10. Assessment of the Northern Rockfish Stock in the Gulf of Alaska

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Executive Summary

Gulf of Alaska northern rockfish (*Sebastes polyspinis*) have historically been assessed on a biennial stock assessment schedule to coincide with the availability of new trawl survey data (odd years). In 2017, the Alaska Fisheries Science Center (AFSC) participated in a stock assessment prioritization process. It was recommended that Gulf of Alaska (GOA) northern rockfish remain on a biennial stock assessment schedule with a full stock assessment produced in even years and a partial stock assessment produced in odd years. For a partial assessment, the projection model is updated with new catch information and results are used to recommend harvest levels for the next two years. This incorporates the most current catch information without re-estimating model parameters and biological reference points.

Gulf of Alaska northern rockfish are classified as a Tier 3 stock and are assessed using a statistical age-structured model. This assessment consists of a population model, which 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 used in this assessment includes total catch biomass, fishery age and size compositions, trawl survey abundance estimates, and trawl survey age compositions.

Summary of Changes in Assessment Inputs

Changes in the input data: There were no changes made to the assessment model inputs as this is an off-cycle year. New data added to the projection model included updated catch data from 2022 (1,898 t) and new estimated catches for 2023-2025. Catch data were queried on 2023-10-17. The 2023 catch was estimated by increasing the observed catch by an expansion factor of 1.095, which accounts for the average fraction of catch taken after October 17 in the last three complete years (2020-2022). This expansion factor increased from last year's expansion factor of 1.036 and resulted in an estimated catch for 2023 of 1,441 t. To estimate future catches, we updated the yield ratio to 0.46, which was the average ratio of catch to ABC for the last three complete catch years. This yield ratio was multiplied by the projected ABCs from the updated projection model to generate catches of 2,192 t in 2024 and 2,048 t in 2025.

Changes in assessment methodology: There were no changes from the 2022 assessment (Williams *et al.* 2022) since this is an off-cycle year.

Summary of Results

ABC recommendation

The projected total biomass for 2024 is 94,319 t. The recommended ABC for 2024 is 4,816 t, the maximum allowable ABC under Tier 3a. This ABC is a -3% decrease compared to the 2023 ABC of 4,965 and a 1% increase from the projected 2024 ABC from the last full assessment. The 2024 GOA-wide OFL for northern rockfish is 5,750 t. The stock is not being subject to overfishing, is not currently overfished, nor is it approaching a condition of being overfished.

Reference values for GOA northern rockfish are summarized in the following table, with the recommended ABC and OFL values in bold.

Quantity/Status	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
	2023	2024	2024[*]	2025[*]
M (natural mortality)	0.059	0.059	0.059	0.059
Tier	3a	3a	3a	3a
Projected total (age 2+) biomass (t)	95,452	93,022	94,319	93,088
Projected female spawning biomass (t)	39,445	37,470	38,118	36,510
$B_{100\%}$	82,350	82,350	82,350	82,350
$B_{40\%}$	32,940	32,940	32,940	32,940
$B_{35\%}$	28,822	28,822	28,822	28,822
F_{OFL}	0.074	0.074	0.074	0.074
$maxF_{ABC}$	0.061	0.061	0.061	0.061
F_{ABC}	0.061	0.061	0.061	0.061
OFL (t)	5,927	5,661	**5,750**	5,548
maxABC (t)	4,965	4,742	4,816	4,647
ABC (t)	4,965	4,742	**4,816**	4,647
	As determined *last* year for:		As determined *this* year for:	
Status	2022	2023	2023	2024
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

[*]Projections are based on an estimated catch of 1,441 t for 2023 and estimates of 2,192 t and 2,048 t used in place of maximum permissible ABC for 2024 and 2025.

Area Allocation of Harvest

The following table shows the recommended ABC apportionment for 2024 and 2025. The apportionment percentages are the same as in the last full assessment. Please refer to the 2022 full stock assessment report (Williams *et al.* 2022) for information regarding the apportionment rationale for GOA northern rockfish.

		Western	Central	Eastern	Total
Area Apportionment		52.65%	47.33%	0.02%	100%
2024	ABC (t)	2,535	2,280	1	4,816
2024	OFL (t)				5,750
2025	ABC (t)	2,446	2,200	1	4,647
2025	OFL (t)				5,548

Responses to SSC and Plan Team Comments on Assessments in General

"The SSC supports the JGPT's recommendation that stock assessment authors transition from the ADMB RE variants to the rema framework, which implements the same model variants in a single framework with several improvements."(SSC, Oct 2022)

This model currently implements the rema framework for apportionment. However, the current rema model uses the design-based survey biomass estimates as inputs. As this model uses VAST instead of design-based survey biomass examinations of changing to regional VAST data estimates will be explored in the next full assessment.

