

Hake (*Merluccius merluccius*) in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock (Greater North Sea, Celtic Seas, and the northern Bay of Biscay)

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2019 should be no more than 142 240 tonnes.

Stock development over time

The spawning-stock biomass (SSB) has increased substantially since 2006 and is well above historical estimates. Fishing mortality (F) has decreased markedly after 2005 and has been below F_{MSY} since 2012. The two most recent recruitment (R) estimates are above the average of the time-series.

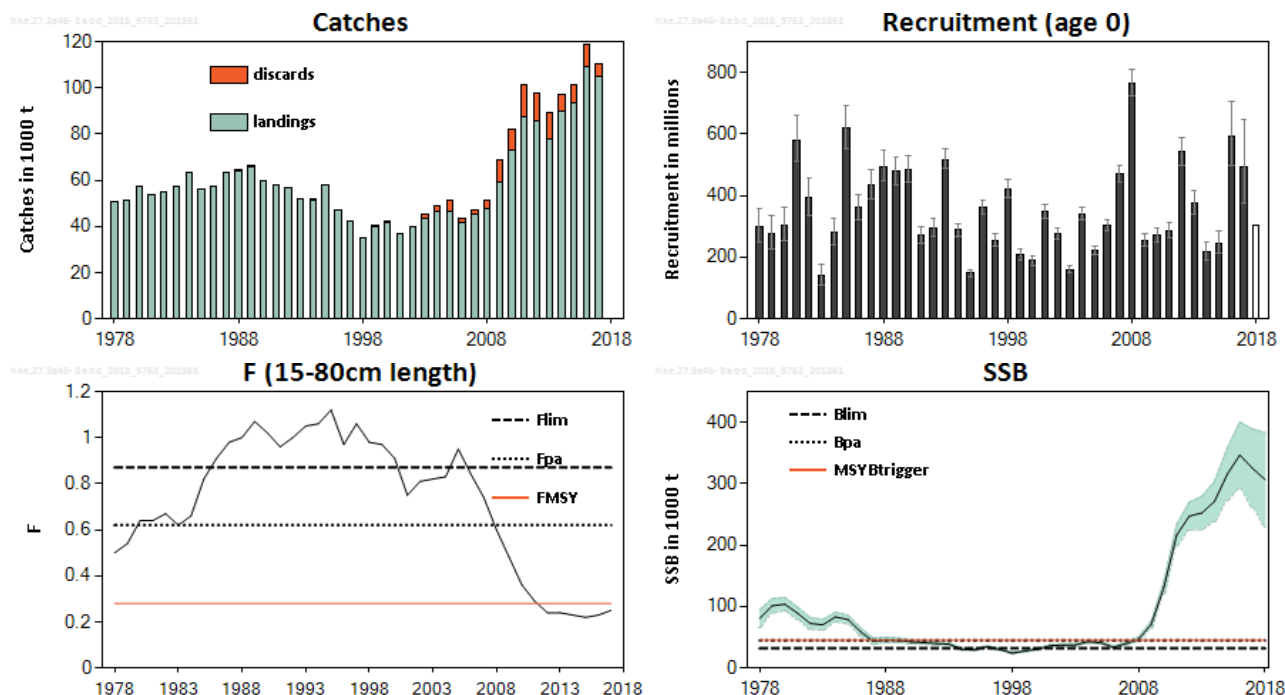


Figure 1 Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Summary of the stock assessment. Complete discard estimates are available only since 2003. Recruitment and SSB plots show 95% confidence intervals (shaded area). Assumed recruitment values are unshaded.

Stock and exploitation status

ICES assesses that fishing pressure on the stock is below F_{MSY} , F_{pa} , and F_{lim} and that spawning-stock size is above MSY $B_{trigger}$, B_{pa} , and B_{lim} .

Table 1 Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. State of the stock and fishery relative to reference points.

