

6. Assessment of the Rex Sole Stock in the Gulf of Alaska

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Executive Summary

Introduction

The Gulf of Alaska rex sole stock is assessed every four years and was last assessed in 2017. In between the full assessment years, we present an executive summary to recommend harvest levels for the next two years. Please refer to the 2017 full stock assessment report for further information regarding the assessment model (McGilliard and Palsson, 2017, available online at <https://www.afsc.noaa.gov/REFM/Docs/2017/GOArex.pdf>). A full stock assessment document with updated assessment and projection model results will be presented in 2021.

Rex sole is assessed using an age-structured model and Tier 3 determination within the context of a two-area model. The Western-Central GOA and Eastern GOA are modeled as separate areas with distinct growth patterns estimated by area. Thus, the single species projection model was run separately for the two areas using parameter values from the accepted 2017 rex sole assessment model (McGilliard and Palsson 2017), together with updated catch information for 2017-2019, to predict stock status for rex sole in 2020 and 2021 and to make ABC recommendations for those years. Projections are conducted using numbers-at-age for rex sole from age 3-20+ by area and historical recruitment of age 3 individuals by area to calculate OFL's and ABC's.

Summary of Results

Based on the updated projection model results, the recommended ABC's for 2020 and 2021 in the Western-Central GOA are 11,480 t and 11,925 t, and the OFL's are 13,974 t and 14,512 t. The new ABC recommendation and OFL for the Western-Central GOA in 2020 are similar to those developed in 2019 (11,308 t and 13,755 t). The recommended ABC's for 2020 and 2021 in the Eastern GOA are 3,339 t and 3,491 t, and the OFL's are 4,153 t and 4,267 t. The new ABC recommendation and OFL for the Eastern GOA in 2019 are almost exactly the same as those developed in 2018 because realized and projected catches as estimated last year and this year were approximately 2 t. The principal reference values are shown in the following three tables. The first table shows quantities for the entire GOA, the second table shows quantities for the Western-Central GOA, and the third table shows quantities for the Eastern GOA. The Western-Central and Eastern GOA are based on a Tier 3a approach, and the entire GOA table is simply the sum of the two areas.

Quantity	As estimated or <i>specified this year for:</i>		As estimated or <i>recommended this year for:</i>					
	2019	2020	2020*	2021*				
<i>M</i> (natural mortality rate)	0.17	0.17	0.17	0.17				
Tier	3a	3a	3a	3a				
Projected total (3+) biomass (t)	98,818	99,383	100,198	101,244				
Female spawning biomass (t)	44,072	43,392	43,855	44,500				
<i>B</i> _{100%}	See area-specific tables below		See area-specific tables below					
<i>B</i> _{40%}								
<i>B</i> _{35%}								
<i>F</i> _{OFL}								
<i>maxF</i> _{ABC}	See area-specific tables below		See area-specific tables below					
<i>F</i> _{ABC}								
OFL (t)					17,889	17,942	18,127	18,779
maxABC (t)					14,692	14,725	14,878	15,416
ABC (t)	14,692	14,725	14,878	15,416				
Status	As determined <i>last</i> year for:		As determined <i>this</i> year for:					
	2017	2018	2018	2019				
Overfishing	no	n/a	no	n/a				
Overfished	n/a	no	n/a	no				
Approaching overfished	n/a	no	n/a	no				

