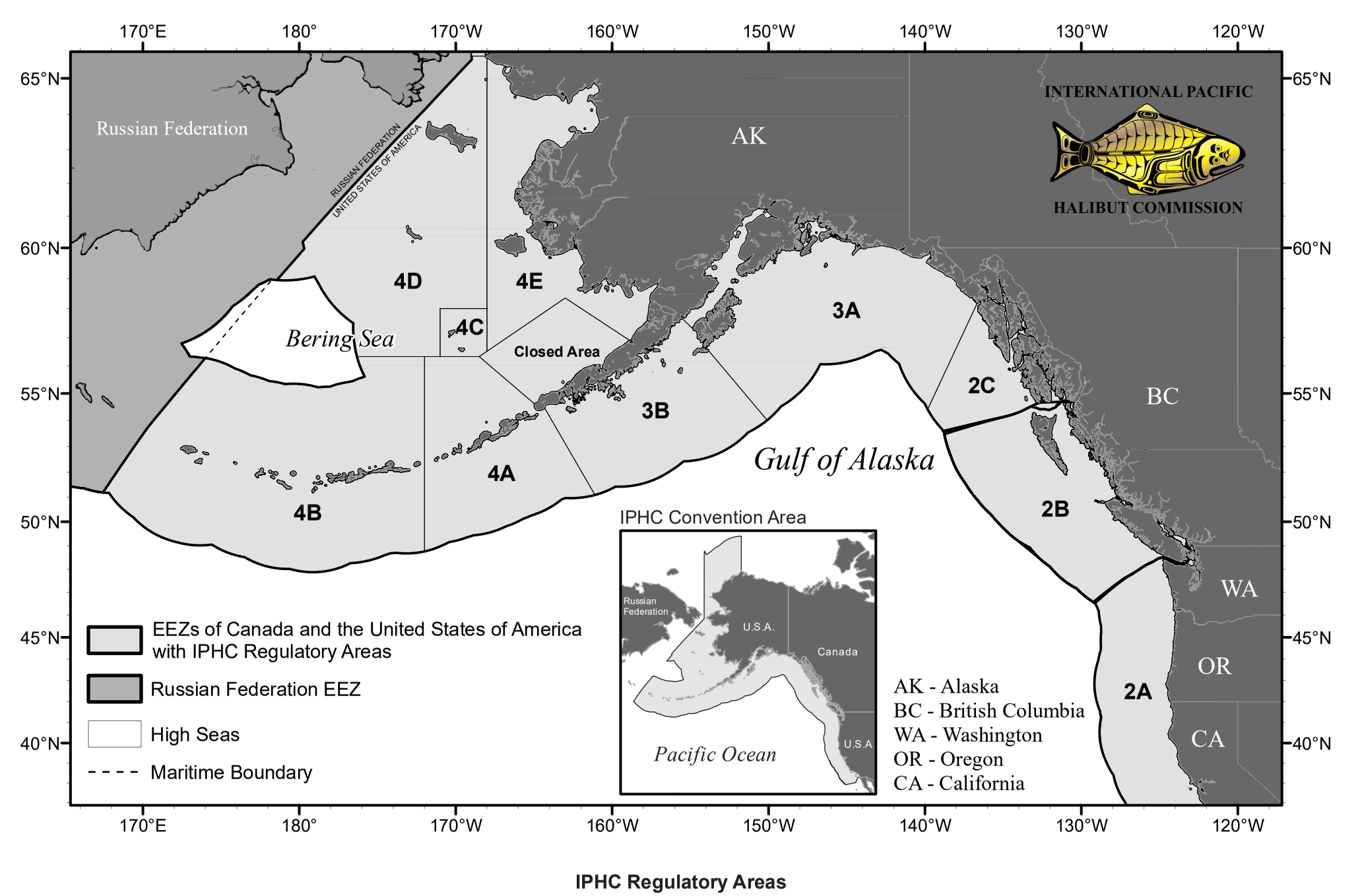
ISSN: 0074-7238

2023 Annual Report

INTERNATIONAL PACIFIC HALIBUT COMMISSION



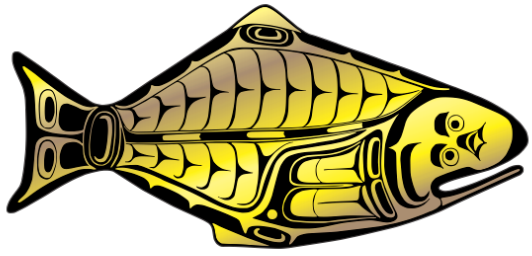
IPHC Regulatory Areas

ISSN: 0074-7238

INTERNATIONAL PACIFIC HALIBUT COMMISSION

ANNUAL REPORT
2023

INTERNATIONAL PACIFIC



HALIBUT COMMISSION

Commissioners

Canada	United States of America
Paul Ryall	Jon Kurland
Neil Davis	Robert Alverson
Peter DeGreef	Richard Yamada

Executive Director

David T. Wilson, Ph.D.

Bibliography entry

IPHC (2024) International Pacific Halibut Commission Annual Report 2023. *IPHC-2024-AR2023-R. 62 p.*

Table of Contents

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 second international agreement providing for the joint management of a marine fishery 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's 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 Commission appoints 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 Convention waters. 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 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 domestic 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 2023 and reported at the 100th Session of the IPHC Annual Meeting (AM100) held in January 2024. 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.

All photographs within the report were provided by the IPHC.

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
EC - 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 [Pacific] Halibut

Executive Director's Message

Throughout 2023, the IPHC Secretariat has continued to make strong 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.

Despite the ongoing difficulties and constraints of operating in a post-pandemic environment, we again successfully completed our Fishery-Independent Setline Survey (FISS) for 2023 without incident, effectively sampling 864 stations coastwide. This produced a precise and reliable index of the Pacific halibut stock and is the primary source of biomass trend information for the 2023 stock assessment, as well as the basis for the 2024 management decision making processes. Thus, the 2023 FISS was a great success, meeting both our scientific requirements and maintaining our economic goal of long-term revenue neutrality.

From a fishery perspective, the 2023 TCEY (36.97 million pounds; 16,769 t) represented a 10% decrease over that set for 2022 (41.2 million pounds; 18,697 t). This decrease was projected to correspond to $F_{53\%}$, a lower level of fishing intensity than the IPHC's 'reference' ($F_{43\%}$), 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 FISS numbers-per-unit-effort were down 2% from 2022, the legal-sized weight-per-unit-effort (WPUE) was down 3%, and the directed commercial longline fishery WPUE decreased by 12% from 2022. The FISS declines largely reflected the trend in the 2012 year-class, while the fishery trends corresponded to the continued transition from older fish (born in 2005 and earlier) to the 2012 year-class, which was 11 years old during the 2023 fishery.

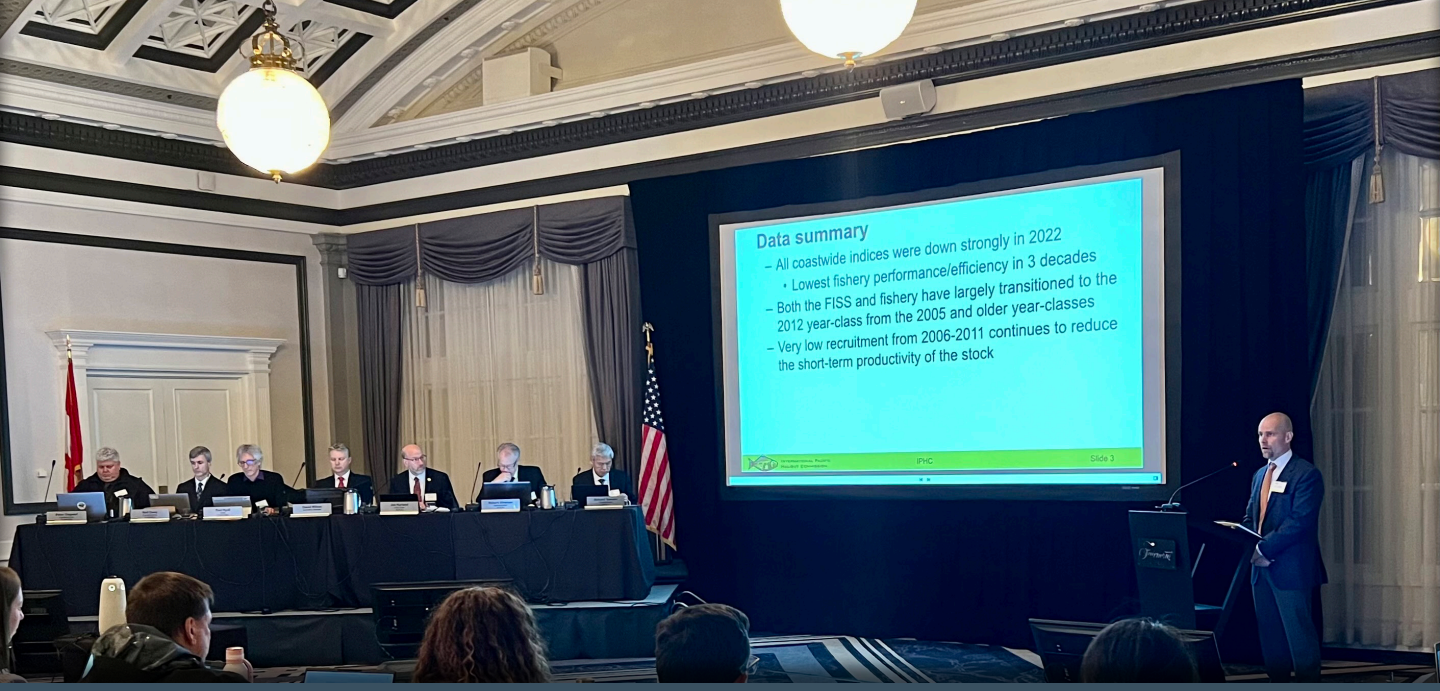
The 2023 stock assessment (consistent with all recent assessments) estimated that the spawning biomass has declined by ~22% since 2016, and that this decline would continue with a high probability at mortality levels consistent with the reference fishing intensity. This continued trend of low productivity is a function of weak recruitments from 2006-2011 and estimates for 2012 and 2014 only large enough to support yields near the status quo. The 2024 yield projected to maintain at least a 50% chance that the spawning biomass would decline no further was 39.1 million pounds (17,735 t), 6% above the status quo. Yields less than that level were projected to result in an increasing stock trend over the next three years.

We started the year with the female spawning biomass estimated to be at 41% (21-55%) of the level expected in the absence of fishing, and at the beginning of 2024 this estimate remained at almost the same level of 42% (20–56%). 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 biology and ecology play a large role in determining species-specific levels. For Pacific halibut, simulations have indicated that $SB_{30\%}$ is a reasonable proxy for SB_{MSY} (the spawning biomass that produces the maximum fishery yield), and $SB_{36\%}$ is likely near SB_{MEY} (the biomass that produces the maximum economic yield).

Looking forward, 2024 promises to be an exciting year for the IPHC as we turn 100 on 21 October 2024. 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. Rest assured, the IPHC Secretariat team will continue to develop and communicate the best possible scientific advice, to ensure that the Commission is equipped with the information it needs to make informed, timely, and scientifically-based management decisions. The overall aim of course, being to take a precautionary-based approach to fishery management, thereby ensuring a sustainable resource and its associated fisheries.

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 2024.

David T. Wilson, Ph.D.
IPHC 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**).

99th Session of the IPHC Annual Meeting (AM099; 2023)

The 99th Session of the IPHC Annual Meeting (AM099) was held in Victoria, B.C., Canada, from 23-27 January 2023. A total of 18 participants (6 Commissioners: Members; 12 advisors/experts) attended the Session from the two (2) Contracting Parties, as well as 134 members of the public (78 in-person and 56 remote). The meeting was opened by the Chairperson, Mr Paul Ryall (Canada), and the Vice-Chairperson, Mr Jon Kurland (U.S.A.) who welcomed participants.

The Commission heard reports from the IPHC Secretariat about the status of the Pacific halibut (*Hippoglossus stenolepis*) population, reviewed financial and administrative matters, 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 2023

The Commission recommended to the governments of Canada and the United States of America a total mortality limit for 2023 of 16,769 tonnes (36.97 million pounds) net weight, and adopted the mortality limits for each IPHC Regulatory Area as described in Table 1.

The area and sector 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 2023 was set at 13,535 tonnes (29.84 million pounds), representing a 10 percent decrease from the fishery limits

of 15,055 tonnes (33.19 million pounds) implemented by the Commission for 2022.

The Commission adopted fishing periods for 2023 as follows:

- All commercial fishing for Pacific halibut in all IPHC Regulatory Areas may begin no earlier than 10 March and shall cease on 7 December.

With the transition of management authority of the IPHC Regulatory Area 2A non-tribal directed commercial Pacific halibut fishery from the IPHC to the Pacific Fishery Management Council (PFMC) and NOAA Fisheries (final rule 87 FR 74322 published on 5 December 2022), the Commission no longer needed to consider setting dates for the 2A non-tribal directed commercial fishery. The dates were set by the Contracting Parties within the overall commercial fishing period dates.

Other decisions made at the meeting

The Commission made a range of other decisions at the 99th Session of the IPHC Annual Meeting (AM099), including recommendations concerning the following:

- The Commission agreed on four coastwide objectives to be used in the development of an updated harvest strategy policy
  - o Maintain the long-term coastwide female spawning stock biomass above a biomass limit reference point ($SB_{20\%}$) at least 95% of the time.
  - o Maintain the long-term coastwide female spawning stock biomass at or above a biomass reference point ($SB_{36\%}$) 50% or more of the time.
  - o Optimise average coastwide TCEY.
  - o Limit annual changes in the coastwide TCEY.
- After reviewing an evaluation of the size limits, the Commission agreed to not change the current 32-inch size limit.
- The Commission agreed that there is utility in continuing to explore multi-year stock assessment management procedures.

99th Session of the IPHC Interim Meeting (IM099; 2023)

The 99th Session of the IPHC Interim Meeting (IM099), held electronically from 30 November to 1 December 2023 was an occasion to prepare for the 100th Session of the IPHC Annual Meeting (AM100) scheduled for 22-26 January 2024. The Commission and the public were able to hear the IPHC Secretariat present and discuss a variety of topics, including a review of the 2023 fisheries statistics and preliminary stock assessment results, and the preliminary 2024 harvest decision table.

Table 1. 2023 adopted mortality limits (net weight).

