9. Assessment of the Flathead Sole-Bering flounder Stock in the Bering Sea and Aleutian Islands

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Executive Summary

Introduction

"Flathead sole" as currently managed by the North Pacific Fishery Management Council (NPFMC) in the Bering Sea and Aleutian Islands (BSAI) represents a two-species complex consisting of true flathead sole (*Hippoglossoides elassodon*) and its morphologically-similar congener Bering flounder (*H. robustus*). In 2012, the BSAI Groundfish Plan Team moved flathead sole to a biennial stock assessment schedule because it has been lightly exploited for a substantial period of time (BSAI Plan Team, 2012) and a full stock assessment report was produced in 2016. This year, a partial assessment is presented. In partial assessment years, an executive summary is presented to recommend harvest levels for the next two years, along with trends in catch and biomass. The single species projection model is run using parameter values from the accepted 2016 assessment model, together with updated catch information for 2016 and 2017, to predict stock status for flathead sole in 2018 and 2019 and to make ABC recommendations for those years. Please refer to last year's full stock assessment report for further information regarding the stock assessment model (McGilliard et al. 2016, available online at https://www.afsc.noaa.gov/REFM/Docs/2016/BSAIflathead.pdf). A full stock assessment document with updated assessment and projection model results will be presented in next year's SAFE report.

Updated catch and projection

The most recent EBS Groundfish Survey was conducted in 2017. A preliminary examination of results from the survey indicates that survey biomass of flathead sole in the standard survey area increased from 433,469 t in 2016 to 531,291 t in 2017. Biomass of Bering flounder in the standard survey area decreased from 12,831 t in 2016 to 9,275 t in 2017.

Flathead sole is managed in Tier 3a. To run the projection model to predict ABC's for 2018 and 2019, estimates are required for the total catches in 2017-2019. The final catch for 2017 was estimated by adding the average catch between October 8 and December 31 over the years 2012-2016 to the current catch. The 2018 and 2019 catches were estimated as the average catch over the previous 5 years (2012-2016). Based on the updated projection model results, the recommended ABC's for 2018 and 2019 are listed in the table below. The new ABC recommendation and OFL for 2018 are similar to those developed using the 2016 full assessment model.

Quantity	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
	2017	2018	2018*	2019*
M (natural mortality rate)	0.2	0.2	0.2	0.2
Tier	3a	3a	3a	3a
Projected total (3+) biomass (t)	747,557	758,543	762,513	777,961
Projected Female spawning biomass (t)	223,469	206,029	214,124	205,156
$B_{100\%}$	322,938	322,938	322,938	322,938
$B_{40\%}$	129,175	129,175	129,175	129,175
$B_{35\%}$	113,028	113,028	113,028	113,028
F_{OFL}	0.41	0.41	0.41	0.41
$maxF_{ABC}$	0.34	0.34	0.34	0.34
F_{ABC}	0.34	0.34	0.34	0.34
OFL (t)	81,654	79,136	79,862	78,036
maxABC (t)	68,278	66,164	66,773	65,227
ABC (t)	68,278	66,164	66,773	65,227
Status	As determined in 2016 for:		As determined in 2017 for:	
	2015	2016	2016	2017
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 9,495 t for 2017 and 13,385 t used in place of maximum permissible ABC for 2018 and 2019. The 2017 projected catch was calculated as the current catch of BSAI flathead sole as of October 8, 2017 added to the average October 8–December 31 BSAI flathead sole catches over the 5 previous years. The 2018 and 2019 projected catches were calculated as the average catch for BSAI flathead sole for the previous 5 years.

