INTERNATIONAL PACIFIC HALIBUT COMMISSION

COUNTRY (CANADA/USA)

Report on Groundfish Activities by the International Pacific Halibut Commission (IPHC) in 2025

April 2026

Prepared for the
Canada-United States Groundfish Technical Committee

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1. Executive Summary

Management of the Pacific halibut resource and fishery has been the responsibility of the International Pacific Halibut Commission (IPHC) since its creation in 1923 (Figure 1). Assessing, forecasting, and managing the resource and fishery requires accurate assessments, continuous monitoring, and research responsive to the needs of managers and stakeholders. The fishery for Pacific halibut (*Hippoglossus stenolepis*) is one of the most valuable and geographically largest in the northeast Pacific Ocean. Industry participants from Canada and the United States of America have prosecuted the modern fishery and have depended upon the resource since the 1880s. Annual removals have been as high as 100 million pounds, and the long-term average of removals is 64 million pounds.

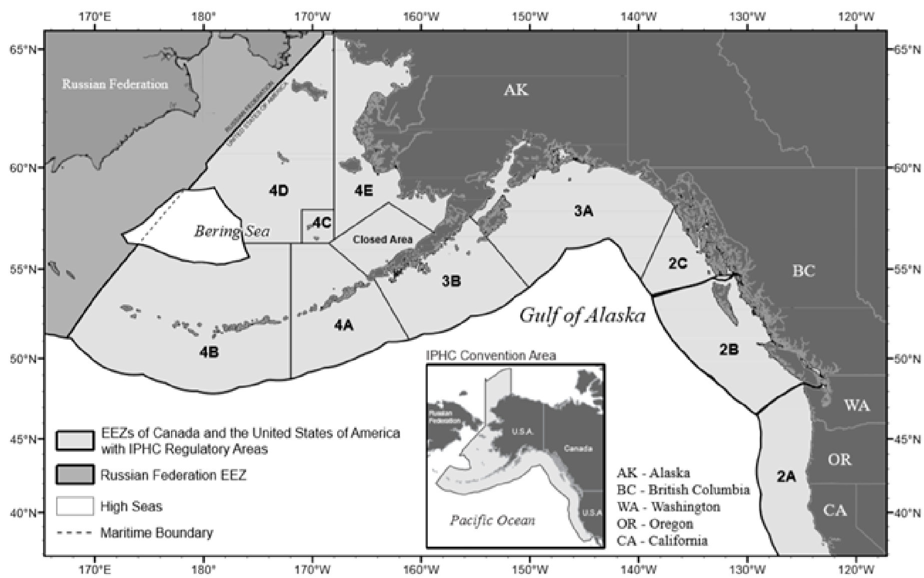


Figure 1. Map of the IPHC Convention Area and IPHC Regulatory Areas.

2. Monitoring

The IPHC's Fishery-Independent Setline Survey (FISS) provides catch information and biological data on Pacific halibut (*Hippoglossus stenolepis)* that are collected independently of the commercial fishery. These data, which are collected using standardized methods, bait and gear during the summer of each calendar year, provide an important comparison with data collected from the commercial fishery. The directed commercial fishery is variable in its gear composition and distribution of fishing effort over time and presents a broad spatial and temporal sampling of the stock. Pacific halibut biological data collected on the FISS (e.g. the size, age, and sex composition) are used to monitor changes in biomass, growth, and mortality in adult and sub-adult components of the Pacific halibut population. In addition, records of non-target species caught during FISS operations provide insight into bait competition, rate of bait attacks, and serve as an index of abundance over time, making them valuable to the assessment, management, and avoidance of non-target species. For details on FISS work conducted in 2025, please refer to the following paper *IPHC Fishery-Independent Setline Survey (FISS) design and implementation in 2025*.

Furthermore, the IPHC collects data each year through ongoing data collection projects that are funded separately, either as part of the FISS or as part of the directed commercial fishery data collection program. Ongoing data collections projects include the following:

IPHC Secretariat aboard National Marine Fisheries Service groundfish trawl surveys in the Gulf of Alaska, Bering Sea and Aleutian Islands

The National Oceanic and Atmospheric Administration (NOAA) Fisheries has conducted annual bottom trawl surveys on the eastern Bering Sea continental shelf since 1979 and the IPHC has participated in the survey on an annual basis since 1998 by directly sampling Pacific halibut from trawl survey catches. The IPHC has participated in the NOAA Fisheries Aleutian Islands trawl survey, which takes place every two years, since 2012. Alternating year by year with the Aleutian Islands trawl survey is the NOAA Fisheries Gulf of Alaska trawl survey, which IPHC has participated in since 1996. The IPHC uses the NOAA Fisheries trawl surveys to collect information on Pacific halibut that are not yet vulnerable to the gear used for the IPHC FISS or directed commercial fishery, and as an additional data source and verification tool for stock analysis. In addition, trawl survey information is useful as a forecasting tool for cohorts approaching recruitment into the FISS or directed commercial fishery.

