Assessment of the Pacific halibut (*Hippoglossus stenolepis*) stock at the end of 2025

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PURPOSE

To provide the Commission with a detailed report of the 2025 stock assessment analysis.

EXECUTIVE SUMMARY

This stock assessment reports the status of the Pacific halibut (*Hippoglossus stenolepis*) resource in the International Pacific Halibut Commission (IPHC) Convention Area at the end of 2025. A summary of the data and assessment results, as well as stock projections and the harvest decision table are provided both on the stock assessment webpage and in the meeting materials for the IPHC's 102nd Annual Meeting (AM102; IPHC-2026-AM102-10; IPHC-2026-AM102-12). The input data files for each model included in this stock assessment are available on the IPHC's stock assessment webpage.

A detailed overview of data sources is provided in a separate document (IPHC-2026-SA-02); only a few key observations are described here. Fishing mortality from all sources in 2025 was estimated to be down 12% from 2024. In addition to the estimated mortality, the assessment includes data from both fishery dependent and fishery independent sources, as well as auxiliary biological information. The 2025 modelled Fishery-Independent Setline Survey (FISS; see IPHC-2026-AM102-08 and IPHC-2026-AM102-09) detailed a coastwide aggregate Numbers-Per-Unit-Effort (NPUE) which decreased by 2% from 2024 to 2025. The modelled coastwide FISS Weight-Per-Unit-Effort (WPUE) of legal (O32) Pacific halibut, the most comparable metric to observed commercial fishery catch rates, was unchanged from 2024 to 2025. Preliminary coastwide commercial fishery WPUE (based on all 2025 logbook records available for this assessment) decreased 1% coastwide. Biological information (ages and lengths) from both the commercial fishery and FISS shows a shift from the 2012 cohort (13 years old in 2025) to the 2016 and 2017 cohorts (9 and 8 years old in 2025, respectively). At the coastwide level, individual size-at-age showed mixed trends, with previously observed increases for younger ages (<11) reversing in some cases but slight improvements in fish aged 12-16.

This stock assessment is implemented using the generalized Stock Synthesis software (Methot and Wetzel 2013). The analysis consists of an ensemble of four equally weighted models: two long time-series models reconstructing historical dynamics back to the beginning of the modern fishery, and two short time-series models incorporating data only from 1992 to the present, a time-period for which estimates of all sources of mortality and survey indices are available for all regions. For each time-series length, there are two models: one fitting to coastwide aggregate data, and one fitting to data disaggregated into the four geographic regions. This combination of models includes uncertainty in the form of alternative hypotheses about several important axes of uncertainty, including natural mortality rates (estimated in all models except the short coastwide time-series model), environmental effects on recruitment (estimated in the long time-series models), and other model parameters. Results are based on the approximate probability distributions derived from the ensemble of models, thereby incorporating the uncertainty within each model as well as the uncertainty among models.

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

(IPHC-2025-SRB026-07, IPHC-2025-SRB027-07) were provided for review at SRB026 (IPHC-2025-SRB026-R) and SRB027 (IPHC-2025-SRB027-R).

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

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

Following the bridging analysis and review by the SRB, all data sources that were preliminary in the 2024 stock assessment were updated, along with the addition of all available data (as of 31 October) from 2025.

The results of the 2025 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 reduced recruitment levels compared to those observed during the 1980s. The spawning biomass (SB) is estimated to have increased gradually to 2016, and then decreased to a low of 153 million pounds (~69,500 t) at the beginning of 2024. At the beginning of 2026, the spawning biomass is estimated to be 166 million pounds (75,300 t) with an approximate 95% credible interval ranging from 113 to 272 million pounds (~51,300-123,600 t). The recent spawning biomass estimates from the 2025 stock assessment are very consistent with those from the 2024 stock assessment, and below terminal assessment estimates for 2021 through 2024. Changes in the estimated scale of recent stock size, caused by the lower-than-expected commercial fishery catch-rates observed in 2023 and 2024, did not occur in the 2025 assessment. Pacific halibut recruitment estimates show relatively large cohorts in 1999 and 2005, followed by much lower average recruitment beginning in 2006, which has led to recent estimated declines in both the stock and fishery yield as these low recruitments have moved into the spawning biomass. Based on age data through 2024, this assessment estimates that the 2012, 2016 and 2017 year-classes are currently the most important in the fishery and survey catches but are only near average when compared to the preceding 15 years.

The IPHC's Harvest Strategy Policy (HSP) uses a relative spawning biomass of 30% as a fishery trigger, reducing the reference fishing intensity if relative spawning biomass decreases further toward a limit reference point at 20%. Below 20%, directed fishing is halted due to the critically low stock status. The relative spawning biomass at the beginning of 2026 was estimated to be 38% (credible interval: 21-57%), slightly higher than the estimate for 2024 (36%). The probability that the stock is below $SB_{30\%}$ is estimated to be 28% at the beginning of 2025, with a 1% chance that the stock is below $SB_{20\%}$. The IPHC's HSP specifies a reference level of fishing intensity (using the Spawning Potential Ratio; SPR) corresponding to an $F_{43\%}$; this equates to the level of fishing that would reduce the lifetime spawning output per recruit to 43% of the unfished level given current biology, fishery characteristics and demographics. Based on the 2025 assessment, the 2025 fishing intensity is estimated to correspond to an $F_{52\%}$ (credible interval: 38-70%). Stock projections were conducted using the integrated results from the stock assessment ensemble, details of IPHC Regulatory Area-specific catch sharing plans and estimates of mortality from the 2025 directed fisheries and other sources of mortality. There is a 15% probability of stock decline in 2026 for the *status quo* level of coastwide mortality. The 2025 "3-year surplus" alternative, corresponds to a TCEY of 39.0 million pounds (17,690 t), and a projected SPR of 43% (credible interval 28-62%); therefore the reference level of fishing intensity (a projected SPR of 43%) corresponds to the same mortality.

Sensitivity and retrospective analyses for each of the four models, as well as a discussion of major sources of uncertainty are also included in this document.

INTRODUCTION

The stock assessment reports the status of the Pacific halibut (*Hippoglossus stenolepis*) resource in the IPHC Convention Area. As in recent stock assessments, the resource is modelled as a single stock extending from northern California to the Aleutian Islands and Bering Sea, including all inside waters of the Strait of Georgia and the Salish Sea, but excludes known extremities in the western Bering Sea within the Russian Exclusive Economic Zone (Figure 1). The Pacific halibut fishery has been managed by the IPHC since 1923. Mortality limits for each of eight IPHC Regulatory Areas[1] are set each year by the Commission. The stock assessment provides a brief summary of recently collected data; a more detailed treatment of data sources included in the assessment and used for other analyses supporting harvest policy calculations is provided in a separate document (IPHC-2026-SA-02) on the IPHC's stock assessment webpage. Results in this document include current model estimates of stock size and trend reflecting all available data. Specific management information is summarized via projections and a decision table reporting the estimated risks associated with alternative management actions. Mortality tables projecting detailed summaries for fisheries in each IPHC Regulatory Area will be reported at the 102nd Session of the IPHC Annual Meeting (AM102) in January 2026.

[1] The IPHC recognizes sub-Areas 4C, 4D, 4E and the Closed Area for use in domestic catch agreements but manages the combined Area 4CDE.

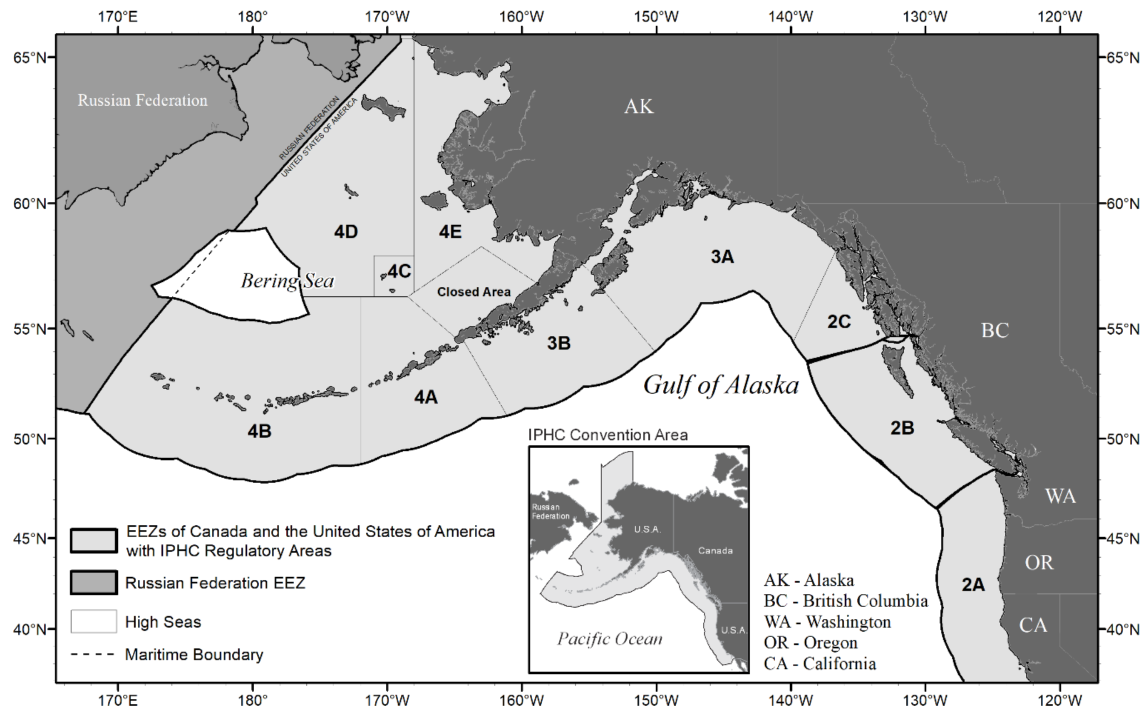

FIGURE 1. IPHC Convention Area (inset) and IPHC Regulatory Areas.

The IPHC's current stock assessment and review process, developed from an *ad hoc* meeting held in 2012 (Stewart et al. 2013), includes a formal SRB process and periodic external independent peer review. The IPHC's SRB meets two times per year: in June to review stock assessment development, and in September to review progress in response to the June review and to finalize the model structure and methods to be used in conducting the year's stock assessment. Within this annual review process two types of stock assessments are produced: 1) updated assessments where new data are added but the methods and model structures remain largely unchanged, and 2) full stock assessments occurring approximately every three years in which model structure and methods are revised to reflect new data, approaches and comments from the SRB and independent review. The 2015 (Stewart and Martell 2016; Stewart et al. 2016), 2019 (Stewart and Hicks 2019; Stewart and Hicks 2020), and 2022 (Stewart and Hicks 2023) stock assessments (IPHC-2023-SA01) were full analyses. This stock assessment represents a full assessment, following updates conducted in 2023 and 2024. The 2025 stock assessment revisited all data sources and structural choices; preliminary results (IPHC-2025-SRB026-07, IPHC-2025-SRB027-07) were provided for review at SRB026 (IPHC-2025-SRB026-R) and SRB027 (IPHC-2025-SRB027-R).

DATA SOURCES

Each year, the data sources used to support this assessment are updated to include the most current and accurate information available to the IPHC. Major reprocessing and development of supplementary data sources was conducted in 2013, 2015, 2019, 2022 and again in 2025. No major changes were made to the standard processing of data sources for 2023 or 2024. For 2025 there were several important improvements made to data sources. These included revisions to the commercial logbook database, a transition to using an updated time-series of PDO anomalies and the replacement of the historical maturity ogive with an updated estimate using improved methods and utilizing data spanning a greater time-period (see IPHC-2026-SA-02 for additional information).

All available information for the 2025 stock assessment was finalized on 31 October 2025 in order to provide adequate time for analysis and modeling. As has been the case in all years, some data are incomplete (e.g. 2025 commercial fishery WPUE, 2025 commercial fishery age composition data) or include projections for the remainder of the year (e.g. 2025 mortality estimates for all fisheries still operating after 31 October). All preliminary data series in this analysis will be fully updated as part of the 2026 stock assessment.

Data for stock assessment use are initially compiled by IPHC Regulatory Area and then aggregated to four Biological Regions: Region 2 (Areas 2A, 2B, and 2C), Region 3 (Areas 3A, 3B), Region 4 (4A, 4CDE) and Region 4B and then coastwide. In addition to the aggregate mortality (including all sizes of Pacific halibut), the assessment includes data from both fishery dependent and fishery independent sources as well as auxiliary biological information, with the most spatially complete data available since the late-1990s. Primary sources of information for this assessment include modelled indices of abundance (IPHC-2026-AM102-09); based on the FISS combined with other surveys (in numbers and weight), commercial fishery Catch-Per-Unit-Effort (weight), and biological summaries from both sources (length-, weight-, and age-composition data). In aggregate, the historical time series of data available for this assessment represents a considerable resource for analysis. The range of relative data quality and geographical scope are also considerable, with the most complete information available only in recent decades (Figure 2). A detailed description of data sources included in the assessment and used for other analyses supporting harvest policy calculations is provided in a separate document (IPHC-2026-SA-02) on the IPHC's stock assessment webpage.

Briefly, known Pacific halibut mortality consists of directed/targeted commercial fishery landings and discard mortality (including research), recreational fisheries, subsistence, and non-directed discard mortality ('bycatch') in fisheries targeting other species and where Pacific halibut retention is prohibited. Over the period 1888-2025, mortality from all sources has totaled 7.4 billion pounds (~3.4 million metric tons, t). Since 1926, the fishery has ranged annually from 29 to 100 million pounds (13,000-45,000 t) with an annual average of 62 million pounds (~28,000 t). Annual mortality was above this average from 1985 through 2010 and has averaged 34.6 million pounds (~15,700 t) from 2021-25, with 2025 representing the lowest mortality in the 100-year period. Coastwide commercial Pacific halibut fishery landings (including research landings) in 2025 were approximately 16.7 million pounds (~7,600 t), down 16% from 2024. Discard mortality in non-directed fisheries was estimated to be 4.6 million pounds in 2025 (~2,100 t) up 6% from 2024 and representing the highest estimate since 2019. The total recreational mortality (including estimates of discard mortality) was estimated to be 5.7 million pounds (~2,600 t) down 10% from 2024. Mortality from all sources decreased by 12% to an estimated 28.8 million pounds (~13,100 t) in 2025 based on preliminary information available for this assessment.

