

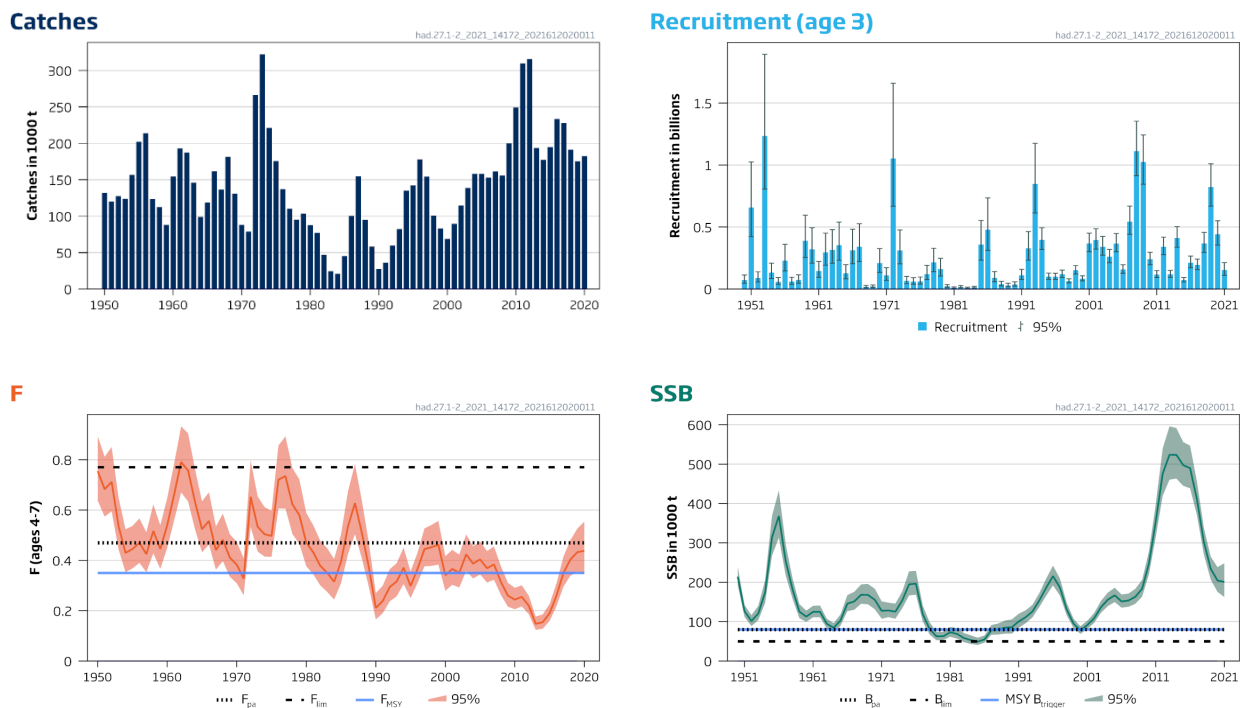
## Haddock (*Melanogrammus aeglefinus*) in subareas 1 and 2 (Northeast Arctic)

### ICES advice on fishing opportunities

ICES advises that when the Joint Norwegian–Russian Fisheries Commission (JNRFC) management plan is applied, catches in 2022 should be no more than 180 003 tonnes.

### Stock development over time

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



**Figure 1** Haddock in subareas 1 and 2. Summary of the stock assessment. For this stock,  $F_{MGT} = F_{MSY}$  and  $SSB_{MGT} = MSY B_{trigger} = B_{pa}$ ; therefore, the horizontal lines representing these points in the graph overlap.

