INTERNATIONAL PACIFIC HALIBUT COMMISSION

IPHC–2025–IM101–00
Last Update: 2 December 2025

101st Session of the IPHC Interim Meeting (IM101) – *Compendium of meeting documents*

2 December 2025, Seattle, WA, USA

Commissioners

Canada	United States of America
Mark Waddell	Jon Kurland
Neil Davis	Robert Alverson
Peter DeGreef	Richard Yamada

Executive Director

David T. Wilson, Ph.D.

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INTERNATIONAL PACIFIC HALIBUT COMMISSION

Last updated: 13 November 2025

DRAFT: AGENDA & SCHEDULE FOR THE 101st SESSION OF THE IPHC INTERIM MEETING (IM101)

Date: 2 December 2025
Location: Electronic
Venue: Adobe Connect
Time: 09:00-17:00 (PST)
Chairperson: Mr Jon Kurland (USA)
Vice-Chairperson: Mr Mark Waddell (Canada)

***Note: Document deadline**: 02 November 2025 (30 days prior to the opening of the Session)*

AGENDA FOR THE 101st SESSION OF THE IPHC INTERIM MEETING (IM101)

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 101st Session of the IPHC Annual Meeting (AM101), 2025 Special Sessions, and intersessional decisions (D. Wilson)
   - 3.2 Report of the IPHC Secretariat (2025): Draft (D. Wilson & B. Hutniczak)
   - 3.3 Reports of IPHC Subsidiary Bodies (Q&A only)
   - 3.4 International Pacific Halibut Commission Integrated Research and Monitoring Plan (D. Wilson, J. Planas, I. Stewart, A. Hicks, B. Hutniczak, & R. Webster)
   - 3.5 Rules of Procedure: Amendments (D. Wilson, B. Hutniczak)

4. **FISHERY MONITORING**
   - 4.1 Fishery-dependent data overview (2025)
     - 4.1.1 Port Operations (M. Thom)
     - 4.1.2 Fisheries data (B. Hutniczak)
   - 4.2 Fishery-independent data overview (2025)
     - 4.2.1 IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2025 (K. Ualesi)

5. **STOCK STATUS OF PACIFIC HALIBUT (2025)**
   - 5.1 Space-time modelling of survey data (R. Webster)
   - 5.2 Stock Assessment: Data overview and stock assessment (2025)

6. **MANAGEMENT STRATEGY EVALUATION**
   - 6.1 IPHC Harvest Strategy Policy (A. Hicks)

7. HARVEST DECISION TABLE 2026

7.1 Stock projections and harvest decision table 2026-2028 (I. Stewart & A. Hicks)

8. FISS DESIGN EVALUATIONS 2026-2028

8.1 2025-29 FISS design evaluation (R. Webster)

9. BIOLOGICAL AND ECOSYSTEM SCIENCES – PROJECT UPDATES

9.1 Report on Current and Future Biological and Ecosystem Science Research Activities (J. Planas)

10. IPHC FISHERY REGULATIONS: PROPOSALS FOR THE 2025-26 PROCESS

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. OTHER BUSINESS

11.1 Preparation for the 102nd Session of the IPHC Annual Meeting (AM102) and associated subsidiary bodies (D. Wilson)

12. REVIEW OF THE DRAFT AND ADOPTION OF THE REPORT OF THE 101st SESSION OF THE IPHC INTERIM MEETING (IM101) (Chairperson & Executive Director)

SCHEDULE FOR THE 101st SESSION OF THE IPHC INTERIM MEETING (IM101)

Tuesday, 2 December 2025		
Time	**Agenda item**	**Lead**
09:00-09:05	1. Opening of the Session	Chairperson
09:05-09:10	2. Adoption of the agenda and arrangements for the Session	Chairperson
09:10-09:30	3. IPHC Process 3.1 Update on actions arising from the 101st Session of the IPHC Annual Meeting (AM101), 2025 Special Sessions, and intersessional decisions (D. Wilson) 3.2 Report of the IPHC Secretariat (2025): Draft (D. Wilson & B. Hutniczak) 3.3 International Pacific Halibut Commission Integrated Research and Monitoring Plan (D. Wilson, J. Planas, I. Stewart, A. Hicks, B. Hutniczak, & R. Webster) 3.4 Reports of IPHC Subsidiary Bodies 3.5 Rules of Procedure: Amendments	D. Wilson Q&A only D. Wilson Q&A only D. Wilson
09:30-09:45	4. Fishery Monitoring 4.1 Fishery-dependent data overview (2025) 4.1.1 Port Operations (M. Thom) 4.1.2 Fisheries data (B. Hutniczak)	M. Thom B. Hutniczak
09:45-10:00	4.2 Fishery-independent data overview (2025) 4.2.1 IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2025	K. Ualesi
10:00-10:30	5. Stock status of Pacific halibut (2025) 5.1 Space-time modelling of survey data	R. Webster
10:30-10:45	Break	
10:45-12:00	5.2 Stock Assessment: Data overview and stock assessment (2025)	I. Stewart
12:00-12:30	6. Management strategy evaluation 6.1 IPHC Harvest Strategy Policy	A. Hicks
12:30-12:45	*Public comment and questions (Agenda Items 5 & 6)*	
12:45-13:30	Lunch	
13:30-14:00	7. Harvest decision table for 2026-28	I. Stewart
14:00-15:00	8. FISS design evaluations 2026-2028 8.1 2026-28 FISS design evaluation	R. Webster
15:00-15:30	*Public comment and questions (Agenda Items 7 & 8)*	
15:30-15:45	Break	

15:45-16:10	9. Biological and ecosystem sciences – project updates *Public comment and questions (Agenda Item 9)*	J. Planas
16:10-16:30	10. IPHC Fishery Regulations: Proposals for the 2025-26 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
16:30-16:40	11. Other business 11.1 Preparation for the 102nd Session of the IPHC Annual Meeting (AM102) and associated subsidiary bodies	D. Wilson
16:40-17:00	Break: Report drafting Session	IPHC Secretariat
17:00-17:30	12. Review of the draft and adoption of the Report of the 101st Session of the IPHC Interim Meeting (IM101)	Chairperson & Executive Director

LIST OF DOCUMENTS FOR THE 101st SESSION OF THE IPHC INTERIM MEETING (IM101)

Last updated: 2 December 2025

Document	Title	Availability
IPHC-2025-IM101-01	Agenda & Schedule for the 101st Session of the IPHC Interim Meeting (IM101)	✓ 3 Sept 2025 ✓ 31 Oct 2025 ✓ 13 Nov 2025
IPHC-2025-IM101-02	List of Documents for the 101st Session of the IPHC Interim Meeting (IM101)	✓ 3 Sept 2025 ✓ 31 Oct 2025 ✓ 2 Dec 2025
IPHC-2025-IM101-03	Update on actions arising from the 101st Session of the IPHC Annual Meeting (AM101), and 2025 intersessional decisions (D. Wilson)	✓ 29 Oct 2025
IPHC-2025-IM101-04	Report of the IPHC Secretariat (2025): Draft (D. Wilson & B. Hutniczak)	✓ 29 Oct 2025
IPHC-2025-IM101-05	International Pacific Halibut Commission Integrated Research and Monitoring Plan (D. Wilson, J. Planas, I. Stewart, A. Hicks, B. Hutniczak, & R. Webster)	✓ 29 Oct 2025
IPHC-2025-IM101-06	IPHC Fisheries Dependent Data Collection Design and Implementation in 2025 – Port operations: Preliminary (M. Thom, I. Stewart & R. Webster)	✓ 29 Oct 2025
IPHC-2025-IM101-07 Rev_1	Fisheries data overview (2025): Preliminary (B. Hutniczak, H. Tran, T. Kong, K. Sawyer van Vleck, & K. Magrane)	✓ 29 Oct 2025 ✓ 6 Nov 2025
IPHC-2025-IM101-08	IPHC Fishery-independent setline survey (FISS) design and implementation in 2025 (K. Ualesi, T. Jack, R. Rillera, & K. Coll)	✓ 29 Oct 2025
IPHC-2025-IM101-09 Rev_1	Space-time modelling of survey data (R. Webster)	✓ 30 Oct 2025 ✓ 10 Nov 2025
IPHC-2025-IM101-10 Rev_1	Data overview and stock assessment for Pacific halibut (*Hippoglossus stenolepis*) at the end of 2025 (I. Stewart, A. Hicks, R. Webster, D. Wilson)	✓ 16 Oct 2025 ✓ 24 Nov 2025
IPHC-2025-IM101-11a Rev_1	Harvest Strategy Policy (A. Hicks, I. Stewart, & D. Wilson)	✓ 30 Oct 2025 ✓ 11 Nov 2025
IPHC-2025-IM101-11b Rev_1	DRAFT: IPHC Harvest Strategy Policy (IPHC)	✓ 30 Oct 2025 ✓ 11 Nov 2025
IPHC-2025-IM101-12 Rev_1	Stock projections and harvest decision table for 2026-2028 (I. Stewart & A. Hicks)	✓ 16 Oct 2025

		✓ 24 Nov 2025
IPHC-2025-IM101-13 Rev_1	FISS Design 2026-28 (R. Webster, I. Stewart, K. Ualesi, T. Jack, & D. Wilson)	✓ 31 Oct 2025 ✓ 11 Nov 2025
IPHC-2025-IM101-14	Report on Current and Future Biological and Ecosystem Science Research Activities (J. Planas)	✓ 29 Oct 2025
IPHC-2025-IM101-15 Rev_1	IPHC Fishery Regulations: Proposals for the 2025-26 process (B. Hutniczak)	✓ 22 Oct 2025 ✓ 3 Nov 2025
IPHC-2025-IM101-16	IPHC Rules of Procedure: Amendments (D. Wilson, B. Hutniczak)	✓ 31 Oct 2025
IPHC Fishery Regulation proposals for 2025		
IPHC Secretariat Fishery Regulation proposals for 2025		
IPHC-2025-IM101-PropA1	IPHC Fishery Regulations: Mortality and Fishery Limits (Sect. 5)	✓ 22 Oct 2025
IPHC-2025-IM101-PropA2	IPHC Fishery Regulations: Commercial Fishing Periods (Sect. 9)	✓ 22 Oct 2025
Contracting Party Fishery Regulation proposals for 2025		
IPHC-2025-IM101-PropB1	IPHC Fishery Regulations: 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)	Deferred until AM102
IPHC-2025-IM101-PropB2	IPHC Fishery Regulations: Recreational (Sport) Fishing for Pacific Halibut - IPHC Regulatory Area 2B (Sect. 28) - Daily bag limit in IPHC Regulatory Area 2B (Canada)	✓ 2 Nov 2025
Other Stakeholder Fishery Regulation proposals for 2025		
IPHC-2025-IM101-PropC1	Nil to date	
Information papers		
IPHC-2025-IM101-INF01 Rev_1	Stakeholder Statements on IPHC Fishery Regulation proposals (B. Hutniczak)	✓ 22 Oct 2025 ✓ 2 Dec 2025
IPHC-2025-IM101-INF02	Considerations relating to allowing year-round landings of Pacific halibut in Canada (I. Stewart, B. Hutniczak, A. Hicks, J. Planas, M. Thom, D. Wilson)	✓ 22 Oct 2025
IPHC-2025-IM101-INF03	Using artificial intelligence (AI) for supplementing Pacific halibut age determination from collected otoliths (B. Hutniczak, J. Forsberg, K. Sawyer Van Vleck, & K. Magrane)	✓ 22 Oct 2025

Reports from IPHC subsidiary bodies		
IPHC-2025-MSAB021-R	Report of the 21st Session of the IPHC Management Strategy Advisory Board (MSAB021)	✓ 15 May 2025
IPHC-2025-SRB026-R	Report of the 26th Session of the IPHC Scientific Review Board (SRB026)	✓ 12 Jun 2025
IPHC-2025-SRB027-R	Report of the 27th Session of the IPHC Scientific Review Board (SRB027)	✓ 18 Sept 2025
IPHC-2025-RAB026-R	Report of the 26th Session of the IPHC Research Advisory Board (RAB026)	✓ 20 Nov 2025

Update on actions arising from the 101st Session of the IPHC Annual Meeting (AM101), and 2025 intersessional decisions

PREPARED BY: IPHC SECRETARIAT (D. WILSON; 29 OCTOBER 2025)

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.

BACKGROUND

At the 101st Session of the IPHC Annual Meeting (AM101), 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 intersessional decisions, 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-2025-IM101-03, 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.

APPENDICES

Appendix A: Update on actions arising from the 101st Session of the IPHC Annual Meeting (AM101: January 2025)

Appendix B: Update on actions arising from 2025 intersessional decisions of the Commission

APPENDIX A

Update on actions arising from the 101st Session of the IPHC Annual Meeting (AM101: January 2025)

101st Session of the IPHC Annual Meeting (AM101)		
Action No.	**Description**	**Update**
RECOMMENDATIONS		
Nil	Nil	Nil
REQUESTS		
AM101–Req.01 (para. 21)	***Report of the 25th Session of the IPHC Research Advisory Board (RAB025)*** The Commission **REQUESTED** that additional Canadian membership beyond the two (2) current RAB members would be desirable and encouraged the Canadian delegation to explore recruiting new members from Canada.	**Lead**: Canada (M. Waddell) & IPHC Secretariat (D. Wilson & J. Planas) **Status/Plan**: In progress Canada: IPHC Secretariat: a media release calling for Canadian RAB members was circulated on 24 February 2025 (IPHC-2025-MR-005). Subsequent to the media release, we are yet to receive any nominations for Canadian RAB members. We continue to seek support from Canadian Commissioners and advisors to identify potential candidates.
AM101–Req.02 (para. 30)	***Port Operations*** The Commission **REQUESTED** an annual compilation of reports of comments received by the IPHC's Fisheries Data Specialists (Field) on current harvesting conditions.	**Lead**: IPHC Secretariat (M. Thom) **Status/Plan**: Completed & ongoing See paper **IPHC-2025-IM101-06**. A summary will be included in this paper moving forward to AM102.
AM101–Req.03 (para. 32)	***Fisheries Data*** The Commission **REQUESTED** that the description of data on non-directed discard mortality for IPHC Regulatory Areas 3A and 3B be updated to align with the information provided in IPHC-2025-AM101-NR02 Rev_1. (Note: A Rev_2 of this paper was published on 30 January 2025 to accommodate this request in-session: IPHC-2025-AM101-08 Rev_2).	**Lead**: IPHC Secretariat (B. Hutniczak) **Status/Plan**: Completed and ongoing A Rev_2 of this paper was published on 30 January 2025 to accommodate this request in-session: IPHC-2025-AM101-08 Rev_2). A process has been established to ensure this occurs prior to the Annual Meeting publication deadline each year.

101st Session of the IPHC Annual Meeting (AM101)		
Action No.	**Description**	**Update**
AM101–Req.04 (para. 53)	***Management Strategy Evaluation*** The Commission **REQUESTED** that the Secretariat facilitate informal intersessional workshops, consisting of Commissioners and key advisors, to review and consider the draft Harvest Strategy Policy, for adoption in mid-to-late 2025.	**Lead**: IPHC Secretariat (A. Hicks) **Status/Plan**: Completed The first workshop occurred on 23 April 2025, and the second on 6 August 2025.
AM101–Req.05 (para. 88)	***IPHC Fishery Regulations: Commercial Fishing Periods (Sect. 9) (Regulatory Area 2B)*** The Commission **REQUESTED** that the IPHC Secretariat prepare an analysis detailing the biological, logistical and socioeconomic effects of year-round fishing in Canada, including challenges related to data compilation and marketing implications, for presentation at AM102.	**Lead**: IPHC Secretariat (I. Stewart) **Status/Plan**: In progress See paper: **IPHC-2025-IM101-INF02** *Considerations relating to allowing year-round landings of Pacific halibut in Canada* (I. Stewart, B. Hutniczak, A. Hicks, J. Planas, M. Thom, D. Wilson) A paper for AM102 will be developed subsequent to further discussion at IM101.
AM101–Req.06 (para. 90)	***IPHC Fishery Regulations: Application of Commercial Fishery Limits (Sect. 12) – addressing concerns regarding localized depletion around St. Matthew Island*** The Commission **REQUESTED** that the Secretariat communicate the details of proposal IPHC-2025-AM101-PropC2 to the NPFMC for their awareness and consideration and specifically to advise the NPFMC that the Commission considers that the proposal falls under the NPFMC purview.	**Lead**: IPHC Secretariat (D. Wilson & B. Hutniczak) **Status/Plan**: Completed A letter was sent via email to the Chair of the NPFMC and Executive Director on 22 February 2025, with all IPHC Commissioners in CC. **EL2025006** dtd 21 February 2025 - IPHC Letter to the NPFMC. Following a request from the NPFMC for additional information, received on 16 April 2025, an additional response was communicated on 26 June 2025, with all IPHC Commissioners in CC. **EL2025038** dtd 26 June 2025 - IPHC Response Letter to the NPFMC.

101st Session of the IPHC Annual Meeting (AM101)		
Action No.	**Description**	**Update**
AM101–Req.07 (para. 124)	***IPHC Fishery Regulations*** The Commission **REQUESTED** that the IPHC Secretariat finalise and publish the IPHC *Pacific Halibut Fishery Regulations (2025)* as soon as possible, **NOTING** that only minor editorial and formatting changes are permitted beyond the decisions made by the Commission at the AM101.	**Lead**: IPHC Secretariat (B. Hutniczak) **Status/Plan**: Completed Published on the IPHC website 5 February 2025: IPHC-2025-FISHR25

OTHER KEY ACTIONS		
(para. 113)	***Budget estimates: FY2026 (for approval); FY2027 and FY2028 (for information)*** The Commission **NOTED** and **AGREED** to the following FAC101 request: FAC101-Req.01 (para. 28) *The FAC REQUESTED that the Secretariat evaluate the following potential options for cost savings that could be considered for the FY2026 or FY2027 budgets, recognizing that the FISS funding shortfall and prudent fiscal management may warrant departures from past IPHC practices:* *a) Options for restructuring future Annual Meetings to accomplish necessary business in three (3) or four (4) days rather than five (5) days;* *b) Options for restructuring the Conference Board and Processor Advisory Board into a single subsidiary body (that could reduce meeting space rental requirements and costs, including associated technology support/rental, secretariat staff support needed, minimum charges by hotels for food and beverage) and engaging a team of members of the CB and PAB to advise the Commission on a potential new structure that would ensure both processor and harvester perspectives are fairly represented and conveyed to the Commission;* *c) Options for using more economical venues for future Annual Meetings;*	**Lead**: IPHC Secretariat (D. Wilson) **Status/Plan**: In progress The Commission met on 4-5 September 2025 at the 2025 Work Meeting (WM2025). The following are the recommendations arising: **Part A: Options for restructuring future Annual Meetings to accomplish necessary business in three (3) or four (4) days rather than five (5) days.** ***Contracting Party National Reports:*** **Recommendation #1**: The Commission **RECOMMENDED** that: 1) Contracting Party National Reports be submitted for pre-session review (30 days prior to each session in accordance with the IPHC Rules of Procedure), and 2) that no presentation would be made at the Annual Meeting; 3) authors would be available for a 15-30 minute Q&A session during Plenary (maximum 1-hour for the agenda item). ***Finance and Administration Committee (FAC):*** **Recommendation #2**: The Commission **RECOMMENDED** that the FAC meeting be moved to the week prior to the Annual Meeting

	d) *Any other potential cost savings the Secretariat may identify for future Annual Meetings.*	each year, and for it to be held online/virtual only. **Recommendation #3**: The Commission **RECOMMNEDED** that the upcoming FAC meeting in January 2026 (FAC102), be held for 2-3 hours in the afternoon of 14 January 2026. ***Reduction or Removal of the Wednesday delegation caucus day:*** **Recommendation #4**: The Commission **RECOMMENDED** that for AM102, Plenary would open at 09:00 hrs on Monday 19 January 2026, with the goal of presenting all key papers during the first day of the Annual Meeting. **Recommendation #5**: The Commission **RECOMMENDED** that the CB and PAB meetings should commence their work at 09:00 hrs on Tuesday 20 January 2026, with the goal of completing their discussions and developing their recommendations for presentation to the Commission, starting mid-afternoon (15:30-17:00 hrs) on Wednesday the 21 January 2026. **Recommendation #6**: The Commission **RECOMMENDED** pausing discussion on reducing the Annual Meeting to 3 or 3.5 days, until after the discussions on the CB/PAB operations are completed, and Recommendations 1-5 have been implemented and tested at AM102 (in January 2026). **Part B: Options for efficiency gains (operational and financial) in the activities of the Conference Board and Processor Advisory Board.** **Recommendation #7**: The Commission **RECOMMENDED** that a separate working paper be developed and shared with the CB and PAB Co-Chairpersons, that incorporates the following elements: 1) assigns the task of leading internal discussions on potential efficiency gains to be had with each body to the Co-Chairpersons; 2) includes a range of starting options, including 1) status quo, 2) status quo with

		efficiency gains; 3) a single Stakeholder Advisory Board with two (2) voting chambers, one for harvesters, and another for processors; and 4) A single Stakeholder Advisory Board with no voting chambers; 3) draft Terms of Reference and Voting Chamber description to aid in discussions; 4) request their consolidated feedback be provided to the Commission 30 days prior to AM102 for discussion in Plenary. **Part C: Options for using more economical venues for future Annual Meetings.** **Recommendation #8**: The Commission **ACKNOWLEDGED** that the process undertaken by the Secretariat each year to select annual meeting venues is robust and ensures that the most economical meeting venue is being selected, based on Commission space/operational needs, and city selected. Thus, the Commission **RECOMMENDED** that no further action was necessary at this time. **Part D: Any other potential cost savings the Secretariat may identify for future Annual Meetings.** The Commission **AGREED** that the Secretariat undertakes detailed consideration of the Annual Meeting series budgets and expenditures based on the operational needs of the Commission, as directed. While noting that the current operational needs may change based on other sections outlined and discussed within this Briefing Note, no further action was needed at this time.

APPENDIX B

Update on actions arising from 2025 Intersessional Decisions of the Commission

<table>
<tr><th colspan="3">Intersessional Decisions (ID)</th></tr>
<tr><td>IPHC-2025-ID001</td><td>The Commission ENDORSED the appointment of the following new MSAB member for a four (4) year term commencing on the date of this Circular:
• Commercial harvester USA (1) (targeting Pacific halibut): Garrett Elwood
In addition, the following five (5) MSAB members whose terms expired at the end of 2024, have been renewed for another four (4) years, effective on the date of this Circular:
Member — Position
• Hauknes, Robert — CDN Commercial harvester
• Johnson, James — USA Commercial harvester
• Mazzone, Scott — USA Treaty Tribes
• Parker, Peggy — USA Processing
• Braden, Forrest — USA sportfishing (AK)</td><td>Lead: IPHC Secretariat (D. Wilson & A. Hicks)
Status/Plan: Completed
The endorsed and renewed members were notified of their appointments.</td></tr>
<tr><td>IPHC-2025-ID002</td><td>The Commission ADOPTED the FY2026 budget (1 October 2025 to 30 September 2026) as detailed in Appendix I, including the contributions from the Contracting Parties to the General Fund for FY2026 as follows:
• Canada: Contribution to the General Fund: US$1,019,136.94.
• U.S.A.: Contribution to the General Fund: US$4,642,734.94.
• U.S.A.: Contribution to the headquarters building lease and maintenance costs: US$418,599.43 (Rent = US$289,623.08; Common area maintenance = US$128,976.35).</td><td>Lead: IPHC Secretariat (D. Wilson)
Status/Plan: Completed
7 April 2025: The FY2026 budgets were communicated to the respective Contracting Party contacts.
Update:
7 May 2025: Canadian FY2026 contribution received in full (US$1,019,136.94).</td></tr>
<tr><td>IPHC-2025-ID003</td><td>The Commission NOTED the optional extra-budgetary (IFCP Fund deficit) contributions from each Contracting Party for FY2026 as follows:
• Canada:
  ○ 50% Contribution to the IFCP Fund deficit (former staff pension plan): US$150,573
• U.S.A.:
  ○ 50% Contribution to the IFCP Fund deficit (former staff pension plan): US$150,573</td><td>Lead: IPHC Secretariat (D. Wilson)
Status/Plan: Completed
The IFCPF deficit payments are Invoiced in January of each year.
The 2026 Invoices will be communicated in January 2026.</td></tr>
</table>

IPHC-2025-ID004	The Commission provisionally **ENDORSED** the budgets for FY2027 and FY2028 (1 October 2026 to 30 September 2027, & 1 October 2027 to 30 September 2028, as detailed in Appendix II and Appendix III, that should be used by each Contracting Party for their internal planning and budgeting processes.	**Lead**: IPHC Secretariat (D. Wilson) **Status/Plan**: Completed
IPHC-2025-ID005	The Commission **NOTED** that the Pilot Study (Part I: IPHC-2024-BN05) was successfully conducted in the fall of 2024 (FY2025) to assess the viability (sampling and fiscal) of the fecundity study in 2025 and 2026 (ref. Objective 1). The Pilot Study sampled female Pacific halibut at 50 stations (Table 1 of Appendix I) in Biological Region 2.	**Lead**: IPHC Secretariat (J. Planas) **Status/Plan**: Completed
IPHC-2025-ID006	The Commission **ENDORSED** the implementation of Objectives 2 and 3 (Part II) (IPHC-2025-CR-016): a) Objective 2 will be conducted in the late summer/Fall of 2025 (FY2025). This study will sample female Pacific halibut at 50 stations in Biological Region 2 (IPHC Regulatory Area 2B); b) Objective 3 will be conducted in late summer/Fall of 2026 (FY2026). This study will investigate potential regional differences in fecundity by estimating fecundity in female Pacific halibut collected in different Biological Regions within the same year of collection.	**Lead**: IPHC Secretariat (J. Planas) **Status/Plan**: In progress The 2025 Fecundity study is completed. The 2026 Fecundity Study is scheduled for mid-2026.

Report of the IPHC Secretariat (2025): Preliminary

PREPARED BY: IPHC SECRETARIAT (D. WILSON & B. HUTNICZAK, 29 OCTOBER 2025)

1 PURPOSE

To provide the Commission with a report on the IPHC Secretariat activities in 2025, not already contained within other papers before the Commission.

2 IPHC SECRETARIAT 2025

The 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 signed on 2 March 1923, ratified on 21 July 1924, and came into effect on **21 October 1924** upon exchange.

The basic texts of the Commission are available on the IPHC website, 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 Secretariat, formed in support the Commission's activities, is based in Seattle, WA, U.S.A. (Fig. 1) and currently consists of 29 fulltime positions (FTEs) and ~24-45 temporary/seasonal positions to staff our ports and research vessels (Appendix I). As our 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.***

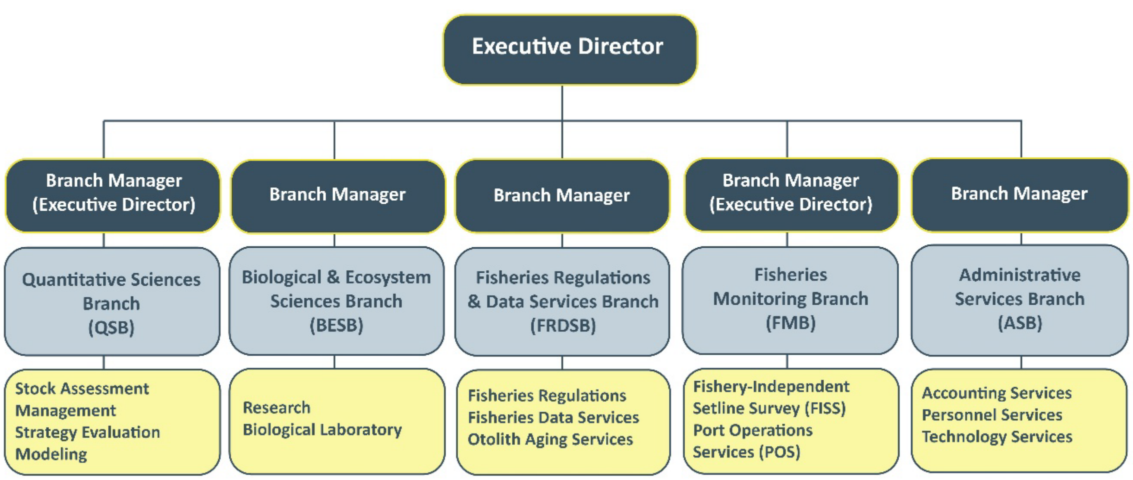

Figure 1. IPHC Secretariat organisation chart (2025).

3 ORGANISATIONAL TRANSFORMATIONS

3.1 Implementation of the Recommendations from the 2nd IPHC Performance Review

The Report of the 2nd Performance Review of the IPHC (PRIPHC02), IPHC-2019-PRIPHC02-R was adopted on 11 October 2019. Since then, the IPHC Secretariat has provided twice-yearly updates on the implementation of the 26 Recommendations to the Commission. The most recent update is available in paper IPHC-2025-AM101-05.

Ony three (3) recommendations remain 'In progress', with all others either fully "Completed", or completed and "annually ongoing".

At AM101, the Commission reached the following agreement:

IPHC-2025-AM101-R, para. 13. "*The Commission AGREED to continue to monitor progress on the implementation of the PRIPHC02 recommendations and determine at a later date when to initiate the next performance review. At this point in time the Commission does not see a need to initiate a third performance review.*"

The three (3) Recommendations that remain in progress are as follows:

REF#	RECOMMENDATION	PRIORITY	RESPONSIBILITY	UPDATE/STATUS
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.	N/A	N/A	**N/A**
	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.	High	Contracting Parties	**In progress**: The Contracting Parties have yet to engage on this recommendation. See paper: **IPHC-2023-AM099-16.** At IM099 (Dec. 2023) the Commission provided the following update: (IM099, para. 7) The Commission **RECALLED** recommendation 09 from the PRIPHC02 (shown below) and **NOTED** that while there was no current agreement between the Contracting Parties to collectively move this recommendation forward, the Commission would continue discussions to seek common ground. PRIPHC02-Rec.09: *"The Commission RECOMMENDED that the IPHC Secretariat, in consultation with the Commission, develop minimum*

REF#	RECOMMENDATION	PRIORITY	RESPONSIBILITY	UPDATE/STATUS
				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."
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; Commission	**In progress**: A draft Harvest Strategy Policy will be presented at IM101 for potential adoption. See paper **IPHC-2025-IM101-11** ***Next steps***: The Commission to formally adopt a harvest strategy.
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	Commission; IPHC Secretariat	**In progress**: A draft Harvest Strategy Policy will be presented at IM101 for potential adoption. See paper **IPHC-2025-IM101-11** for the latest update. ***Next steps***: The Commission to formally adopt a harvest strategy.

3.2 Artificial Intelligence (AI) Strategy

The Secretariat is actively developing an artificial intelligence (AI) Ambition Statement to strengthen our support for the Commission's objectives using AI. Our broad goal will be to harness AI in support of the IPHC's core objective (shown below) to transform our current management practices, optimise data collection and analysis, enhance decision-making processes, and improve internal governance.

> *IPHC Objective: 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.*

By embedding AI into our tactical and strategic operational frameworks, we aim to cultivate an AI-enhanced data-driven (and reproducible) operational environment that further supports the optimum utilisation of Pacific halibut and the long-term viability of target fisheries and the communities that depend on the resource.

Working closely with our partners at DFO and NOAA, we also aim to draw upon their AI expertise and experiences, and where feasible, integrate our own strategy with theirs to achieve mutual advancement and success.

Key components to be included in our AI Strategy:

1) **Problem Definition:**

We will initiate our AI journey by identifying specific challenges in Pacific halibut management, including:

- Fluctuating stock levels

- Climate change impacts
- Complex relationship with the environment and ecosystem
- Fishing practices
- Cost-efficient data collection

Engaging stakeholders via a range of formats will be essential in clarifying these challenges and prioritising the most impactful and sustainable AI applications.

2) **Strategic Timing and Planning:**

Implementing AI solutions requires careful timing. We will adopt a phased approach that aligns with the Commission's operational calendar to ensure AI tools are identified for potential use as they become available, tested to ensure accuracy and precision are understood, and then deployed in support of Commission objectives and key performance indicators. This will be supported by detailed project timelines that will outline key milestones, designate responsible teams, and allocate resources effectively to ensure seamless execution.

3) **Benefit Measurement:**

Defining success metrics will be vital for our AI initiatives to be successful. We will establish a framework to evaluate the impact of AI using key performance indicators to be developed on:

- Data collection efficiency (time and cost)
- Advances in the understanding of Pacific halibut biology and ecology (ecosystem relationships)
- Stock assessments
- Fishing yields
- Operational efficacy (governance)

Regular reviews will be conducted to ensure our AI strategy remains aligned with the IPHC's objectives and is adaptable to changing challenges in the field.

4) **Data, Algorithms, and Infrastructure Considerations:**

A robust data infrastructure is crucial for the success of our AI initiatives. We will:

- Conduct an inventory of existing data sources, emphasizing data quality and accessibility.
- Identify data collection and processing needs that could be addressed with AI.
- Invest in scalable cloud-based infrastructure to support our secure data collection, storage, and processing needs, ensuring our AI systems are sustainable and future-proof.
- Collaborate with data scientists (both internal and external) to identify suitable algorithms for data analysis, predictive modeling, and scenario analysis.

By strategically implementing these components, we are committed to realising our AI ambitions, thereby enhancing our capacity to support the optimum utilisation of Pacific halibut.

4 IPHC INTERNSHIP PROGRAM: 2025

The IPHC funds full-time internships each summer. In 2025 the IPHC hosted two (2) undergraduate interns, Mr Justin Kim and Mr Liam Naylor-Komyatte, recent graduates of the University of California Santa Barbara, and Eckerd College, respectively. The two interns have actively participated in IPHC's efforts to genotype the sex of commercial landings and to develop an automatized method for aging of otoliths using artificial intelligence, among other activities. The internship period ran from 27 May through 29 August 2025.

Justin Kim
(University of California, Santa Barbara)
2025

Liam Naylor-Komyatte
(Eckerd College)
2025

5 IPHC MERIT SCHOLARSHIP FOR 2025-28

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.

Since the scholarships inception in 2002, the IPHC has awarded over US$160,000 in scholarship funds to 20 recipients.

As 2025 was an off-year for the scholarship process, no further action was necessary other than to support our existing recipients. A new call will be made in 2026.

In 2024, the IPHC Merit Scholarship Selection Panel reviewed applications and selected an outstanding candidate from a very strong application pool, based on academic qualifications, career goals, and relationship to the Pacific halibut industry.

The Selection Panel consists of the following four (4) panelists:

- Robert Alverson (USA Commissioner)
- Peter DeGreef (Canadian Commissioner)
- Angel Drobnica (Industry representative)
- Christa Rusel (Industry representative)

The Selection Panel unanimously awarded Mr Shea Davis (Cordova, AK, USA) the 2024 IPHC Merit Scholarship. The current recipients and their expected years of receipt are provided below.

Name	2024	2025	2026	2027
Lucy Hankins (Seward, AK, USA)	$4,000	$4,000	$4,000	.
Shea Davis (Cordova, AK, USA)	$4,000	$4,000	$4,000	$4,000


Shea Davis
2024


Lucy Hankins
2022

6 Meetings of the Commission and subsidiary bodies during 2025

Meeting	No.	Date	Location	Secretariat material
Finance and Administration Committee (FAC)	101st	27 Jan	Vancouver, BC, USA & Electronic	5 working papers
Annual Meeting (AM)	**101st**	**27-30 Jan**		15 working papers, 9 regulatory proposals
Conference Board (CB)	95th	28-29 Jan		Commission papers
Processor Advisory Board (PAB)	30th	28-29 Jan		Commission papers
Management Strategy Advisory Board (MSAB)	21st	13-15 May	Juneau, AK, USA	7 working papers
Scientific Review Board (SRB)	26th	10-12 June	Seattle, USA & Electronic	8 working papers
Work Meeting (WM)	2025	4-5 Sept	Bellingham, USA	14 working papers
Scientific Review Board (SRB)	27th	23-25 Sept	Seattle, USA & Electronic	8 working papers
Research Advisory Board (RAB)	26th	18-19 Nov	Seattle, USA & Electronic	6 working papers
Interim Meeting (IM)	**101st**	**2 Dec**	Electronic	13 working papers 2 regulatory proposals

7 IPHC Pacific Halibut Fishery Regulations adopted in 2025

In 2025, the Commission adopted **three (3)** fishery regulations proposals (IPHC-2025-AM101-R) in accordance with Article III of the Convention, as follows:

7.1 IPHC Secretariat fishery regulation proposals

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

(par. 75) The Commission **ADOPTED** fishery regulation proposal IPHC-2025-AM101-PropA1, that provided the mortality and fishery limits framework for population at AM101 (Appendix IV). [*CAN/USA: Unanimous*] (par. 76) The Commission **ADOPTED** the distributed mortality limits for each Contracting Party, by IPHC Regulatory Area, (Table 5) and sector, as provided in Appendix IV. [*CAN/USA: Unanimous*]

Table 5. Adopted TCEY mortality limits for 2025

Contracting Party IPHC Regulatory Area	Mortality limit (TCEY) (metric tonnes)	Mortality limit (TCEY) (mlbs)
Canada Total: 2B	**2,472.08**	**5.45**
USA: 2A	748.43	1.65
USA: 2C	2,367.75	5.22
USA: 3A	4,118.62	9.08
USA: 3B	1,297.27	2.86
USA: 4A	607.81	1.34
USA: 4B	471.74	1.04
USA: 4CDE	1,397.06	3.08
United States of America Total	**11,008.68**	**24.27**
Total (IPHC Convention Area)	**13,480.75**	**29.72**

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

(par. 81) The Commission **ADOPTED** fishery regulation proposal IPHC-2025-AM101-PropA2, that provided the framework for setting fishing periods for the commercial Pacific halibut fisheries. [*CAN/USA: Unanimous*]

(par. 83) The Commission **ADOPTED** fishing periods for 2025 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 **06:00 hrs local time on 20 March 2025** and must cease at **23:59 hrs local time on 7 December 2025**. [*CAN/USA: Unanimous*]

7.2 *Contracting Party fishery regulation proposals*

IPHC Fishery Regulations: Recreational (Sport) Fishing for Pacific Halibut—IPHC Regulatory Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, 4E (Sect. 28) - Charter Management Measures in IPHC Regulatory Areas 2C and 3A (USA)

(par. 85) The Commission **ADOPTED** fishery regulation proposal IPHC-2025-AM101-PropB1, that included charter management measures in IPHC Regulatory Areas 2C and 3A reflective of mortality limits adopted by the IPHC and resulting allocations under the North Pacific Fisheries Management Council's (NPFMC) Pacific halibut Catch Sharing Plan. (Appendix VI). [*CAN/USA: Unanimous*]

8 INTERACTIONS WITH CONTRACTING PARTIES

8.1 *Contracting Party reports*

The IPHC Secretariat engages annually with agency representatives from both Contracting Parties to ensure comprehensive reporting of all forms of Pacific halibut removals. Efforts are ongoing to identify and address data gaps, as well as to improve data collection processes.

Additionally, the Secretariat collaborates with both Contracting Parties to streamline the development of the National Report and enhance consistency across parties.

8.2 Canada

Fisheries and Oceans Canada (DFO)

Multiyear permit for the IPHC survey in Gwaii Haanas National Marine Conservation Area

In May 2025, the Archipelago Management Board (AMB) approved the application the DFO put forward to permit multi-year approvals for the IPHC Fishery-Independent Setline Survey (FISS) in Gwaii Haanas National Marine Conservation Area (NMCA). What this means is that the IPHC has approval to fish the FISS stations within Gwaii Haanas for the 2025, 2026 and 2027 FISS without having to annually apply for these permissions when they apply for their Canadian scientific licences.

Collaboration with DFO and AMR to complete IPHC Regulatory Area 2B logbook coverage

The IPHC is collaborating with DFO and Archipelago Marine Research (AMR) to obtain Canadian logbook data that were not previously included in IPHC's standard data collection. Through this collaboration, IPHC will gain access to the complete set of Regulatory Area 2B logbooks, ensuring comprehensive coverage of fishing activity for incorporation into the Pacific halibut stock assessment. This initiative strengthens data completeness and improves the accuracy and consistency of catch information used in scientific analyses and management decisions.

Pilot project aimed to improve the accounting of liced, predated or damaged fish

The DFO has launched a pilot project effective 23 July 2025, to improve the accuracy of catch accounting in the groundfish hook and line fisheries. The initiative adds a new audit test comparing electronic monitoring (EM) imagery with fishing log data for fish released as *liced, predated, or otherwise damaged*. During the pilot, these test results will be evaluated separately and will not affect trip or annual audit scores. Released fish recorded as damaged must be clearly visible on EM footage for verification; if the damage cannot be confirmed, the fish will be evaluated as a standard legal or sublegal release. The pilot aims to refine procedures for documenting release categories and ensuring more consistent EM verification, with results reviewed by the DFO Audit Review Board.

Areas of conservation concern

The IPHC Secretariat continues to work with the DFO representatives to address gaps in coverage for the IPHC FISS in the IPHC Regulatory Area 2B. Currently, the FISS license excludes Marine Protected Areas as described by Hecate Strait and Queen Charlotte Sound Glass Sponge Reefs Marine Protected Areas Regulations, and Rockfish Conservation Areas (RCAs).

Memorandum of Understanding/Collective Agreement – Rockfish

This agreement has been put on hold for 2025 by DFO.

Northern Shelf Bioregion

The action plan for the development of a network of marine protected areas (MPAs) in the Northern Shelf Bioregion is a collaborative partnership between the Government of Canada, the Province of British Columbia and First Nations. The action plan supports implementation of the

Reconciliation Framework Agreements. The MPA Network zones have been organized into three implementation categories with category 1 zones targeted for establishment by 2025.

While detailed management plans for individual MPAs within the network remain in the planning phase, the Secretariat follows the process in relation to network's overlap with FISS (see Fig. 2). Proposed extension of the network covers 29 FISS stations.

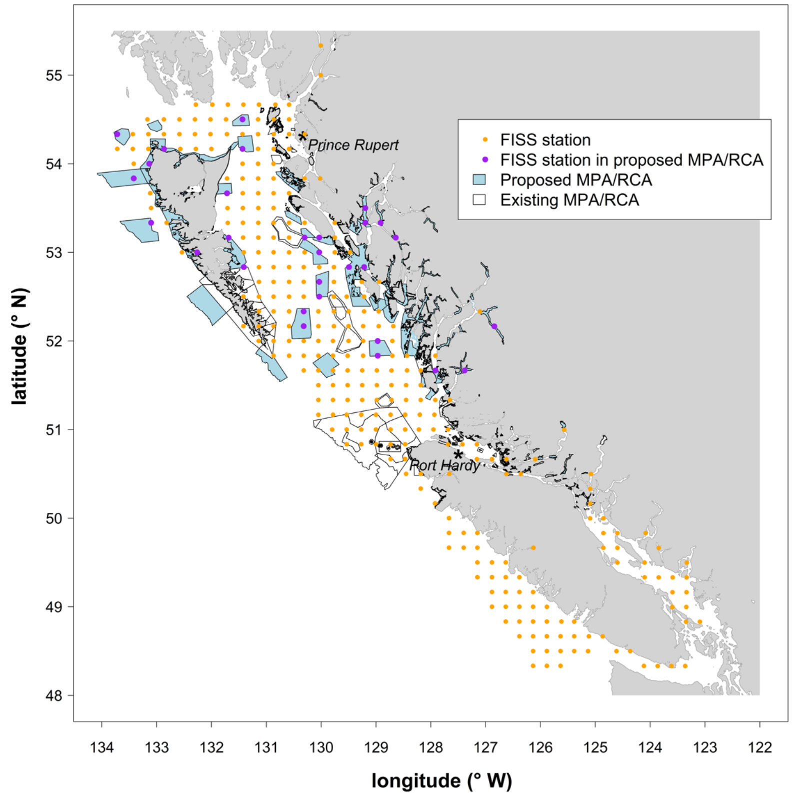

Figure 2: Overlap between locations of FISS stations and proposed area of the Northern Shelf Bioregion.

Proposed Central Coast National Marine Conservation Area Reserve

Proposed Central Coast National Marine Conservation Area Reserve (NMCAR) is a partnership between Parks Canada and six First Nations: Wuikinuxv, Nuxalk, Kitasoo Xai'xais, Heiltsuk, Gitxaala and Gitga'at Nations. The area in question falls within the Northern Shelf Bioregion Network (Fig. 3). At this stage, the feasibility assessment has concluded with a report and recommendation that was submitted to the leadership of all partners.

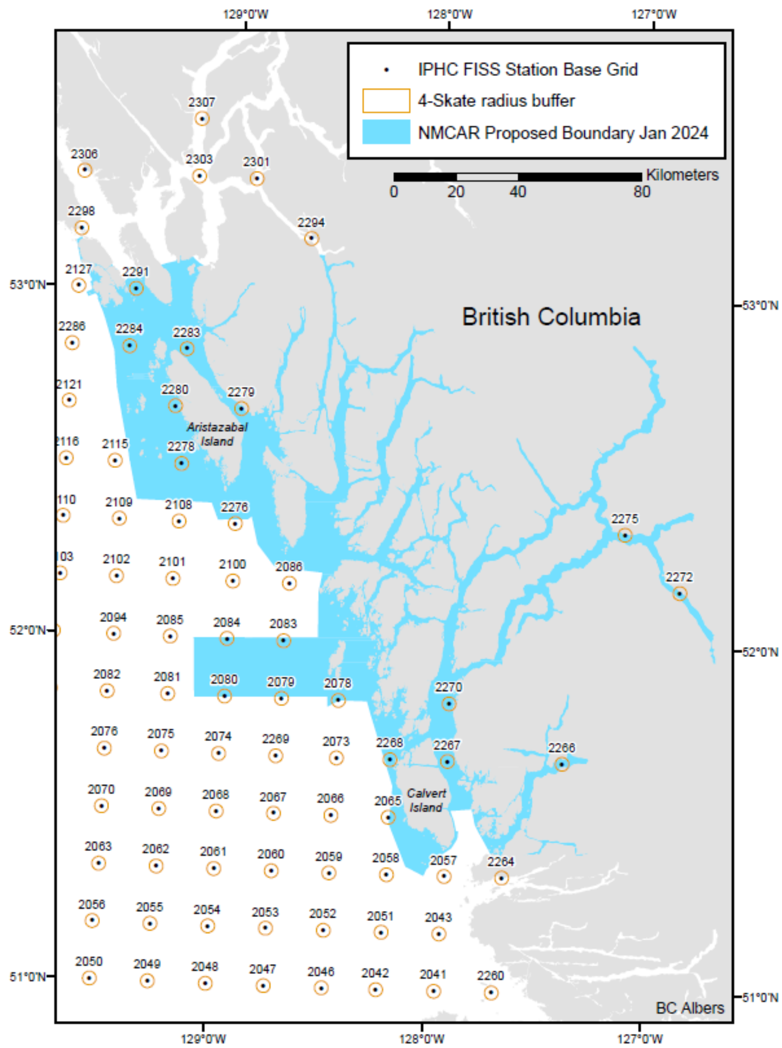

Figure 3: Central Coast National Marine Conservation Area with IPHC Standard Grid Stations

Halibut Advisory Board (HAB)

The Executive Director (Dr. Wilson) participates as a HAB member, with the Fisheries Regulations and Data Services Branch manager (Dr. 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.

8.3 United States of America

2025 Annual Management Measures were published in the Federal Register on 21 March 2025 (retrospectively effective 14 March 2025) and are available here.

NOAA Fisheries

Electronic logbooks in Alaska

In 2025, the IPHC continues to support the implementation of electronic logbooks in Alaska. Building on the successful 2024 trial, the Secretariat is working with the vendor and NOAA Fisheries to expand adoption and integration of the system, which enables digital recording and verification of fishing activity without the need for paper records.

NOAA Fisheries is also finalizing the development of its application programming interface (API), which should allow the IPHC to access electronically submitted Daily Fishing Logbooks (DFLs) through the eLandings platform, further enhancing data sharing and coordination between agencies.

NMFS Proposed Rule on Confidentiality of Information

The IPHC Secretariat is closely monitoring implications of the NMFS Final Rule on Confidentiality of Information, which was published on 17 December 2024, and became effective 16 January 2025. Under the updated rule, NOAA Fisheries revised 50 CFR part 600 to clarify regulatory procedures governing the management and disclosure of confidential data. The rule also defines an information-sharing obligation of a Regional Fishery Management Organization (RFMO) as a measure, or part thereof, that creates a binding requirement on the United States to report specified information by virtue of its membership in that RFMO. The Secretariat continues to assess how these revisions may affect existing data-sharing agreements and confidentiality commitments, particularly those between IPHC and NOAA Fisheries.

Management in IPHC Regulatory Area 2A

The Secretariat has a data sharing agreement with NOAA Fisheries West Coast Region to access confidential data, including:

- All non-trawl logbook data submissions that include landings or discards of Pacific halibut, either sourced from the electronic application (FishVue Float) or paper logbooks, which are currently located in a data system maintained by the Pacific States Marine Fisheries Commission (PacStates); and
- All permit data for directed commercial fishery, recreational charter fishery, incidental salmon troll, and incidental longline sablefish fishery permits for Pacific halibut, which are currently located in a data system maintained by NOAA Fisheries.

These data are essential for efficient fulfilment of tasks related to collection of biological sampling and compiling log data for IPHC Regulatory Area 2A. Agreement has been signed on 16 October 2023 and is valid for five years.

Nomination of the Alaĝum Kanuux̂ (Heart of the Ocean) for consideration as a new national marine sanctuary

In June 2022, NOAA announced nomination of the Alaĝum Kanuux̂ (Heart of the Ocean) for consideration as a new national marine sanctuary (87 FR 34851), which was the first phase of the of the Pribilof Island Marine Island Ecosystem (PRIME) initiative. However, in 2025, the Aleut Community of St. Paul Island Tribal Government has decided not to pursue its designation as a national marine sanctuary. Instead, it has signed an agreement with the federal government focused on Indigenous-led conservation in waters surrounding the Bering Sea island. The IPHC will monitor for the potential implications for FISS survey.

North Pacific Fishery Management Council (NPFMC)

The IPHC provided the Council with the outcomes of the 101st Session of the IPHC Annual Meeting (AM101) during its April 2025 meeting (B8 report).

At the meeting in April 2025, the Council adopted a motion on Area 4 vessel use caps (C1 Council Motion), recommending Alternative 2 as the preferred alternative: to create a new vessel limitation specific to IFQ regulatory Area 4, while maintaining existing vessel caps for other IFQ areas. The Council supported Option 1, setting the cap at 5% of the Area 4 Pacific halibut TAC, and included a suboption specifying that Pacific halibut IFQ held by an Area 4B CQE would not accrue toward the Area 4 vessel cap.

This action is being considered to increase utilization of quota and fishery revenues in Area 4 by providing additional harvest opportunities for vessels that were constrained by the previous vessel use cap while maintaining the Council's objectives for the IFQ program to provide entry level opportunities and support sustained participation by fishery-dependent communities.

At the meeting in October 2025, the Council considered the discussion paper on IFQ/CQE transfers and beneficiary changes. Considered to allow in-season transfer of IFQ between CDQ residents.

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The implementation of the Recreational Quota Entity (RQE) is postponed to 2026.

The Council will be taking the following items relevant to Pacific halibut later this year:

- Final action on 2026 charter management measures (December 2025)

Pacific Fishery Management Council (PFMC)

At the meeting in March 2025, the IPHC presented to the Council the outcomes of the 101st Session of the IPHC Annual Meeting (AM101) (C.1.a PPT).

2A Pacific Halibut Catch Sharing Plan and the structure of the non-Tribal directed commercial Pacific halibut fishery

At the meeting in December 2024, the Council adopted the 2025 Area 2A Pacific halibut fisheries season structure for the 2025 non-Tribal directed commercial Pacific halibut fishery and Washington, Oregon, and California sport fisheries. Details are available in the Decision Summary Document.

The management measures for the Area 2A Pacific halibut directed commercial fishery are published in the Federal Register (90 FR 15129, 8 April 2025 – currently as Proposed Rule).

At the meeting in September 2025, Council adopted for public review the status quo Area 2A Pacific halibut non-Tribal directed commercial fishery season structure for 2026. The Council will adopt final changes to the 2026 Pacific halibut Catch Sharing Plan and annual fishery regulations at their November 2025 meeting.

Incidental Catch Limits for Fixed Gear Sablefish Fisheries

Adopted in March 2025, the Council's final recommendation for the 2025 incidental Pacific halibut catch limits in the fixed gear fishery north of Point Chehalis beginning 1 April was 75 pounds of dressed weight Pacific halibut for every 1,000 pounds dressed weight of sablefish, plus 2 additional Pacific halibut in excess of the ratio, which was consistent with the Groundfish Advisory Subpanel recommendations.

Incidental Catch Limits for Salmon Troll Fishery

Under the Pacific Halibut Catch Sharing Plan, the salmon troll fishery is provided a portion of the non-tribal commercial Pacific halibut allocation for incidental retention of Pacific halibut. In April 2025, the Council adopted catch ratio and vessel limits for incidental Pacific halibut retention in the salmon troll fishery which are effective from 16 May 2025 through the end of the 2025 salmon troll fishery, and beginning 1 April 2026, until modified through in-season action or the 2026 management measures. License holders may land no more than one Pacific halibut per two Chinook, except one Pacific halibut may be landed without meeting the ratio requirement, and no more than 35 Pacific halibut landed per trip.

Bureau of Ocean Energy Management (BOEM) offshore wind planning activities

The IPHC is monitoring the progress of offshore wind development proposals off the coasts of Oregon and Washington, particularly with respect to potential overlap with FISS operations. However, the planned wind energy auctions were postponed on 27 September 2024, following the implementation of a presidential memorandum issued by President Trump, which temporarily halted offshore wind leasing on the Outer Continental Shelf.

Alaska Fisheries Science Center (AFSC)

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 FISS stations surveyed in 2025. The IPHC has been collecting these data from Pacific spiny dogfish since 2011, from Pacific cod in the Bering Sea since 2007 and from Pacific cod in the Gulf of Alaska (GOA) since 2017. In 2025, the IPHC FISS team collected 1,344 lengths of Pacific cod and 828 lengths/sex of Pacific spiny dogfish as a part of this agreement.

Data sharing agreement with the Fisheries Monitoring Division

The Secretariat has a standing data sharing agreement with the NOAA Alaska Fisheries Science Center Fisheries Monitoring Division to obtain confidential information from commercial fisheries observers and electronic monitoring systems, including haul information: fishing gear, location, date and time, lengths of specimens and species composition.

Northwest Fisheries Science Center (NWFSC)

The Secretariat has a standing data sharing agreement with the Northwest Fisheries Science Center to obtain confidential data from commercial fishing vessels observed by the West Coast Groundfish Observer Program (WCGOP) or the At-sea Hake Observer Program (A-SHOP). This includes haul-level observer data: fishing vessel information, gear used, Pacific halibut catch, catch of other species, species biological data (e.g. length, weight, sex), mortality assessments, haul locations, tow or soak time duration, depth, date, and time.

Washington Department of Fish and Wildlife (WDFW)

Memorandum of Understanding – Rockfish

The objective of the Memorandum of Understanding with the WDFW is to 1) collect and utilize catch and biological sample data from species caught during FISS; 2) agree on how proceeds from the sale of Pacific halibut, rockfish and Pacific cod 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 2025, the IPHC sampled eight (8) additional stations at the request of the WDFW. The IPHC tagged rockfish at sea, which were then sampled by WDFW staff during the offloads in Port Angeles, and Westport, WA. The number of tagged rockfish will be provided later in the year. The costs incurred by these activities are 100% cost-recovered from the WDFW. California Department of Fish and Wildlife (CDFW)

Data sharing agreement with California Department of Fish and Wildlife

The IPHC and the CDFW entered into a data sharing agreement for the purpose of tracking all Pacific halibut removals from within Convention waters. The agreement provides the Secretariat with access to commercial landing receipt data from California. The agreement was extended in 2025 and is now valid through 31 March 2027.

9 IPHC PUBLICATIONS AND OUTREACH

9.1 IPHC Website

The IPHC Secretariat continues to enhance the accessibility of data and statistics for stakeholders and other interested parties, with a particular focus on providing timely and informative visual displays such as those listed below. In 2025, the IPHC website underwent ongoing improved design and simplified content management.

1) **Pacific halibut fishery limits (FCEY) report:** https://www.iphc.int/data/fishery-limits-2025/
2) **Year to date directed commercial Pacific halibut landings visualization:** https://www.iphc.int/data/year-to-date-directed-commercial-landing-patterns-all-regions/
3) **Commercial Pacific halibut WPUE data from available fishing logbooks:** https://www.iphc.int/data/directed-commercial-landed-weight-and-wpue/
4) **Time series datasets (all sectors):** https://www.iphc.int/data/time-series-datasets
5) **Fishery-independent setline survey (FISS) datasets:** https://www.iphc.int/data/datatest/fishery-independent-setline-survey-fiss
6) **Water column profiler data:** https://www.iphc.int/datatest/data/water-column-profiler-data

9.2 Annual Report

The 2024 Annual Report (1 January to 31 December 2024) was published on 14 February 2025 and is available for download from the IPHC website at the following link:

https://www.iphc.int/uploads/2025/02/IPHC-2025-AR2024-R-2024-Annual-Report.pdf

The 2025 Annual Report is expected to be published by 1 March 2026.

9.3 IPHC Circulars and Media Releases

2025 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. The following are those published in 2025, and a full list may be accessed via the following weblink: https://www.iphc.int/library/documents/category/circulars

Circular	Title	Date published
IPHC-2025-CR-001	Report of the 101st Session of the IPHC Finance and Administration Committee (FAC101)	28 Jan 2025
IPHC-2025-CR-002	Report of the 30th Session of the IPHC Processor Advisory Board (PAB030)	30 Jan 2025
IPHC-2025-CR-003	Report of the 95th Session of the IPHC Conference Board (CB095)	30 Jan 2025
IPHC-2025-CR-004	Report of the 101st Session of the IPHC Annual Meeting (AM101)	31 Jan 2025
IPHC-2025-CR-005	Invitation to the 21st Session of the IPHC Management Strategy Advisory Board (MSAB021)	10 Feb 2025
IPHC-2025-CR-006	Publication of IPHC Annual Report 2024 (IPHC-2025-AR2024-R)	14 Feb 2025
IPHC-2025-CR-007	Invitation to the 26th Session of the IPHC Scientific Review Board (SRB026)	12 Mar 2025
IPHC-2025-CR-008	For Decision – MSAB Membership (For Approval)	25 Mar 2025
IPHC-2025-CR-009	For Information – Intersessional Decision 2025-ID001 – MSAB Membership	3 Apr 2025
IPHC-2025-CR-010	For Decision – FY2026 Budget (For Approval), FY2027 and FY2028 (For Provisional Endorsement)	4 Apr 2025
IPHC-2025-CR-011	For Information – Intersessional Decision 2025-ID002-ID004 – FY2026, FY2027 and FY2028 Budget Estimates	11 Apr 2025
IPHC-2025-CR-012	Report of the 21st Session of the IPHC Management Strategy Advisory Board (MSAB021)	16 May 2025
IPHC-2025-CR-013	Invitation to the 2025 Session of the IPHC Work Meeting (WM2025)	6 Jun 2025
IPHC-2025-CR-014	Report of the 26th Session of the IPHC Scientific Review Board (SRB026)	12 Jun 2025
IPHC-2025-CR-015	Invitation to the 27th Session of the IPHC Scientific Review Board (SRB027)	17 Jun 2025
IPHC-2025-CR-016	For Decision – Fecundity Research: Part II (2025 and 2026)	28 Jun 2025
IPHC-2025-CR-017	For Information – Intersessional Decisions 2025-ID005-ID006 - Fecundity Research: Part II (2025 and 2026)	8 Jul 2025
IPHC-2025-CR-018	Invitation to the 26th Session of the IPHC Research Advisory Board (RAB026)	20 Aug 2025
IPHC-2025-CR-019	Invitation to the 101st Session of the IPHC Interim Meeting (IM101)	3 Sep 2025
IPHC-2025-CR-020	Report of the 27th Session of the IPHC Scientific Review Board (SRB027)	18 Sep 2025
IPHC-2025-CR-021	Invitation to the 102nd Session of the IPHC Finance and Administration Committee (FAC102)	16 Oct 2025
IPHC-2025-CR-022	Invitation to the 102nd Session of the IPHC Annual Meeting (AM102)	20 Oct 2025

IPHC-2025-CR-023	Invitation to the 96th Session of the IPHC Conference Board (CB096) and the 31st Session of the IPHC Processor Advisory Board (PAB031)	22 Oct 2025

2025 IPHC Media Releases are the primary informal communication with all stakeholders. https://www.iphc.int/library/documents/category/media-releases

Media Release	Title	Date published
IPHC-2025-MR001	AM101 Hotel booking reminder	2 Jan 2025
IPHC-2025-MR002	IPHC Requests Tenders for the 2025 Fishery-Independent Setline Survey (FISS) Reminder and Q&A Session	16 Jan 2025
IPHC-2025-MR003	Outcomes of the 101st Session of the IPHC Annual Meeting (AM101)	31 Jan 2025
IPHC-2025-MR004	Open Call for Expressions of Interest: IPHC Management Strategy Advisory Board (MSAB) Member Representing U.S.A. Commercial Fisheries	19 Feb 2025
IPHC-2025-MR005	Open Call for Expression of Interest: IPHC Research Advisory Board (RAB) Members Representing Canada	24 Feb 2025
IPHC-2025-MR006	Notification of Potential Pacific Halibut Sales in 2025, Seeking Buyers Interested in Fish Sales from the IPHC Fishery-Independent Setline Survey (FISS)	27 Feb 2025
IPHC-2025-MR007	Notification of IPHC Fishery-Independent Setline Survey (FISS) 2025 Contract Awards	17 Mar 2025
IPHC-2025-MR008	Pacific Halibut Commercial Fishing Period Set to Open on 20 March	18 Mar 2025
IPHC-2025-MR009	Fishery-Independent Setline Survey (FISS): 2025	30 May 2025
IPHC-2025-MR010	2025 Fecundity Study Request for Tender	13 Jun 2025
IPHC-2025-MR011	Attention Salmon Processors – Chum Salmon Needed for the 2026 IPHC Fishery-Independent Setline Survey (FISS)	6 Aug 2025
IPHC-2025-MR012	Call for proposals: IPHC 2025-26 Fishery Regulations process	24 Sep 2025
IPHC-2025-MR013	Attention Salmon Processors – Request for Bids: Chum Salmon for the 2026 IPHC Fishery-Independent Setline Survey (FISS)	16 Oct 2025

All interested persons are encouraged to request that their email addresses be added to IPHC distribution lists at the following link: https://www.iphc.int/media-news-subscription/.

9.4 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.

Committees and external organisation appointments

North America:

1) *Canada – U.S. Groundfish Technical Committee* - Dr. Josep Planas

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) *NPFMC Scientific and Statistical Committee* - Dr. Ian Stewart
4) *North Pacific Research Board Science Panel* - Dr. Josep Planas, Dr. Allan Hicks
5) *Marine Resource Education Program, North Pacific* – Dr. Ian Stewart
6) *Fisheries Monitoring Science Committee (NOAA-Alaska)* – Dr. Ray Webster
7) *Interagency electronic reporting system for commercial fishery landings in Alaska (eLandings) Steering Committee* – Dr. Basia Hutniczak

Academic affiliations 2025

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 - University of Washington School of Aquatic & Fishery Sciences, Seattle, WA, USA
4) Dr. Josep Planas - Alaska Pacific University, Anchorage, AK, USA

Cooperation with other organisations

Since its inception, the IPHC has entered into a number of arrangements with other institutions, almost invariably of a technical nature, either to conduct activities in cooperation or to facilitate exchange of information that would enhance the output of both organisations. Some of these are outlined in Section 8 (Interactions with Contracting Parties).

The arrangements take a variety of forms, including Memorandum of Understanding, agreements to share data, and permits to undertake research on Pacific halibut. Current and closed arrangements are publicly available on the IPHC website: https://www.iphc.int/about/cooperation-with-other-organizations/.

Of particular note is our engagement with the North Pacific Marine Science Organization (PICES) facilitating collaboration between IPHC and PICES. The current Memorandum of Understanding was signed on 14 February 2024 and will remain in effect for five years.

10 IPHC Publications in 2025

10.1 Published peer-reviewed journal papers

Planas, JV, Jasonowicz, AJ, Simeon, A, Simchick, C, Timmings-Schiffman, E, Nunn, BL, Kroska, AC, Wolf, N, Hurst, TP. 2025. Molecular mechanisms underlying thermally induced growth plasticity in juvenile Pacific halibut. Journal of Experimental Biology. 228: jeb251013. https://doi.org/10.1242/jeb.251013.

Ritchie, BA, Smeltz, TS, **Stewart, IJ**, Harris, BP, and N. Wolf. 2025. Exploring Spatial and Temporal Patterns in the Size-At-Age of Pacific Halibut in the Gulf of Alaska. Fisheries Management and Ecology. doi:10.1111/fme.12814.

Stewart, I.J., and Monnahan, C.C. 2025. Diagnosing common sources of lack of fit to composition data in fisheries stock assessment models using One-Step-Ahead (OSA) residuals. Canadian Journal of Fisheries and Aquatic Sciences. http://dx.doi.org/10.1139/cjfas-2025-0158.

Adams, G.D., Holsman, K., Rovellini, A., **Stewart, I.J.**, Privitera-Johnson, K., Wassermann, S.N., and Punt, A.E. 2025. Implications of predator–prey dynamics for single species management. Canadian Journal of Fisheries and Aquatic Sciences **82**: 1–19. doi:10.1139/cjfas-2024-0225.

10.2 In press peer-reviewed journal papers

Nil

10.3 Submitted peer-review journal papers – In review

McGilliard, C.R., Ianelli, J., Cunningham, C., **Hicks, A**., Hanselman, D., Stram, D., Henry, A. Evaluating Bering Sea Pacific halibut bycatch management options using closed-loop simulations in a dynamic, multi-agency setting. Canadian Journal of Fisheries and Aquatic Sciences.

11 RECOMMENDATION

That the Commission **NOTE** paper IPHC-2025-IM101-04 that provides the Commission with an update on the IPHC Secretariat activities in 2025 not detailed in other papers before the Commission.

12 APPENDICES

Appendix I: IPHC Secretariat positions – Effective 01 July 2025

Appendix I
IPHC Secretariat positions – 29 October 2025

(https://www.iphc.int/locations/map)

Branch	Sub-Section	Position	Current Employee
-	-	Executive Director	Dr Wilson, David
Quantitative Sciences	-	Quantitative Scientist (Stock Assessment)	Dr Stewart, Ian
Quantitative Sciences	-	Quantitative Scientist (Management Strategy Evaluation)	Dr Hicks, Allan
Quantitative Sciences	-	Quantitative Scientist (Biometrician)	Dr Webster, Raymond
Biological and Ecosystem Sciences	-	Branch Manager (Biological and Ecosystem Sciences)	Dr Planas, Josep
Biological and Ecosystem Sciences	-	Research Biologist (Mortality and Survivorship)	Dykstra, Claude
Biological and Ecosystem Sciences	-	Research Biologist Genetics	Jasonowicz, Andrew
Biological and Ecosystem Sciences	-	Research Biologist (Life History)	Jones, Colin
Biological and Ecosystem Sciences	-	Biological Science Laboratory Technician	Simchick, Crystal / May, Darran
Fisheries Monitoring	Port Operations Services	Port Operations Coordinator	Thom, Monica
Fisheries Monitoring	Port Operations Services	Fisheries Data Specialist (Field)	Multiple Employees (9-10)
Fisheries Monitoring	Fishery-Independent Setline Survey	Setline Survey Coordinator	Ualesi, Kayla
Fisheries Monitoring	Fishery-Independent Setline Survey	Setline Survey Specialist (Snr)	Jack, Tyler
Fisheries Monitoring	Fishery-Independent Setline Survey	Setline Survey Specialist	Rillera, Rachel
Fisheries Monitoring	Fishery-Independent Setline Survey	Setline Survey Specialist	Coll, Kevin
Fisheries Monitoring	Fishery-Independent Setline Survey	Setline Survey Specialist (Field)	Multiple Employees (10-35)
Fisheries Regulations and Data Services	-	Branch Manager (FRDS)	Dr Hutniczak, Barbara

Fisheries Regulations and Data Services	Fisheries Data Services	Fisheries Data Coordinator	Tran, Huyen
Fisheries Regulations and Data Services	Fisheries Data Services	Fisheries Data Specialist (HQ-GIS)	Kong, Thomas
Fisheries Regulations and Data Services	Fisheries Data Services	Fisheries Data Specialist (HQ) & Otolith Technician	Sawyer Van Vleck, Kim
Fisheries Regulations and Data Services	Fisheries Data Services	Fisheries Data Specialist (HQ) & Otolith Technician	Magrane, Kelsey
Fisheries Regulations and Data Services	Otolith Aging Services	Otolith Laboratory Technician (Snr)	Forsberg, Joan
Fisheries Regulations and Data Services	Otolith Aging Services	Otolith Laboratory Technician	Chin, Andrew
Administrative Services	-	Branch Manager (Administrative Services Branch)	Dr White, Brad
Administrative Services	Personnel Services	Administrative Coordinator	Chapman, Kelly
Administrative Services	Personnel Services	Administrative Specialist (Snr)	Wietecha, Ola
Administrative Services	Personnel Services	Administrative Specialist	Wickham, Kenneth
Administrative Services	Personnel Services	Administrative Specialist	Sherk, Sydney
Administrative Services	Accounting Services	Accountants	Sommerville & Associates
Administrative Services	Accounting Services	Administrative Services (Accounting)	Arian, Mohammad
Administrative Services	Technology Services	Systems Administrator	Tynes, Robert
Administrative Services	Technology Services	Information Technology Specialist (Application Developer)	Taheri, Afshin
Administrative Services	Technology Services	Information Technology Specialist (Application Developer)	Outsourced

INTERNATIONAL PACIFIC HALIBUT COMMISSION INTEGRATED RESEARCH AND MONITORING PLAN: DRAFT

PREPARED BY: IPHC SECRETARIAT (D. WILSON, J. PLANAS, I. STEWART, A. HICKS, B. HUTNICZAK, AND R. WEBSTER; 29 OCTOBER 2025)

PURPOSE

To provide the Commission with an update on the development of the next Integrated Research and Monitoring Plan.

BACKGROUND

Recalling that:

a) the IPHC Secretariat conducts activities to address key issues identified by the Commission, its subsidiary bodies, the broader stakeholder community, and the IPHC Secretariat;

b) the process of identifying, developing, and implementing the IPHC's science-based activities involves several steps that are circular and iterative in nature, but result in clear project activities and associated deliverables;

c) the process includes developing and proposing projects based on direct input from the Commission, the experience of the IPHC Secretariat given its broad understanding of the resource and its associated fisheries, and concurrent consideration by relevant IPHC subsidiary bodies, and where deemed necessary, including by the Commission, additional external peer review;

Also recalling that an overarching goal of the IPHC's Integrated Research and Monitoring Plans are to promote integration and synergies among the various research and monitoring activities of the IPHC Secretariat in order to improve knowledge of key inputs into the Pacific halibut stock assessment, and Management Strategy Evaluation (MSE) processes, thereby providing the best possible advice for management decision making processes.

The 1st iteration of the Plan was formally presented to the Commission at IM097 in November 2021 (IPHC-2021-IM097-12) for general awareness of the documents ongoing development. At the 98th Session of the IPHC Annual Meeting (AM098) in January 2022, the Commission requested a number of amendments which were subsequently incorporated.

In 2023 and 2024, the plan went through two cycles of review and improvement with the SRB, with amendments being suggested and incorporated accordingly. The current plan is provided at **Appendix A** for reference.

Noting that the current 5YPIRM is due to end in 2026, the Secretariat, in collaboration with the SRB, is in the process of updating the Plan to reflect changing priorities in light of major progress on research area, as well as ongoing monitoring and funding challenges.

DISCUSSION

The Commission should note that:

a) the intention is to ensure that the next plan is kept as a '*living plan*', and is reviewed and updated annually based on the resources available to undertake the work of the Commission (e.g. internal and external fiscal resources, collaborations, internal expertise);

b) the plan focuses on core responsibilities of the Commission; and any redirection provided by the Commission;

c) each year the SRB may choose to recommend modifications to the current Plan, and that any modifications subsequently made would be documented both in the Plan itself, and through reporting back to the SRB and then the Commission.

Next steps:

The SRB considered the draft of the Integrated Research and Monitoring Plan at its September meeting (SRB027: 16-18 September 2025) and provided the following suggestions for future refinement:

REQUESTS

International Pacific Halibut Commission Integrated Research and Monitoring Plan

SRB027–Req.01 (para. 12) The SRB **REQUESTED** that, in a future iteration of the Plan, the following elements be considered:

a) **Tactical workplan**: Develop a 3-5 year tactical workplan with defined milestones.

b) **Prioritizing research**: according to needs for stock assessment, MSE, and other potential applications. This may require a new process for determining priority such as sensitivity analyses on the stock assessment or MSE.

c) **Rang-wide research**: including collaboration with western Pacific Ocean countries fishing for Pacific halibut (Ref. PRIPHC02-Rec.03).

d) **Cost-benefit analysis**: innovation and emerging scientific methods could use a procedure for determining the cost-benefit of proposed or ongoing projects. For example, AI-assisted ageing and epigenetic ageing presumably have different operational costs as supplemental ageing methods (although non-lethal epigenetic ageing has other potential applications)

e) **Addition of decision-points**: to determine whether internally funded projects continue or stop. Many of the items in the IRMP are potentially open-ended but should not be continued indefinitely if the question is answered sufficiently to remove it from the high priority list. For example, questions about stock structure could certainly be continued, but they have been sufficiently addressed that the possibility of stock structure is no longer a high priority risk

f) **Observer coverage**: Evaluation of observer coverage and/or other methods of catch and discard reporting across the entire fishery (Ref. PRIPHC02-Rec.09)

g) **Dashboards**: The IRMP emphasizes outreach via websites, meetings, publications, and plain language summaries. Outputs could be made more actionable for decision-makers and other stakeholders through graphical dashboard summaries of key stock and harvest indicators, perhaps by IPHC Regulatory Area.

h) **Communication**: supplemental documentation is needed of completed projects, progress against independent review recommendations, etc., and how these may or may not affect organization and prioritization of ongoing projects. For example, the IRMP Supplement could include a brief summary of the stock structure conclusions and what that means for ongoing stock structure related projects.

i) **Measures of Success**: although the plan lists broad performance categories, there is a need for project-level indicators. Some performance measures, such as relevance and impact, may require surveys of science information users to elicit performance data.

j) **Capacity building**: Is there a formal capacity building plan to ensure the long-term viability of the IRMP?

The Secretariat is in the process of considering and incorporating the suggestions into a revised draft.

RECOMMENDATION

That the Commission:

1) **NOTE** paper IPHC-2025-IM101-05 that provides an update on the development of the next Integrated Research and Monitoring Plan.

APPENDICES

Appendix A: IPHC Integrated Research and Monitoring Plan: Draft

APPENDIX A

INTERNATIONAL PACIFIC HALIBUT COMMISSION INTEGRATED RESEARCH AND MONITORING PLAN (IRMP)

INTERNATIONAL PACIFIC HALIBUT COMMISSION

BIBLIOGRAPHIC ENTRY

IPHC 2026. International Pacific Halibut Commission Integrated Research and Monitoring Plan. Seattle, WA, U.S.A. *IPHC–2026-IRMP, 49 pp.*

INTERNATIONAL PACIFIC HALIBUT COMMISSION

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ACRONYMS

AI	Artificial Intelligence
AM	Annual Meeting
CB	Conference Board
DMR	Discard Mortality Rate
FAC	Finance and Administration Committee
FISS	Fishery-Independent Setline Survey
FSC	First Nations Food, Social, and Ceremonial [fishery]
IM	Interim Meeting
IPHC	International Pacific Halibut Commission
IRMP	Integrated Research and Monitoring Plan
MP	Management Procedure
MSAB	Management Strategy Advisory Board
MSE	Management Strategy Evaluation
OM	Operating Model
PAB	Processor Advisory Board
PDO	Pacific Decadal Oscillation
QAQC	Quality assurance/quality control
RAB	Research Advisory Board
SHARC	Subsistence Halibut Registration Certificates
SRB	Scientific Review Board
TCEY	Total Constant Exploitation Yield
U.S.A.	United States of America
WM	Work Meeting

DEFINITIONS

A set of working definitions are provided in the IPHC Glossary of Terms and abbreviations: https://www.iphc.int/glossary-of-terms-and-abbreviations/

TABLE OF CONTENTS

EXECUTIVE SUMMARY

To be developed once the IRMP is developed in full

1. Introduction

The International Pacific Halibut Commission (IPHC) is a public international organisation so designated via Presidential Executive Order 11059 and established by a Convention between Canada and the United States of America. The IPHC Convention was signed on 2 March 1923, ratified on 21 July 1924, and came into effect on 21 October 1924 upon exchange. 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 1979 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 fisheries are conducted and redefined the role of IPHC in the management of the fishery. 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 organisation 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 of the Commission's activities, is based in Seattle, WA, U.S.A. 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.***

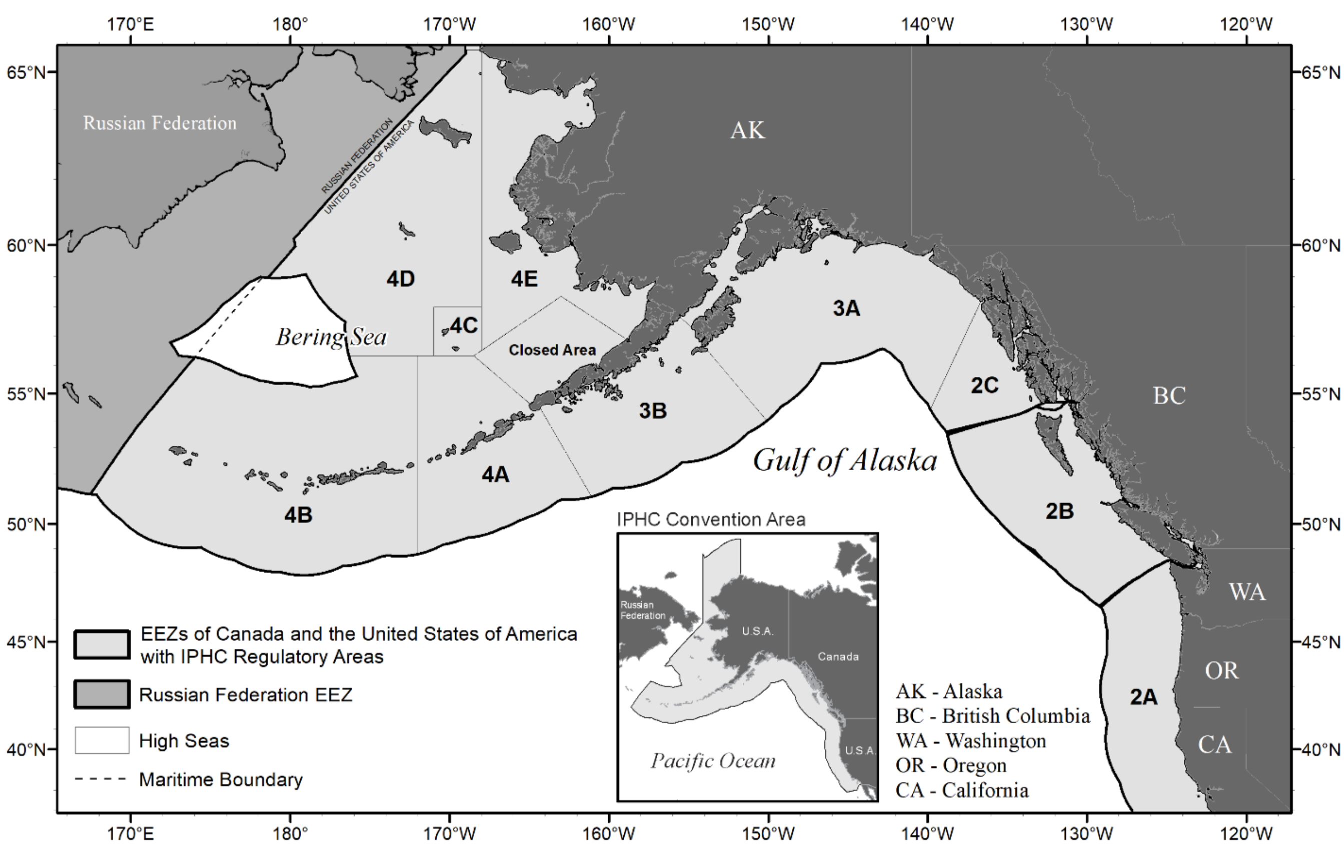

Figure 1. Map of the IPHC Convention Area (map insert) and IPHC Regulatory Areas.