IPHC Regulatory Area	Distributed Mortality Limits (TCEY) (net weight)	
	Tonnes (t)	Million Pounds (Mlb)
Area 2A (California, Oregon, and Washington)	748	1.65
Area 2B (British Columbia)	3,075	6.78
Area 2C (southeastern Alaska)	2,654	5.85
Area 3A (central Gulf of Alaska)	5,479	12.08
Area 3B (western Gulf of Alaska)	1,665	3.67
Area 4A (eastern Aleutians)	785	1.73
Area 4B (central and western Aleutians)	617	1.36
Areas 4CDE (Bering Sea)	1,746	3.85
Total	**16,769**	**36.97**

Table 2. 2023 fishery limits resulting from the IPHC-adopted distributed mortality limits and 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)	**689**	**1.52**
Non-treaty directed commercial (south of Pt. Chehalis)	117	*257,819**
Non-treaty incidental catch in salmon troll fishery	21	*45,497**
Non-treaty incidental catch in sablefish fishery (north of Pt. Chehalis)	32	*70,000**
Treaty Indian commercial	228	*502,500**
Treaty Indian ceremonial and subsistence (year-round)	13	*29,500**
Recreational – Washington	128	*281,728**
Recreational – Oregon	133	*293,436**
Recreational – California	18	*39,520**
Area 2B (British Columbia) (includes recreational catch allocation)	**2,685**	**5.92**
Commercial fishery	2,282	5.03
Recreational fishery	404	0.89
Area 2C (southeastern Alaska) (combined commercial/ guided recreational)	**1,978**	**4.36**
Commercial fishery (3.41 Mlb retained catch and 0.07 Mlb discard mortality)	1,615	3.56
Guided recreational fishery (includes retained catch and discard mortality)	363	0.80
Area 3A (central Gulf of Alaska) (combined commercial/ guided recreational)	**4,677**	**10.31**
Commercial fishery (7.05 Mlb retained catch and 0.29 Mlb discard mortality)	3,819	8.42
Guided recreational fishery (includes retained catch and discard mortality)	857	1.89
Area 3B (western Gulf of Alaska)	**1,402**	**3.09**
Area 4A (eastern Aleutians)	**640**	**1.41**
Area 4B (central/western Aleutians)	**553**	**1.22**
Areas 4CDE	**916**	**2.06**
Area 4C (Pribilof Islands)	408	0.90
Area 4D (northwestern Bering Sea)	408	0.90
Area 4E (Bering Sea flats)	100	0.22
Total	**13,535**	**29.84**

Commercial Fishery

The Pacific halibut directed commercial fishery, as managed by the IPHC, spans northern California to northern and western Alaska in U.S.A. and Canadian waters of the northeastern Pacific Ocean. The Pacific halibut commercial fishery remains a vital component of the maritime economy, engaging in harvest of fish for commercial profit. The commercial Pacific halibut mortality in 2023 totaled 10,280 tonnes or 22,664,394 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. For updates on landings data, please refer to the IPHC website at: **https://www.iphc.int/data/time-series-datasets/** (see time series TSD-018).

Licensing and landings

Licensing

In 2023, for the first time, the licensing and annual management measures for the non-tribal directed commercial fishery in IPHC Regulatory Area 2A were implemented by NOAA Fisheries. The process of transitioning management authority from the IPHC to NOAA Fisheries was initiated in 2019. The final rule (**87 FR 74322**) implementing the transition was published on 5 December 2022 and became effective on 4 January 2023. Details about the fishing periods and vessel limits were announced via **NOAA Fisheries website**. The IPHC Secretariat actively supported setting the measures by providing relevant data and sharing past experience.

Landings

The directed commercial Pacific halibut fisheries in IPHC Regulatory Area 2A consisted of the directed commercial fishery with fishing period limits, the incidental Pacific halibut catch during the salmon troll and

Table 3. Summary of 2023 Pacific halibut directed commercial landings, discard mortality, fishery limits and percent of fishery limit attained by IPHC Regulatory Area.

Reg Area	Directed commercial fishery limits (FCEY)		Directed commercial landings		Directed commercial discard mortality		Directed commercial total mortality		Percent attained
	tonnes	pounds	tonnes	pounds	tonnes	pounds	tonnes	pounds	%
2A	397	875,816	373	822,271	45	100,000	419	922,271	94%
2B	2,282	5,030,000	2,233	4,922,721	57	192,000	2,320	5,114,721	98%
2C[1,2]	1,547	3,410,000	1,386	3,055,951	51	113,000	1,437	3,168,951	93%
3A[1]	3,556	7,840,000	3,247	7,158,822	259	570,000	3,506	7,728,822	99%
3B	1,402	3,090,000	1,272	2,804,039	109	240,000	1,381	3,044,039	91%
4A	640	1,410,000	419	924,010	15	34,000	435	958,010	66%
4B	553	1,220,000	183	403,082	2	5,000	185	408,082	33%
4CDE	916	2,020,000	574	1,266,498	4	52,000	598	1,318,498	63%
Total	**11,294**	**24,900,000**	**9,688**	**21,357,394**	**593**	**1,307,000**	**10,280**	**22,664,394**	**89%**

[1] Directed commercial limit includes discard mortality.

[2] IPHC Regulatory Area 2C includes the Metlakatla fishery landed catch.

limited-entry sablefish fisheries, and the treaty Indian fisheries. Farther north, the directed commercial fisheries consisted of the Individual Vessel Quota (IVQ) fishery in IPHC Regulatory Area 2B in British Columbia, Canada; the Metlakatla fishery in IPHC Regulatory Area 2C; the Individual Fishing Quota (IFQ) system in Alaska, U.S.A.; and the CDQ fisheries in IPHC Regulatory Areas 4B and 4CDE. The summaries in the following sections are compiled using 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 (ADF&G), Washington Department of Fish and Wildlife (WDFW), Oregon Department of Fish and Wildlife (ODFW), and California Department of Fish and Wildlife (CDFW).

Landing patterns

In Canada (IPHC Regulatory Area 2B), Port Hardy (including Coal Harbour and Port McNeill) and Prince Rupert/Port Edward were the primary receivers of the commercial Pacific halibut catch, accounting for 93 percent of the landings. The total landed catch was 2,233 tonnes (4.9 million pounds).

In the U.S.A., the estimates of the commercial landings amounted to 7,455 tonnes (16.4 million pounds). IPHC Regulatory Area 3A accounted for the largest share of the commercial landings, representing 44% of the U.S.A. total. Homer received the largest portion of the U.S.A. commercial catch (17 percent), followed by Kodiak (6 percent). IPHC Regulatory Area 2A accounted for 5 percent of U.S.A. commercial landings.

Sampling of commercial landings

The collection of Pacific halibut commercial landing samples is crucial to the IPHC's annual stock assessment. This

process involves the collection of otoliths for age determination, tissue samples for sex determination, measurements of individual fish lengths and weights, logbook information, final landing weights, and information on recovered IPHC tags. The data collection protocol facilitates the computation of seasonal length-weight ratios by area, determination of size-at-age, and estimation of the sex composition of the commercial landings. 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 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, locations, and percentage of fish sampled are based on the previous year's landing patterns and are reviewed annually. The protocols can vary from port to port to achieve the appropriate sampling representation.

Given the Pacific halibut commercial fishery's operations across multiple IPHC Regulatory Areas, the IPHC Secretariat maintained a presence in ports coastwide in 2023. In Canada, the IPHC Secretariat was stationed in Port Hardy and Prince Rupert. In IPHC Regulatory Area 2A, the IPHC Secretariat collected samples from Newport, Oregon, and Bellingham, Washington. In addition, samples were taken in several ports in Washington by staff from the treaty Indian fishery management offices and in California by CDFW staff. In Alaska, the IPHC Secretariat was stationed in the ports of Dutch Harbor, Kodiak, Homer, Juneau, Petersburg, Seward, and Sitka.

Otoliths

The annual coastwide otolith collection target included 1,500 from each of IPHC Regulatory Areas 2B-4B and 4CD (combined) and 1,000 from Area 2A. The target for IPHC Regulatory Area 2A is subdivided into a target of 650 otoliths from the treaty Indian fisheries and 350 otoliths from the IPHC Regulatory Area 2A non-tribal commercial fisheries. The 2023 coastwide collection resulted in 10,888 otoliths. Otolith collections were below target in IPHC Regulatory Areas 2C and 4A-D 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 programs 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 Fishery-Independent Setline Survey (FISS) unless the sampling rate for the age determination collection is 100%. For this reason, in 2023 COAC samples were to be collected from commercial landings from IPHC Regulatory Areas 4B, 4C, and 4D. The COAC targets from the 2023 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 (28% in IPHC Regulatory Area 4A, 18% in Area 4B, and 44% 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, 2,731 logs were collected in 2023. A total of 492 were collected from Canadian landings, and 2,239 were collected from U.S.A. landings.

Recovered tags

In 2023, a total of 64 tags of several types were recovered from tagged Pacific halibut. A total of 61 of these recoveries were from U32 wire tagging releases conducted between 2015 and 2023 in waters off British Columbia, the Gulf of Alaska, and the Bering Sea. These recoveries included subsets from tail pattern recognition studies and one tag from the recreational discard mortality study conducted out of Sitka and Seward, Alaska in 2022. Tag data collected dockside included fork lengths, individual fish weights, otoliths, fin clips, and capture location of the recovered tagged fish.

Electronic data collection

The IPHC has digitized data collection to reduce the need for post-collection data entry and enhance the efficiency of data editing.

In Alaska, the IPHC Secretariat uses tablets to directly input data from paper logbooks into a remote data entry application. This initiative prioritizes the digitalization of as much log data as possible, within the constraints of time and operational duties at the ports. Ongoing updates and improvements to this application are part of the IPHC's commitment to technological advancement.

In British Columbia, Canada, the IPHC Secretariat utilizes a field version of the log entry program used at the IPHC Headquarters to enter as many Canadian logs as time permits. However, the priority is given to tasks such as biological sampling. In addition, Bluetooth-enabled tablets are provided for collection of electronic logs from vessels using Archipelago Marine Research's FLOAT - Fishing Log On A Tablet.

Pacific halibut directed commercial discard mortality

In the directed commercial Pacific halibut fishery, not all captured Pacific halibut were retained; some were released back into the sea. While a portion of these released Pacific halibut survive, others do not. These removals are known as discard mortality or in this case, directed commercial discard mortality.

In 2023, estimates of directed commercial discard mortality resulted to 593 tonnes (1.3 million pounds) (Table 3). The IPHC monitors three primary sources of directed commercial discard mortality: (1) Pacific halibut caught but never retrieved due to lost or abandoned fishing gear; (2) undersized Pacific halibut, below the minimum legal size limit of 32 inches (U32; 81.3 cm), that are discarded; and (3) Pacific halibut that meet or exceed the legal size limit (O32; over 32 inches or 81.3 cm) but are discarded due to regulatory compliance, such as when a vessel reaches its trip, catch, or quota share limit.

Directed commercial discard mortality due to lost or abandoned gear

During the 1980s and early 1990s in Alaska and British Columbia, 'derby' fisheries characterized by short fishing periods led harvesters to compete for Pacific halibut within a limited timeframe. This resulted in a considerable quantity of lost fishing gear, which continued to capture Pacific halibut and other species. Estimates of the volume of missing gear were derived from total catch values using available logbook catch and effort statistics. The introduction of quota-share fishery management in these areas have greatly reduced mortality due to lost or abandoned gear.

The rate of O32 Pacific halibut discard mortality from lost gear is determined by initially calculating the ratio of effective skates lost to effective skates hauled aboard the vessels for trips with log records. This ratio is then applied to the total landed catch. 'Effective skates' are defined as those with complete data (including skate length, hook spacing, and number of hooks per skate), and meeting the gear type standardization criteria. The calculation considers both snap gear and fixed-hook gear in all IPHC Convention waters. The U32 Pacific halibut discard mortality from lost gear is calculated in a similar manner, incorporating the U32

to O32 ratio for discarded U32 Pacific halibut outlined below. Pacific halibut mortality from lost or abandoned gear is assumed 100%.

Directed commercial discard mortality from discarded U32 Pacific halibut

The estimation of weight of discarded U32 Pacific halibut requires indirect methods where direct observation or electronic monitoring are not available. Within the IPHC Convention Area, the Canadian fishery in British Columbia (IPHC Regulatory Area 2B) offers the most accurate accounting due to direct observation. Harvesters in Regulatory Area 2B self-report their discards, and these reports are validated through video monitoring aboard the vessels. For the IPHC Regulatory Areas covering Alaska, the IPHC Fishery-Independent Setline Survey (FISS), utilizing comparable fishing gear, serves as a proxy measure for the expected encounter rates by area and year. This approach prioritizes FISS stations with higher catch rates (by weight) of O32 Pacific halibut, reflecting patterns observed in the directed commercial fishery. In IPHC Regulatory Area 2A, the non-tribal fishery discard estimates (legal and sublegal) from 2017 to the present are estimated by the West Coast Observer Program. Tribal fishery estimates are generated based on FISS as there is no observer coverage in that fishery.

A universal mortality rate of 16 percent is applied to all Pacific halibut discards from the quota fisheries in Canada and U.S.A. For derby fisheries in IPHC Regulatory Area 2A, a higher mortality rate of 25% is applied. The mortality of discarded U32 Pacific halibut in the directed commercial fishery is estimated by multiplying the ratio of U32 to O32 Pacific halibut by the total commercial catch, followed by application of the appropriate fishery mortality rate.

Directed commercial discard mortality for regulatory compliance

In IPHC Regulatory Area 2A, the directed commercial fishery operates under 'derby' fishing periods, where the amount of Pacific halibut that may be caught by each vessel is limited by a fishing period limit based on the vessel's size. This results in O32 Pacific halibut being discarded when catches exceed the vessel or trip limits. In quota share fisheries, regulatory discards occur due to damaged fish, or on the last trip of the season when catch may exceed remaining quota. Regulatory discards are based on the logbook-reported discards of legal (O32) Pacific halibut.

The amount of Pacific halibut retained by the IPHC Regulatory Area 2A non-treaty incidental to salmon and sablefish directed commercial fisheries is not included in these calculations. These removals are accounted for under non-directed commercial discard mortality estimates.

Recreational fishery

The Pacific halibut recreational fishery encompasses guided (charter) and unguided (non-charter) sectors. In 2023, the coastwide recreational harvest of Pacific halibut, including discard mortality, was estimated at approximately 2,727 tonnes (6.0 million pounds), using data provided by state and federal agencies from each of the Contracting Parties (Table 4). Changes in harvests vary across areas, often in response to changes in bag limits, size restrictions, and season opening dates. Updates on the recreational mortality can be found on the IPHC website: **https://www.iphc.int/data/time-series-datasets/** (see time series TSD-019).

IPHC Regulatory Area 2B – British Columbia (Canada)

The IPHC Regulatory Area 2B recreational fishery operated under a 133 cm (52.4 inch) maximum size limit and one Pacific halibut had to be between 90 and 133 cm (35.4 - 52.4 inches) or two under 90 cm (35.4 inch) when attaining the two fish possession limit, with an annual limit of ten per licence holder (Fisheries and Oceans Canada Fishery Notice **FN100**). Effective 1 April, the maximum size limit was decreased to 126 cm (49.6 inch) (**FN0264**). On 8 July, the daily limit was increased to equal the possession limit, that is one fish between 90 and 126 cm (35.4 - 49.6 inch) or two fish under 90 cm (35.4 inch) (**FN0628**). The fishery closed on 30 September (**FN1049**). The IPHC Regulatory Area 2B recreational harvest was at 100% of the recreational fishery limit at 404 tonnes (889,881 pounds).