### Catch scenarios

**Table 1** Haddock in subareas 1 and 2. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
$F_{ages\ 4-7}$ (2021)	0.44	Based on catch of 232 537 (TAC); tonnes
SSB (2022)	204751	Short-term forecast; tonnes
$R_{age\ 3}$ (2021)	153680	SAM estimates; thousands
$R_{age\ 3}$ (2022)	30736	RCT3 estimates; thousands
$R_{age\ 3}$ (2023)	94702	RCT3 estimates; thousands
Total catch (2021)	232537	TAC for 2021; tonnes

**Table 2** Haddock in subareas 1 and 2. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch (2022)	$F_{\text{ages 4-7}}$ (2022)	SSB (2023)	% SSB change *	% TAC change **	% Advice change ***
ICES advice basis						
Management plan	180003	0.35	201485	-1.6	-22.6	-22.6
Other scenarios						
MSY approach: $F_{\text{MSY}}$	180003	0.35	201485	-1.6	-22.6	-22.6
$F = 0$	0	0	309362	51.1	-100.0	-100.0
$F = F_{2021}$	214185	0.44	181739	-11.2	-7.9	-7.9
$F_{\text{pa}}$	227071	0.47	174372	-14.8	-2.4	-2.4
$F_{\text{lim}}$	320921	0.77	122248	-40.3	38.0	38.0

\* SSB 2023 relative to SSB 2022.

\*\* Catch in 2022 relative to TAC in 2021 (232537 tonnes).

\*\*\* Catch for 2022 relative to the advice for 2021 (232537 tonnes).

The advice for 2022 is 22.6% lower than the advice for 2021 because of the downward revision of stock biomass estimates.

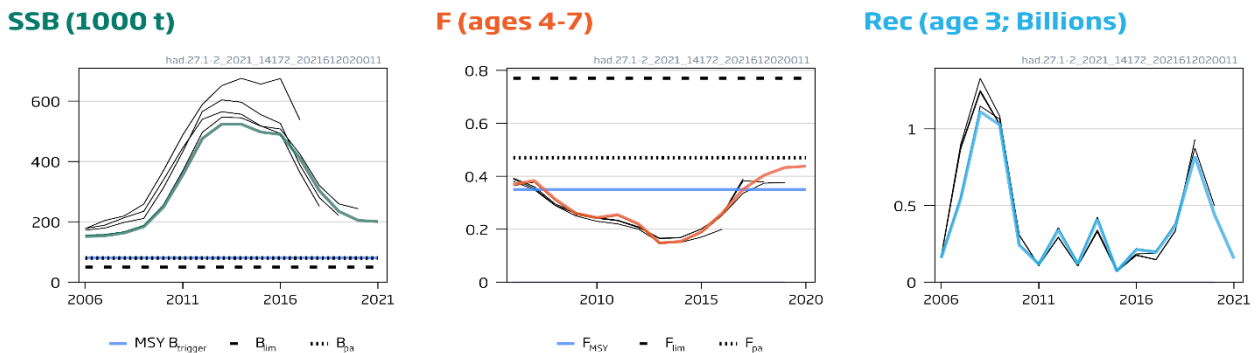
### Basis of the advice

**Table 3** Haddock in subareas 1 and 2. The basis of the advice.

Advice basis	Joint Norwegian–Russian Fisheries Commission management plan
Management plan	<p>The current harvest control rule (HCR) for haddock is as follows (see details in Protocol of the 46th Session of the Joint Norwegian–Russian Fisheries Commission [JNRFC, 2016]):</p> <ul style="list-style-type: none"> <li>– TAC for the next year will be set at level corresponding to FMSY.</li> <li>– The TAC should not be changed by more than <math>\pm 25\%</math> compared with the previous year TAC.</li> <li>– If the spawning stock falls below <math>B_{\text{pa}}</math>, the procedure for establishing TAC should be based on a fishing mortality that is linearly reduced from FMSY at <math>B_{\text{pa}}</math> to <math>F = 0</math> at SSB equal to zero. At SSB-levels below <math>B_{\text{pa}}</math> in any of the operational years (current year and a year ahead) there should be no limitations on the year-to-year variations in TAC.</li> </ul> <p>At the 46th Session of the Joint Norwegian–Russian Fisheries Commission in 2016 it was decided to keep the existing HCR for haddock for the next five years.</p> <p>Quota flexibility: In 2014, JNRFC decided that from 2015 onwards, Norway and Russia can transfer to, or borrow from, the following year up to 10% of the country's quota.</p> <p>ICES evaluated this HCR in 2016 (ICES, 2016) and rechecked it in 2020 (ICES, 2020). ICES concluded that the HCR is precautionary.</p>

## Quality of the assessment

The assessment from the current year is consistent with the assessment carried out at the latest benchmark (ICES, 2020).



