)**[4]	**Average Price USD/kg**[5]	**Average Price USD/lb**[5]
2A	Oregon	*Pacific Surveyor*	947061	25	43	42	2	4,131	$12.57	$5.70
2A	Washington	*Pacific Surveyor*	947061	20	37	34	2	5,272	$12.64	$5.73
2B	Charlotte	*Vanisle*	21912	51	89	86	29	63,954	$18.06	$8.19
2B	Goose Island	*Vanisle*	21912	42	57	56	16	35,251	$17.97	$8.15
2B	St. James	*Pender Isle*	27282	34	60	59	17	36,970	$17.72	$8.04
2B	Vancouver	*Pender isle*	27282	14	29	29	2	3,615	$16.51	$7.49
2C	Ketchikan	*Bold Pursuit*	99997	26	43	43	16	34,268	$15.36	$6.97
2C	Ommaney	*Star Wars II*	99997	31	52	49	23	51,170	$14.43	$6.55
2C	Sitka	*Bold Pursuit*	27282	31	52	49	24	52,334	$14.70	$6.67
3A	Albatross	*Predator*	33133	26	49	46	21	46,454	$13.55	$6.15
3A	Fairweather	*Bold Pursuit*	99997	24	51	40	12	26,228	$14.37	$6.52
3A	Gore Point	*Kema Sue*	41033	26	48	47	13	28,067	$15.05	$6.83
3A	Portlock	*Kema Sue*	41033	33	51	49	19	41,840	$15.74	$7.14
3A	PWS	*Star Wars II*	99997	44	67	65	21	47,373	$16.11	$7.31
3A	Seward	*Kema Sue*	41033	27	52	52	17	38,039	$16.30	$7.39
3A	Seward (Snap)	*Star Wars II*	99997	37	52	49	15	33,727	$16.15	$7.33
3A	Shelikof	*Devotion*	42892	38	64	62	24	53,331	$15.02	$6.81
3A	Yakutat	*Seymour*	17530	35	64	57	23	50,314	$15.87	$7.20
3B	Chignik	*Polaris*	19266	18	31	30	7	14,365	$13.81	$6.27
3B	Sanak	*Allstar*	55922	14	25	24	3	7,109	$11.54	$5.23
3B	Semidi	*Polaris*	19266	18	32	31	4	9,355	$13.88	$6.29
3B	Shumagin	*Allstar*	55922	23	30	30	6	12,910	$12.37	$5.61
3B	Trinity	*Allstar*	55922	32	56	52	19	42,028	$13.63	$6.18
4A	Unalaska	*Devotion*	42892	31	59	33	12	25,446	$11.94	$5.42

4B	Adak	*Norcoaster*	38137	53	73	37	10	22,177	$12.15	$5.51
4C	4CDE	*Grant*	19262	12	57	20	2	4,966	$12.05	$5.46
4D	4CDE	*Norcoaster*	38137	30	80	42	1	1,362	$12.05	$5.46
Closed Area	4CDE	*Grant*	19262	6	3	3	0	101	$12.05	$5.46
Total		**13 Vessels**		**801**	**1,406**	**1,216**	**359**	**792,157**	**$10.51**	**$6.91**

[1] Canada: Vessel Registration Number and USA: ADF&G vessel number.
[2] Days are estimated - some vessels fished two charter regions in one day.
[3] Stations that did not meet setting parameters or deemed ineffective are excluded.
[4] Net weight (head-off, dressed, washed). May not sum to correct total due to rounding.
[5] Ex-vessel price.

Table 1c. Effort and landing summary by FISS charter region and vessel for all 2021 stations and sampled U32 Pacific halibut.

IPHC Regulatory Area	Charter Region	Vessel	Vessel Number[1]	Charter Days[2]	Planned Stations	Effective Stations[3]	Pacific halibut Sold (t) [4]	Pacific halibut Sold (lb)[4]	Average Price USD/kg[5]	Average Price USD/lb[5]
2A	Oregon	*Pacific Surveyor*	947061	25	43	42	0	1,030	$9.41	$4.27
2A	Washington	*Pacific Surveyor*	947061	20	37	34	1	1,870	$6.61	$3.00
2B	Charlotte	*Vanisle*	21912	51	89	86	1	1,506	$15.72	$7.13
2B	Goose Island	*Vanisle*	21912	42	57	56	1	1,474	$15.45	$7.01
2B	St. James	*Pender Isle*	27282	34	60	59	0	523	$14.62	$6.63
2B	Vancouver	*Pender isle*	27282	14	29	29	0	177	$15.13	$6.86
2C	Ketchikan	*Bold Pursuit*	99997	26	43	43	0	617	$14.47	$6.56
2C	Ommaney	*Star Wars II*	99997	31	52	49	1	1,430	$13.78	$6.25
2C	Sitka	*Bold Pursuit*	27282	31	52	49	1	1,628	$13.42	$6.09
3A	Albatross	*Predator*	33133	26	49	46	1	1,526	$13.23	$6.00
3A	Fairweather	*Bold Pursuit*	99997	24	51	40	0	404	$12.94	$5.87
3A	Gore Point	*Kema Sue*	41033	26	48	47	0	575	$14.12	$6.40
3A	Portlock	*Kema Sue*	41033	33	51	49	0	328	$12.27	$5.56
3A	PWS	*Star Wars II*	99997	44	67	65	0	336	$16.09	$7.30
3A	Seward	*Kema Sue*	41033	27	52	52	0	359	$16.20	$7.35
3A	Seward (Snap)	*Star Wars II*	99997	37	52	49	0	180	$15.86	$7.20
3A	Shelikof	*Devotion*	42892	38	64	62	0	1,083	$14.05	$6.37
3A	Yakutat	*Seymour*	17530	35	64	57	0	827	$14.37	$6.52
3B	Chignik	*Polaris*	19266	18	31	30	1	1,885	$13.57	$6.16
3B	Sanak	*Allstar*	55922	14	25	24	0	944	$10.86	$4.92
3B	Semidi	*Polaris*	19266	18	32	31	1	1,167	$13.58	$6.16
3B	Shumagin	*Allstar*	55922	23	30	30	1	1,591	$11.76	$5.34
3B	Trinity	*Allstar*	55922	32	56	52	1	1,791	$13.73	$6.23
4A	Unalaska	*Devotion*	42892	31	59	33	2	4,811	$10.58	$4.80
4B	Adak	*Norcoaster*	38137	53	73	37	1	1,944	$11.97	$5.43
4C	4CDE	*Grant*	19262	12	57	20	0	521	$9.92	$4.50
4D	4CDE	*Norcoaster*	38137	30	80	42	0	221	$8.82	$4.00
Closed Area	4CDE	*Grant*	19262	6	3	3	0	11	$9.92	$4.50

Total	13 Vessels	801	1406	1216	14	30,759	$9.16	$5.66

[1] Canada: Vessel Registration Number and USA: ADF&G vessel number.
[2] Days are estimated - some vessels fished two charter regions in one day.
[3] Stations that did not meet setting parameters or deemed ineffective are excluded.
[4] Net weight (head-off, dressed, washed). May not sum to correct total due to rounding.
[5] Ex-vessel price.

Vessels chartered by the IPHC delivered fish to 19 different ports (Tables 2). Fish sales were awarded based on obtaining a fair market price. 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. Individual sales were evaluated after each event to ensure that the buyer was meeting IPHC standards. Average prices increased from $10.49/kg in 2020 to $15.13/kg in 2021 (Tables 3). This represents a 44.2% increase in price.

Table 2a. FISS Pacific halibut landings by port for all Pacific halibut (sampled U32 and all O32), 2021[1,2].

Offload Port	Trips	Tonnes	Pounds	Total USD	Average Price (USD/kg)	Average Price (USD/lb)
Akutan	7	21	47,284	$258,146.09	$12.04	$5.46
Alitak	1	5	10,086	$52,382.27	$11.45	$5.19
Coos Bay	1	0	636	$3,808.75	$13.20	$5.99
Cordova	2	9	20,852	$150,976.65	$15.96	$7.24
Dutch Harbor	2	6	14,276	$73,972.26	$11.42	$5.18
Homer	4	22	49,592	$359,935.42	$16.00	$7.26
Juneau	3	17	37,244	$245,130.63	$14.51	$6.58
Ketchikan	4	19	42,205	$288,623.96	$15.08	$6.84
King Cove	2	4	8,965	$46,511.29	$11.44	$5.19
Kodiak	12	65	142,288	$895,636.20	$13.88	$6.29
Newport	2	2	4,525	$24,135.50	$11.76	$5.33
Petersburg	3	21	45,280	$298,141.46	$14.52	$6.58
Port Hardy	8	31	67,980	$539,792.38	$17.51	$7.94
Prince Rupert	7	34	75,490	$621,518.45	$18.15	$8.23
Sand Point	1	5	10,692	$57,773.76	$11.91	$5.40
Seward	16	76	167,098	$1,213,823.80	$16.01	$7.26
Sitka	2	16	34,732	$233,800.83	$14.84	$6.73
Westport	2	3	7,142	$35,830.80	$11.06	$5.02
Yakutat	3	17	36,549	$246,807.35	$14.89	$6.75
Grand Total	**82**	**373**	**822,916**	**$5,646,747.85**	**$15.13**	**$6.86**

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

Table 2b. FISS Pacific halibut landings by port for O32 Pacific halibut, 2021[1,2].

Offload Port	Trips	Tonnes	Pounds	Total USD	Average Price (USD/kg)	Average Price (USD/lb)
Akutan	7	19	42,016	$232,426.29	$12.20	$5.53
Alitak	1	5	10,086	$52,382.27	$11.45	$5.19
Coos Bay	1	0	503	$3,143.75	$13.78	$6.25
Cordova	2	9	20,694	$150,151.65	$16.00	$7.26
Dutch Harbor	2	5	12,036	$62,772.26	$11.50	$5.22
Homer	4	22	49,063	$356,464.67	$16.02	$7.27
Juneau	3	16	36,080	$238,042.48	$14.55	$6.60
Ketchikan	4	19	40,904	$280,300.34	$15.11	$6.85
King Cove	2	4	7,889	$41,269.29	$11.53	$5.23
Kodiak	12	61	134,830	$849,719.36	$13.89	$6.30
Newport	2	2	3,628	$20,402.50	$12.40	$5.62
Petersburg	3	20	44,534	$293,478.96	$14.53	$6.59
Port Hardy	8	30	65,500	$522,701.69	$17.59	$7.98
Prince Rupert	7	34	74,290	$612,859.97	$18.19	$8.25
Sand Point	1	4	9,693	$52,778.76	$12.00	$5.45
Seward	16	75	165,430	$1,202,817.01	$16.03	$7.27
Sitka	2	15	34,013	$229,371.28	$14.87	$6.74
Westport	2	2	5,272	$30,220.80	$12.64	$5.73
Yakutat	3	16	35,696	$241,435.95	$14.91	$6.76
Grand Total	**82**	**359**	**792,157**	**$5,472,739.28**	**$15.23**	**$6.91**

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

Table 2c. FISS Pacific halibut landings by port for sampled U32 Pacific halibut, 2021[1,2].

Offload Port	Trips	Tonnes	Pounds	Total USD	Average Price (USD/kg)	Average Price (USD/lb)
Akutan	7	2	5,268	$25,719.80	$10.76	$4.88
Alitak	1	0	0	$0.00	$0.00	$0.00
Coos Bay	1	0	133	$665.00	$11.02	$5.00
Cordova	2	0	158	$825.00	$11.51	$5.22
Dutch Harbor	2	1	2,240	$11,200.00	$11.02	$5.00
Homer	4	0	529	$3,470.75	$14.46	$6.56
Juneau	3	1	1,164	$7,088.15	$13.43	$6.09
Ketchikan	4	1	1,301	$8,323.62	$14.10	$6.40
King Cove	2	0	1,076	$5,242.00	$10.74	$4.87
Kodiak	12	3	7,458	$45,916.84	$13.57	$6.16
Newport	2	0	897	$3,733.00	$9.17	$4.16
Petersburg	3	0	746	$4,662.50	$13.78	$6.25
Port Hardy	8	1	2,480	$17,090.69	$15.19	$6.89
Prince Rupert	7	1	1,200	$8,658.48	$15.91	$7.22
Sand Point	1	0	999	$4,995.00	$11.02	$5.00
Seward	16	1	1,668	$11,006.79	$14.55	$6.60
Sitka	2	0	719	$4,429.55	$13.58	$6.16
Westport	2	1	1,870	$5,610.00	$6.61	$3.00
Yakutat	3	0	853	$5,371.40	$13.88	$6.30
Grand Total	**82**	**14**	**30,759**	**$174,008.57**	**$12.47**	**$5.66**

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

Table 3a. FISS landings (total pounds and price) of all Pacific halibut (sampled U32 and all O32) by IPHC Regulatory Area in 2021[1].

IPHC Regulatory Area	2A	2B	2C	3A	3B	4A	4B	4C	4D	Closed Area	Combined
Tonnes	6	65	64	168	42	14	11	2	1	0	373
Pounds	12,303	143,470	141,447	370,991	93,145	30,257	24,121	5,487	1,583	112	822,916
Price USD/kg	$11.43	$17.85	$14.74	$15.35	$13.29	$11.73	$12.14	$11.84	$11.60	$11.84	$15.13
Price USD/lb	$5.18	$8.09	$6.69	$6.96	$6.03	$5.32	$5.51	$5.37	$5.26	$5.37	$6.86

[1] Net weight (head-off, dressed, washed).

Table 3b. FISS landings (total pounds and price) of O32 Pacific halibut by IPHC Regulatory Area in 2021[1].

IPHC Regulatory Area	2A	2B	2C	3A	3B	4A	4B	4C	4D	Closed Area	Combined
Tonnes	4	63	62	166	39	12	10	2	1	0	359
Pounds	9403	139,790	137,772	365,373	85,767	25,446	22,177	4,966	1,362	101	792,157
Price USD/kg	$12.61	$17.91	$14.77	$15.37	$13.32	$11.94	$12.15	$12.05	$12.05	$12.05	$15.23
Price USD/lb	$5.72	$8.12	$6.70	$6.97	$6.04	$5.42	$5.51	$5.46	$5.46	$5.46	$6.91

[1] Net weight (head-off, dressed, washed)

Table 3c. FISS landings (total pounds and price) of sampled U32 Pacific halibut by IPHC Regulatory Area in 2021[1].

IPHC Regulatory Area	2A	2B	2C	3A	3B	4A	4B	4C	4D	Closed Area	Combined
Tonnes	1	2	2	3	3	2	1	0	0	0	14
Pounds	2900	3,680	3,675	5,618	7,378	4,811	1,944	521	221	11	30,759
Price USD/kg	$7.61	$15.43	$13.73	$13.87	$12.87	$10.58	$11.97	$9.92	$8.82	$9.92	$12.47
Price USD/lb	$3.45	$7.00	$6.23	$6.29	$5.84	$4.80	$5.43	$4.50	$4.00	$4.50	$5.66

[1] Net weight (head-off, dressed, washed)

FISS timing

Each year, the months of June, July, and August are targeted for FISS fishing. In 2021, this activity took place from 29 May through 14 September. 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 8). All FISS activity was completed by mid-September.

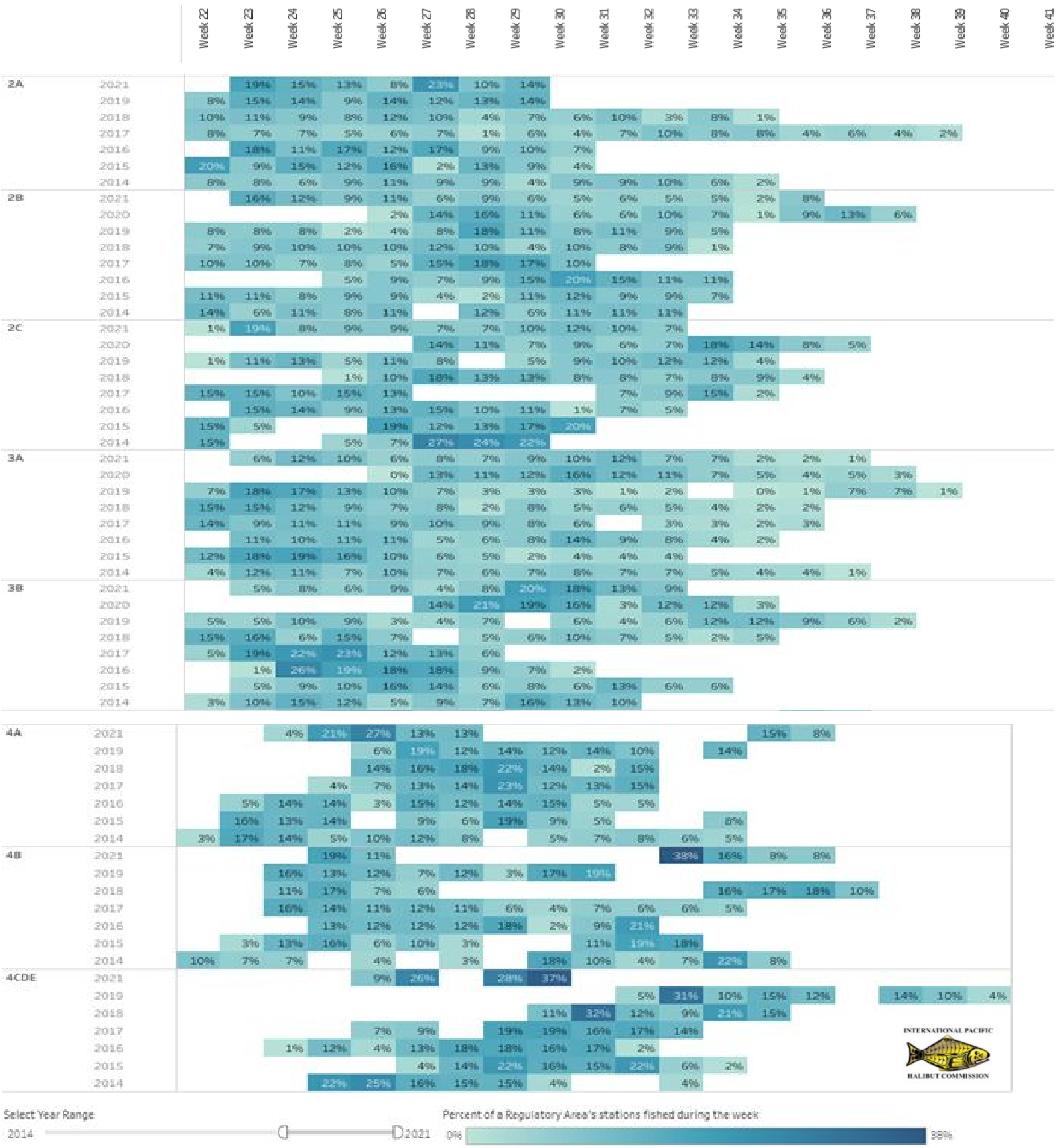

Figure 8. Percent of the total FISS stations completed by IPHC Regulatory Area during each week of the year (2014-2021). Week 22 begins in late May or early June depending on the year.

Recommendation/s

That the Commission:

1) **NOTE** paper IPHC-2021-IM097-07 which provides the Commission a summary of the IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2021.

Appendices

Nil.

Space-time modelling of survey data

PREPARED BY: IPHC SECRETARIAT (R. A. WEBSTER; 28 OCTOBER, 12 NOVEMBER 2021)

PURPOSE

To provide results of the space time modelling of Pacific halibut survey data for the period 1993-2021.

INTRODUCTION

As described in Webster (2021a), since 2016 space-time modelling has been used by the IPHC to produce estimates of mean O32 WPUE (weight per unit effort), all sizes WPUE and all sizes NPUE (numbers per unit effort) indices of Pacific halibut density and abundance. The modelling depends primarily on data from the IPHC's fishery-independent setline survey (FISS, Ualesi et al, 2021), but in the Bering Sea also integrates data from the National Marine Fisheries Service annual trawl survey and the Alaska Department of Fish and Game's annual Norton Sound trawl survey. Both surveys are fishery-independent data sources.

Since 2019, weighing of Pacific halibut onboard FISS charter vessels has meant that the vast majority of the weight data used to compute WPUE has come from observed weights of fish rather than estimates from a length-net weight relationship. For fish without directly measured weights, weights are predicted from a year- and IPHC Regulatory Area-specific length-net weight relationship estimated from the FISS length and weight data. For U32 fish with round weight recorded, net weights are estimated from a round-net weight relationship estimated from coastwide sample data from the 2019 FISS (Webster 2021b).

In 2021, a comparison of snap gear to fixed gear on the FISS was conducted in the Seward charter region (IPHC Regulatory Area 3A) to expand on data collected in 2019 and 2020 in IPHC Regulatory Areas 2B and 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. It was hoped that results of this comparison would contribute to our overall understanding of gear differences and whether such differences were consistent across geographic regions or not.

Results of space-time modelling in 2021

Figures 1 and 2 show time series estimates of O32 WPUE (most comparable to fishery catch-rates) and all sizes NPUE over the 1993-2021 period included in the 2021 space-time modelling. Overall, there was an estimated increase of 4% in the coastwide O32 WPUE index from 2020, due largely to a 11% increase in Region 3 (Figure 1). The estimated increase in coastwide all sizes NPUE was greater, with a 17% estimated increase (Figure 2), driven by increases in both Regions 2 and 3. Estimated 1993-21 time series by IPHC Regulatory Area are in Appendix A.

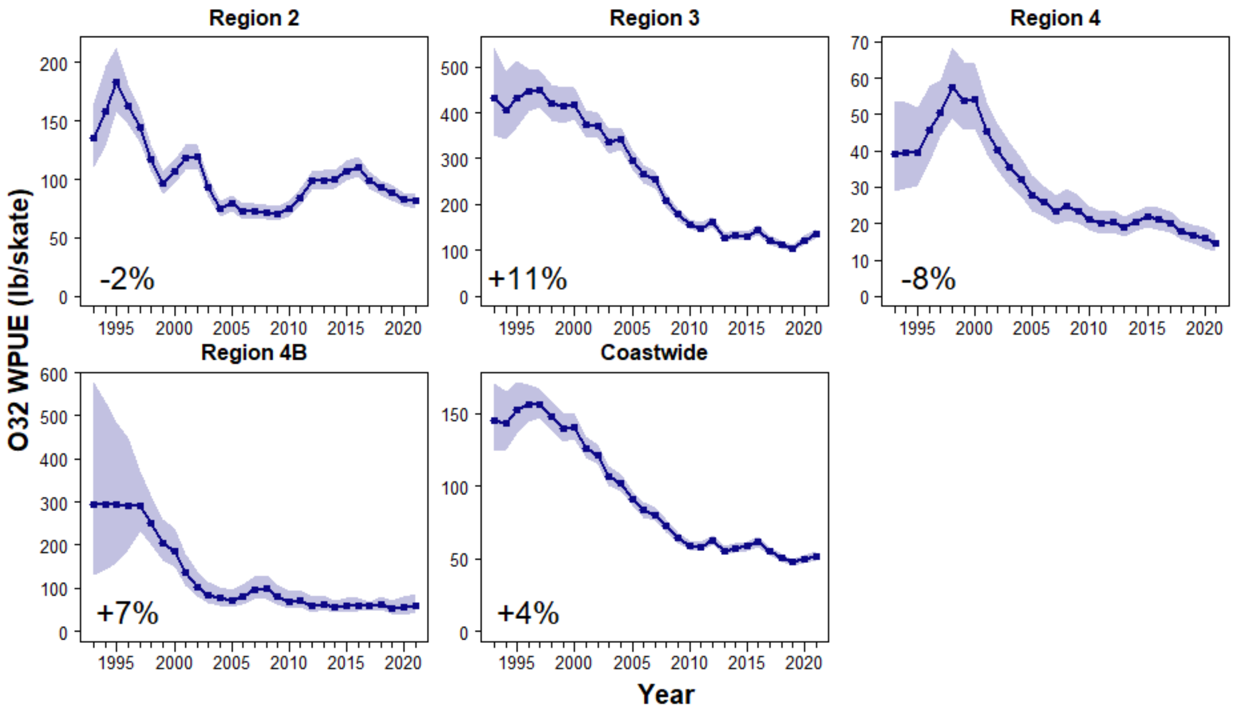

Figure 1. Space-time model output for O32 WPUE for 1993-2021 for Biological Regions. Filled circles denote the posterior means of O32 WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean O32 WPUE from 2020 to 2021.

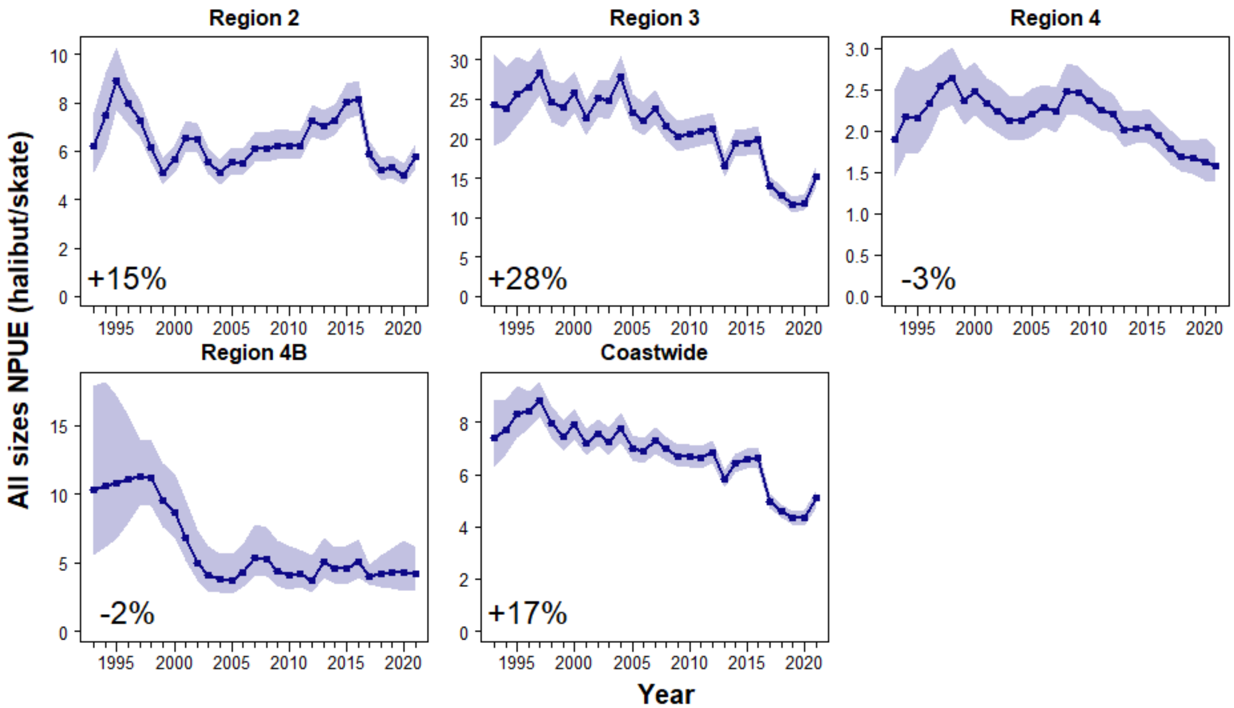

Figure 2. Space-time model output for all sizes NPUE for 1993-2021 for Biological Regions. Filled circles denote the posterior means of all sizes NPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean all sizes NPUE from 2020 to 2021.

In Regulatory Area 3A, 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. The design and analysis is consistent with the treatment of the data from both gears fished in IPHC Regulatory Areas 2C and 2B in 2019 and 2020 respectively. Parameter estimates of gear type differences all implied that snap gear catch rates were greater on average (Table 1), with estimated catch rate ratios of 1.18 to 1.43 for the three indices modelled in 2021 (i.e., we estimate snap gear had 125% to 143% of the catch rates of fixed gear, depending on the index). These results are at odds with those of the much larger gear comparison study in all of IPHC Regulatory Area 2C, which estimated a ratio of 0.86 for all three indices, and from the IPHC Regulatory Area 2B study in the St James charter region, which estimated ratios of 0.72-0.83. The 2021 study had two design limitations that make it impossible to draw conclusions regarding the cause of the differences: two vessels were used, each fishing a different gear; and there was almost no overlap in the time periods over which each gear was fished. In other words, gear differences were confounded with vessel effects and possible changes in underlying Pacific halibut density during the study period. These ambiguous and inconsistent results imply the need for a larger and more carefully designed comparison in this geographic region, one that controls as much as possible for factors such as vessel and temporal effects on catch rates of Pacific halibut, as was the case in the 2019 gear comparison study.

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 the Seward charter region in Regulatory Area 3A in 2021.

Variable	**Ratio of snap to fixed catch rate**	
	Posterior mean	**95% credible interval**
O32 WPUE	1.28	0.96 – 1.72
All sizes WPUE	1.18	0.89 – 1.56
All sizes NPUE	1.43	1.08 – 1.89

RECOMMENDATION

That the Commission **NOTE** paper IPHC-2021-IM097-08 which provides results of the space-time modelling of Pacific halibut survey data for 1993-2021.

REFERENCES

Ualesi, K., Wilson, D., Jones, C. & Rillera, R. IPHC Fishery-independent setline survey (FISS) design and implementation in 2021. IPHC-2021-IM097-07.

Webster R. 2021a. 2022-24 FISS design evaluation. IPHC-2021-IM097-09.

Webster R. 2021b. IPHC Fishery-Independent Setline Survey (FISS) and commercial data modelling. IPHC-2021-SRB019-05.

APPENDIX A
Space-time modelling results by IPHC Regulatory Area

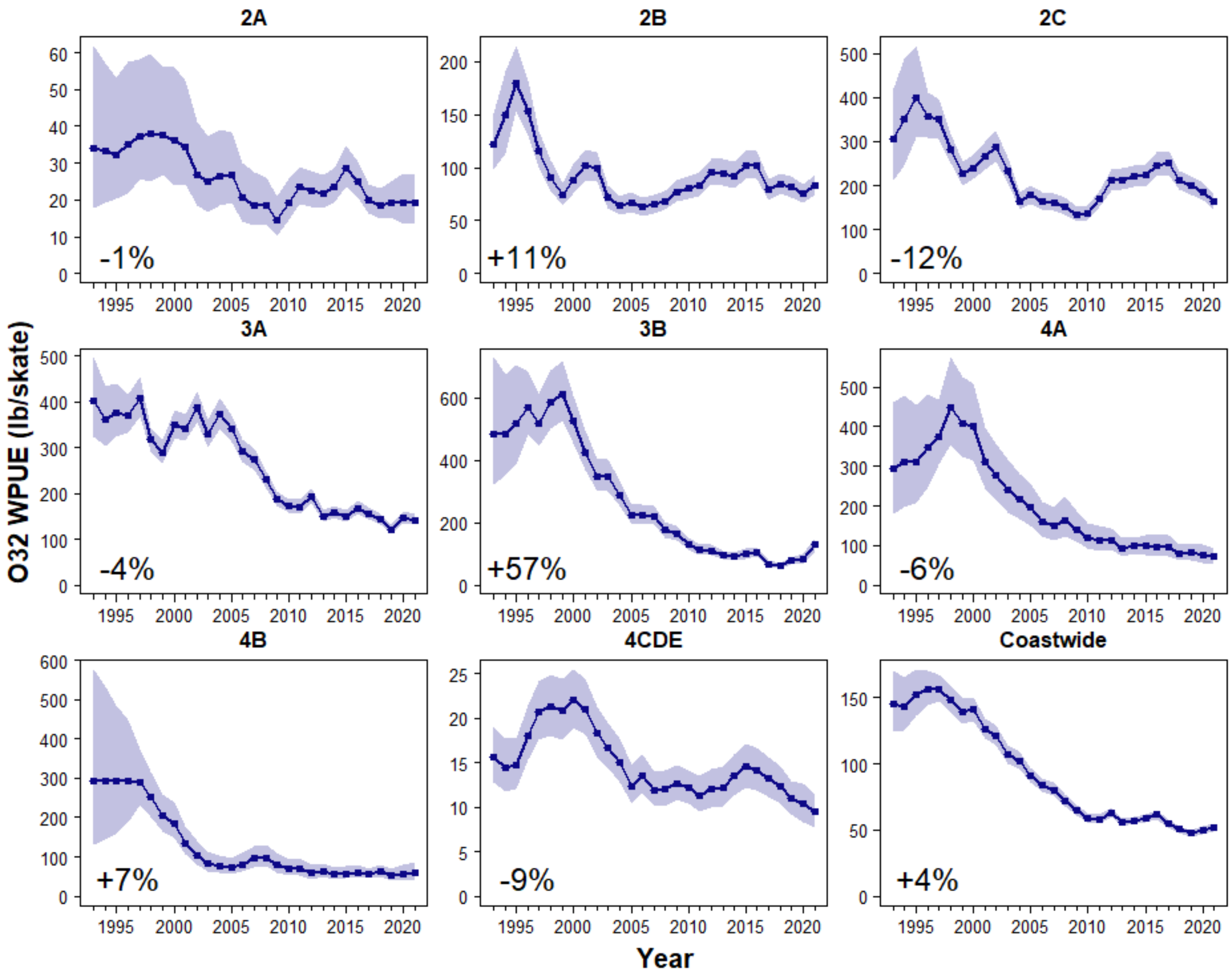

Figure A.1. Space-time model output for O32 WPUE for 1993-2021. Filled circles denote the posterior means of O32 WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean O32 WPUE from 2019 to 2021.

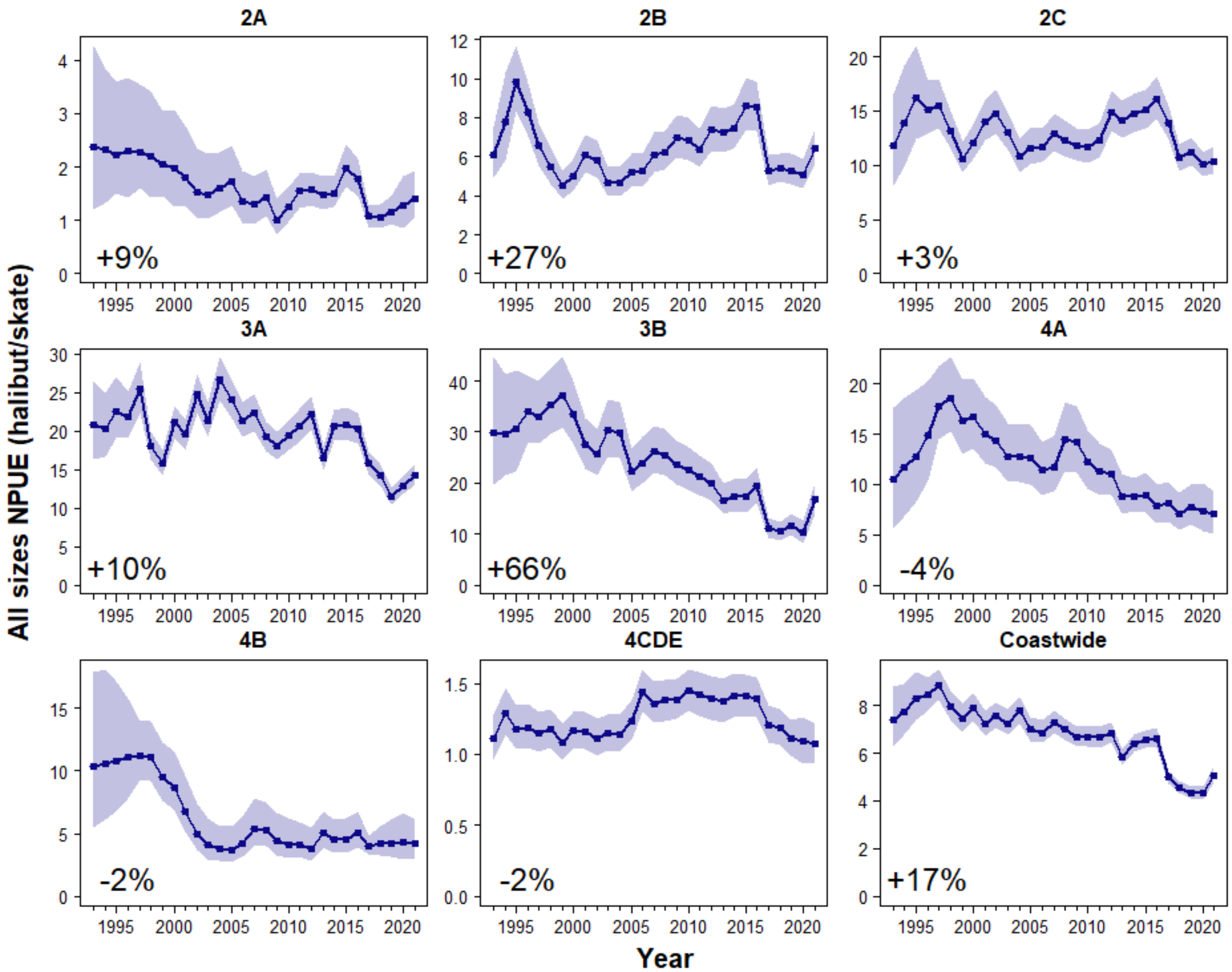

Figure A.2. Space-time model output for all sizes NPUE for 1993-2021. Filled circles denote the posterior means of all sizes NPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean total NPUE from 2019 to 2021.

2022-24 FISS design evaluation

PREPARED BY: IPHC SECRETARIAT (R. WEBSTER; 29 OCTOBER 2021)

PURPOSE

To present proposed designs for the IPHC's Fishery-Independent Setline Survey (FISS) for the 2022-24 period, and an evaluation of those designs, as reviewed and endorsed by the Scientific Review Board in June 2021 (SRB018).

BACKGROUND

The IPHC's Fishery-Independent Setline Survey (FISS) provides data used to compute indices of Pacific halibut density for use in monitoring stock trends, estimating stock distribution, and as an important input in the stock assessment. Stock distribution estimates are based on the annual mean weight-per-unit effort (WPUE) for each IPHC Regulatory Area, computed as the average of WPUE of all Pacific halibut and for O32 (greater than or equal to 32" or 81.3cm in length) Pacific halibut estimated at each station in an area. Mean numbers-per-unit-effort (NPUE) is used to index the trend in Pacific halibut density for use in the stock assessment models.

FISS history 1993-2019

The IPHC has undertaken FISS activity since the 1960s. However, methods were not standardized to a degree (e.g., the bait and gear used) that allows for simple combined analyses until 1993. From 1993 to 1997, the annual design was a modification of a design developed and implemented in the 1960s, and involved fishing triangular clusters of stations, with clusters located on a grid (IPHC 2012). Coverage was limited in most years, and was generally restricted to IPHC Regulatory Areas 2B through 3B. The modern FISS design, based on a grid with 10 nmi (18.5 km) spacing, was introduced in 1998, and over the subsequent two years was expanded to include annual coverage in parts of all IPHC Regulatory Areas within the depth ranges of 20-275 fathoms (37-503 m) in the Gulf of Alaska and Aleutian Islands, and 75-275 fathoms (137-503 m) in the Bering Sea (IPHC 2012). Annually-fished stations were added around islands in the Bering Sea in 2006, and in the same year, a less dense grid of paired stations was fished in shallower waters of the southeastern Bering Sea, providing data for a calibration with data from the annual National Marine Fishery Service (NMFS) trawl survey (Webster et al. 2020).

Examination of commercial logbook data and information from other sources, it became clear by 2010 that the historical FISS design had gaps in coverage of Pacific halibut habitat that had the potential to lead to bias in estimates derived from its data. These gaps included deep and shallow waters outside the FISS depth range (0-20 fathoms and 275-400 fathoms), and unsurveyed stations on the 10 nmi grid within the 20-275 fathom depth range within each IPHC Regulatory Area. This led the IPHC Secretariat to propose expanding the FISS to provide coverage within the unsurveyed habitat with United States and Canadian waters. In 2011 a pilot expansion was undertaken in IPHC Regulatory Area 2A, with stations on the 10 nmi grid added to deep (275-400 fathoms) and shallow (10-20 fathoms) waters, the Salish Sea, and other, smaller gaps in coverage. The 10 fathom limit in shallow waters was due to logistical difficulties in fishing longline gear in shallower waters. A second expansion in IPHC Regulatory Area 2A was completed in 2013, with a pilot California survey between latitudes of 40-42°N.

The full expansion program began in 2014 and continued through 2019, resulting in the sampling of the entire FISS design of 1890 stations in the shortest time logistically possible. The FISS expansion program allowed us to build a consistent and complete picture of Pacific halibut density throughout its range in Convention waters. Sampling the full FISS design has reduced bias as noted above, and, in conjunction with space-time modelling of survey data (see below), has improved precision and fully quantified the uncertainty associated with estimates based on partial annual sampling of the species range. It has also provided us with a complete set of observations over the full FISS design (Figure 1) from which an optimal subset of stations can be selected when devising annual FISS designs. This station selection process began in 2019 for the 2020 FISS and continues with the current review of design proposals for 2022-24. Note that in the Bering Sea, the full FISS design does not provide complete spatial coverage, and FISS data are augmented with calibrated data from National Marine Fisheries Service (NMFS) and Alaska Department of Fish and Game (ADFG) trawl surveys (stations can vary by year – 2019 designs are shown in Figure 1). Both supplementary surveys are conducted approximately annually.

Space-time modelling

In 2016, a space-time modelling approach was introduced to estimate time series of weight and numbers-per-unit-effort (WPUE and NPUE), and to estimate the stock distribution of Pacific halibut among IPHC Regulatory Areas. This represented an improvement over the largely empirical approach used previously, as it made use of additional information within the survey data regarding the degree of spatial and temporal of Pacific halibut density, along with information from covariates such as depth (Webster et al. 2020). It also allowed a more complete accounting of uncertainty: for example, prior to the use of space-time modelling, uncertainty due to unsurveyed regions in each year was ignored in the estimation - these unsampled regions were either filled in using independently estimated scalar calibrations (if fished at least once), or catch-rates at unsampled stations were assumed to be equal to the mean for the entire Regulatory Area. The IPHC's Scientific Review Board (SRB) has provided supportive reviews of the space-time modelling approach (e.g., IPHC-2018-SRB013-R), and the methods have been published in a peer-review journal (Webster et al. 2020). Similar geostatistical models are now routinely used to standardise fishery-independent trawl surveys for groundfish on the West Coast of the U.S. and in Alaskan waters (e.g., Thorson et al. 2015 and Thorson 2019).

FISS design objectives

The primary purpose of the annual FISS is to sample Pacific halibut to provide data for the stock assessment (abundance indices, biological data) and estimates of stock distribution for use in the IPHC's management procedure. The priority of a rationalised FISS is therefore to maintain or enhance data quality (precision and bias) by establishing baseline sampling requirements in terms of station count, station distribution and skates per station. Potential considerations that could add to or modify the design are logistics and cost (secondary design layer), and FISS removals (impact on the stock), data collection assistance for other agencies, and IPHC policies (tertiary design layer). These priorities are outlined in Table 1.

Table 1. Prioritization of FISS objectives and corresponding design layers.

Priority	Objective	Design Layer
Primary	Sample Pacific halibut for stock assessment and stock distribution estimation	Minimum sampling requirements in terms of: • Station distribution • Station count • Skates per station
Secondary	Long term revenue neutrality	Logistics and cost: operational feasibility and cost/revenue neutrality
Tertiary	Minimize removals, and assist others where feasible on a cost-recovery basis.	Removals: minimize impact on the stock while meeting primary priority Assist: assist others to collect data on a cost-recovery basis IPHC policies: ad-hoc decisions of the Commission regarding the FISS design

Review process

Since completion of the FISS expansions, a review process has been developed for annual FISS designs created according the above objectives:

- The Secretariat presents design proposals based only on primary objectives (Table 1) to the SRB for three subsequent years at the June meeting (recognizing that data from the current summer FISS will not be available for analysis prior to the September SRB meeting);
- These design proposals, revised if necessary based on June SRB input, are then reviewed by Commissioners at the September work meeting;
- At their September meeting, the SRB reviews revisions to the design proposals made to account for secondary objectives;
- Presentation of FISS designs for 'endorsement' by the Commission occurs at the November Interim Meeting;
- Ad-Hoc modifications to the design for the current year (due to unforeseen issues arising) are possible at the Annual Meeting;
- The endorsed design for current year is then modified (if necessary) to account for tertiary objectives prior to summer implementation (February-April).

Consultation with industry and stakeholders occurs throughout the FISS planning process, at the Research Advisory Board meeting (29 November in 2021) and particularly in finalizing design details as part of the FISS charter bid process, when stations can be added and other adjustments made to provide for improved logistical efficiency. We also note the opportunities for stakeholder input during public meetings (Interim and Annual Meetings).

Note that while the review process examines designs for the next three years, revisions to designs for the second and third years are expected during subsequent review periods. Having design proposals available for three years instead of the next year only assists the IPHC with medium-term planning of the FISS, and allows reviewers (SRB, IPHC Commissioners) and stakeholders to see more clearly the planning process for sampling the entire FISS footprint over multiple years. Extending the proposed designs beyond three years was not considered worthwhile, as we expect further evaluation undertaken following collection of data during the one to three-year time period to influence design choices for subsequent years.

PROPOSED DESIGNS FOR 2022-24

The designs proposed for 2022-24 (Figures 2 to 4) use efficient subarea sampling in IPHC Regulatory Areas 2A, 4A and 4B, and incorporate a randomized subsampling of FISS stations in IPHC Regulatory Areas 2B, 2C, 3A and 3B (except for the near-zero catch rate inside waters around Vancouver Island), with a sampling rate chosen to keep the sample size close to 1000 stations in an average year. This was also used to generate the designs originally proposed for 2020 (but modified as a result of the impact of COVID19 and cost considerations), and for those proposed and approved for 2021. In 2020, designs for 2022-23 were also approved subject to revision. We are proposing one change from that 2022 design, bringing forward by one year (from 2023 to 2022) the sampling of the central and western subareas of IPHC Regulatory Area 4B to reduce the risk of bias in estimates from that area. Thus, we propose that:

- In 2022 the lower-density western and central subareas of IPHC Regulatory Area 4B are sampled, followed by the higher-density eastern subarea in 2023-24
- The higher-density western subarea of IPHC Regulatory Area 4A be sampled in all three years, with the medium-density northern shelf edge subarea added in 2023 only
- The highest-density waters of IPHC Regulatory 2A in northern Washington and central/southern Oregon are proposed for sampling in each year of the 2022-24 period
- The low-density waters of the Salish Sea in IPHC Regulatory Areas 2A and 2B are not proposed for sampling in 2022-24

Following this three-year period, it is expected that all subareas not recently sampled will be included during the subsequent 3-5 years. These include the southeastern subarea of IPHC Regulatory 4A, and lower-density waters of IPHC Regulatory 2A (see below).

The design proposals again include full sampling of the standard FISS grid in IPHC Regulatory Area 4CDE. The Pacific halibut distribution in this area continues to be of particular interest, with an apparently northward-shifting distribution of Pacific halibut, and increasing uncertainty regarding connectivity with populations adjacent to and within Russian waters. Distribution and density shifts of other demersal species and crab stocks, as well as sustained environmental change, continue to indicate the need for increased monitoring in this IPHC Regulatory Area.

We note that at SRB018, the SRB endorsed the final 2022 FISS design as presented in Figure 2, and provisionally endorsed the 2023-24 designs (Figs. 3 and 4) (IPHC-2021-SRB018-R).

FISS DESIGN EVALUATION

Precision targets

In order to maintain the quality of the NPUE estimates used for the assessment and of the WPUE estimates used to estimate stock distribution, the IPHC Secretariat has set a target range of less than 15% for the coefficient of variation (CV) of mean O32 and all sizes WPUE for all IPHC Regulatory Areas. We also established precision targets of IPHC Biological Regions and a coastwide target (IPHC-2020-AM096-07), but achievement of the Regulatory Area targets is expected to ensure that targets for the larger units will also be met.

Reducing the potential for bias

In IPHC Regulatory Areas in which stations are not subsampled randomly (IPHC Regulatory Areas 2A, 4A and 4B in the 2022-24 proposals), sampling a subset of the full data frame in any area or region brings with it the potential for bias. This is due to trends in the unsurveyed portion of a management unit (Regulatory Area or Region) potentially differing from those in the surveyed portion. To reduce the potential for bias, we also looked at how frequently part of an area or region ("subarea") should be surveyed in order to reduce the likelihood of appreciable bias. For this, we proposed a threshold of a 10% absolute change in biomass percentage: how quickly can a subarea's percent of the biomass of a Regulatory Area change by at least 10% (e.g., from 15 to 25% of the area's biomass)? By sampling each subarea frequently enough to reduce the chance of its percentage changing by more than 10% between successive surveys of the subarea, we minimize the potential for appreciable bias in the Regulatory Area's index.

We examined the effect of subsampling the FISS stations for a management unit on precision as follows:

- Where a randomised design is not used, identify logistically efficient 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 observed data series augmented with 1 to 3 additional years of simulated data, where the design over those three years reflects the sampling priorities identified above
- Project precision estimates and quantify bias potential for comparison against threshold

Table 2 shows projected CVs following completion of the proposed 2022-24 FISS designs. With these designs, we are projected to maintain CVs within the target range. Estimates from the terminal year are most informative for management decisions, but they also typically have the largest CVs (all else being equal). The final column in Table 2 shows the CV projections immediately following the 2022 FISS, which are also within the target range.

The projected CV for 2024 for IPHC Regulatory Area 2A is close to exceeding the target, and in future revisions of the 2024 design, we may wish to consider adding stations from southern Washington/northern Oregon, and northern California to the design ("subarea 2" for this Regulatory Area). While historical data show this subarea to be highly stable over time in terms of its biomass proportion, by 2024 it will have been five years since any part of it was last sampled, and with no other lower-density subareas planned for sampling that year in IPHC Regulatory Areas 4A and 4B, this may be a logistically feasible year for fishing those stations. Should estimated CVs increase more rapidly than projected, future designs would be revised accordingly.

Table 2. Projected CVs (%) for 2021-24 for O32 WPUE estimated after completion of the proposed 2022-24 FISS designs, and (final column) after completion of the proposed 2022 FISS design only.

Reg. Area	2021	2022	2023	2024	2022 (Estimated in 2022)
2A	13	13	14	15	14
4A	10	9	9	10	10
4B	10	12	10	12	14

For maintaining low bias, we looked at estimates of historical changes in the proportion of biomass in each subarea, and used that to guide the sampling frequency in future designs. Thus subareas that have historically had rapid changes in biomass proportion need to be sampled most frequently, and those that are relatively stable can be sampled less frequently. For example, if a subarea's % of its Regulatory Area's biomass changed by no more than 8% over 1-2 years (in absolute terms) but by up to 12% over three years, we should sample it at least every three years based on the 10% criterion discussed above.

Based on estimates from the historical times series (1993-2020) of O32 WPUE, the proposed designs for 2022-24 would be expected to maintain low bias by ensuring that it is unlikely that biomass proportions for all subareas change by more than 10% since they were previously sampled (Table 3).

Table 3. Maximum expected absolute changes (%) in biomass proportion since previous sampling of subareas that are unsampled in a given year, based on estimated the 1993-2020 time series.

Reg. Area	2021	2022	2023	2024
2A	8	9	9	9
4A	8	10	6	6
4B	10	9	8	10

CONSIDERATION OF COST

Ideally, the FISS design would be based only on scientific needs. However, some Regulatory Areas are consistently more expensive to sample than others, so for these the efficient subarea designs were developed. The purpose of factoring in cost was to provide a statistically efficient and logistically feasible design for consideration by the Commission. After initial scientific designs, focused solely on primary objectives have been established, secondary and tertiary considerations (Table 1) are factored in to produce the final design for implementation in the current year. It is anticipated that under most circumstances, cost considerations can be addressed by adding stations to the minimum design proposed in this report (2020 was an exceptional case). In particular, the FISS is funded by sales of captured fish and is intended to have long-term revenue neutrality, meaning that any design must also be evaluated in terms of the following factors:

- Expected catch of Pacific halibut
- Expected Pacific halibut sale price
- Charter vessel costs, including relative costs per skate and per station
- Bait costs
- IPHC Secretariat administrative costs

Balancing these factors may result in modifications to the design such as increasing sampling effort in high-density regions and decreasing effort in low density regions. At present, with stocks near historic lows and extremely low prices for fish sales, the current funding model may require that some low-density habitat be omitted from the design entirely (as occurred in 2020). This will have implications for data quality, particularly if such reductions in effort relative to proposed designs continue over multiple years. Note that this did not occur in the 2021 design, as the price increases observed in 2021 made it sufficient to include additional stations in core IPHC Regulatory Areas to generate a revenue-neutral coastwide design.

Optimised designs for 2022

IPHC Secretariat proposed two potential modifications of the proposed scientific minimum design (Figure 2) for 2022 that optimize the design to help achieve the secondary objective of long-term revenue neutrality. Optimized Design 1 (Figure 5) adds stations to the core IPHC Regulatory Areas (2B, 2C, 3A and 3B) to meet the secondary objective. Optimized Design 2 (Figure 6) adds fewer stations than those added in Optimized Design 1 and removes the northern stations from IPHC Regulatory Area 4CDE in order to meet the secondary objective. Both optimized designs meet the precision and bias criteria of the evaluation conducted above, as reducing the northern Bering Sea design for a single year is not expected to have a meaningful impact on either precision or bias in that area.

At SRB019, the optimized designs were noted by the SRB (IPHC-2021-SRB019-R), which also drew attention to the potential importance of increased sampling in the Bering Sea:

> SRB019–Rec.02 (para. 14):
>
> *NOTING the presentation of three alternative 2022 sampling designs (Figs. 1, 2, and 3) that optimize the SRB018-endorsed proposed 2022 design for cost, thereby meeting the goals of long-term revenue neutrality (Secondary Objective), without compromising the scientific goals of the FISS (Primary Objective), the SRB RECOMMENDED that the Secretariat prioritize 2022 sampling designs that include IPHC Regulatory Area 4CDE despite the relatively low contribution of this area to overall biomass and variance. This region is an important area to monitor for future range shifts and biological samples collected here are likely to be important for understanding the biology of Pacific halibut at their leading range edge.*

Based on the SRB's comments and the factors suggesting elevated priority for 4CDE identified by the Secretariat above, optimized design 1 (all stations in IPHC Regulatory Area 4CDE) is recommended by the Secretariat. Optimized design 2 is reserved as an alternative if bid availability and or other considerations arise.

RECOMMENDATIONS

That the Commission:

1) **NOTE** paper IPHC-2021-IM097-09 that presents the FISS design proposals for 2022-24 together with an evaluation of the proposed designs;
2) **ENDORSE** optimized design 1 for the 2022 FISS, with full sampling in IPHC Regulatory Area 4CDE (Figure 5), and optimized design 2, reduced sampling in IPHC Regulatory Area 4CDE (Figure 6), as an alternative if necessary.
3) Provisionally **ENDORSE** the proposed designs for 2023-24, as provisionally endorsed by the Scientific Review Board at SRB018, recognizing that the 2023-24 designs are expected to be modified in subsequent years.

