15 Cod (*Gadus morhua*) in NAFO Subarea 1, inshore (West Greenland cod)

15.1 Stock description and management units

Cod in Greenland originate from four distinct stocks that are labelled by their spawning areas: I) offshore West Greenland; II) West Greenland fjords; III) offshore East Greenland and Icelandic and IV) inshore Icelandic waters (Therkildsen *et al*., 2013).
The inshore component (West Greenland, NAFO Subarea 1) has since 2012 been assessed separately from the offshore stocks. The Stock Annex provides more details on the stock identities including the references to the primary literature.

15.2 Scientific data

Historical trends in landings and fisheries

Details on the historical development of the fishery is described in the stock annex. The fishery developed in the yearly part of the 20th century, and by 1960 it peaked at 35 000 t (Figure 15.2.1). The fishery then declined but additional peaks in landings resulted from single large year classes during the 1970s and 1980s. Between 1990 and 2000, landings were below 5000 t, but has since increased gradually.

The present fishery

The TAC in 2019 was originally 30 000 tons, but 2 000 t. were transfered to the offshore fishery in West Greenland in the summer, and 200 t. were transferred to a trial fishery on capelin, resulting in an end TAC of 27 800 t. The 2019 catches were 19 753 t (Table 15.2.1). Poundnet remains the dominant gear, accounting for 61% of the catches followed by the longlines (122%), hooks (13%) and gill nets (4%) (Table 15.2.2, Figure 15.2.1,). Approximately 78% of the total catch is caught from May–October with a peak in June–July (Table 15.2.3). More details on the inshore fishery is found in Retzel 2020a.

North Greenland (NAFO division 1A, subarea 1AX (Disco Bay))

Catches in North Greenland have gradually increased from 500 t in 2012 to an historic high of nearly 6000 t comprising close to 20% of the catches in 2017 (Table 15.2.1, Figure 15.2.2). In 2018 and 2019 catches decreased around 60% to 1316 t. and they accounted for 7% of the total catch in 2019 (Table 15.2.3). Cod are caught as a combination of bycatch in the gillnet and longline fishery for Greenland Halibut and a poundnet directed fishery (Table 15.2.2).

Midgreenland (NAFO divisions 1B and 1C)

7139 tons where fished in midgreenland in 2019 which is a decrease of 70% to the historic high of 22 000 t in 2016 and 2017 (Table 15.2.1, Figure 15.2.2). In both areas the dominating gear are pound nets which caught 27% of the total catch in 2019 (Table 15.2.2). The fishery is concentrated around the towns of Kangatsiaq, Sisimiut and Maniitsoq (figure 15.2.3 and 15.2.4).

Midgreenland (NAFO divisions 1D)

The fishery in NAFO division 1D has in contrast to more northern areas increased from 2017 to 2019. Total catch in 1D (8632 t) is 44% of the total catch (Table 15.2.3). In 2017, the share was less than 15%, and the catch in Disko Bay (NAFOF 1AX) was higher than in 1D.

South Greenland (NAFO divisions 1E and 1F)

The catches in South Greenland have gradually declined and now correspond to 2% of the total inshore catch (Table 15.2.3, Figure 15.2.3, 15.2.4). However catches increased abruptlyfrom 390 t in 2018 to 1823 t in 2019 in NAFO 1F resulting in 9% of the total inshore catch in this region (table 15.2.3). The inshore cod stock is believed to be distributed from Midgreenland and northwards as there are no significant spawning taking place in South Greenland (Retzel and Hedeholm, 2012). Hence, the fishery in this area depends on offshore fish migrating inshore. Survey results from the offshore area found increasing numbers of cod in West and South Greenland (Retzel 2020b, Werner & Foc 2020).

East Greenland (ICES Subdivision 14.b)

Over the past five years, a small inshore fishery using hooks has developed in East Greenland, but less than 150 t are caught annually (Table 15.2.1, Figure 15.2.3). No length measurements are available from this fishery but individuals in this area do not belong to the West Greenland inshore cod stock. These fish are therefore not included in the overall calculations of catch and weight at age, but since the area is by definition part of the inshore area the catches are compiled here.

Catch-at-age

Catches in 2019 were comprised of the 2012-2015 yar classes (YC) and specially the 2014 YC dominating the fishery(Table 15.2.4, Figure 15.2.5, Figure 15.2.6). The mean catch length increased from 53 cm in 2010–2013 to 58 cm in 2014–2017. In 2018, the mean length decreased to 54 cm and further to 51 cm in 2019.

Weight-at-age

Geographical conditions, i.e., the existence of many small landing sites separated along more than 1000 km of coastline prevents a well-balanced sampling of the Greenland coastal fleets catches. . Cod are also landed without head, which hinder otolith sampling. This means that age information from the commercial fishery is limited. The mean weight-at-age in the landings are therefore primarily based on survey sampling and set equal to stock mean weight-at-age in the assessment. A more comprehensive description of the fishery and sampling procedures are provided in the stock annex.

Maturity-at-age

Maturity information from the early period of the assessment is only available for November 1987 (n = 484 cod). Although of limited size, the sample is from the bottom of the fjord where there is minimal mixing with the offshore stock (Storr-Poulsen *et al.*, 2004) and represents the best estimate of maturity during this period. Recent maturity (2007–2015) information is available from the spawning season (n = 3326 cod). The maturity ogive for the two periods was estimated by a general linear model (GLM) with binomial errors. The ogive for the two periods are different: L50 was 5.07 years in 1987 (SE = 0.18), and 4.32 years (SE = 0.04) from 2007 to 2015. It was decided to use the years with very low catches (600–800 t) as transition years between the two maturity ogives. The maturity ogive for the period 1976–2006 was set to that of the 1987 ogive. For the remaining period (2007–present) the maturity ogive was set constant based on maturity information from 2007–2015. The reason for not applying different maturity ogives for each year is due to high variation in number of samples between years that results in noisy data.

Even though the maturity ogive for the period 1976–2006 is based on relatively few fish caught outside spawning season it was decided to use it as this maturity ogive is supported by earlier maturity ogives from the 1930s with a similar L50 (Hansen, 1949).

Results of the West Greenland gillnet survey

The numbers of valid net settings in 2019 was 48 in NAFO 1B and 54 in NAFO 1D (Table 15.2.5). Area and site specific catch rates can be seen in Figure 15.2.7.

In NAFO 1B the abundance index of all ages except ages 1 and 4 increased in 2019 (Table 15.2.6). Ages 2 and 3 are above historic mean (figure 15.2.8).

In NAFO 1D the number of 2 year-olds increased by 107% compared to 2017 (Table 15.2.6). The 3 year-olds declined by 18%. The combined index for age 2 and 3 are around the time series mean (figure 15.2.8). The number of older fish is however high and the overall index including all ages (217) remains well above historical average (108) (Table 15.2.6). Hence, the number of 5, 6, 7 and 8 year-olds are the highest in the time series.

Combining 1B and 1D in a joint index results in an increase across all ages compared to 2018 (Figure 15.2.8). The index remains intermediate compared to 2010–2013 and is similar to the values in 2015-2017, but 2010–2013 was a period of historic high recruitment. Normally, catch rates are highest in 1B, but in the period 2014-2018, the two areas have had similar recruitment (Table 15.2.6, Figure 15.2.8). In 2019 recruitment was higher in 1B.