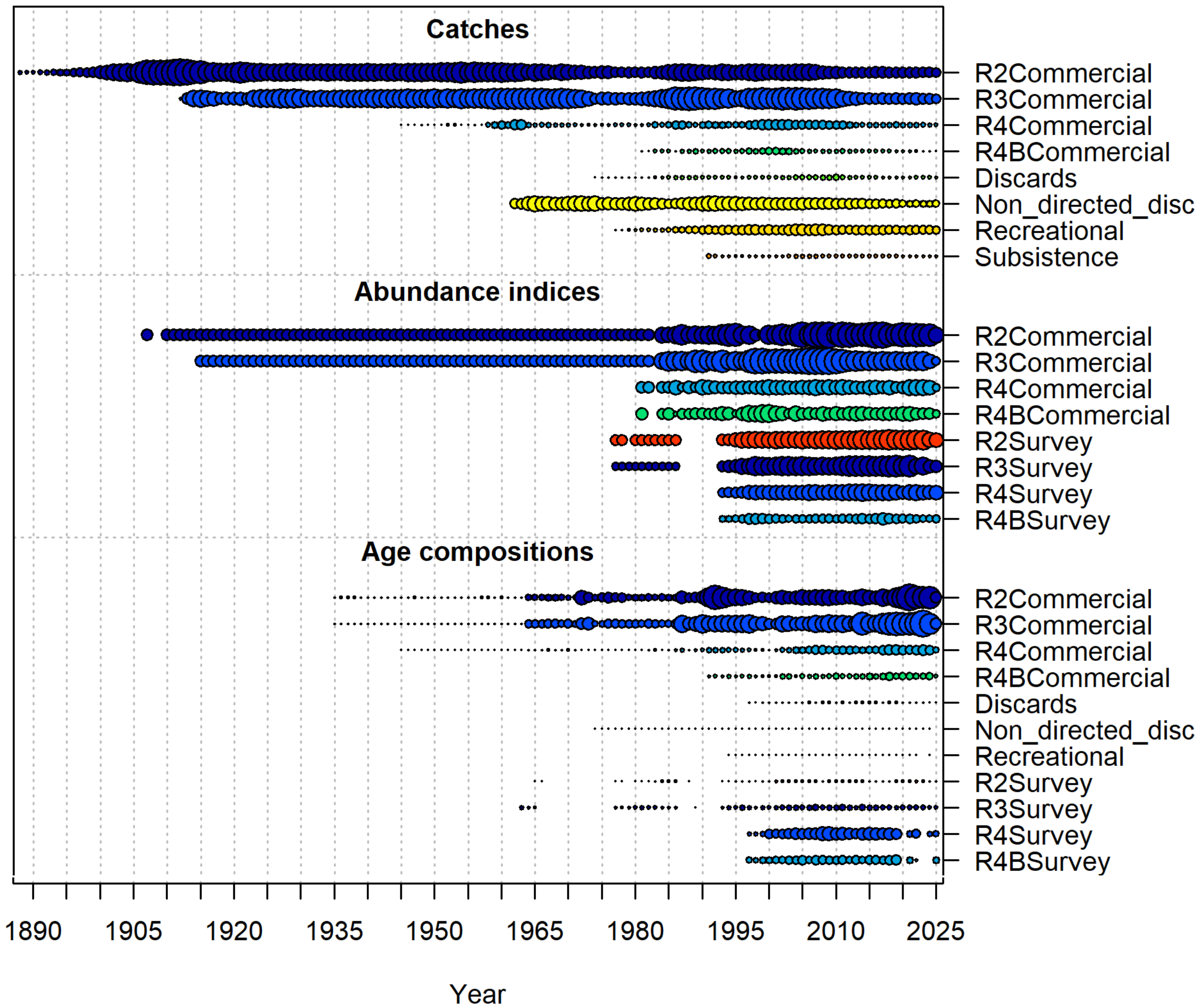

FIGURE 2. Overview of data sources. Circle areas are proportional to magnitude (mortality/catches) or the relative precision of the data (larger circles indicate greater precision for indices of abundance and age composition data).

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

The modelled FISS results for the coastwide Weight-Per-Unit-Effort (WPUE) of legal (O32) Pacific halibut, the most comparable metric to observed commercial fishery catch rates, was unchanged from 2024 to 2025, remaining at the lowest levels observed since the early 1990s. Individual IPHC Regulatory Areas varied from an estimated 7% increase (Regulatory Area 3B) to an 11% decrease (Regulatory Areas 2B and 2C) in O32 WPUE. Preliminary commercial fishery WPUE estimates from 2025 logbooks showed a 1% decrease from 2024 to 2025 at the coastwide level. Trends varied among IPHC Regulatory Areas, fisheries, and gears; however, all areas from 2A to 3B showed decreased CPUE in one or more index, with increases observed in Regions 4 and 4B. All time-series remain near the lowest commercial WPUE observed since the early 1990s. The updated fishery WPUE from previous years has generally shown an additional decrease as additional logbooks were included (on average by around 7%); however, this was not the case in 2024.

Biological information (ages and lengths) from the commercial fishery landings showed that in 2025 the 2016 year-class (9 years old) was the largest coastwide contributor (in numbers) to the fish landed (15%) and there was also a large proportion of 8 year-old fish (the 2017 year class; 14%). This is a shift to younger fish from the 2012 year-class (now 13 years old and 10% in 2025) that comprised the largest proportion of the 2024 landings. The 2005 year-class (now 20 years old) was the primary component in the commercial fishery until 2021 but comprised less than 3.3% of the commercial landings in 2025. The 2016 year-class has been the most numerous in the FISS all-sizes catches for both 2024 and 2025. Recent trawl survey age data also support one or more strong year-classes in 2016-2018. Individual size-at-age trends appear mixed through 2025 with previously observed increases for younger ages (<11) reversing in some cases but slight improvements in fish aged 12-16. Direct estimates of the sex-ratio at age for the directed commercial fishery from 2024 (these data lag one year due to laboratory processing time) showed an average of 78% female (by number) in the landings, up slightly from 2022-23 (75% and 73%).

The population distribution (measured via the modelled all-sizes FISS catch in weight of all Pacific halibut) showed a decrease in Biological Region 2 and increases in the other Regions in 2025. However, values for Regions 2 and 3 remain within the range observed over the last decade. Biological Region 4 increased to the highest proportion of the coastwide stock observed. For Biological Region 4B, the credible intervals for stock distribution are wide (5-11%) relative to its proportion of the stock due to a paucity of recent observations in this region. Survey data are insufficient to estimate stock distribution prior to 1993. It is therefore unknown how historical distributions may compare with recent observations.

STOCK ASSESSMENT

Creating robust, stable, and well-performing stock assessment models for the Pacific halibut stock has historically proven to be problematic due to the highly dynamic nature of the biology, distribution, and fisheries (Stewart and Martell 2014). The stock assessment for Pacific halibut has evolved through many different modeling approaches over the last 40 years (Clark 2003). These changes have reflected improvements in fisheries analysis methods, changes in model assumptions, and responses to recurrent retrospective biases and other lack-of-fit metrics (Stewart and Martell 2014). Although recent modelling efforts have created some new alternatives, no single model satisfactorily approximates all aspects of the available data and scientific understanding. For 2024, an ensemble of four stock assessment models was again used to describe the range of plausible current stock estimates. The ensemble approach recognizes that there is no “true” assessment model, and that a robust risk assessment can be best achieved via the inclusion of multiple models in the estimation of management quantities and the uncertainty about these quantities (Stewart and Martell 2015; Stewart and Hicks 2018). This stock assessment is based on the approximate probability distributions derived from an ensemble of models, thereby incorporating the uncertainty within each model as well as the uncertainty among models. This approach reduces potential for abrupt changes in management quantities as improvements and additional data are added to individual models and provides a more realistic perception of uncertainty than any single model; therefore providing a stronger basis for risk assessment.

This stock assessment is implemented using stock synthesis, a generalized stock assessment software (Methot and Wetzel 2013). The analysis consists of an ensemble of four equally weighted models: two long time-series models, reconstructing historical dynamics back to the beginning of the modern fishery, and two short time-series models incorporating data only from 1992 to the present, a time-period for which estimates of all sources of mortality and survey indices are available for all regions. For each time-series length, there are two models: one fitting to coastwide aggregate data, and one fitting to data disaggregated into the four geographic regions (Areas-As-Fleets; AAF). AAF models are commonly applied when biological differences among areas or sampling programs make coastwide summary of data sources problematic (Waterhouse et al. 2014). AAF models treat the population dynamics as a single aggregate stock, but fit to each of the spatial datasets individually, allowing for differences in selectivity and catchability of the fishery and survey among regions. In addition, the AAF models more easily accommodate temporal and spatial trends in where and how data have been collected, and fishery catches have occurred. This is achieved through explicitly accounting for missing information in some years, rather than making assumptions to expand incomplete observations to the coastwide level.

This combination of models included a broad suite of structural and parameter uncertainties, including natural mortality rates (estimated in three of the four models and fixed in one model), environmental effects on recruitment (estimated in the long time-series models), fishery and survey selectivity (by region in the AAF models), and other model parameters. These sources of uncertainty have historically been very important to the understanding of the stock, as well as the annual assessment results (Clark and Hare 2006; Clark et al. 1999; Stewart and Hicks 2020; Stewart and Martell 2016). The benefits of the long time-series models include historical perspective on recent trends and biomass levels; however, these benefits come at a computational and complexity cost. The short time-series models make fewer assumptions about the properties of less comprehensive historical data, but they suffer from much less information in the truncated data series as well as little context for current dynamics.

Each of the four models in the ensemble was equally weighted, and within-model uncertainty from each model was propagated through to the ensemble results via the maximum likelihood estimates and an asymptotic approximation to their variance. Point estimates in this stock assessment correspond to median values from the ensemble with the simple probabilistic interpretation that there is an equal probability above or below the reported value.

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

COMPARISON WITH PREVIOUS ASSESSMENTS

As in recent analyses, the transition from the 2024 stock assessment to the final 2025 models was performed in a stepwise manner, making changes incrementally to identify which new information had the largest effect on the results. The sequential results of each step were outlined in detail for SRB026 (IPHC-2025-SRB026-07). Starting with the final 2024 stock assessment data, models and results (Stewart and Hicks 2025b; Stewart and Webster 2025), the preliminary analysis included:

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

Generally, the preliminary model changes resulted in a slightly higher level of spawning biomass throughout the time-series than was estimated in the 2024 stock assessment (Figures 3-6; upper panels). Adding the 2025 data had only a minor effect on the spawning biomass time-series, although it did cause all four models to show a slightly increasing trend from 2025 to 2026. Inspection of the recruitment estimates (Figures 3-6; lower panels) shows that the 2025 data increased the estimate of the 2017 cohort relative to the preliminary models.

Comparison of this year's ensemble results with previous stock assessments indicates that the recent spawning biomass estimates from the 2025 stock assessment are very consistent with those from the 2024 stock assessment, and below terminal assessment estimates for 2021 through 2024 (Figure 7). However, each of the previous terminal assessment values lie inside the predicted 50% interval of the current ensemble. The uncertainty is much greater in the 1990s, reflecting the differences among the four individual models, particularly the two short models. The 2025 fishing intensity is estimated to be $F_{52\%}$ (credible interval: 38-70%), very close to the value projected by the 2024 stock assessment (Figure 8).

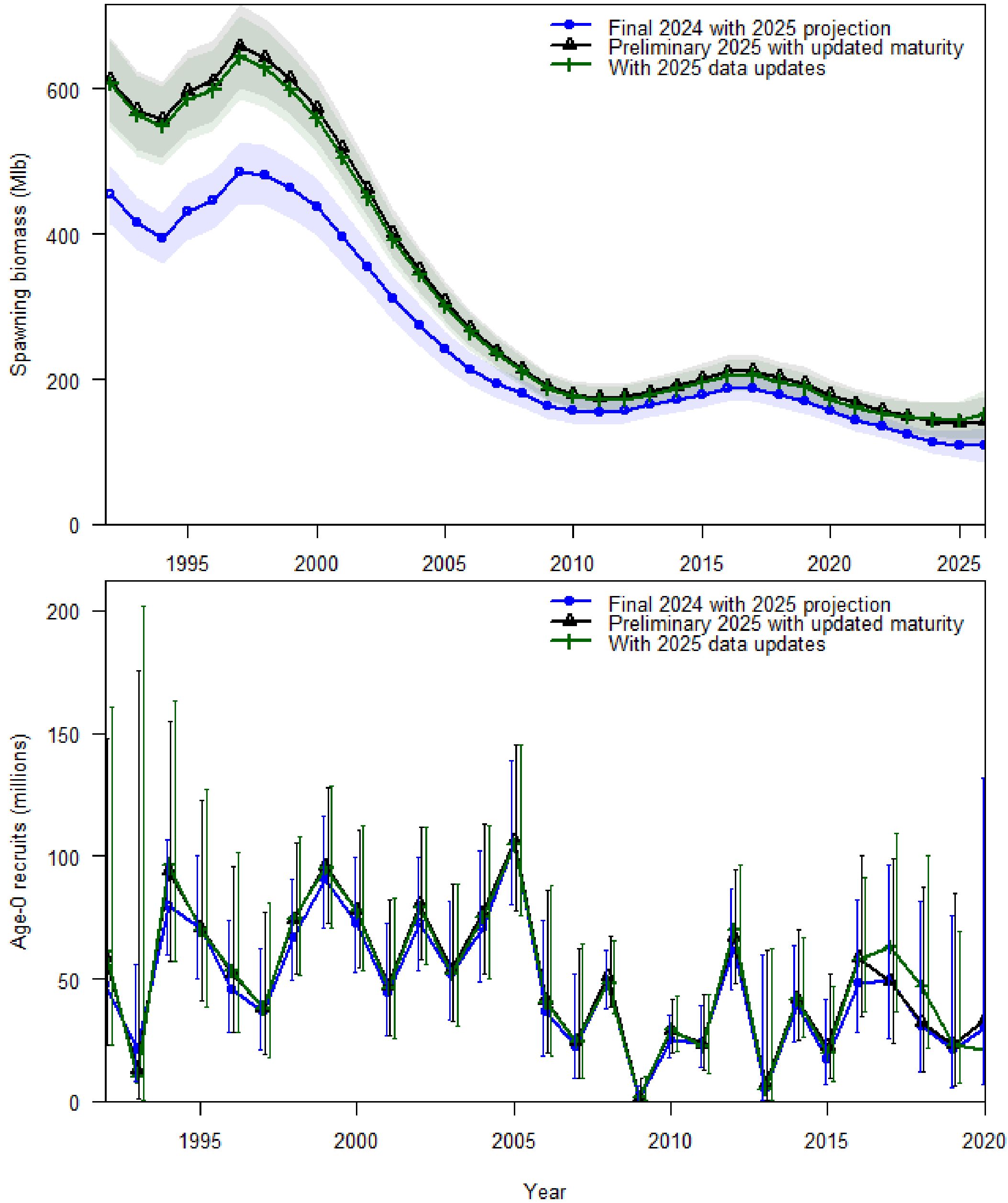

FIGURE 3. Bridging analysis for the coastwide short model comparing the final 2024 stock assessment results with the preliminary 2025 results (without 2025 data) and the final 2025 results.