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. 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 stock assessment, management strategy evaluation, management supporting information, and biology & ecology, all interact with each other as well as with fisheries monitoring activities in the IPHC program of integrated 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 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 research 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.

Over the last ten (10) years, the research conducted by the IPHC Secretariat has been guided by two sequential detailed plans.

- 2017-2021: 5-Year Biological and Ecosystem Science Research Plan (IPHC–2019–BESRP-5YP).
- 2022-2026: 5-Year Program of Integrated Research and Monitoring (2022-2026) (IPHC-2022-5YPIRM)

The aim of the first plan (2017-2021) was to increase our knowledge on the biology of Pacific halibut in order to improve the accuracy of the stock assessment and in the management strategy evaluation (MSE) process. The IPHC-2019-BESRP-5YP contemplated research activities in five focal areas, namely Migration and Distribution, Reproduction, Growth and Physiological Condition, Discard Mortality Rates and Survival, and Genetics and Genomics. Research activities were highly integrated with the needs of stock assessment and MSE by their careful alignment with biological uncertainties and parameters, and the resulting prioritisation (IPHC–2019–BESRP-5YP). The outcomes of the IPHC-2019-BESRP-5YP (summarised in Appendix I of IPHC-2023-5YPIRM) provided key inputs into stock assessment and the MSE process and, importantly, provided foundational information for subsequent plans. The first plan (2017-2021) developed into a second broader and more inclusive plan that encompassed all research and monitoring activities planned and conducted by the IPHC Secretariat as described in the 5-Year Program of Integrated Research and Monitoring (2022-2026) (IPHC-2023-5YPIRM).

The 2nd Performance Review of the IPHC (IPHC-2019-PRIPHC02-R), carried out over the course of 2019, also provided a range of recommendations to the Commission on ways in which it could continue to improve on the quality of scientific advice being provided to the Commission. There were nine (9) specific recommendations relevant to the research and monitoring, as provided below. Of these, only recommendations 3 and 9 remain to be fully implemented and have been incorporated into this current IRMP:

Science: Status of living marine resources

*PRIPHC02–Rec.03 (para. 44) The PRIPHC02 **RECOMMENDED** that opportunities to engage with western Pacific halibut science and management agencies be sought, to strengthen science links and data exchange. Specifically, consider options to investigate pan-Pacific stock structure and migration of Pacific halibut.*

*PRIPHC02–Rec.04 (para. 45) The PRIPHC02 **RECOMMENDED** that:*

a) further efforts be made to lead and collaborate on research to assess the ecosystem impacts of Pacific halibut fisheries on incidentally caught species (retained and/or discarded);

b) where feasible, this research be incorporated within the IPHC's 5-Year Research Plan (https://www.iphc.int/uploads/pdf/besrp/2019/iphc-2019-besrp-5yp.pdf);

c) findings from the IPHC Secretariat research and that of the Contracting Parties be readily accessible via the IPHC website.

Science: Quality and provision of scientific advice

*PRIPHC02–Rec.05 (para. 63) The PRIPHC02 **RECOMMENDED** that simplified materials be developed for RAB and especially MSAB use, including training/induction materials.*

*PRIPHC02–Rec.06 (para. 64) The PRIPHC02 **RECOMMENDED** that consideration be given to amending the Rules of Procedure to include appropriate fixed terms of service to ensure SRB peer review remains independent and fresh; a fixed term of three years seems appropriate, with no more than one renewal.*

*PRIPHC02–Rec.07 (para. 65) The PRIPHC02 **RECOMMENDED** that the peer review process be strengthened through expanded subject specific independent reviews including data quality and standards, the FISS, MSE, and biological/ecological research; as well as conversion of "grey literature" to primary literature publications. The latter considered important to ongoing information outreach efforts given the cutting-edge nature of the Commission's scientific work.*

*PRIPHC02–Rec.08 (para. 66) The PRIPHC02 **RECOMMENDED** that the IPHC Secretariat develop options for simple graphical summaries (i.e. phase plot equivalents) of fishing intensity and spawning stock biomass for provision to the Commission.*

Conservation and Management: Data collection and sharing

*PRIPHC02–Rec.09 (para. 73) The PRIPHC02 **RECOMMENDED** that observer coverage be adjusted to be commensurate with the level of fishing intensity in each IPHC Regulatory Area.*

Conservation and Management: Consistency between scientific advice and fishery Regulations adopted

*PRIPHC02–Rec.10 (para. 82) The PRIPHC02 **RECOMMENDED** that the development of MSE to underpin multi-year (strategic) decision-making be continued, and as multi-year decision making is implemented, current Secretariat capacity usage for annual stock assessments should be refocused on research to investigate MSE operating model development (including consideration of biological and fishery uncertainties) for future MSE iterations and regularized multi-year stock assessments.*

*PRIPHC02–Rec.11 (para. 83) The PRIPHC02 **RECOMMENDED** that ongoing work on the MSE process be prioritised to ensure there is a management framework/procedure with minimal room for ambiguous interpretation, and robust pre-agreed mortality limit setting frameworks.*

The work outlined in this document builds on the previous Research and Monitoring Plans (IPHC–2019–BESRP-5YP; and IPHC-2023-5YPIRM), closing completed projects, extending efforts where needed, and adding new avenues in response to new information. Appendix I provides a detailed summary of the outcomes of the previous IPHC-2023-5YPIRM plan and the status of the work specifically undertaken. Key highlights relevant to the stock assessment and MSE include:

- Investigations on population genomics, including the delineation of a genetic baseline and genomic analyses of population structure.
- Population-level sampling and analysis of maturity and fecundity leading to incorporation of an updated maturity ogive in the 2025 stock assessment and ongoing progress toward an updated fecundity relationship.
- Investigations on methods for reducing whale depredation in the Pacific halibut commercial longline fishery.

All previously described research areas continue to represent critical sources of information for the stock assessment and MSE and thus are closely linked to management performance. The previous 5-year plans were successful in either providing direct new information to the stock assessment or building the foundation for the collection/analysis of such information in this updated plan. As noted below, some new priorities have emerged, and others have evolved based on the work completed to date. The incorporation of research objectives in the current IRMP that address climate change as a factor influencing Pacific halibut biology and ecology as well as fishery performance and dynamics constitutes a timely and relevant contribution towards advancing IPHC-led research to the forefront of fisheries science.

An **overarching goal** of this current *IPHC Integrated Research and Monitoring Plan* (IRMP) is to continue to promote integration and synergies among the various research and support activities of the IPHC Secretariat in order to improve the Pacific halibut stock assessment and MSE process and our knowledge of key inputs into the Pacific halibut stock assessment and MSE processes, in order to provide the best possible advice for management decision-making processes. In doing so, the Plan also responds to emerging challenges and opportunities, particularly those presented by advances in artificial intelligence (AI), to enhance analytical capacity, improve efficiency, and support innovation across scientific and operational domains. The intention is no longer to designate the Plan for a defined period, but rather, to annually review and update the Plan as needed, based on resources available to the IPHC, as well as new Commission directives.

Along with the implementation of the short- and medium-term activities contemplated in this IRMP and in pursuit of the overarching goal, the IPHC Secretariat will also aim to:

1) undertake cutting-edge research programs in fisheries research in support of fisheries management of Pacific halibut.
2) undertake groundbreaking methodological research.
3) undertake applied research.
4) establish new collaborative agreements and interactions with research agencies and academic institutions.
5) promote the international involvement of the IPHC by continued and new participation in international scientific organisations and by leading international science and research collaborations.
6) effectively communicate IPHC research outcomes
7) incorporate talented students and early researchers in research activities.

The research and monitoring activities conducted by the IPHC Secretariat are organized into the following five

(5) areas: stock assessment, MSE, biology and ecology, monitoring, and additional management support. The overall aim is to provide integrated research and monitoring where each area informs and benefits from the others (Fig. 2):

Research

1) **Stock assessment**: to improve the accuracy and reliability of the current stock assessment and the characterisation of uncertainty in the resultant stock management advice provided to the Commission;

2) **Management Strategy Evaluation (MSE)**: to develop an accurate, reliable, and informative MSE process to appropriately characterize uncertainty and provide for the robust evaluation of the consequences of alternative management options, known as harvest strategies, using defined conservation and fishery objectives;

3) **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

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

Integrated management support

5) **Additional management-supporting inputs**: respond to Commission requests for additional information supporting management and policy development.

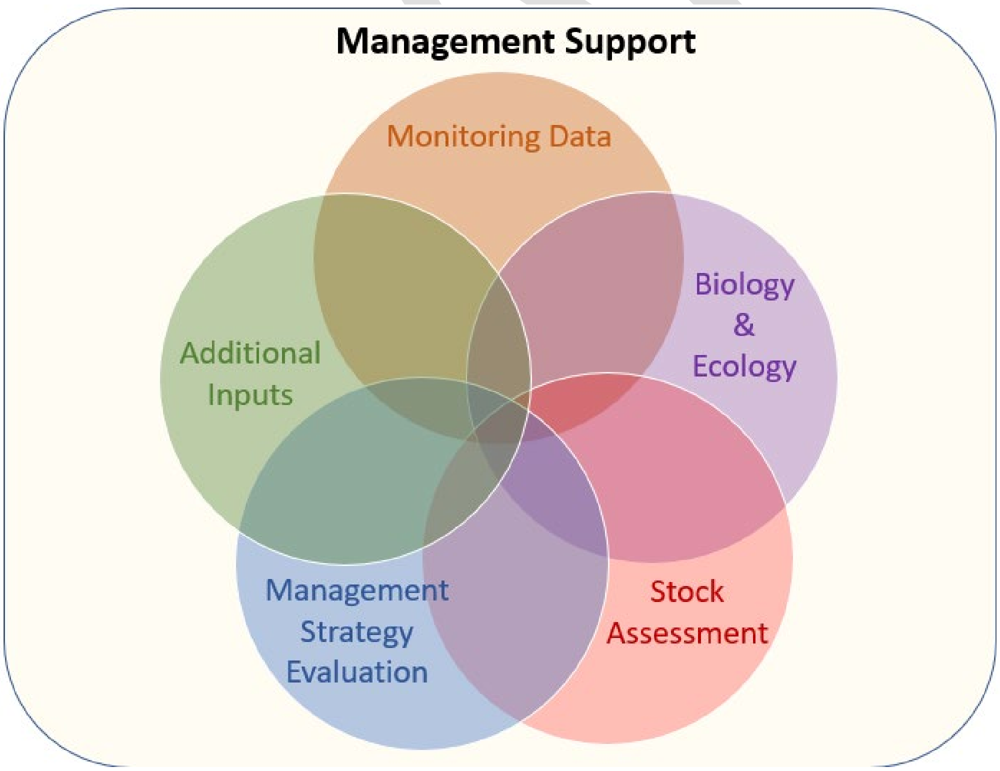

Figure 2. Core areas of the IPHC's Integrated Research and Monitoring Plan (IRMP) provide management support.

3. Strategy

The IPHC Secretariat has five (5) enduring strategic goals in executing our mission, including our overarching goal and associated science and research objectives, as articulated in our Strategic Plan (IPHC Strategic Plan (2023-27)): 1) To operate in accordance with international best practice; 2) Be a world leader in scientific excellence and science-based decision making; 3) To foster collaboration (within Contracting Parties and internationally) to enhance our science, monitoring, and management advice; 4) Create a vibrant IPHC culture; and 5) Set the standard for fisheries commissions globally.

Although priorities and tasking will change over time in response to events and developments, the Strategic 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, are operationalised through a multi-year tactical activity matrix 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.

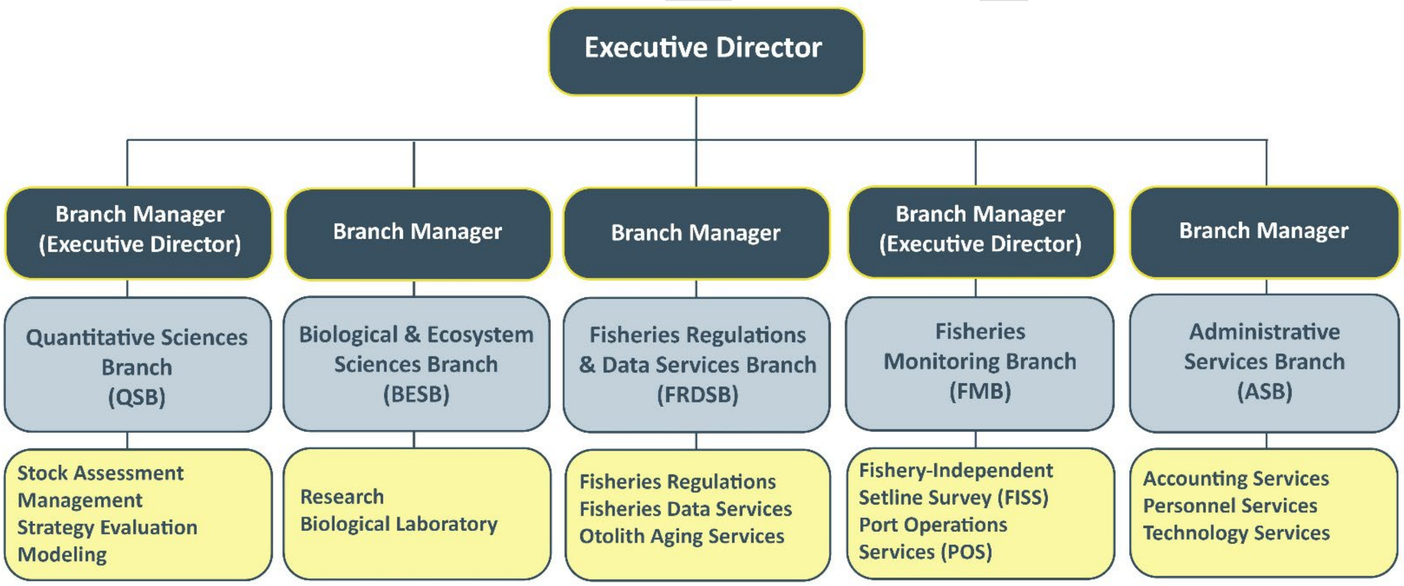

Figure 3. IPHC Secretariat organisation chart (2025).

4. Measures of Success

The Secretariat's success in implementing the IRMP will be measured according to the following criteria relevant to the stock assessment, the MSE, and for all inputs to IPHC management:

1) Timeliness – was the research conducted, analysed, published, and provided to the Commission at the appropriate points to be included in annual management decisions?
2) Accessibility – was the research published and presented in such a way that it was available to other scientists, stakeholders, and decision-makers?
3) Relevance - was the information used to inform decisions made by the Commission?
4) Impact – did the research improve the perceived accuracy of or provide a better estimate of the uncertainty associated with information for use in management?

5) Reliability - has research resulted in more consistent information provided to the Commission for decision-making.

4.1 Delivery of specified products

Each project line item will contain specific deliverables that constitute useful inputs into the understanding of the Pacific halibut stock and fisheries, 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

The IPHC Secretariat will disseminate information about the activities contemplated in the IRMP and the resulting products to Contracting Parties, stakeholders, the scientific community, and the general public through a variety of channels:

1) IPHC website (www.iphc.int);
2) Formal documentation provided for IPHC meetings (Interim and Annual Meetings, Subsidiary Body meetings, etc.);
3) Presentations at national and international scientific conferences;
4) Published reports and peer-reviewed publications (section 4.4);
5) Outreach events;
6) Posts on social media platforms;
7) Informal presentations and interactions with partners, stakeholders, and decision-makers at varied times and venues when needed;
8) Accessible and plain-language summaries of key findings, where appropriate, to facilitate broader stakeholder engagement and understanding.

4.3 External research funding

The Secretariat has set a funding goal of at least 20% of the funds for our research and monitoring activities, to be sourced from external funding bodies on an annual basis. Continuing the successful funding-recruitment strategy adopted during the previous plans (Appendix II), the Secretariat will target available external funding opportunities that are timely and that aim at addressing key research objectives that have important implications for stock assessment and the MSE process. The IPHC Secretariat has the necessary expertise to propose novel and important research questions to funding agencies and to recruit external collaborators from research agencies and universities as deemed necessary. The IPHC Secretariat will continue to capitalise on the strong analytical contributions of quantitative scientists to the development of biological research questions within the framework of research projects funded by external as well as internal funding sources. While the external funding environment has changed substantially in recent years, we will continue with this goal and adapt accordingly.

4.4 Peer-reviewed journal publication

Publication of research outcomes in peer-reviewed journals will be clearly documented and monitored as a primary 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. In the sections that follow, the expected publications from each research stream and cross-stream are defined.

5. Core focal areas – Background

The main activities of the IRMP involve 1) monitoring (fisheries-dependent and –independent data collection), 2) research (biological, ecological), and 3) modelling (FISS, stock assessment, and MSE), as outlined in the following sub-sections. These components are closely linked to one another, have goals that are integrated across the organisation, and all feed into management decision-making (Fig. 4). Additionally, management-supporting information constitutes a range of additional decision-making inputs within and beyond IPHC's current research and monitoring programs. The current program builds on the outcomes and experiences of the Commission arising from the implementation of the previous two (2) plans, and which are summarised in IPHC-2023-5YPIRM and Appendix I, respectively.

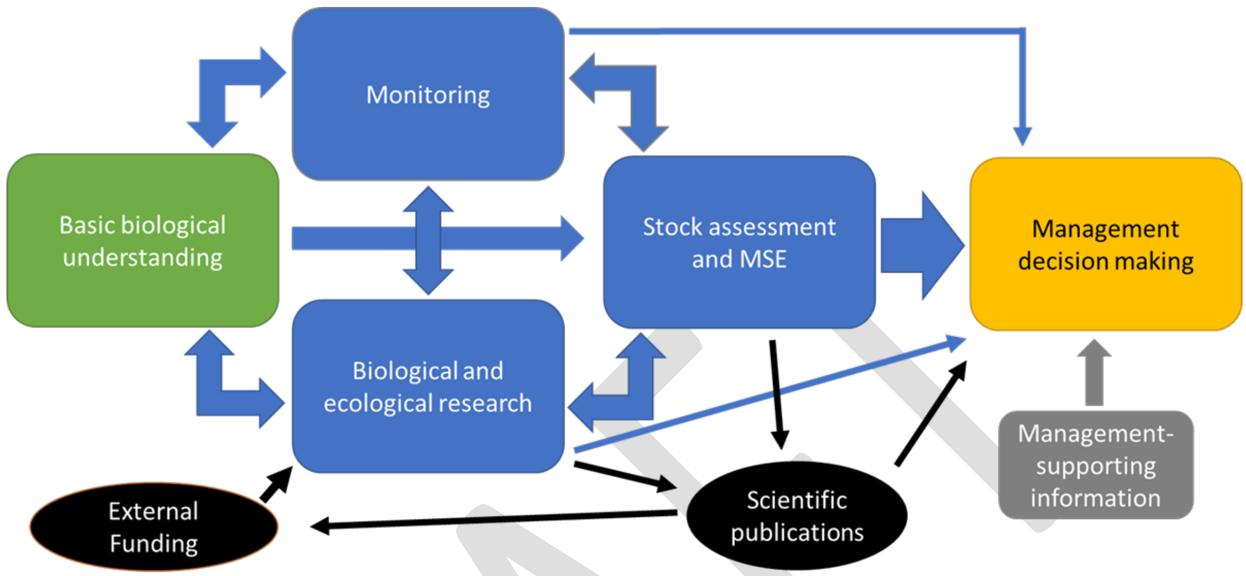

Figure 4. Flow of information from basic biological understanding of the Pacific halibut resource, through IPHC research components (monitoring, biological and ecological research, stock assessment, and MSE) to management decision-making. Management-supporting information (grey) constitutes a range of additional decision-making drivers within and beyond IPHC's current research and monitoring programs. Arrows indicate the strength (size of the arrow) 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

5.1.1 Stock Assessment

Focal Area Objective	To improve the accuracy and reliability of the current stock assessment and the characterisation of uncertainty in 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 directed and non-directed fisheries, as well as biological information from its research program and programs from other fisheries agencies. 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.

All recent stock assessments have 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 IPHC's harvest strategy policy and other considerations, as well as the harvest decision table. 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 three categories:

1) Assessment data collection and processing;
2) technical development;
3) biological understanding and fishery yield

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

5.1.2 Management Strategy Evaluation (MSE)

Focal Area Objective	To develop an accurate, reliable, and informative MSE process to appropriately characterise uncertainty and provide for the robust evaluation of the consequences of alternative management options, known as harvest strategies, using defined conservation and fishery objectives.
IPHC Website portal	https://www.iphc.int/management/science-and-research/management-strategy-evaluation

Management Strategy Evaluation (MSE) is a process to evaluate 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.

The MSE uses an operating model that includes each part of the management cycle: the population and all fisheries, management decisions, the monitoring program, the estimation model, and potential ecosystem effects using a closed-loop simulation.

MSE is a simulation technique based on modelling the population and fisheries with closed-loop feedback from each part of the management cycle. An operating model (OM) represents aspects that are not controlled by management, such as fishery behavior, recruitment into the population, natural sources of mortality, and potential environmental and ecosystem effects. The management procedure (MP) represents the elements of the decision-making process, including data collection, estimation models (e.g. stock assessment), and harvest rules such as fishing intensity. The MP also characterizes uncertainty in the decision-making process through sampling error, estimation error, and decision-making variability.

MSE reveals the trade-offs among a range of possible management decisions, given alternative harvest strategies, preferences, and attitudes to risk. The MSE is an essential part of the process of developing, evaluating, and adopting a harvest strategy, and is used to develop and maintain a Harvest Strategy Policy.

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 research priorities that would continue to improve the MSE framework and the presentation of future results to the Commission; they can be divided into five general categories:

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 Total Constant Exploitation Yields (TCEY) 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 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 inform the Commission on updates to the Harvest Strategy Policy.

5.1.3 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/research/biological-and-ecosystem-science-research/

Since its inception, the IPHC has had a long history of research activities devoted to describing and understanding the biology of and fisheries for the Pacific halibut. At present, the main objectives of the Biological and Ecosystem Science Research activities 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 in the biology of the Pacific halibut and its fisheries; and 3) apply the resulting knowledge to reduce uncertainty in the stock assessment and MSE.

The primary biological research activities at the IPHC follow Commission objectives, are selected for their important management implications, and are identified and described in this current IRMP. An overarching goal of the IRMP is to promote integration and synergies among the various research activities led by the IPHC 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 IRMP are therefore aligned and integrated with the IPHC stock assessment and MSE processes.

The biological research activities contemplated in the IRMP and their specific aims are detailed in Section 6. Overall, the biological research activities at the IPHC aim to provide information on 1) 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); 2) the spawning (female) population (e.g. reproductive maturity and fecundity, skipped spawning, reproductive migrations); and 3) resulting changes in population structure and dynamics. Furthermore, the research activities of IPHC also aim to develop and evaluate methods for estimating and reducing incidental mortality of Pacific halibut, to investigate modifications of fishing gear and/or methods to reduce whale depredation and bycatch of non-targeted species, and to investigate changes in the directed Pacific halibut fishery in response to environmental, biological, and technological drivers.

5.2 Monitoring

Focal Area Objective	To collect fishery-dependent and fishery-independent data on the distribution, abundance, and demographics of Pacific halibut, as well as other key biological data, through ongoing monitoring activities.
IPHC Website portal	***Fishery-dependent data:*** • https://www.iphc.int/fisheries/commercial-fisheries/ • https://www.iphc.int/fisheries/recreational-fisheries/ • https://www.iphc.int/fisheries/subsistence-fisheries/ • https://www.iphc.int/data/time-series-datasets/ ***Fishery-independent data:*** • https://www.iphc.int/data/fishery-independent-setline-survey-fiss/ • https://www.iphc.int/data/water-column-profiler-data/

5.2.1 Fishery-dependent data

The IPHC estimates the magnitude and demographics of all Pacific halibut removals within the IPHC Convention Area and uses this information in its annual stock assessment and other analyses. These data are collected and compiled by the IPHC Secretariat and include information provided by Federal and State agencies of each Contracting Party. Specific activities in this area are described below.

5.2.1.1 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). For each IPHC Regulatory Area, a sampling rate is determined by port and calculated annually based on the current year's mortality limits and the estimated proportion of Pacific halibut weight landed and sampled in each port. This ensures that an adequate number of biological samples is collected by IPHC Regulatory Area. Details on the data collected and sampling methods are provided in the annually updated *IPHC Directed Commercial Landings Sampling Manual* (e.g. for 2025: IPHC-2025-PSM01). Complementary to these efforts, the IPHC provides training to Tribal commercial fishery stakeholders in IPHC Regulatory Area 2A that supply additional data. In addition, the IPHC Secretariat summarises annually directed commercial fishery landings recorded by Federal and State agencies of each Contracting Party. Discard mortality for the directed commercial fishery is currently estimated using a combination of logbook, research survey, and observer data.

5.2.1.2 Recreational fisheries data

Recreational removals of Pacific halibut, including estimated recreational discard mortality, are provided by Federal and State agencies of each Contracting Party. These data are compiled annually for use in the stock assessment and other analysis.

5.2.1.3 Subsistence fisheries data

Subsistence fisheries refer to non-commercial, customary, and traditional use of Pacific halibut for direct personal, family, or community consumption, sharing as food, or customary trade. The primary subsistence fisheries include:

- 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 in Alaska (USA), carried out by rural residents and federally recognised Native Tribes under the Subsistence Halibut Registration Certificate (SHARC) program.

Subsistence fishery removals of Pacific halibut, including estimated subsistence discard mortality, are provided by State and Federal agencies of each Contracting Party. These data are compiled annually for use in the stock assessment and other analyses.

5.2.1.4 Non-directed commercial discard mortality data

Non-directed commercial discard mortality estimates by IPHC Regulatory Area and sector are provided by State and Federal agencies of each Contracting Party and compiled annually for use in the stock assessment and other analyses.

Non-directed commercial discard mortality of Pacific halibut is estimated because not all fisheries are allowed to retain Pacific halibut, and not all discarded Pacific halibut are assumed to die. In most fisheries, non-directed commercial discard mortality is estimated directly using data from observer programs operated by Contracting Party agencies. In cases where observer data are unavailable, estimates are based on non-IPHC research surveys or other sources.

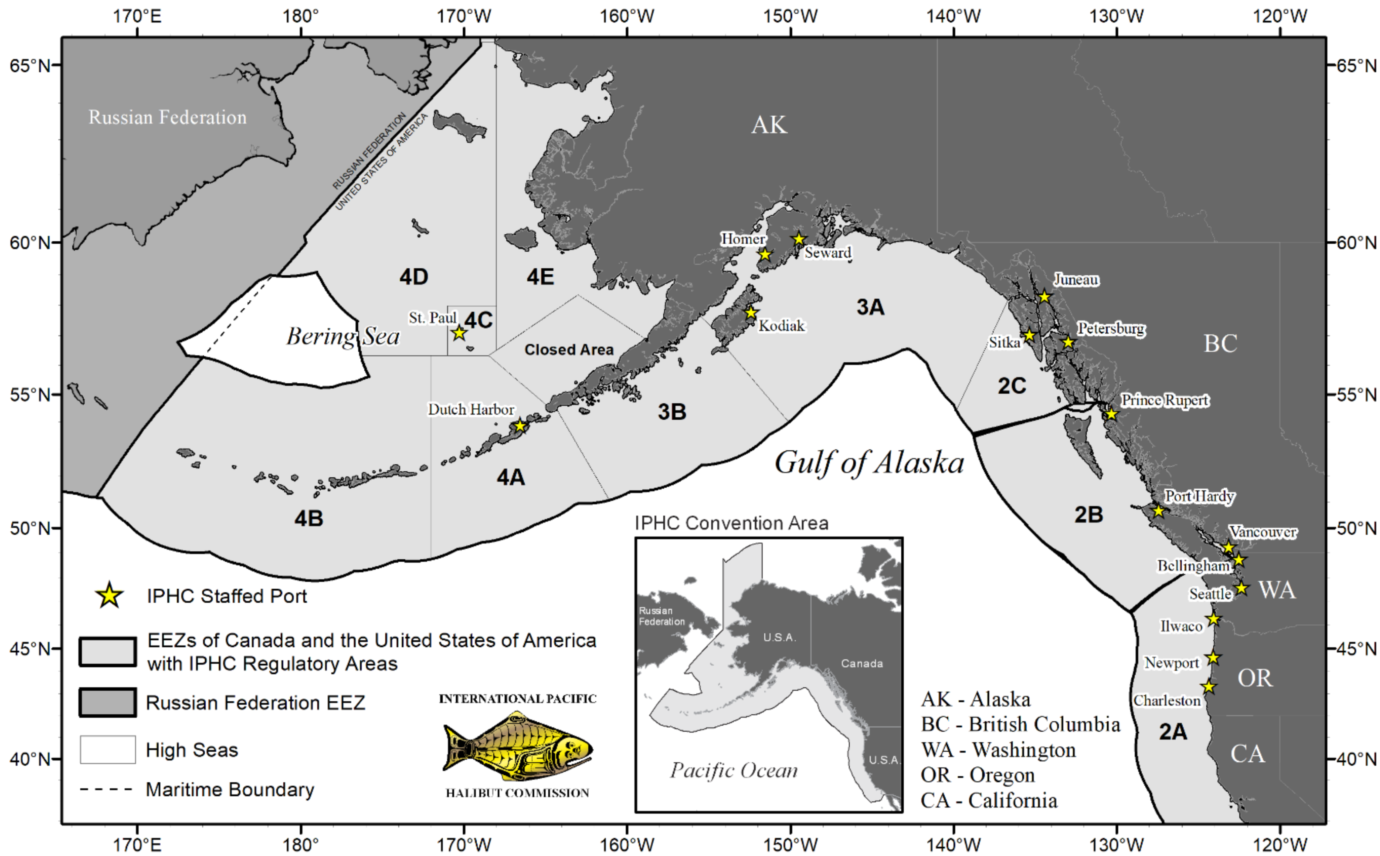

Figure 5. Ports where the IPHC has sampled directed commercial landings throughout the fishing period in recent years (note: ports sampled may change from year to year for operational reasons).

5.2.2 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.

5.2.2.1 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 fisheries. These data, collected using standardised methods, bait, and gear, 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 almost all known Pacific halibut habitat in Convention waters outside the Bering Sea, including the commercial fishing grounds in the Pacific halibut fishery. The standard FISS grid totals 1,890 stations from which a subset is sampled each year (Fig. 6). Biological data collected on the FISS (e.g. the length, weight, age, and sex of Pacific halibut) are used to monitor changes in year-class strength, biomass, growth, and mortality. In addition, records of non-target species caught during FISS operations provide the basis for estimating bait competition and are used to index species abundance over time, making them valuable to the potential management and avoidance of non-target species. Environmental data are also collected, including water column temperature, salinity, dissolved oxygen, pH, and chlorophyll concentration, to help identify the conditions in which the fish were caught, and these data can serve as covariates in space-time modeling used in the stock assessment. An example of the data collected and the methods used is provided in the annually updated FISS sampling manual (e.g. IPHC FISS Sampling Manual 2025: IPHC-2025-VSM01).

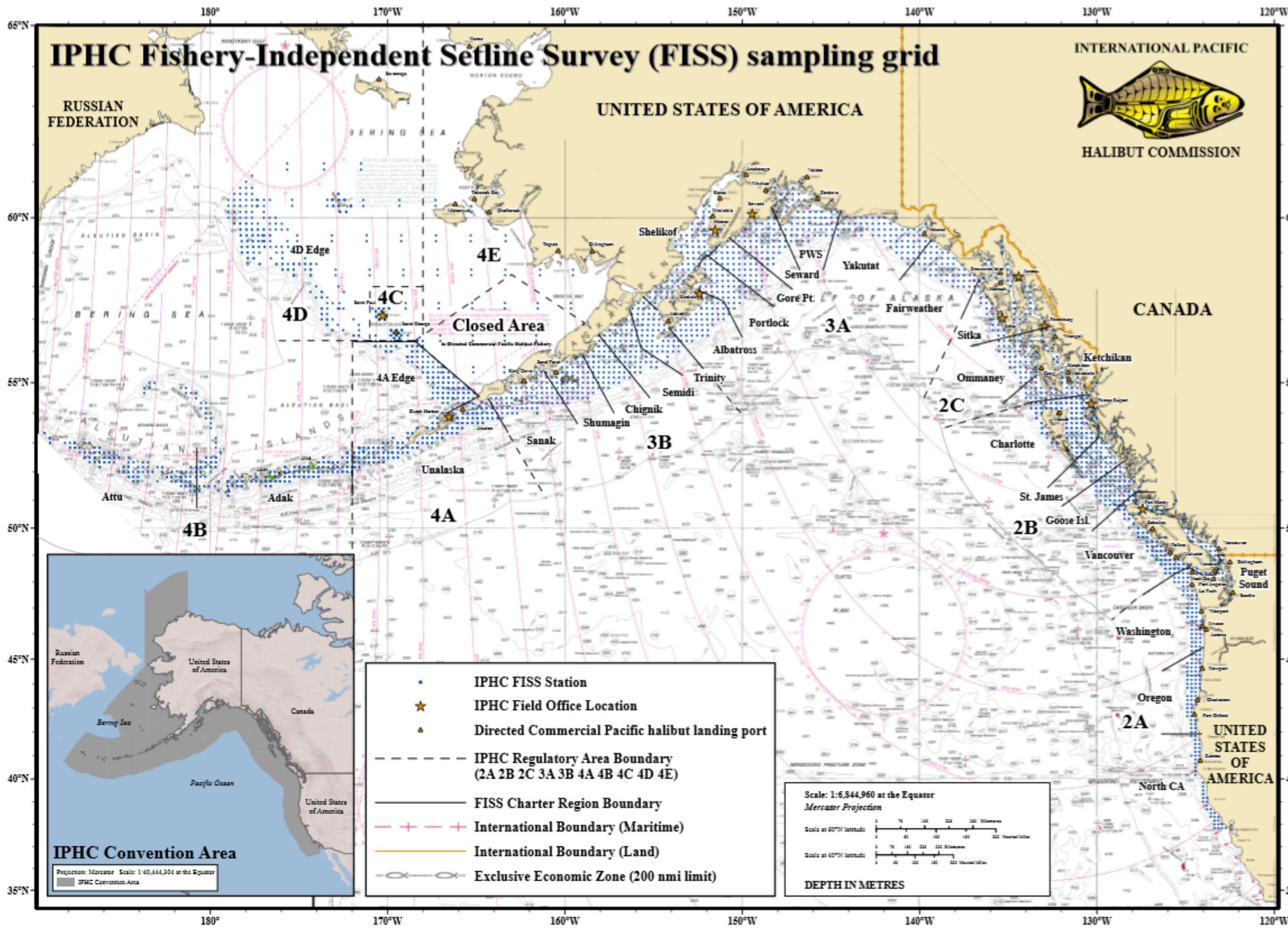

Figure 6. IPHC Fishery-Independent Setline Survey (FISS) with full sampling grid and charter regions.

Following a program of planned FISS expansions from 2014-19, a process of rationialisation of the annual FISS designs was undertaken. Currently, sampled stations are prioritised each year so that density indices will be estimated with high precision and low potential for bias. Based on funding and previous FISS results, potential FISS designs for the subsequent three years are evaluated. The resulting proposed designs and their evaluation are presented for review at the June Scientific Review Board (SRB) meetings and modified following SRB input and in-year FISS sampling results 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).

5.2.2.2 Fishery-independent Trawl Survey (FITS)

The IPHC relies on the NOAA Fisheries trawl surveys operating in the Bering Sea (Fig. 7), Aleutian Islands and Gulf of Alaska. The information collected from Pacific halibut caught on these surveys, together with data from the IPHC Fishery-Independent Setline Survey (FISS) is used in estimating indices of abundance and to monitor population demographics.

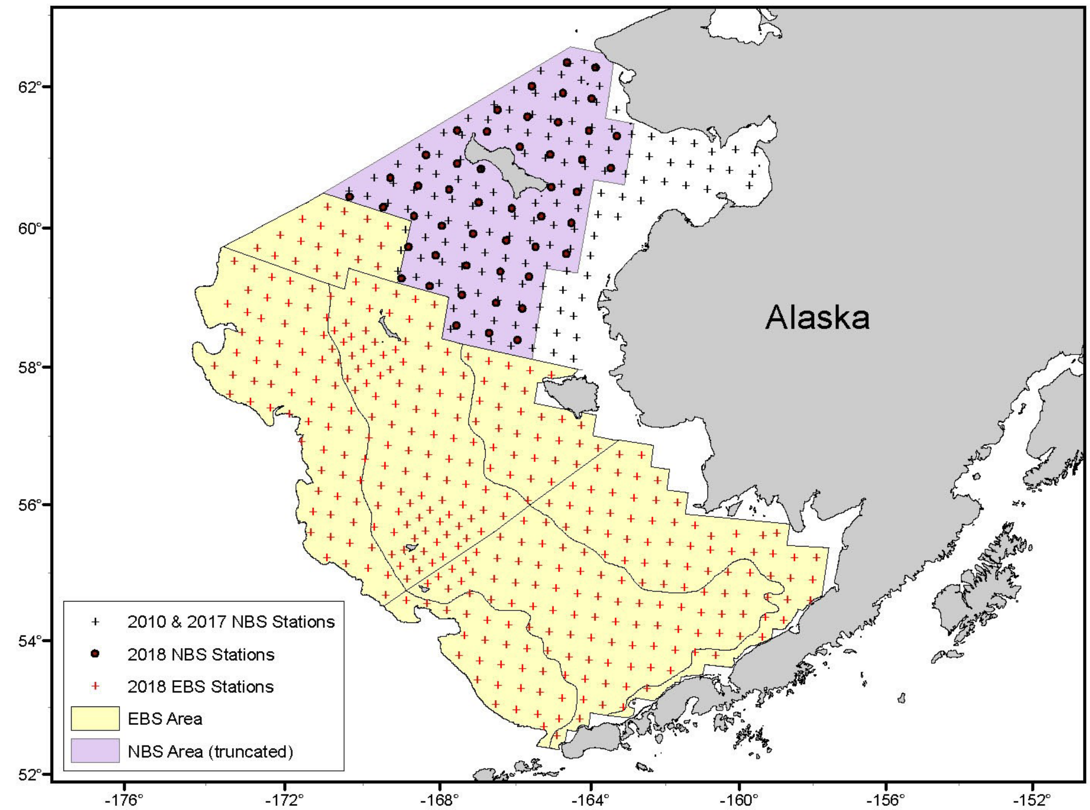

Figure 7. Representative sampling design for the NOAA Bering Sea bottom trawl survey. Black dots are stations sampled in the 2018 and black plus signs are stations sampled in subsequent Northern Bering Sea trawl surveys.

5.2.2.3 Norton Sound trawl survey

The Alaska Department of Fish and Game's annual Norton Sound trawl survey data contribute to the estimation of Pacific halibut indices of abundance in IPHC Regulatory Area 4CDE.

5.2.3 Age composition data (both fishery-dependent and fishery-independent)

Biological samples collected annually from commercial fisheries and FISS include otoliths, crystalline calcium carbonate structures found in the inner ear of fish whose growth patterns can be analysed to estimate the age of fish. Fish age is a key input to stock assessment models that inform management decisions related to fish exploitation and harvest strategies. Since its inception, the IPHC has aged over 1.5 million otoliths by trained readers under the stereoscopic microscope.

The IPHC Secretariat continues to age otoliths manually to provide the high-quality age estimates for the stock assessment. However, substantial progress has now been made toward an AI-assisted workflow. A deep-ensemble convolutional neural network (CNN) model has been developed and trained on otolith images. Adopting fine-tuning procedure, the model outputs results with progressively improving predictive accuracy. The deep ensemble approach also provides uncertainty estimates, allowing low-confidence cases to be flagged for expert review. This facilitates a mixed-method protocol where portion of high-confidence estimates is fast-tracked while manual verification is retained for the remainder.

In addition to AI-based methods, the IPHC is exploring epigenetic ageing that may offer comparable precision to traditional human-read methods, potentially expanding the toolkit for robust and scalable age estimation in the future.

5.3 Management-supporting information

To support science-based decision-making and advance the Commission's objective of developing Pacific halibut stock to the level that permits the optimum yield from the fishery over time, the IPHC Secretariat undertakes a range of supplementary analyses that provide direct input into management procedures and policy evaluations. These efforts complement the stock assessment and biological data streams by addressing specific questions raised by the Commission, domestic agencies, and other stakeholders.

In recent years, the IPHC Secretariat has undertaken a project evaluating Pacific halibut multiregional economic impact, illustrating economic interdependencies between sectors and regions to bring a better understanding of the role and importance of the Pacific halibut resource to regional economies of Canada and the United States of America. Other work has focused on regulatory questions, such as evaluating size limits and associated tradeoffs between yield optimisation, reducing discards, and economic outcomes, as well as assessing the socioeconomic and logistical challenges of implementing year-round fishing.

The IPHC Secretariat remains well-positioned to respond to requests from the Commission or Contracting Parties for technical support on a broad range of management-relevant topics. These may include, among others, socioeconomic considerations, community development, political constraints, or logistical feasibility analyses to inform emerging policy needs. Such analyses are developed collaboratively, leverage a range of available data sources and partners, and can be tailored to specific regulatory or planning contexts.

6. Core focal areas – Planned and opportunistic activities (2027-31)

The IPHC Secretariat works with IPHC advisory bodies and the Commission to identify research priorities and refine hypotheses. This process occurs via an annual schedule of meetings, as shown in Fig. 8. In May, an MSE informational session may be held to prepare stakeholders for the Management Strategy Advisory Board (MSAB) meeting in October. Recommendations related to the MSE and development of a harvest strategy are then directed to the Commission. The SRB holds two meetings each year: one in June, where requests are typically directed to IPHC Secretariat, and one in September, where recommendations are made to the Commission. The June SRB meeting has a focus on research; the September meeting represents a final check of science products to be presented to the Commission for use in management. The Research Advisory Board (RAB) meets in November to discuss ongoing research, provide guidance, and recommend new research projects. The Work Meeting (WM) is held in September to allow the IPHC Secretariat and the Commission to prepare for the Interim Meeting (IM) held in November and the Annual Meeting (AM) held in January. Outcomes from the AM include mortality limits (coastwide and by IPHC Regulatory Area), directed fishery commercial fishing period dates, domestic regulations, and requests and recommendations for the IPHC Secretariat. In conjunction with the AM are meetings of the Finance and Administration Committee (FAC), the Conference Board (CB), and the Processor Advisory Board (PAB). The Commission may also hold Special Sessions (SS) throughout the year to take up and make decisions on specific topics.

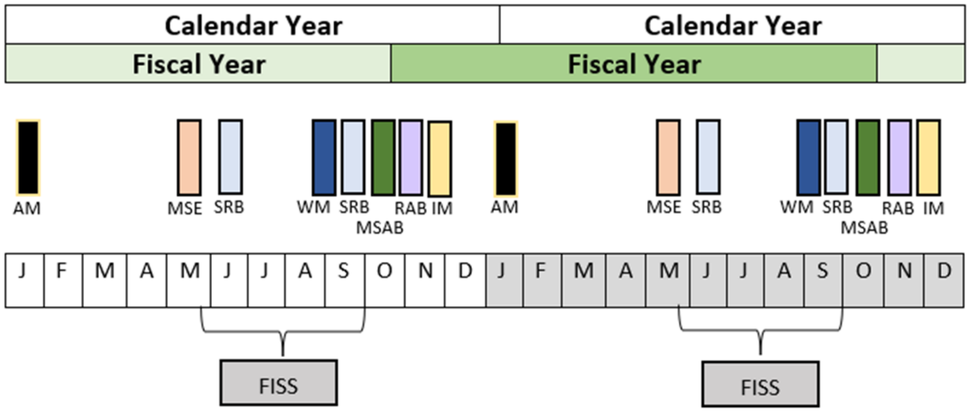

Figure 8. The typical IPHC annual meeting schedule with the calendar year and fiscal year shown. The meetings, shown in the middle row are: Annual Meeting where the Commission makes many final decisions for that year (AM), an MSE informational session (MSE), Scientific Review Board meetings (SRB), the Commission Work Meeting (WM), the Management Strategy Advisory Board meeting (MSAB), the Research Advisory Board Meeting (RAB), and the Interim Meeting (IM). The annual FISS schedule is also shown.

In addition to the annual meeting process at IPHC, individual core focal areas of research may identify and prioritise 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 by simulation testing to identify research that may have the largest benefit to improving the management of Pacific halibut.

The top priorities of research for various categories in each of the core focal areas are provided below. The top priorities are a subset of the potential research topics in each core focal area. More exhaustive and up-to-date lists of research topics, that may extend beyond a five-year timeframe, can be found in recent meeting documents related to each core focal area.

6.1 Research

6.1.1 Stock Assessment

Within the three 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. More extensive lists of research topics are produced every three years as part of each full stock assessment analysis.

6.1.1.1 Stock Assessment data collection and processing

6.1.1.1.1 Commercial fishery sex-ratio-at-age via genetics

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 a short time-series (2017-24) of commercial sex-ratio-at-age information available for the 2025 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. This assessment priority directly informs *6.1.3.2 Reproduction* as described below.

6.1.1.1.2 Whale depredation accounting and tools for avoidance

Whale depredation represents a source of unobserved and unaccounted-for mortality in the assessment and management of Pacific halibut. Reduction of depredation mortality through improved fishery avoidance and/or catch protection would be a preferable extension and/or solution to methods for estimation. As such, research to provide the fishery with tools to reduce depredation is considered a high priority. This assessment priority directly informs *6.1.3.4.2 Fishing Innovations* as described below.

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 of 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 Estimation of natural mortality

The stock assessment has been shown to be extremely sensitive to the value of natural mortality. The current approach uses four separate models to estimate management quantities, with three of these models estimating natural mortality directly from the data and one using a fixed historical assumption. Further work to determine the conditions under which natural mortality is estimable in the fourth model and plausible ranges of values for this parameter could reduce perceived and actual uncertainty in the stock assessment and the management information arising from it. 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 better integrate this source of uncertainty into the stock assessment ensemble.

6.1.1.2.3 Development of state-space models

The IPHC has relied on statistical catch-at-age models for most of its stock assessment history (Stewart and Martell 2014). New programming environments (e.g., TMB; Kristensen et al. 2016) have led to an increased use of state-space models for stock assessment (e.g. SAM, WHAM; Nielsen and Berg 2014; Nielsen et al. 2021; Stock and Miller 2021). These models provide extremely efficient capabilities for modelling random effects and sparse matrices. As the Pacific halibut stock assessment models include time-varying processes (i.e. recruitment, selectivity, and catchability), it would be ideal to treat them as random effects, rather than using the penalised likelihood approach currently employed. Although few such applications include sex-specific dynamics that can accommodate the necessary dimorphic growth capability to be applicable to Pacific halibut, development of a state-space model for Pacific halibut is prioritised in this research plan.

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 the 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 processes 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). Building on the success of the previous research plan, we now have an updated maturity relationship included in the 2025 stock assessment. Moving forward, we will extend that research to include an updated fecundity relationship and an investigation of the potential for skip-spawning. After updated 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. This assessment priority directly informs *6.1.3.2 Reproduction* as described below.

6.1.1.3.2 Factors affecting size-at-age

Changes in size-at-age, along with recruitment, have been the largest contributors to the historical trends in biomass and fishery yield from the Pacific halibut stock. The relative role of potential factors underlying changes in size-at-age is not currently understood. Delineating between competition, density dependence, environmental effects, size-selective fishing, and other factors could allow improved prediction of size-at-age under future conditions and a better understanding of how management can adapt to changing trends.

6.1.2 Management Strategy Evaluation

MSE priorities have been subdivided into three categories: 1) biological parameterisation, 2) fishery parameterisation, and 3) technical development. Research provides specifications for the MSE simulations, such as inputs to the Operating Model (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 parameterisation

6.1.2.1.1 Distribution of life stages

Research topics in this category will mainly inform parameterisation of movement in the OM but will also provide further understanding of Pacific halibut movement, connectivity, and temporal variability. This knowledge may also be used to refine specific MSE objectives. Larval and juvenile distribution is a main source of uncertainty in the OM and continued research in this area will improve the OM and provide justification for parameterising temporal variability. Outcomes may also provide information on recruitment strength and the relationship with environmental factors. For example, recent work by Sadorus et al (2021) used biophysical and spatio-temporal models to examine connectivity across the Bering Sea and Gulf of Alaska. Furthermore, improved understanding of the distribution of adults resulting from ontogenetic movement 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. Research under Section 6.1.3.1 will inform this MSE priority.

Finally, genomic analysis of population size (close-kin mark-recapture, *6.1.3.1*) is also included in this ranked category. Close-kin mark-recapture (CKMR) may provide insights into spatial relationships between juveniles and adults as well as abundance in specific regions. It would help inform the 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 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. Research under Section 6.1.3.3 will inform this MSE priority.

6.1.2.1.3 Spatial spawning patterns and connectivity between spawning populations

Further research into sub-population structure and connections between those sub-populations would provide an understanding of the importance of spatial heterogeneity in the Pacific halibut population. This may be incorporated directly into the OM, and/or into an objective to maintain spatial heterogeneity. This includes the identification of important spawning locations, temporal variability in spawning and recruitment, and the importance of spawning locations to a sustainable population and efficient fisheries across the IPHC convention area. This research is described in Section 6.1.3.1 below.

6.1.2.1.4 MSE fishery parameterisation

The definition of fisheries and their parameterisations in the MSE operating model involved consultation with Pacific halibut stakeholders, but some aspects of those parameterisations would 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. Research under Sections 6.1.3.4 will inform this MSE priority.

6.1.2.2 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 and support of the Harvest Strategy Policy. Coordination with the technical development of the stock assessment (Section 6.1.1.2.1) is necessary to ensure consistent assumptions and hypotheses for tactical (i.e. stock assessment) and strategic (i.e. MSE) models. Investigations done in the stock assessment will inform the MSE operating model, which will then inform management and stock assessment development through investigations using the closed-loop simulation framework. Conducting assessments at intervals longer than annually may allow for additional opportunity to coordinate between stock assessment and MSE.

6.1.2.2.1 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. Research under Section 6.1.3.1 will inform this MSE priority.

6.1.2.2.2 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.

6.1.2.2.3 Incorporate additional sources of implementation uncertainty

Implementation uncertainty consists of three subcategories: 1) decision-making uncertainty, 2) realised 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 implemented in the MSE framework but improvements could be made. Realised uncertainty is the difference between the mortality limit set by the Commission and the actual mortality realised by the various fisheries. This type of uncertainty is currently partially implemented in the MSE framework. Finally, perceived uncertainty is the difference between the realised 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. Improving the implementation of decision-making uncertainty is a priority for the MSE and will assist in understanding the performance of management procedures given the flexibility desired by the Commission.

6.1.2.3 Potential Future MSE projects

Management Strategy Evaluation is an iterative process where new management procedures may be evaluated, current management procedures may be re-evaluated under different assumptions, and the understanding of the population, environment, and fisheries may be updated with new information stemming from the stock assessment and biological/ecological research. The current research priorities focus on technical development, but various elements of Management Procedures will likely be of interest once technical improvements are made. The research being done now will inform the development of the MSE in the future to ensure a robust evaluation of any management procedure.

6.1.3 Biology and Ecology

Capitalising on the outcomes of the first 5-year plan (IPHC–2019–BESRP-5YP), the second 5-year plan (IPHC-2022-5YPIRM) developed five research areas to provide key inputs for stock assessment and the MSE process. In addition to linking genetics and genomics with migration and distribution studies in the area of Migration and Population Dynamics, a novel research area on Fishing Technology was incorporated in the IPHC-2023-5YPIRM. The outcomes of IPHC-2023-5YPIRM are provided in Appendix I, and the resulting peer-reviewed publications are provided in Appendix III. The present plan (IPHC-2026-5YPIRM) describes the continuation of these five research areas into the next phase of management-serving research goals, with Fishing Technology being incorporated into a new research area that includes Mortality Estimations and Fishery Practices and Behavior. A series of key objectives for each of the five research areas has been identified that integrate with specific needs for stock assessment and MSE processes and that are ranked according to their relevance (Appendix IV and Appendix V, respectively). To further describe the IPHC Secretariat's rationale for establishing research priorities, a ranked list of biological uncertainties and parameters for stock assessment and the MSE process, and their links to research activities and outcomes derived from the IRMP is also provided.

6.1.3.1 Migration and Population Dynamics

Studies aimed at improving current knowledge of Pacific halibut distribution and population dynamics throughout all life stages in order to achieve a complete understanding of stock structure and distribution across the entire range of Pacific halibut in the North Pacific Ocean and the biotic and abiotic factors that influence it through multiple approaches. Specific objectives in this area include:

- Integrate analyses of Pacific halibut population dynamics, connectivity, and distribution changes by incorporating genomic 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.
- Improve our understanding of population structure.
- Improve our understanding of the contribution of known and putative (e.g. Washington coast) spawning areas to nursery/settlement areas in relation to year-class, recruit survival and strength, juvenile genetic diversity, and environmental conditions in the North Pacific Ocean.
- Improve our understanding of the relationship between the presence of juveniles in mapped nursery/settlement areas and adult distribution and abundance over temporal and spatial scales.
- Build upon the current conceptual model of Pacific halibut movement through a synthetic analysis of existing tagging data.
- Apply methods for individual identification based on computer-assisted tail image matching systems as an alternative for traditional mark and recapture tagging.

Horizon scan:

- Evaluate the potential use of environmental DNA (eDNA) for improving current understanding of Pacific halibut distribution and assist with mapping of juvenile habitat.
- Examine the feasibility of close-kin mark-recapture-based approaches to improve estimates of population size, migration rates among geographical regions, and demographic parameters (e.g. fecundity-at-age, natural mortality).

6.1.3.2 Reproduction

Studies aimed primarily at addressing several critical issues for stock assessment analysis based on estimates of female spawning biomass: 1) the sex ratio of the commercial catch; 2) revised maturity estimates, and 3) fecundity estimates. Specific objectives in this area include:

- Continued temporal and spatial analysis of female histology-based maturity-at-age estimates: identification of potential drivers (e.g. environmental, etc.) of temporal and spatial changes in maturity schedules.
- Develop and validate methods for fecundity estimations based on the auto-diametric method applied to other species.
- Provide estimates of fecundity-at-age and fecundity-at-size.
- Investigate the possible presence of skip spawning in Pacific halibut females.
- Improve accuracy in the 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 the genetic basis of variation in age and/or size-at-maturity, fecundity, and spawning timing, by conducting genome-wide association studies.
- Characterise the temporal progression of reproductive development and gamete production throughout an entire annual reproductive cycle in male Pacific halibut.

6.1.3.3 Growth and size-at-age

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:

- Investigate the effects of environmental and ecological conditions driving size-at-age and somatic growth in Pacific halibut.
- Investigate the influence of early growth (e.g. juveniles) in determining growth patterns during adulthood. Analysis of NMFS trawl data and investigation of potential early life regulatory mechanisms (e.g. epigenetic, etc.) that direct adult growth patterns.
- Investigate variation in somatic growth patterns in Pacific halibut as informed by physiological growth markers, physiological condition, energy content, and dietary influences.
- Evaluate the relationship between somatic growth, temperature, and trophic histories in Pacific halibut through the integrated use of physiological growth markers (e.g. gene expression, stable isotope profiles).
- Develop a non-invasive alternative method for aging Pacific halibut based on genetic analyses of DNA methylation patterns in tissues (fin clips). Development of an epigenetic clock and possible insights into the aging process/senescence in Pacific halibut.
- Improve our understanding of the genetic basis of variation in somatic growth and size-at-age by conducting genome-wide association studies.
- Explore emerging technological advances in genome sequencing that produce genomic and epigenetic data (e.g. PacBio, Oxford Nanopore) to assist in understanding the genetic and epigenetic basis of growth.
- Investigate the feasibility of otolith (or eye lens lamina) growth increment analyses for reconstructing individual growth histories in Pacific halibut.

Horizon scan:

- Investigate dietary composition in stomachs through metabarcoding (i.e. molecular identification of prey items in stomach contents).
- Investigate liver parasite loading and its effect on physiological conditions in Pacific halibut

6.1.3.4 Fishery dynamics and fishing technology

6.1.3.4.1. <u>Mortality estimations</u>. Studies aimed at developing and evaluating methods for estimating and reducing incidental mortality of Pacific halibut. Specific objectives in this area include:

- Incorporate experimentally-derived discard mortality rate data in the recreational fishery (based on research conducted under IPHC-2023-5YPIRM) into management.
- Review status of discard mortality rate (DMR) research conducted by the IPHC: synthesis paper of experimentally-derived DMR for Pacific halibut in different fisheries, with future research avenues and management recommendations.
- Investigate the application of electronic monitoring and AI-based analyses of discards for mortality estimations.
- Investigate new methods (e.g. AI-based) for improved estimation of depredation mortality from marine mammals.
- Support and collaborate in efforts to reduce Pacific halibut bycatch in other fisheries

- Investigate potential biological and ecological causes of mortality in Pacific halibut.

6.1.3.4.2. Fishing innovations. Studies investigating modifications of fishing gear/methods with the purpose of reducing depredation of Pacific halibut by toothed whales and reducing bycatch of non-targeted species. Specific objectives in this area include:

- Prepare a review paper summarising past and present directed (fixed) gear-related research by the IPHC.
- Investigate methods for whale avoidance and/or deterrence for the reduction of Pacific halibut depredation by whales (e.g. catch protection methods, pots).
- Investigate physiological and behavioral responses of Pacific halibut to fishing gear in order to increase the catch and reduce bycatch of non-targeted species: influence of lights on fishing gear, hook size, design or modification, pots, etc.

6.1.3.4.3. Fishery practices and behavior. Studies aimed at investigating changes in the directed Pacific halibut fishery in response to environmental, biological, and technological drivers. Specific objectives in this area include:

- Investigations into the interaction between climate change and fishing patterns
- Evaluations of the effects of sand fleas- and dogfish-prevalent areas on longline fisheries
- Tradeoffs of snap, fixed, and Autoline gear use on fishery efficiency.

6.2 Monitoring

The Commission's monitoring programs include both direct data collection by the IPHC Secretariat and coordination with domestic agencies to generate comprehensive fishery-dependent and fishery-independent information on Pacific halibut stock and fishery trends. These critical sources include estimates of fishing mortality across all fisheries encountering Pacific halibut, biological sampling from these fisheries, as well as catch rates and biological sampling from longline and trawl surveys. Monitoring data will continue to underpin the stock assessment and MSE process, support numerous biological research studies, and inform the decision-making process (Fig. 4).

6.2.1 Fishery-dependent data

The IPHC Secretariat will continue collecting fishery-dependent data from the directed commercial fishery, with a focus on maintaining adequate spatial and temporal coverage of catch, effort, and biological data. Coordination with Tribal, State and Federal agencies will continue to support the standardisation of data collection protocols, increase data collection capacity, improve reporting consistency, and help identify and fill data gaps that may impact stock assessment and management.

Collaborative work with commercial stakeholders will also continue to further the use of electronic logbooks which began in 2023, to enhance the accuracy and efficiency of data submission. The ongoing development of digital QA/QC systems will strengthen data integrity, ease operational demands, and increase the capacity of IPHC Secretariat for other advancements.

Efforts will include annual reviews of sampling distribution across ports, data collection methods, sampling rates, and QA/QC procedures, with in-season assessments of port sampling completely yearly. These initiatives aim to ensure that data collection continues to support stock assessment, MSE, and management needs, while integrating relevant research findings into long-term monitoring strategies.

6.2.2 Fishery-independent setline survey (FISS)

An annual review process for the FISS station design has been developed (Fig. 9) and is expected to continue in the coming years. This process involves scientific review of proposed FISS designs by the Scientific Review Board and includes input from stakeholders prior to review and approval of designs by the Commissioners.

Sample rates for genetic monitoring will need to be determined for future sampling. Sampling rates of otoliths for aging, archive otoliths, and tagged fish will continue to be reviewed annually to ensure the data needs of the IPHC stock assessment and research program are met. Annual FISS sampler training and data QAQC (including at the point of data collection and during post-sampling review) will ensure high-quality data from the FISS program.

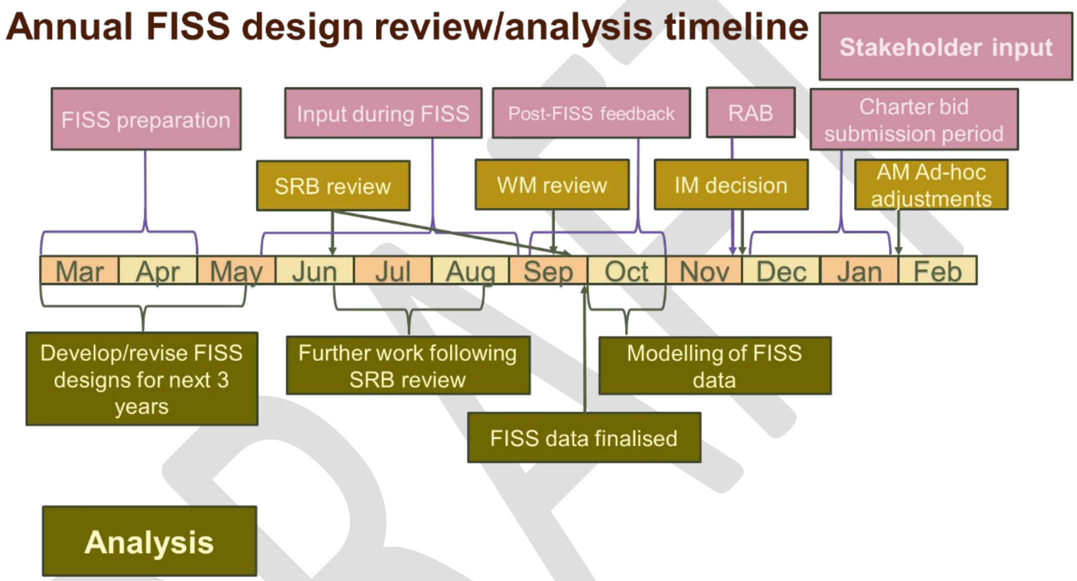

Figure 9. Timeline of annual FISS design review process.

6.2.2.1 Fishery-independent Trawl Survey (FITS)

The IPHC will continue to collaborate with NMFS on sampling procedures for Pacific halibut and on the placement of an IPHC sampler onboard a survey vessel for the collection of biological data.

6.2.3 Ageing methods (both fishery-dependent and fishery-independent)

6.2.3.1. Application of artificial intelligence (AI) for determining the age of fish from images of collected otoliths.

Progress in applying AI for determining the age of Pacific halibut from images of collected otoliths presents both opportunities and challenges, particularly in balancing gains in efficiency with the need to maintain data integrity and spatiotemporal consistency.

Integration and testing in the assessment: AI-generated ages will be introduced as an auxiliary input in a split-sample experiment. One assessment run will use the current manual series, while a parallel run will blend AI-derived ages ranked by confidence estimates (based on standard deviation scores), selecting increasing proportions (e.g., 25%, 50%, and 75%) of AI-derived ages, with manual ages used elsewhere. Additional assessment runs may explore prediction performance across regions and years that are not represented or are underrepresented in the training data, in order to understand the potential for bias when applying AI out-of-sample. Further development of accuracy and imprecision matrices will support comparisons between manual ages and different blends of AI-derived ages, based on ranked confidence thresholds. Uncertainty in management quantities and year-class strengths will be used to evaluate the robustness of incorporating AI-derived ages into the stock assessment model.

Cost-benefit analysis: The comparative scenarios will include the current manual-only protocol and hybrid protocols that apply AI-derived ages to high-confidence images. Evaluation metrics will include labor costs, turnaround time, variance in cohort-specific age compositions, and implications for stock assessment performance, particularly with respect to stability and reliability in informing mortality limit decisions.

Spatial-coverage considerations: As currently observed, AI accuracy declines when applied to otolith images from regions or years not represented in the training data. If future reductions in spatial coverage of the FISS occur, the risk of regional data imbalances in the training set may increase, potentially affecting AI reliability. However, this limitation may be mitigated over time as the training database expands to include a broader diversity of samples, potentially improving the model's generalisation across space and time. To ensure robustness in the interim, the continued inclusion of a subset of manually aged otoliths remains important. Additionally, the AI model can be fine-tuned using targeted market samples to reinforce spatial coverage and improve training representativeness when needed.

6.2.3.2. Application of an epigenetic clock for aging Pacific halibut using fin clips.

Epigenetic aging is a genetic method for aging that is based on the fact that methylation patterns on genomic DNA change predictably with age. Therefore, age-associated DNA methylation patterns can be modelled to generate molecular (i.e., epigenetic) age predictors capable of estimating chronological age with high accuracy. These are referred to as "epigenetic clocks" and can be developed from DNA isolated from any tissue, including non-lethal biological samples, such as a fin clip.

The objective of this project is to develop an epigenetic clock for Pacific halibut using fin clips from Pacific halibut of known ages. The specific objectives are (1) to identify DNA methylation signals in Pacific halibut fin tissue, (2) to develop an age prediction model based on age-associated DNA methylation patterns, and (3) to develop a targeted assay with selected age-associated epigenetic markers for cost-effective, high-throughput age estimations in Pacific halibut.

6.3 Management-supporting information

6.3.1 Potential of integrating human dynamics into management decision-making

Effective Pacific halibut management requires understanding not only biological stock dynamics, but also the human dimensions that shape fishery outcomes (Lane and Stephenson 1995). As new technologies such as AI, digital logbooks, and real-time monitoring evolve, so too does the potential to integrate human behavior, economic dependencies, and community-level impacts into the management framework.

Recent socioeconomic analyses conducted by the IPHC highlight disparities in how different regions and user groups benefit from Pacific halibut fisheries, and how external forces such as shifting markets and climate change can amplify these differences (Cheung and Frölicher 2020). Recognising these factors can improve both the fairness and resilience of fishery policies.

Looking ahead, the IPHC Secretariat aims to be prepared to integrate human dynamics, such as fleet behavior, market access, or social vulnerability, into stock assessment and MSE, where such complementary analyses may add value to the decision-making process (Lynch et al. 2018). This may include linking fishery performance metrics to socioeconomic indicators or exploring how alternative management scenarios affect community and fisher behavior. These efforts will ensure that science-based advice not only supports biological sustainability but is also responsive to the evolving realities of people and communities who depend on the resource.

7. Amendment

As with the previous two (2) plans, the IPHC Secretariat intends to maintain this IRMP document as a '*living plan'*, subject to annual reviews and updates as necessary. Revisions will reflect evolving priorities, resources available to undertake the work (e.g. internal and external fiscal resources, collaborations, internal expertise), and emerging opportunities. The IPHC Secretariat remains committed to transparency and to upholding the principles of open science in the development and implementation of this plan.

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ACKNOWLEDGEMENTS

To be populated

APPENDICES

Appendix I: Outcomes of IPHC-2023-5YPIRM

Appendix II: External funding received by the IPHC

Appendix III: Publications arising

Appendix IV: List of ranked research priorities for stock assessment

Appendix V: List of ranked research priorities for management strategy evaluation

APPENDIX I
OUTCOMES OF THE IPHC-2023-5YPIRM

1. Biology and Ecology

A. Outcomes by Research Area:

1. Migration and Population Dynamics

1.1. Development and application of genomic approaches. Planned research outcomes: generation of genomic resources for Pacific halibut that will support genomic research.

Main results:

- Sequencing of the Pacific halibut genome.
- Generation of a high-quality chromosome-level genome assembly for Pacific halibut and full characterisation of the genome
- Complete sequencing and annotation of the Pacific halibut genome into a publicly available online resource
- Identification of the sex determining region of the Pacific halibut genome in Chromosome 9.
- Successful mapping of single nucleotide polymorphisms used for genetic sexing into the sex determining region of the Pacific halibut genome.
- Generation of tissue-specific transcriptomes and combined transcriptome for Pacific halibut. Identification of tissue-specific transcriptomic characteristics.

1.2. Population genomic studies. Planned research outcomes: delineation of population structure within Convention Waters.

Main results:

- Application of low-coverage whole-genome resequencing to screen genomic variation at very high resolution.
- Development of a bioinformatic platform to process and analyse high-throughput whole genome sequencing data.
- Establishment of a baseline of genetic diversity by whole genome resequencing of genetic samples from spawning individuals collected from the main five spawning areas within Convention Waters.
- Lack of evidence for population structure, as evidenced by the inability of high-resolution genomics techniques to identify discrete genetic groups.
- Low ability to assign individuals back to the location in which they were sampled.
- Lack of population structure supports the modeling of the Pacific halibut stock as a single coastwide stock

1.3. Environmental influences on Pacific halibut distribution. Planned research outcomes: relationship between Pacific halibut distribution and environmental variables.

Main results:

- Establishment of baseline environmental data for Pacific halibut habitat for older juvenile and adult individuals in different Biological Regions.
- Application of environmental profiler data in spatio-temporal modeling.
- Identification of changes in Pacific halibut density and distribution of Pacific halibut in Biological Region 2 associated with low near-bottom dissolved oxygen levels. These hypoxic events are the result of seasonal upwelling.

Publications:

Jasonowicz, A.J., Simeon, A., Zahm, M., Cabau, C., Klopp, C., Roques, C., Iampietro, C., Lluch, J., Donnadieu, C., Parrinello, H., Drinan, D. P., Hauser, L., Guiguen, Y., Planas, J.V. Generation of a chromosome-level genome assembly for Pacific halibut (*Hippoglossus stenolepis*) and characterization of its sex-determining genomic region. *Molecular Ecology Resources*. 2022. 22: 2685–2700. https://doi.org/10.1111/1755-0998.13641.

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Integration with Stock Assessment and MSE: The relevance of research outcomes from activities in this research area for stock assessment is in evaluating the biological support for modeling the Pacific halibut stock as a coastwide stock and in the improvement of estimates of productivity. 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 stock assessment. Additionally, current assumptions of stock structure used in the current stock assessment will be tested by these research activities. The relevance of these research outcomes for MSE is in the improvement of the parametrisation of the Operating Model and represent the top ranked biological input into the MSE.

2. Reproduction

2.1 Sex ratio of commercial landings. Planned monitoring outcomes: sex ratio information.

Main results:

- Sex ratio information for the 2017-2024 commercial landings.

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

Main results:

- Application of histological ovarian development classification criteria to revise female maturity and establishment of criteria to identify immature versus mature females.
- Successful staging of ovarian samples collected in the FISS from 2022 to 2024.
- Testing of various types of models (i.e. generalised linear models (GLMs) and generalised additive models (GAMs)) to fit maturity data.
- Application of best-fit GAM models to estimate maturity ogives by Biological Region and year.
- Generation of a coastwide maturity ogive using weighed Biological Region ogives for the period 2022-2024.
- Development of a calibration factor between histology- and field (visual)-based maturity estimates.
- Integrate the calibration factor to revise FISS historical maturity data with which to investigate decadal changes in female maturity.
- Description of endocrine parameters that are associated with female developmental stages and identification of potential physiological markers for maturity.
- Collection of samples in the summers of 2023-2025 and fall of 2024 for the development of the fecundity estimation method and for generating the first estimates of fecundity.

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, T., Wolf, N., Smeltz, T. S., Harris, B. P., and Planas, J. V. Reproductive Biology of Female Pacific Halibut (*Hippoglossus stenolepis*) in the Gulf of Alaska. *Frontiers in Marine Science.* 2022. 9:801759. doi: 10.3389/fmars.2022.801759.

Simchick, C., Simeon, A., Bolstad, K., Planas, J.V. Endocrine patterns associated with ovarian development in female Pacific halibut (*Hippoglossus stenolepis*). *General and Comparative Endocrinology*. 2024. 347: 114425. https://doi.org/10.1016/j.ygcen.2023.114425

Integration with Stock Assessment and MSE: 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 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 stock assessment and represent the most important biological inputs for stock assessment. The relevance of these research outcomes for MSE is in the improvement of the simulation of spawning biomass in the Operating Model.

3. Growth

3.1 Identification of physiological growth markers and their application for growth pattern evaluation. Planned research outcomes: informative physiological growth markers to monitor somatic growth variation in Pacific halibut.

Main results:

- Transcriptomic profiling by RNA sequencing of white skeletal muscle from juvenile Pacific halibut subjected to temperature-induced growth manipulations.
- Identification of a set of genes that change their expression levels in response to growth suppression and to growth stimulation: growth marker identification.
- Proteomic profiling by LC-MS/MS of white skeletal muscle from juvenile Pacific halibut subjected to temperature-induced growth manipulations.
- Identification of a set of proteins that change their abundance in response to growth suppression and to growth stimulation: growth marker identification.
- Application of putative growth marker genes in the characterisation of somatic growth variation in Pacific halibut juveniles collected in the Eastern Bering Sea by the NMFS Trawl Survey.
- Transcriptomic profiling by RNA sequencing of white skeletal muscle from juvenile Pacific halibut subjected to density- and stress-induced growth manipulations under experimental conditions.

Publications:

Planas, J.V., Jasonowicz, A.J., Simeon, A., Simchick, C., Timmins-Schiffman, E., Nunn, B.L., Kroska, A.C., Wolf, N., and Hurst, T.P. Molecular mechanisms underlying thermally induced growth plasticity in juvenile Pacific halibut. *Journal of Experimental Biology*. 2025. In Review.

Integration with Stock Assessment and MSE: Research activities conducted in this Research Area 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. The relevance of these research outcomes for MSE is in the improvement of the simulation of variability and to allow for scenarios investigating climate change.

4. Mortality and Survival Assessment

4.1 Discard mortality rate estimation in the longline Pacific halibut fishery. Planned research outcomes: full characterisation of discarded Pacific halibut in the longline fishery.

Main results:

- Hook release methods strongly influence the viability category assigned to discarded Pacific halibut in the longline fishery, with careful shaking and gangion cutting resulting in >75% of fish being assigned to the excellent viability category.
- The use of the hook stripper results in >85% of the fish being classified in the moderate and poor viability categories, and sustained injuries of medium and high severity particularly among

smaller fish. These results support minimising the use of hook strippers in non-directed fisheries to optimise survival of discarded Pacific halibut.

- High lactate plasma levels and low hematocrit were characteristic of fish assigned to the dead viability category, and were attributed to sand flee intrusion.
- Reducing the use of hook strippers and limiting soak times in areas of known sand flea activity are likely to improve viability outcomes of Pacific halibut released from commercial longline gear.

Publications:

Dykstra, C., Wolf, N., Harris, B.P., Stewart, I.J., Hicks, A., Restrepo. F., Planas, J.V. Relating capture and physiological conditions to viability and survival of Pacific halibut discarded from commercial longline gear. *Ocean & Coastal Management*. 2024. 249: 107018. https://doi.org/10.1016/j.ocecoaman.2024.107018.

4.2 Discard mortality rate estimation in the guided recreational Pacific halibut fishery. Planned research outcomes: experimentally-derived discard mortality rate, full characterisation of discarded Pacific halibut and assessment of best handling practices.

Main results:

- The mortality rate estimated from Pacific halibut captured and released in excellent viability category is 1.35%.
- The size of circle hooks (12/0 and 16/0) does not affect the size of the catch nor the types of injuries incurred by captured fish, with torn cheek being the predominant injury for both hook sizes.
- The levels of stress indicators in the blood (glucose and lactated, and cortisol to a lesser extent) increase with fight time.
- Our results on the low level of mortality associated with the release of Pacific halibut in excellent viability category is consistent with current discard mortality estimates.

Integration with Stock Assessment and MSE: The relevance of research outcomes from these activities for stock assessment resides in their ability to accurately capture trends in unobserved mortality in order to improve estimates of stock productivity and represent the most important inputs in fishery yield for stock assessment. The relevance of these research outcomes for MSE is in fishery parametrisation

5. Fishing Technology

5.1 Investigations on new methods for whale avoidance and/or deterrence for the reduction of Pacific halibut depredation by whales (e.g. catch protection methods). Planned research outcomes: information on feasibility, and performance of catch protection devices.

Main results:

- A virtual International Workshop (link) was organised in 2022 on protecting fishery catches from whale depredation with industry (affected fishers, gear manufacturers), gear researchers and scientists to identify methods to protect fishery catches from depredation.
- Development of two catch protection designs stemming from the outcomes of the International Workshop into functional prototypes.

- Successful initial testing of two selected catch protection devices (underwater shuttle and branch gear with sliding shroud system) in the field.
- As a catch protection device, the shuttle is a safe and effective gear type that entrained comparable quantities, sizes and types of fish as control (i.e. longline) gear.
- Additional testing in the presence of whales was conducted in May of 2025.

5.2 Investigate physiological and behavioral responses of Pacific halibut to fishing gear in order to reduce bycatch. Planned research outcomes: effective ways to reduce Pacific halibut bycatch and bycatch of non-targeted species.

Main results:

- Hook size did not significantly affect the catch efficiency of Pacific halibut or yelloweye rockfish.
- Circle hooks with a 45° appendage angle caught fewer yelloweye rockfish than hooks without an appendage, irrespective of hook size, and did not affect the catch efficiency of Pacific halibut.
- Hook appendages could have potential use in reducing catch rates on yelloweye rockfish in Pacific halibut longline fisheries.

Publications:

Lomeli, M.J.M., Wakefield, W.W., Abele, M., Dykstra, C.L., Herrmann, B., Stewart, I.J., and G.C. Christie. 2023. Testing of hook sizes and appendages to reduce yelloweye rockfish bycatch in a Pacific halibut longline fishery. Ocean & Coastal Management 241: 106664. https://doi:10.1016/j.ocecoaman.2023.106664.

Integration with Stock Assessment and MSE: The relevance of research outcomes from these activities for stock assessment resides in the improvement of mortality accounting through a reduction of depredation mortality, thereby increasing the available yield for directed fisheries. Depredation mortality can also be included as another explicit source of mortality in the stock assessment and mortality limit setting process depending on the estimated magnitude.