British Columbia, Canada has a program that allows recreational harvesters to land fish under quota leased from the directed commercial fishery. Approximately 7 tonnes (15,790 pounds) were landed under the Experimental Recreational Quota (XRQ) 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 32 tonnes or 70,000 pounds were allocated to the incidental Pacific halibut catch in the commercial sablefish fishery in Washington. This subdivision resulted in 128 tonnes or 281,728 pounds allocated to Washington subareas and 133 tonnes or 293,436 pounds to Oregon subareas. In addition, California received an allocation of 18 tonnes or 39,520 pounds. Recreational fishery harvest seasons varied by subarea and were managed in-season in coordination with the Contracting Party agencies, with fisheries opening on 1 April. The IPHC Regulatory Area 2A recreational harvest totaled 239 tonnes (527,389 pounds), 14% under the recreational allocation.

IPHC Regulatory Areas 2C to 4 – Alaska (U.S.A.)

A reverse slot limit allowing for the retention of one Pacific halibut, if less than or equal to 101.6 cm (40 inches) or more than or equal to 203.2 cm (80 inches) in total length, was in place for the charter fishery in IPHC Regulatory Area 2C. Retention was

also prohibited on any Monday from 24 July to 31 December. In IPHC Regulatory Area 3A, charter anglers were allowed to retain two fish per day, but only one could exceed 71.1 cm (28 inches) in length. One trip per calendar day per charter permit was allowed, with no charter retention of Pacific halibut on Wednesdays or on the following Tuesdays: 20 June, 27 June, 4 July, 11 July, 18 July, 25 July, 1 August, 8 August, and 15 August.

The non-guided recreational fishery season was open from 1 February to 31 December and the fishery operated under the daily bag limit of two Pacific halibut of any size per day per person.

In addition, a Guided Angler Fish (GAF) program allows recreational harvesters to land fish under quota leased from the commercial fishery. A total of 50 tonnes (109,927 pounds) in IPHC Regulatory Area 2C and 4 tonnes (8,395 pounds) in IPHC Regulatory Area 3A were leased from the directed commercial quota fisheries and subsequently landed as recreational harvest.

Table 4. Summary of 2023 recreational Pacific halibut allocations and landed catch by IPHC Regulatory Area.

Regulatory Area	Recreational fishery limits (FCEY)[1]		Recreational retained		Recreational discard mortality		Recreational total mortality		Limit-Percent attained
	tonnes	pounds	tonnes	pounds	tonnes	pounds	tonnes	pounds	%
2A	279	614,684	239	527,389	1	2,058	240	529,447	86%
2B - XRQ leased			7	15,790			7	15,790	
2B - non-XRQ	404	890,000	404	889,881	12	27,330	416	917,211	100%
2B			411	905,671			411	905,671	
2C - GAF leased			50	109,927			50	109,927	
2C - Charter[1]	363	800,000	357	786,438	12	26,338	369	812,776	102%
2C - Non-charter			476	1,050,000	7	15,000	483	1,065,000	
2C			883	1,946,365	19	41,338	902	1,987,703	
3A - GAF leased			4	8,395			4	8,395	
3A - Charter[2]	857	1,890,000	701	1,546,445	4	9,219	706	1,555,664	82%
3A - Non-charter			439	968,000	9	19,000	448	987,000	
3A			1,144	2,522,840	13	28,219	1,157	2,551,059	
3B			3	6,000			3	6,000	
4A			2	5,000			2	5,000	
Total	**1,903**	**4,194,684**	**2,682**	**5,913,265**	**45**	**98,945**	**2,727**	**6,012,210**	**90%**

[1] Set through existing Contracting Party catch sharing arrangements.

[2] Limit includes discard mortality

Pacific halibut subsistence harvest

Pacific halibut is taken throughout its range as subsistence harvest by several fisheries. Subsistence fisheries are non-commercial, customary, and traditional use of Pacific halibut for direct personal, family, or community consumption or sharing as food, or customary trade. The primary subsistence fisheries are the treaty Indian Ceremonial and Subsistence (C&S) fishery in IPHC Regulatory Area 2A off northwest Washington State; the First Nations Food, Social, and Ceremonial (FSC) fishery in British Columbia; and the subsistence fishery by rural residents and federally recognized native tribes in Alaska documented via Subsistence [Pacific] Halibut Registration Certificates (SHARC). Subsistence harvest also includes U32 fish retained for personal consumption in the Community Development Quota (CDQ) fishery (excluded from commercial CDQ landings statistics), reported directly to the IPHC. The IPHC allows the retention of U32 Pacific halibut under the CDQ program due to its history of customary use in the area. The remote location makes it unlikely that these fish will be commercially traded. Table 5 provides a summary of subsistence removals by IPHC Regulatory Area. The coastwide subsistence estimate for 2023 was 376 tonnes (828,513 pounds). Time series of the estimates is available on the IPHC website: **https://www.iphc.int/data/time-series-datasets/** (see time series TSD-020).

Estimated harvests by IPHC Regulatory Area

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

The Pacific Fishery Management Council's Catch Sharing Plan allocates the Pacific halibut fishery limit to commercial, recreational, and treaty Indian users in IPHC Regulatory Area 2A. The treaty tribal fishery limit is further sub-divided into commercial and C&S fisheries. It is estimated that 10 tonnes (21,305 pounds) were retained as C&S in IPHC Regulatory Area 2A.

Canada (IPHC Regulatory Area 2B: British Columbia)

The subsistence harvest in British Columbia is represented by the FSC fishery. Fisheries and Oceans Canada (DFO) has maintained a consistent annual estimate of 184 tonnes (405,000 pounds) for this fishery since 2007.

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

The Alaska Pacific halibut subsistence fishery was formally recognized in 2003. The fishery allows the customary and traditional use of Pacific halibut by rural residents and members of federally recognized native

tribes who can retain Pacific halibut for non-commercial use, food, or customary trade. The NOAA Fisheries regulations define legal gear, number of hooks, and daily bag limits, and IPHC regulations set the fishing season. Estimates for Alaska's subsistence Pacific halibut harvest rely on a biennial survey, with the most recent survey conducted in 2022. Consequently, the estimate for 2023 was extrapolated from the previous year's data.

Retention of U32 Pacific halibut in the CDQ fishery

The IPHC permits commercial Pacific halibut vessels fishing for certain Community Development Quota (CDQ) organizations in IPHC Regulatory Areas 4D and 4E (Bering Sea) to retain Pacific halibut less than 32 inches (81.3 cm; U32) in fork length under an exemption requested by the North Pacific Fishery Management Council. The CDQ harvest supplements the Alaskan subsistence catch. Unlike the subsistence fishery in other areas of Alaska, which depends on a biennial survey for estimates, this removal is reported directly to the IPHC, facilitating annual estimates. In 2023, retention of U32 Pacific halibut in the CDQ fishery was 0.3 tonnes or 604 pounds. Reports were received from three CDQ management organizations: Bristol Bay Economic Development Corporation (BBEDC), Norton Sound Economic Development Corporation (NSEDC), and Coastal Villages Regional Fund (CVRF). The harvest in this fishery tends to reflect the effort by local fishing fleets and the availability of fish in their nearshore fisheries.

Table 5. Summary of 2023 subsistence Pacific halibut mortality by IPHC Regulatory Area.

IPHC Regulatory Area	Tonnes	Pounds
2A	9.7	21,305
2B[1]	183.7	405,000
2C[2]	114.5	252,492
3A[2]	55.2	121,642
3B[2]	4.8	10,475
4A[2]	1.9	4,164
4B[2]	0.1	218
4C[2]	0.2	375
4D[2]	0.0	0
4E[2]	5.6	12,238
4D/4E2 (CDQ U32)	0.3	604
Total	**375.8**	**828,513**

[1] British Columbia, Canada estimates from Fisheries and Oceans Canada have remained constant from 2007-2023.

[2] Alaska, USA estimates for 2023 were carried over from 2022, with the exception that 4D/4E subsistence harvest in the CDQ fishery updated annually.

Pacific halibut discard mortality in non-directed commercial fisheries

Non-directed commercial discard mortality (ND-CDM), commonly referred to as bycatch, is the incidental catch of Pacific halibut by commercial fisheries targeting other species, which are not legally permitted to retain Pacific halibut. Estimates of ND-CDM of Pacific halibut are provided by Contracting Party agencies. The amounts are estimated since all fisheries do not have 100% monitoring, and not all Pacific halibut that are discarded are assumed to not survive. The IPHC relies upon information supplied by observer programs run by Contracting Party agencies for ND-CDM estimates in most fisheries.

In 2023, the estimated ND-CDM of Pacific halibut was 1,971 tonnes (4,346,000 pounds) (Table 6), representing a 14% decrease from the 2022 estimates. Estimates for 2023 are preliminary and subject to change as new information becomes available. Updated values are available on the IPHC website: https://www.iphc.int/data/time-series-datasets/ (see time series TSD-025).

Sources of information for discard mortality in non-directed fisheries

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

In Canada, Fisheries and Oceans Canada (DFO) monitors fisheries off British Columbia (IPHC Regulatory Area 2B) where there is 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.

Groundfish fisheries in Alaska are managed by NOAA Fisheries, following advice and recommendations developed

by the North Pacific Fishery Management Council. Pacific halibut bycatch in groundfish fisheries is managed with prohibited species catch (PSC) limits. In November 2023, NOAA Fisheries published a final rule to implement regulations that links the Pacific halibut PSC allowance of the Amendment 80 commercial groundfish trawl fleet to indices of Pacific halibut abundance. There are varying levels of monitoring on non-trawl vessels and fisheries. The Annual Deployment Plan (ADP) describes how NOAA Fisheries intends to assign at-sea and shoreside fishery observers and electronic monitoring to vessels and processing plants engaged in Pacific halibut and groundfish fishing operations in the North Pacific.

Discard mortality rates

The discard mortality rate (DMR) for Pacific halibut, which represents the percentage of Pacific halibut that die as a result of being caught and subsequently discarded, varies across fisheries and geographic areas. In fisheries where observers are present, DMRs are determined by assessing the survival likelihood of the Pacific halibut observed, using pre-set criteria. For fisheries without observer coverage, DMRs are based on similar fisheries in other areas where data are available. This method ensures that estimates of discard mortality in non-directed commercial fisheries are informed by the best available data, even in the absence of direct observation.

Table 6. Summary of 2023 non-directed commercial fisheries discard mortality estimates of Pacific halibut by IPHC Regulatory Area and fishery.[1]

Pounds	2A	2B	2C	3A	3B	4A	4B	4CDE+ Closed Area
Dredge (Scallop & Sea Cucumber)	--	--	--	24,000	13,000	n/a	--	n/a
Hook & Line	18,000	n/a	36,000	44,000	22,000	41,000	0	212,000
Pot (Groundfish)	1,000	--	3,000	13,000	5,000	10,000	2,000	5,000
Pot (Shellfish)	--	n/a	0	--	50,000	26,000	2,000	37,000
Trawl (Groundfish)	60,000	402,000	0	306,000	165,000	339,000	155,000	2,355,000
Trawl (Shrimp)	0	n/a	--	--	--	--	--	--
Trawl (Salmon)	n/a	n/a	0	n/a	n/a	--	--	--
TOTAL	**79,000**	**402,000**	**39,000**	**387,000**	**255,000**	**416,000**	**159,000**	**2,609,000**
Tonnes	**2A**	**2B**	**2C**	**3A**	**3B**	**4A**	**4B**	**4CDE+ Closed Area**
Dredge (Scallop & Sea Cucumber)	--	--	--	11	6	n/a	--	n/a
Hook & Line	8	n/a	16	20	10	19	0	96
Pot (Groundfish)	<1	--	1	6	2	5	1	2
Pot (Shellfish)	--	n/a	0	--	23	12	1	17
Trawl (Groundfish)	27	182	0	139	75	154	70	1,068
Trawl (Shrimp)	0	n/a	--	--	--	--	--	--
Trawl (Salmon)	n/a	n/a	0	n/a	n/a	--	--	--
TOTAL	**36**	**182**	**18**	**176**	**116**	**189**	**72**	**1,183**

[1]In the table, n/a indicates value is not available, whereas -- indicates non-applicability.

Discard mortalityin non-directed commercial fisheries by IPHC Regulatory Area

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

Pacific halibut are caught incidentally in several U.S.A. West Coast fisheries and must be discarded, with the exception of the salmon troll fishery and the sablefish fishery north of Pt. Chehalis, WA. 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. NOAA Fisheries uses observer data to account for the mandatory discarding of Pacific halibut in the West Coast Groundfish Trawl Catch Share Program. In this fishery, NOAA Fisheries has implemented a limit that is 15% of the IPHC Regulatory Area 2A TCEY for legal sized Pacific halibut, with a cap of 100,000 lbs. Individual Bycatch Quotas are distributed to vessels in an effort to not exceed this cap.

Canada (IPHC Regulatory Area 2B; British Columbia)

In Canada, Pacific halibut non-directed commercial discard mortality in trawl fisheries are monitored and capped at 454 tonnes round weight 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 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 are primarily targeting Pacific cod and rockfish in open access fisheries, and sablefish in the quota 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 (ADF&G), and the estimate was again rolled forward from 2022 to 2023.

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 IPHC Regulatory Areas 3A and 3B, with hook-and-line fisheries a distant second. State-managed crab and scallop fisheries are also known to contribute to Pacific halibut non-directed commercial discard mortality. Estimates of ND-CDM in IPHC Regulatory Areas 3A and 3B reflect different levels of observer coverage by gear and type of fishing trip. Therefore, ND-CDM estimates for IPHC Regulatory Area 3 have both a greater uncertainty and potential for bias than those from areas with higher coverage rates and/or where there is no evidence of different behavior when observed.

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

IPHC Regulatory Areas 4A, 4B and 4CDE non-directed commercial discard mortality estimates are the highest due to groundfish fisheries which target flatfish in the Bering Sea. The estimated ND-CDM of Pacific halibut in the groundfish trawl accounts for 89% of the total in this region (1,292 tonnes or 2,849,000 pounds).

Fishery-independent surveys

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 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 2023 FISS covered both nearshore and offshore waters of British Columbia, Canada, and Alaska and Washington, U.S.A., (Figure 1). The IPHC chartered eight (8) commercial longline vessels for FISS operations. During a combined 49 trips and 497 charter days, these vessels fished 17 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 2023 FISS design was a selection of stations from the full FISS design of 1,890 stations. The 2023 FISS design was to comprise a random subsample of 958 stations following decisions made at the 98th Session of the IPHC Interim Meeting (IM098). In addition to the 958 FISS stations planned for the 2023 FISS season, there were an additional eight (8) rockfish index stations added in IPHC charter region Washington, and one (1) station added back to IPHC charter region Trinity to ensure 100% sampling in that region. Of this total of 967 FISS stations planned, 864 (89%) were effectively sampled. A total of 68

initially planned stations were not sampled in 2023. There were challenges with vessel recruitment this season due to: 1) increased sablefish quota availability and 2) vessels unable to meet FISS tender specifications regarding deck space, communication capabilities, safety equipment, etc. Due to the challenges with vessel recruitment, the following stations within IPHC charter regions were not sampled: Yakutat (36 stations), Unalaska (16 stations) and Adak (16 stations). In addition, two (2) stations in Sitka were unsampled as they were within Glacier Bay National Park, and NOAA did not permit these stations to be completed. There were also two (2) stations in Prince William Sound not sampled due to poor weather; and two (2) stations in St. James/Charlotte (one in each charter region) that could not be completed due to the station's location within the Hecate MPA. Coastwide, twenty-nine (29) stations were ultimately deemed ineffective due to Orca depredation (n=3), Sperm whale depredation (n=16), gear soak time (n=1), shark predation (n=3), pinniped predation (n=1), and setting and gear issues (n=5).

