

4. Assessment of the Northern and Southern Rock Sole Stock in the Gulf of Alaska

Meaghan D. Bryan

November 2023

This report may be cited as:

Bryan, M. 2023. Assessment of the northern and southern rock sole stock in the Gulf of Alaska. North Pacific Fishery Management Council, Anchorage, AK. Available from <https://www.npfmc.org/library/safe-reports/>

Executive Summary

Gulf of Alaska northern and southern rock sole (*Lepidopsetta ployxystra* and *Lepidopsetta bilineatta*) are assessed every 4-years following the stock prioritization schedule. GOA northern rock and southern rock sole are classified as Tier 3 stocks and are assessed using a statistical catch-at-age models that account for regional differences in growth configured in Stock Synthesis 3 (Methot and Wetzel 2013). The western GOA and central-eastern GOA are modeled separately with estimated area-specific growth patterns. The assessment model is not run during an off-cycle year. During off-cycle years, harvest projections are presented with recommendations of harvest levels for the next two years, using updated catch information in the projection model. The last full assessment in 2021 is available online <https://apps-afsc.fisheries.noaa.gov/refm/docs/2021/GOAnsrocksole.pdf>. A full stock assessment document with updated assessment and projection model results will be presented in November, 2025.

Description of Updated Catch

An assumption of the northern and southern rock sole assessment models is that total rock sole catch is split evenly between the species. New catch data were added to the projection model and the values reported here are representative of the 50% split between species.

New data added to the projection model included an updated 2022 catch of 509 t and 12 t for the central and western GOA, respectively. We estimated the 2023 catch by increasing the official catch as of September 27th, 2023 by an expansion factor. The expansion factors used were 1.216 for the central GOA and 1.135 for the western GOA. The expansion factor represents the average fraction of catch taken after September 27th in the last five complete years (2018-2022). This resulted in an estimated catch for 2023 of 223 t and 10 t for the central-eastern GOA and western GOA, respectively and represents a small reduction in the 2023 catch estimates used in the 2022 harvest projection.. The 2023 preliminary catch estimates were also used for the 2024 and 2025 catch values in the projection model.

Summary of Results

The recommended ABCs for northern rock sole in the central-eastern GOA for 2024 and 2025 are 4,466 t and 4,631 t. The recommended OFLs are 5,227 t and 5,419 t for 2024 and 2025 in the central-eastern GOA. The recommended ABCs for northern rock sole in the western GOA for 2024 and 2025 are 8,916 t and 9,168 t. The recommended OFLs are 10,749 t and 11,047 t. The 2024 advice from the updated projection models is similar to what was recommended in the 2022 assessment for 2024.

The recommended ABCs for southern rock sole in the central-eastern GOA for 2024 and 2025 are 15,024 t and 15,482 t. The recommended OFLs are 17,786 t and 18,321 t. The recommended ABCs for southern rock sole in the western GOA for 2024 and 2025 are 12,430 t and 12,162 t. The recommended OFLs are 14,718 t and 14,926 t. The 2024 advice from the updated projection models is similar to what was recommended in the 2022 assessment for 2024.

Northern rock sole biomass declined in both the central-eastern and western GOA in 2023 as compared to 2021 (Figure 1). Southern rock sole biomass was stable in the central-eastern GOA and declined in the western GOA in 2023 as compared to 2021 (Figure 1).

Exploitation has been generally declining in the central-eastern GOA and consistent levels in the western GOA for both species (Figure 2).

Northern rock sole, Central-Eastern GOA Quantity	As estimated or <i>recommended last year for:</i>		As estimated or <i>recommended this year for:</i>	
	2023	2024	2024	2025
<i>M</i> (natural mortality rate; female, male)	0.2, 0.232*	0.2, 0.232*	0.2, 0.232*	0.2, 0.232*
Tier	3a	3a	3a	3a
Projected total (age 0+) biomass (t)	37,080	38,502	38,855	40,172
Projected Female spawning biomass (t)	13,431	15,845	16,054	17,427
<i>B</i> _{100%}	20,913	20,913	20,913	20,913
<i>B</i> _{40%}	8,365	8,365	8,365	8,365
<i>B</i> _{35%}	7,320	7,320	7,320	7,320
<i>F</i> _{OFL}	0.181	0.181	0.181	0.181
<i>maxF</i> _{ABC}	0.153	0.153	0.153	0.153
<i>F</i> _{ABC}	0.153	0.153	0.153	0.153
OFL (t)	4,934	5,175	5,227	5,419
maxABC (t)	4,214	4,421	4,466	4,631
ABC (t)	4,214	4,421	4,466	4,631
	As determined <i>last year</i> for:		As determined <i>this year</i> for:	
Status	2021	2022	2022	2023
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

* Female natural mortality is fixed and male natural mortality is estimated in the assessment model.

