

3.3.9 Saithe (*Pollachius virens*) in subareas 1 and 2 (Northeast Arctic)

ICES stock advice

ICES advises that when the Norwegian management plan is applied, catches in 2017 should be no more than 150 000 t. Bycatches of coastal cod (*Gadus morhua*) and golden redfish (*Sebastes norvegicus*) in fisheries targeting saithe in subareas 1 and 2 should be kept as low as possible.

Stock development over time

The spawning-stock biomass (SSB) has shown wide fluctuations and has been above B_{pa} since 1996. The fishing pressure (F) has been below F_{pa} since 1997, with the exception of 2010 and 2011. Recruitment (R) has fluctuated with no clear trend.

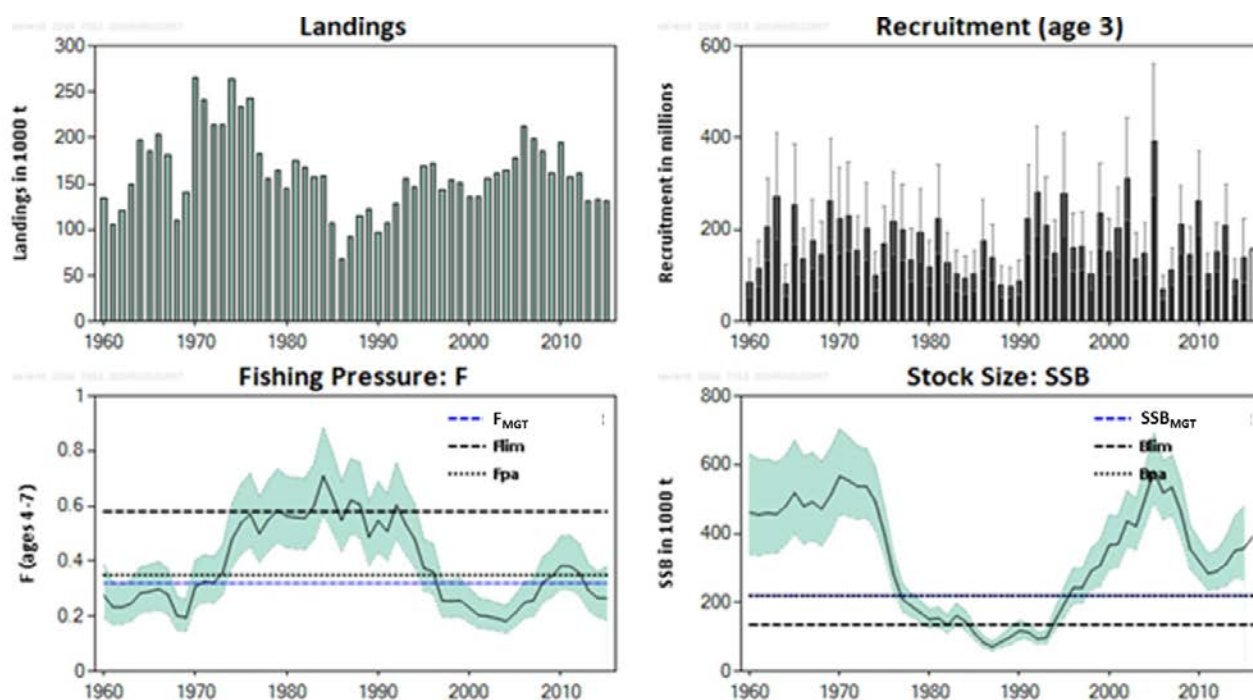


Figure 3.3.9.1 Saithe in subareas 1 and 2. Historical development of the stock from the summary of stock assessment (weights in thousand tonnes). Recruitment (R), fishing pressure (F), and spawning-stock biomass (SSB) have uncertainty boundaries (95%) in the plots. Predicted recruitment values are not shaded. For this stock, $SSB_{MGT} = B_{pa}$; therefore, the horizontal lines representing these points in the graph overlap.

Stock and exploitation status

Table 3.3.9.1 Saithe in subareas 1 and 2. State of the stock and fishery relative to reference points.

		Fishing pressure				Stock size			
		2013	2014	2015		2014	2015	2016	
Maximum sustainable yield	F_{MSY}	?	?	?	Undefined	MSY	?	?	Undefined
Precautionary approach	F_{pa} , F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa} , B_{lim}	✓	✓	Full reproductive capacity
Management plan	F_{MGT}	✓	✓	✓	Below	SSB_{MGT}	✓	✓	Above

Catch forecast and outlook

Table 3.3.9.2 Saithe in subareas 1 and 2. The basis for the catch options.