In 2017 and 2019 the survey was extended to include Kangaatsiaq (NAFO 1B) and since 2017 to include Maniitsoq (NAFO 1C). A similar number of stations as in the traditional areas were successfully fished (Table 15.2.5). In Maniitsoq, the index combining all ages was similar to 1B and 1D in 2017. The index decreased in 2018 and further in 2019 (Table 15.2.6). Similar to 1D, the number of 2 year olds decreased, whereas number of 3 year olds increased and older fish (especially 5 year olds) dominated the catches. In Kangatsiaq, the index combining all ages was much lower than in Sisimiut, Maniitsoq and Nuuk in both 2017 and 2019.

Disko Bay survey

For 2019 32 gillnets where set targeting Greenland Halibut at fixed stations corresponding to previous years in the Diko Bay. Catches in the Disko Bay gill net survey were low from 2005–2012 (Table 15.2.7). From 2013–2016, catches of cod increased substantially, mainly driven by the 2009 and 2010 YCs. Catches declined from 2017 to 2018 but they increased in 2019.

Disko Bay is also covered as part of the annual bottom trawl survey in West Greenland.. The trawl survey catches smaller cod, and a similar increase as seen in the gill net survey was documented two years earlier, driven by the 2009 YC and subsequently by the relatively large 2010 and 2011 YCs (Table 15.2.8). Since then, catches have remained substantial in both the gill net and the trawl survey, but the latest numbers indicates a decline in abundance, which is consistent with smaller year classes as observed in the 1B and 1D recruitment surveys in recent years. Jointly, the inshore surveys suggests that the increase in recruitment starting with the 2009 YC resulted in not only local biomass increases, but also an expansion of the stock into the northern part of the inshore area. Recent recruitment declines can therefore also be expected to have the largest effect in the northern part of the area.

More details on inshore survey results can be found in Retzel 2020c.

15.3 Tagging experiments

A total of 5642 cod have been tagged inshore in West Greenland from 2003–2019, primarily in NAFO 1B, 1D and 1F (table 15.3.1).

Inshore recaptures are found almost exclusively in the same fjord as tagged (Table 15.3.2). No tags from the inshore area have been recaptured offshore except three that were recaptured in Iceland. These three cod were tagged in the South Greenland (1F) inshore area. One cod tagged offshore in NAFO 1C was recaptured inshore in NAFO 1E, 29 cod tagged offshore on Dana Bank have been recaptured in the inshore fjord system. Most of these were recaptured in the inshore area south of Dana Bank, but four were recaptured inshore north of Dana Bank. These results confirm the general perception: adult cod present deep in the fjords tends to remain in the same area and that the southern part of the inshore area is a mixing area of different stocks.

15.4 Methods

The stock was benchmarked in 2018 (ICES, 2018). It was decided to use the SAM model and perform an analytical assessment. Hence, the assessment was upgraded from a category 3 (Data Limited Stock) to a category 1 stock. This is considered a vast improvement, as all data are now utilized, and the assessment is presented with uncertainty estimates and multiple catch options.

At the NWWG 2020 meeting a short presentation was given of the likely outcome of a SAM assessment would be if the inshore and offshore cod stocks in West Greenland were treated as one stock. F_{2019} would be 0.47 and applying the EQSIM programme F_{msy} is estimated to 0.24. Using MSY advise, the 2021 advise would be 19 326 t for the total West Greenland area (except NAFO Div. 1F). However, these values are only indicative and more work is needed. A benchmark for the stock is proposed to take place in 2022.

15.5 Reference points

Reference points were defined at IBPGCod (ICES, 2018). The estimations were conducted in EQSIM according to ICES guidelines (see ICES (2018) for details). The reference points are shown in Table 15.5.1. However, F_{lim} and F_{pa} has not be defined. In last year NWWG meeting attempts were presented using age 2 or age 3 as recruits, or removing certain years in the SSB-recruit relationship but further work is needed (Riget *et al.*, 2019).

15.6 State of the stock

There have been several years of high recruitment between 2003 and 2012 and the spawning stock biomass was at a level not seen for 25 years in 2015, since then it has declined in the past four years and recruitment is currently close to historically low levels. The recent decrease in stock size was expected as the failing recruitment begins to affect the number of adults. The catches have decreased since the time series highs in 2016 and 2017. Catches are comprised of ages 4–7 and low recruitment for a few consecutive years will quickly affect the fishable biomass, which is evident in the catches of 2019 that was around half compared to 2016. TACs have not been obtained the last two years and it is unlikely that the TAC of 29 800 t in 2020 will be caught. ICES has assumed that F_{2020} will equal F_{2019} corresponding to estimated catches in 2020 of 13 525 t.

Genetic studies have been carried out on catches from the surveys and the commercial catch in the Sisimiut (1B) and Nuuk (1D) fjord systems. The studies should be considered as preliminary and further work is needed before a more firm conclusion can be reached. The proportion of each

stock were investigated in catches in Sisimiut (1B) and Nuuk (1D) in 2017. Results showed that the proportion of the inshore cod stock in the inshore catches were approximately 50% (Christensen, 2019).

A considerable proportion (30%) of the inshore catches belongs to the West Greenland offshore stock. The stock is in a depleted condition and the current ICES advice is zero catch. A continued high fishing pressure in the inshore areas can prolong the recovery time of the offshore stock.

The remaining part (20%) of the inshore catches belongs to the East Greenland/Icelandic stock. It is assumed that a large part of these cod migrate to East Greenland/Iceland to spawn. The spawning stock in East Greenland has in recent years declined. A continued high fishing pressure in the inshore areas can have a negative influence on the spawning stock in East Greenland.

15.7 Short term forecast

Input data

The SAM model provides predictions that carry the signals from the assessment into the short term forecast. The forecast procedure starts from the last year's estimate of the state (log(N) and log(F)). One thousand replicates of the last state are simulated from the estimated joint distribution. Each of these replicates are then simulated forward according to the assumptions and parameter estimates found by the assessment model.

In the forward simulations, a 5-year average (up to the assessment year) is used for catch mean weight, stock mean weight, proportion mature, and natural mortality. Recruitment is re-sampled from the entire time series. In each forward simulation step the fishing mortality is scaled, such that the median of the distribution is matching the requirement in the scenario (e.g. hitting a specific mean F value, a specific catch or level of SSB).

Results

The results from the assessment are shown as estimated numbers-at-age and F-at-age in tables 15.7.1 and 15.7.2. All other output can be found on stockassessment.org (run: codWestInsNWWG2020, Riget *et al*., 2020).

The forecasts from the different scenarios are presented in Table 15.7.3. Fishing at F_{MSY} in 2021 will result in catches of 5283 t and a spawning stock biomass increase with 12% in 2022. Recently the catches have been above the ICES advice, and an F status quo will result in catches of 10 697 t, but at the same time a decrease in the spawning stock biomass of 26% in 2022.

15.8 Long term forecast

No long term forecast was performed for this stock.

15.9 Uncertainties in assessment and forecast

The major uncertainty of the assessment is related to mixing of cod stocks (West Greenland offshore and East Greenland/Icelandic).

