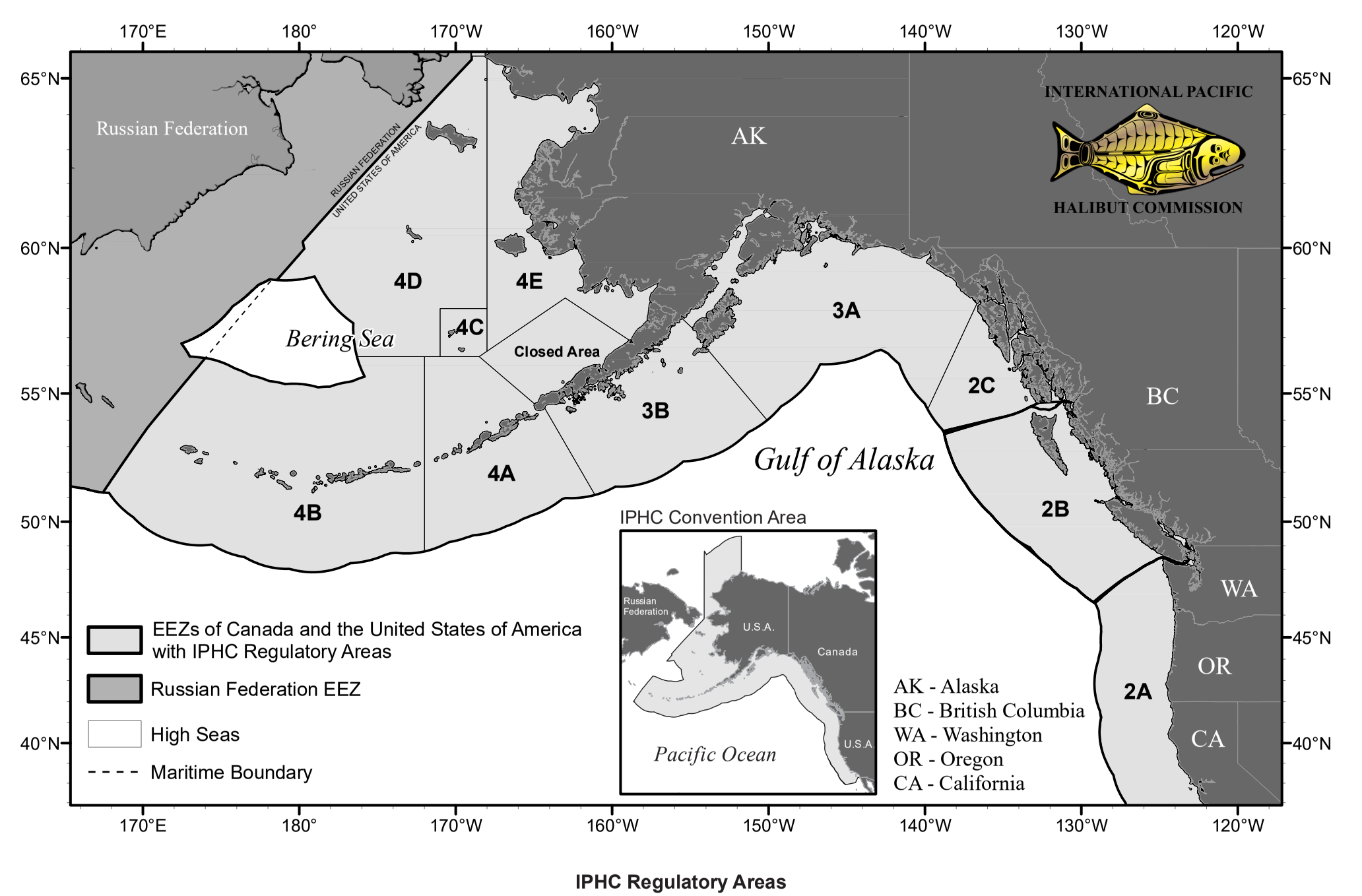
2022

Annual Report

INTERNATIONAL PACIFIC

HALIBUT COMMISSION



IPHC Regulatory Areas

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INTERNATIONAL PACIFIC HALIBUT COMMISSION

ANNUAL REPORT
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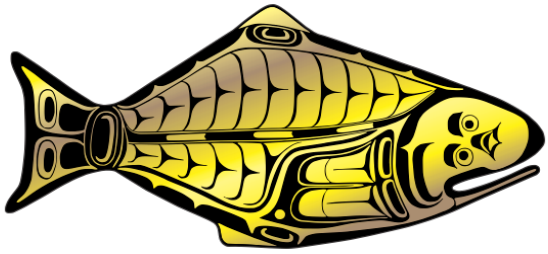

HALIBUT COMMISSION

Commissioners

Canada	United States of America
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Neil Davis	Robert Alverson
Peter DeGreef	Richard Yamada

Executive Director

David T. Wilson, Ph.D.

Bibliography entry

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Pacific halibut landing
Photographed by Dr. Barbara Hutniczak

Preface

The International Pacific Halibut Commission (IPHC) was established in 1924 by a Convention between Canada and the United States of America. The Convention was the first international agreement providing for the joint management of a marine resource. The Commission's authority was expanded by several subsequent conventions, the most recent being signed in 1953 and amended by the Protocol of 1979.

The IPHC mission is "… to develop the stocks of [Pacific] halibut in the Convention waters to those levels which will permit the optimum yield from the fishery and to maintain the stocks at those levels. …." (IPHC Convention, Article I, sub-article I, para. 2).

Three (3) IPHC Commissioners are appointed by the Governor General of Canada and three (3) by the President of the United States of America. The Commissioners appoint the Executive Director, who supervises the scientific, technical, field, and administrative personnel at the Secretariat. The Secretariat collects and analyzes the statistical and biological data needed to inform the management of the Pacific halibut stock within the Convention Area. The IPHC Secretariat headquarters is located in Seattle, Washington, U.S.A.

The Commission meets annually to review all regulatory proposals, including those made by the IPHC Secretariat, Contracting Parties, and by other interested stakeholders. The measures adopted by the Commission are recommended to the two governments for approval and implementation. Upon approval the regulations are published in the Canada Gazette and U.S. Federal Register and are enforced by the appropriate agencies of both governments.

Our shared vision is 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.

Data in this report have been updated using all information received by the IPHC through 31 December 2022 and reported at the 99th Session of the IPHC Annual Meeting in 2023. Some data may have been subsequently updated and readers are encouraged to access the IPHC website for the latest information: https://www.iphc.int/. Unless otherwise indicated, all weights in this report are net weight (eviscerated, head-off, no ice and slime). Round (whole) weight may be calculated by dividing the net weight by 0.75.

On the cover

The photographs featured on the cover of this report were taken by the Secretariat while engaged in field activities.

Acronyms used in this report

ADEC - Alaska Department of Environmental Conservation
ADF&G - Alaska Department of Fish and Game
BBEDC - Bristol Bay Economic Development Corporation
BSAI - Bering Sea and Aleutian Islands
CDFW - California Department of Fish and Wildlife
CDQ - Community Development Quota
CGOARP - Central Gulf of Alaska Rockfish Program
COAC - Clean Otolith Archive Collection
C&S - Ceremonial and Subsistence
CSP - Catch Sharing Plan
CVRF - Coastal Villages Regional Fund
DFO - Fisheries and Oceans Canada
DMR - Discard Mortality Rate
DO - Dissolved Oxygen
EBS - Eastern Bering Sea
EM - Electronic Monitoring
FISS - Fishery-independent setline survey
GAF - Guided Angler Fish
GOA – Gulf of Alaska
HCR - Harvest Control Rule
HARM - Halibut Angler Release Mortality
IFMP - Integrated Fisheries Management Plan
IFQ - United States Individual Fishing Quota
IPHC - International Pacific Halibut Commission
IQ - Individual Quota
IVQ - Canadian Individual Vessel Quota
MP - Management Procedure
MPR - Mortality Per Recruit
MSAB - Management Strategy Advisory Board
MSE - Management Strategy Evaluation
NBS – Northern Bering Sea
NMFS - National Marine Fisheries Service
NOAA - National Oceanic and Atmospheric Administration
NPFMC - North Pacific Fishery Management Council
NPUE - Numbers-Per-Unit-Effort
NSEDC - Norton Sound Economic Development Corporation
ODFW - Oregon Department of Fish and Wildlife
PAT - Pop-up Archival Transmitting
PDO - Pacific Decadal Oscillation
PFMC - Pacific Fishery Management Council
PHI - Prior Hook Injury
PSC - Prohibited Species Catch
PSMFC - Pacific States Marine Fisheries Commission
QS - Quota Share
RDE - Remote Data Entry
RI - Rockfish Index
RSL - Reverse Slot Limit
SRB - Scientific Review Board
SPR - Spawning Potential Ratio
WDFW - Washington Department of Fish and Wildlife
WPUE - Weight-Per-Unit-Effort
XRQ - Experimental Recreational Halibut

Executive Director's Message

Throughout 2022, the IPHC Secretariat has continued to make progress in enhancing our scientific processes and the communication of scientific advice emanating from our core functions as a Secretariat serving the Commission. This has continued to occur in tandem with an evaluation of the supporting governance procedures of the organisation, including how stakeholder inputs are incorporated into the decision-making framework to ensure that all points of view are being adequately considered in a transparent and accountable manner.

The 2022 TCEY (41.2 million pounds; 18,697 t) represented a 6% increase over that set for 2021 (39.0 million pounds; 17,690 t). This increase was projected to correspond to a fishing intensity of F43%, the IPHC's 'reference' level, tested through the Management Strategy Evaluation (MSE) process and found to meet long-term conservation and fishery objectives. Primary stock abundance indices decreased at the coastwide level and in most IPHC Regulatory Areas: the IPHC Fishery-Independent Setline Survey (FISS) numbers-per-unit-effort were down 8% from 2021, the legal-sized weight-per-unit-effort (WPUE) was down 15%, and the directed commercial longline fishery WPUE decreased by 15% from 2021. The declines corresponded to a shift from older fish (born in 2005 and earlier) to the 2012 year-class, which was 10 years old during the 2022 fishery.

The 2022 stock assessment (consistent with all recent assessments) estimated that the spawning biomass has declined by ~16% since 2016, and that this decline would continue with a high probability at mortality levels consistent with the reference fishing intensity. Improvements made to the stock assessment in 2022 revealed that recent productivity, largely a function of the poor recruitments occurring from 2006-2011, has been even lower than previously estimated, despite a more optimistic assessment of long-

(L-R) William Hankins, Lucy Hankins, and IPHC Executive Director Dr. David Wilson
Photograph provided by the IPHC

term productivity of the stock. The 2023 yield projected to maintain at least a 50% chance that the spawning biomass would decline no further than the 2022 estimate was 43 million pounds (19,504 t), just slightly above the status quo. Yields less than that level were projected to result in an increasing stock trend.

We started the year with the female spawning biomass estimated to be at 41% (22-54%) of the level expected in the absence of fishing, and at the beginning of 2023 this estimate remained at almost the same level of 42% (21–55%). These estimates are somewhat higher than in recent assessments due to improvements made for the 2022 assessment. Such a level of relative biomass is widely considered to be close to a reasonable target level for sustaining optimal harvest rates of groundfish species, though species biology and ecology play a large role in determining species-specific levels. For Pacific halibut, simulations have indicated that SB30% is a reasonable proxy for SBMSY (the spawning biomass that produces the maximum fishery yield), and SB36% is likely near SBMEY (the biomass that produces the maximum economic yield).

Looking forward, 2023 promises to be an exciting year for the IPHC as we commence our centenary year on 24 October 2023 and running until 23 October 2024 when we turn 100 as an organization. As the oldest RFMO in the world, the IPHC has blazed a path for others to follow in terms of quality science being used to inform management decision making processes.

I again look forward to engaging with all of you over the coming year, either through the Commission's subsidiary bodies, or in person at our landing ports and communities that so heavily rely on Pacific halibut as a source of income, food, and cultural identity. Wishing you all a safe and healthy 2023.

David T. Wilson, Ph.D.
Executive Director

Activities of the Commission

The Commission is composed of six (6) members (Commissioners) who are appointed by the Contracting Parties. They meet several times a year, in both formal and informal capacities, to consider matters relevant to the Pacific halibut stock, the fisheries, and governance. All meeting documents, presentations, and reports as well as more information on the structure of the Commission can be found on the IPHC website (https://www.iphc.int).

98th Session of the IPHC Annual Meeting (AM098; 2022)

The 98th Session of the IPHC Annual Meeting (AM098) was held electronically, from 24 to 28 January 2022. For AM098, Mr. Glenn Merrill of the United States of America presided as Chairperson and Mr. Paul Ryall of Canada presided as Vice-Chairperson. The Commission heard reports from the IPHC Secretariat about the status of the Pacific halibut (*Hippoglossus stenolepis*) population, reviewed finance and administration, discussed stakeholder concerns, considered the suggestions of its subsidiary bodies, and solicited public comment before adopting fishery regulations and making other decisions.

Mortality and fishery limits, and fishing periods for 2022

The Commission recommended to the governments of Canada and the United States of America a total mortality limit for 2022 of 18,697 tonnes (41.22 million pounds) net weight[1], and adopted the mortality limits for each IPHC Regulatory Area as described in Table 1.

The area and sector mortality and fishery limits resulting from the IPHC-adopted total mortality limits and the application of the existing Contracting Party catch sharing arrangements were as described in Table 2.

The total fishery limit (FCEY) for 2022 was set at 15,055 tonnes (33.19 million pounds), which represented about a 9 percent increase from the fishery limits of 13,757 tonnes (30.33 million pounds) implemented by the Commission in 2021.

The Commission adopted fishing periods for 2022 as follows:

- All commercial fishing for Pacific halibut in all IPHC Regulatory Areas could begin no earlier than 6 March and must cease on 7 December.

[1] Note that all weight values in this section are expressed in terms of net weight, meaning the weight of Pacific halibut that is without gills and entrails, head-off, washed, and without ice and slime.

IPHC Comissioners and Executive Management Team
Photographed by Tara Coluccio

Table 1. Adopted mortality limits (net weight) from AM098.

IPHC Regulatory Area	Mortality limit (TCEY) (tonnes)	Mortality limit (TCEY) (Mlbs)
2A	748	1.65
2B	3,429	7.56
2C	2,681	5.91
3A	6,600	14.55
3B	1,769	3.90
4A	953	2.10
4B	658	1.45
4CDE	1,860	4.10
Total (IPHC Convention Area)	**18,697**	**41.22**

- For the IPHC Regulatory Area 2A non-tribal directed commercial fishery, three-day (58-hour) fishing periods could take place beginning on 28 June and 12 July with additional openings and fishing period limits (vessel quota) to be determined and communicated by the IPHC Secretariat.

Other decisions made at the meeting

The Commission made a range of other recommendations and requests at the 98th Session of the IPHC Annual Meeting (AM098), including the following:

- Changes to the IPHC regulations to allow for the the use of trap gear in the IPHC Regulatory Area 2B commercial fishery.
- A request to the Secretariat that a range of distribution procedures be used to highlight potential differences in the performance of size limits and multi-year assessments.
- A request to the Secretariat that work continue on methods to evaluate MSE outcomes, including providing new alternative methods to quickly evaluate large sets of management procedures, which may involve ranking them in various ways.
- A request to the Secretariat to work with the Scientific Review Board and others to investigate the costs and benefits of a triennial stock assessment.
- A recommendation to establish record-keeping requirements for the recreational charter fisheries to ensure compliance with annual limits.

98th Session of the IPHC Interim Meeting (IM098; 2022)

The 98th Session of the IPHC Interim Meeting (IM098), held 30 November to 1 December 2022 via a hybrid electronic and in-person format, was an occasion to prepare for the 99th Session of the IPHC Annual Meeting (AM099) scheduled for 23-27 January 2023. The Commissioners and the public were able to hear the IPHC Secretariat presentations and discuss a variety of topics, including a review of the 2022 fisheries statistics and preliminary stock assessment results, and the preliminary 2023 harvest decision table.

Table 2. 2022 Mortality and Fishery limits and application of the existing Contracting Party catch sharing arrangements.

IPHC Regulatory Area	Fishery limits (net weight)	
	Tonnes (t)	Million Pounds (Mlb)
Area 2A (California, Oregon, and Washington)	**676**	**1.49**
Non-treaty directed commercial (south of Pt. Chehalis)	115	252,730*
Non-treaty incidental catch in salmon troll fishery	20	45,599*
Non-treaty incidental catch in sablefish fishery (north of Pt. Chehalis)	23	50,000*
Treaty Indian commercial	226	498,000*
Treaty Indian ceremonial and subsistence (year-round)	11	23,500*
Recreational – Washington	134	294,786*
Recreational – Oregon	130	287,786*
Recreational – California	18	38,740*
Area 2B (British Columbia) (includes recreational catch allocation)	**3,044**	**6.71**
Commercial fishery	2,587	5.70
Recreational fishery	457	1.01
Area 2C (southeastern Alaska) (combined commercial/ guided recreational)	**2,023**	**4.46**
Commercial fishery (3.41 Mlb retained catch and 0.07 Mlb discard mortality)	1,656	3.65
Guided recreational fishery (includes retained catch and discard mortality)	372	0.82
Area 3A (central Gulf of Alaska) (combined commercial/guided recreational)	**5,475**	**12.07**
Commercial fishery (7.05 Mlb retained catch and 0.29 Mlb discard mortality)	4,518	9.96
Guided recreational fishery (includes retained catch and discard mortality)	957	2.11
Area 3B (western Gulf of Alaska)	**1,520**	**3.35**
Area 4A (eastern Aleutians)	**798**	**1.76**
Area 4B (central/western Aleutians)	**581**	**1.28**
Areas 4CDE	**934**	**2.06**
Area 4C (Pribilof Islands)	417	0.92
Area 4D (northwestern Bering Sea)	417	0.92
Area 4E (Bering Sea flats)	100	0.22
Total	**15,055**	**33.19**

* Allocations resulting from the IPHC Regulatory Area 2A catch sharing arrangement are listed in pounds.

Pacific halibut commercial fishery

Commercial fishing is distinguished from other harvest types in that it is the activity of catching fish for commercial profit. The commercial Pacific halibut landings in 2022 totaled 11,140 tonnes or 24,559,270 pounds (Table 3). All values in this section are provided as net weight unless otherwise noted. Net weight is defined as the weight of Pacific halibut without gills, entrails, head, ice, and slime. Keep in mind that this chapter reflects data as of 10 January 2023. For updates on landings data, please refer to the IPHC website at: https://www.iphc.int.

Licensing and landings

Licensing

Licensing regulations for IPHC Regulatory Area 2A non-tribal fisheries were unchanged in 2022. All vessels fishing in that area had to follow these guidelines: procure an IPHC license, select one type of license (choices were directed longline, incidental in the troll salmon or sablefish fisheries, and recreational), and submit commercial fisheries applications by the deadline.

Landings

When Pacific halibut are delivered to a port for processing, they are considered to be "landed" for tracking purposes. The following sections review commercial landings, seasons, and trends for each area, with data from the IPHC, Fisheries and Oceans Canada (DFO), NOAA Fisheries, Metlakatla Indian Community, Washington Indian tribal fisheries management departments (including the Northwest Indian Fisheries Commission, Makah, Lummi, Jamestown S'Klallam, Swinomish, Port Gamble S'Klallam, Quileute, and Quinault Indian tribes), and state agencies including Alaska Department of Fish and Game, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, and California Department of Fish and Wildlife.

Setline Survey Specialist (Field) Monica Fezuk
Photographed by Jonathan Turnea

Landing patterns

In Canada (IPHC Regulatory Area 2B), two out of the 13 ports receiving commercial deliveries in 2022 received 93 percent of the landed catch: Port Hardy and Prince Rupert/Port Edward. Port Hardy (including Coal Harbour and Port McNeill) received 46 percent of the commercial landed catch (1,139 tonnes; 2,510,000 pounds), and Prince Rupert received 47 percent (1,174 tonnes; 2,589,000 pounds). The total landed catch was 2,488 tonnes (5,484,000 pounds).

In Alaska, the landed catch was 8,277 tonnes (18,248,000 pounds). IPHC Regulatory Area 3A again had the highest fishery limit and landed catch. Kodiak received the largest portion of the Alaskan commercial catch, with 1,240 tonnes (2,733,000 pounds; 15%). Homer received the second and Seward the third largest landing volumes at 14 percent (1,126 tonnes; 2,483,000 pounds) and 11 percent (913 tonnes; 2,012,000 pounds) of the Alaskan commercial landings, respectively. In Southeast Alaska (IPHC Regulatory Area 2C), Juneau and Sitka received the most in landed weight, together totaling 14% of total commercial Alaskan landings (Table 3).

In IPHC Regulatory Area 2A (Washington, Oregon, and California), the commercial fishery, comprised of the treaty Indian commercial fishery; the non-treaty directed commercial fishery south of Point Chehalis, WA; and the incidental Pacific halibut catch during the salmon troll and limited-entry sablefish fisheries, had landings totalling 375 tonnes (826,819 pounds), which was 2% below the fishery limit. Neah Bay, WA received roughly 51% of the Regulatory Area 2A catch, while Bellingham, WA saw the second highest amount at 11%.

Table 3. 2022 Pacific halibut landings (net weight) by IPHC Regulatory Area (as of 10 January 2023).