Responses to SSC and Plan Team Comments Specific to this Assessment

"The SSC supports the GOA GPT recommendations to investigate potential mechanisms for the underlying pattern [to the fishery length composition] and recommends the authors consider whether a selectivity time block, to account for changes in the fishery (i.e., POP rebuilding), is appropriate and improves fit to the compositional information." (SSC December 2022)

"The SSC notes the MCMC on the estimates of q include a long right tail with unrealistic values of q. The SSC requests the authors investigate a model run with a fixed M." (SSC December 2022)

"The SSC also requests the following for future assessments: bubble plots of Pearson residuals for all age and length data, including the sign and scale of residuals; and inclusion of a figure showing changes in previous VAST estimates due to updating with new survey information." (SSC December 2022)

Model runs addressing the above requests will be examined in the next full assessment.

"The SSC reiterates its past support of empirical research projects on maturity and skip spawning, perhaps with industry partnership."(SSC December 2022)

Examinations of maturity and skip spawning are ongoing.

References

Williams, B.C., Hulson, P.-J.F., Lunsford, C.R. and Ferriss, B. (2022) Assessment of the Northern Rockfish stock in the Gulf of Alaska. In: *Stock assessment and fishery evaluation report for the groundfish resources of the Gulf of Alaska*. North Pacific Fishery Management Council, Anchorage, AK.
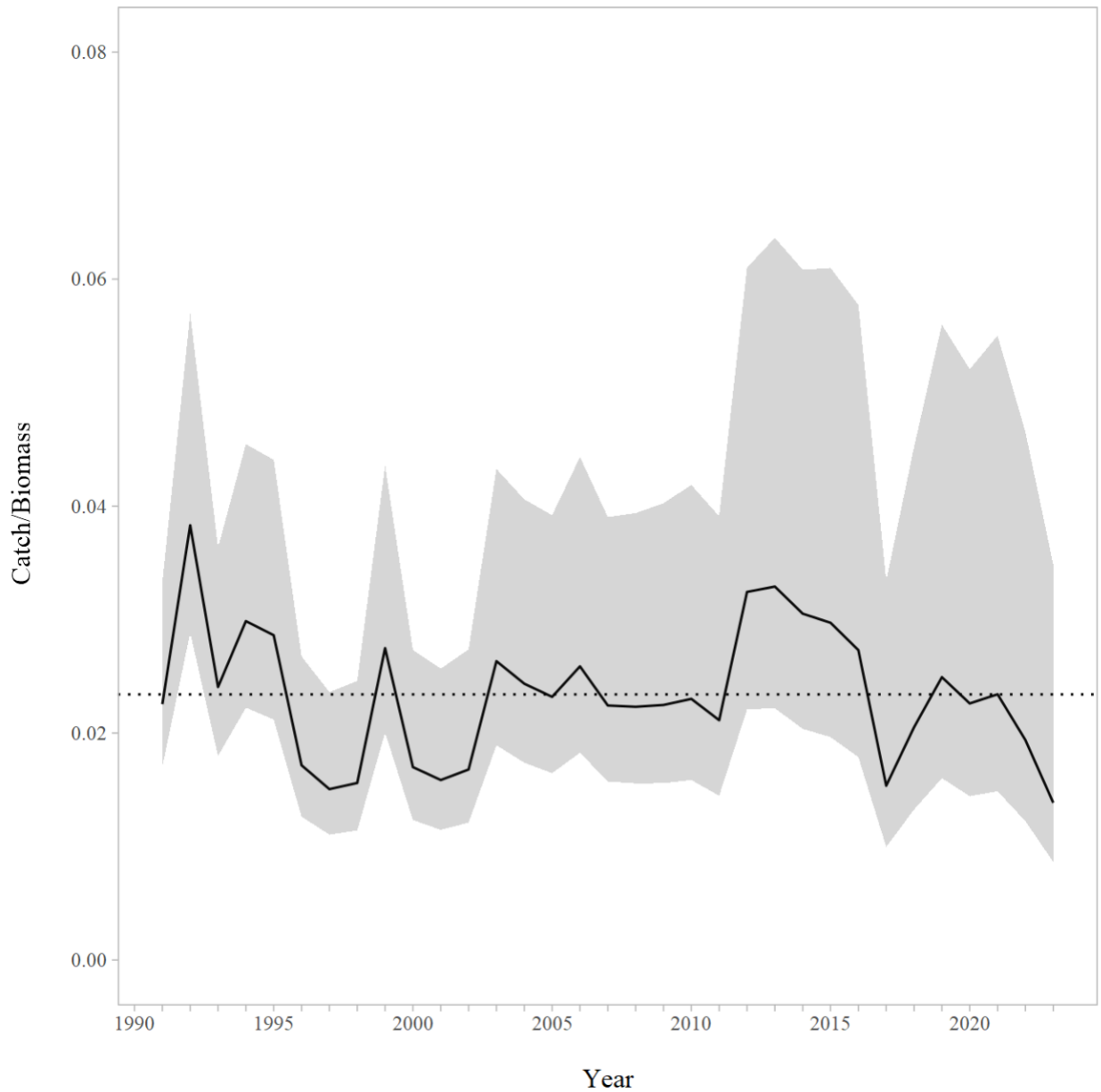
Figures