There is no incentive to discard fish or misreport catches under the current management system and any small cod released from the poundnets survive. The surveys show relatively good internal consistency and jointly data input to the assessment is of high quality and the time series are long which should provide a good basis for a robust assessment.

The model fits the data relatively well (Figure 15.9.1), but does consistently underestimate the spawning stock biomass (Figure 15.9.2). Although this is consistently a way-residual, the Mohn's rho measure of uncertainty is -0.23, which is not considered high (Hurtado-Ferro *et al*., 2015) and the 95% confidence intervals include all the retrospective runs. For the fishing mortality, there are also year-to-year changes in the perception. These are, however, both positive and negative, and the resulting Mohn's rho is only 0.03 with all retrospective runs being inside the model 95% confidence intervals (Figure 15.9.3).

The poorest model performance is in the fit between actual and estimated catches (Figure 15.9.4). Especially the poor fit to the catches in years with large catches is noteworthy, as catches are known with a high degree of certainty. The cause of this is emigration; immigration and mixing of stocks both in the survey and in the catches (see 'State of the stock'). The general picture of the stock dynamics is relatively well understood, but difficult to quantify, especially on an annual basis. It does present a challenge in the forecast. The TAC in the intermediate year is known at the time of the assessment meeting. This TAC is valid for the mixed fishery and does not reflect the expected catch of solely the inshore stock. Because of this, the TAC is not used in the forecast. Instead we have assumed than F will be similar and apply an F-scaler of 1 in the intermediate year. This then assumes that the model output is a valid estimate of the inshore cod stock landings and not total catches. In the current period, with very high landings, the model has estimated the actual landings to be roughly double the model estimate. This is consistent with sparse information from genetic studies on the actual proportions in the catches (Henriksen, 2015, Christensen, 2019).

Hence, the forecast should be considered as an estimate of the development of the inshore cod stock and not cod in the inshore area.

15.10 Comparison with previous assessment and forecast

The stock was benchmarked in 2018 (ICES, 2018) and the SAM model accepted. The spawning-stock biomass (SSB) of West Greenland inshore cod has decreased since 2015 after having been at a historical high level. Fishing mortality (F) has increased slightly in recent years and have been above F_{MSY} during the whole time-series. Recent recruitment has gradually decreased from a decade of high values and is currently close to historically low levels.

15.11 Management plans and evaluations

There is no management plan for this stock.

15.12 Management considerations

The TAC for this stock has consistently been set above the ICES advice. The quota is a common TAC for the entire inshore area and does not distinguish between stocks. Furthermore, it is allowed to fish offshore on the inshore quota. Historically, when the TAC was reached, the TAC was increased. Hence, the fishery in the West Greenland inshore area has always been an unlimited fishery.

Due to stock mixing, ICES is currently not able to accurately estimate the stock proportions in the catches. Therefore, the TAC can be set higher than the ICES advice, while still being in accordance with the advice. ICES cannot advice on such a TAC level.

15.13 Ecosystem considerations

The gear used for this fishery have little effect on the ecosystem, especially the main gear (pound-net).

15.14 Regulations and their effects

The fishery has never been limited by a TAC, as the TAC has always been set well above the fleet capacity or raised when reached. Therefore, it is unknown what the effect would be of limiting the fishery.

15.15 Changes in fishing technology and fishing patterns

With the northward expansion of the fishery over the past decade, there has been an increase in the importance of the gill nets, long liners and hooks. This has changed the selectivity of the fishery, as these gears have a higher selectivity for the older ages. This is also reflected in the assessment, were the F selectivity has gradually increased in recent years and the SAM model is explicitly able to handle time-varying selectively (Nielsen and Berg, 2014).

15.16 Changes in the environment

No data is collected to support any conclusions.

15.17 Benchmark 2022

Inshore catches have recently increased to historic heights. New genetic investigations of especially the inshore component reveals that the WestGreenland offshore component (cod.21.1.a-e) is mixing with the inshore component to a larger extent than previously thought (Christensen 2019).

Advice is based on analytical assessment (SAM) with catches from the inshore area going into the model. With high degree of mixing with other stocks the input data are not consistently expressing the status of the inshore stock component, and the model can produce unreliable estimates i.e. sustain fishing pressure well above F_{msy}, while staying above all reference points for biomass. Aim of the benchmark is either:

- Scenario 1: Treat the inshore and offshore West Greenland (cod.21.1.a-e) stocks together in an combined analytical assessment.
- Scenario 2: Reduce the catch in the inshore area by including genetic results.

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15.19 Tables

Table 15.2.1. Cod catches (t) divided into NAFO divisions, caught in the inshore fishery (1911–1993: Horsted 2000, 1994–2006: ICES 2007, Statistic Greenland, 2007-present: Greenland Fisheries License Control). ICES 14.b = inshore East Greenland.

	NAFO divisions								
Year	**1A**	**1B**	**1C**	**1D**	**1E**	**1F**	**Unknown NAFO div.**	**Total West Greenland**	**ICES 14b**
1911				19				19	
1912				5				5	
1913				66				66	
1914				60				60	
1915		47	6	45				98	
1916		66	24	103				193	
1917		67	28	59				154	
1918		106	26	140		169		441	
1919		39	37	140	148	137		501	
1920		117	32	187	23	95		454	
1921		116	92	97	7	196		508	
1922		82	178	144	40	158		602	
1923		120	116	147	0	307		690	
1924		131	223	221	1	267		843	
1925		122	371	318	45	168		1024	
1926		97	785	673	170	499		2224	
1927		282	974	982	305	1027		3570	
1928		426	888	1153	497	1199		4163	
1929		1479	1572	1335	642	2052		7080	
1930	137	2208	2326	1681	994	2312		9658	
1931	315	1905	2026	1520	835	2453		9054	
1932	358	1713	2130	1042	731	3258		9232	
1933	304	1799	1743	1148	948	2296		8238	
1934	451	2080	1473	652	921	3591		9168	

	NAFO divisions								
Year	**1A**	**1B**	**1C**	**1D**	**1E**	**1F**	**Unknown NAFO div.**	**Total West Greenland**	**ICES 14b**
1935	524	1870	1277	769	670	2466		7576	
1936	329	2039	1199	705	717	2185		7174	
1937	135	1982	1433	854	496	2061		6961	
1938	258	1743	1406	703	347	1035		5492	
1939	416	2256	1732	896	431	1430		7161	
1940	482	2478	1600	1061	646	1759		8026	
1941	636	3229	1473	823	593	1868		8622	
1942	879	3831	2249	1332	1003	2733		12027	
1943	1507	5056	2016	1240	1134	2073		13026	
1944	1795	4322	2355	1547	1198	2168		13385	
1945	1585	4987	2844	1207	1474	2192		14289	
1946	1889	5210	2871	1438	1139	2715		15262	
1947	1573	5261	3323	2096	1658	4118		18029	
1948	1130	5660	3756	1657	1652	4820		18675	
1949	1403	4580	3666	2110	2151	3140		17050	
1950	1657	6358	4140	2357	2278	4383		21173	
1951	1277	5322	3324	2571	2101	3605		18200	
1952	646	4443	2906	2437	2216	4078		16726	
1953	1092	5030	3662	5513	3093	4261		22651	
1954	950	6164	3118	3275	1773	3418		18698	
1955	591	5523	3225	4061	2773	3614		19787	
1956	475	5373	3175	5127	3292	3586		21028	
1957	277	6146	3282	5257	4380	5251		24593	
1958	19	6178	3724	5456	3975	6450		25802	
1959	237	6404	5590	5009	3767	6570		27577	
1960	188	6741	6230	3614	3626	6610		27009	
1961	601	6569	6726	4178	6182	9709		33965	