APPENDIX II
EXTERNAL FUNDING RECEIVED BY THE IPHC

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 Engineering Program - NOAA**	Adapting Towed Array Hydrophones to Support Information Sharing Networks to Reduce Interactions Between Sperm Whales and Longline Gear in Alaska	Alaska Longline Fishing Association	IPHC, University of Alaska Southeast, AFSC-NOAA	-	Whale Depredation	September 2018 – August 2019
4	**Bycatch Reduction Engineering Program - NOAA**	Use of LEDs to reduce Pacific halibut catches before trawl entrainment	Pacific States Marine Fisheries Commission	IPHC, NMFS	-	Bycatch reduction	September 2018 – August 2019
5	**National Fish & Wildlife Foundation**	Improving the characterisation 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
7	**Bycatch Reduction Engineering Program - NOAA**	Gear-based approaches to catch protection as a means for minimising whale depredation in longline fisheries (NA21NMF4720534)	IPHC	Deep Sea Fishermen's Union, Alaska Fisheries Science Center-NOAA, industry representatives	$99,700	Mortality estimations due to whale depredation	November 2021 – October 2022
8	**North Pacific Research Board**	Pacific halibut population genomics (NPRB Award No. 2110)	IPHC	Alaska Fisheries Science Center-NOAA	$193,685	Stock structure	December 2021- January 2024

9	**Bycatch Reduction Engineering Program - NOAA**	Full scale testing of devices to minimize whale depredation in longline fisheries (NA23NMF4720414)	IPHC	NOAA Fisheries -Alaska Fisheries Science Center (Seattle)	$199,870	Mortality estimations due to whale depredation	November 2023 – April 2026
10	**Alaska Sea Grant**	Development of a non-lethal genetic-based method for aging Pacific halibut (R/2024-05)	IPHC, Alaska Pacific Univ. (APU)	Alaska Fisheries Science Center-NOAA (Juneau)	$60,374	Stock structure	January 2025-December 2026
				Total awarded ($)	**$1,281,045**		

APPENDIX III
PUBLICATIONS ARISING

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.

Stewart, I.J., Hicks, A.C., and Carpi, P. 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.

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.

Forrest, R.E., Stewart, I.J., Monnahan, C.C., Bannar-Martin, K.H., and Lacko, L.C. 2020. Evidence for rapid avoidance of rockfish habitat under reduced quota and comprehensive at-sea monitoring in the British Columbia Pacific halibut fishery. Canadian Journal of Fisheries and Aquatic Sciences **77**: 1409–1420.

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.

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*). *Conservation Physiology* 2021. 9(1):coab001. https://doi:10.1093/conphys/coab001.

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*. 2021. 243: 106072. https://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. Use of Artificial Illumination to Reduce Pacific Halibut Bycatch in a U.S. West Coast Groundfish Bottom Trawl. *Fisheries Research*. 2021. 233: 105737. doi: 10.1016/j.fishres.2020.105737.

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.

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., and 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 **46**(7): 313–320. doi:10.1002/fsh.10603.**2022:**

Fish, T., Wolf, N., Smeltz, T. S., Harris, B. P., and Planas, J. V. Reproductive Biology of Female Pacific Halibut (*Hippoglossus stenolepis*) in the Gulf of Alaska. *Frontiers in Marine Science* 2022. 9:801759. doi: 10.3389/fmars.2022.801759.

Jasonowicz, A.C., Simeon, A., Zahm, M., Cabau, C., Klopp, C., Roques, C., Iampietro, C., Lluch, J., Donnadieu, C., Parrinello, H., Drinan, D.P., Hauser, L., Guiguen, Y., Planas, J.V. Generation of a chromosome-level genome assembly for Pacific halibut (*Hippoglossus stenolepis*) and characterization of its sex-determining genomic region. *Molecular Ecology Resources*. 2022. 22: 2685–2700. doi: https://doi.org/10.1111/1755-0998.13641.

Loher, T., McCarthy, O., Sadorus, L.L., Erikson, L.M., Simeon, A., Drinan, D.P., Hauser, L., Planas, J.V., and Stewart, I.J. 2022. A Test of Deriving Sex-Composition Data for the Directed Pacific Halibut Fishery via At-Sea Marking. Marine and Coastal Fisheries **14**(4). doi:10.1002/mcf2.10218.

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 using acceleration-logging tags. *North American Journal of Fisheries Management*. 2022. 42: 37-49. DOI: http://dx.doi.org/10.1002/nafm.10711.

2023:

Lomeli, M.J.M., Wakefield, W.W., Abele, M., Dykstra, C.L., Herrmann, B., Stewart, I.J., and G.C. Christie.. Testing of hook sizes and appendages to reduce yelloweye rockfish bycatch in a Pacific halibut longline fishery. *Ocean & Coastal Management* .2023. 241: 106664. https://doi:10.1016/j.ocecoaman.2023.106664.

Planas, J.V., Rooper, C.N., Kruse, G.H. Integrating biological research, fisheries science and management of Pacific halibut (Hippoglossus stenolepis) across the North Pacific Ocean. *Fisheries Research*. 2023. 259: 106559. https://doi.org/10.1016/j.fishres.2022.106559.

2024:

Dykstra, C., Wolf, N., Harris, B.P., Stewart, I.J., Hicks, A., Restrepo. F., Planas, J.V. Relating capture and physiological conditions to viability and survival of Pacific halibut discarded from commercial longline gear. *Ocean & Coastal Management*. 2024. 249: 107018. https://doi.org/10.1016/j.ocecoaman.2024.107018.

Hutniczak, B., Wilson, D.T., Stewart, I.J., and Hicks, A.C. 2024. A hundred years of Pacific halibut management in the context of global events and trends in fisheries management. Frontiers in Marine Science **11**. doi:10.3389/fmars.2024.1424002.

Sadorus, L.L., Webster, R.A. and Sullivan, M.E. Environmental conditions on the Pacific halibut (Hippoglossus stenolepis) fishing grounds obtained from a decade of coastwide oceanographic monitoring, and the potential application of these data in stock analyses. *Marine and Freshwater Research*. 2024. 75: MF23175. https://doi.org/10.1071/MF23175

Simchick, C., Simeon, A., Bolstad, K., Planas, J.V. Endocrine patterns associated with ovarian development in female Pacific halibut (*Hippoglossus stenolepis*). *General and Comparative Endocrinology*. 2024. 347: 114425. https://doi.org/10.1016/j.ygcen.2023.114425

2025:

Ritchie, BA, Smeltz, TS, Stewart, IJ, Harris, BP, and N. Wolf. 2025. Exploring Spatial and Temporal Patterns in the Size-At-Age of Pacific Halibut in the Gulf of Alaska. Fisheries Management and Ecology. doi:10.1111/fme.12814.

In press peer-reviewed journal papers

Adams, GD, Holsman, K, Rovellini, A, Stewart, IJ, Privitera-Johnson, K., Essington, TE, Wassermann, SN, and Punt, AE. 2025. Implications of predator-prey dynamics for single species management. Canadian Journal of Fisheries and Aquatic Sciences.

Submitted peer-reviewed journal papers – In review

McGilliard, C.R., Ianelli, J., Cunningham, C., Hicks, A., Hanselman, D., Stram, D., Henry, A. Evaluating Bering Sea Pacific halibut bycatch management options using closed-loop simulations in a dynamic, multi-agency setting. Canadian Journal of Fisheries and Aquatic Sciences.

Planas, JV, Jasonowicz, AJ, Simeon, A, Simchick, C, Timmings-Schiffman, E, Nunn, BL, Kroska, AC, Wolf, N, Hurst, TP. Molecular mechanisms underlying thermally induced growth plasticity in juvenile Pacific halibut. Journal of Experimental Biology.

Stewart, IJ and Monnahan, CC. Diagnosing common sources of lack of fit to composition data in fisheries stock assessment models using One-Step-Ahead (OSA) residuals. Canadian Journal of Fisheries and Aquatic Sciences.

APPENDIX IV
LIST OF RANKED RESEARCH PRIORITIES FOR STOCK ASSESSMENT

Research priorities for the Pacific halibut stock assessment are delineated into three broad categories: improvements in basic biological understanding (including fishery dynamics), investigation of existing data series and collection of new information, and technical development of models and modelling approaches. The highest priority items in each of these categories are highlighted in the 5YPIRM and are expected to be the primary focus of ongoing efforts. However, it is helpful to maintain a longer list of items to inform future prioritization, to create a record of data and research needs, and to foster opportunistic and/or collaborative work on these topics when possible.

Biological understanding and fishery yield:

- *Highest priority*: Updating the fecundity-weight relationship and the presence and/or rate of skip spawning.
- *Highest priority*: The relative role of potential factors underlying changes in size-at-age is not currently understood. Delineating between competition, density dependence, environmental effects, size-selective fishing and other factors could allow improved prediction of size-at-age under future conditions.
- Movement rates among Biological Regions at the adult, juvenile and larval stages remain uncertain and likely variable over time. Long-term research to inform these rates could lead to a spatially explicit stock assessment model for future inclusion into the ensemble.
- Improved understanding of recruitment processes and larval dynamics could lead to covariates explaining more or the residual variability about the stock-recruit relationship than is currently accounted for via the binary indicator used for the Pacific Decadal Oscillation.

Potential projects relating to existing and new data sources that could benefit the Pacific halibut stock assessment:

- *Highest priority*: Continued collection of sex-ratio from the commercial landings will provide valuable information for determining relative selectivity of males and females, and therefore the scale of the estimated spawning biomass, and the level of fishing intensity as measured by SPR.
- *Highest priority*: Evaluation of the magnitude of marine mammal depredation and tools to reduce it.
- A space-time model could be used to calculate weighted FISS and/or commercial fishery age-composition data. This might alleviate some of the lack of fit to existing data sets that is occurring not because of model misspecification but because of incomplete spatial coverage in the annual FISS sampling which is accounted for in the generation of the index, but not in the standardization of the composition information.
- The work of Monnahan and Stewart (2015) modelling commercial fishery catch rates could be used to provide a standardized fishery index for the recent time-series that would be analogous to the space-time model used for the FISS.
- There is a vast quantity of archived historical data that is currently inaccessible until organized, electronically entered, and formatted into the IPHC's database with appropriate meta-data. Information

on historical fishery landings, effort, and age samples would provide a much clearer (and more reproducible) perception of the historical period.

- Additional efforts could be made to reconstruct estimates of subsistence harvest prior to 1991.
- Discard mortality estimates for the IPHC Regulatory Area 2B recreational fishery are currently unavailable, but there is an estimation system in place. Further work to develop these estimates would be preferable to the use of proxy rates from IPHC Regulatory Area 2C.
- NMFS observer data from the directed Pacific halibut fleet in Alaska could be evaluated for use in updating discard mortality rates and the age-distributions for discard mortality. This may be more feasible if observer coverage is increased and if smaller vessels (< 40 feet LOA, 12.2 m) are observed in the future. Post-stratification and investigation of observed vs. unobserved fishing behavior may be required.
- Historical bycatch length frequencies and mortality estimates should be reanalyzed accounting for sampling rates in target fisheries and evaluating data quality over the historical period.
- There are currently no comprehensive variance estimates for the sources of mortality used in the assessment models. In some cases, variance due to sampling and perhaps even non-sampling sources could be quantified and used as inputs to the models via scaling parameters or even alternative models in the ensemble.

Technical explorations and improvements that could benefit the stock assessment models and ensemble framework:

- *Highest priority*: Maintaining consistency and coordination between MSE, and stock assessment data, modelling and methodology.
- *Highest priority*: Exploration of state-space models for Pacific halibut allowing for direct estimation of the variance in time-varying processes.
- *Highest priority*: Continued exploration into the estimation of *M* in the short coastwide model.
- Continued refinement of the ensemble of models used in the stock assessment. This may include investigation of alternative approaches to modelling selectivity that would reduce relative down-weighting of certain data sources (see section above), evaluation of additional axis of uncertainty (e.g., steepness, as explored above), or others.
- Exploration of methods for better including uncertainty in directed and non-directed discard mortalities in the assessment (now evaluated only via alternative mortality projection tables or model sensitivity tests) in order to better include these sources uncertainty in the decision table. These could include explicit discard/retention relationships, including uncertainty in discard mortality rates, and allow for some uncertainty directly in the magnitude of mortality for these sources.
- Bayesian methods for fully integrating parameter uncertainty may provide improved uncertainty estimates within the models contributing to the assessment, and a more natural approach for combining the individual models in the ensemble (see section above).

- Alternative model structures, including a growth-explicit statistical catch-at-age approach and a spatially explicit approach may provide avenues for future exploration. Efforts to develop these approaches thus far have been challenging due to the technical complexity and data requirements of both. Previous reviews have indicated that such efforts may be more tractable in the context of operating models for the MSE, where conditioning to historical data may be much more easily achieved than fully fitting an assessment model to all data sources for use in tactical management decision making.

APPENDIX V
LIST OF RANKED RESEARCH PRIORITIES FOR MANAGEMENT STRATEGY EVALUATION

To be populated after HSPWS02 – 6 August 2025

IPHC Fisheries Dependent Data Collection Design and Implementation in 2025 – Port operations: Preliminary

PREPARED BY: IPHC SECRETARIAT (M. THOM, I. STEWART, R. WEBSTER; 29 OCTOBER 2025)

PURPOSE

To provide the Commission with the design and implementation of the IPHC fishery-dependent data collection activities in 2025 – Port Operations.

BACKGROUND

The International Pacific Halibut Commission (IPHC) undertakes fishery-dependent data collection activities coastwide to collect Pacific halibut biological data and catch per unit effort data in the form of vessel logbooks. The IPHC fishery-dependent data collection is the IPHC's primary data source providing extensive information on both spatial and temporal variation of commercial landings for Pacific halibut on an annual basis. With sampled ports receiving landings from across the spatial range of the fishery throughout the commercial fishing period, the IPHC is able to obtain representative data that allow us to characterize spatio-temporal patterns in Pacific halibut length, weight, age, sex and genetic information.

Historical logbooks have been provided to the IPHC dating back to 1907. Biological data collection from the commercial sector began in 1933 and continues to the present day. The sampling design and implementation of these data collections have changed in line with the changing fishery regulations, fleet behaviour and best scientific practices.

The Canadian and U.S.A. governments implemented an Individual Vessel Quota (IVQ) in Canada, and an Individual Fishing Quota (IFQ) program in Alaska, in 1991 and 1995, respectively. As a result of this change, the Pacific halibut fishery along the Canadian and USA Alaskan coasts went from a 'derby style race for fish' open from 1-22 days to a nearly year-round fishery lasting 245 days with a winter closure. The length of the fishing period has extended further to present day and in 2025 is 263 days. Prior to the implementation of IVQ/IFQ, the fishery-dependent data collection was accomplished by one or more Secretariat staff stationed in landing ports for up to a week. After implementation, it became necessary to staff major ports throughout the fishery's extended duration (8-9 months) to meet the spatio-temporal sampling objectives.

In addition to collecting data directly, the IPHC coordinates with other entities for standardised collection of fishery-dependent data. This includes provided training and materials for samplers from IPHC Regulatory Area 2A Tribes, California Department of Fish and Wildlife (CDFW), Oregon Department of Fish and Wildlife (ODFW), Washington Department of Fish and Wildlife (WDFW), and Alaska Department of Fish and Game (ADF&G).

FISHERIES DEPENDENT DATA COLLECTION DESIGN

The primary goal and objective of the IPHC port operations is to collect representative samples from Pacific halibut offloads from across the geographical range of the commercial fishery and throughout the commercial fishing period:

- To provide biological input data for the annual IPHC stock assessment;
- To ensure accurate estimation of quantities such as age composition of the landings, mean weights, size at age, and length-weight relationships;
- To provide data in support of the IPHC research goals, including the collection of biological samples for genetics;
- To field-verify commercial logbook information and reconcile incomplete or conflicting information with captains, where possible;

- To maintain field-based points of contact between the fishing industry and the IPHC headquarters Secretariat.

These goals are achieved through staffing major ports for Pacific halibut landings throughout the commercial fishing period and collaborating with other entities as mentioned above.

Methods for Pacific halibut data collection

The IPHC Secretariat collects data from commercial Pacific halibut landings in major ports. Individual fish are randomly sampled from each landing using prescribed sampling rates for each port and IPHC Regulatory Area, with the goal of sampling a constant proportion of the landed catch over the entire fishing period within each IPHC Regulatory Area. Sampling Pacific halibut consists of the collection of fish lengths, weights, otoliths, and fin clips as well as Pacific halibut logbook data. Biological sampling targets are established by IPHC Regulatory Area to ensure sample sizes are sufficient for the needs of the stock assessment. Prior to the start of each fishing period, landing patterns from each port (for the previous fishing period) are reviewed to ensure proportional sampling (by weight landed) by IPHC Regulatory Area and to ensure minimum data goals are met.

Canada 2025: The IPHC staffed two (2) ports in Canada (Port Hardy and Prince Rupert, BC) with Fisheries Data Specialists (Field, FDS(F)) (Fig. 1).

USA 2025: The IPHC staffed eight (9) ports in Alaska, (Dutch Harbor, St. Paul, Kodiak, Homer, Seward, Juneau, Sitka, Petersburg, and Yakutat) with Fisheries Data Specialists (Field, FDS(F)) (Fig. 1). The port of Yakutat was staffed from 3 to 23 August 2025. In addition, Pacific halibut landings in Bellingham, WA and Newport, OR were sampled by headquarters-based Secretariat. In 2025 assistance was also provided by IPHC Secretariat for sampling IPHC Regulatory Area 2A Tribal commercial landings in Neah Bay, Washington. Training and support was provided for 2A Tribal commercial fishery samplers, and eight (8) Washington Treaty Tribes were represented at training.

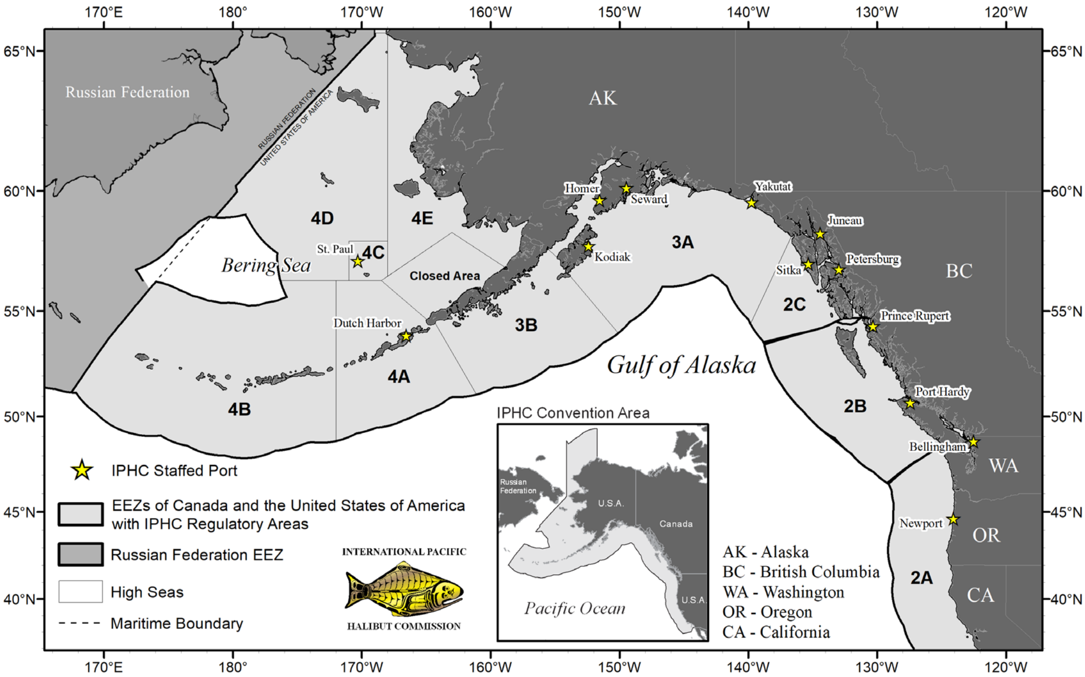

Figure 1. IPHC Fishery-Dependent Data Collection Ports 2025.

Sampling protocols

The IPHC Secretariat collects data according to protocols established in the 2025 International Pacific Halibut Commission Manual for Sampling Directed Commercial Landings (IPHC-2025-PSM01).

DATA COLLECTED IN 2025

Biological data were collected from randomly selected Pacific halibut during the 2025 fishing period. The following metrics were recorded for each sampled fish: left (blind side) sagittal otolith for age determination, fork length measured to the nearest centimeter, weight documented to the nearest tenth of a pound, and a fin clip collected for genetic sex determination.

Sampling targets were established to ensure adequate representation of the Pacific halibut population across all IPHC Regulatory Areas. The targets were set at 1,500 samples from each of the IPHC Regulatory Areas 2B, 2C, 3A, 3B, 4A, and the combined Areas 4CDE, and 1,000 samples from IPHC Regulatory Area 2A. Port and IPHC Regulatory Area-specific sampling rates were determined based on access to catch, spatial and temporal goals, and to meet minimum sampling target numbers. Rationalisation for these targeted minimums are detailed in Appendix I. The summary of biological sampling can be found in Table 1.

Table 1. Biological samples collected as of 29 October 2025 during the 2025 Pacific halibut commercial fishing period. Percent landed reported as of 15 October 2025.

IPHC Regulatory Area	Fish Sampled	Percent of Sampling Target	Percent Landed
2A	731	73%	94%
2B	1,444	96%	87%
2C	1,357	90%	81%
3A	1,426	95%	85%
3B	1,352	90%	80%
4A	1,165	78%	58%
4B	326	22%	*%
4CDE	1,238	83%	33%
Total	9,039		-

* Data not yet available or confidential, in accordance with IPHC Data Confidentiality Policy and Data Sharing Procedures

As seen in Table 1, sampling in IPHC Regulatory Areas 2B, 2C, 3A, 3B and 4A goals are similar to the percent landed and should be close to the targets for 2025. These areas have so far benefited from sufficient staffing to allow access to catch. Conversely, IPHC Regulatory Area 2A data collections may not meet the target due to reduced access to catch caused by staffing shortages, and the structure of the fishery. In IPHC Regulatory Area 2A, the fishery has multiple openers and ports for which we are unable to staff. IPHC Regulatory Areas 4A, 4B and 4CDE will likely not reach the sampling goals, likely due to lower amounts of fish landed, though we have maximized sampling rates and we do staff ports where most of those fish are landed.

Table 2 summarizes fishery logbook and biological data collection, as well as associated costs, by port as of 29 October 2025 for the 2025 fishing period. A total of 1,678 logbooks and 9,039 biological samples were collected across all ports, with a program-wide cost of $654,004 (estimated as of 30 September 2025), excluding costs of IPHC Secretariat staff based in Seattle as well as indirect costs associated such at technology, and administrative staff time.

In addition to standard biological samples and to provide support for IPHC research goals, in 2025 female maturity samples were also collected in Sitka by IPHC Secretariat staff in collaboration with the commercial fishing fleet. These samples were collected from vessels which were able to collect the gonads of female Pacific halibut and maintain them cold until the offload. Once at the dock, IPHC Secretariat staff dissected the gonads and prepared samples to be shipped to IPHC HQ for histological assessment of maturity. These data will be used to supplement maturity data collected on the IPHC Fishery Independent Setline Survey and are collected outside of the regular survey season, providing valuable data outside of that temporal range at little to no additional cost to the IPHC.

Table 2. Fishery logbook and biological data collected by port as of 29 October 2025 during the 2025 fishing period and estimated program costs for FY2025 by port as of 1 October 2025. Costs do not include IPHC Secretariat staff based at the headquarters office in Seattle which directly assist with and manage IPHC fishery dependent data collection, or indirect costs such as technology or administrative staffing. Logbook counts in this table only include logs collected in 2025 and trips fished in 2025; they do not include logs from fishing trips completed in previous years that were collected this year.

Port	2025 Logbooks	Biological samples	Total Estimated Cost (USD)	Total Estimated Cost/Month (USD)	Total Estimated Operational Costs (USD)
Dutch Harbor	67	1,718	$93,500	$13,169	$43,000
Homer	254	1,450	$64,500	$7,062	$6,000
Juneau**	63	247	$63,500	$6,953	$6,000
Yakutat**	64	98	$5,000	N/A	$5,000
Kodiak	258	1,115	$74,000	$8,102	$18,000
Petersburg	216	801	$62,000	$6,788	$6,000
Seward	163	339	$81,000	$8,869	$17,000
Sitka	167	507	$69,000	$7,555	$6,000
St. Paul	111	589	$32,000	$11,163	$14,000
Prince Rupert	129	811	$55,000	$6,022	$9,500
Port Hardy	186	633	$49,000	$5,365	$4,000
2ATribal*	N/A	550	$1,488	N/A	$1,488
Bellingham	N/A	52	$400	N/A	$400
Newport*	N/A	129	$3,616	N/A	$3,616
TOTAL	**1,678**	**9,039**	**$654,004**		

*Indicates actual costs. **Same staff member for Juneau and Yakutat. Yakutat costs only include travel costs.

Data from IPHC Regulatory Areas 4A, 4B, and 4CDE were collected nearly solely from Dutch Harbor and St. Paul. These data were prioritized due to their critical role in understanding Pacific halibut stocks in this region. These areas experience variable sampling coverage by the IPHC Fishery-Independent Setline Survey, further emphasizing the importance of data collected through fishery-dependent programs. The higher monthly costs of sampling in Dutch Harbor and

St. Paul reflect the high cost of living, elevated travel expenses, and the shorter fishing periods compared to other ports. For example, St. Paul was staffed for 2.5 months, meaning travel costs are divided over a much shorter period than ports staffed for nine or more months.

Costs in the two Canadian ports, Prince Rupert and Port Hardy, are typically lower than those in Alaska ports, largely due to the reduced cost of employee benefits in Canada compared to the United States of America. Costs also vary across ports based on factors such as employee turnover, travel expenses, housing and transportation needs.

Sampling in IPHC Regulatory Area 2A was concentrated in Bellingham, Newport, and 2A Tribal locations. While logbook data were collected, these were handled by IPHC Secretariat staff based in Seattle and are not included in Table 2.

In 2025, there were an additional 54 logs collected from previous years in Yakutat, this is likely due to many of not staffing this port and highlights the need for consistent year over year sampling and staffing as many ports as possible. Previous year logs were collected across all ports, but much fewer in ports which staff are available yearly.

CHALLENGES

While sampling goals may be met in most areas, challenges remain in achieving adequate sampling coverage in IPHC Regulatory Areas 2A, 4A, 4B, and 4CDE due in part to limited access to catch. To address these challenges, increased staffing or alternative data collection strategies such collaboration with more external entities should be considered. Additional resources may be needed to support sampling in regions with historically low access.

RESULTS

Fishery-dependent data collected and verified prior to 30 October of this year will be used in 2025 the Pacific halibut stock assessment. Data collected and processed after 30 October will be used in the following year's stock assessment.

Commercial biological and catch data interactives including 2025 fishery limits reports which are updated bi-monthly can be found at this link https://www.iphc.int/data/.

RECOMMENDATION

That the Commission:

1) **NOTE** paper IPHC-2025-IM101-06 that provides the Commission with a preliminary summary of the IPHC fishery-dependent data collection design and implementation in 2025.

APPENDICES

APPENDIX I – FISHERY DEPENDENT DATA SAMPLING TARGETS

Appendix I
Fishery Dependent Data Sampling Targets

PURPOSE

To provide clarification of IPHC's rationalised biological data collection targets.

INTRODUCTION

Biological sampling by the IPHC provides the primary source of biological information used for the annual stock assessment and management supporting analyses for Pacific halibut. Biological samples are collected by two primary resources; the Secretariat on the IPHC's Fishery-Independent Setline Survey (FISS) and commercial fishery landings in major landing ports coastwide.

In addition, the Alaska Department of Fish & Game (ADFG) collects data from the recreational fishery in Alaska, and both IPHC Secretariat [subject to funding] and National Oceanographic and Atmospheric Administration Fisheries (NOAA) staff collect data from fish captured on the fishery-independent NOAA trawl surveys conducted in Alaska.

This total comprises approximately:

1) 10,000-12,000 otoliths from the FISS (target collections include 2,000 per IPHC Regulatory Area, but are often lower due to actual vs projected catch rates and generally insufficient overall catch in Biological Region 4 even at a 100% sampling rate);
2) 11,500 otoliths from the directed commercial fishery landings (1,500 targeted per IPHC Regulatory Areas 2B, 2C, 3A, 3B, 4A, 4B and 4CDE combined, and 1000 from IPHC Regulatory Area 2A);
3) 1,500-2,000 from the recreational sector (collected in the previous year); and
4) 1,500-3,000 from the NOAA trawl surveys (collected in the previous year).

Ideally, all commercial Pacific halibut landings would have an equal chance of being sampled, creating a truly representative sampling frame across the entire fishery. In practice, this is not feasible. Instead, sampling is focused on ports with the highest landing volume except in the case of Dutch Harbor and St. Paul, which are essential for coverage of IPHC Regulatory Areas 4A, 4B, and 4CDE, respectively.

The Secretariat has undertaken a review and analysis of the IPHC capacity for sampling, aging and annual needs for stock assessment and provides the following information for general awareness.

ASSESSMENT OF THE EFFECTIVE SAMPLE SIZE

To inform future data collection priorities, the IPHC Secretariat conducted an analysis in early 2024 to assess how reductions in the number of otoliths aged from biological samples might impact the overall information content of the age dataset. This analysis relied on the concept of effective sample size (Hulson et al. 2023; Stewart and Hamel 2014), which is used as the starting point for weighting the age data in the IPHC's stock assessment models.

Effective sample size is calculated using a statistical method known as bootstrapping, which involves repeatedly resampling the observed age data thousands of times. These simulated datasets are then compared to the full dataset across the entire age range. This allows for an estimate of how much unique information the original sample contains. Unlike the total number of fish sampled, the effective sample size accounts for the fact that fish caught on the same trip tend to be more similar in age than fish from different trips (Pennington and Volstad 1994). As a result, individual fish are not truly independent observations. This means that increasing the number of trips sampled (or unique logbook entries) contributes more to statistical power than simply increasing the number of otoliths collected from a few trips, and conversely, decreasing the number of otoliths read is preferable to decreasing the number of trips sampled. However, the number of otoliths remains important, particularly when data are later subdivided by IPHC Regulatory Area, sex, or other relevant categories (e.g. in analyses of legal vs. sublegal fish under recent minimum size limits).

To evaluate effective sample sizes, we summarized commercial fishery age reading over the most recent five years of available data (2017-2021). Table A1 presents the average annual number of trips sampled, the average number of otoliths aged from those trips, and the resulting effective sample size for each Biological Region. To assess the impact of reduced age reading effort, the analysis was repeated using a random subsample of 50% of the original number of fish. Comparing the effective sample sizes between the full and reduced datasets helps answer the question: If we had aged only 50% of the collected otoliths in recent years, how much statistical information would have been lost?

While this analysis is based on historical data, the results provide insight into how future reductions in age reading or data collections could affect data quality. Biological Regions were used in this analysis because they represent the most detailed spatial scale at which data are applied in the stock assessment process.

Table A1. Summary of 2017-2021 commercial fishery fish ages by Biological Region and possible reductions for 2024. Values reported for effective sample size are the simulated sample size and percentage reduction from the actual effective sample sizes.

Biological Region	Average number of trips sampled	Average number of ages	Effective sample size	Effective sample size from 50% subsampling	Percentage reduction from actual
Region 2	366	4,436	1,525	1,069	30%
Region 3	169	2,552	905	646	29%
Region 4	81	1,866	629	478	24%
Region 4B	13	1,148	57	54	5%

As expected, the effective sample size is considerably lower than the number of fish because multiple fish are sampled from each unique trip. The largest effective sample sizes come from the commercial fishery in Biological Region 2. Regions 3, 4, and 4B follow in descending order. Simulated subsampling for age reading at 50% resulted in only a 5-30% reduction in effective sample size, respectively. Regions 2 and 3 could be subsampled at 50% and still outperform Regions 4 and 4B. Based on similar 2022 analyses and field staff capacity, Region 4B's sampling target was reduced in 2023, effectively implementing subsampling in the field with the goal of increasing trip coverage and therefore increasing the effective sample size.

Given staffing limits, IPHC reads otoliths from a subsample of those collected in the field at rates detailed in Table A2. The results presented here suggest that commercial fishery data from Biological Regions 2 and 3 subsampled at a rate of 50% still result in effective sample sizes only modestly reduced from recent levels.

In the long term, it is preferable to maintain current field sampling rates, even if only a subsample of otoliths is aged. Once staff are deployed to a port, collecting fewer otoliths offers little cost savings, while reducing ports staffed would significantly lower the number of trips sampled and, in turn, the effective sample size. Maintaining field sampling preserves the option to age additional otoliths later if needed or if an alternative ageing method is established, ensuring flexibility without permanently compromising the dataset, as would occur with reduced field sampling.

Table A2. Biological sampling rates in commercial fisheries for 2025, and the target size of the sample for ageing by IPHC Regulatory Area.

Regulatory Area	Rate	Ageing subsample
2A	1	1000
2B	0.5	750
2C	0.5	750
3A	0.5	750
3B	0.5	750
4A	1	1,500
4B	1	1,500
4C	1	750
4D	1	750
4E	1	NA
TOTAL		**8,000**

PORT-SPECIFIC PATTERNS IN BIOLOGICAL DATA

To further explore the need for sampling across a network of ports in Alaska, the IPHC Secretariat examined patterns in the fishery-dependent biological data collected between 2017 and 2022 in each port where samples were collected. The results provide supporting evidence that landings vary meaningfully by port, month, and season. These differences are biologically significant and would likely introduce bias into the data if sampling were reduced or eliminated in any location or season.

In recent years (2017-2022), the IPHC has sampled biological information from the directed commercial fishery in eight primary Alaskan ports, with a small number of samples also collected from deliveries made into ports in the state of Washington (Table A3). Two ports provide most of the samples for entire Regulatory Areas: Dutch Harbor supplies 96% of 4B and 85% of 4A samples, while St. Paul provides 52% of 4CDE (up to 76% when the local fleet is inactive). In contrast, samples from 2C, 3A, and 3B are spread across three main ports each; Juneau, Petersburg, and Sitka for 2C; Homer, Kodiak, and Seward for 3A and 3B.

Table A3. Distribution among ports of complete directed commercial fishery biological samples collected from each IPHC Regulatory Area in Alaska over 2017-2022.

Port	2C	3A	3B	4A	4B	4CDE
Dutch	0	0	95	5,236	6,005	1,709
Homer	0	2,293	3,074	415	177	394
Juneau	1,694	820	0	0	0	0
Kodiak	0	1,840	2,301	376	101	383
Petersburg	4,064	121	0	0	0	0
Seward	0	2,276	1,312	128	0	114
Sitka	2,709	643	0	0	0	0
St. Paul	0	0	0	0	0	2,783
Washington	153	661	0	0	0	0

To evaluate the potential loss of samples if coverage was reduced over certain time-periods during the fishing season, the distribution of all samples collected into each port was summarized by month (Table A4). Some ports have fewer landings at the beginning of the season (e.g. Homer, Kodiak, Seward), the end of the season (most ports) or months during the summer when fishing/processing focuses on other species (e.g. Juneau and Petersburg in July, Sitka in August). These months may be the best candidates if there is a need to reduce or eliminate sampling for a portion of the fishing season, though they may not lead to much cost savings due to increased travel costs for mid-year reductions (July, August).

Table A4. Samples collected from 2017-2022 by port and month

Port	March	April	May	June	July	August	September	October	November
Dutch	-	214	749	2,352	2,113	2,687	3,227	1,173	530
Homer	98	584	1,102	976	784	1,075	768	842	124
Juneau	359	495	563	254	77	241	258	177	90
Kodiak	38	484	951	377	595	630	667	840	419
Petersburg	389	704	789	530	173	553	591	353	103
Seward	86	655	640	447	447	716	418	274	147
Sitka	381	703	673	406	308	156	283	335	107
St. Paul	-	-	-	241	986	1,556	-	-	-
Washington	-	13	27	42	16	130	229	174	183

In addition to maintaining adequate sample sizes by IPHC Regulatory Area and Biological Region, it is critical that sampled landings reflect the full range of fish demographics; age, length, weight, and sex. This ensures that the data accurately represent the entire fishery.

The examples below illustrate how bias could be introduced if sampling were eliminated from a port or for an entire season by highlighting differences in age-structure, and sex composition across ports within IPHC Regulatory Areas and across seasons.

- For Regulatory Area 3A, landings into Southeast Alaska ports (Juneau and Sitka) include fewer males than those in 3A ports (Seward, Homer and Kodiak) (Figure A1).
- For Regulatory Area 3A, fish sampled in Kodiak tend to be younger than those from other ports, and the relative strength of specific age classes varies by port in which they are landed (Figure A1).
- For Regulatory Area 3B, females landed in Seward tend to be slightly older than those landed in Homer and Kodiak (Figure A2).
- In 2017, Sitka landings showed a much stronger 2002 year-class (age-15) than Petersburg or Juneau (Figure A3).
- Very few males are seen in the summer fishery in Area 4CDE (Figure A4).
- In Area 2C, older fish are mostly absent from landings until August (Figure A5).

These seasonal differences tend to persist across months, so minor adjustments to sampling effort within a month or port may not introduce significant bias. However, because Pacific halibut are highly migratory, landings may reflect different segments of the population depending on whether fish are encountered during spawning migrations or summer feeding.

Both spatial and seasonal patterns in age and sex composition suggest that further reductions in biological sampling at ports would likely introduce bias. The extent of the impact depends on the availability and quality of other data (e.g., FISS) and whether reductions in sampling are short-term or persist over multiple years.

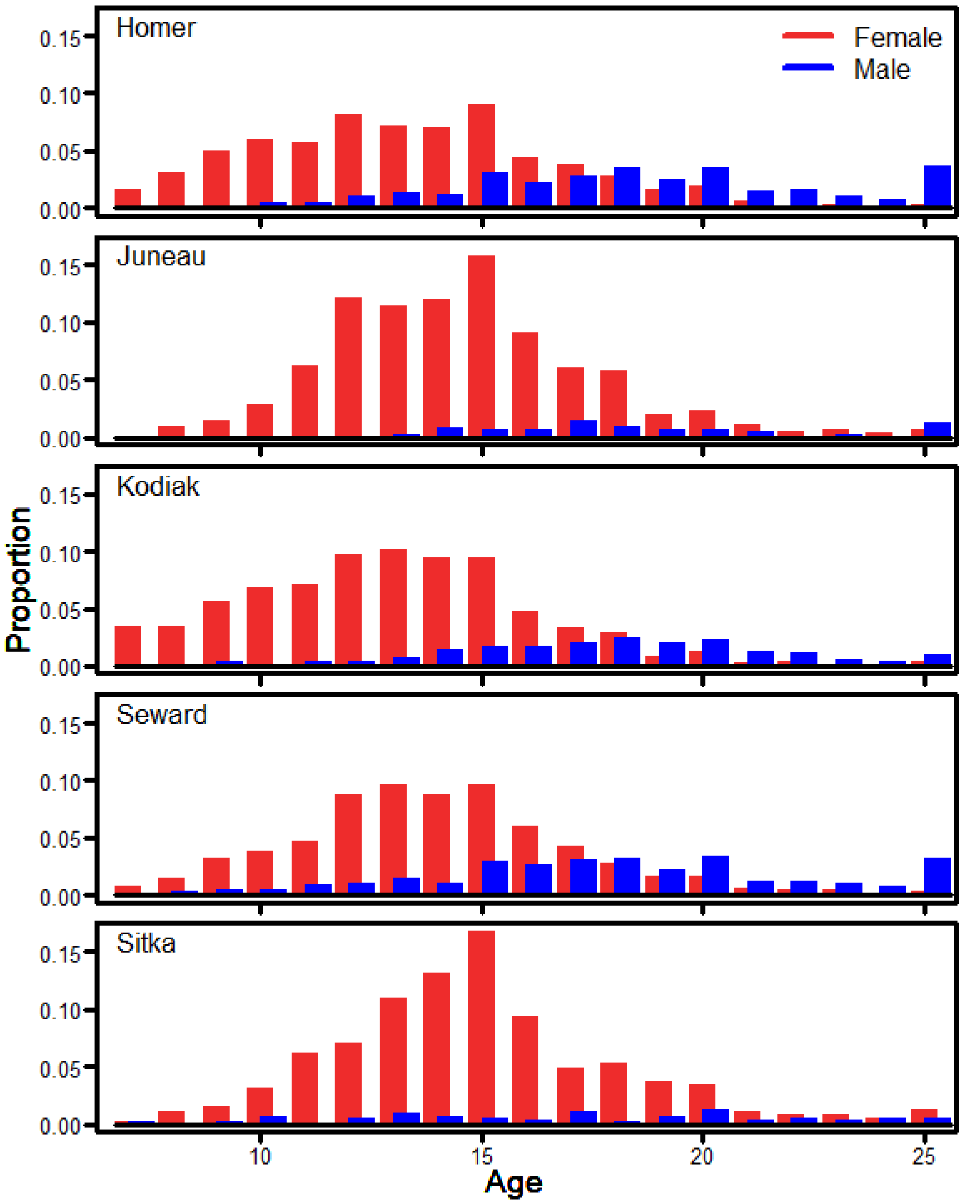

Figure A1. Age frequency distributions for 2017-2022 from IPHC Regulatory Area 3A landings by the port in which they were sampled. Red bars represent the proportion of the landings (by number of fish) that were female at each age (age-7 includes all fish up to age-7 and age-25 includes all fish 25 or older), and blue bars represent the proportion of males at each age.

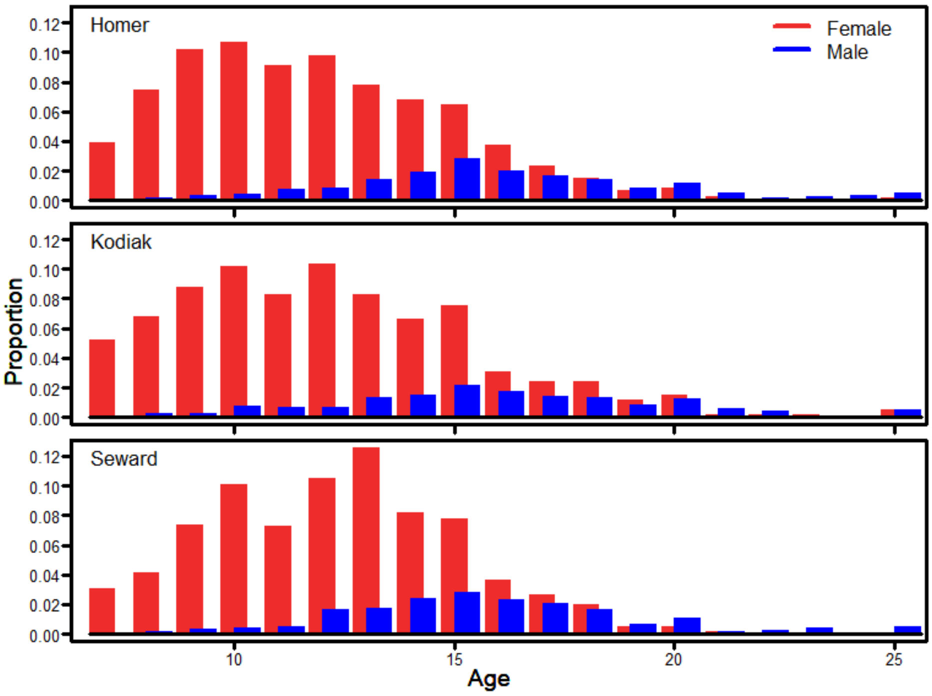

Figure A2. Age frequency distributions for 2017-2022 from IPHC Regulatory Area 3B landings by the port in which they were sampled. Red bars represent the proportion of the landings (by number of fish) that were female at each age (age-7 includes all fish up to age-7 and age-25 includes all fish 25 or older), and blue bars represent the proportion of males at each age.

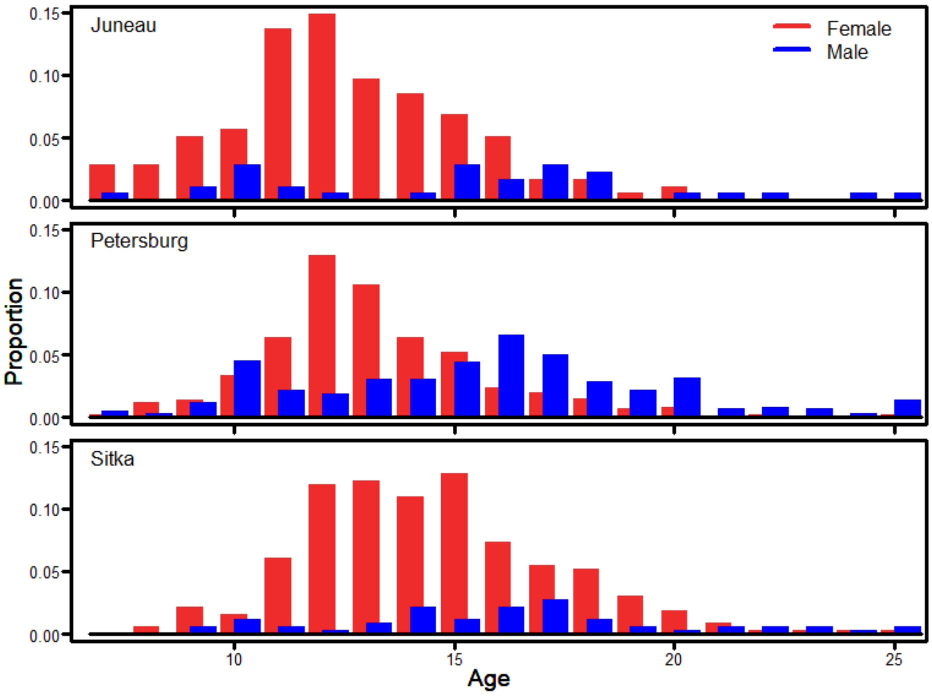

Figure A3. Age frequency distributions from IPHC Regulatory Area 2C landings in 2017 by the port in which they were sampled. Red bars represent the proportion of the landings (by number of fish) that were female at each age (age-7 includes all fish up to age-7 and age-25 includes all fish 25 or older), and blue bars represent the proportion of males at each age.

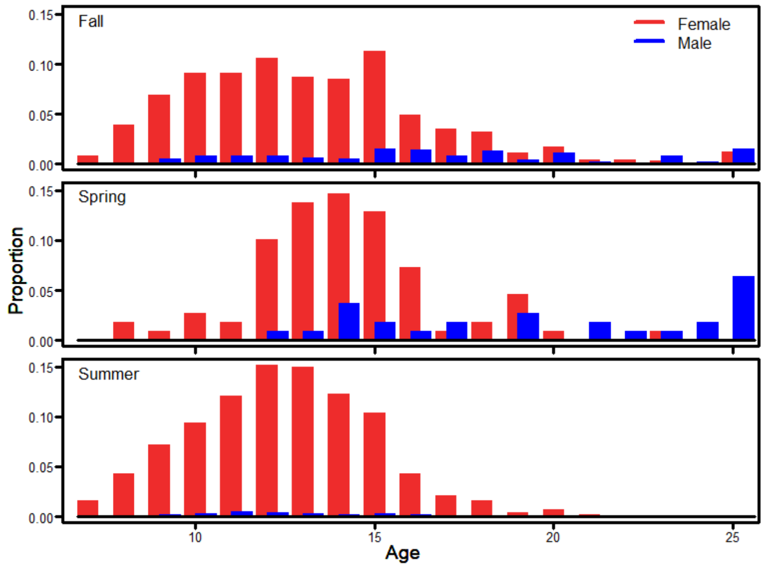

Figure A4. Age frequency distributions for 2017-2022 from IPHC Regulatory Area 4CDE by season in which they were sampled. Spring indicates March-May, Summer June-August, and Fall September-December. Red bars represent the proportion of the landings (by number of fish) that were female at each age (age-7 includes all fish up to age-7 and age-25 includes all fish 25 or older), and blue bars represent the proportion of males at each age.

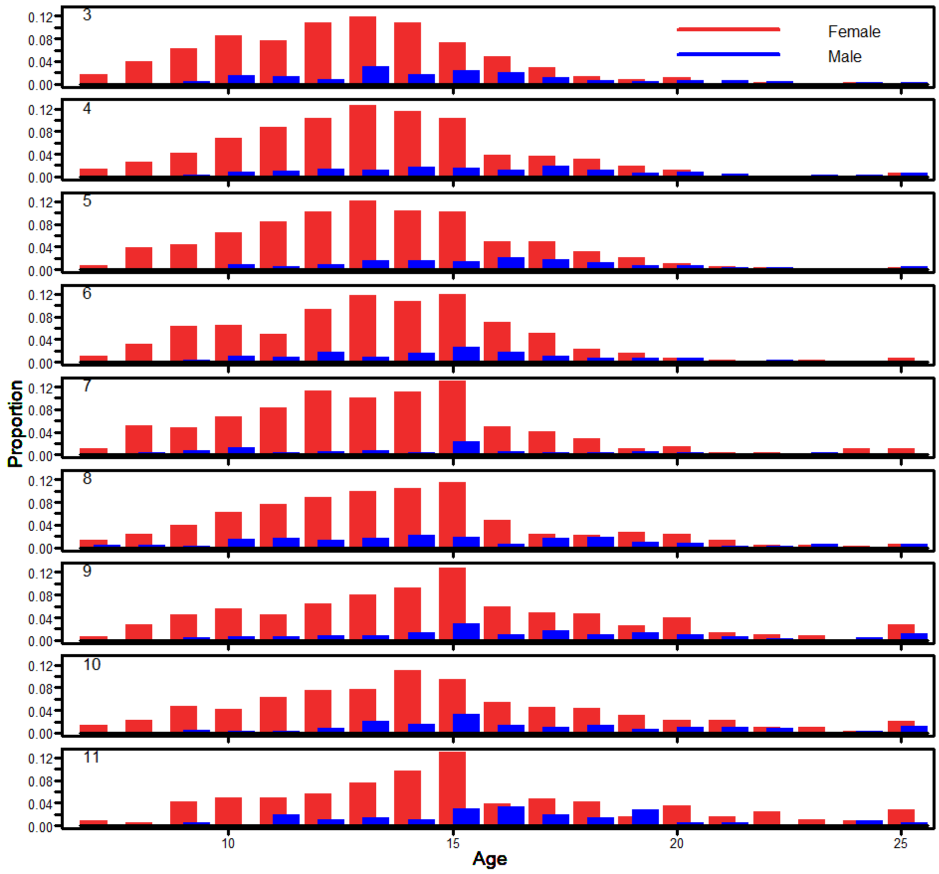

Figure A5. Age frequency distributions for 2017-2022 from IPHC Regulatory Area 2C by the month in which they were sampled. Red bars represent the proportion of the landings (by number of fish) that were female at each age (age-7 includes all fish up to age-7 and age-25 includes all fish 25 or older), and blue bars represent the proportion of males at each age.

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Fisheries Data Overview (2025): preliminary

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PURPOSE

To provide a preliminary overview of the 2025 Pacific halibut removals, including the status of mortality reported against mortality and fishery limits adopted by the Commission and outlined in the IPHC Fishery Regulations (2025). Data provided in this paper include current data and end-of-year projections as of 5 November 2025.

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-2025-IM101-10) and other analyses. The data are compiled by the IPHC Secretariat and include data from federal and state agencies of each Contracting Party. All 2025 data are in net weight (head-off, dressed, ice and slime deducted) and considered preliminary at this time. The IPHC Regulatory Areas are provided in Figure 1.

The report provides a preliminary summary of removals in Tables 1 and 2. Table 2 provides estimates of mortality reported against the fishery limits (FCEY) resulting from the IPHC-adopted distributed mortality (TCEY) limits and the existing Contracting Party catch sharing arrangements, as well as non-FCEY mortality projections, by IPHC Regulatory Area. Figure 2 provides cumulative percentages of the directed commercial Pacific halibut limit landed by week.

Historical data for all sectors are available on the IPHC website.

DEFINITIONS

Directed commercial fisheries include commercial landings and discard mortality. Directed commercial discard mortality includes estimates of sub-legal Pacific halibut (under 81.3 cm or 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 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 that uses Alaska Subsistence [Pacific] Halibut Registration Certificate (SHARC), and
iv) U32 Pacific halibut retained for personal use by the Community Development Quota (CDQ) fishery in IPHC Regulatory Areas 4D and 4E.

Non-directed commercial discard mortality includes incidentally caught Pacific halibut by fisheries targeting other species and that cannot legally be retained, e.g. by the trawl fleet. This category 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 (FISS) and other IPHC research.

Table 1. 2025 mortality reported against mortality limits (TCEYs) by IPHC Regulatory Area and U26 non-directed discards (end-of year projections as of 5 November 2025).

IPHC Regulatory Area	Mortality limits (TCEY) (net weight)		Mortality to date (net weight)		Percent attained
	Tonnes (t)	Pounds (lb)	Tonnes (t)	Pounds (lb)	(%)
IPHC Regulatory Area 2A	748	1,650,000	682	1,503,310	91.1
IPHC Regulatory Area 2B	2,472	5,450,000	2,348	5,175,522	95.0
IPHC Regulatory Area 2C	2,368	5,220,000	2,468	5,441,978	104.3
IPHC Regulatory Area 3A	4,119	9,080,000	3,865	8,519,954	93.8
IPHC Regulatory Area 3B	1,297	2,860,000	1,173	2,586,540	90.4
IPHC Regulatory Area 4A	608	1,340,000	465	1,025,172	76.5
IPHC Regulatory Area 4B	472	1,040,000	148	325,380	31.3
IPHC Regulatory Area 4CDE and Closed Area	1,397	3,080,000	1,099	2,422,289	78.6
Subtotal (TCEY)	**13,481**	**29,720,000**	**12,247**	**27,000,145**	**90.8**
Non-directed commercial discard mortality (U26)	862	1,900,000	845	1,862,000	98.0
Total	**14,343**	**31,620,000**	**13,092**	**28,862,145**	**91.3**

Table 2. 2025 estimates of mortality reported against fishery limits (FCEY) and mortality projections (non-FCEY components of TCEY) by IPHC Regulatory Area (end-of-year projections as of 5 November 2025).

IPHC Regulatory Area	Fishery limit / projection[1] (net weight)		Mortality to date[1] (net weight)		Pct (%) attained
	Tonnes (t)	**Pounds (lb)**	**Tonnes (t)**	**Pounds (lb)**	**(%)**
Area 2A (California, Oregon, and Washington)	**748**	**1,650,000**	***682***	***1,503,310***	91.1
Domestic mortality limits (FCEY)					
Non-treaty directed commercial fishery	118	259,515	*120*	264,004	101.7
Non-treaty incidental catch in salmon troll fishery	21	45,797	11	23,995	52.4
Non-treaty incidental catch in sablefish fishery[2]	32	70,000	*32*	*70,000*	100.0
Treaty Indian commercial fishery	236	520,700	*236*	*520,700*	100.0
Treaty Indian ceremonial and subsistence (year-round)	7	14,800	*7*	*14,800*	100.0
Recreational – Washington	129	284,042	*129*	*285,091*	100.4
Recreational – Oregon	134	295,367	*80*	*176,193*	59.7
Recreational – California	18	39,780	*9*	*19,500*	49.0
Projections (non-FCEY)[3]					
Directed commercial discard mortality	27	60,000	*29*	*63,000*	105.0
Recreational discard mortality	--	--	*2*	*4,005*	--
Non-directed commercial discard mortality (O26)	27	60,000	*23*	*51,000*	85.0
IPHC fishery-independent setline survey and research[4]	--	--	5	11,022	--
Non-TCEY mortality					
Non-directed commercial discard mortality (U26)	5	10,000	*2*	*5,000*	50.0
Area 2B (British Columbia)	**2,472**	**5,450,000**	***2,348***	***5,175,522***	**95.0**
Domestic mortality limits (FCEY)					
Directed commercial fishery landings	1,755	3,870,000	*1,728*	*3,810,483*	98.5
Recreational fishery	308	680,000	*240*	*528,280*	77.7
Recreational fishery (XRQ - Experimental Quota)[5]	--	--	*0*	*0*	--
Projections (non-FCEY)[3]					
Directed commercial discard mortality	68	150,000	*78*	*173,000*	115.3
Recreational discard mortality	14	30,000	*10*	*21,203*	70.7
Subsistence	186	410,000	*184*	*405,000*	98.8
Non-directed commercial discard mortality (O26)	141	310,000	*68*	*151,000*	48.7
IPHC fishery-independent setline survey and research[4]	--	--	39	86,556	--
Non-TCEY mortality					
Non-directed commercial discard mortality (U26)	18	40,000	*24*	*52,000*	130.0

IPHC Regulatory Area	Fishery limit / projection[1] (net weight)		Mortality to date[1] (net weight)		Pct (%) attained
	Tonnes (t)	Pounds (lb)	Tonnes (t)	Pounds (lb)	
Area 2C (southeastern Alaska)	**2,368**	**5,220,000**	***2,468***	***5,441,978***	**104.3**
Domestic mortality limits (FCEY)					
Directed commercial fishery landings	1,393	3,070,000	*1,176*	*2,592,204*	84.4
Directed commercial discard mortality	54	120,000	*44*	*97,000*	80.8
Metlakatla (Annette Island Reserve)	--	--	22	49,316	--
Guided recreational fishery	327	720,000	*333*	*734,336*	102.0
Guided recreational fishery (GAF)[5]	--	--	*106*	*233,000*	--
Projections (non-FCEY)[3]					
Unguided recreational fishery	458	1,010,000	*618*	*1,363,223*	135.0
Subsistence	113	250,000	*115*	*252,492*	101.0
Non-directed commercial discard mortality (O26)	23	50,000	*24*	*52,000*	104.0
IPHC fishery-independent setline survey and research[4]	--	--	31	68,407	--
Non-TCEY mortality					
Non-directed commercial discard mortality (U26)	0	0	*0*	*0*	--
Area 3A (central Gulf of Alaska)	**4,119**	**9,080,000**	***3,865***	***8,519,954***	**93.8**
Domestic mortality limits (FCEY)					
Directed commercial fishery landings	2,672	5,890,000	*2,445*	*5,391,377*	91.5
Directed commercial discard mortality	204	450,000	*151*	*333,000*	74.0
Guided recreational fishery	671	1,480,000	*633*	*1,396,302*	94.3
Guided recreational fishery (GAF)[5]	--	--	*22*	*48,000*	--
Projections (non-FCEY)[3]					
Unguided recreational fishery	399	880,000	*407*	*897,075*	101.9
Subsistence	54	120,000	*55*	*121,642*	101.4
Non-directed commercial discard mortality (O26)	118	260,000	*121*	*266,000*	102.3
IPHC fishery-independent setline survey and research[4]	--	--	30	66,558	--
Non-TCEY mortality					
Non-directed commercial discard mortality (U26)	113	250,000	*90*	*199,000*	79.6
Area 3B (western Gulf of Alaska)	**1,297**	**2,860,000**	***1,173***	***2,586,540***	**90.4**
Domestic mortality limits (FCEY)					
Directed commercial fishery landings	1,120	2,470,000	*986*	*2,172,883*	88.0
Projections (non-FCEY)[3]					
Directed commercial discard mortality	91	200,000	*86*	*190,000*	95.0
Recreational fishery	0	0	*1*	*3,022*	--
Subsistence	5	10,000	*5*	*10,475*	104.8
Non-directed commercial discard mortality (O26)	77	170,000	*73*	*161,000*	94.7
IPHC fishery-independent setline survey and research[4]	--	--	22	49,160	--
Non-TCEY mortality					
Non-directed commercial discard mortality (U26)	50	110,000	*59*	*129,000*	117.3
Area 4A (eastern Aleutians)	**608**	**1,340,000**	***465***	***1,025,172***	**76.5**
Domestic mortality limits (FCEY)					
Directed commercial fishery landings	454	1,000,000	*302*	*666,846*	66.7
Projections (non-FCEY)[3]					
Directed commercial discard mortality	18	40,000	*16*	*36,000*	90.0
Recreational fishery	5	10,000	*4*	*9,499*	95.0
Subsistence	0	0	*2*	*4,164*	--
Non-directed commercial discard mortality (O26)	132	290,000	*133*	*294,000*	101.4
IPHC fishery-independent setline survey and research[4]	--	--	7	14,663	--
Non-TCEY mortality					
Non-directed commercial discard mortality (U26)	59	130,000	*87*	*192,000*	147.7

IPHC Regulatory Area	Fishery limit / projection[1] (net weight)		Mortality to date[1] (net weight)		Pct (%) attained
	Tonnes (t)	Pounds (lb)	Tonnes (t)	Pounds (lb)	
Area 4B (central and western Aleutians)	**472**	**1,040,000**	***148***	***325,380***	**31.3**
Domestic mortality limits (FCEY)					
Directed commercial fishery landings	408	900,000	*89*	*197,122*	21.9
Projections (non-FCEY)[3]					
Directed commercial discard mortality	5	10,000	*0*	*1,000*	10.0
Recreational fishery	0	0	*0*	*0*	--
Subsistence	0	0	*0*	*218*	--
Non-directed commercial discard mortality (O26)	59	130,000	*54*	*118,000*	90.8
IPHC fishery-independent setline survey and research[4]	--	--	4	9,040	--
Non-TCEY mortality					
Non-directed commercial discard mortality (U26)	5	10,000	*9*	*19,000*	190.0
Areas 4CDE and Closed Area	**1,397**	**3,080,000**	***1,099***	***2,422,289***	**78.6**
Domestic mortality limits (FCEY)					
Directed commercial fishery landings	730	1,610,000	*315*	*695,214*	43.2
Projections (non-FCEY)[3]					
Directed commercial discard mortality	18	40,000	*11*	*25,000*	62.5
Recreational fishery	0	0	*0*	*0*	--
Subsistence[6]	5	10,000	*6*	*14,075*	140.8
Non-directed commercial discard mortality (O26)	640	1,410,000	*766*	*1,688,000*	119.7
IPHC fishery-independent setline survey and research[4]	--	--	0	0	--
Non-TCEY mortality					
Non-directed commercial discard mortality (U26)	612	1,350,000	*574*	*1,266,000*	93.8
Total	**13,481**	**29,720,000**	***12,247***	***27,000,145***	**90.8**
Directed commercial fishery landings	9,424	20,776,012	*7,880*	*17,372,144*	83.6
Recreational fishery	2,463	5,429,189	*2,594*	*5,718,729*	105.3
Subsistence	370	814,800	*373*	*822,866*	101.0
Non-directed commercial discard mortality (O26)	1,216	2,680,000	1,261	2,781,000	103.8
IPHC fishery-independent setline survey and research[4]	--	--	139	305,406	--
Non-directed commercial discard mortality (U26)	**862**	**1,900,000**	**845**	**1,862,000**	**98.0**

Values shown in italics represent year-end projections.

[1] Totals by IPHC Regulatory area include all TCEY components, i.e. exclude non-directed commercial discard mortality (U26).
[2] North of Pt. Chehalis; non-treaty incidental to sablefish fishery limit allocated from Washington sport allocation in accordance with the Pacific halibut Catch Sharing Plan for IPHC Regulatory Area 2A.
[3] Fishery projection is value used in setting the TCEY for each IPHC Regulatory Area (i.e., non-FCEY components of TCEY).
[4] Includes U32 Pacific halibut landed during FISS.
[5] XRQ and GAF leased from commercial quota.
[6] Includes U32 CDQ landings retained for personal consumption and not accounted as commercial CDQ landings in IPHC Regulatory Areas 4D and 4E.

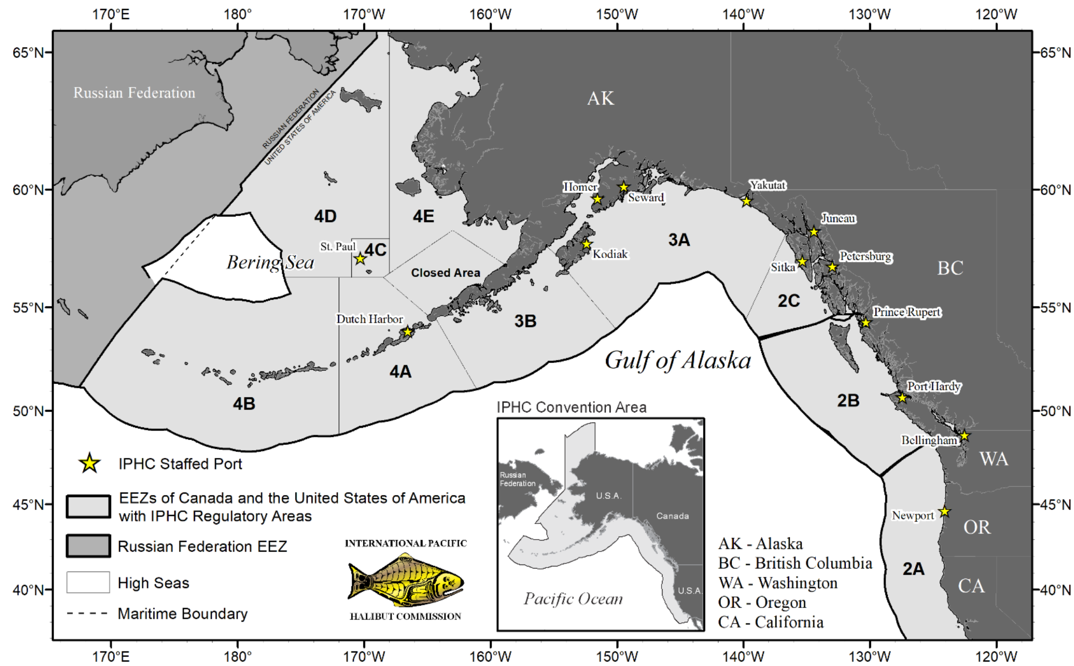


Figure 1. IPHC Convention Area and associated IPHC Regulatory Areas.

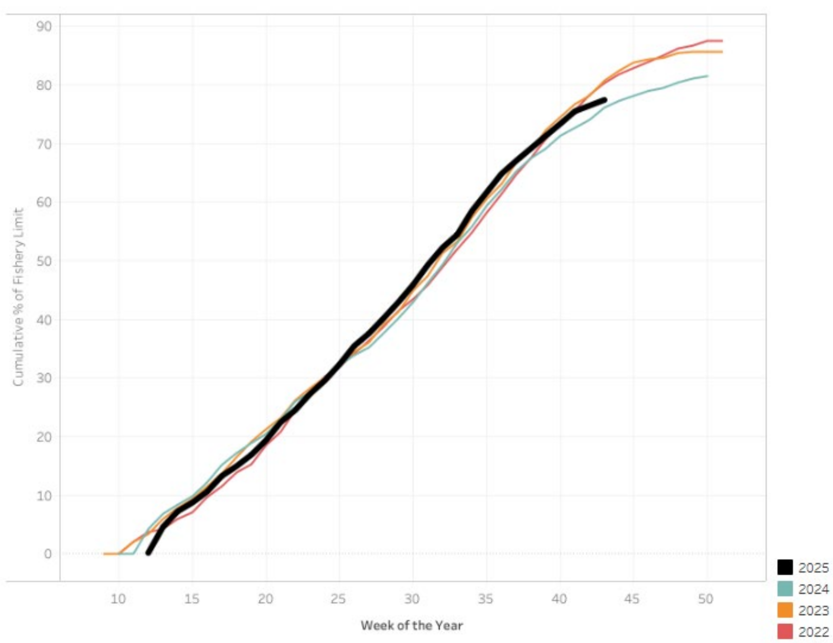


Figure 2. Cumulative percentage of directed commercial Pacific halibut limit landed by week.

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 Metlakatla fishery in IPHC Regulatory Area 2C; the Individual Fishing Quota (IFQ) system in Alaska, USA; and the CDQ fisheries in IPHC Regulatory Areas 4B and 4CDE.

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 6:00 local time on 20 March and will close at 23:59 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 period. In IPHC Regulatory Area 2A, the non-treaty directed commercial fishery operated under 58-hour fishing periods beginning on the fourth Tuesday in June. Each fishing period began on the Tuesday at 08:00 and ended on the following Thursday at 18:00 local time and was further restricted by fishing period limits. The fishery closed for the remainder of the year after the third opening, which ended on 24 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, 2019-2025 (d = days; h = hours).

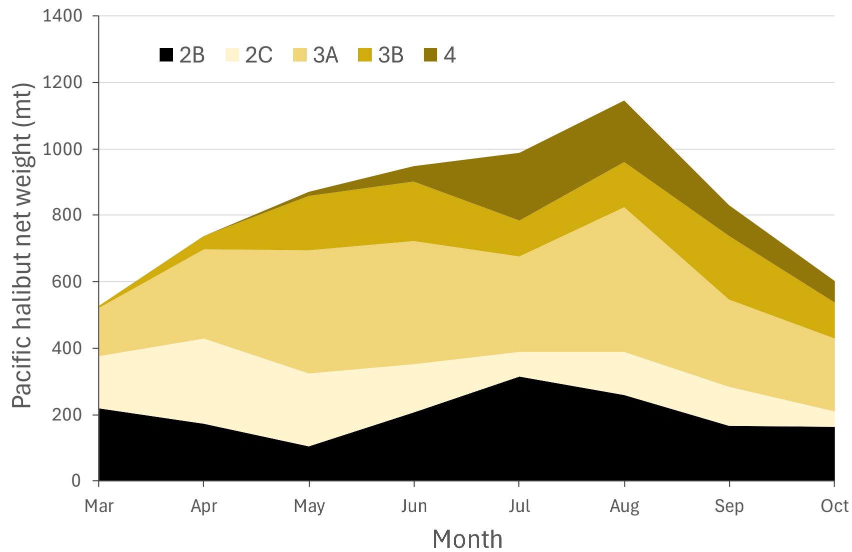
IPHC Regulatory Area	**Year**						
	2025	2024	2023	2022	2021	2020	2019
Canada: 2B	20 Mar-7 Dec (262 d)	15 Mar-7 Dec (267 d)	10 Mar -7 Dec (272 d)	6 Mar-7 Dec (276 d)	6 Mar-7 Dec (276 d)	14 Mar-7 Dec (268 d)	15 Mar-14 Nov (244 d)
USA: 2A Treaty Indian	20 Mar-19 Jun (24 h) (Unrestricted) 20 Mar-19 Jun (122 h) (Restricted) 23 Jun-31 Jul (81.5 h) (Restricted) 23 Jun-31 Jul (48 h) (Unrestricted) 11 Aug-7 Dec (Restricted)	15 Mar-19 Jun (24 h) (Unrestricted) 15 Mar-19 Jun (93.5 h) (Restricted) 24 Jun-31 Jul (2x 41 h) (Restricted) 24 Jun-31 Jul (24 h) (Unrestricted) 9 Aug-30 Sep (6x24 h) (Restricted)	10 Mar-10 Jun (55 h) (Unrestricted) 10 Mar-31 May (122 h) (Restricted) 1 Jun-31 Jul (2x 24 h) (Restricted) 17 Jun-31 Jul (20 h) (Unrestricted) 1 Sep-15 Oct (2x24 h) (Restricted)	6 Mar-31 May (55 h) (Unrestricted) 6 Mar-31 May (122 h) (Restricted) 3 Jun-30 Sep (48 h and 72 h) (Restricted)	6 Mar-16 May (55 h) (Unrestricted) 6 Mar-16 May (102 h) (Restricted) 16 May-20 Jun (24 h)	14 Mar-30 Sep (55 h) (Unrestricted) 14 Mar-30 Sep (222 h) (Restricted) 5 Oct-18 Oct (13 d)	15 Mar-15 May (55 h) (Unrestricted) 15 Mar-15 May (84 h) 20 May-15 Jun (72 h) (Restricted) 11 Jun-24 Jul (35 d)
USA: 2A Commercial Directed	24-26 Jun 8-10 Jul 22-24 Jul (58 h each)	25-27 Jun 9-11 Jul 6-8 Aug 27-29 Aug 24-26 Sep (58 h each)	27-29 Jun 11-13 Jul 1-3 Aug (58 h each)	28-30 Jun 12-14 Jul 26-28 Jul (58 h each)	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)

USA: 2A Commercial Incidental	Salmon 1 Apr- 31 Oct (213 d) Sablefish 1 Apr-7 Dec (250 d)	Salmon 1 Apr- 31 Oct (213 d) Sablefish 1 Apr-7 Dec (250 d)	Salmon 1 Apr-31 Oct (213 d) Sablefish 1 Apr-7 Dec (250 d)	Salmon 1 Apr-31 Oct (213 d) Sablefish 1 Apr-31 Oct (213 d)	Salmon 1 Apr-7 Dec (250 d) Sablefish 1 Apr-7 Dec (250 d)	Salmon WA: 15 Apr-30 Sep (168 d) OR: 15 Apr-31 Oct (199 d) CA: 1 Aug-30 Sep (60 d) Sablefish 1 Apr- 15 Nov (228 d)	Salmon WA, CA: 20 Apr- 30 Sep (163 d) OR: 20 Apr- 31 Oct (194 d) Sablefish 1 Apr-31 Oct (213 d)
USA: Alaska (2C, 3A, 3B, 4A, 4B, 4CDE)	20 Mar-7 Dec (262 d)	15 Mar-7 Dec (267 d)	10 Mar-7 Dec (272 d)	6 Mar-7 Dec (276 d)	6 Mar-7 Dec (276 d)	14 Mar-15 Nov (246 d)	15 Mar-14 Nov (244 d)

Directed commercial landings

Directed commercial fishery limits and landings by IPHC Regulatory Area for the 2025 fishing season are shown in Table 2. The directed commercial fishery limit, as referred to here, is the IPHC commercial fishery limit set by the Contracting Parties following the IPHC Annual Meeting and is equivalent to the Fishery Constant Exploitation Yield (FCEY). The fishery limits with adjustments from the underage and overage programs from the previous year's quota share programs are not shown. The *Use of Fish* allocation in IPHC Regulatory Area 2B, as defined in the Pacific Region Integrated Fisheries Management Plan – Groundfish are also not presented.

The 2025 directed commercial fishery landings were spread over ten months (March – December) of the year in Canada and the USA (Figure 2). On a month-to-month comparison, July took the lead as the busiest month for total poundage (20%) landed from IPHC Regulatory Area 2B. On a month-to-month comparison, August was the busiest month for total poundage (18%) from Alaska, USA. A year-to-date visualization is also available on the IPHC website.



Regulatory Area 2B landings from DFO Fishery Operations System (FOS).
Regulatory Areas 2C, 3, and 4 landings from NOAA Fisheries Restricted Access Management (RAM) Program.

Figure 3. 2025 directed commercial landings (tonnes, net weight, preliminary) of Pacific halibut for individual quota fisheries by IPHC Regulatory Area and month.

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

The 2025 IPHC Regulatory Area 2A fisheries and respective fishery limits are listed in Table 2. The total IPHC Regulatory Area 2A commercial landings (directed and incidental to salmon troll, sablefish, and Treaty Indian) of 399 tonnes (878,699 pounds) was 2% below the fishery limit. The total non-treaty directed commercial landings of 120 tonnes (264,004 pounds) was 2% over of the fishery limit of 118 tonnes (259,515 pounds) after three 58-hour openers. The fishing period limits by vessel size class for each opening in 2025 are listed in Table 4.

The salmon troll fishery season was open from 1 April to 31 October in Oregon and Washington (CA closed) with an allowable incidental landing ratio of one Pacific halibut per two Chinook (*Onchorhynchus tshawytscha*), plus an additional Pacific halibut per landing, and a vessel trip limit of 35 fish. Total landings of 11 tonnes (23,995 pounds) were 48% under the fishery limit of 21 tonnes (45,797 pounds).

Incidental Pacific halibut retention during the limited-entry sablefish fishery is open from 1 April to 7 December. The allowable landing ratio was se at 0.03 tonnes (75 pounds) of Pacific halibut to 0.45 tonnes (1,000 pounds) of sablefish, with an allowance for up to two additional Pacific halibut in excess of the ratio limit. The estimated removals of 32 tonnes (70,000 pounds) are at 100% of the fishery limit.

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:

- The unrestricted fishery occurred between 20 March and 19 June.
- The restricted fishery occurred between 20 March to 19 June.
- There were two late-season openers: one from 23 June to 31 July and another from 11 August to 7 December.

Estimated overall total landings of 236 tonnes (520,700 pounds) are at 100% of the fishery limit.

Table 4. The fishing periods and limits (tonnes, dressed, head-on with ice/slime) by vessel class used in the 2025 directed commercial fishery in IPHC Regulatory Area 2A.

Vessel Class		Commercial fishing periods (dates) & limits (t)		
Letter	Feet	24-26 Jun	8-10 Jul	22-24 Jul
A, B and C	1-35	0.9	0.9	2.3
D and E	36-45	1.5	1.5	2.3
F and G	46-55	2.0	2.0	2.3
H	56+	2.3	2.3	2.3

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 126 in 2025. In addition, Pacific halibut can be landed as incidental catch in other licensed groundfish fisheries. In 2025, this occurred from a total of 32 licences from other fisheries. The 2025 projected directed commercial landings represent 1,728 tonnes (3,810,483 pounds) of Pacific halibut. The Experimental Recreational Halibut (XRQ) Program was postponed until further notice (FN0262) .

Directed commercial trips from IPHC Regulatory Area 2B were delivered into 12 different ports in 2025. The ports of Port Hardy (including Coal Harbour and Port McNeill) and Prince Rupert/Port Edward were the major landing locations, receiving 93% of the commercial landings. Port Hardy received 40% and Prince Rupert received 53% of the directed commercial landings. In 2025, a total of 26 Canadian vessels landed frozen, head-off Pacific halibut for a total of 36 tonnes (79,607 pounds) over 57 landings. Live landings resulted in a total landed weight of <1 tonne (525 pounds).

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

In Alaska, 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 2025, RAM reported that 2,206 persons/entities held QS.

The total 2025 landings from the IFQ/CDQ Pacific halibut fishery for the waters off Alaska projected through 7 December was 5,314 tonnes (11,715,646 pounds), 22% under the directed commercial fishery landings limit. By IPHC Regulatory Area, the directed commercial landings are projected under the fishery limit by 16% for Area 2C, 8% for Area 3A, 12% for Area 3B, 33% for Area 4A, 78% for Area 4B (IFQ/CDQ), and 57% for 4CDE (IFQ/CDQ).

Homer received approximately 24% (1,254 tonnes or 2,765,482 pounds) of the Alaskan directed commercial landings, making it the port that received the greatest landed volume in 2025. Kodiak received the second largest landing volume at 14% (734 tonnes or 1,619,044 pounds) of the Alaskan commercial landings. In Southeast Alaska, the two largest landing volumes were received in Petersburg and Sitka, with their combined landings representing 15% of the directed commercial Alaskan landings (798 tonnes or 1,758,762 pounds). The Alaskan QS catch that was landed in Bellingham, WA was less than 2%.

Directed commercial sector mortality was 16% under the commercial sector FCEY limit (includes directed commercial discard mortality in IPHC Regulatory Areas 2C and 3A, Metlakatla and GAF).

In Alaska, 10 tonnes (22,500 pounds) of Pacific halibut were caught with pot gear and landed within the directed commercial fishery, representing 0.2% 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 14 two-day openings between 4 April and 12 October for total landings of 22 tonnes (49,316 pounds). The fishery closed on 12 October.

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 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 vessel's 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 FISS 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 an estimated 16% mortality rate and Pacific halibut mortality from lost gear is assumed to be 100%.

Pacific halibut discard mortality estimates from the commercial Pacific halibut fishery are summarized by IPHC Regulatory Area in Table 2.

RECREATIONAL FISHERIES

The 2025 recreational removals of Pacific halibut, including discard mortality, was estimated at 2,594 tonnes (5,718,729 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.