Sampling of directed commercial landings

The IPHC positions Secretariat to sample the directed commercial landings for Pacific halibut in Alaska, British Columbia, Washington, and Oregon. Sampling of commercial landings involves collecting Pacific halibut otoliths, tissue samples (fin clips) for genetic sexing, fork lengths, weights, logbook information, and final landing weights. The collected data are used in the stock assessment and other research. The collected otoliths provide age composition data and the tissue samples provide sex composition. Lengths and weight data, in combination with age data and sex data, provide size-at-age analyses by sex. Mean weights are combined with final landing weights to estimate catch in numbers. Logbook information provides weight per unit effort data, fishing location for the landed weight, and data for research projects. Finally, tags are collected to provide information on migration, exploitation rates, and natural mortality. In addition to sampling the catch, other objectives include collecting recovered tags, and copying information from fishing logs along with the respective landed weights, for as many Pacific halibut trips as possible throughout the entire season.

Environmental data collection in the IPHC FISS

Since 2009, the IPHC has been collecting environmental data as water column profiles in each station sampled as part of the IPHC FISS. The data collected includes surface to depth profiles of pressure (depth), temperature, conductivity (salinity), dissolved oxygen, pH, and chlorophyl a concentration. From 2009 until 2025, collected environmental data, related metadata and maps of profiled FISS stations are publicly available on the IPHC website (https://www.iphc.int/datatest/data/water-column-profiler-data).

3. Research

Population genomics

Understanding population structure is imperative for sound management and conservation of natural resources. Pacific halibut in US and Canadian waters are managed as a single, panmictic population on the basis of tagging studies and historical (pre-2010) analyses of genetic population structure that failed to demonstrate significant differentiation in the eastern Pacific Ocean. The IPHC Secretariat is currently revising Pacific halibut population structure in IPHC Convention waters using low-coverage whole genome resequencing (lcWGR) methods. For this purpose, the IPHC Secretariat used genetic samples from male and female adult Pacific halibut collected during the spawning (winter) season from known spawning grounds in five geographic areas: Western and Central Aleutian Islands, Bering Sea, Central Gulf of Alaska and British Columbia (Figure 2).

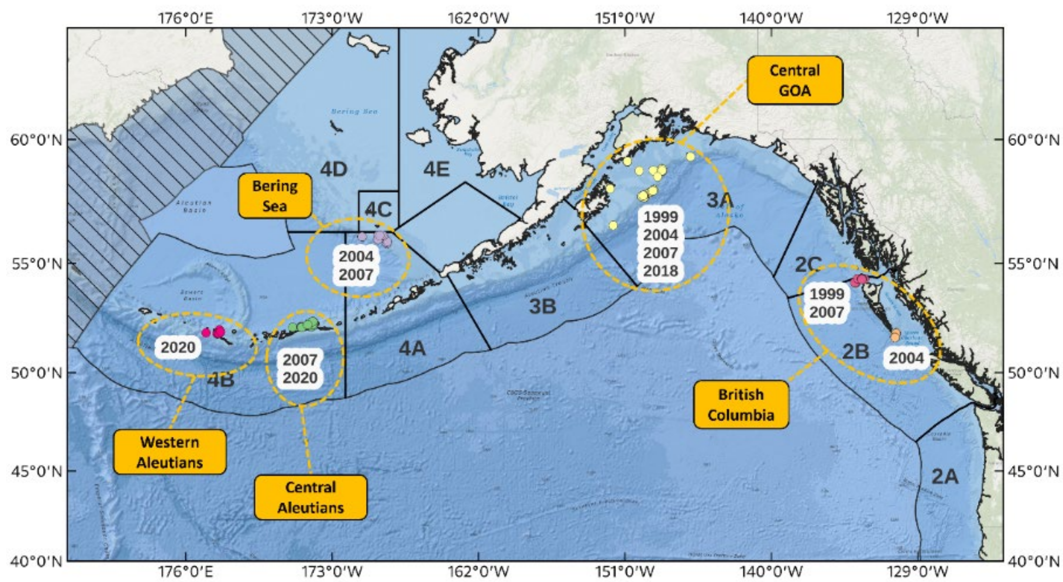


Figure 2. Map of sample collections made during the spawning season used for genomic analysis of population structure in Pacific halibut in the northeast Pacific Ocean.

Temporal replicates at many of these geographic locations are available and have enabled the IPHC Secretariat to evaluate the stability of genetic structure over time, ensuring confidence in the results. As a requisite for the lcWGR approach used, the IPHC Secretariat first produced a high-quality reference genome (Jasonowicz et al., 2022) that has been used to generate genomic sequences from 731 individual Pacific halibut collected from the five above-mentioned geographic areas (Table1).

