19. Partial assessment of the sculpin stock complex in the Gulf of Alaska

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Summary of Results

This assessment is a partial assessment in accordance with the current assessment schedule. The estimated 2019 total sculpin complex biomass in the GOA is 33,010 t from a random effects model fit to survey data. This represents a small decrease from the last full assessment in 2015. The recommended 2020 and 2021 ABC is 5,199 t based on an F_{ABC}=0.16 and the 2020 and 2021 overfishing level is 6,932 t based on an F_{OFL}=0.21. The decrease is due to decreasing sculpin biomass in the 2019 GOA survey relative to the 2017 survey.

	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
Quantity	2019	2020	2020	2021
M (natural mortality rate)	0.21	0.21	0.21	0.21
Tier	5	5	5	5
Biomass (t)	33,134	33,134	33,010	33,010
F_{OFL}	0.21	0.21	0.21	0.21
$maxF_{ABC}$	0.16	0.16	0.16	0.16
F_{ABC}	0.16	0.16	0.16	0.16
OFL (t)	6,958	6,958	6,932	6,932
maxABC (t)	5,301	5,301	5,199	5,199
ABC (t)	5,301	5,301	5,199	5,199
	As determined *last* year for:		As determined *this* year for:	
Status	2017	2018	2018	2019
Overfishing	No	n/a	No	n/a

GOA sculpins are managed with a single total allowable catch (TAC) for the entire Gulf of Alaska region; there is no area apportionment. Biomass for this assessment is based on survey estimates for the four most abundant sculpins in the GOA: bigmouth (*Hemitripterus bolini*), great (*Myoxocephalus polyacanthocephalus*), plain (*Myoxocephalus jaok*, yellow Irish lord (*Hemilepidotus jordani*) and other sculpins not in the list above, applied to a random effects model.

Sculpins are a group of benthic-dwelling predatory teleost fishes that include 48 species in waters off the coast of Alaska. The four most common species have been identified in the AFSC GOA surveys since 1984. A total of forty-six species of sculpins have been listed as occurring in the GOA, and 39 of these have been identified on NMFS GOA research surveys. Sculpins are broadly distributed throughout the shelf and slope regions of the GOA, occupying all benthic habitats and depths. Sculpins are currently a non-target species complex in the GOA, so sculpin catch depends solely on the TAC and spatial temporal limitations placed on target fisheries. Catches have declined the past three years from 1,318 t in 2017 to 563 in 2019 (as of October 19) and are moderately exploited.

Year	Sculpin complex total catch
1997	898
1998	526
1999	544
2000	940
2001	587
2002	919
2003	629
2004	701
2005	626
2006	583
2007	960
2008	1,925
2009	1,374
2010	911
2011	763
2012	795
2013	1,966
2014	1,187
2015	1,016
2016	1,330
2017	1318
2018	721
2019	563

Survey

Aggregate sculpin biomass estimates are derived from the GOA bottom trawl surveys. In the GOA, these aggregate data show no clear temporal trend, and should not be used as an indicator of population status for a complex with so much species diversity. Approximately 95% of the 2019 sculpin biomass is comprised of the larger sculpin species in the GOA: great, plain, bigmouth sculpin, and yellow Irish lord.

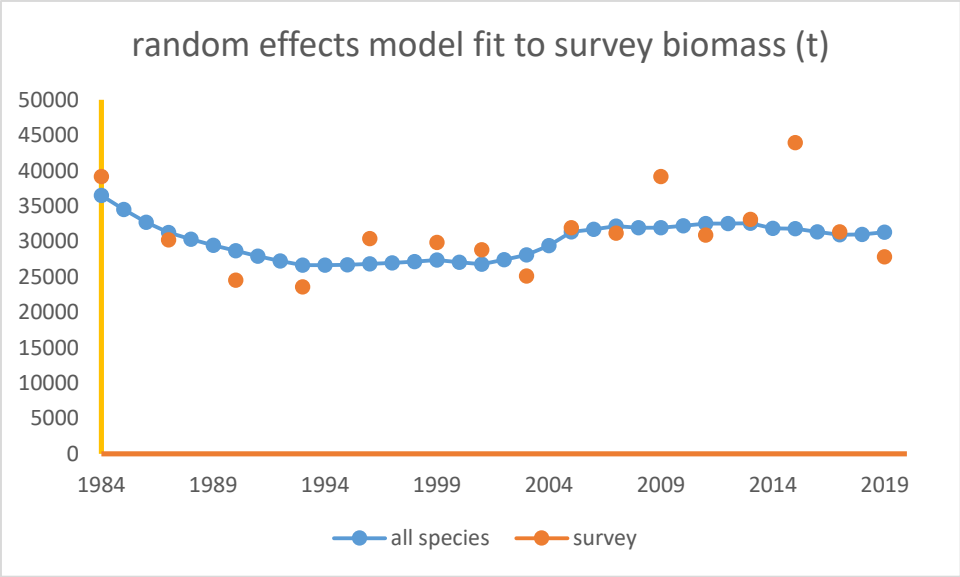
Gulf of Alaska survey estimates of the major sculpin species.