Variable	Value	Source	Notes
F ages 4–7 (2016)	0.28	ICES (2016a)	TAC constraint
SSB(2017)	366 kt	ICES (2016a)	
R _{age3} (2016 onwards)	157 million	ICES (2016a)	Geometric mean (1960–2015)
Total catch (2016)	140 kt	ICES (2016a)	TAC

Table 3.3.9.3 Saithe in subareas 1 and 2. The catch options. Weights are in thousand tonnes.

Rationale	Catches (2017)	Basis	F (2017)	SSB (2018)	% SSB change *	% TAC change **
Management plan	150	F_{MP}	0.30	341	–7	7
Precautionary approach	169	F_{pa}	0.35	326	–11	21
Zero catch	0	$F = 0$	0	480	31	–100
Other options	74	$F_{sq(2016)} \times 0.5$	0.14	411	12	–47
	138	$F_{sq(2016)} \times 1.0$	0.28	352	–4	–1
	167	$F_{sq(2016)} \times 1.25$	0.345	326	–11	19

* SSB 2018 relative to SSB 2017.

** Catch in 2017 relative to TAC 2016.

Basis of the advice

Table 3.3.9.4 Saithe in subareas 1 and 2. The basis of the assessment and advice.

Advice basis	Norwegian management plan.
Management plan	The harvest control rule as revised in 2013 and communicated to ICES by the Norwegian Ministry of Fisheries and Coastal Affairs contains the following elements: • Estimate the average TAC level for the coming 3 years based on $F_{mp} = 0.32^*$. TAC for the next year will be set to this level as a starting value for the 3-year period. • The year after, the TAC calculation for the next 3 years is repeated based on the updated information about the stock development. However, the TAC should not be changed by more than $\pm 15\%$ compared with the previous year's TAC. • If the spawning-stock biomass (SSB) in the beginning of the year for which the quota is set (first year of prediction), is below B_{pa}, the procedure for establishing TAC should be based on a fishing mortality that is linearly reduced from F_{mp} at $SSB = B_{pa}$ to 0 at SSB equal to zero. At SSB levels below B_{pa} in any of the operational years (current year and 3 years of prediction) there should be no limitations on the year-to-year variations in TAC.

* F_{mp} was formerly 0.35.

Quality of the assessment

The low level of biological sampling of commercial catches continued to be an issue in 2015 and will affect the precision of the catch-, weight-, and maturity-at-age data. Poor sampling of commercial catches is impairing the quality of the assessment and the advice. Because reliable recruitment estimates are lacking, predicted catches are dependent upon assumptions of average recruitment.

Recreational catches are not included in the assessment.

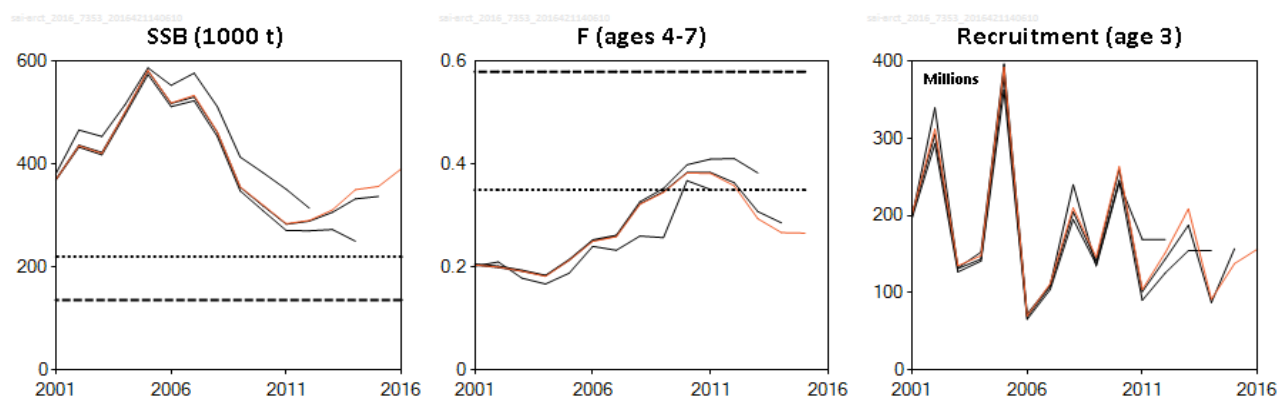


Figure 3.3.9.2 Saithe in subareas 1 and 2. Historical assessment results (final-year recruitment estimates included). The year 2013 is omitted because no assessment was accepted. The assessment model changed from XSA to SAM in 2014.