IPHC Regulatory Area	Fishery limits (net weight)		Landings (net weight)		Percent
	tonnes	pounds	tonnes	pounds	(%)
Area 2A (California, Oregon, Washington)	**384**	**845,329**	**375**	**826,819**	**98**
Non-treaty directed commercial	115	252,730	109	241,365	96
Non-treaty incidental to salmon troll fishery	20	44,599	12	27,281	61
Non-treaty incidental to sablefish fishery	23	50,000	28	61,000	122
Treaty Indian directed commercial	226	498,000	226	497,173	100
Area 2B (British Columbia)	**2,585**	**5,700,000**	**2,488**	**5,484,107**	**96**
Area 2C (southeastern Alaska)[1]	**1,592**	**3,510,000**	**1,459**	**3,216,972**	**92**
Area 3A (central Gulf of Alaska)	**4,332**	**9,550,000**	**3,965**	**8,742,275**	**92**
Area 3B (western Gulf of Alaska)	**1,520**	**3,350,000**	**1,314**	**2,897,116**	**86**
Area 4A (eastern Aleutian Is.)	**798**	**1,760,000**	**579**	**1,277,563**	**73**
Area 4B (central/western Aleutian Is.)	**581**	**1,280,000**	**248**	**547,046**	**43**
Areas 4CDE and Closed	**934**	**2,060,000**	**711**	**1,567,372**	**76**
Total	**12,726**	**28,055,329**	**11,140**	**24,559,270**	**88**

* Includes Metlakatla landings.

Pacific halibut coming over the roller
Photographed by Jonathan Turnea

Sampling of commercial landings

Sampling commercial landings is a key component to collecting data on Pacific halibut for the annual IPHC stock assessment. The IPHC Secretariat collects otoliths (ear bones) that, when read under a microscope, give the animal's age in years; tissue samples for analysis and sex determination; associated fork lengths and fish weights; as well as logbook information, final landing weights, and any IPHC tagged fish caught during fishing. Lengths and weights of sampled Pacific halibut allow the IPHC to calculate seasonal length-weight ratios by area and, in combination with age data, size-at-age information. Fin tissue samples are analyzed to provide the sex of individual fish and, in turn, estimate the sex composition of the commercial landings. Mean weights are combined with final landing weights to estimate landed catch in numbers. Logbook information provides weight-per-unit-effort data, fishing location for the landed weight, and data for research projects. Recovered tags along with corresponding biological data can provide information on migration, growth, exploitation rates, and natural and discard mortality. More information on the annual stock assessment and research activities can be found later in this report.

Sampling protocols are designed to ensure that the sampled Pacific halibut are representative of the population of landed Pacific halibut throughout the Convention Area; sampling days and places, and percentage of fish sampled are based on landing patterns and are reviewed annually. The protocols can vary slightly from port to port to achieve the appropriate sampling representation.

Considering that vessels fish in multiple IPHC Regulatory Areas and are not limited in where they may land their catch, the IPHC Secretariat was stationed in ports coastwide in 2022. In Canada, the IPHC Secretariat was stationed in Port Hardy and Prince Rupert. In the U.S.A., in IPHC Regulatory Area 2A, the IPHC Secretariat was stationed in Newport and Charleston, Oregon and in Bellingham, Washington. In addition, samples were taken in several ports in Washington by staff from the treaty Indian fishery management offices. In Alaska, the IPHC Secretariat was stationed in the ports of Akutan, Dutch Harbor, Kodiak, Homer, Juneau, Petersburg, Seward, and Sitka.

Otoliths

The otolith collection targets included 1500 from each of IPHC Regulatory Areas 2B-4B and 4CD (combined) for a total of 11,500 Pacific halibut otoliths. The target for IPHC Regulatory Area 2A was set at 1,000; subdivided into a target of 650 for the treaty Indian fisheries and 350 for the IPHC Regulatory Area 2A non-tribal directed commercial fisheries. All collections resulted in 11,750 otoliths by sampling from 30 percent of the landed catch in 731 samples. Otolith targets were below target in Regulatory Areas 4BCD due to changes in landing patterns.

The IPHC Secretariat also collected specimens for the Clean Otolith Archive Collection (COAC), which comprises samples gathered from all IPHC otolith collection activities and other research opportunities. These otoliths are not used for age determination, but are cleaned, dried, and stored whole in climate-controlled conditions for future analysis. COAC samples are collected from the IPHC fishery-independent setline survey (FISS) unless the sampling rate for the age determination collection is 100%. For this reason, COAC samples were to be collected from commercial landings from IPHC Regulatory Areas 4B, 4C, and 4D in 2022. The COAC targets from the 2022 commercial catch were 100 otoliths from each of IPHC Regulatory Areas 4A and 4B and 100 otoliths from Area 4CD combined; these targets were not attained (87 % in IPHC Regulatory Area 4A, 29% in Area 4B, and 12% in Area 4CD) due to changes in landing patterns.

Logbooks

Alongside otolith samples, the IPHC Secretariat in the ports collected logbook information from harvesters. In total, 2,747 logs were collected in 2022 (as of 9 January 2023). A total of 343 logs were collected from Canadian landings, and 2,404 logs were collected from U.S.A. landings.

Recovered tags

In 2022, a total of 73 tags from a variety of projects were recovered from tagged Pacific halibut. A total of 56 of these recoveries were from U32 wire tagging releases conducted between 2015 and 2022 in the Gulf of Alaska and Bering Sea which included subsets from discard mortality and tail pattern recognition studies, and 16 were from the recreational discard mortality study conducted out of Sitka and Seward, Alaska in 2022. Tag data collected dockside included fork lengths, individual fish weight(s), otoliths, fin clips, and capture location of the recovered tagged fish.

Electronic data collection

The IPHC has digitized data collection to eliminate or reduce the need for post-collection data entry and increase the efficiency of data editing. The IPHC Secretariat used an electronic tablet in Alaska to input data from paper logbooks into a remote data entry application. The goal was to enter data from as many of the logs collected as priorities and time allowed during the course of regular port duties. Modifications and enhancements to the application continue.

In British Columbia, Canada, the IPHC Secretariat was provided with a field version of the log entry program used at the IPHC Headquarters office. The goal was to enter as many Canadian logs as time permitted, though priority was given to other tasks such as biological sampling. In addition, Bluetooth-enabled tablets were provided for collection of electronic logs from vessels using Archipelago Marine Research's FLOAT - Fishing Log On A Tablet.

Recreational Fishery

Recreational fishing trip
Photograph provided by IPHC

The recreational fishery is comprised of both guided (charter) and unguided (non-charter) sectors. In 2022 coastwide recreational harvest of Pacific halibut, including discard mortality, was estimated at approximately 2,968 tonnes (6,542,950 pounds) by the IPHC, using information provided by state and federal agencies from each of the Contracting Parties. The regulations governing recreational fishing of Pacific halibut were specifically geared to each IPHC Regulatory Area. Table 4 provides a brief summary of overall removals and more detailed tables providing a summary of seasons and retained catch can be found on the IPHC website: https://www.iphc.int.

IPHC Regulatory Area 2B – British Columbia (CANADA)

Size and/or annual limit requirements changed twice during the season in IPHC Regulatory Area 2B. Initially, the limit was a 133 cm (52.4 inch) maximum size limit and one Pacific halibut had to be between 90 – 133 cm (35.4 - 52.4 inches) or both under 90 cm (35.4 inch) when attaining the two fish possession limit with an annual limit of ten per licence holder. On 20 August, the possession limit was increased to three fish if all were under 90 cm (35.4 inch), still with an annual limit of ten per licence holder. British Columbia, Canada has a program that allows recreational harvesters to land fish that is leased from directed commercial fishery quota shareholders for the current season. Approximately seven tonnes (15,000 pounds) were landed under British Columbia's Experimental Recreational Quota program.

IPHC Regulatory Area 2A – California, Oregon and Washington (U.S.A.)

IPHC Regulatory Area 2A's recreational allocation was 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 23 tonnes or 50,000 pounds were allocated to the incidental Pacific halibut catch in the commercial sablefish fishery in Washington. This subdivision resulted in 134 tonnes or 294,786 pounds being allocated to Washington subareas and 130 tonnes or 287,645 pounds to Oregon subareas. In addition, California received an allocation of 18 tonnes or 38,740 pounds. Recreational fishery harvest seasons by subareas varied and were managed in-season in coordination with the Contracting Party domestic agencies, with fisheries opening on 1 April. The IPHC Regulatory Area 2A recreational harvest totaled 213 tonnes (470,674 pounds), 24% under the recreational allocation (Table 4).

IPHC Regulatory Areas 2C, 3A, 3B, 4A, 4B, 4CDE – Alaska (U.S.A.)

The IPHC Regulatory Area 2C charter fishery reverse slot limit, allowing for the retention of one Pacific halibut that was ≤ 101 cm or 40 inches or ≥ 203 cm or 80 inches in fork length. In IPHC Regulatory Area 3A, charter anglers were allowed to retain two fish, but only one could exceed 71.1 cm (28 inches) in length, and a possession limit equaled to two daily bag limits with no annual limit on the number of daily bag limits obtained. One trip per calendar day per charter permit was allowed, with no charter retention of Pacific halibut on Wednesdays.

Similar to British Columbia (Canada), Alaska (U.S.A.) has the Guided Angler Fish program that allows recreational harvesters to land fish that is leased from commercial fishery quota shareholders for the current season. In IPHC Regulatory Area 2C a total of 45 tonnes (100,067 pounds) and Area 3A 3 tonnes (6,487 pounds), respectively, were leased from the directed commercial quota fisheries and landed as recreational harvest.

Table 4. Summary of 2022 recreational Pacific halibut allocations and landed catch by IPHC Regulatory Area.

	Allocation		Retained catch		Percent of allocation
Area	tonnes	pounds	tonnes	pounds	
2A	277	610,180	184	405,869	67
2B	417	920,000	366	806,000	88
2C (charter)[1,2]	367	810,000	523	1,153,862	142
3A (charter)[1,2]	885	1,950,000	1,113	2,454,045	126

[1] There is no allocation limit for the non-charter recreational fishery in these IPHC Regulatory Areas.
[2] Includes discard mortality

Discard mortality of Pacific halibut in the directed fishery

In the directed commercial Pacific halibut fishery, some Pacific halibut are captured that are not kept and, therefore, do not become part of the landed catch. Some of those released at sea survive, but some do not, and those that do not, must be accounted for. These removals are known as discard mortality or in this case, directed commercial discard mortality.

Estimates of directed commercial discard mortality in 2022 amounted to 684 tonnes (1,509,000 pounds; net weight) (Table 5). There are three main sources of directed commercial discard mortality accounted for by IPHC: (1) fish caught and never retrieved on lost or abandoned fishing gear; (2) the discard of fish that measure below the legal size limit of 32 inches (U32; < 81.3 cm) and subsequently die; and (3) the discard of legal-sized Pacific halibut (O32; ≥ 32 inches or 81.3 cm) for regulatory compliance reasons, such as a vessel reaching its trip, catch, or quota share limit.

Directed commercial discard mortality from lost or abandoned gear

In the 1980s and early 1990s in Alaska and British Columbia, 'derby' fisheries with short fishing periods led to harvesters competing to catch as many Pacific halibut as quickly as possible. This resulted in a considerable quantity of lost fishing gear, which continued to catch fish. Estimates of the amount of missing gear were extrapolated to total catch values using available logbook catch and effort statistics. The advent of quota-share fishery management in these areas has greatly reduced the mortality from lost or abandoned gear.

The rate of O32 Pacific halibut discard mortality from gear loss is calculated by first figuring out the ratio of effective skates lost to effective skates hauled aboard the vessels for trips for which there was a log, then multiplying that number by the total landed catch. "Effective skates" refers to those that include all requisite data (such as skate

Table 5. Directed commercial discard mortality of Pacific halibut (net weight) by IPHC Regulatory Area, 2022.

IPHC Regulatory Area	Discard Mortality	
	tonnes	pounds
2A	24	52,000
2B	90	198,000
2C[1]	76	167,000
3A	307	677,000
3B	136	300,000
4A	23	51,000
4B	3	6,000
4CDE	26	58,000
Total	684	1,509,000

[1]Includes the Metlakatla fishery.

length, hook spacing, and number of hooks per skate), and for which the gear type met the standardization criteria. The ratio includes both snap gear and fixed-hook gear in all IPHC Convention waters. U32 Pacific halibut discard mortality from lost gear was calculated in a similar manner incorporating the U32:O32 ratio calculations for discarded U32 Pacific halibut as described below.

Directed commercial discard mortality from discarded U32 Pacific halibut

The weight of discarded U32 Pacific halibut must be measured indirectly where direct observation and electronic monitoring are not available. Within the IPHC Convention Area, the Canadian fishery (IPHC Regulatory Area 2B; British Columbia) offers the most accurate accounting due to direct observation. Fishers in Regulatory Area 2B self-report their discards, with the values being verified through video monitoring on the vessels. In all other IPHC Regulatory Areas, considering that the IPHC Fishery-Independent Setline Survey (FISS) uses similar fishing gear, FISS data have been used as a proxy for the expected encounter rates by area and year. Results are filtered to use FISS stations with a higher catch rate (by weight) of O32 Pacific halibut, similar to those observed in the directed commercial fishery.

A universal mortality rate of 16 percent has been applied to all Pacific halibut discards from the quota fisheries (Canada and U.S.A.). For derby fisheries in previous years in British Columbia and Alaska, and for the IPHC Regulatory Area 2A directed commercial fishery, a mortality rate of 25 percent is applied. Accordingly, the amount of discarded U32 Pacific halibut that subsequently die in the directed commercial fishery is estimated by multiplying the relative amount (percentage) of U32 to O32 Pacific halibut by the landed commercial catch and then by the mortality rate for the fishery.

Directed commercial discard mortality for regulatory compliance reasons

In IPHC Regulatory Area 2A, the directed commercial fishery is still managed by 'derby' fishing periods in which the quantity of fish that may be caught by each vessel is limited by a fishing period limit and the size of vessel. This may result in catches that exceed the vessel or trip limits, so that "excess" O32 Pacific halibut are discarded. Some vessel captains logged the amount of discards, which were then compared to the landed catch of Pacific halibut for those trips to arrive at a ratio of landed Pacific halibut to O32 discarded Pacific halibut. This ratio was then applied to all landed catch reported on fish tickets to determine the amount of discarded O32 Pacific halibut for all landings to which the mortality rate of 25 percent was applied. U32 Pacific halibut were accounted for in a similar manner incorporating the U32:O32 ratio calculations for discarded Pacific halibut. The amount of Pacific halibut retained by the IPHC Regulatory Area 2A salmon and sablefish directed commercial fisheries was not included in these calculations, however, as these removals were accounted for under non-directed commercial discard mortality estimates.

F/V Pender Isle
Photographed by Emily Miller

Subsistence Harvest

Pacific halibut that are caught by those who have traditionally relied on this fish as a critical food source or for customary purposes are classified as "subsistence," as opposed to recreational or commercial removals. Subsistence harvest is barred from resale, and therefore is not included in the commercial landings. The IPHC defines subsistence harvest further as Pacific halibut taken in: 1) the sanctioned First Nations Food, Social, and Ceremonial (FSC) fishery in British Columbia, Canada; 2) the federal subsistence fishery in Alaska, U.S.A.; 3) tribal Indian Ceremonial and Subsistence (C&S) fisheries in Washington State, U.S.A.; and 4) U32 Pacific halibut (those under the legal size limit of 32 inches or 81.3 cm) retained by commercial fishers in IPHC Regulatory Areas 4D and 4E (U.S.A.) under IPHC Fishery Regulations (2022). In the latter case, IPHC permits U32 Pacific halibut to be retained because of its history of customary use in the area and because the remote location makes it unlikely that these fish will end up being commercially traded. State and federal regulations require that 'take-home' Pacific halibut caught during commercial fishing be recorded as part of the commercial catch on the landing records, so those fish caught within the commercial fisheries and not sold are accounted for as commercial landings and are not included in the estimates here. Table 6 provides a summary of subsistence removals followed by more detail by IPHC Regulatory Area.

John Stevens retireving gear during the FISS
Photographed by Kevin Coll

Estimated harvests by IPHC Regulatory Area

Canada (IPHC Regulatory Area 2B; British Columbia)

The Food, Social and Ceremonial fishery constituted British Columbia's subsistence harvest. Fisheries and Oceans Canada (DFO) has estimated the same level of harvest for this fishery since 2007.

U.S.A. (IPHC Regulatory Area 2A; California, Oregon, and Washington)

The subsistence allocation in IPHC Regulatory Area 2A consists of the Ceremonial and Subsistence fishery that the tribes have subdivided from their directed commercial fishery limit.

U.S.A. (IPHC Regulatory Areas 2C, 3, 4A, 4B, 4CDE; Alaska)

After the Alaska subsistence program began in 2003, the Alaska subsistence catch declined until 2013, after which it rose until 2015. The Alaska estimates for the subsistence Pacific halibut harvest are based on a biennial survey, the last of which was conducted in 2020; so, the 2022 estimate was carried over from the previous year. The next survey is expected in 2023.

Regulations on the subsistence fishery in Alaska set by NOAA Fisheries include a

Table 6. Subsistence Pacific halibut fishery removals (net weight) by IPHC Regulatory Area, 2022.

IPHC Regulatory Area	Subsistence Removals	
	tonnes	pounds
2A	11	23,500
2B	184	405,000
2C	132	290,137
3A	80	176,993
3B	6	13,861
4A	5	12,118
4B	<1	987
4CDE/Closed[1]	17	36,661
Total	**435**	**959,257**

[1] 2020 Alaska estimates were carried over for the 2022 estimates, with the exception of IPHC Regulatory Area 4D/4E subsistence harvest in the CDQ fishery, which were updated.

registration program, and specifications on the type of gear, including the number of hooks and daily bag limits. The IPHC sets the fishing season dates.

According to the Alaska Department of Fish and Game's voluntary annual survey, the IPHC Regulatory Area 2C pulled in the most Pacific halibut as subsistence, followed by IPHC Regulatory Area 3A. The remaining IPHC Regulatory Areas accounted for a small fraction of the total.

Retention of U32 Pacific halibut in the CDQ fishery

The IPHC allows commercial Pacific halibut vessels fishing for certain Community Development Quota (CDQ) organizations in IPHC Regulatory Areas 4D and 4E (Bering Sea) to retain U32 (fork length < 32 inches or 81.3 cm) Pacific halibut under an exemption requested by the North Pacific Fishery Management Council. The CDQ harvest supplements the Alaskan subsistence catch. This removal is reported directly to the IPHC allowing for annual estimates, compared to the subsistence fishery elsewhere in Alaska which relies on a biennial survey. In 2022, retention of U32 Pacific halibut in the CDQ fishery was 0.8 tonnes or 1,873 pounds, a decrease from the 1 tonne or 2,107 pounds of Pacific halibut retained in 2021. Changes in harvest each year tend to reflect the amount of effort by local fishing fleets and the availability of fish in their nearshore fisheries.