Recreational landings

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

The 2025 IPHC Regulatory Area 2A recreational allocation was 281 tonnes (619,189 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 129 tonnes (284,042 pounds) being allocated to Washington subareas, 134 tonnes (295,367 pounds) to Oregon subareas, and 18 tonnes (39,780 pounds) to California.[1] The IPHC Regulatory Area 2A recreational harvest totaled 218 tonnes (WA, OR and CA; 480,784 pounds), 22% under the recreational fishery limit. Recreational fishery harvest seasons by subareas varied and were managed in season with fisheries open in Washington from 3 April to 30 September, in Oregon from 1 May to 31 October, and in California from 1 May to 15 November.

Canada – IPHC Regulatory Area 2B (British Columbia)

IPHC Regulatory Area 2B operated under a 126 cm (49.6 inch) maximum size limit. Anglers had a retention limit choice of one Pacific halibut between 90 and 126 cm (35.4 - 49.6 inches) or two under 90 cm (35.4 inch), with an annual limit of ten per licence holder. Effective 1 April, the daily retention limit was changed to one fish no greater than 102 cm (40.2 inches) (FN0194). The IPHC Regulatory Area 2B recreational harvest was at 78% of the recreational fishery limit.

[1] Since 2024, in IPHC Regulatory Area 2A, the USA (NOAA Fisheries) may take in-season action to reallocate the recreational fishery limits between Washington, Oregon, and California after determining that such action will not result in exceeding the overall IPHC Regulatory Area 2A recreational fishery limit and that such action is consistent with any domestic catch sharing plan.

Recreational landings in British Columbia are also allowed under the Pacific Region Experimental Recreational [Pacific] Halibut Program (XRQ), though the program was deferred in 2025 (FN0262).

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

In IPHC Regulatory Area 2C, charter anglers were permitted to retain one Pacific halibut per day. From 1 February to 31 December, retained Pacific halibut must be less than or equal to 37 inches or greater than or equal to 80 inches. Pacific halibut retention was not allowed on Tuesdays.

In IPHC Regulatory Area 3A, charter anglers were allowed to retain two Pacific halibut per day, with only one fish exceeding 27 inches. If only one Pacific halibut was retained, it could be any size. Charter vessels were limited to one fishing trip per day when retaining Pacific halibut, and Pacific halibut retention was prohibited on Tuesdays and Wednesdays.

In addition, a Guided Angler Fish (GAF) program allows 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 experience some level of mortality and impacts more of the stock with the increasing use of size restrictions, such as reverse slot limits. Current year estimates from USA agencies of recreational discard mortality have been received and are provided in Table 2. Canada has not provided recreational discard mortality estimates; therefore, the discard mortality rate from IPHC Regulatory Area 2C is applied to the estimated landings from IPHC Regulatory Area 2B.

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, the First Nations Food, Social, and Ceremonial (FSC) fishery in British Columbia, and the subsistence fishery by rural residents and federally recognized native tribes in Alaska documented via Subsistence [Pacific] Halibut Registration Certificates (SHARC).

The coastwide subsistence estimate for 2025 was 373 tonnes (822,866 pounds) (Table 2). This includes U32 fish retained for personal consumption in CDQ fishery (excluded from commercial CDQ landings statistics), reported directly to the IPHC in accordance with Section 14 of the IPHC Fishery Regulations (2025).

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, with exception of U32 fish retained by CDQ groups, are accounted for as commercial catch and are not included here.

USA - IPHC Regulatory Area 2A (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 C&S fisheries. It is estimated that 7 tonnes (14,800 pounds) were retained as C&S.

Canada - IPHC Regulatory Area 2B (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).

USA - IPHC Regulatory Areas 2C, 3, and 4 (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 applicants must obtain a SHARC license. The Division of Subsistence at Alaska Department of Fish and Game (ADF&G) was contracted by NOAA Fisheries to estimate the subsistence harvest in Alaska through a data collection program. A voluntary survey of fishers is conducted by mail or phone, with some onsite visits. Since 2018, this survey has been conducted on a biennial schedule rather than annually. The 2023 estimates have been carried forward for 2024 and 2025, except for Regulatory Area 4CDE, which has been updated. Estimates for all Regulatory Areas are provided in Table 2.

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, if 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 2025 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).

CDQ – Bristol Bay Economic Development Corporation (BBEDC)

BBEDC requires their fishers to record the lengths of retained U32 Pacific halibut in a separate log, which are 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 in Naknek and Dillingham. BBEDC reported the landing of two U32 Pacific halibut <1 tonne (135 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 reported 146 U32 Pacific halibut weighing <1 tonne (1,327 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 (CDM) by IPHC Regulatory Area and sector. All removals for 2025 are provided in Table 2.

Estimates of non-directed CDM of Pacific halibut are provided by Contracting Party agencies. The amounts are estimates because not all fisheries are monitored at 100%, and it is not assumed that all discarded Pacific halibut fail to survive. The IPHC relies upon information supplied by observer programs run by Contracting Party agencies for non-directed CDM estimates in most fisheries. Non-IPHC research survey information is used to generate estimates of non-directed CDM in the few cases where fishery observations are unavailable.

Non-directed commercial discard mortality by area

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

Groundfish fisheries off Washington, Oregon, and California are managed by NOAA Fisheries, following advice and recommendations developed by the Pacific Fishery Management Council. Non-directed commercial discard mortality projected estimates are provided by NOAA Fisheries, which operates observer programs off the USA West Coast.

Canada – IPHC Regulatory Area 2B (British Columbia)

In Canada, Pacific halibut non-directed commercial discard mortality in trawl fisheries are monitored and capped at 454 tonnes round weight by DFO. Non-trawl non-directed CDM is handled under the IVQ system within the directed Pacific halibut fishery cap. Non-directed CDM information from trawl fishery is provided to IPHC by DFO.

In 2025, DFO also provided additional data that included hook-and-line and pot (groundfish) discard mortality subject to quota deductions. The submission contained by-landing data for 2022–2025. Data for 2025 were rolled over from 2024, as a full-year projection was not available.

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 and ADF&G.

<u>IPHC Regulatory Area 2C (Southeast Alaska)</u>

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 (*Gadus macrocephalus*) and rockfish (*Sebastes* spp.) in open access fisheries, and sablefish in the IFQ fishery. In 1998, a no trawl zone was established in the Gulf of Alaska eliminating trawl fishing in this area.

Fisheries occurring within state waters and resulting in Pacific halibut non-directed CDM include pot fisheries for red and golden king crab (*Paralithodes camtschaticus*, *Lithodes aequispinus*), and tanner crab (*Chionoecetes bairdi*). Information is provided periodically by ADF&G, and the estimate was rolled forward from 2022 to 2025.

<u>IPHC Regulatory Area 3 (Eastern, Central and Western Gulf of Alaska)</u>

IPHC Regulatory Area 3 is comprised of Areas 3A and 3B. For the purposes of stock assessment and management, IPHC tracks non-directed commercial discard mortality in both IPHC Regulatory Areas. Federal groundfish fisheries operate throughout both areas and a subset of these vessels are monitored for discarded Pacific halibut. Trawl fisheries are responsible for most of the non-directed CDM in Regulatory Area 3, with hook-and-line fisheries a distant second. State-managed crab and scallop fisheries are also known to take Pacific halibut as non-directed CDM, but data from these state-managed fisheries are currently unavailable.

Estimates of non-directed CDM in IPHC Regulatory Area 3 reflect different levels of observer coverage by gear and type of fishing trip. 2024 coverage rates varied from 100% to 9% of the estimated discarded groundfish pounds by gear and fishery (Table 4-3 in AFS 2025). Trawl vessels in the Gulf of Alaska non-pelagic trawl fisheries have a high likelihood of encountering Pacific halibut and are responsible for the majority of the Pacific halibut bycatch. There are three general categories for these trawl vessels, which receive varying rates of catch monitoring. In 2024 in the Gulf of Alaska, 100% of the non-pelagic catcher/processor catch was monitored; 100% of the catch by non-pelagic catcher vessels in the Central Gulf Rockfish Program was monitored; and 18% of the remaining catch of non-pelagic catcher vessels was monitored. In total, 74% of the non-pelagic trawl catch in the Gulf of Alaska was monitored for bycatch in 2024.

There has long been concern that non-directed CDM estimates for non-pelagic trawl catcher vessels in IPHC Regulatory Area 3 have greater uncertainty and potential bias compared to those from other areas and sectors with higher coverage rates (e.g., catcher/processors). This concern had diminished in recent years as a large share of the non-pelagic trawl fleet catch in the Gulf of Alaska became observed. However, the unobserved portion of this fleet catch increased from 13% in 2023 to 26% in 2024. Catcher vessel portion partial coverage decreased from 42% in 2023 to 18% in 2024.

In July 2024, NMFS adopted rules to implement an electronic monitoring (EM) program for pelagic trawl pollock catcher vessels and tender vessels delivering to processors in the Gulf of Alaska (Amendment 114). EM essentially monitors the catch from trawl nets which may not be handled until delivery to a processor where observers monitor and record 100% of the catch. NOAA Fisheries indicated that the program evaluation improved Pacific halibut non-directed discards accounting, specifically in the Western Gulf of Alaska pollock fishery. NOAA Fisheries intends to expand the EM program to the Central Gulf of Alaska Rockfish Program in the near future.

IPHC Regulatory Area 4 (Bering Sea and Aleutian Islands)

In IPHC Regulatory Area 4CDE non-directed commercial discard mortality estimates have typically been the highest (Table 2) due to groundfish fisheries which target flatfish in the Bering Sea.

IPHC Fishery-Independent Setline Survey (FISS) and other IPHC research

In 2025, 139 tonnes (305,406 pounds) of Pacific halibut were landed from the FISS and other IPHC research, including the fecundity study. Totals landed from each IPHC Regulatory Area are provided in Table 2.

Non-IPHC research removals

In 2025, four IPHC research permits were issued to NOAA to allow the harvest of Pacific halibut while conducting their Gulf of Alaska and Bering Sea standardised bottom trawl surveys. A fifth research permit was issued to the Blue Latitudes LLC for a demographic study requiring Pacific halibut capture with no retention.

Removals outside the IPHC Convention Area

The latest Food and Agriculture Organization (FAO) statistics for Pacific halibut capture production outside the IPHC Convention Area (2023) indicate catches by Russia amounting to 1,861 tonnes, or 12% of the global total.

Recommendation

That the Commission:

1) **NOTE** paper IPHC-2025-IM101-07 Rev_1 that provides the Commission with a preliminary overview of the 2025 Pacific halibut removals, including the status of mortality reported against mortality and fishery limits adopted by the Commission and outlined in the IPHC Fishery Regulations (2025).

IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2025

PREPARED BY: IPHC SECRETARIAT (K. UALESI , T. JACK, R. RILLERA, K. COLL; 30 OCTOBER 2025)

PURPOSE

To provide a summary of the IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2025.

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 (Figure 1), within the prescribed depth range of 18 to 732 metres (10 to 400 fathoms).

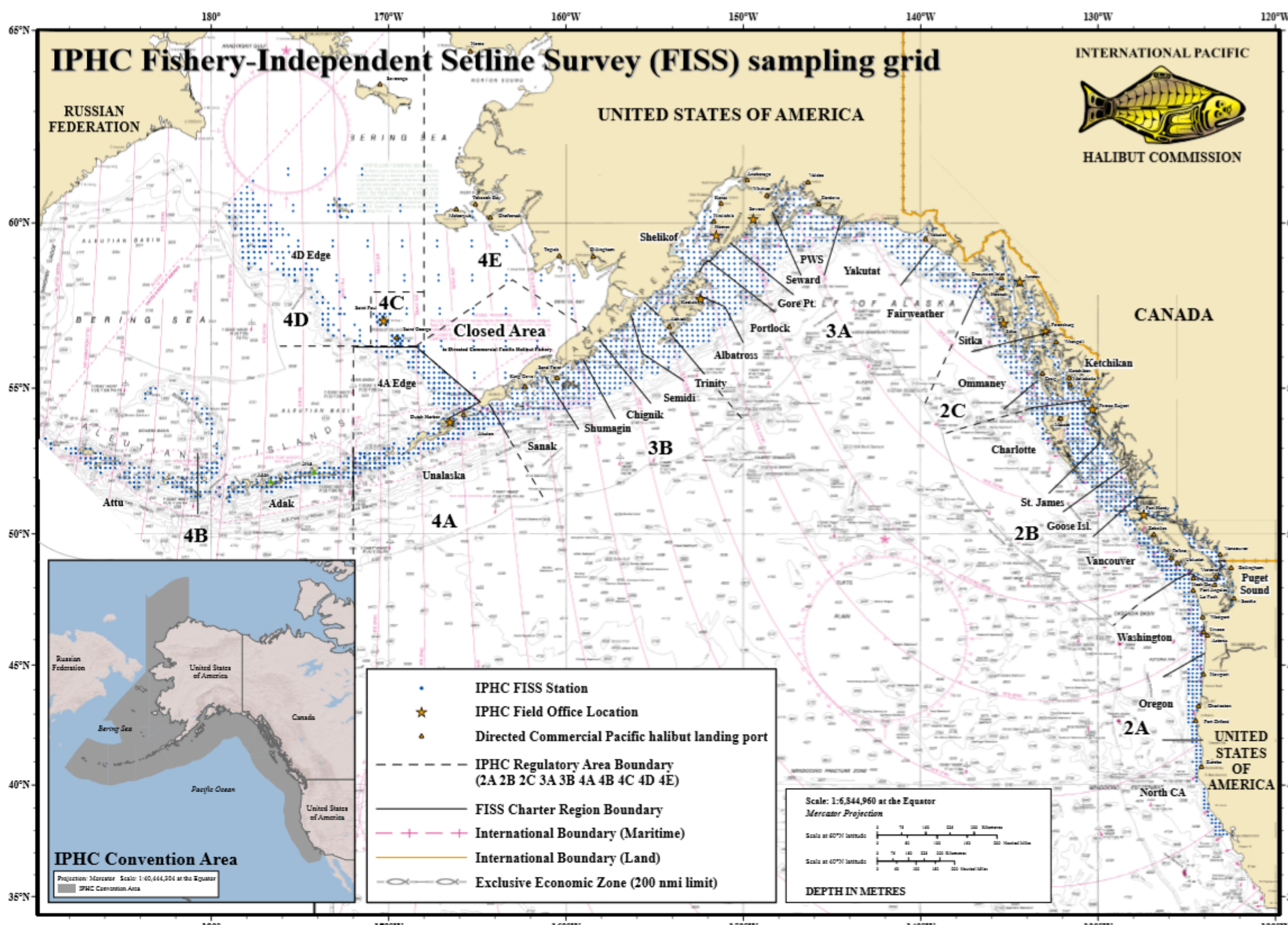


Figure 1. IPHC Fishery-Independent Setline Survey (FISS) with full sampling grid shown.

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. While no study was completed in 2022, we recognized the increased use of snap gear and integrated snap gear into the FISS tender specifications for 2023 and 2024 and 2025.

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.

2025 FISS design

On 13 December 2024, the 2025 FISS Tender Specifications were published to the IPHC website with a deadline of 3 February 2025 for tenders.

Following SS014, the final 2025 FISS design was approved via inter-sessional agreement (IPHC-2024-CR-030, IPHC-2024-CR-031).

The design (Figure 2) comprised sampling of subareas within IPHC Regulatory Areas 2A, 2B, 2C, 3A, 3B, 4A and 4B intended to balance the Commissions primary and secondary objectives for the FISS.

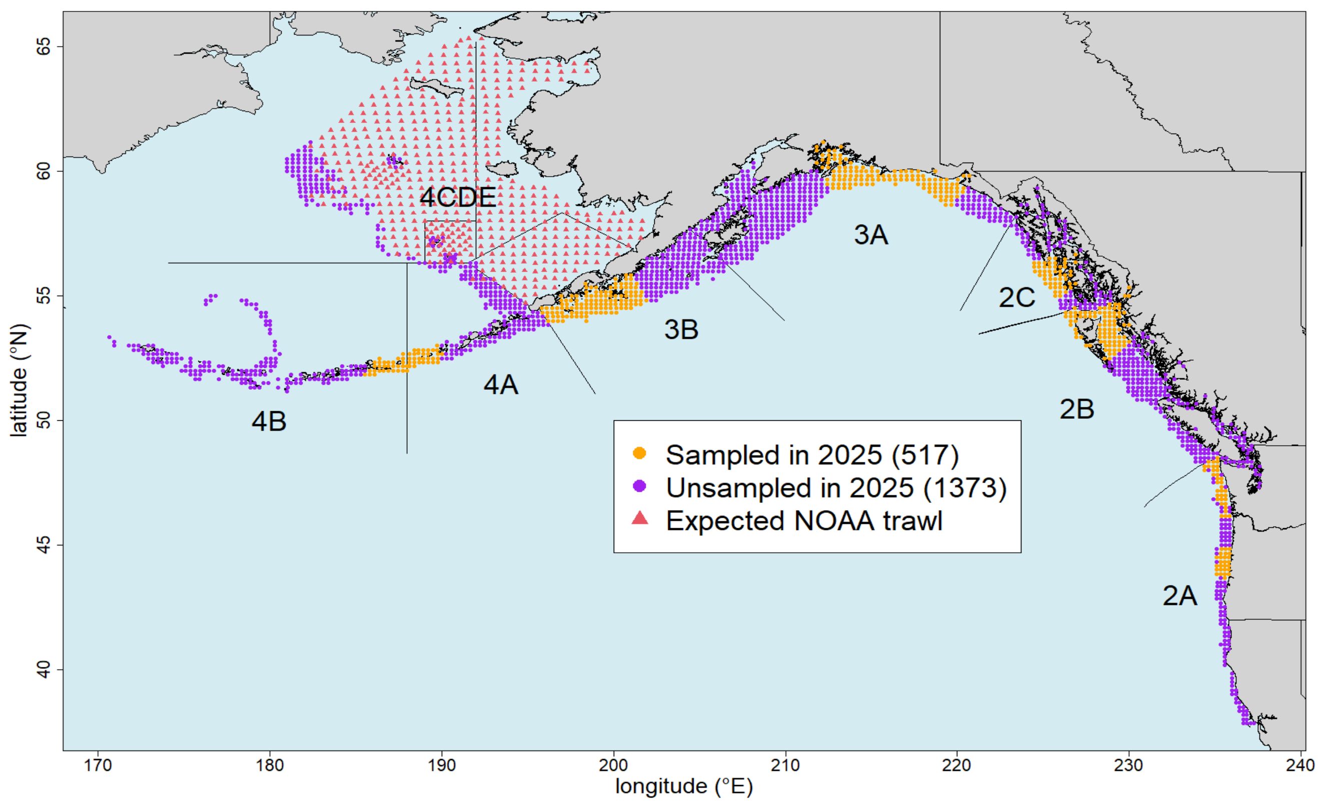


Figure 2. Map of the 2025 FISS design approved by the Commission on 8 November 2024. Purple circles were not sampled in 2025.

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 2025 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 8-15 vessels are chosen. In 2025, the process was clearly documented on the IPHC website for accountability and transparency purposes: Vessel Recruiting - IPHC.

In 2025, six (6) vessels were chartered to complete the FISS, as detailed in IPHC-2025-MR-007 Notification of IPHC Fishery-Independent Setline Survey (FISS) 2025 Contract Awards - IPHC. There was an additional vessel chartered to complete the 2025 Catch Protection Study in 4A Edge that provided FISS data as well.

Sampling protocols

IPHC Setline Survey Specialists (Field) collected data according to protocols established in the 2025 FISS Sampling Manual (IPHC-2025-VSM01).

Sampling challenges - 2025

There were six (6) stations completed during the 2025 Catch Protection Study in 4A Edge that met FISS tender specifications and were added to the total 2025 FISS, making a total of 523 FISS stations planned for the 2025 FISS season. Of the 523 FISS stations planned for the 2025 FISS season, 497 (95%) were effectively sampled.

Not sampled: A total of four (4) stations initially planned for sampling in 2025 were not completed. One station in the Yakutat charter region was not sampled due to the presence of ice. In the Charlotte charter region, one station was excluded because it was located within the Hecate Marine Protected Area. Additionally, two stations in the Unalaska charter region were originally scheduled for sampling but were ultimately removed during the planning phase, following negotiations with the vessel operator.

Ineffective stations: Coastwide, twenty-two (22) stations were deemed ineffective due to orca depredation (n=6), sperm whale depredation (n=10), pinniped depredation (n=1), unknown depredation (n=2), sand fleas (n=1), soak time (n=1), and setting and gear issues (n=1).

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 September 2024 (IPHC Media Release 2024-MR015), the Secretariat made pre-season bait purchases of approximately 72.6 tonnes (145,200 lbs) of chum salmon to ensure a smooth start to the 2025 FISS.

RESULTS

Interactive views of the FISS results are provided via the IPHC website here:

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

As in previous years, legal-sized (O32) Pacific halibut caught on the FISS were sacrificed in order to obtain biological data and were retained for sale. In addition, beginning in 2020, sub-legal (U32) Pacific halibut randomly selected for otolith sampling were also retained and sold. This helped to offset costs of the FISS. FISS vessels also retained for sale incidentally captured rockfish (*Sebastes spp*.) and Pacific cod (*Gadus macrocephalus*) as these species 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 2025 FISS chartered seven (7) commercial longline vessels (three Canadian and four USA), during a combined 33 trips and 271 charter days (Tables 1). Otoliths were removed from 5,670 fish coastwide. Approximately 119 tonnes (261,912 pounds) of Pacific halibut, 28 tonnes (60,662 pounds) of Pacific cod, and 24 tonnes (52,669 pounds) of rockfish were landed from the FISS stations.

Table 1a. Effort and landing summary by FISS charter region and vessel for all 2025 stations and all Pacific halibut (sampled U32 and all O32).

IPHC Regulatory Area	Charter Region	Vessel	Vessel Number1	Charter Days2	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	14	26	26	1	3,276	$16.05	$7.28
2A	Washington	*Pacific Surveyor*	947061	26	42	42	4	7,746	$16.20	$7.35
2B	Charlotte	*Vanisle*	21912	49	89	86	20	44,460	$21.29	$9.66
2C	Ommaney	*Pender Isle*	27282	27	52	49	31	68,407	$22.03	$9.99
3A	Prince William Sound	*Kema Sue*	41033	30	67	66	13	29,128	$17.27	$7.83
3A	Yakutat	*Kema Sue*	41033	31	64	57	17	37,431	$16.47	$7.47
3B	Sanak	*Star Wars II*	99997	35	71	68	13	28,262	$14.45	$6.56
3B	Shumagin	*Star Wars II*	99997	28	54	53	9	20,898	$12.71	$5.77
4A	Unalaska	*Kema Sue*	41033	16	30	26	6	13,265	$13.95	$6.33
4A	4A Edge	*Oracle*	77897	4	6	4	1	1,398	$11.36	$5.15
4B	Adak	*Polaris*	19266	15	30	28	4	9,040	$13.67	$6.20
Total		**7 Vessels**		**271**	**531**	**505**	**119**	**263,310**	**$18.04**	**$8.18**

[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 2025 stations and O32 Pacific halibut.

IPHC Regulatory Area	Charter Region	Vessel	Vessel Number1	Charter Days2	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	14	26	26	1	2,687	$17.64	$8.00
2A	Washington	*Pacific Surveyor*	947061	26	42	42	4	4,823	$18.38	$8.34
2B	Charlotte	*Vanisle*	21912	49	89	86	20	42,155	$21.50	$9.75
2C	Ommaney	*Pender Isle*	27282	27	52	49	31	66,787	$22.16	$10.05
3A	Prince William Sound	*Kema Sue*	41033	30	67	66	13	28,099	$17.30	$7.84
3A	Yakutat	*Kema Sue*	41033	31	64	57	17	36,796	$16.48	$7.48
3B	Sanak	*Star Wars II*	99997	35	71	68	13	26,258	$14.63	$6.64
3B	Shumagin	*Star Wars II*	99997	28	54	53	9	19,423	$12.75	$5.78
4A	Unalaska	*Kema Sue*	41033	16	30	26	6	8,043	$14.58	$6.61
4A	4A Edge	*Oracle*	77897	4	6	4	1	777	$11.83	$5.36
4B	Adak	*Polaris*	19266	15	30	28	4	6,111	$14.01	$6.36
Total		**7 Vessels**		**271**	**531**	**505**	**110**	**241,959**	**$18.43**	**$8.36**

[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 2025 stations and sampled U32 Pacific halibut.

IPHC Regulatory Area	Charter Region	Vessel	Vessel Number1	Charter Days2	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	14	26	26	1	589	$8.82	$4.00
2A	Washington	*Pacific Surveyor*	947061	26	42	42	4	2,923	$12.60	$5.71
2B	Charlotte	*Vanisle*	21912	49	89	86	20	2,305	$17.36	$7.87
2C	Ommaney	*Pender Isle*	27282	27	52	49	31	1,620	$16.86	$7.65
3A	Prince William Sound	*Kema Sue*	41033	30	64	63	13	1,029	$17.27	$7.83
3A	Yakutat	*Kema Sue*	41033	31	67	60	17	634	$15.47	$7.02
3B	Sanak	*Star Wars II*	99997	35	71	68	13	2,004	$12.16	$5.52
3B	Shumagin	*Star Wars II*	99997	28	54	53	9	1,475	$12.26	$5.56
4A	Unalaska	*Kema Sue*	41033	16	30	26	6	5,222	$12.96	$5.88
4A	4A Edge	*Oracle*	77897	4	6	4	1	621	$10.77	$4.89
4B	Adak	*Polaris*	19266	15	30	28	4	2,929	$12.96	$5.88
Total		**7 Vessels**		**271**	**531**	**505**	**10**	**21,351**	**$13.63**	**$6.18**

[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 eleven (11) 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. In the case of multi-port bidding, vessel transit logistics and operational requirements were also considered. Individual sales were evaluated after each event to ensure that the buyer was meeting IPHC standards. Average prices increased from $13.71/kg in 2024 to $18.04/kg in 2025 (Tables 3). This represents a 24% increase in price.

Table 2a. FISS Pacific halibut landings by port for all Pacific halibut (sampled U32 and all O32), 2025[1,2].

Offload Port	Trips	Tonnes	Pounds	Total USD	Average Price (USD/kg)	Average Price (USD/lb)
Cordova	1	5	10,052	$64,554.11	$14.16	$6.42
Dutch Harbor	3	11	23,703	$147,175.43	$13.69	$6.21
False Pass	1	5	9,981	$61,444.80	$13.57	$6.16
Kodiak	1	4	8,718	$68,278.37	$17.27	$7.83
Newport	3	2	3,919	$28,248.00	$15.89	$7.21
Port Angeles	1	1	2,462	$11,633.72	$10.42	$4.73
Prince Rupert	9	51	112,867	$1,113,004.49	$21.74	$9.86
Sand Point	5	14	17,164	$141,691.20	$18.20	$8.26
Seward	2	8	6,888	$56,598.90	$18.12	$8.22
Westport	2	2	4,641	$40,881.64	$19.42	$8.81
Whittier	1	3	6,224	$49,792.00	$17.64	$8.00
Yakutat	4	15	33,118	$251,698.35	$16.76	$7.60
Grand Total	**33**	**119**	**263,310**	**$2,154,484.59**	**$18.04**	**$8.18**

[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, 2025[1,2].

Offload Port	Trips	Tonnes	Pounds	Total USD	Average Price (USD/kg)	Average Price (USD/lb)
Cordova	1	4	9,729	$62,545.45	$14.17	$6.43
Dutch Harbor	3	7	14,931	$96,212.77	$14.21	$6.44
False Pass	1	4	9,331	$57,700.80	$13.63	$6.18
Kodiak	1	4	8,029	$63,317.57	$17.39	$7.89
Newport	3	1	3,143	$25,144.00	$17.64	$8.00
Port Angeles	1	1	1,355	$7,305.35	$11.89	$5.39
Prince Rupert	9	49	108,942	$1,082,471.27	$21.91	$9.94
Sand Point	5	13	28,321	$165,526.56	$12.89	$5.84
Seward	2	8	16,717	$138,294.00	$18.24	$8.27
Westport	2	1	3,012	$29,256.61	$21.41	$9.71
Whittier	1	3	5,828	$46,624.00	$17.64	$8.00
Yakutat	4	15	32,621	$248,101.35	$16.77	$7.61
Grand Total	**33**	**110**	**241,959**	**$2,022,499.73**	**$18.43**	**$8.36**

[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, 2025[1,2].

Offload Port	Trips	Tonnes	Pounds	Total USD	Average Price (USD/kg)	Average Price (USD/lb)
Cordova	1	4	8,772	$50,962.66	$12.81	$5.81
Dutch Harbor	3	0	323	$2,008.66	$13.71	$6.22
False Pass	1	0	650	$3,744.00	$12.70	$5.76
Kodiak	1	0	689	$4,960.80	$15.87	$7.20
Newport	3	0	776	$3,104.00	$8.82	$4.00
Port Angeles	1	1	1,107	$4,328.37	$8.62	$3.91
Prince Rupert	9	2	3,925	$30,533.22	$17.15	$7.78
Sand Point	5	1	2,140	$10,555.92	$10.87	$4.93
Seward	2	0	447	$3,397.20	$16.76	$7.60
Westport	2	1	1,629	$11,625.03	$15.73	$7.14

Whittier	1	0	396	$3,168.00	$17.64	$8.00
Yakutat	4	0	497	$3,597.00	$15.96	$7.24
Grand Total	**33**	**10**	**21,351**	**$131,984.86**	**$13.63**	**$6.18**

[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 2025[1].

IPHC Regulatory Area	2A	2B	2C	3A	3B	4A	4B	Total Weight and Average Price
Tonnes	5	20	31	30	22	7	4	119
Pounds	11,022	44,460	68,407	66,558	49,160	14,663	9,040	263,310
Price USD/kg	$16.15	$21.29	$22.03	$16.82	$13.71	$13.70	$13.67	$18.04
Price USD/lb	$7.33	$9.66	$9.99	$7.63	$6.22	$6.21	$6.20	$8.18

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

Table 3b. FISS landings (total pounds and price) of O32 Pacific halibut by IPHC Regulatory Area in 2025[1].

IPHC Regulatory Area	2A	2B	2C	3A	3B	4A	4B	Total Weight and Average Price
Tonnes	3	19	30	29	21	4	3	110
Pounds	7510	42,155	66,787	64,895	45,681	8,820	6,111	241,959
Price USD/kg	$18.04	$21.50	$22.16	$16.84	$13.79	$14.34	$13.89	$18.43
Price USD/lb	$8.18	$9.75	$10.05	$7.64	$6.26	$6.50	$6.30	$8.36

[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 2025[1].

IPHC Regulatory Area	2A	2B	2C	3A	3B	4A	4B	Total Weight and Average Price
Tonnes	2	1	1	1	2	3	1	10
Pounds	3512	2,305	1,620	1,663	3,479	5,543	2,929	21,351
Price USD/kg	$12.12	$17.36	$16.86	$16.15	$12.71	$12.73	$13.23	$13.63
Price USD/lb	$5.50	$7.87	$7.65	$7.32	$5.77	$5.77	$6.00	$6.18

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

FISS timing

The months of June, July, and August are targeted for FISS fishing every year. In 2025, this activity took place from 24 May through 5 September. On a coastwide basis, FISS vessel activity was highest in intensity at the beginning of the FISS season and declined in early August as most boats finished their charter regions (Figure 3). All FISS activity was completed by early September.

		Week 21	Week 22	Week 23	Week 24	Week 25	Week 26	Week 27	Week 28	Week 29	Week 30	Week 31	Week 32	Week 33	Week 34	Week 35	Week 36	Week 37	Week 38	Week 39	Week 40
2A	2025			12%	16%	16%	18%		22%	16%											
	2023			42%	58%																
	2022			10%	18%	19%	19%	19%	16%												
	2021			19%	15%	13%	8%	23%	10%	14%											
	2019		8%	15%	14%	9%	14%	12%	13%	14%											
2B	2025			17%	13%	9%	20%	13%	9%	17%		2%									
	2024		13%	6%	4%			13%	10%	11%	16%	19%	8%								
	2023	1%	17%	12%	13%	15%	13%	9%	9%	4%	4%	3%									
	2022		2%	10%	9%	9%	8%	7%	10%	14%	16%	13%	2%								
	2021			16%	12%	9%	11%	6%	9%	6%	5%	6%	5%	5%	2%	8%					
	2020						2%	14%	16%	11%	6%	6%	10%	7%	1%	9%	13%	6%			
	2019		8%	8%	8%	2%	4%	8%	18%	11%	8%	11%	9%	5%							
2C	2025			35%	21%	17%	27%														
	2024		6%	10%	12%	22%	15%	11%	20%	3%											
	2023						9%	18%	14%	20%	3%		12%	8%	9%	7%					
	2022			12%	10%	8%	9%	7%	16%	10%	5%	12%	5%	7%							
	2021		1%	19%	8%	9%	9%	7%	7%	10%	12%	10%	7%								
	2020							14%	11%	7%	9%	6%	7%	18%	14%	8%	5%				
	2019		1%	11%	13%	5%	11%	8%		5%	9%	10%	12%	12%	4%						
3A	2025			5%	14%	12%	12%	12%	11%	9%	11%	16%									
	2024				6%	11%	13%	13%	3%	6%	13%	19%	8%	8%							
	2023			8%	7%	15%	13%	19%	7%	9%	8%	6%	8%								
	2022			11%	17%	16%	10%	5%	3%					5%	3%	8%	11%	5%	6%		
	2021			6%	12%	10%	6%	8%	7%	9%	10%	12%	7%	7%	2%	2%	1%				
	2020						0%	13%	11%	12%	16%	12%	11%	7%	5%	4%	5%	3%			
	2019		7%	18%	17%	13%	10%	7%	4%	3%	3%	1%	2%		0%	1%	7%	7%	1%		
3B	2025					6%	12%	9%	12%	14%	14%	11%	9%	12%							
	2024		5%	32%	14%	5%			32%	5%			5%								
	2023		6%	13%	7%		7%	2%	9%	14%	11%	11%	10%	7%	2%						
	2022					3%	37%	38%	22%												
	2021			5%	8%	6%	9%	4%	8%	20%	18%	13%	9%								
	2020							14%	21%	19%	16%	3%	12%	12%	3%						
	2019		5%	5%	10%	9%	3%	4%	7%		6%	4%	6%	12%	12%	9%	6%	2%			
4A	2025															61%	39%				
	2022									21%	28%	10%	19%	7%	16%						
	2021				4%	21%	27%	13%	13%							15%	8%				
	2019						6%	19%	12%	14%	12%	14%	10%		14%						
4B	2025										37%	63%									
	2022				32%	30%	28%	10%													
	2021					19%	11%							38%	16%	8%	8%				
	2019				16%	13%	12%	7%	12%	3%	17%	19%									
4CDE	2024					17%	23%	23%	35%	2%											
	2022								23%	22%	9%	7%	27%	12%							
	2021						9%	26%		28%	37%										
	2019												5%	31%	10%	15%	12%		14%	10%	4%

Figure 3. Percent of the total FISS stations completed by IPHC Regulatory Area during each week of the year (2019-2025). Week 21 begins in late May or early June, depending on the year.

RECOMMENDATION/S

That the RAB:

1) **NOTE** paper IPHC-2025-IM101-08 that provides a summary of the IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2025.

APPENDICES

Nil.

Space-time modelling of survey data

PREPARED BY: IPHC SECRETARIAT (R. A. WEBSTER; 10 NOVEMBER 2025)

PURPOSE

To provide results of the space time modelling of Pacific halibut survey data for the period 1993-2025.

INTRODUCTION

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. 2025), but in the Bering Sea also integrates data from the National Oceanic and Atmospheric Administration (NOAA) - Fisheries annual trawl survey and the Alaska Department of Fish and Game's (ADFG) 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 weight data used to compute WPUE comes almost entirely 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.

Data inputs to the space-time modelling were updated with 2025 data from the IPHC's FISS along with data from NOAA Bering Sea trawl survey data, which included sampling in the northern Bering Sea. The ADFG Norton Sound trawl survey was not undertaken in 2025. The FISS was implemented with reduced spatial coverage relative to years prior to 2023 (Figure 1), but with sampling in IPHC Regulatory Areas 4A and 4B for the first time since 2022. Fifteen stations in IPHC Regulatory Area 4B and six in IPHC Regulatory 4A were replaced with alternative stations largely due to challenging weather and tidal conditions. The sampling in IPHC Regulatory Area 2A was the most extensive since 2022, covering habitat with greatest historical density of Pacific halibut. Sampling for a catch protection gear study in IPHC Regulatory Area 4A (Planas 2025) included six sets that followed FISS sampling protocols, allowing the data from four of these sets that were fished effectively to be included in the modelling.

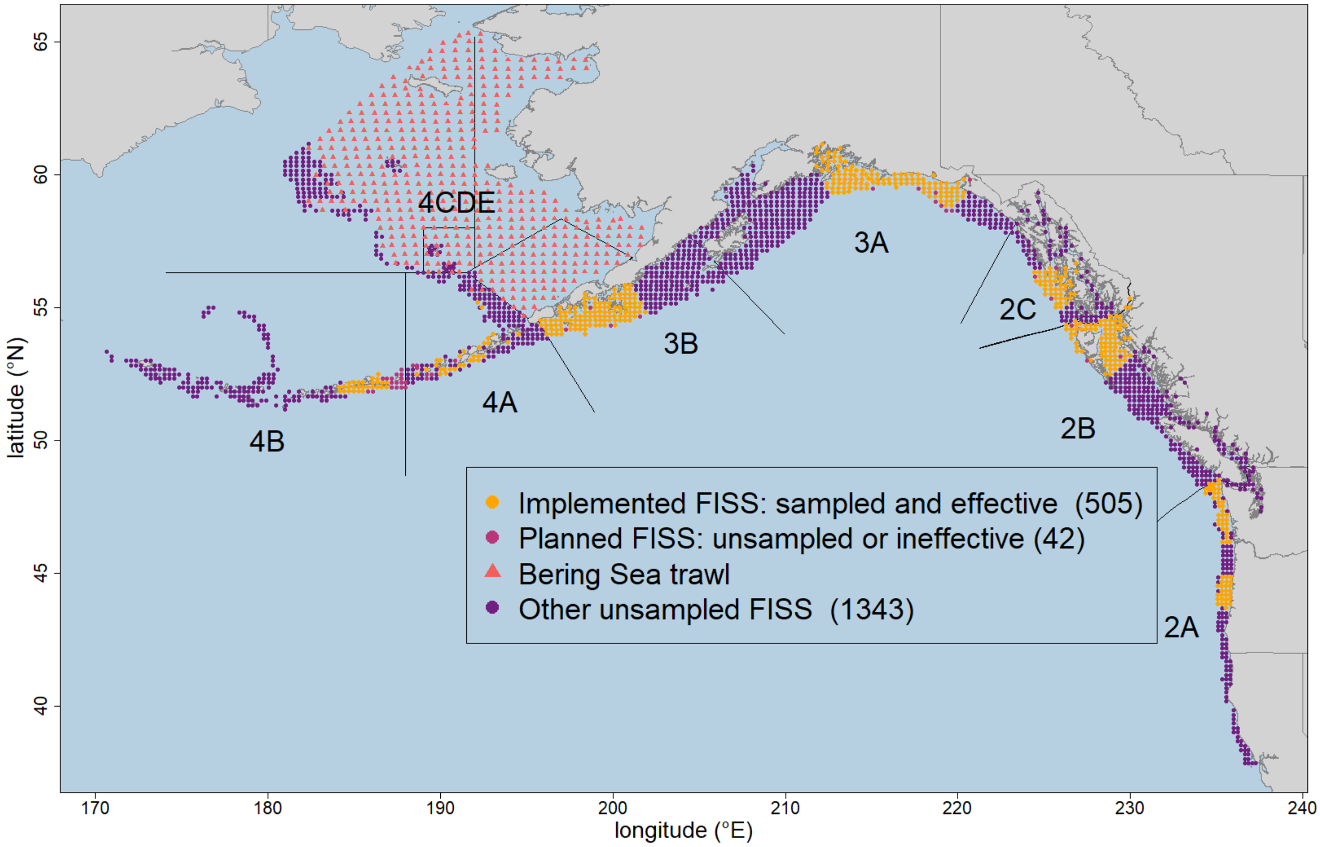


Figure 1. Map of 2025 sampled survey stations with data used in the space-time modelling (orange circles for FISS, red triangles for trawl), along with planned FISS stations that were either ineffective or not fished due to logistical reasons (lighter purple circles).

RESULTS OF SPACE-TIME MODELLING IN 2025

Figure 2 shows the time series estimates of O32 WPUE (most comparable to fishery catch-rates) over the 1993-2025 period included in the 2025 space-time modelling. Coastwide, we estimate a stable index, with 0% estimated change since 2024. The index increased in IPHC Biological Regions 3 and 4 but declined in Region 2. Coastwide indices of all sizes WPUE (Figure 3) and all sizes NPUE (Figure 4) were also estimated to be relatively stable, with changes of −2% since 2024. Declines in IPHC Biological Region 2 were largely offset by increases elsewhere. Results for IPHC Regulatory Areas are shown in Appendix A.

Tables of model output (time series, stock distribution estimates) are updated annually on the IPHC website at https://www.iphc.int/data/time-series-datasets.

FISS model output may also be explored interactively using the link on this page of the IPHC website: https://www.iphc.int/data/datatest/fishery-independent-setline-survey-fiss.

RECOMMENDATION

That the Commission **NOTE** paper IPHC-2025-IM101-09 Rev_1 which provides results of the space-time modelling of Pacific halibut survey data for 1993-2025.

REFERENCE

Planas, J. 2025. Report on current and future biological and ecosystem science research activities. IPHC-2025-IM101-14.

Ualesi, K., Jack, T., Rillera, R. and Coll, K. 2025. IPHC Fishery-independent setline survey (FISS) design and implementation in 2025. IPHC-2025-IM101-08.

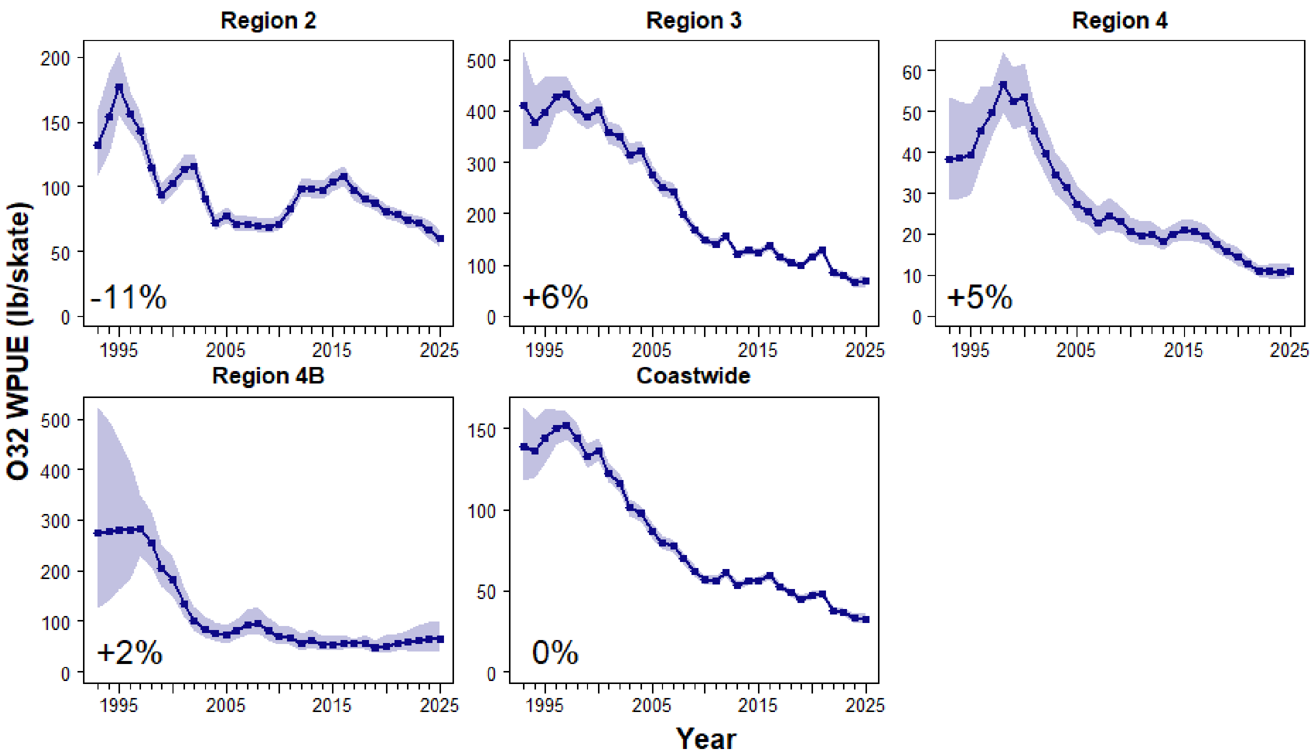


Figure 2. Space-time model output for O32 WPUE for 1993-2025 for Biological Regions. Filled circles denote the posterior means of O32 WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean O32 WPUE from 2024 to 2025.

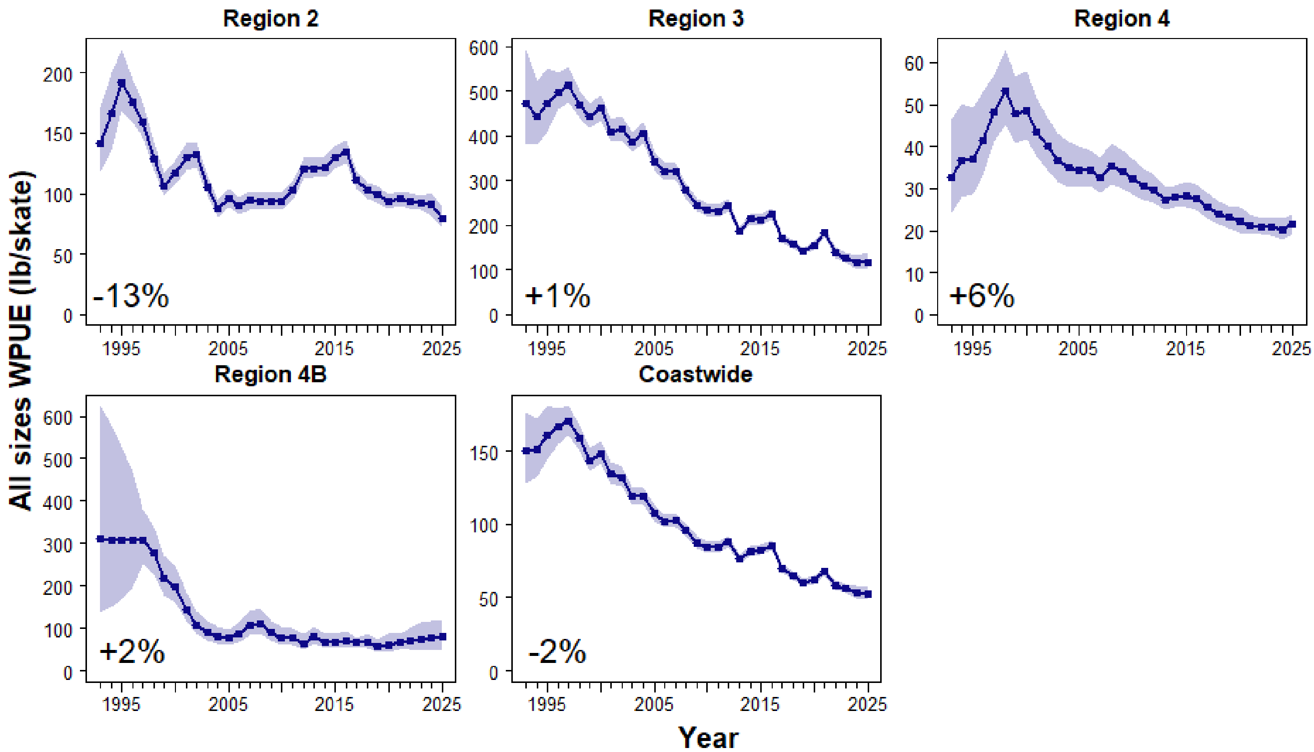


Figure 3. Space-time model output for all sizes WPUE for 1993-2025 for Biological Regions. Filled circles denote the posterior means of all sizes WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean all sizes WPUE from 2024 to 2025.

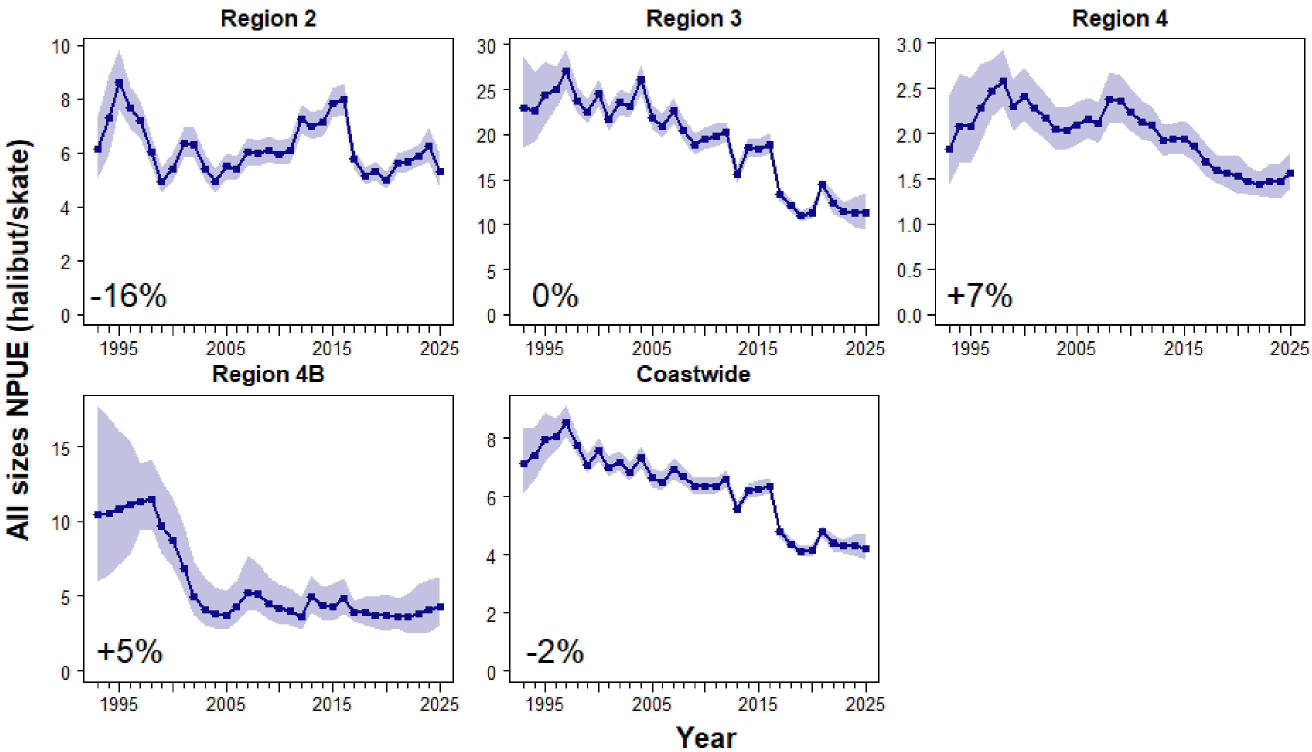


Figure 4. Space-time model output for all sizes NPUE for 1993-2025 for Biological Regions. Filled circles denote the posterior means of all sizes NPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean all sizes NPUE from 2024 to 2025.

APPENDIX A
Space-time modelling results by IPHC Regulatory Area

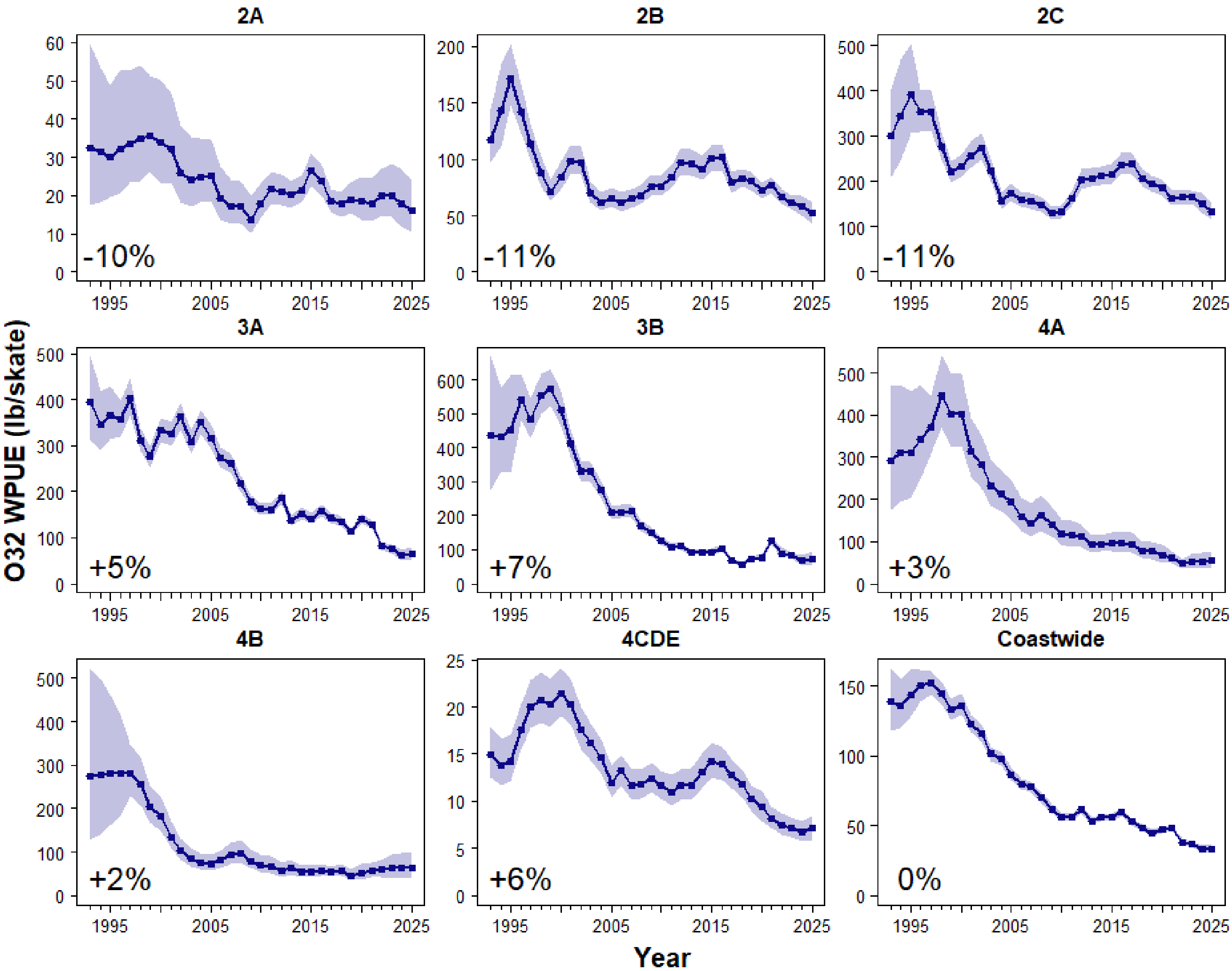


Figure A.1. Space-time model output for O32 WPUE for 1993-2025. Filled circles denote the posterior means of O32 WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean O32 WPUE from 2024 to 2025.

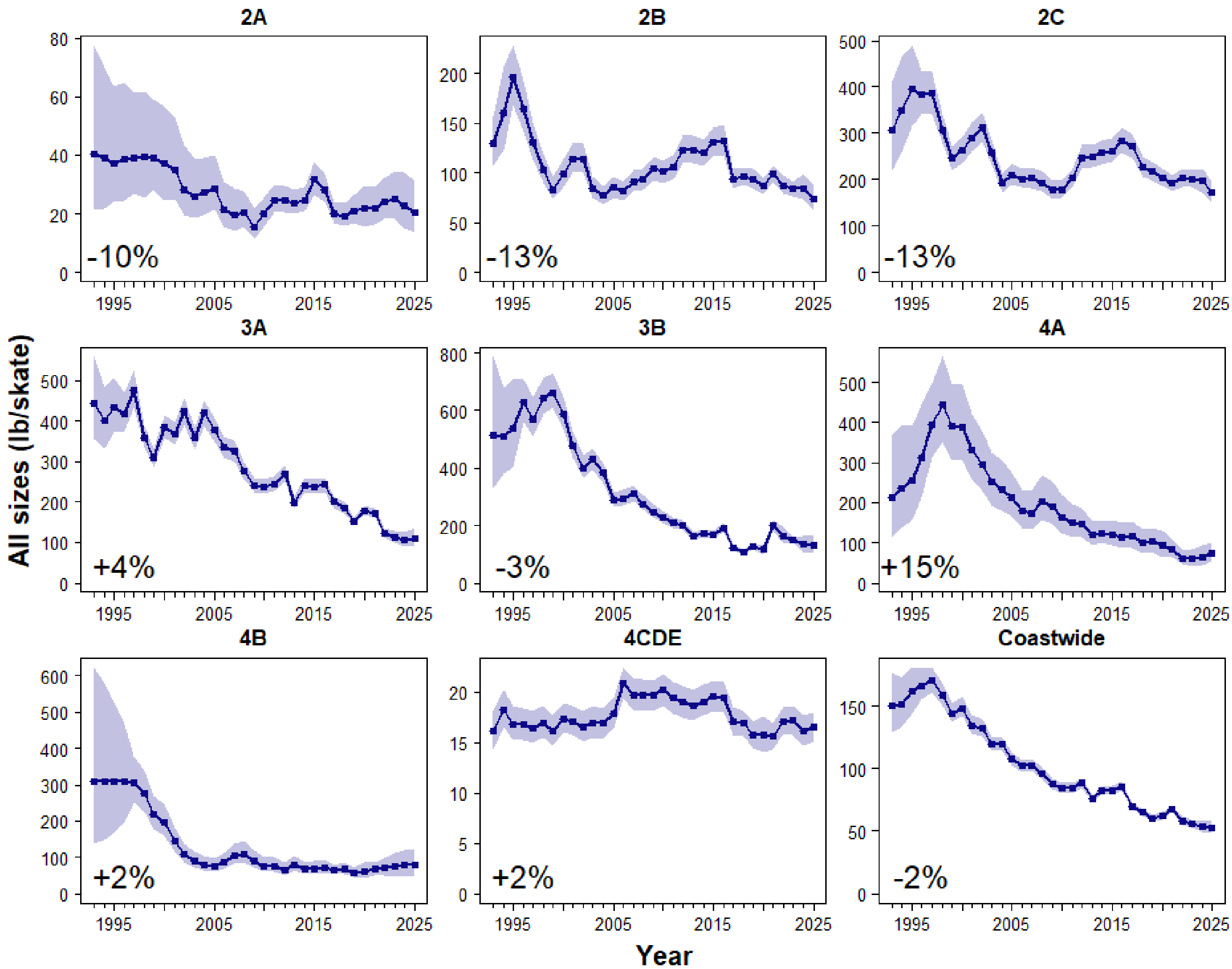


Figure A.2. Space-time model output for all sizes WPUE for 1993-2025. Filled circles denote the posterior means of all sizes WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean all sizes WPUE from 2024 to 2025.

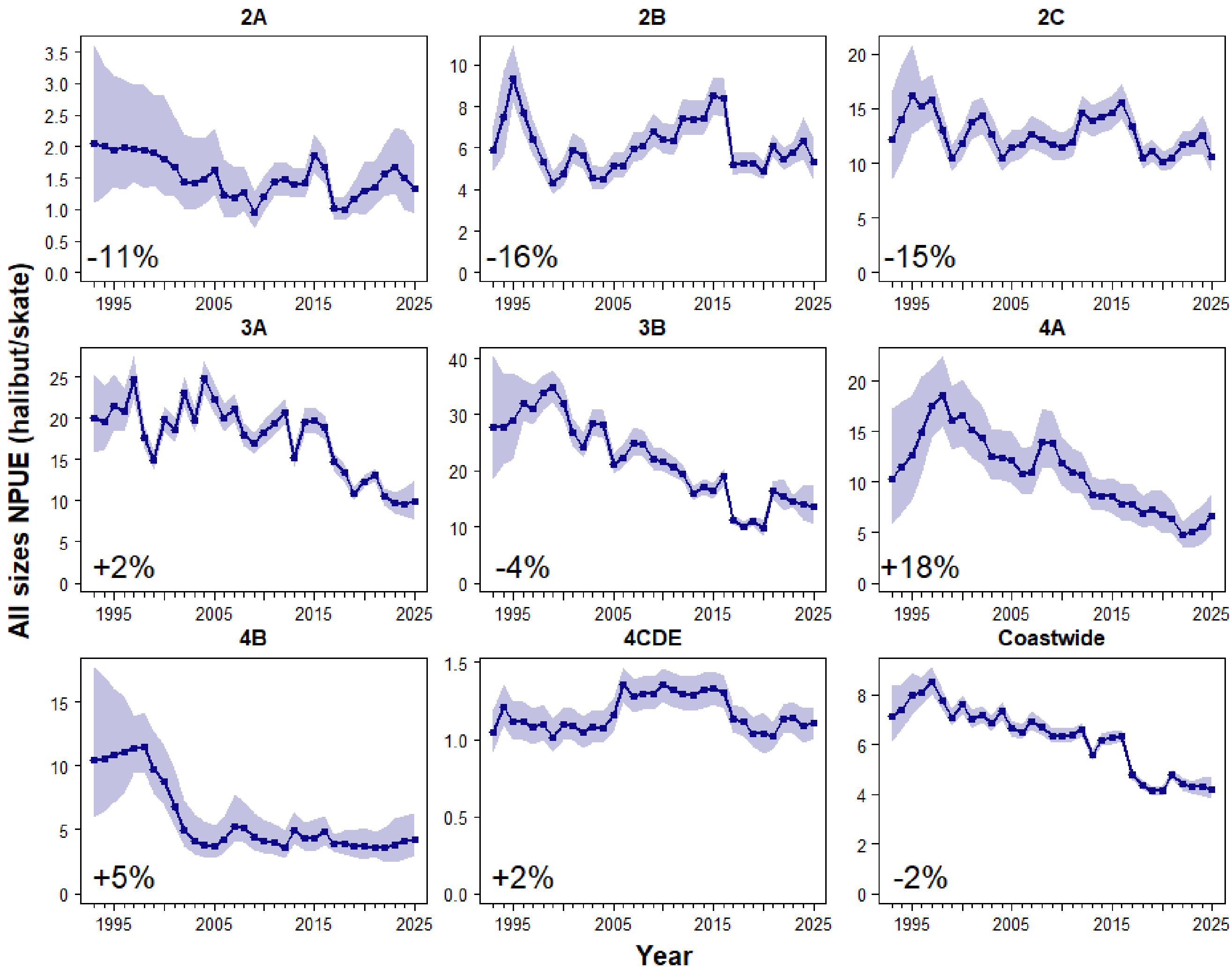


Figure A.3. Space-time model output for all sizes NPUE for 1993-2025. Filled circles denote the posterior means of all sizes NPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean all sizes NPUE from 2024 to 2025.

Data overview and stock assessment for Pacific halibut (*Hippoglossus stenolepis*) at the end of 2025

PREPARED BY: IPHC SECRETARIAT (I. STEWART, A. HICKS, R. WEBSTER, AND D. WILSON; 16 OCTOBER & 24 NOVEMBER 2025)

PURPOSE

To provide the Commission with a summary of the data, stock assessment at the end of 2025.

INTRODUCTION

In 2025 the International Pacific Halibut Commission (IPHC) undertook its annual coastwide stock assessment of Pacific halibut (*Hippoglossus stenolepis*). This stock assessment represents a full assessment, following updates conducted in 2023 and 2024. The most recent full stock assessment was completed in 2022 (IPHC-2023-SA01). The 2025 stock assessment revisited all data sources and structural choices; preliminary results (IPHC-2025-SRB026-07, IPHC-2025-SRB027-07) were provided for review at SRB026 (IPHC-2025-SRB026-R) and SRB027 (IPHC-2025-SRB027-R).

Starting with the final 2024 stock assessment data, models and results (Stewart and Hicks 2025b; Stewart and Webster 2025), the preliminary analysis provided a sequentially updated 'bridge' of the changes made through June 2025, including:

1) Extending the time series to include projected mortality based on limits adopted for 2025 (IPHC 2025c),
2) updating to the newest stock synthesis software version (3.30.23.1; Methot Jr 2024),
3) updating the time-series information for the Pacific Decadal Oscillation, used as a covariate to the stock-recruitment relationship,
4) retuning the constraint on the scale of male time-varying fishery selectivity (the sex-ratio of the commercial fishery) and extending this variability into the forecast,
5) improving the bootstrapping approach to pre-model calculations of maximum effective sample sizes to include ageing imprecision (Hulson and Williams 2024),
6) re-tuning the process and observation error components of these models to achieve internal consistency within each,
7) and updating the maturity ogive to reflect the recent histology-based estimates produced by the IPHC's Biological and Ecosystem Sciences Branch.

This document provides an overview of the data sources available for the 2025 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. All standard data sources have been updated with new information available from 2025 for this analysis, which includes updates to data collected in previous years. In addition, improvements were made to the treatment of commercial CPUE information for the period 1981-2025, including adding additional records not historically included, an updated hook-spacing relationship (Monnahan and Stewart 2018) and extensive error checking.

Overall, recent spawning biomass (SB) estimates are very similar to those estimated in last year's stock assessment. Year-classes estimated for 2012, 2016 and 2017 are both larger than those occurring from 2006-2011, but only average compared to those observed over the last 30 years. Stock distribution trends showed an increase in the proportion of the stock in Biological Region 3 and a decrease in Biological Region 2, although both values are within the range of those observed in recent years.

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 Puget Sound, but excludes known extremities in the western Bering Sea within the Russian Exclusive Economic Zone (Figure 1).

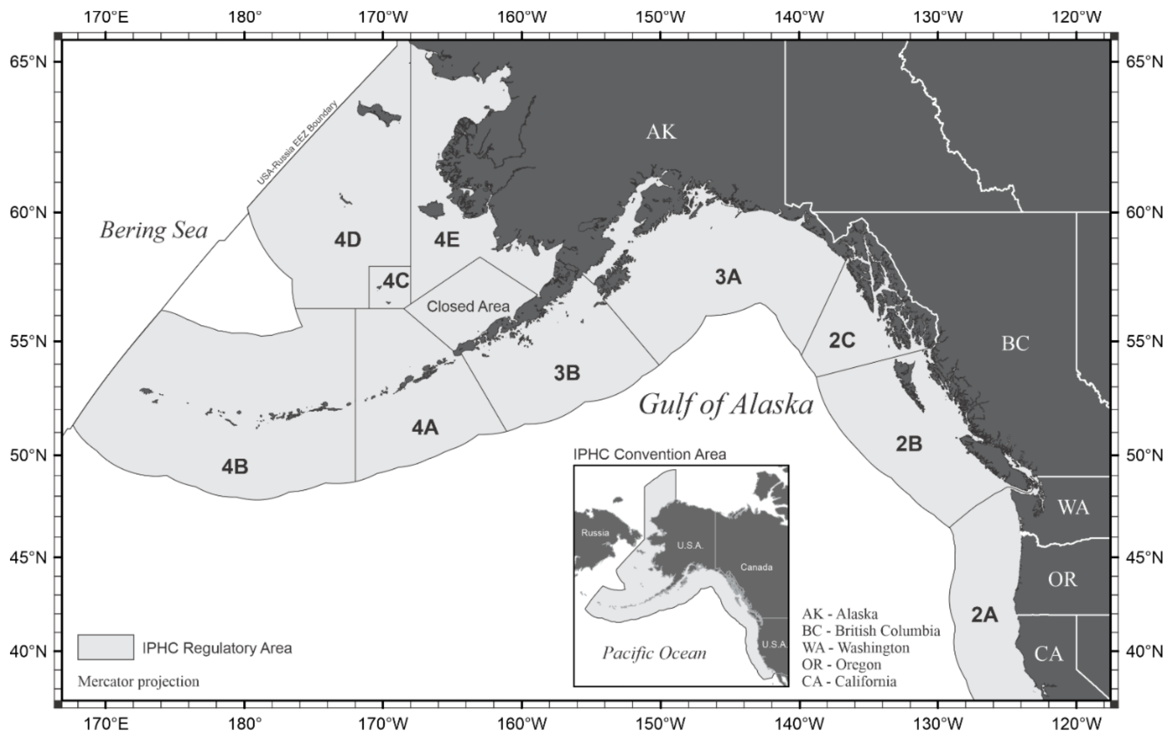


Figure 1. IPHC Convention Area (insert) and IPHC Regulatory Areas.

The Pacific halibut fishery has been managed by the IPHC since 1924. Catch limits for each of eight IPHC Regulatory Areas[1] are set each year by the Commission. The stock assessment provides a summary of recently collected data, and model estimates of stock size and trend. Short-term projections and the harvest decision table for 2026 are reported in a separate document (IPHC-2025-IM101-12 Rev_1).

[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.

DATA

Historical mortality

Known Pacific halibut mortality consists of directed 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 1888-2025, mortality from all sources has totaled 7.4 billion pounds (~3.4 million metric tons, t). Since 1926, the fishery has ranged annually from 29 to 100 million pounds (13,000-45,000 t) with an annual average of 62 million pounds (~28,000 t; Figure 2). Annual mortality was above this average from 1985 through 2010 and has averaged 34.6 million pounds (~15,700 t) from 2021-25, with 2025 representing the lowest mortality in the 100-year period.

2025 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 mostly spatially complete since the late-1990s. Primary sources of information for this assessment include mortality estimates from all sources (IPHC-2025-IM101-07 Rev_1), modelled indices of abundance (IPHC-2025-IM101-09 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).

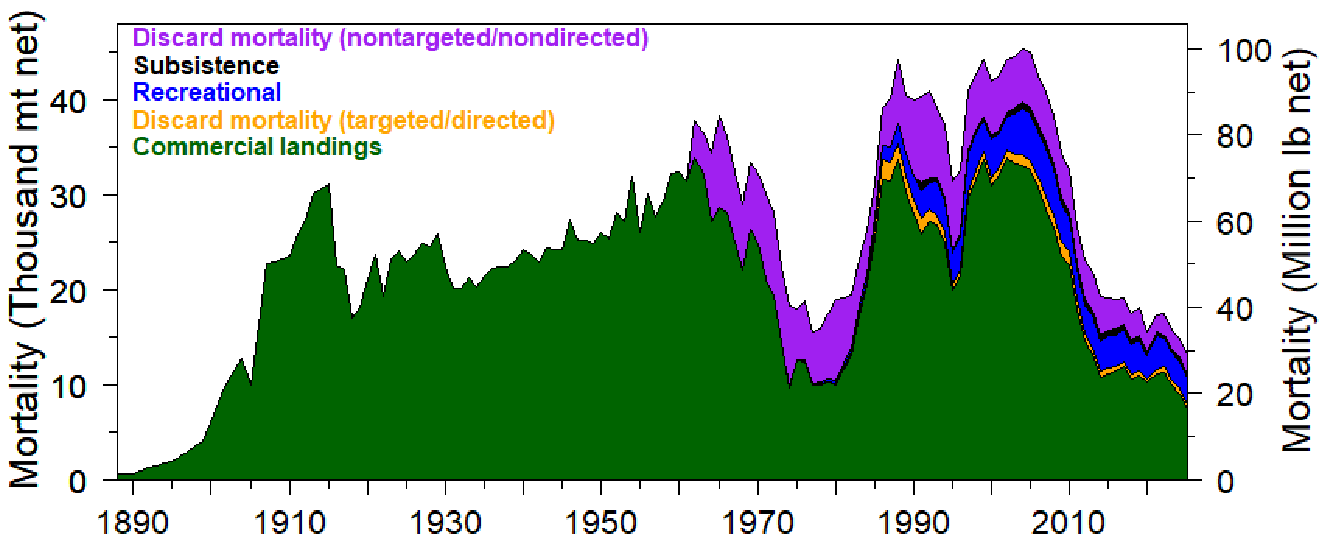


Figure 2. Summary of estimated historical mortality by source (colors), 1888-2025.

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 2025 an extensive update to commercial fishery logbook records was conducted. This effort included:

- adding a revised hook-spacing relationship (Monnahan and Stewart 2018),
- improving the approach to logbooks with incomplete information on the distribution of retained catch, numbers of fish and gear deployed on each set of a trip,
- correction of errors identified in some of the historical records, and

- inclusion of previously unavailable records (particularly in IPHC Regulatory Area 2B) through 2024.

Routine updates of age-frequency observations and individual weights from the commercial fishery were also included. Directed commercial fishery sex-ratios at age from the 2024 fishery were calculated from genetic analysis of fin clip samples and made available for this assessment. Mortality estimates (including changes to the existing time-series where new estimates have become available) from all sources were extended to include 2025. Available information was finalized on 1 November 2025 in order to provide adequate time for analysis and modeling. As has been the case in all years, some data remain incomplete (commercial fishery logbook and age information) or include projections for the remainder of the year (mortality estimates for ongoing fisheries or for fisheries where final estimates are still pending).

Coastwide commercial Pacific halibut fishery landings (including research landings) in 2025 were approximately 16.7 million pounds (~7,600 t), down 16% from 2024[2]. Discard mortality in non-directed fisheries was estimated to be 4.6 million pounds in 2025 (~2,100 t)[3], up 6% from 2024 representing the highest estimate since 2019. The total recreational mortality (including estimates of discard mortality) was estimated to be 5.7 million pounds (~2,600 t) down 10% from 2024. Mortality from all sources decreased by 12% to an estimated 28.8 million pounds (~13,100 t) in 2025 based on preliminary information available for this assessment.

The 2025 modelled FISS results detailed an estimated coastwide aggregate Numbers-Per-Unit-Effort (NPUE) which decreased by 2% from 2024 to 2025, to slightly below the levels observed over the last 3 years and at a level similar to those observed in 2018-2020 (Figure 3). Biological Region 3 was unchanged from 2024, Biological Region 2 decreased by 16%, and Biological Region 4 increased by 7%. Biological Region 4B is estimated to have increased by 5%; however, only a small number of stations near the eastern boundary of this Region were sampled in 2025 and credible intervals reflect considerable uncertainty in recent years.

The modelled FISS results for the coastwide Weight-Per-Unit-Effort (WPUE) of legal (O32) Pacific halibut, the most comparable metric to observed commercial fishery catch rates, was unchanged from 2024 to 2025, remaining at the lowest levels observed since the early 1990s. Individual IPHC Regulatory Areas varied from an estimated 7% increase (Regulatory Area 3B) to an 11% decrease (Regulatory Areas 2B and 2C) in O32 WPUE (Figure 4).

[2] The mortality estimates reported in this document and used in the assessment analysis are those available on 1 November 2025; 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 from the NOAA-Fisheries National Marine Fisheries Service Alaska Regional Office, Northwest Fisheries Science Center, and Fisheries and Oceans Canada in late October (this year some of these estimates were provided in September). Where necessary, projections are added to approximate the total mortality from ongoing fisheries through the end of the calendar year. Further updates are anticipated in January 2026.

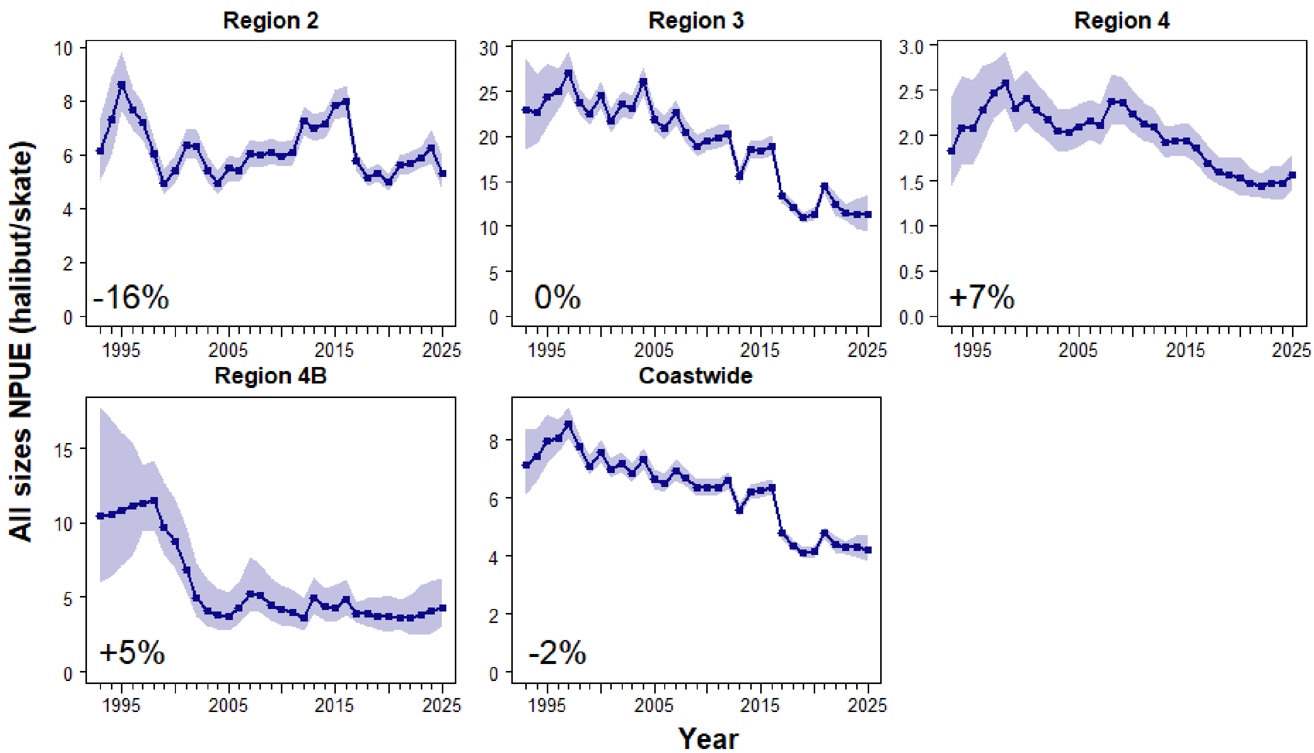


Figure 3. Trends in modelled FISS NPUE by Biological Region, 1993-2025. Percentages indicate the estimated change from 2024 to 2025. Shaded zones indicate 95% credible intervals.

Preliminary commercial fishery WPUE estimates from 2025 logbooks showed a 1% decrease from 2024 to 2025 at the coastwide level (Figure 5). Trends varied among IPHC Regulatory Areas, fisheries, and gears; however, all areas from 2A to 3B showed decreased CPUE in one or more index, with increases observed in Regions 4 and 4B. All time-series remain near the lowest commercial WPUE observed since the early 1990s. In previous years fishery WPUE has generally shown an additional decrease as additional logbooks were included (on average by around 7%); however, this was not the case in 2024.

Biological information (ages and lengths) from the commercial fishery landings showed that in 2025 the 2016 year-class (9 years old) was the largest coastwide contributor (in numbers) to the fish landed (15%). This is a shift to younger fish from the 2012 year-class (now 13 years old) that comprised the largest proportion of the 2024 landings. The 2005 year-class (now 20 years old) was the primary component in the commercial fishery until 2021 but comprised less than 3.3% of the commercial landings in 2025. The 2016 year-class has been the most numerous in the FISS catches for both 2024 and 2025. Individual size-at-age trends appear mixed through 2025 with previously observed increases for younger ages (<11) reversing in some cases but slight improvements in fish aged 12-16.

