Assessment of the Northern rock sole stock in the Bering Sea and Aleutian Islands

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Executive Summary

Northern rock sole (*Lepidopsetta polyxystra*) 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. Please refer to last year's full stock assessment report for further information regarding the stock assessment model (McGilliard et al. 2022). A full stock assessment document with updated assessment and projection model results is scheduled to be presented in next year's SAFE report. A statistical age-structured model is used as the primary assessment tool for the Bering Sea/Aleutian Islands northern rock sole assessment, a Tier 1 stock. 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 sets used in this assessment include total catch biomass, fishery age compositions, trawl survey abundance estimates and trawl survey age compositions. In a partial assessment year, the full assessment model is not rerun but instead a Tier 1 projection model with an assumed future catch is used to estimate the stock level in the next two years. This incorporates the most current catch information for ABC and OFL recommendations without re-estimating model parameters and biological reference points.

The Tier 1 projection operates within the full assessment model by projecting estimates of the female spawning biomass, age 6+ total biomass, ABC and OFL ahead two years. Since the full assessment model is not rerun in this assessment, the projected values from the 2022 assessment are used to provide ABC and OFL.

Summary of Changes in Assessment Inputs

The 2022 catch was updated to realized year-end catch (18,399 t), which was larger than the projected 2022 catch used in the 2022 assessment (16,014 t). The 2023 realized catch as of September 27, 2023 was used in projections. The projected catch in 2024-2025 was estimated as the average over the past decade of final catches and was updated to 34,985 t from 40,739 t (used in the 2022 projections).

Summary of Results

For the 2024 fishery, the maximum ABC (maxABC) is 189,360 t from the updated projection model based on Model 18.3 (McGilliard et al. 2022). This maxABC is higher than last year's maxABC of 158,935 t and slightly more than last year's projected 2024 maxABC of 187,631 t. The 2022 BSAI Northern rock sole assessment (McGilliard et al. 2022) reduced the ABC from maxABC due to concerns about diagnostics and retrospective patterns in the assessment. The reduced ABC was set equal to the OFL from an alternative model (Model 22.1; McGilliard et al. 2022) that shows improved diagnostics and retrospective patterns. This year, the 2024 and 2025 projected ABC is reduced in the same manner, by setting it equal to the OFL from the updated alternative projections based on Model 22.1. This is a risk

table reduction from maxABC using the same concerns that were identified in the 2022 assessment. Reference values are summarized in the following table.

Quantity	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
	2023	2024	2024	2025
M (natural mortality rate)	0.15 (f),0.17 (m)	0.15 (f),0.17 (m)	0.15 (f),0.17 (m)	0.15 (f),0.17 (m)
Tier	1a	1a	1a	1a
Projected total (age 6+) biomass (t)	941,359	1,111,320	1,121,670	1,501,330
Projected Female spawning biomass (t)	260,887	291,774	296,808	347,811
B_0	447,795	447,795	447,795	447,795
B_{MSY}	155,293	155,293	155,293	155,293
F_{OFL}	0.176	0.176	0.176	0.176
$maxF_{ABC}$	0.169	0.169	0.169	0.169
F_{ABC}	0.129	0.108	0.129	0.108
OFL (t)	166,034	196,011	197,828	264,789
maxABC (t)	158,935	187,631	189,360	253,455
ABC (t)**	121,719	119,969	122,091	122,535
Status	As determined *last* year for:		As determined *this* year for:	
	2020	2021	2022	2023
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 realized catches of 18,399 t for 2022, realized catches of 23,093 t as of September 27, 2023, and 34,985 t used in place of maximum permissible ABC for 2024-2025. The 2024-2025 catch was estimated as the average over the past decade of final catches.

** The reduced ABC values were set equal to the OFL from the projected alternative model run (Model 22.1), following the methodology used to establish the ABC in the 2022 assessment (McGilliard et al. 2022).

The stock is not being subject to overfishing, is not currently overfished, nor is it approaching a condition of being overfished.

Fishery Trends
Updated catch data (NMFS Alaska Regional Office Catch Accounting System via the Alaska Fisheries Information Network (AKFIN) database, http://www.akfin.org) are summarized in Table 1 and indicate higher catches in 2023 than in 2021 and 2022, but lower catches in general than in the early to mid 2000s.

Survey Trends
Survey biomass for 2023 is higher than in 2022 (Figure 1). The ratio of total catch to age 6+ modeled total biomass has decreased in recent years (Figure 2).