Bristol Bay Economic Development Corporation

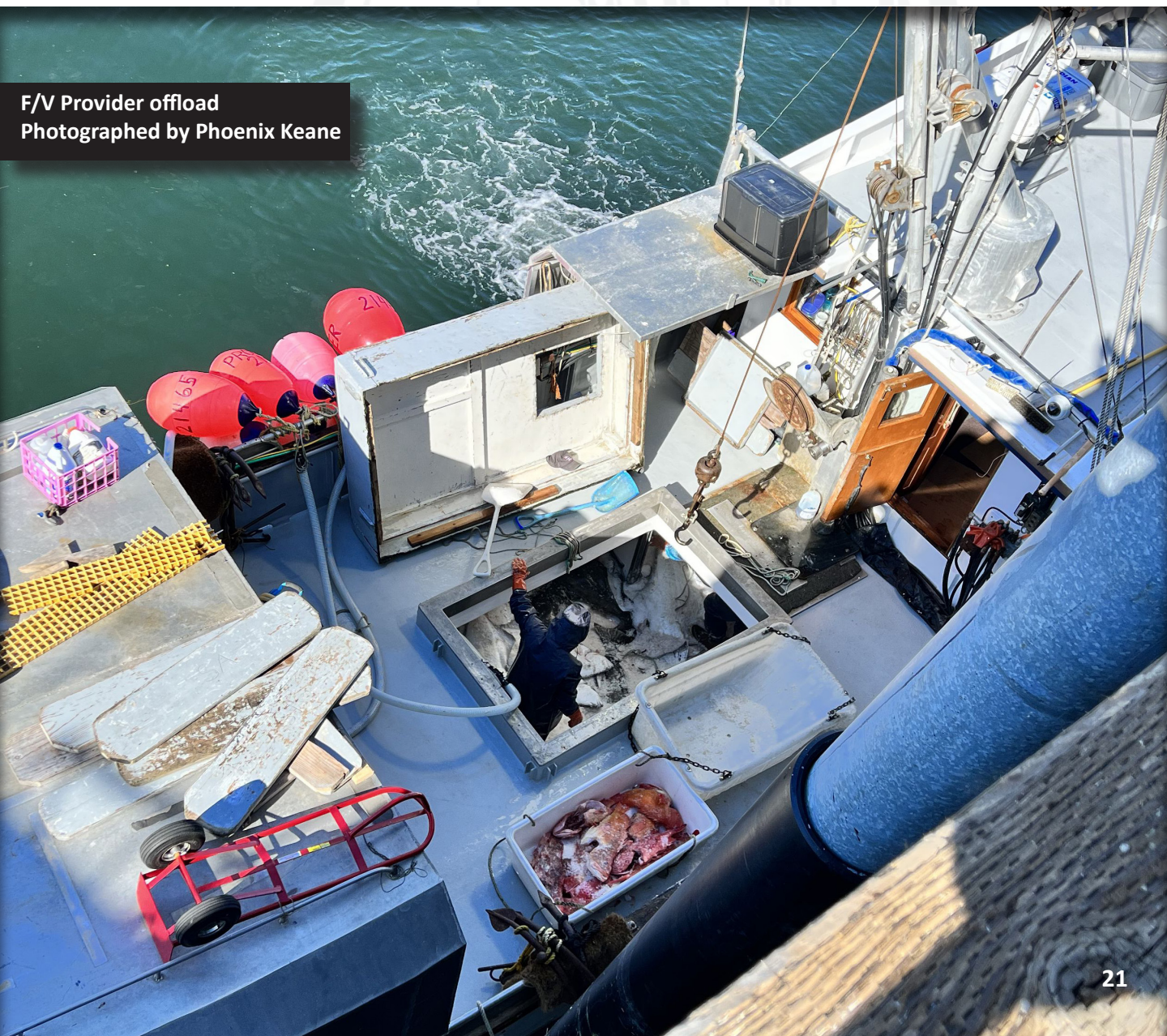
The Bristol Bay Economic Development Corporation (BBEDC), the southernmost of the three CDQ organizations allowed to retain U32 Pacific halibut for subsistence purposes, comprises 17 member villages on the shores of Bristol Bay, AK: Port Heiden, Ugashik, Pilot Point, Aleknagik, Egegik, King Salmon, South Naknek, Naknek, Levelock, Ekwok, Portage Creek, Ekuk, Clark's Point, Dillingham, Manokotak, Twin Hills, and Togiak. The BBEDC aims to use sustainable fish harvesting to improve community life and livelihoods in its member communities. The BBEDC reported that in 2022, five harvesters brought in a catch of 137 U32 Pacific halibut, weighing 0.5 tonnes or 1,209 pounds. Pacific halibut were landed by BBEDC vessels primarily in King Salmon and Dillingham.

Coastal Villages Regional Fund

The Coastal Villages Regional Fund (CVRF) lies between the Norton Sound Economic Development Corporation (NSEDC) to the north, and the BBEDC to the south. It comprises 20 remote coastal villages: Platinum, Goodnews Bay, Quinhagak, Eek, Napaskiak, Oscarville, Napakiak, Tuntutuliak, Kongiganak, Kwigillingok, Kipnuk, Chefornak, Nightmute, Toksook Bay, Mekoryuk, Tununak, Newtok, Chevak, Hooper Bay, and Scammon Bay. In 2022, for the eighth year in a row, CVRF reported that their fishers landed zero Pacific halibut and no fish were received by their facilities.

Norton Sound Economic Development Corporation

The NSEDC is the northernmost of the three organizations, centered at Nome, AK. The NSEDC's purpose is to provide fishing opportunities for its 15 member communities, which are primarily on the coast of the Seward Peninsula, bounded by Kotzebue Sound on the north and Norton Sound on the south: Saint Michael, Stebbins, Unalakleet, Shaktoolik, Koyuk, Elim, Golovin, White Mountain, Nome, Teller, Brevig Mission, Wales, and the island communities of Little Diomede, Gambell, and Savoonga. In 2022, the area's only plant at Nome, received



F/V Provider offload
Photographed by Phoenix Keane

Discard Mortality of Pacific halibut in non-directed commercial fisheries

Described here is the removal of Pacific halibut caught incidentally by commercial fisheries targeting other species (a.k.a. bycatch) and that cannot legally be retained. This section focuses on the discard mortality of those fish, which comprises those that die due to being captured. In 2022, there was an estimated 2,306 tonnes or 5,083,000 pounds of Pacific halibut non-directed commercial fisheries discard mortality, representing a 32 percent increase from the 1,744 tonnes or 3,844,000 pounds recorded in 2021. Estimates for 2022 are preliminary and subject to change as new information becomes available. Current values are available on the IPHC website: https://www.iphc.int

Sources of information for discard mortality in non-directed fisheries

The IPHC relies on observer and electronic monitoring programs run by government agencies from Canada and the U.S.A. for discard mortality in non-directed commercial fisheries estimates and information. In Canada, Fisheries and Oceans Canada (DFO) monitors fisheries off British Columbia (IPHC Regulatory Area 2B) where Canada reports 100 percent fishery monitoring for the groundfish trawl and hook-and-line fisheries. There are varying levels of monitoring for non-groundfish fleets in British Columbia.

In the U.S.A., NOAA Fisheries monitors trawl fisheries off the coast of Alaska (IPHC Regulatory Areas 2C-4) and the west coast (IPHC Regulatory Area 2A). Off the west coast of the U.S.A., NOAA reports 100 percent fishery monitoring for the commercial trawl groundfish fishery. There are varying levels of monitoring on non-trawl vessels and fisheries. Several fishery programs in Alaska have a mandatory 100 percent monitoring requirement, including the Central Gulf of Alaska (GOA) Rockfish Program, the Bering Sea/Aleutian Islands (BSAI) Community Development Quota (CDQ) fisheries, the American Fisheries Act pollock cooperatives, and the BSAI Amendment 80 fishery cooperatives. In Alaska, an annual deployment plan (ADP) provides the scientific guidelines that determine how vessels not involved in these full coverage programs are chosen for monitoring, including vessels in the directed commercial Pacific halibut fishery. The COVID-19 pandemic affected

Trawl survey catch
Photograph provided by the IPHC

implementation of the fishery monitoring and its level of coverage.

Discard mortality rates

The percentage of Pacific halibut that die as a result of being caught (called discard mortality rate or DMR) varies by both fishery and area. If observers are present, DMRs are calculated by judging the likelihood of survival for the Pacific halibut observed, using pre-set criteria. For fisheries without observers, assumed DMRs are used, which are based on similar fisheries in other areas where data are available.

Discard mortality in non-directed commercial fisheries by IPHC Regulatory Area

This section describes the estimated non-directed commercial fisheries discard mortality from each IPHC Regulatory Area (Table 7).

Canada (IPHC Regulatory Area 2B; British Columbia)

In Canada, Pacific halibut non-directed commercial discard mortality in trawl fisheries is capped at 454 tonnes round weight or 750,000 pounds net weight by DFO. Non-directed commercial discard mortality in non-trawl groundfish fisheries is largely handled under the quota system within the directed Pacific halibut fishery limit.

U.S.A. (IPHC Regulatory Area 2A; California, Oregon, and Washington)

As in prior years, the bottom trawl fishery and hook-and-line fishery for sablefish were responsible for the bulk of the non-directed commercial discard mortality in IPHC Regulatory Area 2A. Groundfish fisheries in IPHC Regulatory Area 2A are managed by NOAA Fisheries, following advice and recommendations developed by the Pacific Fishery Management Council (PFMC). Pacific halibut non-directed commercial discard mortality in the trawl IFQ fishery (also called trawl catch shares) in this area is capped at 45 tonnes or 100,000 pounds of O32 (> 32 inches fork length; 81.3 cm) Pacific halibut.

U.S.A. (IPHC Regulatory Area 2C; Southeast Alaska)

NOAA Fisheries reported non-directed commercial discard mortality by hook-and-line vessels fishing in the outside (federal) waters of IPHC Regulatory Area 2C. The vessels in this area were mostly targeting Pacific cod and rockfish in open access fisheries, and sablefish in the IFQ fishery. In state waters, fisheries that contribute to this removal include pot fisheries for red and golden king crab, and tanner crab. Information is provided periodically by Alaska Department of Fish and Game (ADFG), and the estimate was again rolled forward for 2022.

U.S.A. (IPHC Regulatory Areas 3A and 3B; Eastern, Central, and Western Gulf of Alaska)

Trawl fisheries are responsible for the majority of the non-directed commercial discard mortality in these IPHC regulatory areas, with hook-and-line fisheries a distant second. State-managed crab and scallop fisheries are also known to take Pacific halibut as non-directed commercial discard mortality, but at low levels. Limited observer coverage, along with tendering, loopholes in trip scheduling, and safety considerations, likely result in observed trips not being representative of all trips and as a result Area 3 remains the area where non-directed commercial discard mortality is estimated most poorly.

U.S.A. (IPHC Regulatory Areas 4A, 4B, 4CDE; Bering Sea/Aleutian Islands)

The Pacific cod fishery is conducted in the late winter/early spring and late summer, and is the major fishery in these IPHC regulatory areas contributing to the amount of Pacific halibut non-directed commercial discard mortality. In these IPHC regulatory

Table 7. Non-directed commercial fisheries discard mortality estimates of Pacific halibut (net weight) by IPHC Regulatory Area and fishery, for 2022.[1]

IPHC Regulatory Area and Gear Type	Non-directed commercial fisheries discard mortality	
2A	tonnes	Pounds (in thousands)
Trawl (Groundfish)	0	0
Trawl (IFQ Bottom)	30	67
Trawl (Other Groundfish)	2	4
Pot (Groundfish)	<1	3
Hook & Line	15	32
Trawl (Shrimp)	0	0
Total	48	106
2B		
Trawl (Groundfish Bottom)	153	336
Total	153	336
2C		
Pot (Groundfish)	3	7
Pot (Shellfish)	0	0
Trawl (Groundfish)	0	0
Hook & Line (non-IFQ)	<1	2
Hook & Line (IFQ)	13	28
Hook & Line (State Water)	15	33
Total	32	70
3A		
Dredge (Scallop & Sea Cucumber)	11	24
Trawl (Groundfish)	173	382
Hook & Line (non-IFQ)	16	35
Hook & Line (IFQ)	<1	2
Pot (Groundfish)	14	31
Hook & Line (State Water)	5	11
Total	220	485
3B		
Pot (Shellfish)	23	50
Dredge (Scallop & Sea Cucumber)	6	13
Trawl (Groundfish)	87	192
Hook & Line (State Water)	n/a	n/a
Hook & Line (non-IFQ)	8	17
Hook & Line (IFQ)	31	3
Pot (Groundfish)	5	12
Total	130	287
4A		
Pot (Shellfish)	12	26
Dredge (Scallop & Sea Cucumber)	n/a	n/a
Trawl (Groundfish)	172	380
Hook & Line (State Water)	n/a	n/a
Hook & Line (non-IFQ)	10	23
Hook & Line (IFQ)	0	0
Pot (Groundfish)	11	25
Total	206	454

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

4B		
Pot (Shellfish)	<1	2
Trawl (Groundfish)	59	129
Hook & Line (State Water)	n/a	n/a
Hook & Line (non-IFQ)	6	13
Hook & Line (IFQ)	0	0
Pot (Groundfish)	5	12
Total	71	156
4CDE/Closed		
Pot (Shellfish)	17	37
Dredge (Scallop & Sea Cucumber)	n/a	n/a
Trawl (Groundfish)	1,318	2,905
Hook & Line (State Water)	n/a	n/a
Hook & Line (non-IFQ)	106	234
Hook & Line (IFQ)	0	0
Pot (Groundfish)	5	12
Total	1,446	3,189
GRAND TOTAL	2,306	5,083

areas, almost all of the vessels are required to have 100 percent observer coverage because of the larger vessel size and the requirements of their fishery cooperative; very few small vessels fish Pacific cod or other flatfish in these IPHC regulatory areas. Because of this level of observer coverage, non-directed commercial discard mortality estimates for IPHC Regulatory Area 4 fisheries are considered reliable. Pots are used to fish for Pacific cod and sablefish and fish very selectively. Non-directed commercial discard mortality rates are quite low for pots and survival is relatively high. Within the Bering Sea, the non-directed commercial discard mortality has typically been the highest in IPHC Regulatory Area 4CDE due to the groundfish fishery within that area.

Fishery Independent Survey Activities

Each year the International Pacific Halibut Commission (IPHC) conducts a Fishery-Independent Setline Survey (FISS), participates in NOAA (National Oceanic and Atmospheric Administration) Fisheries trawl surveys, and receives survey data from other organisations. Activities during these surveys include collection of biological and oceanographic data, tagging and release of fish, and other projects.

IPHC Fishery-Independent Setline Survey (FISS)

The IPHC Fishery-Independent Setline Survey (FISS) gathers catch rate information to monitor changes in biomass in the Pacific halibut population. The FISS uses standardised methods, including bait, gear, fishing locations, and time of year, to gain a balanced picture that can be compared over a large area and from year to year.

When other species are caught on the FISS, their presence provides data about bait competition, commonly known as 'hook competition'. Other species catch data also provide an indication of their abundance over time, making them valuable for population assessments, management, and potential avoidance strategies.

Design and procedures

The 2022 FISS covered both nearshore and offshore waters of British Columbia, Canada, and Alaska, Washington and Oregon, U.S.A., (Figure 1). The IPHC chartered eight (8) commercial longline vessels for FISS operations. During a combined 498 trips and 513 charter days, these vessels fished 23 charter regions. Each region required between eight (8) and 39 days to complete.

The FISS was conducted via stations arranged in a grid of 10x10 nautical miles with a depth range of 18 to 732 metres (10 to 400 fathoms). The 2022 FISS design was a selection of stations from the full FISS design of 1,890 stations. The 2022 FISS was to comprise a random subsample of 1,196 stations following decisions made at the 97th Session of the IPHC Interim Meeting (IM097). Of the 1,196 FISS stations planned for the 2022 FISS season (1,188 stations plus eight (8) rockfish index stations in Washington), 862 (72%) were effectively sampled. A total of 289 initially planned stations were not sampled in 2022. There were challenges with vessel

2022 Fishery-Independent Setline Survey Team
Provided by the IPHC

recruitment this season due to 1) increased sablefish quota availability; 2) several vessels transitioning to snap-gear; 3) vessel maintenance; and 4) challenges with vessel crew recruitment. Due to the challenges with vessel recruitment, the following stations within IPHC charter regions were not sampled: Gore Point (35 stations), Semidi (27 stations), Chignik (35 stations), Shumagin (26 stations), and 4CDE North (40 stations), Attu (61 stations), Portlock (27 stations), Shelikof (9 stations), Ketchikan (12 stations) and Ommaney (12 stations). In addition, two (2) stations in Sitka were unsampled as they were within Glacier Bay National Park and we were not permitted to complete these stations within the park this year by NOAA. Two (2) stations in Yakutat were unsampled due to the presence of sea ice restricting the vessel's access. One (1) station in Unalaska was also not sampled due to poor weather and tides.

Coastwide, forty-five (45) stations were deemed ineffective due to Orca depredation (n=16), Sperm whale depredation (n=15), gear soak time (n=4), shark predation (n=1), sand flea activity (n=1), station moved > 3nmi (n=1), and setting and gear issues (n=7).

Four standard skates of gear were set at each station in IPHC Regulatory Areas 2A, 4A, 4B and 4CDE, and eight standard skates in IPHC Regulatory Areas 2B, 2C, 3A, 3B. Each vessel conducting FISS work set from one to four stations every day, with boats setting gear as early as 0500 hours and allowing it to soak for at least five hours (but not overnight, if possible) before hauling. Data from gear soaked longer than 24 hours were discarded from the results, as were sets for which predetermined limits for lost gear, snarls, depredation, or displacement were exceeded. FISS gear consisted of fixed-hook, 549 metre (1,800-foot) skates with 100 circle hooks of size 16/0 spaced 5.5 metres (18 feet) apart. The length of the gangions ranged from 61 to 122 centimetres (24 to 48 inches). Each hook was baited with 0.11 to 0.15 kilograms (1/4 to 1/3 pounds) of chum salmon.

Sampling protocols

Following protocols set out in the 2022 FISS Manual, Setline Survey Specialists on contracted vessels assessed recorded the number of hooks set and baits lost per skate. During gear retrieval, hook status (hook occupancy data to species or whether the hook was pulled up empty) for the first 20 consecutive hooks of each skate was recorded.

Setline Survey Specialists recorded lengths and weights of all Pacific halibut caught along with the corresponding skate numbers, and assessed the sex and maturity, prior hooking injury (PHI) incidence and severity, and evidence of depredation for each fish captured. Also collected was a randomized subsample of otoliths from every captured Pacific halibut for later age determination.

The male fish were assessed as either mature or immature, and the females were categorized as immature, ripening, spawning, or spent/resting. The sex and maturity level of U32 (fork length < 81.3 cm or 32 inches) Pacific halibut was recorded only if that fish was randomly selected for otolith removal or was already dead upon hauling. All U32 Pacific halibut not selected for otolith collection were measured and released alive.

Bait purchases

To ensure consistency from year to year, the bait used for the FISS has always been No. 2 semi-bright or better (Alaska Seafood Marketing Institute grades A through E), headed and gutted, and individually quick-frozen chum salmon. In August 2021, the IPHC Secretariat began arranging bait purchases for the 2022 FISS. Approximately 225 tonnes (370,000 pounds) of chum salmon were utilized from one supplier. Bait usage was 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 have met the standard as described above.

Fish sales

O32 (fork length > 81.3 cm or 32 incheO32 (fork length > 81.3 cm or 32 inches) Pacific halibut caught during the FISS have historically been kept and sold to offset the cost of the FISS work with a goal of revenue neutrality. In 2022, U32 (fork length < 81.3 cm or 32 inches) Pacific halibut that were randomly selected for sampling were also kept and sold. All vessel contracts contained a lump sum payment along with a 10 percent share of all Pacific halibut proceeds.

During the 2022 FISS, IPHC's chartered vessels delivered a total of 188 tonnes (414,046 pounds) of Pacific halibut to 21 different ports. The coastwide average price per kilogram was $17.01 USD or $7.72 USD per pound, amounting to sales totaling $3,194,874 USD.

Field personnel

The 2022 FISS vessels were staffed by 22 Setline Survey Specialists, who worked a total of 1,026 person-days, including travel days, sea days, and debriefing days. Two setline survey specialists were aboard each FISS vessel. At a given time, one specialist handled fish, collected data, and sampled on deck, while the other specialist, in a portable shelter, recorded data and observations and stored samples collected by the specialist on deck. IPHC also deployed specialists on the NOAA Fisheries (AFSC) trawl survey in 2022, working the entire survey aboard one of the two vessels completing the Bering Sea Trawl Survey and the Aleutian Island Trawl Survey.

Oceanographic monitoring

This was the fourteenth consecutive year of the IPHC oceanographic data collection program whereby water column profiles were collected during the FISS. Oceanographic data were collected using instruments that collected pressure (depth), conductivity (salinity), temperature, dissolved oxygen, pH, and fluorescence (chlorophyll a

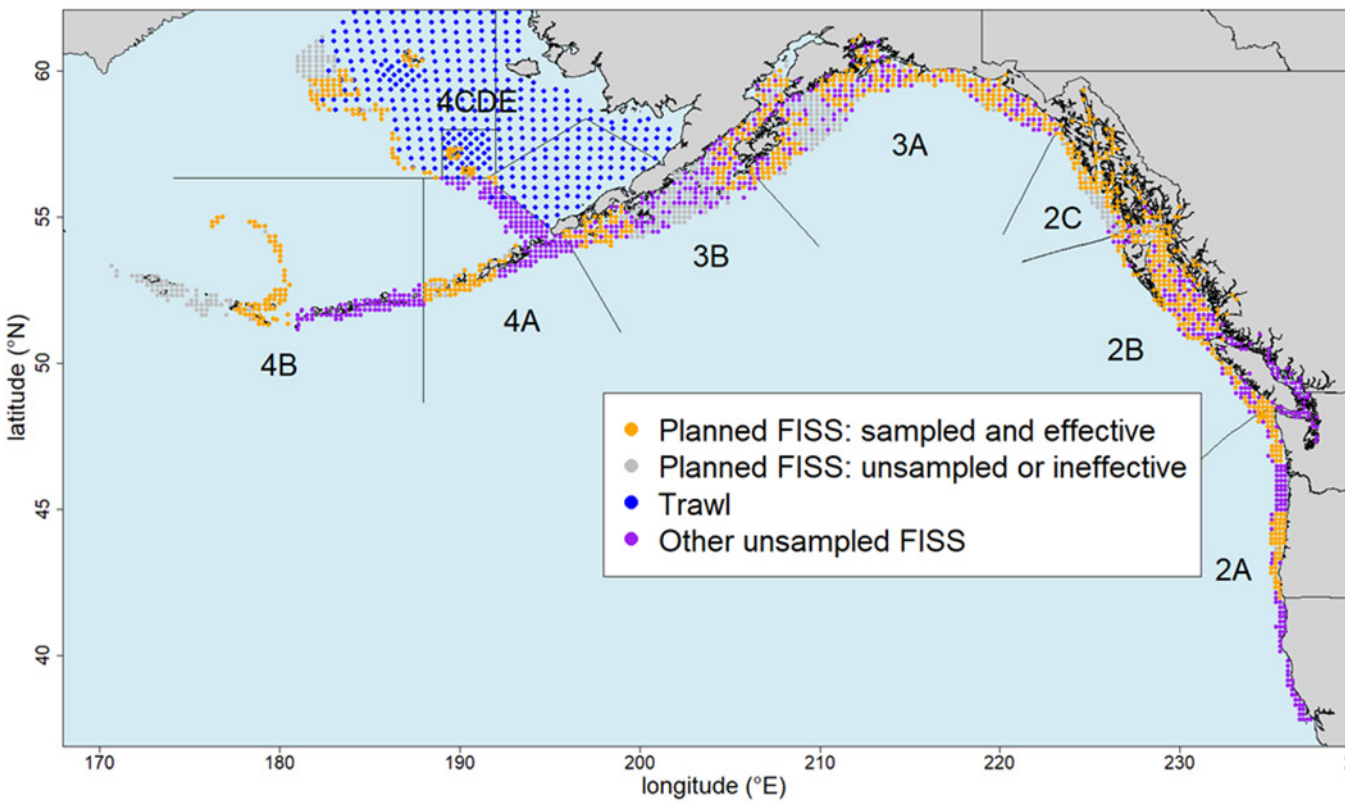


Figure 1. Map of the 2022 FISS design endorsed by the Commission on 1 December 2021 (IPHC-2021-IM097-R) and implemented/sampled in 2022. Purple circles were not planned to be sampled in 2022.

concentration) throughout the water column. Profiles were attempted at each FISS station, conditions permitting, resulting in a total of 625 successful casts.