**Figure 2** Haddock in subareas 1 and 2. Historical assessment results. For the 2016 assessment, the fishing mortality plot shows  $F + M_2$  (natural mortality due to predation by cod), instead of only  $F$ . The stock was benchmarked in 2020 (ICES, 2020), and only last two years' assessments should be compared.

## Issues relevant for the advice

A downward revision of the model estimates has occurred as a consequence of low survey indices. This has resulted in a reduction in the catch advice. The catch in 2020 was 15% lower than the TAC and the catch is also expected to be below the TAC in 2021, especially since the TAC in 2021 was higher than the 2020 TAC. The 2018–2020 year classes are estimated to be below the average of the 1990–2017 year classes.

## Reference points

**Table 4** Haddock in subareas 1 and 2. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	80000 tonnes	$B_{pa}$	ICES (2020)
	$F_{MSY}$	0.35	Stochastic long-term simulations	ICES (2020)
Precautionary approach	$B_{lim}$	50000 tonnes	$B_{loss}$	ICES (2020)
	$B_{pa}$	80000 tonnes	$B_{lim} \times \exp(1.645 \times \sigma)$ , where $\sigma = 0.3$	ICES (2020)
	$F_{lim}$	0.77	Determined from replacement line leading from $SSB = 0$ to the geometric mean recruitment at $SSB = B_{lim}$	ICES (2020)
	$F_{pa}$	0.47	$F_{lim} \times \exp(-1.645 \times \sigma)$ , where $\sigma = 0.3$	ICES (2020)
Management plan	$SSB_{MGT}$	80000 tonnes	$B_{pa}$	ICES (2020)
	$F_{MGT}$	0.35	$F_{MSY}$	ICES (2020)

## Basis of the assessment

**Table 5** Haddock in subareas 1 and 2. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2021a).
Assessment type	Age-based analytical assessment (SAM) that uses catches in the model (ICES, 2021b).
Input data	Commercial landings (international landings, ages, and length frequencies from catch sampling); four survey indices (Joint Norwegian-Russian survey Barents Sea, Feb–Mar (G5348) bottom trawl (BTr) and acoustic (Aco) indices; Russian bottom trawl survey, Oct–Dec (G5348); Joint Norwegian-Russian Ecosystem survey (A5216; Btr)); annual maturity and stock weight-at-age data from surveys; from 1984, the natural mortalities are derived from the consumption of haddock (ages 3–6) by cod.
Discards and bycatch	Discarding is considered negligible in recent years.
Indicators	None.
Other information	Last benchmarked in February 2020 (ICES, 2020).
Working group	Arctic Fisheries Working Group (AFWG).

