

Data-limited Stock Assessment Methods at AFSC

Working Group Report

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Introduction

This document reports on the progress of the Alaska Fisheries Science Center (AFSC) working group on data-limited stock assessment methods (DLMWG). The AFSC established the DLMWG to explore alternative methods to estimate harvest targets and limits for the lower tier, more data-limited stocks managed by the North Pacific Fishery Management Council (NPFMC). The current NPFMC harvest control rules (HCRs) were established by Amendment 56 in 1998 and are detailed in the Bering Sea/Aleutian Islands ([BSAI](#)) and Gulf of Alaska ([GOA](#)) fishery management plans. The current focus of the data-limited assessments working group will be on Tier 6 species and complexes, all of which are non-target species. The HCR states that for Tier 6 species, the overfishing limit (OFL) is the mean of the historical catch from 1978 through 1995 unless an alternative value is established by the NPFMC Scientific and Statistical Committee (SSC) on the basis of the best available scientific information and that the acceptable biological catch (ABC) is $\leq 0.75\text{OFL}$.

Few of the Tier 6 species or complexes meet the requirement of a reliable catch time series, and many use either alternative time series or alternative methods to estimate the OFL. Given advances in DLMs, the AFSC is exploring them for Tier 6 stocks in a risk framework. The DLMWG evaluated the Tier 6 stocks and/or component stocks (i.e., stocks within complexes) and identified a subset that were deemed to be the highest priority for further DLM evaluations.

Tier 6 stock prioritization

For the purposes of this document, the term “stock” will refer to an individual species for a given stock assessment and area. There are 35 individual stocks across complexes and fishery management plan (FMP) areas that are considered Tier 6 (Table 1).

All of the reproducible code and outputs are available at: https://github.com/noaa-afsc/AFSC_DLM_WG. A list of 16 qualitative and quantitative data attributes was compiled for each stock. Data attributes included life history traits, characteristics of the catch history and the relationship of the species to the complex in which it is managed, and were intended to highlight the risk to the species and how it would fit into a DLM approach. After exploration with sensitivity runs, the list was narrowed to seven attributes. This was due to the lack of contrast in sensitivity results (Table 2). We then developed six weighting scenarios because some attributes are closely related; e.g., the statistic on a species’ mean proportion of the complex OFL is closely related to the mean proportion of catch that is observed. These ranged from all attributes being equally weighted to some scenarios where attributes were ignored (Table 2). The final score for a stock in a given weighting scenario was the sum of the individual weighted values.

We selected those stocks that fell within the top 5 across all weighting scenarios (Table 3). To broaden the number of stocks considered, if a member was in the same complex as one that was selected, it was removed from consideration to allow consideration of other stocks. This process was repeated iteratively as stocks were selected or removed from the list until 5 priority stocks were selected. Priority stocks are listed below.

1. GOA Pacific sleeper shark: ranked #1 across all weighting scenarios. BSAI Pacific sleeper shark was removed from further consideration, shifting all stocks below it up one position.
2. GOA salmon shark: after removal of BSAI Pacific sleeper shark, GOA salmon shark was in the top 5 of all weighting scenarios
3. GOA octopus: after removal of BSAI Pacific sleeper shark and BSAI salmon shark, GOA octopus was in the top 5 of five of the weighting scenarios
4. GOA quillback rockfish (Southeast Outside stock): after removal of BSAI Pacific sleeper shark, BSAI salmon shark and BSAI octopus, GOA DSR quillback rockfish was in the top 5 of all weighting scenarios
5. GOA yelloweye rockfish (areas other than Southeast Outside): while only in the top 5 in one weighting scenario, this stock was selected over rosethorn rockfish by group decision due to its prominence in catch and importance to the Demersal Shelf Rockfish complex.