Additional research projects

In addition to core operations, the FISS provides a platform for a number of IPHC research projects as well as external special projects and data collections. Details of those projects are contained in the Biological and Ecosystem Research section of this report.

IPHC Fishery-Independent Setline Survey (FISS) results

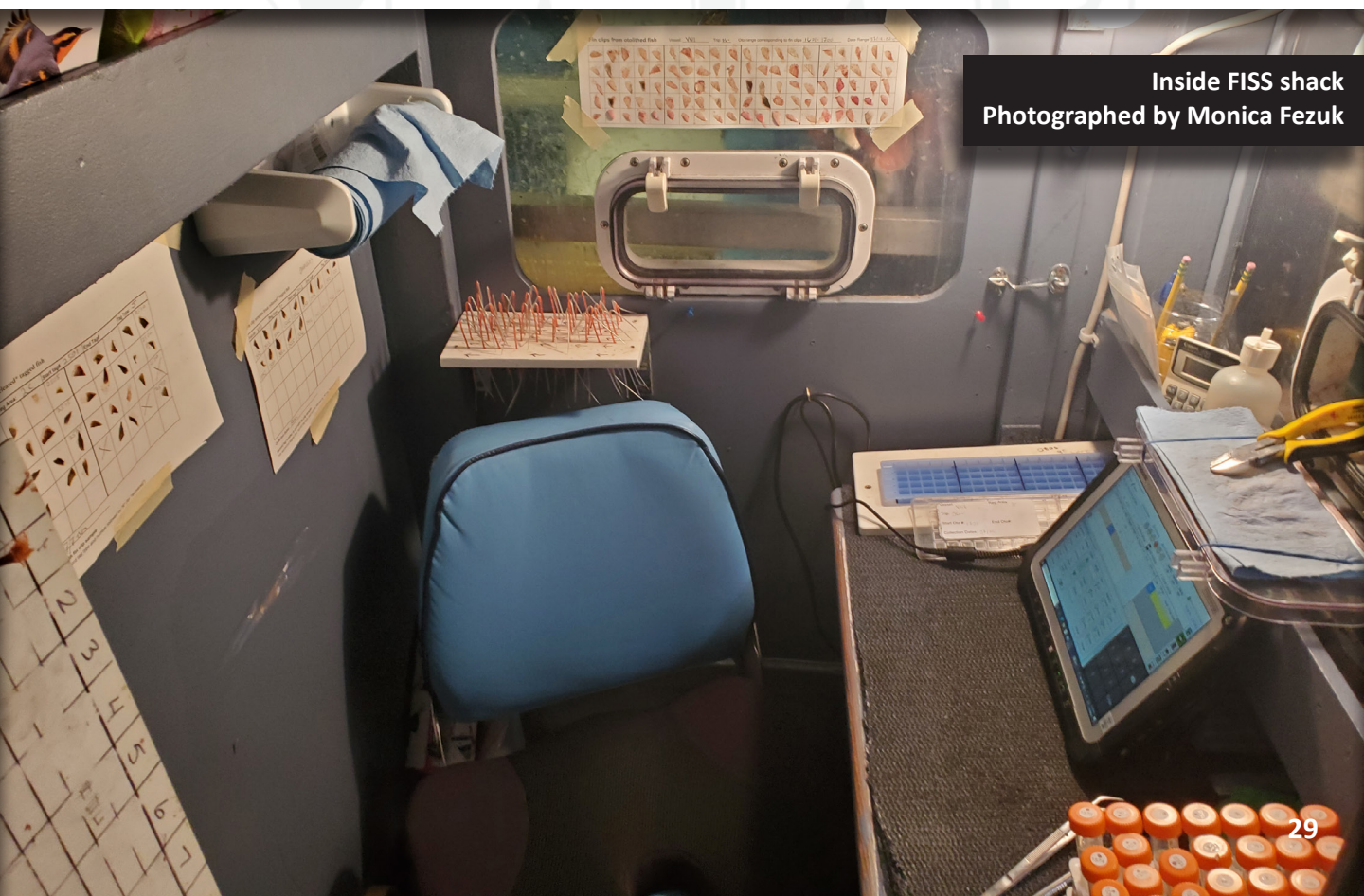
As is typical, the IPHC targeted the summer months—May, June, July, and August—for FISS work. In 2022, this activity took place from 27 May through 15 September. On a coastwide basis, FISS vessel activity was highest in intensity at the beginning of the FISS season and declined early in August as boats finished their charter regions (Figure 1).

Weight and number per unit effort (WPUE)

As a result of including both commercial and non-commercial fishing grounds in the FISS design, the FISS results showed an average weight per unit effort (WPUE) for all IPHC Regulatory Areas below that of the directed commercial Pacific halibut fleet (Table 8), except for IPHC Regulatory Area 2C where FISS results were just slightly higher by 0.5.

Non-Pacific halibut catch

Around 101 species of fish and invertebrates were captured this year as bycatch by the IPHC FISS (For more details on bycatch, visit https://www.iphc.int/data/fiss-bycatch). The predominant incidental catches in each IPHC Regulatory Area are sharks, primarily spiny dogfish (*Squalus suckleyi*). The next most frequent incidental catch in each IPHC Regulatory Area are Pacific cod (*Gadus microcephalus*).



Inside FISS shack
Photographed by Monica Fezuk

Size and age observations

Approximately 55 percent of Pacific halibut caught during the IPHC FISS were smaller than the current commercial legal-size limit (U32; < 81.3 cm or 32 inches) with a median fork length of 73 cm (29 inches). In 2022, median length decreased in IPHC Regulatory Areas 2B, 2C, 3A, 3B, 4C, and 4D when compared to 2021, but increased in 2A and 4B. In IPHC Regulatory Area 4A, median fork length stayed the same. IPHC Regulatory Area 2B, 3A, 3B, 4A, and 4C had a median length below the legal-size limit. The largest median length was in IPHC Regulatory Area 4B (106 cm or 41.7 in).

The sex composition of FISS-caught O32 (> 81.3 cm or 32 inches) Pacific halibut varied widely among IPHC Regulatory Areas, ranging from 29 percent (4B) to 91 percent (4C) female. Most female Pacific halibut caught during the FISS period (i.e. summer months) were in the mature stage and expected to spawn in the upcoming season.

NOAA Fisheries trawl surveys

The IPHC routinely collaborates with NOAA Fisheries to collect biological data from Pacific halibut caught during the groundfish trawl surveys conducted in Alaska. In 2022, survey personnel encountered and measured 1,481 Pacific halibut in the eastern Bering Sea survey, 198 in the northern Bering Sea survey, and 471 in the Aleutian Islands survey. Weights and otoliths for aging were collected from 1,902 Pacific halibut encountered. In addition, IPHC assisted in the collection of 384 Pacific halibut stomachs in the eastern Bering Sea survey as well as 54 Pacific halibut stomachs in the northern Bering Sea survey.

Table 8. The average total raw WPUE for each of the IPHC Regulatory Areas during the FISS 2022.

Regulatory Area	kg/skate	lb/skate	Station Count
2A	17	38	79
2B	48	106	166
2C	74	164	110
3A	44	97	227
3B	44	96	71
4A	19	42	53
4B	8	17	66
4C	25	56	18
4D	10	22	73

Population assessment

Pacific halibut offload
Photographed by Monica Fezuk

Since 1924, one of the IPHC's primary tasks has been to assess the population (or stock) of Pacific halibut. In 2022, the IPHC conducted its annual coastwide stock assessment of Pacific halibut using updated data sources and new information from the 2022 fishing period. This section covers three main topics that have bearing on the population assessment process: (1) the data sources available for the Pacific halibut stock assessment and related analyses, (2) the results of the stock assessment, and (3) the outlook for the stock, scientific advice, and future research directions.

Data sources

The data for the stock assessment is based on both fishery-dependent and fishery-independent data, as well as auxiliary data. The data sources include historical information going as far back as the late 1800s, which allow scientists to better identify trends over time that may be of import to the understanding of the current population. Data collection has continuously improved and is now the best it has ever been; however, the historical data are incomplete and/or imperfect in some cases, limiting the conclusions that can be drawn for years past.

Historical data

Known Pacific halibut mortality consists of target/directed commercial fishery landings and discard mortality (including research), recreational fisheries, subsistence, and non-targeted/directed discard mortality ('bycatch') in fisheries targeting other species

where Pacific halibut retention is prohibited. Over the period 1888-2022 mortality has totaled 7.3 billion pounds (~3.3 million metric tons, t). Since 1923, the fishery has ranged annually from 34 to 100 million pounds (15,000-45,000 t) with an annual average of 63 million pounds (~29,000 t). Annual mortality was above this long-term average from 1985 through 2010 and has averaged 38.1 million pounds (~17,300 t) from 2018-22.

2022 fishery-dependent and fishery-independent survey data

Fishery-dependent data includes information from directed commercial, recreational, subsistence, and non-directed commercial fisheries. Pacific halibut landings data from the commercial fishery since 1981 have been reported to IPHC by way of commercial fish tickets. Annual recreational mortality estimates are provided to the IPHC by state agencies (U.S.A. waters) and Fisheries and Oceans Canada (DFO). Since 1991, DFO and NOAA (National Oceanic and Atmospheric Administration) Fisheries have provided estimates of subsistence (or personal use) harvests; these estimates are not made every year in all cases, so in some instances they are simply repeated from previous years when no new data are available.

Fishery-dependent and fishery-independent data include: 1) weight-per-unit-effort (WPUE), numbers-per-unit-effort (NPUE), 2) age distributions, and 3) weight-at-age. The primary source of trend information is the IPHC Fishery-Independent Setline Survey (FISS); however, IPHC considers the commercial fishery WPUE to be another indicator for the stock, and so its estimates are also treated as an index of abundance, while accounting for possible changes in fishery practices and locations from year to year.

The 2022 modelled FISS results detailed a coastwide aggregate estimate of average NPUE which decreased by 8% from 2021 to 2022, back to levels similar to those observed in 2018-2020 (Figure 2). The modelled coastwide estimate of average WPUE of legal (O32: > 81.3 cm or 32 inches) Pacific halibut, the most comparable metric to observed commercial fishery catch rates, increased by 4% from 2020 to 2021. This reduced trend relative to that for NPUE indicates that recruitment of younger fish is contributing more to current stock productivity than somatic growth of fish already over the legal minimum size limit. Individual IPHC Regulatory Areas varied from an estimated 57% increase (Regulatory Area 3B) to a 9% decrease (Regulatory Area 4CDE) in O32 WPUE. Due to the extensive survey conducted in 2021, uncertainty was near or below historical levels for most IPHC Regulatory Areas in 2021.

Preliminary commercial fishery WPUE estimates from 2022 logbooks decreased by 15% at the coastwide level. The bias correction to account for additional logbooks compiled after the fishing season resulted in an estimate of -18% coastwide. Trends varied among IPHC Regulatory Areas and gears; however, Area-specific trends were generally similar to those from the FISS.

All information used in the 2022 stock assessment was finalized on 1 November 2022 in order to provide adequate time for analysis and modeling. As has been the case in all years, some data are incomplete, or include projections for the remainder of the year. These include commercial fishery WPUE, commercial fishery age composition data, and 2022 mortality estimates for all fisheries still operating. All preliminary data series in this analysis will be fully updated as part of the 2023 stock assessment.

Auxiliary inputs

The population assessment includes a number of additional information sources that are treated as data, even though they represent the products of analyses themselves. These are: 1) the weight-length

relationships, 2) the maturity schedule, 3) estimates of ageing bias and imprecision, and 4) the regimes of the Pacific Decadal Oscillation (PDO). Details of these data sources are as follows.

• The headed and gutted weight (net pounds) of a Pacific halibut has historically been estimated via a simple equation of weight based on fork length. As length increases, weight corresponds at a rate slightly greater than cubic increase. Due to the direct sampling of individual Pacific halibut weights in the port sampling program (beginning in 2015) and the FISS (beginning in 2019), weight-length relationships are used only for sources that do not directly sample individual fish weights (e.g., non-directed commercial discard mortality, recreational mortality). In 2021, the IPHC provided IPHC Regulatory Area specific L-W relationships for use, based on the most up to date estimates from recent sampling.

• Female Pacific halibut are understood to become sexually mature on a set schedule that has been estimated to be stable through several historical investigations. Across all Regulatory Areas, half of all female Pacific halibut become sexually mature by 11.6 years, and nearly all fish are mature by age 17. This maturity schedule is the ongoing focus of research based on data collection that began on the FISS in 2022.

• Age estimates are based on the counting of rings on an otolith, a method that is by nature subject to both bias and imprecision. However, it is relatively easy to estimate the age of Pacific halibut (compared to other groundfish), and analysis shows that the current aging method—referred to as "break-and-bake"—is remarkably precise. The assessment accounts for the small amount of variability in ring counts based on comparison of multiple readers and counts.

• The PDO is a pattern of Pacific climate variability that has historically changed about every 10-30 years. Research has shown that during the 20th century these environmental conditions have been correlated with the recruitment of Pacific halibut. In "positive" phases of the PDO (before 1947, and 1977-2006), the stock saw a higher average recruitment of younger fish. The PDO's longest "negative" phase since the late 1970s occurred from 2006 through 2013. Positive values were observed over 2014-19; however, it is unclear if this represents a change of phase or a different set of environmental conditions altogether. Further, the correspondence between the PDO and other environmental observations seems to be weakening as previously rare extreme conditions become more common.

Stock distribution

Estimates of the biological distribution of the stock are achieved using the modelled FISS WPUE index of Pacific halibut density, weighted by the geographical extent of each IPHC Regulatory Area. To account for factors that are known to affect FISS catch rates, two adjustments to the raw WPUE prior to modelling are made for FISS timing relative to the harvest and hook competition. The measure of "hook competition" accounts for competition from all species including other Pacific halibut. Adjusting for the presence of such competition reduces bias in the observed WPUE index of density and are applied at the station level.

Modelled survey WPUE (representing the density of all sizes of Pacific halibut captured by the FISS; Figure 3) is used to produce the best available estimates of the stock distribution by Biological Region. The current trend in estimated population distribution showed a sharp drop in Biological Region 3 after increases in 2020 and 2021. This corresponds to an increase in all other

Biological Regions (Table 9). It is unknown to what degree current stock distribution corresponds to historical distributions from the mid-1900s or to the average distribution likely to occur in the absence of fishing mortality, as modelled survey estimates are only available beginning in 1993.

Population Assessment at the end of 2022

Stock assessment

The methods for undertaking the population assessment for Pacific halibut have been improved many times over the last 30 years with the development of better model assumptions and analytical approaches. For the last nine years, a method called the "ensemble approach" has been used as a way to make the process both stronger and more flexible to future model changes. Originating from the field of weather and hurricane forecasting, it recognizes that there is no "true" assessment model, and risk assessment based on multiple models provides a basis for the estimation of management quantities (and the uncertainty about these quantities).

The 2022 stock assessment represents a full analysis, following updates in 2020 and 2021 of the last full assessment (2019). Changes were reviewed by the IPHC's Scientific Review Board through a two-meeting process and included: updating the software, data weighting based on actual sampling designs, allowing for higher natural mortality for the youngest (ages 0-2) fish and, most importantly, estimating the rate of natural mortality (deaths of halibut from all causes other than fishing) in one additional model (now 3 of 4). Overall, spawning biomass estimates remain highly consistent with those of recent stock assessments. However, the higher estimated value of natural mortality in the AAF short model when included with the other four models (two of which already estimated natural mortality) strongly affected the ensemble stock assessment estimates of recent and historical fishing intensity. The 2022 stock assessment estimates a lower level of fishing intensity and higher relative stock status compared to previous assessments, as well as a 26% increase in the yield corresponding to the long-term reference level of fishing intensity ($F_{43\%}$) for 2023 compared to 2022. Spawning biomass trends appear to have stabilized, as fish from the 2012 year-class, critically important to short-term projections of stock and fishery dynamics, continue to mature. The 2022 assessment continues to make use of the extensive historical time series of data, as well as integrating both structural and estimation uncertainty via an ensemble of four equally weighted individual models. Within-model uncertainty from each model was propagated through to the risk analysis and decision table (Table 10). Therefore, key quantities such as reference points and stock size are reported as distributions, such that the entire plausible range can be evaluated. Point estimates reported in this stock assessment correspond to median values from the ensemble.

Table 9. Recent stock distribution estimates by Biological Region based on modelling of all sizes of Pacific halibut captured by the FISS.

Year	Region 2 (2A, 2B, 2C)	Region 3 (3A, 3B)	Region 4 (4A, 4CDE)	Region 4B
2018	24.6%	48.3%	22.1%	5.1%
2019	25.5%	46.9%	22.9%	4.7%
2020	23.6%	50.1%	21.4%	4.9%
2021	22.6%	53.8%	18.8%	4.8%
2022	24.8%	48.6%	20.9%	5.6%

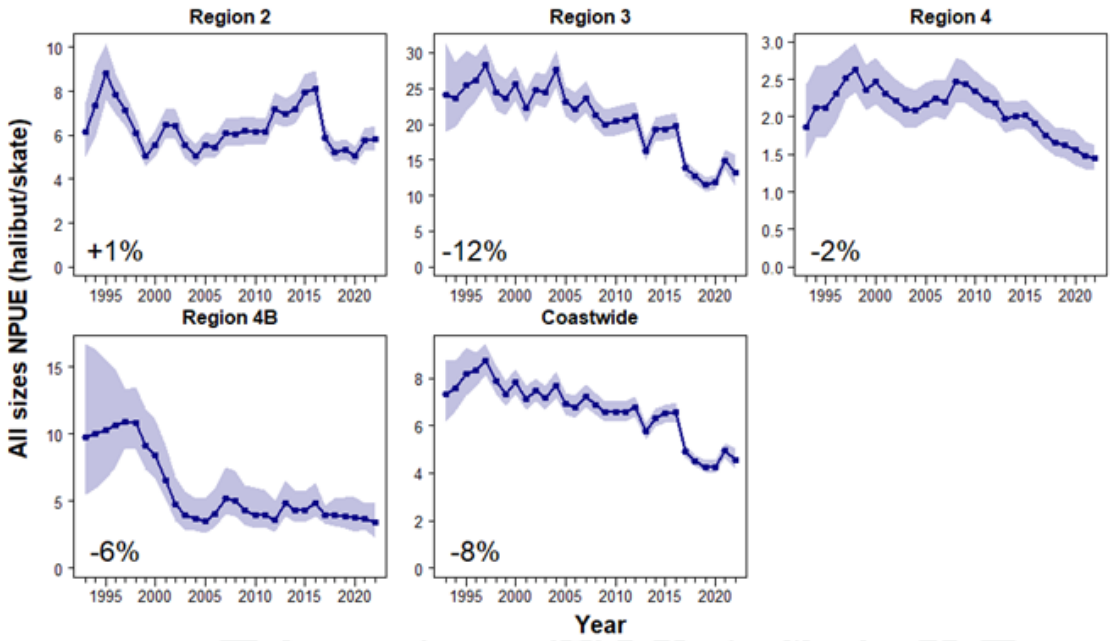


Figure 2. Trends in modelled FISS NPUE by Biological Region, 1993-2022. Percentages indicate the change from 2021 to 2022. Shaded zones indicate 95% credible intervals.

Spawning biomass and recruitment trends

The results of the 2022 stock assessment indicate that the Pacific halibut stock declined continuously from the late 1990s to around 2012. That trend is estimated to have been largely a result of decreasing size-at-age, as well as weaker recruitment strengths than those observed during the 1980s. The spawning biomass (SB) is estimated to have increased gradually to 2016, and then decreased to an estimated 192 million pounds (~87,100 t) at the beginning of 2023, with an approximate 95% credible interval ranging from 122 to 272 million pounds (~55,400-123,200 t; Figure 2). The recent spawning biomass estimates from the 2022 stock assessment are very consistent with previous analyses, back to 2012. Prior to that period, the current assessment indicates a high probability of larger biomass than estimated prior to the 2019 stock assessment; this is largely the result of the addition of sex-ratio information for the directed commercial landings in that year.