Six standard skates of gear were set at each station in IPHC Regulatory Areas 2A and 3A, and eight standard skates in IPHC Regulatory Areas 2B, 2C, 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 or snap gear, 549 metre (1,800-foot) skates with 100 circle hooks of size 16/0 spaced 5.5 metres (18 feet) apart. In snap gear, the swivel was located at the hook. 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.

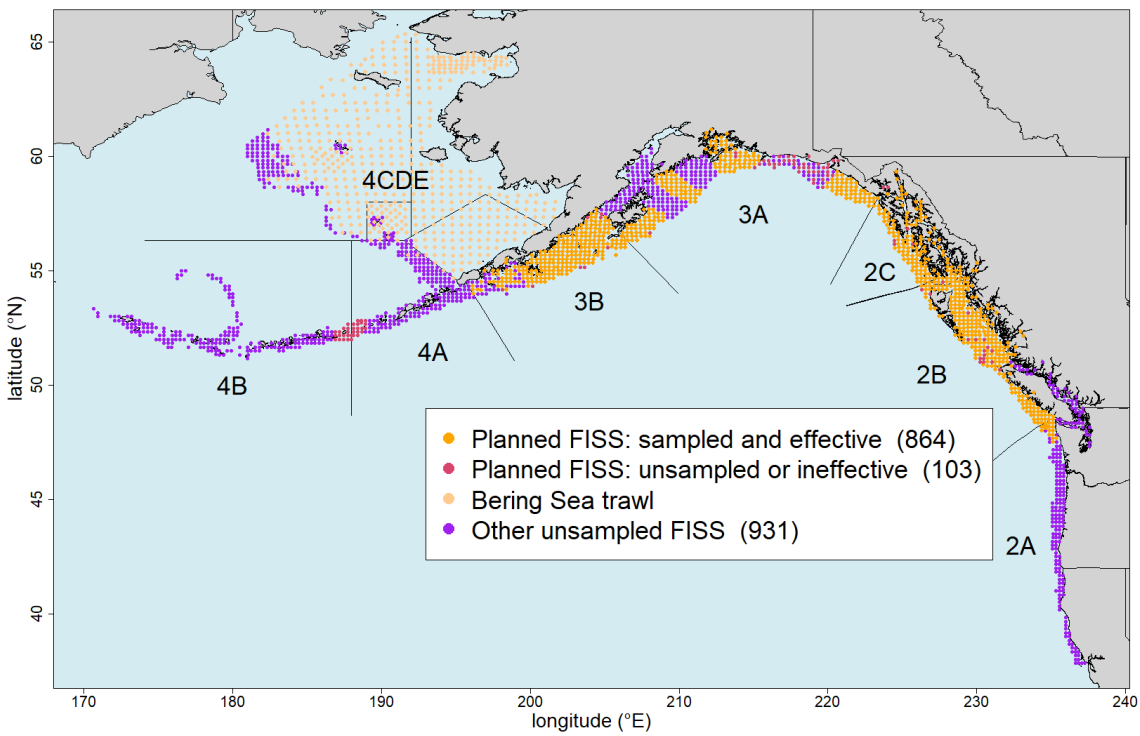


Figure 1. Map of the 2023 IPHC Fishery-Independent Setline Survey (FISS) design.

Sampling protocols

Following protocols set out in the 2023 FISS Manual, Setline Survey Specialists (Field) (SSS(F)) on contracted vessels assessed and 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.

SSS(F) 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 2022, the IPHC Secretariat began arranging bait purchases for the 2023 FISS. Approximately 103 tonnes (227,000 pounds) of chum salmon were utilized from three suppliers. 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 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 2023, 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 2023 FISS, IPHC's chartered vessels delivered a total of 232 tonnes (512,491 pounds) of Pacific halibut to 15 different ports. The coastwide average price per kilogram was $13.31 USD or $6.04 USD per pound, amounting to sales totaling $3,094,010 USD.

Field personnel

The 2023 FISS vessels were staffed by 14 SSS(F), who worked a total of 1,098 person-days, including travel days, sea days, and debriefing days. Two SSS(F) 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 2023, working the entire survey aboard one of the two vessels completing the Bering Sea Trawl Survey and the Gulf of Alaska Trawl Survey.

Oceanographic monitoring

This was the fifteenth 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 concentration) throughout the water column. Profiles were attempted at each FISS station, conditions permitting, resulting in over 600 successful casts.

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 2023, this activity took place from 26 May through 01 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). All FISS activity was completed by early-September.

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 7).

Non-Pacific halibut catch

Around 106 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*).

Table 7. The average total raw WPUE for each of the IPHC Regulatory Areas during the FISS 2023.

Regulatory Area	kg/skate	lb/skate	Station Count
2A	29	65	24
2B	28	62	247
2C	62	137	140
3A	26	58	211
3B	33	74	242

Size and age observations

Approximately 57 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 79 cm (31 inches). In 2023, median length decreased in IPHC Regulatory Areas 2A, 2B, and 3B when compared to 2022, but increased in 2C. In IPHC Regulatory Area 3A, median fork length stayed the same. IPHC Regulatory Area 2A, 2B, 3A, and 3B had a median length below the legal-size limit. The largest median length was in IPHC Regulatory Area 2C (85 cm or 33.5 in).

The sex composition of FISS-caught O32 (> 81.3 cm or 32 inches) Pacific halibut varied among IPHC Regulatory Areas, ranging from 59 percent (3B) to 82 percent (2A) 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 2023, survey personnel encountered and measured 1,735 Pacific halibut in the eastern Bering Sea survey, 16 in the northern Bering Sea survey, and 2,216 in the Gulf of Alaska survey. Weights, otoliths for aging, and fin clips for genetic analysis were collected from 3,147 Pacific halibut encountered. In addition, IPHC assisted in the collection of 458 Pacific halibut stomachs in the Gulf of Alaska survey.

Population Assessment

Since 1924, one of the IPHC's primary tasks has been to assess the population (or stock) of Pacific halibut in the Convention waters. In 2023, the IPHC conducted its annual coastwide stock assessment of Pacific halibut updating all data sources and using new information from the 2023 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 from research studies and other sources. The rich historical data sources include 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. However, historical data was often collected differently and may be incomplete, limiting the conclusions that can be drawn for years past. Current data collection programs are the most comprehensive and informative in the history of the Commission.

2023 fishery-dependent and fishery-independent survey data

Fishery-dependent data includes mortality estimates from directed commercial, recreational, subsistence, and non-directed commercial fisheries. Pacific halibut landings data from the commercial fishery are reported to IPHC by way of commercial fish tickets. Discards in the directed fishery are estimated by the IPHC using a combination of logbook, observer

and fishery-independent data. 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. Non-directed fishery discard mortality estimates are based on observer programs in both the U.S.A. and Canada; annual estimates are reported to the IPHC by fishery.

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 1888-2023 mortality has totaled 7.4 billion pounds (~3.3 million metric tons, t). Since 1923, the fishery has ranged annually from 34 to 100 million pounds (15,500-45,300 t) with an annual average of 63 million pounds (~28,500 t). Annual mortality was above this long-term average from 1985 through 2010 and has averaged 37.4 million pounds (~17,000 t) from 2019-23.

Fishery-dependent and fishery-independent data also 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 2023 modelled FISS results detailed a coastwide aggregate estimate of average NPUE which decreased by 2% from 2022 to 2023, remaining at 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, decreased by 3% from 2022 to 2023. Individual IPHC Regulatory Areas varied from an estimated 10% increase (Regulatory Area 2A) to an 8% decrease (Regulatory Area 3B) in O32 WPUE. Although most areas were sampled extensively enough to provide precise estimates of relative abundance and biomass in 2023, limited sampling in IPHC Regulatory Area 2A, and no direct sampling in IPHC Regulatory Area 4B resulted in broader credible intervals and therefore greater uncertainty about the actual trends.

Preliminary commercial fishery WPUE estimates from 2023 logbooks decreased by 10% at the coastwide level. The bias correction to account for additional logbooks compiled after the fishing season resulted in an estimate of -12% coastwide. Trends varied among IPHC Regulatory Areas and gears; however, Area-specific trends generally decreased to a greater degree than those from the FISS.

All information used in the 2023 stock assessment was finalized on 6 November 2023 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 2023 mortality estimates for all fisheries still operating. All preliminary data series in this analysis will be fully updated as part of the 2024 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,

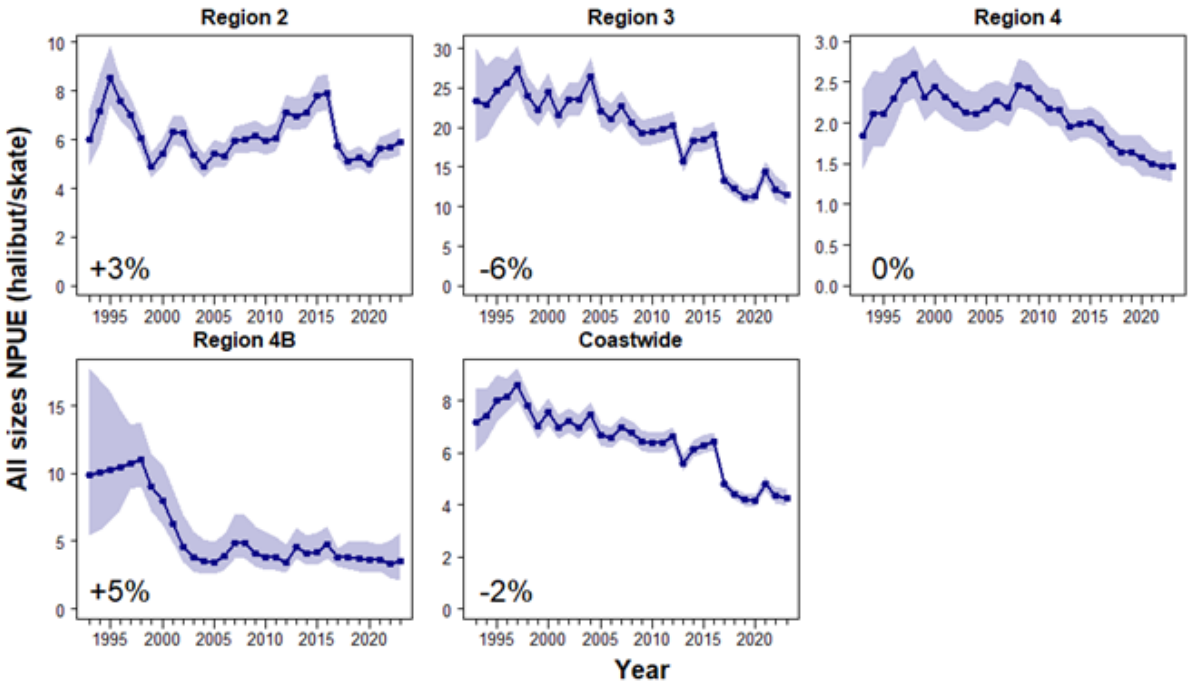


Figure 2. Trends in modelled FISS NPUE by Biological Region, 1993-2023. Percentages indicate the change from 2022 to 2023. Shaded zones indicate 95% credible intervals.

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 updated IPHC Regulatory Area specific L-W relationships based on the recent sampling. These are now applied to all data sources for which directly measured weights are unavailable.

- 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. Updating this maturity schedule based on modern histological methods is the ongoing focus of research based on data collection that began on the FISS in 2022.

- The estimated ages of Pacific halibut are based on the counting of rings on their otoliths (ear bones), 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 general index of productivity and climate variability in the Gulf of Alaska that has historically

Table 8. 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
2019	25.7%	46.3%	23.5%	4.5%
2020	24.0%	49.1%	22.2%	4.8%
2021	22.7%	53.0%	19.5%	4.7%
2022	25.5%	46.8%	22.0%	5.7%
2023	26.3%	45.0%	22.5%	6.2%

changed 'regime' about every 10-30 years. Research has shown that these environmental conditions are correlated with the average level of recruitment (young fish entering the population each year) 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: 1) accounting for FISS timing relative to the fishery and 2) 'hook competition'. The hook competition adjustment uses the number of baits returned at the end of a survey set to accounts for the level of competition from all species including other Pacific halibut for each hook – if a high proportion of hooks were recovered without bait, there was little power to detect additional fish present by the end of the set. Adjusting for the presence of such competition reduces potential bias in the observed WPUE index of density due to the finite number of hooks deployed and the observed catch rates at each station.

Modelled survey WPUE (representing the density of all sizes of Pacific halibut captured by the FISS; Figure 2) is used to produce the best available estimates of the stock distribution by Biological Region. The recent trend in estimated population distribution showed a continued decrease in Biological Region 3 to the lowest proportion of the coastwide stock in the time-series (Table 8). Conversely, Biological Region 2 increased to the highest proportion since modern survey estimates have been available. There was no sampling in biological Region 4B; therefore the credible intervals are very wide, consistent with either a decrease or increase in that Region. It is unknown to what degree current stock distribution corresponds to historical distributions prior to 1993 or to the average distribution likely to occur in the absence of fishing mortality.

Population assessment at the end of 2023

Stock assessment

The methods for undertaking the population assessment for Pacific halibut have constantly improved over the last 30 years with the collection of more comprehensive and informative data, the development of better models and more sophisticated analytical approaches. For the last nine years, a method called the "ensemble approach", drawing inference from multiple models to describe the stock, 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 all assessment models are approximations, and that risk assessment based on multiple models provides a stronger basis for the estimation of management quantities (and the uncertainty about these quantities) than any single model alone.

The 2023 stock assessment represents an update to the full stock assessment conducted in 2022. There were no structural changes to the assessment methods for 2023. Supporting analyses were reviewed by the IPHC's Scientific Review Board through the IPHC's standard two-meeting (June and September) process.

The 2023 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 9). 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.

The most influential source of new information in this assessment was the directed commercial fishery logbook trend, including the 2023 estimate as well as an updated (and lower) estimate of the catch-rate in 2022. The addition of just this information resulted in an 11% decrease in the 2023 spawning biomass estimate, compared to that from the 2022 stock assessment. Although differences in trend between the FISS and commercial fishery are not uncommon in the historical time-series, the sensitivity of this year's assessment results highlights the importance of both time-series in estimating the stock size and trend.