	NAFO divisions								
Year	**1A**	**1B**	**1C**	**1D**	**1E**	**1F**	**Unknown NAFO div.**	**Total West Greenland**	**ICES 14b**
1962	315	7809	6269	3824	5638	11525		35380	
1963	295	4877	3178	2804	3078	9037		23269	
1964	275	3311	2447	8766	2206	4981		21986	
1965	325	5209	4818	6046	2477	5447		24322	
1966	483	8738	5669	7022	2335	4799		29046	
1967	310	5658	6248	6747	2429	6132		27524	
1968	142	1669	2738	6123	2837	7207		20716	
1969	57	1767	4287	7540	2017	5568		21236	
1970	136	1469	2219	3661	2424	5654		15563	
1971	255	1807	2011	3802	1698	3933		13506	
1972	263	1855	3328	3973	1533	3696		14648	
1973	158	1362	1225	3682	1614	1581		9622	
1974	454	926	1449	2588	1628	1593		8638	
1975	216	1038	1930	1269	964	1140		6557	
1976	204	644	1224	904	1367	831		5174	
1977	216	580	2505	2946	3521	4231		13999	
1978	348	1587	3244	2614	4642	7244		19679	
1979	433	1768	2201	6378	9609	15201		35590	
1980	719	2303	2269	7781	10647	14852		38571	
1981	281	2810	3599	6119	7711	11505	7678	39703	
1982	206	2448	3176	7186	4536	3621	5491	26664	
1983	148	2803	3640	7430	5016	2500	7205	28742	
1984	175	3908	1889	5414	1149	1333	6090	19958	
1985	149	2936	957	1976	1178	1245		8441	
1986	76	1038	255	1209	1456	1268		5302	
1987	77	2366	423	6407	3602	1326	403	14604	
1988	333	6294	1342	2992	3346	4484		18791	

	NAFO divisions								
Year	**1A**	**1B**	**1C**	**1D**	**1E**	**1F**	**Unknown NAFO div.**	**Total West Greenland**	**ICES 14b**
1989	634	8491	5671	8212	10845	4676		38529	
1990	476	9857	1482	9826	1917	5241		28799	
1991	876	8641	917	2782	1089	4007		18312	
1992	695	2710	563	1070	239	450		5727	
1993	333	327	168	970	19	109		1926	
1994	209	332	589	914	11	62		2117	
1995	53	521	710	332	4	81		1701	
1996	41	211	471	164	11	46		944	
1997	18	446	198	99	13	130	282	1186	
1998	9	118	79	78	0	38		322	
1999	68	142	55	336	8	4		613	
2000	154	266	0	332	0	12		764	
2001	117	1183	245	54	0	81		1680	
2002	263	1803	505	214	24	813		3622	
2003	1109	1522	334	274	3	479	1494	5215	
2004	535	1316	242	116	47	84	2608	4948	
2005	650	2351	1137	1162	278	382	83	6043	
2006	922	1682	577	943	630	1461	1173	7388	
2007	416	2547	1195	1842	659	4391		11050	42
2008	870	3066	1539	3172	225	1133		10005	6
2009	325	1288	1189	2009	1142	1581		7534	2
2010	559	2990	1607	1795	1458	859		9268	2
2011	567	2364	2850	2905	1274	1047		11007	0
2012	546	1376	2061	4375	1989	325		10672	0.02
2013	1506	2552	2784	4711	1450	198		13202	35
2014	3084	6142	3710	4629	684	82		18331	38
2015	4088	7912	6426	6613	117	115		25272	50

	NAFO divisions								
Year	**1A**	**1B**	**1C**	**1D**	**1E**	**1F**	**Unknown NAFO div.**	**Total West Greenland**	**ICES 14b**
2016	5929	11466	11270	5279	87	173		34204	39
2017	5797	11110	10060	4066	56	131		31220	82
2018	2213	6422	6190	7043	31	390		22290	51
2019	1987	2925	4214	8673	131	1823		19753	143

Table 15.2.2: Landings (%) divided into month and gear and NAFO divisions and gear.

Gear/Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Poundnet				2%	12%	17%	14%	5%	5%	3%	2%	0.5%	**61%**
Gillnet	0.2%	0.4%	0.3%	1%	0.3%	0.4%	0.3%	0.2%	0.3%	1%	0.4%	0.2%	**4%**
Jig	0.1%	0.1%	0.2%	0.3%	1%	1%	2%	2%	3%	2%	1%	0.3%	**13%**
Longline	2%	2%	2%	1%	1%	1%	0.5%	1%	2%	3%	3%	3%	**22%**
Total	**3%**	**2%**	**3%**	**4%**	**13%**	**19%**	**17%**	**9%**	**10%**	**10%**	**6%**	**4%**	

Gear/NAFO	1AUM	1AUP	1AX	1B	1C	1D	1E	1F					Total
Poundnet	1%		3%	12%	15%	26%		4%					**61%**
Gillnet			1%	1%	1%			1%					**4%**
Jig	1%		1%	1%	2%	6%	1%	1%					**13%**
Longline	2%		2%		4%	12%		2%					**22%**
Total	**4%**		**7%**	**14%**	**22%**	**44%**	**1%**	**8%**					

Table 15.2.3 Catches (t) divided into month and NAFO Divisions, caught by the coastal fisheries.

NAFO	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	%
1AUM	26	5	6	28	9	13	7	150	305	68	53	1	**671**	3%
1AUP														
1AX	10	41	44	63	69	112	251	215	178	303	30		**1316**	7%
1B			9	35	465	649	735	156	126	326	352	72	**2925**	15%
1C	121	72	41	37	592	833	1052	326	212	372	354	202	**4214**	21%
1D	363	279	414	607	1379	1695	1035	558	918	662	357	406	**8673**	44%
1E				1	2	21	11	49	23	17	7		**131**	1%
1F	24	44	44	8	119	398	358	323	257	130	70	48	**1823**	9%
Total	**544**	**441**	**558**	**779**	**2635**	**3721**	**3449**	**1777**	**2019**	**1878**	**1223**	**729**	**19753**	
%	3%	2%	3%	4%	13%	19%	17%	9%	10%	10%	6%	4%		
ICES 14b								16	58	63	6		**143**	

Table 15.2.4 Estimated commercial landings in numbers ('000) at age, and total tones by year. * no sampling.