Average Pacific halibut recruitment is estimated to be higher (47 and 44% for the coastwide and Areas-as-Fleets (AAF) models, respectively) during favorable PDO regimes. Pacific halibut recruitment estimates show the large cohorts in 1999 and 2005. Cohorts from 2006 through 2011 are estimated to be much smaller than those from 1999-2005, which has resulted in a decline in both the stock and fishery yield as these low recruitments have moved into the spawning biomass. Based on age data through 2022, individual models in this assessment produced estimates of the 2012 year-classes that are smaller than the 2005 year-class. The 2012 year-class is estimated to be 29% mature in 2021, and the maturation of this cohort has a strong effect on the short-term projections. The 2013 year class appears to be another small cohort, and there is insufficient information to reliably determine the cohort strengths after 2013.

Reference points

The IPHC's interim management procedure uses a relative spawning biomass of 30% as a trigger, below which the target fishing intensity is reduced. At a spawning biomass limit of 20%, directed fishing is

Kevin Coll working aboard F/V Kema Sue
Photographed by Rodolfo Curralo

halted due to the critically low biomass condition. This calculation is based on recent biological conditions: current weight-at-age and estimated recruitments still influencing the stock. Thus, the 'dynamic' calculation measures only the effect of fishing on the spawning biomass. The relative spawning biomass in 2022 was estimated to be 42% (credible interval: 21-55%); this value is larger than those from recent assessments due to the larger estimate of natural mortality in the 2022 assessment and corresponding increase in productivity. The probability that the stock is below the $SB_{30\%}$ level is estimated to be 25% at the beginning of 2021, with less than a 1% chance that the stock is below $SB_{20\%}$. The IPHC's current interim management procedure specifies a target level of fishing intensity of a Spawning Potential Ratio (SPR) corresponding to an $F_{43\%}$; this equates to the level of fishing that would reduce the lifetime spawning output per recruit to 43% of the unfished level given current biology, fishery characteristics and demographics. Based on the 2022 assessment, the 2022 fishing intensity is estimated to correspond to an $F_{51\%}$ (credible interval: 32-64%). Fishing intensity in both 2020-2022 are estimated to be less than values estimated for the last 20+ years (Figure 3). This drop in fishing intensity corresponds both to reduced mortality limits (2020) and actual mortality below the limits (2020-2022).

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 five years (2017-21) of sex-ratio information from the directed commercial fishery landings. However, uncertainty in historical ratios, and the degree of variability likely present in those and future fisheries remains unknown. Additional years of data are likely to further inform selectivity parameters and cumulatively reduce uncertainty in stock size in the future. The treatment of spatial dynamics and movement rates among Biological Regions, which are represented via the coastwide and AAF approaches, has large implications for the current stock trend, as evidenced by the different results among the four models comprising the stock assessment ensemble. This assessment also does not include mortality trends or explicit demographic linkages with Russian waters, although such linkages may be increasingly

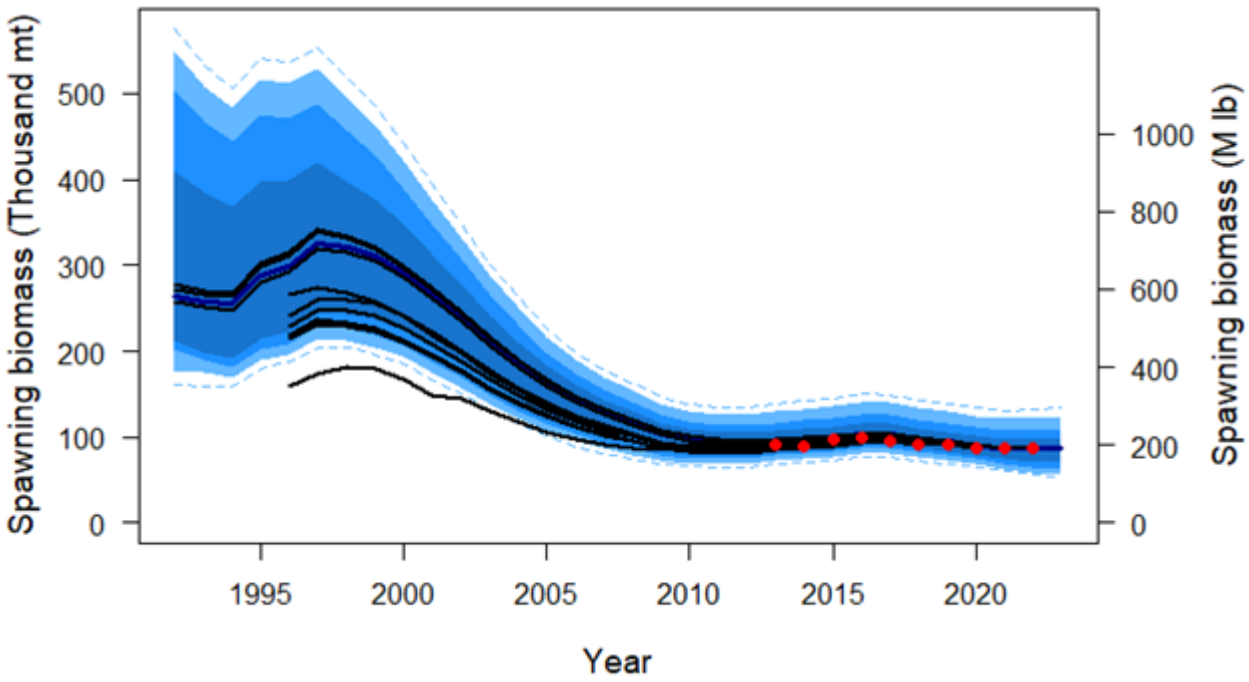


Figure 3. Retrospective comparison among recent IPHC stock assessments. Black lines indicate estimates of spawning biomass estimated by assessments conducted from 2012-2021 with the terminal estimate shown as a point, the shaded distribution denotes the 2022 ensemble: the dark blue line indicates the median (or "50:50 line") with an equal probability of the estimate falling above or below that level; colored bands moving away from the median indicate the intervals containing 50/100, 75/100, and 95/100 estimates; dashed lines indicate the 99/100 interval.

important as warming waters in the Bering Sea allow for potentially important exchange across the international border.

Additional important contributors to assessment uncertainty (and potential bias) include the lag in estimation of incoming recruitment between birth year and direct observation in the fishery and survey data (6-10 years). Like most stock assessments, there is no direct information on natural mortality, and increased uncertainty for some estimated components of the fishery mortality. Fishery mortality estimates are assumed to be accurate; therefore, uncertainty due to discard mortality estimation (observer sampling and representativeness), discard mortality rates, and any other documented mortality in either directed or non-directed fisheries (e.g., whale depredation) could create bias in this assessment. Maturation schedules and fecundity are currently under renewed investigation by the IPHC. Currently used historical values are based on visual field assessments, and the simple assumption that fecundity is proportional to spawning biomass and that Pacific halibut do not experience appreciable skip-spawning (physiologically mature fish which do not actually spawn due to environmental or other conditions). To the degree that maturity, fecundity or skip spawning may be temporally variable, the current approach could result in bias in the stock assessment trends and reference points. New information will be incorporated as it becomes available; however, it may take years to better understand trends in these biological processes at the scale of the entire population. Projections beyond three years are avoided due to the lack of mechanistic understanding of the factors influencing size-at-age and relative recruitment strength, the two most important factors in historical population trends.

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.

Outlook

Stock projections were conducted using the integrated results from the stock assessment ensemble in tandem with summaries of the 2022 directed and non-directed fisheries. The harvest decision table (Table 10) provides a comparison of the relative risk (in times out of 100), using stock and fishery metrics (rows), against a range of alternative harvest levels for 2023 (columns). In addition to the status quo (last year's coastwide TCEY), a range of higher and lower coastwide TCEYs is presented, including TCEYs corresponding to SPRs from 40% to 46%, values identified by the MSE process as performing well with regard to long-term stock and fishery objectives. For each column of the decision table, the mortality (including all sizes and sources), the coastwide TCEY and the associated level of fishing intensity projected for 2023 (median value with the 95% credible interval below) are reported.

The projections of spawning biomass for this assessment are more optimistic than those from recent assessments due to the increasing projected maturity of the 2012 year-class. This translates to a lower probability of stock decline for 2022 than in recent assessments as well as a decrease in this probability through 2023-24 for similar mortality levels. The reference coastwide TCEY for 2023 is 26% higher than the reference coastwide TCEY for 2022 due to the increase in estimated productivity with a third model estimating natural mortality greater than the previously fixed value of 0.15. There is greater than a 50% probability of stock decline in 2024 (53-86/100) for all yields greater than the status quo, including the entire range of SPR values from 40-46%, which includes the $F_{43\%}$ reference level. There is a 49 out of 100 chance that the spawning biomass will decline in 2024 with the status quo TCEY of 41.2 million pounds (~18,700 t). The 2023 "3-year surplus" alternative corresponds to a TCEY of 43.0 million pounds (~19,500 t), and a projected SPR of 48% (credible interval 28-62%). At the reference level (a projected SPR of 43%), the probability of spawning biomass decline from 2023 to 2024 is 75%, decreasing to 71% in three years, as the 2012 cohort matures. The one-year risk of the stock dropping below $SB_{30\%}$ is 25% across all alternatives.

Scientific advice

Sources of mortality

In 2022, total Pacific halibut mortality due to fishing increased to 39.69 million pounds (18,003 t), above the 5-year average of 38.10 million pounds (17,284 t). Of that total, 85% comprised the retained catch, down from 87% in 2021.

Stock status (spawning biomass)

Current (beginning of 2023) female spawning biomass is estimated to be 192 million pounds (87,058 t), which corresponds to an 25% chance of being below the IPHC trigger reference point of $SB_{30\%}$, and less than a 1% chance of being below the IPHC limit reference point of $SB_{20\%}$. The stock is estimated to have declined by 16% since 2016 but is currently at 42% of the unfished state. Therefore, the stock is considered to be 'not overfished'. Projections indicate that mortality consistent with the interim management procedure reference fishing intensity ($F_{43\%}$) is very likely to result in further declining biomass levels in the near future.

Fishing intensity

The 2022 fishing mortality corresponded to a point estimate of SPR = 51%; there is a 27% chance that fishing intensity exceeded the IPHC's current reference level of $F_{43\%}$ (Figure 4). The Commission does not currently have a coastwide fishing intensity limit reference point.

Stock distribution

After increases in 2020-2021, the proportion of the coastwide stock represented by Biological Region 3 has decreased sharply in 2022. This trend occurs in tandem with increases in Biological Regions 2, 4 and 4B; however, all regions remain within the historical range observed from 1993-2021.

Future research in support of the stock assessment

Research priorities for the stock assessment and related analyses have been consolidated with those for the IPHC's MSE and the Biological Research program and are included in the IPHC's 5-year research plan five-year research plan.

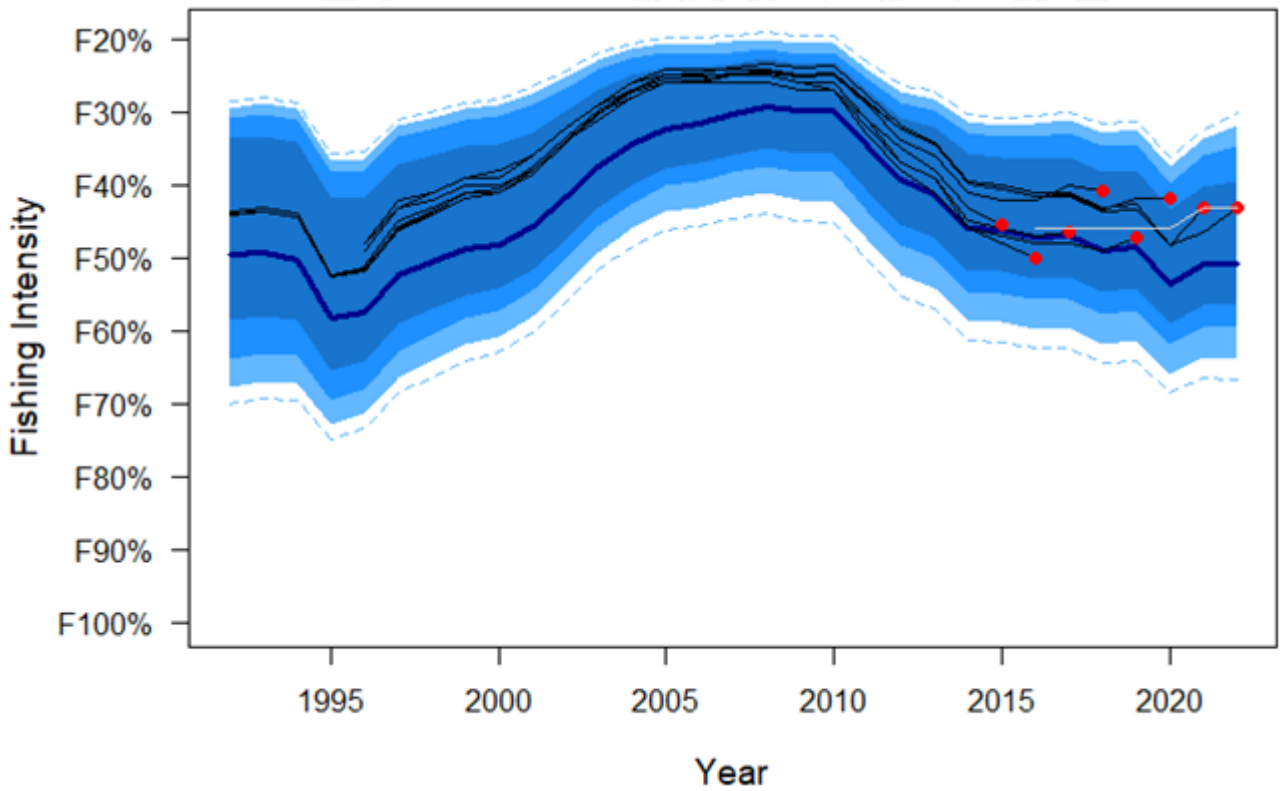


Figure 4. Retrospective comparison of fishing intensity (measured as $F_{xx\%}$, where xx% indicates the Spawning Potential Ratio (SPR) or the reduction in the lifetime reproductive output due to fishing) among recent IPHC stock assessments. Black lines indicate estimates of fishing intensity from assessments conducted in 2014-2021 with the projection for the mortality limit adopted based on that assessment shown as a red point. The shaded distribution denotes the 2022 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 grey 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 $F_{43\%}$ during 2021-2022).

Table 10. Harvest decision table for the 2023 mortality limits. Columns correspond to yield alternatives and rows to risk metrics. Values in the table represent the probablity, in "times out of 100" (or percent chance) of a particular risk.

2023 Alternative					*Status quo -18%*	*Status quo -15%*	*Adopted*	*Status quo -10%*	*Status quo*	3-Year Surplus				*Reference* $F_{43\%}$				
Total mortality (M lb)			0.0	31.3	35.1	36.4	38.3	38.4	42.5	44.3	48.1	49.8	51.5	53.3	55.1	57.1	59.1	61.3	
TCEY (M lb)			0.0	30.0	33.8	35.0	37.0	37.1	41.2	43.0	46.8	48.4	50.2	52.0	53.8	55.8	57.8	60.0	
2023 fishing intensity			$F_{100\%}$	$F_{59\%}$	$F_{55\%}$	$F_{54\%}$	$F_{53\%}$	$F_{53\%}$	$F_{50\%}$	$F_{48\%}$	$F_{46\%}$	$F_{45\%}$	$F_{44\%}$	$F_{43\%}$	$F_{42\%}$	$F_{41\%}$	$F_{40\%}$	$F_{39\%}$	
Fishing intensity interval			–	37-71%	34-68%	33-67%	32-66%	32-66%	29-63%	28-62%	26-59%	25-59%	24-58%	24-57%	23-56%	22-55%	21-54%	21-53%	
Stock Trend (spawning biomass)	in 2024	is less than 2023	<1	20	29	32	38	38	49	53	63	67	71	75	79	83	86	89	a
		is 5% less than 2023	<1	2	4	5	7	7	13	15	22	25	28	31	35	39	43	47	b
	in 2025	is less than 2023	<1	18	27	30	35	35	46	50	60	64	68	72	76	80	83	87	c
		is 5% less than 2023	<1	6	11	13	16	16	24	28	36	40	44	48	52	57	62	67	d
	in 2026	is less than 2023	<1	20	28	31	36	36	46	50	60	63	67	71	75	79	82	85	e
		is 5% less than 2023	<1	10	16	18	22	22	31	35	43	47	51	55	59	64	68	72	f
Stock Status (Spawning biomass)	in 2024	is less than 30%	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	g
		is less than 20%	<1	<1	<1	1	1	1	1	1	1	1	2	2	2	2	3	3	h
	in 2025	is less than 30%	18	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	i
		is less than 20%	<1	<1	1	1	1	1	1	2	3	3	4	4	5	6	6	7	j
	in 2026	is less than 30%	6	23	24	24	24	24	25	25	25	25	25	25	25	25	25	25	k
		is less than 20%	<1	<1	1	1	1	1	2	3	4	5	6	6	7	9	10	11	l
Fishery Trend (TCEY)	in 2024	is less than 2023	0	17	24	24	25	25	28	31	38	41	45	50	55	59	64	69	m
		is 10% less than 2023	0	11	20	22	24	24	26	27	32	35	38	42	46	51	55	60	n
	in 2025	is less than 2023	0	15	22	24	25	25	28	30	37	41	45	50	55	60	66	71	o
		is 10% less than 2023	0	11	19	21	23	23	26	27	32	35	38	42	47	52	57	62	p
	in 2026	is less than 2023	0	14	21	23	24	24	28	30	37	41	46	51	56	62	67	72	q
		is 10% less than 2023	0	10	18	20	22	22	25	27	32	35	39	43	48	53	58	64	r
Fishery Status (Fishing intensity)	in 2023	is above $F_{43\%}$	0	19	24	25	26	26	29	31	38	42	46	50	54	59	63	68	s

Terms: *Constant Exploitation Yield (CEY)*: A specific concept from the IPHC's interim management procedure: the Total CEY (TCEY) is the current basis for Commission mortality limits. TCEY includes all sources and sizes of mortality, except discard mortality in non-directed fisheries less than 26 inches in length (66cm; U26). The Fishery CEY (FCEY) is the amount of yield for directed Pacific halibut fisheries as defined by IPHC Regulatory Area-specific catch agreements, where applicable. *Spawning Potential Ratio (SPR)*: A commonly used metric of fishing intensity. SPR is the ratio of the equilibrium spawning biomass per recruit given some level of fishing and the equilibrium spawning biomass per recruit in the absence of fishing. Sometimes referred to as SBR, relative Spawning Biomass per Recruit.

Harvest strategy policy

Harvest strategy policy at the IPHC is a strategic approach to setting harvest limits that is informed by many analyses and simulation studies. The IPHC Harvest Strategy Policy provides a framework for applying a science-based approach to setting mortality limits for Pacific halibut throughout the IPHC Convention Area. The framework uses a management procedure that incorporates science and policy to determine the coastwide Total Constant Exploitation Yield (TCEY) and then distribute it across all IPHC Regulatory Areas.

In 2017 the Commission agreed to a policy that separates the scale (coastwide fishing intensity) and the distribution of fishing mortality. The first step in the harvest strategy policy is to determine the TCEY from the coastwide fishing intensity (scale) on the coastwide stock based on the Spawning Potential Ratio (SPR). Once the coastwide TCEY is determined it is split into a TCEY for each IPHC Regulatory Area. The final step is the decision-making process by the Commission, which may adjust the TCEY in each IPHC Regulatory Area to account for socio-economic concerns. This separation of scale and distribution accounts for all mortality from all sources and allows the Commission to separate the decision of coastwide fishing intensity from distribution of the TCEY.

In 2018 and 2020, the Management Strategy Evaluation (MSE) process provided recommendations on the scale portion of the harvest strategy policy, resulting in a fishing mortality rate that corresponds to a SPR of 43% (a 57% reduction in the spawning potential). This SPR was based on the range of values identified through the MSE process, considering the trade-off between yield and interannual variability in the yield while ensuring that conservation objectives are met. The SPR can be thought of as the percentage of spawning potential for a fish over its lifetime given a constant level of fishing. For example, a fish may have many chances to spawn without fishing, but that potential will be reduced with fishing.

The distribution of the coastwide TCEY has used estimates from the Fishery-Independent Setline Survey (FISS), relative harvest rates, and agreements for IPHC Regulatory Areas 2A and 2B which expired at the end of 2022. Estimates of biomass from the FISS is a science-based method to distribute the mortality similar to how the stock is distributed. Relative harvest rates, based on science and policy, are used to reduce the fishing mortality in western areas from which Pacific halibut typically migrate to eastern areas and are typically less productive. Socio-economic factors are also considered when determining the final TCEY for each IPHC Regulatory Area.

F/V Vanisle
Photographed by Gregory Jay

Management Strategy Evaluation

Management Strategy Evaluation (MSE) is a formal process in which to evaluate the performance of alternative management procedures for the Pacific halibut fishery against defined goals and objectives. Incorporating uncertainty about stock parameters and dynamics into the MSE can identify management procedures that are robust to those uncertainties. At the IPHC, the MSE process has been interactive, with a Management Strategy Advisory Board (MSAB) made up of stakeholders and managers involved in the resource. The MSAB provides suggestions that are evaluated against objectives defined by all of the parties involved.