## History of the advice, catch, and management

**Table 6** Haddock in subareas 1 and 2. ICES advice, TAC, and the official and ICES landings. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	Official landings*	Unreported landings	ICES landings
1987	No increase in F; TAC	160000	250000	154916		154916
1988	No increase in F	< 240000	240000	95255		95255
1989	Large reduction in F	69000	83000	58518		58518
1990	No directed fishery	-	25000	27182		27182
1991	No directed fishery	-	28000	36216		36216
1992	Within safe biological limits	35000	63000	59922		59922
1993	No long-term gains in increasing F	56000	72000	82379		82379
1994	No long-term gains in $F > F_{med}$	97000**	120000	135186		135186
1995	No long-term gains in $F > F_{med}$	122000**	130000	142448		142448
1996	No long-term gains in $F > F_{med}$	169000**	170000	178128		178128
1997	Well below $F_{med}$	< 242000	210000	154359		154359
1998	Below $F_{med}$	< 120000	130000	100630		100630
1999	Reduce F below $F_{pa}$	< 74000	78000	83195		83195
2000	Reduce F below $F_{pa}$	< 37000	62000	68944		68944
2001	Reduce F below $F_{pa}$	< 66000	85000	89640		89640
2002	Reduce F below $F_{pa}$	< 64000	85000	96062	18736	114798
2003	Reduce F below $F_{pa}$	< 101000	101000	105700	33226	138926
2004	Reduce F below $F_{pa}$	< 120000	130000	124502	33777	158279
2005	Reduce F below $F_{pa}$	< 106000	117000	118015	40283	158298
2006	Reduce F below $F_{pa}$	< 112000	120000	131706	21451	153157
2007	Limit catches	< 130000	150000	146972	14553	161525
2008	Limit catches to 2001–2004 average	< 130000	155000	149776	5828	155604
2009	Apply management plan	< 194000	194000	200061	0	200061
2010	Apply management plan	< 243000	243000	249200	0	249200
2011	Apply management plan	< 303000	303000	309785	0	309785
2012	Apply management plan	< 318000	318000	315627	0	315627
2013	Apply management plan	< 238000	200000	193744	0	193744
2014	Apply management plan	< 150000	178500	177522	0	177522
2015	Apply management plan	< 165000	223000	194756	0	194756
2016	Apply management plan	< 244000^	244000	233416	0	233416
2017	Apply management plan	$\leq 233000$	233000	227588	0	227588
2018	Apply management plan	$\leq 202305$	202305	191276	0	191276
2019	Apply management plan	$\leq 152000$	172000	175402	0	175402
2020	Apply management plan	$\leq 215000$	215000	182468	0	182468
2021	Apply management plan	$\leq 232537$	232537			
2022	Apply management plan	$\leq 180003$				

^ This advice was updated on 7 July 2015 in response to a special request (ICES, 2015) after a mid-year change in TAC in 2015 (from 178500 tonnes to 223000 tonnes).

\* Coastal haddock in Norwegian statistical areas 06 and 07 (south of Lofoten) are included.

\*\* Predicted landings at  $F_{med}$ .

**History of the catch and landings**

**Table 7** Haddock in subareas 1 and 2. Catch distribution by fleet in 2020, as estimated by ICES.

Catch (2020)	Landings			Discards
	trawls 69%	longline 18%	other gears 13%	
182 468 tonnes	182 468 tonnes			Discarding is unknown, but assumed to be negligible

**Table 8** Haddock in subareas 1 and 2. History of official commercial catch and landings by country. All weights are in tonnes.