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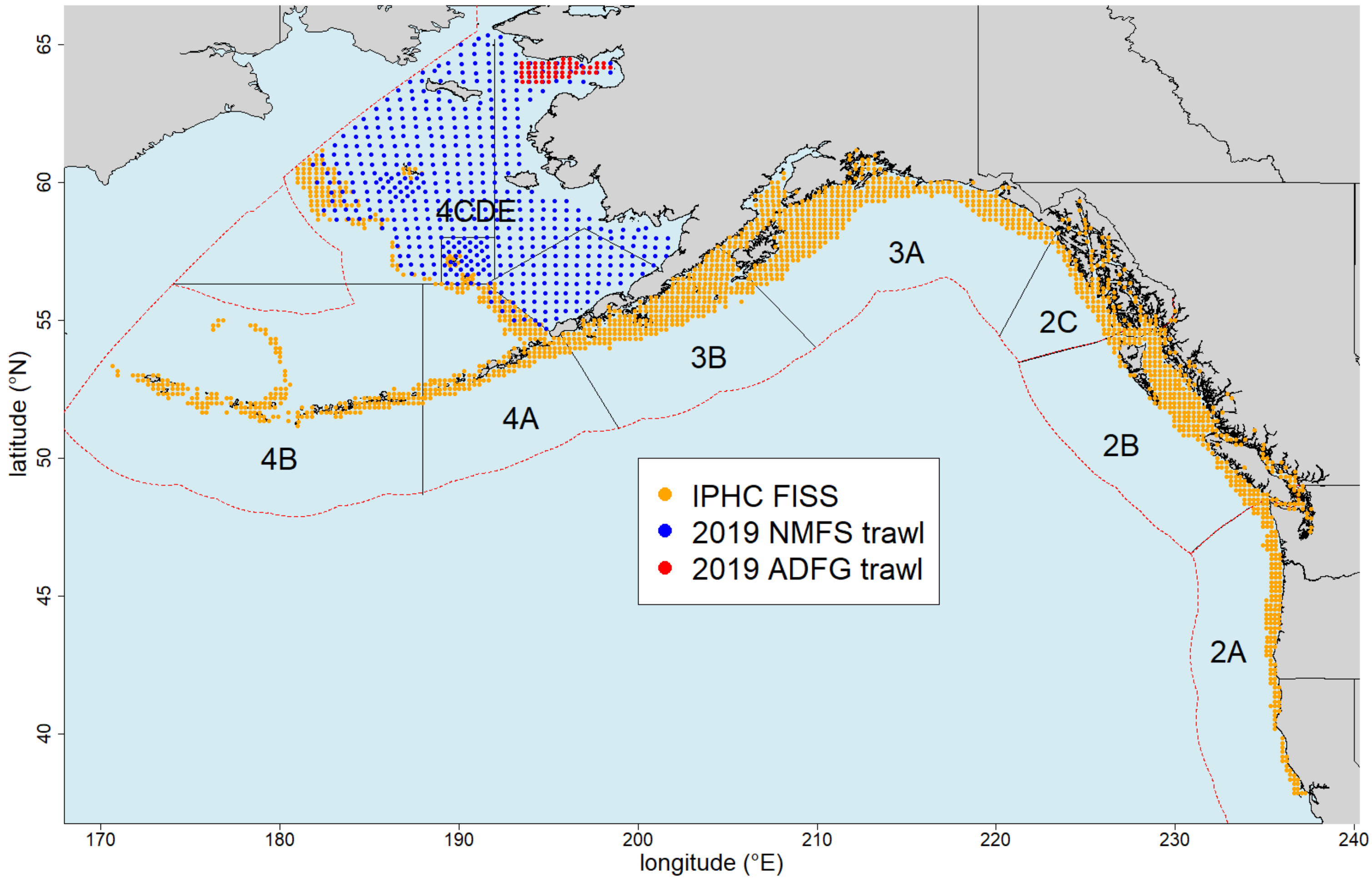
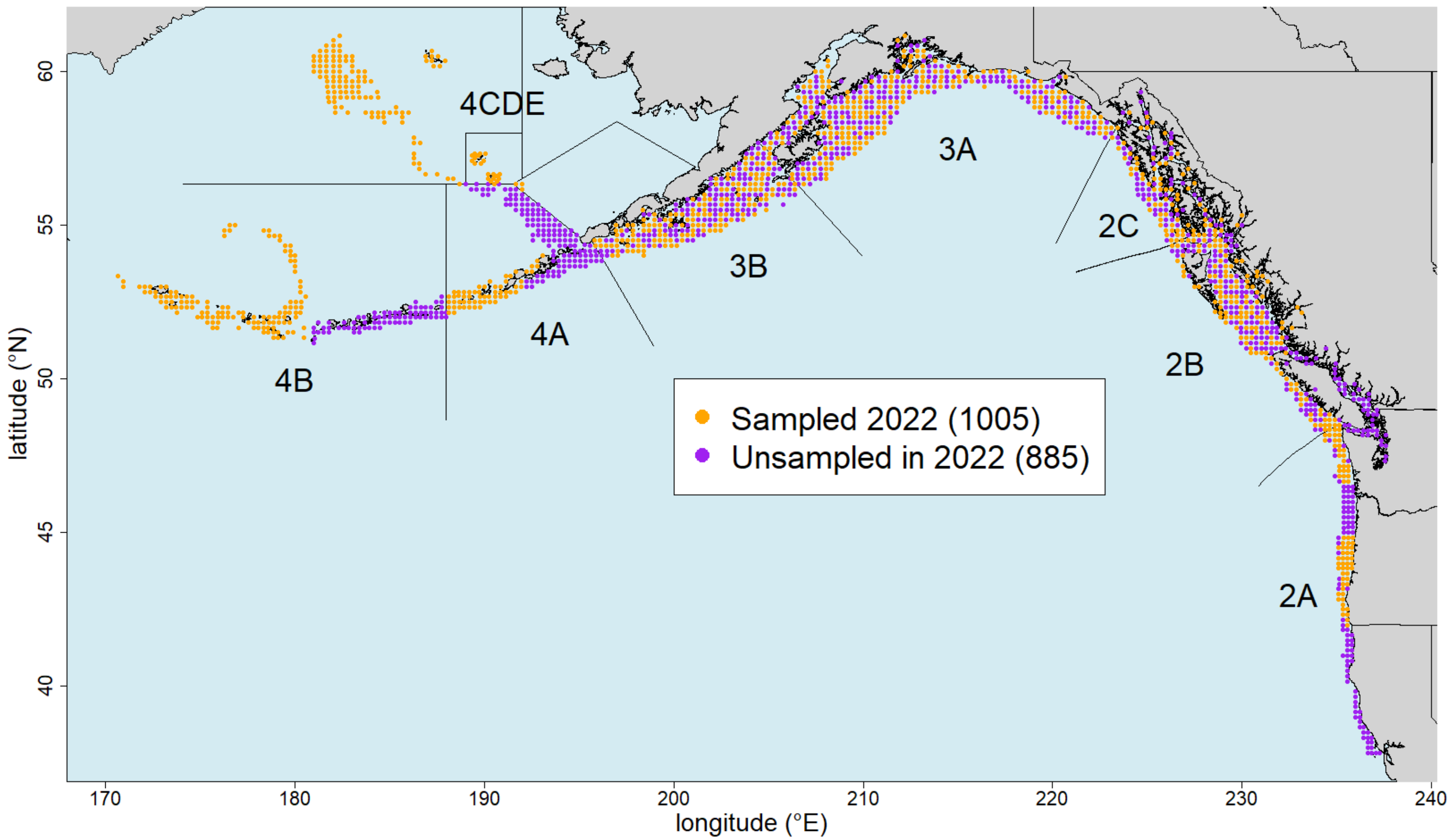


Figure 1. Map of the full 1890 station FISS design, with orange circles representing stations available for inclusion in annual sampling designs, and other colours representing trawl stations from 2019 NMFS and ADFG surveys used to provide complementary data for Bering Sea modelling.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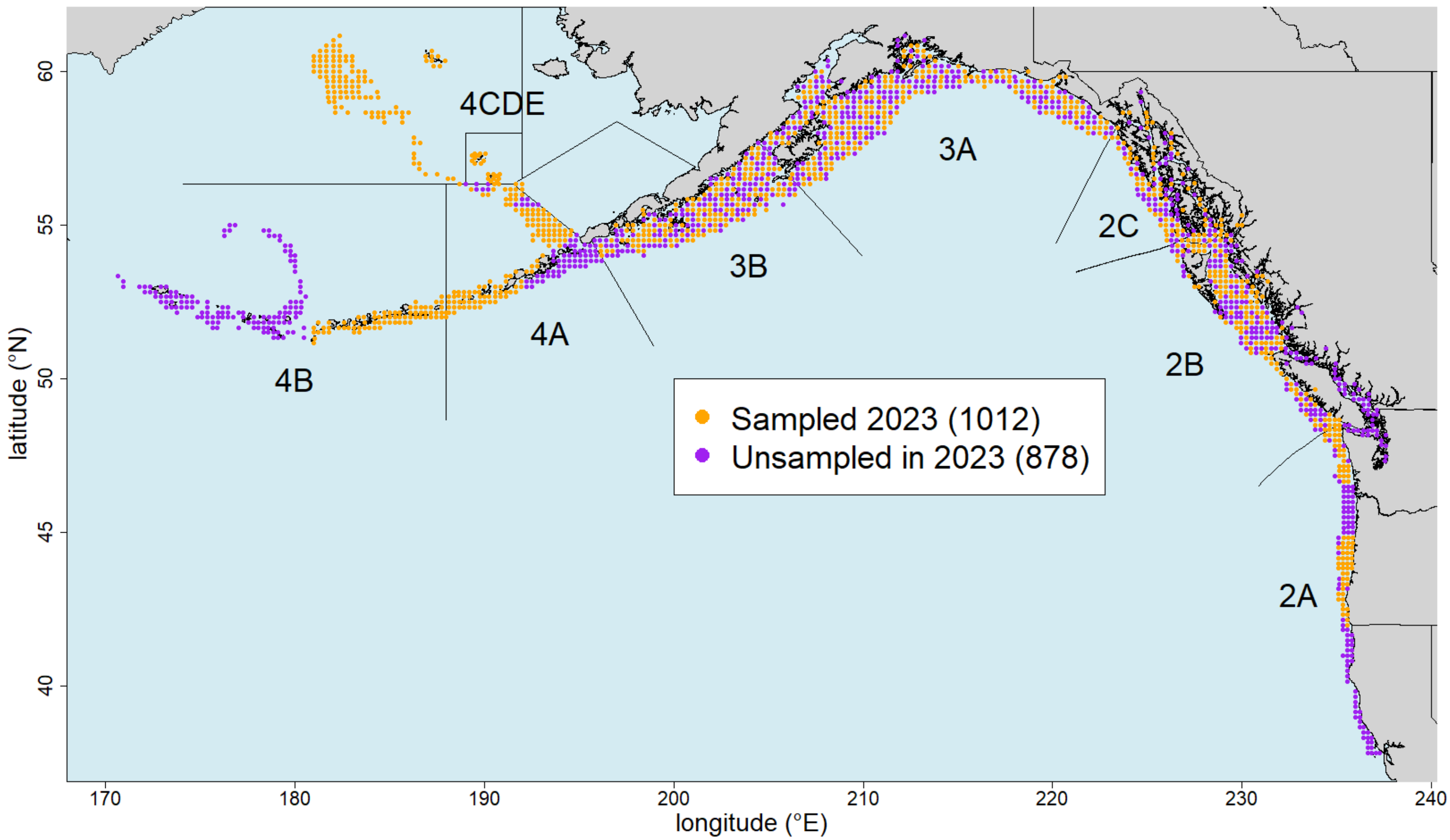
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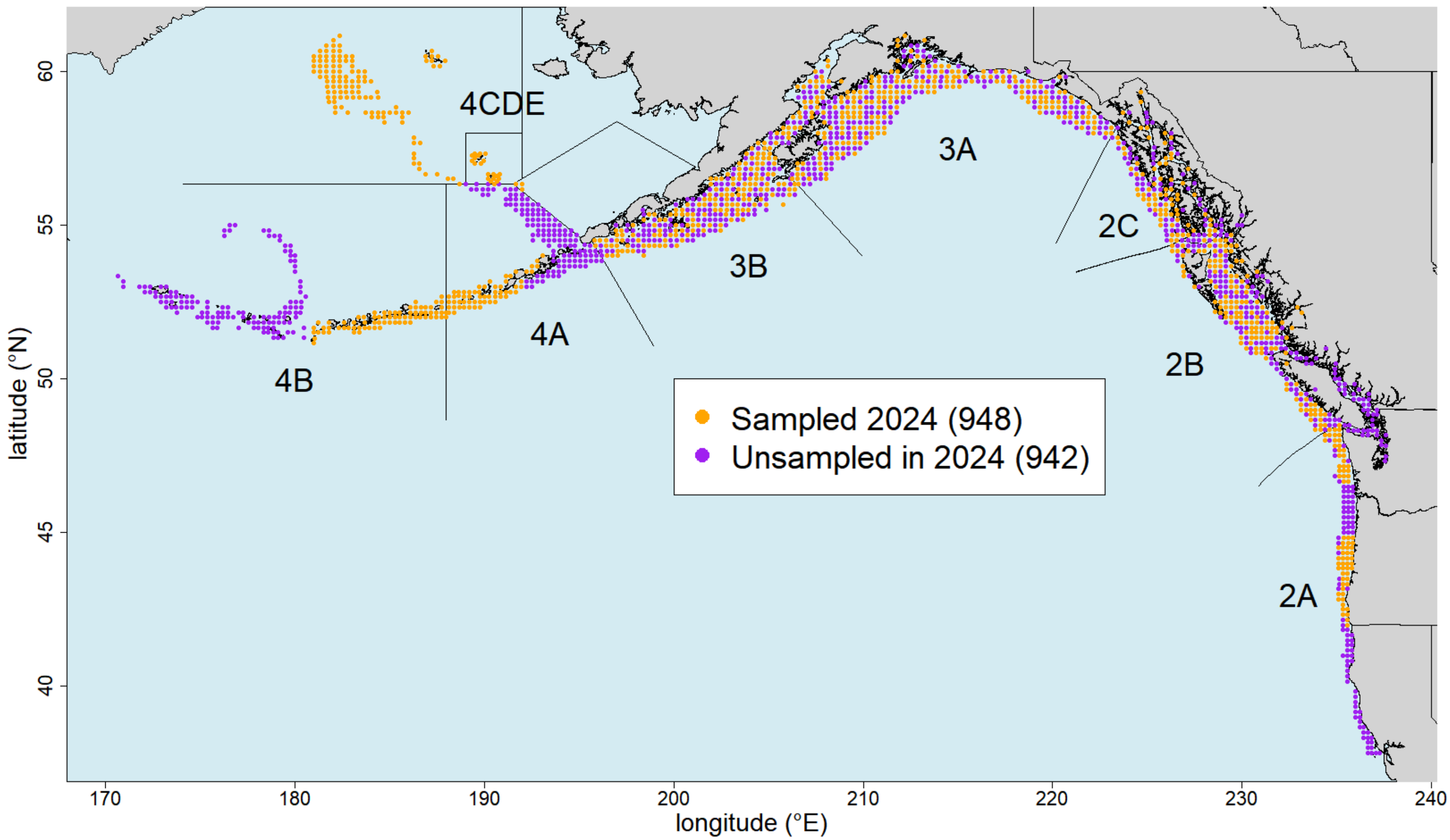
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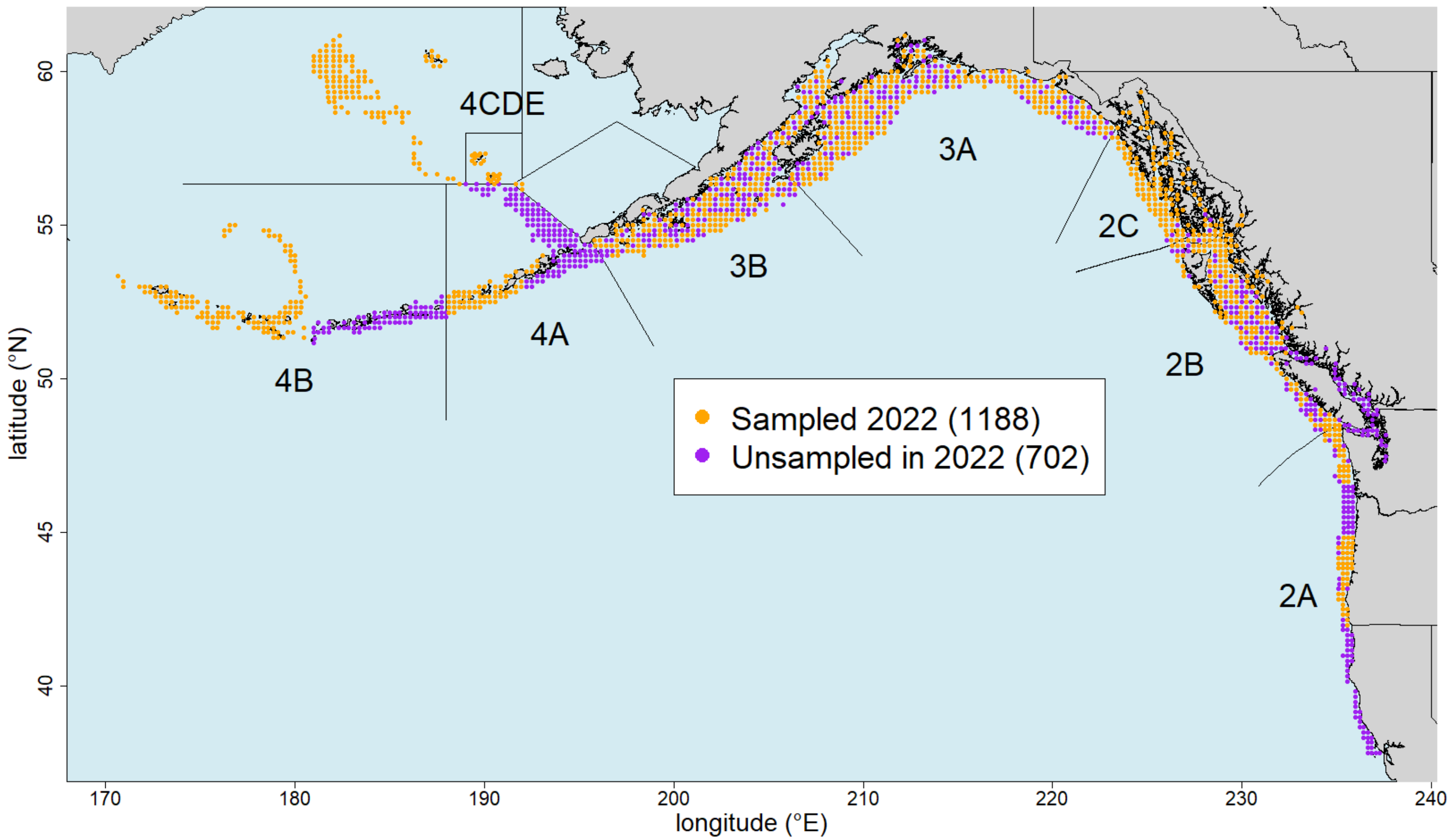

Figure 5. Optimized FISS design for 2022, with original design endorsed at SRB018 augmented with additional stations in IPHC Regulatory Areas 2B, 2C, 3A, and 3B in order to help achieve the secondary objective of long-term revenue neutrality.

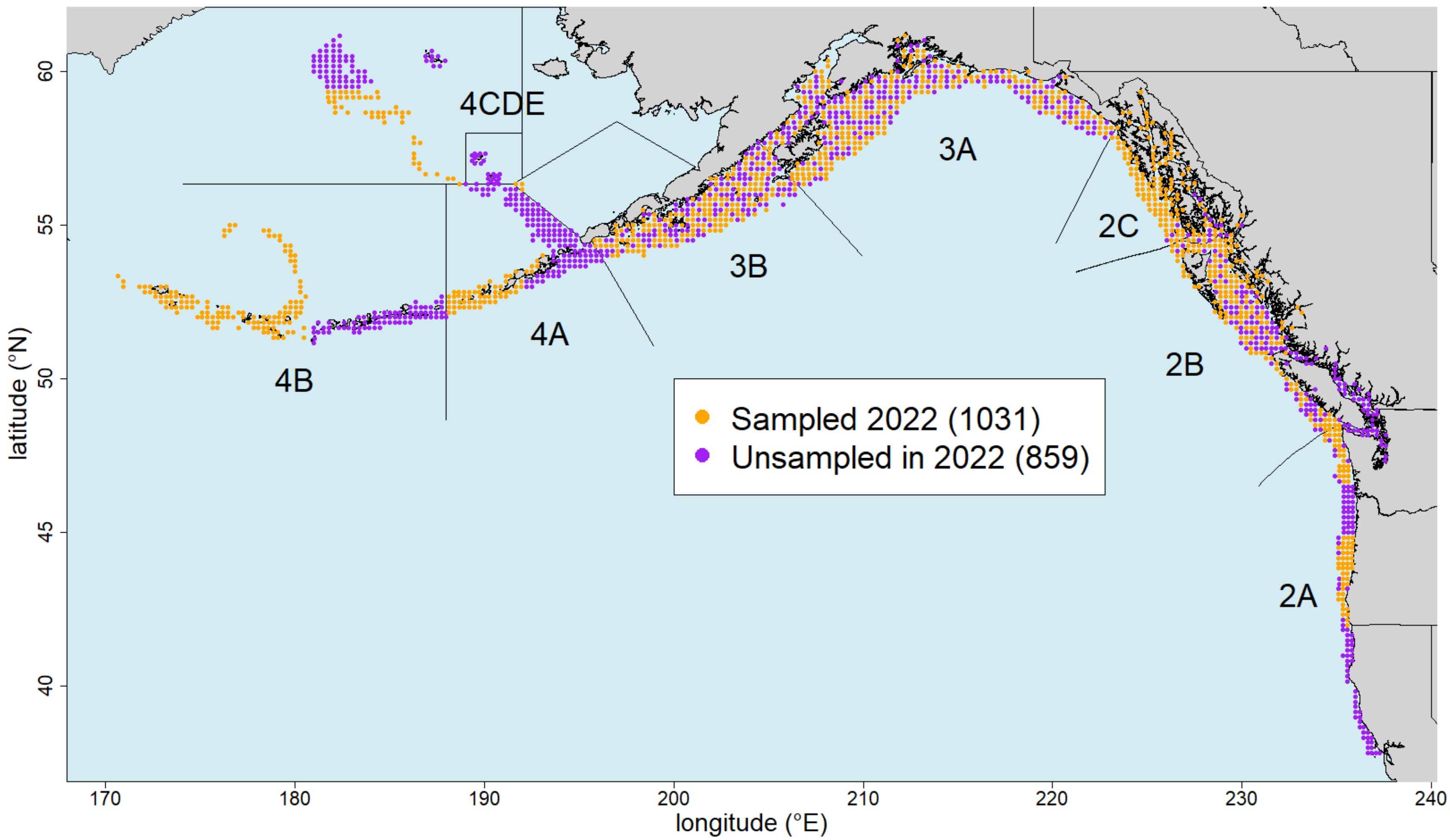

Figure 6. Optimized FISS design for 2022, with original design endorsed at SRB018 modified to remove northern Bering Sea shelf edge stations fished in 2021 augmented with additional stations in IPHC Regulatory Areas 2B, 2C, 3A, and 3B in order to help achieve the secondary objective of long-term revenue neutrality.

Summary of the data, stock assessment, and harvest decision table for Pacific halibut (*Hippoglossus stenolepis*) at the end of 2021

PREPARED BY: IPHC SECRETARIAT (I. STEWART, A. HICKS, R. WEBSTER, D. WILSON, AND B. HUTNICZAK; 13 OCTOBER & 23 NOVEMBER 2021)

PURPOSE

To provide the Commission with a summary of the data, stock assessment, and harvest decision table at the end of 2021.

INTRODUCTION

In 2021 the International Pacific Halibut Commission (IPHC) undertook its annual coastwide stock assessment of Pacific halibut (*Hippoglossus stenolepis*). This assessment represents an update to the 2020 stock assessment (IPHC-2020-SA01), with incremental changes documented through a two-part review by the IPHC's Scientific Review Board (SRB; IPHC-2021-SRB018-R, IPHC-2021-SRB019-R). Changes and new data for 2021 include:

1. Update the version of the stock synthesis software (Methot and Wetzel 2013) used for the analysis (3.30.17).
2. New modelled trend information from the 2021 IPHC's FISS (fishery-independent setline survey), including estimates covering the entire 1890 station design and all IPHC Regulatory Areas.
3. Age, length, individual weight, and average weight-at-age estimates from the 2021 FISS for all IPHC Regulatory Areas.
4. 2021 (and a small amount of 2020) Commercial fishery logbook trend information from all IPHC Regulatory Areas.
5. 2021 Commercial fishery biological sampling (age, length, individual weight, and average weight-at-age) from all IPHC Regulatory Areas. Sex-ratios-at-age for the 2020 commercial fishery (building on the 2017-2019 sex-ratios used in the 2020 stock assessment).
6. Biological information (lengths and/or ages) from non-directed discards (IPHC Regulatory Areas where available) and the recreational fishery (IPHC Regulatory Area 3A only) from 2020.
7. Updated mortality estimates for 2020 (where preliminary values were used) and estimates for all sources in 2021.

This document provides an overview of the final data sources available for the 2021 Pacific halibut stock assessment including the population trends and distribution among IPHC Regulatory Areas based on the modelled IPHC fishery-independent setline survey (FISS), directed commercial fishery data, and results of the stock assessment.

Overall, model results remain highly consistent with those of recent stock assessments. Spawning biomass trends continue slightly downward, although the 2021 assessment reports less decline than projected, partly due to estimated mortality below that associated with limits set for 2021. The 2012 year-class, estimated to be stronger than any since 2005, is critically important to short-term projections of stock and fishery dynamics.

STOCK AND MANAGEMENT

The stock assessment reports the status of the Pacific halibut (*Hippoglossus stenolepis*) 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 the Salish Sea, but excludes known extremities in the western Bering Sea within the Russian Exclusive Economic Zone (Figure 1).

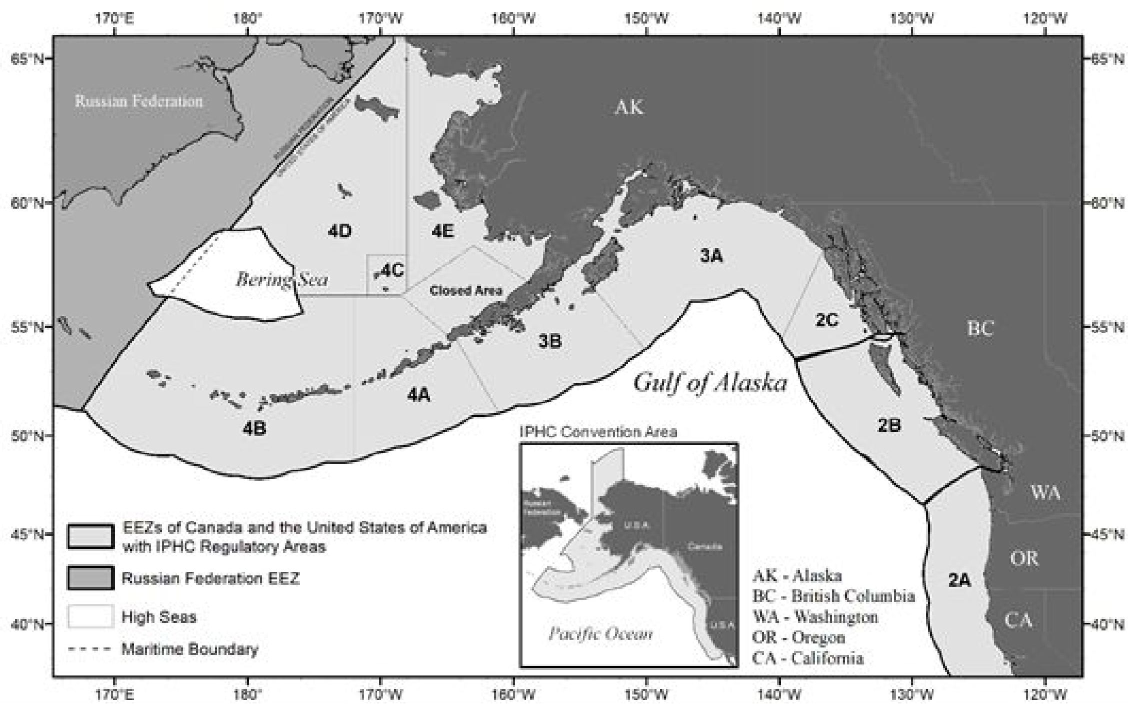

FIGURE 1. IPHC Convention Area (insert) and IPHC Regulatory Areas.

The Pacific halibut fishery has been managed by the IPHC since 1923. Mortality 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 short-term risks associated with alternative management actions. Mortality tables projecting detailed summaries for fisheries in each IPHC Regulatory Area (and reference levels indicated by the IPHC's interim management procedure) will be provided in early January 2022 for exploration via the IPHC's mortality projection tool (IPHC-2021-IM097-INF02).

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 1888-2021 mortality has totaled 7.3 billion pounds (~3.3 million metric tons, t). Since 1922, the fishery has ranged annually from 34 to 100 million pounds

[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.

(15,000-45,000 t) with an annual average of 63 million pounds (~29,000 t; Figure 2). Annual mortality was above this 100-year average from 1985 through 2010 and has averaged 38.5 million pounds (~17,500 t) from 2017-21.

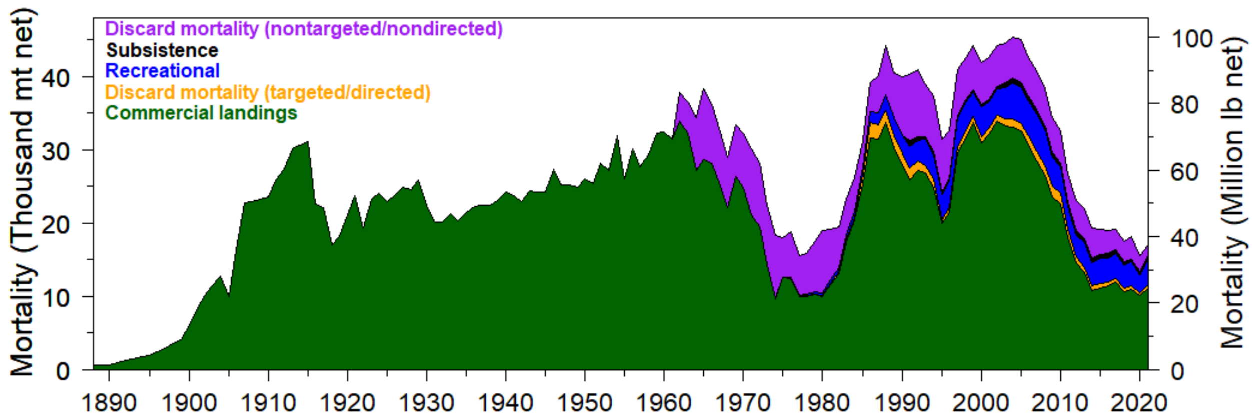

FIGURE 2. Summary of estimated historical mortality by source (colors), 1888-2021.

2021 Fishery and IPHC FISS statistics

Data for stock assessment use are 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). The assessment data from both fishery dependent and fishery independent sources, as well as auxiliary biological information, are most spatially complete since the late-1990s. Primary sources of information for this assessment include mortality estimates from all sources (IPHC-2021-IM097-06), modelled indices of abundance (IPHC-2021-IM097-08 Rev_1) based on the IPHC's FISS (in numbers and weight) and other surveys, commercial Catch-Per-Unit-Effort (in 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 2021, the most important information came from the modelled index of abundance reflecting the extensive 2021 FISS and associated biological sampling. Routine updates of logbook records from the 2021 (and earlier) directed commercial fishery, as well as age-frequency observations and individual weights from the commercial fishery were also included. Directed commercial fishery sex-ratios at age were available for 2020 (building on the genetic data for 2017-2019 previously available). Beginning in 2019, individual weights have been collected during FISS operations such that WPUE (weight per unit effort) and stock distribution estimates are calculated directly, without the use of the historical weight-length relationship. All mortality estimates (including changes to the existing time-series where new estimates have become available) were extended to include 2021. All available information was finalized on 1 November 2021 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).

Coastwide commercial Pacific halibut fishery landings (including research landings) in 2021 were approximately 24.5 million pounds (~11,100 t), up 9% from 2020[2]. Discard mortality in non-directed fisheries was estimated to be 3.5 million pounds in 2021 (~1,600 t)[3], down 23% from 2020 and representing the smallest estimate in the time-series. The total recreational mortality (including estimates of discard mortality) was estimated to be 7.6 million pounds (~3,470 t) up 43% from reduced fisheries that occurred in 2020. Mortality from all sources increased by 10% to an estimated 37.7 million pounds (~17,100 t) in 2021 based on preliminary information available through 1 November 2021.

The 2021 modelled FISS results detailed a coastwide aggregate NPUE (numbers per unit effort) which increased by 17% from 2020 to 2021, reversing the declines observed over the last four years (Figure 3). Biological Region 3 increased by 28%, while Biological Region 2 increased by 15%. Biological Regions 4, and 4B (sampled as planned in 2021 after the curtailed survey in 2021) both showed small declines (3 and 2%) and are at or near the lowest values in the estimated time-series. The 2021 modelled coastwide WPUE of legal (O32) Pacific halibut, the most comparable metric to observed commercial fishery catch rates, increased by 4% from 2020 to 2021. This reduced trend relative to that for NPUE indicates that recruitment of younger fish is contributing more to current stock productivity than somatic growth of fish already over the legal minimum size limit. Individual IPHC Regulatory Areas varied from a 57% increase (Regulatory Area 3B) to a 9% decrease (Regulatory Area 4CDE; Figure 4) in O32 WPUE. Due to the extensive survey conducted in 2021, uncertainty was near or below historical levels for most IPHC Regulatory Areas in 2021.

[2] The mortality estimates reported in this document are those available on 1 November 2021 and used in the assessment analysis; they include projections through the end of the fishing season.

[3] The IPHC receives preliminary estimates of the current year's non-directed commercial discard 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. Further updates are anticipated in January 2022 and will be incorporated into final projections for 2022.

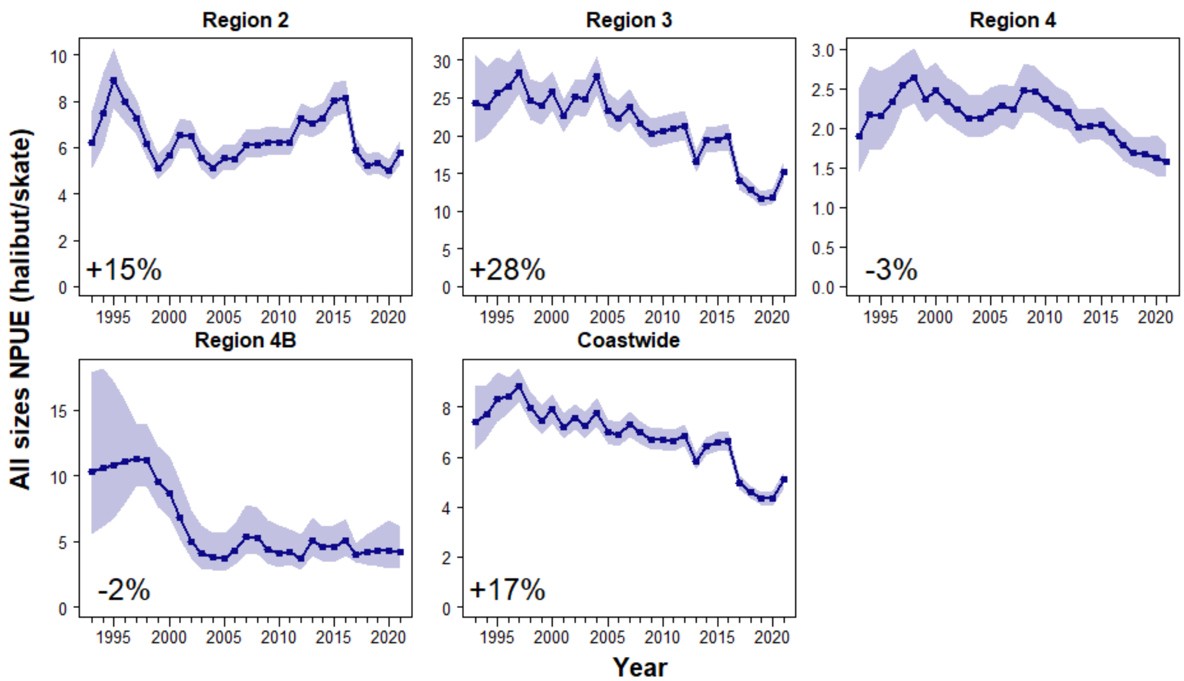

FIGURE 3. Trends in modelled FISS NPUE by Biological Region, 1993-2021. Percentages indicate the change from 2020 to 2021. Shaded zones indicate 95% credible intervals.

Preliminary commercial fishery WPUE estimates from 2020 logbooks increased by 2% at the coastwide level (Figure 5). The bias correction to account for additional logbooks compiled after the fishing season resulted in an estimate of no change (+/- 0%) coastwide. Trends varied among IPHC Regulatory Areas and gears; however, Area-specific trends were mixed, and generally similar to those from the FISS, with the exception of IPHC Regulatory Area 4A which showed a sharp increase in the commercial data.

Biological information (ages and lengths) from the commercial fishery landings continue to show the 2005 year-class as the largest coastwide contributor (in number) to the fish encountered, with the 2012 year-class nearly as abundant. The FISS observed the 2012 cohort (9 years old) at the largest proportion in the total catch of any age class for the first time. Observation of these fish both above and below the commercial fishery minimum size limit indicates their increasing importance to the stock and to future fisheries. Individual size-at-age appears to be increasing for younger ages (<14) in most IPHC Regulatory Areas and coastwide. Although size-at-age changes slowly, if the current pattern persists into older ages, it could have large implications for overall yield.

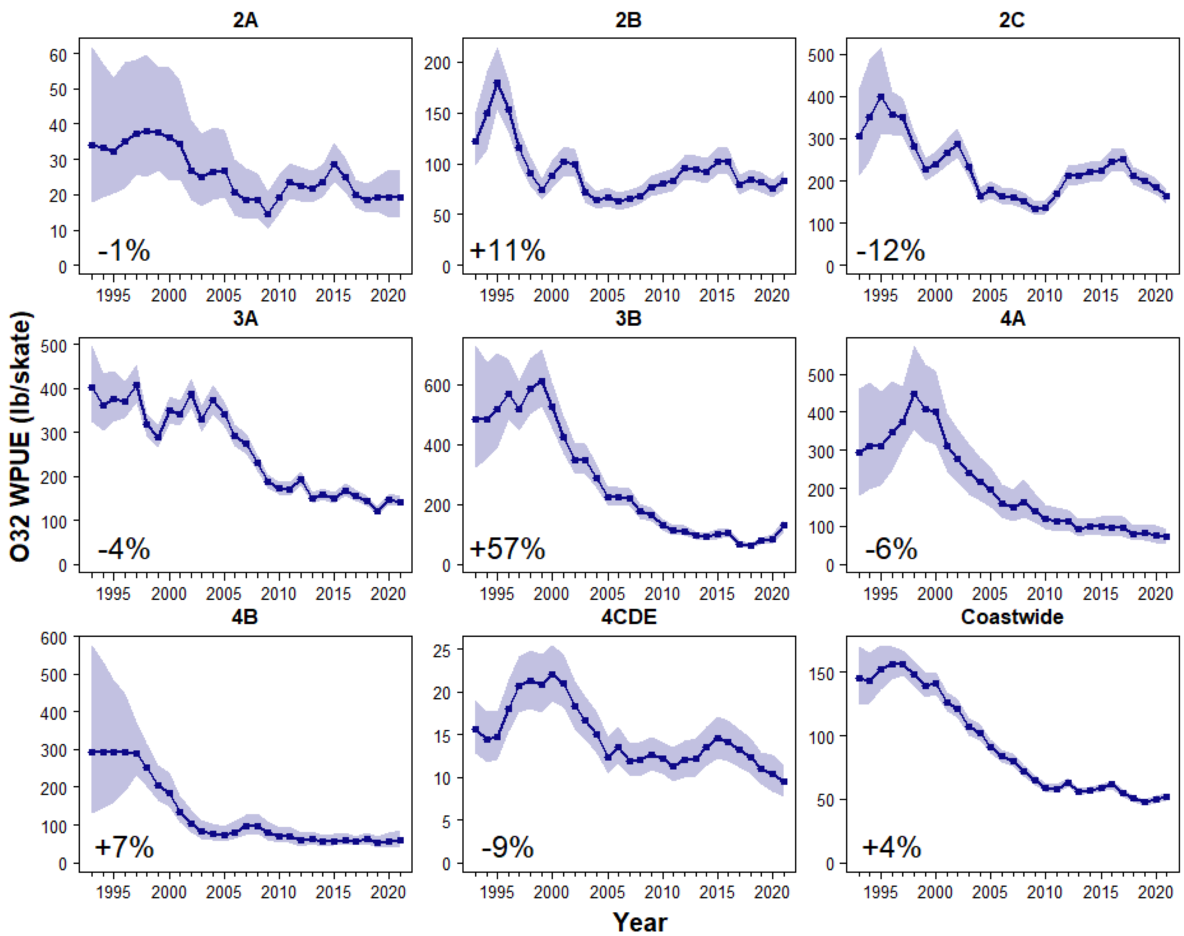

FIGURE 4. Trends in modelled FISS legal (O32) WPUE by IPHC Regulatory Area, 1993-2021. Percentages indicate the change from 2020 to 2021. Shaded zones indicate 95% credible intervals.

Biological stock distribution

The current trend in population distribution (measured via the modelled FISS catch in weight of all Pacific halibut) appears to be shifting back toward Biological Region 3 after more than a decade of decline. In both 2020 and 2021, Biological Regions 2 and 4 have decreased, while Region 4B has stayed relatively constant (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 or the average distribution in the absence of fishing mortality may compare with recent observations.

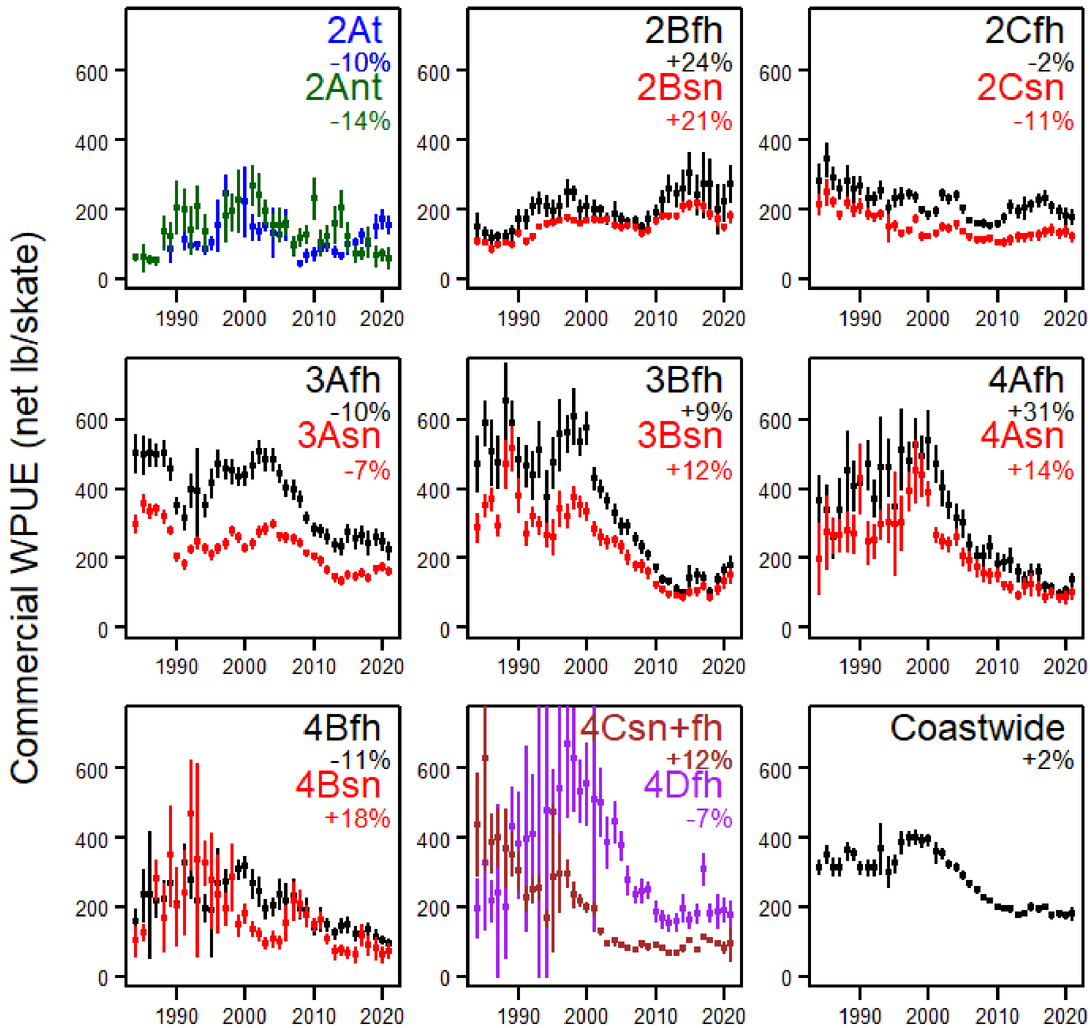

FIGURE 5. Trends in commercial fishery WPUE by IPHC Regulatory Area and fishery or gear, 1984-2021. The tribal fishery in 2A is denoted by "2At", non-tribal by "2Ant", fixed hook catch rates by "fh" and snap gear catch rates by "sn" for IPHC Regulatory Areas 2B-4D. Percentages indicate the change from 2020 to 2021 uncorrected for bias due to incomplete logbooks (see text above). Vertical lines indicate approximate 95% confidence intervals.

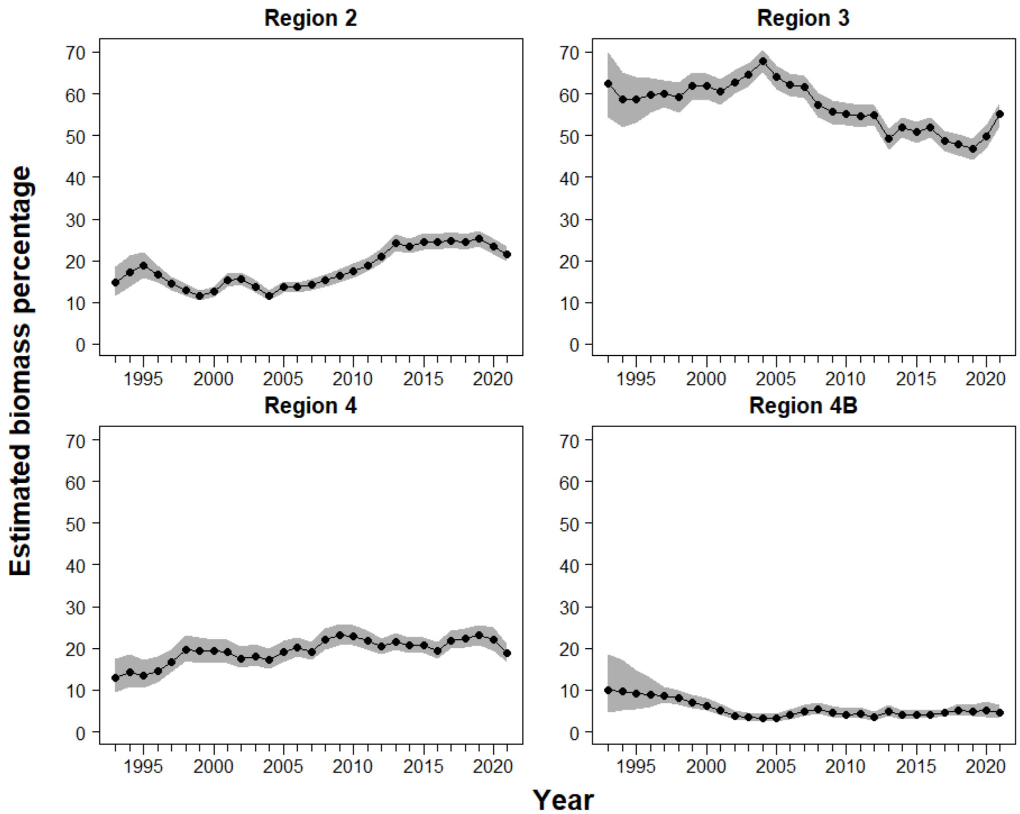

FIGURE 6. Estimated stock distribution (1993-2021) based on modelled survey catch weight of all sizes of Pacific halibut. Shaded zones indicate 95% credible intervals.

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
2017	24.5%	48.3%	22.6%	4.6%
2018	24.1%	47.6%	22.9%	5.4%
2019	24.9%	46.3%	23.8%	5.0%
2020	23.0%	49.4%	22.6%	5.1%
2021	21.3%	54.8%	19.2%	4.7%

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 for all regions are available. For each time-series length, there are two models: one fitting to coastwide aggregate data, and one fitting to data disaggregated into the four Biological 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 was a full analysis, including a complete re-evaluation of all data sources and modelling choices, particularly those needed to accommodate the newly available sex-ratio at age data from the commercial fishery. The 2020 stock assessment represented an update to the 2019 analysis, adding data sources where available, but retaining the same basic model structure for each of the four component models. The 2021 assessment again updates the same model structure with new data; incremental changes were again documented through a two-part review by the IPHC's scientific review process (IPHC-2021-SRB018-R, IPHC-2021-SRB019-R).

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 uncertainty provides a basis for risk assessment and reduces the potential for abrupt changes in management quantities as improvements and additional data are added to individual models. The four models continue to be equally weighted. Within-model uncertainty was propagated through to the ensemble results via the maximum likelihood estimates and an asymptotic approximation to individual model variance estimates. 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 2021 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 191 million pounds (~86,600 t) at the beginning of 2022, with an approximate 95% credible interval ranging from 129 to 277 million pounds (~58,700-125,400 t; Figure 8). The recent spawning biomass estimates from the 2021 stock assessment are very consistent with previous analyses, back to 2012 (Figure 9). Prior to that period, the current assessment indicates a high probability of larger biomass than estimated prior to the 2019 stock assessment; this is largely the result of the addition of sex-ratio information for the directed commercial landings. All assessments since 2015 have indicated a decreasing spawning biomass in the terminal year.

Average Pacific halibut recruitment is estimated to be higher (71 and 72% for the coastwide and AAF models respectively) during favorable Pacific Decadal Oscillation (PDO) regimes, a widely recognized indicator of ecosystem productivity in the north Pacific (primarily the Gulf of Alaska). 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 2019 were positive, with 2020 and 2021 (through September) showing negative average conditions. Although strongly correlated with historical recruitments, it is unclear whether recent conditions are comparable to those observed in previous decades.

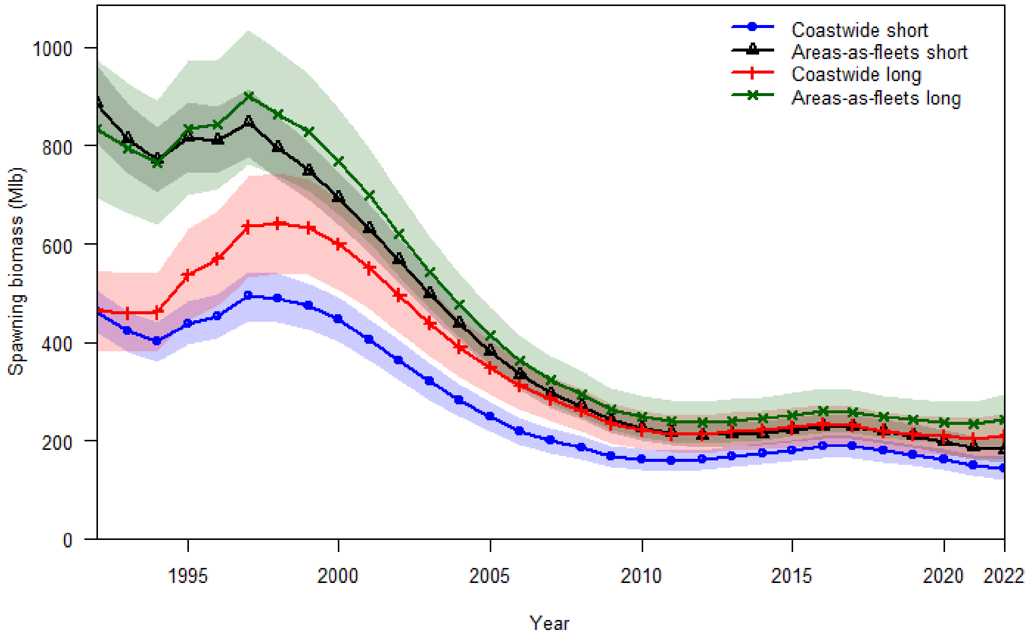

FIGURE 7. Estimated spawning biomass trends (1992-2022) based on the four individual models included in the 2021 stock assessment ensemble. Series indicate the maximum likelihood estimates; shaded intervals indicate approximate 95% credible intervals.

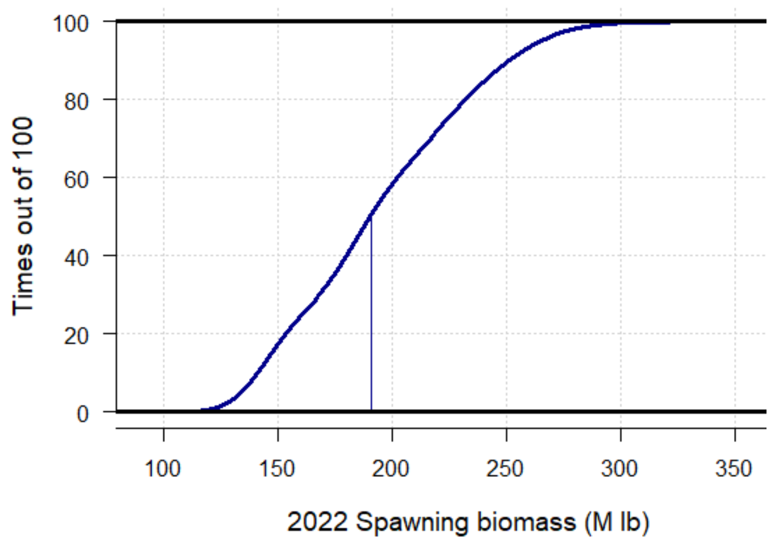

FIGURE 8. Cumulative distribution of the estimated spawning biomass at the beginning of 2022. Curve represents the estimated probability that the biomass is less than or equal to the value on the x-axis; vertical line represents the median (191 million pounds, ~86,600 t).

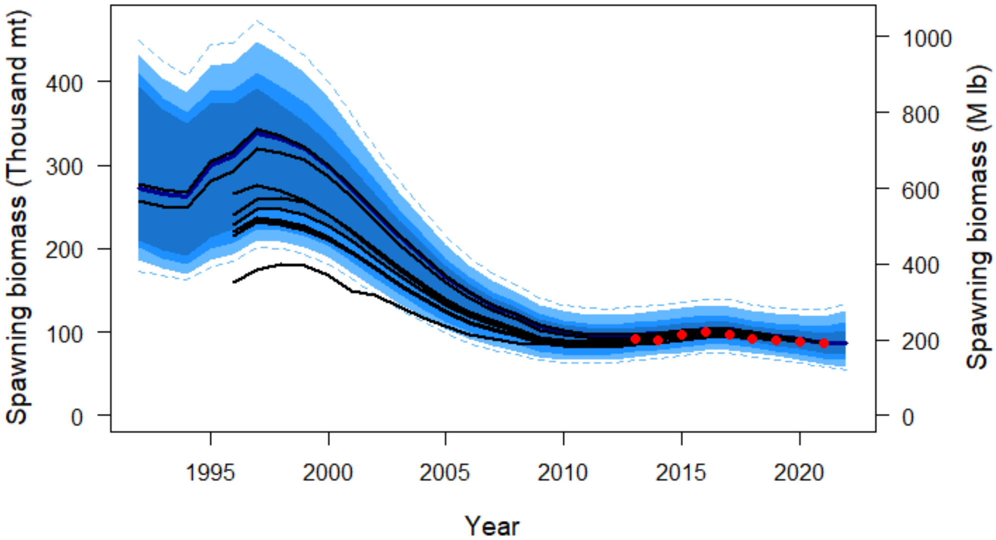

FIGURE 9. Retrospective comparison among recent IPHC stock assessments. Black lines indicate estimates of spawning biomass from assessments conducted in 2012-2020 with the terminal estimate shown as a red point. The shaded distribution denotes the 2021 ensemble: the dark blue line indicates the median (or "50:50 line") with an equal probability of the estimate falling above or below that level; and 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.

Pacific halibut recruitment estimates show the recent large cohorts in 1999 and 2005 (Figure 10). Cohorts from 2006 through 2011 are estimated to be much smaller than those from 1999-2005, which has resulted in a decline in both the stock and fishery yield as these low recruitments have moved into the spawning biomass. Based on age data through 2021, individual models in this assessment produced estimates of the 2012 year-classes that are comparable to the magnitude of the 2005 year-class. The 2012 year-class is estimated to be 19% mature in 2021, and the maturation of this cohort has a strong effect on the short-term projections.

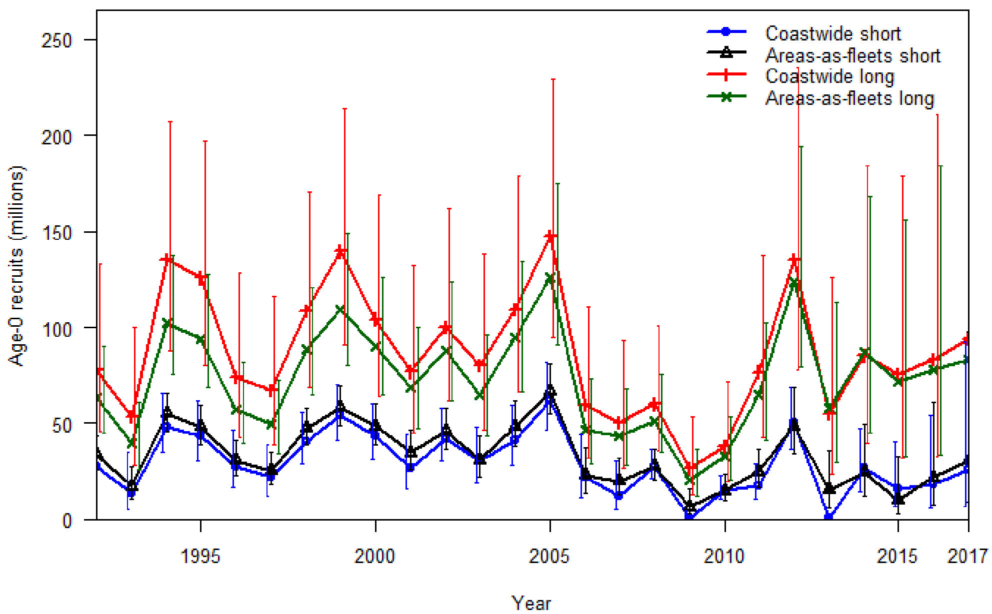

FIGURE 10. Estimated age-0 recruitment trends (1992-2017) based on the four individual models included in the 2021 stock assessment ensemble. Series indicate the maximum likelihood estimates; vertical lines indicate approximate 95% credible intervals.

