C1 GOA Pacific Cod Harvest Specifications

The SSC received a presentation on an operational update of the Gulf of Alaska (GOA) Pacific Cod stock assessment from Sara Cleaver (NPFMC) and Pete Hulson (NOAA-AFSC) to set the 2026/2027 harvest specifications. The out-of-cycle update assessment was requested by the Council in December 2025 to incorporate 2025 survey data, as the bottom trawl survey showed an apparent increase in Pacific cod biomass as the stock continues to recover. In addition to the assessment, the SSC reviewed an abbreviated ESR, presented by Bridget Ferriss (NOAA-AFSC), which focused on environmental conditions relevant to Pacific cod, and an updated ESP for Pacific cod, presented by Kalei Shotwell (NOAA-AFSC). **The SSC commends the AFSC and all the analysts for producing the SAFE and associated documents on an abbreviated timeline and out of cycle. The SSC recognizes that taking up the GOA Pacific cod assessment out of cycle is a unique circumstance, but notes the danger of prioritizing assessments based on perceived trends. This approach, if repeated, can inadvertently create bias in the entire management system that was not anticipated in the FMP[1].**

Written public testimony regarding the Pacific cod assessment was provided by Jim Armstrong and Chad See (Freezer Longline Coalition, FLC), Heather Mann (Midwater Trawlers Cooperative), and Ben Ley on behalf of businesses and fishermen in the communities of False Pass, King Cove, and Sand Point. Oral testimony was provided by Ben Ley, Carlin Hoblet (self, False Pass), and Jim Armstrong (FLC). Public testimony expressed appreciation to the AFSC and the assessment authors for producing the out-of-cycle assessment for Pacific cod and supporting documents. Testimony highlighted the critical importance of Pacific cod to GOA communities and was generally supportive of the authors' and GPT's recommended ABC. Western GOA fishermen requested a thorough analysis of the migratory behavior of GOA Pacific cod and a re-examination of stock structure in the GOA and Bering Sea. The SSC considered these comments in its discussions as noted below.

Ecosystem Status Report (ESR)

Ecosystem conditions in 2025 appeared unfavorable for Pacific cod, reminiscent of the poor conditions associated with the 2014-2016 warm 'blob'. Early signs of low productivity and poor prey conditions include small-sized phytoplankton, low abundances of large copepods, and low larval abundances of cod and other groundfish species. However, mid-trophic level prey such as krill and forage fish (e.g., capelin) appeared to be more available in 2025, although the editor cautioned that primary effects of the 2014-2016 GOA heatwave on mid and upper trophic level species occurred in the second year of the heatwave. The winter of 2025/26 was warmer than expected, given the forecast for La Nina conditions. **While some cooling is occurring, much residual heat remains throughout the water column in the GOA and may affect bottom waters on the shelf in the future, which may adversely affect Pacific cod in 2026 and beyond.**

Ecological and Socio-economic Profile (ESP)

The Pacific cod ESP was updated based on available data for a suite of indicators that are classified as predictive, contextual, or monitoring. Among the predictive indicators, an index of spawning habitat suitability showed a significant positive relationship with recruitment, suggesting promise for inclusion in causal analyses or as a direct input to the assessment. The index was below the long-term mean in 2025, which is expected to result in reduced egg survival associated with warm bottom temperatures and poor recruitment. This is consistent with low catches in both the larval and age-0 surveys in 2025. Furthermore,

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[1] Satterthwaite, W.H. 2023. The reproducibility crisis meets stock assessment science: Sources of inadvertent bias in the stock assessment prioritization and review process. Fisheries Research 266: 106763

there were below- or near-average body conditions for juveniles and adults as well as relatively poor prey conditions for the larval stage reported in the ESR.

The SSC appreciates the new indicator figures that denote good (blue) and poor (red) conditions and supports the GPT recommendations for developing indicator thresholds and asymmetrical 'confidence bands' as appropriate. The SSC noted that some ESP indices show little variability and may be less informative than hoped. Although not in the presentation, the SSC noted and appreciated the inclusion of three economic indicators within the GOA Pacific cod ESP. All three indicators (Real ex-vessel value, ex-vessel price, revenue-per-unit-effort show a significant downward trend from 2023, with several metrics reaching historical lows in 2024. While many of the ecological indicators have gaps in some years and/or consist of relatively short time series, these indicators nevertheless provide valuable context. The SSC encourages analysts to consider including these indices in multivariate analyses (e.g., Dynamic Factor Analyses) to develop composite indices that permit clustering of similar years or in causal models that can accommodate missing values (such as DSEM). In cases where indicators tend to stay above or below average conditions for multiple years, the analysts may want to consider the addition of cumulative stress indicators. The SSC also highlights recent research in the GOA relating changes in size-at-age to the length of the growing season rather than mean temperature, which may affect size at age for both juvenile and adult Pacific cod.

Pacific cod assessment

The authors completed the operational update using the 2024 accepted model (24.0) with new data, including catches through December 8, 2025, fishery length compositions, and results from both the 2025 bottom trawl survey and longline survey (abundances/RPNs and length compositions). The estimated trawl survey biomass increased by 39.2% from 2024 with a relatively large CV (23%) but within the range estimated for other years of the time-series. An analysis in Appendix 2.2 indicated the apparent increase was not a result of the restratification of the survey in 2025, which had little effect on Pacific cod survey estimates when applied to historical data. In contrast to the bottom trawl survey, relative population numbers (RPN) in the longline survey decreased 5%, driven by a large decline in the estimated RPN in the eastern portion of the survey area. The authors noted future plans to re-examine how these longline indices are computed.

The assessment model successfully converged, provided reasonable fits to the survey indices, had an acceptable retrospective pattern in recent years, resulted in good fits to length composition data, and residual diagnostics indicated no concerns.