Year	Faroe Islands	France	German Dem. Rep.	Fed. Rep. Germany.	Greenland	Norway^	Poland	Russia**	Spain	United Kingdom	Others	Unreported catches***	Total
1960	172	-	-	5597		46263	-	57025		45469	125	-	154651
1961	285	220	-	6304		60862	-	85345		39650	558	-	193224
1962	83	409	-	2895		54567	-	91910		37486	58	-	187408
1963	17	363	-	2554		59955	-	63526		19809	-	-	146224
1964	-	208	-	1482		38695	-	43870		14653	250	-	99158
1965	-	226	-	1568		60447	-	41750		14345	242	-	118578
1966	-	1072	11	2098		82090	-	48710		27723	74	-	161778
1967	-	1208	3	1705		51954	-	57346		24158	23	-	136397
1968	-	-	-	1867		64076	-	75654		40129	-	-	181726
1969	2	-	309	1490		67549	-	24211		37234	25	-	130820
1970	541	-	656	2119		37716	-	26802		20423	-	-	88257
1971	81	-	16	896		45715	43	15778		16373	3	-	78905
1972	137	-	829	1433		46700	1433	196224		17166	2231	-	266153
1973	1212	3214	22	9534		86767	34	186534		32408	2501	-	322226
1974	925	3601	454	23409		66164	3045	78548		37663	7348	-	221157
1975	299	5191	437	15930		55966	1080	65015		28677	3163	-	175758
1976	536	4459	348	16660		49492	986	42485		16940	5358	-	137264
1977	213	1510	144	4798		40118	-	52210		10878	287	-	110158
1978	466	1411	369	1521		39955	1	45895		5766	38	-	95422
1979	343	1198	10	1948		66849	2	26365		6454	454	-	103623
1980	497	226	15	1365		66501	-	20706		2948	246	-	92504
1981	381	414	22	2402		63435		13400		1682	-	-	81736
1982	496	53	-	1258		43702		2900	-	827	-	-	49236
1983	428	-	1	729		22364		680	139	259	-	-	24600
1984	297	15	4	400		18813		1103	37	276	-	-	20945
1985	424	21	20	395		21272		22690	77	153	-	-	45052
1986	893	12	75	1079		52313		45738	22	431	-	-	100563
1987	464	7	83	3105		72419		78211	59	563	5	-	154916
1988	1113	116	78	1323		60823		31293	72	435	2	-	95255
1989	1217	-	26	171		36451		20062	1	590	-	-	58518
1990	705	-	5	167		20621		5190	-	494	-	-	27182
1991	1117	-		213		22178		12177	-	514	17	-	36216
1992	1093	151		387	1719	36238		19699	38	596	1	-	59922
1993	546	1215		1165	880	40978		35071	76	1802	646	-	82379
1994	2761	678		2412	770	71171		51822	22	4673	877	-	135186
1995	2833	598		2675	1097	76886		54516	14	3111	718	-	142448
1996	3743	6		942	1510	94527		74239	669	2275	217	-	178128
1997	3327	540		972	1877	103407		41228	364	2340	304	-	154359
1998	1903	241		385	854	75108		20559	257	1229	94	-	100630
1999	1913	64		641	437	48182		30520	652	694	92	-	83195
2000	631	178		880	432	42009		22738	502	747	827	-	68944
2001	1210	324		554	553	49067		34307	1497	1068	1060	-	89640
2002	1564	297		627	858	52247		37157	1505	1125	682	18736	114798
2003	1959	382		918	1363	56485		41142	1330	1018	1103	33226	138926
2004	2484	103		823	1680	62192		54347	54	1250	1569	33777	158279

Year	Faroe Islands	France	German Dem. Rep.	Fed. Rep. Germany	Greenland	Norway <sup>^</sup>	Poland	Russia**	Spain	United Kingdom	Others	Unreported catches***	Total
2005	2138	333		996	15	60850		50012	963	1899	1262	40283	158751
2006	2390	883		989	1830	69272		53313	703	1164	1162	21451	153157
2007	2307	277		1123	1464	71244		66569	125	1351	2511	14553	161525
2008	2687	311		535	1659	72779		68792	283	971	1759	5828	155604
2009	2820	529		1957	1410	104354		85514	317	1315	1845	0	200061
2010	3173	764		3539	1970	123384		111372	379	1758	2862	0	249200
2011	1759	268		1724	2110	158202		139912	502	1379	4763	0	309785
2012	2055	322		1111	3984	159602		143886	441	833	3393	0	315627
2013	1886	342		500	1795	99215		85668	439	639	3260	0	193744
2014	1470	198		340	1150	91306		78725	187	355	3791	0	177522
2015	2459	145		124	1047	95094		91864	246	450	3327	0	194756
2016	2460	340		170	1401	108718		115710	200	575	3838	0	233416
2017	2776	108		170	1810	113132		106714	228	372	2279	0	227588
2018	2333	183		385	1317	93839		90486	169	453	2173	0	191276
2019	1515	143		204	1208	93860		76125	280	456	1611	0	175402
2020*	1392	96		282	910	88108		89030	45	320	2286	0	182468

\* Provisional figures.

