

## **8. Assessment of the Flathead Sole Stock in the Gulf of Alaska**

Carey R. McGilliard, Benjamin J. Turnock, and Wayne Palsson

November 2019

### **Executive Summary**

#### **Introduction**

The Gulf of Alaska flathead sole stock is assessed every four years and was last assessed in 2017. In years without a full assessment, 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 (Turnock et al., 2017, available online at <https://www.afsc.noaa.gov/REFM/Docs/2017/GOAflathead.pdf>). A full stock assessment document with updated assessment and projection model results will be presented in 2021.

Flathead sole is assessed using an age-structured model and Tier 3 determination. Thus, the single species projection model was run using parameter values from the accepted 2017 flathead sole assessment model (Turnock et al. 2017), together with updated catch information for 2017-2018, to predict stock status for flathead sole in 2019 and 2020 and to make ABC recommendations for those years. Projections are conducted using numbers-at-age for flathead sole from age 3-21+ and historical recruitment of age 3 individuals is used to calculate OFL's and ABC's.

#### **Summary of Results**

The ABC for flathead sole is 38,196 t in 2020 and 38,326 t in 2021 and the OFL is 46,572 t in 2020 and 47,919 t in 2021. The new ABC recommendation and OFL for 2020 are similar to those developed in 2018 (38,273 t and 46,666 t). The principal reference values are shown in the following table:

Quantity	As estimated or <i>specified last year for:</i>		As estimated or <i>recommended this year for:</i>	
	2019	2020	2020*	2021*
<i>M</i> (natural mortality rate)	0.2	0.2	0.2	0.2
Tier	3a	3a	3a	3a
Projected total (3+) biomass (t)	283,285	282,750	282,371	280,730
Projected Female spawning biomass (t)	89,205	92,655	92,467	95,216
<i>B</i> <sub>100%</sub>	91,551	91,551	91,551	91,551
<i>B</i> <sub>40%</sub>	36,620	36,620	36,620	36,620
<i>B</i> <sub>35%</sub>	32,043	32,043	32,043	32,043
<i>F</i> <sub>OFL</sub>	0.36	0.36	0.36	0.36
<i>maxF</i> <sub>ABC</sub>	0.28	0.28	0.28	0.28
<i>F</i> <sub>ABC</sub>	0.28	0.28	0.28	0.28
OFL (t)	44,865	46,666	46,572	47,919
maxABC (t)	36,782	38,273	38,196	39,326
ABC (t)	36,782	38,273	38,196	39,326
Status	As determined <i>last year for:</i>		As determined <i>this year for:</i>	
	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 estimated catches of 2,647 t used in place of maximum permissible ABC for 2019 and 2,246 t used in place of maximum permissible ABC for 2020 and 2021. The 2019 projected catch was calculated as the current catch as of October 19, 2019 added to the average October 19 – December 31 catches over the 5 previous years. The 2020 and 2021 projected catch was calculated as the average catch over the previous 5 years.

## Area Apportionment

Area apportionment for ABC of flathead sole is currently based on the proportion of survey biomass projected for each area in 2020 and 2021 using the survey averaging random effects model developed by the survey averaging working group. The recommended ABC area apportionment percentages are listed below.

Quantity	Western	Central	West Yakutat	Southeast	Total
Area	36.08%	52.89%	6.16%	4.86%	100.00%
2020 ABC (t)	13,783	20,201	2,354	1,858	38,196
2021 ABC (t)	14,191	20,799	2,424	1,912	39,326

