

19. Assessment of the sculpin stock complex in the Bering Sea and Aleutian Islands

Ingrid Spies, Kerim Aydin, Dan Nichol, Wayne Palsson, Jerry Hoff, and Todd T. TenBrink
Alaska Fisheries Science Center
National Marine Fisheries Service

Executive Summary

The Bering Sea and Aleutian Island (BSAI) sculpin complex is managed in Tier 5. The last full BSAI sculpin assessment was performed in 2016. The 2016 full assessment can be found at <http://www.afsc.noaa.gov/REFM/stocks/assessments.htm>. This document consists of an executive summary.

Summary of Changes in Assessment Inputs

Summary of Changes in the Input Data

- 1) The 2019 Bering Sea shelf survey estimates of sculpin biomass were used in this assessment.
- 2) Complete catch is presented for all years through 2018, as well as the estimated catch for 2019 (through end of October 2019).

Changes in the assessment methodology:

There were no changes in the assessment methodology.

Summary of Results

The estimated ABC and OFL values for 2019 and 2020 in this update are higher than the values for 2018 and 2019 produced in the 2017 assessment because the biomass estimate of sculpins on the Bering Sea shelf in 2019 were higher than the 2017 estimate (171,760 t vs. 230,291 t). The 2018 Aleutian Islands survey also provided data for this assessment but the slope survey was not conducted and those values have not changed. OFL and ABC also increased primarily because 4 of the 5 most abundant sculpin species on the shelf increased. Catch of sculpins (as bycatch) has exhibited a stable trend in the past 7 years averaging 5,184 t.

Quantity	As estimated or specified last year for:		As estimated or recommended this year for:	
	2018	2019	2019	2020
<i>M</i> (natural mortality rate)*	0.282	0.282	0.282	0.282
Tier	5	5	5	5
Biomass (t)	188,656	188,656	240,487	240,487
F_{OFL}	0.282	0.282	0.282	0.282
$maxF_{ABC}$	0.212	0.212	0.212	0.212
F_{ABC}	0.212	0.212	0.212	0.212
OFL (t)	53,201	53,201	67,817	67,817
maxABC (t)	39,995	39,995	50,863	50,863
ABC (t)	39,995	39,995	50,863	50,863
Status	As determined last year for:		As determined this year for:	
	2016	2017	2017	2018
Overfishing	No	n/a	No	n/a

* The sculpin complex mortality rate is a biomass-weighted average of the instantaneous natural mortality rates for the six most abundant sculpins in the BSAI: bigmouth (*Hemitripterus bolini*), great (*Myoxocephalus polyacanthocephalus*), plain (*Myoxocephalus jaok*), threaded (*Gymnocanthus pistilliger*), warty (*Myoxocephalus verrucosus/scorpius*), and yellow Irish lord (*Hemilepidotus jordani*). The complex mortality rate may change as new survey data become available.

Summary

Results of the annual Bering Sea shelf surveys are shown in Table 19.1 for the sculpin species found on the BSAI shelf: bigmouth, great, plain, warty, yellow Irish lords and species of the other sculpin classification. The Bering Sea slope survey was not conducted in 2018 and 2019. The Aleutian Islands were surveyed in 2018 and those results were incorporated into the random effects model with the shelf survey values in this partial assessment.

Biomass estimates were fairly stable for the major species with the exception of bigmouth sculpin which declined 11%. Plain sculpin increased 67% and was responsible for the gain in ABC and OFL. Catches have been stable the past 7 years, averaging 5,184 t (Figure 19.1 and Table 19.2). The catch to model biomass ratio has remained stable at approximately 3% from 2014 to the present (Figure 19.2). There was no sculpin assessment prior to 2006.

The shelf and Aleutian Island survey biomass estimates and CV, for each species and survey area were fit to a random effects model to provide a modeled estimate of 2019 biomass to determine OFL and ABC. Results indicate an increase in the recommended ABC and OFL from the last assessment (ABC and OFL increase 27% and 12%, respectively, Table 19.4).