\*\* USSR prior to 1991.

\*\*\* Figures based on Norwegian/Russian illegal, unreported, and unregulated fisheries (IUU) estimates.

<sup>^</sup> Landings of coastal haddock in Norwegian statistical areas 06 and 07 (south of Lofoten) are included from 1983.

**Table 9** Haddock in subareas 1 and 2. Catches inside and outside the NEAFC Regulatory Area (RA) as estimated by ICES.

Year	Inside the NEAFC RA (tonnes)	Outside the NEAFC RA (tonnes)	Total catches (tonnes)	Proportion inside the NEAFC RA (%)
2018	24	191252	191276	0.013%
2019	394	175008	175402	0.23%
2020	0	182468	182468	0%

### Summary of the assessment

**Table 10** Haddock in subareas 1 and 2. Assessment summary. High and low represent 95% confidence limits.

Year	Recruitment (thousands)			SSB (tonnes)			Total catch (tonnes)	F		
	Age 3	High	Low	SSB	High	Low		Ages 4-7	High	Low
1950	72387	113757	46062	214451	239657	191896	132125	0.76	0.89	0.64
1951	657549	1024740	421933	126198	142244	111962	120077	0.68	0.81	0.57
1952	88651	139228	56447	101722	116687	88677	127660	0.71	0.85	0.60
1953	1235085	1893203	805743	120624	139915	103993	123920	0.54	0.65	0.44
1954	133361	209168	85029	174452	206344	147488	156788	0.43	0.52	0.35
1955	58610	92912	36972	313927	368803	267217	202286	0.45	0.54	0.37
1956	229244	360280	145866	368382	433358	313148	213924	0.47	0.57	0.39
1957	60266	95158	38168	253706	296473	217108	123583	0.43	0.51	0.35
1958	72860	114287	46450	182036	209837	157918	112672	0.52	0.62	0.43
1959	389171	595585	254295	125360	144599	108680	88211	0.45	0.54	0.37
1960	320748	493573	208438	112847	128128	99388	154651	0.54	0.65	0.45
1961	145185	222773	94620	124852	140333	111078	193224	0.66	0.79	0.56
1962	294861	451325	192640	125250	141117	111167	187408	0.79	0.93	0.67
1963	315359	479068	207593	94365	107352	82948	146224	0.76	0.91	0.63
1964	353500	540029	231399	84511	96329	74143	99158	0.63	0.76	0.52
1965	126853	196486	81897	103153	118418	89857	118578	0.52	0.64	0.43
1966	313477	482241	203773	145776	167746	126683	161778	0.56	0.67	0.46
1967	341190	526492	221107	151263	175829	130129	136397	0.44	0.54	0.36
1968	18013	29212	11107	168174	194610	145329	181726	0.48	0.59	0.40