Quantity: (Western-Central GOA)	As estimated or specified this year for:		As estimated or recommended this year for:	
	2019	2020	2020*	2021*
<i>M</i> (natural mortality rate)	0.17	0.17	0.17	0.17
Tier	3a	3a	3a	3a
Projected total (3+) biomass (t)	77,483	77,939	78,755	79,666
Female spawning biomass (t)	35,066	34,484	34,948	35,506
<i>B</i> _{100%}	48,138	48,138	48,138	48,138
<i>B</i> _{40%}	19,255	19,255	19,255	19,255
<i>B</i> _{35%}	16,848	16,848	16,848	16,848
<i>F</i> _{OFL}	0.29	0.29	0.29	0.29
<i>maxF</i> _{ABC}	0.23	0.23	0.23	0.23
<i>F</i> _{ABC}	0.23	0.23	0.23	0.23
OFL (t)	13,755	13,788	13,974	14,512
maxABC (t)	11,308	11,327	11,480	11,925
ABC (t)	11,308	11,327	11,480	11,925
Status	As determined last year for:		As determined this year for:	
	2017	2018	2018	2019
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 the final catch of 2017-2018 from the Western and Central GOA of 1,483 t and 1,749 t and estimated catches of 1,574 t and 2,103 t that were used in place of maximum permissible ABC for 2019 and 2020-2021, respectively. The 2019 projected catch was calculated as the current catch of GOA rex sole in the Western and Central GOA as of October 19, 2019 added to the average October 19 – December 31 GOA rex sole catches over the 5 previous years. The 2020-2021 projected catch was calculated as the average catch over the previous five years.

Quantity: (Eastern GOA)	As estimated or <i>specified this year for:</i>		As estimated or <i>recommended this year for:</i>	
	2019	2020	2020*	2021*
<i>M</i> (natural mortality rate)	0.17	0.17	0.17	0.17
Tier	3a	3a	3a	3a
Projected total (3+) biomass (t)	21,335	21444	21,443	21,578
Female spawning biomass (t)	9,006	8,908	8,907	8,994
<i>B</i> _{100%}	9,597	9,597	9,597	9,597
<i>B</i> _{40%}	3,839	3,839	3,839	3,839
<i>B</i> _{35%}	3,359	3,359	3,359	3,359
<i>F</i> _{OFL}	0.31	0.31	0.31	0.31
<i>maxF</i> _{ABC}	0.25	0.25	0.25	0.25
<i>F</i> _{ABC}	0.25	0.25	0.25	0.25
OFL (t)	4,134	4,154	4,153	4,267
maxABC (t)	3,384	3,398	3,398	3,491
ABC (t)	3,384	3,398	3,398	3,491
Status	As determined <i>last</i> year for:		As determined <i>this</i> year for:	
	2017	2018	2018	2019
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 the final catch of 2017-2018 from the Eastern GOA and estimated catches of 2.3 t and 1.5 t that were used in place of maximum permissible ABC for 2019 and 2020-2021, respectively. The 2019 projected catch was calculated as the current catch of GOA rex sole in the Eastern GOA as of October 19, 2019. The 2020-2021 projected catch was calculated as the average catch over the previous five years. In many years catches from the Eastern GOA are small and confidential.

Area Apportionment

The table below shows apportionment of the 2020 and 2021 ABCs among areas. The ABCs calculated for the Western-Central area (based on model estimates) are apportioned based on random effects model predictions of the proportion of Western-Central survey biomass in the Western and Central areas, respectively, in 2020-2021. Likewise, the ABC calculated for the Eastern area (based on model estimates) are apportioned based on random effects model predictions of the proportion Eastern survey biomass in the West Yakutat and Southeast areas, respectively.

Quantity	Western	Central	Total Western-Central	West Yakutat	Southeast	Total Eastern
Area Apportionment	25.27%	74.73%	100.00%	34.55%	65.45%	100.00%
2020 ABC (t)	2,901	8,579	11,480	1,174	2,224	3,398
2021 ABC (t)	3,013	8,912	11,925	1,206	2,285	3,491