Two other species, GOA rosethorn rockfish (Southeast Outside stock) and GOA Atka mackerel, were often in the top stocks as well. As noted above, the group opted to select GOA yelloweye rockfish (areas other than Southeast Outside) over the rosethorn rockfish stock because rosethorn rockfish are at the northern extent of their range and the rankings for this stock were largely driven by extrapolated estimates of total catch approaching or exceeding the proxy species-specific OFL. The species is relatively rare in at-sea observations; as such, haul-level observations can extrapolate to relatively large estimates of total catch. The GOA Atka mackerel stock was not selected because it is also at the edge of the species' distribution, it is not part of a complex, and it is the only stock in this analysis with sufficient data to comply with the 1987-1995 catch time series stated in the Tier 6 HCR.

Next Steps

For each of the priority stocks, the DLMWG will evaluate potential data-limited methods using the FishPath decision support tool (www.fishpath.org). FishPath is an extensive questionnaire about the stock, data collection options, and availability to identify management measures best suited for any given situation. After completing the survey, the software summarizes and matches methods most suited to each stock.

Each member of the working group selected one of the priority stocks and worked through the tool for their chosen stock. After results from each stock were compiled, the DLMWG met to discuss results and important considerations for each stock. Group members traded stocks and reviewed results in detail to highlight differences of opinion or interpretations. The DLMWG will meet after the 2024 assessment cycle to discuss the results of the second review. Given the potential for different user interpretations, these iterative discussions are critical to the process and allow for alternative expert opinions.

The timeline for potential implementation of DLMS for any of these priority stocks is dependent upon the stock assessment timing and the author's capacity to integrate new methods. Table 1 includes the stock assessment schedule for the Tier 6 stocks, with the priority stocks highlighted. The DLMWG has chosen to focus the next steps on GOA Pacific sleeper shark and GOA salmon shark first, as those stocks are in the next upcoming assessment that is most likely to bring forward implementation of alternative Tier 6 methods. The next full operational assessment for GOA sharks is due in 2026. The GOA octopus stock is due for an operational assessment in 2025. The quillback and yelloweye rockfish stocks are due for an operational assessment in 2026 as well, and DLMS may be applied.

Tables

Table 1. List of Tier 6 stocks in the North Pacific Fishery Management Council’s fishery management plans for the Bering Sea/Aleutian Islands (BSAI) and Gulf of Alaska (GOA). The Demersal Shelf Rockfish (DSR) stock complex is divided into two subgroups: DSR SEO are those species in Southeast outside and DSR WG/CG/WY are those species in the western GOA (WG), central GOA (CG) and West Yakutat (WY). OROX is the Other Rockfish stock complex. The Next Operational column shows the year that is the next scheduled operational stock assessment, after the current year. Stocks in bold are the priority stocks.

FMP	Stock Assessment	Stock	Next Operational
BSAI	Octopus	octopus, North Pacific	2027
BSAI	Sharks	Pacific sleeper shark	2026
BSAI	Sharks	shark, salmon	2026
BSAI	Sharks	shark, spiny dogfish	2026
GOA	Atka Mackerel	greenling, atka mackerel	2025
GOA	DSR SEO	rockfish, canary	2026
GOA	DSR SEO	rockfish, china	2026
GOA	DSR SEO	rockfish, copper	2026
GOA	DSR SEO	rockfish, quillback	2026
GOA	DSR SEO	rockfish, rosethorn	2026
GOA	DSR SEO	rockfish, tiger	2026
GOA	Octopus	octopus, North Pacific	2025
GOA	OROX	rockfish, aurora	2025
GOA	OROX	rockfish, blackgill	2025
GOA	OROX	rockfish, bocaccio	2025
GOA	DSR WG/CG/WY	rockfish, canary	2026
GOA	OROX	rockfish, chilipepper	2025
GOA	DSR WG/CG/WY	rockfish, china	2026
GOA	DSR WG/CG/WY	rockfish, copper	2026
GOA	OROX	rockfish, darkblotched	2025
GOA	OROX	rockfish, greenstripe	2025
GOA	OROX	rockfish, pygmy	2025
GOA	DSR WG/CG/WY	rockfish, quillback	2026
GOA	DSR WG/CG/WY	rockfish, rosethorn	2026
GOA	OROX	rockfish, shortbelly	2025
GOA	OROX	rockfish, splitnose	2025
GOA	OROX	rockfish, stripetail	2025
GOA	DSR WG/CG/WY	rockfish, tiger	2026
GOA	OROX	rockfish, vermilion	2025
GOA	OROX	rockfish, widow	2025
GOA	DSR WG/CG/WY	rockfish, yelloweye (red snapper)	2026
GOA	OROX	rockfish, yellowmouth	2025
GOA	OROX	rockfish, yellowtail	2025
GOA	Sharks	Pacific sleeper shark	2026
GOA	Sharks	shark, salmon	2026