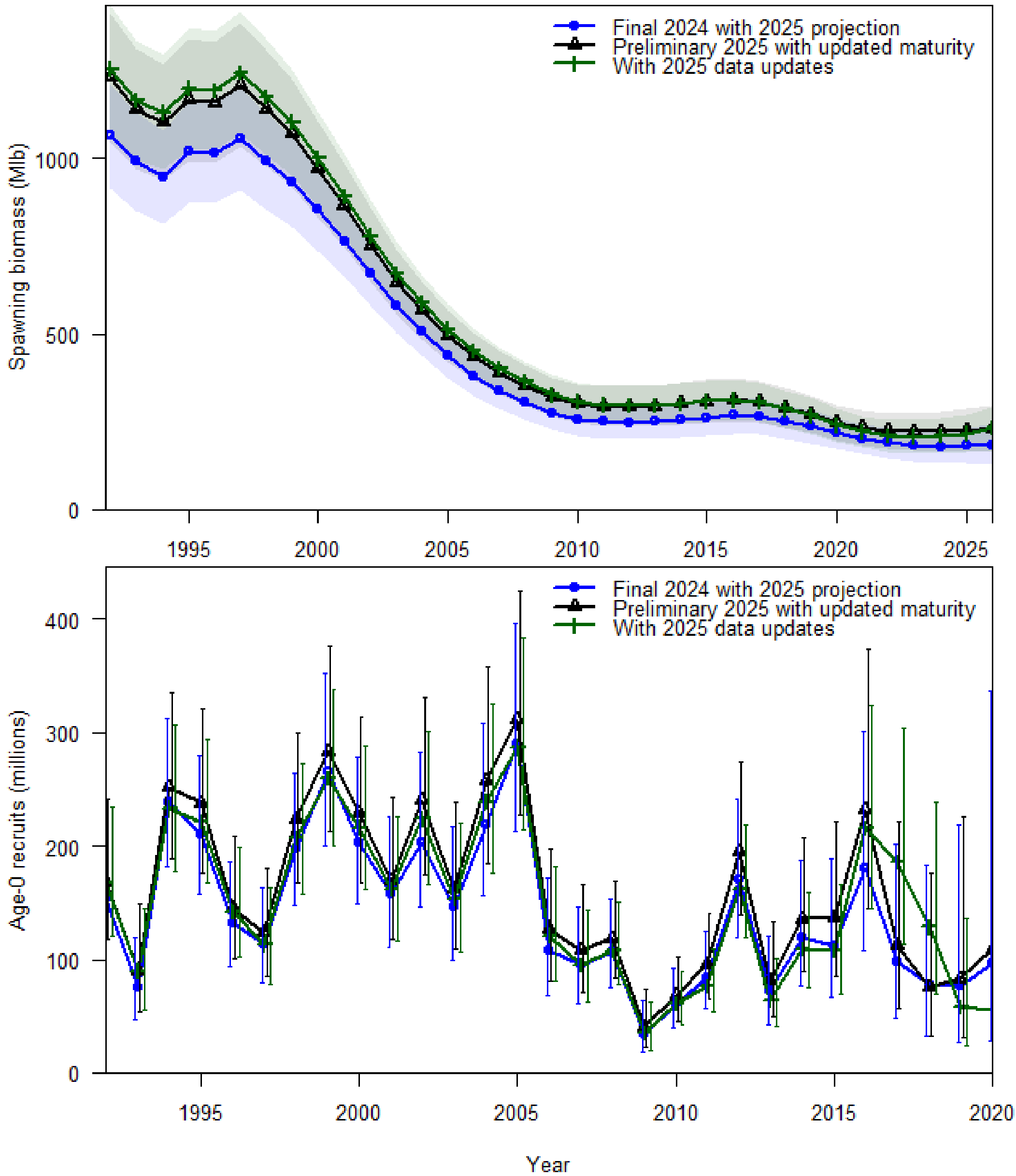

FIGURE 4. Bridging analysis for the AAF short model comparing the final 2024 stock assessment results with the preliminary 2025 results (without 2025 data) and the final 2025 results.

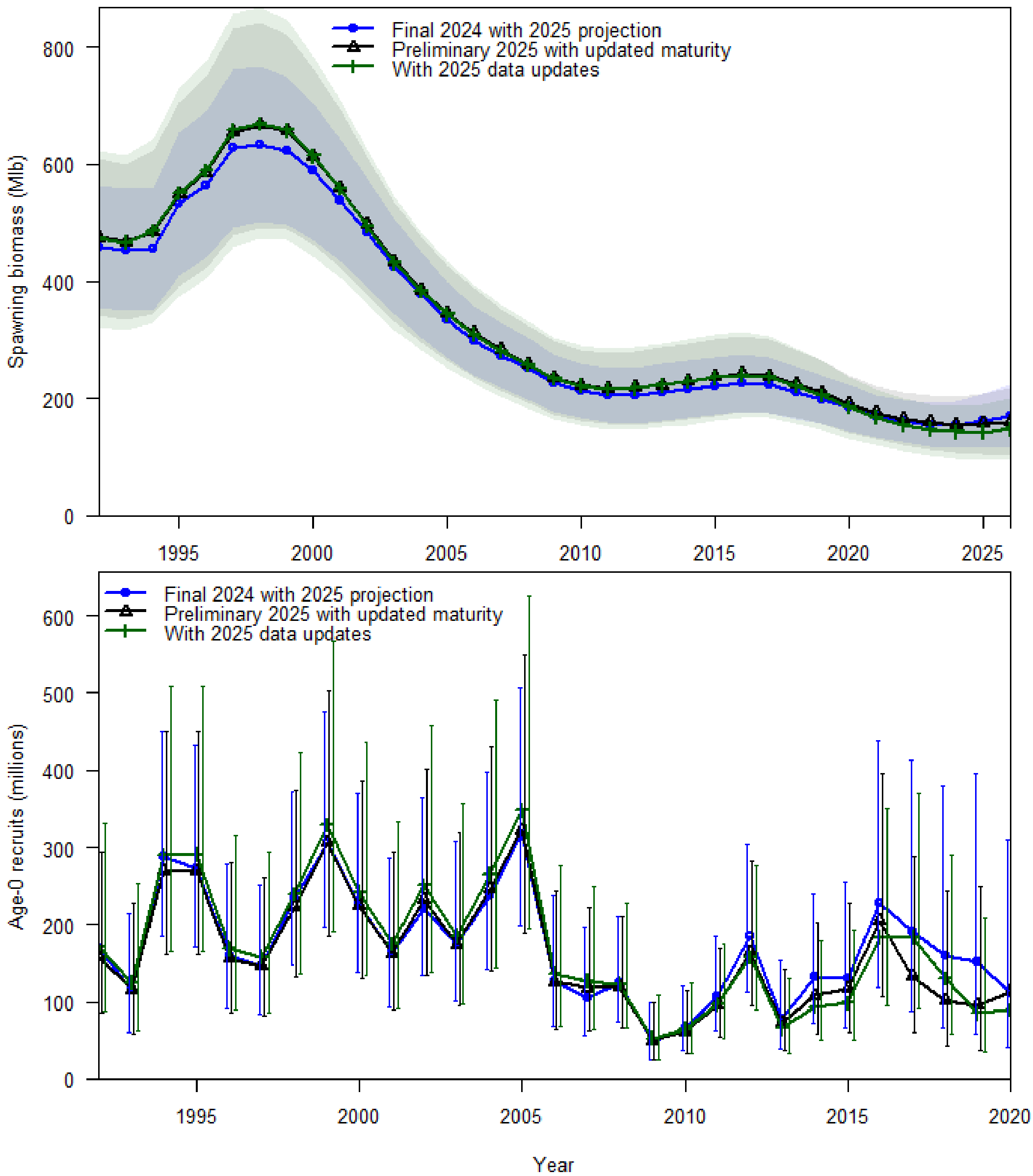

FIGURE 5. Bridging analysis for the coastwide long model comparing the recent final 2024 stock assessment results with the preliminary 2025 results (without 2025 data) and the final 2025 results.

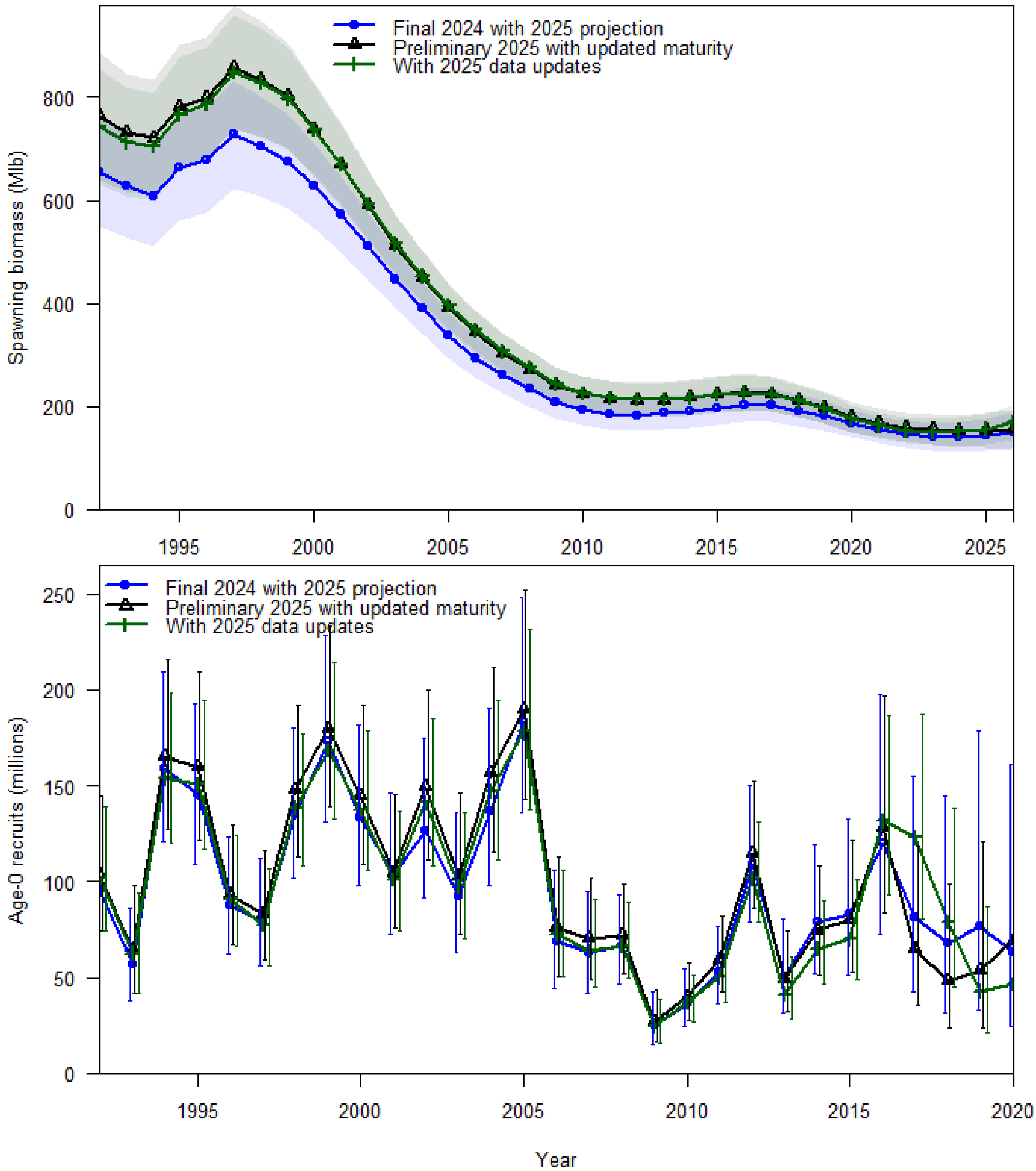

FIGURE 6. Bridging analysis for the AAF long model comparing the recent final 2024 stock assessment results with the preliminary 2025 results (without 2025 data) and the final 2025 results.

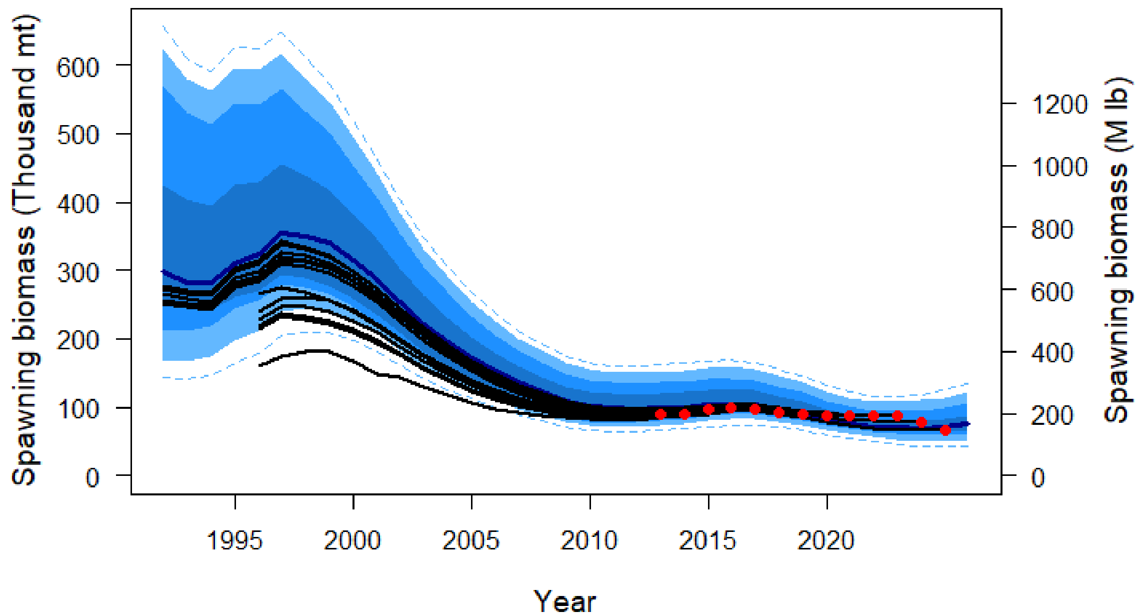

FIGURE 7. Retrospective comparison of female spawning biomass among recent IPHC stock assessments. Black lines indicate estimates from assessments conducted in 2012-2024 with the terminal estimate of the beginning of the year spawning biomass (2013-2025) shown as a red point. The shaded distribution denotes the 2025 ensemble including the terminal spawning biomass in 2026: the dark blue line indicates the median (or "50:50 line") with an equal probability of the estimate falling above or below that level; and colored bands moving away from the median indicate the intervals containing 50/100, 75/100, and 95/100 estimates; dashed lines indicating the 99/100 interval.

BIOMASS, RECRUITMENT, AND REFERENCE POINT RESULTS

Ensemble

The results of the 2025 stock assessment indicate that the Pacific halibut stock declined continuously from the late 1990s to around 2012 (Figure 7, Table 1). That trend is estimated to have been largely a result of decreasing size-at-age, as well as lower recruitment than observed during the 1980s. The spawning biomass increased gradually to 2016 and then decreased to an estimated 153 million pounds (~69,500 t) in 2024. At the beginning of 2026 the spawning biomass is estimated to have increased slightly due to the continued maturation of the 2012 year-class and the onset of maturity of the 2016 year-class. The current spawning biomass estimate is 166 million pounds (75,300 t), with an approximate 95% credible interval ranging from 113 to 272 million pounds (~51,300-123,600 t; Figure 9). The differences among the individual models contributing to the ensemble are most pronounced prior to the early 2000s (Figure 10); however, current stock size estimates also differ substantially among the four models (Figure 11). The differences in both scale reflect the structural assumptions, e.g., higher natural mortality estimated in three models and dome-shaped selectivity for Biological Regions 2 and 3 in the AAF models. All four models indicate a similar recent trend over the last five years.