Figures

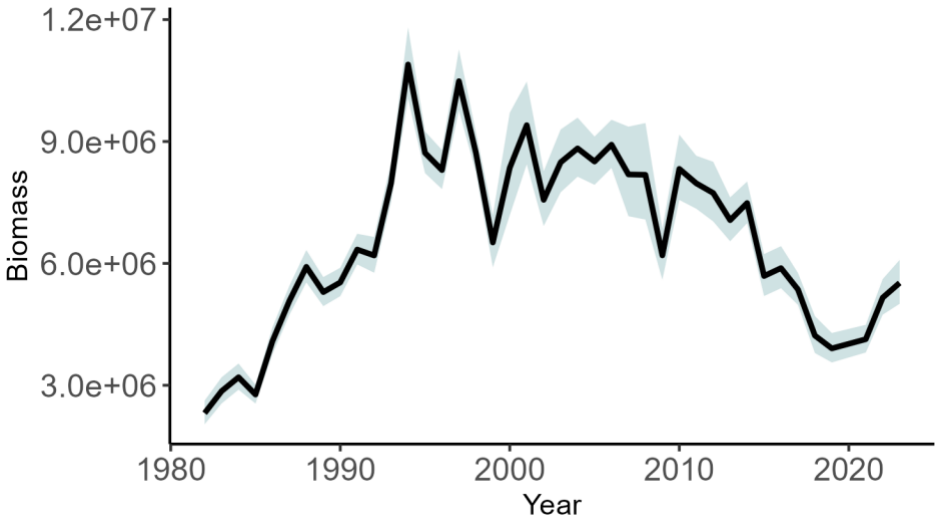

Figure 1. Survey biomass over time for Northern rock sole in the Bering Sea and Aleutian Islands with 95% uncertainty intervals shown in light blue. Survey biomass values prior to 1996 are for unidentified rock sole, as Northern and Southern rock sole were first separately identified in 1996.

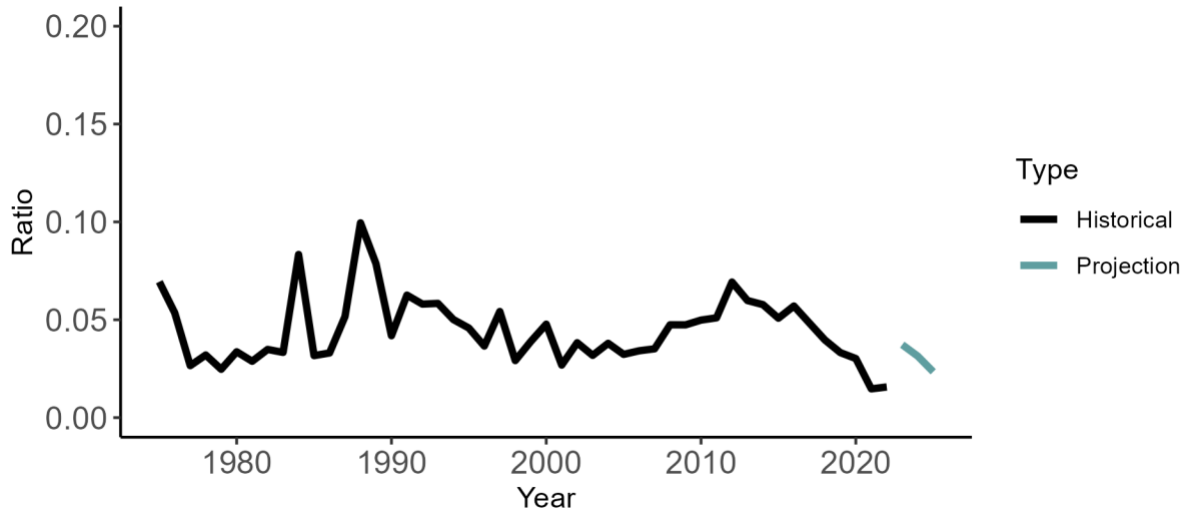

Figure 2. Ratio of total catch to total age 6+ biomass over time for northern rock sole in the Bering Sea and Aleutian Islands to 2023 (black line), including projected catch and biomass in 2024-2025 (light blue line).

Tables

Table 1. Catches of northern rock sole in the Bering Sea and Aleutian Islands as of September 27, 2023.

Year	Foreign	Joint-Venture	Domestic	Total
1977	5,319			5,319
1978	7,038			7,038
1979	5,874			5,874
1980	6,329	2,469		8,798
1981	3,480	5,541		9,021
1982	3,169	8,674		11,843
1983	4,479	9,140		13,619
1984	10,156	27,523		37,679
1985	6,671	12,079		18,750
1986	3,394	16,217		19,611
1987	776	11,136	28,910	40,822
1988		40,844	45,522	86,366
1989		21,010	47,902	68,912
1990		10,492	24,761	35,253
1991			56,058	56,058
1992			52,723	52,723
1993			64,261	64,261
1994			59,607	59,607
1995			55,029	55,029
1996			46,929	46,929
1997			67,815	67,815
1998			33,644	33,644
1999			41,090	41,090
2000			49,668	49,668

Year	Domestic	Total
2001	29,477	29,477
2002	41,867	41,867
2003	36,086	36,086
2004	48,681	48,681
2005	37,362	37,362
2006	36,456	36,456
2007	37,126	37,126
2008	51,276	51,276
2009	48,716	48,716
2010	53,200	53,200
2011	60,534	60,534
2012	75,945	75,945
2013	59,751	59,751
2014	51,690	51,690
2015	45,468	45,468
2016	45,084	45,084
2017	35,222	35,222
2018	28,269	28,269
2019	25,800	25,800
2020	25,938	25,938
2021	14,394	14,394
2022	18,399	18,399
2023	23,093	23,093

References

McGilliard, C.R., Ianelli, J., Bryan, M., Spies, I., Haehn, R., Punt, A.E., and Lowe, S. 2022. Assessment of the northern rock sole stock in the Bering Sea and Aleutian Islands In Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea and Aleutian Islands. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage AK 99510. https://apps-afsc.fisheries.noaa.gov/Plan_Team/2022/BSAIrocksole.pdf.