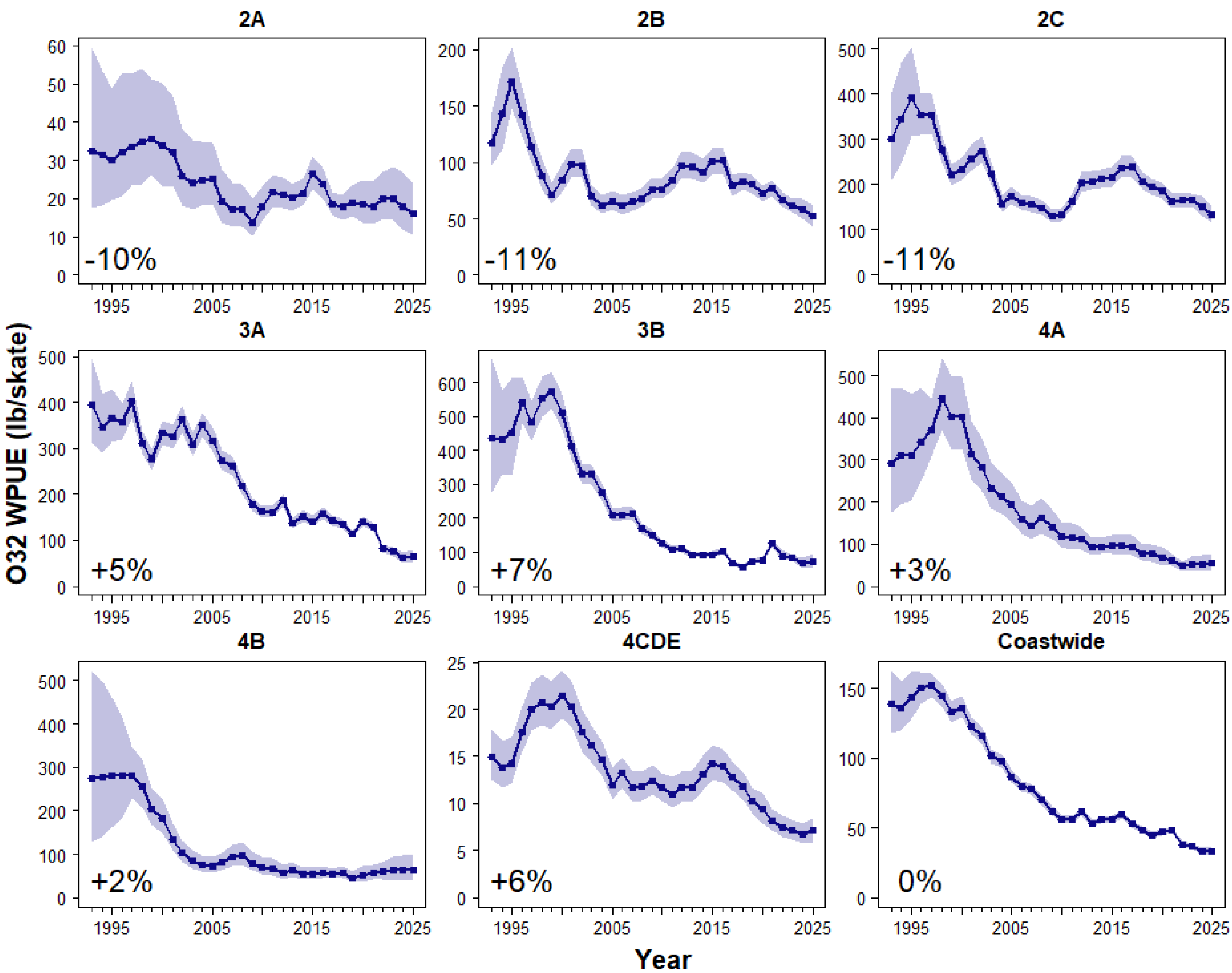


Figure 4. Trends in modelled FISS legal (O32) WPUE by IPHC Regulatory Area, 1993-2025. Percentages indicate the estimated change from 2024 to 2025. Shaded zones indicate 95% credible intervals.

Biological stock distribution

The population distribution (measured via the modelled FISS catch in weight of all Pacific halibut) showed a decrease in Biological Region 2 and increases in the other Regions in 2025 (Figure 6; recent years in Table 1). However, values for Regions 2 and 3 remain within the range observed over the last decade. Biological Region 4 increased to the highest proportion of the coastwide stock observed. For Biological Region 4B, the credible intervals for stock distribution are wide (5-10%) relative to its proportion of the stock. Survey data are insufficient to estimate stock distribution prior to 1993. It is therefore unknown how historical distributions may compare with recent observations.

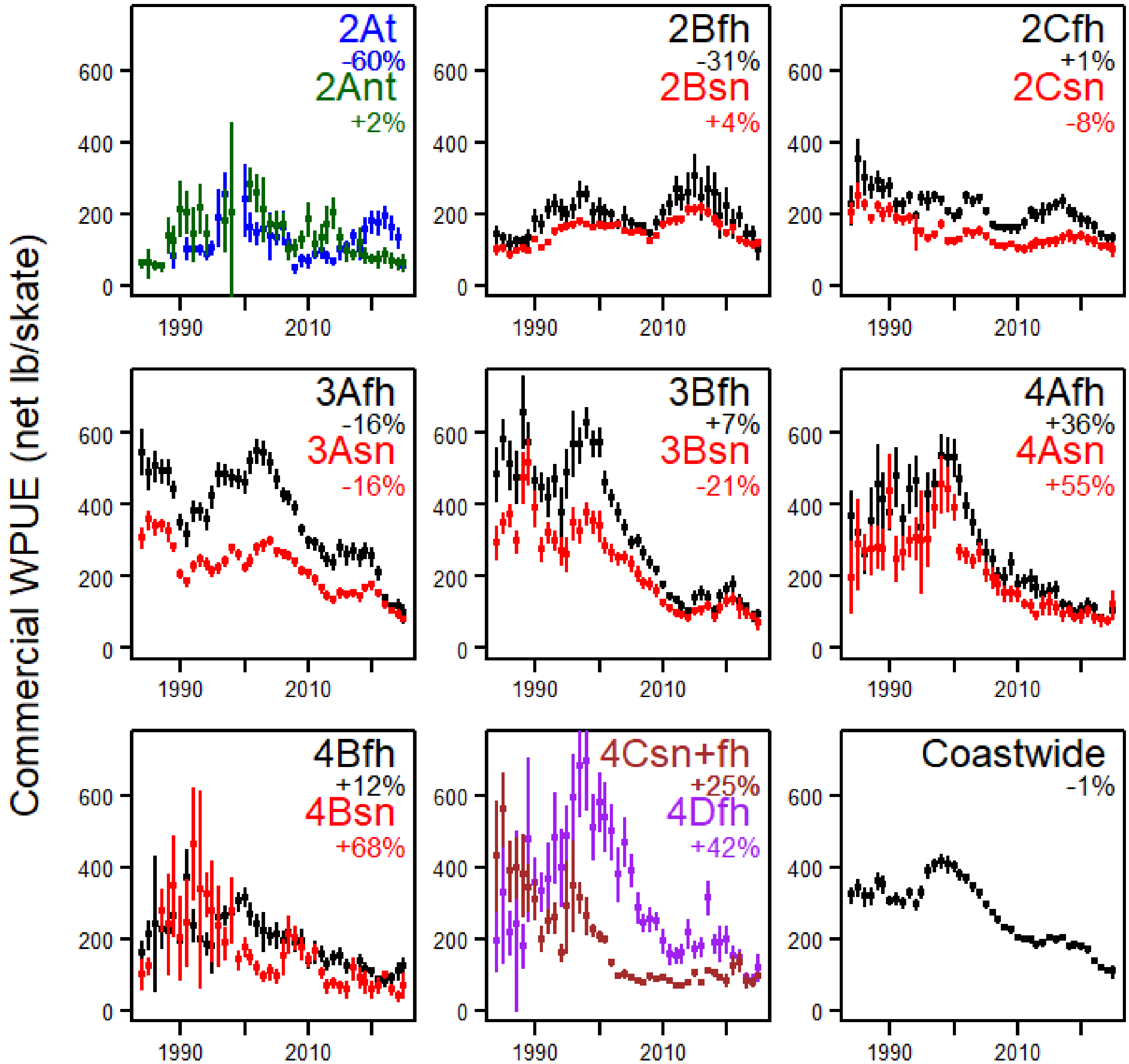


Figure 5. Trends in commercial fishery WPUE by IPHC Regulatory Area and fishery or gear, 1984-2025. The tribal fishery in 2A is denoted by “2At”, non-tribal by “2Ant”, fixed-hook catch rates by “fh” and snap-gear catch rates by “sn” for IPHC Regulatory Areas 2B-4D. Percentages indicate the change from 2024 to 2025 uncorrected for bias due to incomplete logbooks (see text above). Vertical lines indicate approximate 95% confidence intervals.

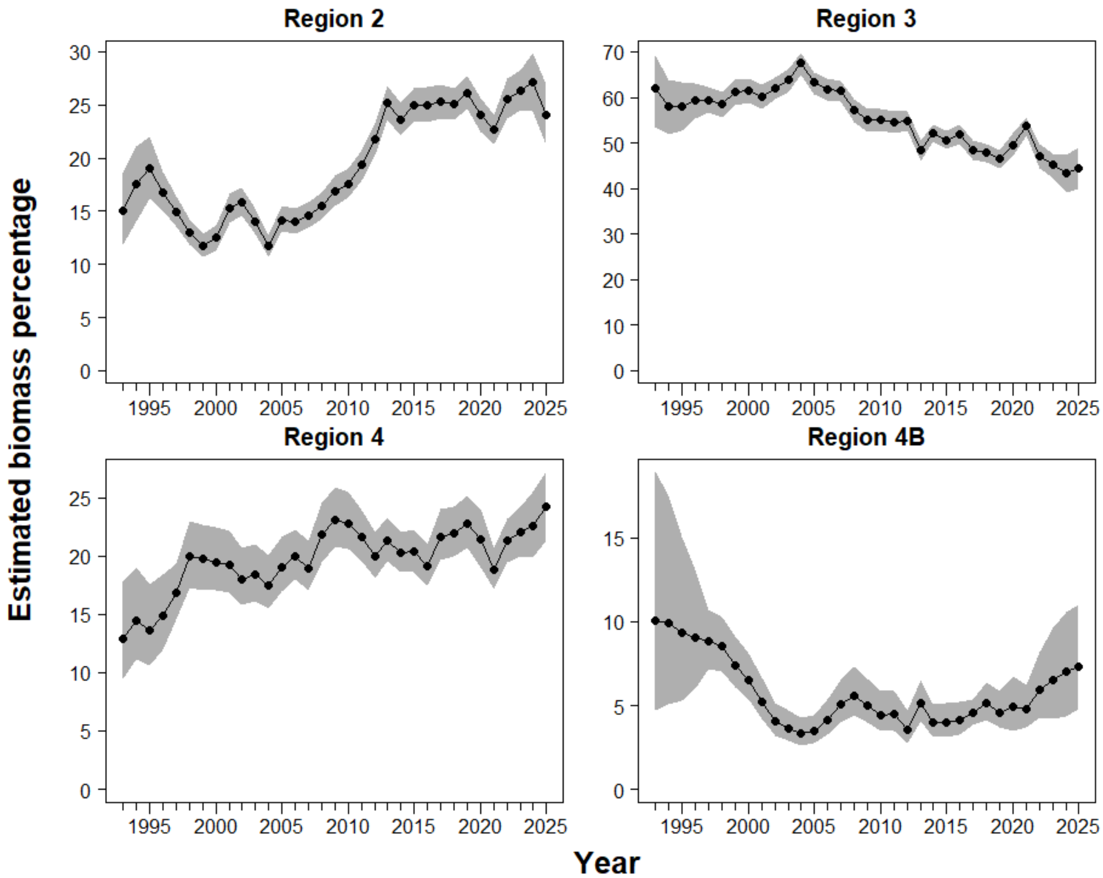


Figure 6. Estimated stock distribution (1993-2025) based on modelled survey catch weight per unit effort of all sizes of Pacific halibut. Shaded zones indicate 95% credible intervals.

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
2021	22.7%	53.7%	18.8%	4.8%
2022	25.6%	47.1%	21.3%	6.0%
2023	26.3%	45.1%	22.1%	6.5%
2024	27.1%	43.3%	22.5%	7.1%
2025	24.1%	44.4%	24.2%	7.3%

STOCK ASSESSMENT

This stock assessment continues to be implemented using the generalized Stock Synthesis software (Methot and Wetzel 2013). The analysis consists of an ensemble of four models: two long time-series models, reconstructing historical dynamics back to the beginning of the modern fisheries (1888), 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 three of the four models), environmental effects on recruitment (estimated in the two long time-series models), selectivity, and other model parameters.

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.

This stock assessment represents a full assessment, following updates conducted in 2023 and 2024. The most recent full stock assessment was completed in 2022 (IPHC-2023-SA01). The 2025 stock assessment revisited all data sources and structural choices; preliminary results (IPHC-2025-SRB026-07, IPHC-2025-SRB027-07) were provided for review at SRB026 (IPHC-2025-SRB026-R) and SRB027 (IPHC-2025-SRB027-R).

BIOMASS, RECRUITMENT, AND FISHING INTENSITY TRENDS

The results of the 2025 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 lower recruitment than observed during the 1980s. The spawning biomass increased gradually to 2016 and then decreased to an estimated 153 million pounds (~69,500 t) in 2024. At the beginning of 2026 the spawning biomass is estimated to have increased slightly due to the continued maturation of the 2012 year-class and the onset of maturity of the 2016 year-class. The current spawning biomass estimate is 166 million pounds (75,300 t), with an approximate 95% credible interval ranging from 113 to 272 million pounds (~51,300-123,600 t; Figure 8). The recent spawning biomass estimates from the 2025 stock assessment are very consistent with those from the 2024 stock assessment, and below terminal assessment estimates for 2021 through 2024 (Figure 9).

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 relative spawning biomass limit of 20%, directed fishing is halted due to the critically low biomass condition. This calculation is based on recent biological conditions currently influencing the stock and therefore measures only the effect of fishing on the spawning biomass, and not natural fluctuations due to recruitment variability and weight-at-age. The relative spawning biomass at the beginning of 2026 was estimated to be 38% (credible interval: 21-57%) slightly higher than the estimate for 2025 (36%). The probability that the stock is below the $SB_{30\%}$ level is estimated to be 28% at the beginning of 2026, with 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 (50%), and the coastwide model above (113%). The relative differences among models reflect both the uncertainty in historical dynamics (there was very little data available from IPHC Regulatory Areas 4A-4CDE prior to the 1970s) as well as the importance of spatial patterns in the data and population processes, for which all of the models represent only simple approximations.

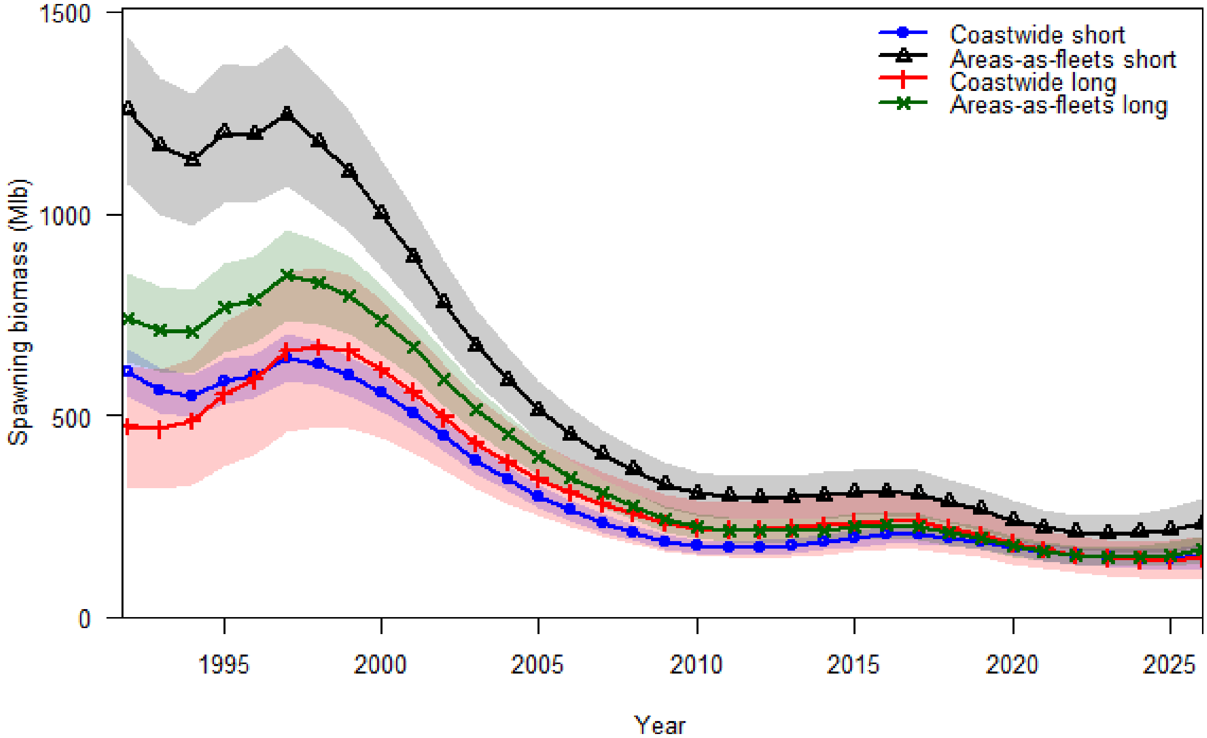


Figure 7. Estimated spawning biomass trends (1992-2026) based on the four individual models included in the 2025 stock assessment ensemble. Series indicate the maximum likelihood estimates; shaded intervals indicate approximate 95% credible intervals.

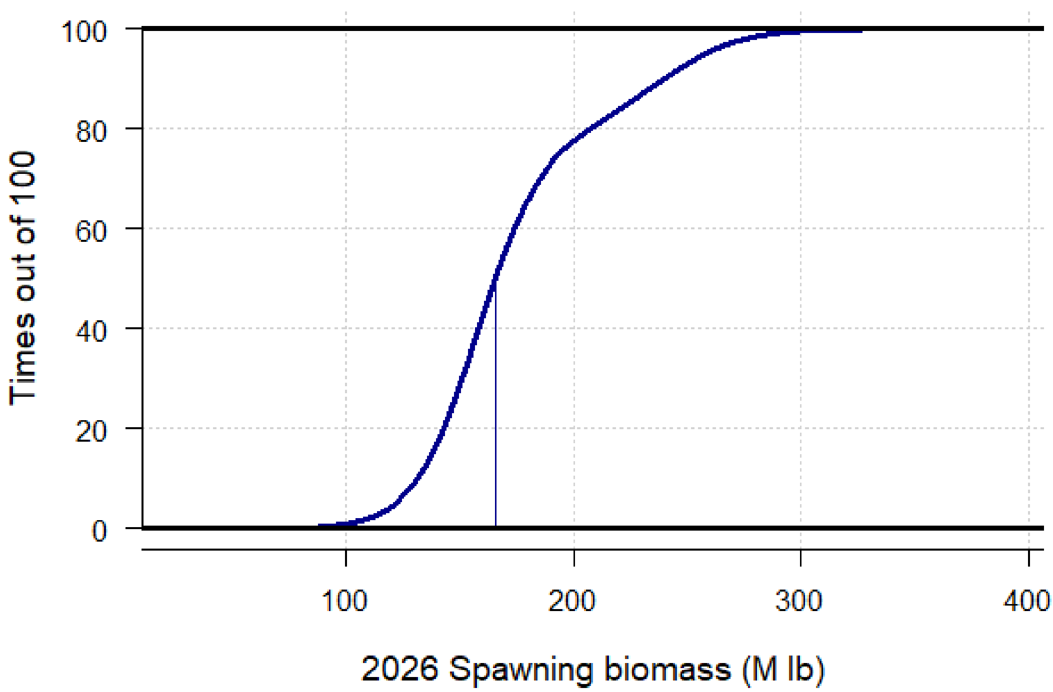


Figure 8. Cumulative distribution of the estimated spawning biomass at the beginning of 2026. Curve represents the estimated probability that the biomass is less than or equal to the value on the x-axis; vertical line represents the median (166 million pounds, ~75,300 t).

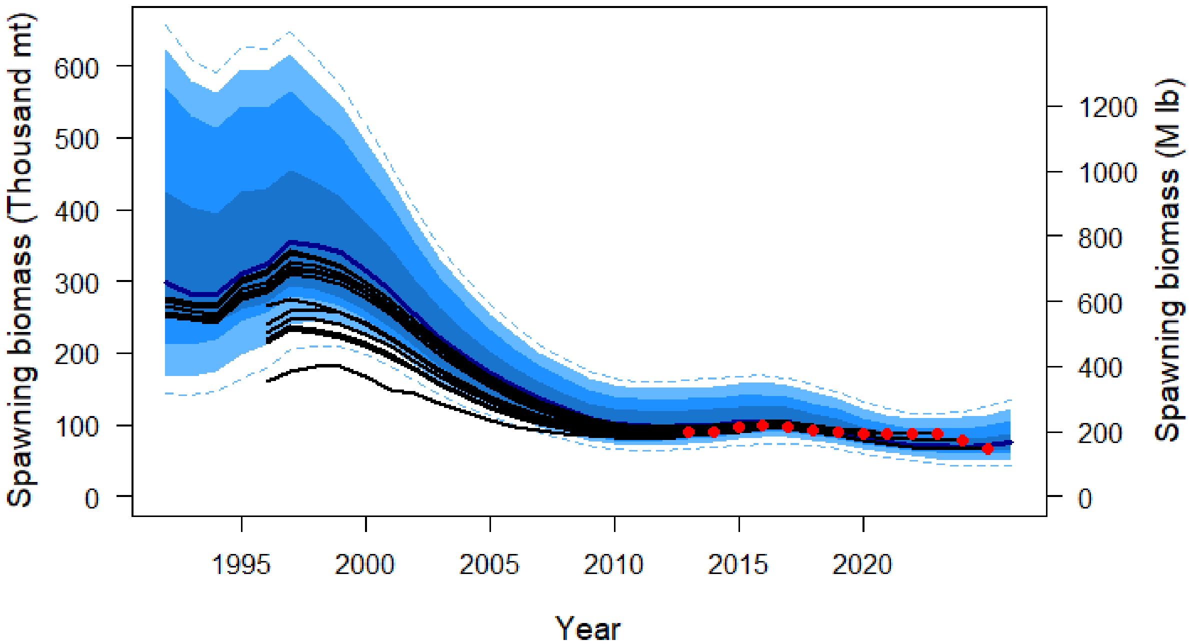


Figure 9. Retrospective comparison of female spawning biomass among recent IPHC stock assessments. Black lines indicate estimates from assessments conducted in 2012-2024 with the terminal estimate of the beginning of the year spawning biomass (2013-2025) shown as a red point. The shaded distribution denotes the 2025 ensemble including the terminal spawning biomass in 2026: 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.

Average Pacific halibut recruitment is estimated to be higher (60 and 54% 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). This indicator was updated to a new PDO standardization with no loss of explanatory power for the 2025 stock assessment (IPHC-2025-SRB026-07). The updated regimes suggest a multi-decadal pattern with negative conditions from 1943 to 1976, positive conditions from 1977 through 1997 and negative conditions to the present (November 2025). Although strongly correlated with historical recruitments, it is unclear whether recent conditions are comparable to those observed in previous decades.

Pacific halibut recruitment estimates show the largest recent cohorts to have been born 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 moved through the spawning biomass. Based on age data through 2025, individual models in this assessment produced estimates of the 2012, 2016 and 2017 year-classes that were similar to the average level observed over 1994-2005. Of the fish comprising the 2016 year-class, 22% are estimated to be mature in 2025 based on the revised maturity ogive included in this year’s stock assessment. The continued maturation of the 2016 and 2017 cohorts has a strong effect on short-term projections. There is little information on recruitments after 2016 in the data currently available.

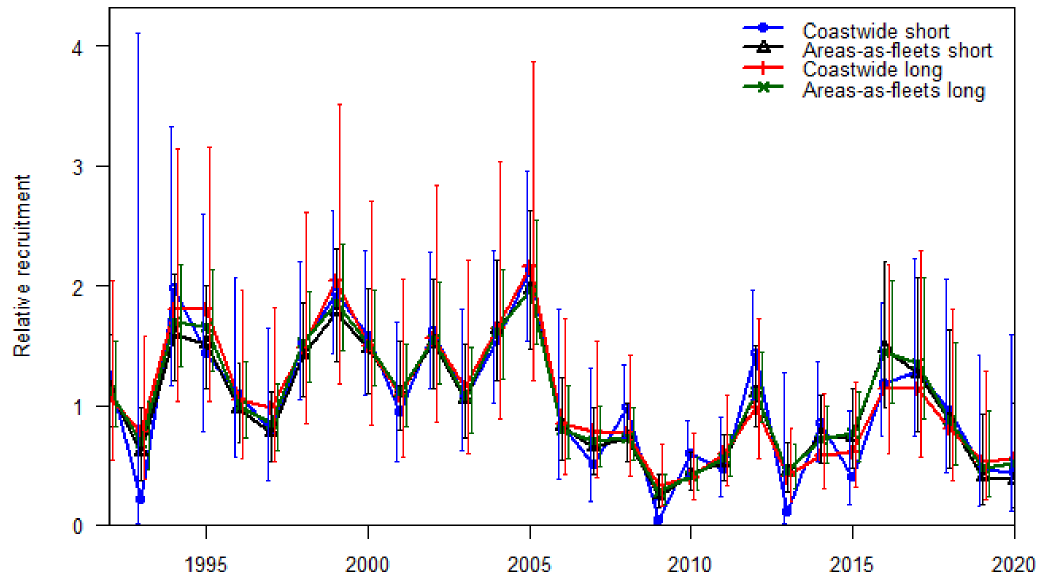


Figure 10. Estimated trends in age-0 relative recruitment (standardized to the mean for each model) from 1992-2020, based on the four individual models included in the 2025 stock assessment ensemble. Series indicate the maximum likelihood estimates; vertical lines indicate approximate 95% credible intervals.

The IPHC's interim management procedure specifies a reference level of fishing intensity of $F_{43\%}$ (SPR=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 historical time-series of fishing intensity is estimated to have peaked in the period from 2004-2011 (Figure 11). From approximately 2014 to 2022 previous and current estimates have fluctuated around reference levels, after which the estimated fishing intensity has declined. The 2025 fishing intensity is estimated to be $F_{52\%}$ (credible interval: 38-70%; Table 2), below both the current and previous ($F_{46\%}$) reference levels and below both 2023 and 2024. 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 subsequently increased as fishing intensity was reduced (Figure 12).

Major Sources of Uncertainty

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

The assessment utilized 8 years (2017-2024) of sex-ratio information from the directed commercial fishery landings. However, uncertainty in historical ratios remains unknown. Additional years of data are likely to further inform selectivity parameters and cumulatively reduce uncertainty in future stock size estimates. 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.

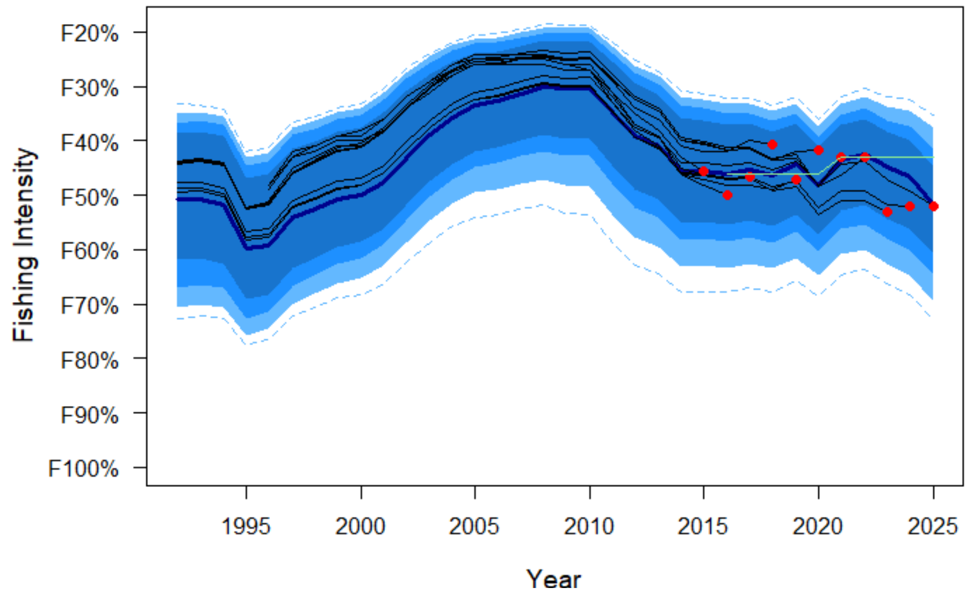


Figure 11. Retrospective comparison of fishing intensity (measured as $F_{xx\%}$, where xx% indicates the Spawning Potential Ratio (SPR) or the reduction in the lifetime reproductive output (due to fishing) among recent IPHC stock assessments. Black lines indicate estimates of fishing intensity from assessments conducted in 2014-2024 with the projection for the mortality limit adopted based on that assessment shown as a red point. The shaded distribution denotes the 2025 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. The green line indicates the reference level of fishing intensity used by the Commission in each year it has been specified ($F_{46\%}$ during 2016-2020 and $F_{43\%}$ thereafter).

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. Although the maturity ogive was updated for this assessment, relative fecundity per unit body mass is currently under renewed investigation by the IPHC. The assessment uses 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 continue to 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 along with fishing mortality.

The reduction in estimated commercial fishery catch-rates from the time the data sets for the stock assessment are closed until the data are relatively complete (sometime the following year) is a previously identified bias that produced strong effects on the 2023 and 2024 stock assessments. Concern over the potential for incomplete fishery CPUE to bias the assessment results led to the recommendation to 'down-weight' the terminal year via doubling the estimated variance in the index (IPHC-2017-SRB11-R). The precision of the fishery trend information interacts with the FISS information such that when the FISS design is sufficient to provide relatively precise trend estimates with little risk of bias (a 'base block' level; IPHC-2025-IM101-13 Rev_1) the assessment models rely more heavily on the survey. During periods when the two sources of information differ this can create an additional source of uncertainty not captured in the annual results.

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 of management procedures that are robust to estimation uncertainty via the stock assessment, and to a wide range of hypotheses describing population dynamics.

Table 2. Status summary of the Pacific halibut stock and fishery in the IPHC Convention Area at beginning of 2026.

Indicators	Values	Trends	Status
Biological			
SPR_{2025}: P(SPR<43%): P(SPR<limit):	52% (38-70%)[2] 19% Limit not specified	Fishing intensity reduced from 2024 to 2025	**Fishing intensity below reference level[3]**
SB_{2026} (Mlbs): SB_{2026}/SB_0: $P(SB_{2026}<SB_{30})$: $P(SB_{2026}<SB_{20})$:	166 (113–272) Mlbs 38% (21-57%) 28% 1%	SB increased 7% from 2025 to 2026	**Not overfished[4]**
Biological stock distribution:	See Tables and Figures	Region 3 increased, Region 2 decreased from 2024 to 2025	**Region 4 at the highest observed proportion**
Fishery Context			
Total mortality 2025: Percent retained 2025: Average mortality 2021-25:	28.80 Mlbs, 13,063 t[1] 81% 34.58 Mlbs, 15,687 t	Mortality decreased from 2024 to 2025	**2025 was the lowest mortality in 100 years**

[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 $SB_{20\%}$.

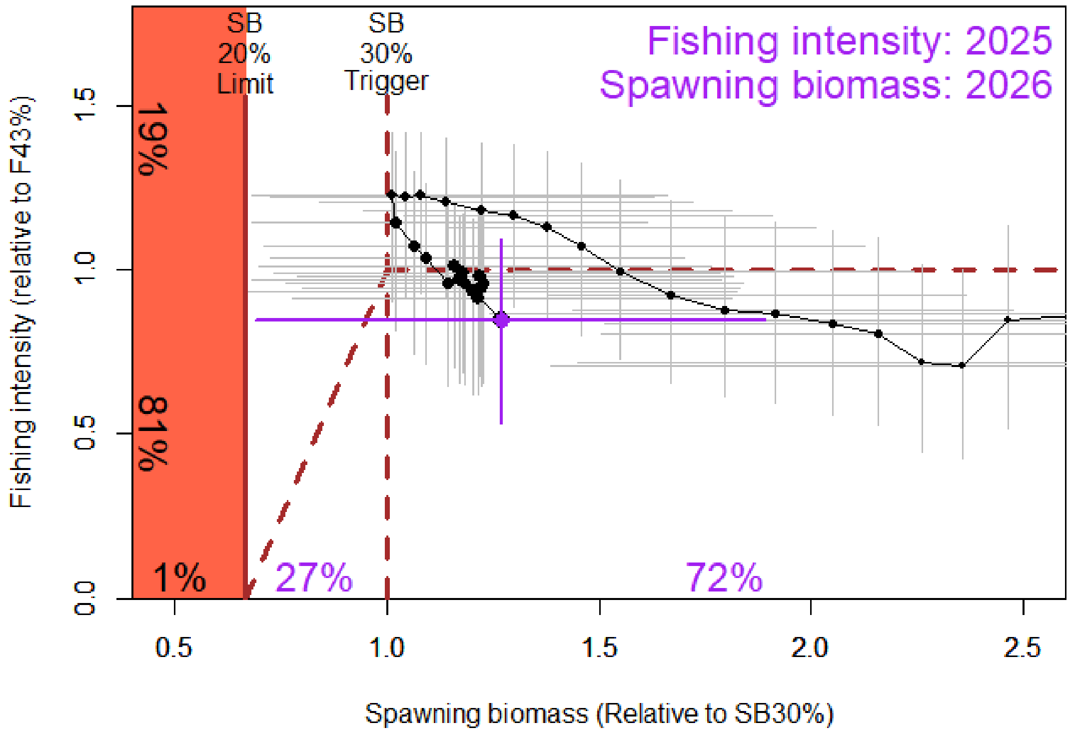


Figure 12. Phase plot showing the estimated time-series of spawning biomass (1993-2026) and fishing intensity (1992-2025) relative to the reference points specified in the IPHC's interim management procedure. Dashed lines indicate the current $F_{43\%}$ (horizontal) reference fishing intensity, with 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 2025 and spawning biomass at the beginning of 2026 shown as the largest point (purple). Percentages along the y-axis indicate the probability of being above and below $F_{43\%}$ in 2025; 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 2026.

Summary of Scientific Advice

Sources of mortality: In 2025, total Pacific halibut mortality due to fishing decreased to 28.80 million pounds (13,063 t), below the 5-year average of 34.58 million pounds (15,687 t), largely due to a 16%TCEY reduction from 2024 to 2025. Of that total mortality, 81% was retained and utilized across all fishery sectors (Table 2); this is lower than the percent utilized in 2021 to 2024 which ranged from 83% to 87%.

Fishing intensity: The 2025 fishing mortality corresponded to a point estimate of SPR = 52%; there is a 19% 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, but the draft Harvest Strategy Policy includes an overfishing limit equal to the MSY-proxy of SPR=35%. There is a <1% chance that the 2025 fishing intensity exceeded $F_{35\%}$.

Stock status (spawning biomass): Current (beginning of 2026) female spawning biomass is estimated to be 166 million pounds (73,300 t), which corresponds to a 28% chance of being below the IPHC trigger reference point of $SB_{30\%}$, and a <1% chance of being below the IPHC limit reference point of $SB_{20\%}$. The stock is estimated to have declined 34% from 2016 to 2024, then increased by 8% to the beginning of 2026. The relative spawning biomass (compared to the biomass projected to be present at the beginning of 2025 in the absence of any fishing) is currently estimated to be 38%, after reaching the lowest point in the recent time series (30%) in 2011. Therefore, the stock is considered to be '**not overfished**'.

Stock distribution: After increases in 2020-2021, the proportion of the coastwide stock represented by Biological Region 3 has increased in 2025 but remains near the lowest observed in the time-series, (Figure 6, Table 1). This trend occurs in tandem with a decrease in Biological Region 2. The proportion of the stock in both Biological Regions 4 and 4B has been increasing; however, little FISS sampling in Biological Region 4B in 2023-25 has resulted in increased uncertainty in both the trend and scale of the stock distribution in this Region.

Additional risks not included in this analysis: Directed commercial fishery catch rates coastwide, and in nearly all IPHC Regulatory Areas were at or near the lowest observed in the last 40 years. The absolute level of spawning biomass is also estimated to be near the lowest observed since the 1970s. The directed commercial fishery transitioned from the 2005 year-class to the 2012 year-class in 2022, and to the 2016 year-class in 2025. This shift from older to younger (and smaller fish) has contributed to observed reduced catch rates. The current spawning stock is heavily reliant on the 2012, 2016 and 2017 year-classes. Environmental conditions continue to be unpredictable, with important deviations from historical patterns in both oceanographic and biological processes observed across the stock range in the last decade.

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 draft 5-year research plan.

OUTLOOK

Short-term projections and the harvest decision table for 2026-2028 are reported in a separate document (IPHC-2025-IM101-12 Rev_1).

ADDITIONAL INFORMATION

A more detailed description of the stock assessment (IPHC-2026-SA-01) and the data sources (IPHC-2026-SA-02), will be published directly to the stock assessment page on the IPHC's website. That page also includes all 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 providing detailed tables of data and other information.

RECOMMENDATION/S

That the Commission:

a) **NOTE** paper IPHC-2025-IM101-10 Rev_1 which provides a summary of the data and the results of the 2025 stock assessment.

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IPHC Harvest Strategy Policy

PREPARED BY: IPHC SECRETARIAT (A. HICKS, I. STEWART, & D. WILSON; 11 NOVEMBER 2025)

PURPOSE

To provide the Commission with a draft of the interim Harvest Strategy Policy (HSP) **for adoption**, and to update the Commission with MSE results completed in 2025.

INTRODUCTION

A draft Harvest Strategy Policy (HSP) has been developed for adoption by the Commission. The HSP provides a framework for applying a consistent and transparent science-based approach to setting mortality limits for Pacific halibut (*Hippoglossus stenolepis*) fisheries throughout the Convention Area while ensuring sustainability of the Pacific halibut population. This draft contains principles developed during the Management Strategy Evaluation (MSE) process at IPHC. Three Commissioner workshops were held throughout 2025 where the draft HSP was considered and subsequently updated. The recent draft HSP is provided in document IPHC-2025-IM101-11b Rev_1 where additions since the last Commissioner workshop are shown in red text.

MSAB AND SRB REQUESTS/RECOMMENDATIONS RELATED TO THE HSP

The 21st Session of the Management Strategy Advisory Board (MSAB021) was held on 13–15 May 2025 in Juneau, AK. The MSAB discussed many topics, including productivity regimes, objectives, and the draft HSP. The following subset of recommendations and requests is directly related to the HSP. Additional requests regarding management procedures (MPs) to investigate are not included here, although they would likely influence future updates to the HSP.

> **IPHC-2025-MSAB021-R, para. 34**: *The MSAB **AGREED** that an objective to stay above a threshold based on a TCEY or minimum absolute historical spawning biomass (e.g. SB_{2024}) may be useful to continue investigating at MSAB022.*

> **IPHC-2025-MSAB021-R, para. 43**. *The MSAB **REQUESTED** that the Commission clarify the intent of the phrase "spatial and temporal scale relevant to the fishery" which is stated in the objective in the draft Harvest Strategy Policy (IPHC-2025-MSAB021-09) related to a threshold reference point, but is not in objective b) from AM099 (para. 16 above).*

> **IPHC-2025-MSAB021-R, para. 44**. *The MSAB **RECOMMENDED** the following wording for the objectives in the Harvest Strategy Policy:*

a) maintain the long-term coastwide Pacific halibut female relative spawning biomass above a biomass limit reference point ($RSB_{20\%}$) at least 95% of the time;

b) maintain the long-term coastwide Pacific halibut female relative spawning biomass at or above a threshold reference point ($RSB_{36\%}$) at least 50% of the time;

c) subject to meeting the previous two objectives, maximise the sustainable coastwide yield while minimising annual changes in the coastwide mortality limit.

There was also an informational session for the MSAB on 21 October 2025. Some discussions related to the HSP that occurred at this meeting included the following:

- *The MSAB discussed the concept of depleted and how it relates to overfished. They realised that it may have implications as a conservation tool and look forward to future research defining depleted and associated concepts.*
- *The MSAB feels that trace plots (e.g. "purple plots") are useful for visualizing short- and long-term spawning biomass projections at given SPR values, along with trade-off plots that compare AAV and TCEY values at differing spawning biomass levels. The MSAB thinks that these will be useful to the Commission decision-making process, but suggests that the Commission be given an example and notified that additional plots at differing SPR levels can be produced as requested.*
- *The section on the rebuilding plan needs additional specification, including a) ensuring this section and other sections in the HSP are consistent (e.g. clarifications of fishing activities when at an overfished state), b) describing the actions for the directed fishery if the stock is declared overfished before a rebuilding plan is in place and when a rebuilding plan is implemented.*

The 26th Session of the Scientific Review Board (SRB026) took place in Seattle, WA, from 10-12 June 2025 and the 27th Session of the Scientific Review Board (SRB027) also took place in Seattle, WA, from 16-18 September 2025. A review of definitions of "Overfished" and "Overfishing" from other fishery management entities was provided by the Secretariat via presentation (IPHC-2025-SRB026-08-Rev_1-ppt). This led to the following recommendations from the SRB related to the HSP.

IPHC-2025-SRB026-R, para. 30: ***NOTING*** *that "Overfished" implies that fishing was the cause of a current biomass state while the term "Depleted" is agnostic about the cause of low biomass, the SRB* ***RECOMMENDED*** *that the Secretariat consider defining "Overfished" relative to a dynamic reference point that incorporates productivity change while "Depleted" should refer to an absolute biomass reference point.*

IPHC-2025-SRB026-R, para. 31. *The SRB* ***RECOMMENDED*** *that the Secretariat/Commission adopt an absolute biomass limit defining "Depleted" to avoid low* *biomass levels where stock dynamics are poorly understood such that recovery projections would be unreliable.*

IPHC-2025-SRB026-R, para. 33. *The SRB **RECOMMENDED** that the Secretariat evaluate via simulation the ability to detect overfishing (based on the proposed definition) under scenarios of reduced assessment performance when defining "Overfishing" based on probabilities of stock status.*

IPHC-2025-SRB026-R, para. 34. *The SRB **RECOMMENDED** that the Secretariat consider and justify alternative timelines to the three-year rebuilding period specified in the proposed definition of "overfishing" since a three-year period is probably unrealistic for rebuilding timelines.*

IPHC-2025-SRB027-R*, para. 18. The SRB **RECOMMENDED** that the definition of "overfishing" be tied to the Fmsy proxy rather than a probability of becoming overfished or depleted. This is a standard definition of overfishing and distinguishes it from the state of being overfished/depleted.*

IPHC-2025-SRB027-R*, para. 19. The SRB **NOTED** the definition of "overfishing" in the draft Harvest Strategy Policy and **RECOMMENDED** adopting the revised definition developed at SRB027 to align with the recommendation in paragraph 18.*

*a. **Overfishing**: When the annual fishing intensity is higher than the level required to sustain maximum sustainable yield (MSY). The MSY fishing intensity is currently FSPR=35% based on current understanding of Pacific halibut population dynamics and fishery characteristics. The MSY fishing intensity may be revised as new information becomes available.*

IPHC-2025-SRB027-R*, para. 20. The SRB **NOTED** the paragraphs describing "overfished" and "depleted" in the draft Harvest Strategy Policy and **RECOMMENDED** adopting the revised paragraphs developed at SRB027 which clarify these descriptions while retaining the intended meaning.*

a. Overfished is a relative limit reference point defining an unacceptably low ratio of spawning biomass to dynamic unfished spawning biomass that results from fishing alone rather than the combined effects of fishing and the environment. The dynamic unfished spawning biomass is that which would have occurred without any fishing given natural variability (e.g. recruitment deviations, changes in size-at-age, etc). Therefore, an overfished state may be fully mitigated by management actions.

b. Depleted is an absolute limit reference point defined by a spawning biomass below which the potential for recovery is uncertain. Natural variability affects stock size *resulting in fluctuations of the spawning biomass, which along with fishing may result in a 'depleted' stock where reductions in fishing mortality may not lead to recovery without a change in the environmental conditions affecting the stock. Therefore, a depleted state may be only partially mitigated by management actions.*

c. *Because overfished and depleted represent 'limit' reference points, the Commission may choose additional precautionary actions whenever needed, including when at, or approaching, either of these states.*

***IPHC-2025-SRB027-R**, para. 21. The SRB **RECOMMENDED** defining an "exceptional circumstance" if the stock is determined to be "depleted" as this state is unlikely to occur under the circumstances in which the HSP is implemented and may be indicative of a need for model revision.*

SECRETARIAT RESPONSES TO MSAB AND SRB REQUESTS

Following work and analyses influenced by the above requests and recommendations, the IPHC Secretariat has modified the draft HSP. Below is a summary of that work.

Coastwide Objectives

The Commission previously defined four priority coastwide objectives, which have been consolidated into three objectives to highlight that maximising yield and minimising variability are considered without priority over each other. Edits to the HSP by the Commission following HSPWS01, with consideration of MSAB recommendations, resulted in the following wording for the three priority objectives.

1. Maintain the long-term coastwide Pacific halibut female relative spawning biomass above a biomass limit reference point where the risk to the stock is regarded as unacceptable ($RSB_{20\%}$), at least 95% of the time;
2. Maintain the long-term coastwide Pacific halibut female relative spawning biomass, at least 50% of the time, at or above a threshold reference point that optimises fishing activities on a spatial and temporal scale relevant to the fishery ($RSB_{36\%}$);
3. Maximize the sustainable average coastwide yield while minimising annual changes in the coastwide mortality limit, given the constraints above.

One recommendation of the MSAB was to clarify the intent of the phrase "on a spatial and temporal scale relevant to the fishery" in previous versions of the second objective. This objective currently states "coastwide", which implies a spatial scale. However, the spatial and temporal scale of the fishery when determining the appropriate reference point (e.g. MSY analyses) is important. The Secretariat believes that this statement is there to reflect the "current" fisheries across all areas and sectors and is clear by specifying coastwide.

Definitions of overfished and depleted

The SRB noted that Overfished implies that fishing was the cause of a low biomass state, whereas Depleted is agnostic about the cause of low biomass. Both definitions are important to fisheries management because managers control fishing to avoid precariously low biomass, but the population may be at low biomass for reasons that cannot be controlled by management yet may require management action to ensure recovery. The use of dynamic reference points allows for the separation of fishing effects from other effects on population size. A dynamic relative spawning biomass (as currently used by IPHC) is appropriate to determine if the population is overfished. An absolute spawning biomass is appropriate to determine if the population is at a low population state from which recovery could be compromised, which the SRB suggested calling Depleted following the New Zealand Harvest Strategy Standard[1].

Both Overfished and Depleted are important reference points to include in an HSP. A stock may be Depleted without being Overfished due to environmental conditions or may be Overfished without being Depleted due to high fishing rates. Continued high fishing rates when a stock is Overfished would likely lead to a Depleted stock, thus the HSP is designed to avoid a Depleted state with a high probability. The priority objectives in the IPHC HSP already contain a reference point to determine Overfished. This is $RSB_{20\%}$, using a dynamic relative spawning biomass, and the Secretariat suggests retaining the definition for Overfished that is currently in the draft HSP.

> **Overfished**: when the estimated probability that coastwide female relative spawning stock biomass is below the limit reference point ($RSB_{20\%}$) is greater than 50%.

The SRB also recommended including a reference point based on an absolute spawning biomass to determine if the stock is Depleted, and recovery projections may be unreliable due to uncertain stock dynamics. This implies a spawning biomass below the lowest level observed from which the population is known to have recovered. The Secretariat has currently identified two possible approaches to identify an appropriate absolute spawning biomass reference point.

First, the Secretariat has been suggesting the lowest spawning biomass observed in the estimated time series from the ensemble stock assessment, which is 2024 according to the most recent stock assessment. The estimated spawning biomass in the 1970s is highly uncertain and may have been at similar levels seen in recent years. However, given that recent levels are known to be low with a much greater certainty, the Secretariat suggests using the 2023 or 2024 spawning biomass as this absolute reference point. The advantage of choosing a year to define the absolute reference point (or the lowest estimated spawning biomass in a range of years) is that it scales to changes in the stock assessment due to updates to data and new assumptions, and it accounts for the uncertainty. Although it is likely that the population will recover from the recent low period of spawning biomass, it has not been observed. Therefore, it is a challenge to

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[1] https://fs.fish.govt.nz/Doc/16543/harveststrategyfinal.pdf.ashx.

determine the correct level relative to the lowest observed spawning biomass that should define Depleted.

Alternatively, simulation (via the MSE framework) could be used to determine a justifiable absolute spawning biomass reference point. To explore this, we simulated the Pacific halibut population forward at a high fishing rate for 40 years under a 'worst-case' scenario, assuming low weight-at-age, low PDO (defining poor recruitment and alternative movement), and a depensation parameter in the stock-recruit curve equal to 5. Depensation, or the Allee effect, is when recruitment is further depressed when the spawning biomass is very low. This may occur because of effects of environmental regimes, difficulties finding mates, low fertilization rates with reduced spawning output, or increased predation with smaller numbers. Depensation is not likely to have occurred at the spawning biomass levels observed for Pacific halibut, but previous research estimated a range of potential depensation levels (see IPHC-2024-SRB025-07). After 40 years, simulated fishing stops, except for 3 million pounds representing a small amount of bycatch and subsistence fishing, and the population is simulated forward another 50 years. A bifurcation point in the spawning biomass where trajectories either recover or stabilize and those that continue to decline is then determined.

All trajectories with a spawning biomass greater than 90 M lbs recovered and no trajectories recovered when starting at a spawning biomass less than 40 M lbs (see IPHC-2025-SRB027-08 for details). A high proportion of the trajectories (greater than 50%) in the worst-case scenario recovered when above a spawning biomass near 70 M lbs. Additional simulations will be done to bolster this analysis after reconditioning the operating model following the final 2025 stock assessment.

The concept of these two reference points, Overfished and Depleted, is shown in Figure 1. An example level for Depleted is shown, as it is not currently defined. Overfished is currently defined as 20% of unfished spawning biomass and changes over time when calculated as an absolute spawning biomass, depending on current stock conditions. Depleted is a constant absolute spawning biomass and varies in terms of relative spawning biomass.

Defining both Overfished and Depleted reference points in the IPHC HSP highlights the differences between natural fluctuations in the population due to extrinsic forces such as the environment, and the changes in the population due to fishing. Delineation of these factors is important to evaluate the efficacy of management actions; both factors can lead to low population sizes that should be avoided. The Commission will need to consider what response would be taken if a Depleted condition is approached, and the SRB suggested using Depleted to define an exceptional circumstance. The IPHC Secretariat will continue working to further specify Depleted in the HSP.

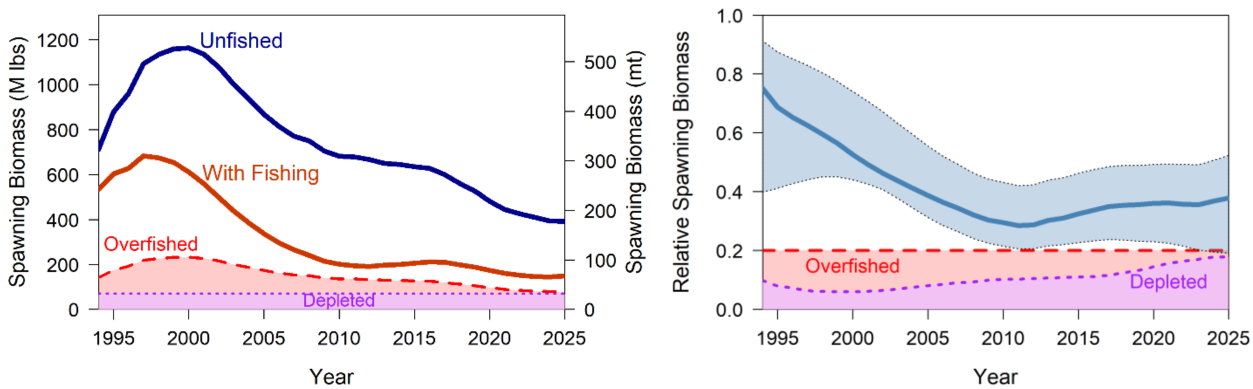

Figure 1. Estimated spawning biomass if fishing had not occurred (unfished) and estimated spawning biomass from the 2024 stock assessment (with fishing). The Overfished threshold of 20% of unfished spawning biomass is shown as a dashed line, and changes over time. An example "Depleted" threshold is shown as a straight horizontal line, assuming that it is defined as a constant absolute spawning biomass. The relative spawning biomass ("with fishing" divided by "unfished") is shown on the right with a 95% credible interval (accounting for the covariance in the biomass estimated with and without fishing). The Overfished threshold is shown at 20% and the example Depleted value is shown in purple.

Definition of overfishing

The definition of Overfishing was incomplete in previous drafts of the HSP. Following the SRB's recommendation, overfishing is defined as follows.

> **Overfishing**: when the annual fishing intensity is higher than the level required to sustain maximum sustainable yield (MSY). The MSY fishing intensity is currently FSPR=35% based on current understanding of Pacific halibut population dynamics and fishery characteristics. The MSY fishing intensity may be revised as new information becomes available

Effects of productivity regimes on the HSP

Pacific halibut exhibit high variability in weight-at-age and recruitment. Over the past 100 years, the average weight of an age 12 Pacific halibut has ranged from below 20 pounds in recent years to near 40 pounds in the mid-1970's (Figure 2). In the last ten years, the weight of the oldest fish has been declining or stable, but the weight of younger fish has been increasing. Recruitment is variable as well, and 1987 was one of the largest recruitments on record, as estimated in both 'long time-series' assessment models (Figure 3). These two models in the IPHC stock assessment (IPHC-2025-SA-01) estimated a link between the Pacific Decadal Oscillation (PDO, Mantua et al. (1997)) and average unfished equilibrium recruitment (R_0), with an estimated average recruitment more than 50% greater during a positive PDO . Previous analyses (Clark and Hare 2002; Stewart and Martell 2016) have also shown that a positive PDO phase is correlated with enhanced productivity, while productivity decreases in negative PDO phases. Although the PDO is strongly correlated with historical recruitments, it is unclear whether the effects of climate change and other recent anomalous conditions in both the Bering Sea and Gulf of Alaska are comparable to those observed in previous decades (Litzow et al. 2020).

To investigate the effects of these low and high weight-at-age and recruitment regimes, different scenarios were defined from past observations and the population was projected 70 years with an SPR of 43%, assuming constant weight-at-age and average recruitment defined by the scenario. Three levels were developed for weight-at-age: low weight-at-age was defined from a five-year period in the 2010s, high weight-at-age was defined from a five-year period in the 1970s, and current weight-at-age was defined as the most recent five-years (Figure 2). These three weight-at-age levels show different patterns and although the low weight-at-age and current weight-at-age scenarios were both low in general, they differed between the weight of young fish and older fish. The current weight-at-age scenario had larger young fish but smaller older fish. High and low recruitment regimes were defined based on the stock assessment estimates of average recruitment in positive and negative PDO regimes. The PDO also affects movement and distribution of newly recruited (age-0) Pacific halibut. Overall, there were six scenarios crossing current, low, and high weight-at-age with low and high PDO.

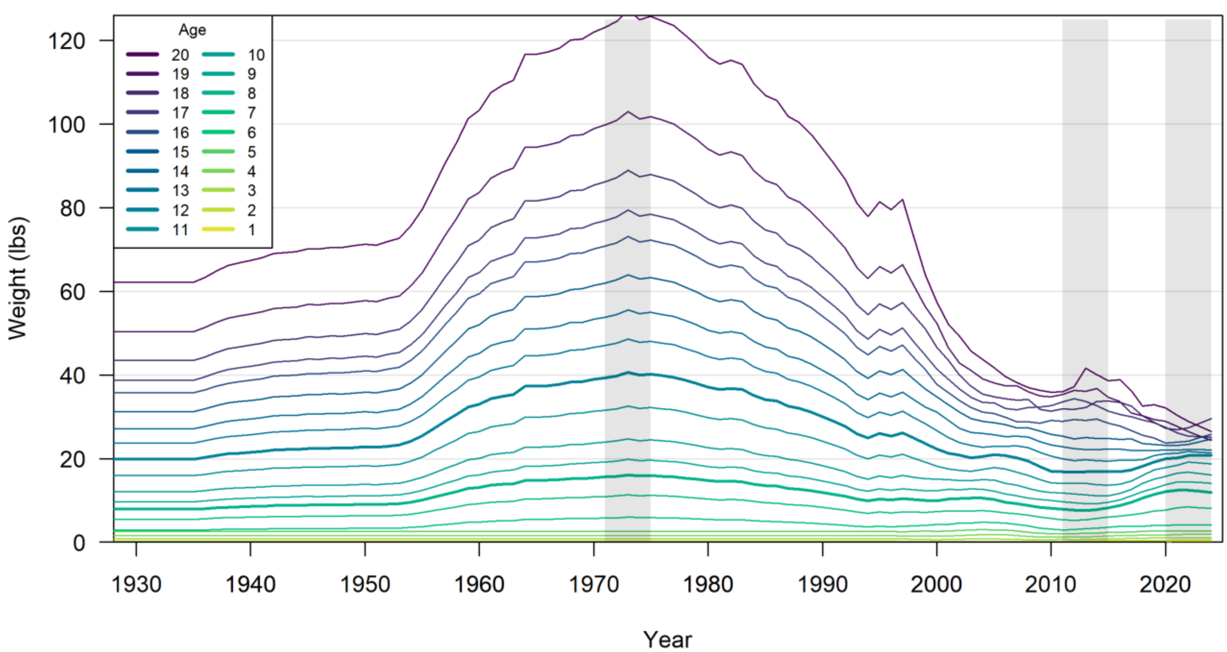

Figure 2. Average historical weight of Pacific halibut for ages one to twenty. Gray bands show three blocks of five years classified as *high* (1970s), *low* (2010s) and *current* (recent).

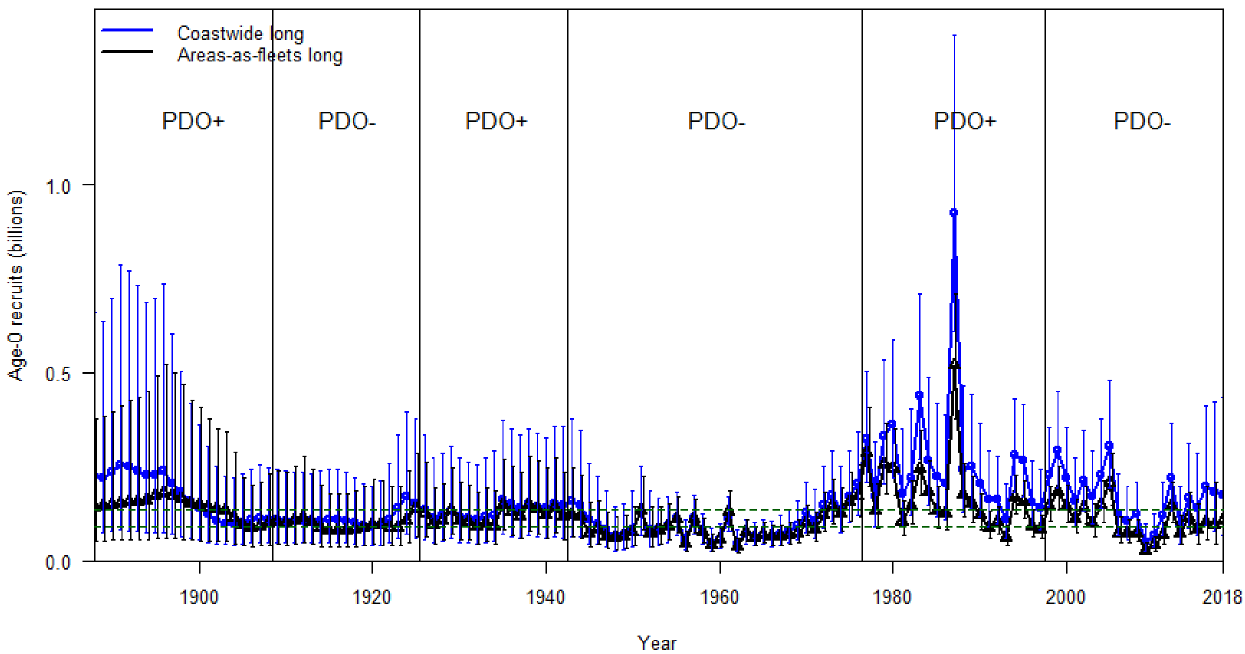

Figure 3. Trend in historical recruitment strengths (by birth year) estimated by the two long time-series stock assessment models, including the effects of the Pacific Decadal Oscillation (PDO) regimes. Figure reproduced from IPHC-2025-SA-01.

The spawning biomass differed substantially across different scenarios, but the high weight-at-age scenarios showed a considerable higher spawning biomass than the others (Figure 4). The sudden increase in the spawning biomass when the projections began indicates that weight-at-age is an important driver to the spawning biomass in both the current year and future years. Average recruitment had a significant effect as well but lagged in its effect on the spawning biomass since the fish must age into the spawning biomass. The differences due to average recruitment were more prevalent with higher weight-at-age. For a given recruitment regime, the current weight-at-age scenario resulted in a smaller spawning biomass than the low weight-at-age scenario. This indicates the importance of the older fish in the spawning biomass.

Simulated TCEYs showed the same pattern for high weight-at-age, but different patterns for low and current weight-at-age scenarios (Figure 4). Weight-at-age and recruitment both had a very large effect on the TCEY with the high weight-at-age and high recruitment scenario supporting TCEYs near 120 Mlb and the high weight-at-age and low recruitment scenario supporting TCEYs near 75 Mlb. The low and current weight-at-age scenarios resulted in TCEYs in the range of 30 to 60 Mlb, on average. The TCEY showed a different pattern in the low and current weight-at-age scenarios when compared to the spawning biomass. The TCEY was higher for the current weight-at-age scenario while the spawning biomass was higher for the low weight-at-age scenario. Young Pacific halibut are more influential to the TCEY than to the spawning biomass because some are selected by the fishery before they become mature.

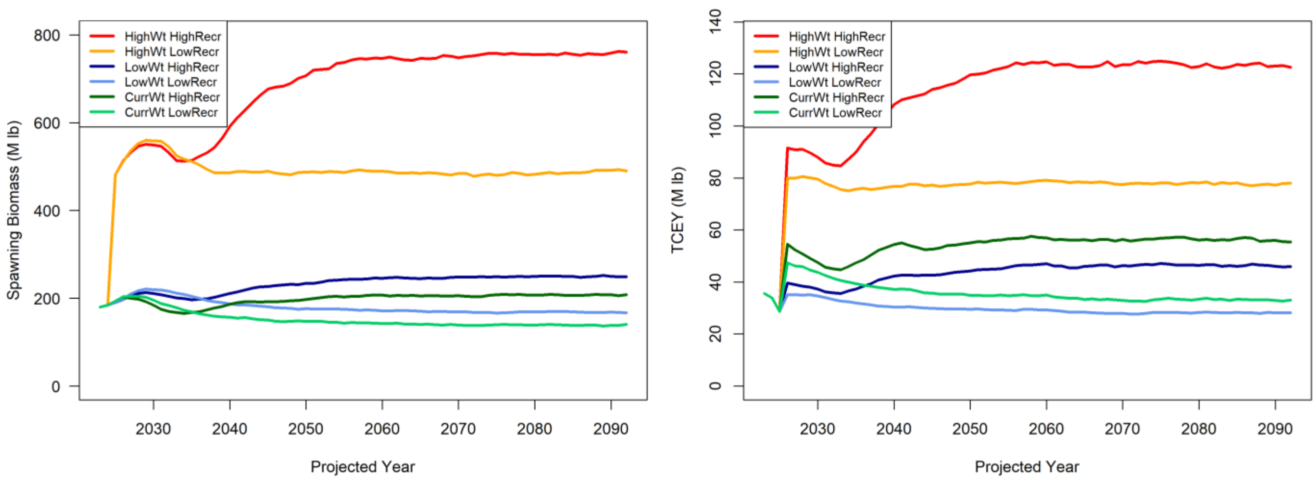

Figure 4. Simulated projections of spawning biomass (left) and TCEY (right) assuming six different regimes for combinations of weight-at-age and recruitment and an SPR of 43%. Each projection held the weight-at-age and average recruitment at the defined level for all projected years.

Pacific halibut have been in what can be called a low productivity period (e.g. low weight-at-age and low recruitment) for at least the last 15 years. MSE simulations assume that weight-at-age will likely increase and the PDO will soon switch to a positive regime, therefore spawning biomass and the TCEY are likely to increase in the simulated near future. However, simulations assuming that weight-at-age remains similar to the recent 5 years (current weight) and the PDO remains in a negative regime (low recruitment) show a potential further decline in the spawning biomass (Figure 5). The plot in Figure 5 is what the MSAB referred to as trace plots (e.g. purple plots).

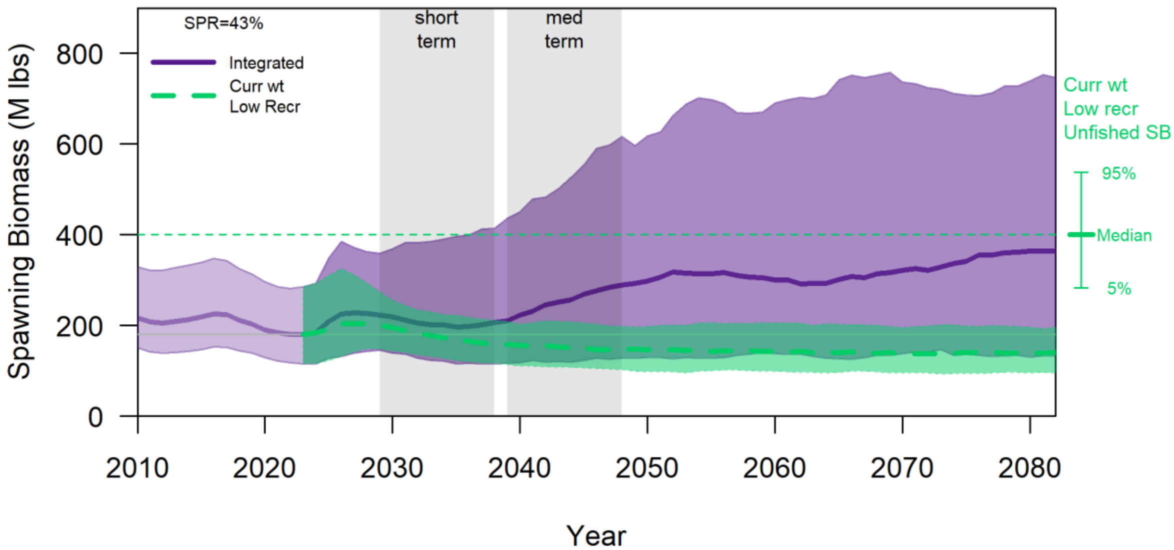

Figure 5. Simulated spawning biomass when fishing at an SPR=43% fishing intensity for productivity integrated over low and high levels (purple) and productivity assumed to remain at recent low levels (green). The 2023 median spawning biomass is shown as a horizontal grey line for reference, and the range of unfished spawning biomass for the low productivity scenario is shown on the right.

REFERENCE FISHING INTENSITY

The effect of the productivity regime on the optimal fishing intensity was investigated by conducting MSE simulations across various SPR values assuming a low productivity scenario (i.e. current weight-at-age and negative PDO) and comparing the performance metrics associated with the four priority objectives to the MSE results integrating over changes in weight-at-age and cyclical PDO. The probability that the short-term spawning biomass will be less than the spawning biomass in 2023 was also compared for both sets of simulations (Table 1). The median TCEY is less for the low productivity scenario and the AAVs slightly higher. The probability that the relative spawning biomass is less than 36% is also higher for the low productivity scenario and this performance metric is not met with an SPR of 40%. The short-term probability of being below the 2023 spawning biomass is also higher for the low productivity scenario with an approximate 1 in 2 chance for the low productivity scenario with an SPR of 43% versus an approximate 1 in 3 chance with integrated productivity.

The trade-offs between the TCEY and variability in the TCEY (AAV) are similar for the integrated productivity and low productivity scenario. There are slight differences between the AAVs at different fishing intensities with the lowest AAVs occurring between SPRs of 43% and 52%. The AAV increased at a faster rate for lower SPRs in the low productivity scenario than when integrating productivity. However, the TCEY increased by approximately 1 M lbs per every 1% reduction in SPR. Further defining what an optimal fishery is would help evaluate this trade-off.

Table 1. Performance metrics for different SPR values and simulations integrating over changes in weight-at-age and cyclical PDO and assuming a recent (i.e. low) productivity scenario (i.e. current weight-at-age and negative PDO). Green colors indicate that the performance metrics passes and red indicates that it does not.

Integrated (low & high) Productivity						
SPR (%)	**40**	**43**	**46**	**49**	**52**	**55**
P(RSB<20%)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
P(RSB<36%)	0.372	0.195	0.066	0.014	0.001	<0.001
Median TCEY	55.0	52.0	48.9	45.9	42.5	39.1
AAV	28.5%	26.3%	25.6%	25.5%	26.0%	26.7%
Short-term P(SB < SB_{2023})	0.401	0.350	0.297	0.254	0.214	0.179

Recent (low) Productivity						
SPR (%)	**40**	**43**	**46**	**49**	**52**	**55**
P(RSB<20%)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
P(RSB<36%)	0.677	0.462	0.236	0.081	0.016	<0.001
Median TCEY	43.5	41.2	38.7	36.1	33.3	30.6
AAV	29.0%	28.3%	27.7%	28.3%	29.2%	30.3%
Short-term P(SB < SB_{2023})	0.609	0.543	0.466	0.390	0.312	0.241

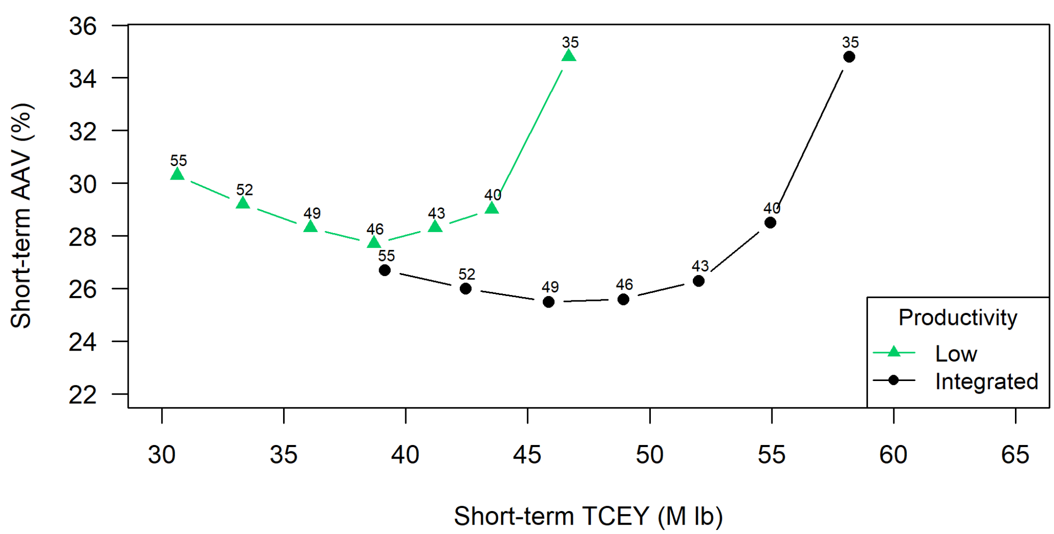

Figure 6. Trade-off between variability in the TCEY (AAV) and the TCEY for different fishing intensities (SPR labelling the points) when integrating over a range of productivity from low to high (black circles) and consistent low productivity similar to recent observations (green triangles).

RECOMMENDATION/S

That the Commission:

1) **NOTE** paper IPHC-2025-IM101-11a Rev_1 that provides an updated draft interim Harvest Strategy Policy and a description of how productivity regimes affect the optimal fishing intensity.
2) **ADOPT** the IPHC Harvest Strategy Policy (IPHC-2025-IM101-11b Rev_1), noting that updates to the reference fishing intensity and the definition of depleted may occur in 2026 following further work by the Secretariat.

SEE ALSO

IPHC-2025-IM101-11b: International Pacific Halibut Commission Interim: Harvest Strategy Policy (2025)

INTERNATIONAL PACIFIC HALIBUT COMMISSION

INTERIM: HARVEST STRATEGY POLICY (2025)

INTERNATIONAL PACIFIC

HALIBUT COMMISSION

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NOTE: The following is an interim document based on an amalgamation of current IPHC practices and best practices in harvest strategy policy. Current research is ongoing and it is expected that this policy document will then be updated accordingly.

ACRONYMS

DEP	Depleted
EC	Exceptional Circumstance
HCR	Harvest Control Rule
HSP	Harvest Strategy Policy
IPHC	International Pacific Halibut Commission
LIM	Limit
MEY	Maximum Economic Yield
MP	Management Procedure
MSAB	Management Strategy Advisory Board
MSE	Management Strategy Evaluation
NER	Net Economic Returns
NPUE	Numbers-per-unit-effort
OM	Operating Model
RSB	Relative Spawning Biomass
SB	Spawning Biomass (female)
SPR	Spawning Potential Ratio
SRB	Scientific Review Board
TCEY	Total Constant Exploitable Yield
THRESH	Threshold
U.S.A.	United States of America
WPUE	Weight-per-unit-effort

DEFINITIONS

A set of working definitions are provided in the IPHC Glossary of Terms, Acronyms and Abbreviations: https://www.iphc.int/the-commission/glossary-of-terms-and-abbreviations

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EXECUTIVE SUMMARY

The *IPHC Harvest Strategy Policy* (HSP) provides a framework for applying a consistent and transparent science-based approach to setting mortality limits for Pacific halibut (*Hippoglossus stenolepis*) fisheries throughout the Convention Area while ensuring sustainability of the Pacific halibut population. It defines biological, fishery, and economic objectives that apply to the development of a harvest strategy for Pacific halibut. It also identifies a management procedure and reference points for use in the harvest strategy to achieve the Commission's stated objectives. This policy, together with the *Protocol amending the Convention between Canada and the United States of America for the preservation of the [Pacific] halibut fishery of the northern Pacific Ocean and Bering Sea (1979)*, provides the basis to manage the risk to Pacific halibut fisheries and the Pacific halibut population.

The IPHC is responsible for determining the coastwide mortality limit and the allocation of this limit among eight (8) IPHC Regulatory Areas. The mortality limit in each IPHC Regulatory Area consists of all fishing mortality of all sizes and from all known sources, except for discard mortality of under 26-inch (U26) Pacific halibut from non-directed commercial (e.g. trawl) fisheries, which is accounted for at the coastwide level. The distribution of the mortality limit to each sector within an IPHC Regulatory Area is determined by Contracting Party domestic agencies. Therefore, this Harvest Strategy Policy is specific to the mortality limit in each IPHC Regulatory Area, across all sectors (i.e. TCEY).

Being a framework, the harvest strategy policy encompasses the entire process of the management procedure and decision-making process to determine mortality limits as well as other important considerations such as objectives, key principles, and responses to specific events. A harvest strategy, which may also be referred to as a management strategy, is the management framework necessary to achieve defined biological, fishery, and economic objectives for Pacific halibut.

> **Management Procedure (MP)**: A formulaic procedure to determine a management outcome (e.g. mortality limit) that produces a repeatable outcome and can be simulation tested.
>
> **Harvest Strategy**: The framework for managing a fish stock, including the MP and objectives.
>
> **Harvest Strategy Policy (HSP)**: The harvest strategy and decision-making process that results in endpoint management outcomes.

A goal of the IPHC Harvest Strategy Policy is the long-term sustainable use (optimum yield) of Pacific halibut through the implementation of a harvest strategy that maintains the stock at sustainable levels while supporting healthy and accessible fisheries which includes maximising economic returns in directed commercial fisheries. The Commission's current priority objectives to achieve this goal are:

1. Maintain the long-term coastwide~~-~~ Pacific halibut female relative spawning biomass~~,~~ above a biomass limit reference point where the risk to the stock is regarded as unacceptable ($RSB_{20\%}$) at least 95% of the time;
2. Maintain the long-term coastwide Pacific halibut female relative spawning biomass at or above a threshold reference point that optimises fishing activities ($RSB_{36\%}$) at least 50% of the time;
3. Maximize the short-term coastwide yield while minimising annual changes in the short-term coastwide mortality limit, given the constraints above to ensure a sustainable fishery.

The harvest strategy will ensure fishing is conducted in a manner that does not lead to *overfishing*. Overfishing is defined as where the stock is subject to a level of fishing that would likely be greater than the level associated with maximum sustainable yield.

Overfished: when the estimated probability that coastwide female relative spawning stock biomass is below the limit reference point ($RSB_{20\%}$) is greater than 50%.

Overfishing: when the annual fishing intensity is higher than the level required to sustain maximum sustainable yield (MSY). The MSY fishing intensity is currently $F_{SPR=35\%}$ based on current understanding of Pacific halibut population dynamics and fishery characteristics. The MSY fishing intensity may be revised as new information becomes available.

A transparent and systematic approach to meet the objectives of the Harvest Strategy Policy is supported by a number of requirements. These include accounting for all mortality of all sizes and from all known sources; accounting for multiple sources of uncertainty including environmental and biological; balancing risk, cost, and catch; developing threshold and limit reference points as indicators for managing Pacific halibut; robust simulation testing of management procedures; and identifying circumstances when the harvest strategy may be reconsidered and possibly updated. One threshold reference point and one limit reference point are currently defined.

Reference point	Definition	Proxy
Threshold reference point SB_{THRESH}	The female dynamic spawning biomass level supporting maximum economic yield (SB_{MEY}) and healthy fisheries.	36% of the unfished female spawning biomass ($RSB_{36\%}$).
Overfished limit reference point SB_{LIM}	The female dynamic spawning biomass level where the ecological risk to the population and the risk to the health of the fisheries is regarded as unacceptable.	20% of the unfished female spawning biomass ($RSB_{20\%}$).
Depleted limit reference point SB_{DEP}	The female absolute spawning biomass level below which the potential for recovery is uncertain.	In development

The coastwide reference mortality limit from the management procedure is currently determined using the stock assessment and a fishing intensity (F_{SPR}). The reference SPR (43%) is linearly reduced when the stock status is estimated below 30% and is set to 100% (no fishing for directed fisheries) when the stock status (RSB) is estimated at or below 20% (SB_{LIM}). A rebuilding strategy must be developed if the stock is estimated to be below SB_{LIM}.

The management of Pacific halibut is an annual process with a coastwide mortality limit and allocation to each IPHC Regulatory Area decided upon by the Commission at each Session of the IPHC Annual Meeting with the input of management supporting information including mortality tables, the harvest decision table, stakeholder input, and any other requests by the Commission. A mortality table shows the resulting allocation of mortality limits to each sector within each IPHC Regulatory Area. The harvest decision table is a stock assessment output that provides an estimate of risk relative to stock trend, stock status, fishery trends, and fishery status for a range of short-term coastwide mortality levels including the coastwide reference fishing mortality.