	Fishing pressure			Stock size						
	2015	2016	2017	2016	2017	2018				
Maximum sustainable yield	F_{MSY}	✓	✓	✓	Appropriate	MSY $B_{trigger}$	✓	✓	✓	Above trigger
Precautionary approach	F_{pa}, F_{lim}	✓	✓	✓	Harvested sustainably	B_{pa}, B_{lim}	✓	✓	✓	Full reproductive capacity
Management plan	F_{MGT}	–	–	–	Not applicable	B_{MGT}	–	–	–	Not applicable

Catch scenarios

Table 2 Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Assumptions made for the interim year and in the forecast. All weights are in tonnes.

Variable	Value	Notes
F (2018)	0.23	Mean $F_{2015-2017}$
SSB (2019)	346616	
R (2018 – 2019)	303550	GM 1990–2015 (in thousands)
Total catch (2018)	103238	Forecast catch from the assessment model (based on $F_{2018} = \text{mean } F_{2015-2017}$) plus additional discards*
Wanted** catch (2018)	94812	Based on average landings rate during 2015–2017
Unwanted** catch (2018)	8426	Based on average discards rate during 2015–2017

* Additional discards are the discards that were not included in the assessment, amounting to approximately 2.8% of the total catch.

** “Wanted” and “unwanted” catch are used to describe fish that would be landed and discarded in the absence of the EU landing obligation.

Table 3 Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Annual catch scenarios. All weights are in tonnes. Note: The % change in TAC is not computed because the stock area does not correspond to the area for the TAC.

Basis	Total catch (2019)	Wanted catch* (2019)	Unwanted catch*^ (2019)	F _{total} (2019)	F _{wanted} (2019)	F _{unwanted} (2019)	SSB (2020)	% SSB change **	% Advice change ***
ICES advice basis									
MSY approach: F _{MSY}	142240	128236	14004	0.28	0.23	0.052	365492	5.5	23
Other scenarios									
F _{MSY lower}	96792	87371	9422	0.180	0.147	0.033	408019	17.7	-16.1
F _{MSY upper}	208200	187317	20883	0.45	0.37	0.083	303739	-12.4	81
F = 0	0	0	0	0	0	0	498590	44	-100
F _{pa}	262175	235410	26765	0.62	0.51	0.115	253142	-27	127
F _{lim}	324439	290502	33937	0.87	0.71	0.161	194612	-44	181
SSB (2020) = B _{lim}	491220	433027	58193	2.8	2.3	0.52	32039	-91	326
SSB (2020) = B _{pa}	479239	423457	55782	2.4	1.95	0.44	44977	-87	316
SSB (2020) = MSY B _{trigger}	479239	423457	55782	2.4	1.95	0.44	44977	-87	316
F = F ₂₀₁₈	122397	110408	11989	0.23	0.191	0.044	384060	10.8	6.1
EU Recovery Plan^^	129168	116494	12674	0.25	0.20	0.046	377724	9.0	12.0

* “Wanted” and “unwanted” catch are used to describe fish that would be landed and discarded in the absence of the EU landing obligation.

** SSB 2020 relative to SSB 2019.

*** Total catch 2019 relative to the catch advice for 2018 (115 335 tonnes).

^ Unwanted catch includes forecast unwanted catch (discards included in the assessment) and additional unwanted catch (the discards that were not included in the assessment, amounting to approximately 2.8% of the total catch).

^^ Catch option corresponds to F₂₀₁₈ = 0.25.

The catch for 2019 corresponding to the MSY framework is 23% higher than the advice given for 2018. The increase is mainly a consequence of the increase in SSB in 2019 as a result of strong incoming year classes.

Basis of the advice

Table 4 Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. The basis of the advice.

Advice basis	MSY approach
Management plan	The current recovery plan (EU, 2004) is based on precautionary reference points that are no longer appropriate. ICES has not evaluated this plan. The European Commission has proposed a multiannual management plan (MAP) for the Western Waters, which is not yet finalized (EU, 2018).

Quality of the assessment

The model confidence intervals underestimate uncertainty as they are narrower than interannual changes in estimates between consecutive assessments.