Northern rock sole, central-eastern GOA: Projections are based on the final catch of 509 t for 2022 and preliminary catch of 223 t used in place of maximum permissible ABC for 2023, 2024, and 2025.

Northern rock sole, Western GOA Quantity	As estimated or <i>recommended last year for:</i>		As estimated or <i>recommended this year for:</i>	
	2023	2024	2024	2025
<i>M</i> (natural mortality rate; female, male)	0.2, 0.254*	0.2, 0.254*	0.2, 0.254*	0.2, 0.254*
Tier	3a	3a	3a	3a
Projected total (age 0+) biomass (t)	66,512	67,083	67,086	67,327
Projected Female spawning biomass (t)	26,525	29,301	29,303	30,348
<i>B</i> _{100%}	28,702	28,702	28,702	28,702
<i>B</i> _{40%}	11,481	11,481	11,481	11,481
<i>B</i> _{35%}	10,045	10,045	10,045	10,045
<i>F</i> _{OFL}	0.385	0.385	0.385	0.385
<i>maxF</i> _{ABC}	0.313	0.313	0.313	0.313
<i>F</i> _{ABC}	0.313	0.313	0.313	0.313
OFL (t)	10,259	10,749	10,749	11,047
maxABC (t)	8,508	8,916	8,916	9,168
ABC (t)	8,508	8,916	8,916	9,168
Status	As determined <i>last year for:</i>		As determined <i>this year for:</i>	
	2021	2022	2022	2023
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

* Female natural mortality is fixed and male natural mortality is estimated in the assessment model.

Northern rock sole, western GOA: Projections are based on a final catch of 12 t for 2022 and preliminary catch of 10 t used in place of maximum permissible ABC for 2023, 2024, and 2025.

Southern rock sole, Central-Eastern GOA Quantity	As estimated or <i>recommended last year for:</i>		As estimated or <i>recommended this year for:</i>	
	2023	2024	2024	2025
<i>M</i> (natural mortality rate; female, male)	0.2, 0.253*	0.2, 0.253*	0.2, 0.253*	0.2, 0.253*
Tier	3a	3a	3a	3a
Projected total (age 0+) biomass (t)	133,391	134,647	134,978	135,672
Projected Female spawning biomass (t)	43,539	49,696	49,889	54,623
<i>B</i> _{100%}	53,439	53,439	53,439	53,439
<i>B</i> _{40%}	21,376	21,376	21,376	21,376
<i>B</i> _{35%}	18,703	18,703	18,703	18,703
<i>F</i> _{OFL}	0.268	0.268	0.268	0.268
<i>maxF</i> _{ABC}	0.224	0.224	0.224	0.224
<i>F</i> _{ABC}	0.224	0.224	0.224	0.224
OFL (t)	16,874	17,733	17,787	18,322
maxABC (t)	14,246	14,978	15,024	15,483
ABC (t)	14,246	14,978	15,024	15,482
Status	As determined <i>last year for:</i>		As determined <i>this year for:</i>	
	2021	2022	2022	2023
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

* Female natural mortality is fixed and male natural mortality is estimated in the assessment model.
Southern rock sole, central-eastern GOA: Projections are based on the final catch of 509 t for 2022 and preliminary catch of 223 t used in place of maximum permissible ABC for 2023, 2024, and 2025.