## Figures

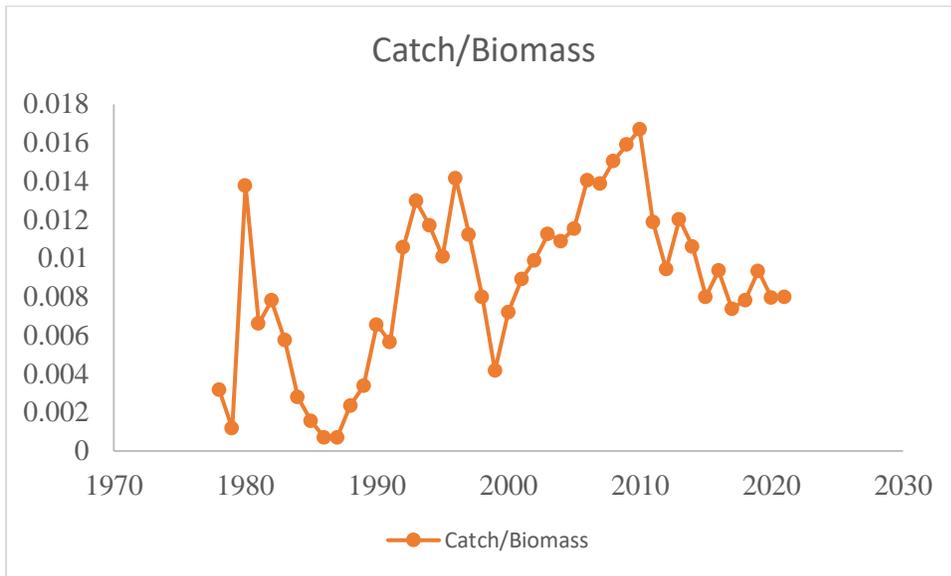


Figure 1. Catch to total biomass ratio using total biomass for age 3+ individuals for GOA flathead sole.

## Tables

Table 1. Total catch of GOA flathead sole. Catch for 2019 is current up to October 19, 2019. Columns left blank indicate confidential catch information by area.

<b>Year</b>	<b>Total Catch</b>	<b>Western Gulf</b>	<b>Central Gulf</b>	<b>Eastern Gulf</b>
1978	452			
1979	165			
1980	2,068			
1981	1,070			
1982	1,368			
1983	1,080			
1984	549			
1985	320			
1986	147			
1987	151			
1988	520			
1989	747			
1990	1,447			
1991	1,237	199	1,036	2
1992	2,315	355	1,947	13
1993	2,824	581	2,242	0
1994	2,525			
1995	2,180	589	1,563	28
1996	3,074	807	2,166	101
1997	2,441			
1998	1,731			
1999	897	186	687	25
2000	1,548			
2001	1,912			
2002	2,146			
2003	2,459	525	1,934	0
2004	2,398			
2005	2,552	611	1,941	
2006	3,142	462	2,679	1
2007	3,130	666	2,462	2
2008	3,446			
2009	3,663	303	3,359	1
2010	3,856	462	3,394	0
2011	2,732	393	2,338	0
2012	2,168	277	1,891	0
2013	2,819	588	2,230	0
2014	2,557	219	2,336	1
2015	2,000	199	1,801	1
2016	2,422	228	2,191	2
2017	2,051	73	1,978	0
2018	2,202	150	2,051	0
2019	2,291	197	2,093	0

Table 2. Flathead sole survey biomass (Bio) and CV by year and regulatory area.

Year	Total		Western		Central		Eastern	
	Bio	CV	Bio	CV	Bio	CV	Bio	CV
1984	249,341	0.12	45,100	0.41	158,539	0.14	45,703	0.18
1987	177,546	0.11	33,603	0.19	113,483	0.13	30,459	0.33
1990	243,055	0.12	58,740	0.19	161,257	0.16	23,059	0.31
1993	188,579	0.13	57,760	0.21	113,976	0.19	16,843	0.19
1996	205,521	0.09	66,732	0.18	122,730	0.11	16,059	0.16
1999	207,590	0.12	49,636	0.21	139,356	0.15	18,598	0.45
2001	153,594	0.12	68,164	0.20	85,430	0.14		
2003	257,294	0.08	67,055	0.13	170,852	0.10	19,388	0.14
2005	213,213	0.08	59,458	0.17	142,043	0.09	11,712	0.30
2007	281,402	0.08	78,361	0.16	177,641	0.11	25,400	0.28
2009	225,377	0.11	80,115	0.21	128,910	0.14	16,351	0.34
2011	235,639	0.09	76,049	0.16	128,428	0.12	31,162	0.34
2013	201,233	0.09	62,131	0.19	121,063	0.11	18,039	0.27
2015	218,548	0.08	67,665	0.18	126,200	0.09	24,684	0.14
2017	236,588	0.11	99,009	0.19	123,087	0.14	14,493	0.30
2019	185,840	0.09	66,710	0.17	94,280	0.13	24,849	0.24

### Literature Cited

Turnock, B.J., McGilliard, C.R., and Palsson, W. 2017. 8. Assessment of the Flathead Sole 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, P.O. Box 103136, Anchorage AK 99510.