The IPHC's interim management procedure uses a relative spawning biomass of 30% as a trigger, below which the reference fishing intensity is reduced. At a spawning biomass limit of 20%, directed fishing is halted due to the critically low biomass condition. This calculation is based on recent biological conditions: current weight-at-age and estimated recruitments still influencing the stock. Thus, the 'dynamic' calculation measures only the effect of fishing on the spawning biomass. The relative spawning biomass in 2022 was estimated to be 33% (credible interval: 22-54%) equal to the estimate from 2020, and greater than the values estimated for the previous decade. The probability that the stock is below the $SB_{30\%}$ level is estimated to be 45% at the beginning of 2022, with less than a 1% chance that the stock is below $SB_{20\%}$. The two long time-series models (coastwide and areas-as-fleets) show different results when comparing the current stock size to that estimated at the historical low in the 1970s. The AAF model estimates that recent stock sizes are well below those levels (57%), and the coastwide model above (225%). The 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.

The IPHC's interim management procedure specifies a reference level of fishing intensity of a Spawning Potential Ratio (SPR) corresponding to an $F_{43\%}$; this equates to the level of fishing that would reduce the lifetime spawning output per recruit to 43% of the unfished level given current biology, fishery characteristics and demographics. The 2021 fishing intensity is estimated to correspond to $F_{46\%}$ (credible interval: 35-63%; Table 2). Both 2020 and 2021 are estimated to be less than values estimated for the last 20+ years. This drop in fishing intensity corresponds both to reduced mortality limits (2020) and actual mortality below the limits (2020 and 2021). Comparing the relative spawning biomass and fishing intensity over the recent historical period 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).

BIO-SOCIOECONOMIC TRENDS

New for the 2021 assessment, the bio-socioeconomic conditions for the Pacific halibut fishery are described via an index of the relative price, costs (fuel and wages) and stock condition (see IPHC-2021-IM097-INF03 for additional details). The index value increased from 2020 to 2021 and is now 23% above the last 10-year average, reflecting relatively favorable conditions (Table 2). This increase was mainly driven by higher fish prices that recovered faster than fuel prices from the depressed values observed in 2020, and to some degree lower labor costs; the higher observed WPUE in 2021 had very little impact on the index (Figure 12).

TABLE 2. Status summary of Pacific halibut in the IPHC Convention Area at beginning of 2022.

Indicators	Values	Trends	Status
Total mortality 2021: Percent retained 2021: Average mortality 2017–21:	37.66 Mlbs, 17,084 t[1] 88% 38.48 Mlbs, 17,456 t	Mortality increased from 2020 to 2021	**2021 mortality near 100-year Low**
SPR_{2021}: P(SPR<43%): P(SPR<limit):	46% (35-63%)[2] 47% Limit not specified	Fishing intensity increased from 2020 to 2021	**Fishing intensity below reference level[3]**
SB_{2022} (Mlbs): SB_{2022}/SB_0: $P(SB_{2022}<SB_{30})$: $P(SB_{2022}<SB_{20})$:	191 (129–277) Mlbs 33% (22-54%) 45% <1%	SB decreased 17% from 2016 to 2022	**Not overfished[4]**
Biological stock distribution:	See Tables and Figures	Region 3 Increasing	**Within historical ranges**
Bio-socioeconomic conditions	23% above 10-year average	Increased from 2020 to 2021	**Favorable[5]**

[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 43%.
[4] Status determined relative to the IPHC's interim management procedure biomass limit of $SB_{20\%}$.
[5] Status determined relative to the most recent 10-year (2011-2020) average.

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.

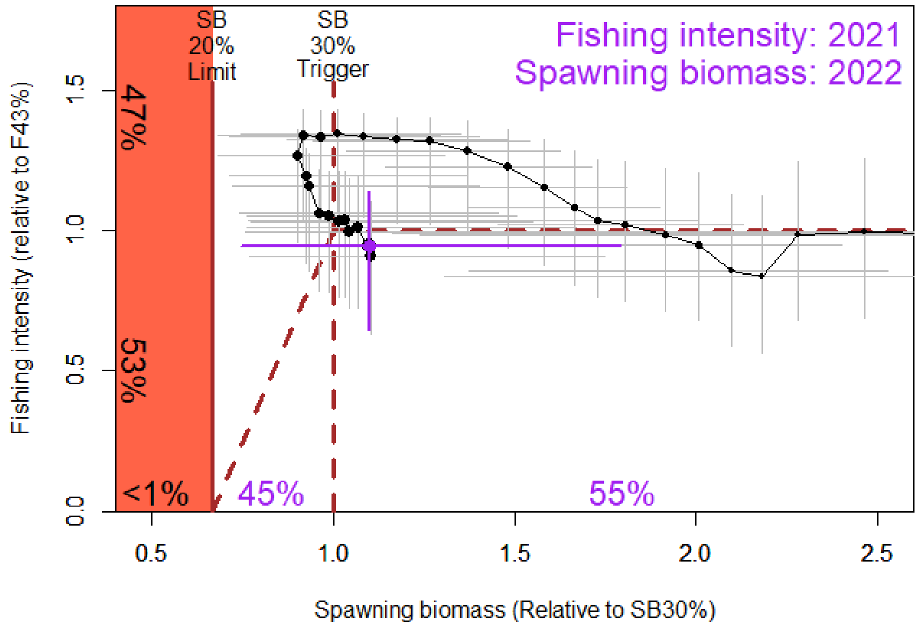

FIGURE 11. Phase plot showing the time-series (1992-2022) of estimated spawning biomass and fishing intensity relative to the reference points specified in the IPHC's interim management procedure. Dashed lines indicate the current $F_{43\%}$ (horizontal) reference fishing intensity, with linear reduction below the $SB_{30\%}$ (vertical) trigger, the red area indicates relative spawning biomass levels below the $SB_{20\%}$ limit. 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 2021 and spawning biomass at the beginning of 2022 shown as the largest point (purple). Percentages along the y-axis indicate the probability of being above and below $F_{43\%}$ in 2021; 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 2022.

The assessment utilized four years (2017-20) of sex-ratio information from the directed commercial fishery landings. However, uncertainty in historical ratios 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. This assessment also does not include mortality, trends, or explicit demographic linkages in 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 the lag in estimation of incoming recruitment between birth year and direct observation in the fishery and survey data (6-10 years). Like most stock assessments, there is no direct information on natural mortality, and increased uncertainty for some estimated components of the fishery mortality. Fishery mortality estimates are assumed to be accurate; therefore, uncertainty due to discard mortality estimation (observer sampling and representativeness), discard mortality rates, and any other documented mortality in either directed or non-directed fisheries (e.g., whale depredation) could create bias in this assessment. Maturation schedules and fecundity 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 trends in these biological processes at the scale of the entire population. Projections beyond three years are avoided due to the lack of mechanistic understanding of the factors influencing size-at-age and relative recruitment strength, the two most important factors in historical population trends.

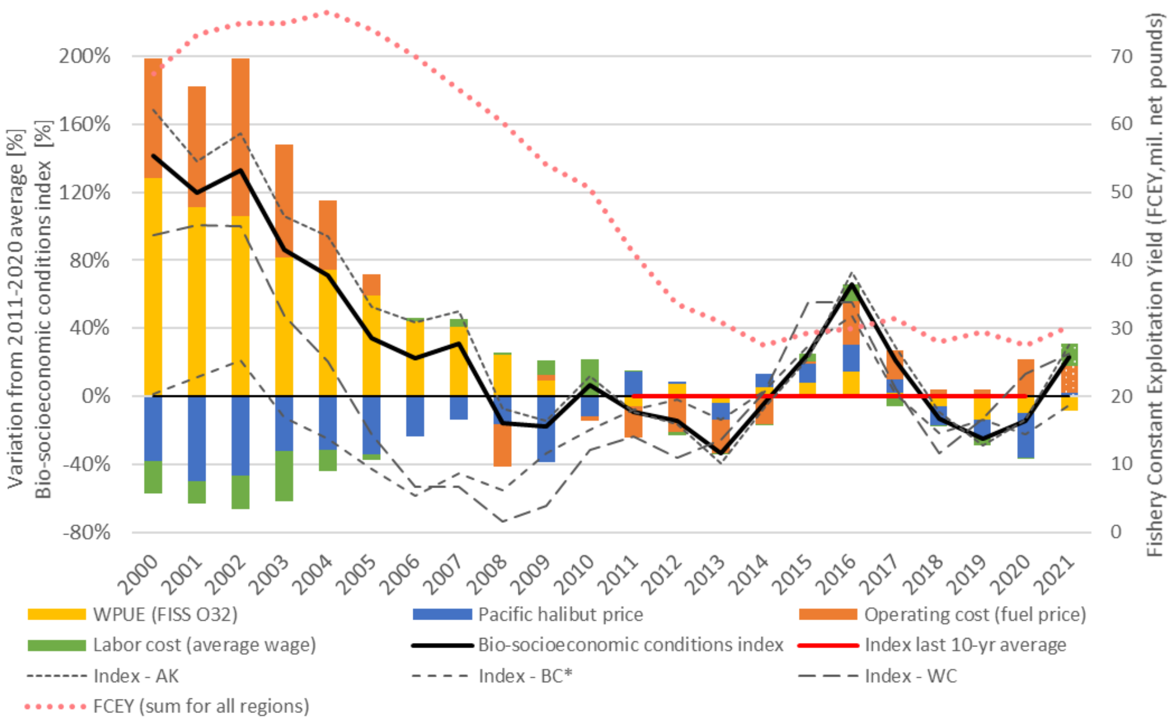

FIGURE 12. Bio-socioeconomic index for Pacific halibut fisheries (2000-2021). Thick black line denotes the annual index, stacked bars denote the contributing components, dashed lines show the regional indices, and the dotted line reports the coastwide FCEY (mortality limit for the directed fisheries) on the second axis. See IPHC-2021-IM097-INF03 for additional details.

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. Results of the IPHC's ongoing Management Strategy Evaluation (MSE) process can inform the development management procedures that are robust to estimation uncertainty via the stock assessment, and to a wide range of hypotheses describing population dynamics.

OUTLOOK

Stock projections were conducted using the integrated results from the stock assessment ensemble in tandem with summaries of the 2021 directed and non-directed fisheries. The harvest decision table (Table 3) 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 2022 (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) include several levels of mortality intended for evaluation of stock and management procedure dynamics including:

- No fishing mortality (useful to evaluate the stock trend due solely to population processes)
- A 30 million pound (~13,600 t) 2022 TCEY
- The mortality at which there is a 50% chance that the spawning biomass will be smaller in three years than in 2022 ("*3-year surplus*")
- The mortality consistent with repeating the TCEY set for 2021 (39.0 million pounds, 17,690 t; *"status quo"*).
- The mortality consistent with the current "Reference" SPR ($F_{43\%}$) level.
- A 60 million pound (~27,200 t) 2022 TCEY

A grid of alternative TCEY values corresponding to SPR values from 40% to 46% is also provided to allow for finer detail across the range of estimated SPR values identified by the MSE process as performing well with regard to stock and fishery objectives. For each column of the decision table, the total fishing mortality (including all sizes and sources), the coastwide TCEY and the associated level of fishing intensity projected for 2022 (median value with the 95% credible interval below) are reported.

The projections for this assessment are more optimistic than those from the 2019 and 2020 assessments due to the increasing projected maturity of the 2012 year-class. This translates to a lower probability of stock decline for 2022 than in recent assessments as well as a decrease in this probability through 2023-24. There is greater than a 50% probability of stock decline in 2023 (55-64/100) for the entire range of SPR values from 40-46%, which include the *status quo* TCEY and the $F_{43\%}$ reference level. The 2022 "3-year surplus" alternative, corresponds to a TCEY of 38.0 million pounds (~17,240 t), and a projected SPR of 48% (credible interval 32-63%; Table 3, Figure 12). At the reference level (a projected SPR of 43%), the probability of spawning biomass decline from 2022 to 2023 is 59%, decreasing to 55% in three years, as the 2012 cohort matures. The one-year risk of the stock dropping below $SB_{30\%}$ ranges from 43% at the $F_{46\%}$ level to 45% at the at the $F_{40\%}$ level of fishing intensity.

TABLE 3. Harvest decision table for 2022 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.

2022 Alternative						3-Year Surplus		*Status quo*		*Reference $F_{43\%}$*					
		Total mortality (M lb)	0.0	31.2	38.7	39.2	39.9	40.2	41.1	42.4	43.8	45.2	46.6	61.2	
		TCEY (M lb)	0.0	30.0	37.5	38.0	38.7	39.0	39.9	41.2	42.6	44.0	45.4	60.0	
		2022 fishing intensity	$F_{100\%}$	$F_{53\%}$	$F_{46\%}$	$F_{46\%}$	$F_{45\%}$	$F_{45\%}$	$F_{44\%}$	$F_{43\%}$	$F_{42\%}$	$F_{41\%}$	$F_{40\%}$	$F_{32\%}$	
		Fishing intensity interval	--	38-69%	32-64%	32-63%	32-63%	31-63%	31-62%	30-61%	29-60%	28-59%	28-59%	21-51%	
Stock Trend (spawning biomass)	in 2023	is less than 2022	<1	39	55	55	56	57	58	59	61	63	64	84	a
		is 5% less than 2022	<1	3	14	16	18	19	21	25	30	34	37	58	b
	in 2024	is less than 2022	<1	39	53	54	55	55	56	58	59	61	62	80	c
		is 5% less than 2022	<1	16	37	39	40	41	43	46	48	50	52	66	d
	in 2025	is less than 2022	<1	33	49	50	51	52	53	55	56	58	60	77	e
		is 5% less than 2022	<1	18	38	39	41	42	43	46	48	50	52	67	f
Stock Status (Spawning biomass)	in 2023	is less than 30%	31	40	43	43	43	43	44	44	44	45	45	48	g
		is less than 20%	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	h
	in 2024	is less than 30%	16	34	39	39	40	40	41	41	42	43	44	49	i
		is less than 20%	<1	<1	<1	<1	<1	1	1	1	1	1	1	6	j
	in 2025	is less than 30%	4	29	36	37	37	37	38	40	41	42	43	49	k
		is less than 20%	<1	<1	1	1	1	1	1	1	2	2	3	12	l
Fishery Trend (TCEY)	in 2023	is less than 2022	0	21	48	49	49	49	50	50	50	50	51	70	m
		is 10% less than 2022	0	7	41	42	44	45	47	48	49	50	50	58	n
	in 2024	is less than 2022	0	22	48	48	49	49	50	50	50	50	50	69	o
		is 10% less than 2022	0	9	41	42	44	45	46	48	49	50	50	58	p
	in 2025	is less than 2022	0	22	47	48	48	49	49	50	50	50	50	68	q
		is 10% less than 2022	0	10	40	42	43	44	46	48	49	49	50	58	r
Fishery Status (Fishing intensity)	in 2022	is above $F_{43\%}$	0	20	48	49	49	50	50	50	50	50	51	70	s

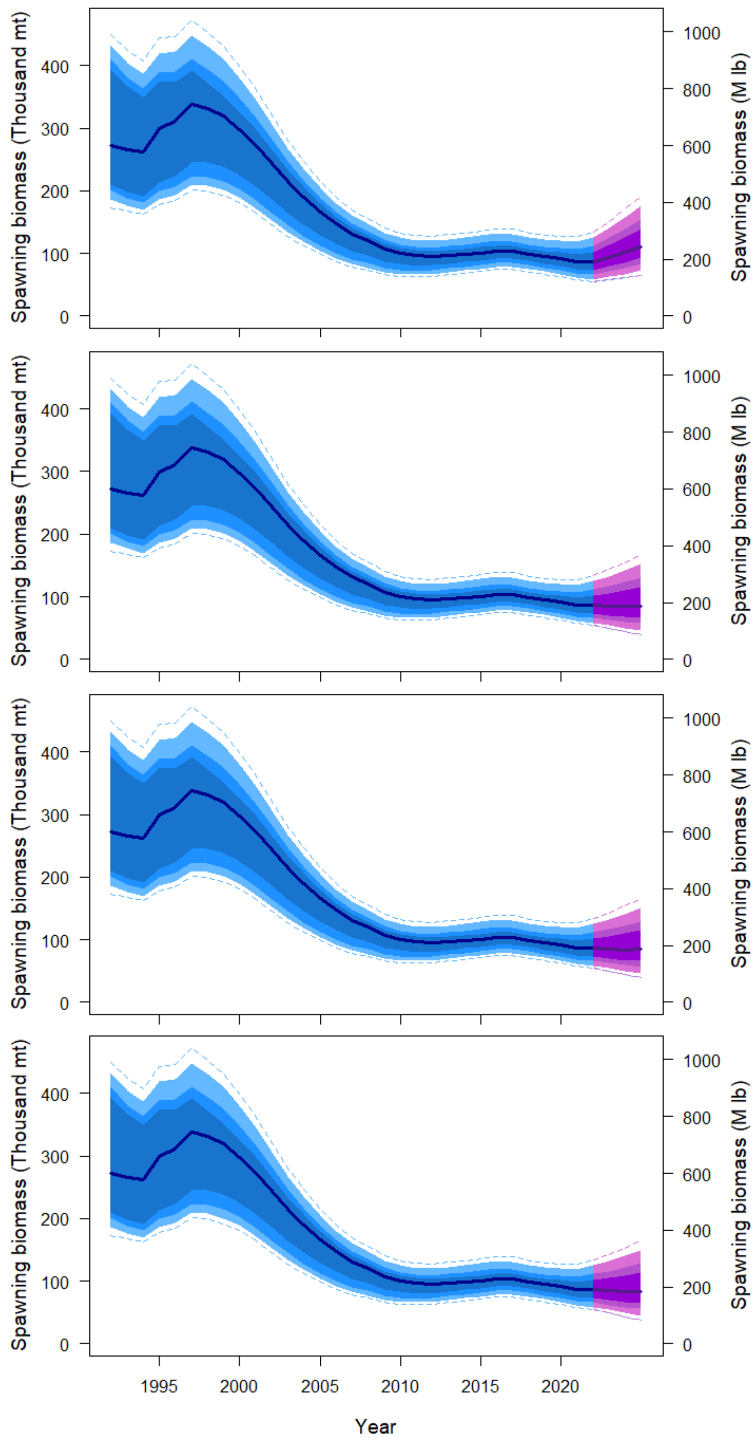

FIGURE 13. Three-year projections of stock trend under alternative levels of mortality: no fishing mortality (upper panel), the 3-year surplus (a TCEY of 38.0 million pounds, ~17,240 t; second panel), the *status quo* TCEY set in 2021 of 39.0 million pounds, 17,690 t; third panel), and the TCEY projected for the IPHC's interim management procedure (41.2 million pounds, 18,700 t; lower panel).

SCIENTIFIC ADVICE

Sources of mortality: In 2021, total Pacific mortality due to fishing increased to 37.66 million pounds (17,084 t) but remained below the 5-year average of 38.48 million pounds (17,456 t). Of that total, 88% comprised the retained catch (Table 2), up from 84% in 2020.

Fishing intensity: The 2021 fishing mortality corresponded to a point estimate of SPR = 46%; there is a 47% chance that fishing intensity exceeded the IPHC's current reference level of $F_{43\%}$ (Table 2). The Commission does not currently have a coastwide fishing intensity limit reference point.

Stock status (spawning biomass): Current (beginning of 2022) female spawning biomass is estimated to be 191 million pounds (86,600 t), which corresponds to an 45% chance of being below the IPHC 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 declined by 17% since 2016 but is currently at 33% 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 ($F_{43\%}$) 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 increased sharply over 2020-21, reversing over a decade of steady decline (Figure 6,Table 1). This trend occurs in tandem with declines in Biological Regions 2 and 4; however, all regions remain within the historical range observed from 1993-2021. These estimates have been updated and strongly informed by the comprehensive FISS design implemented in 2021 (IPHC-2021-IM097-07).

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 and are included in the IPHC's 5-year research plan (IPHC-2021-IM097-12).

DETAILED MANAGEMENT INFORMATION

The IPHC's interim management procedure, in place for 2021-22, includes setting a coastwide TCEY, and also a method for distributing that TCEY among IPHC Regulatory Areas. The distribution method uses the current estimate of stock distribution, relative harvest rates by IPHC Regulatory Area, specific adjustments to the TCEY in IPHC Regulatory Areas 2A and 2B, as well as an increase in the TCEY in IPHC Regulatory Area 2B accounting for the U26 non-directed discard mortality in Alaska. Details of the calculation framework are provided in IPHC-2021-IM097-INF02. The 2022 mortality projection tool will be produced in early January 2022, and will include any end-of-year revisions to mortality estimates from 2021 that are used as a basis for projections.

ADDITIONAL INFORMATION

Detailed material for AM098 will include any revisions to this summary document. As in 2020, a more detailed description of the stock assessment (IPHC-2022-SA-01) and the data sources

(IPHC-2022-SA-02), will be published directly to the stock assessment page on the IPHC's website. That page also includes recent peer review documents and previous stock assessment documents. Further, the IPHC's website contains many interactive tools for both FISS and commercial fishery information, as well as historical data series that replace appendices and tables from previous year's documents.

RECOMMENDATION/S

That the Commission:

a) **NOTE** paper IPHC-2021-IM097-10 Rev_1 which provides a summary of data, the 2021 stock assessment and the harvest decision table for 2022.

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IPHC 5-year Biological and Ecosystem Science Research Plan: Update

PREPARED BY: IPHC SECRETARIAT (J. PLANAS, 13 OCTOBER 2021)

PURPOSE

To provide the Commission with a description of progress on the IPHC 5-year Biological and Ecosystem Science Research Plan (2017-21).

BACKGROUND

The main objectives of the Biological and Ecosystem Science Research at the 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 IPHC Five-Year Biological and Ecosystem Science Research Plan (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 and Distribution. 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 and Distribution.

   Research activities in this Research Area aim at improving existing knowledge on Pacific halibut larval and juvenile distribution. The relevance of research outcomes from these activities for stock assessment (SA) is in the improvement of estimates of productivity. These research outcomes will be used to generate potential recruitment covariates and to inform minimum spawning biomass targets by Biological Region and represent one of the top three biological inputs into SA (Appendix II). The relevance of these research outcomes for the management and strategy evaluation (MSE) process is in the improvement of the parametrization of the Operating Model and represent the top ranked biological input into the MSE (Appendix III).

1.1. Larval distribution and connectivity between the Gulf of Alaska and Bering Sea.
Principal Investigator: Lauri Sadorus (M.Sc.)
Objective: To investigate larval and juvenile connectivity of Pacific halibut within and between the Gulf of Alaska and the Bering Sea.

Knowledge of the dispersal of Pacific halibut larvae and subsequent migration of young juveniles has remained elusive because traditional tagging methods are not effective on these life stages due to the small size of the animals. This larval connectivity project, in cooperation with NOAA EcoFOCI, used two recently developed modeling approaches to estimate dispersal and migration pathways of larval and young juvenile Pacific halibut in order to better understand the connectivity of populations between the Gulf of Alaska and Bering Sea and within each of these two ocean basins. The results of this study have been published in the journal *Fisheries Oceanography* (Sadorus et al., 2021).

1.2. Wire tagging of U32 Pacific halibut.
Principal Investigator: Joan Forsberg (B.Sc.; Fisheries Statistics & Services Branch)
Objective: To investigate the migratory patterns of young Pacific halibut.

The patterns of movement of Pacific halibut among IPHC Regulatory Areas have important implications for management of the Pacific halibut fishery. The IPHC Secretariat has undertaken a long-term study of the migratory behavior of Pacific halibut through the use of externally visible tags (wire tags) on captured and released fish that must be retrieved and returned by workers in the fishing industry. In 2015, with the goal of gaining additional insight into movement and growth of young Pacific halibut (less than 32 inches [82 cm]; U32), the IPHC began wire-tagging small Pacific halibut encountered on the National Marine Fisheries Service (NMFS) groundfish trawl survey and, beginning in 2016, on the IPHC fishery-independent setline survey (FISS). In 2020, 465 Pacific halibut were tagged and released on the IPHC FISS but no tagging was conducted in the NMFS groundfish trawl surveys because of its cancellation due to COVID-19. Therefore, a total of 3,577 U32 Pacific halibut have been wire tagged and released on the IPHC FISS and 96 of those have been recovered to date. In the NMFS groundfish trawl surveys through 2019, a total of 6,536 tags have been released and, to date, 69 tags have been recovered.

2. Reproduction.

Research activities in this Research Area aim at providing information on key biological processes related to reproduction in Pacific halibut (maturity and fecundity) and to provide sex ratio information of Pacific halibut commercial landings. The relevance of research outcomes from these activities for stock assessment (SA) is in the scaling of Pacific halibut biomass and in the estimation of reference points and fishing intensity. These research outputs will result in a revision of current maturity schedules and will be included as inputs into the SA (Appendix II), and represent the most important biological inputs for stock assessment. The relevance of these research outcomes for the management and strategy evaluation process is in the improvement of the simulation of spawning biomass in the Operating Model (Appendix III).

2.1. Sex ratio of the commercial landings.
Principal Investigators: Anna Simeon (M.Sc.), Crystal Simchick (B.Sc.)
Objective: To provide information on the sex ratio of the commercial landings.

The IPHC Secretariat has completed the processing of genetic samples from the 2020 aged commercial landings. The IPHC Secretariat has now produced four consecutive years of commercial catch sex-ratio information (2017-2020) that will inform selectivity parameters and cumulatively reduce uncertainty in future estimates of stock size.

2.2. Maturity assessment.
Principal Investigator: Josep Planas (Ph.D.)
Objective: To characterize maturity and fecundity in female Pacific halibut.

Recent sensitivity analyses have shown the importance of changes in spawning output due to skip spawning and/or changes in maturity schedules for stock assessment (Stewart and Hicks, 2018). Information of these key reproductive parameters provides direct input to stock assessment. For example, information on fecundity-at-age and –at-size could be used to replace spawning biomass with egg output as the metric of reproductive capability in the stock assessment and management reference points. This information highlights the need for a better understanding of factors influencing reproductive biology and reproductive success of Pacific halibut. In order to fill existing knowledge gaps related to the reproductive biology of female Pacific halibut, research efforts are devoted to characterize female maturity in this species. Specific objectives of current studies include: 1) histological assessment of the temporal progression of female developmental stages and reproductive phases throughout an entire reproductive cycle; 2) investigation of skip-spawning in females; and 3) fecundity estimations.

The IPHC Secretariat has described for the first time the different oocyte stages that are present in the ovary of female Pacific halibut and how these are used to classify females histologically to specific maturity stages. This information is contained in a manuscript that has been recently published in the *Journal of Fish Biology* (Fish et al., 2020). In brief, 8 different oocyte developmental stages have been described, from early primary growth oocytes until preovulatory oocytes, and their size and morphological characteristics established. Maturity classification was determined by assigning maturity status to the most advanced oocyte developmental stage present in ovarian tissue sections and 7 different microscopic maturity stages were established. Analysis of oocyte size frequency distribution among the seven different maturity stages provided the first direct evidence for the group-synchronous pattern of oocyte development and for determinate fecundity as the reproductive strategy in female Pacific halibut. The results of this study will allow us to establish a comparison of the microscopic/histological and macroscopic/field classification criteria that are currently used to assign the maturity status of females that is used in stock assessment. The results of this study set the stage for and in-depth study on temporal changes in reproductive development, as assessed by microscopic observations of ovarian samples collected throughout an entire annual reproductive cycle, that is currently underway. Preliminary results confirm that the peak period of spawning for Pacific halibut in the central Gulf of Alaska takes place in January and February. Analysis of the temporal changes in female reproductive phase shows that spawning capable females are detected as early as August, therefore marking the beginning of the spawning capable reproductive phase. For stock assessment purposes, the spawning capable reproductive phase comprises females that are considered mature. Importantly, the detection of spawning capable females in July-August is conducive to conducting routine histological assessments of female maturity during the IPHC's FISS sample collection period (i.e. June to late August).

Furthermore, the IPHC Secretariat is also establishing a comparison of the microscopic (e.g. histological) and macroscopic (e.g. visual) maturity classification criteria to determine whether field classification criteria that are currently used to assign the maturity status of females that is used in stock assessment needs to be revised in light of the improved knowledge on ovarian development.

3. Growth.
Principal Investigator: Josep Planas (Ph.D.)
Objective: To investigate somatic growth variation as a driver for changes in size-at-age.

Research activities conducted in the Research Area on Growth aim at providing information on somatic growth processes driving size-at-age in Pacific halibut. The relevance of research outcomes from these activities for stock assessment resides, first, in their ability to inform yield-per-recruit and other spatial evaluations for productivity that support mortality limit-setting, and, second, in that they may provide covariates for projecting short-term size-at-age and may help delineate between fishery and environmental effects, thereby informing appropriate management responses (Appendix II). The relevance of these research outcomes for the management and strategy evaluation process is in the improvement of the simulation of variability and to allow for scenarios investigating climate change (Appendix III).

The IPHC Secretariat has conducted studies aimed at elucidating the drivers of somatic growth leading to the decline in size-at-age by investigating the physiological mechanisms that contribute to growth changes in the Pacific halibut. The two main objectives of these studies have been: 1) the identification and validation of physiological markers for somatic growth; and 2) the application of molecular growth markers for evaluating growth patterns in the Pacific halibut population.

The IPHC Secretariat has completed a study funded by the North Pacific Research Board (NPRB Project No. 1704; 2017-2020) to identify relevant physiological markers for somatic growth. This study resulted in the identification of 23 markers in skeletal muscle that were indicative of temperature-induced growth suppression and 10 markers in skeletal muscle that were indicative of temperature-induced growth stimulation. These markers represented genes and proteins that changed both their mRNA expression levels and abundance levels in skeletal muscle, respectively, in parallel with changes in the growth rate of Pacific halibut. A manuscript describing the results of this study is currently in preparation (Planas et al., in preparation).

In addition to temperature-induced growth manipulations, the IPHC Secretariat has conducted similar studies as part of NPRB Project No. 1704 to identify physiological growth markers that respond to density- and stress-induced growth manipulations. The respective justifications for these studies are that (1) population dynamics of the Pacific halibut stock could be affected by fish density, and (2) stress responses associated with capture and release of discarded Pacific halibut may affect subsequent feeding behavior and growth. Investigations related to the effects of density and stress exposure are still underway.

4. Discard Mortality Rates (DMRs) and Survival Assessment.
Information on all Pacific halibut removals is integrated by the IPHC Secretariat, providing annual estimates of total mortality from all sources for its stock assessment (SA). Bycatch and wastage of Pacific halibut, as defined by the incidental catch of fish in non-target fisheries and by the mortality that occurs in the directed fishery (i.e. fish discarded for sublegal size or for regulatory reasons), respectively, represent important sources of mortality that can result in significant reductions in exploitable yield in the directed fishery. Given that the incidental mortality from the commercial Pacific halibut fisheries and bycatch fisheries is included as part of the total removals that are accounted for in the SA, changes in the estimates of incidental mortality will influence the output of the SA and, consequently, the catch levels of the directed fishery. Research activities conducted in this Research Area aim at providing information on discard mortality rates and producing guidelines for reducing discard mortality in Pacific halibut in the longline and recreational fisheries. The relevance of research outcomes from these activities for SA resides in their ability to improve trends in unobserved mortality in order to improve estimates of stock productivity and represent the most important inputs in fishery yield for SA (Appendix II). The relevance of these research outcomes for the management and strategy evaluation process is in fishery parametization (Appendix III).

For this reason, the IPHC Secretariat is conducting two research projects to investigate the effects of capture and release on survival and to improve estimates of DMRs in the directed longline and guided recreational Pacific halibut fisheries:

4.1. Evaluation of the effects of hook release techniques on injury levels and association with the physiological condition of captured Pacific halibut and estimation of discard mortality using remote-sensing techniques in the directed longline fishery.
Principal Investigator: Claude Dykstra (B.Sc.)
Objective: To provide estimates of discard mortality and best-handling practices in the Pacific halibut directed fishery.

The IPHC Secretariat, with funding by a grant from the Saltonstall-Kennedy Grant Program NOAA (NA17NMF4270240; 2017-2020), has recently conducted studies to evaluate the effects of hook release techniques on injury levels, their association with the physiological condition of captured Pacific halibut and, importantly, has generated experimentally-derived estimates of discard mortality rate (DMR) in the directed longline fishery. The initial results on individual survival outcomes for Pacific halibut released in excellent condition as the viability category assigned to the fish following capture indicate a range of DMRs between 4.2% (minimum) and 8.4% (maximum), that is consistent with the currently-applied DMR value of 3.5%. A manuscript describing these results has been accepted for publication in the *Journal of North American Fishery Management* (Loher et al., in press).

The IPHC Secretariat is currently conducting modeling analyses of potential relationships between individual physiological characteristics of discarded Pacific halibut, environmental conditions and handling practices, as well as on the ability of electronic monitoring systems to capture release methods and individual lengths of captured fish.

4.2. Discard mortality rates of Pacific halibut in the charter recreational fishery.
Principal Investigator: Claude Dykstra (B.Sc.)
Objective: To provide estimates of discard mortality and best-handling practices in the Pacific halibut guided recreational fishery.

The IPHC Secretariat is conducting a research project to better characterize the nature of charter recreational fisheries with the ultimate goal of better understanding discard practices relative to that which is employed in the directed longline fishery. This project has received funding from the National Fish and Wildlife Foundation (NFWF Project No. 61484) and the North Pacific Research Board (NPRB Project No. 2009) (Appendix IV). The experimental field components of this research project took place in Sitka, Alaska (IPHC Regulatory Area 2C) from 21-27 May 2021, and in Seward, Alaska (IPHC Regulatory Area 3A) from 11-16 June 2021. In brief, Pacific halibut were captured with the use of 12/0 and 16/0 circle hooks that best reflect the gear currently used and fish sizes were targeted to cover the Pacific halibut size distribution recorded by ADFG on an annual basis. All injuries were documented, along with length, weight, somatic fat measurements (using the Distell Fatmeter), and a blood sample (for measuring the levels of physiological stress indicators in plasma) was collected for each fish, before they were tagged and released. Environmental information on temperature (bottom/surface) and time (fight time, time on deck) was also tracked. Eighty (80) Pacific halibut of Excellent release viability were fitted with satellite pop-up archival tags (sPAT) for near term survival estimation in IPHC Regulatory Area 3A. Analysis of survival data is currently underway.

5. Genetics and genomics.
Principal Investigator: Andy Jasonowicz (M.Sc.)
Objective: To investigate the genetic structure of the Pacific halibut population and to conduct genetic analyses to inform on Pacific halibut movement and distribution in the Convention Waters.

The IPHC Secretariat is conducting studies that incorporate genomics approaches in order to produce useful information on population structure and distribution and connectivity of Pacific halibut. The relevance of research outcomes from these activities for stock assessment (SA) resides (1) in the introduction of possible changes in the structure of future stock assessments, as separate assessments may be constructed if functionally isolated components of the population are found (e.g. IPHC Regulatory Area 4B), and (2) in the improvement of productivity estimates, as this information may be used to define management targets for minimum spawning biomass by Biological Region. These research outcomes provide the second and third top ranked biological inputs into SA (Appendix II). Furthermore, the relevance of these research outcomes for the management and strategy evaluation process is in biological parametization and validation of movement estimates, on one hand, and of recruitment distribution, on the other hand (Appendix III).

Understanding population structure is imperative for sound management and conservation of natural resources (Hauser, 2008). Pacific halibut in Canadian and USA waters are managed by the International Pacific Halibut Commission (IPHC) as a single coastwide unit stock since 2006. The rationale behind this management approach is based on our current knowledge of the highly migratory nature of Pacific halibut as assessed by tagging studies (Webster et al., 2013) and of past analyses of genetic population structure that failed to demonstrate significant differentiation in the North-eastern Pacific Ocean population of Pacific halibut by allozyme (Grant, 1984) and small-scale microsatellite analyses (Bentzen, 1998; Nielsen *et al.*, 2010). However, more recent studies have reported slight genetic population structure on the basis of genetic analysis conducted with larger sets of microsatellites suggesting that Pacific halibut captured in the Aleutian Islands may be genetically distinct from other areas (Drinan et al., 2016). These findings of subtle genetic structure in the Aleutian Island chain area are attributed to limited movement of adults and exchange of larvae between this area and the rest of the stock due to the presence of oceanographic barriers to larval and adult dispersal (i.e. Amchitka Pass) that could represent barriers to gene flow. Unfortunately, genetic studies suggesting subtle genetic structure (Drinan et al., 2016) were conducted based on a relatively limited set of microsatellite markers and, importantly, using genetic samples collected in the summer (i.e. non-spawning season) that may not be representative of the local spawning population. With the collection of winter (i.e. spawning season) genetic samples in the Aleutian Islands by the IPHC in early 2020, a collection of winter samples from 5 different geographic areas across the North-eastern Pacific Ocean (i.e. British Columbia, Central Gulf of Alaska, Bering Sea, Central and Western Aleutian Islands) is now available to re-examine the genetic structure of the Pacific halibut population. Importantly, novel, high-throughput and high-resolution genomics approaches are now available for use, such as low-coverage whole genome resequencing, in order to describe with unprecedented detail the genetic structure of the Pacific halibut population. The recently sequenced Pacific halibut genome constitutes an essential resource for the success of the whole genome resequencing approach. The results from the proposed genomic studies will provide important information on spawning structure and, consequently, on the genetic baselines of source populations. Importantly, the results from these studies will provide management advice regarding the relative justifiability for considering the western Aleutians as a genetically-distinct substock. This work has recently received funding from the North Pacific Research Board (NPRB Project No. 2110, 2/1/2022-1/31/2024) (Appendix IV).

6. Other research.

The IPHC Secretariat (PI's: Mr. Claude Dykstra and Dr. Ian Stewart) has been successful in securing funding from NOAA's 2021 Bycatch Reduction Engineering Program (BREP) for a project entitled "Gear-based approaches to catch protection as a means for minimizing whale depredation in longline fisheries" (Appendix IV). This study seeks to identify potential methods for protecting hook captured fish from whale depredation and to develop and field-test several simple low-cost catch-protection designs that can be deployed effectively using current longline fishing techniques. The proposed work entails conducting a workshop with industry (affected fishers, gear researchers, scientists) in late 2021 to identify methods to protect fishery catches from depredation. The top two or three catch protection design outcomes from the workshop will be incorporated into functional prototypes and field tested in 2022 on longline sea trials targeting flatfish.

RECOMMENDATION/S

That the Commission **NOTE** paper IPHC-2021-IM097-11 which outlines progress on the IPHC 5-year Biological and Ecosystem Science Research Plan.

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APPENDICES

Appendix I: Integration of ongoing biological research activities, stock assessment and management strategy evaluation.

Appendix II: List of ranked biological uncertainties and parameters for stock assessment and their links to potential research areas and research activities (2017-21)

Appendix III: List of ranked biological uncertainties and parameters for management strategy evaluation and their potential links to research areas and research activities (2017-21)

Appendix IV: Summary of awarded research grants current in 2021

APPENDIX I

Integration of ongoing biological research activities, stock assessment and management strategy evaluation

Research areas	Research activities	Research outcomes	Relevance for stock assessment	Relevance for MSE	Specific analysis input	SA Rank (Top 3)	MSE Rank (Top 3)
Migration	Larval and juvenile connectivity and early life history studies	Improved understanding of larval and juvenile distribution	Improve estimates of productivity	Improve parametrization of the Operating Model	Will be used to generate potential recruitment covariates and to inform minimum spawning biomass targets by Biological Region	3. Biological input	1. Biological parameterization and validation of movement estimates
Reproduction	Histological maturity assessment	Updated maturity schedule	Scale biomass and reference point estimates	Improve simulation of spawning biomass in the Operating Model	Will be included in the stock assessment, replacing the current schedule last updated in 2006	1. Biological input	
	Examination of potential skip spawning	Incidence of skip spawning			Will be used to adjust the asymptote of the maturity schedule, if/when a time-series is available this will be used as a direct input to the stock assessment		
	Fecundity assessment	Fecundity-at-age and -size information			Will be used to move from spawning biomass to egg-output as the metric of reproductive capability in the stock assessment and management reference points		
	Examination of accuracy of current field macroscopic maturity classification	Revised field maturity classification			Revised time-series of historical (and future) maturity for input to the stock assessment		
	Sex ratio of current commercial landings	Sex ratio-at-age	Scale biomass and fishing intensity		Annual sex-ratio at age for the commercial fishery fit by the stock assessment	1. Assessment data collection and processing	
	Historical sex ratios based on archived otolith DNA analyses	Historical sex ratio-at-age			Annual sex-ratio at age for the commercial fishery fit by the stock assessment		
	Recruitment strength and variability	Establishment of temporal and spatial maturity and spawning patterns	Improve stock-recruitment curve for more precise assessment	Improve simulation of recruitment variability and parametization of recruitment distribution in the Operating Model	May be used to provide a weighted spawning biomass calculation and or inform targets for minimum spawning biomass by Biological Region		2. Biological parameterization and validation of recruitment variability and distribution
Growth	Evaluation of somatic growth variation as a driver for changes in size-at-age	Identification and application of markers for growth pattern evaluation	Scale stock productivity and reference point estimates	Improve simulation of variability and allow for scenarios investigating climate change	May inform yield-per-recruit and other spatial evaluations of productivity that support mortality limit-setting		3. Biological parameterization and validation for growth projections
		Environmental influences on growth patterns			May provide covariates for projecting short-term size-at-age. May help to delineate between effects due to fishing and those due to environment, thereby informing appropriate management response		
Mortality and survival assessment	Discard mortality rate estimate: longline fishery	Experimentally-derived DMR	Improve trends in unobserved mortality	Improve estimates of stock productivity	Will improve estimates of discard mortality, reducing potential bias in stock assessment results and management of mortality limits		1. Fishery parameterization
	Discard mortality rate estimate: recreational fishery				Will improve estimates of discard mortality, reducing potential bias in stock assessment results and management of mortality limits		2. Fishery parameterization
	Best handling practices: longline fishery	Guidelines for reducing discard mortality			May reduce discard mortality, thereby increasing available yield for directed fisheries		
	Best handling practices: recreational fishery	Guidelines for reducing discard mortality			May reduce discard mortality, thereby increasing available yield for directed fisheries		
Genetics and genomics	Population structure	Stock structure of IPHC Regulatory Area 4B relative to the rest of the Convention Area	Altered structure of future stock assessments	Improve parametization of the Operating Model	If 4B is found to be functionally isolated, a separate assessment may be constructed for that IPHC Regulatory Area	2. Biological input	1. Biological parameterization and validation of movement estimates.
	Distribution	Assignment of individuals to source populations and assessment of distribution changes			Will be used to define management targets for minimum spawning biomass by Biological Region	3. Biological input	2. Biological parameterization and validation of recruitment distribution

APPENDIX II

List of ranked biological uncertainties and parameters for stock assessment and their links to potential research areas and research activities (2017-21)

SA Rank	Research outcomes	Relevance for stock assessment	Specific analysis input	Research Area	Research activities
1. Biological input	Updated maturity schedule	Scale biomass and reference point estimates	Will be included in the stock assessment, replacing the current schedule last updated in 2006	Reproduction	Histological maturity assessment
	Incidence of skip spawning		Will be used to adjust the asymptote of the maturity schedule, if/when a time-series is available this will be used as a direct input to the stock assessment		Examination of potential skip spawning
	Fecundity-at-age and -size information		Will be used to move from spawning biomass to egg-output as the metric of reproductive capability in the stock assessment and management reference points		Fecundity assessment
	Revised field maturity classification		Revised time-series of historical (and future) maturity for input to the stock assessment		Examination of accuracy of current field macroscopic maturity classification
2. Biological input	Stock structure of IPHC Regulatory Area 4B relative to the rest of the Convention Area	Altered structure of future stock assessments	If 4B is found to be functionally isolated, a separate assessment may be constructed for that IPHC Regulatory Area	Genetics and Genomics	Population structure
3. Biological input	Assignment of individuals to source populations and assessment of distribution changes	Improve estimates of productivity	Will be used to define management targets for minimum spawning biomass by Biological Region		Distribution
	Improved understanding of larval and juvenile distribution		Will be used to generate potential recruitment covariates and to inform minimum spawning biomass targets by Biological Region	Migration	Larval and juvenile connectivity studies
1. Assessment data collection and processing	Sex ratio-at-age	Scale biomass and fishing intensity	Annual sex-ratio at age for the commercial fishery fit by the stock assessment	Reproduction	Sex ratio of current commercial landings
	Historical sex ratio-at-age		Annual sex-ratio at age for the commercial fishery fit by the stock assessment		Historical sex ratios based on archived otolith DNA analyses
2. Assessment data collection and processing	New tools for fishery avoidance/deterence; improved estimation of depredation mortality	Improve mortality accounting	May reduce depredation mortality, thereby increasing available yield for directed fisheries. May also be included as another explicit source of mortality in the stock assessment and mortality limit setting process depending on the estimated magnitude	Mortality and survival assessment	Whale depredation accounting and tools for avoidance
1. Fishery yield	Physiological and behavioral responses to fishing gear	Reduce incidental mortality	May increase yield available to directed fisheries	Mortality and survival assessment	Biological interactions with fishing gear
2. Fishery yield	Guidelines for reducing discard mortality	Improve estimates of unobserved mortality	May reduce discard mortality, thereby increasing available yield for directed fisheries	Mortality and survival assessment	Best handling practices: recreational fishery

APPENDIX III

List of ranked biological uncertainties and parameters for management strategy evaluation (MSE) and their potential links to research areas and research activities (2017-21)

MSE Rank	Research outcomes	Relevance for MSE	Research Area	Research activities
1. Biological parameterization and validation of movement estimates	Improved understanding of larval and juvenile distribution	Improve parametization of the Operating Model	Migration	Larval and juvenile connectivity studies
	Stock structure of IPHC Regulatory Area 4B relative to the rest of the Convention Area		Genetics and Genomics	Population structure
2. Biological parameterization and validation of recruitment variability and distribution	Assignment of individuals to source populations and assessment of distribution changes	Improve simulation of recruitment variability and parametization of recruitment distribution in the Operating Model		Distribution
	Establishment of temporal and spatial maturity and spawning patterns	Improve simulation of recruitment variability and parametization of recruitment distribution in the Operating Model	Reproduction	Recruitment strength and variability
3. Biological parameterization and validation for growth projections	Identification and application of markers for growth pattern evaluation	Improve simulation of variability and allow for scenarios investigating climate change	Growth	Evaluation of somatic growth variation as a driver for changes in size-at-age
	Environmental influences on growth patterns			
	Dietary influences on growth patterns and physiological condition			
1. Fishery parameterization	Experimentally-derived DMRs	Improve estimates of stock productivity	Mortality and survival assessment	Discard mortality rate estimate: recreational fishery

APPENDIX IV
Summary of awarded research grants

Project #	Grant agency	Project name	PI	Partners	IPHC Budget ($US)	Management implications	Grant period
1	**National Fish & Wildlife Foundation**	Improving the characterization of discard mortality of Pacific halibut in the recreational fisheries (NFWF Award No. 61484)	IPHC Dr J. Planas and Mr Claude Dykstra	Alaska Pacific University, U of A Fairbanks, charter industry	$98,902	Bycatch estimates	1 April 2019 – 1 November 2021
2	**North Pacific Research Board**	Pacific halibut discard mortality rates (NPRB Award No. 2009)	IPHC Dr. J. Planas	Alaska Pacific University	$210,502	Bycatch estimates	1 January 2021 – 31 March 2022
3	**Bycatch Reduction Engineering Program-NOAA**	Gear-based approaches to catch protection as a means for minimizing whale depredation in longline fisheries (NOAA Award Number NA21NMF4720534)	IPHC Mr. Claude Dykstra and Dr. I. Stewart	Deep Sea Fishermen's Union, Alaska Fisheries Science Center-NOAA, industry representatives	$99,700	Whale depredation	1 November 2021 – 30 April 2022
4	**North Pacific Research Board**	Pacific halibut population genomics (NPRB Award No. 2110)	IPHC Dr. J. Planas	Alaska Fisheries Science Center-NOAA	$193,685	Stock structure	1 February 2022 – 31 January 2024
		Total awarded ($)			**$602,789**		

International Pacific Halibut Commission 5-Year program of integrated research and monitoring (2022-26)

PREPARED BY: IPHC SECRETARIAT (D. WILSON, J. PLANAS, I. STEWART, A. HICKS, R. WEBSTER, & B. HUTNICZAK); 29 OCTOBER 2021)

PURPOSE

To provide the Commission with the current draft of the IPHC 5-Year program of integrated research and monitoring (2022-26), which remains in development.

BACKGROUND

The IPHC has a long-standing history (since 1923) of collecting data, undertaking research, and stock assessment, devoted to describing and understanding the Pacific halibut (*Hippoglossus stenolepis*) stock and the fisheries that interact with it.

The IPHC Secretariat conducts activities to address key issues identified by the Commission, its subsidiary bodies, the broader stakeholder community, and the IPHC Secretariat. The process of identifying, developing, and implementing our science-based activities involves several steps that are circular in nature, but result in clear project activities and associated deliverables. The process includes developing and proposing projects based on direct input from the Commission, the experience of the IPHC Secretariat given our broad understanding of the resource and its associated fisheries, and concurrent consideration by relevant IPHC subsidiary bodies, and where deemed necessary, additional external peer review.

An overarching goal of the IPHC 5-Year Program of integrated research and monitoring (2021-26) is therefore to promote integration and synergies among the various research and support activities of the IPHC Secretariat in order to improve our knowledge of key inputs into the Pacific halibut stock assessment, economic impact assessment of the resource, and Management Strategy Evaluation (MSE) processes, thereby providing the best possible advice for management decision making processes.

The program builds on the outcomes and experiences of the Commission arising from the implementation of the 2017-21, 5-Year Biological and Ecosystem Science Research Plan (IPHC–2019–BESRP-5YP).

RECOMMENDATIONS

That the Commission **NOTE** paper IPHC-2021-IM097-12 which provided the current draft of the IPHC 5-Year program of integrated research and monitoring (2022-26), which remains in development.

APPENDICES

Draft: International Pacific Halibut Commission 5-Year program of integrated research and monitoring (2022-26)

INTERNATIONAL PACIFIC HALIBUT COMMISSION

5-YEAR PROGRAM OF INTEGRATED RESEARCH AND MONITORING

(January 2022 - June 2026)

INTERNATIONAL PACIFIC

HALIBUT COMMISSION

BIBLIOGRAPHIC ENTRY

IPHC 2021. International Pacific Halibut Commission 5-Year program of integrated research and monitoring (2022-26). Seattle, WA, U.S.A. *IPHC–2021–5YPIR, 33 pp.*

INTERNATIONAL PACIFIC HALIBUT COMMISSION

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ACRONYMS

<<<To be completed>>>

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

TABLE OF CONTENTS

EXECUTIVE SUMMARY

To be developed once draft below is finalised

1. *Introduction*

The International Pacific Halibut Commission (IPHC) is a public international organization so designated via Presidential Executive Order 11059, and 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. 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. Canada does not require specific enabling legislation to implement the protocol.

The basic texts of the Commission are available on the IPHC website: https://www.iphc.int/the-commission, and prescribe the mission of the organization as:

*"..... **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**. ....." IPHC Convention*, Article I, sub-article I, para. 2). The IPHC Convention Area is detailed in Fig. 1.

The IPHC Secretariat, formed in support the Commission's activities, is based in Seattle, WA, USA. As its shared vision, ***the IPHC Secretariat aims to deliver positive economic, environmental, and social outcomes for the Pacific halibut resource for Canada and the U.S.A. through the application of rigorous science, innovation, and the implementation of international best practice.***

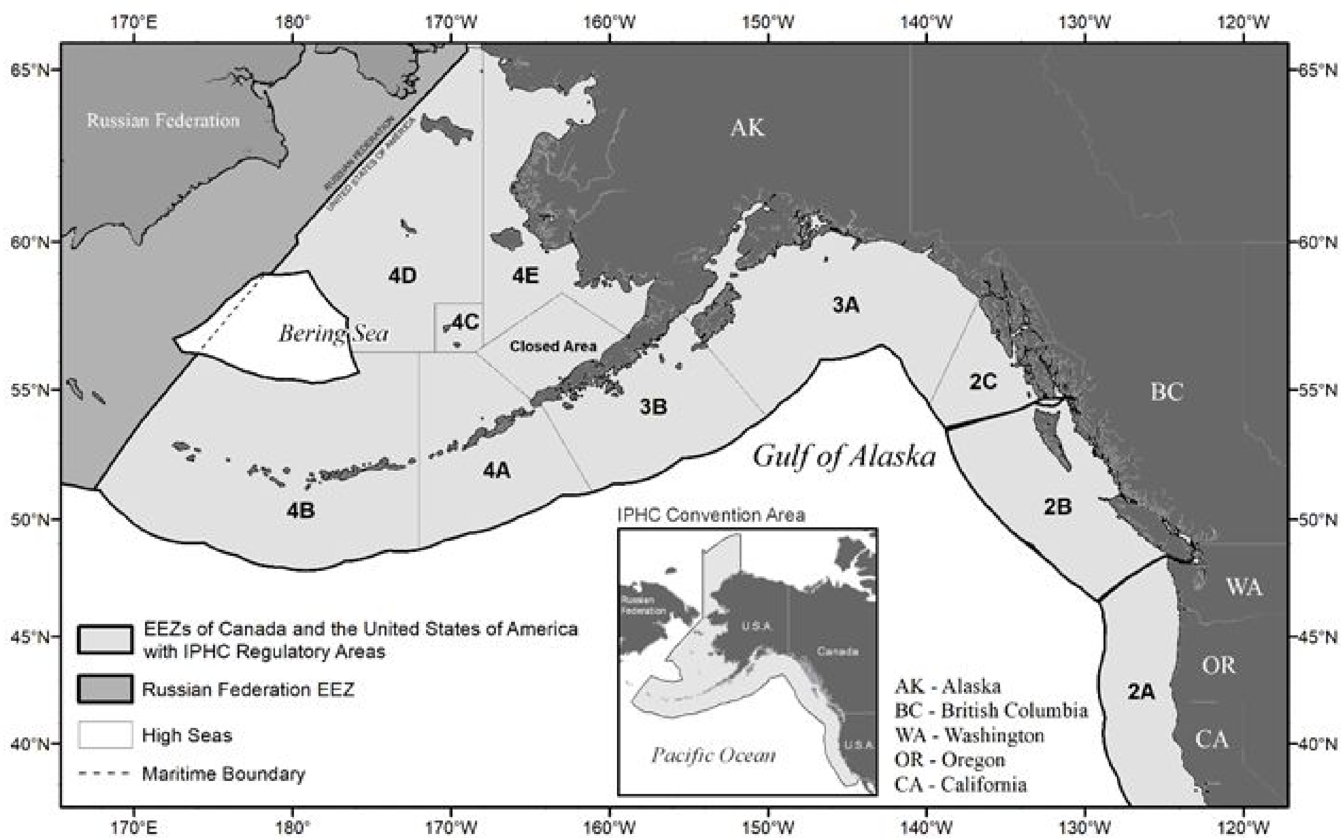

Figure 1. Map of the IPHC Convention Area (map insert) and IPHC Regulatory Areas.

2. *Objectives*

The IPHC has a long-standing history (since 1923) of collecting data, undertaking research, and stock assessment, devoted to describing and understanding the Pacific halibut (*Hippoglossus stenolepis*) stock and the fisheries that interact with it.

The IPHC Secretariat conducts activities to address key issues identified by the Commission, its subsidiary bodies, the broader stakeholder community, and of course, the IPHC Secretariat itself. The process of identifying, developing, and implementing our science-based activities involves several steps that are circular in nature, but result in clear project activities and associated deliverables. The process includes developing and proposing projects based on direct input from the Commission, the experience of the IPHC Secretariat given our broad understanding of the resource and its associated fisheries, and concurrent consideration by relevant IPHC subsidiary bodies, and where deemed necessary, additional external peer review.

[To be added: SRB recommendations arising from the implementation of the 2017-21, 5-Year Biological and Ecosystem Science Research Plan (IPHC–2019–BESRP-5YP), including climate change linkages]

[To be added: 2nd Performance Review of the IPHC process and relevant recommendations]

An **overarching goal** of the *IPHC 5-Year Program of integrated research and monitoring (2021-26)* is therefore to promote integration and synergies among the various research and support activities of the IPHC Secretariat in order to improve our knowledge of key inputs into the Pacific halibut stock assessment, economic impact assessment of the resource, and Management Strategy Evaluation (MSE) processes, thereby providing the best possible advice for management decision making processes.