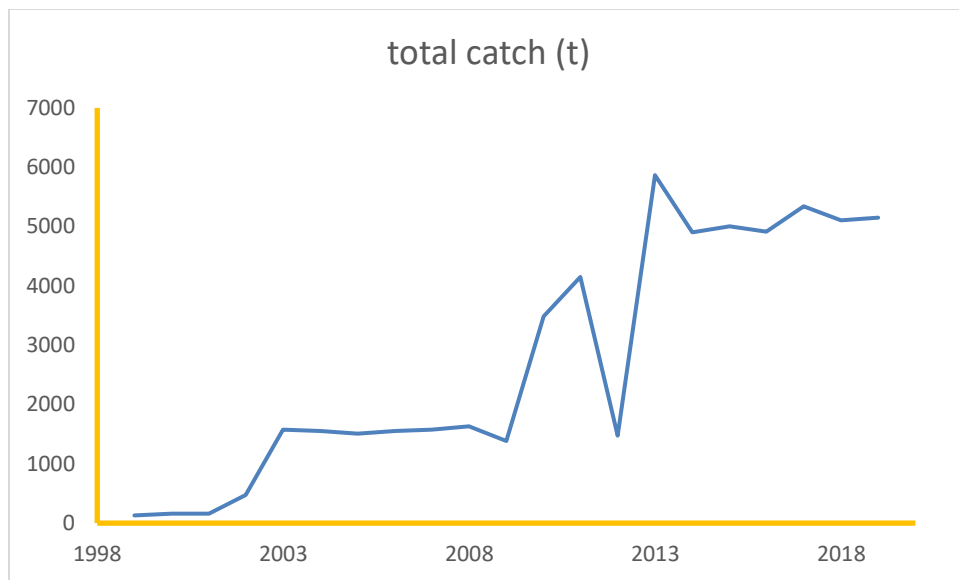


Figure 19.1. Catches of the combined species of the sculpin complex in the BSAI, 1999-2019.

Table 19.1. Eastern Bering Sea (EBS) shelf sculpin biomass estimates (t) from surveys conducted on the EBS shelf, 1987-2019.

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
bigmouth sculpin	22996	22038	16636	16123	20486	18300	19630	28426	29492	31254	29722	36276
great sculpin	50064	40204	37097	35652	67399	93887	67412	98267	88609	86850	80124	65299
plain sculpin	55852	49264	57498	35836	113175	73662	87782	96540	67260	51849	69667	57096
warty sculpin	3938	3483	0	0	3915	0	49	0	0	0	3915	8879
yellow irish lord	41574	24867	22047	10212	10258	17092	22057	17911	19112	14575	23727	13915
antlered sculpin	4	0	0	12	0	3	0	0	0	0	0	0
Arctic staghorn sculpin	0	0	0	2	0	0	0	0	0	0	22	0
armorhead sculpin	2361	3873	436	3599	3098	1851	0	5313	605	523	1252	917
blackfin sculpin	0	0	0	0	0	0	0	0	0	0	0	0
butterfly sculpin	9394	60047	33136	65726	51460	25447	23277	18619	13056	2664	6070	1334
crested sculpin	9	0	0	4	0	0	1	0	0	0	0	0
darkfin sculpin	1	72	7	312	526	6	3	0	0	28	45	0
eyeshade sculpin	3	9	0	0	4	1	6	0	0	0	7	0
highbrow sculpin	0	0	0	0	0	0	0	0	0	0	0	0
hookhorn sculpin	4	0	0	0	13	15	0	7	3	0	0	12
purplegray sculpin	0	0	0	0	0	0	0	0	0	0	0	21
red Irish lord	0	0	0	0	0	11	0	0	0	0	0	0
ribbed sculpin	491	515	114	439	619	158	19	0	6	108	33	71
roughspine sculpin	48	0	22	0	6	0	0	0	11	0	6	50
sailfin sculpin	0	0	0	0	0	0	0	0	0	5	0	0
scissortail sculpin	19	1	16	0	2	0	0	0	14	10	0	3
spatulate sculpin	0	3	0	59	0	451	0	0	0	0	0	14
spectacled sculpin	18	152	369	6	0	37	0	0	0	9	652	168
spinyhead sculpin	253	979	659	1363	2159	2924	1749	1384	1245	684	874	958
thorny sculpin	1706	1825	992	1600	644	1589	160	397	71	191	931	1351
threaded sculpin	151	288	72	0	93	279	0	0	0	0	3867	1803