Issues relevant for the advice

Fisheries targeting Northeast Arctic (NEA) saithe has as a bycatch golden redfish (*Sebastes norvegicus*) and is considerable part of the total catch. This bycatch of golden redfish is still far above any sustainable catch level. Measures to minimise bycatch levels are essential.

Bycatch of coastal cod should be kept as low as possible in order to obtain the reductions in fishing mortality implied by the coastal cod (*Gadus morhua*) rebuilding plan (ICES, 2010).

Reference points

Table 3.3.9.5 Saithe in subareas 1 and 2. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Reference
MSY approach	MSY $B_{trigger}$	Not defined.		
	F_{MSY}	Not defined.		
Precautionary approach	B_{lim}	136 kt	Change point in segmented regression.	ICES (2005)
	B_{pa}	220 kt	$B_{lim} \times \exp(1.645 \times \sigma)$, where $\sigma = 0.3$.	ICES (2005)
	F_{lim}	0.58	F corresponding to an equilibrium stock = B_{lim} .	ICES (2005)
	F_{pa}	0.35	$F_{lim} \times \exp(-1.645 \times \sigma)$, where $\sigma = 0.3$.	ICES (2005)
Management plan	SSB_{MGT}	220 kt	B_{pa} , F is linearly reduced from F_{pa} at $SSB = B_{pa}$ to zero at $SSB = 0$.	ICES (2011)
	F_{MP}	0.32	Average TAC for the coming three years based on F_{MP} .	ICES (2011)

Basis of the assessment

Table 3.3.9.6 Saithe in subareas 1 and 2 (Northeast Arctic). The basis of the assessment.

ICES stock data category	1 (ICES, 2016b)
Assessment type	Age-based analytical assessment (SAM; ICES, 2016a) that uses landings in the model and in the forecast.
Input data	Commercial catches (international landings, ages and length frequencies from Norwegian, German, and Russian catch sampling); one survey index (NOcoast-Aco-4Q, split in 2002); three-year running average maturity based on spawning zones from otoliths from commercial catches and surveys for 1985–2006, constant (2005–2007 average) for later years.
Discards and bycatch	Discarding is considered negligible. Bycatch is included.
Indicators	None
Other information	An inter-benchmark was undertaken in 2014 (ICES IBP NEA SAITHE ; ICES, 2014).
Working group	Arctic Fisheries Working Group (AFWG)

Information from stakeholders

There is no available information.

History of the advice, catch, and management

Table 3.3.9.7 Saithe in subareas 1 and 2 (Northeast Arctic). History of ICES advice, the agreed TAC, and ICES estimates of landings. Weights are in thousand tonnes.

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC*	Official landings	ICES landings
1987	No increase in F; TAC; protect juveniles	90	-	92	92
1988	No increase in F	< 83	-	114	114
1989	Status quo F; TAC	120	120	123	123
1990	$F \leq F_{med}$; TAC	93	103	96	96
1991	F at F_{low} ; TAC	90	100	107	107
1992	Within safe biological limits	115	115	128	128
1993	Within safe biological limits	132 [#]	132	155	155
1994	No increase in F	158 [#]	145	147	147
1995	No increase in F	221 [#]	165	168	168
1996	No increase in F	158 [#]	163	171	171
1997	Reduction of F to F_{med} or below	107	125	144	144
1998	Reduction of F to F_{med} or below	117	145 ^{##}	153	153
1999	Reduce F below F_{pa}	87	144 ^{###}	150	150
2000	Reduce F below F_{pa}	89	125 [^]	136	136
2001	Reduce F below F_{pa}	< 115	135	136	136
2002	Maintain F below F_{pa}	< 152	162 ^{^^}	155	155
2003	Maintain F below F_{pa}	< 168	164	162	162
2004	Maintain F below F_{pa}	< 186	169	165	165
2005	Take account of <i>Sebastes marinus</i> bycatch. Maintain F below F_{pa}	< 215	215	179	179
2006	Take account of <i>Sebastes marinus</i> bycatch. Maintain F below F_{pa}	< 202	193.5	213	213
2007	Take account of <i>Sebastes marinus</i> bycatch. Maintain F below F_{pa}	< 247	222.525	199	199
2008	Take account of <i>Sebastes marinus</i> bycatch. Maintain F below F_{hcr}	< 247	< 247	185	185
2009	Take account of <i>Sebastes marinus</i> bycatch. Apply management plan	< 225	225	162	162
2010	Take account of <i>Sebastes marinus</i> bycatch. Apply management plan	< 204	204	195	195
2011	Take account of <i>Sebastes marinus</i> bycatch. Apply management plan	< 173	173	157	157
2012	Take account of coastal cod and <i>Sebastes marinus</i> bycatch. Apply management plan.	< 164	164	161	161
2013	Take account of coastal cod and <i>Sebastes marinus</i> bycatch. Apply management plan.	< 164	140 ^{^^^}	132	132
2014	Take account of coastal cod and <i>Sebastes marinus</i> bycatch. Stabilize SSB.	< 140	119 ^{^^^}	132	132
2015	Take account of coastal cod and <i>Sebastes norvegicus</i> ** bycatch. Apply management plan.	< 122	122	132	132
2016	Take account of coastal cod and <i>Sebastes norvegicus</i> ** bycatch. Apply management plan.	< 140	140		
2017	Take account of coastal cod and <i>Sebastes norvegicus</i> ** bycatch. Apply management plan.	≤ 150			