The historical FR-EVHOE-WIBTS-Q4 survey was revised and produced some minor changes in the perception of the stock. The FR-EVHOE-WIBTS-Q4 index value for 2017 was not available. However, the IE-IGFS-WIBTS-Q4 survey and the discards also provide information on recruitment. Both indices are consistent in the historical period, hence the recruitment estimate from last year is considered reliable.

Not all discards are included in the analytical assessment, but they are included in the final advice catch estimates. They represent approximately 2%–5% of the total stock catches. Discards have decreased substantially this year.

Given the expansion of the stock into northern areas (ICES, 2017a), biological sampling and discard quantification may be limited.

Owing to a lack of French market sampling of length in Q1 and Q2 of 2017 (biological and onboard sampling was unaffected), for some sampling strata length data were supplemented using data from previous years, which is considered to have limited impact (ICES, 2018).

There has been a tendency for the assessment to underestimate SSB and overestimate F in past years. However, estimates of SSB in the current assessment are close to those estimated in 2017.

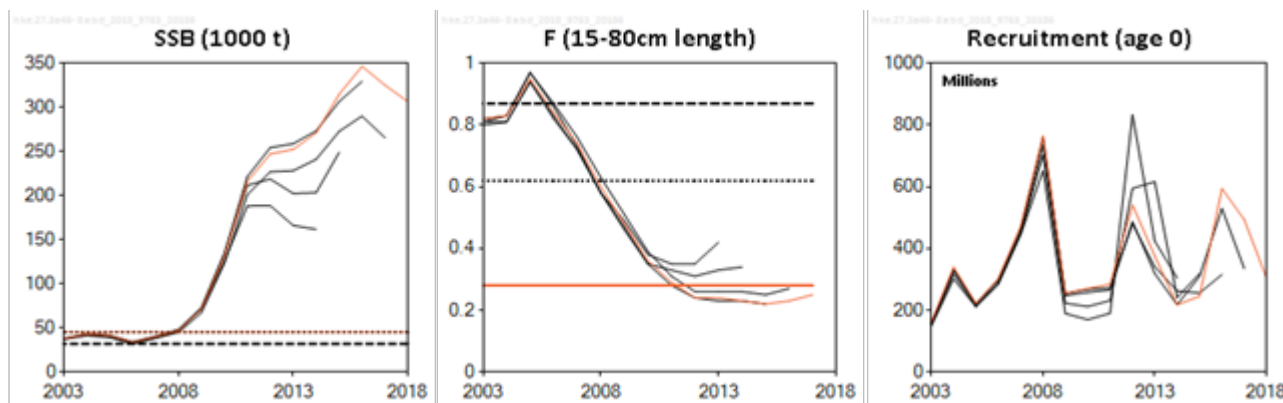


Figure 2 Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a-b, and 8.d, Northern stock. Historical assessment results.

Issues relevant for the advice

Discarding of juvenile hake (undersized and above minimum size) can be substantial in some areas and fleets. In the most recent period, discarding of large individuals increased because of quota restrictions in certain fleets. In 2017, observed discards decreased.

Some fleets fishing this stock have been under the EU landing obligation since 2016.

Reference points

Table 5 Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a-b, and 8.d, Northern stock. Reference points, values, and their technical basis. All weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	45000	B_{pa}	ICES (2016a)
	F_{MSY}	0.28	Stochastic simulations on a segmented regression stock–recruitment relationship	ICES (2016a)
Precautionary approach	B_{lim}	32000	A low biomass which was followed by a quick recovery	ICES (2016b)
	B_{pa}	45000	$1.4 \times B_{lim}$	ICES (2016b)
	F_{lim}	0.87	Fishing mortality resulting in a 5% probability of SSB falling below B_{lim}	ICES(2016b)
	F_{pa}	0.62	$F_{lim}/1.4$	ICES(2016b)
	F_{MGT}	Not defined		
	SSB_{MGT}	Not defined		
	MAP $MSY B_{trigger}$	45000	$MSY B_{trigger}$	
	MAP B_{lim}	32000	B_{lim}	
	MAP F_{MSY}	0.28	F_{MSY}	
	MAP range F_{lower}	0.180	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with MSY (ICES, 2016a)	
MAP range F_{upper}	0.45	Consistent with ranges resulting in no more than 5% reduction in long-term yield compared with MSY (ICES, 2016a)		

