10. Assessment of the Alaska plaice stock in the Bering Sea and Aleutian Islands

Jane Sullivan and Cole Monnahan

Alaska Fisheries Science Center
National Marine Fisheries Service
November 2022

Executive Summary

Alaska plaice (*Pleuronectes quadrituberculatus*) are assessed on a biennial stock assessment schedule as part of the National Marine Fisheries Service assessment prioritization plan implemented in 2017. For Bering Sea/Aleutian Islands partial assessments, an executive summary is presented to recommend harvest levels for the next two years. A statistical age-structured model is used as the primary assessment tool for the Bering Sea/Aleutian Islands Alaska plaice assessment, a Tier 3 stock. This assessment consists of a population model that uses survey and fishery data to generate a historical time series of population estimates, and a projection model, which uses results from the population model to predict future population estimates and recommended harvest levels. The data sets used in this assessment include total catch biomass, fishery age compositions, eastern Bering Sea (EBS) shelf bottom trawl survey abundance estimates, and EBS shelf bottom trawl survey age compositions.

In a partial assessment year, the full assessment model is not rerun but instead a Tier 3 projection model with updated catch estimates is run to estimate the stock level in future years. This incorporates the most current harvest information without re-estimating model parameters and biological reference points. The Tier 3 projection operates outside the full assessment model by projecting estimates of future female spawning biomass, age 3+ total biomass, ABC and OFL from the full model estimate of 2021 numbers-at-age, weight-at-age, maturity, and selectivity. Please refer to last year's full stock assessment report for further information regarding the stock assessment model (Ormseth 2021; available online at https://www.npfmc.org/safe-stock-assessment-and-fishery-evaluation-reports/).

Summary of Changes in Assessment Inputs

Changes in the input data: New data added to the Tier 3 projection model included an updated 2021 catch estimate (15,862 t) and new catch estimates for 2022 through October 15, 2022 (sourced October 24, 2022 from the NMFS Alaska Regional Office using the Alaska Fisheries Information Network [AKFIN] database). Following methods used in the 2021 full assessment, the full-year 2022 catch (12,226 t) was estimated by averaging the three weeks of catch prior to October 15 and using this value as the assumed weekly catch for the remaining 11 weeks in 2022.

Changes in the assessment methodology: There were no changes in assessment methodology since this was an off-cycle year.

Summary of Results

For 2023, the recommended maximum allowable ABC from the Tier 3 projection model was 33,946 t. Reference values for BSAI Alaska plaice are summarized in the following table, with the recommended ABC and OFL values for 2023 in bold.

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Quantity	As estimated or *specified last* year for: 2022	2023	As estimated or *recommended this* year for: 2023	2024
M (natural mortality rate)	0.13	0.13	**0.13**	0.13
Tier	3a	3a	**3a**	3a
Projected total (3+) biomass (t)	442,946	454,030	**461,992**	477,701
Female spawning biomass (t)	141,838	144,767	**149,987**	158,149
$B_{100\%}$	286,587	286,587	**286,587**	286,587
$B_{40\%}$	114,635	114,635	**114,635**	114,635
$B_{35\%}$	100,306	100,306	**100,306**	100,306
F_{OFL}	0.17	0.17	**0.17**	0.17
$maxF_{ABC}$	0.14	0.14	**0.14**	0.14
F_{ABC}	0.14	0.14	**0.14**	0.14
OFL (t)	39,305	39,685	**40,823**	43,328
maxABC (t)	32,697	32,998	**33,946**	36,021
ABC (t)	32,697	32,998	**33,946**	36,021
Status	As determined *last* year for: 2020	2021	As determined *this* year for: 2021	2022
Overfishing	no	n/a	No	n/a
Overfished	n/a	no	n/a	no
Approaching overfished	n/a	no	n/a	no

The stock is not being subject to overfishing, is not currently overfished, nor is it approaching a condition of being overfished. The tests for evaluating these three statements on status determination require examining the official total catch from the most recent complete year (2021) and the current model projections of spawning biomass relative to $B_{MSY\%}$ for 2021 and 2022. The estimated total catch for 2021 is 15,862 t, far below the 2021 OFL of 37,924 t; therefore, the stock is not being subjected to overfishing. The estimates of spawning biomass for 2023 and 2024 from the 2021 stock assessment projections are 149,987 t and 158,149 t, respectively. Both estimates are well above the estimate of $B_{35\%}$ of 100,306 t and therefore the stock is not currently overfished nor approaching an overfished condition.