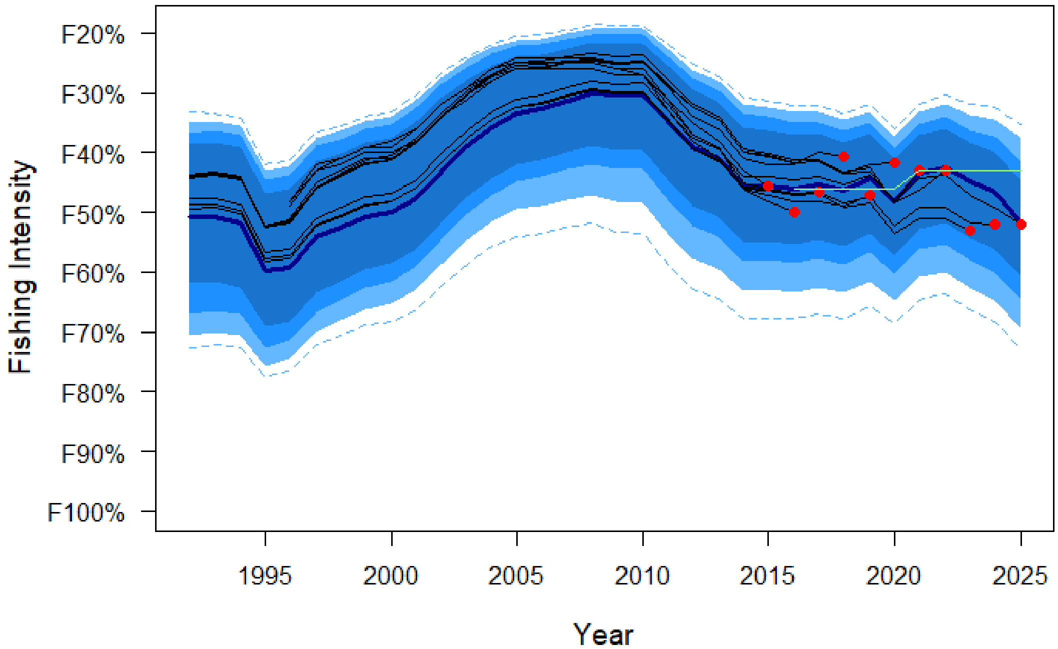

FIGURE 8. Retrospective comparison of fishing intensity (measured as $F_{xx\%}$, where xx% indicates the Spawning Potential Ratio (SPR) or the reduction in the lifetime reproductive output (due to fishing) among recent IPHC stock assessments. Black lines indicate estimates of fishing intensity from assessments conducted in 2014-2024 with the projection for the mortality limit adopted based on that assessment shown as a red point. The shaded distribution denotes the 2025 ensemble: the dark blue line indicates the median (or "50:50 line") with an equal probability of the estimate falling above or below that level; and colored bands moving away from the median indicate the intervals containing 50/100, 75/100, and 95/100 estimates; dashed lines indicating the 99/100 interval. The green line indicates the reference level of fishing intensity used by the Commission in each year it has been specified ($F_{46\%}$ during 2016-2020 and $F_{43\%}$ thereafter).

TABLE 1. Estimated recent median spawning biomass (SB; millions lbs) and fishing intensity (smaller values indicate higher fishing intensity) with approximate 95% credibility intervals, and age-0 recruitment (millions) and age-8+ biomass (millions lbs) from the individual models (CW=coastwide, AAF=Areas-As-Fleets) comprising the ensemble.

					Recruitment				Age-8+ biomass			
Year	SB	SB interval	Fishing intensity ($F_{XX\%}$)	Fishing intensity interval	CW Long	CW Short	AAF Long	AAF Short	CW Long	CW Short	AAF Long	AAF Short
1992	655	374-1374	51%	35-71%	170.6	61.2	101.9	167.7	1732	1273	2179	3414
1993	620	369-1278	51%	35-70%	125.3	10.4	62.7	89	1640	1192	2027	3140
1994	620	383-1239	52%	36-70%	290.3	96.7	154.3	233.5	1594	1130	1931	2939
1995	684	434-1314	60%	43-76%	291.1	70.1	150.6	221.7	2166	1411	2393	3589
1996	714	468-1306	59%	42-75%	168.7	53.3	90.8	142.2	2184	1425	2383	3501
1997	780	528-1358	54%	38-70%	158.6	38.1	77.6	113	2254	1478	2459	3548
1998	774	540-1283	52%	36-68%	239.8	74.5	138.4	207.6	2144	1417	2323	3296
1999	750	533-1203	51%	35-66%	329.1	95.3	168.2	259.9	1986	1303	2142	2991
2000	696	499-1089	50%	34-65%	242.3	77.6	137.3	216.2	1796	1211	1958	2710
2001	633	455-971	48%	31-63%	175.1	46.3	101	162	1585	1047	1743	2379
2002	560	405-848	43%	27-59%	251.8	79.2	141.1	223.9	1504	1009	1627	2206
2003	487	352-731	39%	25-55%	185.9	52.1	97.5	153.2	1437	938	1521	2046
2004	430	311-641	36%	22-52%	265.7	75.3	147.1	239	1307	861	1383	1857
2005	380	275-561	34%	21-49%	348.3	104.8	178.3	287.3	1181	765	1239	1656
2006	336	243-496	33%	21-49%	137.1	40.6	72.8	120.7	1114	719	1162	1556
2007	299	216-442	31%	20-48%	127.1	24.6	63.9	94.8	1116	707	1126	1520
2008	269	193-402	30%	19-47%	123.5	48.4	66.7	107.6	1065	679	1073	1461
2009	241	172-363	30%	19-48%	53.2	1.8	24.6	35.6	966	609	977	1342
2010	225	162-343	30%	19-48%	64.8	29.4	36.9	61.3	935	592	939	1301
2011	217	157-334	35%	23-53%	96.8	22.6	50.3	76.7	885	560	884	1230
2012	215	157-332	39%	26-58%	158.1	70.1	101.5	161.9	890	561	878	1233
2013	216	163-334	41%	28-59%	65.2	5.2	41.3	64.1	951	604	909	1285
2014	220	169-340	45%	32-63%	94.2	41.7	65	109.5	900	584	865	1223
2015	227	177-347	46%	32-63%	98.5	19.7	70	107.7	851	551	821	1151
2016	231	184-351	46%	33-63%	183.7	57.7	131.5	216.1	815	554	790	1105
2017	228	184-343	45%	33-63%	183.7	63	122.8	185.7	741	500	728	1008
2018	215	174-321	46%	35-63%	130.8	46.8	79.1	128.6	673	474	669	926
2019	202	164-301	44%	33-62%	84.9	22.8	42.8	57.9	636	445	629	868
2020	183	147-272	48%	37-65%	89.3	21.1	46.7	55.7	643	480	640	892
2021	169	135-252	43%	33-61%	NA	NA	NA	NA	585	424	595	826
2022	159	125-239	42%	32-60%	NA	NA	NA	NA	550	421	573	805
2023	155	117-238	45%	34-63%	NA	NA	NA	NA	521	386	560	786
2024	153	113-242	47%	34-65%	NA	NA	NA	NA	559	410	616	876
2025	155	110-252	52%	38-70%	NA	NA	NA	NA	593	438	659	928
2026	166	113-272	NA	NA	NA	NA	NA	NA	604	462	673	946

Differences are also apparent in the absolute scale of recent recruitment estimates, primarily as a function of the estimated or fixed value for natural mortality in each model. However, relative recruitments from all four models are much more similar, and show larger year-classes in 1999 and 2005 than in all subsequent years (Figure 12, Table 1). All of these recent recruitments are much lower than the 1987 cohort, and in the two long time-series models they are at or below those in the late 1970s and early 1980s (Figure 13). With the exception of 2012, 2016 and 2017, all cohorts since 2006 have been below the average for the previous decade. This has resulted in declines in both the stock and fishery yield as these low recruitments became increasingly important to the age range over which much of the harvest and spawning takes place. The 2025 stock assessment estimates stronger 2016 and 2017 year-classes than those from 2006 through 2015, except the 2012 cohort. Based on the most recent trend and age data, both the 2016 and 2017 cohorts will be very important to the projected spawning biomass over the next 2-4 years. The 2016 and 2017 year-classes (at ages 8 and 9 in 2025) are still rapidly growing and maturing. All models are estimating a slightly increasing or stable 8+ biomass from a low in 2023 and the ensemble shows a similar pattern in the spawning biomass through the beginning of 2026 (Table 1). Recruitment estimates for 2016 and 2017 are uncertain and those after 2017 remain highly uncertain. Recruitments after 2020 are poorly informed by any direct information from the fishery and survey data.

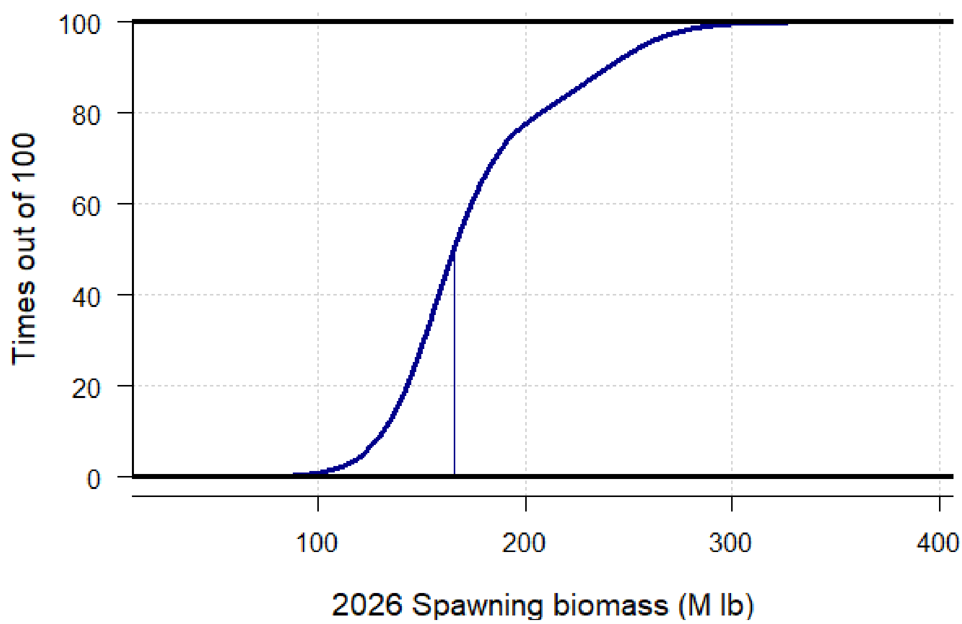

FIGURE 9. Cumulative distribution of the estimated spawning biomass at the beginning of 2026. Curve represents the estimated probability that the biomass is less than or equal to the value on the x-axis; vertical line represents the median (166 million pounds; ~75,300 t).

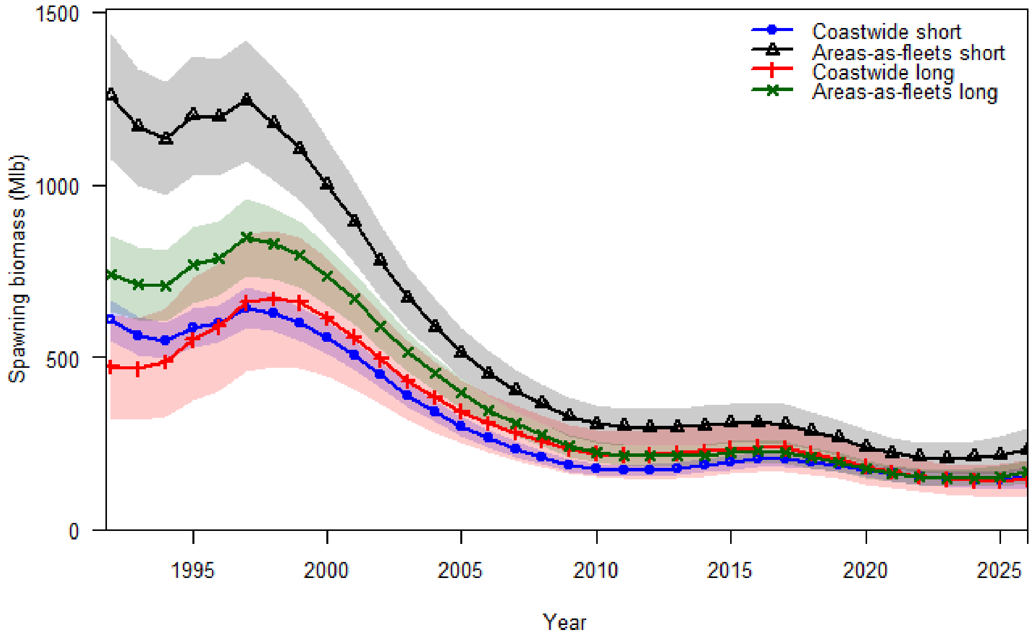

FIGURE 10. Estimated spawning biomass trends (1992-2026) based on the four individual models included in the 2025 stock assessment ensemble. Series indicate the maximum likelihood estimates; shaded intervals indicate approximate 95% credible intervals.

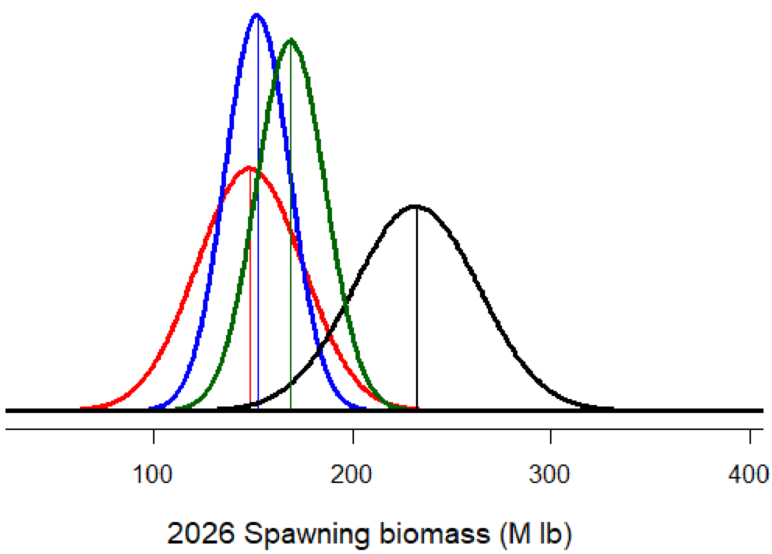

FIGURE 11. Distribution of individual model estimates for the 2026 spawning biomass. Vertical lines indicate the median values.