The MSE analysis was first completed in 2020 with an evaluation and comparison of many candidate management procedures that were presented to the Commission for potential adoption and implementation. These management procedures were made up of many different elements to determine the coastwide Total Constant Exploitation Yield (TCEY) and distribute it to IPHC Regulatory Areas. In 2023, alternative size limits (none, 26 inches, and the status quo 32 inches) and multi-year assessments (annual, biennial, or triennial) were evaluated. Conservation and fishery objectives were used for the evaluations and identification of trade-offs. Even though total yield would likely increase by reducing the size limit, this yield would be composed of more small fish which may have less value than large fish. The Commission has decided not to change the size limit for the directed commercial fisheries.

Overall, the clear communication of MSE results is important so that stakeholders and Commissioners can make informed decisions.

Management Strategy Advisory Board (MSAB)

The central role of the MSAB is to provide advice to the Commission on options for fishery objectives, performance metrics, candidate management procedures, and to identify trade-offs between the various management strategies being evaluated. A range of stakeholders are represented on the MSAB. An MSAB meeting is scheduled to occur in 2023.

Sampling Pacific halibut
Photographed by Dr. Barbara Hutniczak

RESEARCH

Since its inception, the IPHC has had a long history of research activities devoted to describing and understanding the biology and ecology of the Pacific halibut. The main objectives of the IPHC's 5-year Biological and Ecosystem Sciences Research Plan at IPHC are to:

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

The IPHC Secretariat develops new projects that are designed to address key biological and ecological topics as well as the continuation of certain projects initiated in previous years. Projects are based on input from the Commissioners, stakeholders, and specific subsidiary bodies to the IPHC such as the Scientific Review Board (SRB) and the Research Advisory Board (RAB). Importantly, biological and ecological research activities at IPHC are guided by a 5-Year Program of Integrated Research and Monitoring (2022-2026) that identifies key research areas that follow Commission objectives.

The IPHC conducts data collection activities from fishery-independent and fishery-dependent sources such as the IPHC fishery-independent setline survey and commercial fishery landings, respectively, which are described in other chapters of this report.

Migration and population dynamics

Wire tagging to study migration of young Pacific halibut

The patterns of movement of Pacific halibut among IPHC Regulatory Areas have important implications for management of the Pacific halibut fishery. The IPHC Secretariat has undertaken a long-term study of the migratory behavior of Pacific halibut through the use of externally visible tags (wire tags) on captured and released fish that must be retrieved and returned by workers in the fishing industry. In 2015, with the goal of gaining additional insight into movement and

Wire tags
Photographed by Noelle Rucinski

growth of young Pacific halibut (less than 32 inches [82 cm]; U32), the IPHC began wire-tagging small Pacific halibut encountered on the National Marine Fisheries Service (NMFS) groundfish trawl survey and, beginning in 2016, on the IPHC fishery-independent setline survey (FISS).

In 2022, 1,499 Pacific halibut were tagged and released on the IPHC FISS but no tagging was conducted in the NMFS groundfish trawl surveys. Therefore, a total of 7,610 U32 Pacific halibut have been wire tagged and released on the IPHC FISS to date. Of these, a total of 149 tags have been recovered to date. In the NMFS groundfish trawl surveys through 2019, a total of 6,421 tags have been released and, to date, 78 tags have been recovered.

Pacific halibut genome sequencing

The IPHC Secretariat has generated the first chromosome-level assembly of the Pacific halibut genome. The Pacific halibut genome has an estimated size of 602 Mb, 24 chromosome-length scaffolds that contain 99.8% of the assembly and a N50 scaffold length of 27.3 Mb. The Pacific halibut whole genome sequencing data are openly available in NCBI at https://www.ncbi.nlm.nih.gov/bioproject/622249, under BioProject PRJNA622249, and the updated assembly is openly available in NCBI at https://www.ncbi.nlm.nih.gov/assembly/GCA_022539355.2/ with GenBank assembly accession number GCA_022539355.2. The master record for the whole genome shotgun sequencing project has been deposited at DDBJ/ENA/GenBank under the accession JAKRZP000000000 and is openly available in NCBI at https://www.ncbi.nlm.nih.gov/nuccore/JAKRZP000000000. Sample metadata is openly available in NCBI at https://www.ncbi.nlm.nih.gov, under BioSamples SAMN14503176, SAMN25516224, SAMN25600010 and SAMN25600011. This important genomic resource will be instrumental for projects investigating the genetic basis of key life-

Dr. Josep Planas talks about the gonad collection project during FISS training. Photographed by Kayla Ualesi

history traits, for identifying potential local and/or environmental adaptations and to establish a genetic baseline to assign fish to their spawning origin.

The first application of the Pacific halibut genome involved the characterization of the sex determining region. By conducting genome-wide analyses of sex-specific genetic variation, a potential sex-determining region in chromosome 9 of approximately 12 Mb containing a high density of female-specific SNPs has been identified. Examination of the annotated genes contained in the sex-determining region resulted in the identification of a potential candidate for the master sex-determining gene in Pacific halibut. These results, together with data on the Pacific halibut genome sequencing and assembly, have been published in the journal Molecular Ecology Resources (Jasonowicz et al. 2022[1]).

Fine-scale analysis of the genetic structure of the Pacific halibut population in the Convention Area

The IPHC Secretariat has generated genomic sequences from 610 individual Pacific halibut collected from five spawning groups in different geographic areas in the Gulf of Alaska (Haida Gwaii, Portlock), Bering Sea (Pribilof Canyon) and Aleutian Islands (Central and Western Aleutians) using low-coverage whole-genome resequencing (lcWGR). The lcWGR approach offers a cost-effective way to develop a large number (~millions) of single nucleotide polymorphisms (SNPs) that can be used as genetic markers to evaluate population structure with very high resolution. Using this method, the IPHC Secretariat is working to establish a baseline of genetic diversity using sample collections made during the spawning season and will use this data set to develop genomic tools (i.e. genetic marker panels) that can be applied to conduct mixed stock analysis and identify the population of origin for samples collected outside of the spawning season. This project has received funding from the North Pacific Research Board (NPRB Project No. 2110; 2022-2024).

Reproduction

Efforts at IPHC are currently underway to address two critical issues in stock assessment based on estimates of female spawning biomass: the sex ratio of the commercial catch and maturity estimations.

Sex ratio of the commercial landings

Throughout the fishery's history, the sex ratio of commercially-caught Pacific halibut has remained unknown as landed individuals are eviscerated at sea and otherwise sexually indistinguishable. Historically, the sex ratio from the IPHC's fishery independent setline survey (FISS) has been the only direct source of sex-ratio information, but differences in size between individuals landed commercially and on the FISS suggested a greater proportion of females in the fishery.

The IPHC has generated sex information of the entire set of aged commercial fishery samples collected from 2017 until 2021 (>10,000 fin clips per year) using genetic techniques based on the identification of sex-specific single nucleotide polymorphisms (SNPs) (Drinan et al., 2018[2]) using TaqMan qPCR assays conducted at the IPHC's Biological Laboratory. The IPHC Secretariat

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

[2] Drinan DP, Loher T, and Hauser L (2018) Identification of Genomic Regions Associated With Sex in Pacific Halibut. J Hered 109: 326-332.

is currently processing genetic samples from the 2022 commercial landings, as additional years of sex-ratio information of the commercial catch are likely to further inform selectivity parameters and cumulatively reduce uncertainty in future estimates of stock size, in addition to improving simulation of spawning biomass in the MSE Operating Model.

Maturity assessment of female Pacific halibut

Each year, the FISS collects biological data on the maturity of female Pacific halibut that are used in the stock assessment. In particular, a female maturity schedule based on characteristics that can be identified through direct examination is used to estimate spawning stock biomass. Currently used estimates of maturity-at-age indicate that the age at which 50 percent of female Pacific halibut are sexually mature is 11.6 years on average. However, the current method using macroscopic visual criteria of the ovaries collected in the field to estimate maturity may introduce an unknown level of uncertainty. Furthermore, estimates of maturity-at-age have not been revised in recent years and may be outdated. For this reason, current research efforts are devoted to describing reproductive development and maturity in female Pacific halibut.

The IPHC Secretariat has completed the first detailed examination of temporal changes in female ovarian developmental stages, reproductive phases, and biological indicators of Pacific halibut reproductive development. The results obtained by ovarian histological examination indicate that female Pacific halibut follow an annual reproductive cycle involving a clear progression of female developmental stages towards spawning within a single year. These results provide foundational information for future studies aimed at updating maturity ogives by histological assessment and at investigating fecundity in Pacific halibut. Furthermore, the potential use of easily-obtained biological indicators in predictive models to assign reproductive phase in Pacific halibut was demonstrated. The results of this study have been published in the journals Journal of Fish Biology (Fish et al. 2020[3]) and Frontiers in Marine Science (Fish et al. 2022[4]).

Furthermore, the IPHC Secretariat is undertaking studies to revise maturity schedules in all four Biological Regions through histological (i.e. microscopic) characterization of maturity. The maturity schedule that is currently used in SA was based on past visual (i.e. macroscopic) maturity classifications in the field (FISS). In order to be able to accomplish this objective, the IPHC Secretariat has collected ovarian samples for histology in the 2022 FISS by targeting Biological Regions 2, 3, 4 and 4B. Ovarian samples are currently being processed for histology and are expected to be available for examination by early 2023. Subsequently, histological maturity classifications will be conducted by the IPHC Secretariat staff to generate biological region-specific maturity ogives. A comparison between macroscopic and histological maturity classification criteria will be established.

Growth

Current studies in this research area are aimed at understanding the possible role of body growth variation in the observed changes in size-at-age (SAA), and

[3] Fish T, Wolf N, Harris BP, Planas JV (2020) A comprehensive description of oocyte developmental stages in Pacific halibut, Hippoglossus stenolepis. J Fish Biol. 97: 1880–1885. https://doi.org/10.1111/jfb.14551.

[4] Fish T, Wolf N, Smeltz TS, Harris BP, Planas JV (2022) Reproductive biology of female Pacific halibut (Hippoglossus stenolepis) in the Gulf of Alaska. Frontiers Mar. Sci. 9: 801759. https://doi.org/10.3389/fmars.2022.801759.

2022 Undergraduate Fishery Biologist Interns Vasilisa Tyurina (left) and Kaitlyn Murray (right)
Photographs provided by IPHC

at developing tools for measuring growth and physiological condition in Pacific halibut. In view of our limited knowledge on the underlying physiological basis of body growth and, importantly, on the possible contribution of growth alterations in driving changes in SAA, the IPHC is conducting studies to develop and apply tools to evaluate age-specific growth patterns and their response to environmental influences in Pacific halibut over space and time. The specific objectives of these studies are to investigate the effects of temperature, population density, social structure, and stress on biochemical and molecular indicators of body growth. In addition to significantly improving our understanding of the physiological mechanisms regulating growth, these studes aim at identifying key molecular and biochemical growth signatures that could be used to monitor growth patterns in the Pacific halibut population. At the present time, transcriptomic and proteomic analyses of skeletal muscle from fish subjected to different temperature-induced growth manipulations have resulted in the identification of a number of genes and proteins that could represent potential growth markers for Pacific halibut. Results from these studies are currently being analyzed and a draft manuscript intended for peer-reviewed publication is being prepared.

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 the stock assessment. Discarding of Pacific halibut via the incidental catch of fish in non-target fisheries and the mortality that occurs in the directed fishery (i.e. fish discarded for sublegal size or for regulatory reasons), respectively, represent important sources of mortality that can result in significant reductions in exploitable yield in the directed fishery. Given that the incidental mortality from the commercial Pacific halibut fisheries and bycatch fisheries is included as part of the total removals that are accounted for in stock assessment, changes in the estimates of incidental mortality will influence the output of the stock assessment and, consequently, the catch levels of the directed fishery. For this reason, the IPHC Secretariat is conducting investigations on the effects of capture and release on survival, and on providing experimentally-derived estimates of DMRs in the directed longline and guided recreational Pacific halibut fisheries that will improve trends in unobserved mortality in stock assessment and that will be important for fishery parameterisation.

Discard mortality rates in the directed Pacific halibut fishery

The IPHC Secretariat, with funding by a grant from the Saltonstall-Kennedy Grant Program NOAA (NA17NMF4270240; 2017-2020), has conducted studies to evaluate the effects of hook release techniques on injury levels, their association with the physiological condition of captured Pacific halibut and, importantly, has generated experimentally-derived estimates of discard mortality rate (DMR) in the directed longline fishery. The initial results on individual survival outcomes for Pacific halibut released in excellent condition as the viability category assigned to the fish following capture indicate a range of DMRs between 4.2% (minimum) and 8.4% (maximum), that is consistent with the currently-applied DMR value of 3.5%. A manuscript describing these results has been published in the Journal of North American Fishery Management (Loher et al., 2021[5]).

The IPHC Secretariat is currently preparing a manuscript for publication in a peer-reviewed journal describing the results of conducted analyses of potential relationships between individual physiological characteristics of discarded Pacific halibut, environmental conditions and handling practices in relation to the viability outcomes of discarded fish.

[5] Loher T, Dykstra CL, Hicks A, Stewart, IJ, Wolf N, Harris BP, Planas JV (2022). Estimation of post-release longline mortality in Pacific halibut (Hippoglossus stenolepis) using acceleration-logging tags. North American Journal of Fisheries Management. 42: 37-49. https://doi.org/10.1002/nafm.10711

Discard mortality rates of Pacific halibut in the recreational fishery

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

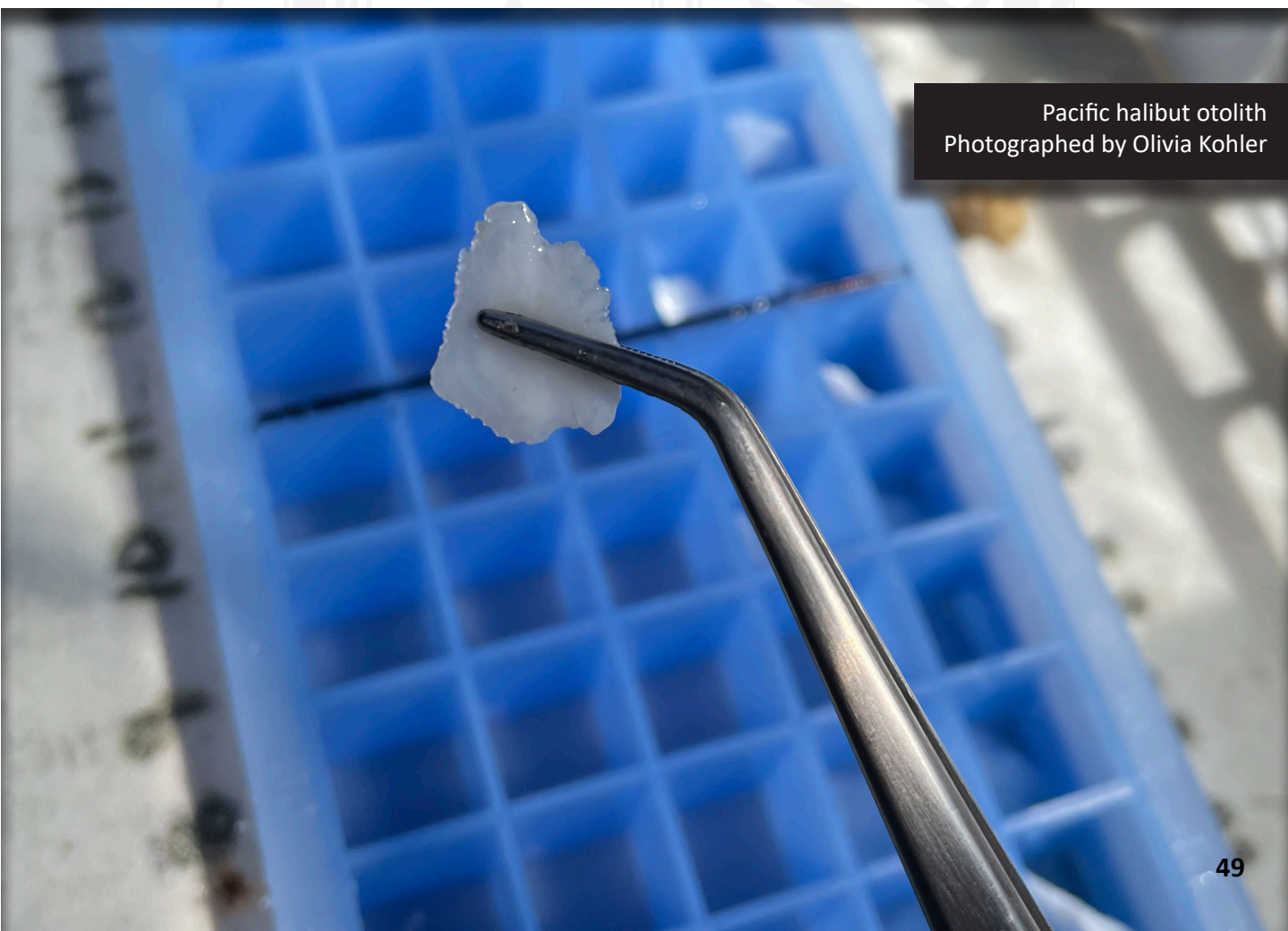
The proportion of the different types of injuries incurred over the hooking and release process were determined for Pacific halibut captured with 12/0 hooks and 16/0 hooks. For Pacific halibut captured with 12/0 hooks, approximately 70% of the fish had injuries corresponding to torn cheek, a type of minor injury that is incurred by the hook penetrating the cheek musculature through a single

location during the capture event. All other injuries were in much smaller proportion. Very similar distribution of injuries were observed in Pacific halibut captured with 16/0 hooks, again with a predominance of torn cheek injuries. Overall, the predominant injury profile of Pacific halibut captured with either type of hook and subsequently released corresponded to relatively minor injuries. In accordance with this observation, release viabilities of captured Pacific halibut corresponded mostly to the excellent viability category (350/361 fish).

Analysis of survival data from 76 sPAT tags that successfully reported data resulted on a discard mortality rate for Pacific halibut released in excellent viability category captured and released from circle hooks of 1.35% (95% CI 0.00-3.95%). This discard mortality rate estimate is consistent with the supposition that fish discarded in the recreational fishery from circle hooks in excellent condition have a mortality rate that is arguably lower than 3.5%, as is currently used for excellent viability fish released in the commercial fishery (Meyer, 2007). As this estimate does not factor in mortality rates on fish in less than excellent condition, does not inform mortality rates on non-circle hooks (J-hooks, jigs, other), nor directly applies to fish captured and released from non charter practices, changes to the overall recreational discard mortality estimation are not currently contemplated. These results represent the first report of experimentally-derived estimates of mortality of Pacific halibut captured and discarded in the recreational fishery.

Fishing technology

The IPHC Secretariat has determined that research to provide the Pacific halibut fishery with tools to reduce Pacific halibut mortality by whale depredation is considered

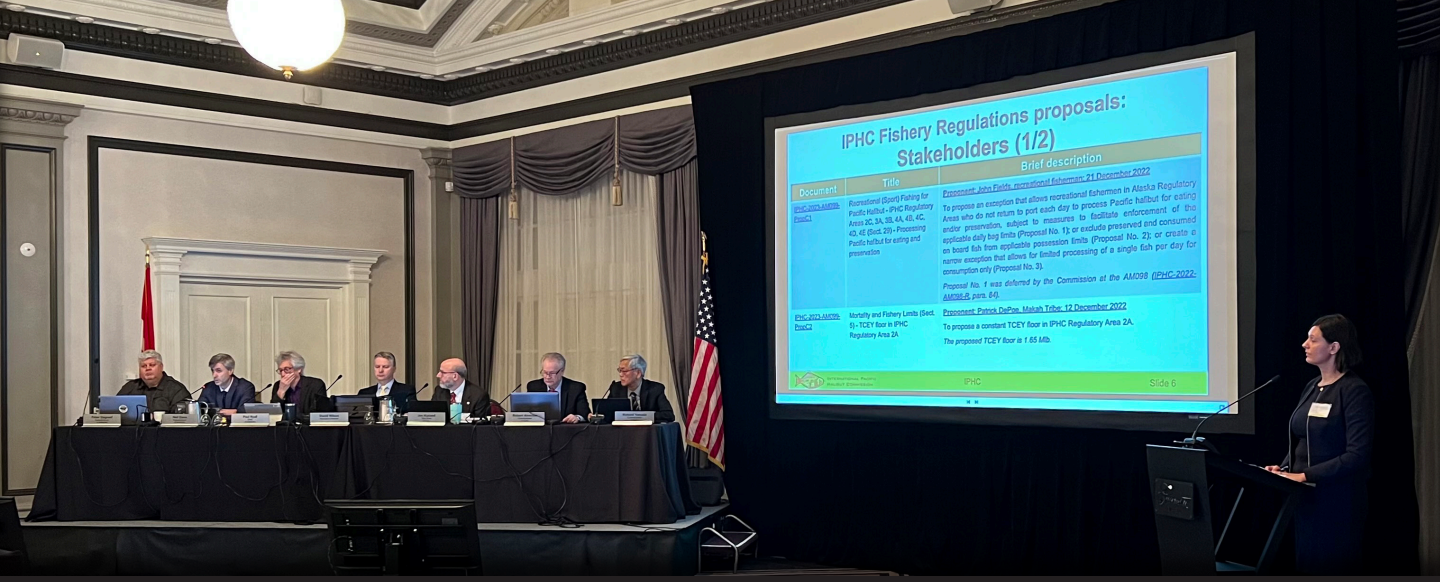


Pacific halibut otolith
Photographed by Olivia Kohler

a high priority. 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). Towards this goal, the IPHC secretariat has recently obtained funding from NOAA's Bycatch Research and Engineering Program (BREP) to investigate gear-based approaches to catch protection as a means for minimizing whale depredation in the Pacific halibut and other longline fisheries (NOAA Award NA21NMF4720534). The objectives of this study are to: 1) work with fishermen and gear manufacturers, via direct communication and through an international workshop, to identify effective methods for protecting hook-captured flatfish from depredation; and 2) develop and pilot test 2-3 simple, low-cost catch-protection designs that can be deployed effectively using current longline fishing techniques and on vessels currently operating in the Northeast Pacific Ocean.