Summary for the Plan Team

Species	Year	Biomass	OFL	ABC	TAC	Catch
Alaska plaice	2021	427,587	37,924	31,657	24,500	15,862
	2022	442,946	39,305	32,697	29,221	9,688*
	2023	461,992	40,823	33,946		
	2024	477,701	43,328	36,021		

*2022 catch as of October 15, 2022, sourced October 24, 2022 from the NMFS Alaska Regional Office using the AKFIN database.

Alaska plaice are caught throughout the year primarily as bycatch in the yellowfin sole (*Limanda aspera*) and northern rock sole (*Lepidopsetta polyxystra*) fisheries. Retention rates of Alaska plaice in these fisheries are high, estimated to be greater than 90% since 2018. The 2022 projected catch for Alaska

plaice is 12,226 t, well below the 2022 ABC of 32,697 t and lower than the 1977-2022 long-term average of 16,513 t (Figure 10.1). The 2022 exploitation ratio (catch/total biomass) is also projected to decrease for 2022 and is estimated to be near the 1975-2022 long-term average of 0.03 (Figure 10.2). If the 2022 projected catch is realized, it will be the lowest catch to biomass ratio for Alaska plaice since 2009.

The 2022 EBS shelf trawl survey biomass estimate for Alaska plaice increased 15% from the 2021 estimate but is still 27% lower than the long-term mean (Figure 10.3). Because this is a partial assessment, the 2022 biomass estimate was not used to inform results in 2022 but will be added to the assessment model in 2023. Interested readers may note the increasing trend in projected population biomass, despite decreasing survey biomass estimates between 2017 and 2021. This result is attributed to strong recruitment events since 2017, which began to emerge in the 2019 assessment (Ormseth 2021).

SSC and Plan Team Comments on Assessments in General

Responses will be provided in the next full assessment.

From the November 2021 BSAI Groundfish Plan Team minutes:
The Team recommends that the AFSC prioritize research on best practices for specifying the selectivity schedules used in projections for Tier 1-3 stocks in general.

From the December 2021 SSC minutes:
The SSC recommends that groundfish, crab and scallop assessment authors do not change recommendations in documents between the Plan Team and the SSC meetings, because it makes it more difficult to understand the context of the Plan Team's rationale and seems counter to the public process without seeing a revision history of the document.

SSC and Plan Team Comments Specific to this Assessment

Responses will be provided in the next full assessment.

From the December 2021 SSC minutes:
The author continued to investigate biomass in the NBS, noting that over 50% of the survey biomass currently resides in the NBS. While trawling is prohibited in the Northern Bering Sea Research Area, the spatial distribution of Alaska plaice does not suggest any stock separation. ***The SSC appreciates the authors' investigation of this issue and recommends examining new models that include the use of the NBS data in a similar manner to many other BSAI stocks, perhaps through a combined EBS+NBS VAST index.*** *The author should also consider the potential for differences in age-at-maturity and size-atage between the EBS and the NBS as they move forward. Additionally, the SSC suggests that the author examine the utility of estimating catchability (q) within the model rather than relying on a fixed value (1.2).*

From the November 2021 BSAI Groundfish Plan Team minutes:
The Team recommends that authors explore the relationship of the southern part of the stock in the EBS to the northern part of the stock in the NBS and consider developing models that include the NBS data.

From the December 2019 SSC minutes:
The SSC … recommends continuing to track survey biomass trends in the NBS. The assessment indicates that sampling in the NBS in 2017 by a NPRB project showed differential age-at-maturity and size-at-age compared to the EBS. For the next full assessment, the SSC requests that the authors investigate differences in length composition and sex ratios between the NBS and EBS surveys. In addition, the SSC recommends analysis of genetic information to inform whether there is evidence of stock structure between the survey regions.

Acknowledgements

We would like to acknowledge the work of the previous author, Dr. Olav Ormseth, who served as a stock assessment scientist at the Alaska Fisheries Science Center from 2007-2022.

Literature cited

Ormseth, O. 2021. Alaska plaice. *In* Stock Assessment and Fishery Evaluation Document for Groundfish Resources in the Bering Sea/Aleutian Islands Region as Projected for 2022. North Pacific Fishery Management Council, 1007 West Third, Suite 400, Anchorage, Alaska 99501.