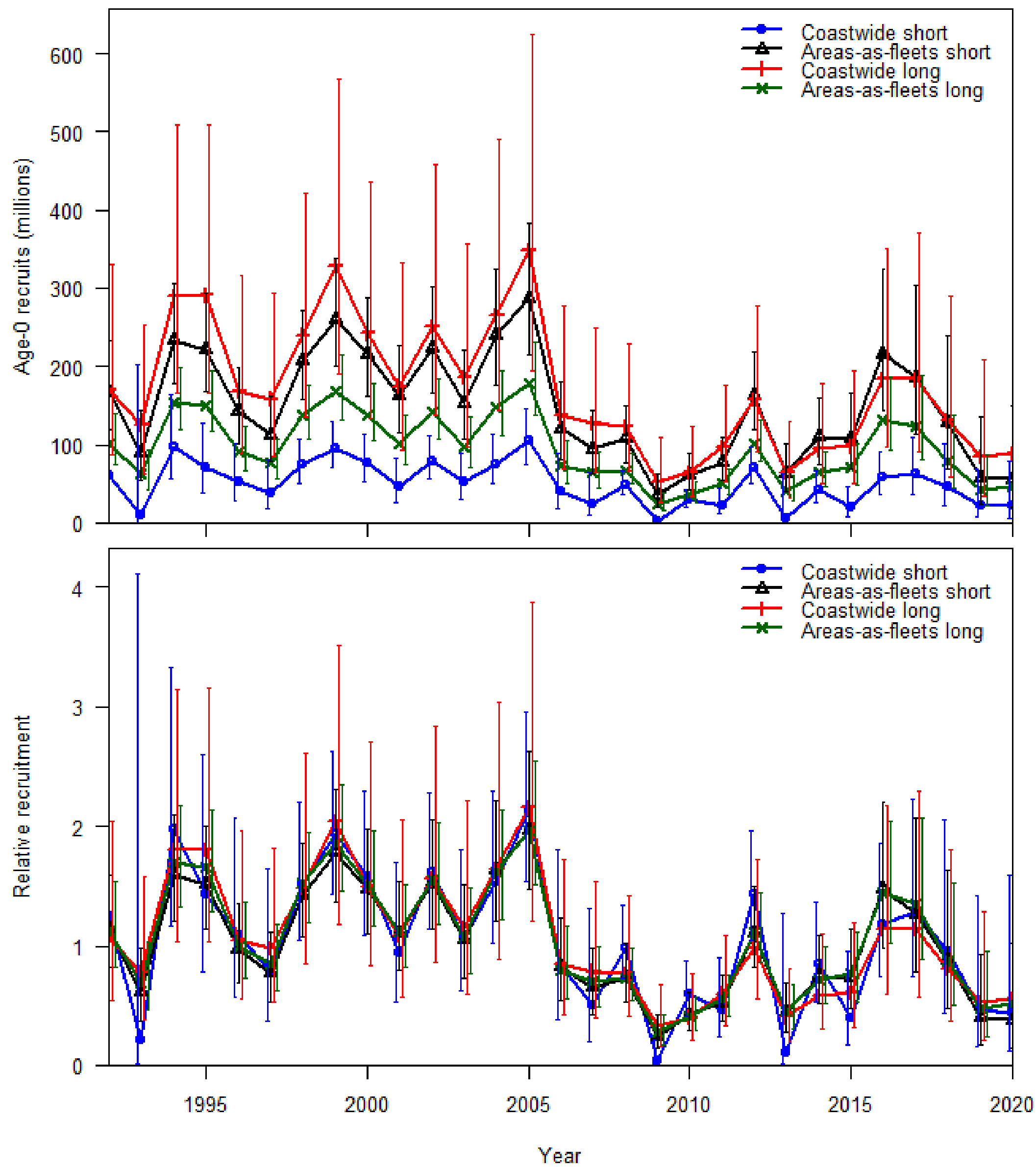

FIGURE 12. Estimated trends in age-0 recruitment (upper panel) and relative recruitment (standardized to the mean for each model over this time-period; lower panel) 1992-2020, based on the four individual models included in the 2025 stock assessment ensemble. Series indicate the maximum likelihood estimates; vertical lines indicate approximate 95% credible intervals.

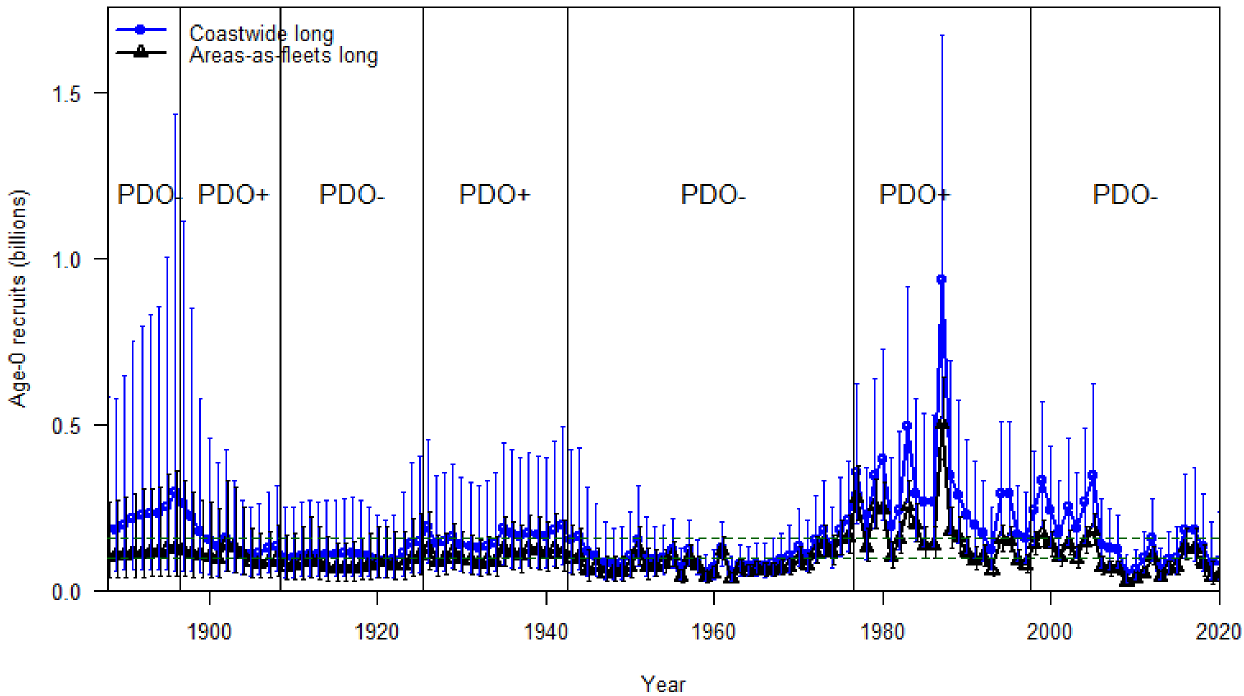

FIGURE 13. Trend in historical recruitment strengths (by birth year) estimated by the two long time-series models, including the effects of the Pacific Decadal Oscillation (PDO) regimes.

Ecosystem conditions

Average Pacific halibut recruitment is estimated to be higher (60 and 54% for the coastwide and AAF models respectively) during favorable Pacific Decadal Oscillation (PDO) regimes (Clark and Hare 2002; Mantua et al. 1997). Based on the revised time-series used in the 2025 stock assessment (IPHC-2026-SA-02), these regimes included positive conditions prior to 1947, poor conditions from 1948-77, positive conditions from 1978-1997, and poor conditions thereafter. Annual averages from 2014 through 2016 were positive, with 2017 to the present showing strongly negative average conditions (data were only available through October for 2025). Although strongly correlated with historical recruitments, it is unclear whether the effects of climate change and other recent anomalous conditions in both the Bering Sea and Gulf of Alaska are comparable to those observed in previous decades (Litzow et al. 2020).

Reference points

The IPHC's harvest strategy (IPHC-2025-HSP) uses a relative spawning biomass of 30% as a trigger, below which the reference fishing intensity is reduced. At a relative spawning biomass limit of 20%, directed fishing is halted due to the critically low stock status. This dynamic calculation is based on recent biological conditions currently influencing the stock and therefore measures only the effect of fishing on the spawning biomass, and not natural fluctuations due to recruitment variability and weight-at-age. The relative spawning biomass decreased continuously over the period 1992-2011 to just above 30% (Figure 14). Since 2016, the relative spawning biomass has increased slightly to 38% at the beginning of 2026 (credible interval: 21-57%). This result indicates that recruitment and size-at-age have generally been more important to the trend in spawning biomass than fishing over the last decade. That the spawning biomass has been decreasing in recent years and the relative spawning biomass has been increasing is not inconsistent: the estimated biomass that would have occurred in the absence of fishing (the denominator of the relative biomass calculation) has also been decreasing, and at a higher rate than the actual estimated spawning biomass (Figure 15). This indicates that recent management actions have eased the effect of fishing on the spawning biomass. The probability that the stock is below the $SB_{30\%}$ level is estimated to be 28% at the beginning of 2026 (Figure 16), with a 1% chance that the stock is below $SB_{20\%}$ (Table 2).

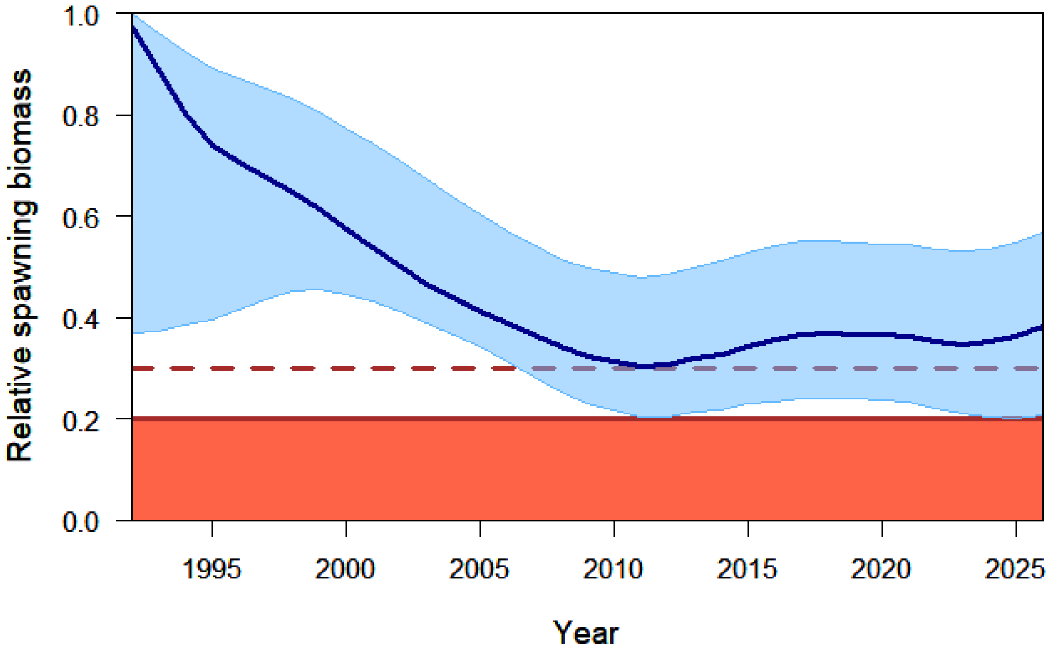

FIGURE 14. Estimated time-series of relative spawning biomass (compared to the unfished condition in each year) based on the median (dark blue line) and approximate 95% credibility interval (blue shaded area). IPHC management procedure reference points ($SB_{30\%}$ and $SB_{20\%}$) are shown as dashed and solid lines respectively, with the region of biological concern ($<SB_{20\%}$) shaded in red.

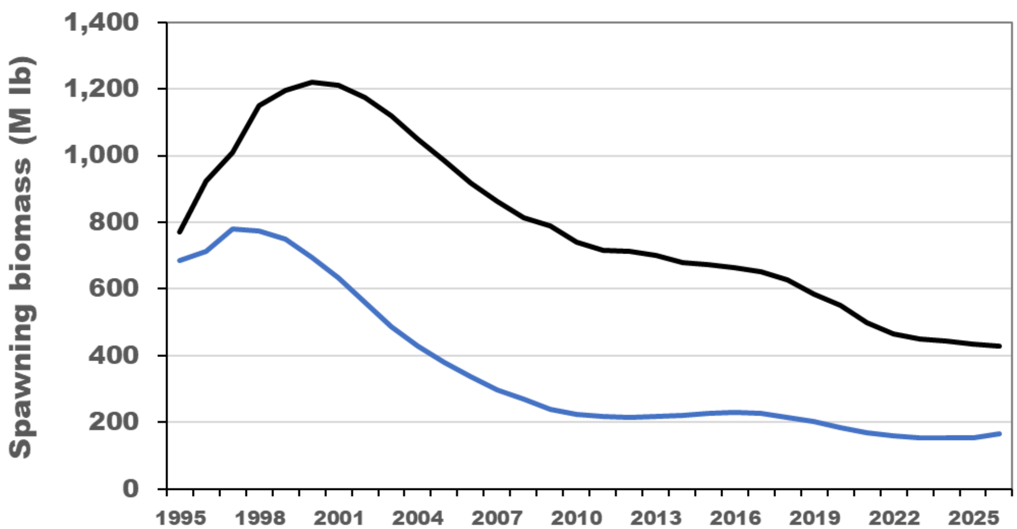

FIGURE 15. Estimated time-series' of spawning biomass (blue line) and estimated spawning biomass in the absence of fishing (black line).

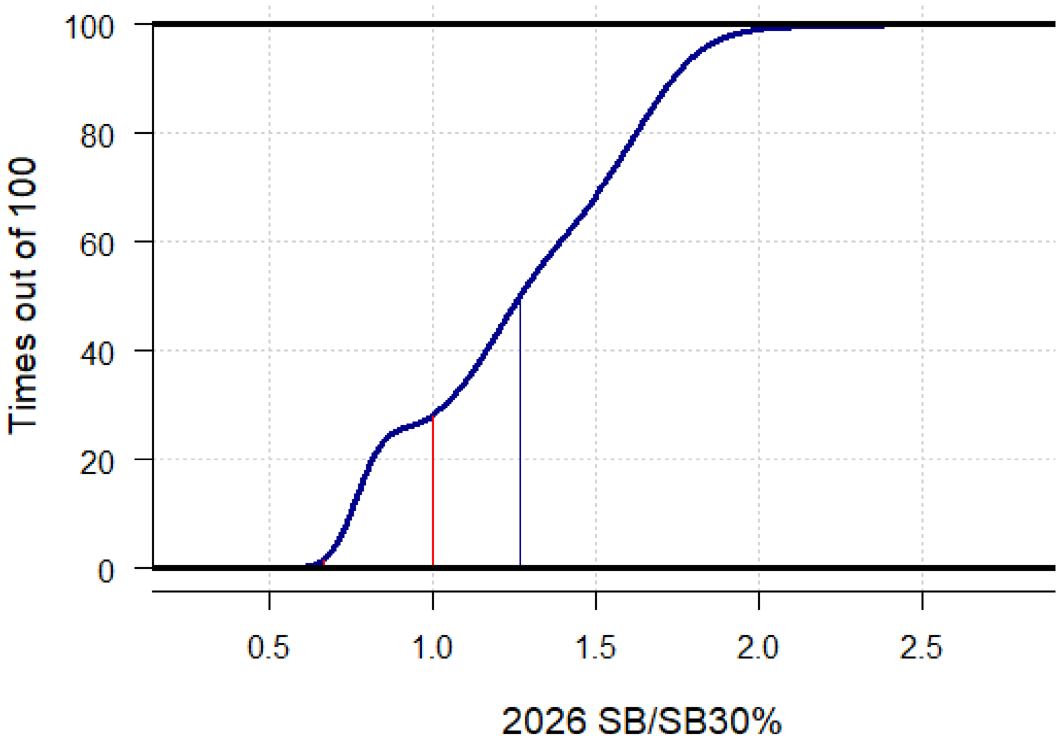

FIGURE 16. Cumulative distribution of ensemble 2026 spawning biomass estimates relative to the $SB_{30\%}$ reference point. Curve represents the estimated probability that the biomass is less than or equal to the value on the x-axis. Vertical lines denote the values corresponding to the fishing intensity trigger and limit in the IPHC's harvest policy (red; $SB_{30\%}$ *and* $SB_{20\%}$), and the median (blue; $SB_{42\%}$).

The IPHC's harvest strategy specifies a reference level of fishing intensity of $F_{43\%}$, based on the Spawning Potential Ratio (SPR; prior to 2021 the reference level was $F_{46\%}$). This reference equates to the level of fishing that would reduce the lifetime spawning output per recruit to 43% of the unfished level given current biology, fishery characteristics and demographics. The historical time-series of fishing intensity is estimated to have peaked in the period from 2004-2011 (Figure 8). From approximately 2014 to 2022 previous and current estimates have fluctuated around reference levels, after which the estimated fishing intensity has declined. The 2025 fishing intensity is estimated to be $F_{52\%}$ (credible interval: 38-70%), below both the current and previous ($F_{46\%}$) reference levels and below both 2023 and 2024. and to have decreased to an estimate of $F_{49\%}$ (credible interval: 30-64%) in 2024 (Figure 17). Comparing the relative spawning biomass and fishing intensity over the recent historical period provides for an evaluation of trends conditioned on the currently defined reference points via a 'phase' plot. The phase plot for Pacific halibut shows that the relative spawning biomass decreased as fishing intensity increased through 2010, then has increased slowly since then (Figure 18).