Figures

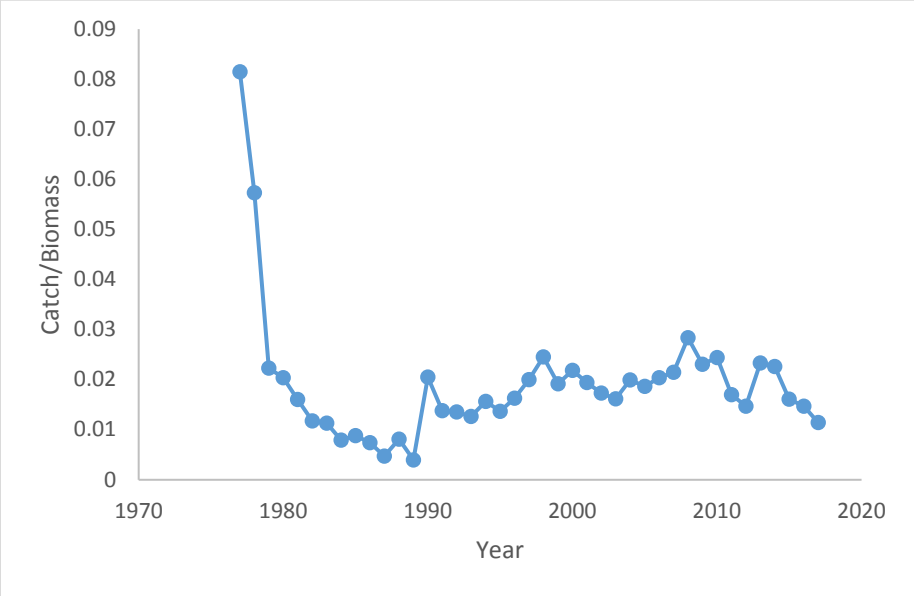

Figure 1. Total catch to total age 3+ biomass ratio for *Hippoglossoides* species in the Bering Sea and Aleutian Islands.

Tables

Table 1. Survey biomass for the EBS shelf survey (EBS only) and the Aleutian Islands Survey

	Hippoglossoides spp. EBS-AI Combined		Aleutian Islands		Hippoglossoides spp. EBS Only		EBS Flathead Sole Only		EBS Bering Flounder Only	
Year	**Bio.**	**CV**	**AI**	**CV**	**Bio.**	**CV**	**EBS**	**CV**	**Bio.**	**CV**
1982	195,201	0.09			192,037	0.09	192,037	0.09	0	
1983	272,185	0.10	1,213	0.20	270,972	0.10	252,612	0.11	18,359	0.20
1984	290,651	0.08			285,849	0.08	270,794	0.09	15,054	0.22
1985	269,874	0.07			265,428	0.07	252,046	0.08	13,382	0.12
1986	363,208	0.09	5,245	0.16	357,963	0.09	344,002	0.09	13,962	0.17
1987	400,272	0.09			393,588	0.09	379,394	0.10	14,194	0.14
1988	571,489	0.09			561,868	0.09	538,770	0.09	23,098	0.22
1989	530,050	0.08			521,140	0.08	502,310	0.09	18,830	0.20
1990	603,678	0.09			593,504	0.09	574,174	0.09	19,331	0.15
1991	552,949	0.08	6,939	0.20	546,010	0.08	518,380	0.08	27,630	0.22
1992	628,945	0.11			618,338	0.11	603,140	0.11	15,198	0.21
1993	618,146	0.07			607,724	0.07	585,400	0.07	22,324	0.21
1994	700,088	0.07	9,935	0.23	690,153	0.07	664,396	0.07	25,757	0.19
1995	604,611	0.09			594,421	0.09	578,945	0.09	15,476	0.18
1996	627,035	0.09			616,460	0.09	604,427	0.09	12,034	0.20
1997	795,463	0.21	11,554	0.24	783,909	0.21	769,783	0.22	14,126	0.19
1998	695,374	0.20			683,627	0.20	675,766	0.21	7,861	0.21
1999	408,010	0.09			401,194	0.09	387,995	0.09	13,199	0.18
2000	401,767	0.09	8,950	0.23	392,817	0.09	384,592	0.09	8,225	0.19
2001	524,171	0.10			515,362	0.10	503,943	0.11	11,419	0.21
2002	563,230	0.18	9,898	0.24	553,333	0.18	548,401	0.18	4,932	0.19
2003	523,669	0.10			514,868	0.10	509,156	0.11	5,712	0.21
2004	625,587	0.09	13,298	0.14	612,289	0.09	604,186	0.09	8,103	0.31
2005	622,971	0.09			612,467	0.09	605,350	0.09	7,116	0.28
2006	644,948	0.09	9,665	0.18	635,283	0.09	621,390	0.09	13,893	0.32
2007	572,201	0.09			562,568	0.09	552,114	0.09	10,453	0.22
2008	554,805	0.14			545,470	0.14	535,359	0.15	10,111	0.19
2009	425,936	0.12			418,812	0.12	412,163	0.12	6,649	0.17
2010	507,047	0.15	11,812	0.31	495,235	0.15	488,626	0.15	6,610	0.16
2011	593,296	0.19			583,300	0.19	576,498	0.19	6,802	0.15
2012	387,043	0.12	5,566	0.15	381,477	0.12	374,842	0.12	6,635	0.14
2013	499,579	0.17			491,191	0.17	485,486	0.17	5,705	0.14
2014	532,886	0.14	13,436	0.14	519,450	0.14	509,801	0.14	9,649	0.18
2015	399,870	0.11			393,194	0.11	382,173	0.12	11,021	0.17
2016	453,060	0.07	6,759	0.15	446,300	0.07	433,469	0.07	12,831	0.24
2017	540,567	0.08			540,567	0.08	531,291	0.08	9,275	0.23