	plain	great	yellow irish	bigmouth	total
1984		8833	14439	15871	39142
1987	403	6007	13592	10196	30198
1990	433	3815	11701	8600	24550
1993	461	5846	11661	5612	23580
1996	1015	7326	17804	4246	30391
1999	1692	3913	20255	3983	29843
2001	932	3540	20900	3470	28842
2003	1220	6040	12100	5770	25130
2005	3913	6542	15943	5543	31940
2007	4550	7970	15500	3130	31150
2009	2562	8215	25219	3154	39150
2011	3160	8384	15771	3591	30906
2013	3036	6282	19841	3947	33107
2015	508	9128	29532	4783	43951
2017	451	7379	19060	4438	31328
2019	1658	5643	14964	5559	27825

Species-specific biomass estimates are available for these four species. Mean proportions in the 2019 survey indicate that yellow Irish lord is currently the most abundant (~53% of all sculpin biomass), followed by great sculpin at 22%, bigmouth sculpin at 15%, and plain sculpin at 4%. These proportions have shown little change relative to the 2017 survey.

As in past years, a random effects model is fit to the survey biomass estimates to produce an estimate of total biomass for each individual species, and the total complex. Results indicate an even biomass trend as shown below.

	plain	great	yellow irish lord	bigmouth	all species
1984	4.05903	7176.07	14299.7	15035.1	36515
1985	15.8647	6917.92	14280.2	13276.8	34491
1986	62.0071	6669.05	14260.8	11724.2	32716
1987	242.354	6429.13	14241.4	10353.1	31266
1988	288.426	6261.54	14257.1	9512.26	30319
1989	343.256	6098.32	14272.8	8739.69	29454
1990	408.508	5939.35	14288.5	8029.86	28666
1991	431.952	5899.41	14387.2	7193.37	27912
1992	456.741	5859.74	14486.4	6444.02	27247
1993	482.953	5820.35	14586.4	5772.74	26662
1994	613.398	5778.22	14904.5	5343.37	26639
1995	779.075	5736.39	15229.5	4945.94	26691
1996	989.502	5694.87	15561.6	4578.07	26824
1997	1137.96	5521.21	15866.8	4436.71	26963
1998	1308.7	5352.83	16178	4299.71	27139
1999	1505.05	5189.6	16495.3	4166.95	27357
2000	1236.11	5255.71	16383.5	4172.91	27048
2001	1015.23	5322.67	16272.4	4178.88	26789
2002	1148.99	5620.27	16085.3	4552.98	27408
2003	1300.38	5934.51	15900.4	4960.58	28096
2004	2167	6224.01	16153.9	4878.62	29424
2005	3611.15	6527.63	16411.4	4798.02	31348
2006	3867.39	6844.13	16751.7	4237.11	31700
2007	4141.82	7175.98	17099	3741.78	32159
2008	3318.04	7368.93	17663.9	3606.39	31957
2009	2658.1	7567.07	18247.4	3475.9	31948
2010	2854.2	7620.51	18175	3573.59	32223
2011	3064.77	7674.33	18102.9	3674.03	32516
2012	2745.09	7557.94	18372.3	3843.4	32519
2013	2458.75	7443.33	18645.7	4020.58	32568
2014	1186.79	7612.7	18789.9	4254.93	31844
2015	572.84	7785.93	18935.2	4502.93	31797
2016	541.577	7622	18634	4559.35	31357
2017	512.021	7461.51	18337.5	4616.48	30928
2018	864.199	7312.87	17971.8	4826.94	30976
2019	1458.61	7167.19	17613.4	5046.99	31286



The catch to biomass (model estimates) ratio indicates a moderately exploited stock. The value has ranged from 0.11(2019) to 0.53 (2008) with an average of 0.23.