	Age								Tonnes
Year	3	4	5	6	7	8	9	10+	Landed
1976	2508	924	556	287	38	31	11	7	5174
1977	467	5437	1100	883	179	7	142	46	13999
1978	97	1262	9904	132	68	7	3		19679
1979	323	2297	2380	8281	170	96	4	14	35590
1980	4343	4334	1646	806	6492	106	29	37	38571
1981	87	15793	5225	725	499	2906	61	17	39703
1982	3013	1587	6309	1545	798	152	610	154	26664
1983	229	16877	1381	4352	368	139	65	75	28742
1984	520	4451	9269	346	634	18	42	12	19958
1985	5	2400	1028	2229	196	363	14	78	8441
1986	286	178	896	460	721	16	102	38	5302
1987	5503	1334	228	710	340	1084	46	265	14604
1988	419	15588	150	51	39	90	161	12	18791
1989	15	5962	23956	271	46	2	93	176	38529
1990	212	2997	15403	6732	33	11	7	16	28799
1991	124	6022	4910	5695	330	0			18312
1992	8	2408	2344	452	139	46	13	5	5727
1993	28	661	575	206	34	41	10	7	1926
1994	22	1468	342	62	45	8	11	1	2117
1995	1	834	773	37	5	0	0		1701
1996	2	165	362	130	25	3	1	0	944
1997	1	397	311	179	31	0			1186
1998*									322
1999	87	465	105	1	0	0			613
2000	4	228	336	7	0	0			764
2001*									1680
2002	532	2243	657	29	9	1	0	0	3622
2003	152	581	1547	258	51	16	15	11	5215

	Age								Tonnes
Year	3	4	5	6	7	8	9	10+	Landed
2004	530	1669	1095	228	37	3			4948
2005	1392	2408	944	186	36	10	4	0	6043
2006	4256	3363	680	22	0	0	0		7388
2007	1944	7910	1010	116	38	13	8	4	11050
2008	1176	5012	2793	319	36	6	2		10005
2009	487	3540	2372	194	13	3	0	4	7534
2010	301	1091	2475	1524	141	32	21	27	9268
2011	129	2929	2567	1480	255	90	12	7	11007
2012	735	1725	2681	850	182	21	13	13	10672
2013	143	3806	2477	1083	361	115	67	9	13202
2014	40	1389	4024	2292	328	168	103	52	18331
2015	20	2006	5680	3008	1337	133	9	8	25272
2016	32	2146	9701	5732	1179	239	57	7	34203
2017	44	1384	6351	5241	3370	498	168	48	31220
2018	21	2214	4255	4180	2319	850	169	76	22290
2019	47	1941	6727	3679	1885	624	145	46	19753

Table 15.2.5: Survey effort in the Greenland Inshore Gill-net survey (nos. of valid net settings)

Division (area)	1B (Kangatsiaq)	1B (Sisimiut)	1C	1D	1F	Total
1985		3		38	27	68
1986		26		22	23	71
1987		24		27	26	77
1988		21		24	24	69
1989		28		19	32	79
1990		18		21	18	57
1991		23		24	20	67
1992		27		29	23	79
1993		23		25	19	67
1994		20		29	17	66
1995		24		21	20	65
1996		26		25	-	51
1997		20		23	-	43
1998		24		26	22	72
1999		-		24	-	24
2000		-		27	20	47
2001		-		-	-	-
2002		21		20	-	41
2003		33		27	-	60
2004		27		31	-	58
2005		25		28	-	53
2006		45		51	-	96
2007		52		-	39	91
2008		-		58	60	118
2009		-		58	18	76
2010		66		52	-	118
2011		57		44	-	101
2012		54		52	-	106

Division (area)	1B (Kangatsiaq)	1B (Sisimiut)	1C	1D	1F	Total
2013		58		52	-	110
2014		60		41	-	101
2015		59		44	-	103
2016		58		40	-	98
2017	60	57	59	46	-	222
2018		58	61	52	-	171
2019	50	48	47	54	-	199

Table 15.2.6: NAFO Div. 1B. Cod abundance indices (numbers of cod caught per 100 hours net settings) by age in the West Greenland inshore gill-net survey. Na = data not available.

	Age								
Year	1	2	3	4	5	6	7	8+	All
1985	26	23	0	6	0	0	0	0	54
1986	4	245	16	8	2	2	0	0	278
1987	0	122	233	25	1	0	0	0	381
1988	0	33	130	111	2	0	0	0	276
1989	1	110	83	57	32	1	0	0	283
1990	0	109	108	62	53	12	0	0	344
1991	0	3	131	53	11	3	0	0	202
1992	0	43	10	18	3	0	0	0	74
1993	0	22	22	2	1	0	0	0	47
1994	4	8	19	12	0	0	0	0	43
1995	2	115	19	7	1	0	0	0	143
1996	0	28	40	7	1	0	0	0	77
1997	0	14	8	3	1	0	0	0	26
1998	2	7	4	6	3	0	0	0	23
1999	na	na	na	na	na	na	na	na	na
2000	na	na	na	na	na	na	na	na	na
2001	na	na	na	na	na	na	na	na	na
2002	31	207	72	21	9	1	0	0	340
2003	1	68	69	21	3	0	0	0	163
2004	32	28	29	9	5	0		0	102
2005	47	123	35	7	5	1	3	0	221
2006	32	148	60	24	1	1	0	0	170
2007	7	170	82	15	1	0	0	0	275
2008	na	na	na	na	na	na	na	na	na
2009	na	na	na	na	na	na	na	na	na
2010	138	155	120	58	12	1	0	0	484
2011	20	526	106	44	19	1	0	0	717

	Age								
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8+**	**All**
2012	7	184	304	30	8	3	0	0	536
2013	4	158	105	104	27	8	1	1	408
2014	7	46	45	25	19	4	0	1	146
2015	2	39	44	59	49	39	3	1	236
2016	6	31	98	42	36	23	7	2	245
2017	1	6	71	79	33	23	10	2	225
2018	1	27	25	26	15	6	2	1	103
2019	0	80	136	19	35	12	1	2	285

Table 15.2.6, *continued* : NAFO Div. 1D. Cod abundance indices (numbers of cod caught per 100 hours net settings) by age in the West Greenland inshore gill-net survey.

	Age								
Year	1	2	3	4	5	6	7	8+	All
1985	68	77	0	3	3	3	0	1	155
1986	0	96	15	0	0	0	0	0	114
1987	1	16	68	5	0	0	0	0	90
1988	0	20	48	30	1	0	0	0	99
1989	0	78	47	13	13	0	0	0	152
1990	0	14	35	4	4	3	0	0	60
1991	124	3	17	6	2	1	0	0	154
1992	0	61	22	10	7	1	0	0	100
1993	0	4	57	20	2	0	0	0	83
1994	0	0	6	5	1	0	0	0	12
1995	0	3	2	4	4	0	0	0	12
1996	0	1	1	1	2	0	0	0	4
1997	3	3	1	0.2	0.5	0.4	0.1	0	8
1998	0	10	17	1	0	0	0	0	28
1999	0	0	1	3	0	0	0	0	5
2000	0	2	2	1	1	0	0	0	6
2001	na	na	na	na	na	na	na	na	na
2002	0	7	4	3	0	0	0	0	14
2003	0	6	4	2	1	0	0	0	13
2004	3	43	6	3	1	1	0	0	57
2005	9	27	7	2	0	0	0	0	45
2006	2	114	37	13	4	0	0	0	170
2007	na	na	na	na	na	na	na	na	na
2008	4	4	47	63	7	0	0	0	124
2009	4	52	14	72	23	1	0	0	166
2010	1	33	107	18	27	3	0	0	189
2011	10	45	3	18	6	4	1	0	88

	Age								
Year	1	2	3	4	5	6	7	8+	All
2012	2	52	46	21	28	2	0	1	151
2013	0	91	61	77	25	8	3	2	267
2014	0	41	74	46	27	6	1	0	196
2015	2	42	79	68	30	7	2	0	229
2016	1	59	92	34	47	9	1	1	243
2017	0	8	81	57	51	18	1	1	217
2018	0	14	50	59	44	31	10	2	210
2019	0	29	41	60	60	20	7	0	217

Table 15.2.6, *continued* : NAFO division 1F, 1B (Kangatsiaq) and 1C Cod abundance indices (numbers of cod caught per 100 hours net settings) by age in the West Greenland inshore gill-net survey. Na = Data not available.