The research and monitoring activities conducted by the IPHC Secretariat are directed towards fulfilling the following five (5) **objectives** within areas of data collection, biological and ecological research, stock assessment, MSE, and fisheries economics, with the overall aim of proving an integrated program of research and monitoring (Fig 2):

Research

1) **Stock assessment**: apply the resulting knowledge to reduce uncertainty in current stock assessment models and the stock management advice provided to the Commission;
2) **Management Strategy Evaluation (MSE)**: to provide inputs that inform the MSE process, which will evaluate the consequences of alternative management options, known as harvest strategies;
3) **Fishery socioeconomics**: to provide stakeholders with an accurate and all-sectors-encompassing assessment of the socioeconomic impact of the Pacific halibut resource in Canada and the United States of America.
4) **Biology and Ecology**: identify and assess critical knowledge gaps in the biology and ecology of Pacific halibut within its known range, including the influence of environmental conditions on population and fishery dynamics;

Monitoring

5) **Monitoring**: collect representative fishery dependent and fishery-independent data on the distribution and abundance of Pacific halibut through ongoing monitoring activities;

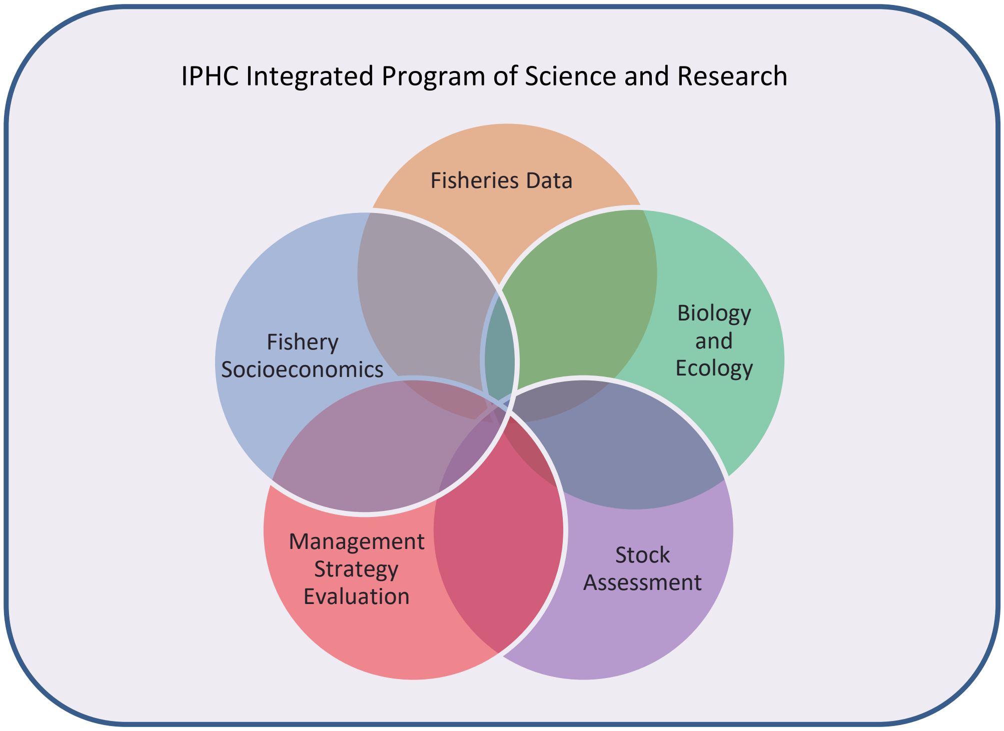

Figure 2. Core areas of the IPHC's integrated program of research and monitoring.

3. Strategy

The IPHC Strategic Plan (2019-23) (the Plan) contains five (5) enduring strategic goals in executing our mission, including our overarching goal and associated science and research objectives. Although priorities and tasking will change over time in response to events and developments, the Plan provides a framework to standardise our approach when revising or setting new priorities and tasking. The Strategic goals as they apply to the science and research activities of the IPHC Secretariat, will be operationalised through a multi-year tactical activity matrix (Appendix I) at the organisational and management unit (Branch) level (Fig. 3). The tactical activity matrix is described in the sections below, and has been developed based on the core needs of the Commission, in developing and implementing robust, scientifically-based management decisions on an annual, and multi-year level. Relevant IPHC subsidiary bodies will be involved in project development and ongoing review.

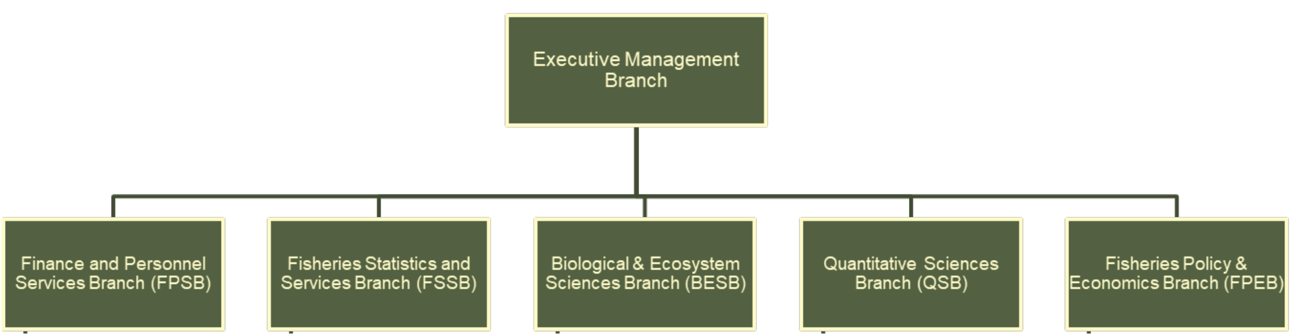

Figure 3. IPHC Secretariat organisation chart (2021).

4. *Measures of Success*

The Secretariat's success in the implementing the *IPHC 5-Year Program of Integrated Research and Monitoring (2022-26)* will be measured according to the following criteria:

4.1 Delivery of specified products

Each project line item will contain specific deliverables that constitute useful inputs into the stock assessment and the management strategy evaluation process, as well as support their implementation in the decision making process at the level of the Commission.

4.2 Communication

[In development]

4.3 External research funding

The Secretariat has set a funding goal of at least 20% of the funds for this program to be sourced from external funding bodies on an annual basis.

4.4 Peer-reviewed journal publication

Publication of research outcomes in peer-reviewed journals will be clearly documented and monitored as a measure of success. This may include single publications at the completion of a particular project, or a series of publications throughout the project as well as at its completion. Each sub-project shall be published in a timely manner, and shall be submitted no later than 12 months after the end of the research.

4.5 Future Strategic Science and Research Activities

Along with the implementation of the short- and medium-term activities contemplated in this *IPHC 5-Year Program of Integrated Research and monitoring (2022-26)*, and in pursuit of the overarching objective, the IPHC Secretariat will also aim to undertake:

1) Cutting-edge research programs in fisheries research in support of fisheries management of Pacific halibut;
2) Groundbreaking methodological research;
3) High impact and applied research;
4) Establish new collaborative agreements and interactions with research agencies and academic institutions;
5) To promote the international involvement of the IPHC by continued and new participation in international scientific organizations and by leading international science and research collaborations.
6) To incorporate talented students and early researchers in research activities contemplated.

5. *Core focal areas - Background*

The goals of the main activities of the *5-Year program of integrated research and monitoring (2022-26)* are integrated across the organisation, involving 1) monitoring (fisheries-dependent and –independent data collection), and 2) research (biological, ecological), modelling (FISS and stock assessment), Management Strategy Evaluation (MSE), and fishery socioeconomic analysis, as outlined in the following sub-sections. These components are closely linked to one another, and all feed into management decision making (Fig. 4). The current program builds on the outcomes and experiences of the Commission arising from the implementation of the 2017-21 5-Year Biological and Ecosystem Science Research Plan (IPHC–2019–BESRP-5YP), and which is summarized in Appendix II.

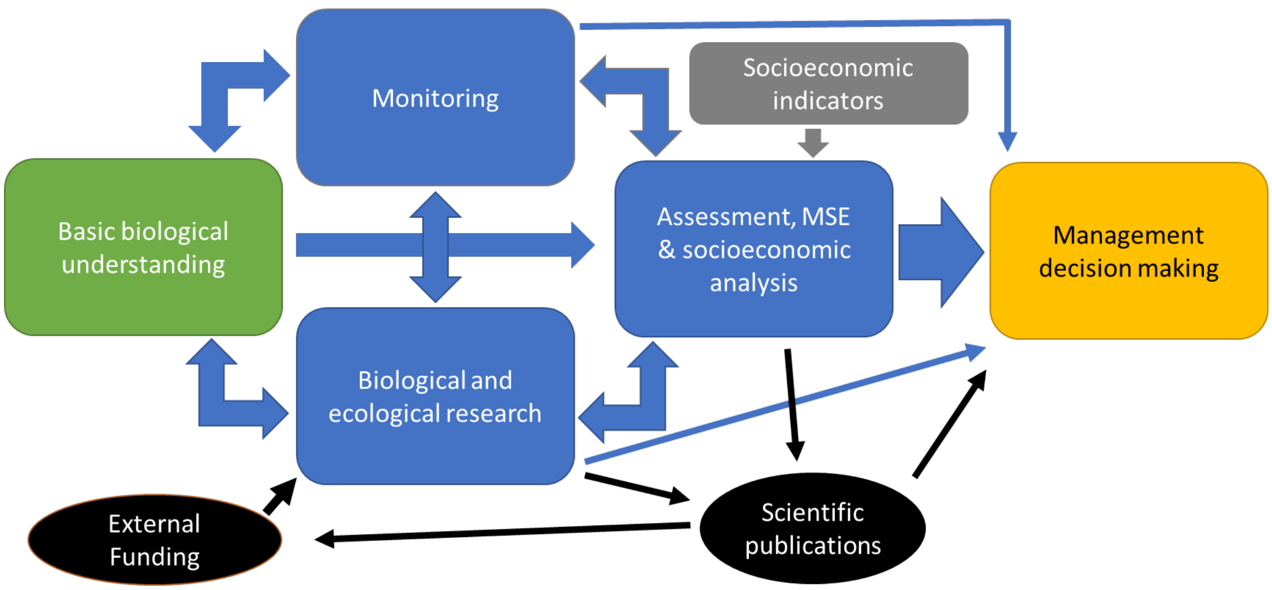

Figure 4. Flow of information from basic biological understanding of the Pacific halibut resource, through IPHC research components (monitoring, biological and ecological research, and assessment, MSE and socioeconomic analysis to management decision-making. Socioeconomic indicators (grey) provide another source of information beyond current monitoring programs. Arrows indicate the strength (size of the arow) and direction of information exchange. Also identified (in black) are the external links from funding and scientific publications which supplement the IPHC's internal process.

5.1 Research

Focal Area Objective	To reduce uncertainty in the current stock assessment and the resultant stock management advice provided to the Commission.
IPHC Website portal	https://www.iphc.int/management/science-and-research/stock-assessment

The IPHC conducts an annual stock assessment, using data from the fishery-independent setline survey (FISS), the commercial Pacific halibut and other fisheries, as well biological information from its research program. The assessment includes the Pacific halibut resource in the IPHC Convention Area, covering the Exclusive Economic Zones 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.

The 2020 stock assessment relied on an ensemble of four population dynamics models to estimate the probability distributions describing the current stock size, trend, and demographics. The ensemble is designed to capture both uncertainty related to the data and stock dynamics (due to estimation) as well as uncertainty related to our understanding of the way in which the Pacific halibut stock functions and is best approximated by a statistical model (structural uncertainty).

Stock assessment results are used as inputs for harvest strategy calculations, including mortality projection tables for the upcoming year that reflect the IPHCs 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 stock assessment research priorities have been subdivided into four categories:

1) Assessment data collection and processing;
2) technical development
3) biological inputs; and
4) fishery yield.

It is important to note that ongoing monitoring, including the annual FISS and directed commercial landings sampling programs is not considered research and is therefore not included in this research priority list despite the critical importance of these collections. These are prescribed in the sections below.

5.1.2 Management Strategy Evaluation (MSE)

Focal Area Objective	To provide inputs that inform the MSE process, which will evaluate the consequences of alternative management options, known as harvest strategies.
IPHC Website portal	https://www.iphc.int/management/science-and-research/management-strategy-evaluation

Management Strategy Evaluation (MSE) is a process to evaluate the consequences of alternative management options, known as harvest strategies. MSE uses a simulation tool to determine how alternative harvest strategies perform given a set of pre-defined fishery and conservation objectives, taking into account the uncertainties in the system and how likely candidate harvest strategies are to achieve the chosen management objectives.

MSE is a simulation technique based on modelling each part of a management cycle. The MSE uses an operating model to simulate the entire population and all fisheries, factoring in management decisions, the monitoring program, the estimation model, and potential ecosystem effects using a closed-loop simulation.

Undertaking an MSE has the advantage of being able to reveal the trade-offs among a range of possible management decisions. Specifically, to provide the information on which to base a rational decision, given harvest strategies, preferences, and attitudes to risk. The MSE is an essential part of the process of developing, evaluating and agreeing to a harvest strategy.

The MSE process involves:

- Defining fishery and conservation objectives with the involvement of stakeholders and managers;
- Identifying harvest strategies (a.k.a. management procedures) to evaluate;
- Simulating a Pacific halibut population using those harvest strategies;
- Evaluating and presenting the results in a way that examines trade-offs between objectives;
- Applying a chosen harvest strategy for the management of Pacific halibut;
- Repeating this process in the future in case of changes in objectives, assumptions, or expectations.

There are many tasks that would improve the MSE framework and the presentation of future results to the Commission. The tasks can be divided into five general categories, which are common to MSE in general:

1. **Objectives**: The goals and objectives that are used in the evaluation.

2. **Management Procedures (MPs)**: Specific, well-defined management procedures that can be coded in the MSE framework to produce simulated TCEYs for each IPHC Regulatory Area.
3. **Framework**: The specifications and computer code for the closed-loop simulations including the operating model and how it interacts with the MP.
4. **Evaluation**: The performance metrics and presentation of results. This includes how the performance metrics are evaluated (e.g. tables, figures, and rankings), presented to the Commission and its subsidiary bodies, and disseminated for outreach.
5. **Application**: Specifications of how an MP may be applied in practice and re-evaluated in the future, including responses to exceptional circumstances.

All of these categories provide inputs and outputs of the MSE process, but the Framework category benefits most from the integration of biological and ecosystem research because the operating model, the simulation of the monitoring program, the estimation model, and potential ecosystem effects are determined from this knowledge.

Outcomes of the MSE process will not only inform the Commission on trade-offs between harvest strategies and assist in choosing an optimal strategy for management of the Pacific halibut resource, but will inform the prioritization of research activities related to fisheries monitoring, biological and ecological research, stock assessment, and fishery socio-economics.

5.1.3 Fishery socioeconomics

Focal Area Objective	To provide stakeholders with an accurate and all-sectors-encompassing assessment of the socioeconomic impact of the Pacific halibut resource in Canada and the United States of America.
IPHC Website portal	https://www.iphc.int/management/economic-research

Under the Convention, the IPHC's mandate is optimum management of the Pacific halibut resource, which necessarily includes a socioeconomic dimension. Fisheries economics is an active field of research around the world in support of fisheries policy and management. Adding the economic expertise to the Secretariat, the IPHC has become the first regional fishery management organization (RFMO) in the world to do so.

The goal of the IPHC economic study is to provide stakeholders with an accurate and all-sectors-encompassing assessment of the socioeconomic impact of the Pacific halibut resource that includes the full scope of Pacific halibut's contribution to regional economies of Canada and the United States of America. The economic effects of changes to harvest policies can be far-reaching. Altered catch limits have an impact on the direct users of the stock (commercial harvesters, recreational anglers, subsistence fishers), but at the same time, there is a ripple effect through the economy. Fisheries operations create demand for inputs from other sectors while at the same time support industries further along the value chain that rely on the supply of fish, such as seafood processors. The viability of the Pacific halibut sectors is vital to the prosperity of fisheries-dependent households, having a considerable impact on coastal communities. The economic impacts are transmitted cross-regionally through business-to-business transactions (trade in commodities), labor commuting patterns, and the dissemination of profits along the value chain. There is also an inflow of economic benefits to the local economies from outside when non-residents partake in local leisure activities that would not attract the same number of visitors if not for the opportunity to catch this iconic fish of the Pacific Northwest. Understanding the formation of the price paid for Pacific halibut products by final consumers (end-users) is an important step in assessing the contribution of Pacific halibut to the Gross Domestic Product (GDP) along the entire value chain. Pacific halibut's value is also in its contribution to the diet through subsistence fisheries and importance to the traditional users of the resource. To native people, traditional fisheries constitute a vital aspect of local identity and a major factor in cohesion.

Understanding such a broad scope of regional impacts is essential for designing policies with desired effects depending on regulators' priorities. The ability to trace the socioeconomic impacts cross-regionally is particularly important in the context of shared resources and joint management, such as the case of collective management of Pacific halibut by the IPHC. Moreover, the study informs on the community impacts of the Pacific halibut resource throughout its range, highlighting communities particularly dependent on economic activities that rely on Pacific halibut. A good understanding of the localized effects is pivotal to policymakers who are often concerned about community impacts, particularly in terms of impact on employment opportunities and households' welfare. Integrating economic approaches with stock assessment and MSE can assist fisheries in bridging the gap between the current and the optimal economic performance without compromising the stock biological sustainability. Moreover, the study can also inform on socioeconomic drivers (human behavior, human organization) that affect the dynamics of fisheries, and thus contribute to improved accuracy of the stock assessment and the MSE. As such, it can provide a complementary resource for the development of harvest control rules, thus directly contributing to Pacific halibut management.

5.1.4 Biology and Ecology

Focal Area Objective	To identify and assess critical knowledge gaps in the biology and ecology of Pacific halibut within its known range, including the influence of environmental conditions on population and fishery dynamics.
IPHC Website portal	https://www.iphc.int/management/science-and-research/biological-and-ecosystem-science-research-program-bandesrp

Since its inception, the IPHC has had a long history of research activities devoted to describe and understand the biology of the Pacific halibut (*Hippoglossus stenolepis*). At present, the main objectives of the Biological and Ecosystem Science Research Program 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 in the biology of the Pacific halibut and its fishery; and 3) apply the resulting knowledge to reduce uncertainty in current stock assessment models.

The primary biological research activities at the IPHC that follow Commission objectives and selected for their important management implications are identified and described in the proposed 5-Year Research Plan for the period 2022-2026. An overarching goal of the 5-Year Research Plan is to promote integration and synergies among the various research activities led by the IPHC in order to improve our knowledge of key biological inputs that feed into the stock assessment and MSE process. The goals of the main research activities of the 5-Year Research Plan are therefore aligned and integrated with the IPHC stock assessment and MSE processes. The IPHC Secretariat conducts research activities to address key biological issues based on the IPHC Secretariat's own input as well as input from the IPHC Commissioners, stakeholders and particularly from specific subsidiary bodies to the IPHC such, including the Scientific Review Board (SRB) and the Research Advisory Board (RAB).

The biological research activities contemplated in the 5-Year Research Plan and their specific aims are detailed in Section 6. Overall, the biological research activities at IPHC aim at providing information on factors that influence the biomass of the Pacific halibut population (e.g. distribution and movement of fish among IPHC Regulatory Areas, growth patterns and environmental influences on growth in larval, juvenile and adult fish, drivers of changes in size-at-age) and, specifically, of the spawning (female) population (e.g. reproductive maturity, skipped spawning, reproductive migrations) and resulting changes in population dynamics. Furthermore, the research activities of IPHC also aim, on one hand, at providing information on the survival of regulatory-discarded Pacific halibut in the directed fisheries with the objective to refine current estimates of discard mortality rates and develop best handling practices, and, on the other hand, at reducing whale depredation and Pacific halibut bycatch through gear modifications and through a better understanding of behavioral and physiological responses of Pacific halibut to fishing gear.

5.2 Monitoring

5.2.1 Fisheries data collection

Focal Area Objective	To collect fishery-dependent and fishery-independent data on the distribution and abundance of Pacific halibut, as well as other key biological data, through ongoing monitoring activities.
IPHC Website portal	***Fishery-dependent data:*** • https://www.iphc.int/datatest/commercial-fisheries • https://www.iphc.int/data/datatest/non-directed-commercial-discard-mortality-fisheries • https://www.iphc.int/data/datatest/pacific-halibut-recreational-fisheries-data • https://www.iphc.int/datatest/subsistence-fisheries • https://www.iphc.int/data/time-series-datasets ***Fishery-independent data:*** • https://www.iphc.int/management/science-and-research/fishery-independent-setline-survey-fiss • https://www.iphc.int/data/datatest/fishery-independent-setline-survey-fiss

5.2.1.1 ***Fishery-dependent data***. The IPHC estimates all Pacific halibut removals taken in the IPHC Convention Area and uses this information in its yearly stock assessment and other analyses. The data are compiled by the IPHC Secretariat and include data from Federal and State agencies of each Contracting Party. Specific activities in this area include:

- **Directed commercial fisheries data**: The IPHC Secretariat collects logbooks, otoliths, tissue samples, and associated sex-length-weight data from directed commercial landings coastwide (Fig. 5). A sampling rate is determined for each port by IPHC Regulatory Area. The applicable rate is calculated from the current year's mortality limits and estimated percentages of weight of fish landed, and estimated percentages of weight sampled in that port to allow for collection of the target number of biological samples by IPHC Regulatory Area. An example of the data collected and the methods used are provided in the annually updated directed commercial sampling manual (e.g. IPHC Directed Commercial Landings Sampling Manual 2021). Directed commercial fishery landings are recorded by the Federal and State agencies of each Contracting Party and summarized each year by the IPHC. Discard mortality for the directed commercial fishery is currently estimated using a combination of research survey (USA) and observer data (Canada).
    - Quality control and sampling rate estimations: [To be developed: QC practices, protocol references, and most recent sampling rate/design evaluation]
- **Non-directed commercial discard mortality data**: The IPHC accounts for non-directed commercial discard mortality by IPHC Regulatory Area and sector. Non-directed commercial discard mortality estimates are provided by State and Federal agencies of each Contracting Party, and compiled annually for use in the stock assessment and other analysis. https://www.iphc.int/data/datatest/non-directed-commercial-discard-mortality-fisheries.
- 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. The IPHC relies upon information supplied by observer programs run by Contracting Party agencies for non-directed commercial discard mortality estimates in most fisheries. Non-IPHC research survey information or other sources are used to generate estimates of non-directed commercial discard mortality in the few cases where fishery observations are unavailable. Trawl fisheries off Canada British Columbia are monitored and non-directed commercial discard mortality information is provided to IPHC by DFO. 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.

  - Quality control and sampling rate estimations: [To be developed: QC practices, protocol references, and most recent sampling rate/design evaluation]

- **Subsistence fisheries data**: 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). Subsistence fishery removals of Pacific halibut, including estimated subsistence discard mortality, are provided by State and Federal agencies of each Contracting Party, estimated, and compiled annually for use in the stock assessment and other analysis. https://www.iphc.int/datatest/subsistence-fisheries.

  - Quality control and sampling rate estimations: [To be developed: QC practices, protocol references, and most recent sampling rate/design evaluation]

- **Recreational fisheries data**: Recreational removals of Pacific halibut, including estimated recreational discard mortality, are provided by State agencies of each Contracting Party, estimated, and compiled annually for use in the stock assessment and other analysis. https://www.iphc.int/data/datatest/pacific-halibut-recreational-fisheries-data.

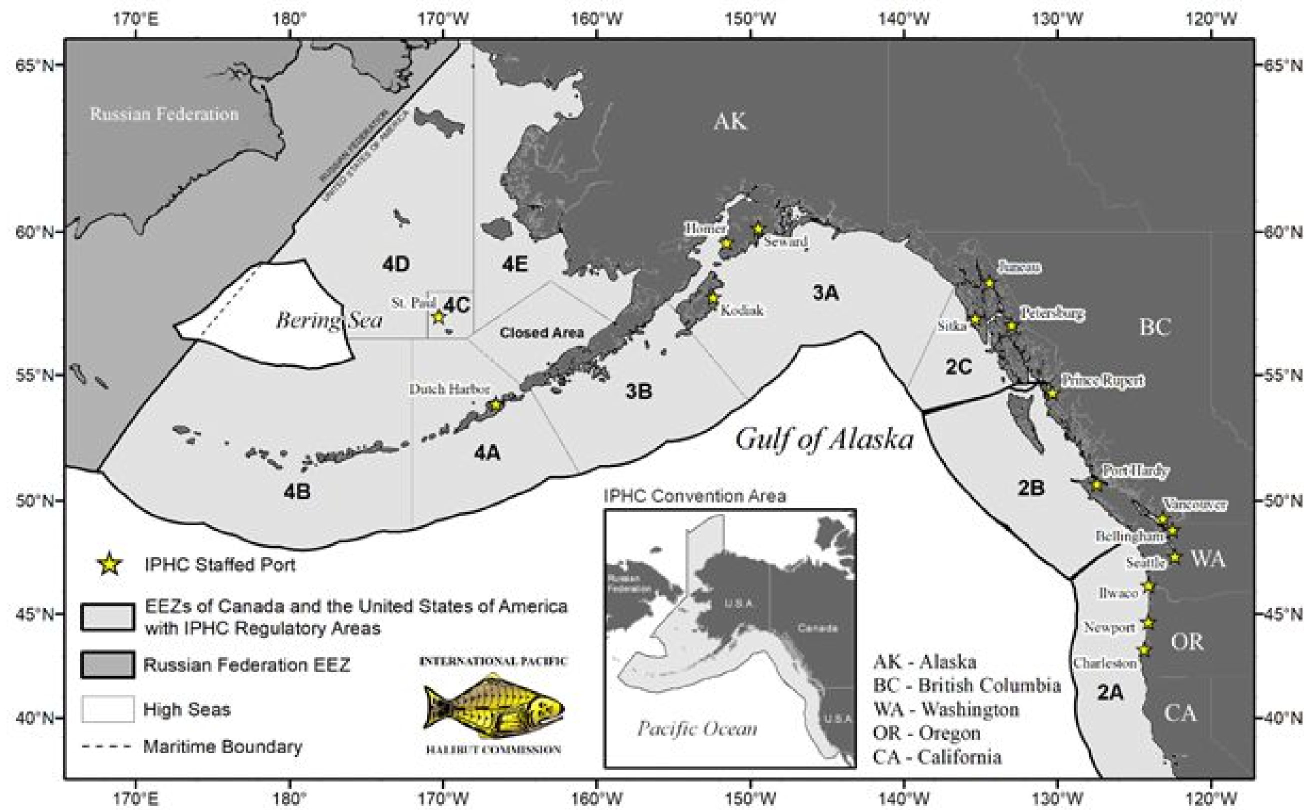

Figure 5. Ports where the IPHC has sampled directed commercial landings throughout the fishing period in recent years (note: ports sampled in a given year may change for operational reasons).

- Quality control and sampling rate estimations: [To be developed: QC practices, protocol references, and most recent sampling rate/design evaluation]

5.2.1.2 ***Fishery-independent data***. Data collection and monitoring activities aimed at providing a standardised time-series of biological and ecological data that is independent of the fishing fleet.

- **Fishery-independent setline survey (FISS)**: The IPHC Fishery-Independent Setline Survey (FISS) provides catch-rate information and biological data on Pacific halibut that are independent of the fishery. These data, collected using standardized methods, bait, and gear during the summer of each year, are used to estimate the primary index of population abundance used in the stock assessment. The FISS is restricted to the summer months, but encompasses nearly all of the commercial fishing grounds in the Pacific halibut fishery, and almost all known Pacific halibut habitat in Convention waters outside the Bering Sea. The standard FISS grid totals 1,890 stations (Fig. 6). Biological data collected on the FISS (e.g. the length, weight, age, and sex composition of Pacific halibut) are used to monitor changes in biomass, growth, and mortality of the Pacific halibut population. In addition, records of non-target species caught during FISS operations provide insight into bait competition, and serve as an index of abundance over time, making them valuable to the potential management and avoidance of non-target species. An example of the data collected and the methods used are provided in the annually updated FISS sampling manual (e.g. IPHC FISS Sampling Manual 2021).

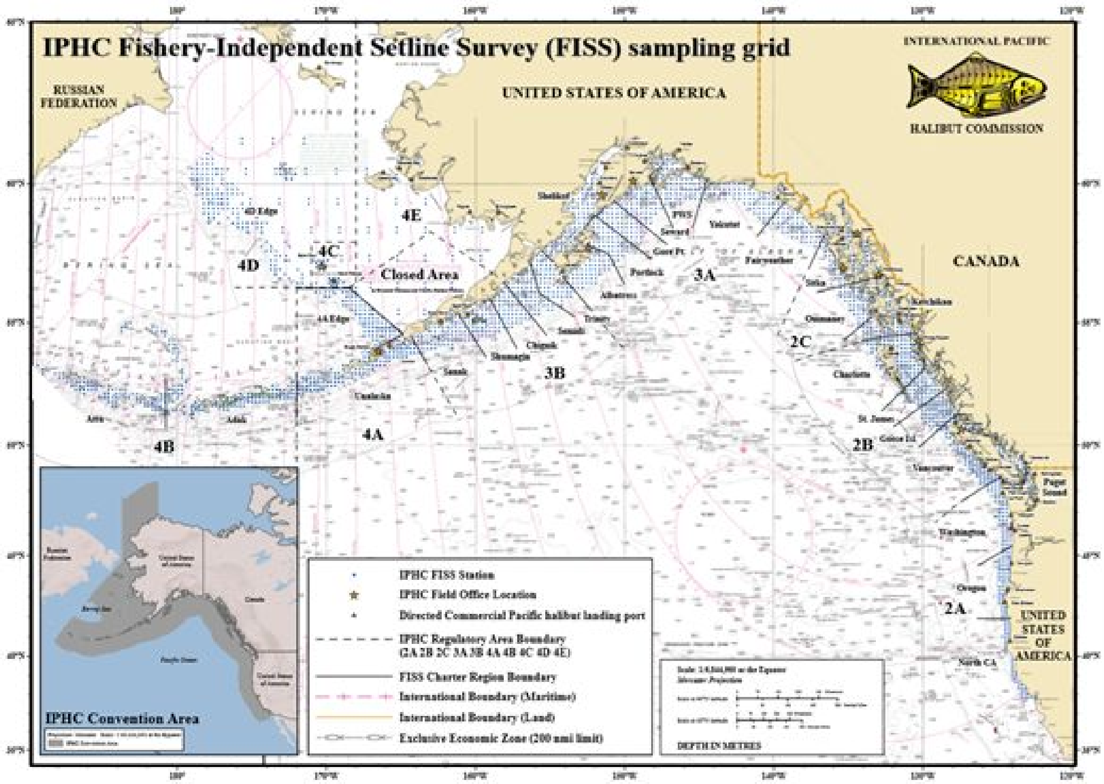

Figure 6. IPHC Fishery-Independent Setline Survey (FISS) with full sampling grid shown.

- Quality control and sampling rate estimations: Following a program of planned FISS expansions from 2014-19, a process of rationialisation of the FISS was undertaken. The goal was to ensure that, given constraints on resources available for implementing the FISS, station selection was such that precise density indices would be estimated with high precision and low bias. An annual design review process has been developed during which potential FISS designs for the subsequent three years are evaluated according to precision and bias criteria. The resulting proposed designs and their evaluation are presented for review at the June Scientific Review Board meeting (IPHC-2021-SRB018-R), and potentially modified following SRB input before presentation to the Commissioners at the Work Meeting and Interim Meeting. Annual biological sampling rates for each IPHC Regulatory Area are calculated based on the previous year's catch rates and an annual target of 2000 sampled fish (with 100 additional archive samples) ().
    - [To be developed: QC practices, protocol references, and most recent sampling rate/design evaluation]

- **Fishery-independent Trawl Survey (FITS)**: Since 1996, the IPHC has participated annually in the NOAA Fisheries trawl surveys operating in the Bering Sea (Fig. 7) and Aleutian Islands (Fig. 8) and Gulf of Alaska (Fig. 9). The information collected from Pacific halibut caught on these surveys, together with data from the IPHC Fishery-Independent Setline Survey (FISS) and commercial Pacific halibut data, are used directly in estimating indices of abundance and in the stock assessment and to monitor population trends, growth/size, and to supplement understanding of recruitment, and age composition of young Pacific halibut.

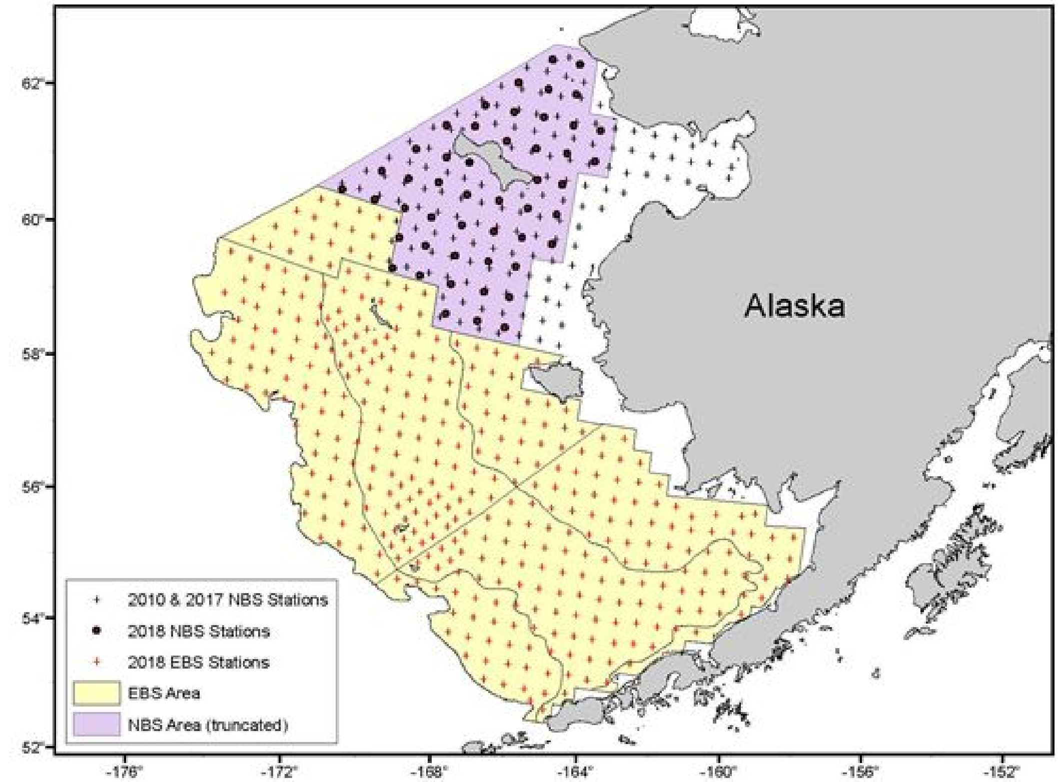

Figure 7. Sampling station design for the 2018 NOAA Bering Sea bottom trawl survey. Black dots are stations sampled in the 2018 "rapid-response" NBS trawl survey and black plus signs are stations sampled in the 2010 and 2017 standard NBS trawl surveys.

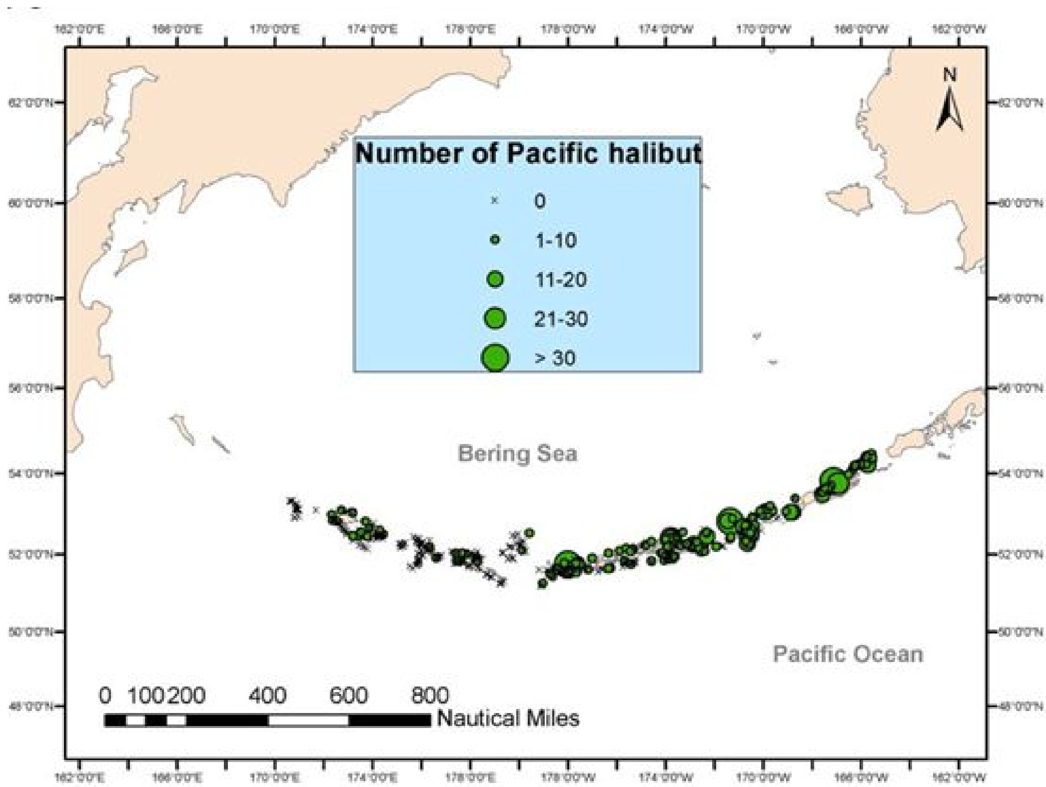

Figure 8. Sampling stations and catch for the 2018 NOAA-Fisheries Aleutian Islands bottom trawl survey.

[2021 Map to be added]

Figure 9. Sampling stations and catch for the yyyy NOAA-Fisheries Gulf of Alaska bottom trawl survey.

- Quality control and sampling rate estimations: [To be developed: QC practices, protocol references, and most recent sampling rate/design evaluation]

6. *Core focal areas – Planned and opportunistic activities (2022-2026)*

[In development – addition of the IPHC Scientific process – meeting schedule/linkages]

Research at IPHC can be classified as "use-inspired basic research" (Stokes 1997) which combines knowledge building with the application of existing and emerging knowledge to provide for the management of Pacific halibut. The four core focal areas: stock assessment, management strategy evaluation, fishery socioeconomics, and biology & ecology, all interact with each other as well as with fisheries monitoring activities in the IPHC integrated program of research and monitoring. Progress and knowledge building in one focal area influences and informs application in other core focal areas, also providing insight into future research priorities. The circular feedback loop is similar to the scientific method of observing a problem, creating a hypothesis, testing that hypothesis through research and analysis, drawing conclusions, and refining the hypothesis. The IPHC Secretariat has been working with IPHC advisory bodies, such as the Scientific Review Board (SRB), and the Commission to conduct scientific research in a way that utilizes the scientific method. Problems are often identified by an advisory body or Commission and hypotheses are developed by the IPHC Secretariat. Research is reviewed by the SRB and refined hypotheses are presented to advisory bodies and the Commission.

In addition to the annual meeting process at IPHC, individual core focal areas of research may identify and prioritize research for other core focal areas. For example, stock assessment research often identifies gaps in the knowledge of Pacific halibut biology and ecology, which then identifies priority research for the Biology and Ecology core area. Vice versa, basic biological and ecological research can identify concepts that could be better understood and result in improved implementation in any of the core areas. Furthermore, Management Strategy Evaluation can often be used to identify priority research topics for any core areas with the process of researching questions through simulation to identify research that may have the largest benefit to improving the management of Pacific halibut.

6.1 Research

6.1.1 Stock Assessment

Within the four assessment research categories, the following topics have been identified as top priorities in order to focus attention on their importance for the stock assessment and management of Pacific halibut. A brief narrative is provided here to highlight the specific use of products from these studies in the stock assessment.

6.1.1.1 Stock Assessment data collection and processing:

6.1.1.1.1 Commercial fishery sex-ratio-at-age via genetics and development of methods to estimate historical sex-ratios-at-age

Commercial fishery sex-ratio information has been found to be closely correlated with the absolute scale of the population estimates in the stock assessment, and has been identified as the greatest source of uncertainty since 2013. With only three years (2017-19) of commercial sex-ratio-at-age information available for the 2020 stock assessment, the annual genetic assay of fin clips sampled from the landings remains critically important. When the time series grows longer, it may be advantageous to determine the ideal frequency at which these assays need to be conducted. Development of approaches to use archived otoliths, scales or other samples to derive historical estimates (if possible) could provide valuable information on earlier time-periods (with differing fishery and biological properties), and therefore potentially reconcile some of the considerable historical uncertainty in the present stock assessment.

6.1.1.1.2 Whale depredation accounting and tools for avoidance

Whale depredation currently represents a source of unobserved and unaccounted-for mortality in the assessment and management of Pacific halibut. A logbook program has been phased in over the last several years, in order to record whale interactions observed by commercial fishermen. Estimation of depredation mortality, from logbook records and supplemented with more detailed data and analysis from the FISS represents a first step in accounting for this source of mortality; however, such estimates will likely come with considerable uncertainty. Reduction of depredation mortality through improved fishery avoidance and/or catch protection would be a preferable extension and/or solution to basic estimation. As such, research to provide the fishery with tools to reduce depredation is considered a closely-related high priority.

6.1.1.2 Stock Assessment technical development:

6.1.1.2.1 Maintaining coordination with the MSE

The stock assessment and MSE operating models have been developed in close coordination, in order to identify plausible hypotheses regarding the processes governing Pacific halibut population dynamics. Important aspects of Pacific halibut dynamics include recruitment (possibly related to extrinsic environmental factors in addition to spawning biomass), size-at-age, movement/migration and spatial patterns in fishery catchability and selectivity. Many approaches developed as part of the tactical stock assessment have been explored in the MSE operating model, and conversely, the MSE operating model has highlighted areas on data uncertainty or alternative hypotheses for exploration in the assessment (e.g., movement rates). Although these two modelling efforts target differing objectives (tactical vs. strategic) continued coordination is essential to ensure that the stock assessment and the MSE represent the Pacific halibut similarly and provide consistent and useful advice for tactical and strategic decision making.

6.1.1.2.2 Data weighting

The stock assessment currently relies on iterative "Francis" weighting of the age compositional data using a multinomial likelihood formulation (Francis 2011). Exploration of alternative likelihoods, possibly including options that are estimable (rather than iterated), such as the Dirichlet-multinomial or the Logistic-normal has been ongoing since the full assessment analysis conducted in 2019. Use of alternative likelihoods could increase computational efficiency and better represent the uncertainty in data weighting.

6.1.1.2.3 Environmental covariates to recruitment

The two long time-series models included in the stock assessment ensemble allow for the Pacific Decadal Oscillation (PDO; Mantua et al. 1997) to be a binary covariate indicating periods of higher or lower average recruitment. This relationship has been observed to be consistent since its development over 20 years ago (Clark et al 1999) and is re-estimated in each year's stock assessment models. With additional years of data, evaluation of the strength of this relationship, as compared to other metrics of the PDO (e.g., annual deviations, running averages) or other indicators of NE Pacific Ocean productivity should be undertaken in order to provide the best estimates and projections of Pacific halibut recruitment and to provide for alternative hypotheses for use in the MSE.

6.1.1.2.4 'Leading' parameter estimation

Stock assessments are generally very sensitive to the estimates of leading parameters (stock-recruitment parameters, natural mortality, etc.). For Pacific halibut some of these are fully integrated into the estimation uncertainty (average unexploited recruitment), or partially integrated (e.g., estimation of natural mortality in two of the four models). As time-series of critically informative data sources like the FISS and the sex-ratio of the commercial landings grow longer it may be possible to integrate additional leading parameters directly in the assessment models and/or include them as nested models within the ensemble. Evaluation of several such alternatives was provided in the 2019 full assessment and should be continued to be explored.

6.1.1.3 Stock Assessment biological inputs:

6.1.1.3.1 Maturity, skip-spawning and fecundity

Management of Pacific halibut is currently based on reference points that rely on relative female spawning biomass. Therefore, any changes to our understanding of reproductive output – either across age/size (maturity), over time (skip spawning) or as a function of body mass (fecundity) are crucially important. Each of these components directly affects the annual reproductive output estimated in the assessment. Ideally, the IPHC would have a program in place to monitor each of these three reproductive traits over time and use that information in the estimation of the stock-recruitment relationship, and the annual reproductive output relative to reference points. This would reduce the potential for biased time-series estimates created by non-stationarity in these traits (illustrated via sensitivity analyses in several of the recent assessments). However, at present we have only historical time-aggregated estimates of maturity and fecundity schedules. Therefore, the current research priority is to first update our estimates for each of these traits to reflect current environmental and biological conditions. After current stock-wide estimates have been achieved, a program for extending this information to a time-series via transition from research to monitoring can be developed.

6.1.1.3.2 Stock structure of IPHC Regulatory Area 4B relative to the rest of the convention area

The current stock assessment and management of Pacific halibut assume that IPHC Regulatory Area 4B is functionally connected with the rest of the stock, i.e., that recruitment from other areas can support harvest in Area 4B and that biomass in Area 4B can produce recruits that may contribute to other Areas. Tagging (Webster et al. 2013) and genetic (Drinan et al. 2016) analyses have indicated the potential for Area 4B to be demographically isolated. An alternative to current assessment and management structure would be to treat Area 4B separately from the rest of the coast. This would not likely have a large effect on the coastwide stock assessment as Area 4B represents only approximately 5% of the surveyed stock (Stewart et al. 2021b). However, it would imply that the specific mortality limits for Area 4B could be very important to local dynamics and should be separated from stock-wide trends. Therefore, information on the stock structure for Area 4B has been identified as a top priority.

6.1.1.3.3 Meta-population dynamics (connectivity) of larvae, juveniles and adults

The stock assessment and current management procedure treat spawning output, juvenile Pacific halibut abundance, and fish contributing to the fishery yield as equivalent across all parts of the Convention Area. Information on the connectivity of these life-history stages could be used for a variety of improvements to the assessment and current management procedure, including: investigating recruitment covariates, structuring spatial assessment models, identifying minimum or target spawning biomass levels in each Biological Region, refining the stock-recruitment relationship to better reflect source-sink dynamics and many others. Spatial dynamics have been highlighted as a major source of uncertainty in the Pacific halibut assessment for decades, and will continue to be of high priority until they are better understood.

6.1.1.4 Stock Assessment fishery yield:

6.1.1.4.1 Biological interactions with fishing gear

In 2020, 16% of the total fishing mortality of Pacific halibut was discarded (Stewart et al. 2021b). Discard mortality rates can vary from less than 5% to 100% depending on the fishery, treatment of the catch and other factors (Leaman and Stewart 2017). A better understanding of the biological underpinnings for discard mortality could lead to increased precision in these estimates, avoiding potential bias in the stock assessment. Further, improved biological understanding of discard mortality mechanisms could allow for reductions in this source of fishing mortality, and thereby increased yield available to the fisheries.

6.1.1.4.2 Guidelines for reducing discard mortality

Much is already known about methods to reduce discard mortality, in non-directed fisheries as well as the directed commercial and recreational sectors. Promotion and adoption of best handling practices could reduce discard mortality, lead to greater retained yield, and reduce the potential uncertainty associated with large quantities of estimated mortality due to discarding.

Looking forward, the IPHC has recently considered adding close-kin genetics (e.g. Bravington et al. 2016) to its ongoing research program. Close-kin mark-recapture can potentially provide estimates of the absolute scale of the spawning output from the Pacific halibut population. This type of information can be fit directly in the stock assessment, and if estimated with a reasonable amount of precision, even a single data point could substantially reduce the uncertainty in the scale of total population estimates. Further, close-kin genetics may provide independent estimates of total mortality (and therefore natural mortality conditioned on catch-at-age), relative fecundity-at-age, and the spatial dynamics of spawning and recruitment. All of these quantities could substantially improve the structure of the current assessment and reduce uncertainty. Data collection of genetic samples from 100% of the sampled commercial landings has been in place since 2017 (as part of the sex-ratio monitoring) and routine comprehensive genetic sampling of FISS catch will begin in 2021. The genetic analysis required to produce data allowing the estimation of reproductive output and other population parameters from close-kin mark-recapture modelling is both complex and expensive, and it could take several years for this project to get fully underway.

6.1.2 Management Strategy Evaluations

MSE priorities have been subdivided into three categories: 1) biological parameterisation, 2) fishery parameterization, and 3) technical development. Research provides specifications for the MSE simulations, such as inputs to the OM, but another important outcome of the research is to define the range of plausibility to include in the MSE simulations as a measure of uncertainty. The following topics have been identified as top priorities.

6.1.2.1 MSE Biological and population parameterization

6.1.2.1.1 Distribution of life stages and stock connectivity

Research topics in this category will mainly inform parameterization of movement in the OM, but will also provide further understanding of Pacific halibut movement, connectivity, and the temporal variability. This knowledge may also be used to refine specific MSE objectives to reflect reality and plausible outcomes.

This research includes examining larval and juvenile distribution which is a main source of uncertainty in the OM that is currently not fully incorporated. Outcomes will assist with conditioning the OM, verify patterns simulated from the OM, and provide information to develop reasonable sensitivity scenarios to test the robustness of MPs.

Also included in this number one priority is stock structure research, especially with regard to IPHC Regulatory Area 4B. The dynamics of this IPHC Regulatory Area are not fully understood and it is useful to continue research on the connectivity of IPHC Regulatory Area 4B with other IPHC Regulatory Areas.

Finally, genomic analysis of population size is also included in this ranked category because that would help inform development of the OM as well as the biological sustainability objective related to maintaining a minimum spawning biomass in each IPHC Regulatory Area. An understanding of the spatial distribution of population size will help to inform this objective as well as the OM conditioning process.

6.1.2.1.2 Spatial spawning patterns and connectivity between spawning populations

An important parameter that can influence simulation outcomes is the distribution of recruitment across Biological Regions. Continued research in this area will improve the OM and provide justification for parameterising temporal variability. Research includes assigning individuals to spawning areas and establishing temporal and spatial spawning patterns. Outcomes may also provide information on recruitment strength and the relationship with environmental factors. For example, recent work by Sadorus et al (2020) used a biophysical and spatio-temporal models to examine connectivity across the Bering Sea and Gulf of Alaska. Furthermore, close-kin mark-recapture (Bravington et al. 2016) may provide insights into spatial relationships between juveniles and adults as well as abundance in specific regions.

6.1.2.1.3 Understanding growth variation

Changes in the average weight-at-age of Pacific halibut is one of the major drivers of changes in biomass over time. The OM currently simulates temporal changes in weight-at-age via a random autocorrelated process which is unrelated to population size or environmental factors. Ongoing research in drivers related to growth in Pacific halibut will help to improve the simulation of weight-at-age.

6.1.2.2 MSE fishery parameterization

The specifications of fisheries and their parameterizations involved consultation with Pacific halibut stakeholders but some aspects of those parameterizations benefit from targeted research. One specific example is knowledge of discarding and discard mortality rates in directed and non-directed fisheries. Discard mortality can be a significant source of fishing mortality in some IPHC Regulatory Areas and appropriately modelling that mortality will provide a more robust evaluation of MPs.

6.1.2.1 MSE technical development

Technical improvements to the MSE framework will allow for rapid development of alternative operating models and efficient simulation of management strategies for future evaluation.

6.1.2.1.1 Alternative migration scenarios

Including alternative migration hypotheses in the MSE simulations will assist in identifying management procedures that are robust to this uncertainty. This exploration will draw on general research on the movement and migration of Pacific halibut, observations from FISS and fisheries data, and outcomes of the stock assessment. Identification of reasonable hypotheses for the movement of Pacific halibut is essential to the robust investigation of management procedures.

6.1.2.1.1 Realistic simulations of estimation error

Closed loop simulation uses feedback from the management procedure to update the population in the projections. The management procedure consists of data collection, an estimation model, and harvest rules;currently IPHC uses a stock assessment as the estimation model. Future development of an efficient simulation process to mimic the stock assessment will more realistically represent the current management process. This involves using multiple estimation models to represent the ensemble and appropriately adding data and updating those models in the simulated projections. Improvements to the current MSE framework include adding additional estimation models to better represent the ensemble stock assessment, ensuring that the simulated estimation accurately represent the stock assessment now and in the future, and speeding up the simulation process.

6.1.2.1.2 Incorporate additional sources of implementation uncertainty

Implementation uncertainty consists of three subcategories: 1) decision-making uncertainty, 2) realized uncertainty, and 3) perceived uncertainty. Decision-making uncertainty is the difference between mortality limits determined from the management procedure and those adopted by the Commission. This uncertainty is currently not implemented in the MSE framework, but has been requested by the SRB and the independent peer review of the MSE. Realized uncertainty is the difference between the mortality limit set by the Commission and the actual mortality realized by the various fisheries. This type of uncertainty is currently partially implemented in the MSE framework. Finally, perceived uncertainty is the difference between the realized mortality and the estimated mortality limits from the various fisheries, which would be used in the estimation model. This third type of implementation uncertainty has not been implemented in the MSE framework. Implementing decision-making uncertainty is a priority for the MSE and will assit in understanding the performance of management procedures when they may not be followed exactly.

6.1.2.2 MSE Program of Work for 2021–2023

Following the 11th Special Session of the IPHC, an MSE program of work for 2021–2023 was developed. Seven tasks were identified that pertained to further developments of the MSE framework, evaluation of alternative MPs, and improvements in evaluation and presentation of results. Table 1 lists these tasks and provides a brief description. Additional details can be found in the program of work available on the MSE webpage.

Table 1. Tasks recommended by the Commission at SS011 (IPHC-2021-SS011-R para 7) for inclusion in the IPHC Secretariat MSE Program of Work for 2021–23.

ID	Category	Task	Deliverable
F.1	Framework	Develop migration scenarios	Develop OMs with alternative migration scenarios
F.2	Framework	Implementation variability	Incorporate additional sources of implementation variability in the framework
F.3	Framework	Develop more realistic simulations of estimation error	Improve the estimation model to more adequately mimic the ensemble stock assessment
F.5	Framework	Develop alternative OMs	Code alternative OMs in addition to the one already under evaluation.
M.1	MPs	Size limits	Identification, evaluation of size limits
M.3	MPs	Multi-year assessments	Evaluation of multi-year assessments
E.3	Evaluation	Presentation of results	Develop methods and outputs that are useful for presenting outcomes to stakeholders and Commissioners

6.1.3 Fishery socioeconomics

The priorities of the IPHC fisheries socioeconomics program can be subdivided into four categories. These are described below.

6.1.3.1 Primary economic data collection

In order to accurately capture the economic impact of the Pacific halibut, the IPHC designed a series of surveys to gather information from the sectors relying on the Pacific halibut resource, intended to fill identified socioeconomic data gaps. The survey target groups are commercial fishers, processing plant operators, and charter business owners. The goal of the survey is to improve the understanding of each sector's production structure (i.e., data on the distribution of revenue between profit and expenditure items), profitability (including the viability of the sector depending on the stock condition), and distribution of earnings. The compiled survey data, together with secondary data from various governmental and non-governmental sources, serve as an input to the economic impact assessment model.

6.1.3.2 Development of the Pacific halibut multiregional economic impact assessment (PHMEIA)

Pacific halibut multiregional economic impact assessment (PHMEIA) model is a multiregional model based on a social accounting matrix (SAM) framework that describes the economic interdependencies between sectors and regions developed to assess the economic contribution of Pacific halibut resource to the economy of the United States and Canada. The model describes the within-region production structure of the Pacific halibut sectors (fishing, processing, charter) and accounts for economic activity generated through sectors that supply fishing vessels, processing plants, and charter businesses with inputs to production. In addition, the PHMEIA model traces the flow of earnings from the harvest stage to the beneficial owners of the resource, accounting for cross-regional income spillovers, which represent economic stimulus in the regions other than the one in which the harvest occurs.

It is important to note that accurate characterization of the Pacific halibut sectors in the PHMIA model requires active participation of IPHC stakeholders, including commercial fishers, processing plant operators, and charter business owners in developing the necessary data for analysis (see section 6.1.3.1).

The following components have been identified as priorities for improving the PHMEIA model for it to better serve management decisions.

6.1.3.2.1 Expanding the static SAM model to a computable general equilibrium model

Relaxing the assumption of fixed technical coefficients by specifying these coefficients econometrically as a function of relative prices of inputs is one of the most compelling extensions to the static SAM model. Such models, generally referred to as computable general equilibrium (CGE) models, require research to develop credible functional relationships between prices and consumption that would guide economic agents' behavior in the model. The CGE approach is a preferred way forward when expanding the model usability and applying it in conjunction with the Pacific halibut management strategy evaluation. In addition, the dynamic model is well suited to analyze the impact of a broad suite of policies or external factors that would affect the stock over time.

6.1.3.2.2 Improving the spatial granularity of the SAM model

Extending the community analysis beyond a simplified approach relying on the calculated multiplier effects and local exposure to the region's Pacific halibut economic impact (as described in the IPHC-2021-SRB018-09, section *Community impacts in Alaska*) to a full community level (or any other spatial scale) SAM-based model requires identifying the economic relationships between different sectors or industries (including both seafood and non-seafood industries) within each broader-defined region, this including deriving estimates on intra-regional trade in commodities and flow of earnings. This extension of the current model has a great potential for more accurate estimates of the community effects. Detailing the geography of impacts of the Pacific halibut fisheries, paying particular attention to quantifying leakage of economic benefits from communities strongly dependent on fisheries, will provide a coherent picture of the exposure of fisheries-dependent households by location to changes in resource availability.