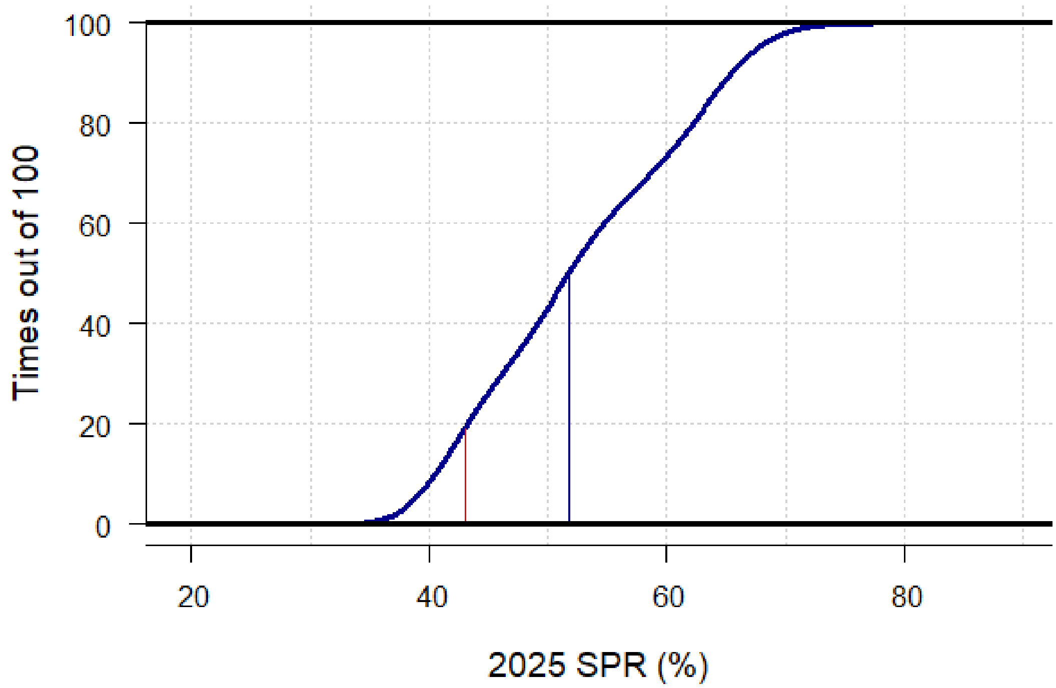

FIGURE 17. Cumulative distribution of the estimated fishing intensity (based on the Spawning Potential Ratio) estimated to have occurred in 2025. Curve represents the estimated probability that the fishing intensity is less than or equal to the value on the x-axis. Vertical lines indicate the reference ($F_{43\%}$; red) and the median value ($F_{49\%}$; blue). The x-axis represents high to low fishing intensity when moving from left to right.

Long time-series models

The two long time-series models provided different perceptions of current vs. historical stock sizes, particularly for the lowest points in the series occurring in the 1930s and 1970s (Figure 19). The AAF model estimates that recent stock sizes are below (50%) those estimated for the 1970s, and the coastwide model above (113%). Relatively large differences among models reflect both the uncertainty in historical dynamics as well as the importance of spatial patterns in the data and population processes, for which all four of the models represent only simple approximations. Recent differences are small, and likely attributable to the separation of signals from each Biological Region (particularly Region 2, with the longest time-series of data), and allowance for different properties in each region's fishery and survey in the AAF models. Historical differences appear to be due to the differing implicit assumptions regarding connectivity between Biological Regions 2-3 and Regions 4-4B during the early part of the 1900s when there are no data available from Regions 4-4B (Stewart and Martell 2016).

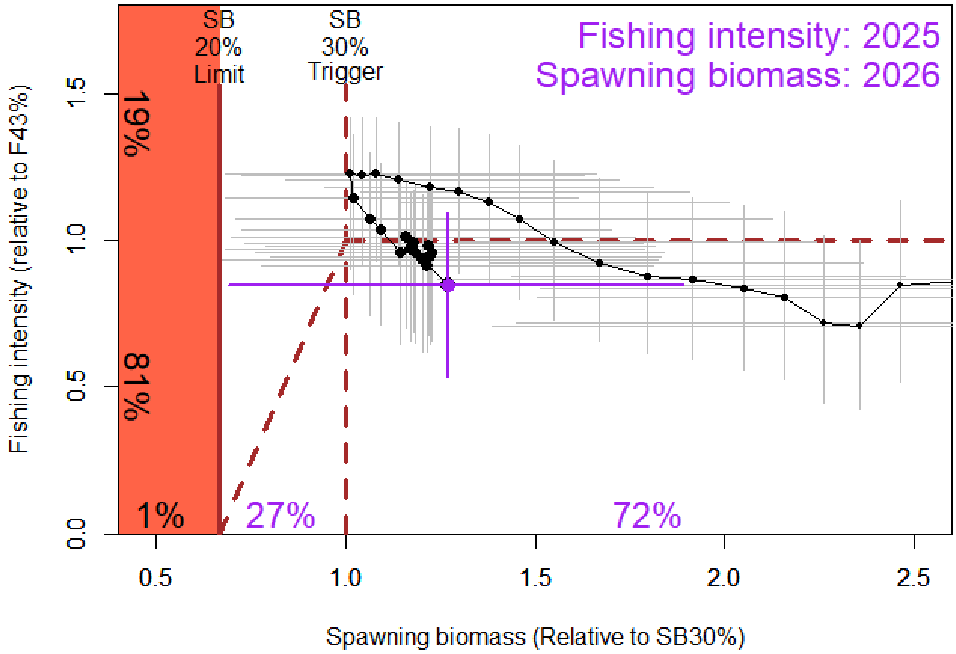

FIGURE 18. Phase plot showing the estimated time-series of spawning biomass (1993-2026) and fishing intensity (1992-2025) relative to the reference points specified in the IPHC's interim management procedure. Dashed lines indicate the current $F_{43\%}$ (horizontal) reference fishing intensity, with linear reduction below the $SB_{30\%}$ (vertical) trigger, the red area indicates relative spawning biomass levels below the $SB_{20\%}$ limit. Each year of the time series is denoted by a solid point (credible intervals by horizontal and vertical whiskers), with the relative fishing intensity in 2025 and spawning biomass at the beginning of 2026 shown as the largest point (purple). Percentages along the y-axis indicate the probability of being above and below $F_{43\%}$ in 2025; percentages on the x-axis indicate the probabilities of being below $SB_{20\%}$, between $SB_{20\%}$ and $SB_{30\%}$ and above $SB_{30\%}$ at the beginning of 2026.

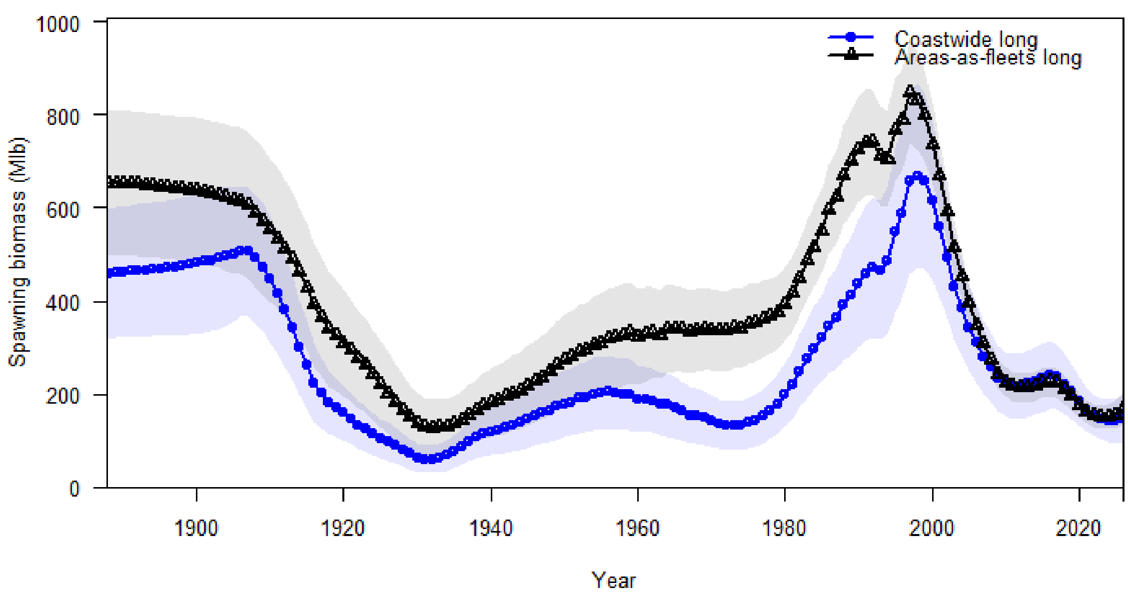

FIGURE 19. Spawning biomass estimates from the two long time-series models. Shaded region indicates the approximate 95% within-model credible interval. The black (upper) series is the Areas-As-Fleets model and the blue (lower) series is the coastwide model.

MAJOR SOURCES OF UNCERTAINTY

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

The 2025 assessment includes eight years (2017-2024) of sex-ratio information from the directed commercial fishery landings. However, uncertainty in historical ratios, and the degree of variability likely present in those historical ratios remains unknown. Additional years of data are likely to further inform selectivity parameters and cumulatively reduce uncertainty in recent stock size moving into the future. The treatment of spatial dynamics (and implicitly movement rates) among Biological Regions, which are represented via the coastwide and AAF approaches, has large implications for the current stock trend, as evidenced by the different results among the four models comprising the stock assessment ensemble. Further, movement rates for adult and younger Pacific halibut (roughly ages 2-6, which were not well-represented in the PIT-tagging study), particularly to and from Biological Region 4 (and especially to and from the Eastern Bering Sea), are important and uncertain components in understanding and delineating between the distribution of recruitment among biological Regions, and other factors influencing stock distribution and productivity. This assessment also does not include mortality, trends or explicit demographic linkages with 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 factors influencing recruitment, size-at-age, and some estimated components of fishery mortality. The link between Pacific halibut recruitment strengths and environmental conditions remains poorly understood, and although correlation with the Pacific Decadal Oscillation is currently useful, it may not remain so in the future. Therefore, recruitment variability remains a substantial source of uncertainty in current stock estimates due to the lack of mechanistic understanding and the lag between birth year and direct observation in the fishery (8+ years) and survey data (6+ years). Reduced size-at-age relative to levels observed in the 1970s has been the most important driver of recent decade's stock productivity, but its cause also remains unknown. Like most stock assessments, fishing mortality estimates are assumed to be accurate. Therefore, uncertainty due to discard mortality estimation (observer sampling and representativeness), discard mortality rates, and any other unreported sources of mortality in either directed or non-directed fisheries (e.g. whale/marine mammal depredation) could create bias in this assessment.

The maturity ogive was updated for the 2025 stock assessment using data from 2002-2024. However, temporal patterns in maturation are still under investigation and will require additional years of data to begin to understand. Unobserved historical variation in maturity will remain a major uncertainty in reconstructing the long-term dynamics of the stock. Further, this assessment relies on the simple assumption that fecundity is proportional to spawning biomass and that Pacific halibut do not experience appreciable skip-spawning (physiologically mature fish which do not actually spawn due to environmental or other conditions). To the degree that maturity, fecundity or skip spawning may be temporally variable, the current approach could result in bias in the stock assessment trends and reference points. New information will be incorporated as it becomes available; however, it may take years to better understand the spatial and temporal variability inherent in these biological processes.

Since 2012, natural mortality has been an important source of uncertainty that is included in the stock assessment. In 2012, three fixed levels were used to bracket the plausible range of values. In 2013, the three models contributing to the ensemble included both fixed and estimated values of natural mortality. In the current ensemble, unchanged since 2022, the four models use both fixed (0.15/year for female Pacific halibut) and estimated values (females in three of the models and males in all four models). Estimates are highly correlated with the relative commercial fishery selectivity of males and females, which is currently estimated based on only eight years of available data. Although this uncertainty is directly incorporated into the ensemble results, uncertainty in female natural mortality in the coastwide short model is not and remains an avenue for future investigation.

The 2025 stock assessment, unlike the 2023 and 2024 assessments, was not sensitive to the addition of new and updated directed commercial fishery data (ages and CPUE). In 2023 these data alone resulted in an 11% decrease in the scale of the current spawning biomass estimate; in 2024 this effect was 17%. It is unclear whether this issue is resolved due to better correspondence in the information coming from the FISS and the commercial fishery, and whether it may arise again in future assessments. Until comprehensive FISS designs have been implemented for several consecutive years, the potential for biased information will be unknown.

This stock assessment contains a broad representation of uncertainty in stock levels when compared to analyses for many other species. This is due to the inclusion of both within-model (parameter or estimation uncertainty) and among-model (structural) uncertainty. Due to the many remaining uncertainties in Pacific halibut biology and population dynamics, a high degree of uncertainty and natural variability in both stock scale and trend will continue to be an integral part of an annual management process, which can result in variable mortality limits from year to year. Potential solutions to reduce the inter-annual variability in mortality limits include management procedures that utilize multi-year management approaches and/or constraints on the inter-annual change in the TCEY. These may be tested with the MSE framework (IPHC-2026-AM102-11).

CONVERGENCE, SENSITIVITY AND RETROSPECTIVE ANALYSES

Basic convergence checks applied to all models included successful calculation of the Hessian matrix, checks for reasonable uncertainty in and correlations among estimated model parameters and tracking of results through sequential model or data changes to ensure plausible results. Final model runs were further evaluated via running models from a wide range of starting values ('jittering', using at least 100 different starting points), and ensuring that no model discovered a better likelihood than was used to produce the final assessment results. Convergence to the maximum likelihood estimate varied from 46-70% indicating that the starting points were sufficiently over-dispersed to provide a solid test for alternative minima.

The bridging analysis (Figures 3-6) illustrates the relative insensitivity of the 2025 stock assessment to the most recent data and the degree of change associated with the full re-evaluation of the model and data that went into the preliminary assessment. The large differences in the scale of the spawning biomass in the historical period between the two long time series models shows the effect of differing assumptions about the connectivity of the stock via spatial availability (Figure 19). As part of the preliminary 2025 assessment (IPHC-2025-SRB026-07) a wide range of alternate model configurations and sensitivity analyses were conducted. These included:

- whether the PDO was used a covariate to recruitment, the fixed value for steepness of the stock-recruitment relationship,

- the value of female natural mortality used in the coastwide short model,
- the updated maturity ogive and whether it was truncated (below the age at which the youngest mature fish has been observed) or not, and
- the effects of large and unobserved whale depredation on recent recruitment.

Results of these and other sensitivity analyses conducted in recent years support the prioritization of fecundity and skip spawning as a high priority topic of research.

To illustrate the effects of sequentially adding data, separate from all other model changes and data updates, retrospective analyses were performed for each of the individual models contributing to the assessment. This exercise consists of sequentially removing the terminal year's data and rerunning the assessment model. Therefore, the retrospective for this year's assessment includes seven 'peels', each cumulatively removing one year of data (2025, 2024-2025, 2023-2025, 2022-2025, 2021-2025, 2020-2025, and 2019-2025). As the current models rely on commercial sex-ratios-at-age which are only available from 2017-2024, this leaves at least 2 years (2017-2018) of these data in the largest peel, consistent with the first use of these data in the 2019 stock assessment. As data accumulate since this change in model structure, the retrospective analyses will be more informative of recent data effects rather than being affected by the lack of information to inform selectivity differences.