Table 2. Description of the metrics used for the ranking calculations and the six weighting scenarios.

Metric	Description	Scen 1	Scen 2	Scen 3	Scen 4	Scen 5	Scen 6
mean_drate	Mean discard rate over last 10 years	1	0	0	0.25	0.25	0.25
meanpOFL	Mean proportion of species specific OFL (or proxy) of complex OFL for the species over last 10 years	1	1	0.5	0.5	0.75	0.25
meancpOFL	Mean proportion of species specific catch that is observed over last 10 years	1	0	0.5	0.5	0.25	0.75
PSA_new	Updated PSA score relevant to region of interest	1	1	1	1	1	1
dominance	Y/N Is the species dominant among the Tier 6 species in the complex? More than one dominant Tier 6 species is allowed	1	0.5	0.5	0.5	0.5	1
Inflat_spec	Y/N is there a single species, other than the species of interest, that is >50% of the complex OFL on average over the last 10 years	1	1	1	1	0.5	1
Teleost	Are you a non-teleost species? (gets at difficulty to get accurate catch data)	1	1	1	1	0.5	0

Table 3. Summary of the top 10 stocks for each of the weighting scenarios.

Rank	Scen 1	Scen 2	Scen 3	Scen 4	Scen 5	Scen 6
1	GOA Pacific sleeper shark	GOA Pacific sleeper shark	GOA Pacific sleeper shark	GOA Pacific sleeper shark	GOA Pacific sleeper shark	GOA Pacific sleeper shark
2	GOA octopus	GOA salmon shark	GOA salmon shark	BSAI Pacific sleeper shark	GOA quillback rockfish DSR SEO	GOA salmon shark
3	BSAI octopus	BSAI Pacific sleeper shark	BSAI Pacific sleeper shark	BSAI octopus	GOA salmon shark	BSAI salmon shark
4	BSAI Pacific sleeper shark	BSAI salmon shark	BSAI salmon shark	GOA octopus	GOA rosethorn rockfish DSR SEO	BSAI Pacific sleeper shark
5	GOA salmon shark	GOA octopus	GOA octopus	BSAI salmon shark	GOA yelloweye rockfish DSR WG/CG/WY	BSAI octopus
6	BSAI salmon shark	BSAI octopus	BSAI octopus	GOA s salmon shark	BSAI salmon shark	GOA octopus
7	GOA quillback rockfish DSR SEO	GOA quillback rockfish DSR SEO	GOA quillback rockfish DSR SEO	GOA quillback rockfish DSR SEO	BSAI Pacific sleeper shark	GOA rosethorn rockfish DSR SEO
8	GOA Atka mackerel	GOA rosethorn rockfish DSR SEO	GOA rosethorn rockfish DSR SEO	GOA Atka mackerel	GOA tiger rockfish DSR SEO	GOA quillback rockfish DSR SEO
9	BSAI spiny dogfish	BSAI spiny dogfish	BSAI spiny dogfish	GOA yelloweye rockfish DSR WG/CG/WY	GOA Atka mackerel	BSAI spiny dogfish
10	GOA rosethorn rockfish DSR SEO	GOA tiger rockfish DSR SEO	GOA tiger rockfish DSR SEO	GOA rosethorn rockfish DSR SEO	GOA octopus	GOA yelloweye rockfish DSR WG/CG/WY