6.1.3.2.3 Study of recreational demand

It is important to note that while it is reasonable to assume that changes in harvest limits have a relatively proportional impact on production by commercial fishers (unless these are dramatic and imply fleet restructure or a significant shift in prices), the effects on the recreational sector are not so straightforward. A separate study estimating changes in saltwater recreational fishing participation as a response to the changing recreational harvest limits applicable to Pacific halibut is necessary to assess policy impacts in the recreational sector rather than provide an economic impact snapshot. Such studies typically require surveying recreational fishers, but adoption of alternative approaches will be also assessed.

6.1.3.2.4 Study of demand for Pacific halibut products

Catches can be converted to revenues, but one has to determine what price to multiply harvests by. Since price fluctuates with harvest levels, pragmatic assessment of harvest limits changes needs to be supplemented with a model of demand for Pacific halibut. The demand-adjusted prices provide more economics-sound projections of gross revenues in the sector. The demand model (e.g. Synthetic Inverse Demand System) can also be used to estimate final consumer benefits from changing Pacific halibut harvests and prices (i.e., consumer surplus).

6.1.3.2.5 Study of demand for Pacific halibut products

In 2021, fresh Alaskan Pacific halibut fillets routinely sold for USD 24-28 a pound, and often more, downtown Seattle (e.g. USD 38 at Pike Place Market). Pacific halibut dishes at the restaurants typically sell for USD 37-43 for a dish including a 6oz fish portion. The complete path of landed fish, from the hook to the plate, includes, besides harvesters, processors, and wholesalers, also retailers, and services. Pacific halibut is primarily sold to upscale retail outlets and white-tablecloth restaurants, resulting in a high price markup in the supply chain.

Understanding the formation of the price paid by final consumers (end-users) is an important step in assessing the contribution of Pacific halibut to the Gross Domestic Product (GDP) along the entire value chain. However, it is important to note that there are many seafood substitutes available to buyers. Thus, including economic impacts beyond processors and wholesalers in the economic impact assessment (as opposed to assessing the snapshot contribution to the GDP) would be misleading when considering that it is unlikely that supply shortage would result in a noticeable change in retail or services level gross revenues.

6.1.3.2.6 Uncertainty in the PHMEIA model

The PHMEIA model results focus on the magnitude of the Pacific halibut contribution to the economy and its spatial distribution. To increase confidence in the PHMEIA results, the model needs to consider sources of input variations and the cumulative effect of interactions among them. The natural next step is to conduct sensitivity analysis to account for the uncertainties in the system. The current framework would benefit from proposing methods for calculating the range (confidence intervals) of impacts from input variations within a PHMEIA framework, explicitly accounting for multiple sources of input variations.

6.1.3.2.7 Assessment of the economic impact of other sources of Pacific halibut mortality

All-sectors-encompassing quantitative assessment of the economic impact of the Pacific halibut resource necessitates the development of a methodological approach for the remaining sources of Pacific halibut mortality, including subsistence fishing, bycatch, and research catch. Methods adopted for the commercial and charter sector are not adequate for this portion of the harvest.

As a part of the socioeconomic program, the IPHC established a collaboration with the Alaska Fisheries Science Center (AFSC) and the Alaska Department of Fish and Game (ADF&G), and will be participating in the following project: Fish, Food, and Fun: Exploring the Nexus of Subsistence, Personal Use, and Recreational Fisheries in Alaska (SPURF project). The SPURF project aims to understand the intersection of Alaska subsistence, personal use, and marine recreational fisheries in fulfilling household food needs and contribute to an improved understanding of the economic and social values of non-commercial Alaska fisheries. The project is scheduled to commence in Fall 2021.

6.1.3.3 Provide stakeholders with a user-friendly tool visualizing the spatial distribution of socioeconomic impacts

The complexity of Pacific halibut supply-side restriction in the form of region-based allocations suggests the need for a tool enabling regulators to assess various combinations of quota allocations easily. To address this, the results of the PHMEIA model are complemented by an interactive web-based application allowing users to estimate and visualize joint economic impacts based on custom changes simultaneously applied to all IPHC-managed Pacific halibut producing areas. In addition, the app highlights the spatial variation of the economic impacts and the importance of cross-regional flows in assessing the dependence of fishing communities on the Pacific halibut resource.

The application will be continuously updated and expanded as the project evolves along the lines described in section 6.1.3.2.

6.1.3.4 Provide input to the management strategy evaluation

MSE implementation has been generally oriented towards biological target reference points despite socioeconomic objectives being prevalent in the legislation of the USA and Canada. The PHMIA model may be used alongside the Pacific halibut MSE framework to translate alternative management options (harvest strategies) and resulting harvest allocations by IPHC Regulatory Area directly to socioeconomic performance metrics by region. Socioeconomic performance metrics presented alongside already developed biological/ecological performance metrics will bring the human dimension to the MSE framework, adding to the IPHC's portfolio of tools for assessing policy-oriented issues for the Pacific halibut throughout the Convention Area.

6.1.4 Biology and Ecology

6.1.4.1 Migration and Population Dynamics. Genetic and genomic studies aimed at improving current knowledge of Pacific halibut migration and population dynamics throughout all life stages in order to achieve a complete understanding of stock structure and distribution across the entire distribution range of Pacific halibut in the North Pacific Ocean and the biotic and abiotic factors that influence it (specifically excluding satellite tagging). Specific objectives in this area include:

- Improve current knowledge of the genetic structure of the Pacific halibut population through the use of state-of-the-art low-coverage whole genome resequencing approaches. Establishment of genetic signatures of spawning sites.
- Improve our understanding of the mechanisms and magnitude of larval connectivity in the North Pacific Ocean. Identification of environmental and biological predictors of larval abundance and recruitment.
- Improve our understanding of spawning site contributions to nursery/settlement areas in relation to year-class, recruit survival and strength, and environmental conditions in the North Pacific Ocean. Measure of genetic diversity of Pacific halibut juveniles from the eastern Bering Sea and the Gulf of Alaska.
- Improve our understanding of the relationship between nursery/settlement origin and adult distribution and abundance over temporal and spatial scales. Genomic assignment of individuals to source populations and assessment of distribution changes.

- Integrate analyses of Pacific halibut connectivity and distribution changes by incorporating genomic approaches.
- Improve estimates of population size, migration rates among geographical regions, and demographic parameters (e.g. fecundity-at-age, survival rate), through the application of close-kin mark-recapture-based approaches.
- Improve our understanding of the influences of oceanographic and environmental variation on connectivity, population structure and adaptation at a genomic level using seascape genomics approaches.

6.1.4.2 Reproduction. Studies aimed primarily at addressing two critical issues for stock assessment analysis based on estimates of female spawning biomass: 1) the sex ratio of the commercial catch and 2) maturity estimations. Specific objectives in this area include:

- Continued improvement of genetic methods for accurate sex identification of commercial landings from fin clips and otoliths in order to incorporate recent and historical sex-at-age information into the stock assessment process.
- Improve our understanding of the temporal progression of reproductive development and gamete production during an entire annual reproductive cycle in female and male Pacific halibut.
- Update current maturity-at-age estimates.
- Provide estimates of fecundity-at-age and fecundity-at-size.
- Investigate the possible presence of skip spawning in Pacific halibut females.
- Improve accuracy in current staging criteria of maturity status used in the field.
- Investigate possible environmental effects on the ontogenetic establishment of the phenotypic sex and their influence on sex ratios in the adult Pacific halibut population.
- Improve our understanding of potential temporal and spatial changes in maturity schedules and spawning patterns in female Pacific halibut and possible environmental influences.
- Improve our understanding of the genetic basis of variation in age and/or size-at-maturity, fecundity, and spawning timing, by conducting genome-wide association studies.

6.1.4.3 Growth. Studies aimed at describing the role of factors responsible for the observed changes in size-at-age and at evaluating growth and physiological condition in Pacific halibut. Specific objectives in this area include:

- Evaluate possible variation in somatic growth patterns in Pacific halibut as informed by physiological growth markers, physiological condition, energy content and dietary influences.
- Investigate the effects of environmental and ecological conditions that may influence somatic growth in Pacific halibut. Evaluate the relationship between somatic growth and temperature and trophic histories in Pacific halibut through the integrated use of physiological growth markers.
- Improve our understanding of the genetic basis of variation in somatic growth and size-at-age by conducting genome-wide association studies.

6.1.4.4 Mortality and Survival Assessment. Studies aimed at providing updated estimates of discard mortality rates (DMRs) for Pacific halibut in the guided recreational fisheries and at evaluating methods for reducing mortality of Pacific halibut. Specific objectives in this area include:

- Provide information on the types of fishing gear and fish handling practices used in the Pacific halibut recreational (charter) fishery as well as on the number and size composition of discarded Pacific halibut in this fishery.
- Establish best handling practices for reducing discard mortality of Pacific halibut in recreational fisheries.
- Investigate new methods for whale avoidance and/or deterrence for the reduction of Pacific halibut depredation by whales and for improved estimation of depredation mortality.
- Investigate physiological and behavioral responses of Pacific halibut to fishing gear in order to reduce Pacific halibut bycatch.

6.1.4.5 Fishing Technology Studies aimed …

<<In development>>>

6.2 Monitoring

6.2.1 Fishery-dependent data. …………………

- **Directed commercial fisheries data**: ………In development…………
- FUTURE Quality control and sampling rate estimations: ………In development…………
- **Non-directed commercial discard mortality data**: ………In development…………
- FUTURE Quality control and sampling rate estimations: ………In development…………
- **Subsistence fisheries data**: ………In development…………
- FUTURE Quality control and sampling rate estimations: ………In development…………
- **Recreational fisheries data**: ………In development…………
- FUTURE Quality control and sampling rate estimations: ………In development…………

6.2.2 Fishery-independent data. Data collection and monitoring activities aimed at providing a standardised time-series of biological and ecological data that is independent of the fishing fleet.

- **Fishery-independent setline survey (FISS)**: ………In development…………
- FUTURE Quality control and sampling rate estimations: ………In development……….
- **Fishery-independent Trawl Survey (FITS)**: ………In development…………
- FUTURE Quality control and sampling rate estimations: ………In development…………

7. Conclusion and future review/amendments

<<In development>>>

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Sadorus, Lauri L., Esther D. Goldstein, Raymond A. Webster, William T. Stockhausen, Josep V. Planas, and Janet T. Duffy-Anderson. 2020. "Multiple life-stage connectivity of Pacific halibut (*Hippoglossus stenolepis*) across the Bering Sea and Gulf of Alaska." Fisheries Oceanography 30 (2): 174-193. https://doi.org/10.1111/fog.12512

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APPENDICES

Appendix I: Multi-year tactical activity matrix

Appendix II: Outcomes of the IPHC 5-Year Biological and Ecosystem Science Research Plan (2017-21)

Appendix III: Proposed schedule of outputs

Appendix IV: Proposed schedule with funding and staffing indicators

APPENDIX I

Multi-year tactical activity matrix

<<In development>>

APPENDIX II

Outcomes of the IPHC 5-Year Biological and Ecosystem Science Research Plan (2017-21) (IPHC–2019–BESRP-5YP)

A. Outcomes by Research Area:

1. Migration and Distribution.

1. Larval and juvenile connectivity and early life history studies. Planned research outcomes: improved understanding of larval and juvenile distribution.

Main results:

- Larval connectivity between the Gulf of Alaska and the Bering Sea occurs through large island passes across the Aleutian Island chain.
- The degree of larval connectivity between the Gulf of Alaska and the Bering Sea is influenced by spawning location.
- Spawning locations in the western Gulf of Alaska significantly contribute Pacific halibut larvae to the Bering Sea.
- Pacific halibut juveniles counter-migrate from inshore settlement areas in the eastern Bering Sea into the Gulf of Alaska through Unimak Pass.
- Elemental signatures of otoliths from juvenile Pacific halibut vary geographically at a scale equivalent to IPHC regulatory areas.

Integration with Stock Assessment and MSE: [In development]

Publications:

- Sadorus, L.; Goldstein, E.; Webster, R.; Stockhausen, W.; Planas, J.V.; Duffy-Anderson, J. Multiple life-stage connectivity of Pacific halibut (*Hippoglossus stenolepis*) across the Bering Sea and Gulf of Alaska. Fisheries Oceanography. 2021. 30:174-193. doi: https://doi.org/10.1111/fog.12512.
- Loher, T., Bath, G. E., Wischniowsky, S. The potential utility of otolith microchemistry as an indicator of nursery origins in Pacific halibut (*Hippoglossus stenolepis*) in the eastern Pacific: the importance of scale and geographic trending. Fisheries Research. 243: 106072. https://doi.org/10.1016/j.fishres.2021.106072.

Links to 5-Year Research Plan (2022-2026):

- Evaluate the level of genetic diversity among juvenile Pacific halibut in the Gulf of Alaska and the Bering sea due to admixture.
- Assignment of individual juvenile Pacific halibut to source populations.

2. **Reproduction**.

    1. Sex ratio of commercial landings. Planned research outcomes: sex ratio information.

Main results:

- Establishment of TaqMan-based genetic assays for genotyping Pacific halibut in the IPHC Biological Laboratory.
- Sex ratio information for the 2017-2020 commercial landings.
- Transfer of genotyping efforts for sex identification to IPHC monitoring program.

Links to 5-Year Research Plan (2022-2026):

- Monitoring effort.

    2. Histological maturity assessment. Planned research outcomes: updated maturity schedule.

Main results:

- Oocyte developmental stages have been characterized and fully described in female Pacific halibut for the first time.
- Oocyte developmental stages have been used for the classification of female developmental stages and to be able to characterize female Pacific halibut as group synchronous with determinate fecundity.
- Female developmental stages have been used for the classification of female reproductive phases and to be able to characterize female Pacific halibut as following an annual reproductive cycle with spawning in January and February.
- Female developmental stages and reproductive phases of females collected in the central Gulf of Alaska have been used to identify the month of August as the time of the transition between the Vtg2 and Vtg3 developmental stages marking the beginning of the spawning capable reproductive phase.
- Future gonad collections for revising maturity schedules and estimating fecundity can be conducted in August during the FISS.

Publications:

- Fish, T., Wolf, N., Harris, B.P., Planas, J.V. A comprehensive description of oocyte developmental stages in Pacific halibut, *Hippoglossus stenolepis*. Journal of Fish Biology. 2020. 97: 1880-1885. doi: 10.1111/jfb.14551.
- Fish et al. 2021. In Preparation.

Links to 5-Year Research Plan (2022-2026):

- Revision of maturity schedule by gonad collection during the FISS, as informed by previous studies on reproductive development.
- Estimation of fecundity by age and size, as informed by previous studies demonstrating determinate fecundity.

3. **Growth**.

    1. Identification of physiological growth markers and their application for growth pattern evaluation. Planned research outcomes: informative physiological growth markers.

Main results:

- Transcriptomic profiling by RNAseq of white skeletal muscle from juvenile Pacific halibut subjected to growth suppression and to growth stimulation resulted in the identification of a number of genes that change their expression levels in response to growth manipulations.
- Proteomic profiling by LC-MS/MS of white skeletal muscle from juvenile Pacific halibut subjected to growth suppression and to growth stimulation resulted in the identification of a number of proteins that change their abundance in response to growth manipulations.
- Genes and proteins that changed their expression levels in accordance to changes in the growth rate in juvenile Pacific halibut were selected as putative growth markers for future studies on growth pattern evaluation.

Publications:

- Planas et al. 2021. In Preparation.

Links to 5-Year Research Plan (2022-2026):

- Application of identified growth markers in studies aiming at investigating environmental influences on growth patterns and at investigating dietary influences on growth patterns and physiological condition.

    2. Environmental influences on growth patterns. Planned research outcomes: information on growth responses to temperature variation.

Main results:

- Laboratory experiments under controlled temperature conditions have shown that temperature affects the growth rate of juvenile Pacific halibut through changes in the expression of genes that regulate growth processes.

Publications:

- Planas et al. 2021. In Preparation.

Links to 5-Year Research Plan (2022-2026):

- Identification of temperature-specific responses in skeletal muscle through comparison between transcriptomic responses to temperature-induced growth changes and to density- and stress-induced growth changes.
- Application of growth markers for additional studies investigating the link between environmental variability and growth patterns and the effects of diet (prey quality and abundance) on growth and physiological condition.

4. **Mortality and Survival Assessment**.

    1. Discard mortality rate estimation in the longline Pacific halibut fishery. Planned research outcomes: experimentally-derived DMR.

Main results:

- Different hook release methods used in the longline fishery result in specific injury profiles and viability classification.
- Plasma lactate levels are high in Pacific halibut with the lowest viability classification.
- Survival of discarded fish with the highest viability classification is estimated to be between 4.2 and 8.4%.

Publications:

- Kroska, A.C., Wolf, N., Planas, J.V., Baker, M.R., Smeltz, T.S., Harris, B.P. Controlled experiments to explore the use of a multi-tissue approach to characterizing stress in wild-caught Pacific halibut (*Hippoglossus stenolepis*). 2021. Conservation Physiology 9(1):coab001; doi:10.1093/conphys/coab001.
- Loher, T., Dykstra, C.L., Hicks, A., Stewart, I.J., Wolf, N., Harris, B.P., Planas, J.V. Estimation of post-release longline mortality in Pacific halibut (*Hippoglossus stenolepis*) using acceleration-logging tags. North American Journal of Fisheries Management (In Review).

Links to 5-Year Research Plan (2022-2026):

- Integration of information on capture and handling conditions, injury and viability assessment and physiological condition will lead to establishing a set of best handling practices in the longline fishery.

    2. Discard mortality rate estimation in the guided recreational Pacific halibut fishery. Planned research outcomes: experimentally-derived DMR.

Main results:

- Field experiments testing two different types of gear types (i.e. 12/0 and 16/0 circle hooks) resulted in the capture, sampling and tagging of 243 Pacific halibut in IPHC Regulatory Area 2C (Sitka, AK) and 118 in IPHC Regulatory Area 3A (Seward, AK).
- The distributions of fish lengths by regulatory area and by hook size were similar.

Links to 5-Year Research Plan (2022-2026):

- Estimation of discard mortality rate in the guided recreational fishery.
- Integration of information on capture and handling conditions, injury and viability assessment and physiological condition linked to survival.
- Establishment of a set of best handling practices in the guided recreational fishery.

5. **Genetics and genomics**.
    1. Generation of genomic resources for Pacific halibut. Planned research outcomes: sequenced genome and reference transcriptome.

Main results:

- A first draft of the chromosome-level assembly of the Pacific halibut genome has been generated.
- The Pacific halibut genome has a size of 586 Mb and contains 24 chromosome-size scaffolds covering 98.6% of the complete assembly with a N50 scaffold length of 25 Mb at a coverage of 91x.
- The Pacific halibut genome has been annotated by NCBI and is available as NCBI Hippoglossus stenolepis Annotation Release 100 (https://www.ncbi.nlm.nih.gov/genome/annotation_euk/Hippoglossus_stenolepis/100/).
- Transcriptome (i.e. RNA) sequencing has been conducted in twelve tissues in Pacific halibut and the raw sequence data have been deposited in NCBI's Sequence Read Archive (SRA) under the bioproject number PRJNA634339 (https://www.ncbi.nlm.nih.gov/bioproject/PRJNA634339) and with SRA accession numbers SAMN14989915 - SAMN14989926.

Publications:

- Jasonowicz et al. 2021. In Preparation.
- Jasonowicz et al. 2022. In Preparation.

Links to 5-Year Research Plan (2022-2026):

- Genome-wide analysis of stock structure and composition.

    2. Determine the genetic structure of the Pacific halibut population in the Convention Area. Planned research outcomes: genetic population structure.

Main results:

- The collection of winter genetic samples in the Aleutian Islands completed the winter sample collection needed to conduct studies on the genetic population structure of Pacific halibut in the Convention Area.
- Initial results of low coverage whole genome resequencing of winter samples indicate that an average of 26.5 million raw sequencing reads per obtained per sample that provided average individual genomic coverages for quality filtered alignments of 3.2x.

Links to 5-Year Research Plan (2022-2026):

- Fine-scale delineation of population structure, with particular emphasis on IPHC Regulatory 4B structure.

B. External funding received:

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 (NOAA Award No. NA17NMF4270240)	IPHC	Alaska Pacific University	$286,121	Bycatch estimates	September 2017 – August 2020
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 Engineerin g 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 Engineerin g 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 (NFWF Award No. 61484)	IPHC	Alaska Pacific University, U of A Fairbanks, charter industry	$98,902	Bycatch estimates	April 2019 – November 2021
6	**North Pacific Research Board**	Pacific halibut discard mortality rates (NPRB Award No. 2009)	IPHC	Alaska Pacific University,	$210,502	Bycatch estimates	January 2021 – March 2022
Total awarded ($)					**$727,416**		

C. Publications in the peer-reviewed literature:

2020:

- Fish, T., Wolf, N., Harris, B.P., Planas, J.V. A comprehensive description of oocyte developmental stages in Pacific halibut, *Hippoglossus stenolepis*. Journal of Fish Biology. 2020. 97: 1880-1885. https://doi: 10.1111/jfb.14551.

2021:

- Carpi, P., Loher, T., Sadorus, L., Forsberg, J., Webster, R., Planas, J.V., Jasonowicz, A., Stewart, I. J., Hicks, A. C. Ontogenetic and spawning migration of Pacific halibut: a review. Rev Fish Biol Fisheries. 2021. https://doi.org/10.1007/s11160-021-09672-w.

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APPENDIX III

Proposed schedule of outputs

<<In development>>

APPENDIX IV

Proposed schedule of funding and staffing indicators

<<In development>>

Update on the IPHC Secretariat MSE Program of Work (2021–2023)

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PURPOSE

To provide the Commission with an update of progress on the Management Strategy Evaluation (MSE) program of work for 2021–2023.

1 INTRODUCTION

The current interim management procedure (MP) at the International Pacific Halibut Commission (IPHC) is shown in Figure 1.

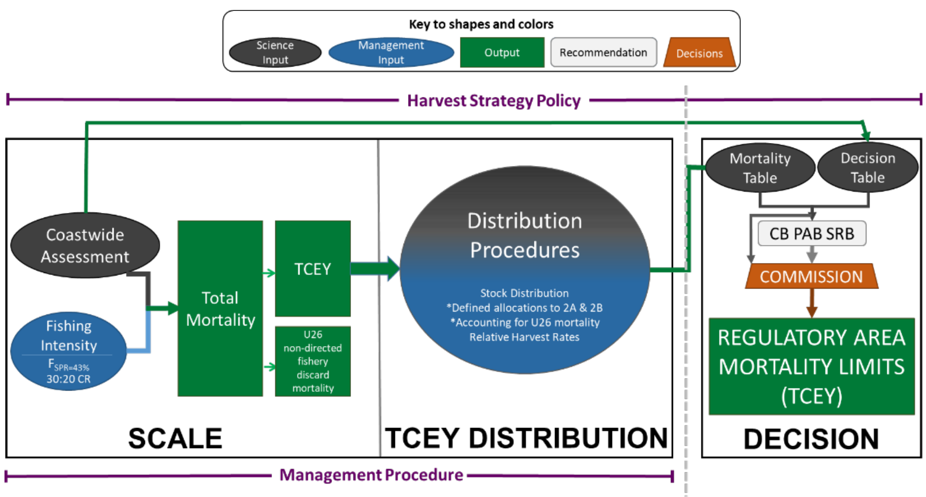


Figure 1. Illustration of the Commission interim IPHC harvest strategy policy (reflecting paragraph ID002 in IPHC-2020-CR-007) showing the coastwide scale and TCEY distribution components that comprise the management procedure. Items with an asterisk are interim agreements in place through 2022. The decision component is the Commission decision-making procedure, which considers inputs from many sources.

The Management Strategy Evaluation (MSE) at the IPHC completed an evaluation in 2021 of management procedures (MPs) relative to the coastwide scale and distribution of the Total Constant Exploitation Yield (TCEY) to IPHC Regulatory Areas for the Pacific halibut fishery using a recently developed framework. The development of this MSE framework supports the evaluation of the trade-offs between fisheries management scenarios. The MSE framework with a multi-area operating model (OM) and three options for examining estimation error is described in Hicks et al. (2020) with technical details available in IPHC-2021-MSE-01. Descriptions of the MPs evaluated and simulation results are presented in Hicks et al. (2021). Additional tasks were identified at the 11th Special Session of the IPHC (IPHC-2021-SS011-R) to supplement and extend this analysis for future evaluation (Table 1). Document IPHC-2021-MSE-02 contains details of the current MSE Program of Work.

Table 1. Tasks recommended by the Commission at SS011 (IPHC-2021-SS011-R para 7) for inclusion in the IPHC Secretariat MSE Program of Work for 2021–2023.

ID	Category	Task	Deliverable
F.1	Framework	Develop migration scenarios	Develop OMs with alternative migration scenarios
F.2	Framework	Implementation variability	Incorporate additional sources of implementation variability in the framework
F.3	Framework	Develop more realistic simulations of estimation error	Improve the estimation model to more adequately mimic the ensemble stock assessment
F.5	Framework	Develop alternative OMs	Code alternative OMs in addition to the one already under evaluation.
M.1	MPs	Size limits	Identification, evaluation of size limits
M.3	MPs	Multi-year assessments	Evaluation of multi-year assessments
E.3	Evaluation	Presentation of results	Develop methods and outputs that are useful for presenting outcomes to stakeholders and Commissioners

This document provides updates on the progress for the framework related tasks and the MP related tasks. Improvements to the evaluation and presentation of results are not presented in this document, but will continue to be worked on in 2022 with input from the MSAB.

2 FRAMEWORK

The framework category consists of three tasks (F.1, F.2, and F.3) that will improve the OM and lead to the completion of the fourth task (F.5) to develop alternative operating models. Current progress has been made on incorporating implementation variability and developing migration scenarios and are the only two tasks reported here.

2.1 Task F.1: Develop migration scenarios

Conditioned movement rates at age in the current OM differed from historically estimated rates for some Regions. This may be due to a number of reasons, two of which are described below.

First, the estimated movement rates from past data may have been reflective of smaller spatial and temporal scales than the entire IPHC Convention Area covered in the OM. The OM was not conditioned to the same observations that the data-determined movement rates were estimated from. Instead, the OM was attempting to describe broad scale historical population trends over the last 100+ years.

Second, the distribution of age-0 recruits (called recruitment distribution) was fixed at the same proportions for each Biological Region over all years in the OM, but it is likely that these proportions actually vary across years. Time-varying recruitment distribution has an affect on movement because it places age-0 recruits in specific regions and movement rates have to 'move' the fish to the places they are expected to be based on data that are representative of older fish. If the distribution of recruits is not correct, movement rates will be estimated differently in the OM than from direct observations of adult movement.

Sadorus et al. (2020) found that recruits were more likely to end up the Bering Sea in "warm years" for most spawning areas in the Gulf of Alaska. Furthermore, "cold years" were likely to have less dispersal to the west in the Bering Sea and "warm years" were more likely to have more dispersal to the northwest from spawning in the Western Gulf of Alaska. Therefore, in the Operating Model with four Biological Regions this may be modelled by allowing the recruitment distribution to change with the phase of the Pacific Decadal Oscillation (PDO; Mantua et al. 1997), thus higher proportions of recruits would go to Regions 4 and 4B in years of a positive PDO.

The OM code was updated in 2021 to allow for time-varying recruitment distribution that is tied to the low and high phases of the PDO, as defined in the stock assessment. Initial investigations conditioning the OM with time-varying recruitment distribution showed the expected pattern of the proportion recruited to western regions (Figure 2), improved expectations of movement rates (relative to historical estimates), and produced similar fits to the spawning biomass trajectory (estimated from the stock assessment ensemble) and distribution of O32 Pacific halibut (estimated from FISS data).

This improvement in the modelling of recruitment was necessary before beginning the identification of movement scenarios.

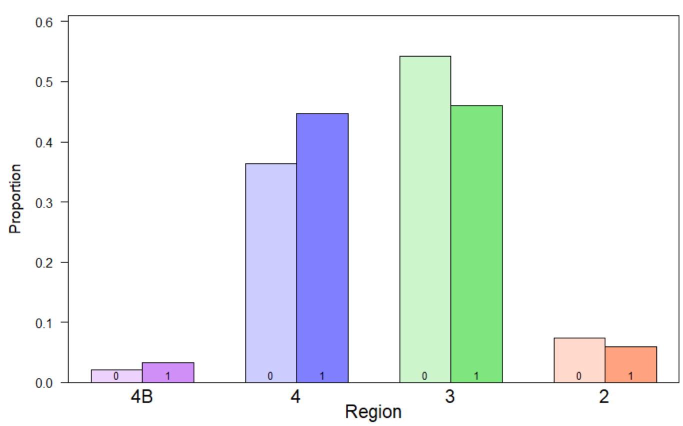


Figure 2. Proportion of coastwide recruitment assigned to each Biological Region in the OM in low PDO years (left bars shown with a 0) and high PDO years (right bars shown with a 1).

2.2 Task F.2: Implementation variability and uncertainty

Implementation variability is defined as the deviation of the fishing mortality from the mortality limit determined from an MP. It can be thought of as what is believed to have happened compared to the limits that were set. It is useful to define four different fishing mortalities that are subject to different types of implementation variability.

- **MP mortality limit**: This is the mortality limit determined from the management procedure which is calculated from a defined method without ambiguity and is repeatable.
- **Adopted mortality limit**: This is the mortality limit determined by the Commission after reviewing all inputs from the stock assessment, subsidiary bodies, and public. It is determined in the "decision" step of Figure 1 which are put into the regulations.
- **Estimated fishing mortality**: This is the perceived mortality after fishing occurs that is determined from landings, at-sea samples, discard mortality rates, and any other observations used in catch accounting. It may also be determined from methods or assumptions that do not used direct observations of catches or landings (e.g. effort). These estimates have sampling uncertainty and are used in estimation models, such as the stock assessment.
- **Actual fishing mortality**: This is the mortality that actually occurred from fishing activities. It is unknown in reality but is used in the OM which simulates the Pacific halibut population. Estimated fishing mortality may affect actual fishing mortality in cases where in-season management uses estimates of fishing mortality to determine if fisheries should be closed or opened.

These four types of mortality are hierarchically related to each other as shown in Figure 3. There are multiple pathways to modelling estimated and actual fishing mortalities. For example, estimated fishing mortality may be a function of the adopted mortality limit or a function of the actual fishing mortality. Actual fishing mortality may be a function of the adopted mortality limit or a function of the estimated fishing mortality. These pathways may differ for different sectors.

We have identified three types of implementation variability that define these relationships. If there is no implementation variability, then all four types of fishing mortality are equal to each other.

1. **Decision-making** variability is the difference between the MP mortality limits and the adopted mortality limits set by the Commission.
2. **Realized** variability is the difference between the adopted mortality limits set by the Commission and the actual mortality resulting from fishing.
3. **Perceived** variability is the variation that determines the estimated fishing mortality, which can differ importantly from actual mortality.

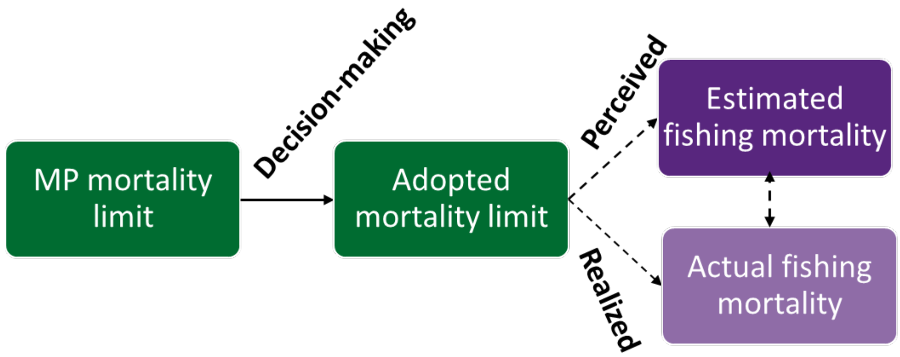


Figure 3. The hierarchy between four fishing mortality types (green and purple boxes) and where implementation variability occurs (black text). Dashed lines indicate that the estimated and actual fishing mortalities could be modelled from different pathways (e.g., estimated fishing mortality is a function of the adopted mortality limit or a function of the actual fishing mortality). Actual fishing mortality is not known in reality but is used in the OM, thus is shown in a lighter color.

Variability is defined as the inherent heterogeneity in the data or population, which cannot be reduced. On the other hand, uncertainty is defined as the incomplete understanding of the data, estimate, or process. Uncertainty can be reduced to zero with increased sampling. With these definitions, we refer to historical variations in implementation of mortality limits as implementation variability, and the future simulation of potential variations in the implementation of mortality limits as implementation uncertainty. Variability has already happened in the past and can be determined and not changed, whereas future simulations are uncertain about the variations, thus simulate a range of possible deviations.

To identify reasonable methods to simulate implementation uncertainty in the MSE, we considered some possible hypotheses and looked at historical implementation variability. First, decision-making uncertainty can be applied to the MP mortality limit ($TCEY_t$) as a multiplier.

$$\widetilde{TCEY}_t = TCEY_t \varepsilon_I$$

where $\widetilde{TCEY}_t$ is the adopted mortality and ε_I is the multiplier. Using observations from 2014 to 2021 of the MP mortality limit determined from the interim management procedure and the adopted mortality limits set by the Commission for that year and IPHC Regulatory Area, the multipliers are shown in Figure 4. These years were chosen because they used a relatively consistent management procedure, although as noted in the following paragraphs from Annual Meeting reports, explicit use of SPR was added in 2017, additional agreements were added in 2019 and 2020, and the reference SPR changed from 46% to 43% in 2021.

> ***IPHC-2017-AM093–R*** ***(para. 29) NOTING*** *that the IPHC Secretariat and the IPHC Scientific Review Board (SRB) have demonstrated that Ebio is outdated and inconsistent with current assessment results, and that numerous elements of the current harvest policy are reliant on Ebio, and that the Commission has agreed that the current harvest policy is considered to be outdated (IPHC–2016–IM092–R, items 21, 22), the Commission*

***RECOMMENDED** IPHC–2017–AM093–R Page 8 of 61 that reference to all elements of the current harvest policy reliant on Ebio, as well as the use of the Blue line, be eliminated subsequent to the close of the 93rd Session of the Commission. The "status quo SPR" (F46%) may serve as an interim "hand rail" that allows all participants to gauge this and future years' catch limit discussions in comparison to previous years.*

***IPHC-2020-AM096-R** **(para. 97)** The Commission **ADOPTED**: a)[…]; and b) a fixed TCEY for IPHC Regulatory Area 2A of 1.65 million pounds is intended to apply for a period from 2019-2022, subject to any substantive conservation concerns; and c) 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 2020, this equates to a share of 18.2% before accounting for U26; and […]*

***IPHC-2020-CR-007** **(ID002).** The Commission **RECOMMENDED** a reference SPR fishing intensity of 43% with a 30:20 control rule be used as an updated interim harvest policy consistent with MSE results pending delivery of the final MSE results at AM097 […]*

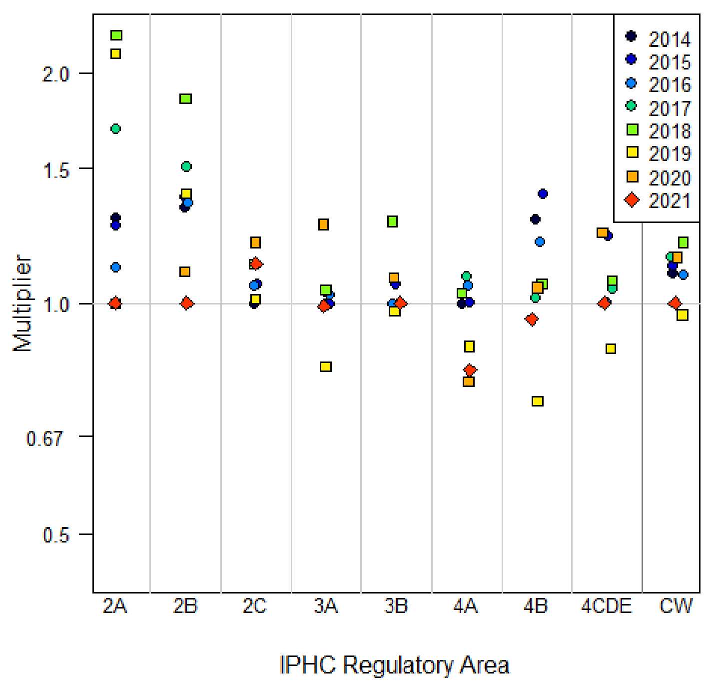


Figure 4. Multipliers for the difference between MP mortality limits and adopted mortality limits from 2014 to 2021. "CW" refers to coastwide.

The Commission does not necessarily choose multipliers for each IPHC Regulatory Area or attempt to keep the coastwide TCEY at the same value as the TCEY determined from the MP (i.e., the right column in Figure 4 is not always at 1.0), but the decisions made for each IPHC Regulatory Area are not independent of each other. Therefore, there is correlation between the multipliers in each IPHC Regulatory Area for a specific year, which must be accounted for when simulating decision-making uncertainty.

This investigation of past decisions can inform the development of methods to simulate decision-making uncertainty. To further aid in the development, six potential decision-making response hypotheses were identified from discussions with the SRB and MSAB, as well as from past observations.

1) When the TCEY is high the Commission may be less inclined to increase the coastwide TCEY above the MP TCEY (the multipliers become closer to 1).
2) When the TCEY is decreasing from the previous year, the multiplier is typically above 1, whereas when the TCEY is increasing, it is typically around 1. The SRB made a recommendation related to this scenario.

   SRB019–Rec.06 (para. 35) ***NOTING*** *the inclusion of uncertainty stemming from implementation* ***uncertainty****, the SRB* ***RECOMMENDED*** *that the IPHC Secretariat develop, for presentation at SRB020, alternative scenarios that represent implementation* ***bias****, i.e. the potential for quota reductions called for by the management procedure to be less likely implemented than quota increases.*

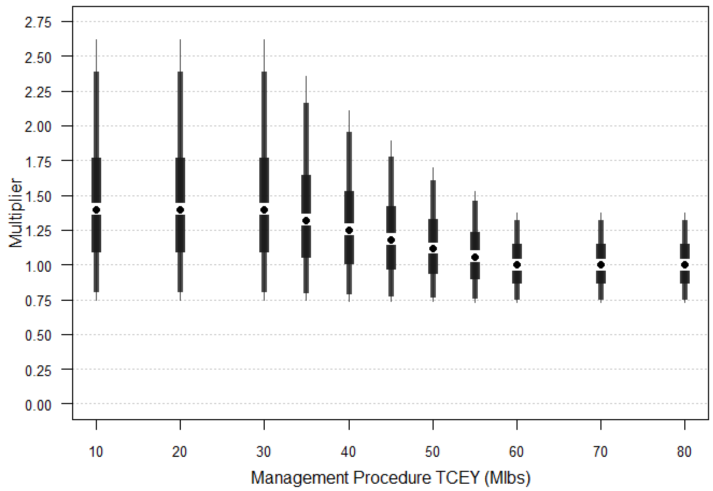
3) When the stock status is less than 30%, the Commission may deviate (increased fishing intensity/higher TCEY) from the MP. An extreme example is that they may decide to not set the TCEY to zero when the relative spawning biomass is less than 20%, as defined by the interim control rule.
4) When coastwide stock status is above 30% (trigger point of CR) the multiplier may be increasingly greater than one as the TCEY becomes lower or is below some threshold.
5) When the decision table from the assessment indicates a lower risk of stock decline or falling below 30% RSB, the multiplier may become increasingly greater than 1.
6) When there is an agreement for an IPHC Regulatory Area, the implementation variability is much less, or near 1.0 for these areas.

2.2.1 Method to simulate decision-making uncertainty

The multiplier to simulate decision-making uncertainty is drawn from a lognormal distribution with correlation between multipliers for each IPHC Regulatory Area. The mean ($\boldsymbol{\mu_\varepsilon}$) and standard deviation ($\boldsymbol{\sigma_\varepsilon}$) of that distribution are modified as follows depending on the TCEY from the MP.

$$\boldsymbol{\mu_\varepsilon} \text{ or } \boldsymbol{\sigma_\varepsilon} = \begin{cases} \bar{\boldsymbol{x}} \text{ or } \boldsymbol{s} & TCEY < TCEY_{low} \\ \boldsymbol{a} + \boldsymbol{b} * TCEY & TCEY_{low} \le TCEY \le TCEY_{high} \\ \boldsymbol{1.0} \text{ or } \boldsymbol{s}/\boldsymbol{2} & TCEY > TCEY_{high} \end{cases}$$

Using IPHC Regulatory Area 2A as an example (no TCEY agreement in place), with a coastwide $TCEY_{low}$ of 30 Mlbs and a coastwide $TCEY_{high}$ equal to 60 Mlbs, the distribution of simulated multipliers gets closer to 1 as the TCEY increases (Figure 5).



The above method may directly address, indirectly or partial address, or not address each management response hypothesis as follows.

1) This is an attempt to directly account for hypothesis 1.
2) This does not take into account decreases or increases. For example, in 2013, the Commission specifically chose to not take the entire decrease. However, it partially addresses hypothesis 2 because as the TCEY increases the multiplier becomes closer to 1, and vice versa.
3) Hypothesis 3 is indirectly addressed because when the stock status is low, the multiplier is more likely to be above 1 because the TCEY will likely be low as well. However, a multiplier on a very low number is still a low number, therefore a minimum on the adopted TCEY may be a scenario to explore.
4) This is an attempt to directly account for hypothesis 4, which is a special case of hypothesis 1.
5) This does not account for the decision table, but if there is a high risk of falling below 30%, the TCEY is likely to be low. Hypothesis 5 suggests the opposite (that the Commissioners will act in a cautionary manner to avoid falling below 30%) of the method proposed above. Therefore, this method does not address hypothesis 5 but could be investigated separately.
6) This method does not address hypothesis 6, but a simple modification when an agreement is in place could be easily implemented for these special case MPs.

Actual decision-making variability is likely more complex than this simple method. In fact, some IPHC Regulatory Areas show a consistent adopted TCEY over a range of MP TCEYs (e.g., 4B in Figure 6). However, the goal of including decision-making uncertainty in the MSE simulations isn't to exactly simulate what the pattern is, but to identify the effect of decision-making uncertainty and identify MPs that are robust to a plausible amount of uncertainty. Therefore, simulations will be done with and without decision-making uncertainty to identify MPs that are robust to this uncertainty.

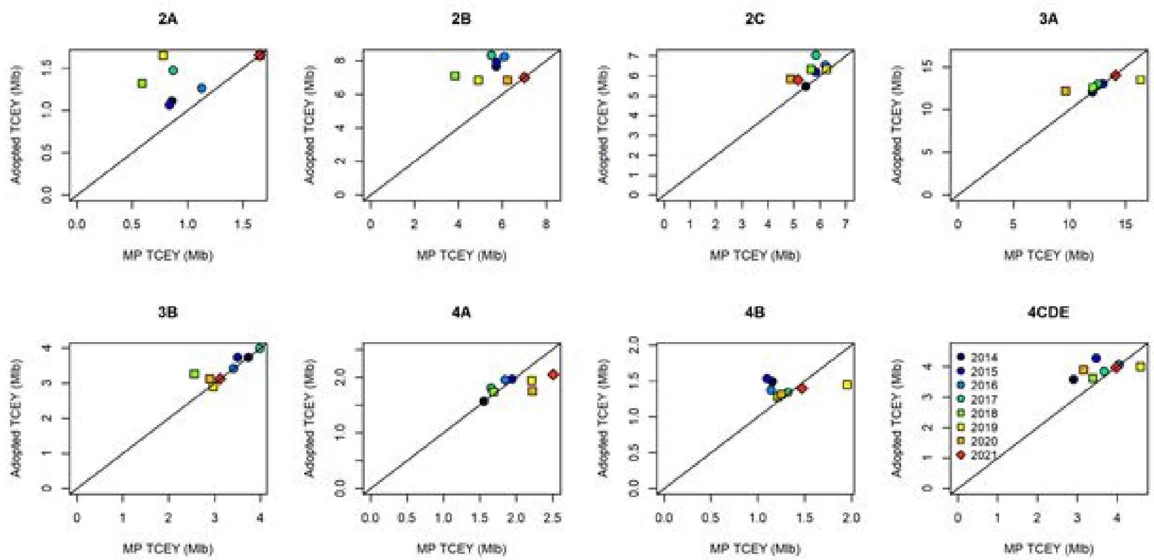


Figure 6. Adopted TCEYs plotted against MP TCEYs for each IPHC Regulatory Area and years 2014 to 2021.

Realized uncertainty is currently implemented in the OM by simulating a range of actual non-directed discard mortality, recreational mortality, and subsistence mortality. These are likely the largest sources of realized variability in the Pacific halibut fisheries.

Perceived uncertainty is currently not simulated in the OM but will be considered as work progresses.

3 Management Procedures

Two categories of MPs were prioritised in the MSE Program of Work for 2021–2023. One was the investigation of size limits (M.1) and the other was to investigate multi-year stock assessments (i.e. not conducting the stock assessment annually; M.3). The investigation of SPR-based MPs, as was done for 2021 will also continue as needed to evaluate the performance of a range of MPs.

3.1 Size limits

Pacific halibut have shown highly variable size- and weight-at-age over time. Studies on growth and analysis of length data continue, but recent population modelling of Pacific halibut has converted numbers-at-age to biomass using weight-at-age relationships directly, instead of using intermediate length-at-age calculations. The OM follows the direct weight-at-age method to avoid modelling the complexities of changing length-at-age relationships over time. However, this means that defining size-based quantities, such as needed for size limits or U26/O32 metrics, for example, must be approximated. The OM currently uses static distributions of length-at-ages (Figure 7) determined from pooled coastwide data to determine quantities such as O32 WPUE from the Fishery-Independent Setline Survey (FISS).

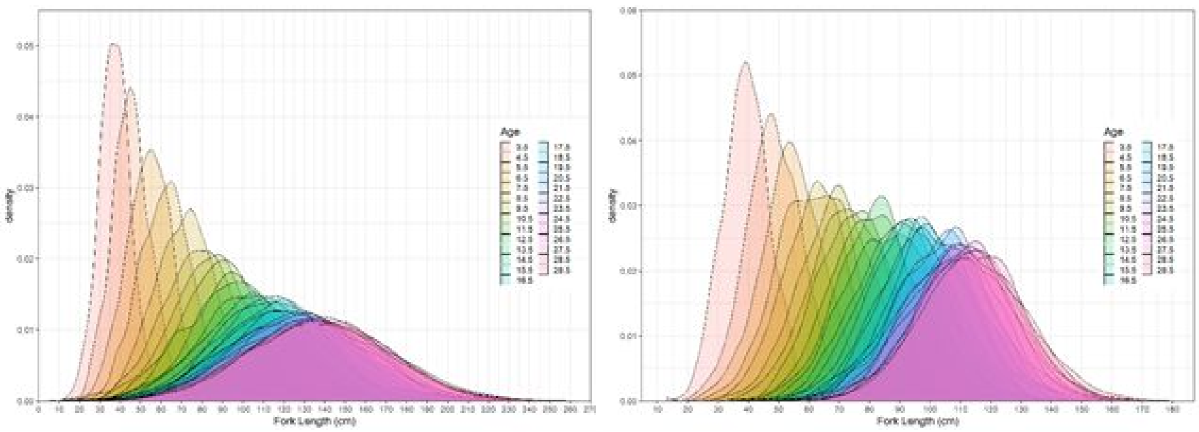


Figure 7. Distribution of length-at-ages 3 to 25 for female (left) and male (right) Pacific halibut.

3.1.1 Modelling time-varying length in the OM

There are two paths for incorporating time-varying length-based processes in the OM. One is to model it independently, not linked to population processes, and use it to calculate size-based quantities only when necessary. The second is to model length-at-age and weight-at-length explicitly such that weight-at-age is determined from these two growth functions.

Modelling length through length-at-age distributions to determine the probability that a specific age fish is above a defined size is the quickest solution as this is partially implemented in the current OM. These length-at-age distributions, however, are currently static across years in the OM, but could be updated through simulation on an annual basis in the projections to simulate time-varying changes in length-at-age. This would require investigating historical data to understand the annual variation, and then coding a method to apply the annual variation in the OM. The most simple and quickest method would be to determine a mean length from the simulated mean weight-at-age using an assumed weight-length relationship. This may not, however, capture the population effects of a size limit and completely account for changes in selectivity with changes in a size limit. Time would be spent determining appropriate simulation methods and then updating the OM code, but some simulations could be completed for the 99th Annual Meeting in 2023 along with other tasks in the MSE program of work.

The second method of directly modelling length-at-age and weight-at-length to determine weight-at-age is much more involved, requiring many changes to the OM, but would be a more complete method of modelling length and weight for the population. Length bins in the population would be directly modelled allowing for length-based processes such as selectivity and movement. However, this is difficult and could be inaccurate due to the complexities of modelling time-varying length for Pacific halibut and the wide range of lengths observed for a single age class. It is a more complete method for modelling length in a population, but also a source of variability that may be distracting when providing management advice. Additionally, it would take a considerable amount of time to determine the appropriate methods and to code the operating model. Some simulations could be completed by the 99th Annual Meeting in 2023 if this was the only task for the MSE framework in the MSE Program of Work.

3.1.2 Multi-year stock assessments

Management procedures with multi-year assessments incorporate a process where the stock assessment occurs at intervals longer than annually. The mortality limits in a year with the stock assessment can be determined as in previously defined MPs, but in years without a stock assessment, the mortality limits would need an alternative approach. This may be as simple as maintaining the same mortality limits for each IPHC Regulatory Area in years with no stock assessment, or as complicated as invoking an alternative MP that does not require a stock assessment (such as an empirical-based MP relying only on data/observations).

Simulations using an MP where the stock assessment occurs biennially and the mortality limits remain unchanged from the previous year were performed using the 2020 MSE framework. The specifications of the simulation model are the same as reported in Hicks et al. (2020), Hicks et al. (2021), and IPHC-2021-MSE-01. The MP specified as A was used with the addition of a biennially assessment (Table 2). Coastwide performance metrics for MP-A with and without the biennial mortality limit specification are shown in Table 3 along with MP-D and MP-J which were the best performing MPs from the previous MSE simulations.

The biennial mortality limit specification improved the coastwide performance metrics related to variability in the TCEY compared to MP-A with an annual mortality limit specification. The median average TCEY was less than MP-A and MP-D, but slightly higher than MP-J. The median relative spawning biomass was above the 36% target, but slightly closer than MP-A.

Table 2. Specifications of MPs with an annual stock assessment and management advice (MP-A, MP-D, and MP-J), and with a biennial stock assessment and mortality limit specification (MP-A2).

Element	**MP-A**	**MP-A2**	**MP-D**	**MP-J**
Maximum coastwide TCEY change of 15%				
Maximum Fishing Intensity buffer (SPR=36%)				
O32 stock distribution				
O32 stock distribution (5-year moving average)				
All sizes stock distribution				
Fixed shares updated in 5th year from O32 stock distribution				
Relative harvest rates of 1.0 for 2-3A, and 0.75 for 3B-4				
Relative harvest rates of 1.0 for 2-3, 4A, 4CDE, and 0.75 for 4B				
Relative harvest rates by Region: 1.0 for R2-R3, 0.75 for R4-R4B				
1.65 Mlbs fixed TCEY in 2A				
Formula percentage for 2B				
National Shares (2B=20%)				
Frequency of stock assessment & mortality limits				

Table 3. Coastwide long-term performance metrics for the biological sustainability objective and P(all RSB<36%) and short-term performance metrics for the remaining fishery sustainability objectives for MPs A, D, and J with an annual mortality limit setting process, and MP-A with a biennial mortality limit setting process (A2). All results use an SPR value of 43% with simulated estimation error.

Input SPR/TM	**43**	**43**	**43**	**43**
Management Procedure	**A**	**A2**	**D**	**J**
Biological Sustainability				
P(any RSB_y<20%)	<0.01	<0.01	0.01	<0.01
Fishery Sustainability				
P(all RSB<36%)	0.25	0.28	0.44	0.28
Median average TCEY (Mlbs)	39.92	38.31	40.22	37.90
P(any3 change TCEY > 15%)	0.44	0.36	0.10	0.00
Median AAV TCEY	12.1%	9.0%	5.9%	9.5%

MP-A2 shows a different pattern of variability that is not completely captured with the performance metrics presented in Table 3. The variability performance metrics with the biennial mortality limit specification show improvements because half of the years in a ten-year period have no change in the TCEY compared to an MP with an annual mortality limit specification while the other half may show a slightly larger change. Trajectories of the projected TCEY for a 60-year period show the biennial specification process in MP-A2 (Figure 8). Comparing the trajectories for MP-A and MP-A2 shows that the biennial process generally follows the annual process but with steps. However, there are cases where the biennial process takes longer to catch up (e.g. the start of the trajectory) and where the biennial process does not unnecessarily change the TCEY (e.g. near the year 2065 for some simulations).

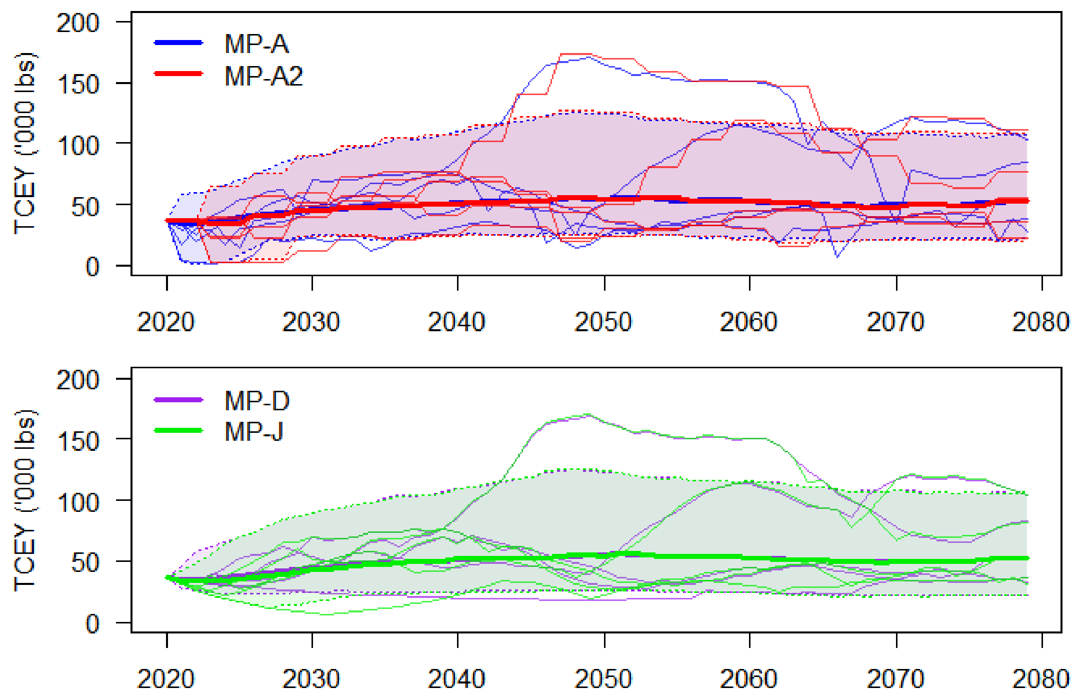


Figure 8. Trajectories of TCEY for MPs A, D, and J with an annual mortality limit setting process, and MP-A with a biennial mortality limit specification process (A2). All results use an SPR value of 43% with simulated estimation error. The 5th and 95th quantiles are shown as a shaded polygon. Five individual trajectories are shown as thin lines and the median of all simulations is shown as a thick line.

Different performance metrics may help to understand the differences between annual stock assessment MPs and multi-year assessment MPs. Three new performance metrics are reported in Table 4 to provide a better indication of how the TCEY may change in a given year. Over a ten-year period these are, the probability that the TCEY exceeds a change greater than 15% in any one year [P(any1 change TCEY > 15%)], the probability that the TCEY exceeds a change greater than 15% in any two years [P(any2 change TCEY > 15%)], and the median maximum absolute percentage change (up or down) in the TCEY over a 10-year period (Median max abs % change TCEY). Table 4 shows that all of these performance metrics are highest for MP-A2, indicating that the change in the TCEY is typically higher in years when it changes compared to an annual mortality limit specification process. Additional performance could be developed, such as a metric for cumulative change over a number of years to bring the measure of variability on the same temporal scale.

Table 4. Additional coastwide short-term and long-term performance metrics for the fishery sustainability objectives related to TCEY variability for MPs A, D, and J with an annual mortality limit setting process, and MP-A with a biennial mortality limit specification process (A2). All results use an SPR value of 43% with simulated estimation error.

	Short-term				**Long-term**			
Input SPR/TM	**43**	**43**	**43**	**43**	**43**	**43**	**43**	**43**
Management Procedure	**A**	**A2**	**D**	**J**	**A**	**A2**	**D**	**J**
Fishery Sustainability								
P(any1 change TCEY > 15%)	0.75	0.93	0.56	0.00	0.46	0.67	0.17	0.00
P(any2 change TCEY > 15%)	0.63	0.74	0.26	0.00	0.31	0.32	0.02	0.00
Median max absolute % change TCEY	18%	23%	11%	15%	13%	21%	9%	14%

Overall, there is a clear trade-off between slightly higher biennial change and consistency within each two-year period. The benefits to a biennial mortality limit specification include stability for a two-year period and resources needed for conducting a stock assessment can be directed towards other research such as improving the stock assessment or MSE. However, it is likely that the change in the mortality limit every other year may be larger than desired for an annual process. These trade-offs must be considered when analysing an MP with a static biennial mortality limit specification.