Table 1. Final sample sizes for each area in the baseline dataset by year of sample collection after a minimum sequencing depth threshold of 1x is applied.

Winter Collections (baseline samples)					
	1999	2004	2007	2018	2020
British Columbia (winter)	59	63	61		
GOA (winter)	61	61	61	60	
Bering Sea (winter)		61	61		
Central AI (winter)			61		61
Western AI (winter)					61

We have identified 8,460,466 Single Nucleotide Polymorphisms (SNPs) in fully assembled autosomal regions of the Pacific halibut genome. Following the removal of 751,285 SNPs in regions of the genome identified as problematic for read mapping and SNPs with a global minor allele frequency (MAF) < 0.05, we retained 3,676,428 SNPs for further analysis. We conducted principal component analysis (PCA) and, after removing 22 outlier samples in the baseline dataset, the results evidenced a single cluster of samples with a large degree of overlap among the geographic areas (Figure 3).

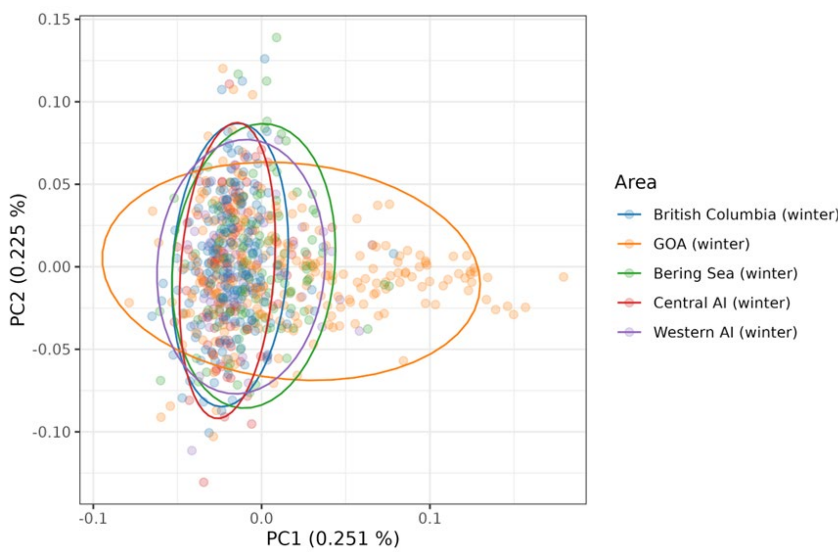


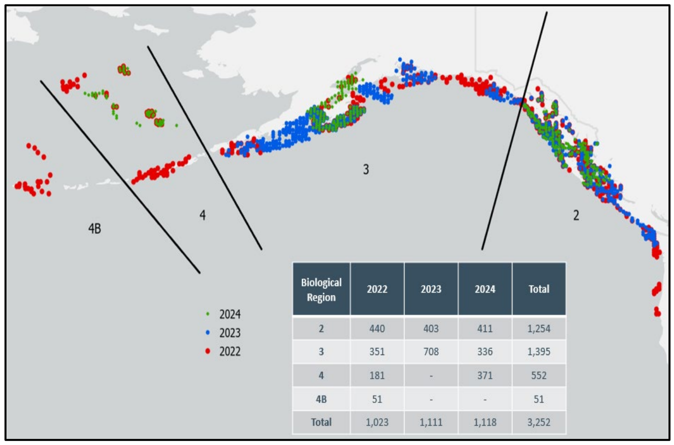
Figure 3. PCA biplot of the first two PC axes for 709 Pacific halibut collected during the spawning season (winter) in IPHC Convention Waters. Individuals are colored by geographic area in all panels with 95% confidence ellipses drawn for each geographic area.

We also conducted assignment testing using the same procedure as previously detailed. With the increased sample sizes afforded by the additional baseline samples, we were able to potentially increase the accuracy of the population specific allele frequency estimates required for conducting individual assignment tests. Nevertheless, our results showed reduced overall assignment accuracy of < 33% when using 5,000 SPNs for the assignment tests.

Our results on Pacific halibut genetic structure are consistent with genetic panmixia despite using very high-resolution genomic methods to characterize genomic variation in spawning groups of Pacific halibut collected over large spatial and temporal scales. From a management perspective, these results support IPHC's current stock assessment practices that model the Pacific halibut stock as a single coastwide unit (Stewart and Hicks 2024).

Revision of maturity schedules for female Pacific halibut

The IPHC Secretariat has conducted studies to revise female Pacific halibut maturity schedules through histological (i.e. microscopic) characterization of maturity. In order to accomplish this, the IPHC Secretariat collected 3,252 ovarian samples for histology in IPHC's Fishery Independent Setline Survey (FISS) from 2022- 2024 throughout the northeastern Pacific Ocean (Figure 4). Ovarian samples were processed for histology and scored for maturity using histological maturity classifications previously developed and used by the IPHC Secretariat (Fish et al. 2020, 2022). Following these, all sampled Pacific halibut females were assigned to either the mature or immature categories. Maturity ogives (i.e., the relationships between the probability of maturity determined by histological assessments and variables including IPHC Biological Region (BR), age, and year) were estimated by fitting generalized additive models (GAM) with logit link (i.e., logistic regression).