Basis of the assessment

Table 6 Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2016c)
Assessment type	Length-based model (SS3; ICES, 2018) that uses landings and some discards. Additional discards are then included to calculate a catch forecast.
Input data	Commercial landings; four survey indices (FR-EVHOE-WIBTS-Q4, SP-PORC-WIBTS-Q3, IE-IGFS-WIBTS-Q4, and RESSGASC); maturity data: constant maturity (Martin, 1991); natural mortality: constant value of 0.4.
Discards and bycatch	Data series from most fleets are available; 75% of the observed discards are included in the assessment (ICES, 2017b, 2018). The discards not included in the assessment are used to top-up the catch advice.
Indicators	None
Other information	Last benchmarked in 2014 WKSOUTH (ICES, 2014)
Working group	Working Group for the Bay of Biscay and the Iberian Waters Ecoregion (WGBIE)

Information from stakeholders

There is no additional information available.

History of the advice, catch, and management

Table 7 Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. ICES advice and catch. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Landings corresponding to advice	Agreed TAC*	ICES landings	Discards	ICES catch
1987	Precautionary TAC; juvenile protection			63500	63369		
1988	Precautionary TAC; juvenile protection		54000	66200	64823	**	
1989	Precautionary TAC; juvenile protection		54000	59700	66473	**	
1990	Precautionary TAC; juvenile protection		59000	65100	59954		
1991	Precautionary TAC; juvenile protection		59000	67000	58129		
1992	If required, precautionary TAC		61500	69000	56617		
1993	Enforce juvenile protection legislation		-	71500	52144		
1994	F significantly reduced		-	60000	51259	**	
1995	30% reduction in F		31000	55100	57621		
1996	30% reduction in F		39000	51100	47210		
1997	20% reduction in F		54000	60100	42465		
1998	20% reduction in F		45000	59100	35060		
1999	Reduce F below F_{pa}		-	55100	39814	**	
2000	50% reduction in F		-	42100	42026	**	
2001	Lowest possible catch, recovery plan		-	22600	36675		
2002	Lowest possible catch / recovery plan		-	27000	40105		
2003	Lowest possible catch / recovery plan		-	30000	43162	1393	44555
2004	70% reduction in F or recovery plan		-	39100	46416	2614	49029
2005	$F = 0.19$		33000	42600	46550	4583	51133
2006	$F = 0.25$		44000	43900	41469	1222	42691
2007	Recovery plan limits		50500	52700	45093	2165	47258
2008	Recovery plan limits		54000	54000	47822	3368	51190
2009	$F = 0.25 = F_{pa}$		51500	51500	58781	11033	69814
2010	$F = 0.25 = F_{pa}$		55200	55105	72760	12118	84878
2011	See scenarios		50600	55105	87540	13903	101443
2012	MSY transition		51900	55105	85677	14870	100547
2013	MSY transition		45400	69440	77708	15400	93108
2014	MSY approach		81846	81846	89928	9800	99728
2015	MSY approach		78457	90849	95023	10900	105923
2016	MSY approach	≤ 109592	≤ 96651	108764	107530	11114	118644
2017	MSY approach	≤ 123777		119765	104670	7100	111770
2018	MSY approach	≤ 115335		111785			
2019	MSY approach	≤ 142240					

* Sum of area TACs, corresponding to northern stock plus Division 2.a (EC zone only).

** Partial discard estimates are available and used in the assessment. For remaining years for which no values are presented, some estimates are available but not considered valid and thus not used in the assessment.

History of the catch and landings

Table 8 Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Catch distribution by fleet in 2017 as estimated by ICES. All weights are in tonnes.

Catch (2017)	Landings				Discards
	7% unspecified gear	34% longline	24% gillnet	35% trawl	
111770	104670				7100

Table 9 Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. History of commercial catch and landings; both the official and ICES estimated values are presented by area for each country participating in the fishery. All weights are in tonnes.