[#] Predicted catch at status quo F.^{##} TAC first set at 125 000 t, then increased in May 1998 after an intersessional assessment.^{###} TAC set after an intersessional assessment in December 1998.[^] TAC set after an intersessional assessment in December 1999.^{^^} TAC first set at 152 000 t, then increased in June 2003 after the spring 2002 assessment.^{^^^} Set by Norwegian authorities based on national advice where cpue was excluded from the assessment.

* TAC set by Norwegian authorities.

** Until 2014 this species was named *Sebastes marinus*. From 2015 it was decided to adopt the species list by WoRMS (<http://www.marinespecies.org/>). The name used for this species will hence hereafter be *Sebastes norvegicus*.

History of catch and landings

Table 3.3.9.8 Saithe in subareas 1 and 2. Catch distribution by fleet in 2015 as estimated by ICES.

Table 2: Catch in 2015 by gear type and fishery. Catch in 2015 is estimated by fishery.						
Total catch (2015)	Commercial landings				Discards	Recreational catch
132 kt	42% trawl	23% purse-seine	18% gillnet	17% other gear types	Discarding is considered to be negligible	Unknown, but not negligible
	132 kt					

Table 3.3.9.9 Saithe in subareas 1 and 2. History of commercial landings. ICES estimated values are presented for each country participating in the fishery. Weights are in tonnes.

Year	Faroes	France	Greenland	Germany Dem. Rep	Fed. Rep. Germany	Iceland	Norway	Poland	Portugal	Russian Federation****	Spain	UK	Others^^	Total all countries
1960	23	1700			25948		96050					9780	14	133515
1961	61	3625			19757		77875					4595	18	105951
1962	2	544			12651		101895			912		4699	4	120707
1963		1110			8108		135297					4112		148627
1964		1525			4420		184700			84		6511	186	197426
1965		1618			11387		165531			137		6741	181	185600
1966		2987		813	11269		175037			563		13078	41	203788
1967		9472		304	11822		150860			441		8379	48	181326
1968				70	4753		96641					8781		110247
1969	20	193		6744	4355		115140					13585	23	140060
1970	1097			29362	23466		151759			43550		15469		264924
1971	215	14536		16840	12204		128499	6017		39397	13097	10361		241272
1972	109	14519		7474	24595		143775	1111		1278	13125	8223		214334
1973	7	11320		12015	30338		148789	23		2411	2115	6841		213859
1974	46	7119		29466	33155		152699	2521		28931	7075	3104	5	264121
1975	28	3156		28517	41260		122598	3860	6430	13389	11397	2763	55	233453
1976	20	5609		10266	49056		131675	3164	7233	9013	21661	4724	65	242486
1977	270	5658		7164	19985		139705	1	783	989	1327	6935		182817
1978	809	4345		6484	19190		121069	35	203	381	121	2827		155464
1979	1117	2601		2435	15323		141346			3	685	1170		164680
1980	532	1016			12511		128878			43	780	794		144554
1981	236	218			8431		166139			121		395		175540
1982	339	82			7224		159643			14		732		168034
1983	539	418			4933		149556			206	33	1251		156936
1984	503	431		6	4532		152818			161		335		158786
1985	490	657		11	1873		103899			51		202		107183
1986	426	308			3470		63090			27		75		67396
1987	712	576			4909		85710			426		57	1	92391
1988	441	411			4574		108244			130		442		114242
1989	388	460**			606		119625			506	506	726		122817
1990	1207	340**			1143		92397			52		709		95848