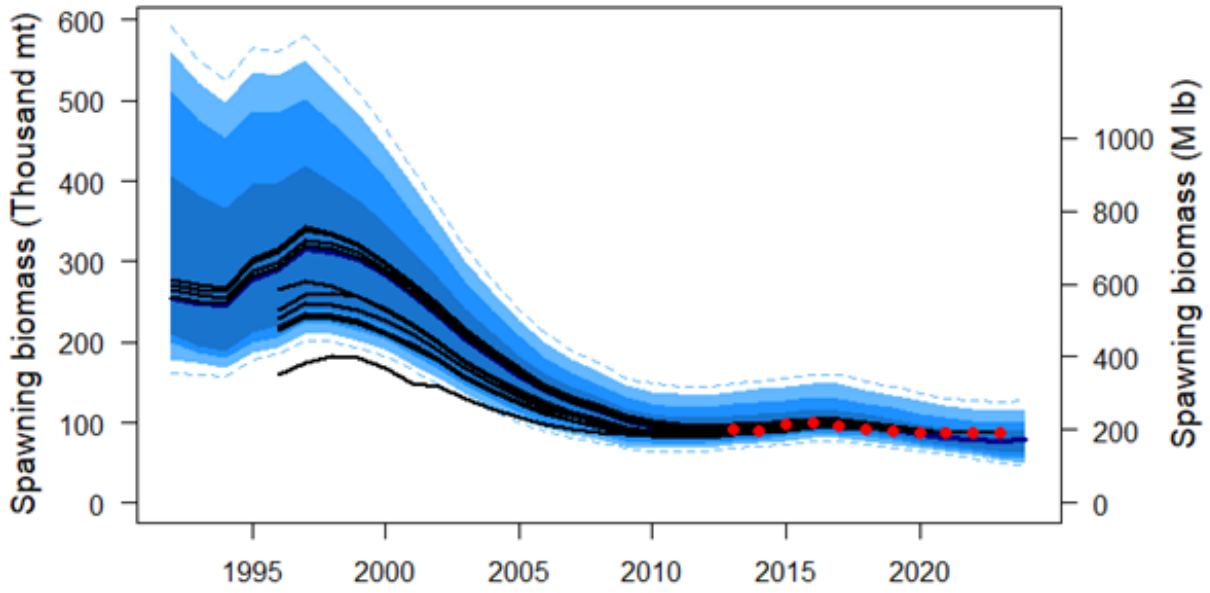


Figure 3. Retrospective comparison among recent IPHC stock assessments. Black lines indicate estimates of spawning biomass estimated by assessments conducted from 2012-2022 with the terminal estimate shown as a point, the shaded distribution denotes the 2023 ensemble: the dark blue line indicates the 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.

Spawning biomass and recruitment trends

The results of the 2023 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 lower recruitment than observed during the 1980s. The spawning biomass (SB) is estimated to have increased gradually to 2016, and then decreased to an estimated 171 million pounds (77,500 t) at the beginning of 2023. At the beginning of 2024 the spawning biomass is estimated to have increased slightly (due to the rapidly maturing 2012 year-class) to 174 million pounds (78,900 t), with an approximate 95% credible interval ranging from 111 to 258 million pounds (~50,400-116,900 t; Figure 3). The recent spawning biomass estimates from the 2023 stock assessment are very consistent with previous analyses up to 2021 and slightly below the 2021 and 2021 stock assessment results.

Average Pacific halibut recruitment is estimated to be higher (50 and 53% 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 (Figure 4), 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 2023, individual models in this assessment produced estimates of the 2012 year-classes that are similar to the average level observed over 1994-2005. The 2012 year-class is estimated to be 42% mature in 2023, and the maturation of this cohort has a strong effect on the short-term projections. The 2023 data indicate that the 2014 year class is larger than those observed from 2006-2011, but smaller than 2012. Estimates of year-classes after 2014 remain very uncertain. However, there is some indication in trawl survey and recreation data that there may have been another larger year class or classes during 2016-18; precise estimates of these cohorts from FISS and directed fishery data will not be possible for several more years.

Table 9. Harvest decision table for the 2024 mortality limits. Columns correspond to yield alternatives and rows to risk metrics. Values in the table represent the probability, in "times out of 100" (or percent chance) of a particular risk.

2024 Alternative					*Status quo -10%*	*Status quo -5%*	*Status quo*	*Status quo +5%*	3-Year Surplus	*Status quo +10%*		*Reference* $F_{43\%}$	*MEY proxy*	*MSY proxy*	
Total mortality (M lb)			0.0	21.6	34.9	36.7	38.6	40.4	40.7	42.3	46.6	50.5	56.1	67.3	
TCEY (M lb)			0.0	20.0	33.3	35.1	37.0	38.8	39.1	40.7	45.0	48.9	54.5	65.7	
2024 fishing intensity			$F_{100\%}$	$F_{68\%}$	$F_{54\%}$	$F_{52\%}$	$F_{51\%}$	$F_{50\%}$	$F_{49\%}$	$F_{48\%}$	$F_{45\%}$	$F_{43\%}$	$F_{40\%}$	$F_{35\%}$	
Fishing intensity interval			--	46-79%	32-68%	31-67%	29-65%	28-64%	28-64%	27-63%	25-60%	23-58%	20-55%	17-50%	
Stock Trend (spawning biomass)	in 2025	is less than 2024	<1	7	35	40	45	50	51	55	66	74	85	96	a
		is 5% less than 2024	<1	<1	7	9	12	15	15	18	26	33	44	69	b
	in 2026	is less than 2024	<1	8	35	40	45	50	50	54	65	74	84	95	c
		is 5% less than 2024	<1	2	17	20	24	28	29	32	42	51	64	85	d
	in 2027	is less than 2024	<1	10	36	40	45	49	50	54	64	72	82	94	e
		is 5% less than 2024	<1	4	23	26	30	34	35	39	49	57	69	87	f
Stock Status (Spawning biomass)	in 2025	is less than 30%	25	25	25	25	25	25	25	25	26	26	26	26	g
		is less than 20%	<1	<1	1	2	2	2	2	2	3	4	5	9	h
	in 2026	is less than 30%	21	24	25	25	25	25	25	25	25	25	26	26	i
		is less than 20%	<1	<1	2	2	2	3	3	3	5	7	9	16	j
	in 2027	is less than 30%	8	21	24	25	25	25	25	25	25	25	26	26	k
		is less than 20%	<1	<1	2	2	3	3	3	4	6	8	12	19	l
Fishery Trend (TCEY)	in 2025	is less than 2024	0	<1	25	27	28	30	31	33	41	50	63	85	m
		is 10% less than 2024	0	<1	23	25	26	27	27	29	34	41	52	75	n
	in 2026	is less than 2024	0	1	25	26	28	30	31	33	42	51	65	87	o
		is 10% less than 2024	0	<1	22	24	26	27	27	29	35	42	55	78	p
	in 2027	is less than 2024	0	1	24	26	28	30	31	33	42	52	67	88	q
		is 10% less than 2024	0	<1	21	23	25	27	27	29	35	43	57	81	r
Fishery Status (Fishing intensity)	in 2024	is above $F_{43\%}$	0	<1	26	27	29	31	32	34	42	50	62	82	s

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 relative spawning biomass limit of 20%, directed fishing is halted due to the critically low biomass condition. This calculation is 'dynamic', based on recent biological conditions: current weight-at-age and the estimated recruitments influencing the stock. This calculation measures only the effect of fishing on the spawning biomass. The relative spawning biomass in 2023 was estimated to be 42% (credible interval: 20-56%); equal to the estimate from the 2022 assessment. The probability that the stock is below the $SB_{30\%}$ level is estimated to be 26% at the beginning of 2024, with a 1% chance that the stock is below $SB_{20\%}$. The IPHC's 'reference' level of fishing intensity is a Spawning Potential Ratio (SPR) of $F_{43\%}$; 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 2023 assessment, the 2023 fishing intensity is estimated to correspond to an $F_{52\%}$ (credible interval: 31-66%). Fishing intensity over 2020-23 is estimated to be less than values estimated for the last 20+ years. This drop in fishing intensity corresponds both to reduced mortality limits and actual mortality consistently below those limits.

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 six years (2017-22) of sex-ratio information from the directed commercial fishery landings. However, uncertainty in historical ratios remains unknown. Additional years of data are likely to further inform selectivity parameters and cumulatively reduce uncertainty in 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. This assessment also does not include mortality, trends, or explicit demographic linkages in Russian waters, although such linkages may be increasingly important as warming waters in the Bering Sea allow for potentially important exchange across the international border.

Additional important contributors to assessment uncertainty (and potential bias) include the lag in estimation of incoming recruitment between birth year and direct observation in the fishery and survey data (6-10 years). Like most stock assessments, there is no direct information on natural mortality, and increased uncertainty for some estimated components of the fishery mortality. Fishery mortality estimates are assumed to be accurate; therefore, uncertainty due to discard mortality estimation (observer sampling and representativeness), discard mortality rates, and any other documented mortality in either directed or non-directed fisheries (e.g., whale depredation) could create bias in this assessment. Maturation schedules and fecundity are currently under renewed investigation by the IPHC. 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

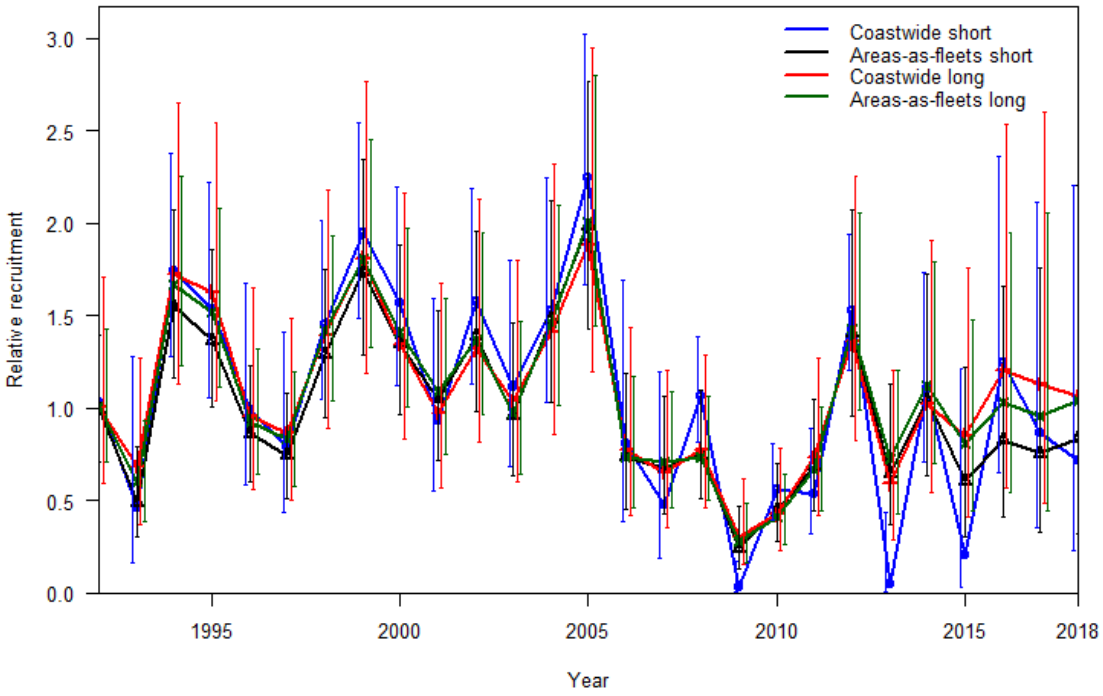


Figure 4. Estimated trends in age-0 relative recruitment (standardized to the mean for each model) from 1992-2018, based on the four individual models included in the 2023 stock assessment ensemble. Series indicate the maximum likelihood estimates; vertical lines indicate approximate 95% credible intervals.

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

Short-term tactical stock projections were conducted using the integrated results from the stock assessment ensemble in tandem with summaries of the 2023 directed and non-directed fisheries. The harvest decision table (Table 9) 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 2024 (columns). In addition to the status quo (last year's coastwide TCEY), a range of higher and lower coastwide TCEYs is presented, including TCEYs bracketing the status quo, mortality levels consistent with the 1-year and 3-year surplus production (less than or equal to a 50% chance that the spawning biomass will be smaller in 2025 and 2027 than it is in 2024), TCEYs consistent with the reference SPR of 43%, values identified by the MSE process as proxies for Maximum Economic Yield (MEY; $F_{40\%}$) and Maximum Sustainable Yield ($F_{35\%}$) as well as other levels to provide for continuous evaluation of the change in risk across alternative yields. For each column of the decision table, the projected fishing mortality (including all sizes and sources), the coastwide TCEY and the associated level of fishing intensity projected for 2024 (median value with the 95% credible interval below) are reported.

Projections indicate that the spawning biomass would increase relatively rapidly in the absence of any fishing mortality, with risks of stock decline over one and three years both less than 1/100. At the status quo coastwide TCEY (36.97 million pounds), risks of stock decrease over one and three years are 45/100. For all harvest levels that exceed the three-year surplus (39.1 million pounds) risks of stock decline are larger than 50/100, and reaching 94/100 for the coastwide TCEY that is projected to correspond to the $F_{35\%}$ MSY proxy harvest level in 2024. Alternative harvest levels around the status quo (+/- 5 and 10%) are projected to result in levels of fishing intensity ranging from $F_{54\%}$ to $F_{48\%}$, similar to those estimated for 2020-2023. At the reference level of fishing mortality ($F_{43\%}$) the 2024 coastwide TCEY is projected to be 48.9 million pounds (50.5 million pounds of mortality including U26 non-directed discard mortality). Stock decline over the next three years is projected to be very likely (72/100) at this level of fishing intensity. The probability of a reduction in the coastwide TCEY in order to maintain a fishing intensity no greater than $F_{43\%}$ over the next three years is projected to be 52/100. All projections result in a low probability of the relative spawning biomass dropping below the $SB_{30\%}$ threshold over the next three years (8-26/100) and an even lower probability of dropping below the $SB_{20\%}$ limit (<1-19%).

Scientific advice

Sources of mortality

In 2023, total Pacific mortality due to fishing increased to 35.87 million pounds (16,270 t), slightly below the 5-year average of 37.37 million pounds (16,950 t). Of that total, 83% comprised the retained catch, equal to the percent utilized in 2022 and down from 87% in 2021.

Stock status (spawning biomass)

Current (beginning of 2024) female spawning biomass is estimated to be 174 million pounds (78,900 t), which corresponds to a 26% chance of being below the IPHC trigger reference point of $SB_{30\%}$, and a 1% chance of being below the IPHC limit reference point of $SB_{20\%}$. The stock is estimated to have declined by 23% from 2016 to 2023, and then increased by 2% to the beginning of 2024. The relative spawning biomass (compared to the biomass projected to be present at the beginning of 2024 in the absence of any fishing) is currently estimated to be 42%, after reaching the lowest point in the time-series (30%) in 2011. 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 2023 fishing mortality corresponded to a point estimate of SPR = 52%; there is a 27% chance that fishing intensity exceeded the IPHC's current reference level of $F_{43\%}$. The Commission does not currently have a coastwide fishing intensity limit reference point.

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.