Biological Region	2022	2023	2024	Total
2	440	403	411	1,254
3	351	708	336	1,395
4	181	-	371	552
4B	51	-	-	51
Total	1,023	1,111	1,118	3,252

Figure 4. Map of maturity samples for histology collected on FISS from 2022-2024. Red (2022), blue (2023) and green dots (2024) indicate a distinct FISS station in which a sample was collected.

Best-fit logistic GAM model using log(Age) and BR was run for the 2022-2024 samples to compare spatial trends among BRs 2, 3, 4 and 4B (Figure 5). BR2 is estimated to have an A_{50} value (age at 50% maturity) of 10.3 years, In contrast, BR3 is estimated to have the youngest maturing females of all BRs with an A_{50} of 8.7 years. BR4 shows older maturing females with an estimated A_{50} of 12.3 years while BR4B shows the steepest maturity curve (A_5= 8.6, A_{95}= 13.3), indicating a rapid progression in maturity between the ages of 9 and 13.

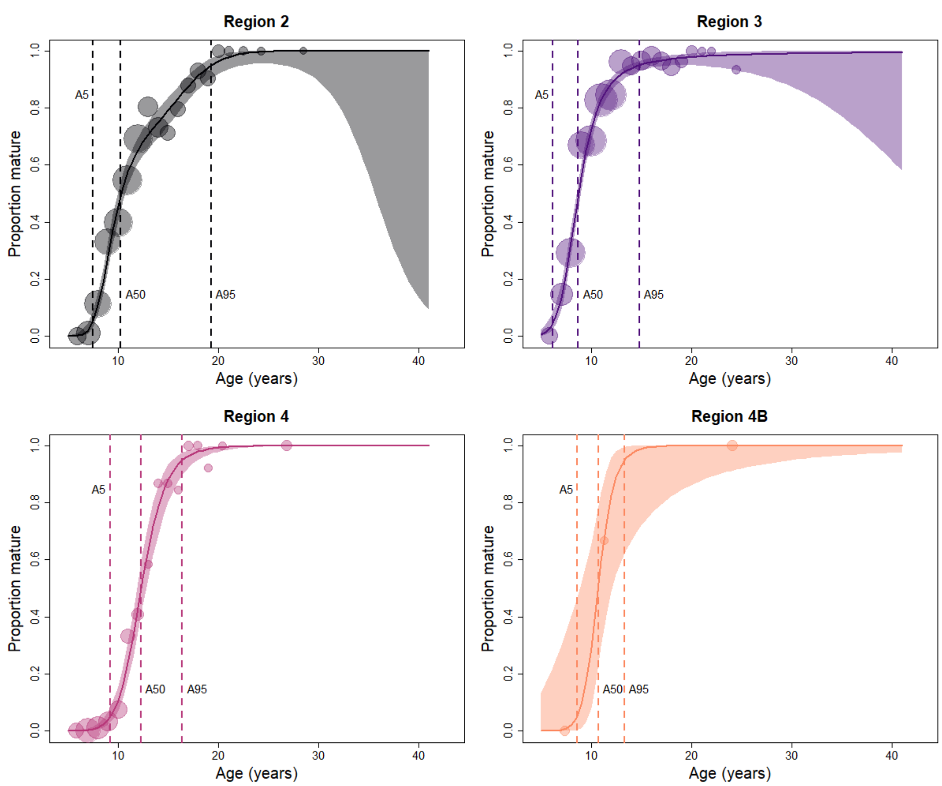


Figure 5. Female Pacific halibut age at maturity by IPHC Biological Region using best-fit logistic GAM. Vertical dashed lines represent the A_5, A_{50} and A_{95} values.

To examine temporal changes in maturity across all BRs, we ran the best-fit logistic GAM with BR and year as factors and plotted the three years of histological data by BR (Figure 6). Overall, there appeared to be a shift to the left in maturity ogives from 2022 to 2024 in the three BRs with at least two years of data with multiple years of data, indicating younger maturing females in 2024 than in 2022 and 2023.