The retrospective analysis revealed that spawning biomass time series for each of the four stock assessment models changed differently in each model as the terminal year's data were removed (Figures 22-25). The AAF short and long models both showed a negative pattern in the scale of spawning biomass estimates over most retrospective years with some years falling outside the current credible interval. The coastwide long model showed a pattern in the recent trend, although this pattern reversed between peels 5-7 and 2-4 with all years still contained in the current credible intervals. The coastwide short model showed a positive trend in biomass over peels 5-7 and little trend thereafter. Removing recent years of data leaves only a small amount of information with which to estimate differences in male and female selectivity; the retrospective results highlight the ongoing need for additional observations of the sex-ratio of commercial fishery landings. The second clear result from the retrospective analysis was the effect of recent data on the magnitude of the estimated 2012 year-class. This cohort is better informed by each year of additional data and the estimated magnitude increased across the model runs in the early years and then decreased with the addition of the 2023-2025 data (Figures 22-25; lower panels). Similarly, the 2016 and 2017 year-class estimates have generally increased with additional years of data.

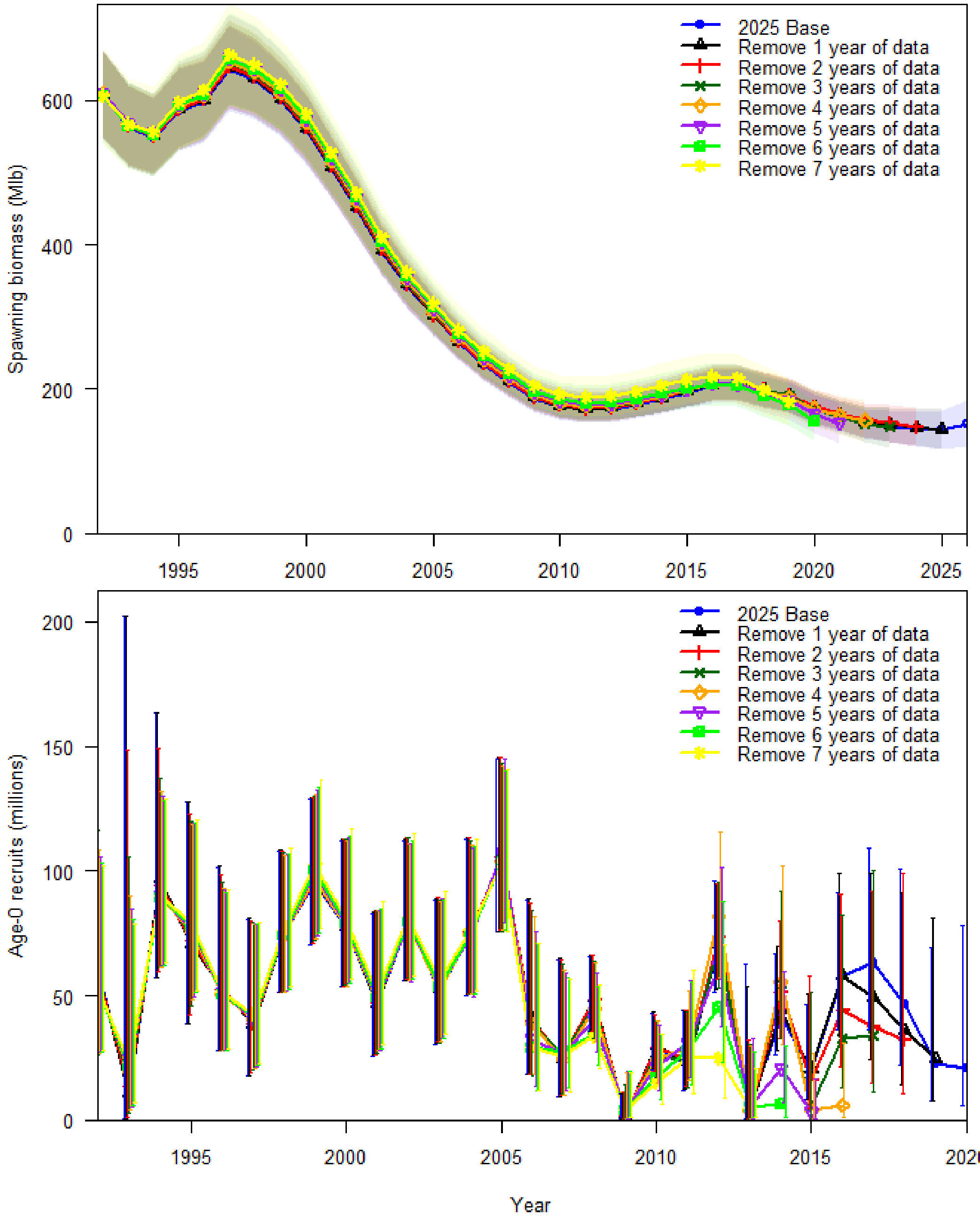

FIGURE 24. Spawning biomass (top panel) and recruitment (bottom panel) estimates from a retrospective analysis sequentially removing terminal years of data from the coastwide short model. Shaded regions and vertical whiskers indicate approximate 95% within-model credible intervals.

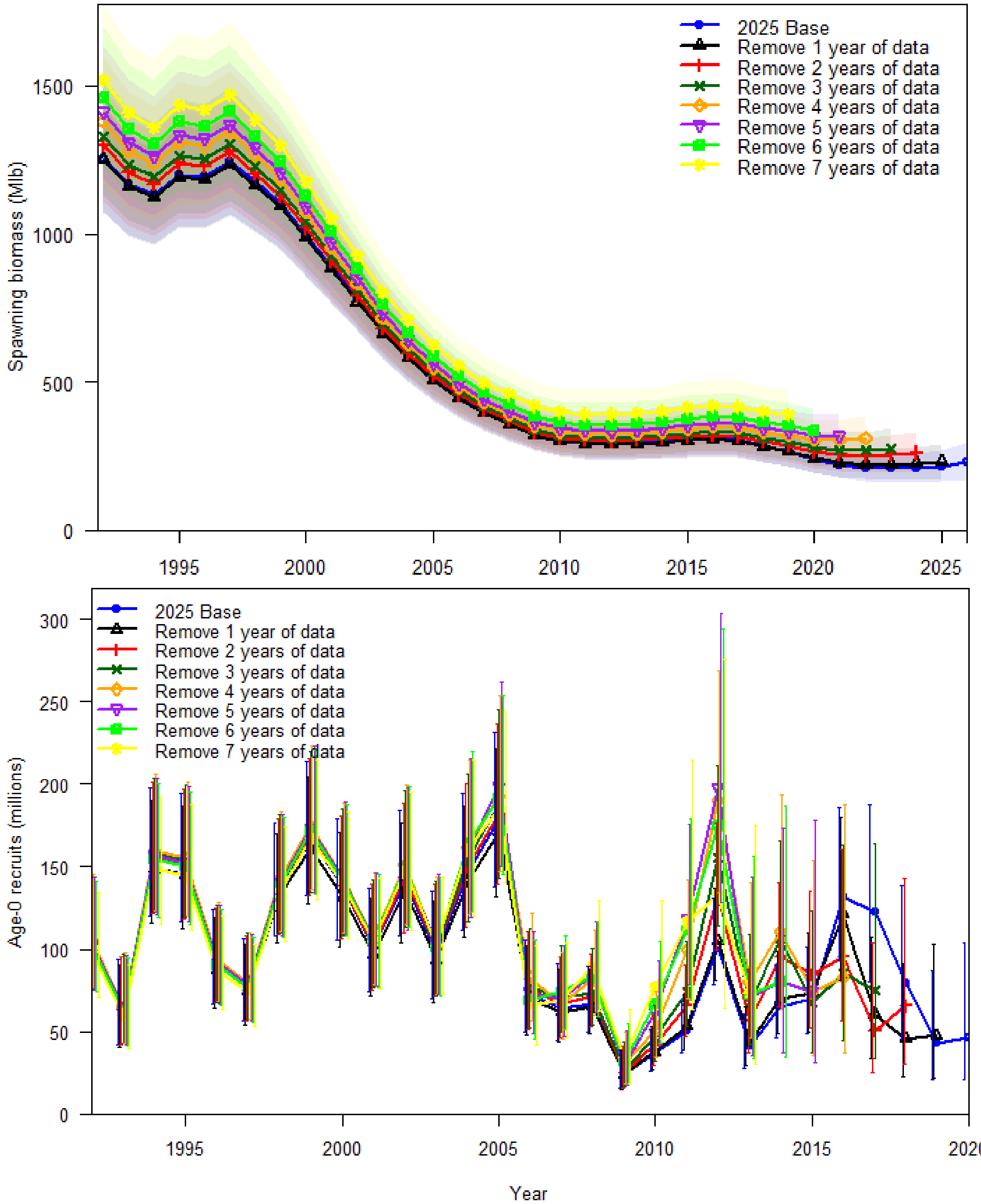

FIGURE 25. Spawning biomass (top panel) and recruitment (bottom panel) estimates from a retrospective analysis sequentially removing terminal years of data from the AAF short model. Shaded regions and vertical whiskers indicate approximate 95% within-model credible intervals.

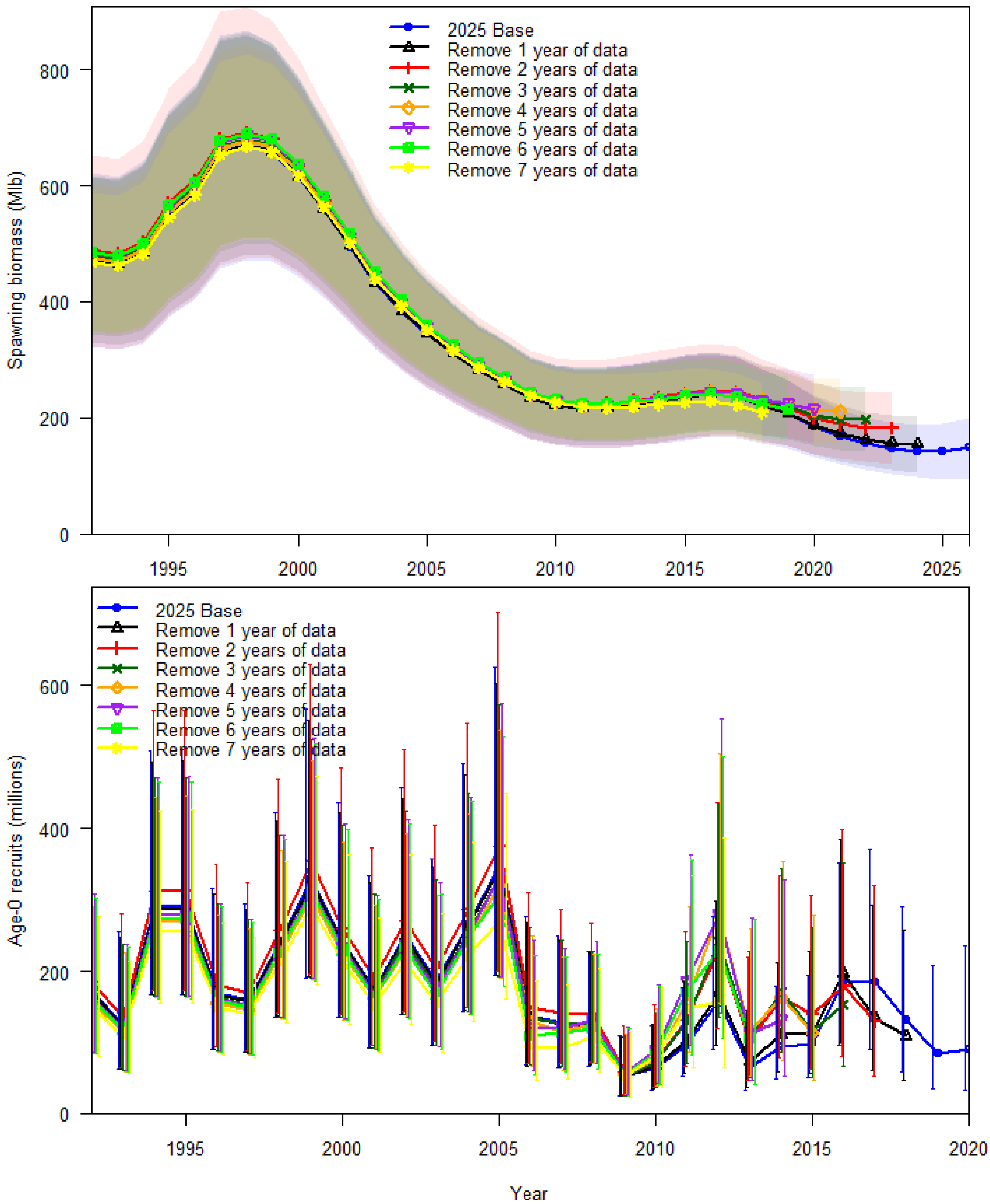

FIGURE 26. Recent spawning biomass (top panel) and recruitment (bottom panel) estimates from a retrospective analysis sequentially removing terminal years of data from the coastwide long model (time series has been truncated to allow for easier inspection of terminal values). Shaded regions and vertical whiskers indicate approximate 95% within-model credible intervals.