Harvest Strategy Policy

Harvest strategy policy at the International Pacific Halibut Commission (IPHC) is a strategic approach to setting harvest limits that is informed by coastwide Total Constant Exploitation Yield (TCEY), which is then distributed across all IPHC Regulatory Areas. The IPHC Harvest Strategy Policy provides a framework for applying a consistent and science-based approach to setting mortality limits for Pacific halibut fisheries throughout the IPHC Convention Area while ensuring sustainability of the Pacific halibut population. The framework uses a management procedure that incorporates science and policy to determine the coastwide TCEY and then distribute it across all IPHC Regulatory Areas. Being a framework, the harvest strategy policy encompasses the entire process of the harvest strategy and decision-making process to determine mortality limits as well as other important considerations such as objectives, key principles, and responses to specific events.

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) in combination with pre-defined relative harvest rates. 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 usually less productive western areas from which Pacific halibut typically migrate to eastern areas. Socio-economic factors are also considered when determining the final TCEY for each IPHC Regulatory Area.

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 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.

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 the 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.

Current MSE work consists of analyses to support the development of a harvest strategy policy. This includes further defining management objectives, evaluating management procedures without an annual stock assessment, evaluating the effect of changes in the Fishery-independent setline survey (FISS) design, identifying exceptional circumstances that would warrant additional evaluations of management procedures, and incorporating these outcomes in the harvest strategy policy.

Overall, the clear communication of MSE results is important so that stakeholders and Commissioners can make informed decisions and implement a harvest strategy policy. An MSAB meeting is scheduled to occur in spring of 2024 to guide the MSE work.

Research

Since its inception, the International Pacific Halibut Commission (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 Biological and Ecosystem Sciences Research activities at the IPHC are to:

1. identify and assess critical knowledge gaps in the biology of the Pacific halibut;
2. understand the influence of environmental conditions; 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 (FISS) and commercial fishery landings, respectively, which are described in other chapters of this report.

Migration and population dynamics

Estimation of Pacific halibut juvenile habitat

The IPHC Secretariat recently completed a study to investigate the connectivity between spawning grounds and possible settlement areas based on a biophysical larval transport model (Sadorus et al., 2021[1]). Although it is known that Pacific halibut, following the pelagic larval phase, begin their demersal stage as roughly 6-month-old juveniles, settling in shallow nursery (settlement) areas,

1 Sadorus, LL, Goldstein, ED, Webster, RA, Stockhausen, WT, Planas, JV, and Duffy-Anderson, JT (2021) Multiple life-stage connectivity of Pacific halibut (*Hippoglossus stenolepis*) across the Bering Sea and Gulf of Alaska. Fisheries Oceanography. Vol. 30(2):174-193. **doi.org/10.1111/fog.12512**

near or outside the mouths of bays (Carpi et al., 2021[2]), very little information is available on the geographic location and physical characteristics of these areas. In order to fill this knowledge gap, the IPHC Secretariat has initiated studies to identify potential settlement areas for juvenile Pacific halibut throughout IPHC Convention waters. A first objective of this study is to create a map of suitable settlement habitat by combining available bathymetry information (e.g. benthic sediment composition and shoreline morphological data) and information on recorded presence of age-0, age-1 and age-2 Pacific halibut juveniles as well as absence of young Pacific halibut noted by various nursery habitat projects focused on other flatfish species. Data sources are currently being analyzed.

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 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 FISS. A total of 1,678 Pacific halibut were tagged and released on the 2023 IPHC FISS. Therefore, a total of 11,149 U32 Pacific halibut have been wire tagged and released on the IPHC FISS and 261 of those have been recovered to date (these totals include a subset of U32 releases that were part of a tail pattern project). In the NMFS groundfish trawl surveys through 2019, a total of 6,421 tags have been released and, to date, 86 tags have been recovered.

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

Understanding population structure is imperative for sound management and conservation of natural resources. Pacific halibut in U.S.A. and Canadian waters are managed as a single, panmictic population. To provide support for this management approach, the IPHC Secretariat is conducting an analysis of Pacific halibut population structure in IPHC Convention waters using modern high-resolution genomic techniques (i.e. low-coverage whole genome resequencing, lcWGR) that allow for the examination of genetic structure of Pacific halibut in IPHC Convention Waters with unprecedented resolution. Genetic samples collected during the winter spawning season in known spawning sites (i.e., Bering Sea, Central Gulf of Alaska, Haida Gwaii, and central and western Aleutian Islands) from 1999 until 2020 have been used to investigate stock structure of Pacific halibut in IPHC Convention waters. The temporal replicates at many of these spawning locations will enable the IPHC Secretariat to evaluate the stability of genetic structure over time, ensuring confidence in the results. The IPHC Secretariat has recently produced a high-quality reference **genome** and has generated genomic sequences from 570 individual Pacific halibut collected from five geographic areas (Figure 5). Using the lcWGR approach, we have identified approximately 10.2 million single nucleotide polymorphisms (SNPs) that are currently being used to evaluate population structure at the highest

2 Carpi, P, Loher, T, Sadorus, LL, Forsberg, JE, Webster, RA, Planas, JV, Jasonowicz, A, Stewart, IJ, and Hicks, AC (2021) Ontogenetic and spawning migration of Pacific halibut: a review. Reviews in Fish Biology and Fisheries. **doi.org/10.1007/s11160-021-09672-w**

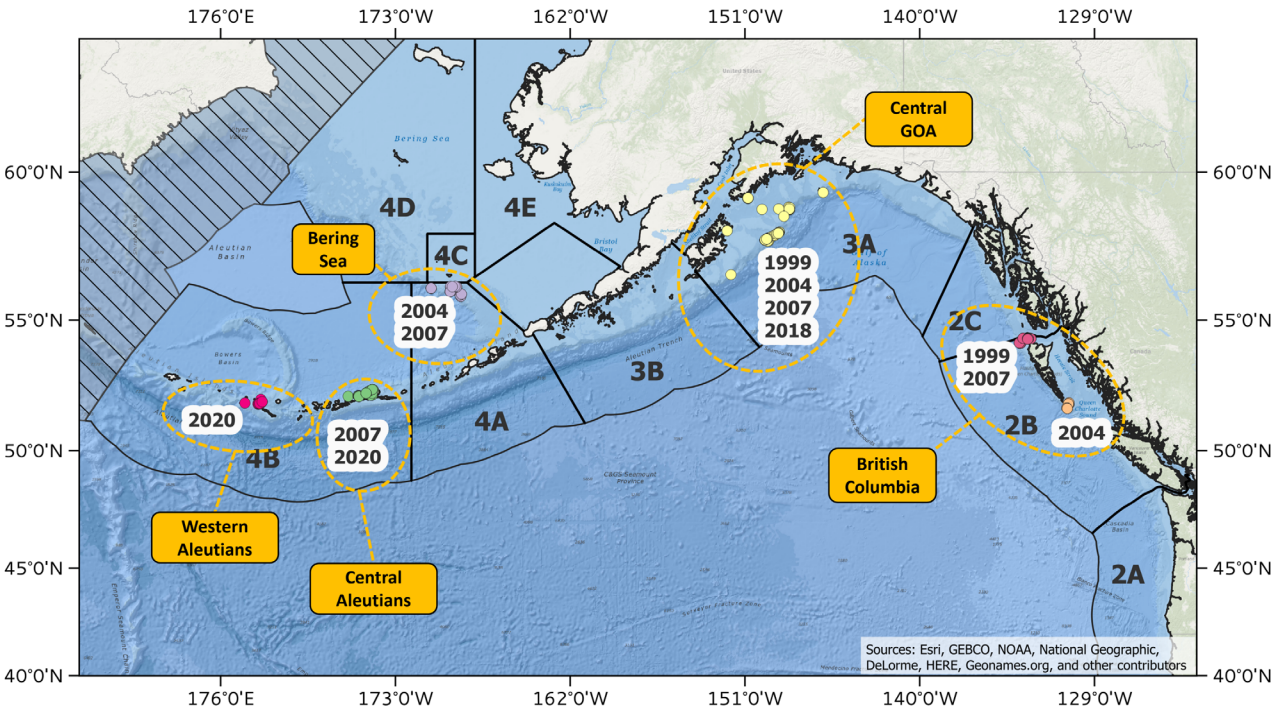


Figure 5. Map of winter sample collections made during the spawning season used for genomic analysis of population structure.

resolution possible. Despite the very high-resolution genomic data, preliminary data on population structure using a genome-wide subset of 4.7 million SNPs suggest that there may be very little spatial structure among the spawning groups sampled in IPHC convention waters. Since evolutionary processes may not act uniformly across the genome, current work is aimed at identifying regions of the genome that contain outlier SNPs which may increase our power to characterize population structure and determine the source population for samples collected outside of the spawning season. This study is partially funded by a research grant from the North Pacific Research Board (NPRB #2110).

Reproduction

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 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 2022 (>10,000 fin clips per year) using genetic techniques based on the identification of sex-specific single nucleotide polymorphisms (SNPs) (Drinan et al., 2018[3]) using TaqMan qPCR assays conducted at the IPHC's Biological Laboratory. The IPHC Secretariat is currently processing genetic samples from the 2023 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

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

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, female maturity schedules have not been revised in recent years and may be outdated. In addition, the currently used macroscopic visual criteria used to score female maturity in the field have an undetermined level of uncertainty and need to be contrasted with more accurate microscopic (i.e. histological) criteria.

In order to address these issues, the IPHC Secretariat conducted a thorough histological investigation of the temporal progression of female developmental stages and reproductive phases throughout an entire reproductive cycle (Fish et al. 2020; 2022). Results from these studies 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 have provided foundational information for ongoing studies aimed at updating maturity ogives by histological assessment in Pacific halibut. One of the most important results obtained show that the period of time when gonad samples can be collected in the FISS (June-August) is an appropriate temporal window during which we can identify Pacific halibut females that are developing towards the spawning capable reproductive phase and, therefore, considered mature for stock assessment purposes.

The IPHC Secretariat is currently conducting studies to revise maturity schedules in all four biological regions through histological (i.e. microscopic) characterization of maturity. For this purpose, the IPHC Secretariat collected ovarian samples for histology during the 2022 FISS (440 samples from Biological Region 2, 351 samples from Biological Region 3, 181 from Biological Region 4, and 51 samples from Biological Region 4B) and during the 2023 FISS (403 samples from Biological Region 2 and 708 samples from Biological Region 3). Ovarian samples from the 2022 FISS collections have been processed for histology and scored for maturity using histological maturity criteria previously defined, leading to immature or mature classification. Current efforts are devoted to the analysis of various methods for best describing the proportion of mature females by age and by length at coastwide and biological region scales.

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 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 studies 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, to obtain experimentally-derived estimates of discard mortality rate (DMR) in the directed longline fishery. Our results on individual survival outcomes for captured Pacific halibut and released in excellent viability condition indicate a minimum DMR of 4.2%, that is consistent with the currently-applied DMR value of 3.5%. A second component of these studies investigated the relationships among hook release techniques (e.g. gentle shake, gangion cutting, and hook stripping), injury levels, viability categories,

stress levels and physiological condition of released fish, as well as the environmental conditions that the fish experienced during capture. Gentle shake and gangion cutting resulted in the same injury and viability outcomes with 75% of sublegal fish classified in the Excellent viability category, while the hook stripper produced the poorest outcomes (only 9% in the Excellent viability category). Hook stripping also resulted in more severe injuries, particularly with respect to tearing injuries, whereas gentle shake and gangion cutting predominantly resulted in a torn cheek, effectively the injury incurred by the hooking event. Physiological stress indicators (plasma levels of glucose, lactate, and cortisol) did not significant change with viability outcomes, except for higher lactate plasma levels in fish in the Dead viability category. Hematocrit was significantly lower in fish that were classified in the Dead viability category. Furthermore, 89% of fish classified as Dead were infiltrated by sand fleas, present in several sets in deeper and colder waters. Our results indicated that avoiding the use of hook strippers and minimizing soak times in areas known to have high sand flea activity result in better survival outcomes (Dykstra et al., 2024[4]).

Discard mortality rates of Pacific halibut in the recreational fishery

The IPHC Secretariat recently completed a study aimed at evaluating the effects of capture and handling conditions on viability and survival of Pacific halibut in the charter recreational fishery, with funding from the National Fish and Wildlife Foundation (Project 61484) and the North Pacific Research Board (Project 2009). Investigations on the discard mortality rate (DMR) of Pacific halibut captured using circle hooks and released in Excellent viability category using electronic accelerometer tags yielded DMR estimates of 1.35% (95% CI 0.00-3.95%) for fish that were captured and released. These results represent the first report of experimentally derived estimates of mortality of Pacific halibut captured and discarded in the recreational fishery. As with the study on the directed commercial fishery (previous section), work is currently being conducted to investigate the relationship of injury types, viability categories and survival of discarded fish with capture (e.g. environmental parameters, time on deck, hooking time, etc.) and physiological (e.g. stress) conditions.

Fishing Technology

The IPHC Secretariat is conducting studies aimed at developing methods that involve modifications of fishing gear with the purpose of reducing Pacific halibut depredation and bycatch. Specific objectives in this area include 1) investigate new methods for whale avoidance and/or deterrence for the reduction of Pacific halibut depredation by whales (e.g. catch protection methods), and 2) investigate behavioral and physiological responses of Pacific halibut to fishing gear in order to reduce bycatch.

Gear-based approaches to catch protection to minimize whale depredation in the Pacific halibut longline fishery

The IPHC Secretariat has conducted investigations on gear-based approaches to catch protection as a means for minimizing whale depredation in the Pacific halibut longline fisheries with funding from NOAA's Bycatch Research and Engineering Program (BREP) (NOAA Award NA21NMF4720534). The objectives of this study were: 1) work with fishermen and gear manufacturers,

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

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 simple, low-cost catch-protection designs that can be deployed effectively using current longline fishing techniques and on vessels currently operating in Convention waters.

From the outcomes of the first part of the study, two different types of catch protection devices were selected for field testing: one based on a modification of a commercial catch protection device (i.e. shuttle system), and one based on a modification of a slinky pot (i.e. shroud system) deployed on branchline gear. Aluminum shuttle devices were modeled after the Sago Extreme device (Sago, Norway) but 80% smaller in size: 2.60 m (8.5 ft) long by 0.80 m (2.6 ft) in diameter, each weighing approximately 100 kg (220 lb.) when empty. Typically, these devices are set with the gear; however, for this study the units were deployed from the surface, during the haulback event. The device encounters the hooks and catch near the seabed, mechanically unhooks fish and entrains them in the storage area. After securing the catch, the device encounters a stopper and is hauled to the surface with fish inside. Several shroud systems were constructed consisting of a modified 'slinky pot' with an opening on one end and a closed end cap on the other that is designed to slide down the branch covering the catch during hauling.