	Age NAFO 1F								
Year	1	2	3	4	5	6	7	8+	All
1985	204	8	1	1	1	1	1	0	217
1986	17	112	5	0	2	0	0	0	136
1987	0	143	147	1	0	0	0	0	291
1988	0	1	83	6	0	0	0	0	89
1989	0	5	2	19	2	0	0	0	29
1990	0	0	3	2	13	1	0	0	18
1991	2	2	0	2	0	1	0	0	7
1992	0	3	1	0	1	0	1	0	6
1993	0	5	2	1	0	0	0	0	8
1994	0	0	1	1	0	0	0	0	3
1995	0	0	0	0	0	0	0	0	0
1996	na	na	na	na	Na	na	na	na	na
1997	na	na	na	na	Na	na	na	na	na
1998	0	4	12	0	0	0	0	0	17
1999	na	na	na	na	Na	na	na	na	na
2000	0	14	8	0	2	0	1	0	24
2001	na	na	na	na	Na	na	na	na	na
2002	na	na	na	na	Na	na	na	na	na
2003	na	na	na	na	Na	na	na	na	na
2004	na	na	na	na	Na	na	na	na	na
2005	na	na	na	na	Na	na	na	na	na
2006	na	na	na	na	Na	na	na	na	na
2007	6	90	9	21	1	0	0	0	108
2008	8	17	30	4	2	0	0	0	62
2009	3	39	14	15	0	0	0	0	71
2010–2019	na	na	na	na	na	na	na	na	na

	Age NAFO 1B (Kangatsiaq)								
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8+**	**All**
2017	0	2	40	8	13	6	5	1	75
2018	na	na	ns	na	na	na	na	na	Na
2019	0	26	14	6	5	1	0	0	52

	Age NAFO 1C								
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8+**	**All**
2017	1	9	94	40	35	18	12	1	210
2018	0	13	19	47	19	11	10	3	122
2019	0	20	34	14	40	4	2	2	116

Table 15.2.7: Cod abundance indices (numbers of cod caught per 100 hours net settings) by age in the Greenland Halibut gill net survey in Disco Bay. Na = Data not available.

Year/age	1	2	3	4	5	6	7	8	9	10+	Total
2005	0	0.07	0.35	0.51	0.51	0.04	0.04	0	0	0	1.52
2006	0	0.21	0.12	0.02	0	0.07	0.04	0	0	0	0.46
2007	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2008	0	0.01	0.01	0.63	3.38	1.80	0.46	0	0	0	6.29
2009	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2010	0	0	0.01	0.98	2.71	1.81	0.13	0	0	0	5.64
2011	0	0.48	0.17	1.26	0.93	2.94	1.38	0.10	0	0	7.26
2012	0	0.01	2.09	2.75	1.65	1.09	0.24	0.16	0	0	7.99
2013	0	0	3.45	43.43	38.21	13.59	2.58	1.06	0.41	0	102.73
2014	0	0	0.37	23.92	46.16	20.56	0.78	0.08	0.26	0.23	92.36
2015	0	0	1.18	8.13	53.86	31.50	6.05	1.70	0	0.40	102.82
2016	0	0	0.6	11	29	59	17	1	0.4	0.1	119
2016 cod st.	0	0	0	5	9	12	4	0.1	0	0	30
2017	0	0	3	4	11	13	17	2	0	0	50
2018		0.2	1	3	3	7	6	8	1	0.3	28
2019			3	3	10	10	31	20	6	0.3	83

Table 15.2.8: Cod abundance indices ('000) by age and total in Disco Bay (NAFO 1AX) in the Greenland Shrimp and Fish bottom trawl survey.

Year/age	0	1	2	3	4	5	6	7	8	9	10+	All
2005	0	52	0	0	90	0	0	0	0	0	0	142
2006	0	0	117	1	1	0	0	0	0	0	0	119
2007	0	20	142	98	0	0	0	0	0	0	0	261
2008	0	38	21	25	24	0	0	0	0	0	0	108
2009	0	0	14	1	16	11	0	0	0	0	0	41
2010	0	0	7	0	9	0	0	0	0	0	0	16
2011	0	400	2907	324	47	26	5	0	0	0	0	3710
2012	0	0	1967	661	31	0	0	0	0	0	0	2659
2013	0	137	1420	1656	479	111	14	0	0	0	0	3817
2014	0	14	159	119	79	25	8	0	13	0	10	428
2015	0	93	411	1271	502	429	197	27	4	0	0	2935
2016	0	24	177	76	38	95	56	40	0	0	0	506
2017	0	19	42	386	84	50	21	64	15	0	0	681
2018	24	29	204	99	121	26	30	44	31	0	0	607
2019	0	0	103	341	139	71	0	22	18	1	0	693

Table 15.3.1. Number of tagged cod in the period of 2003 to 2019 in different regions. Bank (West) = NAFO Division 1D+1E. East Greenland = NAFO Division 1F + ICES Division 14.b.

	TAGGED			
Year	Fjord	Bank (West) NAFO 1C Tovqussaq	Bank (West) NAFO 1D+1E Dana	East Greenland
2003	599			
2004	658			
2005	565			
2006	41			
2007	1137		1061	1047
2008	231			1296
2009	633			526
2010	88			

	TAGGED			
Year	Fjord	Bank (West) NAFO 1C Tovqussaq	Bank (West) NAFO 1D+1E Dana	East Greenland
2011	28			403
2012	86		1563	2359
2013	186		2321	
2014				1203
2015		57		1220
2016		299	998	1912
2017	350	1871	706	
2018		115		
2019	1040	325		

Table 15.3.2: Number of recaptured cod in the period of 2003 to 2019 in different regions. Fjord (West) = NAFO divisions 1B–1F. Bank (West) = NAFO Division 1D+1E. East Greenland = NAFO division 1F + ICES Division 14.