Chapter 1 INTRODUCTION

The *IPHC Harvest Strategy Policy* (HSP) provides a framework for applying a consistent and transparent science-based approach to setting mortality limits for Pacific halibut (*Hippoglossus stenolepis*) fisheries throughout the Convention Area while ensuring sustainability of the Pacific halibut population.

It defines biological, fishery, and economic objectives that apply to the development of a harvest strategy for Pacific halibut. It also identifies a management procedure and reference points for use in the harvest strategy to achieve the Commission's stated objectives. This policy, together with the *Protocol amending the Convention between Canada and the United States of America for the preservation of the [Pacific] halibut fishery of the northern Pacific Ocean and Bering Sea (1979)*[1], provides the basis to manage the risk to Pacific halibut fisheries and the Pacific halibut population.

A harvest strategy developed under this policy will take available information about the Pacific halibut resource and apply a consistent and transparent science-based approach to setting mortality limits. A harvest strategy consistent with this policy will provide all interested sectors with confidence that the Pacific halibut fisheries are being managed for long-term economic viability, opportunity, and accessibility while ensuring long-term ecological sustainability of the Pacific halibut population. The implementation of a clearly specified harvest strategy will also provide the fishing industry with a more certain operating environment.

1.1 SCOPE

The IPHC Harvest Strategy Policy applies to the Pacific halibut population managed by the IPHC, and where overlap with domestic jurisdictional management exists (e.g. coordinated management between the IPHC and Contracting Party domestic agencies) the IPHC will seek to apply and encourage the adoption of this policy in negotiating and implementing cooperative management arrangements.

The IPHC is responsible for determining the coastwide mortality limit and the allocation of this limit among eight (8) IPHC Regulatory Areas (Figure 1). The mortality limit in each IPHC Regulatory Area consists of all fishing mortality of all sizes and from all known sources, except for discard mortality of under 26-inch (U26) Pacific halibut from non-directed commercial (e.g. trawl) fisheries, which is accounted for at the coastwide level. This mortality limit without U26 non-directed commercial discard mortality has been termed the Total Constant Exploitation Yield, or the TCEY, but mortality limit is used here.

The distribution of the mortality limit to each sector within an IPHC Regulatory Area is determined by Contracting Party domestic agencies. Therefore, this Harvest Strategy Policy is specific to the mortality limit in each IPHC Regulatory Area, across all sectors (i.e. TCEY).

[1] https://www.iphc.int/uploads/pdf/basic-texts/iphc-1979-pacific-halibut-convention.pdf

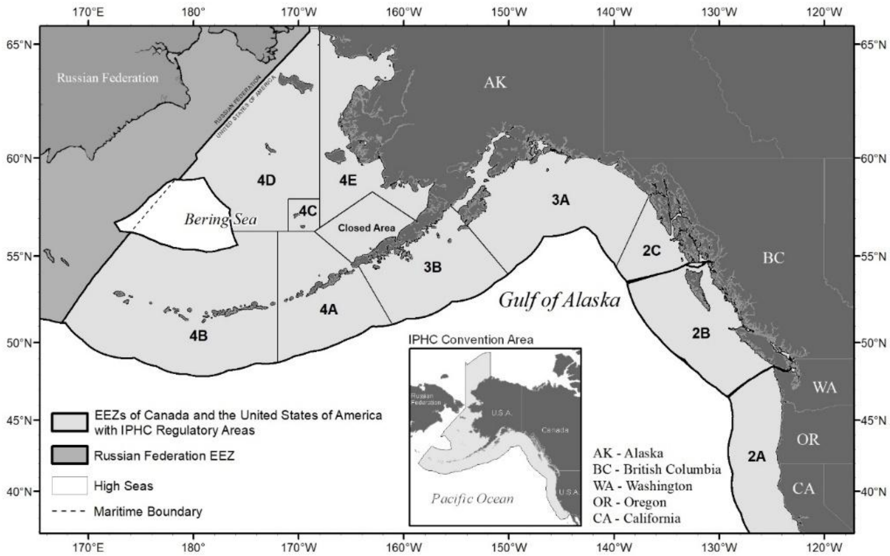

Figure 1. IPHC Regulatory Areas, where 4C, 4D, 4E, and the closed area are considered one IPHC Regulatory Area (4CDE). The IPHC Convention Area is shown in the inset.

1.2 WHAT IS A HARVEST STRATEGY POLICY (HSP)?

Being a framework, the harvest strategy policy encompasses the entire process of the management procedure and decision-making process to determine mortality limits (Figure 2) as well as other important considerations such as objectives, key principles, and responses to specific events. To determine mortality limits, the process begins with determining the coastwide scale of fishing mortality (the Management Procedure or MP). The decision-making process then occurs at the Annual Meeting of the IPHC where various forms of management supporting information are used by subsidiary bodies to provide a recommendation to the Commission of the coastwide mortality limit and allocation to each IPHC Regulatory Area. The Commission uses all this information to arrive at a final decision defining mortality limits for that year. Due to many considerations in this decision-making process, the final coastwide mortality limit may deviate from the coastwide reference mortality limit determined from the management procedure.

1.3 WHAT IS A HARVEST STRATEGY?

A harvest strategy, which may also be referred to as a management strategy, is the management framework necessary to achieve defined biological, fishery, and economic objectives for Pacific halibut. A harvest strategy will outline:

Objectives and key principles promoting sustainable, healthy, and accessible Pacific halibut fisheries.

Reference points and other quantities used when applying the harvest strategy.

Processes for monitoring and assessing the biological conditions of the Pacific halibut population and conditions of Pacific halibut fisheries in relation to biological and fishery reference levels (reference points).

Pre-determined procedures that adjust fishing mortality according to the biological status of the Pacific halibut stock and conditions of the Pacific halibut fisheries (as defined by monitoring and/or assessment). These procedures are referred to as harvest control rules or decision rules, and apply to the determination of a reference mortality limit before the decision-making process.

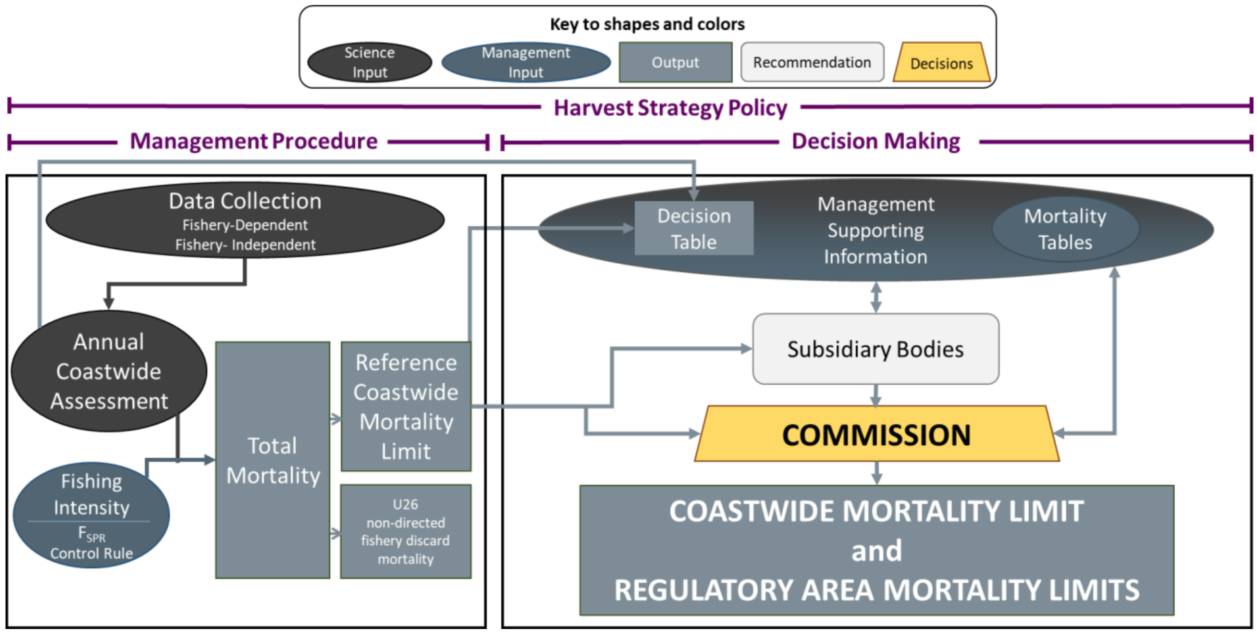

Figure 2. Illustration of the IPHC harvest strategy policy process to determine mortality limits showing the management procedure affecting the coastwide scale and the decision-making component, that considers inputs from many sources to distribute the coastwide mortality limit to IPHC Regulatory Areas and may result in the coastwide mortality limit deviating from the reference coastwide mortality limit determined from the management procedure.

A management procedure (MP) contains many of the components of a harvest strategy and is sometimes synonymous with harvest strategy. Here, we define an MP as the formulaic procedure that defines data collection, assessment, and harvest rules to determine the coastwide reference mortality limit. The MP has been shown to meet the objectives through simulation testing while also being robust to uncertainty and variability. Harvest strategy is a more general concept containing the MP as well as objectives. Simulation testing of MPs is done using Management Strategy Evaluation (MSE) operating models (OMs) with decision-making variability to ensure that a harvest strategy policy is robust to this uncertainty as well as other sources of uncertainty.

Management Procedure (MP): A formulaic procedure to determine a management outcome (e.g. mortality limit) that produces a repeatable outcome and can be simulation tested.

Harvest Strategy: The framework for managing a fish stock, including the MP and objectives.

Harvest Strategy Policy (HSP): The harvest strategy and decision-making process that results in endpoint management outcomes.

Chapter 2 OBJECTIVES AND KEY PRINCIPLES

A goal of the IPHC Harvest Strategy Policy is the long-term sustainable use (optimum yield) of Pacific halibut through the implementation of a harvest strategy that maintains the stock at sustainable levels while supporting healthy and accessible fisheries which includes maximising economic returns in directed commercial fisheries.

To achieve this goal the IPHC will implement a harvest strategy that minimises risk to the stock and pursues maximum economic yield (MEY) for the directed Pacific halibut fisheries. Maximising the net economic returns (NER) from the fishery may not always equate with maximising the profitability of the fishery. Net economic returns may consider interannual stability to maintain markets, and economic activity may also arise from opportunity for recreational and Indigenous fishing. The need to share the resources appropriately will also be considered where necessary.

The Commission's current priority objectives to achieve this goal are:

1. Maintain the long-term coastwide Pacific halibut female relative spawning biomass above a biomass limit reference point where the risk to the stock is regarded as unacceptable ($RSB_{20\%}$) at least 95% of the time;
2. Maintain the long-term coastwide Pacific halibut female relative spawning biomass at or above a threshold reference point that optimises fishing activities($RSB_{36\%}$) at least 50% of the time;
3. Maximize the short-term coastwide yield while minimising annual changes in the short-term coastwide mortality limit, given the constraints above to ensure a sustainable fishery.

The first objective is a sustainability or biological objective and the latter two objectives are fishery objectives. The objectives are hierarchical such that the previous objective must be met before considering the next, which is shown in Figure 3. This is especially important when evaluating MPs and leads to the first two objectives defining the acceptable MPs that ensure a sustainable population and fishery, and the last objective, balancing yield and variability in yield, helping to determine a reference MP that meets short-term goals within the sustainable set of MPs.

Performance metrics developed from measurable objectives are used to aid in the selection of an MP that best meets the objectives. At a minimum, a measurable objective must define a time-period over which the performance metric is calculated. Furthermore, a measurable objective may contain a threshold or limit and a tolerance for meeting that threshold or limit. For the Commission priority objectives, short-term refers to the next 4-13 years while the long-term refers to many generations in the future such that the stock and fishery would be fluctuating around an equilibrium when managed consistently. The first two objectives contain a limit or threshold and a tolerance allowing for a probabilistic performance metric to be calculated indicating a pass or fail for that objective (i.e. it either meets or does not meet the tolerance). The performance metrics for the final objective are calculated over a ten-year period from 4-13 years into the future and reported as the average yield and average variability. The trade-offs between these two can then be evaluated, requiring a decision to be made because there is typically no clear solution as one commonly improves while the other becomes less desirable. These performance metrics are used to determine the reference MP (see Section 3.7), although may be considered during the annual decision-making process.

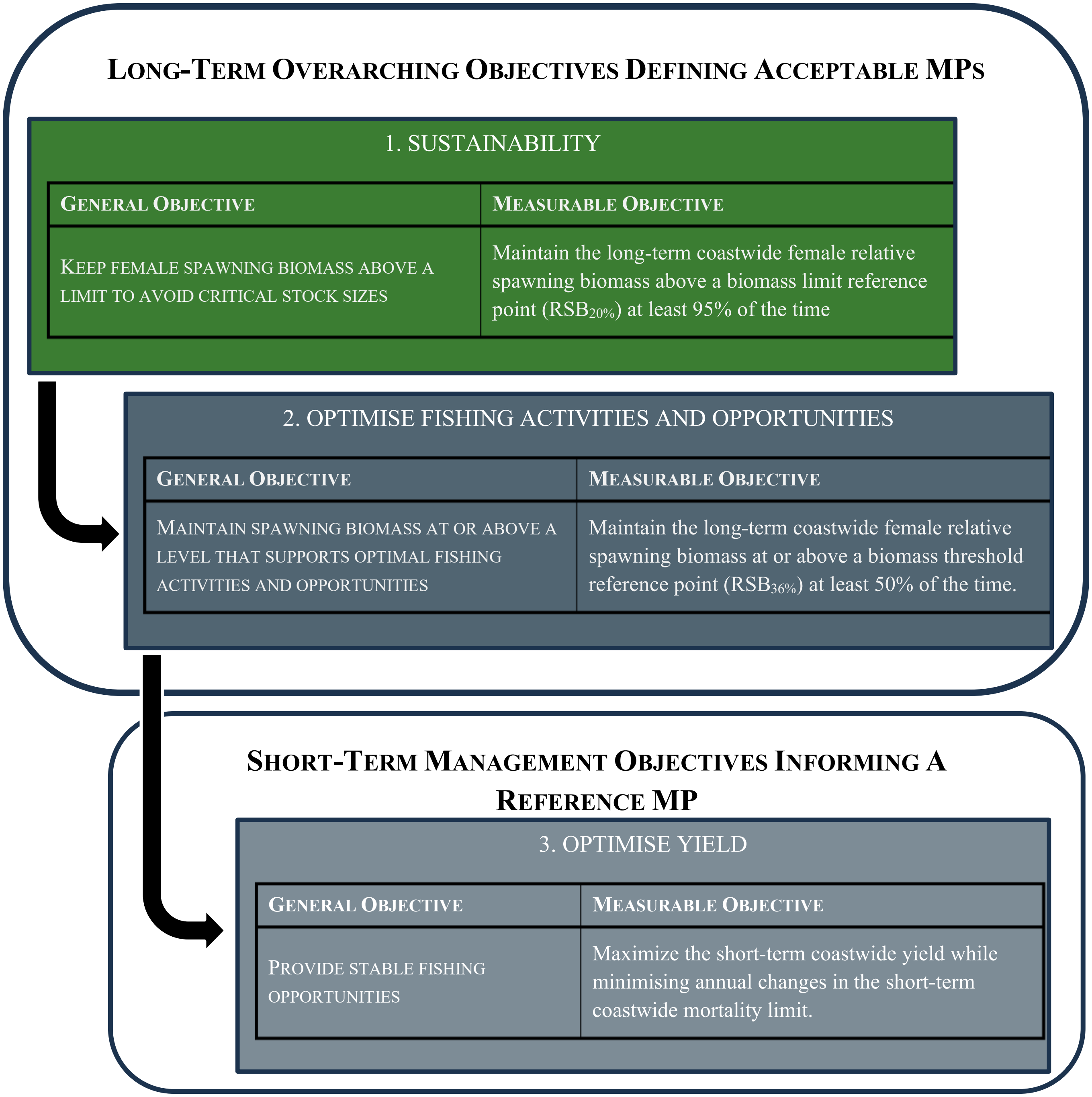

Figure 3. Priority objectives for the long-term sustainable management of Pacific halibut that support optimal yield and fisheries opportunities. The hierarchy of the objectives is shown by the arrows. The green colour indicates a sustainability or biological goal while the blue colours indicate fishery goals.

The harvest strategy will ensure fishing is conducted in a manner that does not lead to *overfishing*. Overfishing is defined as where the stock is subject to a level of fishing that would likely be greater than the level associated with maximum sustainable yield. Where it is identified that overfishing of the stock is occurring, action will be taken immediately to cease that overfishing to ensure long-term sustainability and productivity to maximise NER.

The harvest strategy will also ensure that if the stock is overfished, the fishery must be managed such that, with regard to fishing impacts, there is a high degree of probability the stock will recover. In this case, a stock rebuilding strategy will be developed to rebuild the stock, with high certainty, to the limit female relative spawning biomass level, whereby the harvest control rules would then take effect to build the stock further to the threshold reference female relative spawning biomass level.

Overfished: when the estimated probability that coastwide female relative spawning stock biomass is below the limit reference point ($RSB_{20\%}$) is greater than 50%.

Overfishing: when the annual fishing intensity is higher than the level required to sustain maximum sustainable yield (MSY). The MSY fishing intensity is currently $F_{SPR=35\%}$ based on current understanding of Pacific halibut population dynamics and fishery characteristics. The MSY fishing intensity may be revised as new information becomes available.

Chapter 3 DEVELOPMENT OF THE HARVEST STRATEGY

The following requirements provide the basis for a transparent and systematic approach used when developing the Harvest Strategy Policy to assist in meeting the objectives defined in Chapter 2.

3.1 ACCOUNTING FOR FISHING MORTALITY ON ALL SIZES AND FROM ALL KNOWN SOURCES

The Harvest Strategy Policy accounts for all known sources of fishing mortality on the stock and all sizes of Pacific halibut mortality, including directed commercial, recreational, subsistence, and fishing mortality from fisheries targeting species other than Pacific halibut and may be under the management of another jurisdiction, such as non-directed fishing mortality. Discard mortality of released fish is accounted for using best available knowledge. Some sources of mortality, such as whale depredation and unreported catches, may be of unknown magnitude. These should be acknowledged as an uncertainty.

3.2 VARIABILITY IN THE ENVIRONMENT AND BIOLOGICAL CHARACTERISTICS

The productivity of Pacific halibut is affected by variability in the environment and by changes in biological characteristics. The environment fluctuates naturally and is altered due to climate change and other factors, which may affect biological characteristics such as size-at-age and recruitment of age-0 fish. The following types of variability were considered when developing the Harvest Strategy Policy for Pacific halibut:

- Variability in recruitment of age-0 Pacific halibut due to unknown causes
- Variability in average recruitment of age-0 Pacific halibut due to the environment (e.g. indexed by the Pacific Decadal Oscillation, PDO).
- Variability in the geographical distribution of age-0 recruits linked to the PDO.
- Changes in weight-at-age due to unknown causes
- Variability in movement throughout the Convention Area due to the environment (e.g. linked to the PDO).

Changes in the environment were taken into account when developing the Harvest Strategy Policy and future research on additional effects of climate change on Pacific halibut fisheries and stocks will be incorporated as knowledge improves.

3.3 MONITORING

The harvest strategy includes best practices for monitoring the stock and fisheries and the collection of fishery-dependent and fishery-independent data on the distribution, abundance, and demographics of Pacific halibut, as well as other key biological data. These observations are used in the stock assessment and inform other management supporting information. Fisheries-dependent data include observations from the fisheries and should be collected across the entire geographical range and across all sectors, including landed catch and discards. Fishery-independent data include observations collected from scientifically designed surveys providing standardised biological and ecological data that are independent of the fishing fleet.

3.4 ESTABLISHING AND APPLYING MANAGEMENT ACTIONS

The harvest strategy developed under this policy specifies all required management actions or considerations for Pacific halibut, at the stock or IPHC Regulatory Area level, necessary to achieve the conservation and fishery objectives. Harvest rules are specified in the management procedure to determine a reference coastwide mortality limit (Chapter 4). This reference mortality limit is used along with management supporting information in a decision-making framework to determine mortality limits for each IPHC Regulatory Area, which may sum to a different coastwide mortality limit than the reference coastwide mortality limit. The decision-making process considers additional objectives that may be relevant at that time, and is included as a source of uncertainty in the MSE framework used to determine the reference management procedure.

3.5 BALANCING RISK, COST AND CATCH

This policy establishes a risk-based management approach, which provides for an increased level of caution when establishing harvest rules in association with increasing levels of uncertainty about stock status.

In the context of this policy, the risk, cost, and catch trade-off, refers to a trade-off between the amount of resources invested in data collection, analysis and management of Pacific halibut, and the level of catch (or fishing mortality) applied. Fishing mortality should always be constrained to levels at which scientific assessment indicates the Pacific halibut stock is not exposed to an 'unacceptable ecological risk' (that is the risk that stocks will fall below the limit reference point). The stock assessment and MSE provide analyses of this risk given recent levels of monitoring.

The management decision to be taken in this context is to account for the amount of information available about the Pacific halibut stock. The Commission may consider whether investment of more resources in data collection and analyses and/or additional management will increase the understanding of the risk to the stock from fishing and provide confidence in the sustainability of a higher level of fishing pressure or catch. Alternatively, if resources for data collection and analysis are limited to levels less than desired, the Commission may choose to set mortality limits lower to account for added uncertainty (i.e. it may be necessary to reduce the fishing intensity to manage the risk). Decisions about the trade-offs between the investment in managing risk versus the economic return of the catch taken will be transparently made, clearly documented and publicly available.

3.6 REFERENCE POINTS AND PROXIES

A reference point is a specified level of an indicator used as a basis for managing Pacific halibut. A reference point will often be based on indicators of the female spawning stock size (relative or absolute spawning biomass), the amount of harvest (fishing mortality), or on other factors such as economic return from the fishery.

A harvest strategy for Pacific halibut shall be based on 'threshold' reference points and 'limit' reference points. A threshold reference point is a level that achieves the policy objectives (e.g. acceptable levels of biological impact on the stock and desired health of the fisheries) if the indicator is at or above that level. When the stock is at or above a threshold reference point, optimal yield is possible. A limit reference point indicates a point beyond which the long-term biological health of the stock or the health of the fisheries is considered unacceptable and should be avoided. Fishing when the Pacific halibut population is below the biological limit reference point places the Pacific halibut stock at a range of biological risks, including an unacceptable risk to recruitment and productivity, and an increased risk that the stock will fail to maintain its ecological function, although risk of extinction is not a major concern. A fishery limit reference point indicates a stock level below which the directed commercial fishery is unlikely to remain profitable and opportunities for all fisheries would be severely diminished. Proxy reference points are described in Table 1.

Overfished is a relative limit reference point defining an unacceptably low ratio of spawning biomass to dynamic unfished spawning biomass that results from fishing alone rather than the combined effects of fishing and the environment. The dynamic unfished spawning biomass is that which would have occurred without any fishing given natural variability (e.g. recruitment deviations, changes in size-at-age, etc). Therefore, an overfished state may be fully mitigated by management actions.

Depleted is an absolute limit reference point defined by a spawning biomass below which the potential for recovery is uncertain. Natural variability affects stock size resultings in fluctuations of the spawning biomass, which along with fishing, may result in a '*depleted*' stock where reductions in fishing mortality may not lead to recovery without a change in the environmental conditions affecting the stock. Therefore, a depleted state may be only partially mitigated by management actions.[1]

Because overfished and depleted represent 'limit' reference points, the Commission may choose additional precautionary actions whenever needed, including when at, or approaching, either of these states.[2]

Table 1. Proxy reference points

Reference point	**Definition**	**Proxy**
Threshold reference point SB_{THRESH}	The female dynamic spawning biomass level supporting maximum economic yield (SB_{MEY}) and healthy fisheries.	36% of the unfished female spawning biomass ($RSB_{36\%}$).
Overfished limit reference point SB_{LIM}	The female dynamic spawning biomass level where the ecological risk to the population and the risk to the health of the fisheries is regarded as unacceptable.	20% of the unfished female spawning biomass ($RSB_{20\%}$).
Depleted limit reference point SB_{DEP}	The female absolute spawning biomass level below which the potential for recovery is uncertain.	In development

3.7 TECHNICAL EVALUATION OF THE HARVEST STRATEGY

This harvest strategy has been formally tested to demonstrate that it is highly likely to meet the objectives and key principles of this policy. Management strategy evaluation (MSE), a procedure where alternative management strategies are tested and compared using simulations of stock and fishery dynamics, is one of the best options to test harvest strategies and is recommended for future development of the HSP. MSE involves determining objectives, identifying MPs to evaluate, simulating those MPs with a closed-loop simulation framework, evaluating the MPs to determine which one best meets the objectives (Chapter 2), and finally adopting that MP as part of the harvest strategy. This process receives input from stakeholders throughout the annual meeting cycle and is reviewed by the

[1] The concept of depleted has been added to the Harvest Strategy Policy to recognize it as important while research continues to identify an appropriate threshold and develop management procedures for when the stock approaches or surpasses a depleted state. This research will be considered when updating the HSP following the schedule in Table 2.

IPHC Scientific Review Board (SRB). Outcomes of the evaluations are made publicly available and communicated at meetings throughout the IPHC annual process.

The MSE supporting this HSP incorporates variability and uncertainty, such as described in Section 3.2, structural uncertainty in an operating model (OM), and implementation variability from decision-making and realized fishing mortality. The MSE also represents all fishing sectors as necessary to appropriately remove different cohorts from the population and to determine if objectives are met for each sector. An important component to this HSP is the decision-making component (Figure 2) where the Commission considers management inputs and additional relevant factors when deciding on the coastwide TCEY and distribution of the TCEY to IPHC Regulatory Areas to balance risk, cost, and catch (Section 3.5), and account for current conditions. The MSE simulations use historical decisions to determine how to simulate decision-making variability, ensuring that an MP is robust to that variability as well as other sources of uncertainty.

3.8 Re-evaluating the Harvest Strategy and Management Procedure

A harvest strategy is a transparent and science-based approach to determining mortality limits and is meant to remain in place for many years. Frequent modifications or departures from the harvest strategy reduce the transparency and science-based approach. However, infrequent updates are necessary as more knowledge is gained. Therefore, it is important to specify, as part of the harvest strategy, time periods for re-evaluation of management procedures and to identify exceptional circumstances that would trigger a re-evaluation before that time period.

The IPHC currently operates off a schedule of three-years for full stock assessments, with update stock assessments in the intervening two years, and the MSE OM is updated following each full stock assessment to maintain consistent approaches and paradigms. Therefore, MPs may be re-evaluated three years after implementation, and shall not exceed two cycles (six years as shown in Table 2). The HSP may be updated on a three-year cycle corresponding to the regular re-evaluation of the MP, or as needed. An exceptional circumstance may trigger a re-evaluation of the MP sooner than three-years, which may be subsequently reflected in an update to the HSP.

An exceptional circumstance may trigger a re-evaluation before then and two exceptional circumstances to check for are defined as follows.

- The coastwide all-sizes FISS WPUE or NPUE from the space-time model is above the 97.5^{th} percentile or below the 2.5th percentile of the simulated FISS index for two or more consecutive years.
- The realised coastwide mortality is above the 97.5^{th} percentile or below the 2.5^{th} percentile of the simulated realised coastwide mortality for two or more consecutive years.

Exceptional circumstances would be reviewed by the SRB to determine if one should be declared. In the event that an exceptional circumstance is declared, the following actions are to be completed (also see Table 2).

- Review the MSE simulations to determine if the OM can be improved and MPs should be re-evaluated.
- Consult with the SRB and MSAB to identify why the exceptional circumstance occurred, what can be done to resolve it, and determine a set of MPs to evaluate with an updated OM.
- Present these recommendations to the Commission for a Commission decision whether to update the OM and re-evaluate the reference MP and alternative MPs.
- Further consult with the SRB and MSAB after simulations are complete to recommend a new MP to the Commission.

- Present these results to the Commission to identify whether a new MP is appropriate and the HSP should be updated.

The Commission may depart from the reference MP and reference TCEY in any year to account for other objectives and risk, including if an exceptional circumstance has occurred.

Table 2. Stock assessment, MSE, exceptional circumstances check, review, and decision processes on an annual basis. Year 1 could correspond to 2025, 2028, 2031, and so on. Upper case ‘Y’ indicates that the task is done, a lower case ‘x’ indicates that the task may be done. ‘EC’ refers to Exceptional Circumstance and ‘FISS’ to Fishery-Independent Setline Survey.

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Example Year	2025	2026	2027	2028	2029	2030	2031	2032
FISS coastwide index	Y	Y	Y	Y	Y	Y	Y	Y
Full stock assessment	Y			Y			Y	
Update stock assessment		Y	Y		Y	Y		Y
Commission TCEY decision	Y	Y	Y	Y	Y	Y	Y	Y
MSE OM updated		Y			x			Y
MP re-evaluated		Y			x			Y
Exceptional circumstances checked	Y		Y	Y	x[1]	Y	Y	
- Consult with SRB and MSAB			x	x	x	x	x	
- Present to Commission			x	x	x	x	x	
- Re-evaluate MP due to EC			*	*	Y[2]	x*	x*	
Update HSP			x			x		

[1] The exceptional circumstance would be checked only if a new MSE OM was not updated.
[2] The MP would be re-evaluated as part of the normal three-year cycle due to an exceptional circumstance occurring in two sequential years.
* An exceptional circumstance can be declared after two sequential instances, thus re-evaluation of an MP would have a delay, unless recommended by the Commission outside of the normal process.

Chapter 4 APPLYING THE HARVEST STRATEGY

4.1 COORDINATED MANAGEMENT OF DOMESTIC STOCKS

Consistent with the *Protocol amending the Convention between Canada and the United States of America for the preservation of the [Pacific] halibut fishery of the northern Pacific Ocean and Bering Sea* (1979), the IPHC will pursue the sustainable use of Pacific halibut within fisheries managed by other jurisdictions.

4.2 COORDINATED MANAGEMENT OF INTERNATIONAL STOCKS

The IPHC Harvest Strategy Policy does not prescribe management arrangements in the case of fisheries that are managed by a Party external to the IPHC Convention. This includes management arrangements for commercial and traditional fishing in the US Treaty Tribes and Canadian First Nations, that are governed by provisions within relevant Treaties. However, it does articulate the IPHC preferred approach.

4.3 STOCK ASSESSMENT

A full stock assessment occurs triennially and incorporates all available data through the current year, investigates all data and modelling aspects, and potentially makes changes to any of these components as needed. In the intervening years, an update stock assessment is completed to include all available data through the most current year. The stock assessment includes a summary of the data available for analysis, estimates of current stock size, recent trends of stock size relative to reference points, and uncertainty in the estimates of stock size.

Decision table: The stock assessment also produces a harvest decision table containing short-term projections of various risk metrics (rows) under different levels of future harvest (columns input as a specific amount of fishing mortality, e.g. TCEY). Risk metrics include the probability of a decline in spawning biomass for the next 1 to 3 years, the probability of a decline in spawning biomass that is greater than 5% for the next 1 to 3 years, the probability that the spawning biomass is less than 20% or 30% of unfished spawning biomass in the next 1 to 3 years, the probability that the reference TCEY is less than the selected TCEY in the next 1 to 3 years, the probability that the reference TCEY is at least 10% less than the selected TCEY in the next 1 to 3 years, and the probability that the fishing intensity in the upcoming year is greater than the reference fishing intensity as specified in the MP (currently $F_{SPR=43\%}$). The harvest levels include the reference fishing mortality (i.e. TCEY determined from the MP), a range less than and greater than the reference fishing mortality, no fishing mortality (to assess short-term maximum biological productivity), various levels based on status quo (e.g. the previous year's coastwide mortality), a 3-year surplus that would maintain the spawning biomass at the same level in three years with a 50% probability, fishing mortality based on the SPR proxy for MEY (40%), and the fishing mortality based on the SPR proxy for MSY (35%). The decision table is one component of management supporting information and is used by the Commission to assess the risk for various mortality limits when deciding on the coastwide mortality limit for the upcoming year.

4.4 COASTWIDE REFERENCE MORTALITY LIMIT

The coastwide reference mortality limit is determined using the stock assessment and a fishing intensity (i.e. F_{SPR}) defined by a harvest control rule (Figure 4). The stock assessment estimates the stock status (dynamic RSB) which is used in the harvest control rule to determine if the fishing intensity should be reduced from the reference SPR (43%). The reference SPR is linearly reduced when the stock status (RSB) is estimated below 30% and is theoretically set to 100% (no fishing for directed fisheries) when the stock status is estimated at or below 20% (SB_{LIM}), although this would trigger the development of a rebuilding plan which may allow for some directed fishing.

This management procedure determining the coastwide reference mortality limit is brought into the decision-making step as a reference value from which the Commission uses additional management supporting information to account for other relevant factors during the annual decision-making process on the coastwide TCEY and the distribution of the coastwide TCEY to IPHC Regulatory Areas. The MP provides a reference value in the decision table (see Sections 4.3 and 4.7). The MSE simulations account for this decision-making variability (see Section 3.7).

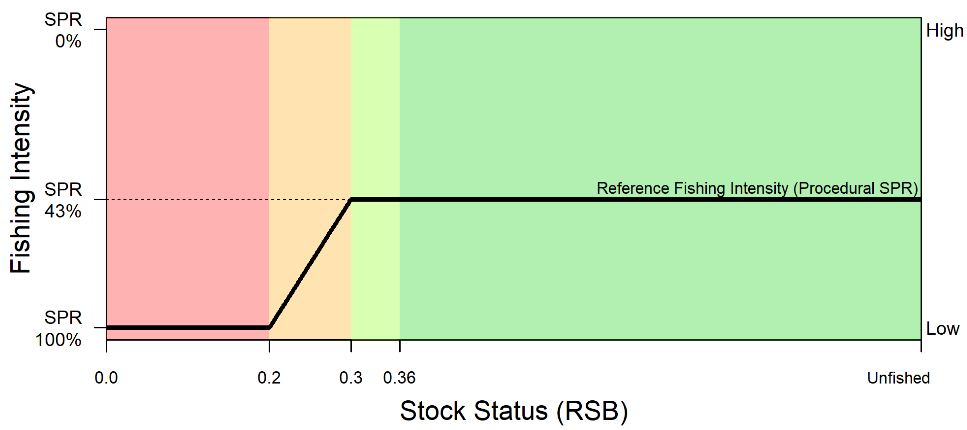

Figure 4. Harvest control rule for the fishing intensity (i.e. F_{SPR}) to determine the coastwide total mortality limit. The stock status is the dynamic relative spawning biomass (RSB) determined from the stock assessment. The reference fishing intensity is $F_{SPR=43\%}$, and is applied when stock status is above the trigger of 30%. SPR is linearly reduced between a stock status of 30% and 20%, and set to 100% when at or below a stock status of 20% (i.e. the limit reference point RSB_{LIM}). The threshold RSB, 0.36, is related to an objective to maintain the relative spawning biomass at or above $RSB_{36\%}$ at least 50 percent of the time. Colours show the area below RSB_{LIM} (red), the area 'on the ramp' (orange), the area above the trigger and below RSB_{THRESH} (light green), and the area above RSB_{THRESH} (green).

4.5 Rebuilding if the stock becomes overfished

If Pacific halibut is determined to be overfished (when the probability that female spawning stock biomass is below the limit reference point, RSB_{LIM}, is greater than 50%), immediate action is required to constrain directed fishing and rebuild the stock to levels that will ensure long-term sustainability and productivity, i.e. at or above RSB_{LIM}. A rebuilding strategy must be developed to rebuild the stock to above its limit reference point, for agreement by the Commission. A rebuilding strategy will be required until the stock is above the limit reference point with a reasonable level of certainty (at least a 70% probability that the stock has rebuilt to or above the limit reference point). It must ensure adequate monitoring and data collection is in place to assess the status of the stock and rebuilding progress.

Directed fishing and incidental mortality of Pacific halibut, if determined to be overfished, should be constrained as much as possible to levels that allow rebuilding to the limit reference point (RSB_{LIM}) within the specified timeframe. Once a stock has been rebuilt to above the limit reference point with a reasonable level of certainty, it may be appropriate to increase directed fishing, and increase incidental mortality in line with the harvest strategy, noting that the usual harvest strategy requirements regarding the application of the harvest control rule and risk of breaching the limit reference point will apply.

The rebuilding strategy should note where sources of mortality exist that cannot be constrained by the IPHC, and must take this mortality into account. Where practical and appropriate, the IPHC will coordinate with other jurisdictions to ensure other sources of mortality from fishing are reasonably constrained consistent with any catch sharing arrangement.

When a rebuilding strategy is being developed, it must include performance measures and details on how and when these measures will be reported. Where there is no evidence that a stock is rebuilding, or is going to rebuild in the required timeframe and probability, the IPHC will review the rebuilding strategy and make the result of the review public. If changes to the rebuilding strategy are considered necessary, such changes should be made in a timely manner.

Rebuilding plan

If the stock is determined to be overfished, a rebuilding plan should be developed as soon as possible. Requiring agreement by the Commission, a rebuilding plan could be developed at the Annual Meeting immediately following the overfished determination, assuming that the overfished determination is presented at the Interim Meeting, but shall be developed within two years after the stock is determined to be overfished (e.g. by the second Annual Meeting following the overfished determination). Before a rebuilding plan is implemented, directed fishing and incidental mortality shall be constrained as much as possible to avoid further declines in the RSB. Guidelines for a rebuilding plan are provided in a separate IPHC document.

Rebuilding timeframes

Rebuilding timeframes are explicitly related to the minimum timeframe for rebuilding in the absence of fishing. Rebuilding timeframes should take into account Pacific halibut productivity and recruitment; the relationship between spawning biomass and recruitment; and the stock's current level of depletion.

4.6 MORTALITY LIMITS FOR EACH IPHC REGULATORY AREA

The final outputs of the harvest strategy policy before domestic management is applied are mortality limits for each IPHC Regulatory Area. These are decided upon by the Commission at the Annual Meeting with the input of management supporting information (Section 4.7) requested by the Commission including mortality tables and the harvest decision table (see Section 4.3).

Mortality table: A mortality table shows the resulting allocation of mortality limits to each sector within each IPHC Regulatory Area. Domestic catch-sharing plans and Commission agreements on projecting non-directed discard mortality are used to fill out the details. This table can be produced for any projected year but is commonly presented for only the first projected year.

4.7 MANAGEMENT SUPPORTING INFORMATION

The Commission may use many sources of information during the decision-making process to assess risk to the stock and fisheries. Annually produced products are the harvest decision table (Section 4.3) and mortality tables (Section 4.6). These show a range of fishing mortality and allocation options that portray the risks in various ways. The harvest decision table represents short-term projections produced from the stock assessment that are useful for tactical decision-making and is an important item in the management supporting information. Longer-term strategic implications of the choices in the harvest decision table are determined from the MSE simulations. If available, performance metrics associated with the three priority objectives (Chapter 2) determined from the most recent MSE simulations should be presented for, at a minimum, some F_{SPR} values associated with the fishing mortality options presented in the decision table.

Additional management supporting information may include, but is not limited to, socioeconomic considerations, community development, political constraints, and operational limitations. This information along with stakeholder and scientific input is used by the Commission to decide on mortality limits for each IPHC Regulatory Area distributed from a coastwide mortality limit that takes into account short-term and long-term risk to the stock and supports optimal yield from the fisheries.

4.8 STAKEHOLDER AND SCIENTIFIC INPUT

Stakeholder and scientific input into the development and application of the harvest strategy is an important process to support the sustainable management of healthy Pacific halibut fisheries. Input from both sources occurs at meetings throughout the year.

Stakeholder input

Stakeholder input can occur via public testimony at any public IPHC meeting or at meetings of various IPHC subsidiary bodies, which are populated by individuals representing various interests related to Pacific halibut. This may include processors, commercial harvesters, recreational interests, subsistence fishing, and tribal or First Nations representatives. Subsidiary bodies may provide advice on management decisions, potential research topics, or guide updates to the Harvest Strategy Policy through MSE analyses.

Scientific input

Scientific input occurs through independent, external reviews, including, but not limited to, semi-annual meetings of the SRB. The SRB reviews science/research proposals, programs, products, strategy, progress, and overall performance.

4.9 ANNUAL PROCESS

A series of meetings occurs throughout the year, leading up the Annual Meeting in January when mortality limit decisions are made. The SRB meets in June and September to peer review IPHC science products, including the stock assessment and MSE. Subsidiary bodies may meet any time during the year and provide recommendations to the Commission and may meet during the week of the Annual Meeting to advise the Commission on issues related to the management of the Pacific halibut resource in the Convention Area.

An Interim Meeting, typically late November, precedes the Annual Meeting and is when the stock assessment, stock projections, and harvest decision table are first publicly presented. The final stock assessment, stock projections, and harvest decision table are presented at the Annual Meeting, typically in late January, to support mortality limit decisions.

4.10 UPDATING THE HARVEST STRATEGY POLICY

This Harvest Strategy Policy represents a stable framework that should be updated infrequently and only when warranted, at the discretion of the Commission. The HSP may be updated on a three-year cycle corresponding to the MSE process schedule such that changes to the HSP occur following a full MSE analysis of the harvest strategy. Table 2 in Section 3.8 shows an example schedule over a six-year period.

Stock projections and the harvest decision table for 2026-2028

PREPARED BY: IPHC SECRETARIAT (I. STEWART AND A. HICKS; 16 OCTOBER & 24 NOVEMBER 2025)

PURPOSE

To provide the Commission with 3-year stock projections and the harvest decision table for 2026-2028.

METHODS

Three-year tactical stock projections under varying levels of constant fishing mortality are conducted using the results from the 2025 stock assessment (IPHC-2025-IM101-10 Rev_1). Standard projections are based on existing Catch Sharing Agreements/Plans (CSPs) for directed commercial and recreational fisheries where they exist, as well as summaries of the 2025 and earlier directed and non-directed fisheries.

Specifically, the projected mortality levels are based on the three-year running average non-directed discard mortality[1] through the most recent year (2025), per the decision made during AM096 para. 97). Subsistence harvest is assumed to be constant at the most recent year's estimates. The discard mortality for the directed commercial fisheries is assumed to occur at the same rate observed in the most recent year, and to scale up or down with the projected landings.

The harvest decision table provides a comparison of the relative risk (in times out of 100), using stock and fishery metrics (rows), against a range of coastwide alternative harvest levels for 2026 (columns). The block of rows entitled "Stock Trend" provides for evaluation of the risks to the 3-year trend in spawning biomass, independent of all harvest policy calculations, based on fixed levels of fishing mortality. The remaining rows portray risks relative to the spawning biomass reference points ("Stock Status") and fishery performance relative to the approaches identified in the interim management procedure (see IPHC-2025-IM101-11b for the draft harvest strategy policy). 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)
- The mortality consistent with repeating the coastwide TCEY set for 2025 (the *status quo*)
- Bracketing alternatives 5 and 10% above and below the *status quo*

[1] The North Pacific Fishery Management Council adopted a new method for setting the Prohibited Species Catch (PSC) limit for Pacific halibut mortality in the Amendment 80 (A80) trawl sector in 2024. This approach adjusts PSC limits based on the NOAA Fisheries Eastern Bering Sea trawl survey and the modelled FISS index of abundance for IPHC Regulatory Areas 4A, 4B, and 4CDE. This new approach resulted in a 20% reduction to the A80 sector's PSC limit in 2024 and an additional 5% reduction for 2025-2026. However, the actual halibut mortality has been below the aggregate PSC limit for all sectors in the Bering Sea and Aleutian Islands (70% in 2025). Therefore, it is unclear whether any future adjustments to the 3-year running average approach might be warranted, as actual mortality could still go up or down from the three year-average under current conditions. Recent actual non-directed discard mortality estimates in both IPHC Regulatory Areas 2A and 2B and in the Gulf of Alaska are similarly far below full regulatory limits (25% in 2025).

- The mortality at which there is less than or equal to a 50% chance that the spawning biomass will be smaller in 2029 than in 2026 ("*3-year surplus*")
- The mortality consistent with the current "Reference" SPR ($F_{43\%}$) level of fishing intensity
- The mortality consistent with the Maximum Economic Yield (*MEY*) proxy SPR ($F_{40\%}$) level of fishing intensity
- The mortality consistent with the Maximum Sustainable Yield (*MSY*) proxy SPR ($F_{35\%}$) level of fishing intensity. This SPR is also the overfishing limit as defined in the draft Harvest Strategy Policy (IPHC-2025-IM101-11b).
- Other levels of mortality are spaced between the above alternatives to provide for continuous evaluation of the change in risk across alternative yields

For each column of the decision table, the projected total fishing mortality (including all sizes and sources), the coastwide TCEY and the associated level of estimated fishing intensity projected for 2026 (median value with the 95% credible interval below) are reported.

RESULTS

Spawning biomass estimates in 2025 (last year) from the 2025 stock assessment are similar to than those from last year's stock assessment (7% higher) and increasing slowly. The 2012, 2016, and 2017 year-classes (all larger than all those occurring from 2006-2011) are highly important in the 3-year stock projections as they will be continuing to mature over the next several years.

Projections indicate that the spawning biomass would increase in the absence of any fishing mortality, with risks of stock decline over one and three years both less than 1/100 (Table 1, Figure 1). At the *status quo* coastwide TCEY (29.72 million pounds; Table 2), risks of stock decrease over one and three years are 15/100 and 18/100. For all harvest levels that exceed the three-year surplus (38.95 million pounds) risks of stock decline are larger than 50/100 and reaching 91/100 for the coastwide TCEY that is projected to correspond to the $F_{35\%}$ Overfishing limit/*MSY* proxy harvest level in 2026. Alternative harvest levels around the *status quo* (+/- 5 and 10%) are projected to result in levels of fishing intensity ranging from $F_{54\%}$ to $F_{48\%}$, at or lower than those estimated in recent years. The reference level of fishing mortality ($F_{43\%}$) corresponds to a TCEY equal to the three-year surplus, which is approximately 30% greater than the current status quo. The probability of a reduction in the coastwide TCEY in order to maintain a fishing intensity no greater than $F_{43\%}$ over the next three years is projected to be 53/100.

All projections result in a probability of the relative spawning biomass dropping below the $SB_{30\%}$ threshold over the next three years of 5-27/100. The probability of dropping below the $SB_{20\%}$ limit is estimated to be <1-6/100.

Table 1. Harvest decision table for 2026-2028 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.

2026 Alternative					*Status quo -10%*	*Status quo -5%*	*Status quo*	*Status quo +5%*	*Status quo +10%*	$F_{46\%}$	*3-Year Surplus / $F_{43\%}$*	*MEY proxy*	*Overfishing limit*	
Total mortality (M lb)			0.0	21.9	28.6	30.1	31.6	33.1	34.6	37.0	40.8	45.1	53.7	
TCEY (M lb)			0.0	20.0	26.8	28.2	29.7	31.2	32.7	35.1	39.0	43.3	51.9	
2026 fishing intensity			$F_{100\%}$	$F_{62\%}$	$F_{54\%}$	$F_{52\%}$	$F_{51\%}$	$F_{49\%}$	$F_{48\%}$	$F_{46\%}$	$F_{43\%}$	$F_{40\%}$	$F_{35\%}$	
Fishing intensity interval			--	47-77%	39-71%	37-70%	36-69%	34-68%	33-67%	31-65%	28-62%	26-59%	22-54%	
Stock Trend (spawning biomass)	in 2027	is less than 2026	<1	3	10	12	15	18	22	28	40	54	80	a
		is 5% less than 2026	<1	<1	1	1	2	2	3	4	8	14	32	b
	in 2028	is less than 2026	<1	2	8	10	13	16	19	26	38	54	82	c
		is 5% less than 2026	<1	<1	2	3	4	5	7	10	17	28	55	d
	in 2029	is less than 2026	<1	3	11	14	18	22	27	35	50	68	91	e
		is 5% less than 2026	<1	1	5	6	8	11	13	19	30	46	77	f
Stock Status (Spawning biomass)	in 2027	is less than 30%	24	25	26	26	26	26	26	26	26	26	27	g
		is less than 20%	<1	<1	<1	1	1	1	1	1	1	1	2	h
	in 2028	is less than 30%	14	22	23	24	24	24	24	25	25	26	27	i
		is less than 20%	<1	<1	<1	<1	<1	1	1	1	1	2	3	j
	in 2029	is less than 30%	5	17	20	21	22	22	23	23	24	25	27	k
		is less than 20%	<1	<1	<1	<1	1	1	1	1	2	3	6	l
Fishery Trend (TCEY)	in 2027	is less than 2026	0	<1	11	16	20	25	30	37	49	60	75	m
		is 10% less than 2026	0	<1	4	9	10	14	18	25	35	47	65	n
	in 2028	is less than 2026	0	<1	11	15	20	24	29	37	50	61	78	o
		is 10% less than 2026	0	<1	4	10	10	14	18	25	36	49	68	p
	in 2029	is less than 2026	0	1	11	15	10	25	30	39	53	65	82	q
		is 10% less than 2026	0	<1	5	10	11	15	19	26	39	53	73	r
Fishery Status (Fishing intensity)	in 2026	is above $F_{43\%}$	0	<1	13	18	23	27	32	39	50	60	73	s

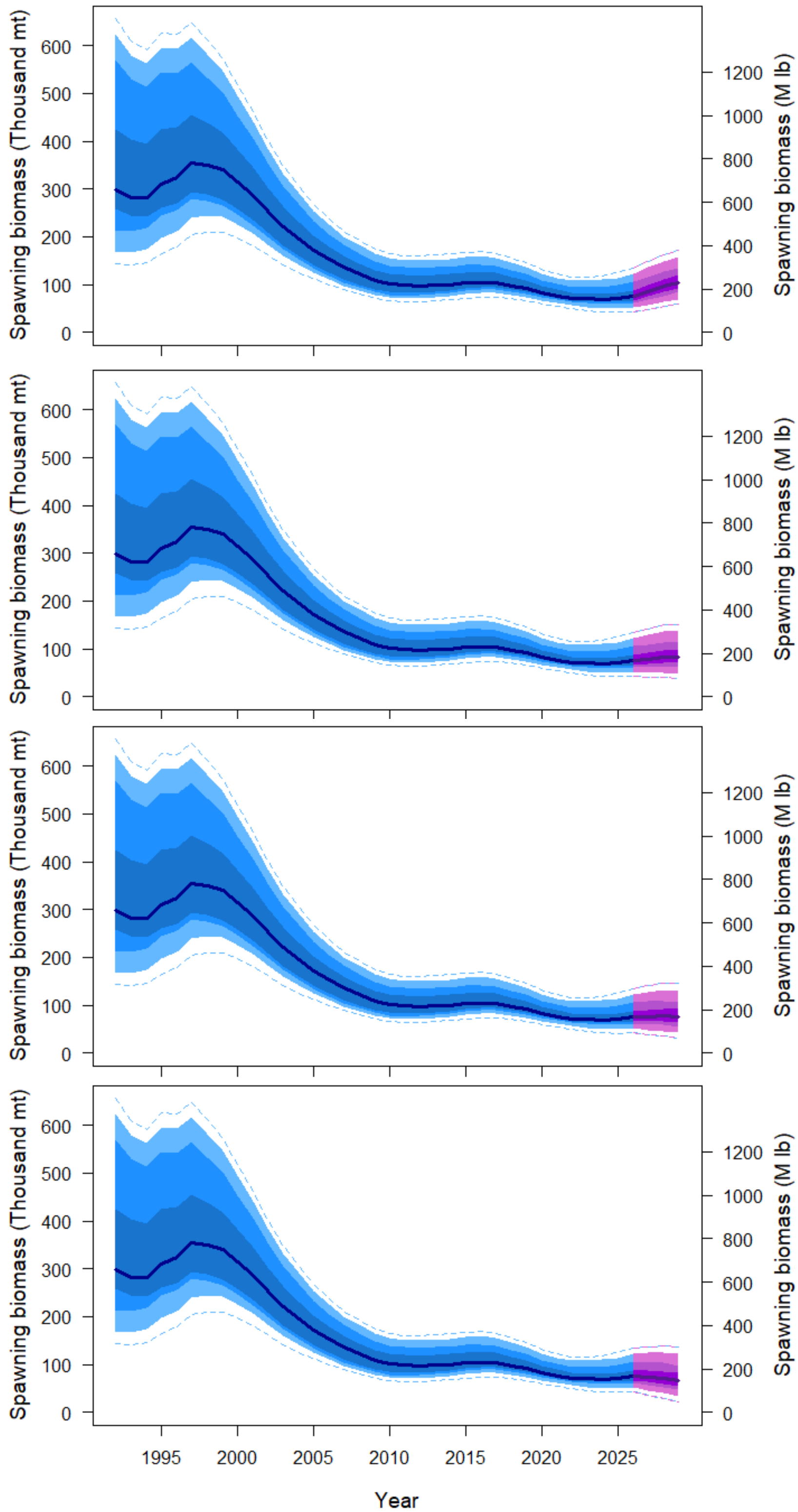

Figure 1. Three-year projections of stock trend under alternative levels of mortality: no fishing mortality (upper panel), the *status quo* coastwide TCEY set in 2025 (29.72 million pounds; second panel), the 3-year surplus and equivalent TCEY projected for the $F_{43\%}$ reference level of fishing intensity (38.95 million pounds, third panel) and the TCEY projected for the $F_{35\%}$ MSY proxy level of fishing intensity / overfishing limit (51.88 million pounds, bottom panel).

Table 2. Recent adopted TCEYs by IPHC Regulatory Area and coastwide (M lbs net).

Year	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
2013	1.11	7.78	5.02	17.07	5.87	2.43	1.93	4.28	45.48
2014	1.11	7.64	5.47	12.05	3.73	1.56	1.49	3.58	36.65
2015	1.06	7.91	6.20	13.00	3.72	1.96	1.53	4.27	39.63
2016	1.26	8.24	6.54	12.75	3.41	1.95	1.37	4.07	39.59
2017	1.47	8.32	7.04	12.96	3.98	1.80	1.34	3.84	40.74
2018	1.32	7.10	6.34	12.54	3.27	1.74	1.28	3.62	37.21
2019	1.65	6.83	6.34	13.50	2.90	1.94	1.45	4.00	38.61
2020	1.65	6.83	5.85	12.20	3.12	1.75	1.31	3.90	36.60
2021	1.65	7.00	5.80	14.00	3.12	2.05	1.40	3.98	39.00
2022	1.65	7.56	5.91	14.55	3.90	2.10	1.45	4.10	41.22
2023	1.65	6.78	5.85	12.08	3.67	1.73	1.36	3.85	36.97
2024	1.65	6.47	5.79	11.36	3.45	1.61	1.25	3.70	35.28
2024	1.65	5.45	5.22	9.08	2.86	1.34	1.04	3.08	29.72

RISKS NOT INCLUDED IN THE HARVEST DECISION TABLE

The IPHC's current management procedure uses threshold and limit reference points in relative spawning biomass (current estimate compared to the spawning biomass estimated to have occurred in that year in the absence of any fishing mortality). This calculation measures the effects of fishing on the stock. Other factors affecting the spawning biomass (i.e., trends in recruitment and weight-at-age) have resulted in the absolute spawning biomass in 2020-2026 estimated to be lower than at any time in the last 34 years. Although this does not represent a conservation concern at this time, low stock size results in additional risks to the IPHC's Fishery Independent Setline Survey (FISS) design objective of revenue neutrality and to fishery efficiency and economic viability. Increased environmental/climate-related variability in the marine ecosystems comprising the Pacific halibut species range in Convention waters lead to little expectation that historical productivity patterns may be relevant for future planning. Specifically, it is unclear whether long-term productivity levels are likely to occur under continued climate change, or whether increases or decreases may be likely for critical life-history stages of Pacific halibut. Recent poor recruitment (2006+) seems to suggest that the stock continues in a state of low productivity with no indication of when this prevailing condition may change.

ADDITIONAL INFORMATION

Estimates of non-directed discard mortality based on end-of-year information for 2025 will be available in early Janaury 2026. At that time, detailed mortality projection tables (reporting allocations to specific fishing sectors within individual IPHC Regulatory Areas) will be available on request and the mortality projection tool will be updated for 2026.

Detailed stock assessment (IPHC-2026-SA-01) and data overview (IPHC-2026-SA-02) documents will be published directly to the stock assessment page on the IPHC's website.

RECOMMENDATION/S

That the Commission:

a) **NOTE** paper IPHC-2025-IM101-12 Rev_1, which provides a summary of projections and the harvest decision table for 2026-2028.
b) **REQUEST** any additional harvest decision table alternatives for evaluation at AM102.
c) **REQUEST** any detailed mortality projections[2] for 2026 (by IPHC Regulatory Area and fishery sector) for evaluation at AM102.

REFERENCES

IPHC. 2020. Report of the 96th Session of the IPHC Annual Meeting (AM096). Anchorage, Alaska, USA, 3-7 February 2020. IPHC-2020-AM096-R. 51 p.

IPHC. 2025. IPHC Harvest Strategy Policy. IPHC-2025-HSP. 22 p.

[2] Detailed projections will include revised non-directed discard estimates through the end of 2025, available in early January 2026.

FISS design 2026-28

PREPARED BY: IPHC SECRETARIAT (R. WEBSTER, I. STEWART, K. UALESI, T. JACK & D. WILSON; 11 NOVEMBER 2025)

PURPOSE

To provide the Commission with updated FISS design options for 2026, along with potential designs for 2027 and 2028.

SUMMARY

The optimal long-term FISS design, the Base Block design, is not financially viable for 2026, with a projected loss of over US$1 million. This document presents a more cost-effective alternative option, the Supplemented Reduced Loss design, with a projected loss of close to US$0.5 million, along with a series of intermediate options in Appendix A.

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 for all stations 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. Annual FISS designs are developed by selecting a subset of stations for sampling from the full 1890-station FISS footprint (Figure 1).

In recent years, financial constraints due to reduced catch rates, lower sales prices and higher costs have led to the implementation of FISS designs with reduced spatial footprints compared to those that would provide optimal scientific information (low risk of bias and good precision while still maintaining cost effectiveness). Effort has been concentrated in IPHC Regulatory Areas 2B, 2C, 3A and 3B, with limited sampling in other areas (Figures 2 and 3).

The **Base Block design** was presented to the Commission at the September 2024 Work Meeting and the 14th Special Session of the IPHC (SS014, IPHC-2024-SS014-03) as a more efficient approach to annual sampling in the core of the stock compared to previous designs based on random selection of FISS stations. This design implements sampling of complete FISS charter regions (subsets of stations generally sampled by a single vessel via multiple trips), with sampled charter regions in the core of the stock (IPHC Regulatory Areas 2B, 2C, 3A and 3B) rotated over two or three years depending on IPHC Regulatory Area. In other IPHC Regulatory Areas, coverage is prioritized coverage based on minimizing the potential for bias and maintaining the coefficients of variation (CV, a relative measure of precision) below 25% for each IPHC Regulatory Area. The **Base Block design** includes some sampling in all IPHC Biological Regions in each year, ensuring that trend and biological data from across the spatial range of Pacific halibut are available to the stock assessment and for stock distribution estimation.

The **Base Block design** is considered the optimal long-term FISS design for the IPHC and is used as the benchmark for all other design proposals. The **Base Block design** will therefore be referred to as Option 1 moving forward.

As in 2025 (IPHC-2024-CR-030, IPHC-2024-CR-031), high projected financial costs to undertake the **Base Block design** (Option 1) in 2026 means that it is not currently a financially viable option without substantial supplementary funding being received (in excess of US$1 million).

Therefore, to assist the Commission in its decision-making processes, the IPHC Secretariat has developed a number of alternative options that reduce or modify the spatial coverage of the FISS, thereby reducing the financial deficit. This includes Option 2, which reduces the deficit to close to US$0.5 million. Option 2 is referred to as the **Supplemented Reduced Loss design**, and like all options considered in this document, its cost is partially covered by a voluntary contribution of US$513,000 from the USA for supporting the 2026 FISS (see Discussion below).

FISS DESIGN OBJECTIVES (Table 1)

Primary objective: *To sample Pacific halibut for stock assessment and stock distribution estimation.*

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 management. The priority of the current rationalized 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.

Secondary objective: *Cost effectiveness.*

The FISS is intended to be cost-effective without compromising the scientific integrity of the design. Any implemented design must consider logistics and cost together with scientific integrity.

Tertiary objective: *Minimize removals and assist others where feasible on a cost-recovery basis.*

Consideration is also given to the total expected FISS removals (impact on the stock), data collection assistance for other agencies, and emerging IPHC informational needs.

Table 1 Prioritized 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	Cost effectiveness without compromising the scientific integrity of the FISS design.	Balance operational feasibility/logistics, cost/revenue, and scientific needs. Includes an aspirational target reserve of US$2,000,000
Tertiary	Minimize removals, assist others where feasible on a cost-recovery basis, address specific Commission informational needs.	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

Annual design review, endorsement, and finalisation process

Since completion of the FISS expansions in 2019, a review process has been developed for annual FISS designs created according to the above objectives:

- Step 1: The Secretariat presents preliminary design options based on the primary objective (Table 1) to the SRB for three subsequent years at the June meeting based on analysis of prior years' data. Commencing in 2024, this has included preliminary cost projections based on prior year fiscal details (revenue) and current year vessel contract cost updates;
- Step 2: Updated design options for the following year that account for both primary and secondary objectives (Table 1) are reviewed by the Commission at the September work meeting, recognising that revenue and cost data from the current year's FISS are still preliminary at this time;
- Step 3: At their September meeting, the SRB reviews design options accounting for both primary and secondary objectives (Table 1) for comment and advice to the Commission (recommendation). FISS revenue and cost information from the current year is near-final at this time;
- Step 4: Designs are further modified to account for updates based on secondary and tertiary objectives before being finalized during the Interim and Annual meetings and the period prior to implementation:
    - Presentation of FISS designs for 'endorsement' by the Commission occurs at the annual Interim Meeting;
    - Ad-hoc modifications to the design for the current year (due to unforeseen issues arising) are possible at the IPHC Annual Meeting;

- The endorsed design for the current year is then modified (if necessary) to account for any additional tertiary objectives or revision to inputs into the evaluation of secondary objectives prior (i.e., updated cost estimates) and logistical considerations raised by the operators of contracted vessels prior to summer implementation (February-April).

Consultation with industry and stakeholders occurs throughout the FISS planning process, at the Research Advisory Board meeting (late November) 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 direct stakeholder input during public meetings (Interim and Annual Meetings).

Although 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 as additional data are collected. Having design proposals available for three years assists the Secretariat with medium-term planning of the FISS, and allows reviewers (SRB, Commission) and stakeholders to see more clearly the planning process for sampling the entire FISS footprint over multiple years.

POTENTIAL DESIGNS FOR 2026-28

OPTION 1: BASE BLOCK DESIGN

The **Base Block designs** (Option 1) shown in Figures 4 to 6 for 2026-28 were revised from the designs presented to Commissioners at AM101 to account for the Commission-approved 2025 design. In particular, charter regions not selected in IPHC Regulatory Areas 3A and 3B in 2025 were prioritized for sampling in 2026.

Using samples generated from the fitted 2024 space-time models as simulated data for 2025-28, we projected the CV for mean O32 WPUE for each year of the design by IPHC Regulatory Area. As CVs are generally greater in the terminal year of the time series and that year is usually the most relevant for informing management decisions, the CV values in Table 2 are for the final year of the modelled time series. For example, the values for 2027 were found by fitting the model to the data for 1993-2027, with simulated data used for 2025-27.

Table 2. Projected coefficients of variation (CVs, %) of mean O32 WPUE for the Base Block design by terminal year of time series and IPHC Regulatory Area and Biological Region.

Regulatory Area	Year 2026	2027	2028
2A	21	22	14
2B	11	7	10
2C	6	6	6
3A	8	7	8
3B	11	15	11
4A	18	22	13
4B	15	16	17
4CDE	9	9	8
Biological Region			
Region 2	6	5	5
Region 3	7	7	7
Region 4	9	10	7
Region 4B	15	16	17
Coastwide	4	4	4

Projected terminal year CVs for the Base Block design are 25% or less for all IPHC Regulatory Areas. In the core areas (2B, 2C, 3A and 3B), CVs are projected to be 15% or less (Table 2). All Biological Region CVs, except that of Region 4B, are at most 10%, while the coastwide CV is projected to be 4% in all years. The Base Block design is therefore expected to maintain precise estimates of indices of Pacific halibut density and abundance across the range of the stock. At the same time, the rotating nature of the sampled blocks means that almost all FISS stations are sampled within a 5-year period (2-3 years within the core areas) resulting in low risk of missing important stock changes and therefore a low risk of large bias in estimates of trend and stock distribution.

OPTION 2: SUPPLEMENTED REDUCED LOSS DESIGN

Option 2, the **Supplemented Reduced Loss Design** (Figure 7) is a design that meets the broad spatial coverage goals of the Option 1, while modifying which stations are sampled in order to account for the Secondary Priority of the FISS (Table 1). If adopted, Option 2 would include FISS sampling in all IPHC Biological Regions, and some sampling in all IPHC Regulatory Areas except 4CDE (expected to be sampled by NOAA trawl) and 2A. Option 2 differs from the Base Block design (Option 1) as follows:

- Replaces one revenue-negative charter region in IPHC Regulatory Area 2B with two regions projected to be revenue-positive
- Adds one revenue-positive region to IPHC Regulatory Area 2C
- Replaces three high-cost regions in IPHC Regulatory Area 3A with two regions that ensure projected overall losses are maintained close to US$0.5 million
- Has one fewer charter region in IPHC Regulatory Area 3B

COST PROJECTIONS

Table 3 provides cost and revenue projections for the Base Block design (Option 1) and the Supplemented Reduced Loss design (Option 2). Projections include the following assumptions:

1. Designs are optimized for numbers of skates, with 4, 6 or 8 skate-sets used, depending on projected catch rates and bait costs
2. Pacific halibut price will decline by 10% from 2025 values
3. Pacific halibut landings will decline by 5% from 2025 values
4. The price of chum salmon bait increases to US$2.50 per pound from $1.65 per pound in 2025.

Regarding #2, there was a large average increase in price from 2024 to 2025, but without fully understanding the reasons for this increase, it seems prudent and precautionary to assume that prices will return to values closer to those experienced in previous years. Further, 2025 FISS catch rates show that in much of the stock, the landings have continued to decline and therefore it is reasonable to assume a further decline from 2025 to 2026.

Potential modular changes to Option 2 that lead to designs (Options 3 to 10) intermediate to it and the **Base Block design** (Option 1) are provided in Appendix A, along with other modular options that add sampling outside of footprint of the 2026 Base Block design (Options 11 to 16). If selected, options from the latter set would bring sampling forwards by 1-3 years from what is currently proposed under future Base Block designs.

Table 3. Comparison of projected income and expenses for the 2026 Base Block design (Option 1) and the Supplemented Reduced Loss design (Option 2) ($US). (Totals may not equal the sum of individual rows due to rounding.)

Design		Option 1 (Base Block)	Option 2 (Supplemented Reduced Loss)
Income	Pacific halibut sales	1,747,000	2,519,000
	Byproduct sales	85,000	102,000
	Voluntary contribution - USA	513,000	513,000
	Total	**2,345,000**	**3,134,000**
Expenses	Base HQ (staff salary and wages, and benefits x 4)	(534,000)	(534,000)
	Vessel contracts	(1,366,000)	(1,382,000)
	Field staff (salary and wages, and benefits)	(492,000)	(492,000)
	Bait	(414,000)	(457,000)
	Non-IPHC fish sales	(224,000)	(301,000)
	Other expenses*	(471,000)	(471,000)
	Total	**(3,500,000)**	**(3,636,000)**
Net revenue		**($1,155,000)**	**($502,000)**

*Other costs include training, personnel expenses, mailing and shipping, travel, technology, gear replacement, customs fees, bait storage fees, field supplies and equipment, equipment maintenance fees, facility rental fees, and communication fees.

DISCUSSION

The **Base Block design** (Option 1) has a projected net loss of ~$1,155,000 and therefore would rely on additional supplementary funding for implementation. While the **Supplemented Reduced Loss design** (Option 2) has a similar number of stations to the Base Block design, it prioritizes some regions that have been fished recently over others that were included in the Base Block design because they lacked recent sampling. This helps ensure that the Secondary Objective is met (Table 1) by reducing net operating losses. Coverage in Biological Region 3 is reduced for the Option 2 design relative to the Base Block design (Option 1), increasing the chance of bias in estimates for that region. Nevertheless, the Option 2 design represents a substantial improvement in coverage over the implemented 2025 design, and complements the 2025 design by including seven charter regions not sampled this year: two each in 2B and 2C, one each in 3A and 3B, and one in 4A. Compared with 2024 and 2025, this will result in more representative biological data, more precise indices of abundance and stock distribution, and an assessment model that is less reliant on commercial data.

Option 2 is financially viable due to the USA's voluntary contribution of **US$513,000** to support the 2026 FISS. We note that the USA requested that the voluntary contribution be spent as follows:

- US$265,000 to fund the FISS in IPHC Regulatory Area 4B;
- US$163,000 to fund one FISS charter region in IPHC Regulatory Area 3B;
- US$85,000 to partially fund the FISS in IPHC Regulatory Area 4A.

The voluntary USA contribution has allowed for a greater number of stations to be included in Option 2 than would otherwise have been viable.

We note that water column profiler information from the FISS in IPHC Regulatory Area 2A shows evidence for hypoxia in some parts of that area. However, initial analysis shows dissolved oxygen levels in most of the sampled habitat to be high enough to support Pacific halibut. Estimated declines in catch rates in IPHC Regulatory Area 2A from 2024 are consistent with other components of Biological Region 2.

RECOMMENDATION

That the Commission:

1. **NOTE** paper IPHC-2025-IM101-13 Rev_1, that provides FISS design options for 2026, and potential designs for 2027-28
2. **ENDORSE** a design for implementation in 2026 from the options provided in Appendix A.

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Appendix A: Modular design options

Table A.1 lists potential modular changes to the 2026 **Supplemented Reduced Loss design** (Option 2) that lead to designs intermediate to Option 1 (**Base Block Design**) and Option 2 in terms of cost. See Figure 8 for a map showing the FISS charter regions named in the table. For Options 3 to 10, the values in the fourth column are the projected changes in net revenue for the overall FISS design that would result from implementing a given option. The change in overall net revenue from selecting multiple modular options from Options 3 to 10 is found by summing the values for each of the selected options.

Table A.2 presents options for expanding coverage into parts of the stock not covered by either the Option 1 or Option 2, in IPHC Regulatory Areas 2A, 4B and 4CDE. Figure 9 shows the stations in each of the options in Table A.2 except for Option 15b, which repeats the 2025 FISS design in IPHC Regulatory Area 2A (Figure 2). As with Options 3 to 10 in Table A.1, the change in overall net revenue from selecting multiple modular options from Options 11 to 16 is found by summing the values for each of the selected options.

Table A.1 Cost projections of modular changes to Option 2 (Supplemented Reduced Loss) design that would result in intermediate designs between it and the 2026 Base Block design (Option 1). Each of modular Options 3 to 10 can be added in any combination to Option 2, with the net revenue of the resulting FISS design found by summing the revenue changes for each selected option. For reference, FISS charter regions are shown in Figure 8.

Option	Design	Sampled IPHC Regulatory Areas (with number of FISS charter regions)	Projected net revenue	Benefit/rationale
1	Base Block	2B(2), 2C(2), 3A(4), 3B(2), 4A(1), 4B(1)	($1,155,000)	Optimal long-term design
2	Supplemented Reduced Loss	2B(3), 2C(3), 3A(3), 3B(1), 4A(1), 4B(1)	($502,000)	Financially viable design using IPHC FISS reserve funds.
	Design change	**Change in sampling**	**Projected change in net revenue**	
3	Add Semidi	3B(+1)	($150,000)	Improves 3B coverage. Last sampled 2023.
4	Replace Prince William Sound with Gore Pt	3A(+0)	($64,000)	Gore Point last sampled 2023, PWS in 2025.
5	Replace Yakutat with Fairweather	3A(+0)	($102,000)	Fairweather last sampled 2023, Yakutat in 2025.
6	Add Goose Island	2B(+1)	($106,000)	Improves 2B coverage. Last sampled 2023.
7	Add Shelikof	3A(+1)	($101,000)	Improves 3A coverage. Last sampled 2024.
8	Remove St James	2B(-1)	($66,000)	Removes lower-priority revenue-positive region. Last sampled 2024.
9	Remove Ketchikan	2C(-1)	($2,000)	Removes lower-priority revenue-positive region. Last sampled 2024.
10	Remove Charlotte	2B(-1)	($65,000)	Removes lower-priority revenue positive region. Last sampled 2025.

Table A.2 Projected change in net revenue for modular design add-ons to Option 1 or Option 2 that would expand FISS coverage to stations not included in either option (Figure 9).

Option	Design change	Change in sampling	Projected change in net revenue	Benefit/rationale	Next proposed sampling in Base Block design
11	Add 4CDE South (includes St George, St Paul and St Matthew)	4CDE(+1)	($205,000)	Add FISS coverage to highest density part of 4CDE. Last sampled in 2024.	2027
12	Add 4CDE Central	4CDE(+1)	($155,000)	Add FISS coverage to 4CDE. Last sampled in 2022.	2029
13	Add 4CDE North	4CDE(+1)	($171,000)	Add FISS coverage to 4CDE. Last sampled in 2021.	2029
14	Add Attu	4B(+1)	($214,000)	Improves 4B coverage. Last sampled in 2019.	2027
15a	Add highest-density stations in 2A	2A(+1)	($268,000)	For comparison with 2025 (localized hypoxia). Partially sampled in 2025.	2028
15b	Repeat 2025 2A design	2A(+1)	($247,000)	Smaller, more cost-effective comparison with 2025 than Option 15a.	N/A
16	Add medium-density stations in 2A	2A(+1)	($295,000)	Last sampled in 2017-18.	2027

Appendix B: FISS history and modelling

FISS history 1993-2019

The IPHC has undertaken FISS activity since the 1960s, although methods were not standardized to a degree (e.g., the bait and gear used) that allowed for simple combined data 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) bottom trawl survey (Webster et al. 2020).

Through 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 historical 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 of the unsurveyed habitat in 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 standardized fishing of longline gear in shallower waters. The 400-fathom maximum depth is understood to cover the vast majority of Pacific halibut summer habitat. A second expansion in IPHC Regulatory Area 2A was completed in 2013, with a pilot survey in California waters between the latitudes of 40 and 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, 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 developing annual FISS designs. This station selection process began in 2019 for the 2020 FISS and continues with the current review of design proposals for 2026-28. 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 the National Oceanic and Atmospheric Administration (NOAA) Bering Sea trawl survey (stations can vary by year – standard grid stations are shown in Figure 1) and the Alaska Department of Fish and Game (ADFG) trawl survey conducted in Norton Sound (40-60 stations). Both supplementary surveys have been conducted approximately annually in recent years.

Rationalized FISS, 2020-25

Following the 2011-2019 program of FISS expansions, a rationalized FISS design was approved for 2020 based on random selection of over 50% of stations in the core of the stock (IPHC Regulatory Areas 2B, 2C, 3A and 3B) and sampling of all stations in selected subareas of the remaining IPHC Regulatory Areas. For the latter areas, sampling priorities were determined based on maintaining precise estimates of area-specific indices of density and ensuring low bias in index estimators. That year, the COVID19 pandemic led to a reduced FISS with realized sampling only in the core areas. The 2021-22 FISS sampling proceeded largely as designed, although planned stations in western IPHC Regulatory 4B in 2022 were unsampled due to a lack of viable charter bids. In some charter regions in the core areas, 100% of stations were sampled in order to achieve revenue goals (see below). The 2023 FISS design had more limited spatial coverage, with almost no FISS sampling outside of the core areas due to large projected revenue losses from designs that included extensive sampling in IPHC Regulatory Areas 2A, 4A, 4B and 4CDE. Limited sampling was carried out in northern IPHC Regulatory 2A, while planned stations around the IPHC Regulatory Area 4A/4B boundary were again not sampled due to a lack of charter bids. The adopted 2024 FISS design (IPHC-2024-AM100-R) included high sampling rates in IPHC Regulatory Areas 2B and 2C, a small number of charter regions in IPHC Regulatory Areas 3A and 3B, and sampling of the southern shelf edge and Bering Sea islands in IPHC Regulatory Area 4CDE. The 2025 design (Figure 2) included stations in IPHC Regulatory Areas 3A and 3B that complemented coverage in recent years along with stations in IPHC Regulatory Areas 2A, 4A and 4B that had not been sampled for three or more years. This design was expected to reduce the potential for bias in most IPHC Regulatory Areas relative to 2023 and 2024 designs (see Figure 3).

Space-time modelling

Since 2016, a space-time modelling approach has been used 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 represents an improvement over the largely empirical approach used previously, as it uses information contained within the survey data to estimate the degree of spatial and temporal correlation in Pacific halibut density, along with information from covariates such as depth (see Webster 2016, 2017). It also allows 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. Prior to the application of space-time modelling, these unsampled regions were either imputed using independently estimated scalar calibrations (if fished at least once) or catch-rates at unsampled stations were assumed to simply be equal to the mean for the entire Regulatory Area. The

IPHC's Scientific Review Board (SRB) has supported 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). The IPHC space-time models are fitted through the R-INLA package in the R software (R Core Team, 2025). Importantly, the space-time modelling approach enables the development of annual designs that are optimized to achieve the maximum quality of scientific information possible with the least amount of sampling required.

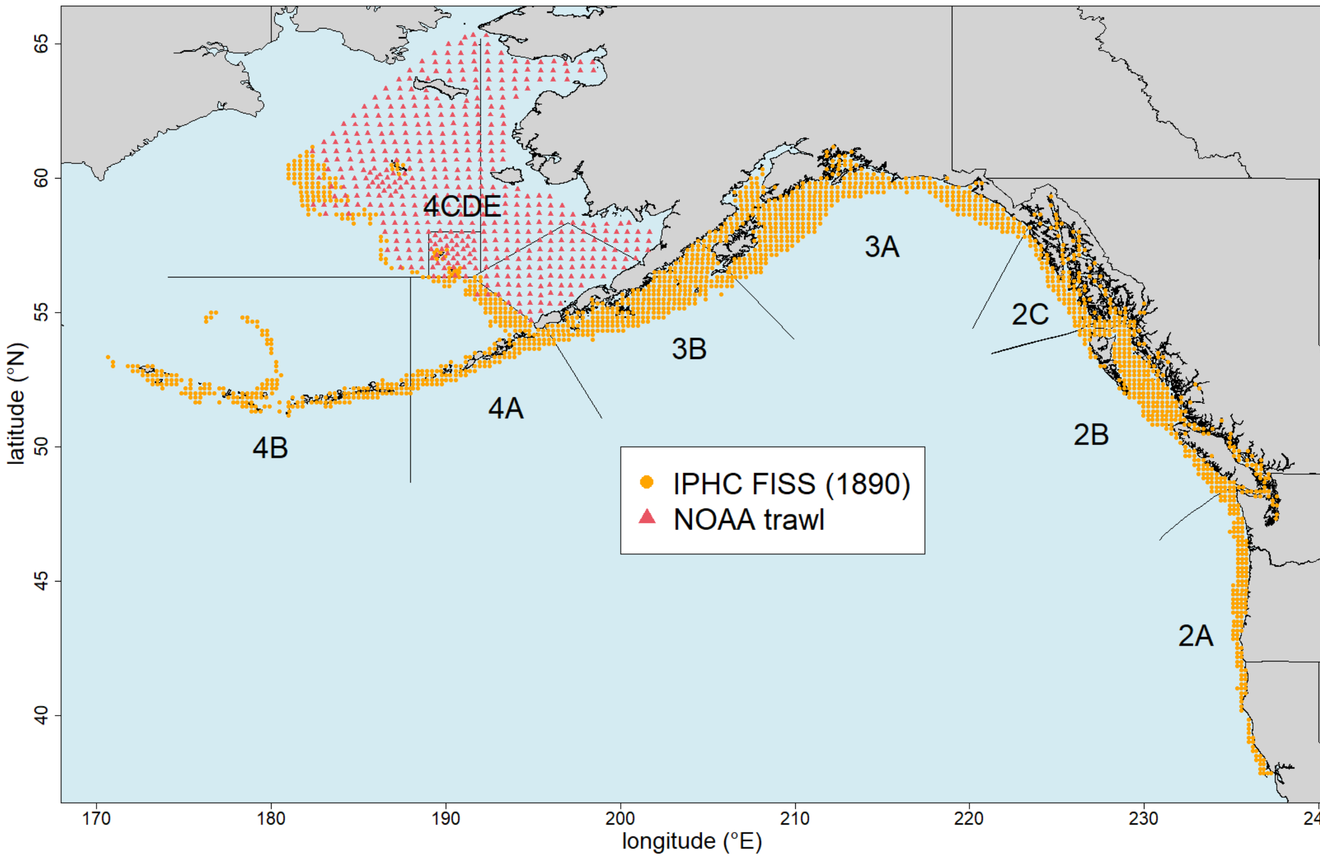


Figure 1. Map of the full 1890 station FISS design, with orange circles representing stations available for inclusion in annual sampling designs. Red triangles represent standard locations of NOAA trawl stations used to provide complementary data for Bering Sea modelling (actual NOAA trawl design can vary year-to-year).