The two different devices were tested off Newport, OR in May of 2023 on a 56' (17m) chartered fishing vessel with an open deck design and typical boom and winch capacity. The focus of the testing was to investigate: 1) the logistics of setting, fishing, and hauling of the two pilot catch protection designs, and 2) the basic performance of the gear on catch rates and fish size compared to non-protected gear in the absence of whales. Pilot testing with the shuttle device consisted of ten sets, each with two 100 hook skates, one acting as a control, and the other equipped with the shuttle. For the shroud system, pilot testing consisted of single sets with six branch lines of 48' affixed on 100' spacing along the groundline. Ten gangions and hooks were snapped to the branch lines on 4' spacing. Three branch lines had a shroud attached and three branch lines acted as controls. Data collected during the pilot testing of the two types of catch protection devices are currently being analyzed.

The IPHC Secretariat recently received funding (BREP, NOAA Award NA23NMF4720414) for further testing of the shuttle concept in the presence of depredating Orcas in Alaskan waters. This work is planned for 2024 and will allow for further refinements (e.g. attachment protocols, gangion/hook strength), statistical testing of catch rates, and catch composition (e.g. size ranges, species, catch volume) when using the devices, as well as allow for quantification of removals of fish from non-shuttle treatments by depredating whales.

Investigations on behavioral and physiological responses to fishing gear to reduce bycatch

The IPHC Secretariat has participated in studies led by Pacific States Fisheries Management Commission and in collaboration with NOAA Fisheries and fishing industry partners on bycatch reduction measures through the use of fishing gear modifications. Studies conducted include investigating the use of artificial illumination on bottom trawl gear to reduce Pacific halibut bycatch, and the results showed a decrease in the number of Pacific halibut caught in trawl gear when LED lights are present (Lomeli et al. 2021[5]). Other studies investigated the introduction of modifications to circle hooks as a means to reduce yelloweye rockfish bycatch in the Pacific halibut longline fishery, and showed that hook appendages can significantly reduce yelloweye rockfish bycatch without affecting Pacific halibut catch rates (Lomeli et al. 2023[6]). On this same topic, studies were also conducted to investigate the potential effectiveness of semi-demersal longlines in reducing yelloweye rockfish bycatch in the Pacific halibut longline fishery, and the resulting data are currently being analyzed.

Age composition data

The IPHC Secretariat is looking at options for supplementing current Pacific halibut ageing protocol with automatized ageing that does not require extensive otolith-reader training. The IPHC is investigating the potential use of artificial intelligence (AI) for determining the age of Pacific halibut from images of collected otoliths. The Secretariat is in the process of initializing creation of a database of pictures with expert-provided labels, utilizing previously aged otoliths, and assessing the option for the development of a Convolutional Neural Network (CNN) model specifically designed for image classification to determine Pacific halibut age. The goal is to create an AI-based age determination system that complements traditional methods for reliable fish stock assessment and management advice.

---

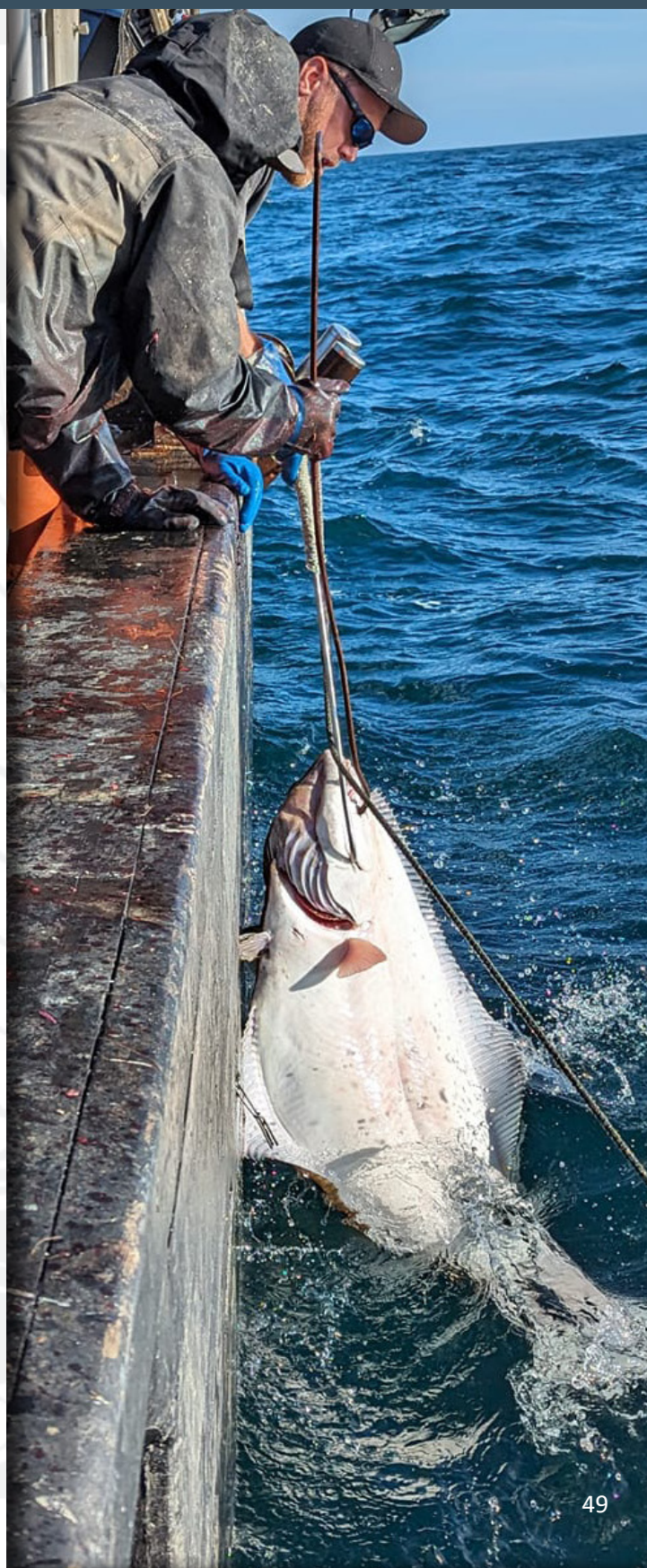
5 Lomeli, MJM., Wakefield, WW, Herrmann, B, Dykstra, CL, Simeon, A, Rudy, DM, and Planas, JV (2021) Use of Artificial Illumination to Reduce Pacific Halibut Bycatch in a U.S. West Coast Groundfish Bottom Trawl. Fisheries Research. 233:105737. doi.org/10.1016/j.fishres.2020.105737

6 Lomeli MJM, Wakefield WW, Abele M, Dykstra CL, Herrmann B, Stewart IJ, Christie GC. 2023. Testing of hook sizes and appendages to reduce yelloweye rockfish bycatch in a Pacific halibut longline fishery. Ocean & Coastal Management. 241: 106664. https://doi.org/10.1016/j.ocecoaman.2023.106664.

Management-Supporting Information

Successful fisheries management requires rigorous application of the scientific method of problem solving in the development of strategic alternatives and their evaluation on the basis of objectives that integrate ecosystem and human dynamics across space and time into management decision-making. This underscores the importance of a holistic understanding of a broad range of factors 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. Management-supporting information beyond IPHC's current core research and monitoring programs relate to, among others, socio-economic considerations, community development, political constraints, and operational limitations.

Understanding the complexity of human dimension of the fisheries sectors is increasingly important in the context of globalization. Local products find themselves competing in markets 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. Seafood prices are influenced by a vast array of external factors. The impact of the development of artificial intelligence (AI) remains uncertain, but holds the potential to significantly transform fisheries management, offering innovative solutions to the challenges highlighted by globalization and the interconnected nature of seafood markets. AI can enhance predictive analytics, enhancing the economic resilience of local fisheries against global perturbations but also to support the sustainable management of marine resources in an era marked by rapid environmental and market changes.



Looking Forward

This section summarises the major decisions made at the 100th Session of the International Pacific Halibut Commission (IPHC) Annual Meeting (AM100), held in Anchorage, Alaska, U.S.A., from 22-26 January 2024. A total of 20 participants (6 Commissioners: Members; 14 advisors/experts) attended the Session from the two (2) Contracting Parties, as well as 221 members of the public (124 in-person and 97 remote). The meeting was opened by the Chairperson, Mr Jon Kurland (U.S.A.), and the Vice-Chairperson, Mr Paul Ryall (Canada). For a full accounting of documents and presentations provided to the Commission for the meeting, and the final report of the meeting, visit the AM100 webpage: **https://www.iphc.int/meetings/100th-session-of-the-iphc-annual-meeting-am100/**

Mortality limits

The Commission adopted mortality limits (described as Total Constant Exploitation Yield, TCEY limits) for 2024 as provided in Table 10. These mortality limits include a variety of estimated sources of mortality which are detailed in Table 11a and 11b.

Fishing periods (season dates)

The Commission recommended a fishing period of 15 March to 7 December 2024 for all commercial Pacific halibut fisheries in Canada and the United States of America. Additionally, the recommendations included adjusting the season's opening hour from noon to 6am, and closing hour from noon to 11:59pm.

Other regulatory changes

Update of log requirements

The Commission adopted a fishery regulation proposal amending a range of requirements related to logs:

- Logs that were not collected previously by the Commission are required to be submitted within 30

days following the end of the fishing season.
- Data must be recorded by set and include location coordinates.
- The hook-and-line logbook previously provided by the Petersburg Vessel Owners Association is no longer listed as an approved logbook.
- All logbook entries must be written clearly and legibly.
- IPHC will now accept electronic logbooks that are approved by NOAA Fisheries.
- IPHC is also authorized to approve electronic equivalents to the IPHC logbook. Pilot program is scheduled for 2024.

Recreational Fisheries

The Commission adopted changes for charter recreational Pacific halibut fisheries in IPHC Regulatory Areas 2C and 3A to achieve the charter Pacific halibut allocation under the North Pacific Fisheries Management Council's (NPFMC) Pacific halibut Catch Sharing Plan:

a) IPHC Regulatory Area 2C – one fish bag limit with size limit of less than or equal to 40 inches or greater than or equal to 80 inches from 1 February to 14 July, and less than or equal to 36 inches or greater than or equal to 80 inches from 15 July to 31 December, closed on any Friday from 19 July to 13 September;

b) IPHC Regulatory Area 3A – two-fish bag limit with one fish of any size and a second fish less than or equal to 28 inches, Wednesdays closed to retention of Pacific halibut, one trip per vessel, one trip per CHP per day, and no annual limit.

The Commission also adopted regulatory language providing clarification reflective of the changes to the catch sharing plan that allocates the IPHC Regulatory Area 2A Pacific halibut catch limit. At its November 2023 meeting, the Pacific Fishery Management Council adopted changes that include in-season process to provide more sharing the IPHC Regulatory Area 2A non-treaty sport allocation between states (California, Oregon, and Washington).

Commission Officers

The Commission elected Mr Paul Ryall (Canada) as Chairperson of the IPHC, and Mr Jon Kurland (U.S.A.) as Vice-Chairperson of the IPHC for the period commencing after AM100 through the completion of AM101.

Table 10. Adopted Mortality limits (TCEY) for 2024.

IPHC Regulatory Area	Distributed mortality limits (TCEY) (net weights)	
	Tonnes (t)	Million Pounds (Mlbs)
Area 2A (California, Oregon, and Washington)	748	1.65
Area 2B (British Columbia)	2,935	6.47
Area 2C (southeastern Alaska)	2,626	5.79
Area 3A (central Gulf of Alaska)	5,153	11.36
Area 3B (western Gulf of Alaska)	1,565	3.45
Area 4A (eastern Aleutians)	730	1.61
Area 4B (central and western Aleutians)	567	1.25
Areas 4CDE (Bering Sea)	1,678	3.70
Total	16,003	35.28

Table 11a. Mortality table projected for the 2024 mortality limits (tonnes) by IPHC Regulatory Area.

Sector	IPHC Regulatory Area								
	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
Commercial discards	50	82	N/A	N/A	109	18	5	36	299
026 non-directed discards	36	132	27	113	100	122	64	703	1,297
Recreational	N/A	14	485	449	5	5	0	0	948
Subsistence	N/A	186	113	54	5	0	0	5	367
Total non-FCEY	**82**	**413**	**621**	**617**	**213**	**150**	**73**	**744**	**2,912**
Commercial discards	N/A	N/A	50	245	N/A	N/A	N/A	N/A	299
Recreational	277	376	367	857	N/A	N/A	N/A	N/A	1,878
Subsistence	9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9
Commercial landings	376	N/A	1,588	3,429	1,352	581	494	934	10,900
Total FCEY	**667**	**2,522**	**2,005**	**4,536**	**1,352**	**581**	**494**	**934**	**13,091**
						4C FCEY		417	
						4D FCEY		417	
						4E FCEY		100	
TECY	**748**	**2,935**	**2,626**	**5,153**	**1,565**	**730**	**567**	**1,678**	**16,003**
U26 non-directed discards	1	19	0	81	40	57	5	501	705
Total	750	2,954	2,626	5,234	1,605	788	572	2,180	16,708

Table 11b. Mortality table projected for the 2024 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	0.11	0.18	N/A	N/A	0.24	0.04	0.01	0.08	0.66
026 non-directed discards	0.08	0.29	0.06	0.25	0.22	0.27	0.14	1.55	2.86
Recreational	N/A	0.03	1.07	0.99	0.01	0.01	0.00	0.00	2.09
Subsistence	N/A	0.41	0.25	0.12	0.01	0.00	0.00	0.01	0.81
Total non-FCEY	**0.18**	**0.91**	**1.37**	**1.36**	**0.47**	**0.33**	**0.16**	**1.64**	**6.42**
Commercial discards	N/A	N/A	0.11	0.54	N/A	N/A	N/A	N/A	0.66
Recreational	0.61	0.83	0.81	1.89	N/A	N/A	N/A	N/A	4.14
Subsistence	0.02	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.02
Commercial landings	0.83	4.73	3.50	7.56	2.98	1.28	1.10	2.06	24.04
Total FCEY	**1.47**	**5.56**	**4.42**	**10.00**	**2.98**	**1.28**	**1.10**	**2.06**	**28.87**
						4C FCEY		0.92	
						4D FCEY		0.92	
						4E FCEY		0.22	
TECY	**1.65**	**6.47**	**5.79**	**11.36**	**3.45**	**1.61**	**1.26**	**3.7**	**35.29**
U26 non-directed discards	0.00	0.04	0.00	0.18	0.09	0.13	0.01	1.11	1.56
Total	1.65	6.51	5.79	11.54	3.54	1.74	1.27	4.81	36.85

IPHC Secretartiat 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. This section highlights some of those activities.