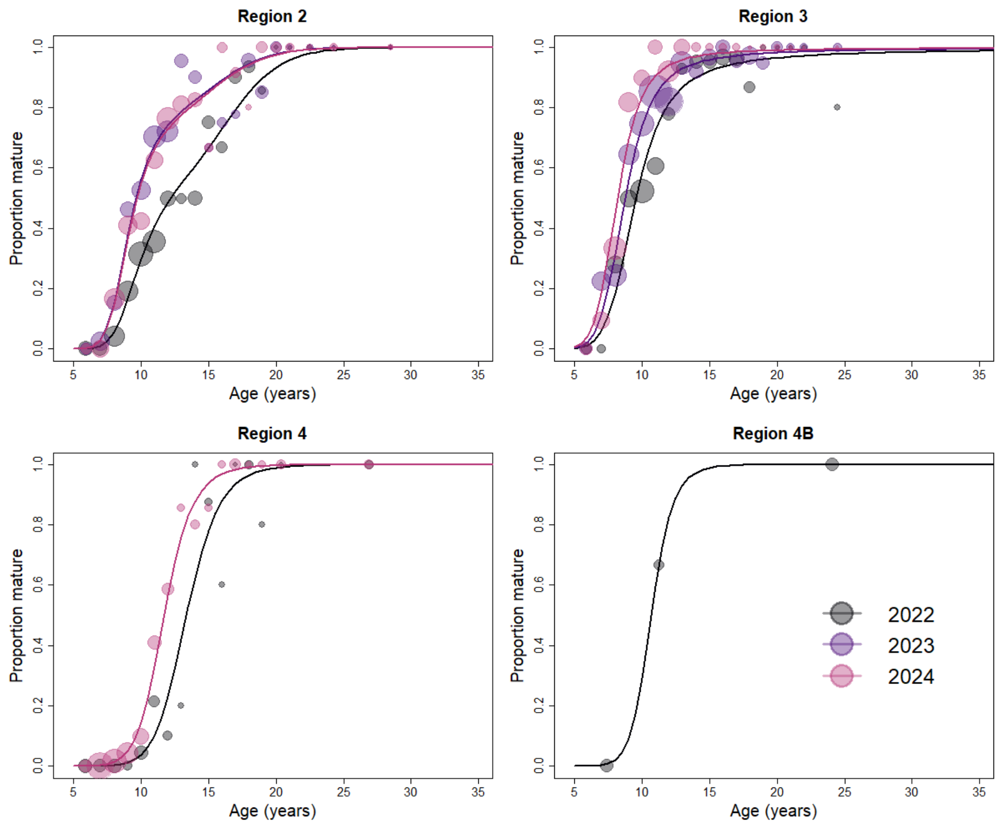


Figure 6. Female Pacific halibut age at maturity by IPHC Biological Region and year using best-fit logistic GAM.

To estimate a coastwide ogive with the 2022-2024 histology-based maturity data, we removed the year effect from the logistic GAM model, pooled all years by BR and estimated maturity curves for each BR. Since sample size was not proportional to population size for each BR, we used the average estimated regional abundance proportions from 2022-2024 from IPHC's space-time modeling of FISS numbers per unit effort (NPUE) data as weights in estimating a coastwide maturity ogive. The coastwide histology-based A_{50} value was 9.8 years (Figure 7; black line), lower than the previous coastwide ogive used in stock assessment (A_{50} = 11.6 years) (Figure 7; red line).

Given that visual (macroscopic) maturity classification data were also collected in 2022-2024 (as has been done in the FISS since 2002), we estimated a visual maturity ogive from the same females used for histology, yielding an A_{50} value of 10.3 years (Figure 7; blue line). We then used these data to establish a calibration between histological and visual maturity curves to apply it to the long-time series of visual maturity data initiated in 2002 and estimate temporal patterns of age at maturity in female Pacific halibut.

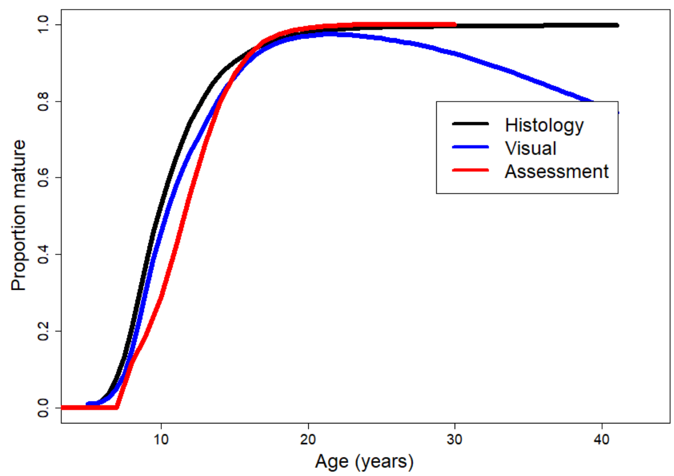


Figure 7. New coastwide maturity ogive generated from 2022-2024 average estimated regional abundance proportions using histological (**black** line) and visual (**blue** line) maturity estimation methods. The previous coastwide ogive (**red** line) is shown for reference.

With the generated calibration, we estimated coastwide calibrated visual maturity ogives for each year from 2002 to 2024 that, when expressed as their A_{50} values, evidenced an early temporal pattern (2005-2015) of increasing values, followed by a sharp decrease from 2016 until 2024 (Figure 8). Studies are planned to identify possible drivers of these temporal shifts in age-at-maturity in female Pacific halibut.