Figures

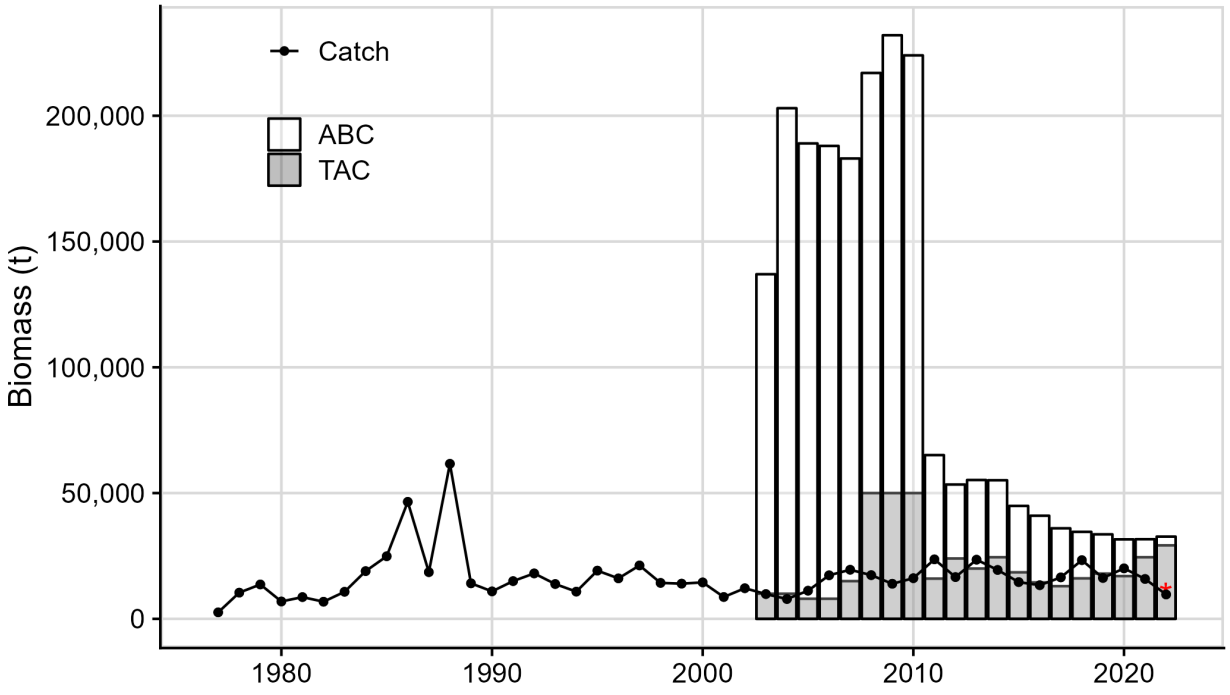

Figure 10.1. Alaska plaice catch, ABC, and TAC from 1977-2022, with the projected 2022 catch estimate shown as a red asterisk. Data reflect catch posted through October 15, 2022 (sourced October 24, 2022 from the NMFS Alaska Regional Office using the AKFIN database).