Committees and Organization appointments

- Technical Subcommittee (TSC) of the Canada-United States Groundfish Committee - Dr. Josep Planas
- Halibut Advisory Board (Canada) - Dr. David Wilson (Dr. Barbara Hutniczak – Alternate)
- Stock Assessment Review for Copper Rockfish in California, Rex Sole, and Shortspine Thornyhead – Dr. Allan Hicks
- Bering Sea/Aleutian Islands Plan Team - Dr. Allan Hicks
- Bering Sea Fishery Ecosystem Plan Team - Dr. Ian Stewart
- NPFMC Scientific and Statistical Committee - Dr. Ian Stewart
- 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. Barbara Hutniczak

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
- Marine Resource Education Program (MREP), NPFMC, 17-21 April, Juneau, AK, U.S.A. – Dr. Ian Stewart

- Western Groundfish Conference, 24-28 April, Juneau, AK, USA – Dr Josep Planas, Claude Dykstra and Dr Ray Webster
- 14th National Stock Assessment Workshop/Working Group on Maturity, Assessment, Reproductive Variability, and Life Strategies (MARVLS), 9-11 May, Providence, RI – Colin Jones
- 12th International Symposium on Reproductive Physiology of Fish, 15-19 May, Crete, Greece – Dr. Josep Planas
- British Ecological Society Climate Change Genomics Workshop, 13-15 September, Virtual – Andy Jasonowicz
- Effects of Climate Change on the World's Ocean (ECCWO5), 17-21 April 2023, Bergen, Norway – Dr. Allan Hicks
- Science Response Process - Pacific Region. Status update of Pacific Cod (Gadus Macrocephalus) off the west coast of Vancouver Island in 2023, 20 October, virtual reviewer – Dr. Ian Stewart
- PICES-2023 Annual Meeting, 23-27 October 2023, Seattle, WA, U.S.A – Dr. David T. Wilson, Dr. Josep Planas, Dr. Barbara Hutniczak, Dr. Allan Hicks, Dr. Ian Stewart, Dr. Ray Webster, Monica Thom, Kayla Ualesi

Outreach

- Community projects participation: Food Lifeline food bank sorting team, Golden Gardens beach clean-up, Tilth Alliance Community Gardens, Seward Park Latino Conservation Week Restoration Project, Ballard Food Bank donation drive, Filipino Community Center Toy Donation Drive – All Secretariat staff contribute throughout the year.

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

Taught courses

- Principles & applications of fisheries-independent surveys. University of Washington School of Aquatic & Fishery Sciences. Winter 2023. - Dr. Ray Webster and Dr. Allan Hicks
- Age-structured models in fisheries stock assessment. University of Washington School of Aquatic & Fishery Sciences. Spring 2023. - Dr. Ian Stewart and Dr. Allan Hicks

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 2023, contributions for general operating expenses were as follows:

- Canada: US$900,407;
- U.S.A.: US$4,157,760

The U.S.A. is responsible for the IPHC Headquarters lease and maintenance which resulted in a supplementory contribution of US$489,250.00.

Independent Auditor

The Commission's financial accounts for FY2023 were audited by the accounting firm of Clark Number PS. The auditor's provided the following opinion:

"In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of the Commission as of September 30, 2023, and the results of its operations and its cash flows for the year then ended in accordance with accounting principles generally accepted in the United States of America."

The full report of the Independent Auditors is publicly available on the IPHC website: **https://www.iphc.int/uploads/2023/12/IPHC-2024-FAC100-05-Audit-FY2023.pdf**

Statement of financial activities

The total Assets at year-end closing totaled US$6,131,471.
The total equity or combined fund balance at year-end closing totaled US$3,922,602

Fund equity balances at year end:

- General Fund (10): US$883,907
- Research Fund (20): US$134,247
- Statistics Fund (30): US$2,480
- AK Cost Recovery (35): US$1,529,438
- FISS Fund (40): (US$64,714)
- Reserve Fund (50): US$1,437,244 - The Reserve Fund carries the majority of the equity in

At year end September 30, 2023, program balances were comprised of:

	10 - General	20 - Research	30 - Statistics	35 - AK Cost Recovery	40 - FISS	50 - Reserve	Total
Cash	$ 1,218,196	$ 246,722	$ 157,604	$ 859,991	$ (1,091,844)	$ 1,437,244	$ 2,827,913
Accounts receivable	12,858				1,443,501		1,456,359
Grants receivable				860,131			860,131
Prepaid expenses and other assets	58,731	4,015	1,038	25,799	5,247		94,830
Capital assets, net	788,883	23,083		67,311	12,961		892,238
Accounts payable	(98,400)	(50)	943	(61,959)	(382,100)		(541,566)
Payroll liabilities	(191,037)	(61,096)	(58,006)	(62,352)	(26,336)		(398,827)
Compensated absences	(122,865)	(78,427)	(99,099)	(18,650)	(26,143)		(345,184)
Lease liabilities	(782,459)			(68,462)			(850,921)
Unearned grant revenue				(72,371)			(72,371)
Net Position	$ 883,907	$ 134,247	$ 2,480	$ 1,529,438	$ (64,714)	$ 1,437,244	$ 3,922,602

INTERNATIONAL PACIFIC HALIBUT COMMISSION

Statement of Revenues, Expenses and Changes in Net Position by Fund
For the Year Ended September 30, 2023

	10 - General	20 - Research	30 - Statistics	35 - AK Cost Recovery	40 - FISS	50 - Reserve	Total
Operating Revenue:							
Contracting party contributions	$ 3,523,605	$ 887,686	$ 1,136,126	$ -	$ 114,000	$ -	$ 5,661,417
Other income	18,980	6,937	17,602	20,535	7,237		71,291
Grants, contracts and agreements		237,545		854,742	34,289		1,126,576
Interest income	15,315						15,315
Fish sales					4,127,214		4,127,214
Unrealized gains/losses	230		(226)		(374)		(370)
Fund transfer	88,745					(88,745)	
Total Income	**3,646,875**	**1,132,168**	**1,153,502**	**875,277**	**4,282,366**	**(88,745)**	**11,001,443**
Expenses:							
General expenses-							
Personnel expense	1,620,977	620,916	784,474	504,618	954,232		4,485,217
Benefits	504,744	227,220	227,175	184,312	155,529		1,298,980
Training and education	32,221	1,317	4,758	10,011	8,320		56,627
Personnel related expenses	1,527		900	3,100	5,300		10,827
Total general expenses	2,159,469	849,453	1,017,307	702,041	1,123,381		5,851,651
Operating expenses-							
Publications	4,037	561	148	420			5,166
Mailing and shipping	7,445	5,051	1,200	1,334	95,589		110,619
Travel	56,596	15,140	6,653	21,067	98,998		198,454
Meetings	163,705				181		163,886
Technology	98,141	348	1,456		6,294		106,239
Total operating expenses	329,924	21,100	9,457	22,821	201,062		584,364
Fees and contract expenses-							
Professional fees	147,952	543			3,655		152,150
Vessel expenses					428,329		428,329
Other fees and charges	47,753		787	8,651	22,948		80,139
Leases and contracts	13,899	46,000	1,359	14,758	2,040,412		2,116,428
Communications	34,775		384	942	1,570		37,671
Total fees and contract expenses	244,379	46,543	2,530	24,351	2,496,914		2,814,717
Facilities and equipment expenses-							
Equipment expense		4,535	637	11,893	9,308		26,373
Supplies expense	40,249	52,705	691	32,176	754,183		880,004
Maintenance and utilities	47,957	2,229	647		986		51,819
Facilities rentals	499,747			32,653	17,325		549,725
Total facilities and equipment expenses	587,953	59,469	1,975	76,722	781,802		1,507,921
Other expenses	10,358	(4,967)			11,711		17,102
Total Expenses	3,332,083	971,598	1,031,269	825,935	4,614,870		10,775,755
Change in Net Position	**314,792**	**160,570**	**122,233**	**49,342**	**(332,504)**	**(88,745)**	**225,688**
Net position, beginning of the year	569,115	(26,323)	(119,753)	1,480,096	267,790	1,525,989	3,696,914
Net Position, End of Year	$ 883,907	$ 134,247	$ 2,480	$ 1,529,438	$ (64,714)	$ 1,437,244	$ 3,922,602

Clark Nuber PS

Independent Auditor's Report

To the Commissioners
International Pacific Halibut Commission
Seattle, Washington

REPORT ON THE AUDIT OF THE FINANCIAL STATEMENTS

Opinion

We have audited the financial statements of International Pacific Halibut Commission (the Commission), which comprise the statement of net position as of September 30, 2023, and the related statements of revenues, expenses, and changes in net position, and cash flows for the year then ended, and the related notes to the financial statements, which collectively comprise the Commission's basic financial statements as listed in the table of contents.

In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of the Commission as of September 30, 2023, and the results of its operations and its cash flows for the year then ended in accordance with accounting principles generally accepted in the United States of America.

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 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.

Responsibilities of Management for the Financial Statements

Management is responsible for the preparation and fair presentation of the financial statements in accordance with accounting principles generally accepted in the United States of America, 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 Commission's ability to continue as a going concern for one year after the date that the financial statements are available to be issued.

CN

T: 425-454-4919
T: 800-504-8747
F: 425-454-4620

10900 NE 4th St
Suite 1400
Bellevue WA
98004

clarknuber.com

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the 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 the 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 the 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 the 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 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 the financial statements.
- Conclude whether, in our judgment, there are conditions or events, considered in the aggregate, that raise substantial doubt about the 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.

Clark Nuber PS

Required Supplementary Information

Accounting principles generally accepted in the United States of America require that the management's discussion and analysis on pages 4 through 6 be presented to supplement the basic financial statements. Such information, although not a part of the basic financial statements, is required by the Governmental Accounting Standards Board, who considers it to be an essential part of financial reporting for placing the basic financial statements in an appropriate operational, economic, or historical context. We have applied certain limited procedures to the required supplementary information in accordance with auditing standards generally accepted in the United States of America, which consisted of inquiries of management about the methods of preparing the information and comparing the information for consistency with management's responses to our inquiries, the basic financial statements, and other knowledge we obtained during our audit of the basic financial statements. We do not express an opinion or provide any assurance on the information because the limited procedures do not provide us with sufficient evidence to express an opinion or provide any assurance.

Supplementary Information

Our audit was conducted for the purpose of forming an opinion on the financial statements as a whole. The statement of revenues, expenses, and changes in net position by fund is presented for purposes of additional analysis and is not a required part of the financial statements. Such information is the responsibility of management and was derived from and relates directly to the underlying accounting and other records used to prepare the financial statements. The information has been subjected to the auditing procedures applied in the audit of the financial statements and certain additional procedures, including comparing and reconciling such information directly to the underlying accounting and other records used to prepare the financial statements or to the financial statements themselves, and other additional procedures in accordance with auditing standards generally accepted in the United States of America. In our opinion, the information is fairly stated in all material respects in relation to the financial statements as a whole.

Clark Nuber P.S.

Certified Public Accountants
December 18, 2023

Thank you

The IPHC wishes to thank all of the agencies, industry, and individuals who helped us in our investigations during 2023 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's Fishery-Independent Setline Survey (FISS) by storing and staging equipment and supplies, as well as our Fisheries Data Specialists operating in the field.
- OBI Seafoods, Icy Straight Seafoods, and E.C. Phillips & Son for working closely with the 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.
- IPHC Regulatory Area 2A tribal biologists and domestic 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.
- Members of IPHC's Subsidiary bodies 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.

2023 Publications

The IPHC publishes an Annual Report, meeting documents, circulars, media releases, and peer reviewed journal articles. The IPHC website (**www.iphc.int**) includes a document library of all publications from 1931-2016. Articles and reports published during 2023 and authored by the IPHC Secretariat are cited below.

Lomeli MJM, Wakefield WW, Abele M, **Dykstra CL**, Herrmann B, **Stewart IJ**, Christie GC. 2023. Testing of hook sizes and appendages to reduce yelloweye rockfish bycatch in a Pacific halibut longline fishery. Ocean & Coastal Management. 241: 106664. **https://doi.org/10.1016/j.ocecoaman.2023.106664**.

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

In Press (2024)

Dykstra C, Wolf N, Harris BP, **Stewart IJ**, **Hicks A**, Restrepo F, **Planas JV**. 2024. Relating capture and physiological conditions to viability and survival of Pacific halibut discarded from commercial longline gear. Ocean & Coastal Management. 249: 1077018. **https://doi.org/10.1016/j.ocecoaman.2024.107018**.

Sadorus LL, **Webster RA**, Sullivan M. 2024. Environmental conditions on the Pacific halibut fishing grounds obtained from a decade of coastwide oceanographic monitoring, and the potential application of these data in stock analyses. Marine and Freshwater Research. MF23175. **https://www.publish.csiro.au/MF/justaccepted/MF23175**.

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

Thomas RE, Gauthier S, Grandin C, **Hicks A**, Parker-Stetter S. 2024. To trawl or not to trawl: Questioning core assumptions of trawl placement choice in fisheries acoustic surveys. Fisheries Research. 270: 106897. **https://doi.org/10.1016/j.fishres.2023.106897**.

In Review:

Ritchie B, Smeltz TS, **Stewart IJ**, Harris B, Wolf N. Exploring spatial and temporal patterns in the size-at-age of Pacific halibut in the Gulf of Alaska. Ecosphere. In review.

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	**Branch**	**Position Title (Official)**
David T. Wilson, Ph.D.		Executive Director
Andrea Keikkala, M.A.	Finance and Personnel Services	Assistant Director/Branch Manager
Kelly Chapman, B.A.	Finance and Personnel Services	Administrative Coordinator
Tara Coluccio, B.A.	Finance and Personnel Services	Administrative Specialist/Publications
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
William Le	Biological and Ecosystem Sciences	Undergraduate Intern
Barbara Hutniczak, Ph.D.	Fisheries Regulations and Data Services	Branch Manager
Huyen Tran, A.A.	Fisheries Regulations and Data Services	Fisheries Data Coordinator
Tom Kong, B.Sc.	Fisheries Regulations and Data Services	Fisheries Data Specialist (HQ-GIS)
Kimberly Sawyer Van Vleck, B.Sc.	Fisheries Regulations and Data Services	Fisheries Data Specialist (HQ)
Kelsey Magrane, B.Sc.	Fisheries Regulations and Data Services	Fisheries Data Specialist (HQ)
Joan Forsberg, B.Sc.	Fisheries Regulations and Data Services	Otolith Laboratory Technician (Snr)
Christopher Johnston, B.Sc.	Fisheries Regulations and Data Services	Otolith Laboratory Technician
Robert Tobin	Fisheries Regulations and Data Services	Otolith Laboratory Technician
Monica Thom, B.Sc.	Port Operation Services	Port Operations Coordinator
Kayla Ualesi, B.Sc.	Fishery-Independent Setline Survey	Setline Survey Coordinator
Tyler Jack, M.Sc.	Fishery-Independent Setline Survey	Setline Survey Specialist
Rachel Rillera, B.Sc.	Fishery-Independent Setline Survey	Setline Survey Specialist
Kevin Coll, B.Sc.	Fishery-Independent Setilne Survey	Setline Survey Specialist

Fisheries Data Specialists (Field) Port Operations Services	
Name	**Location**
Stephen Brennan	Kodiak, AK
Lisa Crawford	Port Hardy, B. C.
Jessica Marx	Homer, AK
Binget Nilsson	Seward, AK
Ann-Marie Stogrin	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	
Colin Blackie	Francis Maddox
Sean Burns	Margaret McDonald
Nancy Franco	Rodolfo Curralo Moreira
Monica Fezuk	Maurice O'Malley
Allen Dean Gaidica	Silvestre Natario
Peter Jankiewicz	Jeffrey Scott
Gregory Jay	Jon Turnea
Taylan Tolga Koken	Sarah Williamson