	RECAPTURES			
	Fjord (West)	Bank (West) NAFO 1C Tovqussaq	Bank (West) NAFO 1D + 1E Dana	East Greenland
Fjord (West)	504	1	29	8
Bank (West) NAFO 1C, Tovqussaq		1		4
Bank (West) NAFO 1D+1E, Dana		2	35	
East Greenland			35	118
Iceland	3		41	183

Table 15.5.1: Reference points

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	5983 t	Assumed at Bpa	ICES (2018a)
	F_{MSY}	0.27	Stochastic simulations with segmented regression and a Beverton–Holt stock–recruitment curve from 1973 to 2018.	ICES (2018a)
Precautionary approach	B_{lim}	4346 t	Breakpoint in segmented regression	ICES (2018a)
	B_{pa}	5983 t	$B_{lim} \times e^{1.645\sigma}$, $\sigma = 0.194$	ICES (2018a)
	F_{lim}	-	Not defined	
	F_{pa}	-	Not defined	
Management plan	SSB_{mgt}	-	-	
	F_{mgt}	-	-	

Table 15.7.1: Estimated number at age in the stock

Year / Age	1	2	3	4	5	6	7	8	9	10
1976	14543	12551	62593	3733	1955	416	65	282	64	30
1977	21261	11509	10276	48590	2293	968	147	19	179	54
1978	41381	16967	9108	7882	31483	1044	365	39	10	116
1979	16331	39079	13540	7561	4781	15504	504	143	20	64
1980	38876	11385	36904	10653	4485	2064	7024	216	69	45
1981	15992	37242	7937	30329	5506	1967	861	2368	105	50
1982	7906	12880	35677	5816	15303	1843	827	270	841	70
1983	2760	6678	10373	30528	2640	5818	518	247	106	253
1984	7678	1877	5640	8294	14767	895	1869	116	107	113
1985	37647	5975	1276	4206	3532	5689	292	610	51	96
1986	25119	36843	4650	980	1592	1370	2116	91	285	59
1987	12345	21136	36057	3283	438	491	471	849	45	127
1988	16935	9784	18953	30313	1147	158	91	168	384	44
1989	8324	15198	8041	16335	14376	402	46	23	81	132
1990	4077	7565	12597	6945	8503	4096	88	15	11	53
1991	12053	2842	6468	9713	3170	2050	433	29	7	20
1992	4420	9153	2333	4746	3357	515	241	85	13	8
1993	2084	3538	6507	1898	1372	323	68	67	24	7
1994	2666	1561	2924	4534	686	101	50	19	26	8
1995	1732	2148	1183	2349	1597	89	20	13	8	13
1996	2386	1251	1509	970	1034	244	29	7	5	9
1997	3074	1966	871	1137	467	234	92	11	3	7
1998	3025	2319	1622	695	498	72	109	38	5	5
1999	4502	2344	1741	1301	300	36	39	49	20	5
2000	6291	3707	1816	1255	609	39	22	18	28	12
2001	7516	5224	3314	1689	624	104	23	10	11	20
2002	9313	6134	4337	2893	973	129	55	12	6	15
2003	9673	6776	4574	3131	1367	247	60	28	8	10
2004	22882	8253	4997	3361	1371	298	97	23	17	7

Year / Age	1	2	3	4	5	6	7	8	9	10
2005	35693	18601	6860	3478	1272	257	108	39	13	10
2006	26131	28765	15284	5198	1154	202	89	44	23	11
2007	14349	21970	22320	10731	1676	206	82	33	25	15
2008	21182	10794	18156	16414	3896	311	73	35	17	20
2009	20276	18085	9038	13799	7022	708	98	32	21	19
2010	38539	15617	15005	7237	6799	1577	232	49	19	21
2011	33469	33698	11518	11335	4244	1817	420	101	26	17
2012	24278	26806	28160	9790	6696	1400	488	164	45	17
2013	18584	21853	21231	21724	6935	2667	423	196	83	23
2014	19321	15757	18423	17112	13357	3363	906	145	81	38
2015	14713	16678	13775	17277	13226	6426	1407	332	45	32
2016	8743	13890	15116	12998	13899	7248	2490	524	126	26
2017	8564	6953	13343	13494	10528	7538	3115	847	206	59
2018	7971	7833	6568	12375	9962	5622	3098	1009	287	94
2019	7971	7174	7484	6080	9592	5266	2260	953	313	124

Table 15.7.2: Estimated fishing mortality-at-age in the stock

Year Age	1	2	3	4	5	6	7	8	9	10
1976			0.037	0.278	0.525	0.813	1.03	0.322	0.414	0.414
1977			0.035	0.271	0.561	0.747	1.036	0.388	0.506	0.506
1978			0.032	0.302	0.564	0.6	0.788	0.444	0.489	0.489
1979			0.034	0.36	0.63	0.629	0.746	0.539	0.49	0.49
1980			0.039	0.435	0.679	0.676	0.881	0.606	0.614	0.614
1981			0.035	0.496	0.82	0.742	0.961	0.752	0.706	0.706
1982			0.038	0.541	0.795	0.963	1.047	0.717	0.974	0.974
1983			0.035	0.583	0.833	0.94	1.184	0.651	0.871	0.871
1984			0.034	0.648	0.792	0.896	0.966	0.586	0.689	0.689
1985			0.027	0.695	0.786	0.851	0.93	0.575	0.745	0.745
1986			0.03	0.639	0.895	0.949	0.809	0.543	0.847	0.847
1987			0.029	0.695	0.861	1.343	0.885	0.595	1.098	1.098
1988			0.019	0.624	0.895	1.141	1.053	0.557	1.013	1.013
1989			0.013	0.591	1.104	1.346	0.984	0.519	1.147	1.147
1990			0.012	0.66	1.287	1.794	0.973	0.603	1	1
1991			0.01	0.825	1.636	1.947	1.156	0.648	0.957	0.957
1992			0.007	0.912	2.102	1.808	1.093	0.763	0.945	0.945
1993			0.006	0.806	2.343	1.633	1.077	0.748	0.912	0.912
1994			0.005	0.765	1.857	1.357	1.066	0.705	0.683	0.683
1995			0.004	0.638	1.671	0.952	0.876	0.672	0.608	0.608
1996			0.004	0.555	1.399	0.761	0.801	0.586	0.542	0.542
1997			0.005	0.581	1.682	0.585	0.687	0.506	0.535	0.535
1998			0.008	0.574	2.27	0.435	0.62	0.437	0.529	0.529
1999			0.012	0.537	1.833	0.329	0.577	0.38	0.524	0.524
2000			0.014	0.499	1.567	0.361	0.549	0.337	0.525	0.525
2001			0.024	0.493	1.374	0.437	0.534	0.303	0.546	0.546
2002			0.04	0.573	1.204	0.529	0.544	0.276	0.601	0.601
2003			0.052	0.631	1.354	0.697	0.682	0.314	0.725	0.725
2004			0.072	0.771	1.475	0.779	0.69	0.312	0.655	0.655

Year Age	1	2	3	4	5	6	7	8	9	10
2005			0.089	0.89	1.578	0.796	0.695	0.335	0.589	0.589
2006			0.092	0.87	1.524	0.714	0.718	0.356	0.547	0.547
2007			0.074	0.781	1.515	0.827	0.667	0.375	0.492	0.492
2008			0.056	0.59	1.465	0.939	0.624	0.348	0.467	0.467
2009			0.04	0.445	1.251	0.954	0.559	0.359	0.518	0.518
2010			0.027	0.339	1.071	1.122	0.641	0.465	0.691	0.691
2011			0.018	0.291	0.893	1.123	0.714	0.557	0.719	0.719
2012			0.013	0.236	0.722	0.996	0.739	0.551	0.795	0.795
2013			0.009	0.203	0.585	0.858	0.83	0.698	0.874	0.874
2014			0.006	0.167	0.54	0.769	0.81	0.868	1.035	1.035
2015			0.004	0.156	0.496	0.741	0.836	0.797	0.848	0.848
2016			0.004	0.156	0.495	0.718	0.881	0.789	0.789	0.789
2017			0.004	0.159	0.492	0.721	0.948	0.879	0.866	0.866
2018			0.004	0.174	0.499	0.739	0.99	0.959	0.907	0.907
2019			0.005	0.193	0.523	0.752	1.028	0.974	0.873	0.873

Table 15.7.3: Cod in NAFO Subarea 1, inshore. Catch scenarios for 2020 assuming $F_{2019} = F_{2020}$. All weights are in tonnes.