Southern rock sole, Western GOA Quantity	As estimated or <i>recommended last year for:</i>		As estimated or <i>recommended this year for:</i>	
	2022	2023	2023	2024
M (natural mortality rate; female, male)	0.2, 0.271*	0.2, 0.271*	0.2, 0.271*	0.2, 0.271*
Tier	3a	3a	3a	3a
Projected total (age 0+) biomass (t)	114,420	114,480	114,483	113,960
Projected Female spawning biomass (t)	40,457	45,479	45,481	49,057
$B_{100\%}$	43,788	43,788	43,788	43,788
$B_{40\%}$	17,515	17,515	17,515	17,515
$B_{35\%}$	15,326	15,326	15,326	15,326
F_{OFL}	0.222	0.222	0.222	0.222
$maxF_{ABC}$	0.185	0.185	0.185	0.185
F_{ABC}	0.185	0.185	0.185	0.185
OFL (t)	14,029	14,718	14,718	14,926
maxABC (t)	11,840	12,430	12,430	12,612
ABC (t)	11,840	12,430	12,430	12,612
Status	As determined <i>last year for:</i>		As determined <i>this year for:</i>	
	2021	2022	2022	2023
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

Female natural mortality is fixed and male natural mortality is estimated in the assessment model.
Southern rock sole, western GOA: Projections are based on a final catch of 12 t for 2022 and preliminary catch of 10 t used in place of maximum permissible ABC for 2023, 2024, and 2025.

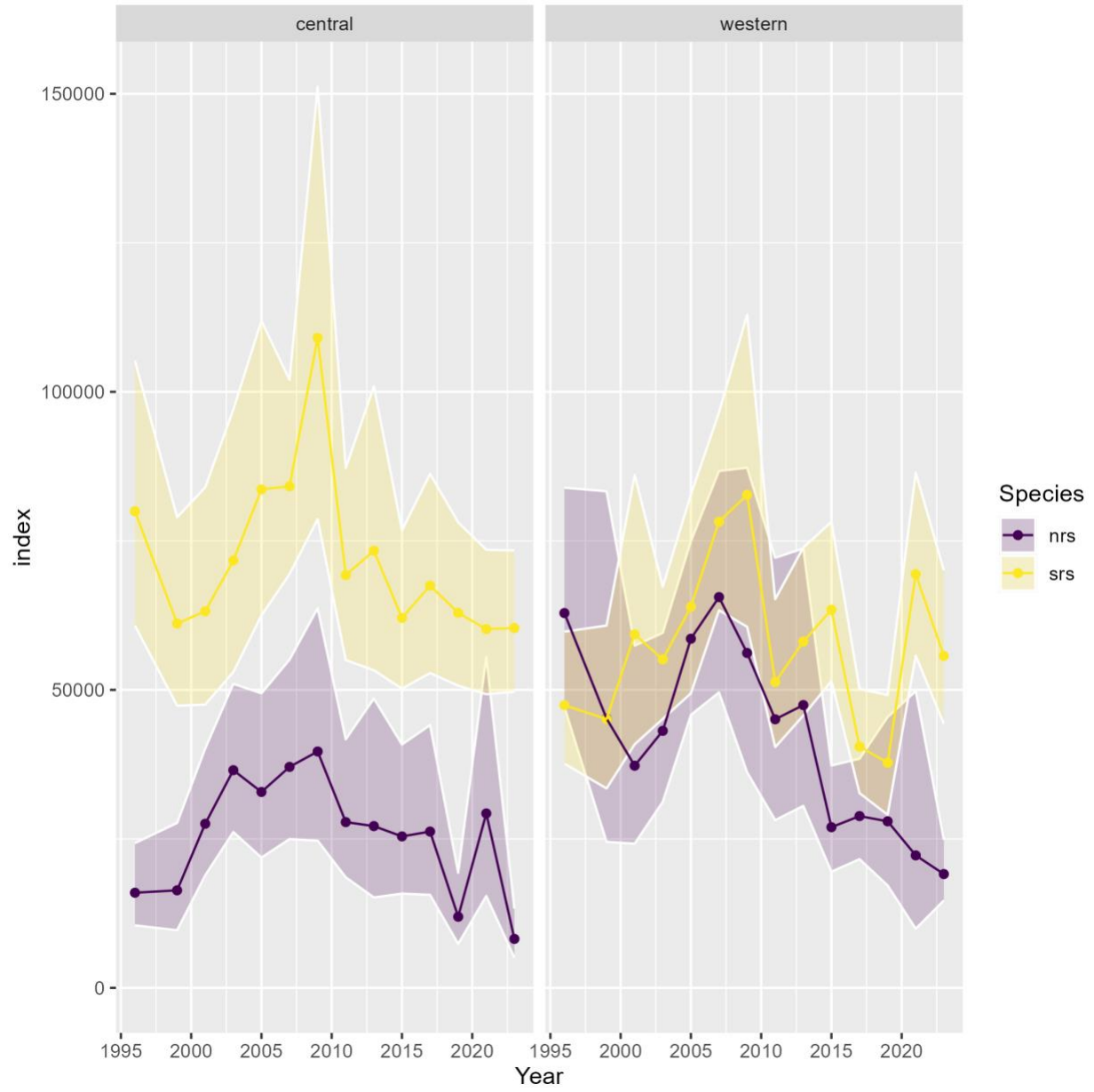
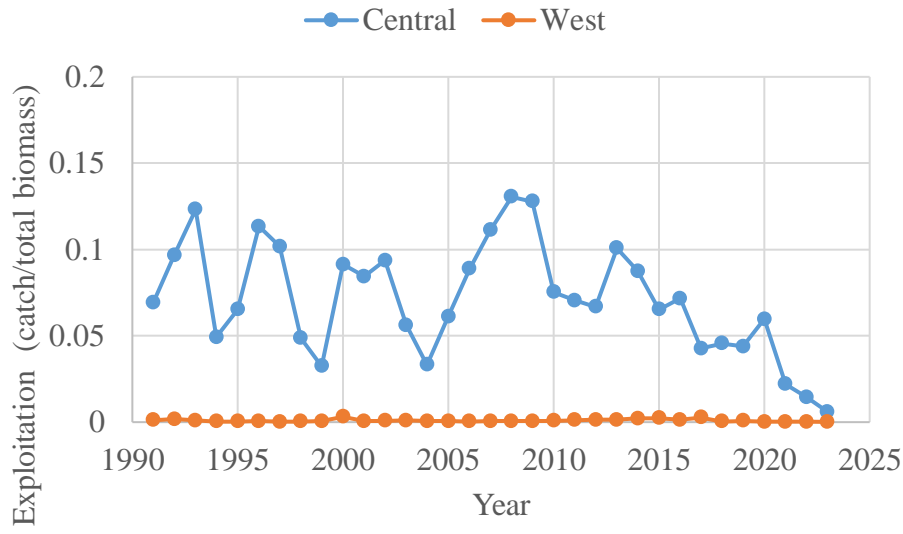