Year	Landings*							Discards**						Total catches***	
	3	4	6	7	8abd	Unn.	Total	3	4	6	7	8abd	Total		
1961			-	-	-	95600	95600							-	95600
1962			-	-	-	86300	86300							-	86300
1963			-	-	-	86200	86200							-	86200
1964			-	-	-	76800	76800							-	76800
1965			-	-	-	64700	64700							-	64700
1966			-	-	-	60900	60900							-	60900
1967			-	-	-	62100	62100							-	62100
1968			-	-	-	62000	62000							-	62000
1969			-	-	-	54900	54900							-	54900
1970			-	-	-	64900	64900							-	64900
1971			8500	19400	23400	0	51300							-	51300
1972			9400	14900	41200	0	65500							-	65500
1973			9500	31200	37600	0	78300							-	78300
1974			9700	28900	34500	0	73100							-	73100
1975			11000	29200	32500	0	72700							-	72700
1976			12900	26700	28500	0	68100							-	68100
1977			8500	21000	24700	0	54200							-	54200
1978			8000	20300	24500	-2249	50551							-	50551
1979			8700	17600	27200	-2404	51096							-	51096
1980			9700	22000	28400	-2835	57265							-	57265
1981			8800	25600	22300	-2782	53918							-	53918
1982			5900	25200	26200	-2306	54994							-	54994
1983			6200	26300	27100	-2093	57507							-	57507
1984			9500	33000	22900	-2114	63286							-	63286
1985			9224	27459	21044	-1628	56099							-	56099
1986			7320	27408	23903	-1539	57092							-	57092
1987			7800	32900	24700	-2031	63369							-	63369
1988			8800	30900	26600	-1477	64823							-	64823
1989			7375	26938	31957	203	66473							-	66473
1990			6680	23011	34424	-4161	59954							-	59954
1991			8328	21546	31635	-3380	58129							-	58129
1992			8561	22475	23465	2116	56617							-	56617

Year	Landings*						Discards**						Total catches***	
	3	4	6	7	8abd	Unn.	Total	3	4	6	7	8abd		Total
1993			8484	20465	19849	3346	52144						-	52144
1994			5421	21080	24727	31	51259						*	51259
1995			5335	24056	28144	86	57621						-	57621
1996			4445	24738	18036	-9	47210						-	47210
1997			3312	18949	20339	-135	42465						-	42465
1998			3208	18705	13147	0	35060						-	35060
1999			4256	23955	11604	-1	39814						*	39814
2000			4033	25991	11998	4	42026						*	42026
2001			4367	23065	9244	0	36675						-	36675
2002			2944	21226	15935	0	40105						-	40105
2003#			3284	25438	14440	0	43162						1393	44555
2004#			4438	27483	14494	0	46416						2614	49029
2005#			5461	26623	14467	0	46550						4583	51133
2006#			6127	24709	10633	0	41469						1222	42691
2007#			7017	27456	10620	0	45093						2165	47258
2008#			10654	22834	14334	0	47822						3368	51190
2009#			13057	25300	20424	0	58781						11033	69814
2010#			14187	33500	25073	0	72760						12118	84878
2011#			18789	18574	16604	32000^	87540						13903	101443
2012#			22415	22166	16716	19300^	85677						14870	100547
2013#	292	10684	5232	28500	19900	13100^	77708	313	2942	1545	6583	4059	15400	93108
2014#	348	12077	11415	40536	25552	0^	89928	287	3105	951	4021	1458	9800	99728
2015#	447	14618	7065	44396	28497	0^	95023	93	3444	71	4208	3096	10900	105923
2016#	695	19603	11365	49377	26490	0	107530	142	4189	344	2281	4150	11114	118644
2017#	775	19690	9614	45737	28853	0	104670	148	1777	314	1168	3692	7100	111770

* Spanish data for 1961–1972 are not revised; data for Subarea 8 for 1973–1978 include data for divisions 8.a,b only. Data for 1979–1981 are revised based on French surveillance data. Divisions 3.a and 4.b,c are included in the column "3.a, 4, and 6" only after 1976. There are some unallocated landings (moreover for the period 1961–1970).