Figure 10-1. Gulf of Alaska northern rockfish catch/age 2+ biomass ratio with approximate 95% confidence intervals. Observed catch values were used for 1991-2022, the 2023 catch values were estimated using an expansion factor. The horizontal dashed line is the mean value for the entire dataset.
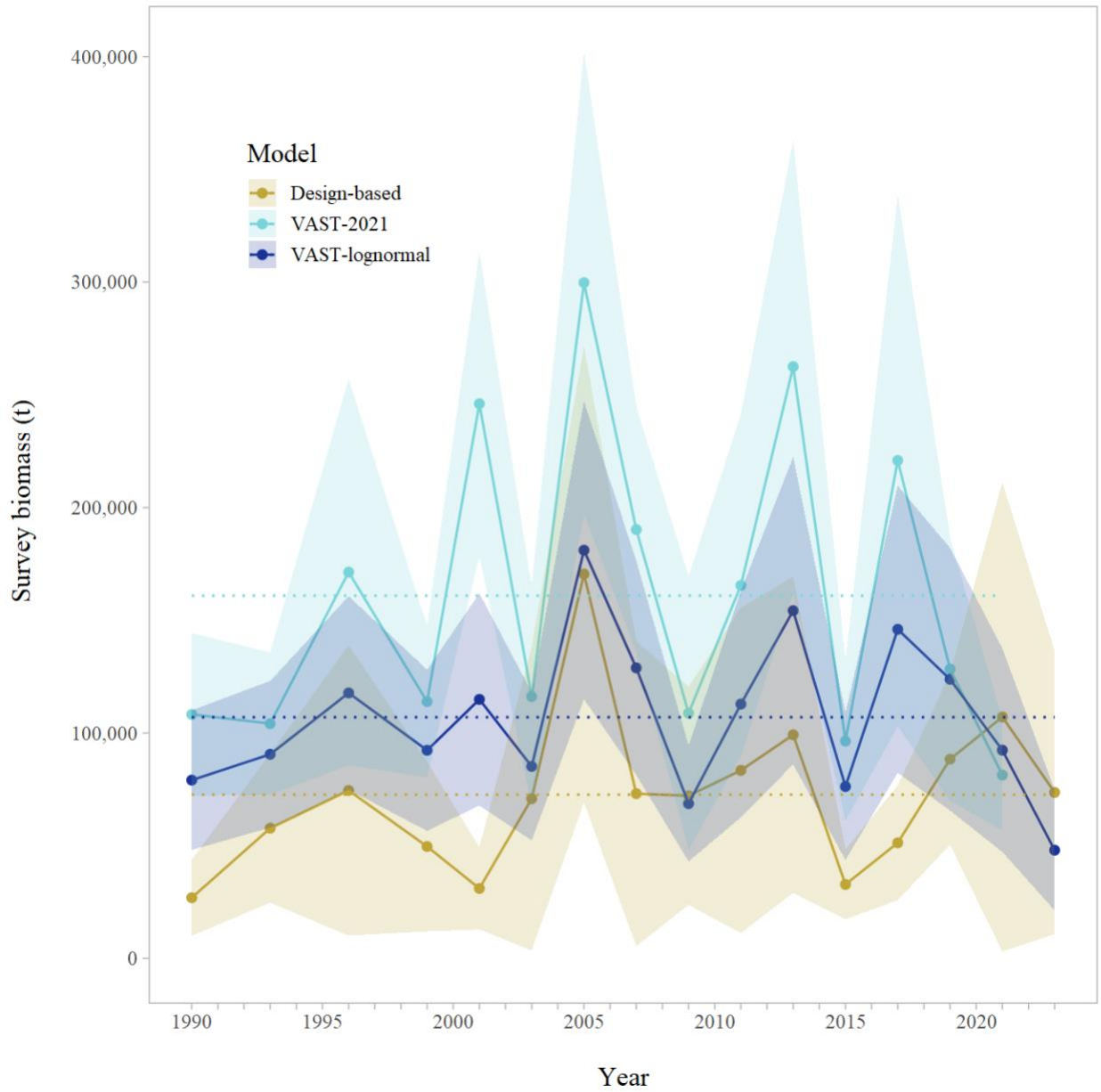
Figure 10-2. Line plot of geostatistical and design-based model estimates of abundance for Gulf of Alaska trawl surveys. Geostatistical model (VAST) and design-based model estimates of trawl survey abundance for northern rockfish in the Gulf of Alaska. Shaded areas are 95% confidence intervals, the dashed lines are the data means. VAST-2021 uses the default Gamma observation error settings with 500 knots, VAST-lognormal uses a lognormal error distribution and will be brought forward as the preferred survey abundance estimator in the next full assessment.