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
bigmouth sculpin	24681	26200	25760	32180	29258	34409	31289	30118	27859	30846
great sculpin	47979	62919	40938	65792	66675	60449	59794	57763	65903	70214
plain sculpin	45430	43621	48449	52525	73448	69363	76426	66851	77922	56914
warty sculpin	10644	11744	15727	9630	7098	10212	25449	16136	13370	11392
yellow irish lord	13230	11249	9121	9415	14386	33637	27441	31720	23622	32389
antlered sculpin	3	0	0	0	0	0	0	1	0	0
Arctic staghorn sculpin	0	0	0	0	0	0	0	7	0	0
armorhead sculpin	254	347	289	1708	732	801	1554	1734	990	2113
blackfin sculpin	0	0	0	0	0	0	0	0	0	0
butterfly sculpin	3810	4501	2710	2921	1068	1069	1319	2766	1956	541
crested sculpin	4	4	2	2	2	0	0	23	0	0
darkfin sculpin	130	49	220	529	11	124	36	69	46	1
eyeshade sculpin	1	1	0	2	0	0	0	0	1	0
highbrow sculpin	0	0	0	0	0	0	0	1	0	0
hookhorn sculpin	2	3	4	2	0	0	4	1	4	3
purplegray sculpin	0	0	0	0	0	0	14	4	0	6
red Irish lord	42	0	0	0	0	0	15	0	5	0
ribbed sculpin	220	78	188	156	140	558	261	385	309	368
roughspine sculpin	12	35	8	3	10	62	111	168	57	176
sailfin sculpin	0	0	0	0	0	0	0	0	0	0
scissortail sculpin	3	1	9	2	0	0	0	42	20	27
spatulate sculpin	12	23	16	19	4	13	23	47	52	23
spectacled sculpin	200	491	174	255	298	29	113	365	217	184
spinyhead sculpin	1462	1816	1681	1194	1272	1027	4520	2425	1949	870
thorny sculpin	1037	992	858	814	748	696	627	667	558	940
threaded sculpin	3572	1697	423	1560	1154	1295	1983	2385	4126	2174

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
bigmouth sculpin	20196	32477	31643	24080	27005	23576	29542	37766	39438	39910	35437
great sculpin	44899	49659	54177	40733	32185	44222	36000	53282	50668	54828	91875
plain sculpin	47322	55200	59306	53271	47273	69999	60641	53570	33962	37301	50402
warty sculpin	7952	6991	6472	6477	4040	7136	10436	16052	11305	7961	8795
yellow irish lord	23056	21518	20212	22155	7990	9218	28835	30743	32351	31627	41561
antlered sculpin	0	0	1	9	0	0	0	0	0	0	0
Arctic staghorn sculpin	0	0	0	0	0	0	0	0	0	0	0
armorhead sculpin	1859	1794	2102	907	909	554	1675	592	919	430	425
blackfin sculpin	0	0	0	0	0	0	0	0	0	0	0
butterfly sculpin	794	939	1948	2426	568	477	1512	1544	666	236	8
crested sculpin	5	0	0	0	0	0	0	0	0	0	0
darkfin sculpin	3	22	17	142	40	25	0	53	17	32	40
eyeshade sculpin	0	0	0	0	0	2	0	0	0	0	0
highbrow sculpin	0	0	0	0	0	0	0	0	0	0	0
hookhorn sculpin	8	17	45	9	7	3	4	3	2	3	0
purplegray sculpin	29	14	17	21	144	61	71	48	14	58	0
red Irish lord	106	0	0	85	0	0	0	0	11	0	28
ribbed sculpin	581	477	84	292	86	85	141	43	46	39	126
roughspine sculpin	64	77	56	19	12	146	52	33	45	51	45

sailfin sculpin	0	1	0	0	0	0	0	0	0	0	0
scissortail sculpin	77	9	0	0	0	0	44	0	2	0	0
spatulate sculpin	60	60	118	49	92	40	19	378	6	281	26
spectacled sculpin	224	503	648	156	269	529	675	817	446	159	219
spinyhead sculpin	1586	1277	1554	707	661	1155	963	558	882	585	855
thorny sculpin	1131	2384	1394	784	522	1177	1301	498	589	156	261
threaded sculpin	1166	1663	962	4990	1217	559	407	96	389	96	189

Table 19.2. Total catch in metric tons (t) of all BSAI sculpin species combined, 1999-2019. 2019 catch includes through end of October 2019.

	total catch (t)
1999	130
2000	162
2001	157
2002	475
2003	1576
2004	1550
2005	1505
2006	1554
2007	1576
2008	1628
2009	1388
2010	3488
2011	4148
2012	1476
2013	5866
2014	4903
2015	5004
2016	4912
2017	5339
2018	5109
2019	5153