The mortality limit does not need to be held constant in years when there is no stock assessment, but may instead use other methods to determine a mortality limit. The projection from the stock assessment may be used, or an empirical, data-driven approach can inform changes to the mortality limit. This may reduce the potential for large changes with biennial stock assessments, would make immediate use of FISS results in intervening years, and could be extended to periods of longer than two years between stock assessments.

An alternative approach that would not require a stock assessment for setting mortality limits in any year would be to adopt an empirical-based MP as the method for setting annual mortality limits. The stock assessment would be used at a defined interval to verify that management is effective and to potentially tune the MSE OM and existing MP (Cox and Kronlund 2008). Any of the MPs mentioned in this section, empirical- or model-based or a hybrid of the two, can be evaluated using the current MSE framework.

Recommendation/s

That the Commission

a) **NOTE** paper IPHC-2021-IM097-13 describing progress on the MSE Program or Work for 2021–2023, including progress on modelling the distribution of recruitment and its effects on estimated movement, simulating implementation uncertainty, methods to investigate size limits, and multi-year assessments.

b) **NOTE** that implementation uncertainty will be incorporated to evaluate the robustness of MPs to plausible departures from the MP determined TCEY.

c) **RECOMMEND** an approach for investigating size limits using the MSE framework.

d) **RECOMMEND** elements of management procedures related to multi-year assessments, including holding the TCEY constant, incorporating empirical approaches in non-assessment years, and using an MP without a stock assessment.

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Appendices

Nil

IPHC-2021-IM097-14 Rev_1

Pacific Halibut Multiregional Economic Impact Assessment (PHMEIA): summary of progress

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PURPOSE

The purpose of this document is to provide the Commission with an update on the development of the Pacific halibut multiregional economic impact assessment (PHMEIA) model. PHMEIA is a core product of the IPHC socioeconomic program that directly responds to the Commission's "desire for more comprehensive economic information to support the overall management of the Pacific halibut resource in fulfillment of its mandate" (economic study terms of reference).

BACKGROUND

The goal of the IPHC economic study is to provide stakeholders with an accurate and all-sectors-encompassing assessment of the socioeconomic impact of the Pacific halibut resource that includes the full scope of Pacific halibut's contribution to regional economies of Canada and the United States of America. To that end, the Secretariat continues improving the Pacific Halibut Multiregional Economic Impact Assessment (PHMEIA) with an intention to inform stakeholders on the importance of the Pacific halibut resource and fisheries to their respective communities, but also broader regions and nations, and contribute to a wholesome approach to Pacific halibut management that is optimal from both biological and socioeconomic perspective, as mandated by the Convention.

The PHMEIA is a multiregional social accounting matrix (SAM)-based model describing economic interdependencies between sectors and regions developed to assess three **economic impact (EI)** components pertaining to Pacific halibut. The **direct EIs** reflect the changes realized by the direct Pacific halibut resource stock users (fishers, charter business owners), as well as the forward-linked Pacific halibut processing sector (i.e., EI related to downstream economic activities). The **indirect EIs** are the result of business-to-business transactions indirectly caused by the direct EIs. The indirect EIs provide an estimate of the changes related to expenditures on goods and services used in the production process of the directly impacted industries. In the context of the PHMEIA, this includes an impact on upstream economic activities associated with supplying intermediate inputs to the direct users of the Pacific halibut resource stock, for example, impact on the vessel repair and maintenance sector or gear suppliers. Finally, the **induced EIs** result from increased personal income caused by the direct and indirect effects. In the context of the PHMEIA, this includes economic activity generated by households spending earnings that rely on the Pacific halibut resource, both directly and indirectly.

The economic impact is most commonly expressed in terms of output, that is the total production linked (also indirectly) to the evaluated sector. PHMEIA also provides estimates using several other metrics, including compensation of employees, contribution to the gross domestic product (GDP), employment opportunities, and households' prosperity (income by place of residence).

To accommodate an increasing economic interdependence of regions and nations, the model also accounts for interregional spillovers. These represent economic stimulus in regions other than the one in which the exogenous change is considered. Economic benefits from the primary area of the resource extraction are leaked when inputs are imported, when wages earned by nonresidents are spent outside the place of employment, or when earnings from quota holdings flow to nonresident beneficial owners. At the same time, there is an inflow of economic benefits to the local economies from when products are exported, or services are offered to non-residents.

MODEL SETUP

The model reflects the interdependencies between eleven major sectors and two Pacific halibut-specific sectors. These include the Pacific halibut fishing sector, as well as the forward-linked Pacific halibut processing sector. While the complete path of landed fish includes, besides harvesters and processors, also seafood wholesalers and retailers, and services when it is served in restaurants, it is important to note that there are many seafood substitutes available to buyers. Thus, including economic impacts beyond wholesale in PHMEIA, as opposed to assessing the snapshot contribution to the GDP along its entire value chain, would be misleading when considering that it is unlikely that supply shortage would result in a noticeable change in retail or services level gross revenues (Steinback and Thunberg, 2006). Snapshot assessment of Pacific halibut contribution to the GDP along the entire value chain, from the ***hook-to-plate***, is available in IPHC-2021-IM097-INF04.

The extended model (referred here as PHMEIA-r) introduces to the SAM also the saltwater charter sector that is disaggregated from the services-providing industry. The estimates assume that the economic impact of Pacific halibut charter fishing is equivalent to estimating the total economic loss resulting from the saltwater charter sector in each region shrinking by share of Pacific halibut effort in total effort. The results for the charter sector, however, should be interpreted cautiously because of the uncertainty on how much of the saltwater angling effort directly depends on Pacific halibut.[1]

The list of industries considered in the PHMEIA and PHMEIA-r models, as well as the primary commodities they produce, is available in **Table 1**. Production by these industries is allocated between three primary Pacific halibut producing regions, as well as residual regions to account for cross-boundary effects of fishing in the Pacific Northwest:

- Alaska (AK)
- US West Coast (WOC – including WA, OR, and CA)
- British Columbia (BC)
- Rest of the United States (US-r)
- Rest of Canada (CA-r)
- Rest of the world (ROW)[2]

[1] Additional analysis of the demand for Pacific halibut recreational trips is proposed in the *IPHC 5-year program of integrated research and monitoring* (2022-26) (IPHC-2021-IM097-12). Current results rely on the available statistics that do not necessarily reflect the willingness to substitute the target species (see details in IPHC-2021-ECON-02-R02).

[2] The ROW region in the model is considered exogenous. This implies that the trade relations with the ROW are unaffected by the changes to the Pacific halibut sectors considered in this project. While the full inclusion of the ROW component allows for assessment of impact outside Canada and the United States if trade with ROW was to be considered responsive to changes in Pacific halibut sector activity, this is not typically seen in the literature.

The adopted methodology is an extension from the multiregional SAM model for Southwest Alaska developed by Seung, Waters, and Taylor (2019) (see IPHC-2021-ECON-03 for details on adopted methodology) and draws on a few decades' worth of experience in developing IO models with applications to fisheries (see IPHC-2021-ECON-01). Model description can be also found in the economic study section of the IPHC website.

Table 1 Industries and commodities considered in the PHMEIA and PHMEIA-r models.

	Industry	Primary commodity produced
1	Pacific halibut fishing	Pacific halibut
2	Other fish and shellfish fishing	Other fish and shellfish(1)
3	Agriculture and natural resources (ANR)	Agriculture and natural resources
4	Construction	Construction
5	Utilities	Utilities
6	Pacific halibut processing	Seafood
7	Other fish and shellfish processing	Seafood
8	Food manufacturing (excluding seafood manufacturing)	Food (excluding seafood) (2)
9	Manufacturing (excluding food manufacturing)	Manufactured goods (excluding food)
10	Transport	Transport
11	Wholesale	Wholesale
12	Retail	Retail
13	Services (including public administration)	Services (including public administration)
14	Saltwater charter sector(3)	Saltwater fishing trips

Notes: (1)In the case of Canada, other fish and shellfish commodity includes, besides wild capture production, also aquaculture output produced by the aquaculture industry that is a part of the ANR industry. Other fish and shellfish processing industry in the USA component, on the other hand, draws more on the ANR commodity that includes aquaculture output. However, this misalignment between model components is not concerning as linking these is based on the trade of aggregated seafood commodity. (2)There is a slight misalignment between model components related to the allocation of beverage and tobacco manufacturing products that, in some cases, are considered non-durable goods and lumped with the food commodity. In the case of the USA component, this misalignment is corrected with the use of additional data available from the Annual Survey of Manufactures (ASM) (US Census, 2021). (3)Saltwater charter sector extension included in PHMEIA-r model. Model results rely on the estimated share of the sector output that directly depends on Pacific halibut..

Demand for goods and services related to anglers' fishing trips, both guided and unguided, also contributes to the economy. In addition to economic impact related to Pacific halibut sectors, PHMEIA-derived multipliers are used to estimate economic impact related to marine angler expenditures on fishing trips (travel, lodging, other trip-related expenses) and durable goods (rods, tackle, boat purchase, other fishing equipment and accessories, second home, or additional vehicle purchase).

UPDATE ON THE MODEL DEVELOPMENT

The current PHMEIA incorporates a series of improvements to the economic impact assessment[3] model presented to the Commission at the AM097. These are as follows:

(1) The model uses an updated set of data, and estimates are now available for 2019. Previously, the estimates were available up to 2018.

[3] While this type of assessment is typically termed "economic impact assessment," calculated alongside the impact in terms of output also the impact on employment and wages, and households' prosperity, introduce a broader socioeconomic context.

(2) The estimates incorporate flows of earnings related to all Pacific halibut sectors in the model. See IPHC-2021-ECON-02-R02 for the compilation of data on the flows of benefits in the Pacific halibut sectors. These are particularly pronounced in Alaska where substantial flows are identified from harvest location to buyer's headquarters, from the landing area to vessel owner residence and quota holder residence, and from sport fishing location to Charter Halibut Permit owner residence.
(3) The latest update of the PHMEIA provides preliminary estimates of community effects. The model informs on the county-level economic impacts in Alaska and highlights areas particularly dependent on Pacific halibut fishing-related economic activities. The current model update also makes use of regional COAR (COAR, 2021) data to refine the spatial distribution of the processing sector contribution to the economy of each Alaskan county (an improvement from results presented in IPHC-2021-SRB019-09).
(4) The extended model (labeled PHMEIA-r) provides preliminary estimates for the saltwater charter sector that is disaggregated from the services-providing industry.
(5) The model incorporates estimates of angler expenditures on fishing trips and durable goods. These are used in conjunction with an estimate of the share of marine angler effort that relies directly on the Pacific halibut stock.
(6) The model adopts an improved production structure for commercial fishing in British Columbia making use of data on quota lease price (Castlemain, 2019).
(7) This update on the PHMEIA development is supplemented by an analysis of the formation of the price paid for Pacific halibut products by final consumers (end-users) that is intended to provide a better picture of Pacific halibut contribution to the GDP along the entire value chain, ***from the hook-to-plate*** (IPHC-2021-IM097-INF04).[4]

It is important to note that the model continues to rely heavily on secondary data sources,[5] and as such, the results are conditional on the adopted assumptions for the components for which up-to-date data are not available (details on data inputs are available in IPHC-2021-ECON-02-R02). That said, the Secretariat strives to make the best use of data collection programs of national and regional agencies, academic publications on the topic, and grey literature reporting on fisheries in Canada and the United States. The model also uses a set of non-fisheries data inputs described in IPHC-2021-AM097-14.

Looking forward, the Secretariat also identified a number of tasks that will enhance the study's ability to support the management of the Pacific halibut resource in fulfillment of the Commission's mandate. These are incorporated into the *IPHC's 5-year program of integrated research and monitoring (2022-26)* (IPHC-2021-IM097-12).

PRIMARY DATA COLLECTION

More accurate results can be achieved by incorporating into the model primary economic data collected directly from members of Pacific halibut-dependent sectors. An essential input to the SAM model is

[4] This analysis will be further refined as a part of collaboration with NOAA Alaska Fisheries Science Center on market profiles for Alaska Groundfish.
[5] That is data collected by other parties, not the IPHC.

data on production structure (i.e., data on the distribution of revenue between profit and expenditure items). The IPHC is collecting these data directly from stakeholders since the AM096 through the web-based survey available:

- Here, for Pacific halibut commercial harvesters;
- Here, for Pacific halibut processors; and
- Here, for Pacific halibut charter business owners.

It should be recognized that the project was challenged by the COVID-19 pandemic that impacted particularly the components directly dependent on the inputs from stakeholders. The Secretariat is working on an improved strategy for primary data collection following the 2021 fishing season. Further simplification of the survey will be announced at the IM097. The Secretariat is also cautiously optimistic regarding engagement with stakeholders on economic data collection in post-covid times.

IPHC stakeholders are encouraged to contribute to the assessment of the importance of the Pacific halibut resource to the economy of Canada and the United States. The subsequent revisions of the model incorporating IPHC-collected data will bring a better characterization of the Pacific halibut sectors' economic impact.

STUDY OBJECTIVES

Appendix A summarizes the progress to date against the IPHC economic study objectives, as first defined in IPHC-2020-IM096-14.

UPDATE ON PHMEIA MODEL RESULTS

The model results suggest that Pacific halibut commercial fishing's total estimated impact in 2019 amounts to USD 195.9 mil. (CAD 259.9 mil.) in households' earnings,[6] including an estimated USD 58.3 mil (CAD 77.3 mil) in direct earnings in the Pacific halibut fishing sectors and USD 11.9 mil. (CAD 15.8 mil.) in the processing sector, and USD 185.2 mil (CAD 245.7 mil.) in household income (**Table 2**).[7]

PHMEIA model also informs on the economic impact by county, highlighting regions where communities may be particularly vulnerable to changes in the access to the Pacific halibut resource. In 2019, from USD 28.9 mil. of direct earnings from Pacific halibut commercial sectors in Alaska, 71% was retained in Alaska.[8] These earnings were unevenly distributed between Alaskan counties (**Figure 1**, see also **Appendix C**). The most direct earnings per dollar landed are estimated for Ketchikan Gateway, Petersburg and Sitka countries, while the least for Aleutians East, Yakutat and

[6] Earnings include both employee compensation and proprietors' income.

[7] Income reflects earnings adjusted for any transfers, including interregional spillovers, i.e. income is related to the place of residence, not the place of work.

[8] Community effects assessment is currently limited to Alaska. The feasibility of a similar assessment for other regions is currently under investigation. For example, Canadian quotas (L fishery), which are vessel-based, can be allocated based on vessel owner's residency, searchable in the Canadian Register of Vessels available through Transport Canada's Vessel Registration Query System.

Aleutians West counties. Low earnings per 1 USD of Pacific halibut landed in the county are a result of the outflow of earnings related to vessels' home base, vessels' ownership and quota ownership, processing locations, and processing companies' ownership.

The total contribution of the Pacific halibut charter sector to household income is assessed at USD 37.8 mil. for 2019. Accounting for angler expenditures adds another USD 106.8 mil. (CAD 141.7 mil.) to the economic impact of the recreational sector. This translates into 30% less for the charter sector and 48% less for the recreational sector overall in comparison with the commercial sector when looking at impact per USD of landed value (for the commercial sector) and USD spent (for the recreational sector, including trip costs and expenditures on durable goods). This is not surprising since the commercial sector's production supports not only suppliers to the harvesting sector, but also the forward-linked processing sector (thus, also households employed by these sectors). Recreational sector results, on the other hand, to a large degree are driven by expenditures on goods that are often imported, consequently supporting households elsewhere.

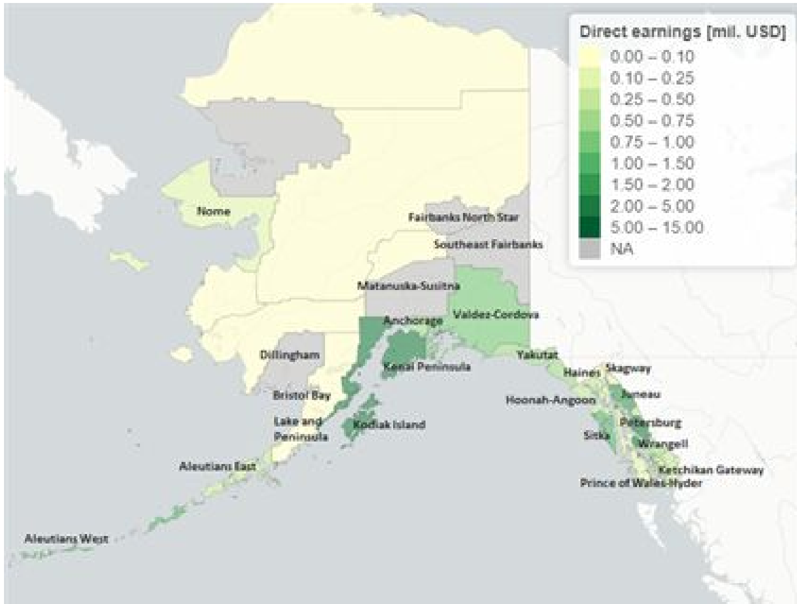
A somewhat different picture emerges when comparing EI per pound of Pacific halibut removal counted against TAC in the stock assessment. This measure is 37% higher for the charter sector, and 170% for the recreational sector overall when compared with the commercial sector. These differences, however, are less pronounced when focusing only on the EI retained within the harvest region.

It should also be noted, however, that this analysis should not be used as an argument in sectoral allocations discussions because, as a snapshot analysis, it does not reflect the implications of shifting supply-demand balance.

Table 2: Economic impact on households

Economic impact	Unit	Commercial	Charter[(1)]	Recreational
EI on households	Total in mil. USD	185.2	37.8	144.6
EI locally (excludes spillovers)	Total in mil. USD	119.3	23.9	76.9
EI on households	USD per 1 USD of landed value/USD spent	1.38	0.97	0.71[(2)]
EI locally (excludes spillovers)	USD per 1 USD of landed value/USD spent	0.89	0.61	0.38[(2)]
EI on households	USD per 1 lb of removals	7.6	10.4[(3)]	20.5
EI locally (excludes spillovers)	USD per 1 lb of removals	4.9	6.0[(3)]	10.9

Notes: [(1)] This includes only the economic impact generated through businesses offering charter trips, i.e., it excludes the impact of angler expenditures other than charter fees. [(2)]In A considerable share of angler expenditures originates from import, which drives the estimate down. [(3)]Charter sector impact per 1 lb of removals was based on EI on households for Alaska where removals estimates are clearly divided between guided and unguided sectors.

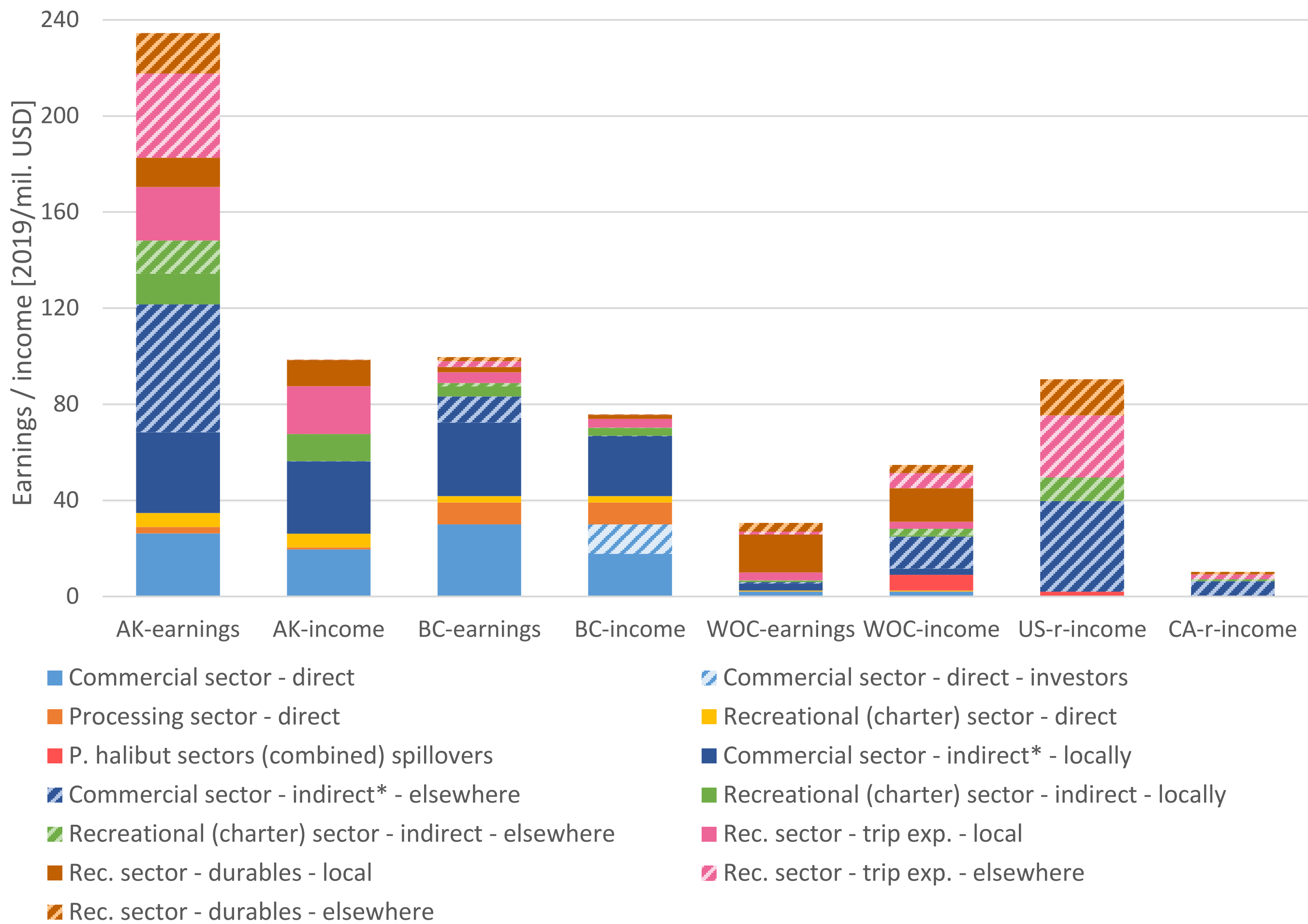


Notes: Alaska retains 71% of direct earnings within the state.

Figure 1: County-level estimates of direct earnings in the Pacific halibut commercial sectors in Alaska in 2019.

Figure 2 depicts the impact of Pacific halibut commercial and recreational fishing on household earnings and income, highlighting the importance of considering cross-regional effects. Earnings estimates (bars with '-earnings' suffix) summarize economic impact by place of work (i.e., where the fishing activity occurs). Income estimates (bars with '-income' suffix) reflect earnings after adjustments for cross-regional flows, i.e., provide estimates by the place of residence of workers, business owners, or owners of production factors (i.e., quota or permit owners).

Results in terms of output, depicted in a similar fashion, are available in **Appendix B**.



Notes: Legend description available in Box 1. Figure omits the impact on ROW (marginal).*Commercial indirect effects include processing.

Figure 2: Pacific halibut impact on household earnings and income (2019).

Box 1: Figure 2 legend description

a) **Commercial sector – direct**: includes earnings and income directly attributable to the Pacific halibut commercial fishing sector within the indicated region.
b) **Commercial sector - direct – investors**: indicates the share of the income described in **Commercial sector – direct** that is retained in the region, but flows from the fishing sector to investors. This component captures the value of the leased quota paid to non-fishing stakeholders.
c) **Processing sector – direct**: includes earnings and income directly attributable to the Pacific halibut processing sector within the indicated region.
d) **Recreational (charter) sector – direct**: includes earnings and income directly attributable to businesses offering Pacific halibut sport fishing within the indicated region.
e) **P. halibut sectors (combined) spillovers**: include income attributable to Pacific halibut sectors (commercial fishing, processing, sport fishing) that leaks from the region where the activity occurs as a result of cross-regional flows.
f) **Commercial sector - indirect** - locally**: includes combined indirect and induced impact on earnings and income resulting from changes in business-to-business transactions and personal income caused by Pacific halibut commercial and processing sector. This component includes only EI resulting from fishing activity in the specified region occurring locally (i.e., in the same region).
g) **Commercial sector - indirect** - elsewhere**: as above, but includes impact on earnings resulting from fishing activity in the specified region occurring elsewhere ('-earnings' bars), and impact on income resulting from fishing activity elsewhere realized in the specified region ('-income' bars).
h) **Recreational (charter) sector - indirect – locally**: includes combined indirect and induced impact on earnings and income resulting from changes in business-to-business transactions and personal income caused by the Pacific halibut charter sector. This component includes only EI resulting from fishing activity in the specified region occurring locally (i.e., in the same region).
i) **Recreational (charter) sector - indirect – elsewhere**: as above, but includes impact on earnings resulting from fishing activity in the specified region occurring elsewhere ('-earnings bars), and impact on income resulting from fishing activity elsewhere realized in the specified region ('-region' bars).
j) **Rec. sector - trip exp. – local**: includes an estimate of the economic contribution of Pacific halibut-dependent angler trip expenditures on earnings and income that is realized locally, i.e., within the region where the fishing activity is occurring.
k) **Rec. sector - trip exp. – elsewhere**: includes an estimate of the economic contribution of Pacific halibut-dependent angler trip expenditures to earnings elsewhere ('-earnings' bars) or income within the indicated region realized as a result of fishing activity elsewhere ('-income' bars).
l) **Rec. sector - durables – local**: includes an estimate of the economic contribution of Pacific halibut-dependent angler expenditures on durable goods on earnings and income that is realized locally, i.e., within the region where the fishing activity is occurring.
m) **Rec. sector - durables – elsewhere**: includes an estimate of the economic contribution of Pacific halibut-dependent angler expenditures on durable goods to earnings elsewhere ('-earnings' bars) or income within the indicated region realized as a result of fishing activity elsewhere ('-income' bars).

ECONOMIC IMPACT VISUALIZATION TOOL

The section on PHMEIA results focuses on the economic impact on households as the most meaningful metric to the general population. However, as noted in the introduction, the EI can be expressed with various other metrics, and derived for just a subset of sectors. Regulators and stakeholders may be also interested in assessing various combinations of regional allocations of mortality limits. Thus, PHMEIA is accompanied by the economic impact visualization tool[9] which disseminates the full set of

[9] The tool is available at: http://iphcecon.westus2.cloudapp.azure.com:3838/ModelApp_azure/ (full link for printed version).

model results. The use of this interactive web-based application can be guided by the PHMEIA app manual (IPHC-2021-ECON-04).

The app update aligning it with the series of latest model improvements is anticipated no later than 22 November 2021.

ECONOMIC IMPACT OF SUBSISTENCE FISHING

Previous research suggested that noncommercial or nonmarket-oriented fisheries' contribution to national GDP is often grossly underestimated, particularly in developing countries (e.g., Zeller, Booth, and Pauly 2006). Subsistence fishing is also important in traditional economies, often built around indigenous communities. Wolfe and Walker (1987) found that there is a significant relationship between the percentage of the native population in the community and reliance on wildlife as a food source in Alaska. However, no comprehensive assessment of the economic contribution of the subsistence fisheries to the Pacific northwest is available. The only identified study, published in 2000 by Wolfe (2000), suggests that the replacement value of the wild food harvests in rural Alaska may be between 131.1 and 218.6 million dollars, but it does not distinguish between different resources and assumes equal replacement expense per lb. Aslaksen et al. (2008) proposed an updated estimate for 2008 based on the same volume, noting that transportation and food prices have risen significantly between 2000 and 2008, and USD 7 a pound is a more realistic replacement value. This gives the total value of USD 306 million, but the approach relies upon the existence of a like-for-like replacement food (in terms of taste and nutritional value), which is arguably difficult to accept in many cases (Haener *et al.*, 2001) and ignores the deep cultural and traditional context of the Pacific halibut in particular (Wolfe, 2002). A more recent study by Krieg, Holen, and Koster (2009) suggests that some communities may be particularly dependent on wildlife, consuming annually up to 899 lbs per person, but no monetary estimates are derived. Moreover, although previous research points to the presence of sharing and bartering behavior that occurs in many communities (Wolfe, 2002; Szymkowiak and Kasperski, 2020), the economic and cultural values of these networks have yet to be thoroughly explored.

The subsistence component of the study is a subject of a collaborative project with NOAA Alaska Fisheries Science Center: Fish, Food, and Fun - Exploring the Nexus of Subsistence, Personal Use, and Recreational Fisheries in Alaska (SPURF project).

FINAL REMARKS

The PHMEIA model fosters stakeholders' better understanding of a broad scope of regional impacts of the Pacific halibut resource. Leveraging multiple sources of socioeconomic data, it provides essential input for designing policies with desired effects depending on regulators' priorities. By tracing the socioeconomic impacts cross-regionally, the model accommodates the transboundary nature of the Pacific halibut and supports joint management of a shared resource, such as the case of collective management by the IPHC. Moreover, the study informs on the vulnerability of communities to changes in the state of the Pacific halibut stock throughout its range, highlighting regions particularly dependent on economic activities that rely on Pacific halibut. A good understanding of the localized effects is pivotal to policymakers who are often concerned about community impacts, particularly in terms of impact on employment opportunities and households' welfare. Fisheries policies have a long history of disproportionally hurting smaller communities, often because potential adverse effects were not sufficiently assessed (Carothers, Lew, and Sepez 2010; Szymkowiak, Kasperski, and Lew 2019).

Understanding the complex interactions within the fisheries sectors is now more important than ever considering how globalized it is becoming. Local products compete on the market with a large variety of imported seafood. High exposure to international markets makes seafood accessibility fragile to perturbations, as shown by the covid-19 outbreak (OECD, 2020). Fisheries are also at the forefront of exposure to the accelerating impacts of climate change. A rapid increase in water temperature of the coast of Alaska, termed *the blob*, is affecting fisheries (Cheung and Frölicher, 2020) and may have a profound impact on Pacific halibut distribution.

Integrating economic approaches with stock assessment and management strategy evaluation (MSE) can assist fisheries in bridging the gap between the current and the optimal economic performance without compromising the stock biological sustainability. Economic performance metrics presented alongside already developed biological/ecological performance metrics bring the human dimension to the IPHC products, adding to the IPHC's portfolio of tools for assessing policy-oriented issues (as requested by the Commission, IPHC-2021-AM097-R, AM097-Req.02). Moreover, the study can also inform on socioeconomic drivers (human behavior, human organization) that affect the dynamics of fisheries, and thus contribute to improved accuracy of the stock assessment and the MSE (Lynch, Methot and Link, 2018). As such, it can contribute to research integration at the IPHC (as presented in IPHC-2021-IM097-12) and provide a complementary resource for the development of harvest control rules, thus directly contributing to Pacific halibut management.

Lastly, while the quantitative analysis is conducted with respect to components that involve monetary transactions, Pacific halibut's value is also in its contribution to the diet through subsistence fisheries and importance to the traditional users of the resource. To native people, traditional fisheries constitute a vital aspect of local identity and a major factor in cohesion. One can also consider the Pacific halibut's existence value as an iconic fish of the Pacific Northwest. While these elements are not quantified at this time, recognizing such an all-encompassing definition of the Pacific halibut resource contribution, the project echoes a broader call to include the human dimension into the research on the impact of management decisions, as well as changes in environmental or stock conditions.

RECOMMENDATION/S

That the Commission:

1) **NOTE** paper IPHC-2021-IM097-14 which provides an update on the development of the Pacific Halibut Multiregional Economic Impact Assessment (PHMEIA).

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Appendix A
The study objectives – summary of progress and notes on outputs

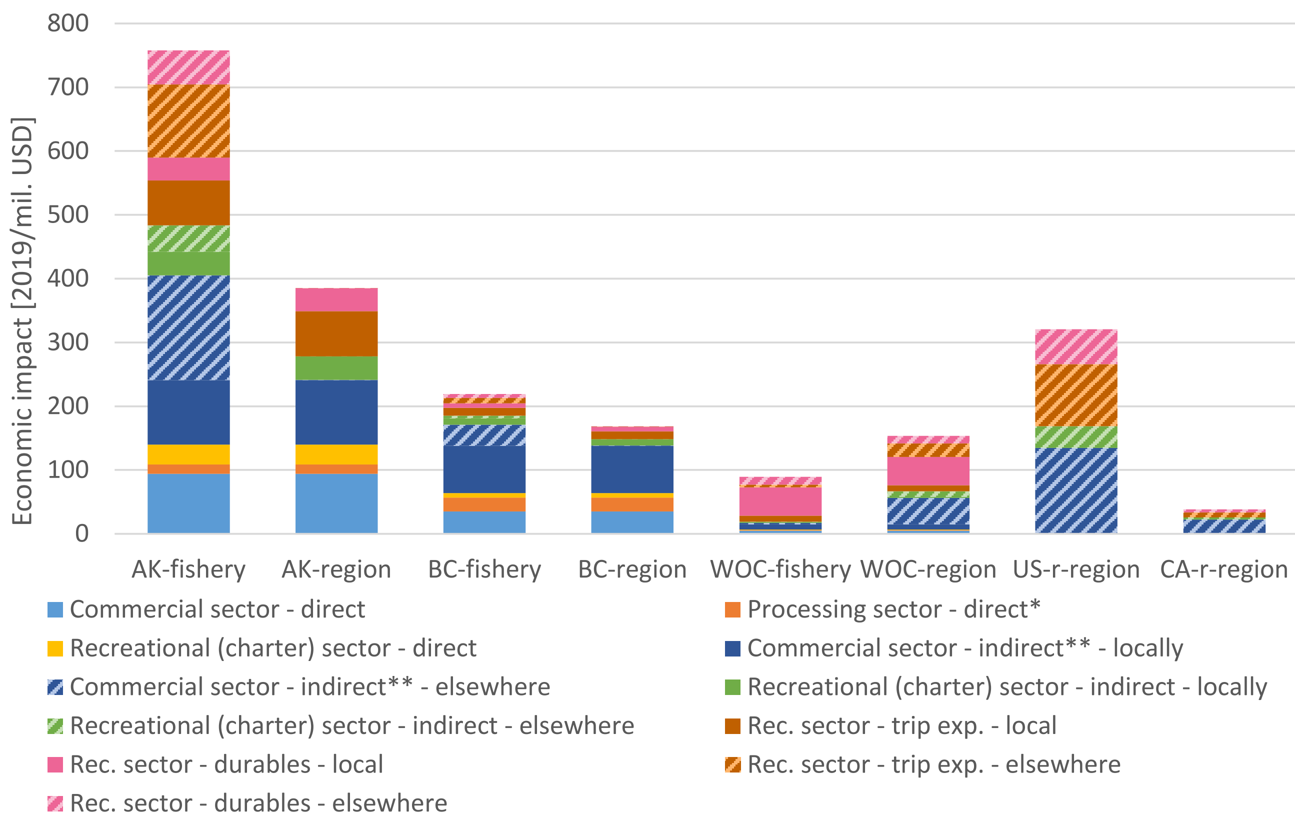
Objective	Status*	Output
Item 1: Survey of previous studies and existing information	---	---
Item 1.a: Literature review	**COMPLETED**	See IPHC-2021-ECON-01 (last revised on 2/9/2021)
Item 1.b: Description of ongoing regular data collection programs	**COMPLETED**	See IPHC-2021-ECON-02-R02 (last revised on 10/27/2021)
Item 1.c: Collection of primary data – commercial sector survey	**IN PROGRESS**	Developed in response to the identified data gaps: Commercial Vessel Expenditures Survey Processor Expenditures Survey Preliminary results available via IPHC economic survey results app
Item 1.d: Collection of primary data – charter sector survey	**IN PROGRESS**	Developed in response to the identified data gaps: Charter Sector Expenditures Survey Preliminary results available via IPHC economic survey results app
Item 2: Comprehensive qualitative structural description of the current economics of the Pacific halibut resource	---	---
Item 2.a: Description of the economics of the Pacific halibut commercial sector	**COMPLETED**	See Economic Research section of the IPHC website (to be updated ahead of the IM097)
Item 2.b: Description of the economics of the Pacific halibut recreational sector	**COMPLETED**	See Economic Research section of the IPHC website (to be updated ahead of the IM097)
Item 2.c: Description of the economics of other Pacific halibut sectors (bycatch, subsistence, ceremonial, research, non-directed)	**IN PROGRESS**	See section on subsistence and ceremonial fishing herein The economic impact of bycatch (U32) was considered in the size limits paper (IPHC-2021-AM097-09) Note also additional work proposed in the *IPHC's 5-year program of integrated research and monitoring (2022-26)*

Item 3: Quantitative analysis of the economic impact of the directed Pacific halibut fishery	**---**	**---**
Item 3.a: Methodology – a model of the economy	**COMPLETED**	See details in IPHC-2021-ECON-03
Item 3.b: Methodology – inclusion of the commercial sector in the SAM	**COMPLETED(1)**	See the update herein and the Economic Research section of the IPHC website (to be updated ahead of the IM097)
Item 3.c: Methodology – inclusion of the recreational sector in the SAM	**COMPLETED(1)**	See the update herein and the Economic Research section of the IPHC website (to be updated ahead of the IM097)
Item 3.d: Methodology – economic value of the subsistence use	**IN PROGRESS(2)**	Subject of collaboration with NOAA Alaska Fisheries Science Center (Fish, Food, and Fun: Exploring the Nexus of Subsistence, Personal Use, and Recreational Fisheries (SPURFs) in Alaska)
Item 4: Account of the geography of the economic impact of the Pacific halibut sectors	**---**	**---**
Item 4.a: Visualization of region-specific economic impacts	**COMPLETED(1)**	See online economic impact visualization tool (to be updated ahead of the IM097)
Item 5: Analysis of the community impacts of the Pacific halibut fishery throughout its range, including all user groups	**---**	**---**
Item 5.a: Community impacts assessment of the Pacific halibut fishery	**COMPLETED(1)**	See the update herein See economic impact visualization tool (*Community impacts in AK* tab) Further improvement of spatial granularity of the estimates is proposed in the *IPHC's 5-year program of integrated research and monitoring (2022-26)*
Item 6: Summary of the methodology and results of the IPHC study in comparison to other economic data and reports for the Pacific halibut resource, other regional fisheries, and comparable seafood industry sectors	**---**	**---**
Item 6.a: Putting results into perspective	**IN PROGRESS**	To be included in the final report concluding this stage of the study

* All items marked as COMPLETED are subject to updates based on the direction of the project and the evolution of the situation in the Pacific halibut fisheries. (1)Subject to changes based on the data collected through the IPHC Economic survey

Appendix B
Pacific halibut economic impact in terms of output

Figure 3 depicts the economic impact of Pacific halibut commercial and recreational fishing in terms of output. The figure distinguishes between the impact by fishery (i.e., by region where the fishing activity occurs, bars with '-fishery' suffix) and impact by region (i.e., by region where the impact is realized; bars with '-region' suffix).



Notes: The figure omits the impact on the ROW (marginal). *Adjusted to the wholesale mark-up and does not include fish buying cost; **Commercial indirect impact includes processing.

Figure 3: Pacific halibut economic impact in terms of output (2019).

The figure specifies the following components:

a. **Commercial sector – direct**: includes direct output of the Pacific halibut commercial fishing sector, which is equivalent to the landing value or value of sales by Pacific halibut directed commercial fisheries. This component is equal in the 'by fishery' and 'by region' EI estimate.
b. **Processing sector – direct**: includes direct output of the Pacific halibut processing sector (wholesale value) adjusted to include only the wholesale mark-up. This means that the estimate does not include the fish buying cost, avoiding this way double counting the landing value of the Pacific halibut commercial sector in the EI estimate. This component is equal in the 'by fishery' and 'by region' EI estimate.

c. **Recreational (charter) sector – direct**: includes value of direct sales by businesses offering services in the form of guided Pacific halibut recreational (sport) fishing (charter boats, fly-in loges, package deals, etc.). The estimate intends to capture the share of output by the sport fishing sector that depends on the Pacific halibut resource availability, i.e., it is adjusted for mixed target species offers. This component is equal in the 'by fishery' and 'by region' EI estimate.
d. **Commercial sector - indirect** - locally**: includes combined indirect and induced impact resulting from changes in business-to-business transactions and personal income caused by Pacific halibut commercial and processing sector. This component includes only EI resulting from fishing activity in the specified region occurring locally (i.e., in the same region). This component is equal in the 'by fishery' and 'by region' EI estimate.
e. **Commercial sector - indirect** - elsewhere**: as above, but includes EI resulting from fishing activity in the specified region occurring elsewhere (i.e., in the regions other than the fishing area specified; '-fishery' bars), and EI resulting from fishing activity elsewhere occurring in the specified region ('-region' bars).
f. **Recreational (charter) sector - indirect – locally**: includes combined indirect and induced impact resulting from changes in business-to-business transactions and personal income caused by the Pacific halibut charter sector. This component includes only EI resulting from fishing activity in the specified region occurring locally (i.e., in the same region). This component is equal in the 'by fishery' and 'by region' EI estimate.
g. **Recreational (charter) sector - indirect – elsewhere**: as above, but includes EI resulting from fishing activity in the specified region occurring elsewhere (i.e., in the regions other than the fishing area specified; '-fishery' bars), and EI resulting from fishing activity elsewhere occurring in the specified region ('-region' bars).
h. **Rec. sector - trip exp. – local**: includes an estimate of the economic contribution of marine angler trip expenditures (travel, lodging, other trip-related expenses) that is realized locally, i.e., within the region where the fishing activity is occurring, and can be attributed to Pacific halibut fishing opportunities. This component is equal in the 'by fishery' and 'by region' EI estimate.
i. **Rec. sector - trip exp. – elsewhere**: includes an estimate of the economic impact of marine angler trip expenditures (share attributed to Pacific halibut) that is realized elsewhere ('-fishery' bars) or realized within the indicated region as a result of fishing activity elsewhere ('-region' bars).
j. **Rec. sector - durables – local**: includes an estimate of the economic contribution of marine angler expenditures on durable goods (rods, tackle, bout purchase, other fishing equipment and accessories, second home, or additional vehicle purchase) that is occurring locally, i.e., within the region where the fishing activity is occurring, and can be attributed to Pacific halibut fishing opportunities. This component is equal in the 'by fishery' and 'by region' EI estimate.
k. **Rec. sector - durables – elsewhere**: includes an estimate of the economic impact of marine angler expenditures on durable goods (share attributed to Pacific halibut) that is realized elsewhere ('-fishery' bars) or realized within the indicated region as a result of fishing activity elsewhere ('-region' bars).

Appendix C
County-level estimates of direct earnings in the Pacific halibut commercial sectors in Alaska in 2019

County	Estimated earnings from Pacific halibut commercial sectors (fishing and processing)	Earning per 1 USD of Pacific halibut landed in the county	Change in % value of landings vs. % estimated earnings
Aleutians East	0.33	**0.068**	-
Aleutians West	1.49	**0.133**	-
Anchorage	0.52	NA	+
Bristol Bay	c	NA	+
Dillingham	c	c	c
Fairbanks North Star	c	NA	+
Haines	0.20	NA	+
Hoonah-Angoon	0.41	0.208	-
Juneau	1.70	0.244	+
Kenai Peninsula	**4.85**	0.188	-
Ketchikan Gateway	0.41	**0.526**	+
Kodiak Island	**3.35**	0.384	+
Lake and Peninsula	c	NA	c
Matanuska-Susitna	c	NA	+
Nome	0.23	0.301	+
Petersburg	**2.95**	**0.458**	+
Prince of Wales-Hyder	0.23	0.379	+
Sitka	1.11	**0.453**	+
Skagway	c	NA	+
Southeast Fairbanks	c	NA	+
Valdez-Cordova	0.85	0.182	-
Wrangell	0.57	0.229	-
Yakutat	0.68	**0.121**	-

Notes: Counties with no Pacific halibut landings or earnings from Pacific halibut sectors omitted. Full economic impact omitted, pending research on cross-county commodity flows in Alaska. c – masked to preserve confidentiality; NA – not applicable (no landings reported for the given county).

IPHC Fishery Regulations: Proposals for the 2021-22 process

PREPARED BY: IPHC SECRETARIAT (B. HUTNICZAK & D. WILSON; 29 OCTOBER 2021)

PURPOSE

To provide the Commission with an indication of the IPHC Fishery Regulation proposals that the IPHC Secretariat, Contracting Parties, and other stakeholders have indicated they anticipate submitting, for consideration by the Commission in the 2021-22 regulatory process.

BACKGROUND

Recalling the IPHC fishery regulation proposal submission and review process instituted in 2017, this paper is intended to provide a preliminary indication of the fishery regulation proposals being submitted to the Commission in the 2021-22 process. Fishery regulation proposals from the Contracting Parties and other stakeholders are typically received later in the process.

***Note: DEADLINES**: The dates for submission of draft proposals for consideration by the Commission are as follows:*

1) *97th Session of the IPHC Interim Meeting (IM097) is **31 October 2021***
2) *98th Session of the IPHC Annual Meeting (AM098) is **25 December 2021***

DISCUSSION

A listing of the preliminary titles, subjects, and sponsors for IPHC fishery regulation proposals expected to be considered as part of the 2021-22 process is provided at Appendix I.

RECOMMENDATION

That the Commission:

1) **NOTE** paper IPHC-2021-IM097-15, which provides the Commission with an initial indication of the IPHC Fishery Regulation proposals that the IPHC Secretariat, Contracting Parties, and other stakeholders have indicated that they anticipate submitting for consideration by the Commission in the 2021-22 regulatory process.

APPENDICES

Appendix I: Preliminary: Titles, subjects, and sponsors for IPHC Fishery Regulation Proposals for 2021-22.

APPENDIX I

Preliminary: Titles, subjects, and sponsors for IPHC Fishery Regulation proposals for 2021-22

Ref. No.	Title	Brief description if provided (Sector/Area)
IPHC Secretariat		
IPHC-2021-IM097-PropA1	Mortality and Fishery Limits (Sect. 5)	To improve clarity and transparency of fishery limits within the IPHC Fishery Regulations: Mortality and Fishery Limits (Sect. 5).
IPHC-2021-IM097-PropA2	Commercial Fishing Periods (Sect. 9)	To specify fishing periods for the directed commercial Pacific halibut fisheries within the IPHC Fishery Regulations: Commercial Fishing Periods (Sect. 9).
IPHC-2021-IM097-PropA3	Minor amendments	To improve clarity and consistency in the IPHC Fishery Regulations.
Contracting Parties		
IPHC-2021-IM097-PropB1	Recordkeeping for charter Pacific halibut annual limits (Sect. 29)	**Proponent**: NOAA-Fisheries The National Marine Fisheries Service (NMFS) proposes a change to Section 29 of the IPHC Fisheries Regulations related to recordkeeping for charter Pacific halibut annual limits
IPHC-2021-IM097-PropB2	Charter Management Measures in IPHC Regulatory Areas 2C and 3A (Sect. 29)	**Proponent**: NOAA-Fisheries To provide charter management measures reflective of fishery limits for the recreational fisheries: 1. IPHC Regulatory Area 2C 2. IPHC Regulatory Area 3A
Stakeholders		
IPHC-2021-IM097-PropC1	Nil-to-date	Nil-to-date

DRAFT: IPHC Rules of Procedure (2021)

PREPARED BY: IPHC SECRETARIAT (D. WILSON & L. ERIKSON, 28 OCTOBER 2021)

PURPOSE

To provide the Commission with proposed amendments to the IPHC Rules of Procedure (2021).

BACKGROUND

In accordance with Rule 19, paragraph 1 of the IPHC Rules of Procedure (2021), which states:

> "1. *These Rules of Procedure should be reviewed for their consistency and appropriateness at least biennially*.",

At the 97th Session of the IPHC (AM097; January 2021), the Commission made the following request of the IPHC Secretariat regarding on the IPHC Rules of Procedure:

> ***IPHC Rules of Procedure (2021)***
>
> AM097–Req.08 (para. 107) *The Commission **REQUESTED** that the IPHC Secretariat undertake an inter-sessional review and recommend further improvements to the IPHC Rules of Procedure to the Commission, noting the CB's recommendation (to change when Chairs are elected in their rule), PAB noting the conflicting text in the Rules, and roles of the Commissions Secretariat.*

DISCUSSION

Provided at Appendix I are proposed revisions to the IPHC Rules of Procedure (2021), which incorporate process and functional amendments intended to further modernise the IPHC's governance procedures.

1) Appendix IV Conference Board (CB) – Terms of Reference and Rules of Procedure
2) Appendix VI Processor Advisory Board (PAB) – Terms of Reference and Rules of Procedure
3) Appendix VII Research Advisory Board (RAB) – Terms of Reference and Rules of Procedure

RECOMMENDATION/S

That the Commission:

1) **NOTE** paper IPHC-2021-IM097-16 which proposed amendments to the IPHC Rules of Procedure (2021).

APPENDICES

Appendix I: DRAFT: International Pacific Halibut Commission Rules of Procedure (2022): Amendments to Appendices IV, VI and VII.

Appendix IV
Conference Board (CB) – Terms of Reference and Rules of Procedure

I. Terms of reference

1. The Conference Board (CB) is a subsidiary body to the Commission on which individuals represent Pacific halibut harvesters organisations and associations from each Contracting Party. The CB shall:

   a) provide a forum for the discussion of management and policy matters relevant to Pacific halibut and provide advice to the Commission on management and policy matters relevant to Pacific halibut;

   b) review IPHC Secretariat reports and recommendations, regulatory proposals received by the Commission, and provide its advice concerning these items to the Commission at its Annual Meeting, or on other occasions as requested.

2. The CB Chairpersons shall communicate with the Commission and the other IPHC subsidiary bodies on the CB's behalf. The Commission's Executive Director may facilitate this communication.

II. Representation

3. CB members are Pacific halibut harvester organisations and associations from each Contracting Party and include commercial, guided sport/recreational, unguided sport/recreational, subsistence, and First Nations/Tribal interests. Members are responsible for designating their individual delegate(s) and no delegate may vote on behalf of more than one CB member.

4. The CB regulates its membership by accrediting members at the beginning of each CB session. Accreditation is documented using the Accreditation Questionnaire provided at Annex 1, submitted through the CB Accreditation portal on the IPHC website. The CB members shall compose nationals from Canada and the United States of America.

5. CB members may be re-accredited for successive meetings for a period of five (5) years from their initial accreditation by a simple role call at the beginning of the CB session if

they have participated in at least three (3) CB annual meetings within the five (5) year period. CB members not meeting this criteria or their five year accreditation cycle has elapsed fill out Accreditation Questionnaire provided in Annex 1, submitted through the CB Accreditation portal on the IPHC website. Returning CB members who need to fill out the Accreditation Questionnaire and potential CB members seeking accreditation for the first time are encouraged to notify the IPHC Secretariat at least two weeks before the beginning of the Annual Meeting of the CB session they wish to attend.

6. Members serve without compensation from the Commission.

III. Officers

Co-Chairperson/s and Vice-Chairperson/s

7. The CB is Co-Chaired by two members, one from each of the two Contracting Parties. The Co-Chairpersons convene and adjourn meetings and preside over them, ensuring that meetings are conducted in an orderly and businesslike manner.

8. The Co-Chairpersons present the CB's decisions, recommendations, and advice to the Commission.

~~9. The Co-Chairpersons may appoint a Secretary, or one of the Co-Chairpersons may fulfill secretarial duties, including accepting the services of the IPHC Secretariat.~~

~~10.~~9. The Co-Chairpersons may be supported by up to two Vice-Chairpersons, as the CB may desire, one from each of the two Contracting Parties.

~~11.~~10. The Co-Chairpersons and Vice-Chairpersons are entitled to vote if the member organisation/association they represent does not have a participating representative at the CB.

Terms of office and election

~~12.~~11. CB members of each Contracting Party elect the Co-Chairperson from their Contracting Party for terms of two (2) years, with no limit to the number of terms an individual Co-Chairperson may serve.

~~13.~~12. Election of new Co-Chairpersons whose two-year term has expired will be at the ~~beginning~~ end of the annual meeting of the Conference Board.

~~14.~~13. Election of Vice-Chairpersons will follow the election of the Co-Chairperson(s) if required. Vice-Chairperson term is for ~~one~~ two (2~~1~~) years.

~~15.~~14. If a Co-Chairperson becomes unable to serve during the annual CB meeting, ~~his/her~~their Contracting Party shall elect another member as Co-Chairperson. If a Co-Chairperson becomes unable to serve sometime after the completion of the Session, the office will remain vacant until the Contracting Party members elects a replacement ~~at the beginning of the next CB Session~~.

IV. Sessions of the Conference Board

~~16.~~15. **Time and place**: The CB typically meets once each year, in conjunction with the IPHC Annual Meeting.

~~17.~~16. **Agenda**: The agenda for the CB will be proposed by the Co-Chairpersons and approved by the membership at the beginning of the Session. The CB typically meets to discuss the issues and proposals under consideration. The CB may call on the IPHC Secretariat or other organisations to clarify or provide more information during its deliberations.

~~18.~~17. **Conduct of meetings**: Parliamentary procedure according to Roberts Rules of Order will be used as a guideline in the conduct of CB meetings, unless otherwise specified in the IPHC Rules of Procedure. The CB may set up its own subgroups or committees to consider specific issues or to produce specific documents or other products.

~~19.~~18. **Decision-making**: Each accredited CB member shall have one vote.

a) Following a vote on any issue the Co-Chairpersons shall announce the result by Contracting Party, which shall be recorded in the record of the meeting (i.e. Canada: In favor/Against (#for and #against); U.S.A.: In favor/Against (#for and #against). When it is clear that the vote reflects differences of opinion within a Contracting Party the Co-Chairpersons shall ensure that minority viewpoints are summarized and reported to the Commission.

b) Decisions regarding the CB's recommendations for mortality limits and fishery regulations, must be made by a recorded vote of members present.

c) Other decisions may be made by voice vote of CB members present, unless the Co-Chairpersons decide that a recorded vote is necessary.

V. Intersessional process and ad-hoc working groups

~~20.~~19. During the annual CB meeting, ad-hoc working groups may be created to work on issues or projects, or to represent the CB's interests.

~~21.~~20. The work of such ad-hoc working groups may not exceed the mandate approved for them by the CB.

~~22.~~21. Completed documents and other work materials from the CB's ad-hoc working groups should be posted for public access on the Commission website.

~~23.~~22. Decisions requiring a vote or approval of the CB, regarding or resulting from work undertaken intersessionally, may only be made at the annual CB meeting.

VI. Reports and Records

~~24.~~23. A report shall be adopted at the end of each Session of the CB. The draft report will be sent to all CB attending members for review, and suggested edits will be adopted or rejected by the CB Co-Chairpersons. If no edits are received then the draft report will be deemed final.

~~25.~~24. The report shall embody the CB's recommendations, including, when requested by a minority of stakeholders within a Contracting Party, a statement of minority views.

a) If requested, divergent views within a Contracting Party will be documented in minority reports by accredited organisations of the minority.

b) Participants requesting the inclusion of a minority report must provide the Co-Chairpersons with a clear and concise serviceable draft in an electronic version "word document" within four (4) hours of the conclusion of the days CB meeting, or within two (2) hours of the conclusion of the annual CB meeting.

c) Draft minority reports are limited only to information and material discussed during the CB session.

d) The Co-Chairpersons reserve the right to edit draft minority reports for accuracy and brevity. All attendant documents shall be considered part of the Report.

~~26.~~25. A copy of the final report from each CB meeting shall be forwarded by the IPHC Executive Director to the Contracting Parties and to the Commissioners no later than **15 days** after the close of the Session.

~~27.~~26. All reports shall be available on the Commission's website.

~~28.~~27. The CB recommendations and advice will be presented by the Co-Chairpersons to the Commission prior to the Commission making final decisions on management and policy matters relevant to Pacific halibut.

INTERNATIONAL PACIFIC HALIBUT COMMISSION

Annex 1

IPHC CONFERENCE BOARD MEMBER ACCREDITATION QUESTIONNAIRE

1. NAME AND ADDRESS OF ORGANISATION:

____

____

____

Mailing Address

____

City State/Province Zip/Postal Code Telephone

____

FAX E-mail

2. NAME AND TITLE OF OFFICERS:

____

____

3. PRIMARY PURPOSE OF ORGANISATION (GENERALLY, WHO DO YOU REPRESENT?)

____

____

4. DATE ORGANISATION WAS FORMED:

5. DATE OF LAST MEETING:

6. HOW MANY MEMBERS IN YOUR ORGANISATION?

7. NAMES OF DELEGATES FOR INITIAL MEETING:

____

____

8. HAS YOUR ORGANISATION EVER VOTED ON THE CONFERENCE BOARD? YES _ NO WHAT YEAR?

____

Authorized Signature **Date of Application**

Appendix VI
Processor Advisory Board (PAB) – Terms of Reference and Rules of Procedure

I. Terms of reference

1. The Processor Advisory Board (PAB) is a subsidiary body of the International Pacific Halibut Commission (IPHC) that represents the commercial Pacific halibut processing industry from Canada and the United States of America. It advises the Commission on issues related to the management of the Pacific halibut resource in the Convention Area.

2. The PAB encourages stability and growth of the North American Pacific halibut industry by fostering a cooperative relationship, better understanding, and a spirit of mutual benefit among seafood processors, fishermen, the Commission, and all other stakeholders.