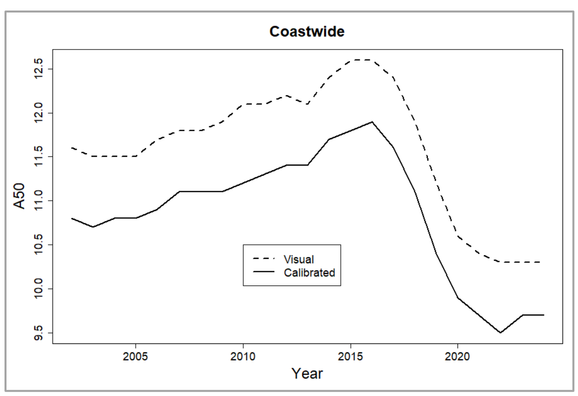


Figure 8. Temporal changes in A_{50} values from coastwide calibrated visual maturity ogives for each year from 2002 to 2024.

A mean coastwide calibrated visual maturity ogive for the 2002-2024 time series was generated by averaging across all three-year rolling data windows (i.e. 2002-2004, 2003-2005, 2004-2006, etc.), yielding an A_{50} value of 11.0 years (Figure 9, overlapping green and black lines) that is 0.6 years lower than that of the visual maturity ogive previously used in SA (A_{50} = 11.6 years; Figure 9, red line). This new coastwide maturity ogive using calibrated visual maturity estimates from the 2002 to 2024 FISS has replaced the previous maturity ogive and has already been incorporated into the 2025 Pacific halibut stock assessment.

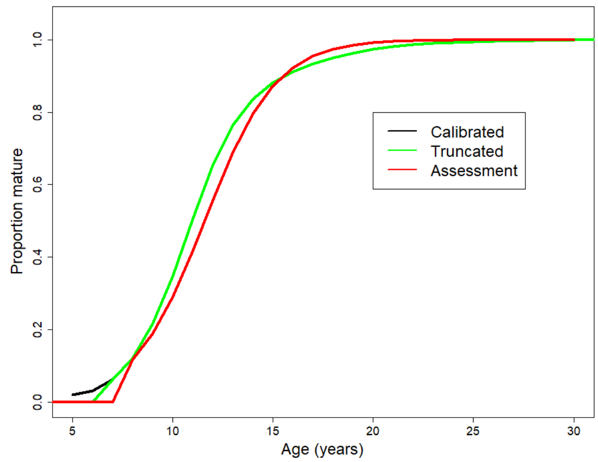


Figure 9. Estimated new mean calibrated visual maturity ogive (green) compared to the previous coastwide ogive (red) used in stock assessments.

Age composition data

The IPHC Secretariat is exploring options to supplement the current Pacific halibut ageing protocol with automated approaches that reduce reliance on extensive otolith-reader training. Current work investigates the use of artificial intelligence (AI) to determine the age of Pacific halibut from images of collected otoliths. This effort includes building a comprehensive database of otolith images with expert-provided age labels derived from previously aged samples. Images are collected under standardized conditions and linked with associated metadata such as collection year, geographic location, and biological information to support model training and evaluation. The initiative aims to improve consistency, efficiency, and scalability of age determination while maintaining compatibility with existing stock assessment processes.

The IPHC Secretariat has tested several deep learning architectures for this task, with preliminary results indicating that a convolutional neural network based on the InceptionV3 architecture currently provides the most reliable performance given the available dataset. The model, trained on otolith images from the IPHC fishery-independent setline survey, achieved an average root mean squared error of approximately 1.8 years, with about 30% of ages predicted exactly and over 70% within ±1 year of expert-assigned ages. A deep-ensemble framework was also implemented to quantify prediction uncertainty and identify samples requiring expert review. While results are promising, model performance declines when applied to data from different years, highlighting the need for ongoing dataset expansion and periodic fine-tuning. The intended application is therefore a hybrid workflow in which AI supports, but does not replace, expert ageing, improving efficiency while maintaining accuracy for stock assessment and management advice.

In addition to the AI-based ageing method described above, the IPHC Secretariat is developing a genomics-based method for estimating the age of Pacific halibut using fin tissue, a sample that can be easily collected from either live or dead individuals. This method is based on the identification of DNA methylation patterns in fin tissue that are associated with age through the development of an age estimation model (i.e., an epigenetic clock) for Pacific halibut. DNA methylation patterns (i.e., a natural process of regulation of gene expression that consists in the covalent modification of the nucleobase cytosine in the genomic DNA sequence) will be investigated by performing genome-wide DNA methylation at single base-pair resolution using reduced representation bisulfite sequencing (RRBS) by leveraging the high-quality genome assembly available for Pacific halibut (RefSeq assembly accession: GCF_022539355.2). RRBS is an efficient and cost-efficient method to identify methylation patterns (i.e. CpG sites) in DNA because it targets bisulfite sequencing to a well-defined set of genomic regions with high CpG density that can be sequenced at high read depth. Age-associated DNA methylation patterns will be modelled to generate an epigenetic age predictor (i.e. epigenetic clock) for Pacific halibut constructed using elastic net penalized regression models that select a group of CpG sites that have a monotonically increasing relationship with age in the selected training data set. By implementing these linear models that select and weight age-correlated CpG sites, chronological age of Pacific halibut will be estimated based on the percentage methylation at these key CpG sites in fin tissue samples.