Year	Recruitment (thousands)			SSB (tonnes)			Totalcatch(tonnes)	F		
	Age 3	High	Low	SSB	High	Low		Ages 4-7	High	Low
1969	20599	33151	12799	167949	195917	143974	130820	0.41	0.50	0.34
1970	209787	326485	134801	155435	183655	131552	88257	0.38	0.47	0.31
1971	109545	171952	69787	127588	151692	107314	78905	0.33	0.41	0.26
1972	1052876	1659631	667948	128490	148176	111420	266153	0.65	0.80	0.53
1973	310449	476042	202458	125203	146001	107368	322226	0.53	0.66	0.44
1974	66135	102289	42760	153690	176650	133714	221157	0.50	0.61	0.42
1975	59421	91892	38424	194817	227875	166555	175758	0.50	0.60	0.41
1976	61869	97225	39371	196331	228881	168410	137264	0.72	0.86	0.61
1977	120514	191393	75884	118795	141140	99987	110158	0.74	0.89	0.61
1978	214589	328722	140083	81208	98254	67119	95422	0.62	0.77	0.51
1979	161504	247938	105201	62610	74542	52588	103623	0.58	0.72	0.47
1980	22094	35894	13599	62985	74317	53381	87889	0.47	0.59	0.38
1981	10280	17337	6095	73069	86634	61627	77153	0.43	0.54	0.35
1982	16749	27298	10277	68801	83398	56759	46955	0.38	0.48	0.30
1983	8656	14729	5087	58364	71239	47816	24600	0.35	0.45	0.28
1984	13271	21611	8149	53199	65423	43258	20945	0.32	0.41	0.24
1985	358813	552199	233153	49169	59223	40822	45052	0.40	0.50	0.31
1986	478572	734868	311663	54924	64919	46468	100563	0.54	0.68	0.43
1987	90214	140923	57751	77959	91369	66517	154916	0.63	0.78	0.50
1988	38984	62344	24377	80099	95402	67250	95255	0.51	0.64	0.41
1989	28853	46599	17865	84610	102976	69520	58518	0.37	0.47	0.29
1990	37125	57992	23767	85901	105854	69709	27182	0.21	0.27	0.165
1991	111048	158188	77956	100647	120159	84303	36216	0.24	0.30	0.190
1992	328727	463631	233077	111090	128808	95809	59922	0.29	0.37	0.24
1993	848769	1175203	613008	125741	142922	110626	82379	0.32	0.39	0.26
1994	396614	493159	318970	153834	172532	137161	135186	0.37	0.45	0.31
1995	100060	128671	77811	186134	209324	165514	142448	0.30	0.36	0.25
1996	99507	127404	77719	215730	242370	192019	178128	0.37	0.43	0.31
1997	119084	152169	93193	186891	210055	166282	154359	0.45	0.53	0.38
1998	63240	81995	48775	130850	148025	115668	100630	0.45	0.54	0.38
1999	151245	189455	120741	94816	107270	83809	83195	0.46	0.56	0.38
2000	83258	106611	65021	78075	88460	68910	68944	0.34	0.42	0.28
2001	367666	450533	300041	91259	102526	81229	89640	0.37	0.44	0.30
2002	395448	485812	321892	108683	122003	96817	114798	0.35	0.42	0.29
2003	340113	424403	272564	136879	152791	122623	138926	0.42	0.50	0.36
2004	260359	319424	212216	155689	173805	139461	158279	0.39	0.46	0.33
2005	366492	447466	300172	166962	186313	149621	158298	0.40	0.48	0.34
2006	157564	195244	127155	151329	169050	135466	153157	0.37	0.44	0.31
2007	543223	668715	441281	153562	171230	137718	161525	0.38	0.46	0.32
2008	1112513	1354200	913961	163092	183272	145133	155604	0.31	0.38	0.26
2009	1025284	1243094	845638	183533	206213	163348	200061	0.26	0.31	0.22
2010	240955	297083	195431	248053	279050	220499	249200	0.24	0.29	0.21
2011	117224	148588	92480	355613	400375	315855	309785	0.26	0.30	0.22
2012	340386	418780	276667	475908	539815	419566	315627	0.22	0.26	0.186
2013	119057	150121	94420	523943	596137	460492	193744	0.148	0.177	0.124
2014	411335	503497	336043	523619	591718	463357	177522	0.154	0.185	0.128
2015	72464	92950	56494	497402	556135	444871	194756	0.190	0.23	0.159
2016	212760	265075	170769	489847	547104	438583	233416	0.26	0.31	0.22
2017	194179	241399	156196	410620	455820	369903	227588	0.35	0.42	0.30
2018	367841	457503	295751	303265	339214	271126	191276	0.40	0.48	0.34
2019	821773	1009689	668831	234446	265549	206986	175402	0.43	0.53	0.36
2020	441844	550361	354723	204484	238429	175372	182468	0.44	0.55	0.35
2021	153680	213373	110687	200849	248417	162390				

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