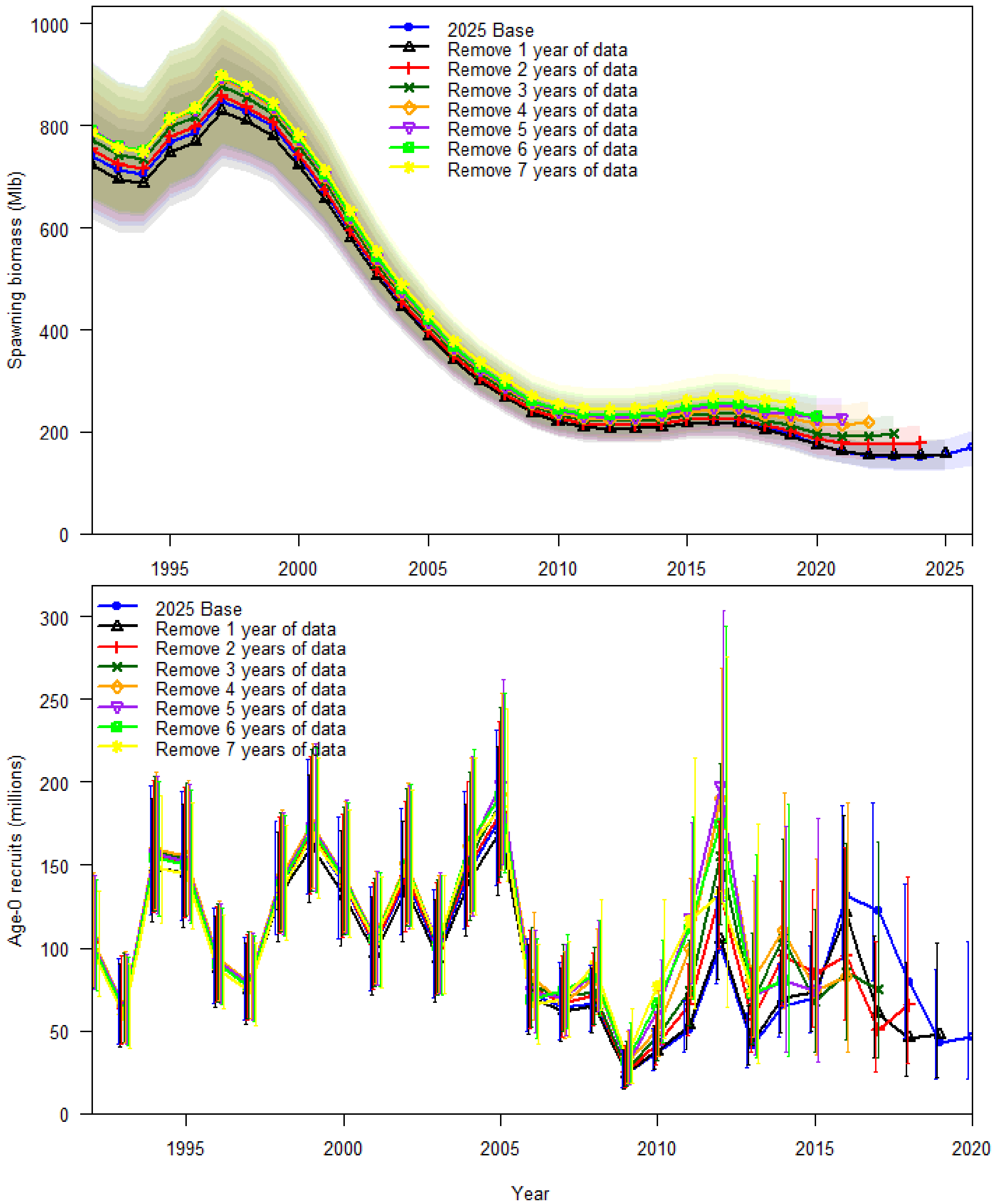

FIGURE 27. Recent spawning biomass (top panel) and recruitment (bottom panel) estimates from a retrospective analysis sequentially removing terminal years of data from the AAF long model (time series has been truncated to allow for easier inspection of terminal values). Shaded regions and vertical whiskers indicate approximate 95% within-model credible intervals.

FORECASTS AND DECISION TABLE

Three-year tactical stock projections under varying levels of mortality are conducted using the results from the 2025 stock assessment. Standard projections are based on existing Catch Sharing Agreements/Plans (CSPs) for directed commercial and recreational fisheries where they exist, as well as summaries of the 2025 and earlier directed and non-directed fisheries. Specifically, the projected mortality levels are based on the three-year running average non-directed discard mortality[2] through the most recent year (2025, per the decision during AM096 para. 97). Subsistence harvest is assumed to be constant at the most recent year's estimates. In IPHC Regulatory Areas 2C and 3A, where guided and unguided recreational fishing mortality is treated separately, the most recent year's unguided mortality estimate is used as the basis for projection. The discard mortality for the directed commercial fisheries is assumed to occur at the same rate observed in the most recent year, and to scale up or down with the projected landings.

The harvest decision table (Table 2) provides a comparison of the relative risk (in times out of 100), using stock and fishery metrics (rows), against a range of coastwide alternative harvest levels for 2026 (columns). The block of rows entitled "Stock Trend" provides for evaluation of the risks to short-term trend in spawning biomass, independent of all harvest policy calculations. The remaining rows portray risks relative to the spawning biomass reference points ("Stock Status") and fishery performance relative to the approach identified in the IPHC's harvest strategy. The alternatives (columns) include several levels of mortality intended for evaluation of stock and management procedure dynamics including:

- No fishing mortality (useful to evaluate the stock trend due solely to population processes)
- The mortality consistent with repeating the coastwide TCEY set for 2025 (the *status quo*)
- Bracketing alternatives 5 and 10% above and below the *status quo*
- The mortality for which there is a 50% chance that the spawning biomass will be smaller in 2029 than in 2026 ("*3-year surplus*")
- The mortality consistent with the current "Reference" SPR ($F_{43\%}$) level of fishing intensity
- The mortality consistent with the Maximum Economic Yield (*MEY*) proxy SPR ($F_{40\%}$) level of fishing intensity
- The mortality consistent with the Maximum Sustainable Yield (*MSY*) proxy SPR and also the overfishing limit in the IPHC's harvest strategy ($F_{35\%}$)
- Other levels of mortality are spaced between the above alternatives to provide for continuous evaluation of the change in risk across alternative yields

For each column of the decision table, the projected total fishing mortality (including all sizes and sources), the coastwide TCEY and the associated level of estimated fishing intensity projected for 2026 (median value with the 95% credible interval below) are reported.

Spawning biomass estimates in 2025 (last year) from the 2025 stock assessment are similar to than those from last year's stock assessment (7% higher) and increasing slowly. The 2012, 2016, and 2017 year-classes (all larger than all those occurring from 2006-2011) are highly

[2]. The North Pacific Fishery Management Council adopted a new method for setting the Prohibited Species Catch (PSC) limit for Pacific halibut mortality in the Amendment 80 (A80) trawl sector in 2024. This approach adjusts PSC limits based on the NOAA Fisheries Eastern Bering Sea trawl survey and the modelled FISS index of abundance for IPHC Regulatory Areas 4A, 4B, and 4CDE. This new approach resulted in a 20% reduction to the A80 sector's PSC limit in 2024 and an additional 5% reduction for 2025. However, the actual halibut mortality has been far below the aggregate PSC limit for all sectors in the Bering Sea and Aleutian Islands (52% in 2024). Therefore, it is unclear whether any future adjustments to the 3-year running average approach might be warranted, as actual mortality could still go up or down from the three year-average under current conditions. Recent actual non-directed discard mortality estimates in both IPHC Regulatory Areas 2A and 2B and in the Gulf of Alaska are similarly far below full regulatory limits (e.g., 25% in the Gulf of Alaska in 2025).

important in the 3-year stock projections as they will be continuing to mature over the next several years.

Projections indicate that the spawning biomass would increase in the absence of any fishing mortality, with risks of stock decline over one and three years both less than 1/100 (Table 2, Figure 26). 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 $F_{35\%}$ Overfishing limit/*MSY* proxy harvest level in 2026. Alternative harvest levels around the *status quo* (+/- 5 and 10%) are projected to result in levels of fishing intensity ranging from $F_{54\%}$ to $F_{48\%}$, at or lower than those estimated in recent years. The reference level of fishing mortality ($F_{43\%}$) corresponds to a TCEY equal to the three-year surplus, which is approximately 30% greater than the current status quo. The probability of a reduction in the coastwide TCEY in order to maintain a fishing intensity no greater than $F_{43\%}$ over the next three years is projected to be 53/100. All projections result in a probability of the relative spawning biomass dropping below the $SB_{30\%}$ threshold over the next three years of 5-27/100. The probability of dropping below the $SB_{20\%}$ limit is estimated to be <1-6/100.

Risks not included in the harvest decision table

The IPHC's harvest strategy uses threshold and limit reference points in relative spawning biomass (current estimate compared to the spawning biomass estimated to have occurred in that year in the absence of any fishing mortality). This calculation measures the effects of fishing on the stock. Other factors affecting the spawning biomass (i.e., trends in recruitment and weight-at-age) have resulted in the absolute spawning biomass in 2020-2026 estimated to be lower than at any time in the last 34 years. Although this does not represent a conservation concern at this time, low stock size results in additional risks to the IPHC's Fishery Independent Setline Survey (FISS) secondary objective of cost effectiveness and to fishery efficiency and economic viability. Increased environmental/climate-related variability in the marine ecosystems comprising the Pacific halibut species range in Convention waters lead to little expectation that historical productivity patterns may be relevant for future planning. Specifically, it is unclear whether long-term productivity levels are likely to occur under continued climate change, or whether increases or decreases may be likely for critical life-history stages of Pacific halibut. Recent poor recruitment (2006+) seems to suggest that the stock continues in a state of low productivity with no indication of when this prevailing condition may change.

Research Priorities

Research priorities for the stock assessment and related analyses have been consolidated with those for the IPHC's MSE and the Biological Research program and included in the 5-year research plan (IPHC-2026-AM102-05).

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assessment in a timely manner. The SRB and Science Advisors continue to provide valuable guidance and input during the development and review process.

TABLE 2. Harvest decision table for 2026-2028 mortality limits. Columns correspond to yield alternatives and rows to risk metrics. Values in the table represent the probability, in "times out of 100" (or percent chance) of a particular risk.

		2026 Alternative			*Status quo -10%*	*Status quo -5%*	*Status quo*	*Status quo +5%*	*Status quo +10%*	*$F_{46\%}$*	*3-Year Surplus / $F_{43\%}$*	*MEY proxy*	*Overfishing limit*	
		Total mortality (M lb)	0.0	21.9	28.6	30.1	31.6	33.1	34.6	37.0	40.8	45.1	53.7	
		TCEY (M lb)	0.0	20.0	26.8	28.2	29.7	31.2	32.7	35.1	39.0	43.3	51.9	
		2026 fishing intensity	$F_{100\%}$	$F_{62\%}$	$F_{54\%}$	$F_{52\%}$	$F_{51\%}$	$F_{49\%}$	$F_{48\%}$	$F_{46\%}$	$F_{43\%}$	$F_{40\%}$	$F_{35\%}$	
		Fishing intensity interval	--	47-77%	39-71%	37-70%	36-69%	34-68%	33-67%	31-65%	28-62%	26-59%	22-54%	
Stock Trend (spawning biomass)	in 2027	is less than 2026	<1	3	10	12	15	18	22	28	40	54	80	a
		is 5% less than 2026	<1	<1	1	1	2	2	3	4	8	14	32	b
	in 2028	is less than 2026	<1	2	8	10	13	16	19	26	38	54	82	c
		is 5% less than 2026	<1	<1	2	3	4	5	7	10	17	28	55	d
	in 2029	is less than 2026	<1	3	11	14	18	22	27	35	50	68	91	e
		is 5% less than 2026	<1	1	5	6	8	11	13	19	30	46	77	f
Stock Status (Spawning biomass)	in 2027	is less than 30%	24	25	26	26	26	26	26	26	26	26	27	g
		is less than 20%	<1	<1	<1	1	1	1	1	1	1	1	2	h
	in 2028	is less than 30%	14	22	23	24	24	24	24	25	25	26	27	i
		is less than 20%	<1	<1	<1	<1	<1	1	1	1	1	2	3	j
	in 2029	is less than 30%	5	17	20	21	22	22	23	23	24	25	27	k
		is less than 20%	<1	<1	<1	<1	1	1	1	1	2	3	6	l
Fishery Trend (TCEY)	in 2027	is less than 2026	0	<1	11	16	20	25	30	37	49	60	75	m
		is 10% less than 2026	0	<1	4	9	10	14	18	25	35	47	65	n
	in 2028	is less than 2026	0	<1	11	15	20	24	29	37	50	61	78	o
		is 10% less than 2026	0	<1	4	10	10	14	18	25	36	49	68	p
	in 2029	is less than 2026	0	1	11	15	10	25	30	39	53	65	82	q
		is 10% less than 2026	0	<1	5	10	11	15	19	26	39	53	73	r
Fishery Status (Fishing intensity)	in 2026	is above $F_{43\%}$	0	<1	13	18	23	27	32	39	50	60	73	s

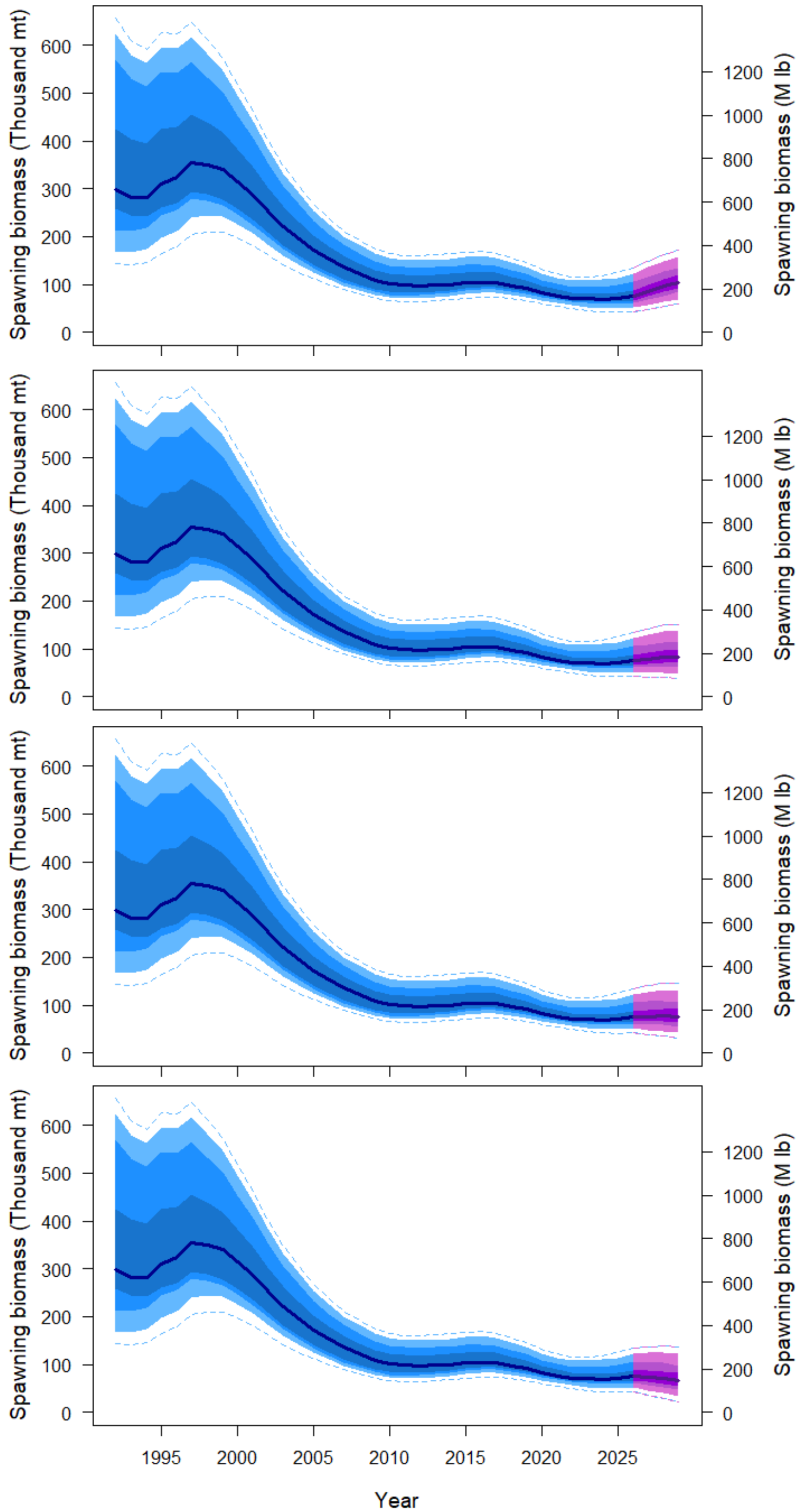

FIGURE 28. Three-year projections of stock trend under alternative levels of mortality: no fishing mortality (upper panel), the *status quo* coastwide TCEY set in 2025 (29.72 million pounds; second panel), the 3-year surplus and equivalent TCEY projected for the $F_{43\%}$ reference level of fishing intensity (38.95 million pounds, third panel) and the TCEY projected for the $F_{35\%}$ MSY proxy level of fishing intensity / overfishing limit (51.88 million pounds, bottom panel).

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