Fin clips from 250 individuals collected in IPHC's FISS from 2021 to 2024 have selected for the generation of an epigenetic clock for Pacific halibut. These genetic samples correspond to fish with known ages (i.e. read twice by the traditional break and bake aging method) between 6 to 30 years and include 10 individual samples (5 males and 5 females) per year of age. All 250 genetic samples have been processed and submitted for sequencing and, once available, the sequencing data will be analyzed using a bioinformatic platform specifically developed in house for this project.

4. Stock Assessments and Management by Species/Group

Pacific halibut & IPHC Activities

Stock assessment

The 2025 stock assessment produced the following scientific advice regarding the Pacific halibut stock:

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

Fishing intensity*: The 2025 fishing mortality corresponded to a point estimate of SPR = 52%; there is a 19% chance that fishing intensity exceeded the IPHC's reference level of F43%. There is a <1% chance that the 2025 fishing intensity exceeded the Commission's overfishing limit and MSY-proxy of F35%.*

Stock status *(spawning biomass): Current (beginning of 2026) female spawning biomass is estimated to be 166 million pounds (73,300 t), which corresponds to a 28% chance of being below the IPHC trigger reference point of SB30%, and a <1% chance of being below the IPHC limit reference point of SB20%. The stock is estimated to have declined 34% from 2016 to 2024, then increased by 8% to the beginning of 2026. The relative spawning biomass (compared to the biomass projected to be present at the beginning of 2025 in the absence of any fishing) is currently estimated to be 38%, after reaching the lowest point in the recent time series (30%) in 2011. Therefore, the stock is considered to be '****not overfished****'.*

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

***Outlook**: Projections indicate that the spawning biomass would increase in the absence of any fishing mortality, with risks of stock decline over one and three years both less than 1/100. At the status quo coastwide TCEY (29.72 million pounds), risks of stock decrease over one and three years are 15/100 and 18/100. For all harvest levels that exceed the three-year surplus (38.95 million pounds) risks of stock decline are larger than 50/100 and reaching 91/100 for the coastwide TCEY that is projected to correspond to the F35% Overfishing limit/MSY proxy harvest level in 2026. Alternative harvest levels around the status quo (+/- 5 and 10%) are projected to result in levels of fishing intensity ranging from F54% to F48%, at or lower than those estimated in recent years. The reference level of fishing mortality (F43%) corresponds to a TCEY equal to the three-year surplus, which is approximately 30% greater than the current status quo. The probability of a reduction in the coastwide TCEY in order to maintain a fishing intensity no greater than F43% over the next three years is projected to be 53/100.*

For more information on the 2025 stock assessment and the fishery status, please refer to paper IPHC-2026-AM102-10 at the IPHC website.

Management

The IPHC completed the 102nd Session of the IPHC Annual Meeting (AM102) on 22 January 2026 with decisions on total mortality limits, fishery limits, fishing period dates, and other fishery regulation changes. A total of 191 members of the public (113 in-person and 78 remote) attended the meeting.

Meeting documents, presentations, recordings of the sessions, and the report of the meeting are available on the AM100 meeting page at the IPHC website: 102nd Session of the IPHC Annual Meeting (AM102). Decisions arising from this meeting, including management decisions, are documented in the following report: Report of the 102nd Session of the IPHC Annual Meeting (AM102).

Mortality limits

Mortality limits adopted for 2026 represent a 1.3% decrease from 2025.

Table 2: Mortality limits for 2026.

IPHC Regulatory Area	TCEY (mlbs)	TCEY (mt)	Change
2A	1.65	748	0.0%
2B	5.06	2,295	-7.2%
2C	5.22	2,368	0.0%
3A	9.08	4,119	0.0%
3B	2.86	1,297	0.0%
4A	1.34	608	0.0%
4B	1.04	472	0.0%
4CDE	3.08	1,397	0.0%

IPHC Convention Area	**29.33**	**13,304**	**-1.3%**

Other Actions

A Harvest Strategy Policy (HSP) was adopted by the Commission in late 2025. The HSP can be found at https://www.iphc.int/research-monitoring/harvest-strategy-policy. The HSP provides a framework for applying a consistent and transparent science-based approach to setting mortality limits for Pacific halibut (*Hippoglossus stenolepis*) fisheries throughout the IPHC Convention Area while ensuring sustainability of the Pacific halibut population. This document contains principles developed during the Management Strategy Evaluation (MSE) process at IPHC.