The first phase of this project consisted in recruiting participants for a catch protection workshop from the scientific community and from the harvesters active in the waters of Alaska, British Columbia and the U.S. west coast. Initial screening of research conducted around the world led to invitations to three different groups actively working on development of catch protection devices (Sago Solutions, Norway; National Institute for Sustainable Development (IRD) – Marine Biodiversity, Exploitation, and Conservation Unit (MARBEC), University of Montpellier – CNRS-INFREMER-IRD National Centre for Scientific Research, Centre d'Etudes Biologiques de Chisé, France; and Fish Tech Inc., United States). In parallel, harvesters active in the Pacific halibut and Greenland Turbot fisheries as well as scientists involved in marine mammal research were actively recruited for participation. The "1st International Workshop on Protecting Fishery Catches from Whale Depredation (WS001)" was held electronically on 9 February 2022. The Workshop brought together 74 participants from 6 countries, ranging from research scientists to active harvesters. A report summarizing the material presented and discussions was produced and posted in the IPHC's website along with video recordings of the entire workshop: https://www.iphc.int/venues/details/1st-international-workshop-on-protecting-fishery-catches-from-whale-depredation-ws001.

Current efforts are devoted to the development of designs for two devices (i.e. shuttle and shroud) for field testing in the Spring of 2023.



Management Support

The IPHC, besides conducting biological and ecological research, stock assessment and MSE, provides a broad range of additional inputs to management and policy development to deliver on the Commission's objective to develop the stocks of Pacific halibut to the levels that permit the optimum yield from the fishery over time.

Between 2019 and 2022, the IPHC conducted a socioeconomic study of Pacific halibut. The goal was to bring a better understanding of economic interdependencies between sectors and regions to highlight the role and importance of the Pacific halibut resource to regional economies of Canada and the United States of America. The results suggest that the revenue generated by Pacific halibut at the harvest stage accounts for only a fraction of economic activity that would be forgone if the resource was not available to fishers in the Pacific Northwest. In a typical year (based on 2019 data), one USD/CAD of Pacific halibut commercial landings was found to be linked to over four USD/CAD-worth economic activity in Canada and the United States, while the recreational sector, to over two USD/CAD circulating in the economy. The total economic activity linked to assessed Pacific halibut sectors was estimated at about USD $1,010 million (CAD $1,350 million), and contribution to households at over USD $320 million (CAD $430 million), highlighting how important Pacific halibut is to regional economies. The 2020 results suggested that Pacific halibut contribution to households' income dropped by a quarter throughout the pandemic.

Understanding the complexity of human dimension of the fisheries sectors is increasingly important in the context of globalization. Local products compete on the market with a large variety of imported seafood. High exposure to international markets makes seafood accessibility fragile to perturbations, as shown by the COVID-19 pandemic. Seafood production is also highly dependent on the production and price of imports. The IPHC's socioeconomic study showed that Pacific halibut contribution to households' income significantly dropped throughout the pandemic. While signs of strong recovery were present in 2021, the study called attention to Pacific halibut sectors' exposure to external factors beyond stock condition and the need for expanded scope of management-supporting information.

Dr. Barbara Hutniczak presenting at AM099
Photographed by Dr. Allan Hicks

Looking Forward

This section summarises the major decisions made at the 99th Session of the IPHC Annual Meeting (AM099), held 23-27 January 2023 via a hybrid format where there was both in-person and remote attendance. For a full accounting of documents and presentations provided to the Commission for the meeting, and the final report of the meeting, visit the AM099 webpage: https://www.iphc.int/venues/details/99th-session-of-the-iphc-annual-meeting-am099

Mortality limits

The Commission adopted mortality limits (described as Total Constant Exploitation Yield, TCEY limits) for 2023 as provided in Table 11. These mortality limits include a variety of estimated sources of mortality which are detailed in Table 12a and 12b.

Fishing periods (season dates)

The Commission recommended a fishing period of 10 March to 7 December 2023 for all commercial Pacific halibut fisheries in Canada and the United States of America. All commercial fishing for Pacific halibut in all IPHC Regulatory Areas may begin no earlier than noon local time on 10 March and must cease by noon local time on 7 December.

Other regulatory recommendations

Commercial fisheries and licensing

The Commission adopted a fishery regulation to accommodate the transition of management in IPHC Regulatory Area 2A from the IPHC to the Pacific Fishery Management Council (PFMC) and NOAA Fisheries.

Recreational fisheries

The Commission adopted three regulations governing the recreational fishery. The first was IPHC regulation changes for charter recreational Pacific halibut fisheries in IPHC Regulatory Areas 2C and 3A, in order to achieve the charter Pacific halibut allocation under the North Pacific Fisheries

Preparing for AM099
Photographed by Kayla Ualesi

Management Council's (NPFMC) Pacific halibut Catch Sharing Plan:

a) IPHC Regulatory Area 2C – size limit is less than or equal to 40 inches or greater than or equal to 80 inches;

b) IPHC Regulatory Area 3A – Wednesdays and nine Tuesdays (20 June, 27 June, 4 July, 11 July, 18 July, 25 July, 1 August, 8 August, 15 August) closed to retention of Pacific halibut.

The second was an addition to the two fish daily bag limit in IPHC Regulatory Area 2B that states the bag limit may be increased to three Pacific halibut per day, per person after 1 August. The addition will remain in effect through 2025 unless changed by a vote of the Commission.

The third was a regulation allowing flexibility to existing recreational Pacific halibut regulations in Alaska to allow limited consumption of recreationally-caught Pacific halibut on board charter vessels and pleasure craft while maintaining existing regulations that provide effective enforcement of daily bag and possession limits.

Logbooks

The Commission adopted a regulation allowing the addition of a qualifying logbook in IPHC Regulatory Area 2A.

Commission officers

The Commission elected Mr. Jon Kurland (U.S.A.) as Chairperson of the IPHC, and Mr. Paul Ryall (Canada) as Vice-Chairperson of the IPHC for the period commencing after AM099 through AM100.

Upcoming IPHC Meetings

- 13th Special Session of the Commission to review and adopt the FY2024 budget: 18 April 2023.
- 99th Session of the IPHC Interim Meeting (IM099); 30 November – 1 December 2023; (format TBD).
- 100th Session of the IPHC Annual Meeting (AM100) will coincide with the 100th Anniversary of the IPHC; 22-26 January 2024; Anchorage, Alaska, U.S.A.

Table 11. Adopted Mortality limits (TCEY) for 2022.

Contracting IPHC Regulatory Area	Mortality limits (TCEY, net weight)		Percent
	Tonnes	Million Pounds	
Area 2B (British Columbia)	3,075.36	6.78	18.34
Total Canada	**3,075.36**	**6.78**	**18.34**
Area 2A (California, Oregon, and Washington)	748.43	1.65	4.50
Area 2C (southeastern Alaska)	2,653.52	5.85	15.82
Area 3A (central Gulf of Alaska)	5,479.40	12.08	32.68
Area 3B (western Gulf of Alaska)	1,664.68	3.67	9.93
Area 4A (eastern Aleutians)	748.71	1.73	4.68
Area 4B (central/western Aleutians)	616.89	1.36	3.68
Areas 4CDE (Bering Sea)	1,860	4.10	10.41
Total United States of America	**13,693.95**	**30.19**	**81.66**
Total (IPHC Convention Area)	**16,769.31**	**36.97**	**100**

Table 12a. Mortality table projected for the 2022 mortality limits (tonnes) by IPHC Regulatory Area.

Sector	IPHC Regulatory Area								
	2A	2B	2C	3A	3B	4A	4b	4CDE	Total
Commercial discards	23	82	NA	NA	132	23	5	36	299
O26 Non-directed discards	36	109	27	177	122	113	59	780	1,420
Recreational	NA	195	517	544	5	5	0	0	1,089
Subsistence	NA	186	132	82	5	5	0	18	426
Total non-FCEY	59	390	676	803	263	145	64	830	3,234
Commercial discards	NA	NA	68	263	NA	NA	NA	NA	331
Recreational	281	404	363	857	NA	NA	NA	NA	1,901
Subsistence	9	NA	NA	NA	NA	NA	NA	NA	9
Commercial landings	399	2,282	1,547	3,556	1,402	640	553	916	11,294
Total FCEY	**689**	**2,685**	**1,978**	**4,677**	**1,402**	**640**	**553**	**916**	**13,535**
						4C FCEY	**408**		
						4D FCEY	408		
						4E FCEY	**100**		
TCEY	**748**	**3,075**	**2,654**	**5,479**	**1,665**	**785**	**617**	**1,746**	**16,769**
U26 Non-directed discards	**0**	**14**	**0**	**109**	**45**	**45**	**5**	**399**	**621**
Total	**748**	**3,089**	**2,654**	**5,588**	**1,710**	**830**	**661**	**2,145**	**17,391**

Table 12b. Mortality table projected for the 2022 mortality limits (millions of net pounds) by IPHC Regulatory Area.

Sector	IPHC Regulatory Area								
	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
Commercial discards	0.05	0.18	NA	NA	0.29	0.05	0.01	0.08	0.66
O26 Non-directed discards	0.08	0.24	0.06	0.39	0.27	0.25	0.13	1.72	3.13
Recreational	NA	0.43	1.14	1.20	0.01	0.01	0.00	0.00	2.40
Subsistence	NA	0.41	0.29	0.18	0.01	0.01	0.00	0.04	0.94
Total non-FCEY	0.13	0.86	1.49	1.77	0.58	0.32	0.14	1.83	7.13
Commercial discards	NA	NA	0.15	0.58	NA	NA	NA	NA	0.73
Recreational	0.62	0.89	0.80	1.89	NA	NA	NA	NA	4.19
Subsistence	0.02	NA	NA	NA	NA	NA	NA	NA	0.02
Commercial landings	0.88	5.03	3.41	7.84	3.09	1.41	1.22	2.02	24.90
Total FCEY	**1.52**	**5.92**	**4.36**	**10.31**	**3.09**	**1.41**	**1.22**	**2.02**	**29.84**
						4C FCEY	**0.90**		
						4D FCEY	0.90		
						4E FCEY	**0.22**		
TCEY	**1.65**	**6.78**	**5.85**	**12.08**	**3.67**	**1.73**	**1.36**	**3.85**	**36.97**
U26 Non-directed discards	**0.00**	**0.03**	**0.00**	**0.24**	**0.10**	**0.10**	**0.01**	**0.88**	**1.37**
Total	**1.65**	**6.81**	**5.85**	**12.32**	**3.77**	**1.83**	**1.37**	**4.73**	**38.34**

IPHC Secretariat update

The activities highlighted in this report account for the majority of the IPHC Secretariat time. However, there is also considerable effort put into public outreach, attending conferences and meetings that enhance knowledge, and contributing expertise to the broader scientific community through participation on boards and committees. As the COVID-19 pandemic began to ease, there were both virtual and in-person formats for the Secretariat's external engagement. This section highlights some of those activities.

Committees and organization appointments

- Technical Subcommittee (TSC) of the Canada-United States Groundfish Committee - Dr. Josep Planas, Dr. Barbara Hutniczak.
- Halibut Advisory Board (Canada) - Dr. David Wilson (Dr. Barbara Hutniczak – Alternate)
- Framework Review for Atlantic Halibut on the Scotian Shelf and Southern Grand Banks in NAFO Divisions 3NOPs4VWX5Zc: Part 2 - Review of Modelling Approaches (DFO) – Dr. Allan Hicks
- Bering Sea Fishery Ecosystem Plan Team - Dr. Ian Stewart
- NPFMC Scientific and Statistical Committee - Dr. Ian Stewart
- Centre for Science Advice Pacific (CSAP) Regional Peer Review (RPR) of a Revised Operating Model for Sablefish in British Columbia in 2022 – Dr. Allan Hicks
- Bering Sea/Aleutian Islands Plan Team - Dr. Allan Hicks
- NPFMC Trawl Electronic Monitoring Committee – Dr. Jason Jannot
- North Pacific Research Board Science Panel - Dr. Josep Planas
- Fisheries Monitoring Science Committee (NOAA-Alaska) – Dr. Ray Webster
- Interagency electronic reporting system for commercial fishery landings in Alaska (eLandings) Steering Committee – Dr. Jason Jannot
- NOAA Marine Recreational Information Program (MRIP) Alaska Regional Implementation Team – Dr. Jason Jannot and Dr. Ian Stewart

Conferences, meetings, and workshops (chronological order)

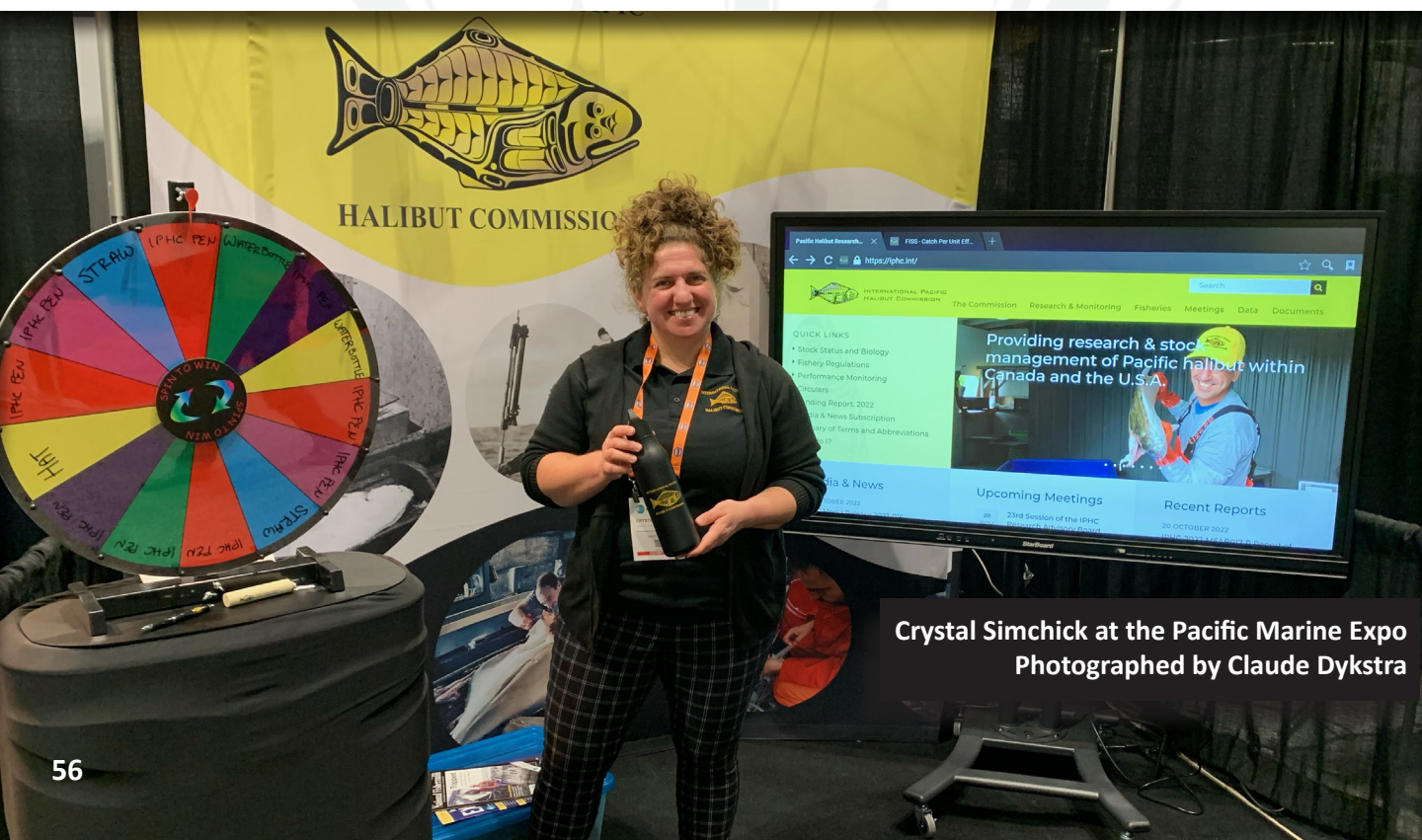
- Alaska Marine Science Symposium, 25-27 January, Virtual – Claude Dykstra, Andy Jasonowicz
- Alaska Chapter of the American Fisheries Society Annual Meeting, 28 February-4 March, Virtual – Andy Jasonowicz
- 20th Biennial Conference of the International Institute of Fisheries Economics and Trade, 18-22 July, Vigo, Spain – Dr. Barbara Hutniczak
- Adapting Fisheries Management to a Changing Ecosystem, 7th National Scientific Coordination Subcommittee Meeting, NPFMC, 15-17 August, Sitka, AK, U.S.A. – Dr. Ian Stewart
- PICES-2022 Annual Meeting, 23 September-2 October, Busan, Korea – Dr. Josep Planas, Claude Dykstra
- British Ecological Society Climate Change Genomics Workshop, 13-15 September, Virtual – Andy Jasonowicz
- IATTC/CAPAM Virtual Workshop on Model Weighting, 28 November – 2 December, Virtual – Dr. Allan Hicks

Outreach

- North America Seafood Expo, Boston, MA, U.S.A., 13-15 March - Kayla Ualesi, Colin Jones, Rachel Rillera, Tyler Jack
- Booth at Pacific Marine Expo, Seattle, WA, U.S.A., 16-19 November – Edward Henry, Lauri Sadorus, Robert Tynes, Ola Wietecha, Andrea Keikkala, Kayla Ualesi, Claude Dykstra, Crystal Simchick, Andy Jasonowicz, Dr. Josep Planas, Rebecca Kuklok
- Community projects participation: Food Lifeline food bank sorting team, Golden Gardens beach clean-up, Gasworks Park clean-up, Ballard Food Bank donation drive, Toys for Tots Donation Drive – Kayla Ualesi, Rachel Rillera, Ola Wietecha, Kelsey Magrane, Joan Forsberg, Crystal Simchick, Dr. Ian Stewart, Tom Kong, Lauri Sadorus, Claude Dykstra, Tyler Jack, Andrea Keikkala, Robert Tynes, Lorissa Burkhalter, Dr. Josep Planas, Dr. Barbara Hutniczak

Academic activities

- Alaska Pacific University affiliate faculty, Anchorage, AK, U.S.A. - Dr. Josep Planas
- University of Washington affiliate faculty, Seattle, WA, U.S.A. - Dr. Ian Stewart, Dr. Allan Hicks
- University of Washington student committee member, Seattle, WA, U.S.A. - Dr. Allan Hicks, Dr. Ian Stewart
- Alaska Pacific University student committee member, Anchorage, AK, U.S.A. - Dr. Josep Planas
- University of Massachusetts School for Marine Science & Technology student committee member, Dartmouth, MA, U.S.A. - Dr. Allan Hicks



Crystal Simchick at the Pacific Marine Expo
Photographed by Claude Dykstra

Financial Performance Report and Statements

The IPHC is funded jointly by the governments of Canada and the United States of America (U.S.A.). For fiscal year 2022, contributions for general operating expenses were as follows:

- Canada: USD $900,407;
- U.S.A.: USD $4,157,790

The U.S.A. is responsible for the IPHC Headquarters lease and maintenance which resulted in an ad-hoc contribution of USD $470,717.

Independent auditor

The Commission's financial accounts for FY2022 were audited by the accounting firm of Moss Adams LLP. The auditor's opinion stated the IPHC's financial statements present fairly in all material respects.

The Commission has adopted a basis of accounting agreed to by the governments of Canada and the United States of America (U.S.A.). The basis of accounting differs in certain respects from generally accepted accounting principles and is known as "other comprehensive basis of accounting" (OCBOA), which is a special purpose framework. The following are the most significant differences that do not include required disclosures under Generally Accepted Accounting Principles (GAAP):

• Historically, the Commission recorded revenues in the fiscal year when appropriated by the governments of Canada and the United States of America and expenditures were recorded in the fiscal year in which the funds are committed by the Commission. During the fiscal year ended September 30, 2021, the Commission began accruing income in the fiscal year of the activity and expenditures are recorded in the fiscal year in which they are incurred. Fund balance prior period adjustments reflected as of September 30, 2022, are a result of fund balance corrections to prior year payroll liabilities in the amount of -$1,579 and adjustments to prior year accrued expenses of $17,794. Carryover general, carryover program funds, carryover reserve funds, and transfers between funds are recognized as income.