Figures

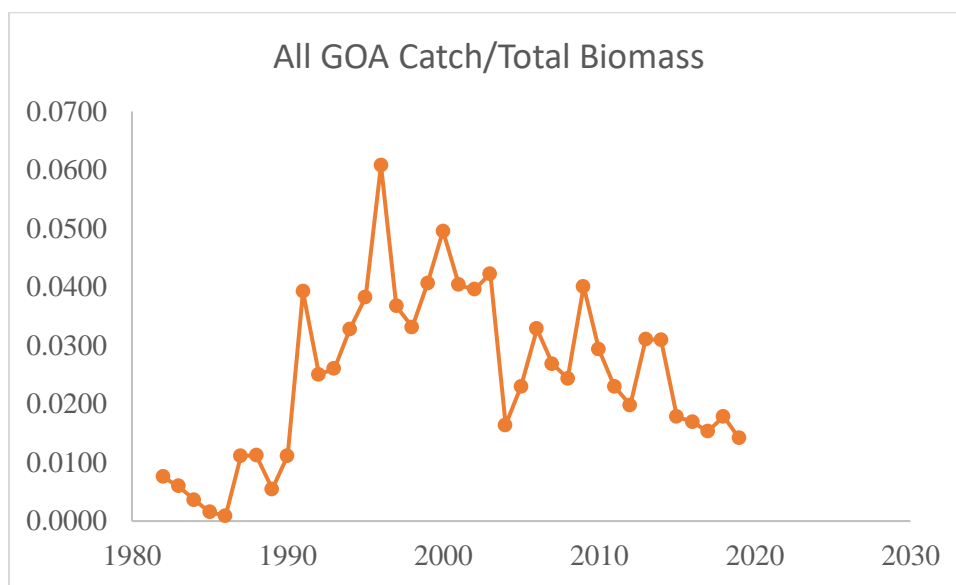


Figure 1. GOA rex sole catch:female spawning biomass ratio using age 3+ biomass for the entire GOA.

Tables

Table 1. Fishery catches for GOA rex sole by management area. Catch for 2019 is through October 19, 2019.

Year	Western Gulf	Central Gulf	Eastern Gulf
1982			
1983			
1984			
1985			
1986			
1987			
1988			
1989			
1990			
1991			
1992			
1993			
1994	49	3508	85
1995	220	3628	174
1996	552	5202	191
1997	681	2438	177
1998	440	2195	36
1999	603	2393	63
2000	883	2702	Confidential
2001	435	2507	Confidential
2002	398	2619	Confidential
2003	772	2726	2
2004	527	940	0
2005	576	1603	Confidential
2006	350	2944	0
2007	411	2438	1
2008	185	2522	Confidential
2009	342	4410	1
2010	134	3498	2
2011	131	2745	1
2012	215	2228	Confidential
2013	104	3603	0
2014	126	3450	1
2015	76	1881	Confidential
2016	172	1574	3
2017	48	1433	Confidential
2018	83	1666	2
2019	73	1324	2

Table 2. GOA rex sole survey biomass by regulatory area.

Year	Western		Central		Eastern		Total	
	Bio	CV	Bio	CV	Bio	CV	Bio	CV
1984	6,672	0.18	40,688	0.14	13,311	0.12	60,670	0.10
1987	8,801	0.27	39,722	0.13	15,304	0.14	63,826	0.09
1990	6,765	0.21	75,147	0.13	16,313	0.24	98,225	0.11
1993	10,760	0.20	55,310	0.09	20,901	0.14	86,972	0.07
1996	9,419	0.27	43,778	0.09	19,560	0.11	72,757	0.07
1999	12,755	0.52	42,750	0.12	19,464	0.12	74,969	0.12
2001	9,571	0.14	41,687	0.10			51,258	0.09
2003	13,265	0.13	57,973	0.10	28,659	0.15	99,897	0.08
2005	12,766	0.20	60,600	0.11	27,795	0.15	101,161	0.08
2007	11,614	0.15	76,514	0.12	15,672	0.17	103,800	0.09
2009	19,780	0.14	82,091	0.09	22,873	0.22	124,744	0.08
2011	12,964	0.16	63,490	0.10	18,681	0.12	95,134	0.08
2013	13,877	0.22	64,188	0.20	22,913	0.21	100,978	0.14
2015	15,936	0.14	48,903	0.11	22,474	0.21	87,313	0.09
2017	20,192	0.19	57,176	0.20	20,352	0.18	97,720	0.13
2019	17,142	0.16	49,029	0.15	24,243	0.17	90,414	0.10

Literature Cited

McGilliard, C.R. and Palsson, W. 2017. 6. Assessment of the rex sole stock in the Gulf of Alaska. In Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. pp. 657-742. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage AK 99510.