II. Representation

3. Any company or association, including sole-proprietorships, corporation, or partnerships whose direct business is purchasing, processing and selling Pacific halibut caught in Alaska, British Columbia, Washington, Oregon, or California is eligible for PAB membership.

4. Potential members shall present authorization from their company to represent that company in PAB deliberations. Such authorization will be presented to the general membership of the PAB at its annual meeting. If this authorization is not valid, the member will be removed from the PAB membership list.

5. PAB members agree to carefully and objectively consider all aspects of an issue.

6. PAB members serve without compensation from the Commission.

7. Membership is renewed each year, upon attending the PAB annual meeting.

~~8. The Halibut Association of North America (HANA) shall serve as the PAB's organisational, administrative, communications, and recruitment facilitator.~~

III. Officers

~~9.~~8. The PAB's annual meeting shall be convened by the ~~President of HANA for the purpose of nominating and electing the~~ PAB Chairperson and Vice-Chairperson. ~~Once nominations are made, the election is confirmed by a simple majority vote of PAB members present~~.

~~10.~~9. In years when the Commission's Annual Meeting is held in Canada, the PAB Chairperson shall be a Canada-based member and the Vice-Chairperson shall be a U.S.A.-based member. In years when the Commission meets in the U.S.A., the PAB Chairperson shall be a U.S.A.-based member and the Vice-Chairperson shall be a Canada-based member.

~~11.~~10. Officers' terms shall be for one year, or until a replacement is elected.

IV. Sessions of the PAB

~~12.~~11. **Time and place**: The PAB meets once a year over the course of a few days, in conjunction with the IPHC Annual Meeting. A quorum is established each year.

~~13.~~12. **Agenda**: The PAB's draft agenda will be presented by the Chairperson and approved by the membership at the beginning of the meeting. Members may suggest changes to the agenda prior to approval.

~~14. **Conduct of meetings**: Parliamentary procedure will be used in the conduct of the PAB meeting.~~

~~15.~~13. **Decision-making**: Only one vote per company member is allowed.

a) If a company has more than one representative in attendance, those representatives will choose from among them one individual to cast the company's single vote on any issue.

b) Proxies are allowed only from members who have attended the last two sequential meetings of the PAB.

c) Only one Proxy per member is allowed.

d) Proxies will be submitted to ~~a PAB member or the executive director of HANA~~ the IPHC Secretariat prior to the PAB meeting in written or electronic form.

~~e) If a Proxy is submitted to a PAB member, that member must submit the Proxy to the Executive Director of HANA. At the meeting, HANA's executive director will submit all Proxies to the chairperson of the PAB.~~

~~f)~~e) A General Proxy will authorize a designated PAB member to vote on any or all topics brought before the PAB, on behalf of a PAB member who cannot attend. A Specific Proxy will authorize a PAB member to vote on specifically named topics (listed on the proxy itself) on behalf of the PAB member who cannot attend.

V. Intersessional process and ad-hoc working groups

~~16.~~14. The PAB may establish ad-hoc working groups to address issues or projects, or to represent the PAB's interests. Completed documents and other work materials from the PAB working groups will be posted for public access on the IPHC website.

~~17.~~15. Additional work group members outside of the PAB membership may be added as judged appropriate by the Chairperson.

~~18.~~16. When determined by the PAB Chairperson and Vice-Chairperson as necessary, Special Sessions of the PAB may be called. These meetings shall be for a purpose requiring discussion or other action by a quorum of PAB members.

~~19.~~17. A quorum is established by a majority of the PAB members who were present at the current PAB meeting. ~~Minutes and other reports of the Special Meeting will be distributed to the Commission for posting on the IPHC website in a timely manner by the Executive Director of HANA or his/her designee.~~

~~20.~~18. Attendance, discussion, voting, reportage, and all other aspects of the Special Meeting may be done electronically.

VI. Reports and records

~~21.~~19. A report shall be adopted at the end of each Session of the PAB.

~~22.~~20. The report shall embody the PAB's recommendations, including, when requested, a statement of minority views.

~~23.~~21. A copy of the final report from each PAB meeting shall be forwarded by the IPHC Executive Director to the Contracting Parties and to the Commissioners no later than **15 days** after the close of the Session.

~~24.~~22. All reports shall be available on the Commission's website.

Appendix VII
Research Advisory Board (RAB) – Terms of Reference and Rules of Procedure

I. Terms of reference

1. The Research Advisory Board (RAB) is composed of members of the Pacific halibut community that shall:
   a. suggest research ~~ideas,~~ topics to be considered for incorporation in the IPHC 5-year Research Plan,
   ~~b. review IPHC research proposals, and~~
   ~~c.~~b. provide the IPHC Secretariat staff (who participate in Sessions of the RAB as Observers) with direct input and advice from industry on current and planned research activities contemplated for inclusion in the IPHC 5-year Research Plan~~during the development of research plans~~.

2. The RAB may also make recommendations to the Scientific Review Board concerning options for new suggested research topics and current and planned research atividies and their prioritization ~~research plans and priorities~~ for its consideration.

3. 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.

II. Representation

4. RAB members are Pacific halibut industry representatives from each Contracting Party and may include commercial, guided sport, unguided sport/recreational, subsistence, and First Nations/Tribal interests.

5. The RAB shall consist of ten to fifteen members.

6. New RAB members shall be nominated by current members, by other IPHC subsidiary bodies, or by the IPHC Secretariat staff. The nominees are reviewed and approved by the IPHC Secretariat staff. Nominees must be members of the Pacific halibut community with

an expressed interest in scientific research. They must be available for meetings and willing to participate in candid discussions about the IPHC research program. It is not necessary to achieve a particular regional or sector balance in the membership of the RAB.

7. The term for RAB membership is two years. There is no limit to how many terms a RAB member may serve.

8. RAB members serve without compensation from the Commission.

III. Officers

9. The IPHC Executive Director shall act as Chairperson of the RAB and the IPHC Biological and Ecosystem Science Branch Manager shall act as the Vice-Chairperson of the RAB, unless the RAB decides otherwise.

IV. Sessions of the RAB

10. **Time and place**: The RAB shall meet once each year at the IPHC offices in Seattle. The RAB may also meet at other times and places, or via electronic means, to consider specific issues or to produce specific documents or other products.

11. **Agenda**: The agenda for the RAB meeting is proposed by the Commission's Executive Director and approved by the membership at the beginning of the meeting, in accordance with the Commission's rules of procedure. The agenda will include time for broad discussion of scientific issues between the RAB and the IPHC Secretariat.

V. Intersessional process and ad-hoc working groups

12. The RAB may set up ad-hoc working groups to consider particular issues and report back to the RAB.

VI. Reports and Records

13. A report shall be adopted at the end of each Session of the RAB.

14. The report shall embody the RAB's recommendations, including, when requested, a statement of minority views.

15. A copy of the final report from each RAB meeting shall be forwarded by the IPHC Executive Director to the Contracting Parties and to the Commissioners no later than **15 days** after the close of the Session.

16. All reports shall be available on the Commission's website.

Report of the Independent auditors and Financial Statements (FY2021)

PREPARED BY: IPHC SECRETARIAT (D. WILSON; 25 OCTOBER 2021)

PURPOSE

To provide the Commission with the process for completion of the Independent External Auditors Report for FY2021, as per Regulation 14 of the IPHC Financial Regulations (2021).

> ***Regulation 14 – External Audit***
> "*1. The accounts of the Commission shall be audited annually by external auditors recommended by the FAC and appointed by the Commission. The Auditors shall be appointed for a term of three (3) years, and may be reappointed to multiple terms.*"

BACKGROUND

05 October 2021: The existing three (3) year contract with Moss Adams to undertake and complete annual Statement Audits, was confirmed for FY2021 through the signing of an Engagement Letter details the FY2021 professional services to be provide.

Included in the engagement letter are the Audit timings:

> *"We expect to begin our audit on approximately November 1, 2021, and issue our report no later than December 18, 2021."*

25 October 2021: In accordance with paragraph 2, Regulation 14, of the IPHC Financial Regulations (2021) (shown below) the IPHC Secretariat commenced the provision of the initial Provided By Client (PBC) list of items to the independent external auditor (25 days after the end of the FY2021 fiscal year).

> (para. 2) "*The contents identified in the Auditors Provided By Client (PBC) list shall be submitted by the Executive Director to the Auditors appointed by the Commission not later than **sixty (60)** days after the end of a fiscal year.*"

01 November 2021: Moss Adams will commence their audit process.

19 December 2021: In accordance with paragraph 7, Regulation 14, of the IPHC Financial Regulations (2021) (shown below) the independent external auditors will provide the final report to the IPHC Secretariat on 19 December 2021 (80 days after the end of the FY2021 fiscal year, 10 days ahead of the deadline set-forth in the IPHC Financial Regulations, to ensure adequate review time).

> (para. 7) "*The Auditors shall prepare a report on the accounts certified, and shall discuss their report with the Executive Director prior to submission to the FAC and Commission. The Auditors shall submit their report to the Commission, via the FAC, no later than **90 days** following the end of the fiscal year to which the accounts relate."*

RECOMMENDATIONS

That the Commission:

1) **NOTE** paper IPHC-2021-IM097-19 which provided the process for the independent external auditors report for FY2021, as per Regulation 14 of the IPHC Financial Regulations (2021).

APPENDICES

Nil.

FY2022 Budget – Update

PREPARED BY: IPHC SECRETARIAT (D. WILSON, 29 OCTOBER 2021)

PURPOSE

To provide the Commission with an update on the FY2022 budget (financial period: 1 October 2021 to 30 September 2022), including potential modifications based on the 2022 FISS sampling design.

BACKGROUND

At the 11th Special Session of the IPHC (SS011, June 2021), the Commission reviewed and adopted a budget for FY2022 (provided at Appendix I).

> IPHC-2021-SS011-R (para. 11) *The Commission ADOPTED the FY2022 budget (1 October 2021 to 30 September 2022), as detailed in Appendix IV, including the Contracting Party contributions to the General Fund as follows:*
> - *Canada: Contribution to the General Fund: US$900,407*
> - *U.S.A.: Contribution to the General Fund: US$4,157,760*

DISCUSSION

FY2021 was the IPHC's first year implementing a Fund Accounting system. As such, there were areas identified throughout the year where expense allocation to specific Funds was deemed appropriate and subsequently implemented. An example being salary & wages, and benefits, which were originally allocated fully to the 10 General Fund, but throughout FY2021 were allocated across funds on a twice monthly schedule based on actual Secretariat work schedules. This has brought a heightened level of accounting accuracy across our core programs and activities.

Noting that the FY2022 Budget by Fund was adopted in June of 2021, the allocation of line items such as salaries & wages, and benefits were allocated fully to Fund 10 – General. Thus, there will be a need to adjust the FY2022 budget to accommodate the expense allocations across Funds. It is expected that this will be presented at the upcoming Finance and Administration Committee (FAC098) in January 2022.

It should be noted that this will not result in an overall budget adjustment that would impact Contracting Party contributions for FY2022.

Fund 40 - FISS: Noting that the budget for Fund 40 – FISS is tentative until the final 2022 design is agreed to, the Secretariat will be providing a revised FY2022 budget at the upcoming

FAC098 in January 2022 for adoption. Fund 40 - FISS does not receive funding from Contracting Party contributions, but rather has a goal of mid-term revenue neutrality.

RECOMMENDATION/S

That the Commission **NOTE** paper IPHC-2021-IM097-18 which provided the Commission with an update on the FY2022 budget (financial period: 1 October 2021 to 30 September 2022), including potential modifications based on the 2022 FISS sampling design.

APPENDICES

Appendix I: FY2022 Financial Budget – Adopted June 2021

APPENDIX I
FY2022 Financial budget – Adopted

Account Number	Account Name	10 - General FY2022	20 - Research FY2022	30 - Statistics FY2022	10,20,30 - TOTAL FY2022	40 - FISS FY2022	10,20,30,40 - TOTAL FY2022
Income							
40000	Contracting Party Contributions						
40000.01	Canada	$ 900,407.00	$ -	$ -	$ 900,407.00	$ -	$ 900,407.00
40000.02	United States of America	$ 4,157,760.00	$ -	$ -	$ 4,157,760.00	$ -	$ 4,157,760.00
	Total 40000 - Contracting Party Contributions	**$ 5,058,167.00**	**$ -**	**$ -**	**$ 5,058,167.00**	**$ -**	**$ 5,058,167.00**
40050	IFC Pension						
40050.01	IFC Pension - Canada	$ 127,848.00	$ -	$ -	$ 127,848.00	$ -	$ 127,848.00
40050.02	IFC Pension - United States of America	$ 127,848.00	$ -	$ -	$ 127,848.00	$ -	$ 127,848.00
	Total 40050 - IFC Pension	**$ 255,696.00**	**$ -**	**$ -**	**$ 255,696.00**	**$ -**	**$ 255,696.00**
40055	Headquarters (Lease & Maintenance)	$ 475,000.00	$ -	$ -	$ 475,000.00	$ -	$ 475,000.00
40060	Other Income	$ -	$ -	$ -	$ -	$ -	$ -
40100	Grants, Contracts & Agreements	$ -	$ 44,917.00	$ 559,975.00	$ 604,892.00	$ 48,720.00	$ 653,612.00
40200	Interest Income	$ -	$ -	$ -	$ -	$ 11,550.00	$ 11,550.00
40200.01	Bank Interest	$ -	$ -	$ -	$ -	$ -	$ -
40200.02	CD Interest	$ -	$ -	$ -	$ -	$ -	$ -
	Total 40200 - Interest Income	**$ 475,000.00**	**$ 44,917.00**	**$ 559,975.00**	**$ 1,079,892.00**	**$ 60,270.00**	**$ 1,140,162.00**
40350	Fish Sales						
40350.01	Fish Sales - Pacific Halibut	$ -	$ -	$ -	$ -	$ 5,471,025.00	$ 5,471,025.00
40350.02	Fish Sales - Byproduct	$ -	$ -	$ -	$ -	$ 58,800.00	$ 58,800.00
	Total 40350 - Fish Sales	**$ -**	**$ -**	**$ -**	**$ -**	**$ 5,529,825.00**	**$ 5,529,825.00**
	Total Income	**$ 5,788,863.00**	**$ 44,917.00**	**$ 559,975.00**	**$ 6,393,755.00**	**$ 5,590,095.00**	**$ 11,983,850.00**
Expense							
Personnel Expenses							
50000	Salaries & Wages	$ 2,925,000.00	$ 85,447.00	$ 668,115.00	$ 3,678,562.00	$ 478,584.75	$ 4,157,146.75
50100	Benefits	$ 1,260,000.00	$ 20,335.00	$ 199,552.50	$ 1,479,887.50	$ 14,837.55	$ 1,494,725.05
50100.09	Medical Reimbursement - Retiree	$ 92,958.60	$ -	$ -	$ 92,958.60	$ -	$ 92,958.60
50200	Training & Education	$ 5,000.00	$ -	$ 21,000.00	$ 26,000.00	$ 54,600.00	$ 80,600.00
50300	Personnel Related Expenses	$ -	$ -	$ 14,700.00	$ 14,700.00	$ 36,376.20	$ 51,076.20
50300.01	Scholarship Awards	$ 8,000.00	$ -	$ -	$ 8,000.00	$ -	$ 8,000.00
	Total Personnel Expenses	**$ 4,290,958.60**	**$ 105,782.00**	**$ 903,367.50**	**$ 5,300,108.10**	**$ 584,398.50**	**$ 5,884,506.60**
Operational Expenses							$ -
51000	Publications	$ 6,000.00	$ -	$ 9,000.00	$ 15,000.00	$ -	$ 15,000.00
51100	Mailing and Shipping	$ 4,000.00	$ 2,000.00	$ 8,400.00	$ 14,400.00	$ 79,800.00	$ 94,200.00
51200	Travel	$ 70,300.00	$ 4,150.00	$ 10,000.00	$ 84,450.00	$ 117,516.00	$ 201,966.00
51300	Meeting and Conference Expenses	$ 171,000.60	$ -	$ -	$ 171,000.60	$ -	$ 171,000.60
51400	Technology	$ 135,000.00	$ -	$ -	$ 135,000.00	$ -	$ 135,000.00
	Total Operational Expenses	**$ 386,300.60**	**$ 6,150.00**	**$ 27,400.00**	**$ 419,850.60**	**$ 197,316.00**	**$ 617,166.60**
Fees and Contract Expenses							
52000	Professional Fees	$ 240,000.00	$ -	$ -	$ 240,000.00	$ -	$ 240,000.00
52200	Other Fees and Charges	$ -	$ -	$ -	$ -	$ 590,965.20	$ 590,965.20
52300	Leases and Contracts	$ 365,000.00	$ 76,979.00	$ 38,850.00	$ 480,829.00	$ 2,428,391.70	$ 2,909,220.70
54000	Communications	$ 25,000.00	$ -	$ 420.00	$ 25,420.00	$ 86,782.50	$ 112,202.50
	Total Fees and Contract Expenses	**$ 630,000.00**	**$ 76,979.00**	**$ 39,270.00**	**$ 746,249.00**	**$ 3,106,139.40**	**$ 3,852,388.40**
Facilities and Equipment Expenses							
53000	Equipment Expense	$ 28,000.00	$ -	$ 18,900.00	$ 46,900.00	$ 34,020.00	$ 80,920.00
53100	Supplies Expense	$ 32,000.00	$ 106,452.00	$ 2,100.00	$ 140,552.00	$ 933,980.25	$ 1,074,532.25
53200	Maintenance and Utilities	$ 24,000.00	$ -	$ -	$ 24,000.00	$ 42,000.00	$ 66,000.00
53300	Facility Rentals	$ 378,000.00	$ -	$ 6,300.00	$ 384,300.00	$ 21,000.00	$ 405,300.00
	Total Facilities and Equipment Expenses	**$ 462,000.00**	**$ 106,452.00**	**$ 27,300.00**	**$ 595,752.00**	**$ 1,031,000.25**	**$ 1,626,752.25**
Other Expenses							
55000	Budget Contingency	$ 35,000.00	$ -	$ -	$ 35,000.00	$ -	$ 35,000.00
55200	Fund Cost Recovery (20 - 30)	$ 687,808.50	$ (250,446.00)	$ (437,362.50)	$ -	$ -	$ -
55201	Fund Cost Recovery (40)	$ (703,204.70)	$ -	$ -	$ (703,204.70)	$ 703,204.70	$ -
	Total Other Expenses	**$ 19,603.80**	**$ (250,446.00)**	**$ (437,362.50)**	**$ (668,204.70)**	**$ 703,204.70**	**$ 35,000.00**
	Total Expense	**$ 5,788,863.00**	**$ 44,917.00**	**$ 559,975.00**	**$ 6,393,755.00**	**$ 5,622,058.85**	**$ 12,015,813.85**
	Net Income (Loss)	**$ -**	**$ -**	**$ -**	**$ -**	**$ (31,963.85)**	**$ (31,963.85)**

Stakeholder statements on IPHC Fishery Regulation proposals

PREPARED BY: IPHC SECRETARIAT (B. HUTNICZAK; 29 OCOTBER 2021)

PURPOSE

To provide the Commission with a consolidated document containing 'Statements' from stakeholders submitted to the Commission for its consideration at the 97th Session of the IPHC Interim Meeting (IM097).

BACKGROUND

The IPHC Secretariat has continued to make 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

Table 1 provides a list of the Stakeholder Statements which are provided in full in the Appendices. The IPHC Secretariat does not provide commentary on the Statements, but simply collates them in this document for the Commission's consideration. Not all relate to current proposals before the Commission.

Table 1. Statements from stakeholders received by 1200 on 29 October 2021.

Appendix No.	Title and author	Date received
Appendix I	Statement by Andrew Smyth	29 September 2021
Appendix II	Statement by Steve Ramp	14 October 2021
Appendix III	Statement by Sean Daly	22 October 2021

APPENDICES

As listed in Table 1.

APPENDIX I

Statement by Andrew Smyth

IPHC Regulatory Areas that may be affected	All
Fishery Sectors	• Directed Commercial
Explanatory Memorandum	To address commercial bottom trawl Regs.
Suggested Regulatory Language	Propose to limit commercial bottom trawls only to areas deeper than 400 ft. This would leave the areas used by recreational and charter fishing companies better stocks and encourage economic benefit to a broader segment of the people living in our coastal communities.

APPENDIX II

Statement by Steve Ramp

IPHC Regulatory Areas that may be affected	2C
Fishery Sectors	• Recreational
Explanatory Memorandum	In recent years, there has been large growth of businesses in Southeast Alaska that rent sportfishing vessels to non-residents, who utilize this arrangement to qualify for more liberal "Non-Guided" bag limits for Halibut. Most of these vessels are smaller than the average charter vessel and, as a result, I believe these anglers focus their halibut harvests in areas close to the communities of Southeast AK. The Sitka Fish and Game Advisory Committee (in which I currently hold the Resident Sport Fishing seat) believes this activity reduces the opportunity for resident anglers to harvest halibut close to our homes and has submitted a State of Alaska Board of Fisheries proposal similar to this one.
Suggested Regulatory Language	Enact a new regulation that would require any Non-Resident Unguided Angler fishing from a rented vessel in the waters of Halibut Management Area 2C abide by the NOAA halibut bag limits then in effect for Guided Anglers.

APPENDIX III

Statement by Sean Daly

IPHC Regulatory Areas that may be affected	All
Fishery Sectors	• Non-directed Commercial (bycatch)
Explanatory Memorandum	To Whom it May Concern: My name is Sean Daly, I am a United States citizen and a resident of Alaska. I am a father of two boys who one day will be old enough to fish in Alaskan waters. I ask that the commission advocate for expansion of the halibut stock assessment analysis focused on halibut sex ratios to include those of the halibut caught by the A80 fleet, and establish enforcement of quotas for the A80 fleet so that the fishery is immediately closed when the quotas are met or exceeded. I also ask that the council consider revising the bycatch limits to a lower number given declining stocks for numerous saltwater species commonly caught by the A80 fleet as bycatch, and the destructive practice of bottom trawling to ocean habitat on the sea floor including sponges, coral, etc. To date there has been no evidence of any ocean bottom recovery in or near Alaskan waters in the North Pacific after being trawled by bottom trawling vessels, even after decades of research. In my comment, I've included some data on wasted Halibut bycatch from the A80 fleet in Alaska that could have made it to Alaskan residents' freezers, on consumer's tables, or left in the wild to maintain overall fishing stocks and ocean habitat. Statewide Halibut: 3,022,537 lbs. Grand total of above categories is over 24 million pounds of waste. Note that the above categories are just the "Hot Topic" bycatch categories. If you go through and tally total bycatch for ALL species, it comes out to close to 100 million pounds per year. Approximately 10% of total halibut and salmon bycatch is kept and donated each year. Historically, approximately 70% of that donated halibut and salmon goes out-of-state. Thank you for your time!
Suggested Regulatory Language	N/A

The IPHC mortality projection tool for 2022 mortality limits

PREPARED BY: IPHC SECRETARIAT (I. STEWART; 12 OCTOBER 2021)

PURPOSE

This document provides a description of the IPHC's web-based mortality projection tool (https://www.iphc.int/data/projection-tool) for setting mortality limits in 2022.

BACKGROUND

To support the IPHC's process for setting the 2019 mortality limits, IPHC Secretariat staff developed an interactive tool for the evaluation of alternative Pacific halibut mortality levels based on the coastwide TCEY and the distribution of that mortality among IPHC Regulatory Areas. The tool was updated for use in developing mortality limits for 2020; however, agreements made during AM095 and IM095 led to additional complexity that rendered simple use of the tool challenging.

For the evaluation of 2021 mortality limits, the existing web-based tool was updated to again provide all participants in the process the ability to create alternative projection tables as is necessary for decision making, without having to rely directly on the IPHC Secretariat. Specifically, agreements in place for 2021-022 were included by default in the automatic calculations. No additional changes were made for 2022, beyond updating the data sources and assessment results underlying the tool.

THE MORTALITY PROJECTION TOOL

The tool relies on previously calculated stock assessment outputs representing a broad range of total mortality. These include projections of spawning stock size and fishing intensity, such that alternative harvest levels can be evaluated in the context of the harvest decision table as well as relative trends. The tool is divided into five components:

1) Inputs
2) Summary results
3) Biological distribution
4) Detailed sector mortality information
5) Graphics

A brief description of each of these is provided below.

Inputs

The first section of the tool provides the user with inputs primary information (Figure 1):

1) The total distributed mortality limit (TCEY) in millions of net[1] pounds.
2) The percent of the distributed mortality limit (TCEY) assigned to each IPHC Regulatory Area.

[1] Net pounds refer to the weight with the head and entrails removed; this is approximately 75% of the round (wet) weight.

The default values loaded into the tool reflect the IPHC's interim management procedure, adjusted for current agreements for 2022 mortality limits and TCEY distribution, as well as an intersessional decision during 2020. The total TCEY is based on the value that produces a projected level of fishing intensity equal to $F_{43\%}$, or the fishing intensity that reduces the spawning output of the stock per recruit to 43% of its unfished level (SPR=43%) given recent recruitment, and current biology (weight at age, maturity, fecundity), allocation among fisheries and selectivity within fisheries. This level of fishing intensity reflects an adjustment made intersessionally (after AM096; IPHC 2020a) to the previous $F_{46\%}$ handrail adopted in 2016, in response to the results from the IPHC's ongoing Management Strategy Evaluation (MSE) process. The MSE results, presented at AM096 (IPHC-2020-AM096-12), found that a management procedure utilizing an $F_{43\%}$ target level of fishing intensity, and a control rule reducing that level of fishing intensity linearly if the relative spawning biomass drops below 30%, to a target value of $F_{100\%}$ (no fishing) if the spawning biomass reaches 20% successfully met the coastwide conservation and fishery objectives.

Inputs

Enter 2022 coastwide mortality limit (TCEY): **39.00**

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
Enter 2022 distributed mortality limit %	4.2%	17.9%	14.9%	35.9%	8.0%	5.3%	3.6%	10.2%	100.0%

Select non-directed discard option:	**Three-year average discards**
Select weight units:	**Millions of net pounds**

Figure 1: Example of the "Inputs" section of the mortality projection tool. Cells in yellow are intended to be modified by the user. Note that specific values are for illustration only and do **NOT** correspond to default values for 2022.

The IPHC's interim management procedure also includes a method for distributing the coastwide TCEY among IPHC Regulatory Areas. The distribution method consists of the following steps:

1) Determine the current stock distribution of Pacific halibut greater than 32-inches (82.5 cm, O32) from the modeled survey WPUE and geographic extent of each IPHC Regulatory Area.
2) Assign relative harvest rates of 1.0 to IPHC Regulatory Areas 2A-3A and 0.75 to IPHC Regulatory Areas 3B-4CDE.
3) Generate a target TCEY distribution, as the normalized product (sums to 100%) of steps 1 and 2.

During AM095 (para. 69) two additional steps were adopted by the Commission, to apply to mortality limits for 2019-2022:

4) Set the IPHC Regulatory Area 2A TCEY to a value of 1.65.
5) Set the IPHC Regulatory Area 2B target TCEY percentage to a weighted average of 20% (weight = 0.7) and the result of step 3 (weight = 0.3).

6) In order to satisfy the coastwide TCEY as well as steps 4-5, reduce the target TCEY percentages for IPHC Regulatory Areas 2C-4CDE in proportion to the result of step 3.

At IM095 (Req.03, para. 49) an additional adjustment was added:

7) Remove all non-directed commercial discard ('bycatch') mortality of Pacific halibut less than 26 inches in length (66 cm; U26) occurring in Alaska from the projections.
8) Recalculate the TCEY (using the stock assessment ensemble) that corresponds to the reference fishing intensity (coastwide) and the distribution percentages from step 6.
9) Compare the recalculated TCEYs to those from step 6 to determine the 'yield gained' in IPHC Regulatory Area 2B.

This adjustment was further modified during AM096 (para. 97):

10) Add 50% the yield gained for IPHC Regulatory Area 2B (step 9) to that from step 6.
11) In order to satisfy the coastwide TCEY as well as steps 6 and 10, reduce the target TCEY percentages for IPHC Regulatory Areas 2C-4CDE in proportion to the result of step 6 (also equivalent to step 3).

The mortality projection tool satisfies these constraints by using the input coastwide TCEY to determine the distributed components. This relies on the inputs described above, as well as a range of pre-calculated yield gained values for 2B due to accounting for U26 non-directed discard mortality (the yield gained depends on the overall level of fishing intensity). Therefore, the distribution percentages for 2A and 2B are shaded grey[2] in the mortality projection tool, and will update to the appropriate percentages if the coastwide TCEY is adjusted. The distribution percentages for IPHC Regulatory Areas 2C-4CDE can be adjusted manually. Although the percentages describing the distribution of the mortality limit are intended to sum to 100%, if they do not the total will be highlighted in red, and 2C-4CDE are automatically rescaled so that the sum of the distributed mortality limits across all IPHC Regulatory Area will exactly match the coastwide total input.

There are two optional inputs, with drop-down menus, specifying:

1) The basis for projecting non-directed discard mortality. The default projection, consistent with the IPHC's Interim Management Procedure (specified during AM096 para. 97), is to use the three-year average non-directed discard mortality from the most recent year. Alternatives include the previous year's estimates and the values consistent with full regulatory attainment of domestic non-directed discard mortality limits.
2) The units of mortality measurement. This can either be millions of net pounds (default) or net metric pounds.

Summary results

The second section of the tool provides the projected coastwide SPR for comparison with the harvest decision table. In addition, this section reports the distributed mortality limit (TCEY) for each IPHC Regulatory Area; the total can be compared to the total input above to verify that

[2] Note that the percentages for 2A and 2B can be adjusted manually for comparison of alternative distribution procedures, but the tool must be refreshed to return to automatic calculations that satisfy the Interim Management Procedure.

the calculations are working properly. The total mortality limit (all sizes and sources of mortality, including U26 non-directed discard mortality of Pacific halibut) is also summarized by IPHC Regulatory Area.

Biological and fishery distribution

The third section of the mortality projection tool provides the most current modelled estimates of stock distribution by Biological Region, compared to the distributed mortality limits (TCEY). These two values are then used to project a harvest rate by Region, standardized such that Region 3 (IPHC Regulatory Areas 3A and 3B) is always equal to a value of 1.0 and the other Regions (2, 4 and 4B) are relative to that value.

Detailed sector mortality information

This section provides a full distribution of mortality among IPHC Regulatory Areas and fishery sectors. Calculations are based on catch sharing agreements used by the domestic agencies for IPHC Regulatory Areas 2A, 2B, 2C, 3A, and 4CDE (4CDE allocating among sub-Areas). Static projections are used for non-directed discard mortality (see above), and subsistence mortality (based on the most recent estimates available). Discard mortality in directed fisheries scales with the landings based on the most recently observed rates for each fishery. The total of this section (matching the total in the summary results) provides the best projection of all sizes and sources of Pacific halibut mortality based on the specified mortality limits.

Graphics

The last section of the projection tool provides a series of five graphical results updated to reflect the inputs made by the user. These graphics are similar to those provided in the annual stock assessment and/or presentation material.

The first figure uses previously calculated three-year projections for a range of coastwide TCEY (and corresponding SPR) values to illustrate the coastwide spawning biomass trend associated with the specified inputs to the tool. Uncertainty is shown as a shaded region, with the projected period highlighted by the brighter color relative to the darker estimated time-series. Importantly, not all possible SPR values are available, so the closest value available is reported. The projected SPR is reported above the figure, and a warning will be returned if the user has specified a coastwide TCEY outside of the range of values available, or if the value lies between the pre-calculated grid.

The second figure provides a bar chart of the time-series of estimated relative fishing intensity with 95% confidence intervals. The inputs to the projection tool provide the basis for the projected fishing intensity, shown as the hatched bar at the end of the series. Values are relative to the IPHC's Interim Management procedure, currently based on an SPR of 43% (see description above), such that values above the target ('handrail' from 2016-2020) represent higher fishing intensity.

The third figure provides a graphical display of the relative harvest rates by Biological Region as reported in the ***Biological and fishery distribution*** section.

The fourth and fifth figures provided the detailed sector mortality information (allocations) in both absolute values (millions of net pounds) and relative values (percent of the projected mortality) by IPHC Regulatory Area.

DISCUSSION

There may be some alternatives (e.g., evaluations of alternative relative harvest rates by IPHC Regulatory Area) that will not be possible using this tool. Such alternatives will continue to be produced by the Secretariat staff as needed to support all meetings and decision-making.

UPDATE SCHEDULE

The existing mortality projection tool will be updated in early January 2022, in order to include the final end-of-year 2021 mortality estimates from various fisheries, for use during the 2022 Annual Meeting (AM098).

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BIO-SOCIOECONOMIC CONDITIONS INDEX FOR PACIFIC HALIBUT FISHERIES

PREPARED BY: IPHC SECRETARIAT (B. HUTNICZAK; 29 OCTOBER 2021)

PURPOSE

The purpose of this document is to provide details on the construction of the IPHC's bio-socioeconomic conditions index for Pacific halibut fisheries.

This document supplements produced annually by the IPHC *Summary of the data, stock assessment, and harvest decision table for Pacific halibut (Hippoglossus stenolepis).*

INTRODUCTION

The IPHC's bio-socioeconomic conditions index monitors key factors directly related to the economic performance of the Pacific halibut fisheries operations in the Convention waters. It intends to capture trends in relative opportunities at the entire stock level (coastwide scale), as well as for major Pacific halibut-producing regions individually: Alaska, British Columbia, and the USA West Coast (WOC, covering Washington, Oregon, and California).

The index is based on trends in four indicators: fish prices (ex-vessel), fishing cost factors represented here by the average fuel price and wages in the fishing sector,[1] and stock condition represented by the weight per unit of effort (WPUE) of legal-size fish (i.e. O32) derived from the IPHC's Fishery-Independent Setline Survey (FISS). The aggregate index value weights region-specific indicators, specifically their variation from the average over the previous ten years, by Fishery Constant Exploitation Yield (FCEY), as adopted by the Commission at the time for each year and region (see section Index formula for details on index construction). FCEY was chosen as the weighting variable because the index intends to capture opportunities available to the stock users (i.e., fishers), and these are not necessarily equal to realized catch that represents outcome conditional on the behavior of stock users and the incentives they are presented with.

Figure 1 illustrates the evolution of the index over time, covering the period from 2000 to 2021 (black solid line), as well as the contribution of each of the four factors to the formation of the index (colored bars). Dotted bars represent preliminary estimates based on incomplete data (e.g., when the fishing season is still in progress or there is a data publication lag). Note that

[1] Fishing costs are determined by a number of factors besides fuel price and wages. These include vessel maintenance, provisions, government-mandated fees (license fees), and bait. However, the index captures the impact of the two most important cost components for the Pacific halibut fleet that are also subject to the most fluctuations across years. Thus, it should reflect cost-driven shifts in the economic performance of the Pacific halibut fisheries. Given the cost determinants are also adjusted for inflation (see Data sources section), this approach is equivalent to assuming that other factors have been increasing at the same rate as the GDP, that is they have remained constant over time in real terms.

increasing price and WPUE impact the index positively, while cost factors impact the index negatively.[2] The figure also depicts the index derived separately for each region, presenting region-specific trends with no weighting applied (dashed lines).

Because the index is depicted at a relative scale, it does not provide an absolute measure of the bio-socioeconomic conditions in the given fishing season but rather informs on the relative changes from year to year. For example, the index value for 2021 indicates the bio-socioeconomic conditions improved by 37 percentage points when compared with the 2020 fishing season and were 23% above the last 10-year average. This was mainly driven by higher fish prices, and to some degree also lower labor costs. The overall coastwide increase in biomass available (i.e., higher WPUE), because of minimal estimated change, had very little impact on index movement between 2020 and 2021.

Region-specific index values, in general, follow the coastwide trend, although the change reported for the current (2021) year is mainly driven by the situation in Alaska. The increase for British Columbia is more modest, mainly because of slower price increase. While there are indications that the prices in BC experience a similar surge as these in Alaska and the US West Coast (see, e.g., Fry, 2021), the average price for BC was not available at the time of publication of this document and the index adopts price trend derived from the FISS sales. Thus the 2021 index value for BC should be interpreted cautiously.[3]

While the index intends to capture factors contributing to the economic performance of the Pacific halibut fisheries operations, the figure also depicts the evolution of absolute harvest opportunities represented in the figure by the sum of FCEY for all IPHC Regulatory Areas. The absolute level of opportunity (FCEY) will also affect overall profit, likely because of economies of scale. Economies of scale are cost advantages companies experience when fixed costs can be spread over a larger amount of output.

Note that data for 2021 is preliminary and the final index value is subject to change following the publication of final data for all index components (see details in the section Data sources).

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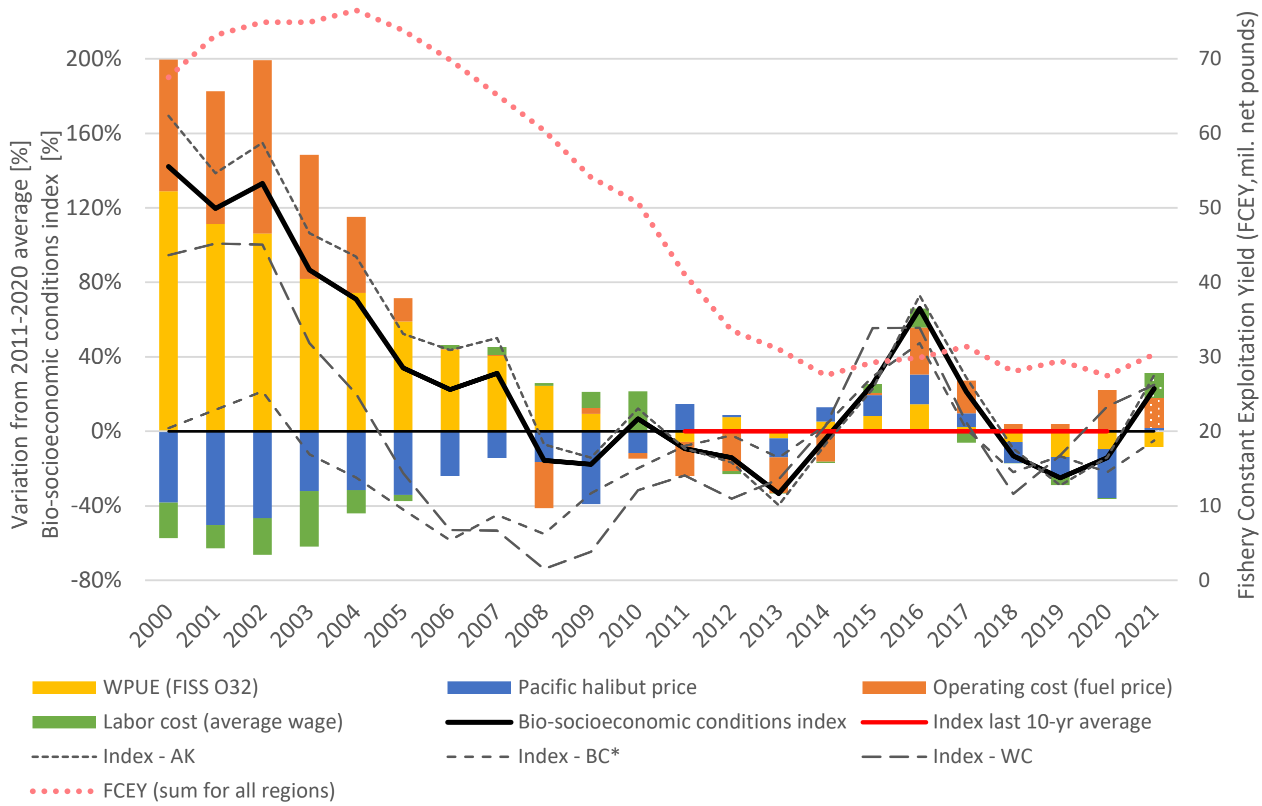
[2] In practice, cost factors are incorporated in the calculation of the index as inverse values. This translates into the use of fuel volume per USD/CAD and labor input per USD/CAD. See details on the index calculation in section Index formula.

[3] The index price component for British Columbia for 2020 and 2021 is based on price trend derived from FISS sales. Pearson correlation coefficient for current prices in BC and AK for the period 2011-2019 (years in the baseline period with all prices available) was 0.26, and for current prices in BC and WOC for the same period, 0.02. Thus the use of trends in other areas was deemed inappropriate.



Stacked columns represent indicators contributing to the formation of the index. Columns above the 0% axis represent indicators being above the last 10-year average, while columns below the 0% axis represent indicators being below the last 10-year average. Index average over the previous ten years (2011-2020) is set to 0%. Dotted bars represent preliminary estimates, based on data reported up to October 2021. * Index value for 2020 and 2021 calculated based on incomplete fish price data for BC. Last two year's trend is approximated from FISS sales data. BC price data for 2020 are anticipated in November/December 2021, with the new release of the report *British Columbia Seafood Industry Year in Review*.

Figure 1: Bio-socioeconomic index for Pacific halibut fisheries (2000-2021).

DATA SOURCES

The bio-socioeconomic conditions index for Pacific halibut fisheries combines into a single value trends in the following four indicators:

(1) FISS WPUE:
  a. stock conditions are based on the time series of modeled FISS WPUE of legal-size fish (i.e., O32) reported in net lb/skate by IPHC Regulatory Area (IPHC-2021-IM097-08);

(2) fish prices:
  a. AK: Average fish prices for Alaska are available via the Alaska Fisheries Information Network (AKFIN, 2021). Last year's trend is approximated based on available to date (last updated on 19 October 2021) fish tickets data provided through the eLandings reporting system (ADFG, 2021).

b. BC: Average fish prices for British Columbia (2B) are sourced from series *British Columbia Seafood Industry Year in Review* (2014-18, e.g., AgriService BC, 2020) and direct reports to the IPHC (e.g., IPHC-2021-AM097-NR01 includes data for 2019). Prices for 2020 and 2021 are approximated from the trend from FISS sales, using average change in price between 2019 and 2020 or 2021. BC price data for 2020 are anticipated in November/December 2021, with the new release of the report *British Columbia Seafood Industry Year in Review*.
c. WOC: Fish prices for the US West Coast (2A) are based on the data reported by PacFIN (PacFIN, 2021). The current update is based on the data download on October 11, 2021.

(3) average fuel prices:

a. Marine fuel prices for Alaska, Washington, Oregon, and California are compiled by the PSMFC's Fisheries Economics Data Program (PSMFC, 2021). The latest update covers data up to September 2021 (last accessed on October 4, 2021).
b. The cost of fuel for British Columbia was approximated using average monthly retail prices of diesel in Vancouver and Victoria (Statistics Canada, 2021c). The current update covers data up to August 2021 (last accessed Oct 11, 2021).

(4) average wages in the fishing sector:[4]

a. AK: Alaska's labor cost is approximated by average wages in *Fishing, hunting and trapping* sector reported in *Nonresidents working in Alaska* series (2014-19, see Kreiger & Whitney (2021) for the latest report). Change from 2019 to 2020 is approximated using the trend in average wages derived for *Fishing, Hunting and Trapping* sector from the US Bureau of Economic Analysis (BEA), tables BSAEMP25N & SAINC6N (BEA, 2020). Change from 2020 to 2021 is based on the data reported in the Quarterly Census of Employment and Wages for the *Fishing, hunting and trapping* sector (BLS, 2021). The currently reported trend is based on the change in Q1 only (last accessed on October 7, 2021).
b. BC: British Columbia's labor cost is assessed as the average wage in *Fishing, hunting and trapping* sector reported by Statistics Canada (2021a) for 2000-2020. The change from 2020 to 2021 is approximated from the trend in the monthly-reported data for the BC's *Forestry, fishing, mining, quarrying, oil and gas* sector (Statistics Canada, 2021a).
c. WOC: and West Coast labor cost approximated by average wage in *Fishing, hunting and trapping* sector reported by BEA in tables SAINC6N and SAEMP25N (2014-19).
d. Labor cost for the US West Coast is approximated by average wages derived for *Fishing, Hunting and Trapping* sector from the US Bureau of Economic Analysis

[4] We do not need to use labor data specific to the Pacific halibut fishing sector. The more general sector data should reflect well the supply of qualified workers and the resultant wages.

(BEA), tables BSAEMP25N & SAINC6N (BEA, 2020).[5] Change from 2020 to 2021 is based on the data reported in the Quarterly Census of Employment and Wages for the *Fishing, hunting and trapping* sector (BLS, 2021). The currently reported trend is based on the change in Q1 only (last accessed Oct 7, 2021).

All monetary values are adjusted for inflation using the GDP deflator based on data published by the Organisation for Economic Co-operation and Development (OECD, 2021), and are expressed in 2020 USD/CAD.

FCEY by region, as adopted by the Commission at the time for each year and region, is sourced from the IPHC's data table IPHC-2020-TSD-013 (Time Series of Historical Management Information).

INDEX FORMULA

We denote indicators used in the construction of the bio-socioeconomic conditions index for Pacific halibut fisheries in region r ($r \in R$, where R represents the whole set of Pacific halibut-producing regions – AK, BC, and WOC) and year t as follows: b_t^r – modeled O32 WPUE (b for biomass), p_t^r – average Pacific halibut price, f_t^r – inverse of average fuel price, and l_t^r – inverse of average cost of labor in the fishing sector. The region-specific index values (I_t^r) are calculated as:

$$I_t^r = \frac{b_t^r - \bar{b}}{\bar{b}} + \frac{p_t^r - \bar{p}}{\bar{p}} + \frac{f_t^r - \bar{f}}{\bar{f}} + \frac{l_t^r - \bar{l}}{\bar{l}},$$

where variables with bar represent baseline period averages. Here, we have chosen to use the previous 10-year average for the calculation of the most current index update. For all years in the 2021 update, this implies a baseline covering 2011-2020. Note that the index uses a moving average, so future updates of the bio-socioeconomic conditions index for Pacific halibut fisheries will cover a shifting baseline period.

The weighting variable, FCEY, is represented by w_t^r. The aggregated index value for year t (I_t) is derived as follows:

$$I_t = \sum\nolimits_{r \in R} w_t^r \, I_t^r / \sum\nolimits_{r \in R} w_t^r.$$

[5] Note that this source was not suitable for Alaska because of data gaps for 2001-2002, 2006-2008 and 2018.

Note that the index assumes additivity of the factors contributing to the bio-socioeconomic conditions of the Pacific halibut fisheries and does not apply weighting between these factors. Thus, it would not be directly comparable with an indicator that would seek to trace profitability.[6]

Similar indicators have been used before in tuna fisheries (Ruaia, Gu'urau, & Reid, 2020).

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[6] Profitability in fisheries would be typically expressed as $p \times WPUE - \sum_{i \in I} c_i$, where p represents unit price (USD/CAD per weight unit), WPUE is weight per unit of effort, and c_i $(i \in I)$ represent cost items expressed in USD/CAD per unit of effort.

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PACIFIC HALIBUT MARKET PROFILE

PREPARED BY: IPHC SECRETARIAT (B. HUTNICZAK; 29 OCTOBER 2021)

PURPOSE

The purpose of this document is to provide stakeholders with general information about the Pacific halibut markets and the formation of the price paid for Pacific halibut products by final consumers (end-users). The content of this analysis serves as a base for understanding Pacific halibut's contribution to the Gross Domestic Product (GDP) along the entire value chain, from the ***hook-to-plate***.

INTRODUCTION

Canada and the United States of America account for the majority (70-80% over the 2014-2019 period, Table 1) of Pacific halibut global output, as reported by the Food and Agriculture Organization of the United Nations (FAO, 2021b). The aquaculture output of Pacific halibut is currently marginal (not specified by the FAO (2021a)), but on the rise (Welch, 2020a). In Canada's and the United States' West Coast (including Alaska), Pacific halibut accounts for about 5% of fish production (harvest) volume, while in terms of value, less than 0.5% (based on 2019 data, AKFIN, 2021; DFO, 2021; PacFIN, 2021). This showcases its high unit value (typically over USD 5/lb, see also Figure 1) in comparison with other fisheries in the Pacific Northwest region.

Pacific halibut is a premium product known for its mild taste and flaky texture, suitable for a variety of dishes and flavor combinations. It is commonly grilled, fried, baked, sautéed, and poached. As it has relatively few bones, it makes for a popular food fish. It is primarily sold to upscale retail outlets and white-tablecloth restaurants, resulting in high price markups in the supply chain. Amidst the pandemic, Pacific halibut products also noted an increase in online sales, following the general trend for more seafood products consumption at home (Wells, 2020), but since then the restaurant industry started showing a strong recovery (Kelso, 2021).

Pacific halibut is typically consumed as fillets, but it is also sold as fletches,[1] steaks, collars, or cheeks. Cheeks are considered a high-valued delicacy. Fresh products are available during the Pacific halibut commercial fishing season, starting typically sometime in March and ending in November or December.[2] Frozen products can be found year-

[1] Fletch is a skinless fillet cut for large flatfish, such as 'halibut'. The fletch is then further divided into boneless portions.
[2] Until 2019, the fishing season end date was set for November. In 2020, an extended commercial fishing season in Canada was agreed upon because of unusual circumstances (covid-19 pandemic), and the extension allowed fishing in the IPHC Regulatory Area 2B up to December 7 (regulatory update from 17 September 2020). Current (2021)

round. Excess fish parts are ground and discharged as waste or turned into fish meal (AFSC, 2019).

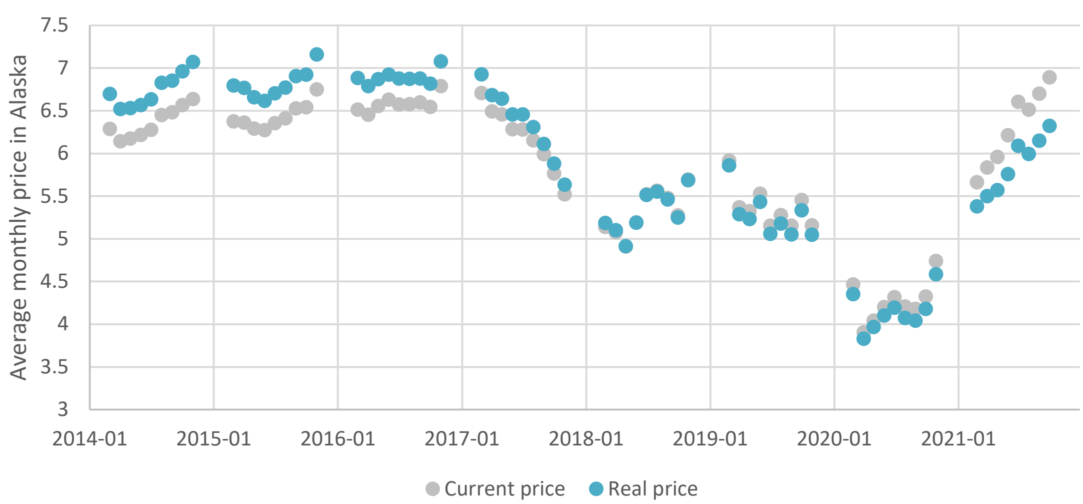
The majority of Pacific halibut on the North American market is produced from fish landed in Alaska or British Columbia, and processed in Canada or the United States, but wholesalers carry also Pacific halibut products originating from Russian waters processed in China. These are typically offered in the form of fletches (Tradex, 2021c).

The main substitute product is Atlantic halibut, but weak substitutes include Pacific cod and other whitefish (AFSC, 2019).

Table 1: Global Pacific halibut production (t, 2014-2020).

	2014	2015	2016	2017	2018	2019	2020[1]
Canada	3,619	3,710	3,747	3,812	3,330	3,163	2,959
USA	10,479	11,008	11,286	11,895	9,877	11,203	10,106
Russia	4,754	4,220	4,346	3,895	5,932	4,172	NA
% IPHC	74.8%	77.7%	77.6%	80.1%	69.0%	77.5%	NA

[1] Based on IPHC data. Note that the FAO data in principle should include harvest volume for all commercial, industrial, recreational, and subsistence purposes, and aquaculture. However, the FAO values for Canada and USA align with commercial landings reported by DFO (2021) and NOAA (2021a).



Notes: Based on eLandings data (ADFG, 2021). Converted from nominal to real prices using Consumer Price Index (CPI, BLS 2021), with baseline in January 2019.

Figure 1: Average monthly Pacific halibut ex-vessel price in Alaska.

regulations provide for the fishing season lasting until December 7 in all IPHC Regulatory Areas (latest update from 22 February 2021).

PROCESSING AND PRIMARY WHOLESALE

The total value of Pacific halibut products processed by Alaska and British Columbia (i.e., wholesale value)[3] in 2019 was about USD 165.3 mil., of which Alaska accounted for 66%.[4] The covid-19 pandemic had a considerable impact on the 2020 output of the processing sector in Alaska. The state noted a year-on-year drop in wholesale value by 28%, from USD 108.7 mil. in 2019 to USD 78.3 mil in 2020. The 2021 season was marked by a prompt recovery, with wholesale prices continuing an upward trend throughout the year (Tradex, 2021a). No Pacific halibut-specific statistics are currently available for the processing sector in British Columbia in 2020,[5] but monthly data on sales by the *Seafood product preparation and packaging* sector suggest a slow start of the 2020 season (year-on-year drop in July by 40% and in August by 20%, data for January-June suppressed to meet the confidentiality requirements) that picked up in the period from September to December, resulting in nearly the same output in terms of value when compared with 2019 (Statistics Canada, 2021b). Early indicators for 2021 (data available for July and August) suggest further strong recovery with a 29% year-on-year increase in sales (Statistics Canada, 2021b).

The main Pacific halibut product of both Alaska and British Columbia is headed and gutted (H&G fish). It accounted for 65% of 2019 Alaska production and 81% of 2018 British Columbia production. Fresh products dominate British Columbia's production (90% output value in 2018, includes fresh dressed fish and fresh fillets), while Alaska delivers a mix of fresh and frozen products (fresh products typically account for 50-60% of output value). Figure 2 and Figure 3 show year-to-year changes in Pacific halibut processing output by type of product (fresh, frozen, other) and wholesale value in comparison with landings value.

H&G fish are typically available as individually quick frozen (IQF) product, most commonly 60-80lb in size.[6] H&G fish marketed in North America are typically produced by national

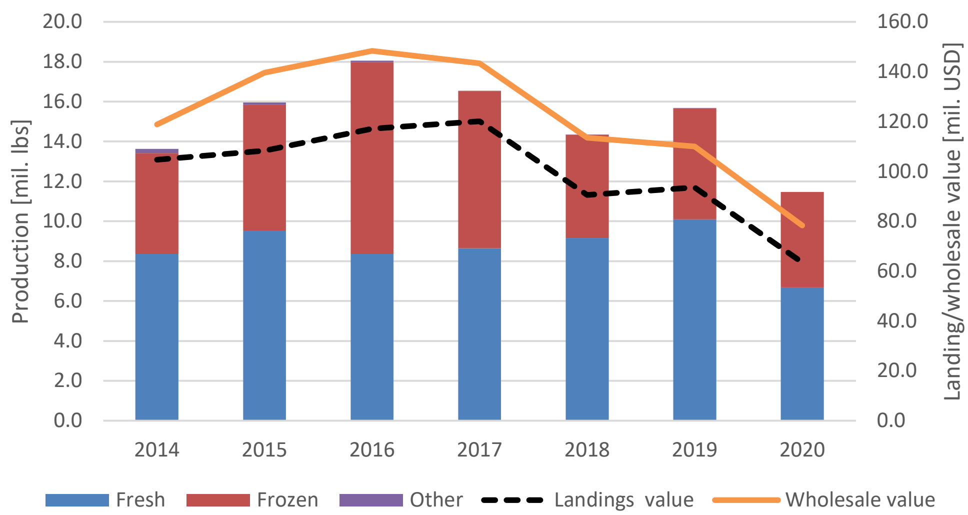
[3] This excludes commercial production in Washington, Oregon, and California (collectively, WOC). See details on gaps in economic statistics for the Pacific halibut processing sector described in IPHC-2021-ECON-02. The estimated output of the US West Coast is USD 5.0 mil. The estimate is based on the Pacific halibut multiregional economic impact assessment (PHMEIA) model (see details in IPHC-2021-IM097-14).

[4] The sum is based on values reported by the Alaska Department of Fish and Game (COAR, 2021) and the Province of BC (as reported to the IPHC, see IPHC-2021-AM097-NR01) In the case of British Columbia, the wholesale value may include the value of imported seafood. This is not the case for Alaska, particularly not for the last number of years. As noted by the ADFG, there may be a handful of records pertaining to such scenario, but these are not recent (Sabrina Larsen, ADFG, personal communication). The Secretariat also discussed with the Province of BC the possibility of splitting locally sourced production and processing of imports. The discussion is ongoing, and the Secretariat will be informing on any updates.

[5] Update on British Columbia's production statistics is anticipated by November/December 2021 (Kevin Romanin, Province of BC, personal communication).