Figure 1. Biomass (t) estimates of northern rock sole (nrs) and southern rock sole (srs) by area from the AFSC Gulf of Alaska biennial bottom trawl survey, 1996-2023, with 95% confidence intervals.

a)



b)

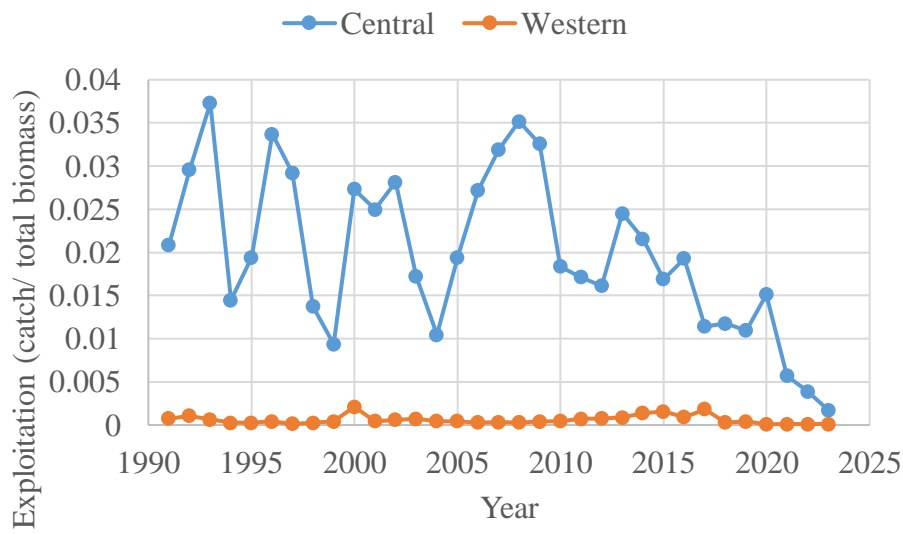


Figure 2. Exploitation (catch / total biomass) by area for a) northern rock sole and b) southern rock sole.