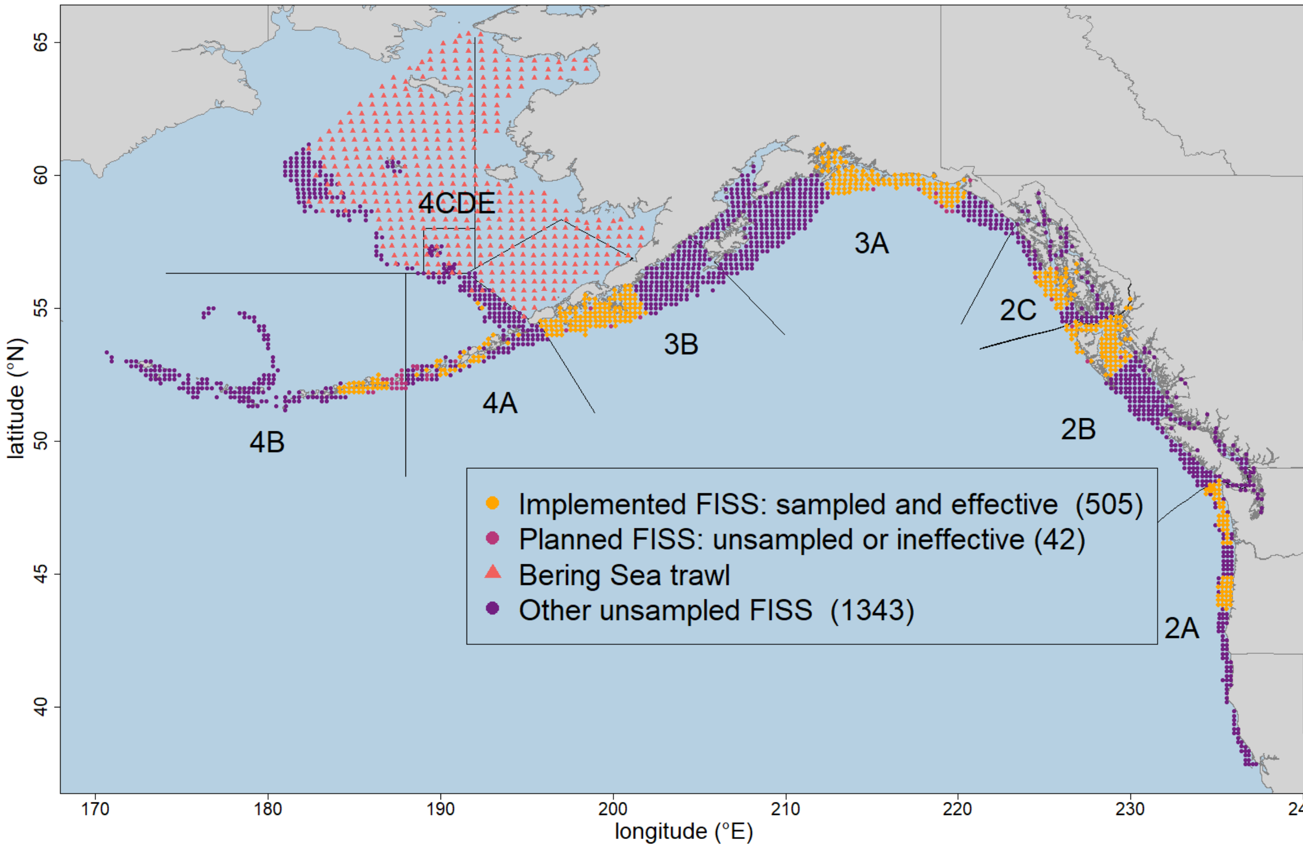


Figure 2. Map of implemented 2025 sampled FISS design showing sampled stations with data used in modelling (orange circles for FISS, red triangles for trawl), along with planned but ineffective FISS stations.

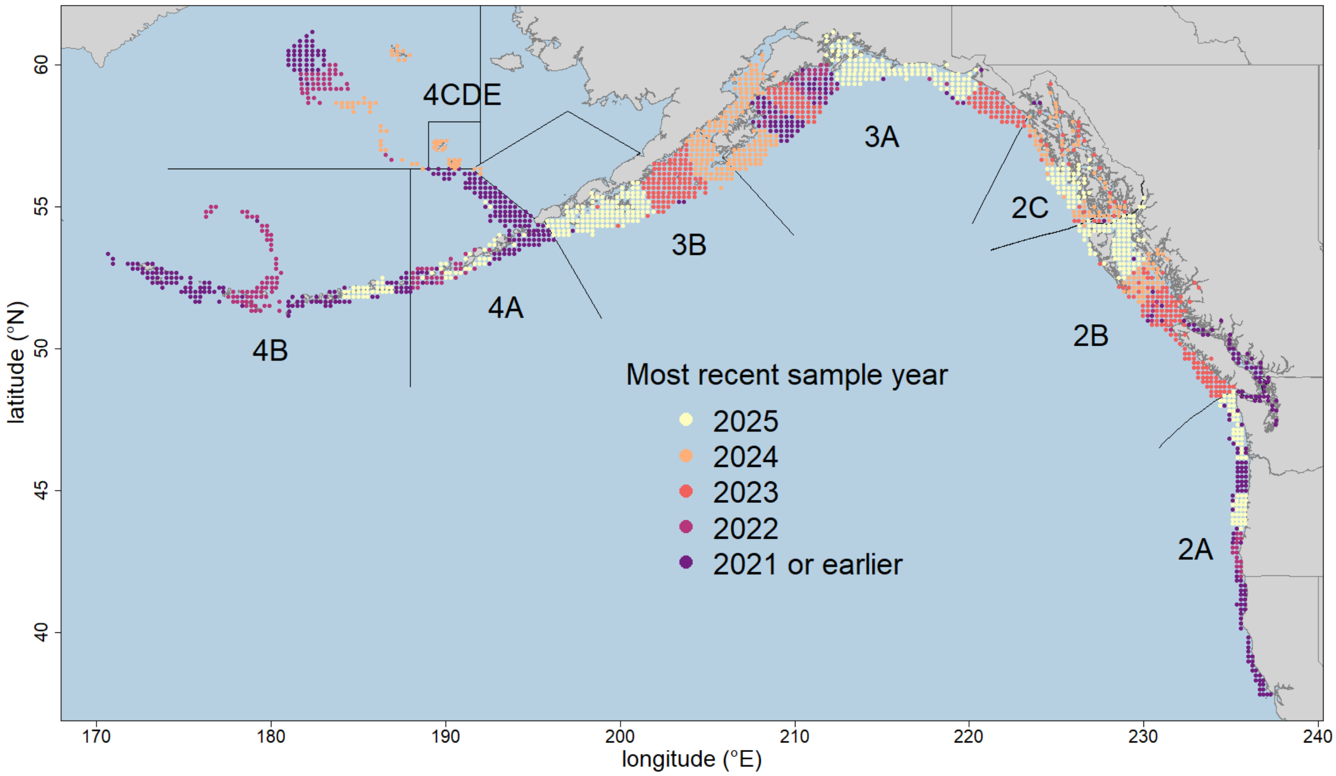


Figure 3. Map showing the most recent sample year of each station on the full FISS grid.

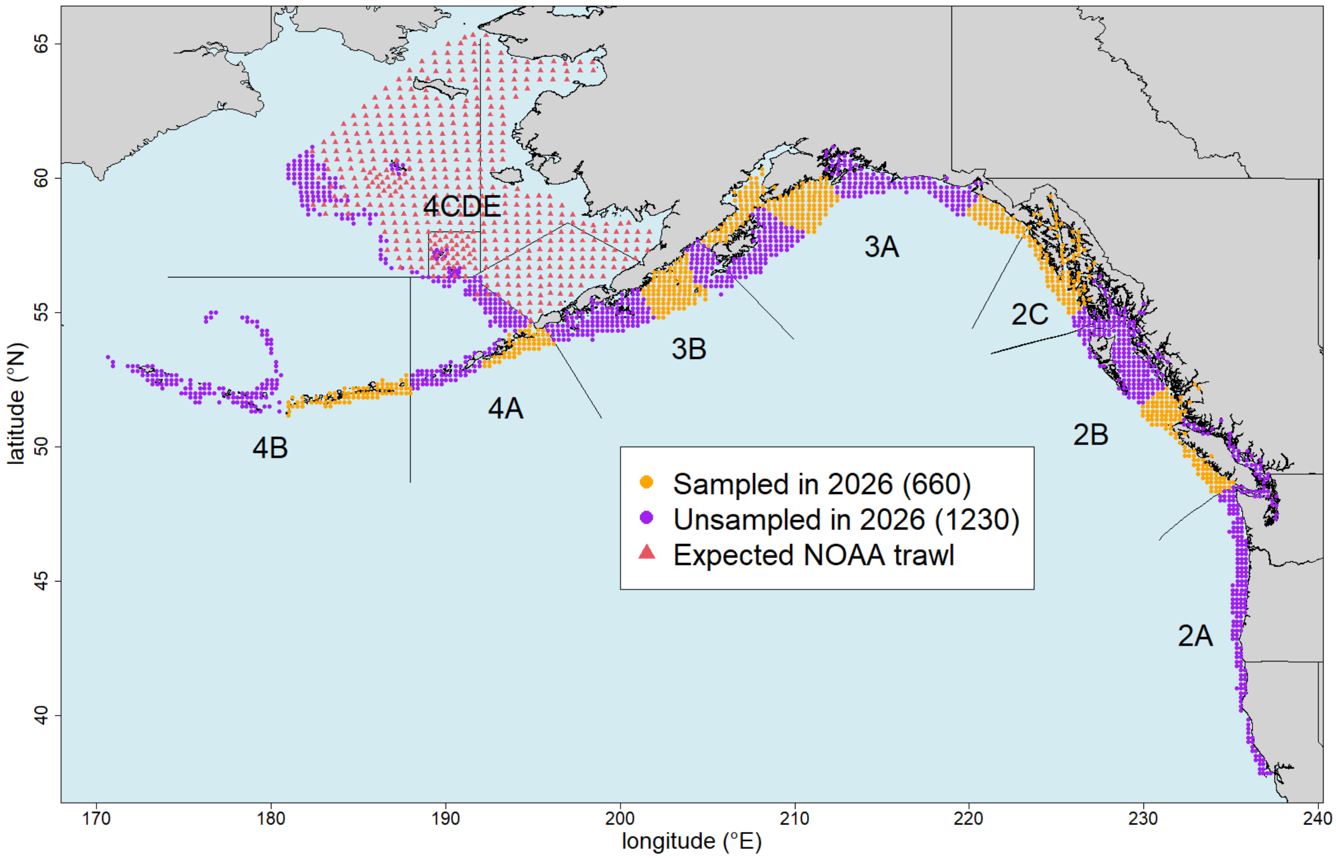


Figure 4. Base Block design for 2026 (orange circles). Design is based on fishing 2-4 complete blocks of stations (charter regions) in the core areas (2B, 2C, 3A and 3B) and previously implemented subareas elsewhere.

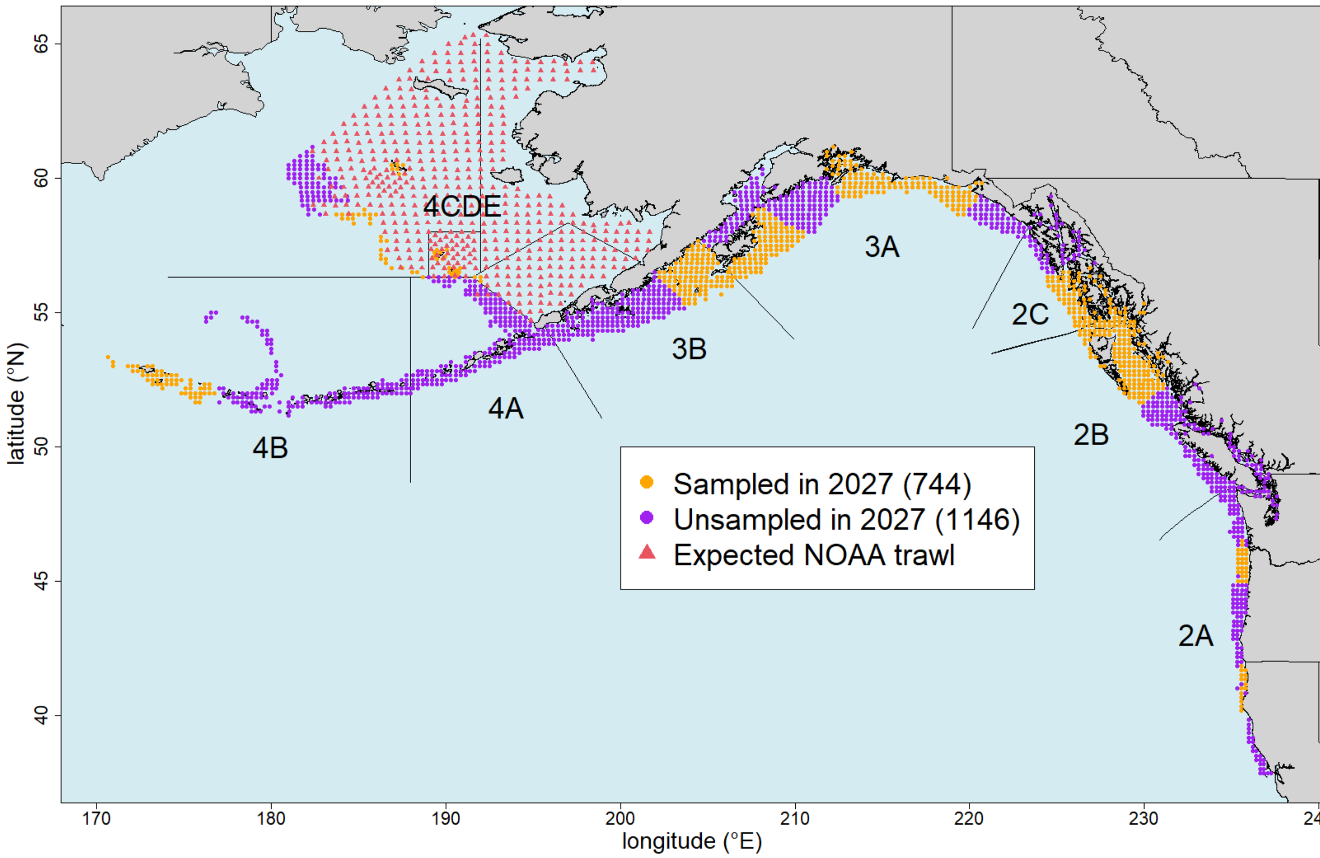


Figure 5. Base Block design for 2027 (orange circles). Design is based on fishing 2-4 complete blocks of stations (charter regions) in the core areas (2B, 2C, 3A and 3B) and previously implemented subareas elsewhere.

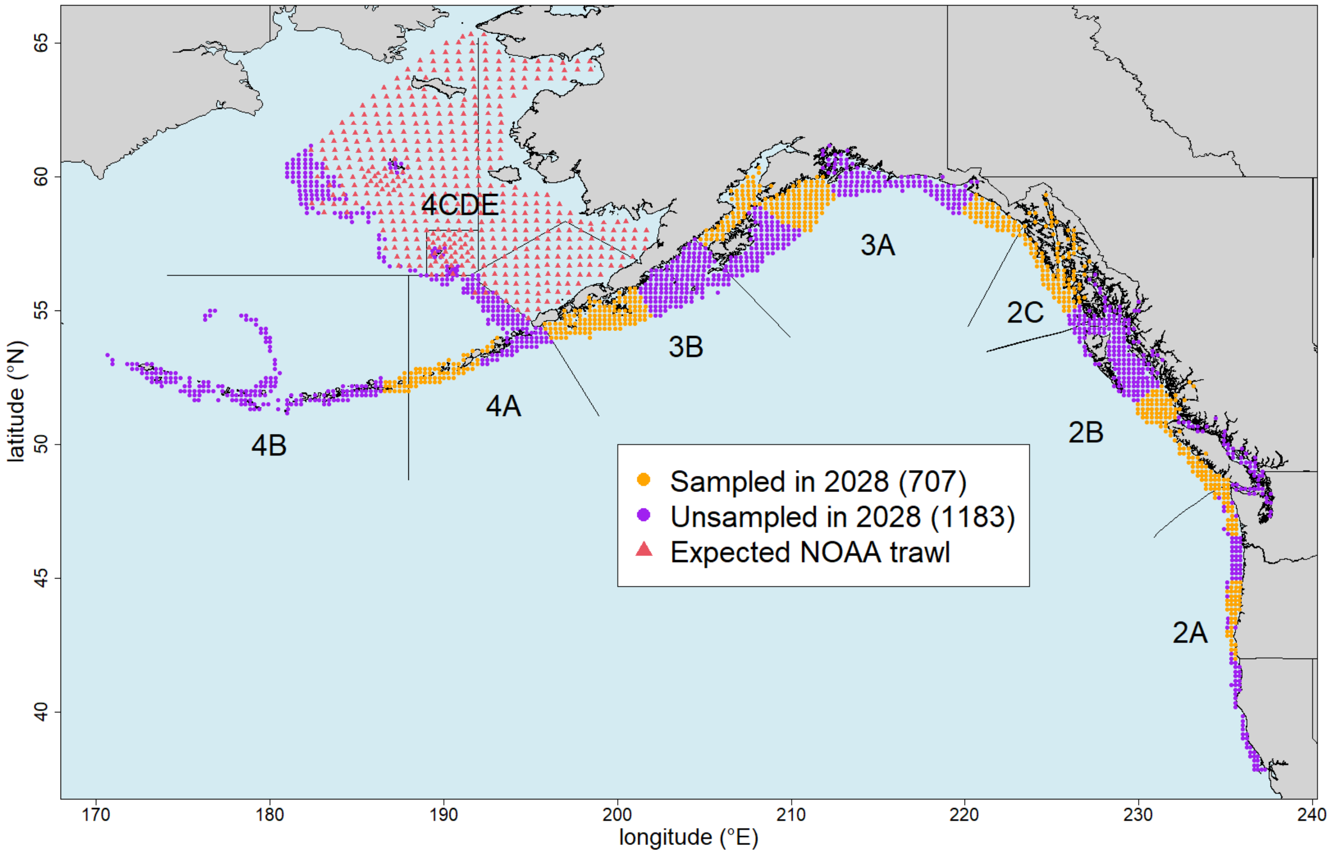


Figure 6. Base Block design for 2028 (orange circles). Design is based on fishing 2-4 complete blocks of stations (charter regions) in the core areas (2B, 2C, 3A and 3B) and previously implemented subareas elsewhere.

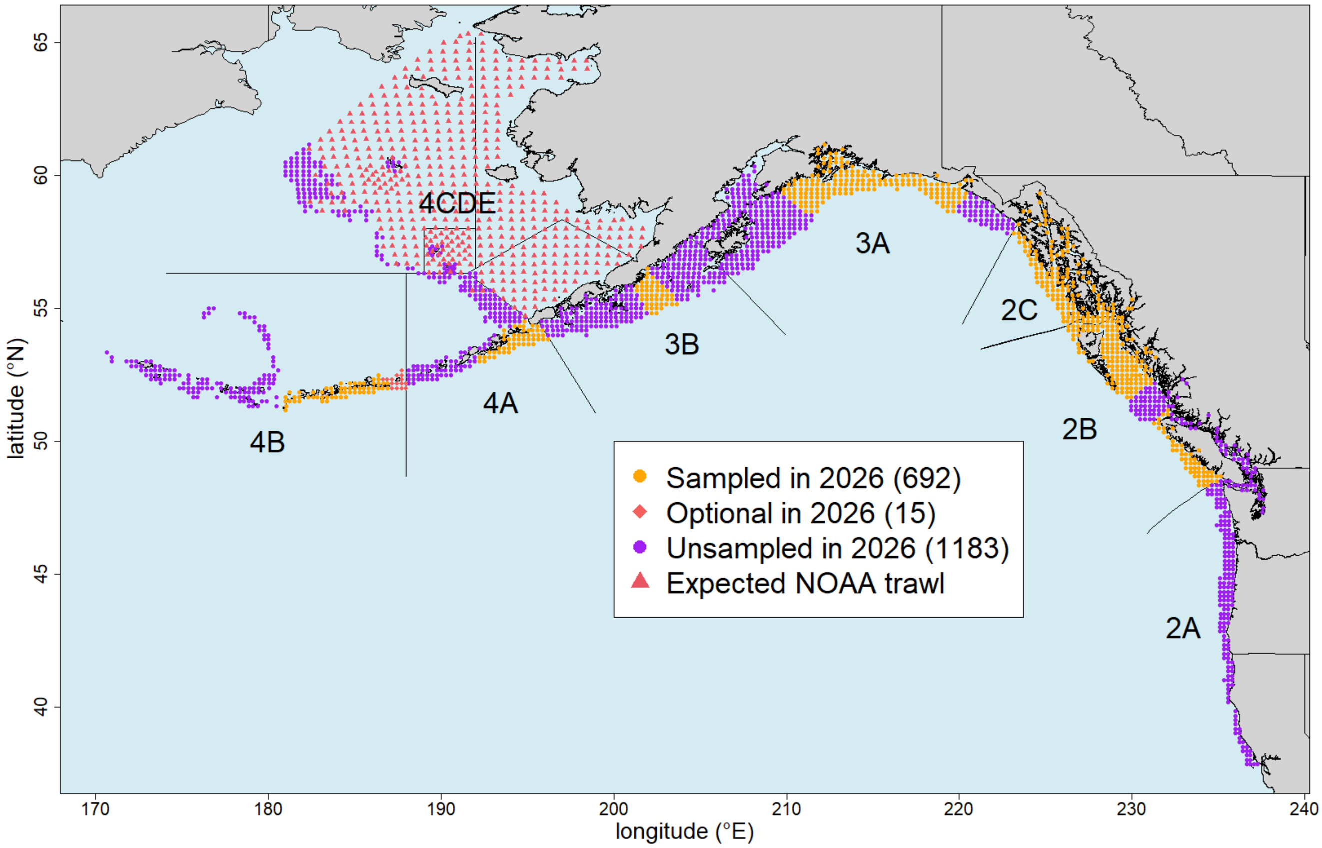


Figure 7. Supplemented Reduced Loss design for 2026 that includes the most cost-effective charter regions in Biological Region 3, projected revenue-positive charter regions in Biological Region 2, and stations in IPHC Regulatory Areas 2A, 4A and 4B covered by supplementary funding. Fifteen stations in IPHC Area 4B have proved challenging to fish successfully in recent years and are considered optional for 2026 to help attract charter bids.

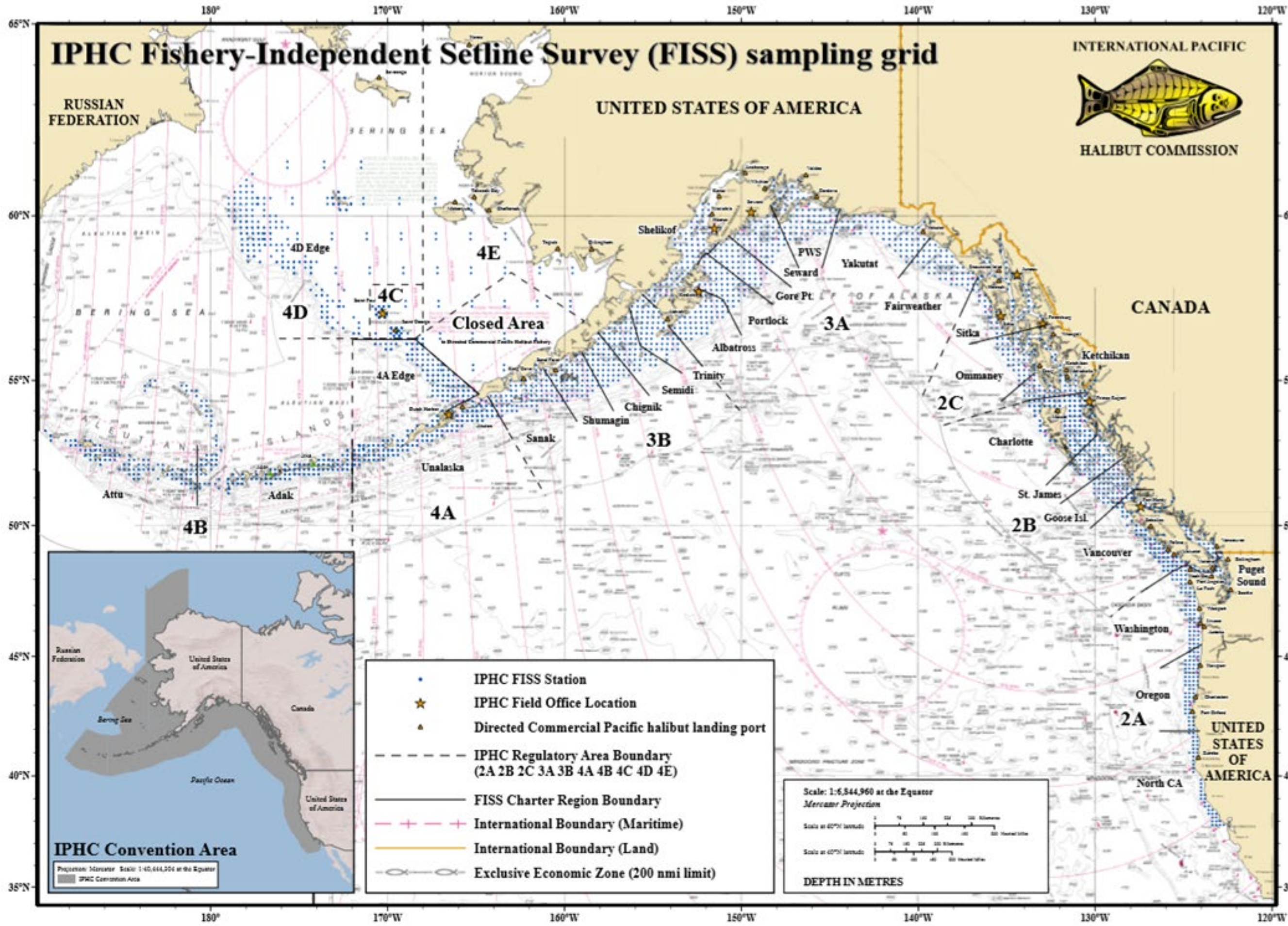


Figure 8. IPHC FISS showing full station grid and current FISS charter regions.

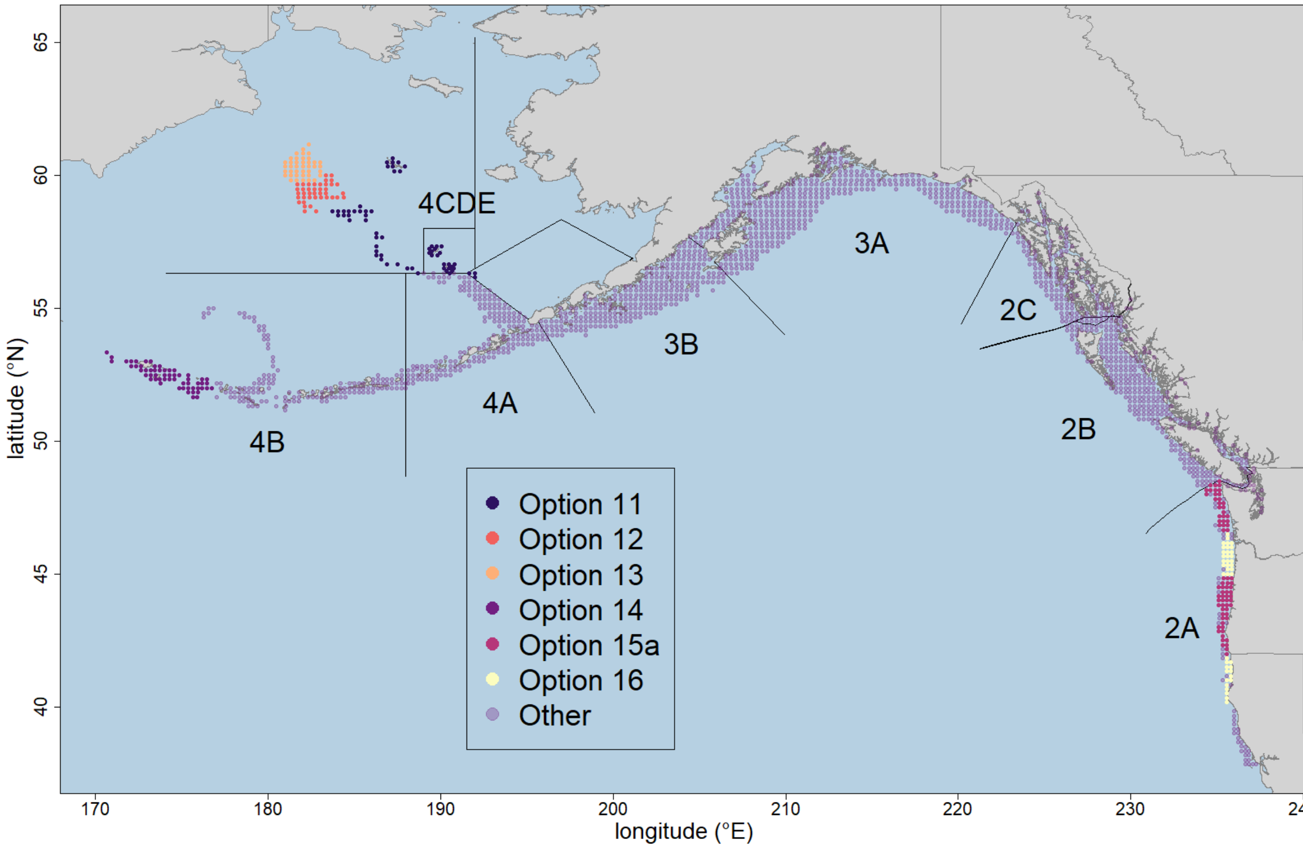


Figure 9. IPHC FISS modular Options 11 to 16 (Table A.2) for 2026.

Report on Current and Future Biological and Ecosystem Science Research Activities

PREPARED BY: IPHC SECRETARIAT (J. PLANAS, 29 OCTOBER 2025)

PURPOSE

To provide the Scientific Review Board with a description of progress towards research activities described in the IPHC's five-year Program of Integrated Research and Monitoring (2022-2026).

BACKGROUND

The primary biological and ecological research activities at the IPHC that follow Commission objectives are identified and described in the IPHC Five-Year Program of Integrated Research and Monitoring (2022-2026). These activities are integrated with stock assessment (SA) and the management strategy evaluation (MSE) processes (Appendix I) and are summarized in five main areas, as follows:

1) Migration and Population Dynamics. Studies are 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.
2) Reproduction. Studies are aimed at providing information on the sex ratio of the commercial catch and to improve current estimates of maturity and fecundity.
3) Growth. Studies are 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.
4) Mortality and Survival Assessment. Studies are aimed at providing updated estimates of discard mortality rates in the guided recreational fisheries and at evaluating methods for reducing mortality of Pacific halibut.
5) Fishing Technology. Studies are aimed at developing methods that involve modifications of fishing gear with the purpose of reducing Pacific halibut mortality due to depredation and bycatch.

A ranked list of biological uncertainties and parameters for SA (Appendix II) and the MSE process (Appendix III) and their links to research activities and outcomes derived from the five-year research plan are provided.

UPDATE ON PROGRESS ON THE MAIN RESEARCH ACTIVITIES

1. Migration and Population Dynamics.

   The IPHC Secretariat is currently focusing on studies that incorporate genomics approaches in order to produce useful information on population structure, distribution and connectivity of Pacific halibut. The relevance of research outcomes from these activities for the 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 the SA (Appendix II). Furthermore, the relevance of these research outcomes for the MSE process is in biological parameterization and validation of movement estimates, on one hand, and of recruitment distribution, on the other hand (Appendix III).

1.1. Population genomics. Understanding population structure is imperative for sound management and conservation of natural resources. Pacific halibut in US and Canadian waters are managed as a single, panmictic population on the basis of tagging studies and historical (pre-2010) analyses of genetic population structure that failed to demonstrate significant differentiation in the eastern Pacific Ocean. While genetic techniques previously employed in fisheries management have generally used a small number of markers (i.e. microsatellites, ~10-100), whole-genome scale approaches can now be conducted with lower cost and are able to provide orders of magnitude more data (millions of markers) that allow investigating genetic variation in fish populations at an unprecedented resolution.

The main purpose of the present study is to conduct an analysis of Pacific halibut population structure in IPHC Convention waters using state-of-the-art low-coverage whole genome resequencing (lcWGR) methods that leverage the reference genome for Pacific halibut generated by the IPHC Secretariat (Jasonowicz et al., 2022). We have recently conducted additional sequencing of genetic samples in order to balance the sample sizes for the sample collections that comprise our genetic baseline (i.e. samples collected in the winter during the spawning season) (Figure 1) and to increase the total number of samples available for analysis. With the additional 161 samples sequenced, the final collection of genetic samples representing the complete baseline dataset to finalize our population genomic studies consists of 731 separate individuals (Figure 1, Table 1).

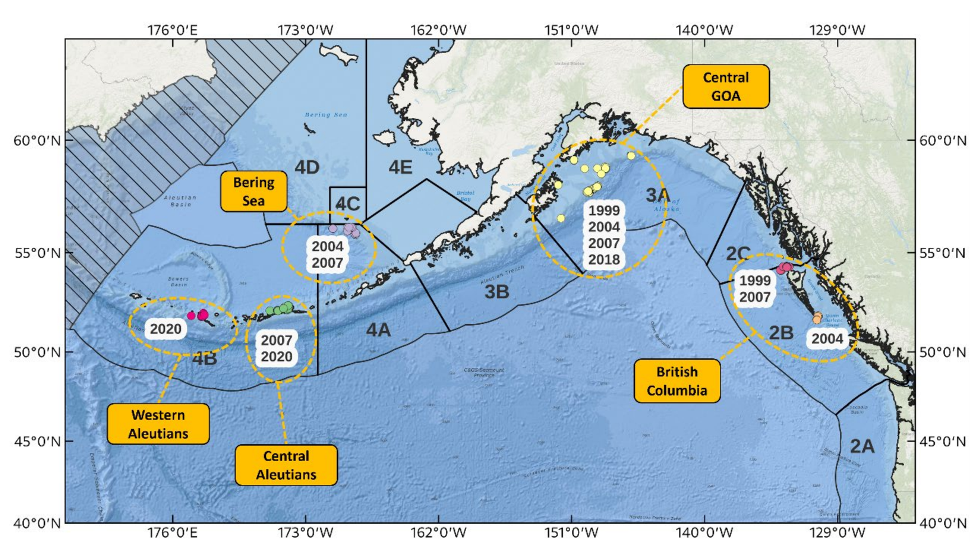


Figure 1. Map of sample collections made during the spawning season used for genomic analysis of population structure in Pacific halibut in the northeast Pacific Ocean.

Winter Collections (baseline samples)					
	1999	2004	2007	2018	2020
British Columbia (winter)	59	63	61		
GOA (winter)	61	61	61	60	
Bering Sea (winter)		61	61		
Central AI (winter)			61		61
Western AI (winter)					61

Table 1. Final sample sizes for each area in the baseline dataset by year of sample collection after a minimum sequencing depth threshold of 1x is applied.

We identified 8,460,466 Single Nucleotide Polymorphisms (SNPs) in fully assembled autosomal regions of the Pacific halibut genome. Following the removal of 751,285 SNPs in regions of the genome identified as problematic for read mapping and SNPs with a global minor allele frequency (MAF) < 0.05, we retained 3,676,428 SNPs for further analysis. We conducted principal component analysis (PCA) and, after removing 22 outlier samples in the baseline dataset, the results evidenced a single cluster of samples with a large degree of overlap among the geographic areas (Figure 2).

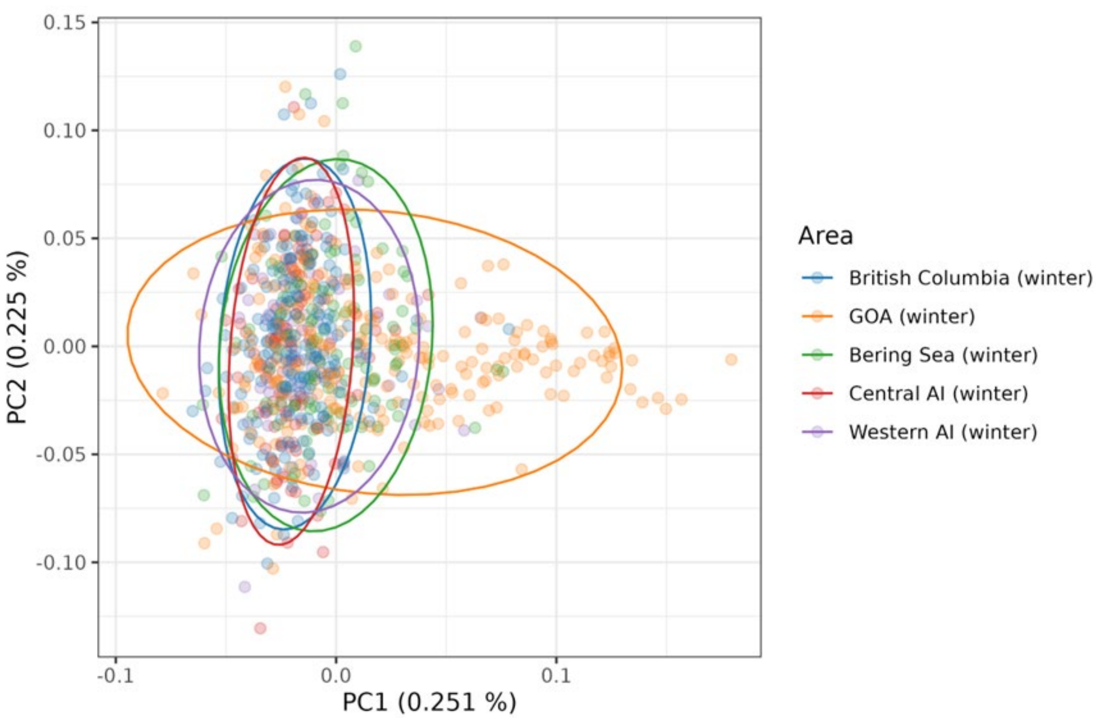


Figure 1. PCA biplot of the first two PC axes for 709 Pacific halibut collected during the spawning season (winter) in IPHC Convention Waters. Individuals are colored by geographic area in all panels with 95% confidence ellipses drawn for each geographic area.

We also conducted assignment testing using the same procedure as previously detailed. With the increased samples sizes afforded by the additional baseline samples, we are able to potentially increase the accuracy of the population specific allele frequencies required for conducting individual assignment tests. Nevertheless, our results showed reduced overall assignment accuracy of 27.27% with 8.06% of the individuals being classified as unassigned.

The concept of stock and the ability to define management units is central to sound management of marine fishes (Begg et al. 1999; Cadrin 2020). Advances in genomic technology have led to the development of useful and powerful tools that can aid in the delineation of management units (Bernatchez et al. 2017). Despite using very high-resolution genomic methods to characterize genomic variation in spawning groups of Pacific halibut collected over large spatial and temporal scales, the results presented here are consistent with genetic panmixia. From a management perspective, these results support IPHC's current stock assessment practices that model the Pacific halibut stock as a single coastwide unit (Stewart and Hicks 2024). A paper describing these results is currently being written for publication in a leading peer-reviewed journal.

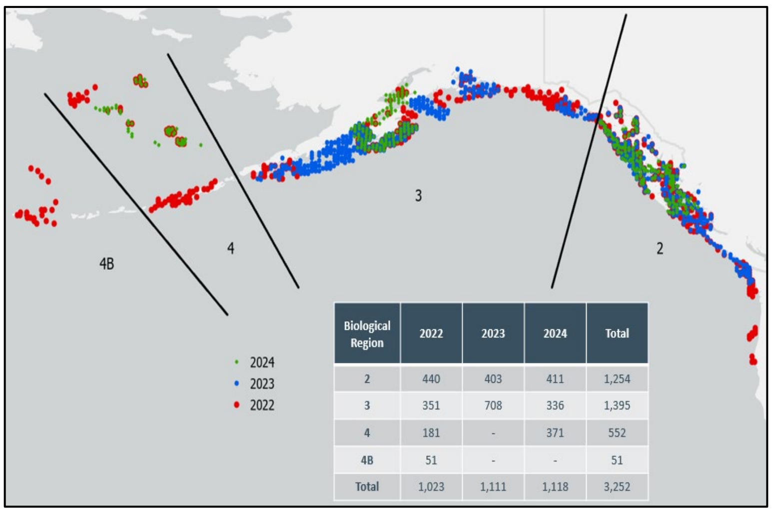
2. Reproduction.

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 the 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 some of the most important biological inputs for the SA. The relevance of these research outcomes for the MSE 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. The IPHC Secretariat has completed the processing of genetic samples from the 2024 aged commercial landings.

2.2. Reproductive assessment. Recent sensitivity analyses have shown the importance of changes in spawning output due to changes in maturity schedules and/or skip spawning and fecundity for the SA (Stewart and Hicks, 2018). Information on these key reproductive parameters provides direct input to the SA. For example, information on fecundity-at-age and -size could be used to replace spawning biomass with egg output as the metric of reproductive capability in the SA and management reference points. This information highlights the need for a better understanding of factors influencing reproductive biology and success of Pacific halibut. To fill existing knowledge gaps related to the reproductive biology of female Pacific halibut, research efforts are devoted to characterizing female reproduction in this species. Specific objectives of current studies are: 1) to update maturity schedules based on histological-based data; 2) to calibrate historical visual maturity schedules using histological-based data; and 3) to conduct fecundity estimations.

2.2.1. Update of maturity schedules based on histological-based data. The IPHC Secretariat is undertaking studies to revise maturity schedules in all four IPHC Biological Regions through histological (i.e. microscopic) characterization of maturity, as reported previously. The coastwide maturity schedule (i.e. the proportion of mature females by age) that is currently used in the SA was based on visual (i.e. macroscopic) maturity classification in the field (Fishery-independent Setline Survey (FISS)). To revise currently used maturity schedules, the IPHC Secretariat has collected ovarian samples for histology during the 2022, 2023 and 2024 FISS. The 2022 FISS sampling resulted in a total of 1,023 ovarian samples collected. Due to a reduced FISS design in 2023, sampling only occurred in Biological Regions 2 and 3 and resulted in a total of 1,111 ovarian samples collected. In 2024, 411, 336 and 371 ovarian samples were collected in Biological Regions 2, 3 and 4, respectively. In total, 3,252 ovarian samples have been collected for histology between 2022 and 2024 (Figure 3).



Biological Region	2022	2023	2024	Total
2	440	403	411	1,254
3	351	708	336	1,395
4	181	-	371	552
4B	51	-	-	51
Total	1,023	1,111	1,118	3,252

Figure 3. Map of 2022, 2023 and 2024 maturity samples for histology collected on FISS. Red dots (2022), blue dots (2023) and green dots (2024) indicate a distinct FISS station in which a sample was collected.

The IPHC Secretariat has continued to collect ovarian samples for maturity in the 2025 FISS. Targets for 2025 were to collect 400 samples in Biological Regions 2 and 3, 188 in Biological Region 4, and 414 in Biological Region 4B. These samples will allow us to further investigate both spatial and temporal differences in histological-based female Pacific halibut maturity.

Ovarian samples from 2022 to 2024 were processed for histology and scored for maturity using histological maturity classifications previously developed and used by the IPHC Secretariat (Fish et al. 2020, 2022). Following this maturity classification criteria, all sampled Pacific halibut females were assigned to either the mature or immature categories. Maturity ogives (i.e., the relationships between the probability of maturity determined by histological assessments and variables including IPHC Biological Region, age, and year) were estimated by fitting generalized additive models (GAM) with logit link (i.e., logistic regression). We first ran again the best-fit logistic GAM models using log(Age), Biological Region, and year for the 2022-2024 samples.

To examine temporal changes in maturity across all Biological Regions, we plotted the three years of histological data by Biological Region (Figure 4). Overall, there appeared to be a shift to the left in maturity ogives from 2022 to 2024 in the three Biological Regions (2, 3, and 4) with multiple years of data, indicating younger maturing females in 2024 than in 2022 and 2023. This could potentially be indicative of a particular year class maturing through the population; however, this is difficult to discern with only three years of data. Therefore, it will be important to continue to monitor temporal trends in histological-based maturity ogives.

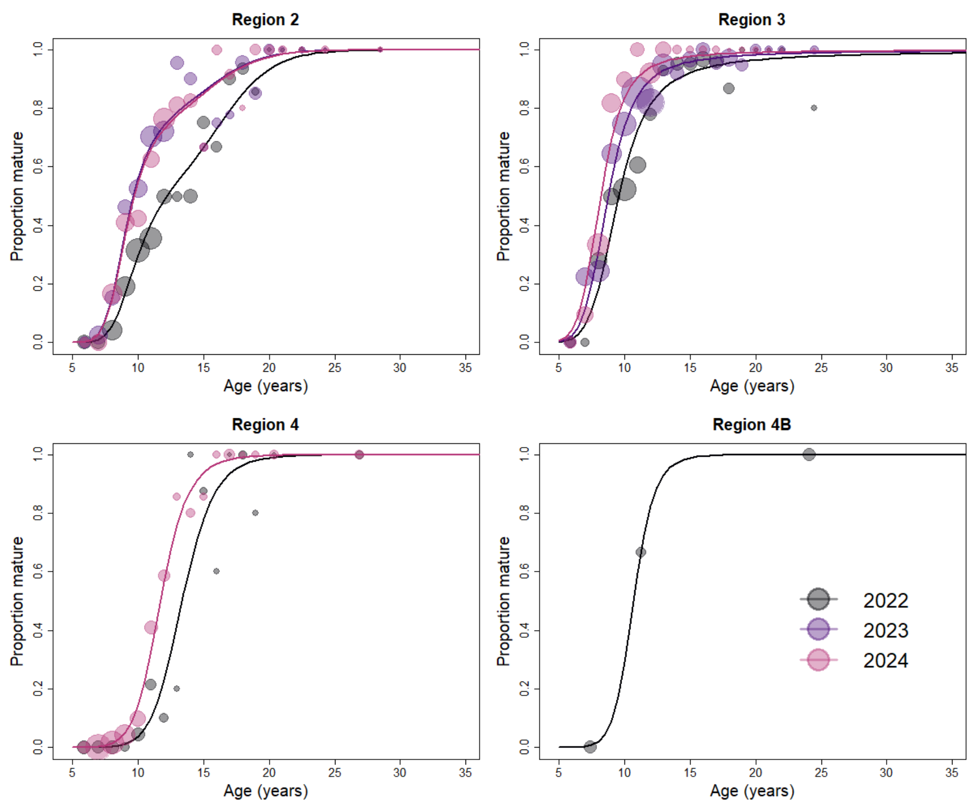


Figure 4. Female Pacific halibut age at maturity by IPHC Biological Region and year using best-fit logistic generalized additive models (GAM).

To estimate a coastwide ogive with the 2022-2024 histology-based maturity data, we removed the year effect from the logistic GAM model and pooled all years by Biological Region. The logistic GAM estimated maturity curves for each IPHC Biological Region. Noting that sample size was not proportional to population size for each region, we used the average estimated regional abundance proportions from 2022-2024 from IPHC's space-time modeling of FISS numbers per unit effort (NPUE) data as weights in estimating a coastwide maturity ogive (Figure 5).

Histology-based age at 50% maturity (A50) was at 9.8 years, lower than the currently used maturity estimates from visual (field) data (A50 = 11.6 years).

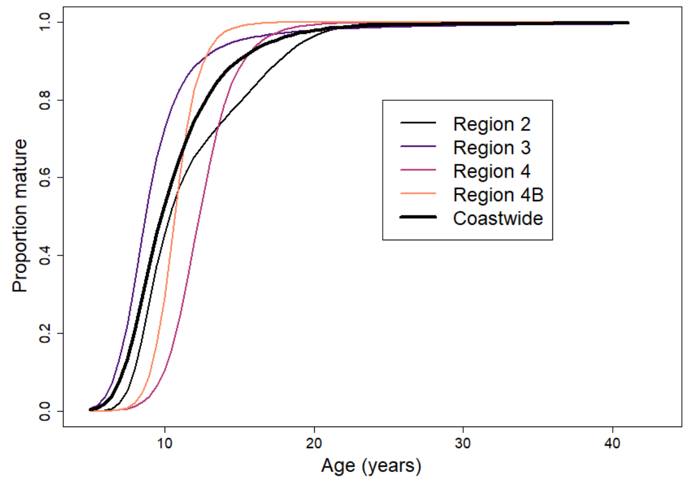


Figure 5. Coastwide maturity ogive generated from 2022-2024 average estimated regional abundance proportions (thick black line) and individual Biological Region ogives.

2.2.2 Calibration of historical visual maturity schedules using histology-based data. After creating a new coastwide maturity ogive using histology-based maturity estimates from 2022 to 2024 (Figures 5 and 6, black lines), we created a new coastwide visual maturity ogive based on visual (field) maturity estimates from the same females (Figure 6, blue line), yielding an A50 value of 10.3 years. When comparing this new coastwide visual ogive to the current SA ogive (Figure 6, red line), a higher proportion of mature females is observed between the ages of 8 to 13 years.

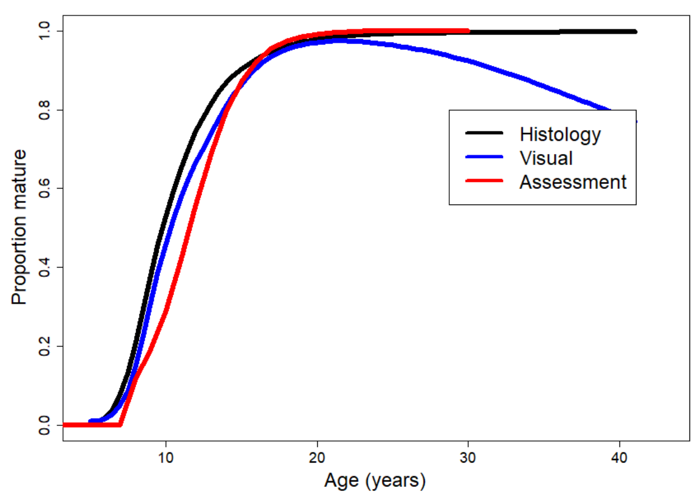


Figure 6. Coastwide maturity ogive generated from 2022-2024 average estimated regional abundance proportions using histological (black) and visual (blue) maturity estimation methods. The current coastwide ogive (red) used in SA is shown for reference.

The IPHC Secretariat has been collecting visual maturity data during the FISS since 2002 with ages determined using the current break-and-burn method. To create a maturity time series consistent with the more accurate histological assessments, we first developed a calibration between histological and visual maturity curves from the 2022-2024 data. Just as maturity curves are estimated for each Biological Region, we estimated separate calibration factors for each region. The coastwide calibrated visual maturity ogives for each year of the 2002-2024 time series are shown in Figure 7. These results evidence two temporal shifts, one characterized by the maturity curves shifting to the right (i.e. females maturing at a later age) from approximately 2005 to 2015, and the second characterized by the maturity curves shifting to the left (i.e. females maturing at an earlier age) from approximately 2016 until 2024. Studies are planned to identify possible drivers of these temporal shifts in age-at-maturity in female Pacific halibut.

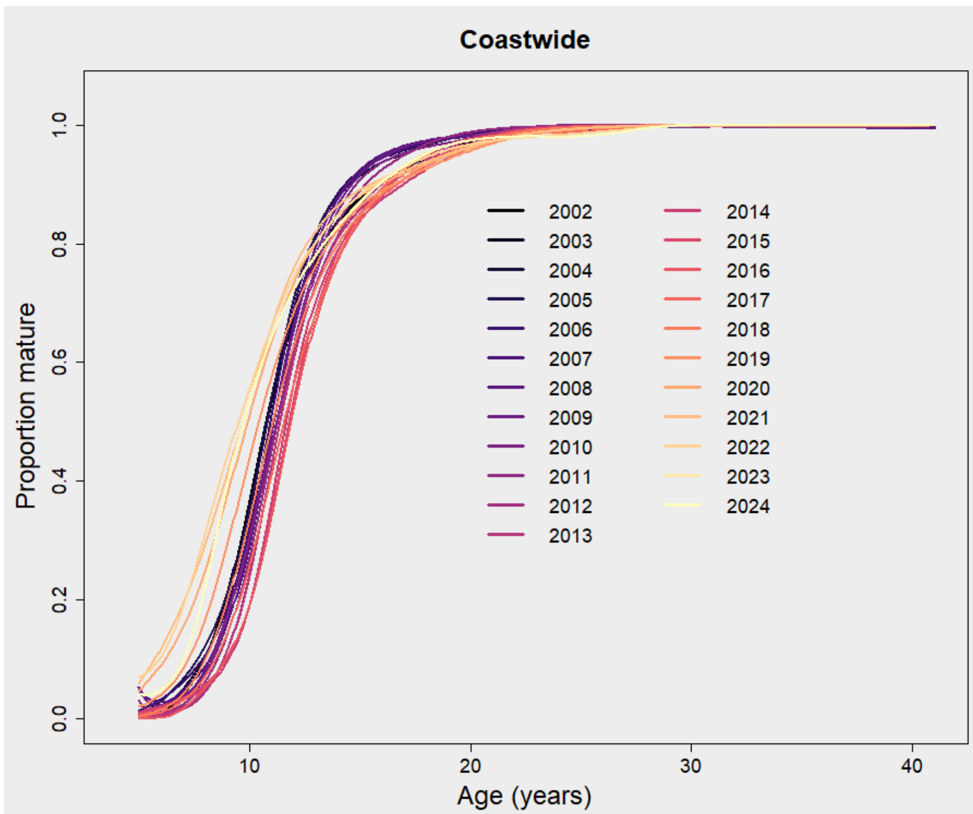


Figure 7. Estimated calibrated maturity ogives as a function of age.

A mean coastwide calibrated visual maturity ogive for the 2002-2024 time series was generated by averaging across all three-year rolling data windows (i.e. 2002-2004, 2003-2005, 2004-2006, etc.) (Figure 8, overlapping green and black lines). This new coastwide calibrated visual ogive has an A50 value of 11.0 years, that is, 0.6 years lower than that of the visual maturity ogive currently used in SA (A50 =

11.6 years, as derived exclusively from two years of maturity data from IPHC Regulatory Areas 2B and 3A; Figure 8, red line). These results, although not directly comparable because of differences in the length of the data series and in the geographic coverage, suggest that the new calibrated maturity ogive estimates a higher proportion of younger maturing females ages 8-15 years as well as a lower proportion of older maturing females ages 15-20 years when compared to the currently used maturity ogive. These shifts in the maturity curves are to be expected as the histology-based data provide a better indicator of younger maturing females, but also of older immature females. Current efforts are devoted to incorporate the new revised visual maturity ogive into future SAs.

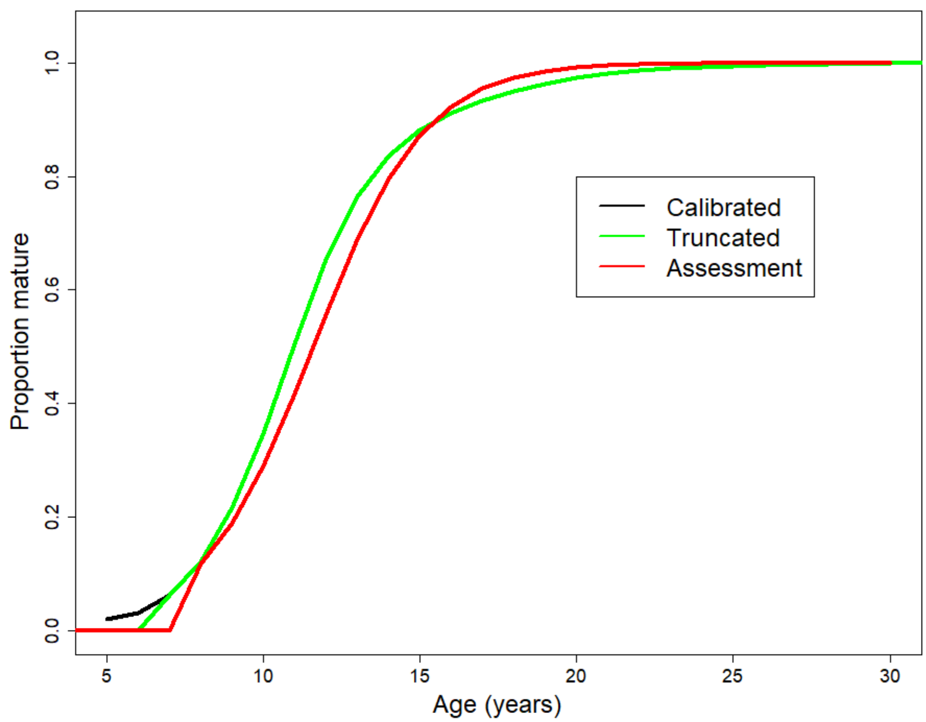


Figure 8. Estimated mean calibrated visual maturity ogive (black) with same ogive overlayed but truncated to zero at age 7 (green) because no females under this age have been found to be mature. Current coastwide ogive (red) used in stock assessment shown for reference.

2.2.3. <u>Fecundity estimations.</u> The IPHC Secretariat has initiated studies that are aimed at improving our understanding of Pacific halibut fecundity. This will allow us to estimate fecundity-at-size and -age and could be used to replace spawning biomass with egg output as the metric for reproductive capability in stock assessment and management reference points. Fecundity determinations will be conducted using the auto-diametric method (Thorsen and Kjesbu 2001; Witthames et al., 2009) and IPHC Secretariat staff received training on this method by experts in the field (NOAA Fisheries, Northeast Fisheries Science Center, Wood Hole, MA) in May 2023. Ovarian samples for the development and application of the auto-diametric method to estimate fecundity in female Pacific halibut have been collected during the FISS in 2023, 2024 and 2025. In 2023, sampling was conducted only in Biological Region 3, with a total of 456 fecundity samples collected. In 2024, sampling was conducted in Biological Regions 2 and 4, with 149 and 359 fecundity samples collected, respectively. In the Fall of 2024, 273 additional fecundity samples targeting large females (85-200+ cm in fork length) were collected in Biological Region 2. In 2025, in addition to samples collected in the FISS, 254 fecundity samples were collected in Biological Region 2 in a special project targeting large females during the late Summer/early Fall. This comprehensive collection of ovarian samples will be used initially for the development of the auto-diametric method, followed by actual fecundity estimations by age and by size (length and weight).

3. Growth.

Research activities conducted in this Research Area aim at providing information on somatic growth processes driving size-at-age in Pacific halibut. The relevance of research outcomes from these activities for the SA 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 MSE 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. By conducting integrated transcriptomic, proteomic and stable isotope analyses, we have demonstrated growth plasticity to temperature in juvenile Pacific halibut and identified growth biomarkers that could help characterize somatic growth variation in the Pacific halibut population. The results of these studies have been recently published in a leading peer-reviewed journal (Planas et al., 2025).

4. Mortality 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 SA. Bycatch and wastage of Pacific halibut, as defined, respectively, 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 regulatory reasons), 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 the SA resides in their ability to improve trends in unobserved mortality to improve estimates of stock productivity and represent the most important inputs in fishery yield for the SA (Appendix II). The relevance of these research outcomes for the MSE process is in fishery parametrization (Appendix III).

4.1. Estimation of discard mortality rates in the charter recreational sector. Results from a recently completed study investigating discard mortality rates and characteristics of fish captured and released using guided recreational fishery practices are currently being prepared for publication in a peer-reviewed journal.

5. Fishing technology.

The IPHC Secretariat has determined that research to provide the Pacific halibut fishery with tools to reduce whale depredation is considered a high priority (Appendix I). This research is now contemplated as one of the research areas of high priority within the 5-year Program of Integrated Research and Monitoring (2022-2026). Important management implications of these studies reside in improving estimations of mortality of Pacific halibut in the directed commercial fishery that will lead to improved estimates of stock productivity (Appendix II). Depending on the estimated magnitude of whale depredation, this may be included as another explicit source of mortality in the SA and mortality limit setting process.

The IPHC secretariat has been investigating gear-based approaches to catch protection as a means for minimizing whale depredation in the Pacific halibut and other longline fisheries with funding from NOAA's Bycatch Research and Engineering Program (BREP) (NOAA Awards NA21NMF4720534 and NA23NMF4720414; Appendix IV). The results and outcomes of the initial pilot phase of this project indicated that the underwater shuttle was a safe and effective catch protection device which entrained comparable quantities, sizes, and species of fish as the control gear. The second phase of this project took place in May 2025 in IPHC Regulatory Area 4A aboard a chartered commercial fishing vessel (Figure 9), and involved refining effective methods related to the deployment and use of the underwater shuttle, and conducting tests in the presence of orcas to demonstrate the efficacy and safety of the gear. Eighteen sets were successfully completed, generating 15 sets of shuttle and control catch comparison data along with close to 80 hours of underwater footage combined (control, shuttle exterior, shuttle interior). Depredating orcas were present at 6 of the paired sets (Figure 9D). Preliminary comparisons of data from 10 sets with completed video review show good entrainment for Pacific halibut, but high escapement for sablefish. Catch rate comparisons between the control gear and the shuttle (deployed across two skates of gear or 200 hooks) demonstrated capacity for good entrainment by the shuttle, but with variable rates overall between sets.

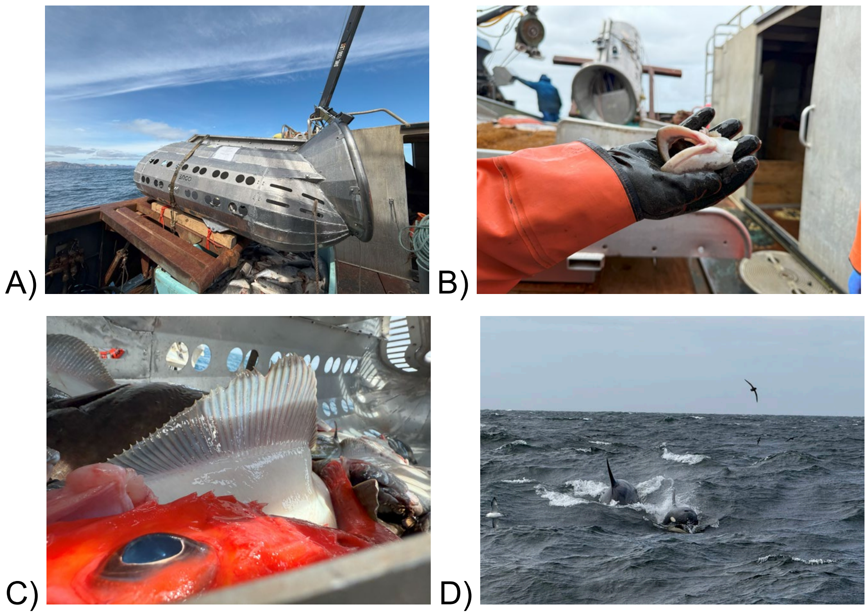


Figure 9. A) Shuttle device in transport. B) Typical evidence (lips only) of depredation. C) Catch entrained within the shuttle. D). Killer whales rapidly approaching the hauling site.

The IPHC Secretariat is currently reviewing the remainder of the video data and conducting the final catch data analyses.

Recommendation/s

That the Commission:

1) **NOTE** paper IPHC-2025-IM101-14, that provides a report on current and planned biological and ecosystem science and research activities contemplated in the IPHC's Five-Year Program of Integrated Research and Monitoring (2022-2026).

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APPENDIX I

Integration of biological research, stock assessment (SA) and management strategy evaluation (MSE): rationale for biological research prioritization

Research areas	Research activities	Research outcomes	Relevance for stock assessment	Relevance for MSE	Specific analysis input	SA Rank	MSE Rank	Research priorization
Migration and population dynamics	Population structure	Population structure in 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 and recruitment distribution	2
	Distribution	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	3. Biological input		2
	Larval and juvenile connectivity studies	Improved understanding of larval and juvenile distribution	Improve estimates of productivity		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	2
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		1
	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			1
	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			1
	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			1
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	5
		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			5
		Dietary influences on growth patterns and physiological condition			May provide covariates for projecting short-term size-at-age. May help to deleineate between effects due to fishing and those due to environment, thereby informing appropriate management response			5
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 yield	1. Fishery parameterization	4
	Discard mortality rate estimate: recreational fishery				Will improve estimates of discard mortality, reducing potential bias in stock assessment results and management of mortality limits			4
	Best handling and release practices	Guidelines for reducing discard mortality			May reduce discard mortality, thereby increasing available yield for directed fisheries	2. Fishery yield		4
Fishing technology	Whale depredation accounting and tools for avoidance	New tools for fishery avoidance/deterence; improved estimation of depredation mortality	Improve mortality accounting	Improve estimates of stock productivity	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	1. Assessment data collection and processing		3

APPENDIX II

List of ranked biological uncertainties and parameters for stock assessment (SA) and their links to biological research areas and research activities

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 links to biological research areas and research activities

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
1. Biological parameterization and validation of movement estimates	Stock structure of IPHC Regulatory Area 4B relative to the rest of the Convention Area	Improve parametization of the Operating Model	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	Genetics and Genomics	Distribution
2. Biological parameterization and validation of recruitment variability and 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
3. Biological parameterization and validation for growth projections	Environmental influences on growth patterns	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
3. Biological parameterization and validation for growth projections	Dietary influences on growth patterns and physiological condition	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
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 current external research grants

Project #	Grant agency	Project name	PI	Partners	IPHC Budget ($US)	Management implications	Grant period
1	**Bycatch Reduction Engineering Program - NOAA**	Full scale testing of devices to minimize whale depredation in longline fisheries (NA23NMF4720414)	IPHC	NOAA Fisheries - Alaska Fisheries Science Center (Seattle)	$199,870	Mortality estimations due to whale depredation	November 2023 – April 2026
2	**Alaska Sea Grant**	Development of a non-lethal genetic-based method for aging Pacific halibut (R/2024-05)	IPHC, Alaska Pacific Univ. (APU)	Alaska Fisheries Science Center-NOAA (Juneau)	$60,374	Stock structure	January 2025-December 2026
Total awarded ($)					**$260,244**		

IPHC Fishery Regulations: Proposals for the 2025-26 process

PREPARED BY: IPHC SECRETARIAT (B. HUTNICZAK; 22 OCTOBER & 3 NOVEMBER 2025)

PURPOSE

To provide the Commission with an overview of the IPHC Fishery Regulations proposals that the IPHC Secretariat, Contracting Parties, and other stakeholders have submitted or indicated their intent to submit for consideration by the Commission in the 2025-26 process.

BACKGROUND

Recalling the IPHC Fishery Regulations proposals submission and review process instituted in 2017, this paper is intended to provide an indication of the fishery regulations proposals being submitted to the Commission in the 2025-26 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 in the 2025-26 process are as follows:

- 101st Session of the IPHC Interim Meeting (IM101) is 2 November 2025;
- 102nd Session of the IPHC Annual Meeting (AM102) is 20 December 2025.

DISCUSSION

A list of preliminary titles, subjects, and sponsors for IPHC Fishery Regulations proposals expected to be submitted as part of the 2025-26 process is provided in **Appendix I**.

Note on Section 27 – Recreational (Sport) Fishing - IPHC Regulatory Area 2B

The IPHC Secretariat notes that Section 27(1)(c) of the IPHC Fishery Regulations includes a provision allowing the daily bag limit to increase from two to three Pacific halibut per person on or after 1 August in IPHC Regulatory Area 2B. This provision is currently set to remain in effect through 2025, unless extended by a vote of the Commission.

RECOMMENDATION

That the Commission:

1) **NOTE** paper IPHC-2025-IM101-15 Rev_1, which provides the Commission with an overview of the IPHC Fishery Regulations proposals that the IPHC Secretariat, Contracting Parties, and other stakeholders have submitted or indicated their intent to submit for consideration by the Commission in the 2025-26 process.

APPENDICES

Appendix I: Preliminary titles, subjects, and sponsors for IPHC Fishery Regulations proposals expected to be submitted for consideration in the 2025-26 process.

APPENDIX I

Preliminary titles, subjects, and sponsors for IPHC Fishery Regulations proposals expected to be submitted for consideration in the 2025-26 process.

Ref. No.	Title	Brief description
<u>IPHC Secretariat</u>		
IPHC-2025-IM101-PropA1 [draft provided]	Mortality and Fishery Limits (Sect. 5)	To provide clear documentation of mortality and fishery limits within the IPHC Fishery Regulations: Mortality and Fishery Limits (Sect. 5). *Mortality and fishery limits tables will be filled when the Commission adopts TCEYs for the individual IPHC Regulatory Areas.*
IPHC-2025-IM101-PropA2 [draft provided]	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).
<u>Contracting Parties</u>		
IPHC-2026-AM102-PropB1 [expected]	Recreational (Sport) Fishing for Pacific Halibut - IPHC Regulatory Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, 4E (Sect. 28): Charter Management Measures in IPHC Regulatory Areas 2C and 3A	<u>**Proponent:** USA (NOAA Fisheries)</u> To propose charter management measures in IPHC Regulatory Areas 2C and 3A reflective of mortality limits adopted by the IPHC and resulting allocations under the North Pacific Fishery Management Council (NPFMC) Pacific halibut Catch Sharing Plan.
IPHC-2025-IM101-PropB2	Recreational (Sport) Fishing for Pacific Halibut - IPHC Regulatory Area 2B (Sect. 28) - Daily bag limit in IPHC Regulatory Area 2B	<u>**Proponent:** Canada (Fisheries and Oceans Canada)</u> To propose the daily bag limit of up to three fish per day per person in the recreational fishery in IPHC Regulatory Area 2B beginning on or after 1 August of each year.
<u>Stakeholders</u>		
Null		

IPHC Rules of Procedure: Amendments

PREPARED BY: IPHC SECRETARIAT (D. WILSON, B. HUTNICZAK; 31 OCTOBER 2025)

PURPOSE

To provide the Commission with proposed amendments to the current IPHC Rules of Procedure (2024).

BACKGROUND AND DISCUSSION

In accordance with Rule 19, paragraph 1 of the IPHC Rules of Procedure (2024), which states:

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

Amendments proposed:

Two rules are proposed for amendment as follows:

Rule 13 – Functions of Executive Director

Rule 13 would be amended by removing reference to an Assistant Director in the Rule title, and sub-para. 2, as shown below.

Rule 13 – Functions of Executive Director ~~and Assistant Director~~

~~2. The Executive Director shall recruit and appoint an Assistant Director (Chief Operations Officer), under the guidance of the Commission.~~

Justification: In 2024, the Chairperson and Vice-Chairperson agreed to the removal of the Assistant Director position. The proposed amendment will reflect that decision.

Rule 14 – Subsidiary Bodies

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

The proposed revisions to the CB Rules of Procedure are designed to streamline administrative processes and improve clarity in documentation and reporting. These updates reflect input from CB co-chairs, CB members and the Secretariat, with the goal of enhancing efficiency during CB meetings and report preparation.

Summary of Proposed Changes

1. Simplified re-accreditation for active members

   Members who have attended at least three of the last five annual CB meetings will not be required to resubmit the full accreditation questionnaire for 2026. This change reduces administrative effort while ensuring continuity for active participants.

2. Clarified Reporting Process

   The revisions clarify that the CB Report should focus on key discussion outcomes and recommendations to the Commission.

   - Oral statements made during the meeting will continue to be captured in the official recording.
   - Summaries of positions and viewpoints will appear in the written report.
   - Written statements may be included upon specific request, provided they are consistent with what was presented during the session.

   This approach keeps the CB Report concise, consistent, and focused on substantive matters for Commission consideration.

3. Editorial Improvements

   Minor language edits have been made to improve readability and consistency of the document.

Consultation process undertaken:

- Initial consultations with the CB Co-Chairpersons were conducted to ensure that the proposed edits align with the overall goal of improving efficiency and streamlining CB administrative processes.
- The CB Co-Chairpersons contacted their respective members and sought confirmation.
- In addition, a Q&A session open to all CB members was held on 28 October 2025, with invitations distributed through the Co-Chairpersons to provide an opportunity for all members to review and discuss the proposed changes.
- No objections were received and questions were satisfactorily answered during the Q&A session.
- No further question or concerns have been raised following the Q&A session.
- The CB Chairpersons provided written confirmation that the CB was in agreement with the final proposed amendments provided at **Appendix A**.

RECOMMENDATION/S

That the Commission:

1) **NOTE** paper IPHC-2025-IM101-16 that proposes amendments to the IPHC Rules of Procedure (2024).
2) **ADOPT** revised Rules of Procedure by consensus, amending Rules 13 and 14.

APPENDICES

Appendix A: IPHC Rules of Procedure (2025) – revisions to Rule 14.

APPENDIX A

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~~ of the International Pacific Halibut Commission (IPHC) ~~on which individuals~~that represents Pacific halibut harvester~~s~~ organisations and associations from Canada and the United States of America~~each Contracting Party~~. The CB ~~shall~~:

   a) provides a forum for the discussion of management and policy matters relevant to Pacific halibut and ~~provide~~ advises~~ce to~~ the Commission on management and policy matters relevant to Pacific halibut;

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

2. The CB Co-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 directed commercial, guided sport/recreational, unguided sport/recreational, subsistence, and First Nations/Tribal interests. Each ~~M~~member~~s~~ ~~are~~ is responsible for designating ~~their individual~~one (1) or more~~-~~ delegates~~(s)~~ to represent it; however, each CB member is entitled to only one (1) vote, and no delegate may vote on behalf of more than one (1) CB member.

4. The CB regulates its membership by accrediting members at the beginning of each CB session by a simple roll call. Eligibility for ~~Accreditation~~ accreditation is established in advance by ~~documented~~ completing~~using~~ the *Accreditation Questionnaire* ~~provided at~~

Annex 1, submitted available through the CB Accreditation portal on the IPHC website. The CB members shall be composed of nationals from Canada and the United States of America.

5. CB members may be re-accredited for successive meetings by roll call without re-submitting the *Accreditation Questionnaire* for a period of five (5) years from their initial accreditation by a simple role call at the beginning of the CB sessionprovided if they have participated in at least three -(3) out of five (5) most recent CB annual CB meetings within the five (5) year period. CB members not meeting this attendance thresholdcriteria or their five year accreditation cycle has elapsedmust re-establish eligibility by submittingfill out a new *Accreditation Questionnaire* provided in Annex 1, submitted through the CB Accreditation portal on the IPHC website.

5.6. -Returning CB members requiring re-submission of the *Accreditation Questionnaire* who need to fill out the Accreditation Questionnaire and prospectivepotential CB members seeking accreditation for the first time are encouraged to submit the *Accreditation Questionnaire* notify the IPHC Secretariat at least two (2) weeks before prior to the beginning of the Annual annual CB mMeeting of the CB session they wish to attend, and are required to do so no later than one (1) day prior to the meeting. Failure to meet these timelines will result in accreditation being deferred and the member assigned observer status for that meeting.

6.7. Members serve without compensation from the Commission.

III. Officers

Co-Chairperson/s and Vice-Chairperson/s

8. The CB is Coco-Chaired 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. The role of presiding Co-Chairperson rotates between the two Contracting Parties at successive meetings, with the host country presiding.

7.9. The Co-Chairpersons present the CB's decisions, recommendations, and advice to the Commission prior to the Commission making final decisions on management and policy matters relevant to Pacific halibut.

8.10. 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.

9.11. The Co-Chairpersons and Vice-Chairpersons are entitled to vote if the member organisationorganization or /association they represent does not have a participating representative at the CB.

Terms of office and election

10.12. 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.

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

12.14. Election of Vice-Chairpersons will follow the election of the Co-Chairperson(s) if required. Vice-Chairperson term is for two (2) years.

13.15. If a Co-Chairperson becomes unable to serve during the annual CB meeting, 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.

IV. Sessions of the Conference Board

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

15.17. **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.

~~16.~~18. **Conduct of meetings**: Parliamentary procedure according to Robert's 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.

~~17.~~19. **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~~a 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

~~18.~~20. 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.

~~19.~~21. The work of such ad-hoc working groups may not exceed the mandate approved for them by the CB.

~~20.~~22. Completed documents and other work materials from the CB's ad-hoc working groups should be posted for public access on the Commission website.

~~21.~~23. 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

~~22.~~24. A report shall be adopted prior to the close ~~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~~is deemed final.

~~23.~~25. 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)~~a) Participants requesting the inclusion of a minority report must provide the Co-Chairpersons with a clear and concise ~~serviceable~~ draft in an electronic format ~~version "word document" within four (4) hours of the conclusion of the days CB meeting, or within two (2) hours of~~before the conclusion of the annual CB meeting.

~~c)~~b) Draft minority reports are limited ~~only~~ to information and material discussed during the CB session.

c) 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.

d) Oral statements made during the meeting are encouraged in place of written submissions.

~~24.~~26. 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.

~~25.~~27. All reports and the full recording of annual CB meeting shall be made available on the Commission's website.~~CB meeting shall be also made available on the Commission's website.~~

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

PREPARED BY: IPHC SECRETARIAT (22 OCTOBER 2025)

PURPOSE

To provide clear documentation of mortality and 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 outlines a framework for amending IPHC Fishery Regulations Section 5, '*Mortality and Fishery Limits,'* to reflect Total Constant Exploitation Yield (TCEY) values adopted by the Commission and the corresponding fishery sector limits resulting from those TCEY values, as determined by the existing domestic catch sharing arrangements of the Contracting Parties.

DISCUSSION

Changes to IPHC Fishery Regulations Section 5, '*Mortality and Fishery Limits,'* provide clear documentation of the limits for fishery sectors within defined Contracting Party domestic catch sharing arrangements, which are 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 102nd Session of the IPHC Annual Meeting (AM102) in January 2026.

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 which decisions are made by the Commission.

Sectors Affected: This proposal affects all sectors of the Pacific halibut fishery.