Year	Faroes	France	Greenland	Germany Dem. Rep	Fed. Rep. Germany	Iceland	Norway	Poland	Portugal	Russian Federation***	Spain	UK	Others^^	Total all countries
1991	963	77**			2003		103283			504^		492	5	107327
1992	165	1980	734		3451		119763			964	6	541		127604
1993	31	566	78		3687	3	140604		1	9509	4**	415	5	154903
1994	67**	557	15		1863	4**	141589		1**	1640**	655**	557	2	146950
1995	172**	358	53		935		165001		5	1148		688	18	168378
1996	248**	346	165		2615		166045		24	1159	6	707	33	171348
1997	193**	560	363**		2915		136927		12	1774	41	799	45	143629
1998	366	932	437**		2936		144103		47	3836	275	355	40	153327
1999	181	638**	655**		2473	146	141941		17	3929	24	339	32	150375
2000	224**	1438	651**		2573	33	125932		46	4452	117	454	8**	135928
2001	537	1279	701**		2690	57	124928		75	4951	119	514	2	135853
2002	788	1048	1393		2642	78	142941		118	5402	37	420	3	154870
2003	2056	1022	929**		2763	80**	150400		147	3894	18	265	18**	161592
2004	3071	255	891**		2161	319	147975		127	9192	87	544	14	164636
2005	3152	447	817**		2048	395	162338		354	8362	25	630		178568
2006	1795	899	786**		2779	255	195462	89	339**	9823	21**	532	42	212822
2007	2048	966	810**		3019	219	178644	99	412	12168	53**	558	12	199008
2008	2314	1009	503**		2263	113	165998	66	348	11577	33**	506	10	184740
2009	1611**	326	697		2021	69	144570	30	204**	11899	2**	379	45**	161853
2010	1632	677	954		1592	109**	174544	279	93	14664	8	283	2**	194837
2011	112	367	445		1371	65	143314		46	10007	2	972	15	156716
2012	146	781	658		1371	126	143145		23**	13607	4	1000	4**	160865
2013	80	1901	972		1326^^^	290**	111962	2	17	14796	5	433	22	131806
2014	273	1674	407		259	659	115798	1	8	12396	12	518		132005
2015*	576	514	393		424	249	114830	1154	10	13181	34	400		131765

* Provisional figures.

** As reported to Norwegian authorities.

*** USSR prior to 1991.

^ Includes Estonia.

^^ Includes Denmark, Netherlands, Ireland, and Sweden.

^^^ As reported by Working Group members.

Summary of the assessment

Table 3.3.9.10 Saithe in subareas 1 and 2. Assessment summary. Weights are in tonnes. CI = confidence interval.