The HSP provides a schedule describing tasks of the fishery-independent setline survey (FISS), the stock assessment, and the MSE. Following the triennial full stock assessment, the MSE operating model (OM) is updated, and management procedures (MPs) re-evaluated. The current MSE OM was last conditioned based on the 2022 stock assessment and many updates to the understanding of Pacific halibut dynamics have occurred since then (e.g. maturity). The simulation of management outputs from the stock assessment (i.e. estimation model or EM) in the MSE framework has been implemented up until now using a simplified approach of adding random error to simulated management quantities. A more appropriate approach would be to simulate data and use those in the ensemble stock assessment, but that would increase simulation time beyond a practical point. A compromise is to develop a simplified estimation model to mimic the behaviours of the stock assessment while minimizing the time needed to apply this estimation model in the simulation framework.

Overall, clear communication of MSE results is important so that stakeholders and Commissioners can make informed decisions and implement a harvest strategy policy. For more information on the 2025 MSE work, please refer to paper IPHC-2026-AM102-11 at the IPHC website.

5. Reserves

N/A

6. Data Management

N/A

7. Upcoming Work, Emerging Needs, and Challenges

The approved fishery-independent setline survey (FISS) design for 2026 involves sampling 717 stations in four Biological Regions and seven IPHC Regulatory Areas (2B, 2C, 3A, 3B, 4A and 4B) (Figure 10).

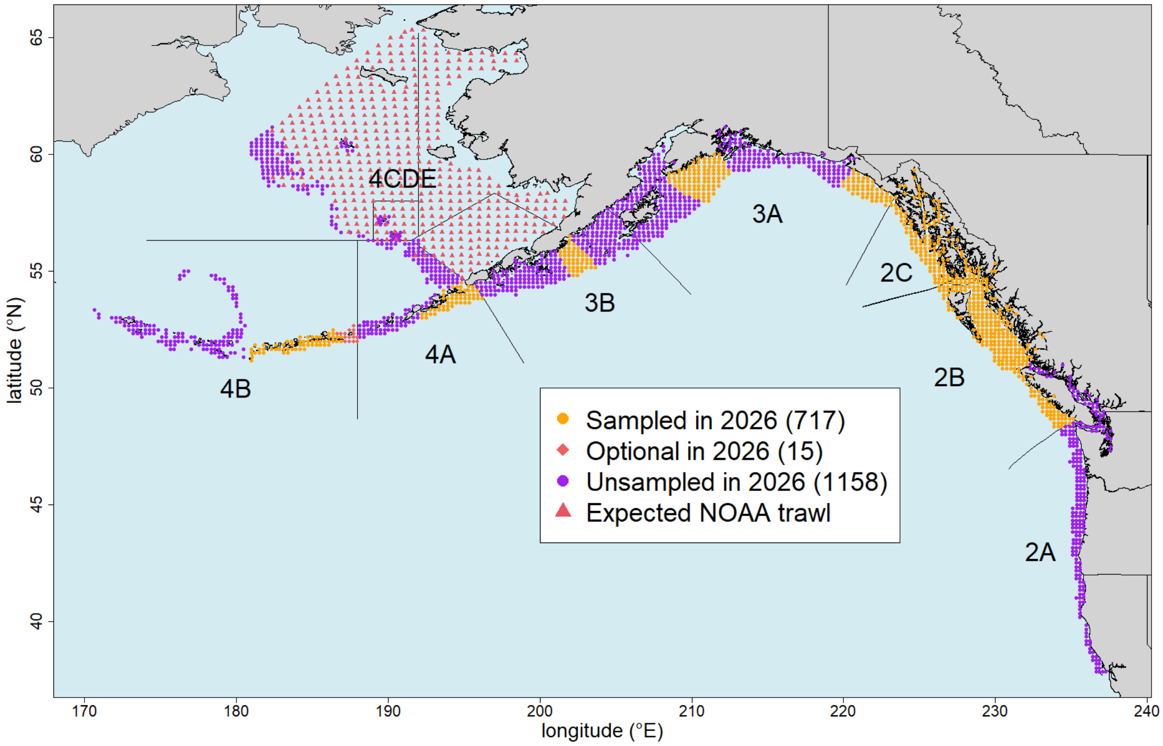


Figure 10. Approved 2026 FISS design.

8. Other Publications

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

Planas JV, Jasonowicz AJ, Simeon A, Simchick C, Timmins-Schiffman E, Nunn BL, Kroska AC, Wolf N, Hurst TP. Molecular mechanisms underlying thermally induced growth plasticity in juvenile Pacific halibut. Journal of Experimental Biology. 2025. 228 (19): jeb-251013. https://doi.org/10.1242/jeb.251013

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

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

9. Agency Contact List

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