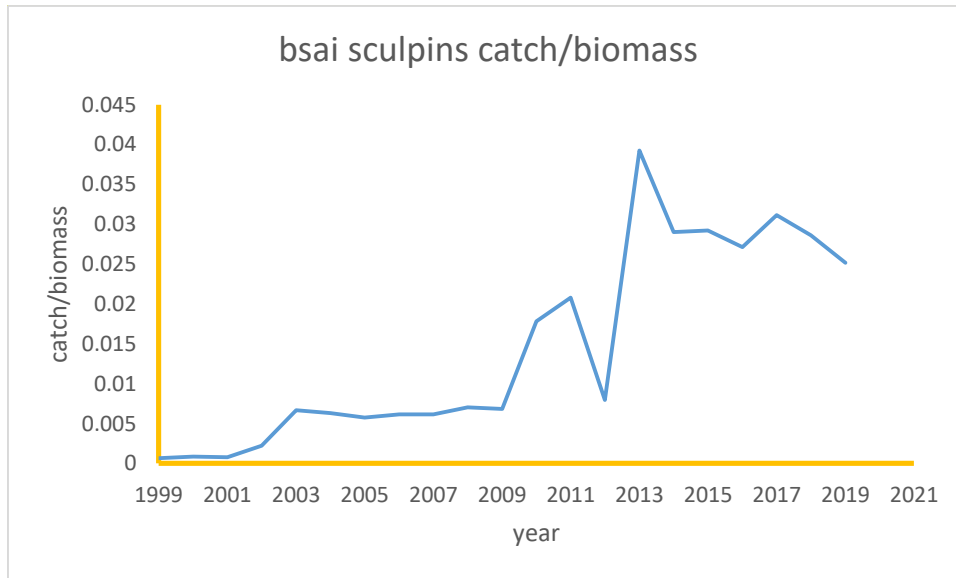


Figure 19.2. Catch divided by biomass (re model estimates), 1999-2019.

Table 19.3. Total allowable catch (TAC), acceptable biological catch (ABC), and catch of the BSAI sculpin complex 2011 to 2019. Source: NMFS AKRO Blend/Catch Accounting System, Alaska Regional Office Harvest Specification Tables. 2019 catch through late October.

Year	OFL (t)	ABC (t)	TAC (t)	Catch (t)
2011	58,300	43,700	5,200	5,377
2012	58,300	43,700	5,200	5,798
2013	56,400	42,300	5,600	5,857
2014	56,400	42,300	5,600	4,878
2015	52,365	39,725	4,700	4,967
2016	52,365	39,725	4,500	4,892
2017	56,582	42,387	4,500	5,339
2018	53,201	39,995	5,000	5,109
2019	53,201	39,995	5,000	5153

Table 19.4. Random effect estimates for Bering Sea shelf sculpin species bigmouth, great, plain, warty, yellow Irish lord and other (t), 1987-2019.

	bigmouth	great	plain	warty	yil	other
1987	22666	51716	55142	19177	30465	25304
1988	22015	46442	52557	17293	26041	43337
1989	21248	45522	57803	15549	20762	50024
1990	21084	51316	64205	13982	15132	68525
1991	21544	65520	101038	12572	14353	54225
1992	22280	80791	81871	12012	18585	39659
1993	23603	77474	87047	11614	20949	32081
1994	25818	92883	90600	12210	22108	28433
1995	27575	89519	69164	12437	21957	18279
1996	28723	85360	56602	12947	20502	10659
1997	29340	76247	66102	13836	21938	16665
1998	29387	65353	56767	16572	19320	12103
1999	28571	55201	47333	19017	17750	15038
2000	28508	56068	44687	20560	16424	14186
2001	28807	55559	48930	22617	15464	12377
2002	29747	61620	57803	17980	16069	14434
2003	30543	63586	71948	17125	20795	12329
2004	31534	62015	71829	20960	29269	12920
2005	31346	61239	76130	26559	33030	16357
2006	30823	60688	71169	28652	35290	16985
2007	30008	64850	74785	27264	35316	16136
2008	29508	63605	61411	25631	36631	14111
2009	28326	51185	52713	23670	35095	14185
2010	29681	50610	57834	23025	34089	15431
2011	29589	49696	61562	22404	32641	14943
2012	28100	43299	58225	21952	31291	14881
2013	28147	38779	56698	20103	28126	9920
2014	28565	41845	68397	21826	29653	9305
2015	31285	41080	59679	23365	33365	10114
2016	34958	50418	50728	24464	36732	8648
2017	37166	52894	37811	10708	40891	3758
2018	37816	59850	39194	8733	44061	2318
2019	36906	74033	48585	8775	34101	2232