• Pension costs are charged to expense at each pay period as accrued by the employee.

• Historically, post-retirement health care and life insurance costs were charged to expense when the related premiums were paid. During the fiscal year ended September 30, 2022, the Commission began accruing post-employment benefits at the end of each month based on reports from the third-party benefit administrator.

• Rent expense related to operating leases is expensed when paid and is not recognized on a straightline basis over the life of the lease. Contributions of free rents are not recognized in the financial statements.

Statement of financial position

The total Assets at year-end closing totaled USD $3,516,085.07.
The total equity or combined fund balance at year-end closing totaled USD $1,728,916.98.

Fund equity balances at year end:
• General Fund (10): USD $789,516.16
• Research Fund (20): (USD $17,113.02)
• Statistics Fund (30): (USD $175,332.57)
• FISS Fund (40): US$202,928.06
• Reserve Fund (50): US$928,918.35 – The Reserve Fund carries the majority of the equity in the checking and saving cash accounts.

Statement of financial activities

For FY2022, the IPHC total income received as USD $9,476,235.57, while the budgeted income was USD $10,331,127.00. Appendix III provides the Income Statement by Fund.

Carryover from the previous fiscal year by Fund was as follows:

• 10 - General Fund: $161,561
• 20 - Research Fund: $72,288
• 30 - Statistics Fund: $108,439
• 40 - FISS Fund: $1,147,517
• 50 - Reserve Fund: $1,134,338

The total carryover (included in income on the audited Statement of Activities) was $1,728,916.00

	2022					
	10 - General	20 - Research	30 - Statistics	40 - FISS	50 - Reserve	Total
Fund balance, beginning of year	$ 161,561	$ 72,288	$ 108,439	$ 1,147,517	$ 1,134,338	$ 2,624,143
Fund balance, prior period adjustment	(22,068)	18,540	10,991	8,752	-	16,215
Advances, net	3,297,992	641,979	1,118,196	-	-	5,058,167
IPHC headquarter maintenance	475,000	-	-	-	-	475,000
Grants, contracts and agreements	-	95,865	352,999	32,656	-	481,520
Interest	656	-	-	35	-	691
Other income	165,961	-	5,133	3,316,577	-	3,487,671
Commission expense	(3,294,656)	(769,972)	(1,776,202)	(4,573,661)	-	(10,414,491)
Fund transfers	5,070	(75,813)	5,111	271,052	(205,420)	-
Fund balance, end of year	$ 789,516	$ (17,113)	$ (175,333)	$ 202,928	$ 928,918	$ 1,728,916

MOSSADAMS

Report of Independent Auditors

The Commissioners
International Pacific Halibut Commission

Report on the Audit of the Financial Statements

Opinion

We have audited the accompanying special purpose Statement of Revenues and Expenses (compared to budget) and fund balances – regulatory basis, of the International Pacific Halibut Commission (a nonprofit organization) as of September 30, 2022, and the related notes to the financial statements.

In our opinion, the accompanying special purpose statement of revenues and expenses (compared to budget) and fund balances – regulatory basis referred to above present fairly, in all material respects, the financial position of the International Pacific Halibut Commission as of September 30, 2022, and the results of its operations for the year then ended in accordance with the financial reporting practices prescribed or permitted by the governments of the United States of America and Canada as described in Note 1.

Basis for Opinion

We conducted our audit in accordance with auditing standards generally accepted in the United States of America (GAAS). Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are required to be independent of the International Pacific Halibut Commission and to meet our other ethical responsibilities, in accordance with the relevant ethical requirements relating to our audit. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Basis of Accounting

We draw attention to Note 1 of the financial statements, which describes the basis of accounting. These financial statements were prepared in conformity with the financial reporting practices prescribed or permitted by the governments of the United States of America and Canada, which is a basis of accounting other than accounting principles generally accepted in the United States of America, to meet the requirements of the governments of the United States of America and Canada. Our opinion is not modified with respect to this matter.

Responsibilities of Management for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with reporting practices prescribed or permitted by the governments of the United States of America and Canada, and for the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is required to evaluate whether there are conditions or events, considered in the aggregate, that raise substantial doubt about the International Pacific Halibut Commission's ability to continue as a going concern within one year after the date that the financial statements are issued.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether these financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance but is not absolute assurance and therefore is not a guarantee that an audit conducted in accordance with GAAS will always detect a material misstatement when it exists. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control. Misstatements are considered material if there is a substantial likelihood that, individually or in the aggregate, they would influence the judgment made by a reasonable user based on these financial statements.

In performing an audit in accordance with GAAS, we:

- Exercise professional judgment and maintain professional skepticism throughout the audit.
- Identify and assess the risks of material misstatement of these financial statements, whether due to fraud or error, and design and perform audit procedures responsive to those risks. Such procedures include examining, on a test basis, evidence regarding the amounts and disclosures in these financial statements.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the International Pacific Halibut Commission's internal control. Accordingly, no such opinion is expressed.
- Evaluate the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluate the overall presentation of these financial statements.
- Conclude whether, in our judgment, there are conditions or events, considered in the aggregate, that raise substantial doubt about the International Pacific Halibut Commission's ability to continue as a going concern for a reasonable period of time.

We are required to communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit, significant audit findings, and certain internal control–related matters that we identified during the audit.

Restriction of Use

Our report is intended solely for the information and use of the commissioners and management of International Pacific Halibut Commission and is not intended to be and should not be used by anyone other than these specified parties.

Moss Adams LLP

Everett, Washington
January 23, 2022

International Pacific Halibut Commission
Statement of Revenues and Expenses (Compared to Budget) and Fund Balances – Regulatory Basis
September 30, 2022

	Annual Budget	10 - General	20 - Research	30 - Statistics	40 - FISS	50 - Reserve	Total	Percent of Budget	Over (Under) Budget
Income									
Contribution from Canada	$ 900,407	$ 587,077	$ 114,279	$ 199,051	$ -	$ -	$ 900,407	100%	$ -
Contribution from the USA	4,157,760	2,710,915	527,700	919,145	-	-	4,157,760	100%	-
Headquarters (Lease and Maintenance)	475,000	475,000	-	-	-	-	475,000	100%	-
Fish Sales	4,019,100	-	-	-	3,289,793	-	3,289,793	82%	(729,307)
Grants, Contracts and Agreements	766,560	-	95,865	352,999	32,656	-	481,520	63%	(285,040)
Other Income	-	177,762	-	5,247	25,321	-	208,330		208,330
Interest Income	12,300	656	-	-	35	-	691	6%	(11,609)
Foreign Exchange Rates	-	(11,801)	-	(114)	1,463	-	(10,452)		(10,452)
Total Income	**10,331,127**	**3,939,609**	**737,844**	**1,476,328**	**3,349,268**	**-**	**9,503,049**	**92%**	**(828,078)**
Carryover General Fund	-	161,561	-	-	-	-	161,561		-
Carryover Program Funds	-	-	72,288	108,439	1,147,517	-	1,328,244		-
Carryover Reserve Fund	-	-	-	-	-	1,134,338	1,134,338		-
Prior Period Adjustments	-	(22,068)	18,540	10,991	8,752	-	16,215		-
Transfers Between Funds	-	5,070	(75,813)	5,111	271,052	(205,420)	-		-
Total Funds Available	**10,331,127**	**4,084,172**	**752,859**	**1,600,869**	**4,776,589**	**928,918**	**12,143,407**	**118%**	**1,812,280**
General Expenses									
Salaries and Wages	4,507,066	1,343,262	494,675	1,221,099	906,304	-	3,965,340	88%	(541,726)
Payroll Taxes	-	90,525	36,932	80,643	46,667	-	254,767		254,767
Benefits	1,244,791	542,325	161,166	353,717	175,043	-	1,232,251	99%	(12,540)
Professional Fees	221,416	310,576	-	-	3,015	-	313,591	142%	92,175
Training and Education	118,600	28,947	183	1,568	36,640	-	67,338	57%	(51,262)
Personnel Related Expenses	51,876	(2,220)	-	13,829	-	-	11,609	22%	(40,267)
General Liability Insurance	13,992	10,239	-	10,395	-	-	20,634	147%	6,642
Other Expenses	65,099	42,083	3,334	172	3,561		49,150	76%	(15,949)
Total General Expenses	**6,222,840**	**2,365,737**	**696,290**	**1,681,423**	**1,171,230**	**-**	**5,914,680**	**95%**	**(308,160)**
Operating Expenses									
Meetings and Conferences	170,000	110,097	-	-	-	-	110,097	65%	(59,903)
Travel	237,966	58,000	8,426	57,496	144,296	-	268,218	113%	30,252
Publications	14,000	6,095	8,230	225	420	-	14,970	107%	970
Mailing and Shipping	139,500	4,952	247	4,534	105,945	-	115,678	83%	(23,822)
Technology	137,100	123,431	-	209	18,855	-	142,495	104%	5,395
Vessel Expenses	-	-	-	-	419,721	-	419,721		419,721
Customs and Bait storage	15,909	-	-	-	23,461	-	23,461	147%	7,552
Leases and Contracts	2,122,715	46,545	-	15,760	1,922,165	-	1,984,470	93%	(138,245)
Communications	53,500	35,943	-	1,701	1,609	-	39,253	73%	(14,247)
Capital Acquisitions	54,000	6,230	-	2,273	13,541	-	22,044	41%	(31,956)
Supplies	777,600	35,656	48,874	7,121	736,322	-	827,973	106%	50,373
Maintenance and Utilities	122,416	46,249	7,905	-	375	-	54,529	45%	(67,887)
Facility Rentals	469,000	455,721	-	5,460	15,721	-	476,902	102%	7,902
Total Operating Expenses	**4,313,706**	**928,919**	**73,682**	**94,779**	**3,402,431**	**-**	**4,499,811**	**104%**	**186,105**
Total Expense	**$ 10,536,546**	**$ 3,294,656**	**$ 769,972**	**$ 1,776,202**	**$ 4,573,661**	**$ -**	**$ 10,414,491**	**99%**	**$ (122,055)**
Excess Revenues over Expenditures		**$ 789,516**	**$ (17,113)**	**$ (175,333)**	**$ 202,928**	**$ 928,918**	**$ 1,728,916**		

Thank You

The IPHC wishes to thank all of the agencies, industry, and individuals who helped us in our investigations during 2022 in support of the Commission's mandate. A special thank you goes to the following:

- Personnel in the many processing plants who assist the IPHC Secretariat in port sampling and the Fishery-Independent Setline Survey (FISS) by storing and staging equipment and supplies.
- IPHC Regulatory Area 2A tribal biologists and state agency staff for sampling IPHC Regulatory Area 2A tribal and non-tribal commercial fishery landings.
- CDQ managers for providing the total number and weight of undersized Pacific halibut retained by authorized persons and the methodology used to collect these data.
- The Observer Programs coastwide for deploying observers on vessels fishing in the directed commercial fishery, and for collecting, documenting, and forwarding tags recovered.
- The North Pacific Fishery Management Council and Pacific Fishery Management Council for their ongoing coordination with the IPHC.
- Fisheries and Oceans Canada for their ongoing coordination with the IPHC, in particular with electronic logbooks, Pacific halibut removal estimates, and with IPHC FISS operations given protected habitats and species.
- Provincial, state and federal agency staff from both Canada and the U.S.A., as well as government contractors, for their assistance in the provision of data for the various fisheries impacting Pacific halibut mortality, landing notifications, and for their assistance in conducting the IPHC FISS.
- OBI Seafoods, Icy Straight Seafoods, E.C. Phillips & Son for working closely with IPHC Secretariat throughout the FISS to provide quality chum salmon to be used as bait, and to the captains, crews, and buyers who help to make the FISS successful.
- Members of IPHC Advisory Boards that dedicated their time and expertise to improve research, science, and management products.
- Grant funding agencies (North Pacific Research Board, National Fish and Wildlife Foundation, Bycatch Reduction Engineering Program – NOAA) for their financial support of IPHC research activities.

(L-R) Setline Survey Specialists (Field) Rodolfo Curralo, Christopher Noren, Gregory Jay, Noelle Rucinski, and Henry
Photographed by Noelle Rucinski

2022 Publications

The IPHC publishes Annual reports, meeting support documents, media releases, web-only documents, a quarterly newsletter, and primary publications. The IPHC website (www.iphc.int) includes these documents and also includes a document library of scientific and technical reports published from 1931-2016. Articles and reports published during 2022 and authored by the Secretariat are cited below.

Adams, G. D., Holsman, K. K., Barbeaux, S. J., Dorn, M. W., Ianelli, J. N., Spies, I., **Stewart, I**. J., Punt, A. E. (2022) An ensemble approach to understand predation mortality for groundfish in the Gulf of Alaska. Fish. Res. Vol.251:106303. https://doi.org/10.1016/j.fishres.2022.106303

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Loher, T., McCarthy, O., Sadorus, L.L., Erikson, L.M., Simeon, A., Drinan, D.P., Hauser, L., **Planas, J.V., Stewart, I.J**. (2022) A Test of Deriving Sex-Composition Data for the Directed Pacific Halibut Fishery via At-Sea Marking. Mar. Coast. Fish. 14: e10218. https://doi.org/10.1002/mcf2.10218

Commissioners

Canada

John Pease Babcock 1924-1936
William A. Found 1924-1936
George L. Alexander..... 1936-1937
Lewis W. Patmore 1937-1943
A. J. Whitmore 1936-1948
Stewart Bates..... 1948-1949
George W. Nickerson 1943-1953
George W. Clark 1949-1955
S. V. Ozere 1955-1957
Harold S. Helland 1953-1963
Richard Nelson..... 1953-1964
William Sprules 1957-1973
Martin K. Eriksen..... 1963-1973
Jack T. Prince 1974-1976
Francis W. Millerd 1964-1977
Clifford R. Levelton..... 1974-1979
John A. O'Connor 1978-1980
Peter C. Wallin 1977-1982
Michael Hunter 1979-1984
Sigurd Brynjolfson..... 1982-1986
Donald McLeod..... 1981-1987
Garnet E. Jones 1986-1987
Dennis N. Brock 1988-1989
Gary T. Williamson 1987-1992
Linda J. Alexander 1987-1992
Allan T. Sheppard 1991-1995
Brian Van Dorp..... 1993-1997
Gregg Best 1995-1999
Rodney Pierce 1997-1999
Kathleen Pearson 2000-2001
John Secord..... 2000-2005
Richard J. Beamish 1990-2005
Clifford Atleo 2002-2008
Larry Johnson..... 2009-2011
Gary Robinson 2005-2012
Laura Richards 2006-2012
Michael Pearson 2012-2014
David Boyes 2012-2016
Ted Assu 2014-2018
Jake Vanderheide..... 2017-2018
Robert Day 2018-2018
Paul Ryall..... 2013-
Neil Davis 2018-
Peter DeGreef 2018-

United States of America

Miller Freeman 1924-1932
Henry O'Malley..... 1924-1933
Frank T. Bell..... 1933-1940
Charles E. Jackson 1940-1946
Milton C. James 1946-1952
Edward W. Allen..... 1932-1955
J.W. Mendenhall..... 1954-1958
Seton H. Thompson 1952-1959
Andrew W. Anderson..... 1959-1961
Mattias Madsen 1955-1964
William A. Bates..... 1958-1964
L. Adolph Mathisen..... 1965-1970
Harold E. Crowther 1961-1972
Haakon M. Selvar 1964-1972
Neils M. Evens..... 1970-1982
Robert W. Schoning 1972-1982
William S. Gilbert 1972-1983
Gordon Jensen 1983-1983
Robert W. McVey 1983-1988
James W. Brooks 1988-1989
George A. Wade..... 1984-1992
Richard Eliason..... 1984-1995
Kris Norosz 1995-1997
Steven Pennoyer 1989-2000
Andrew Scalzi..... 1998-2003
Ralph Hoard 1993-2013
Phillip Lestenkof..... 2003-2013
Chris Oliver 2013-2013
Donald Lane 2014-2015
Jeffrey Kauffman 2015-2016
James Balsiger..... 2000-2018
Linda Behnken 2016-2018
Chris Oliver 2018-2020
Glenn Merrill..... 2021-2022
Robert Alverson 2014-
Richard Yamada 2018-
Jon Kurland..... 2022-

Executive Directors

William F. Thompson 1923-1940
Henry A. Dunlop 1940-1963
F. Heward Bell 1963-1970
Bernard E. Skud 1970-1978
Donald A. McCaughran..... 1978-1998
Bruce M. Leaman 1997-2016
David T. Wilson 2016-

Secretariat

Seattle Headquarters		
Name (Official)	**Branch**	**Position Title (Official)**
David T. Wilson, Ph.D.	Executive	Executive Director
Andrea Keikkala, M.A.	Executive	Assistant Director
Barbara Hutniczak, Ph.D.	Fisheries Policy	Branch Manager
Kelly Chapman, B.A.	Finance and Personnel Services	Administrative Coordinator
Tara Coluccio, B.A.	Finance and Personnel Services	Administrative Specialist/Communications
Ola Wietecha, B.A.	Finance and Personnel Services	Administrative Specialist
Rebecca Kuklok, B.A.	Finance and Personnel Services	Administrative Specialist (Accounting)
Lorissa Burkhalter, B.A.	Finance and Personnel Services	Administrative Specialist
Robert Tynes	Finance and Personnel Services	Lead IT Specialist (INFOSEC/SysAdmin)
Afshin Taheri, B.Sc.	Finance and Personnel Services	IT Specialist (Application Developer)
Lauri Sadorus, M.Sc.	Finance and Personnel Services	Communications Coordinator & Research Biologist
Edward Henry, M.Sc.	Finance and Personnel Services	Communications Specialist
Allan Hicks, Ph.D.	Quantitative Sciences	Quantitative Scientist (Management Strategy Evaluation)
Ian Stewart, Ph.D.	Quantitative Sciences	Quantitative Scientist (Stock Assessment)
Raymond Webster, Ph.D.	Quantitative Sciences	Quantitative Scientist (Biometrician)
Josep Planas, Ph.D.	Biological and Ecosystem Sciences	Branch Manager
Claude Dykstra, M.Sc.	Biological and Ecosystem Sciences	Research Biologist (Mortality and Survivorship)
Andy Jasonowicz, M.Sc.	Biological and Ecosystem Sciences	Research Biologist (Genetics)
Colin Jones, M.Sc.	Biological and Ecosystem Sciences	Research Biologist (Life History)
Crystal Simchick, B.Sc.	Biological and Ecosystem Sciences	Biological Science Laboratory Technician
Vasilisa Tyurina	Biological and Ecosystem Sciences	Undergraduate Intern
Kaitlyn Murray	Biological and Ecosystem Sciences	Undergraduate Intern
Jason Jannot, Ph.D.	Fisheries Data Services	Branch Manager
Huyen Tran, A.A.	Fisheries Data Services	Fisheries Data Coordinator
Tom Kong, B.Sc.	Fisheries Data Services	Fisheries Data Specialist (HQ-GIS)
Kimberly Sawyer Van Vleck, B.Sc.	Fisheries Data Services	Fisheries Data Specialist (HQ)
Kelsey Magrane, B.Sc.	Fisheries Data Services	Fisheries Data Specialist (HQ)
Caroline Prem, B.Sc.	Fisheries Data Services	Fisheries Data Specialist (HQ)
Joan Forsberg, B.Sc.	Fisheries Data Services	Otolith Laboratory Technician (Snr)
Christopher Johnston, B.Sc.	Fisheries Data Services	Otolith Laboratory Technician
Robert Tobin	Fisheries Data Services	Otolith Laboratory Technician
Monica Thom, B.Sc.	Fisheries Data Services	Port Operations Coordinator
Kayla Ualesi, B.Sc.	Fishery-Independent Setline Survey	Setline Survey Coordinator
Colin Jones, M.Sc.	Fishery-Independent Setline Survey	Setline Survey Specialist
Tyler Jack, M.Sc.	Fishery-Independent Setline Survey	Setline Survey Specialist
Rachel Rillera, B.Sc.	Fishery-Independent Setline Survey	Setline Survey Specialist

Fisheries Data Specialists (Field) Fisheries Statistics & Services Branch	
Name (Official)	**Location**
Stephen Brennan	Kodiak, AK
Chelsea Baker-Hutton	Port Hardy, B. C.
Jessica Marx	Homer, AK
Binget Nilsson	Seward, AK
Laurel Osborne	Prince Rupert, B. C.
Phoenix Keane	Dutch Harbor, AK
Natachan (Tachi) Sopow	Sitka, AK
Matthew Thompson	Petersburg, AK

Setline Survey Specialists (Field) Fisheries Independent Setline Survey	
Name (Official)	
Colin Blackie	Olivia Kohler
Guy Boxall	Taylan Tolga Koken
Sean Burns	Francis Maddox
Kevin Coll	Emily Miller
Lisa Crawford	Silvestre Natario
Rodolfo Curralo	Christopher Noren
Monica Fezuk	Jennifer Paton
Nancy Franco	Denny Padilla Rivera
Allen Dean Gaidica	Noelle Rucinski
Peter Jankiewicz	Jonathan Turnea
Gregory Jay	Sarah Williamson