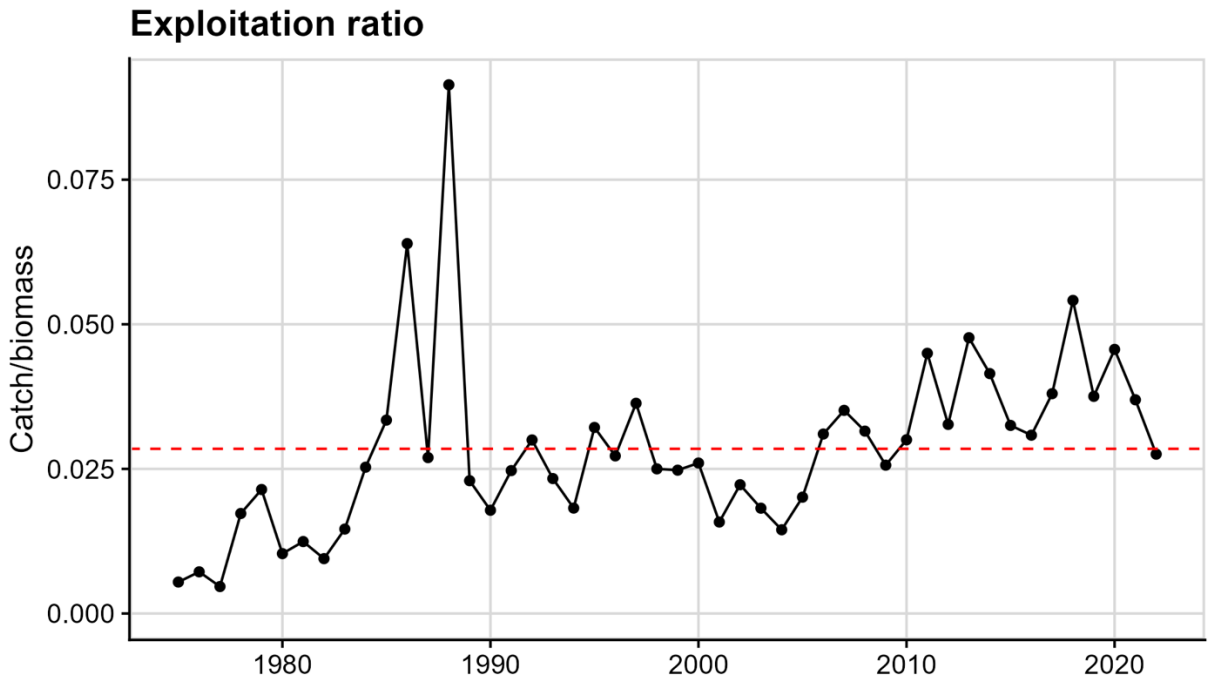

Figure 10.2. Exploitation ratio for Alaska plaice in the BSAI. Exploitation ratio is defined as the catch divided by the total predicted age-3+ biomass. The total predicted biomass time series was obtained from the 2021 assessment model (1975-2020) and the 2022 projection model (2021-2022). The 2022 exploitation ratio is based on the projected 2022 catch of 12,226 t. The 1975-2022 long-term average (0.03) is shown in the horizontal dashed red line.

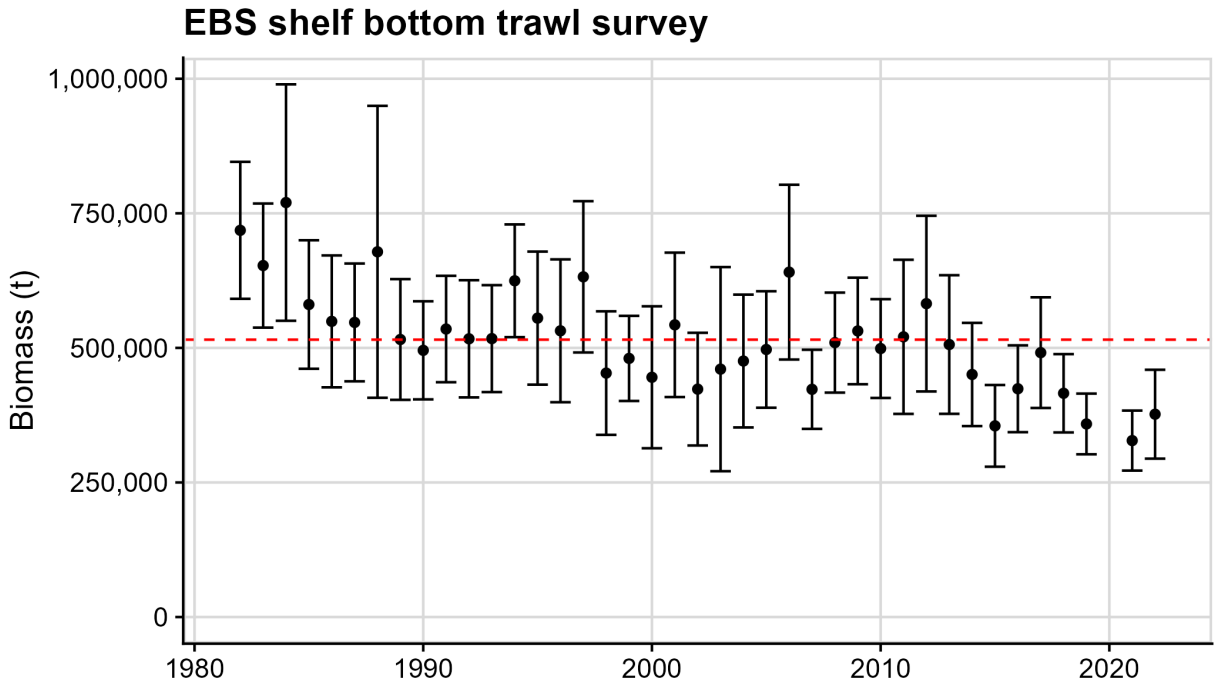

Figure 10.3. Alaska plaice biomass estimates from the EBS shelf trawl survey using the standard grid (no Northern EBS), 1982-2022. No survey was conducted in 2020 due to the COVID-19 pandemic. Data sourced for all years from the AKFIN database, and may differ slightly from previous assessments due to minor modifications in strata definitions. The 1982-2022 long-term average biomass (515,308 t) is shown in the horizontal dashed red line.