** Discard estimates from observer programmes. In years marked with # partial discard estimates are available and used in the assessment. For the remaining years where no values are presented, some estimates are available but are not considered valid and thus not used in the assessment. In the years with data only Spanish discards, and discards from French *Nephrops* trawlers are included.

*** The working group used total catches from 1978.

^ Unallocated landings for the years 2011–2014 were revised in 2015.

See ** footnote.

Summary of the assessment

Table 10 Hake in subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock. Assessment summary. Weights are in tonnes. Highs and lows are 95% confidence intervals.

Year	Recruitment age 0	High	Low	SSB	High	Low	Landings*	Discards*	F 15–80 cm length
	thousands			tonnes			tonnes		
1978	298362	356522236	249689568	80488	94829	66148	50551		0.50
1979	274926	332948076	227015295	101357	113038	89676	51096		0.54
1980	303736	362172930	254726244	103838	114778	92898	57265		0.64
1981	579898	658580341	510616047	89265	99451	79078	53918		0.64
1982	392556	458475881	336114111	72684	82196	63173	54994		0.67
1983	139840	175995804	111111885	70355	78970	61740	57507		0.62
1984	279464	325473470	239958505	83045	91084	75005	63286		0.66
1985	619933	693906688	553843465	78908	85918	71897	56099		0.82
1986	359882	403387888	321068276	58963	65252	52674	57092		0.91
1987	434200	482467856	390762837	43524	48780	38269	63369		0.98
1988	494257	545542884	447792446	45994	50497	41491	64823	2	1.00
1989	478272	524131463	436425062	45086	48989	41182	66473	73	1.07
1990	484780	529283338	444018603	42352	45522	39181	59954		1.02
1991	270044	297952526	244749601	41351	44352	38350	58129		0.96
1992	294630	324385350	267604061	39836	42780	36893	56617		1.00
1993	517317	549711456	486831547	38743	41310	36177	52144		1.05
1994	288462	309830734	268567047	30489	32691	28287	51259	356	1.06
1995	147553	160916492	135299294	29596	31610	27582	57621		1.12
1996	362975	386197193	341149167	34790	36855	32726	47210		0.97
1997	255130	277252985	234770445	30089	32045	28133	42465		1.06
1998	422379	452353521	394388828	24356	26012	22700	35060		0.98
1999	207423	225591711	190717561	27703	29485	25921	39814	349	0.97
2000	188288	203398182	174300333	30600	32541	28659	42026	83	0.91
2001	346704	369281275	325507064	36341	38508	34175	36675		0.75
2002	274312	293176871	256661015	37273	39660	34885	40107		0.81
2003	160600	173152768	148957249	37656	40127	35185	43162	2110	0.82
2004	340348	360545514	321283825	42778	45364	40191	46417	2552	0.83
2005	221565	237314277	206860918	41195	43799	38591	46550	4676	0.95
2006	302086	320023554	285155747	33614	36023	31204	41467	1816	0.84
2007	471269	499703261	444452714	39797	42666	36929	45028	2191	0.74
2008	765300	807079837	725682966	46978	50743	43214	47739	3248	0.60
2009	254872	278045852	233629583	71072	76940	65204	58818	9871	0.48
2010	270378	292667853	249785763	131320	141613	121027	72799	9415	0.36
2011	284226	310040115	260563017	216114	233263	198965	87540	13775	0.29
2012	540727	587750350	497467623	247175	269865	224485	85677	12225	0.24
2013	375538	416626597	338501648	252407	279461	225353	77753	11637	0.24
2014	217417	246976079	191395669	271088	303658	238518	89940	7047	0.23
2015	245139	284717743	211062116	314983	357272	272694	93670	7396	0.22
2016	593993	707486502	498705888	346653	400514	292792	109106	9939	0.23
2017	493394	645701128	377011347	325230	388883	261577	104671	5616	0.25
2018	303550	329012418	280057422	306516	383117	229915			

* Model estimated landings or discards.

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