Table 2. Catches of flathead sole and Bering flounder

Year	Total *(Hippo. spp)*	Flathead sole	Bering Flounder
1977	7,909	7,909.00	0.00
1978	6,957	6,891.61	65.39
1979	4,351	4,350.69	0.31
1980	5,247	4,897.00	350.00
1981	5,218	5,213.00	5.00
1982	4,509	4,498.40	10.60
1983	5,240	5,231.69	8.31
1984	4,458	4,394.75	63.25
1985	5,636	5,626.04	9.96
1986	5,208	5,145.85	62.15
1987	3,595	3,478.97	116.03
1988	6,783	6,697.08	85.92
1989	3,604	3,593.61	10.39
1990	20,245	19,263.85	981.15
1991	14,197	14,175.93	21.07
1992	14,407	14,346.72	60.28
1993	13,574	13,462.77	111.23
1994	17,006	16,987.43	18.57
1995	14,713	14,708.58	4.42
1996	17,344	17,339.24	4.76
1997	20,681	20,675.87	5.13
1998	24,597	24,590.40	6.60
1999	18,555	18,534.64	20.36
2000	20,422	20,389.10	32.90
2001	17,809	17,792.62	16.38
2002	15,572	15,546.78	25.22
2003	14,184	14,165.74	18.26
2004	17,394	17,369.90	24.10
2005	16,151	16,120.18	30.82
2006	17,947	17,941.22	5.78
2007	18,744	18,738.18	5.82
2008	24,539	24,524.78	14.22
2009	19,549	19,360.02	188.98
2010	20,125	19,898.93	226.07
2011	13,556	13,474.99	81.01
2012	11,366	11,360.28	5.72
2013	17,358	17,277.76	80.24
2014	16,513	16,479.90	33.10
2015	11,308	11,274.59	33.41
2016	10,384	10,371.47	12.22
2017[1]	8,534	8,530.72	3.73

[1] Catch to October 8, 2017

References

McGilliard, C.R. ,Nichol, D., and Palsson, W. 2016. 9. Assessment of the Flathead Sole-Bering flounder Stock in the Bering Sea and Aleutian Islands. In Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. pp. 1151-1258. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage AK 99510.