Appendix A provides details on the suggested regulatory language.

[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.

RECOMMENDATIONS

That the Commission:

1) **NOTE** regulatory proposal IPHC-2025-IM101-PropA1, which provides the Commission with an opportunity to recall the format of the IPHC Fishery Regulations: *Mortality and Fishery Limits* (Sect. 5), to be populated at the 102nd Session of the IPHC Annual Meeting (AM102) in January 2026.

APPENDICES

Appendix A: Suggested regulatory 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 and 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 and recreational)		
Commercial fishery		
Recreational fishery		

Area 2C (southeastern Alaska) (combined commercial and guided recreational)		
Commercial fishery (includes XX Mlb landings and XX Mlb discard mortality)		
Guided recreational fishery (includes landings and discard mortality)		
Area 3A (central Gulf of Alaska) (combined commercial and guided recreational)		
Commercial fishery (includes XX Mlb landings and XX Mlb discard mortality)		
Guided recreational fishery (includes landings and discard mortality)		
Area 3B (western Gulf of Alaska)		
Area 4A (eastern Aleutians)		
Area 4B (central and 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*.

** In IPHC Regulatory Area 2A, the USA (NOAA Fisheries) may take in-season action to reallocate the recreational fishery limits between Washington, Oregon, and California after determining that such action will not result in exceeding the overall IPHC Regulatory Area 2A recreational fishery limit and that such action is consistent with any domestic catch sharing plan. Any such reallocation will be announced by the USA (NOAA Fisheries) and published in the Federal Register.

IPHC Fishery Regulations: Commercial Fishing Periods (Sect. 9)

PREPARED BY: IPHC SECRETARIAT (22 OCTOBER 2025)

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 the IPHC Regulatory Area 2A.

DISCUSSION

The IPHC Secretariat proposes that the commercial fishing periods for all IPHC Regulatory Areas be set at 102nd Session of the IPHC Annual Meeting (AM102) in January 2026 following stakeholder input.

Moreover, with 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 (per final rule 87 FR 74322 published on 5 December 2022), the Commission no longer needs to consider setting dates for the 2A non-tribal directed commercial fishery and the dates will be set by the Contracting Party within the overall commercial fishing period dates.This is consistent with the IPHC Convention[1], which states that the Contracting Parties may implement fishery regulations that are more restrictive than those adopted by the IPHC.

Benefits/Drawbacks: This proposal clearly indicates that the decision on commercial fishing periods is within the Commission's mandate and the season dates can be changed annually. Moreover, it clarifies that more strict fishing periods can be implemented by the Contracting Parties.

Sectors Affected: Commercial Pacific halibut fisheries in each IPHC Regulatory Area.

Appendix A provides details on the suggested regulatory language.

[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.

RECOMMENDATIONS

That the Commission:

1) **NOTE** regulatory proposal IPHC-2025-IM101-PropA2, which provides the Commission with an opportunity to recall the format of the IPHC Pacific Halibut Fishery Regulations: *Commercial Fishing Periods* (Sect. 9), to be populated at the 102nd Session of the IPHC Annual Meeting (AM102) in January 2026.

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 06:00 local time on ~~15 March~~DD MMMM.

(3) All commercial fishing for Pacific halibut in all IPHC Regulatory Areas shall cease for the year at 23:59 local time on ~~7 December~~DD MMMM.

(4) Regulations pertaining to the non-tribal directed commercial fishing[2] periods in the IPHC Regulatory Area 2A will be promulgated by NOAA Fisheries and published in the Federal Register. This fishery will occur between the dates and times listed in paragraphs (2) and (3) of this Section.

(5) Notwithstanding paragraph (4) of this Section, 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) of this Section, 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.

IPHC Fishery Regulations proposal:

Recreational (Sport) Fishing for Pacific Halibut - IPHC Regulatory Area 2B (Sect. 28) - Daily bag limit in IPHC Regulatory Area 2B

SUBMITTED BY: CANADA (FISHERIES AND OCEANS CANADA) (2 NOVEMBER 2025)

Directed Commercial ☐ Recreational ☒ Subsistence ☐ Non-directed commercial ☐ All ☐

All Regulatory Areas ☐ All Alaska Regulatory Areas ☐ All U.S. Regulatory Areas ☐

2A ☐ 2B ☒ 2C ☐ 3A ☐ 3B ☐ 4A ☐ 4B ☐ 4C ☐ 4D ☐ 4E ☐

PURPOSE

To propose the daily bag limit of up to three fish per day per person in the recreational fishery in IPHC Regulatory Area 2B beginning on or after 1 August of each year.

EXPLANATORY MEMORANDUM

Canada is proposing to keep changes made to section 28 (Recreational (Sport) Fishing for Pacific Halibut – IPHC Regulatory Area 2B) of the IPHC Fishery Regulations to allow a maximum daily bag limit of three (3) fish per day, per person, beginning on or after 1 August. The purpose of the proposed change is to align IPHC fishery regulations with Canada's domestic sportfishing regulations, to simplify unnecessary regulatory complexity, and to retain Canada's ability and autonomy to manage its domestic fishery.

The Commission previously supported and approved an increase in the Canadian daily bag limit from two (2) per day, to three (3) per day, on a one-year basis from 1 April 2021 to 31 March 2022, and once again from 1 April 2022 to 31 March 2023. The Commission then approved this provision to be in effect from 2023-2025, inclusive. Annually the Sport Fishing Advisory Board (SFAB) works with Fisheries and Oceans Canada (DFO) to model a pre-season fishing plan with the objectives of maintaining a full recreational season (February to December) and supporting the recreational sector's access to the Total Allowable Catch (TAC) it is allocated. Canada has chosen to not utilize this conditional flexibility since it was put into place in 2023, due to reduced TAC available to the sector. However, this flexibility has increased Canadian domestic benefits, whilst allowing for the effective in-season management of the resource.

The IPHC daily bag limit of two (2) fish per day constrains Canada's flexibility to make critical in-season changes to the fishing plan to support meeting TAC goals and Canadian domestic fishery objectives.

The SFAB has a long history of collaborating with DFO in Canada's endeavours to achieve IPHC objectives, while maximizing Canadian domestic objectives. DFO and SFAB meet monthly in-season to review timely and robust recreational catch estimates to consider and evaluate appropriate fishery management measures. Increased regulatory flexibility would augment the existing successful management tool kit to achieve improved fishery performance.

RECOMMENDATIONS

That the Commission:

1) **NOTE** IPHC Fishery Regulation proposal IPHC-2025-IM101-PropB2, which proposes the daily bag limit of up to three fish per day per person beginning on or after 1 August in the recreational fishery in IPHC Regulatory Area 2B.

APPENDICES

Appendix A: Suggested Regulatory Language.

APPENDIX A

SUGGESTED REGULATORY LANGUAGE

28. Recreational (Sport) Fishing for Pacific Halibut—IPHC Regulatory Area 2B

(1) In all waters off British Columbia:[6, 7]

(a) the recreational (sport) fishing season will open on 1 February;

(b) the recreational (sport) fishing season will close when the recreational (sport) fishery limit allocated by DFO is taken, or 31 December, whichever is earlier; and

(c) the daily bag limit is two (2) Pacific halibut of any size per day, per person, and may be increased to a daily bag limit of three (3) Pacific halibut per day, per person on or after 1 August. ~~This provision shall remain in effect through 2025, unless extended by a vote of the Commission.~~

(2) In British Columbia, no person shall fillet, mutilate, or otherwise disfigure a Pacific halibut in any manner that prevents the determination of minimum size or the number of fish caught, possessed, or landed.

(3) The possession limit for Pacific halibut in the waters off the coast of British Columbia is three Pacific halibut.[6, 7]

[6] DFO could implement more restrictive regulations for the recreational (sport) fishery, therefore anglers are advised to check the current Federal or Provincial regulations prior to fishing.

[7] For regulations on the experimental recreational fishery implemented by DFO check the current Federal or Provincial regulations.

Stakeholder comments on IPHC Fishery Regulations or published regulatory proposals

PREPARED BY: IPHC SECRETARIAT (B. HUTNICZAK; 22 OCTOBER & 2 DECEMBER 2025)

PURPOSE

To provide the Commission with a consolidated document containing comments from stakeholders on IPHC Fishery Regulations or published regulatory proposals submitted to the Commission for its consideration at the 101st Session of the IPHC Interim Meeting (IM101).

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 comments to the Commission for its consideration. Specifically:

> "*Informal statements or comments on IPHC Fishery Regulations or published regulatory proposals can be submitted using the form below up until the day before the IPHC Session. Submitted comments will be collated into a single document and provided to the Commissioners at the IPHC Session.*"

Comments may be submitted using the IPHC Stakeholder Comment Form.

DISCUSSION

Table 1 provides a list of the stakeholder comments 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.

Table 1. Statements from stakeholders received by noon on 20 October 2025.

Appendix No.	Title and author	Date received
Appendix I	Denny Corbin, Pacific halibut fisherman	4 May 2025
Appendix II	Forrest Braden, Southeast Alaska Guides Organization	1 December 2025

RECOMMENDATION

That the Commission:

1) **NOTE** paper IPHC-2025-IM101-INF01 Rev_1 that provides the Commission with a consolidated list of comments from stakeholders on IPHC Fishery Regulations or published regulatory proposals submitted to the Commission for its consideration at the 101st Session of the IPHC Interim Meeting (IM101).

APPENDICES

As listed in Table 1.

APPENDIX I

Statement by Denny Corbin (Pacific halibut fisherman)

Topic	This is a comment regarding mortality of undersized Pacific halibut as a cause of stock decline and the solution.
Section of IPHC Fishery Regulations or regulatory proposal reference the comment will refer to	NA
Submitted comment	Pacific halibut stocks are at their lowest in 40 years. What is the cause of this? I propose that the main source of decline is excessive mortality from release of small fish.

It works like this:

1. Various environmental factors in the last few decades caused a boom in the Pacific halibut stock but this resulted in massive schools of small fish that were either under 32" or legal but small and not worth as much money resulting in "high-grading".
2. What happens when you set gear and it comes back with undersized Pacific halibut every hook for miles? The fisherman's hands hurt from decades of work at the roller. It is a lot of extra time and wear and tear physically for a fisherman to properly release small Pacific halibut without harm. When balls of fire/pain are running up and down your arms and hands and your back is about ready to blow the choice is simple. Bring down the crucifier (the bait removal device...) and turn the hydraulics up full blast. This rips the faces from the small Pacific halibut as they are torn off the hooks and fall back into the water. It is likely that mortality is high when half the face is missing.
3. After a while fishing on schools of small Pacific halibut in this manner, these schools were decimated. This may be why there is still some good fishing for a portion of the season now, but then it goes dead. The fish schools that are still ok were the larger fish but those schools are not as numerous, and big schools of small Pacific halibut that were affected and now in bad shape overall are not recruiting as many to larger fish. There are of course many factors that could affect a population of fish, but in my estimation this (illegal) method of releasing small Pacific halibut with a crucifier was the main cause.
4. It is of course illegal to release Pacific halibut in this manner. But in the real world, absent an observer, it is likely still and definitely has been done excessively in the past. As the fishery has developed and the older generation has aged out this practice may be much less, however, in my opinion it should be considered as a dominant factor over the last several decades that has resulted in the current predicament.
5. I have written in the past regarding this issue but it has been ignored because there was never a reasonable solution. The fishery management was dominated by commercial interests and it has always been easier to engage in fantasies blaming other factors and user groups instead of acknowledging the real issue. However, now with the advent of Starlink high speed satellite it is possible to monitor the roller for every fish. And yes, I realize that observer coverage is draconian and much of the fishing is now monitored and that the fleet likely now uses better practices to avoid mortality. However, it may be useful to at least look

back and understand that mortality from the commercial fleet releasing small fish has been a major factor in the Pacific halibut stock decline.

6. The solution. Require camera monitoring of every fish and limit the soak time so that fish are not laying on the bottom becoming exhausted. Yes, it is hard, but if there is hope for a rebound in Pacific halibut stock this is what needs to happen, a focus on best practice to avoid mortality of released fish and full-time monitoring to keep everyone honest.

Thank you for your consideration

APPENDIX II

Statement by Forrest Braden (Southeast Alaska Guides Organization)

Topic	Harvest Decision Table
Section of IPHC Fishery Regulations or regulatory proposal reference the comment will refer to	NA
Submitted comment	IPHC Commissioners,

IPHC Commissioners,

Southeast Alaska Guides Organization represents the interests of Southeast's guided saltwater sportfishing fleet, which accounts for roughly half of Alaska's marine charter sector by vessel count and angler participation. The fleet plays a key economic role for the State and region.

The Alaska charter fleet needs your support—especially in Southeast, where current regulations have become a major deterrent for new and returning clients. Guided halibut anglers in Area 2C have seen opportunity fall from two halibut per day without size limits to one halibut per day under 37 inches, and not all harvest can realistically meet that mark. Recent size averages hover around 31 inches—smaller than the commercial legal size and below the criteria the IPHC uses for area distribution. Area 2C cannot absorb further reductions to FCEY.

The Commission is meeting all biological targets. The current relative spawning biomass is successfully above the B36 minimum threshold. Regional survey distribution is within normal ranges. Total spawning biomass is increasing. Status quo TCEY is currently 9 million pounds below the 3-year surplus.

The Commission's recent tactical cuts may have contributed to the uptick in spawning biomass, but the primary drivers of stock growth remain the size of incoming year classes and weight at age. The Secretariat has repeatedly stated that there is no established link between the level of spawning biomass and good recruitment events, which leaves tactical cuts somewhat arbitrary and aimed to a large extent at the economics of the fishery— chiefly the commercial fishery.

Sport fisheries function very differently than commercial fisheries. Scarcity in commercial fisheries can increase economic returns with higher ex-vessel prices and lower fishing costs as seen this past fishing season. Lost opportunity in the charter fishery decreases value, reduces revenue through lower participation, and leads to a loss of future demand. Building and maintaining a client base takes years, and losing momentum has long-term consequences.

We urge you not to cut Coastwide TCEY but to consider a modest increase to help alleviate the strain on the guided sport fisheries. Status Quo +5 would help. At F49% (still conservative against an F46% the Commission is currently considering for long-term harvest strategy), the decision table shows a 78% probability spawning biomass in 2029 will be equal or higher than it is now. Those are good odds. The Secretariat will continue to survey and project three years out based on incoming year classes and weight at age, and the Commission can adjust future catch limits as needed, but we need relief now.

Respectfully,

Forrest Braden

Kim Landeen

SEAGO Co-directors

Considerations relating to allowing year-round landings of Pacific halibut in Canada

PREPARED BY: IPHC SECRETARIAT

(I. STEWART, B. HUTNICZAK, A. HICKS, J. PLANAS, M. THOM, D. WILSON; 22 OCTOBER 2025)

PURPOSE

To provide the Commission with a preliminary response to:

> AM101-Req.05 (para. 88) *"The Commission REQUESTED that the IPHC Secretariat prepare an analysis detailing the biological, logistical and socioeconomic effects of year-round fishing in Canada, including challenges related to data compilation and marketing implications, for presentation at AM102."*

Following consultation with Contracting Party agencies, this paper focuses on evaluating the **feasibility and implications of allowing the retention of small quantities of incidentally encountered Pacific halibut** that would otherwise be discarded during the winter closed period **in IPHC Regulatory Area 2B**, rather than assessing a broad reopening of the directed fishery.

BACKGROUND

The Commission enacted a winter closure period for the Pacific halibut fishery on 15 November 1924 as its first regulatory measure (Hutniczak et al. 2024). This closure period was originally motivated mainly by economic factors, including marketing considerations, and a reduction in overall supply (IPHC 1954; Skud 1977). Over time, additional factors, including processing capability, biological conservation, and safety, have been used to support the use of a closed fishing period through the present day. Specific reference to the winter closure period as a conservation tool have become more common only quite recently (e.g. Hoag et al. 1993). The Commission requested a review of extending the length of the coastwide fishing period in 1995 and again in 1999. In 1999, a workshop was held, and the Secretariat provided several responses, mainly focusing on concerns related to the movement of Pacific halibut among areas relative to the summer distribution and fishery allocation, with some acknowledgment of logistical and safety concerns (Gilroy and Sadorus 2000; Leaman and Clark 2000; Leaman et al. 2001).

INTRODUCTION

Pacific halibut are known to spawn during the winter months and may move to spawning areas sometimes located long distances from summer feeding areas, and to deeper water for winter spawning (Carpi et al. 2021; IPHC 1978; St.Pierre 1984). The winter closure, as implemented since the introduction of quota programs in the USA (Alaska) and Canada (Hutniczak et al. 2024), closes fishing over some but not all of the seasonal migration and spawning period (Loher 2011).

To assess the potential impact of year-round landings of Pacific halibut in Canada, the IPHC requested discard data from Fisheries and Oceans Canada. Data received in August 2025 quantify winter discards of legal-sized Pacific halibut (over 32 inches or 81.3 cm; O32) and inform an evaluation focused on retaining small quantities of incidentally encountered Pacific halibut that would otherwise be discarded.

Accordingly, this document examines the biological, logistical, and socioeconomic implications of such a retention provision for vessels operating in IPHC Regulatory Area 2B, while maintaining the integrity of the existing winter closure and avoiding any expansion of directed fishing effort.

SUPPLEMENTARY DATA

Between 13 and 20 August 2025, the IPHC received updated discard information from DFO. Winter mortality associated with these discards was calculated using the mortality rate and average weight reported in the *Groundfish Pacific Region Integrated Fisheries Management Plan*:

- Mortality rate: 16% for longline gear, 10% for traps and 5% for troll/jig
- Average weight: 21 lb (used for regulatory purposes; may not be reflective of true harvest weights)
- Liced/bait discards were excluded.

These figures indicate that the total potential mortality reduction from retaining such fish would be small (≤ 0.2 % of the 2B FCEY), suggesting negligible biological risk if restricted to incidental encounters.

Table 1: Winter discard information.

Winter	Legal-size fish discarded in winter [N]	Mortality with discards (current estimates) [lb]	Mortality if retained [lb]	Mortality if retained as % 2B FCEY
2022/23	428	1,204	8,988	0.18%
2023/24	478	1,490	10,038	0.21%
2024/25	258	688	5,418	0.14%

BIOLOGICAL CONSIDERATIONS

Fisheries management can be generally divided into input-controlled fisheries and output-controlled fisheries. The former utilizes limits on fishing capacity (vessels, gear etc.), areas, and fishing periods to control resulting fishing mortality to a degree that supports sustainable and optimal yields. The latter limits the overall mortality directly (possibly also including some input controls) as the primary tool to ensure optimal harvest. Importantly, when the closed period for Pacific halibut was first implemented, it was an input-controlled fishery. Today, it (and most other industrial fisheries) is output-controlled, with coastwide annual TCEY allocated to individual IPHC Regulatory Areas set by the IPHC. Many details of specific fishing methods and capacity are determined by the domestic parties. Therefore, the consideration of the closed period does not impact the total mortality on the stock.

Primary biological concerns raised by stakeholders during previous discussions of the closed period include allowing fish to spawn before they are harvested and disruption of spawning activity. Fisheries where harvest is before or after spawning are of importance, including stocks with very high natural mortality (e.g. squid fisheries where multi-year survival is very low) and fisheries with extremely high fishing mortality rates such that next year’s recruitment success depends heavily on the current spawning stock. Natural mortality and sustainable harvest rates for Pacific halibut are far lower than would warrant concern over whether the annual harvest occurs before or after the spawning season. Disruption of spawning by fishing activity has been observed for some species, particularly those that form aggregations (Dean et al. 2012). There are known Pacific halibut spawning areas in the IPHC Regulatory Area 2B (Carpi et al. 2021), but active fishing gear (e.g. trawls) is much more likely to disrupt aggregations than passive gear such as longlines, where the fish can choose to interact with the gear or not.

Seasonal spawning migrations of Pacific halibut are generally to the north in Biological Region 2 (Carpi et al. 2021; Loher and Soderlund 2018; Webster et al. 2013). This means that a large winter fishery in IPHC Regulatory Area 2B could have some effects on IPHC Regulatory Area 2A as many of the mature fish may be in Canadian waters during the winter months.

Given the small scale of winter discards observed (≤ 0.2 % of the 2B FCEY), a limited retention allowance for these incidental captures would not materially affect total stock mortality or spawning potential. The risk of disrupting spawning aggregations remains low, provided there is no directed effort for Pacific halibut during this period.

The demographics (size, age, and sex) of Pacific halibut captured during the winter months could differ from those during the rest of the calendar year. If the retained volume remains ≤ 0.2 % of the 2B FCEY, the scale would not warrant dedicated sampling.

Logistical Considerations

The IPHC deploys Fisheries Data Specialists in major ports throughout most of the directed fishing period, with staffing reduced as landings decrease toward the end of the fishing period due to weather, closure of processing facilities, and financial considerations. In IPHC Regulatory Area 2B, currently staffed ports are Port Hardy and Prince Rupert.

If a substantial winter fishery were contemplated, continuous sampling would be necessary to avoid demographic bias in biological data. However, because the potential retention of incidental Pacific halibut represents a very small volume (≤ 0.2 % of the FCEY), additional sampling would not be required. Continued coordination between DFO and IPHC on catch reporting and data sharing would remain essential.

Socioeconomic Considerations

Historical comparisons of commercial CPUE suggest that higher directed commercial fishery catch rates might be achieved during the winter months due to the aggregation of fish for spawning (Skud 1975; St.-Pierre 1984). If processing capacity were available, efficiency gains could lead to a valuable incidental fishery and/or strong incentives for targeting Pacific halibut during winter months when all other fisheries are unable to retain them.

Processor readiness for off-season landings varies. Some facilities in Canada operate year-round and could handle small incidental landings, while others close during the winter for maintenance or holiday downtime. These interruptions could limit processing availability in the short term but are unlikely to affect the limited incidental volumes under consideration.

From a market standpoint, early-season Pacific halibut landings have historically commanded a price premium, suggesting that even limited winter fishing activity could be economically attractive. If landings were allowed only in IPHC Regulatory Area 2B outside the commercial fishing period in other areas, this could create a market advantage for 2B harvesters and processors relative to those in other areas, especially immediately prior to the general fishery opening. However, at small quantities involved, this measure is likely to have a negligible influence on market dynamics or pricing.

Broader participation in a winter fishery could raise safety concerns. Larger vessels equipped to operate in poor weather conditions would have an advantage over smaller vessels. Potentially high prices could incentivize smaller vessels to fish in less-than-ideal conditions and therefore reduce the safety of the fishery. Improved safety at sea was a recognized secondary benefit of the traditional winter closure period, even though it did not directly limit total removals. Because this proposal limits retention only to Pacific halibut already incidentally caught in other fisheries, it introduces no clear incentive for vessels to alter fishing behavior and thus would not compromise safety at sea.

An additional effect of allowing harvest during the current closed period is a reduction in discard mortality relative to the total TCEY. Specifically, if there is no increase in targeting of Pacific halibut during the winter months, then legal-sized Pacific halibut catch for vessels with remaining quota would be converted from discards (with a 16% discard mortality) to landed catch. This should have the effect of increasing the FCEY for a given TCEY set by the IPHC. The benefits would diminish if directed targeting of Pacific halibut occurred beyond current incidental levels.

Previous consideration of the closed period extensively evaluated the potential for fish to be surveyed in the summer in a different IPHC Regulatory Areas than they might be captured in during the winter while on the spawning grounds. Extensive tagging (Loher 2011; Carpi et al. 2021) and Management Strategy Evaluation (MSE) simulations suggest mixing is occurring among IPHC Regulatory areas during the currently open fishing period. Therefore, stock dynamics are highly linked among IPHC Regulatory Areas within Biological Regions and also between biological regions. For these reasons, this concern appears much less important today with a coastwide stock assessment than when separate stock assessments and yield recommendations were developed for each individual IPHC Regulatory Area. The negligible scale of winter retention further minimizes any potential redistribution effects.

CONCLUSIONS

Based on available discard data and the clarified intent to assess winter Pacific halibut retention limited to discards at current levels, there is no biological or management concern associated with such a measure in IPHC Regulatory Area 2B. Management of the total TCEY, paired with ongoing data collection on the size, age, and sex composition of harvested fish, would continue to provide the same level of precision in population demographics and management quantities currently achieved under the existing arrangement with the winter closure.

Allowing limited winter retention in IPHC Regulator Area 2B would primarily convert existing discard mortality into recorded landings, which is estimated to be 0.14–0.21 % of the 2B FCEY. This would modestly improve catch efficiency while maintaining total removals within the established TCEY.

The IPHC Secretariat therefore finds no biological or conservation-based impediment to considering a regulatory change that would enable a narrowly defined retention provision that is limited to recent discard mortality levels. This assessment does not consider reopening a directed winter fishery.

Implementation of such a measure would require minimal additional monitoring, as long as the volume of landings would remain small and could be accurately documented through existing DFO–IPHC coordination. Broader logistical or socioeconomic effects (e.g., processor capacity, port staffing, or price dynamics) are expected to be negligible given the limited scale of incidental winter catch.

RECOMMENDATIONS

That the Commission:

1) **NOTE** IPHC-2025-IM101-INF02 that provides a preliminary response to the following Commission request:

   AM101-Req.05 (para. 88) "*The Commission REQUESTED that the IPHC Secretariat prepare an analysis detailing the biological, logistical and* *socioeconomic effects of year-round fishing in Canada, including challenges related to data compilation and marketing implications, for presentation at AM102.*"

2) **REQUEST** any further analyses for consideration at AM102, as needed, should the Commission wish to explore potential regulatory changes related to limited incidental retention of Pacific halibut during the winter closure in Canada.

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Using artificial intelligence (AI) for supplementing Pacific halibut age determination from collected otoliths

PREPARED BY: IPHC SECRETARIAT (B. HUTNICZAK, J. FORSBERG, K. SAWYER VAN VLECK, & K. MAGRANE; 22 OCTOBER 2025)

PURPOSE

This document summarizes the information available on the use of artificial intelligence (AI) for determining the age of fish from images of collected otoliths and provides an update on the exploratory work of implementing an AI-based age determination model for Pacific halibut.

The progress summarized in this document includes:

- Testing various deep learning architectures to identify the optimal approach given the available otolith images.
- Evaluating model generalization by comparing age predictions from a model trained on images from one year to those from a different year.
- Assessing differences in model performance between images of processed (sectioned and baked) and unprocessed (surface) otoliths.
- Utilizing confidence intervals derived from deep ensemble techniques to assess the model's capability in identifying ambiguous or noisy samples.

The purpose of this document is twofold. First, it provides essential background information to support ongoing efforts in establishing a comprehensive database of otolith images with expert-provided labels for future ageing use. Second, it provides an update on the viability of an AI-based modeling approach for supplementing current Pacific halibut ageing protocol, while also outlining the remaining steps and requirements necessary for operational implementation.

BACKGROUND

Otoliths are crystalline calcium carbonate structures, mostly in the form of aragonite, found in the inner ear of fish. They contain growth rings, that are often compared to tree growth rings. By analyzing the growth patterns in otoliths, scientists estimate the age of fish (Campana, 1999; Campana & Neilson, 1985), supporting the estimation of fish population demographics and population dynamics (Campana & Thorrold, 2001). In turn, fish age is a key input to stock assessment models that inform management decisions related to fish exploitation (Methot & Wetzel, 2013). It is estimated that the number of otoliths from captured fish that are read annually worldwide is on the order of one million (Campana & Thorrold, 2001).

The current method for determining ages of most fish species relies on manually extracting, preparing (embedding, sectioning), and reading otoliths. The simplest approach to reading the otolith is to immerse it in a clear liquid, such as water or alcohol solution, illuminate it from above, and view it against a dark background, using a stereo microscope. This method is suitable only for otoliths that are relatively thin with all annual bands visible from the surface. For species such as Pacific halibut, as the growth rate of the fish slows down, the outer growth bands become increasingly compressed and difficult to read from the surface of the whole otolith. To correctly determine the number of annual bands in such cases, otoliths are typically viewed in cross section which allows viewing the bands that are not visible from the surface view. In addition, the contrast between the growth rings can be enhanced through the baking process. Pacific halibut otoliths are aged using the 'break and bake' technique.

This manual ageing process is expensive, time-consuming,[1] and can be subject to bias[2] as well as imprecision due to variations in age estimations between readers and within readers over time. Recent advances in imaging technologies and machine learning suggest that AI can assist in this process by automating the analysis of otolith images[3] and identifying the growth rings to determine age. AI algorithms can be trained on a large dataset of otolith images with known ages to learn the patterns and variations in growth rings. Once trained, the AI model can analyze new otolith images and predict the age of the fish based on the identified patterns in the image.

Using AI for age determination of Pacific halibut could improve consistency and replicability of age estimates, as well as provide time and cost savings to the organization, providing age data for reliable management advice. However, it's important to note that the AI model's accuracy depends on the quality and diversity of the training data, as well as the expertise of the scientists involved in training and validating the model. Regular validation and calibration with manual age determinations may be necessary to ensure the accuracy and reliability of the AI predictions. Thus, the proposed approach explores integrating AI-based age determination and traditional ageing methods for maximum accuracy of the estimates.

MODEL

Model framework

The proposed model framework (Figure 1) includes a continuous process of training the model using available labelled data (aged otoliths), querying the model to select the next sample, labeling or relabeling the selected sample, and enriching the model with newly labelled samples. This model relies on automated ageing that is supplementing the expert-derived age estimates continuously improving the model.

[1] While the actual reading may account only for a fraction of the total cost and time required to process the otolith from collection to age determination, skilled readers require years of training, which should be considered when conducting a cost-benefit analysis.

[2] While the count of annual rings on Pacific halibut otoliths was found to provide unbiased age estimate using validation against bomb radiocarbon isotopes (Piner & Wischniowski, 2004), an earlier oxytetracycline (OTC) mark-recapture study indicated biases among age readers (Blood, 2003). In the 1980s, the IPHC applied injections with the antibiotic oxytetracycline (OTC) during routine tagging operations to evaluate validity of ageing method (IPHC, 1985). Upon injection, the OTC is absorbed by the fish's bony structure, including the otoliths, and leaves a mark that is easily seen when viewed under an ultraviolet light. When an OTC-injected tagged fish is recovered, the otoliths are removed and examined under the ultraviolet light. By comparing the number of annuli laid since the OTC mark to the fish recovery, the accuracy of the age readings can be determined.

[3] Although the idea of taking pictures of Pacific halibut otoliths is not new. See 1960 report by G. Morris Southward, *Photographing Halibut Otoliths for Measuring Growth Zones* (Southward, 1962).

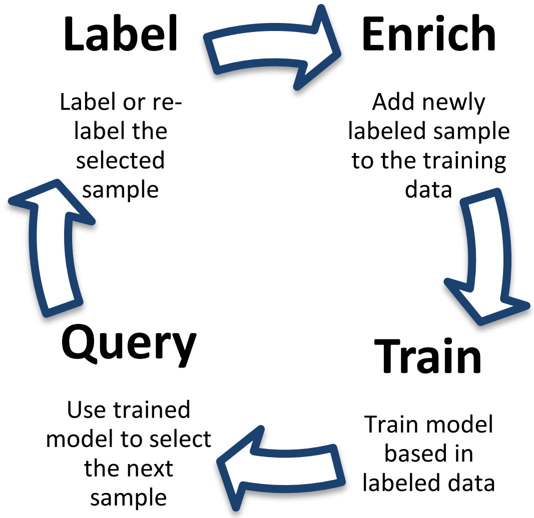

Figure 1. Model framework.

Modeling approach

Previous literature (see perspective piece by Malde et al., 2020) suggests adapting a pre-trained convolutional neural network (CNN) designed for image classification to estimate age using otolith images obtained via microscope camera. This type of model is trained on a large collection of images of otoliths previously aged by human readers. Moen et al. (2018) presents the first case of the use of deep learning and CNN to estimate age from images of whole otoliths of Greenland halibut (*Reinhardtius hippoglossoides*).[4]

Artificial neural networks (ANNs) are computational structures inspired by biological neural networks. They consist of simple computational units referred to as neurons, organized in layers. The neuron parameters (or weights) are estimated by training the model using supervised learning. This process consists of two steps: forward propagation, where the network makes a prediction based on the input; and back propagation, where the network learns from its mistake by calculating the gradient of a loss function, and then uses the gradient to update the neuron weights. The ANNs approach has been used for fish ageing by Robertson & Morison (1999) and Fablet & Le Josse (2005) with a limited success.

The neural networks approach significantly improved in recent years with the increase in the number of layers, applying an approach often referred to as deep learning. Deep learning neural networks are known for their generality. With sufficient training data, they can be used to classify raw data (e.g., an array of pixels) directly, without explicit design of low-level features. The deep learning algorithm lower layers learn to distinguish between primitive features automatically, typically identifying sharp edges or color transitions. Subsequent layers then learn to recognize more abstract features as combinations of lower layer features, and finally merge this information to provide a high-level classification.

In CNNs (LeCun et al., 1998; Simonyan & Zisserman, 2015), the layers are structured as stacks of filters, each recognizing increasingly abstract features in the data. Convolutional layers may be understood as an efficient way to transform an input image into another image, highlighting meaningful patterns, learned from data during training. The training is sequential, meaning the output of each layer is the input of the next layer, and the useful features are learned in the

[4] CNN was also applied for other tasks related to fisheries management, e.g. fish species identification (Allken et al., 2019).

various layers during training. This approach is very effective for many image analysis problems, where objects are often recognized independent of their location. During network training, the performance is monitored over sequential epochs. Epochs represent the number of times that the training dataset is passed forward and backward through the network to refine model weights. Whenever the validation loss decreases, the trained model is saved, ending up with the network that corresponds to the minimum loss and highest accuracy on the validation set. The trained network is then evaluated on the testing set.

In the CNN model, age prediction from otolith images can be formulated either as a classification task - where age is treated as a categorical variable - or as an image regression task, which involves predicting a continuous numerical value. Although treating fish age as a discrete parameter is a common method for identifying individual year classes, i.e., grouping fish by spawning year (Moen et al., 2018), this approach has proven less effective for Pacific halibut. As a long-lived species with a wide distribution of age classes, Pacific halibut pose a challenge for classification-based methods. The oldest Pacific halibut on record have been aged at 55 years (Keith et al., 2014).

Software and architectural options

The proposed approach builds on prior work by Moen et al., (2018) and Moore et al., (2019), who implemented CNNs for otolith-based fish age estimation using the TensorFlow and Keras libraries. TensorFlow remains one of the most widely used and well-supported frameworks for deep learning, and Keras provides a high-level API that simplifies TensorFlow model development.

The approach utilizes a transfer-learning technique to develop a CNN for otolith age estimation. Transfer learning is the process of repurposing a machine learning model that has been pre-trained for another, related, task. Specifically, it starts with the InceptionV3 model from Google, pre-trained on the ImageNet database. ImageNet database contains over 14 million annotated images classified into 1,000 categories. By loading CNN layers with publicly available pre-trained weights rather than random initialization, transfer learning significantly enhances model performance.

To adapt this model specifically for Pacific halibut ageing, modifications included scaling the input layer to match otolith images' resolution[5] and changing the output from multi-dimensional class probabilities to a single numeric output for regression.[6] Thus, the architecture employed follows the pattern: Input → InceptionV3 (feature extractor) → Regressor → Output, optimized

[5] Resolution is the total number of pixels along an image's width and height, expressed as pixels per inch (PPI). The Inception v3 model processes images that are 299 x 299 pixels in size. The original images (2548 × 2548 pixels) were first resized to 400 × 400 pixels prior to input into the model. This intermediate resizing step preserves more visual detail than a direct downscaling to 299 × 299 and allows for subsequent data augmentation operations (such as cropping, flipping, or rotation) to be applied more effectively before the final resize to the model's required input size.

[6] Alternatively, Politikos et al. (2021) replaced the last layer with a feed-forward network with two hidden layers replacing the default 1000-categories output layer with a fully-connected layer with six hidden nodes, corresponding to a limited number of age categories [Age-0 – Age-5+], with the last one representing fish of age 5 and older, In this case, the network outputs probabilities using the softmax function, a function that performs multi-class classification and transforms the outputs to represent the probability distributions over a list of potential outcomes. The IPHC uses in its stock assessment bins Age-2 – Age 25+ for the current age data and Age-2 - Age-20+ for the historical surface read ages. The adoption of a larger number of age categories prompted the decision to incorporate a regression layer in place of class probabilities.

using stochastic gradient descent (SGD) to minimize mean squared error (MSE) between model predictions and expert annotations.[7]

A similar approach, although adopting classification approach, was applied for ageing Greek Red Mullet (*Mullus barbatus*) (Politikos et al., 2022) and the associated code is available on GitHub (github.com/dimpolitik/DeepOtolith). The available open-source code was adapted to test the approach for Pacific halibut.

In addition to the InceptionV3 architecture, alternative architectures were explored to identify potentially superior performance or efficiency advantages. These included EfficientNet variants (EfficientNetB4, EfficientNetB5, EfficientNetV2 S/M/L) and ConvNeXt. EfficientNet architectures are known for their balanced approach to scaling depth, width, and resolution, optimizing computational efficiency and accuracy. EfficientNetV2 further refines this by introducing progressive training and improved scaling techniques. ConvNeXt architectures, inspired by transformer models, incorporate modifications to convolutional structures, achieving competitive accuracy with a simplified design and potentially improved model interpretability.

While TensorFlow/Keras has been the primary framework used in the current implementation, future work may explore alternative frameworks such as PyTorch (originally developed by Meta), which offers flexible dynamic computation graphs and growing adoption in the deep learning research community.

Performance metrics and achieved accuracy

Performance of the CNN to correctly assign ages (rounded output of the regression layer) to otolith images in the test set is assessed via the root mean squared error (RMSE) and the percentage of correctly predicted ages, as well as predictions within ±1 year tolerance. Moen et al., (2018) also suggest calculating coefficient of variation (CV).[8]

Moen et al., (2018), for Greenland halibut, achieved MSE for the left and right otoliths and pair of 3.27, 2.71 and 2.99, respectively. Age was correctly estimated for 48 out of the 164 tested otolith-pairs (29%). In addition, 63 cases (38%) were estimated to be one year off the read age. There was also a clear tendency for the system to predict a lower age for older individuals, when compared to human readers. The variance of the predictions also increased with the age of the otolith.

The model developed by Moore et al. (2019), for prediction of age of snapper using CT scans,[9] gave the same age as the human reader for 47% of otoliths in a test dataset, with a further 35% of ages estimated within 1 year of the human reader estimate of age (n=687). For hoki, the model gave the same age as the human reader for 41% of individuals (n=882).

The age model for Greenland halibut by Politikos et al., (2022) gave RMSE of 1.69 years between age prediction and age reading by experts (n=8,218, 26 age categories). For Greek

[7] In practice, the neural network minimizes the MSE of normalized age values, i.e., age values divided by the maximum age provided as input.

[8] The CV of the predicted age at true age is the primary input to the IPHC stock assessment. It is generally modelled as a parametric function of age accounting for the complex joint probability that both estimates can be incorrect (Punt et al., 2008).

[9] CT scanning uses X-ray technology to produce image slices through objects, which can be reconstructed into virtual, three-dimensional (3D) images that can be rotated and viewed in any orientation (Moore et al., 2019). Such images may provide more accurate estimates, but the cost of this approach is prohibitive at (based on trial conducted in New Zealand) $1,500 per day, with scan timed for an individual otolith between 40 min to one hour. However, as the technology progresses, this approach may provide an option for fully automating the entire ageing process by scanning a whole fish (e.g., along a conveyor belt). Deep learning methods (i.e., CNN) developed for age determination from surface images could serve as a base for age determination from CT scans.

red mullet, correct age was predicted for 69.2% individuals, with an additional 28.2% being within 1 year of error (n=5,027).

Benson et al., (2023), using near-infrared spectroscopy of otoliths, supplemented by geospatial and biological data routinely collected on the survey, estimated age of walleye pollock. For the optimal multimodal CNN model, an RMSE of 0.83 for the training set and an RMSE of 0.91 for the test set indicated that at least 67% of estimated ages were predicted within ±1 year of age compared to traditional microscope-based ages.

However, it should be noted that neither the traditional ageing methods for Pacific halibut are perfectly accurate. Within- and between-reader agreement in age assignment is generally 60%-70% complete agreement, 80% to 90% within one year, and 100% within 3 years. The IPHC Secretariat's publications report on % agreement (see *Technical Report No. 46* and *No. 47*).

Use of auxiliary data

The accuracy and precision of age predictions from otolith images using neural networks could potentially be enhanced by incorporating auxiliary data into the modeling process (Moen et al., 2018). For example, the geographic location where fish are captured could offer valuable supplementary information to the model. Past IPHC work suggests a good deal of spatial variation in Pacific halibut growth ring patterns. This points to the importance of good spatial coverage in the training sample.

The project plans to explore the integration of spatial covariates, such as latitude, longitude, or defined regulatory areas, to refine age predictions. Inclusion of these spatial factors could help the neural networks better interpret and account for region-specific growth patterns that influence otolith formation. Other available auxiliary data include collection year, which could be applied to account for variation between cohorts and prevalent environmental conditions throughout the aged fish life histories, and the collection dates, which provide insights into seasonal variation to the interpretation of the otolith edge.

Database

The IPHC annually ages a considerable number of otoliths (see *Appendix A* for details). Since 1925, over 1.5 million otoliths have been aged and stored for potential future use. Otoliths collected by the IPHC for ageing purposes undergo additional processing. Otoliths are sectioned (broken in half) and baked to enhance the contrast between the growth rings. These stored and previously aged otoliths serve as a valuable resource for creating a database of images for training purposes. To optimize model training, the selection of otoliths included in the model covers a broad spectrum of fish sizes, ages, sexes, and collection locations.

Before photographing, processed otoliths were placed in a monochrome tray featuring an elongated groove designed to keep the otolith upright and immersed in water. The pictures were taken with AmScope 8.5MP eyepiece cameras,[10] under consistent lighting conditions and magnification. The input database includes images of standardized size, 2,548 by 2,548 pixels, which are later resized to the desired resolution based on the model's specification.[11]

[10] The camera fits in one of the microscope eyepieces, eliminating the need to purchase a separate camera mount for the microscope.

[11] Moen et al. (2018) used images 400 by 400 pixels, which required the input layer to be scaled to match the Inception V3 requirements (299 by 299 pixels). Ordoñez et al. (2020), using the same set of images, built a CNN with images resized to 224 by 224 pixels, the default input of the VGG-19 model. Higher resolution images offer the flexibility to adapt the model in the future to more detailed and complex image analysis tasks, potentially improving the accuracy and effectiveness of image recognition capabilities.

It is important to note that it may not be necessary to image the otoliths at resolutions sufficient for human viewers to resolve, because the CNN may be able to arrive at an age estimate without directly counting bands (Moore et al., 2019).

Figure 2 shows an example of a range of images used in the CNN training dataset.

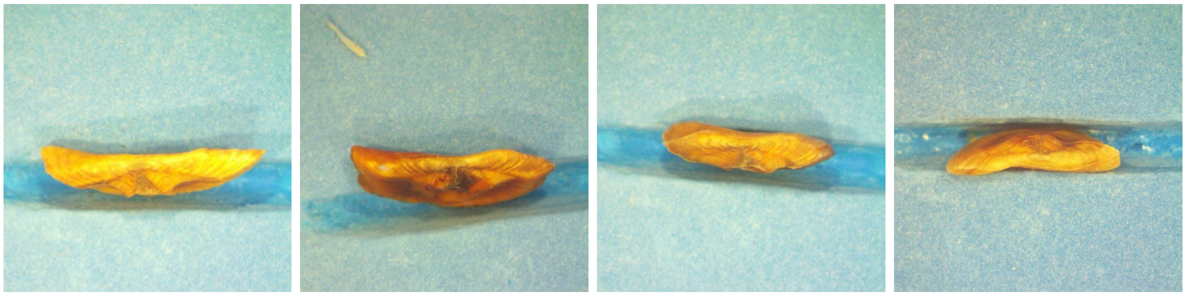

Figure 2. Examples of Pacific halibut otolith images taken for inclusion in the training set.

In addition, the IPHC is in the process of creating complimentary database comprising labelled images of otoliths captured prior to processing to conduct a cost-benefit analysis of using processed versus unprocessed otoliths for AI-based age determination. Example images are provided in Figure *3*. In their research, Politikos et al. (2022) utilized digital images of otoliths that were not subject to any additional processing in the laboratory, immersed in water and placed under a stereomicroscope on a white background with transmitted light. However, it is important to note that even if results indicate that breaking and baking is not necessary for age determination using AI, a subsample would have to be fully processed for age determination with traditional methods by an expert reader.

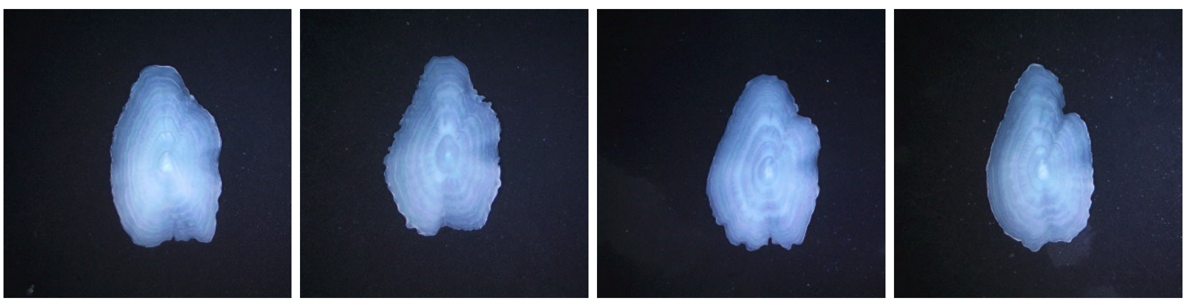

Figure 3. Examples of Pacific halibut otolith images taken for inclusion in the training set.

Presorting otoliths

The adopted procedure excludes broken otoliths, applying manual presorting at the image-taking stage. Presorting has also occurred at the collection stage when crystalized otoliths[12] are omitted when collecting samples.

Image collection

The image collection is associated with labels storing:

1. Otolith reference number – using referencing system already in place;
2. Image name and location – exact path for image access;
3. Resolved age – human reader derived age (**rsvage**);

[12] Crystalized otoliths have an altered composition – specifically, where the aragonite in the otolith is partially or mostly replaced by vaterite, a phenomenon known as otolith crystallization. Crystallized otoliths are not suitable for ageing. About 1% of otoliths are partly crystallized and are assigned ages.

4. Year collected – to account for variation between cohorts and prevalent environmental conditions;
5. Date collected – to account for the ‘edge effect’ reflecting seasonal changes;
6. Geospatial characteristics of the collection site (latitude, longitude and IPHC Regulatory Area) – to capture regional variation;
7. Resolved sex – to determine whether otolith characteristics (possibly not directly visible to human eye) could be used for sex determination.[13]

Uncertainty estimates

To further refine accuracy in a production setting, a mixed-method approach can be applied. This approach involves selecting a subset of otolith images - e.g., 10% or 20 % - for re-examination by human experts, focusing specifically on cases where the AI model expresses low confidence in its predictions. These selections can be guided by model-derived uncertainty estimates. The newly relabeled samples can then be incorporated into the training set for annual fine-tuning, contributing to ongoing model improvement in a resource-efficient and targeted manner.

In practice, this strategy would allow human experts to focus on “difficult” otoliths—those with high uncertainty—while automating the processing of “easy” ones with high model confidence. This hybrid workflow enhances throughput without compromising the accuracy and consistency necessary for applications such as stock assessment, where minimizing systematic bias is critical.[14]

Two approaches were considered for quantifying model uncertainty:

- **Monte Carlo dropout** (Gal & Ghahramani, 2016): This technique involves performing multiple forward passes through the model with dropout layers activated during inference. The resulting variability in predictions across passes is used to estimate confidence intervals. Monte Carlo Dropout is computationally efficient and easy to implement, and it provides a useful proxy for identifying ambiguous or noisy samples. This form of per-sample uncertainty is also referred to as training dynamics or soft loss tracing.
- **Deep ensembles** (Lakshminarayanan et al., 2017): This approach involves training multiple independently initialized models and aggregating their predictions to form a consensus output. The variance across ensemble members serves as an estimate of prediction uncertainty. Deep ensembles are generally more robust than Monte Carlo Dropout, especially in identifying out-of-distribution samples and capturing both model and data uncertainty. Their main advantage lies in their improved predictive performance and better-calibrated confidence intervals, though at the cost of increased computational resources.

Together, these tools support the design of a semi-automated, quality-controlled ageing protocol that leverages the strengths of both AI and human expertise.

[13] IPHC is currently using genotyping for Pacific halibut sex determination.
[14] If there is a strong junction in the relative precision between old and younger fish due to the change in methods this may require a nonparametric approach to ageing imprecision. If an AI method is biased as a function of age (standard for surface reading methods) and the break and bake method is unbiased, integrating the methods may prove challenging.

PRELIMINARY RESULTS

Comparison of model architectures

Several modern CNN architectures were systematically evaluated to determine the most suitable approach for ageing Pacific halibut using otolith images. The architectures tested included:

- **InceptionV3**: A widely used CNN known for its balanced computational efficiency and accuracy.
- **EfficientNet (B4, B5, V2 S/M/L)**: Architectures optimized for scaling model depth, width, and resolution uniformly, enhancing computational efficiency and predictive accuracy.
- **ConvNeXt**: Inspired by transformer-based models, ConvNeXt utilizes modified convolutional operations aiming to simplify model complexity while maintaining competitive performance.

Each architecture was adapted via transfer learning, leveraging publicly available pre-trained weights, and subsequently fine-tuned specifically for the task of Pacific halibut age prediction. Adaptations involved resizing input images to match each architecture's requirements and adjusting the output layer to perform regression predicting age as a continuous numeric value.

The models were evaluated using standardized procedures to ensure valid and robust comparisons. The main evaluation criteria included:

- RMSE, percentage of exact age matches, and percentage within ±1 year tolerance between predicted ages and expert-provided ages for a test set of images collected within the same year as those used for training (without image overlap).
- RMSE, percentage of exact age matches, and percentage within ±1 year tolerance for a second test set comprising images collected five years after the training images, providing an assessment of temporal generalization.

The evaluation involved multiple experimental runs to ensure robustness. Selection of model run configurations and evaluation results are provided in *Appendix 2*.

The comparative evaluation revealed significant performance differences among tested CNN architectures. Despite their advanced theoretical advantages - such as better scalability, computational efficiency, and deeper learning capabilities - EfficientNet and ConvNeXt models underperformed relative to the simpler InceptionV3 architecture. Several configurations of EfficientNet and ConvNeXt exhibited limited learning, with predictions regressing toward the mean age of the test dataset. This outcome suggests that these more complex models struggled to extract meaningful age-related features from the otolith images, likely due to a combination of insufficient training data and overfitting driven by model complexity.

In contrast, the InceptionV3 architecture consistently derived more accurate and reliable predictions, suggesting that its simpler structure is more suitable given the current limitations in dataset size and variability. However, the selected final InceptionV3 configuration presented in this update demonstrates substantial improvements compared to previously evaluated models. Driven by the goal of improved temporal generalization, the new model applies more aggressive image augmentation strategies,[15] an adaptive learning rate and better tuned training parameters. These methodological enhancements contribute to improved model performance and predictive reliability.

[15] Rotation range=360, width shift range=0.1, height shift range=0.1, brightness range=[0.95, 1.05], and zoom range=[0.98, 1.02].

Selected model evaluation

The selected model configuration utilized 2,799 images of otoliths collected during the 2019 IPHC fishery-independent setline survey (FISS). The 2019 FISS represents a comprehensive sampling effort expected to reflect regional variability in Pacific halibut otolith characteristics. As such, it provides a robust foundation for initial model development and evaluation.

The images were divided into training, validation, and test datasets. The training set (1,665) was used for training purposes. The validation set (294) was used to evaluate the model during the training process, allowing for adjustments without using the test set, which was reserved for the final evaluation. The test dataset (30%, 840) was used to assess the performance of the model after training, providing an unbiased evaluation of its generalization capability to new, unseen data. Additionally, a separate set of 2,704 images of otoliths collected during the 2024 FISS was used to verify model performance on additional unseen data, testing the temporal generalization of the model configurations. All images were resized to 400x400 pixels. Images of broken otoliths were excluded.

The selected model employed a maximum of 600 training epochs, with early stopping patience set to 80 epochs. A learning rate reduction was triggered if validation loss plateaued for 40 epochs, reducing the rate by a factor of 0.6. The initial learning rate was set at 0.0002, and training was performed using a batch size of 16. A comprehensive suite of image augmentation techniques (e.g., rotation, zoom, flipping, brightness variation) was applied to improve generalization and robustness.

To enhance model reliability and quantify uncertainty, a deep ensemble approach was adopted. The model was trained 15 times, each with a different random seed. Ensemble outputs were averaged to produce final predictions and calculate prediction uncertainty. Detailed results for individual ensemble members are provided in *Appendix C*.

Across ensemble runs, the model trained for an average of 288 epochs (208 effective epochs with early stopping set at 80). It achieved a normalized MSE of 0.00016 on the validation set and 0.00188 on the test set. When results were rounded to the nearest integer age, the average RMSE for the test set was 1.80. On average, the ensemble predicted the exact age correctly for 30.3% of test images, and an additional 41.7% were within ±1 year of the manually assigned age, resulting in a total agreement within 1 year for over 70% of cases.

Figure *4* shows a comparison between manually derived ages and AI-predicted ages across the ensemble. Figure 5 compares the age composition estimated manually with that derived from the ensemble model predictions.

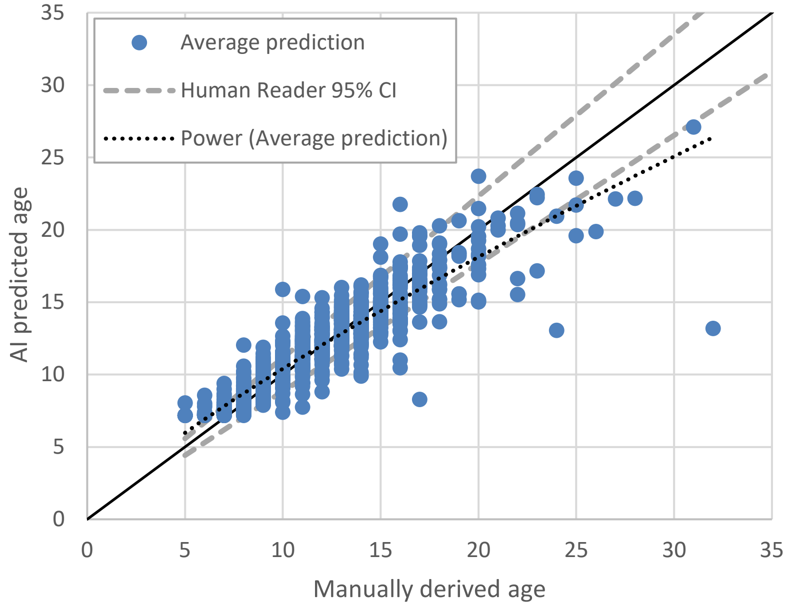

Figure 4. Comparison between manually derived age with AI predicted age.

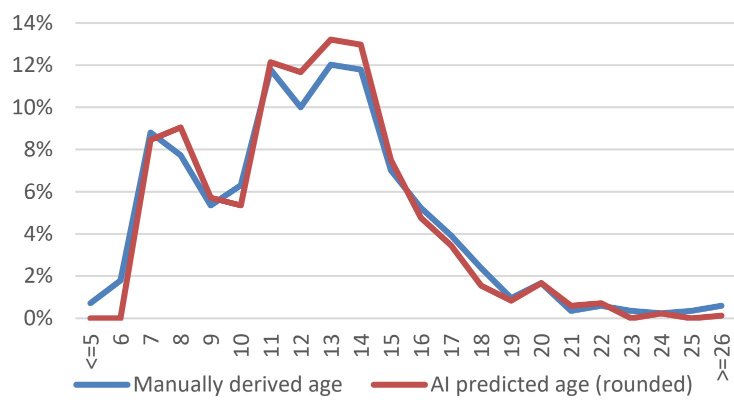

Figure 5. Comparison between manually derived age with AI predicted age – age composition.

It is important to note that statistically significant bias continues to be observed in age categories 21 and older. However, the latest results indicate an upward shift in the threshold of observed bias, which was previously starting at age 16. The number of observations for older age categories remains low despite an overall increase in sample size (Figure *6*). This suggests that the saturation point for achieving optimal accuracy in older age categories may not yet have been reached, and the model could benefit from further improvement by adding more images representing older age categories to the training set. Currently, only 2.6% of the otoliths (74 samples) used in the model were from fish aged 21 or older.

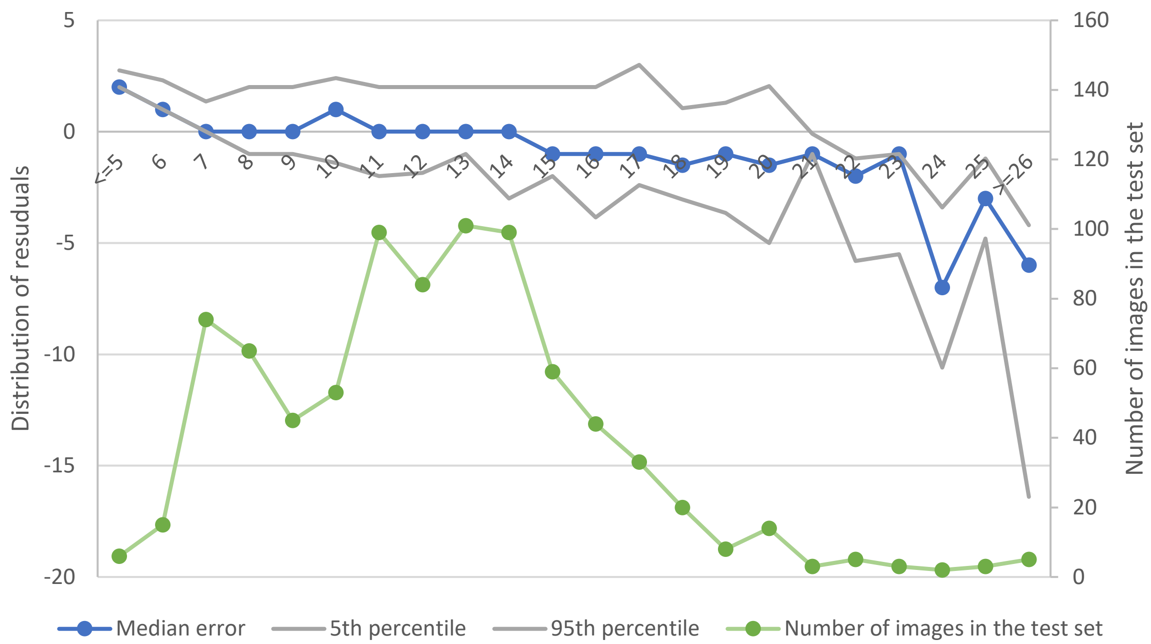

Figure 6. Distribution on residuals and number of images by age in the test set.

Testing temporal generalization

The performance of the model trained on the 2019 FISS sample declined when applied to otolith images collected during the 2024 survey, reflecting the challenges of temporal generalization. On average, the root mean squared error (RMSE) increased to 2.562, representing an approximate 42% increase compared to the 2019 test set. Furthermore, the proportion of predictions within ±1 year of the manually assigned age dropped by 16.7 percentage points, indicating a decline in predictive accuracy.

However, the use of a deep ensemble approach enabled a more nuanced evaluation of model reliability. Specifically, the ensemble framework provided per-sample uncertainty estimates (measured as the standard deviation across model predictions), which helped distinguish between confidently and less confidently predicted samples. This enabled stratification of predictions by uncertainty level.

Figure 7 shows the cumulative proportion of 2024 test samples for which the ensemble prediction falls within ±1 year of the manually assigned age, as a function of increasing prediction uncertainty (measured by the standard deviation across the ensemble). The curve confirms that predictions with lower uncertainty levels tend to be more accurate. For the least uncertain subset of the test data (e.g., the first ~20%), accuracy within ±1 year exceeds 80%, while this metric gradually declines as predictions with higher uncertainty are included. By the time the entire sample is considered, accuracy drops to approximately 59%.

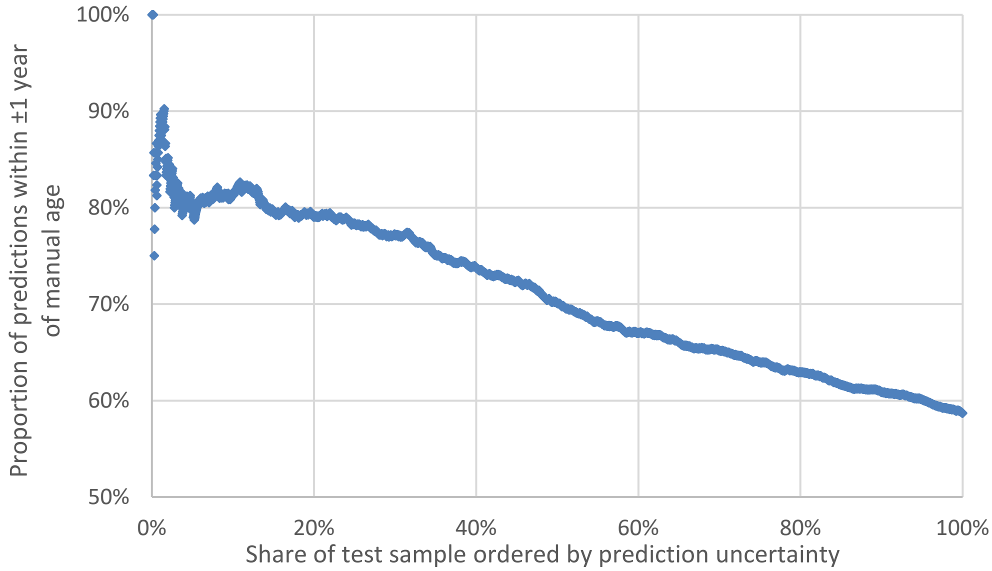

Figure 7. Proportion of ensemble predictions within ±1 year of manual age as a function of cumulative share of the test sample, ordered by prediction uncertainty (standard deviation).

Fine-tuning the model

To assess the impact of fine-tuning on model generalization across years, the ensemble originally trained on 2019 FISS images was fine-tuned using a randomly selected 20% subset of otoliths collected in 2024. The model was then evaluated on the remaining unseen 80% of 2024 images. Fine-tuning yielded modest improvements: the average RMSE across ensemble runs decreased from 2.562 to 2.396, and the proportion of predictions within ±1 year of the manually assigned age increased from 55.4% to 57.6%.

In a separate analysis, the fine-tuning subset was selected based on uncertainty rather than random sampling. Specifically, 20% of 2024 images with the highest standard deviation across ensemble predictions - interpreted as the most ambiguous or noisy samples - were used for fine-tuning. This targeted approach led to further gains in predictive accuracy. When evaluated on the remaining 80%, the model achieved an RMSE of 2.150.

Surface images

This analysis examined whether otolith images captured prior to processing (surface images) can be used to reliably predict fish age using AI models, and how their performance compares to the use of images of processed otoliths. The goal was to evaluate both the viability and potential accuracy of surface images as a practical alternative.

Three configurations were tested:

1. **BB match**: The model was trained using 2,696 sectioned and baked otolith images collected during the 2024 FISS, for which matching surface images were also available (5 runs).
2. **Surface match**: The model was trained on the same selection of 2,696 surface images (5 runs) to allow a direct comparison under identical input conditions (sample size and age distribution).
3. **Surface ALL**: A model was trained using the full set of 5,557 available surface images, maximizing data size (3 runs).

The comparative analysis of otolith surface images and images of processed otoliths (see Table 1) demonstrated that surface images are a viable alternative for AI-based age prediction. When models were trained on matched datasets, predictive performance using surface images was comparable to that of processed otoliths images, with similar test set MSE and R^2 values. Furthermore, the model trained on the full set of 5,557 available surface images achieved strong results, with an average test MSE of 0.00298. These findings suggest that surface images, when available in sufficient quantity, can potentially match models based on processed otoliths. This highlights the potential to streamline future otolith ageing workflows by relying on unprocessed images without compromising predictive accuracy. However, it is important to note that this evaluation was limited to data from a single year. In the absence of a multi-year surface image dataset, it was not possible to assess the temporal robustness or generalization capability of the surface-image-based models.

Table 1: Average results of model configurations used to assess viability of surface images for AI-based ageing.

	BB match	Surface match	Surface ALL
Epochs trained	231	223	229
Validation MSE	0.00273	0.00298	0.00284
Test MSE	0.00315	0.00297	0.00298
R^2	0.79	0.80	0.79
Run time (VM)	159	164	345

CONCLUSIONS

The ongoing advancement of AI technologies in the field of marine science offers considerable potential to enhance the efficiency of age determination of Pacific halibut using otolith images. Preliminary results presented here suggest that convolutional neural networks (CNNs), particularly when implemented using a deep ensemble approach, could provide predictive accuracy that supports their use as a supplement- or in some cases, a potential alternative - to the current manual ageing protocol.

Among the models tested, the InceptionV3 architecture outperformed newer and more complex architectures such as EfficientNet and ConvNeXt. This outcome likely reflects the relatively limited size and variability of the training dataset, which favors architectures with fewer parameters and less sensitivity to overfitting. While deeper models may eventually outperform simpler ones with more data and advanced tuning, InceptionV3 currently offers the most robust and consistent performance for this application.

These results also highlight the practical value of the deep ensemble framework. In addition to improving predictive performance, ensemble-based models provide per-sample uncertainty estimates that can be used to identify potentially unreliable predictions. This enables a mixed-method protocol in which low-confidence predictions (e.g., those with high standard deviation across ensemble members) can be flagged for expert review, while high-confidence outputs may be accepted directly - streamlining the ageing workflow while maintaining accuracy.

Results also showed that model performance deteriorates when predictions are made on data collected in years different from the training sample (i.e., temporal generalization is limited). However, modest fine-tuning with current-year data improved predictive performance, reducing RMSE of predictions and increasing accuracy within ±1 year of expert labels. When fine-tuning was focused specifically on uncertain samples - those with the highest variance across ensemble predictions - performance gains were even better. These findings confirm that targeted fine-tuning, guided by uncertainty, is an effective strategy for adapting models to new data while minimizing manual ageing need.

Surface images also showed promise as a practical input for ageing models. When trained on matched datasets, models using unprocessed surface images performed comparably to those using sectioned and baked otoliths. These findings point to the possibility of eliminating otolith processing steps for AI-based ageing in the future, though further multi-year evaluation is needed to confirm long-term robustness.

Despite promising progress, important limitations remain. Statistically significant bias was observed in predictions for the oldest age categories (21+), which remain underrepresented in the training dataset. Only 2.6% of otoliths used in the main model were from fish aged 21 or older, suggesting that improved model accuracy for older fish will require supplementing database in a targeted manner with images from older fish. Expanding the dataset to improve representation across all age classes especially older individuals will be essential to reduce residual bias and ensure model reliability across the full biological age range.

Finally, it is crucial to emphasize that AI-based ageing models must continue to rely on human experts, both for validation and for providing high-quality training data that reflect temporal, spatial, and environmental variability. As environmental conditions and stock structure continue to change, integrating expert oversight and continual model updating will remain a critical part of accurate AI implementation for ageing process.

RECOMMENDATION

That the Commission:

- **NOTE** paper IPHC-2025-IM101-INF03 that summarizes the information available on the use of artificial intelligence (AI) for determining the age of fish from images of collected otoliths and provides an update on the exploratory work of implementing an AI-based age determination model for Pacific halibut.

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APPENDIX A: COUNTS OF OTOLITHS AGED BY THE IPHC

Collection year	Ageing method	IPHC FISS*	Commercial (Market Sample)*	NOAA Trawl survey*	Tag recovery*	ADF&G recreational*	Clean collection
pre-1960	surface	70,984			10,068		
1960	surface	6,606			681		
1961	surface	4,727		4,576	842		
1962	surface	2,605		1,692	594		
1963	surface	8,257		2,209	440		
1964	surface	10,295	27,828	1,001	353		
1965	surface	5,169	27,252	1,186	493		
1966	surface	3,750	24,638	1,777	796		
1967	surface	6,325	29,797	2,271	1,151		
1968	surface	2,314	29,772	1,887	1,813		
1969	surface	1,510	23,361	1,019	1,869		
1970	surface	1,138	24,686	1,184	867		
1971	surface	2,702	16,374	2,294	732		
1972	surface	2,597	23,381	1,180	490		
1973	surface	1,747	16,683	893	244		
1974	surface	1,021	11,569	1,189	128		
1975	surface	1,212	14,128	1,136	131		
1976	surface	1,843	14,103	969	72		
1977	surface	1,853	13,514	1,102	83		
1978	surface	1,933	11,434	1,309	61		
1979	surface	2,021	7,219	730	93		
1980	surface	5,022	10,317	717	168		
1981	surface	7,942	8,267	460	129		
1982	surface	5,720	9,644	443	208		
1983	surface	5,822	9,262	1,355	286		
1984	surface	6,508	10,233	1,089	455		
1985	surface	5,872	12,986	1,192	778		
1986	surface	5,139	12,426	1,120	1,020		
1987	surface	42	16,137		859		
1988	surface	1,179	17,154	98	761		
1989	surface	6,130	14,122		710		
1990	surface	2,201	14,800	4,802	397		
1991	surface	1,315	13,461	2,598	280		
1992	surface/BB	7,530	14,564	222	182		
1993	surface/BB	3,384	13,747		147		
1994	surface/BB	2,618	13,311		99		
1995	surface/BB	4,512	12,297	433			
1996	surface/BB	10,893	13,452	2,211			
1997	surface/BB	14,784	15,501	834	148		
1998	surface/BB	8,587	14,395	1,145	98		

1999	surface/BB	11,971	12,858	3,029	70	3,672	
2000	surface/BB	14,122	13,982	1,209	46	2,706	
2001	surface/BB	14,731	13,181	2,952	27	2,609	
2002	BB	13,635	17,932	761	24	2,349	
2003	BB	12,626	13,915	3,876	79	2,754	
2004	BB	14,474	11,798	897	450	3,288	
2005	BB	12,651	14,650	2,028	643	3,183	
2006	BB	14,976	13,399	2,621	679	3,179	
2007	BB	16,285	13,964	3,930	455	3,026	
2008	BB	15,545	13,460	1,527	304	1,500	
2009	BB	15,706	13,583	4,922	276	1,500	
2010	BB	14,080	16,106	1,915	21	1,500	625
2011	BB	14,451	11,391	4,592	26	1,500	676
2012	BB	17,896	12,902	1,639	9	1,500	1164
2013	BB	12,717	11,039	2,044	19	1,503	1020
2014	BB	16,194	12,606	1,476	22	1,500	1096
2015	BB	15,815	12,312	2,133	24	1,500	1072
2016	BB	15,113	11,618	742	21	1,502	902
2017	BB	12,565	10,821	1,384	15	1,500	756
2018	BB	12,935	11,013	576	39	1,499	798
2019	BB	17,716	10,711	1,640	34	1,497	925
2020	BB	10,323	10,568	-	34	1,413	577
2021	BB	12,253	11,051	1,444	38	1,500	547
2022	BB	9,702	10,942	1,902	39	2,334	519
2023	BB	8,506	10,932	(3,147)	(48)	(1,958)	462
2024	BB	5,770	10,474[1]	(1,058)	(61)	(1,542)	458

Notes:

- Star (*) indicates blind side otolith.
- BB stands for ‘break and bake’ approach.
- All otoliths reported in this table were aged with the exception of the clean collection.
- All aged otoliths are stored in glycerol/thymol solution.
- Some small fish from trawl survey collection are still aged by surface method; otoliths with surface age>4 are sectioned and baked.
- Sample data not entered prior to 1960 for FISS, 1964 for commercial, 1961 for NOAA trawl survey.
- Clean collection is not aged, stored dry, and include paired otoliths.
- Tribal otoliths are included in the Market Sample series.
- Additionally, there are 144 not aged 2A recreational otoliths, all from Hein Bank collected between 2004 and 2009.
- Sex information available since 2017 (typically ca. 1 year of lag).
- Trawl and recreational otoliths lag one year in ageing.
- In brackets, otoliths available for ageing but ageing not completed.

[1] Commercial otolith collection subsampled: 10,474 otoliths were collected, 7,057 were selected for ageing

APPENDIX B: SELECTION OF MODEL RUNS

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SETUP				**												**
Architecture	InceptionV3	InceptionV3	InceptionV3	InceptionV3	EfficientNetB4	EfficientNetB4	EfficientNetB4	EfficientNetB5	EfficientNetB5	EfficientNetB5	EfficientNetV2 S	EfficientNetV2 M	EfficientNetV2 L	ConvNeXt	ConvNeXt	InceptionV3
Max epochs	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
EarlyStopping patience	50	100	100	80	50	50	50	50	50	50	60	50	100	100	60	80
ReduceLROnPlateau	NA	NA	NA	40/r=0.6	NA	NA	NA	NA	NA	NA	30 /f=.8	30 /f=.8	50 / f=0.5	50 / f=0.9	30 /f=.8	40/r=0.6
Learning rate (initial)	0.0002	0.0004	0.0004	0.0002	0.0004	0.0002	0.0004	0.0004	0.0004	0.0004	0.0016	0.0004	0.0008	0.0016	0.0016	0.0002
Batch size	16	8	16	16	16	16	8	8	16	4	8	8	8	16	12	16
Image size	400	400	400	400	380	380	380	456	456	456	384	480	512	224	224	400
Dropout rate	0.2	0.2	0.2	0.2/0.25	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2/0.25
L2 parameter	0.025	0.025	0.025	.025	0.025	0.025	0.025	0.025	0.025	0.025	0.03	0.025	0.025	0.025	0.025	0.025
Augmentation[1]	NA	NA	NA	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full
RESULTS																
Validation MSE	0.00195	0.00167	0.00156	0.00170	0.00334	0.00372	0.00444	0.00414	0.00308	0.00375	0.00865	0.00223	0.00789	0.00856	0.00334	0.00163
Epochs trained	92	297	249	260	156	109	80	126	128	166	142	123	224	199	138	318
Test MSE	0.0023	0.0021	0.0020	0.0019	0.0032	0.0040	0.0044	0.0038	0.0030	0.0041	0.0087	0.0025	0.0087	0.0087	.0087	0.0019
R^2	*	*	*	.77	*	*	*	*	*	*	*	*	*	*	*	0.78
RMSE-unscaled	1.986	1.880	1.877	1.834	2.341	2.591	2.718	2.543	2.254	2.649	*	2.072	3.833	*	*	1.782
Correctly predicted	29.5%	33.6%	31.7%	31.7%	21.3%	15.6%	22.9%	31.1%	27.9%	26.9%	*	26.5%	19.3%	*	*	30.4%
Correctly predicted with ±1 year tolerance	75.6%	77.4%	78.8%	72.1%	55.4%	43.9%	63.9%	72.1%	75.3%	70.8%	*	75.6%	65.1%	*	*	74.4%
RUN parameters																
Machine[2]	DS	DS	DS	MM	QS	QS	QS	QS	QS	QS	QS	QS	QS	QS	QS	VM
Run time in hours	14.0	47.3	35.2	11	*	*	*	30.0	32.3	38.9	12.3	29.0	116.4	45.3	45	4
RESULTS for 2024																
RMSE-unscaled	2.852	2.864	2.970	2.779	3.057	3.274	*	*	*	*	*	2.801	*	*	*	2.696
Correctly predicted	18.0%	18.0%	19.3%	19.0%	17.7%	10.9%	*	*	*	*	*	15.7%	*	*	*	19.9%
Correctly predicted with ±1 year tolerance	52.5%	48.3%	50.4%	50.2%	46.4%	32.8%	*	*	*	*	*	48.9%	*	*	*	54.9%

Note: All models for randomly selected seed numbers – individual results would vary.

1: Full augmentation setup included rotation range=360, width shift range=0.1, height shift range=0.1, brightness range=[0.95, 1.05], and zoom range=[0.98, 1.02].

2: Machine setups were as follows:

- QS: 11th Gen Intel(R) Core(TM) i7-11700K @ 3.60GHz; 8 cores
- DS: 12th Gen Intel(R) Core(TM) i7-12700; 12 cores
- MM: AMD Ryzen 9 5900X; 12 cores
- VM: AMD EPYC 7V12 64-Core Processor with Nvidia Tesla T4 GPU

* Indicates values not recorded for the given run.

**Indicates models selected for further investigation.

APPENDIX C: DEEP ENSEMBLE INDIVIDUAL RESULTS

Model run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	**AVERAGE**
Epochs trained	194	557	172	159	318	235	263	338	204	380	192	483	292	174	364	**288**
Validation MSE	0.0017	0.0015	0.0017	0.0017	0.0016	0.0017	0.0015	0.0016	0.0018	0.0015	0.0017	0.0015	0.0014	0.0016	0.0016	**0.0016**
Test MSE	0.0020	0.0018	0.0021	0.0022	0.0019	0.0019	0.0019	0.0018	0.0021	0.0017	0.0020	0.0017	0.0018	0.0019	0.0018	**0.0019**
R^2	0.776	0.797	0.756	0.749	0.783	0.784	0.779	0.794	0.764	0.804	0.774	0.809	0.797	0.785	0.796	**0.783**
Rum time (VM, min)	148	418	133	123	240	179	203	256	156	286	148	369	223	134	276	**219**
RESULTS – TEST SET																
Test RMSE unscaled	1.819	1.742	1.908	1.960	1.782	1.786	1.817	1.757	1.876	1.719	1.856	1.693	1.741	1.814	1.745	**1.80**
Correctly predicted	30.0%	30.6%	28.9%	23.5%	30.4%	31.3%	32.0%	31.4%	28.7%	32.5%	30.6%	32.1%	33.6%	29.0%	30.4%	**30.3%**
Correctly predicted with ±1 year tolerance	72.0%	74.5%	69.8%	64.6%	74.3%	71.3%	73.3%	74.4%	69.5%	74.5%	69.2%	75.1%	72.6%	71.3%	74.2%	**72.0%**
RESULTS – 2024 IMAGES																
RMSE	2.509	2.472	2.598	2.844	2.514	2.539	2.631	2.498	2.613	2.477	2.660	2.548	2.481	2.519	2.518	**2.562**
Correctly predicted with ±1 year tolerance	56.8%	57.4%	55.4%	52.7%	55.9%	55.1%	55.2%	55.5%	54.0%	58.8%	52.1%	57.1%	56.3%	52.1%	56.0%	**55.4%**
RMSE – fine-tuned on 20% images	2.378	2.350	2.451	2.418	2.328	2.404	2.396	2.389	2.440	2.331	2.493	2.379	2.408	2.444	2.334	**2.396**
Correctly predicted with ±1 year tolerance– fine-tuned on 20% images	59.7%	58.0%	54.4%	56.2%	59.1%	56.5%	58.0%	57.5%	57.0%	59.7%	56.3%	58.8%	57.0%	57.1%	58.4%	**57.6%**
RMSE – fine-tuned on 20% images with highest standard deviation	2.151	2.105	2.142	2.211	2.069	2.133	2.159	2.108	2.270	2.073	2.280	2.084	2.116	2.260	2.089	**2.150**
Correctly predicted with ±1 year tolerance– fine-tuned on 20% images with highest standard deviation	56.3%	59.4%	58.7%	53.7%	60.9%	59.0%	57.6%	59.3%	52.1%	57.9%	51.6%	60.5%	59.1%	52.8%	60.2%	**57.3%**