Year	Recruitment Age 3 thousands	High (includes 95% CI)	Low (includes 95% CI)	SSB	High (includes 95% CI)	Low (includes 95% CI)	Landings	Mean F Ages 4–7	High (includes 95% CI)	Low (includes 95% CI)
1960	84881	136320	52851	461390	630041	337885	133515	0.276	0.387	0.196
1961	114577	174786	75108	454976	615457	336341	105951	0.233	0.32	0.17
1962	203822	309255	134333	460008	616442	343273	120707	0.233	0.317	0.172
1963	271305	411210	179000	456343	605216	344091	148627	0.247	0.332	0.184
1964	81879	125197	53549	479740	626761	367207	197426	0.284	0.379	0.213
1965	254486	385339	168067	518658	670367	401282	185600	0.29	0.386	0.218
1966	134457	203118	89006	479740	624246	368686	203788	0.299	0.398	0.224
1967	175255	265221	115807	491885	634759	381170	181326	0.279	0.373	0.208
1968	143774	217280	95136	471182	609382	364324	110247	0.202	0.271	0.15
1969	262498	398276	173009	511447	647815	403786	140060	0.195	0.261	0.146
1970	222126	335246	147175	566368	703132	456206	264924	0.308	0.403	0.236
1971	230038	345594	153120	554599	680838	451766	241272	0.326	0.423	0.251
1972	153430	230268	102232	537132	654056	441111	214334	0.321	0.415	0.248
1973	201390	302223	134199	537132	646673	446147	213859	0.358	0.458	0.279
1974	100609	151676	66736	492377	589949	410942	264121	0.479	0.607	0.378
1975	167544	251641	111551	398714	476138	333880	233453	0.538	0.678	0.426
1976	217075	326916	144140	282377	339425	234918	242486	0.571	0.718	0.453
1977	199386	299365	132797	210239	253605	174288	182817	0.5	0.632	0.396
1978	133786	201032	89035	189473	227018	158137	155464	0.551	0.692	0.438
1979	193494	290669	128806	171099	205042	142776	164680	0.585	0.734	0.467
1980	117243	175975	78112	151146	181170	126097	144554	0.564	0.707	0.449
1981	224583	339667	148491	154817	186568	128470	175540	0.559	0.702	0.445
1982	128156	193007	85095	135673	163499	112582	168034	0.556	0.7	0.442
1983	101417	153188	67143	161781	196637	133104	156936	0.602	0.754	0.481
1984	93246	141393	61494	145947	176811	120471	158786	0.709	0.883	0.57
1985	101722	154184	67111	111525	134524	92457	107183	0.634	0.795	0.507
1986	174207	265359	114366	83952	101397	69508	67396	0.548	0.689	0.435
1987	138829	209760	91884	71826	86678	59519	92391	0.621	0.772	0.499
1988	78826	120377	51618	86250	104877	70931	114242	0.607	0.757	0.487
1989	76880	116983	50525	100108	129312	77499	122817	0.487	0.615	0.385
1990	86509	132341	56549	117948	148129	93916	95848	0.547	0.689	0.434
1991	224583	340326	148203	114348	139830	93510	107327	0.508	0.642	0.402
1992	281250	426181	185606	94940	113287	79564	127604	0.604	0.757	0.482
1993	207939	313069	138112	97343	117247	80819	154903	0.534	0.67	0.425
1994	149044	219705	101110	148005	182572	119982	146950	0.48	0.607	0.379
1995	277895	410964	187914	196025	244576	157113	168378	0.375	0.479	0.293
1996	161297	236670	109928	243531	299341	198126	171348	0.362	0.464	0.282
1997	162755	239139	110769	243045	297586	198499	143629	0.257	0.333	0.198
1998	102847	150732	70174	291851	356939	238633	153327	0.256	0.333	0.197
1999	235155	344724	160412	307429	380636	248302	150375	0.258	0.337	0.198
2000	151903	222584	103667	366590	453178	296547	135928	0.231	0.302	0.177
2001	200988	292085	138303	369904	451127	303306	135853	0.204	0.267	0.157
2002	312075	443015	219837	435827	523432	362884	154870	0.2	0.259	0.154
2003	134996	192298	94769	421258	501757	353673	161592	0.192	0.249	0.148
2004	148153	214302	102422	501320	591936	424576	164636	0.182	0.238	0.14
2005	392385	560509	274690	582451	691245	490779	178568	0.213	0.276	0.164
2006	69982	99728	49109	519177	611921	440490	212822	0.25	0.324	0.194
2007	111636	158584	78587	533919	628264	453742	199008	0.259	0.335	0.2

Year	Recruitment Age 3 thousands	High (includes 95% CI)	Low (includes 95% CI)	SSB	High (includes 95% CI)	Low (includes 95% CI)	Landings	Mean F Ages 4–7	High (includes 95% CI)	Low (includes 95% CI)
2008	210029	296470	148791	463240	552163	388637	184740	0.322	0.414	0.251
2009	145947	206125	103338	356112	424785	298541	161853	0.345	0.442	0.27
2010	263550	370363	187542	320616	382390	268822	194837	0.383	0.491	0.3
2011	104193	148562	73075	284361	341708	236638	156716	0.382	0.492	0.297
2012	152055	215049	107514	290686	352600	239644	160865	0.358	0.464	0.277
2013	208772	297598	146459	311141	389368	248630	131806	0.294	0.389	0.223
2014	91583	135050	62106	350459	450593	272578	132005	0.267	0.362	0.197
2015	137861	221771	85699	356825	478428	266130	131765	0.266	0.38	0.186
2016	156678*			391404						
Average	169526	252116	114396	326976	403980	263267	161252	0.384	0.492	0.3

*Predicted (GM 1960–2015).

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