[6] Wholesale market analysis beyond statistics published by national agencies is based on the historical prices for offers made via Tradex Live (Tradex, 2021c). Tradex Foods is sourcing, processing, distributing and marketing frozen seafood supplying over 40 mil. lbs per year to food service, supermarkets, and retailers worldwide. Tredex is based in Canada, and has offices in Victoria and Vancouver. The sample size for Pacific halibut products for 2018 was 153, for 2019 72,

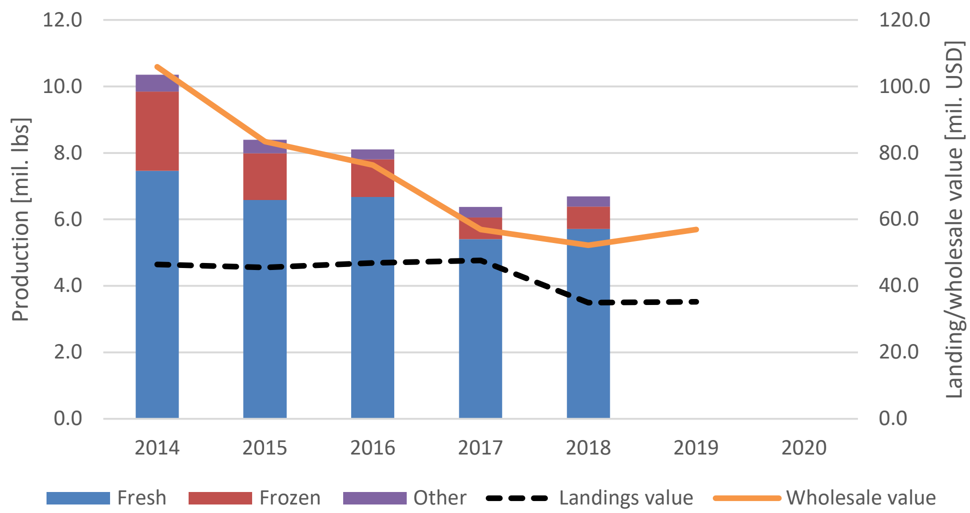
processors from Alaska and British Columbia's harvest. The second most popular product at the wholesale level is Pacific halibut IQF fletches (typically 1-3lb in size). The origin of the fletches, unlike the H&G fish, varies. What is available on the market is typically a mix of USA-produced fish originating from Alaskan waters and China-produced fish (typically 20-30% of offers on fletches, besides for 2020), much of which is produced from fish harvested in Russian waters. Harvest from Russia is typically about 10-35% cheaper (Table 2).



Based on data submitted through Commercial Operator's Annual Report (COAR, 2021).

Figure 2: Pacific halibut production – Alaska (2014-2020).

for 2020 34, and for 2021, to date, 13. Pacific halibut products are typically offered as Free on Board (FOB) Seattle, FOB Vancuver, or FOB Bellingham. FOB refers to a trade agreement in which the seller is responsible for clearing goods for export, delivering them to the vessel, and loading them for transport at the named port of departure.



Based on data provided by the Province of BC (Ministry of Agriculture). Full time series anticipated by November/December 2021 (James Dalby, Province of BC, personal communication).

Figure 3: Pacific halibut production - British Columbia (2014-2020).

Table 2: Pacific halibut prices on the wholesale market – comparison between Alaskan and Russian harvest (Tradex, 2021b).

	Fishing Area	2020	2019
Pacific halibut fletches, USA production, 1-3lb, 3-5lb	Alaska	USD 10.25-12.75/lb	USD 13.25-14.50/lb
Pacific halibut fletches, China production, 1-3lb, 3-5lb	Russia	USD 9.25-10.75/lb	USD 8.50-10.50/lb
Pacific halibut H&G, USA production, 10-20lb, 20-40lb	Alaska	USD 6.35-6.65/lb	USD 6.50-7.90/lb
Pacific halibut H&G, Russia production, 10-20lb, 20-40lb	Russia	USD 5.80/lb	USD 5.80/lb

RETAIL MARKET AND SERVICES

On the retail market, Pacific halibut is most commonly sold in the form of fillets (portions, 4-8oz each), but one can also find Pacific halibut steaks and halibut cheeks. Some retailers (e.g., Pike Place Fish Market in Seattle) would also sell fish whole. In 2021, fresh Alaskan Pacific halibut fillets routinely sold for USD 24-28 a pound (Welch, 2021), and often more, downtown Seattle (e.g., USD 38 at Pike Place Market). Online, Pacific halibut fillets currently (October 2021) retail at about USD 35-48 per pound for fillet portions and USD 35-36 per pound for steaks. Cheeks are available at USD 34-47 per pound.[7] Online,

[7] The analysis is based on the database created specifically to analyze retail prices of Pacific halibut. The database currently includes 21 retailers carrying Pacific halibut. It covers all places mentioned in the USA today as the best places to order seafood online (Birdsall, 2020), as well as major retailers that advertise Pacific halibut as a product

the shoppers can also choose between Pacific halibut and Atlantic halibut. Atlantic halibut typically retails at slightly lower prices. One online retailer also carried aquaculture-produced halibut from Norway at USD 30 per pound.[8]

Pacific halibut dishes at the restaurants in metropolitan areas typically sell for USD 37-43 for a dish including 6oz fish portion.[9] This translates to about USD 100-115 per pound.

Pacific halibut retail market and COVID-19

Widespread closure of restaurants (Figure 1),[10] the Pacific halibut's biggest customers, diminished the demand for fish, particularly high-quality fresh fish that fetch higher prices. Lower prices, down in 2020 by up to 30% in comparison with the previous year (Stremple, 2020), also seen in data from fish tickets from the eLandings reporting system, ADFG, 2021), caused a slow first half of the 2020 season (Ess 2020, IPHC, 2021). However, amidst the pandemic, Pacific halibut products also noted an increase in online sales, following the general trend for more seafood products consumption at home (Wells, 2020). At the beginning of the lockdown in spring 2020, halibut was the top 5th surging cooking recipe searched online in the Seattle-Tacoma metro area (Varriano, 2020). By spring 2021, the restaurant industry started showing a strong recovery (Kelso, 2021), pushing up the prices of Pacific halibut.

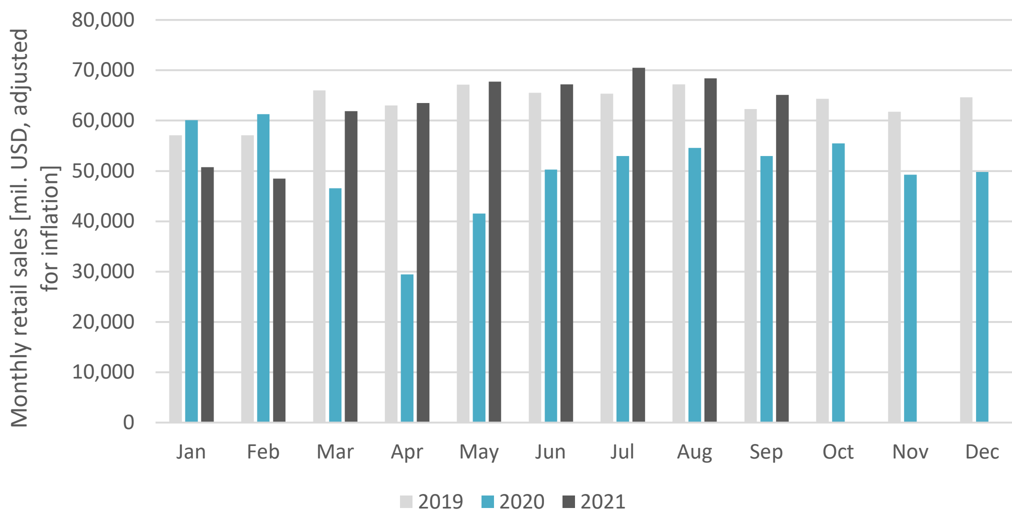
Less harvest activity in 2020 had repercussions in the economy beyond the harvest sector as it also affected harvest sector suppliers and downstream industries that rely on its output. Outbreaks of covid-19 in fish processing plants (Estus, 2020; Krakow, 2020) affected economic activity generated regionally by this directly related to the Pacific halibut supply sector. Moreover, seafood processors incurred additional costs related to protective gear, testing, and quarantine accommodations (Ross, 2020; Sapin & Fiorillo, 2020; Welch, 2020b), and these costs were passed on to consumers.

available on Instacart (i.e., prices could be verified via www.instacart.com). The database includes only products that are specifically advertised as Pacific halibut, i.e., excludes products when halibut species was not specified. The database also records the fishinf area.

[8] Norway is increasing aquaculture production of Atlantic halibut for export, including production of sashimi-grade halibut (Wright, 2018).

[9] Based on prices in 26 seafood restaurants in major metropolitan areas in Alaska, Washington, and Oregon (Anchorage, Seattle, Bellingham, Portland) that publish menus online (dinner offerings).

[10] Equivalent data for Canada is published by Statistics Canada annually and is currently available up to 2019 (Table 11-10-0125-01, Statistics Canada 2021). Thus, at this time, similar effects cannot be confirmed for Canada.



Converted from nominal to real values using Consumer Price Index (CPI, BLS 2021), with baseline in January 2019.

Figure 4: Monthly Retail Trade and Food Services - Food Services and Drinking Places: U.S. Total (US Census, 2021).

Certification of Pacific halibut products

Pacific halibut longline fishery in the Bering Sea off Alaska, and the Pacific waters off British Columbia and Washington state are certified by the Marine Stewardship Council (MSC). Sustainable production certification, such as the one offered by the MSC, typically adds about 15%, and up to 30% depending on fishery, premium to the product price (Asche & Bronnmann, 2017; Blomquist et al., 2019; Roheim et al., 2011; Vitale et al., 2020).

The USA MSC catch certification requires product landing at a processor listed on the certificate.[11] The BC catch is certified via the Pacific Halibut Management Association of BC (PHMA). Access to the certificate for Canada Pacific halibut is limited to approved fish buyers in good standing with PHMA.[12]

Pacific halibut Alaska catch is also certified through the Responsible Fisheries Management (RFM) certification program, which is aligned with the FAO Code of Conduct for Responsible Fisheries. RFM certificate also covers Pacific halibut delivered by Southeast Alaska salmon trollers.

[11] There are 35 companies approved to participate in the use of MSC Certification for Alaska and Washington state Pacific halibut (MSC-F-31514)

[12] Currently, there are 13 authorized fish buyers named in the Certificate (MSC-F-30019).

Western Bering Sea Pacific halibut longline fishery in Russian territorial waters operated by Longline Fishery Association (57 vessels in total) is also certified by the MSC (MSC-F-31439). This fishery is primarily processing fish on board and landing in the ports of Vladivostok or Petropavlovsk-Kamchatskyis.

Traceability

The ability to fully trace a product from the point of sale back to its point of origin, assuring fish is sustainably and legally caught, is increasingly important to customers, although it is mostly adopted in the relation to products that may be illegally sourced (e.g., use of blockchain in strengthening tuna traceability to combat illegal fishing, Visser & Hanich, 2018).

No widely-practices traceability initiatives were identified for Pacific halibut. However, one online retailer[13] advertised products traced to a specific fisher in the Prince William Sound.

SEAFOOD TRADE

Understanding the Pacific halibut trade balance is vital to assessing the total supply of Pacific halibut products available on the market. Export of the raw products eliminates it from the country's value chain, preventing additional value added contribution. Imports compete with other domestically-produced seafood, but can create additional economic impact when there are associated markups.

The NOAA database (NOAA, 2021b) provides no evidence for the export of fresh Pacific halibut, although some must be included in the generic category HS[14] 0302290100: *Flatfish NSPF fresh*. There is a modest import by Canada[15] of 'halibut' (HS 302210090: *Halibut NES fresh/chilled*) from Alaska (USD 11.9 mil. in 2019), and Washington and Oregon (USD 7.3 mil. in 2019), presumably dominated by Pacific halibut. Frozen Pacific halibut exports from the United States are lumped with Atlantic halibut (HS 303310015: *Flatfish halibut Atlantic, Pacific frozen)*. Within this category, exports from Alaska and WOC were USD 4.6 mil. in 2019. Comparing this with Canadian statistics suggests that the majority of frozen Pacific halibut is sent to the Canadian market (USD 4.3 mil., HS 0303310020: *Halibut, Pacific, frozen*). Overall, this suggests that the majority of the US-caught Pacific halibut is contributing to the US economy throughout its value chain. Exports of processed Pacific halibut products (e.g., fillets) are difficult to trace because they are generally merged with other halibut species and could include imported products.

[13] Crowd Cow, see details at https://www.crowdcow.com/products/wild-alaskan-halibut.
[14] The Harmonized System (HS) is a standardized numerical method of classifying traded products.
[15] Trade statistics provided directly by the Province of BC, personal communication.

Imports of fresh Pacific halibut, primarily coming from Canada (USD 29.5 mil., 89% from Canada in 2019; USD 23.1 mil., 89% from Canada in 2020), adds to the US domestic supply. There is, however, strong evidence that the domestic Pacific halibut is facing increasing pressure from imports. While the imports of fresh products (HS 302210020: *Flatfish Halibut Pacific Fresh*) increased between 2018 and 2019 only modestly (6%), import of frozen Pacific halibut (HS 0303310020: *Flatfish Halibut Pacific Frozen*) increased by 165%. The majority of the increase is attributed to imports from Russia. Although the import of frozen Pacific halibut is still modest (USD 7.5 mil. in 2019), there are growing concerns regarding the Alaskan Pacific halibut sector's vitality given the competition flooding the market with cheaper products (Welch, 2020a).

Fresh Pacific halibut accounts for about 5% of fresh fish exports from British Columbia, amounting to USD 26.1 mil. in 2019. Canadian statistics on exports of frozen Pacific halibut (HS 03033120: *Pacific halibut, frozen*) end in 2016, but replacing it generic frozen halibut category (HS 03033100: *Halibut frozen*) suggest that British Columbia exported in 2019 also up to USD 0.6 mil. worth of frozen Pacific halibut products. There are no fresh Pacific halibut-specific import statistics for Canada. Fresh Pacific halibut is lumped in HS 0302210090: *Halibu NES fresh/chilled*, but data on import from Alaska and WOC suggest import by British Columbia of USD 6.2 mil. and by Canada as a whole of USD 19.2 mil. Imports of frozen Pacific halibut fillets (HS 0304830020: *Fillets, of Pacific halibut, frozen*) by Canada amounted to USD 11.0 mil. in 2019, of which USD 9.0 mil. was from China.

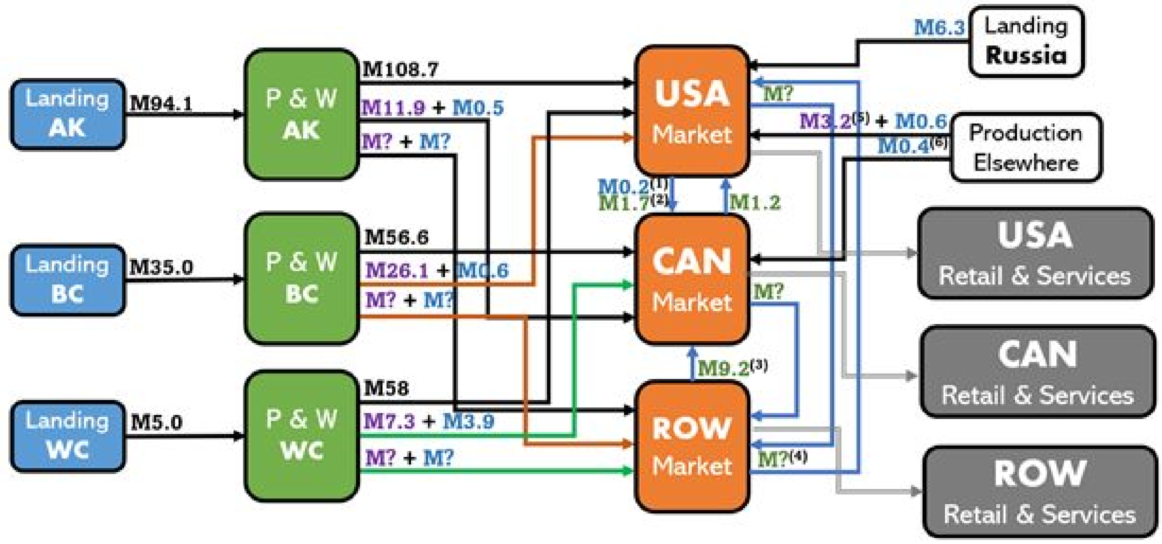
FINAL REMARKS

Figure 5 summarizes market flows for Pacific halibut, from the landing area to retail and services, accounting for trade balance in fresh, frozen, and processed products, when these could be attributed to Pacific halibut specifically.[16] Overall, it is estimated that the total value added activity related to Pacific halibut products added up to USD 230 mil. in the United States and USD 140 mil. in Canada. The total consumer expenditures on Pacific halibut products in the United States are assessed at USD 460 mil, and in Canada at USD 232 mil. **Table 2** in the Appendix I summarizes calculations of the value added, margins, and consumer expenditures for commercial Pacific halibut fishery products in Canada and the United States in 2019.

Understanding the formation of the price paid by final consumers (end-users) is an important step in assessing the contribution of Pacific halibut to the GDP along the entire value chain. However, it is important to note that there are many seafood substitutes available to buyers. Thus, including economic impacts beyond processors and

[16] As noted in section Seafood trade, processed Pacific halibut products (e.g., fillets) are often difficult to trace because they are generally merged with other halibut species and could include imported products.

wholesalers in the economic impact assessment (i.e., PHMEIA model, see details in IPHC-2021-IM097-14), as opposed to assessing the snapshot contribution to the GDP along its entire value chain, would be misleading when considering that it is unlikely that supply shortage would result in a noticeable change in retail or services level gross revenues (Steinback & Thunberg, 2006).



Notes: All values associated with arrows are based on 2019 data, all in millions USD. P&W stands for processing and wholesale. This includes seafood products preparation and packaging., i.e., the output can be fresh fish. ROW stands for the rest of the world, i.e., all countries besides Canada and the United States. Values in black indicate domestic production. Values in color inform on trade: purple – fresh fish, blue – frozen fish, and green – processed products (here: fillets). (1) Imports of frozen products from states other than AK, WA, OR, or CA. (2) See footnote 19. (3) Of which USD 9.0 mil. coming from China. (4) Excludes processed products because it is reported without the distinction between halibut species. However, fletches produced from Russian harvest processed in China are available on the market (Tradex, 2021c). (5) USD 2.5 mil. reported as imported from Mexico. (6) Of which USD 0.3 mil. coming from South Korea.

Figure 5: Market flows for Pacific halibut.

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Appendix I

***Table 3**: Summary of 2019 value added, margins, and consumer expenditures for commercial Pacific halibut fishery products in Canada and the United States.*

Sector or type of activity	Purchase of fishery inputs	Mark-up of fishery inputs	Total mark-up within sector	Value added as a percent of total mark-up	Value added within sector	Value of sales by sector	Value added contribution	Exported fishery products[17]	Source
	[mil. USD]	Percentage of fishery inputs	[mil. USD]	Percentage	[mil. USD]	[mil. USD]	Percentage of GDP contribution	[mil. USD]	
USA									
Domestic harvest									
AK	-	100%	94.1	27.9%	26.3	94.1	11.4%	-	(AKFIN, 2021)
WA, OR, CA (WOC)	-	100%	5.0	40.4%	2.0	5.0	0.9%	-	(PacFIN, 2021)
Processing/wholesale									
AK	92.5	17.5%	16.2	17.4%	2.8	108.7	1.2%	-	(COAR, 2021)
WA, OR, CA (WOC)	5.0	14.8%	0.7	37.1%	0.3	5.8	0.1%	-	Markup based on communication with NOAA (Jerry Leonard, NOAA NWFSC, pers. com.)
Rest of the USA	~0	n.a.	n.a.	n.a.	~0	~0	~0%	-	No indication of processing outside AK/WOC
Imports, fresh	29.5	-	-	-	-	29.45	-	-	(NOAA, 2021b)[18]
Exports, fresh	-	-	-	-	-	-	-	19.2	(Katie Fraser, Province of BC, pers. com.)[19]
Import, frozen	7.5					7.45			(NOAA, 2021b)[20]
Export, frozen	-	-	-	-	-	-	-	4.3	(Katie Fraser, Province of BC, pers. com.)[21]

[17] This could also include harvest landed in foreign ports, but this does not apply to Pacific halibut.
[18] Includes HS 0302210020: *Flatfish halibut Pacific fresh*. Canada accounts for the majority (89% in 2019) of this import.
[19] Pacific halibut may be included in NOAA's database (NOAA, 2021b) under HS 0302290100: *Flatfish NSPF fresh*. Canadian statistics specify the import of fresh halibut (HS 0302210090: *Halibut NES fresh/chilled)* from Alaska, Washington, and Oregon. Here, we assume that fresh halibut from these regions is most likely Pacific halibut.
[20] Includes HS 0303310020: *Flatfish halibut Pacific frozen*. The majority of this production (84% in 2019) is coming from Russia but monor import is also recorded from China and South Korea. Canada accounts for a small portion (3% in 2019) of this import.
[21] NOAA's database (NOAA, 2021b) lumps exports of frozen Pacific halibut with frozen Atlantic halibut (HS 0303310015: *Flatfish halibut Atlantic Pacific frozen*). As the majority of this category is reported as destined for Canada, we use here HS 0303310020: *Halibut Pacific frozen* imports to Canada from Alaska, Washington, Oregon, and California.

Imports, processed	1.2	-	-	-	-	1.2	-	-	(NOAA, 2021b)[22]
Exports, processed	-	-	-	-	-	-	-	2.1	(NOAA, 2021b)[23]
Secondary processing	127.0	63%	80.0	28%	22.4	207.0	9.8%		FUS[24]
Retail									
Food service	124.2	182%	226.0	70%	158.2	350.19	68.9%	-	FUS
Stores	82.8	33%	27.3	64%	17.5	110.11	7.6%	-	FUS
TOTAL VALUE ADDED ACTIVITY					229.5		100%		
CONSUMER EXPENDITURES						460.3			
Canada									
Domestic harvest									
BC	-	100%	35.0 [CAD 46.4]	88.9	31.1	35.0 [CAD 46.4]	22.2%	-	Direct report to the IPHC (IPHC-2021-AM097-NR01)
Processing / wholesale									
BC	35.0 [CAD 46.4]	61.7%	21.6	42.4%	9.1	56.6 [CAD 75.1]	6.5%	-	Direct report to the IPHC (IPHC-2021-AM097-NR01)
Rest of Canada	~0	n.a.	n.a.	n.a.	~0	~0	~0%	-	No indication of processing outside BC
Imports, fresh	19.2	-	-	-	-	19.2	-	-	(Katie Fraser, Province of BC, pers. com.)[25]
Exports, fresh	-	-	-	-	-	-	-	26.1	(Katie Fraser, Province of BC, pers. com.)[26]
Import, frozen	5.0	-	-	-	-	5.0	-		(Katie Fraser, Province of BC, pers. com.)[27]
Export, frozen	-	-	-	-	-	-	-	0.6	(NOAA, 2021b)[28]

[22] This includes HS 0304835025: *Flatfish Halibut NSPF fillet frozen* imported from Canada to Alaska and WOC only. This is most likely an underestimate, because the Pacific halibut is also produced by Russia. The number may be also confounded by imports of Atlantic halibut from Canada, but imports to the West Coast are assumed to be dominated by Pacific halibut.

[23] This includes HS 0304835005: *Flatfish halibut NSPF fillet frozen*, only export from Alaska and Washington (97.8% for this product export). This would be an underestimate in the case of secondary processing elsewhere in the United States.

[24] Calculated based on the average mark-up of fishery inputs and value added as a percent of total mark-up reported by NMFS (2018), Fisheries in the United States (FUS) report.

[25] Canadian trade statistics only record imports for generic fresh halibut products (HS 0302210090: *Halibut NES fresh/chilled*). Here, we report only import from Alaska, Washington and Oregon, assuming this reflects import of Pacific halibut as opposed to Atlantic halibut. However, import from the rest of the world is expected to play an increasing role in the coming years, and alternative sources for understanding Canada's Pacific halibut imports should be reviewed.

[26] Here, HS 03022120: *Halibut Pacific fresh/chilled* was used. US market is nearly the only export destination recorded for this product (99.994% in 2019).

[27] This includes HS 0303310020: *Halibut Pacific frozen*. Alaska, Washington and Oregon account for the majority (86.3% in 2019) of frozen import.

[28] Includes US imports of HS 0303310020: *Flatfish halibut Pacific frozen*. More generic category in the Canadian database (HS 03033100: *Halibut frozen*) reports nearly the same value and indicates that nearly all of this product (96.8% in terms of value in 2019) goes to the United States.

Imports, processed	11.0	-	-	-	-	11.0	-	-	(Katie Fraser, Province of BC, pers. com.)[29]
Exports, processed	-	-	-	-	-	-	-	1.2	(NOAA, 2021b)[30]
Secondary processing	63.9	63%	40.3	28%	11.3	104.2	8.1%		FUS
Retail									
Food service	62.5	182%	113.8	70%	79.7	176.3	56.9%	-	FUS
Stores	41.7	33%	13.8	64%	8.8	55.4	6.3%	-	FUS
TOTAL VALUE ADDED ACTIVITY					140.0		100%		
CONSUMER EXPENDITURES						231.8			

Note: The table reports the contribution of commercial marine fishing to the national economy as measured by margin, value added, and sales. These measures are consistent with the Bureau of the Census definitions. n.a. – not applicable. Values in blue are from the Pacific halibut multiregional economic impact assessment (PHMEIA) model (see details in IPHC-2021-IM097-14). Values in grey are trade values that are derived based on the noted assumptions and may be underestimates/overestimates. All reported trade may be underestimated if Pacific halibut or some of its products are included in more generic product categories. The analysis was limited to products that included halibut. Values in orange are calculated based on the average mark-up of fishery inputs and value added as a percent of total mark-up reported by NMFS (2018), in the Fisheries in the United States (FUS) report. These are likely underestimates for Pacific halibut, which is typically sold as a high-end product. FUS assumes reports about fifty-fifty split for edible products between food services and stores. For Pacific halibut, we assume a slightly higher share of restaurant sales (60%). The results herein are part of a continuing analysis and subject to change.

[29] Includes HS 0304830020: *Fillets of Pacific halibut*.
[30] Includes HS 0304835025: *Flatfish halibut NSFP Fillet frozen*, limited to imports by WOC from Canada. This is likely an underestimate, because it would not include any exports to other countries.

INTERNATIONAL PACIFIC HALIBUT COMMISSION

A description of the IPHC fishery-independent setline survey (FISS) abundance-based management (ABM) index

PREPARED BY: IPHC SECRETARIAT (29 NOVEMBER 2021)

PURPOSE

This document provides a description of the abundance-based management (ABM) index developed from the IPHC Fishery-Independent Setline Survey (FISS).

BACKGROUND

Abundance-based management (ABM) of the Pacific halibut Prohibited Species Catch (PSC) limit is currently being evaluated by the North Pacific Fishery Management Council (NPFMC). The alternatives being evaluated include two-dimensional look-up tables to determine the PSC limit dependent on the Eastern Bering Sea (EBS) trawl survey index and the International Pacific Halibut Commission (IPHC) Fishery-Independent Setline Survey (FISS)[1] index. Breakpoints for these two survey indices define categories from which the PSC limit is determined (Figure 1). The EBS trawl survey index is categorized as low or high, and the IPHC FISS index is categorized into a low, medium, or high category along with a very low category for two of the three alternatives.

Alternative 3		**EBS shelf trawl survey index (t)**	
		Low **< 150,000**	**High** **≥** **150,000**
IPHC setline survey index in Area 4ABCDE (WPUE)	**High** **≥ 11,000**	1,745 mt (current limit)	2,007 mt (15% above current)
	Medium **8,000 – 10,999**	1,396 mt (20% below current)	1,745 mt (current limit)
	Low **6,000-7,999**	1,309 mt (25% below current)	1,396 mt (20% below current)
	Very Low **< 6,000**	1,222 mt (30% below current)	1,309 mt (25% below current)

Figure 1. Alternative #3 being considered by the NPFMC for determination of Pacific halibut PSC limits. This is one of three alternatives being considered.

This document describes the IPHC FISS index, how it is calculated, and provides some insights and potential alternative calculations. It updates the index to include the 2021 estimate.

[1] https://iphc.int/management/science-and-research/fishery-independent-setline-survey-fiss

METHODS

The methods used to calculate the ABM index are provided below. The ABM index is calculated from model outputs provided by IPHC. Three different calculations of the ABM index are provided for consideration. They are exactly the same in trends, but have different units associated with them.

Space-Time model

The IPHC FISS data are analysed using a spatiotemporal model (called the space-time model) to account for correlations between observations in space and time (IPHC-2021-IM097-08 Rev_1, Webster et al 2020). This has a number of benefits, one of which is the ability to predict unobserved stations. This improves the consistency between years and reduces concerns regarding the influence of missed stations in some years.

The model parameters are estimated for the entire time-series with the addition of new data. Therefore, when a new year is available, the index values for all years are updated. Years farther back in time are typically less affected unless the new data provide a significant update to the model parameters or provide information on a region that was unsampled or sparsely sampled in the past. The use of additional data to update the understanding of the entire time-series is a very useful outcome of this approach and these types of methods are being adopted in many analyses of fisheries and survey data.

Timing of FISS and space-time model output

The FISS is conducted annually from late May until mid-September. Collected data are immediately vetted and finalized for analysis in early October. The space-time modelling takes several weeks to complete, and the space-time results are typically available in November.

The space-time model output consists of weight-per-unit-effort (WPUE) in the units of net[2] pounds per standardised skate (100 hooks, 1800 feet in length) for each IPHC Regulatory Area (Figure 2). The ABM index uses all sizes encountered by the FISS and combines observations across IPHC Regulatory Area 4A, 4B, and 4CDE. Station-level WPUE values are standardized to account for the effects of hook competition on catch rates using adjustments calculated from the proportion of returned baits (e.g. greater % of returned baits implies less competition, IPHC-2021-SRB019-05).

[2] Net pounds refer to the weight with the head and entrails removed; this is approximately 75% of the round (wet) weight.

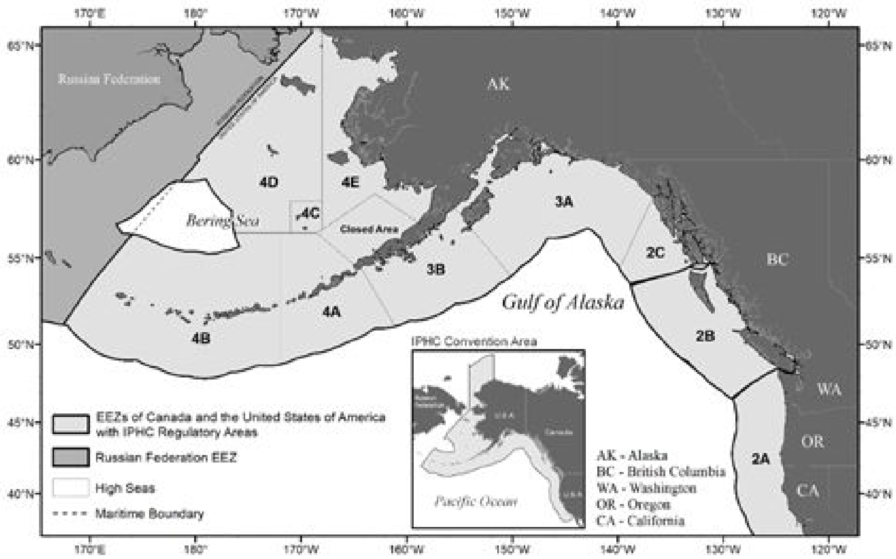

Figure 2. IPHC Convention Area (inset) and IPHC Regulatory Areas.

For each Regulatory Area, bottom area multiplied by mean WPUE provides a biomass index for that area. Therefore, an appropriate index combined across these IPHC Regulatory Areas uses the bottom area within the 0 to 400 fathom depth range (the assumed range of Pacific halibut habitat) to weight the mean WPUE from each IPHC Regulatory Area. Thus, this index is determined as follows.

$$I_{ABM,y} = \sum_{i \in \{4A,4B,4CDE\}} WPUE_{i,y} * A_i \quad (1)$$

where A_i is the bottom area (nm^2) within the IPHC Regulatory Area (which is subject to occasional revision as new bathymetry data become available). The resulting units of this index are net pounds*nm^2/skate which is not intuitive. More intuitive outputs may be to standardise the index to a specific year or to divide equation (1) by the total bottom area, thus yielding a weighted average in the original WPUE units of net pounds per skate.

Standardising the index to a particular year has been considered during the development of ABM approaches. For example, standardising the index to the value predicted for 2019 or 2021 would provide an indication of whether the index is above or below that year and by what amount. This calculation, standardising to 2019 for example, would simply be

$$I^{s}_{ABM,y} = \frac{I_{ABM,y}}{I_{ABM,2019}} \quad (2)$$

where $I_{ABM,y}$ is the year-specific index from equation (1) above. There are no units on this standardised index, as it is relative to a specific year. The value for 2019 ($I^{s}_{ABM,2019}$) would always be 1.0 regardless of changes to the time-series predicted from the space-time model. The benefit of this is that the variability due to re-analysis of the data each year is reduced and the index is more reflective of relative changes in the Pacific halibut abundance.

Another approach is to simply use the bottom areas as weights in a weighted mean. This is analogous to equation (1) except that the sum of the bottom areas is used as a divisor.

$$I^{w}_{ABM,y} = \frac{\sum_{i\in\{4A,4B,4CDE\}} WPUE_{i,y} * A_i}{\sum_{i\in\{4A,4B,4CDE\}} A_i} \quad (3)$$

The units on this index are net pounds per skate, which is more intuitive than those from equation (1).

ABM index

The three versions of the index are presented in Table 1 along with the resulting units of each version. Two different standardisations are provided for index version (2): one is standardised to 2019 as has been suggested at previous ABM discussions, and the other is standardised to 2021 which is the most recent year that an index is available. They all show the exact same trends, but provide different absolute numbers reflective of the resulting units.

For each version of the index, the breakpoints for the look-up table are provided in Table 2. These breakpoints are simply mapped from the breakpoints provided in the current Council alternatives. Given these breakpoints and the appropriate version of the index (Table 1) the outputs from the lookup table (i.e. PSC limit) would be exactly the same for the year of interest.

DISCUSSION

The IPHC FISS data are analysed using a state-of-the-art space-time model that has been peer reviewed and accepted by the International Pacific Halibut Commission. The ABM index uses these model outputs to calculate an index over IPHC Regulatory Areas 4A, 4B, and 4CDE. This includes appropriately weighting by the bottom area in each IPHC Regulatory Area.

Two alternative version of the index are provided for consideration. All three versions show the exact same trends, but each has different units associated with it and thus differs only in scale. This simply provides different interpretations of the index without changing the output PSC limit based on the index in a particular year. The currently accepted ABM index has units of net pounds times nm^2 per skate, which is complicated and unfamiliar to most stakeholders. A simple change to the calculation of the index, which only changes the absolute scale of the index but not the trends, leads to units of average net pounds per skate. This has a clear meaning and can be easily interpreted by many stakeholders. Another alternative method standardises the index to a specific year, such as its 2019 or 2021 value, providing an interpretation relative 2019 and the additional benefit of reducing interannual variability in the index due to revisions in the space-time model output with each additional year of data.

All three versions of the index presented here would result in the same PSC limit when the breakpoints of the lookup table are appropriately mapped to the index. However, the standardised index is the only one that reduces interannual variability and the potential confusion that updating the index in each year may bring. For example, the 2019 index value was calculated as 7,104 in 2019, 7,460 in 2020 (with the addition of 2020 space-time model outputs produced in the absence of Bering Sea IPHC and NMFS surveys), and 7,227 in 2021 (using data through 2021 as presented in Table 1). The interannual variability in the index is minimised by standardising the index to a specific year. The clearest example is that the index for 2019 would be 1.0 regardless of which year it was calculated in. The trend between years may change interannually, resulting in a change to the standardised version of the index, but that interannual variability would be less than the other versions of the index. For example, the 2018 ABM index was 7,228 in 2019, 7,709 in 2020, and 7,550 in 2021, thus increased by 6.7% then decreased by 2.1%. The standardised version of the index for 2018 was 1.02, 1.03, and 1.04 in 2019, 2020, and 2021, respectively, thus increased by 1% in each year. Another benefit of the standardised version of the index is that the breakpoints can be clearly presented as a percentage difference from 2019. For example, a breakpoint of 1.51 means that the index would be 51% higher than in 2019. The standardised version of the index may lose some interpretability if a specific measure such as net pounds per skate is desired for setting breakpoints in the lookup table. Therefore, the third version of the index is presented as an option.

Any of the three versions of the index can be easily calculated once the modelling is completed at IPHC and is expected to be available before the December NPFMC meeting in any given year.

REFERENCES

Webster, R.A., Soderlund, E., Dykstra, C.L., and Stewart, I.J. 2020. 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 **77**: 1421-1432.

Table 1. The ABM index for the years 1998–2021 along with two alternative versions.

Year	ABM index	Standardised index	Standardised index	Weighted average index
Equation	(1)	(2)	(2)	(3)
Units	net pounds*nm²/skate	Relative to 2019	Relative to 2021	net pounds/skate
1998	18,254	2.526	2.625	70.6
1999	16,069	2.223	2.310	62.1
2000	15,859	2.194	2.280	61.3
2001	13,538	1.873	1.947	52.4
2002	12,025	1.664	1.729	46.5
2003	10,988	1.520	1.580	42.5
2004	10,366	1.434	1.490	40.1
2005	10,182	1.409	1.464	39.4
2006	10,472	1.449	1.506	40.5
2007	10,481	1.450	1.507	40.5
2008	11,081	1.533	1.593	42.9
2009	10,338	1.430	1.486	40.0
2010	9,725	1.346	1.398	37.6
2011	9,340	1.292	1.343	36.1
2012	8,858	1.226	1.274	34.3
2013	8,514	1.178	1.224	32.9
2014	8,457	1.170	1.216	32.7
2015	8,638	1.195	1.242	33.4
2016	8,469	1.172	1.218	32.8
2017	7,819	1.082	1.124	30.2
2018	7,550	1.045	1.086	29.2
2019	7,227	1.000	1.039	28.0
2020	7,134	0.987	1.026	27.6
2021	6,955	0.962	1.000	26.9

Table 2. The breakpoints of the setline survey index for the lookup table in different units reflective of the units for each version of the ABM index.

Classification	ABM index	Standardised index	Standardised index	Weighted average index
Equation	(1)	(2)	(2)	(3)
Units	net pounds*nm²/skate	Relative to 2019	Relative to 2021	net pounds/skate
High	≥ 11,000	≥ 1.52	≥ 1.58	≥ 42.5
Medium	8,000–10,999	1.11–1.51	1.15–1.57	30.9–42.49
Low	6,000–7,999	0.83–1.10	0.86–1.14	23.2–30.89
Very Low	< 6,000	< 0.83	< 0.86	< 23.2

IPHC Fishery Regulations:

Mortality and Fishery Limits (Sect. 5)

PREPARED BY: IPHC SECRETARIAT (12 OCTOBER 2021)

PURPOSE

To improve clarity and transparency of fishery limits within the IPHC Fishery Regulations: Mortality and Fishery Limits (Sect. 5).

BACKGROUND

The Commission considers new and revised IPHC Fishery Regulations, including proposed changes to mortality and 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 is to amend IPHC Fishery Regulations Section 5, '*Mortality and Fishery 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 domestic catch sharing arrangements.

DISCUSSION

IPHC Fishery Regulations Section 5, '*Mortality and Fishery Limits,'* was adopted in 2021 in order to provide clear documentation of the limits for fishery sectors within defined Contracting Party domestic catch sharing arrangements, which are themselves tied to the mortality distribution (TCEY) decisions of the Commission. This section includes 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 98th Session of the IPHC Annual Meeting (AM098) in January 2022.

Benefits/Drawbacks: The benefit is a 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. The intention is to reinforce that distinction by clarifying

[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.

which decisions are made by the Commission.

Sectors Affected: This proposal affects all sectors of the Pacific halibut fishery.

ADDITIONAL DOCUMENTATION / REFERENCES

None

RECOMMENDATIONS

That the Commission:

1) **NOTE** regulatory proposal IPHC-2021-IM097-PropA1, which provides the Commission with an opportunity to recall the format of the IPHC Fishery Regulations: *Mortality and Fishery Limits* (Sect. 5), which will be populated at the next Annual Meeting of the Commission.

APPENDICES

Appendix A: Suggested IPHC Fishery Regulation Language

APPENDIX A

SUGGESTED REGULATORY LANGUAGE

5. Mortality and Fishery Limits

(1) The Commission has adopted the following distributed mortality (TCEY) values:

IPHC Regulatory Area	***Distributed mortality limits (TCEY) (net weight)***	
	Tonnes (t)	**Million Pounds (Mlb)**
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)		
Total		

(2) The fishery limits resulting from the IPHC-adopted distributed mortality (TCEY) limits and the existing Contracting Party catch sharing arrangements are as follows, recognising that each Contracting Party may implement more restrictive limits:

IPHC Regulatory Area	***Fishery limits (net weight)***	
	Tonnes (t)	**Million Pounds (Mlb)**
Area 2A (California, Oregon, and Washington)		
Non-tribal directed commercial (south of Pt. Chehalis)		
Non-tribal incidental catch in salmon troll fishery		
Non-tribal 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 (X.XX Mlb catch and 0.XX Mlb incidental mortality)		
Guided recreational fishery (includes catch and incidental mortality)		
Area 3A (central Gulf of Alaska) (combined commercial/guided recreational)		
Commercial fishery (X.XX Mlb catch and 0.XX Mlb incidental mortality)		
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		

* Allocations resulting from the IPHC Regulatory Area 2A Catch Share Plan are listed in *pounds*.

IPHC Fishery Regulations:

Commercial Fishing Periods (Sect. 9)

PREPARED BY: IPHC SECRETARIAT (12 OCTOBER 2021)

PURPOSE

To specify fishing periods for the directed commercial Pacific halibut fisheries within the IPHC Fishery Regulations: Commercial Fishing Periods (Sect. 9).

BACKGROUND

Each year the International Pacific Halibut Commission (IPHC) selects fishing period dates for the directed 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.

These dates have varied from year to year, and in recent years have allowed directed commercial fishing to begin sometime in March and end sometime in November or December for all IPHC Regulatory Areas with the exception of IPHC Regulatory Area 2A.

DISCUSSION

The IPHC Secretariat proposes that the commercial fishing periods for all IPHC Regulatory Areas be set at AM098 following stakeholder input.

No change is recommended for IPHC Regulatory Area 2A for 2021 given the fishery's management is transitioning from the IPHC to domestic agencies within the USA.

Expected outcomes

Should the transition of management authority of the IPHC Regulatory Area 2A non-tribal directed commercial Pacific halibut fishery from the IPHC to the Pacific Fishery Management Council (PFMC) and NOAA-Fisheries be completed, the need for setting dates for the 2A derby fishery would no longer be an IPHC consideration and the dates would be set by the Contracting Party within the overall commercial fishing period dates.

Sectors Affected: Commercial Pacific halibut fisheries in each IPHC Regulatory Area.

RECOMMENDATIONS:

That the Commission:

1) **NOTE** fishery regulation proposal IPHC-2021-IM097-PropA2, which proposed the adoption of fishing periods for the commercial Pacific halibut fisheries within the IPHC Pacific Halibut Fishery Regulations: Commercial Fishing Periods (Sect. 9).

APPENDICES

Appendix A: Suggested regulatory language

APPENDIX A
SUGGESTED REGULATORY LANGUAGE

9. Commercial Fishing Periods

(1) The fishing periods for each IPHC Regulatory Area apply where the fishery limits specified in section 5 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 1200 local time on ~~6 March~~DD MMMM.

(3) All commercial fishing for Pacific halibut in all IPHC Regulatory Areas shall cease for the year at 1200 local time on ~~7 December~~DD MMMM.

(4) The first fishing period in the IPHC Regulatory Area 2A non-tribal directed commercial fishery[2] shall begin at 0800 on the fourth Tuesday in June and terminate at 1800 local time on the subsequent Thursday, unless the Commission specifies otherwise. If the Commission determines that the fishery limit specified for IPHC Regulatory Area 2A in Section 5 has not been exceeded, it may announce a second fishing period of up to three fishing days to begin on Tuesday two weeks after the first period, and, if necessary, a third fishing period of up to three fishing days to begin on Tuesday four weeks after the first period.

(5) Notwithstanding paragraph (4), and paragraph (6) of section 12, an incidental catch fishery[3] 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 (4), and paragraph (6) 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.

[2] The non-tribal directed fishery is restricted to waters that are south of Point Chehalis, Washington, (46°53.30´ N. latitude) under regulations promulgated by NOAA Fisheries and published in the Federal Register.

[3] The incidental fishery during the directed, fixed gear sablefish season is restricted to waters that are north of Point Chehalis, Washington, (46°53.30´ N. latitude) under regulations promulgated by NOAA Fisheries at 50 CFR 300.63. Landing restrictions for Pacific halibut retention in the fixed gear sablefish fishery can be found at 50 CFR 660.231.

12. Application of Commercial Fishery Limits

(1) …

(5) If the Commission determines that the fishery limit specified for IPHC Regulatory Area 2A in section 5 would be exceeded in an additional directed commercial fishing period as specified in paragraph (4) of section 9, the fishery limit for that area shall be considered to have been taken and the directed commercial fishery closed as announced by the Commission.

IPHC Fishery Regulations: minor amendments

PREPARED BY: IPHC SECRETARIAT (22 OCTOBER 2021)

PURPOSE

To improve clarity and consistency in the IPHC Fishery Regulations.

BACKGROUND

This proposal would make minor clarifying amendments to the existing IPHC Fishery Regulations. The proposed revisions are a result of a review by the Secretariat and consultations with domestic agencies.

DISCUSSION

Periodically, the IPHC Fishery Regulations are reviewed to ensure they are clear, concise, consistent, and current. The proposed revisions, which are outlined below in detail, are a result of a holistic review performed by the Secretariat, as well as discussions with the domestic agencies. Input from Contracting Parties was sought to streamline the process of adopting the revised regulations at the 98th Session of the IPHC Annual Meeting (AM098).

Proposed amendments to the IPHC Fishery Regulations:

1. Section 3, Definitions, (1)(b) would include "*an authorized representative of the Commission*."
2. Section 3, Definitions would include the following definition of an authorized representative of the Commission: "any IPHC employee or contractor authorized to perform any task described in these Regulations."
3. Section 8, Retention of Tagged Pacific Halibut, (1)(a) and (1)(b) would include "an authorized representative of the Commission."
4. Section 11, Closed Periods, (6) and (7) would include "an authorized representative of the Commission."
5. Section 16, Vessel Clearance in IPHC Regulatory Area 4, (3)-(5) and (7)-(10) would use "*the authorized clearance personnel*."
6. Minor edits throughout for stylistic consistency among Sections.

Appendix A provides details on the suggested regulatory language.

Benefits/Drawbacks: The benefit is clearer and more consistent regulations that are easier to use. No known drawbacks.

Sectors Affected: This proposal affects all sectors of the Pacific halibut fishery.

RECOMMENDATIONS:

That the Commission:

1) **NOTE** regulatory proposal IPHC-2021-IM097-PropA3, which recommends changes to improve the clarity and transparency of the IPHC Fishery Regulations.
2) **ADOPT** the recommended changes to the IPHC Fishery Regulations as provided in Appendix A at AM098 in January 2022.

ADDITIONAL DOCUMENTATION / REFERENCES

None

APPENDICES:

APPENDIX A: Suggested regulatory language

APPENDIX A
SUGGESTED REGULATORY LANGUAGE

1. Section 3, Definitions, (1)(b) would include "an authorized representative of the Commission."

3. Definitions

(1) In these Regulations, […]

(b) "authorized clearance personnel" means an authorized officer of the United States of America, an authorized representative of the Commission, or a designated fish processor;

1. Section 3, Definitions would include the following definition of an authorized representative of the Commission: "any IPHC employee or contractor authorized to perform any task described in these Regulations."

3. Definitions

(1) In these Regulations, […]

(c) "authorized representative of the Commission" means any IPHC employee or contractor authorized to perform any task described in these Regulations.

2. Section 8, Retention of Tagged Pacific Halibut, (1)(a) and (1)(b) would include "an authorized representative of the Commission."

8. Retention of Tagged Pacific Halibut

(1) Nothing contained in these Regulations prohibits any vessel at any time from retaining and landing a Pacific halibut that bears a Commission external tag at the time of capture, if the Pacific halibut with the tag still attached is reported at the time of landing and made available for examination by an authorized representative of the Commission or by an authorized officer.

(2) After examination and removal of the tag by an authorized representative of the Commission or an authorized officer, the Pacific halibut:

(a) may be retained for personal use; or

(b) may be sold only if the Pacific halibut is caught during commercial Pacific halibut fishing and complies with the other commercial fishing provisions of these Regulations.

3. Section 11, Closed Periods, (6) and (7) would include "an authorized representative of the Commission."

11. Closed Periods

(6) A vessel that has no Pacific halibut on board may retrieve any Pacific halibut fishing gear during the closed period after the operator notifies an authorized officer or an authorized representative of the Commission prior to that retrieval.

(6) A vessel that has no Pacific halibut on board may retrieve any Pacific halibut fishing gear during the closed period after the operator notifies an authorized officer or an authorized representative of the Commission prior to that retrieval.

4. Section 16, Vessel Clearance in IPHC Regulatory Area 4, (3)-(5) and (7)-(10) would use "*the authorized clearance personnel*."

16. Vessel Clearance in IPHC Regulatory Area 4

(3) The vessel clearance required under paragraph (1) prior to fishing in IPHC Regulatory Area 4A may be obtained only at Nazan Bay on Atka Island, Dutch Harbor, or Akutan, Alaska, from the authorized clearance personnel.

(4) The vessel clearance required under paragraph (1) prior to fishing in IPHC Regulatory Area 4B may only be obtained at Nazan Bay on Atka Island or Adak, Alaska, from the authorized clearance personnel.

(5) The vessel clearance required under paragraph (1) prior to fishing in IPHC Regulatory Area 4C or 4D may be obtained only at St. Paul or St. George, Alaska, from the authorized clearance personnel by VHF radio and allowing the person contacted to confirm visually the identity of the vessel.

[…]

(7) Before unloading any Pacific halibut caught in IPHC Regulatory Area 4A, a vessel operator may obtain the clearance required under paragraph (1) only in Dutch Harbor or Akutan, Alaska, by contacting the authorized clearance personnel.

(8) Before unloading any Pacific halibut caught in IPHC Regulatory Area 4B, a vessel operator may obtain the clearance required under paragraph (1) only in Nazan Bay on Atka Island or Adak, by contacting the authorized clearance personnel by VHF radio or in person.

(9) Before unloading any Pacific halibut caught in IPHC Regulatory Areas 4C and 4D, a vessel operator may obtain the clearance required under paragraph (1) only in St. Paul, St. George, Dutch Harbor, or Akutan, Alaska, either in person or by contacting the authorized clearance personnel. The clearances obtained in St. Paul or St. George, Alaska, can be obtained by VHF radio and allowing the person contacted to confirm visually the identity of the vessel.

(10) Any vessel operator who complies with the requirements in Section 17 for possessing Pacific halibut on board a vessel that was caught in more than one regulatory area in IPHC Regulatory Area 4 is exempt from the clearance requirements of paragraph (1) of this Section, provided that:

(a) the operator of the vessel obtains a vessel clearance prior to fishing in IPHC Regulatory Area 4 in either Dutch Harbor, Akutan, St. Paul, St. George, Adak, or Nazan Bay on Atka Island by contacting the authorized clearance personnel. The clearance obtained in St. Paul, St. George, Adak, or Nazan Bay on Atka Island can be obtained by VHF radio and allowing the person contacted to confirm visually the identity of the vessel. This clearance will list the areas in which the vessel will fish; and

(b) before unloading any Pacific halibut from IPHC Regulatory Area 4, the vessel operator obtains a vessel clearance from Dutch Harbor, Akutan, St. Paul, St. George, Adak, or Nazan Bay on Atka Island by contacting the authorized clearance personnel. The clearance obtained in St. Paul or St. George can be obtained by VHF radio and allowing the person contacted to confirm visually the identity of the vessel. The clearance obtained in Adak or Nazan Bay on Atka Island can be obtained by VHF radio.

5. Minor edits throughout for stylistic consistency among Sections.

IPHC-2021-IM097-PropB1
Received: 29 October 2021

FISHERY REGULATORY PROPOSAL 2022
TITLE: RECREATIONAL (SPORT) FISHING FOR PACIFIC HALIBUT—IPHC REGULATORY AREAS 2C, 3A, 3B, 4A, 4B, 4C, 4D, 4E (SECT. 29) - RECORDKEEPING FOR CHARTER PACIFIC HALIBUT ANNUAL LIMITS

SUBMITTED BY:
UNITED STATES OF AMERICA
NOAA-FISHERIES
AFFILIATION: NMFS, ALASKA REGION
USA

All Regulatory Areas ☐ All Alaska Regulatory Areas ☒ All U.S. Regulatory Areas ☐

2A ☐ 2B ☐ 2C ☐ 3A ☐ 3B ☐ 4A ☐ 4B ☐ 4C ☐ 4D ☐ 4E ☐

Fishery Sectors

Directed Commercial ☐ Recreational ☒ Subsistence ☐ Non-directed Commercial ☐ All ☐

The National Marine Fisheries Service (NMFS) proposes a change to Section 29 of the IPHC Fisheries Regulations related to recordkeeping for charter Pacific halibut annual limits.

Justification provided:

This proposal establishes recordkeeping requirements needed to enforce Pacific halibut annual limits for recreational (sport) fishing for Pacific halibut in IPHC Convention waters in and off Alaska. Two primary elements are included.

1. It consolidates the recordkeeping requirements needed to enforce annual limits (when implemented) for recreational Pacific halibut fishing into the general provisions of Section 29. This eliminates the requirement to annually add or remove these regulatory provisions for each area. Under this proposal, in a year when Pacific halibut annual limits are implemented, these regulations would be in effect without requiring additional modifications to IPHC regulations.
2. It authorizes the use of ADF&G approved electronic harvest records to satisfy this harvest record requirement. Currently, ADF&G authorizes the use of electronic harvest records in State managed recreational fisheries. This proposal would allow anglers to use ADF&G approved electronic harvest records to legibly record recreational halibut catch off Alaska to satisfy the annual limit record keeping requirement when in place. Existing approved physical harvest records would also continue to be accepted. This creates regulatory consistency for anglers that may concurrently retain halibut as well as State managed species for which there is an annual limit.

The suggested modifications to the IPHC Fishery Regulations are provided in red text, at Appendix I.

APPENDIX I

Suggested Regulatory Language

29. Sport Fishing for Pacific Halibut—IPHC Regulatory Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, 4E

(1) In Convention waters in and off Alaska: [8, 9]

(a) The recreational (sport) fishing season is from 1 February to 31 December.

(b) The daily bag limit is two Pacific halibut of any size per day per person unless a more restrictive bag limit applies in Commission regulations or Federal regulations at 50 CFR 300.65.

(c) No person may possess more than two daily bag limits.

(d) No person shall possess on board a vessel, including charter vessels and pleasure craft used for fishing, Pacific halibut that have been filleted, mutilated, or otherwise disfigured in any manner, except that each Pacific halibut may be cut into no more than 2 ventral pieces, 2 dorsal pieces, and 2 cheek pieces, with a patch of skin on each piece, naturally attached;

(e) Pacific halibut in excess of the possession limit in paragraph (1)(c) of this section may be possessed on a vessel that does not contain recreational (sport) fishing gear, fishing rods, hand lines, or gaffs.

(f) Pacific halibut harvested on a charter vessel fishing trip in IPHC Regulatory Areas 2C or 3A must be retained on board the charter vessel on which the Pacific halibut was caught until the end of the charter vessel fishing trip as defined at 50 CFR 300.61.

(g) Guided angler fish (GAF), as described at 50 CFR 300.65, may be used to allow a charter vessel angler to harvest additional Pacific halibut up to the limits in place for unguided anglers, and are exempt from the requirements in paragraphs (2) and (3) of this section; and

(h) if there is an annual limit on the number of Pacific halibut that may be retained by an angler, for purposes of enforcing the annual limit, each angler must:

(1) maintain a nontransferable harvest record in the angler's possession if retaining a Pacific halibut for which an annual limit has been established. Such harvest record must be maintained either on the angler's State of Alaska recreational (sport) fishing license, an ADF&G approved electronic harvest record, or on a Sport Fishing Harvest Record Card obtained, without charge, from ADF&G offices, the ADF&G website, or fishing license vendors;

(2) immediately upon retaining a Pacific halibut for which an annual limit has been established, permanently and legibly record the date, location (IPHC Regulatory Area), and species of the catch (Pacific halibut) on the harvest record;

(3) record the information required by paragraph 1(h)(2) on any duplicate or additional recreational (sport) fishing license issued to the angler, duplicate electronic harvest record, or any duplicate or additional Sport Fishing Harvest Record Card obtained by the angler for all Pacific halibut previously retained during that year that were subject to the harvest record reporting requirements of this section.

[8] NOAA Fisheries could implement more restrictive regulations for the recreational (sport) fishery or components of it, therefore, anglers are advised to check the current Federal or State regulations prior to fishing.

[9] Charter vessels are prohibited from harvesting Pacific halibut in IPHC Regulatory Areas 2C and 3A during one charter vessel fishing trip under regulations promulgated by NOAA Fisheries at 50 CFR 300.66.