The SSC concurs with the use of Model 24.0 for setting harvest specifications for 2026 and 2027. Results from this model indicate the estimated spawning biomass for the stock is currently slightly below the $B_{35\%}$ reference point ($B_{34.5\%}$) and is projected to decrease slightly to $B_{33.1\%}$ in 2026, **placing the stock in Tier 3b.** The authors and GPT recommended setting the ABC at maxABC. **The SSC concurs with the authors' and GPT's recommendation on the resulting OFLs and ABCs of 49,782 t and 41,520 t, respectively, in 2026, decreasing to 38,812 t and 32,209 t in 2027. The stock is not subject to overfishing in 2024 and is not overfished or approaching an overfished condition in 2025.**

The SSC appreciates the detailed discussion of all categories in the risk table, regardless of the level of concern/no concern. The risk table changed in two important ways from the previous full assessment in 2024. First, the Population Dynamics category was assessed as a Level 2 concern in 2024, due to the historically low spawning biomass and below-average recruitment. The authors recommended reducing the risk to a Level 1 (normal) because the stock continues to recover and both recruitment and biomass dynamics are believed to be adequately accounted for in the model or encompassed in the application of the harvest control rule. Despite some remaining concerns related to continued below-average recruitment

in recent years, the SSC agrees with the level 1 designation. The SSC highlights continued concerns over the use of the full recruitment time series for projections, as the stock appears to be in a period of reduced productivity with below-average recruitment estimates since 2014. Using average recruitment since 1977 likely results in overly optimistic biomass projections for future years (2028 and beyond) but does not affect short-term projections for setting OFL and ABC in 2026 and 2027. Moreover, there are some indications from beach seine monitoring and from fishery-dependent data that recruitment was above average for the 2020 and 2022 year classes and may be underestimated in the model.

Second, the Ecosystem Considerations category was elevated to a level 2 concern, due to continued elevated temperatures, which may affect egg survival as well as prey quality and availability for juveniles and possibly for adults in the future. As noted in the ESR, conditions are similar to the first year of the 'blob' (2014 – 2016) that led to the collapse of the Pacific cod stock. However, at this time, krill and forage fish availability appear favorable. The Fishery-informed Considerations category remained at a Level 1, and no concerning signals were reported by the fishing fleet in public testimony.

The SSC notes that these unfavorable environmental conditions imply an increased risk of continued poor recruitment, as well as poor growth and survival of Pacific cod in coming years. Therefore, conditions should be carefully monitored, especially if warm conditions continue into 2026 and beyond.

Subarea apportionments

The authors and GPT recommend a new methodology for subarea apportionments that uses the *rema* model with a single process error and an estimated additional observation error, consistent with other stocks (e.g. GOA thornyhead). The new approach tends to smooth the time series observations, thereby stabilizing apportionments over time, which the SSC considers to be a desirable feature. **The SSC supports the revised approach and the resulting subarea apportionments.** The SSC highlights and appreciates the clear comparison of the estimated biomass distribution among subareas over time using both the old and new methodology (Fig. 2.17).

The updated apportionment model estimates that 24.8%, 69.2% and 6.0% of the current biomass occur in the western, central and eastern GOA, respectively, resulting in the following subarea apportionments (in metric tons):

	Western	Central	Eastern	Total
2026 apportionment	10,297	28,732	2,491	41,520
2027 apportionment	7,987	22,289	1,933	32,209

Additional recommendations

The SSC notes that there have been numerous suggestions for model improvements since the last full assessment and looks forward to the authors and other analysts exploring recommendations from that assessment as well as those below in the next full assessment and through ongoing or new research.

- Given that recruitment as estimated in the model has been below average since 2014 and the expectation of continuing warm conditions, the SSC supports the GPT recommendation that the authors re-evaluate the portion of the recruitment time series used for projections to better reflect currently prevailing environmental conditions.

- The SSC suggests that the authors explore the use of temperature-informed mechanisms within the assessment model and temperature-informed growth or mortality. For example, the spawning habitat index identified in the ESP could be used as a predictor of recruitment. Alternatively, these relationships could first be explored and refined through causal modeling (e.g. DSEM) before considering their use in the assessment.

- The SSC highlights and supports public comments to re-examine the stock structure of Pacific cod in the Bering Sea and GOA regions based on historical and ongoing tagging work and other information. The SSC notes that a research project developing a spatial model for the combined GOA and Bering Sea region is under development and will incorporate movement among regions informed by tagging work. The SSC looks forward to results from this work.

- **In light of emerging information about the migratory behavior of Pacific cod, the SSC highlights the need to re-consider the assessment and management of Pacific cod in the Alaska region.** In addition to the development of a combined model that accounts for movement among regions, this may require an assessment of the data needed to support these modeling efforts as well as changes to the management of Pacific cod.

- The SSCs reiterates its recommendations from December 2024 regarding the relationship between trawl and longline survey selectivities and natural mortality, as well as among temperatures, changes in spatial distribution and estimates of selectivity (see December 2024 SSC report).

- The SSC supports the authors' plans to re-examine the computation of the RPN indices from longline survey data to better reflect the distribution of longline sets across depth strata and between the eastern and western portions of the survey region.

- The SSC supports bringing forward either harvest projections or an operational update in the fall 2026 assessment cycle, and looks forward to the next full assessment to address some of the research recommendations from various review bodies. Regardless of the type of assessment brought forward, the SSC requests that previous GPT and SSC comments, author responses, and plans for the next operational full assessment and for research models be tracked for prioritization.

- In response to the authors' request for feedback on abbreviated SAFE documents, such as this update, the SSC recommends including a brief section that describes planned or anticipated improvements by the assessment team. This is not intended to replace the Responses to SSC/GPT comments section typically included in operational assessments.