Rationale	Catch (2020)	F (2020)	SSB (2021)	% SSB change *	% advice change **	% TAC change ***
ICES advice basis						
MSY approach: F_{MSY}	5283	0.268	24539	+12%	-5%	-82%
Other scenarios						
F = 0	0	0	31103	+42%	-100%	-100%
$F = F_{2019}$ (*status quo*)	10697	0.694	18469	-16%	+93%	-64%
$SSB_{2021} = B_{lim}$	25123	9.57	4367	-80%	+354%	-16%
$SSB_{2021} = B_{pa}$= MSY $B_{trigger}$	23040	5.15	5907	-73%	+316%	-23%

*** SSB_{2021} relative to SSB_{2020}.**

**** Advice value for 2020 relative to the advice value for 2019, from this updated assessment.**

***** Advice value for 2020 relative to the TAC in 2019, from this updated assessment.**

15.20 Figures

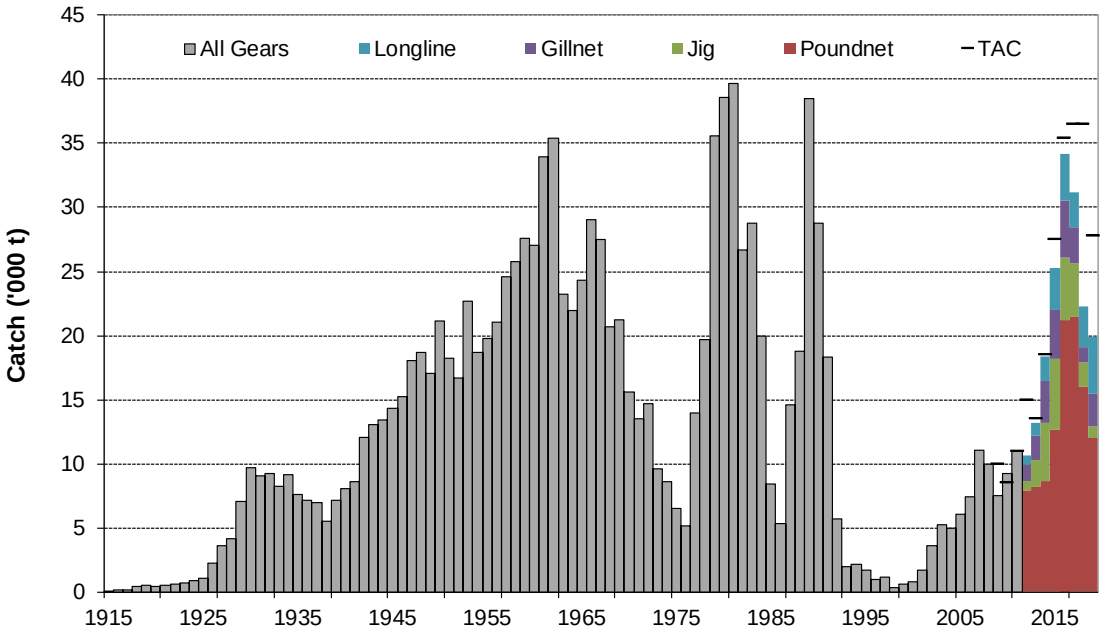

Figure 15.2.1 Inshore landings from West Greenland (Horsted, 1994; 2000). From 2012 divided into gears.

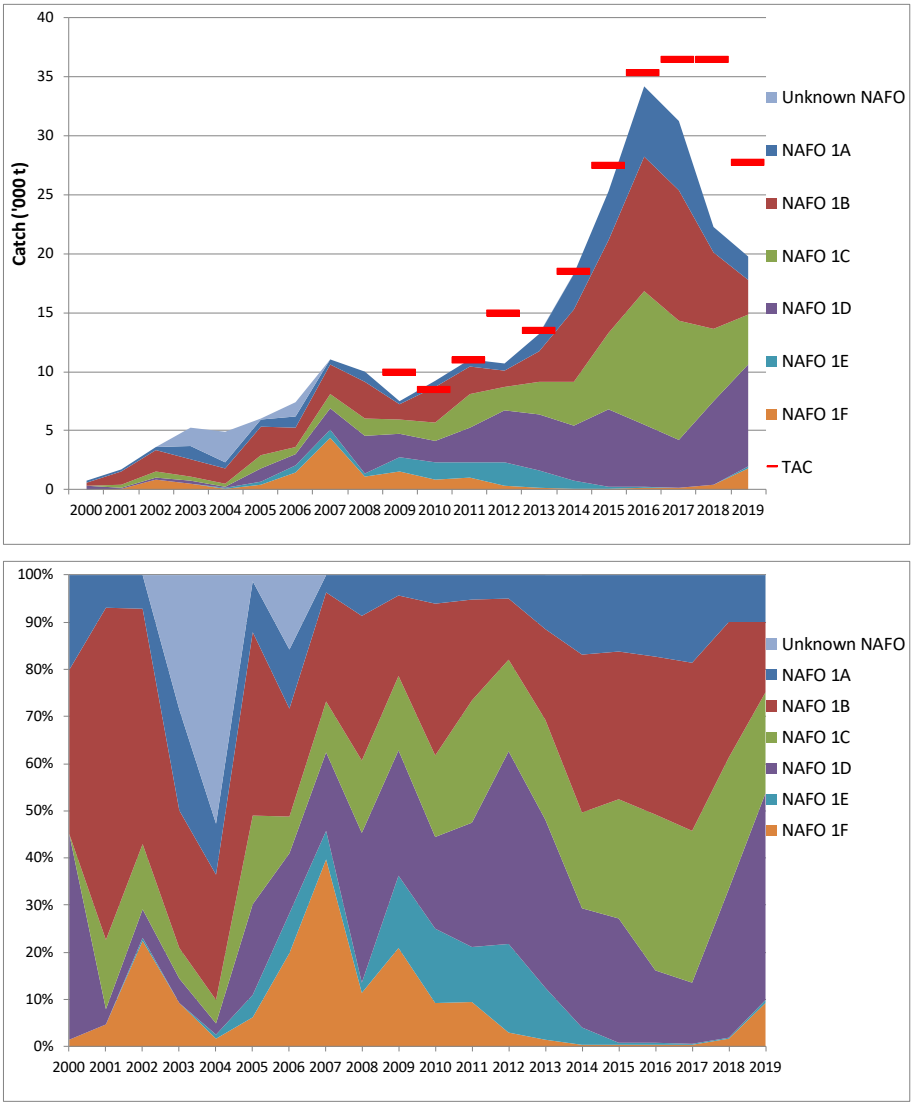

Figure 15.2.2. Total (top) and percentage (bottom) cod catches and TAC in the inshore fishery by NAFO divisions from 2000.

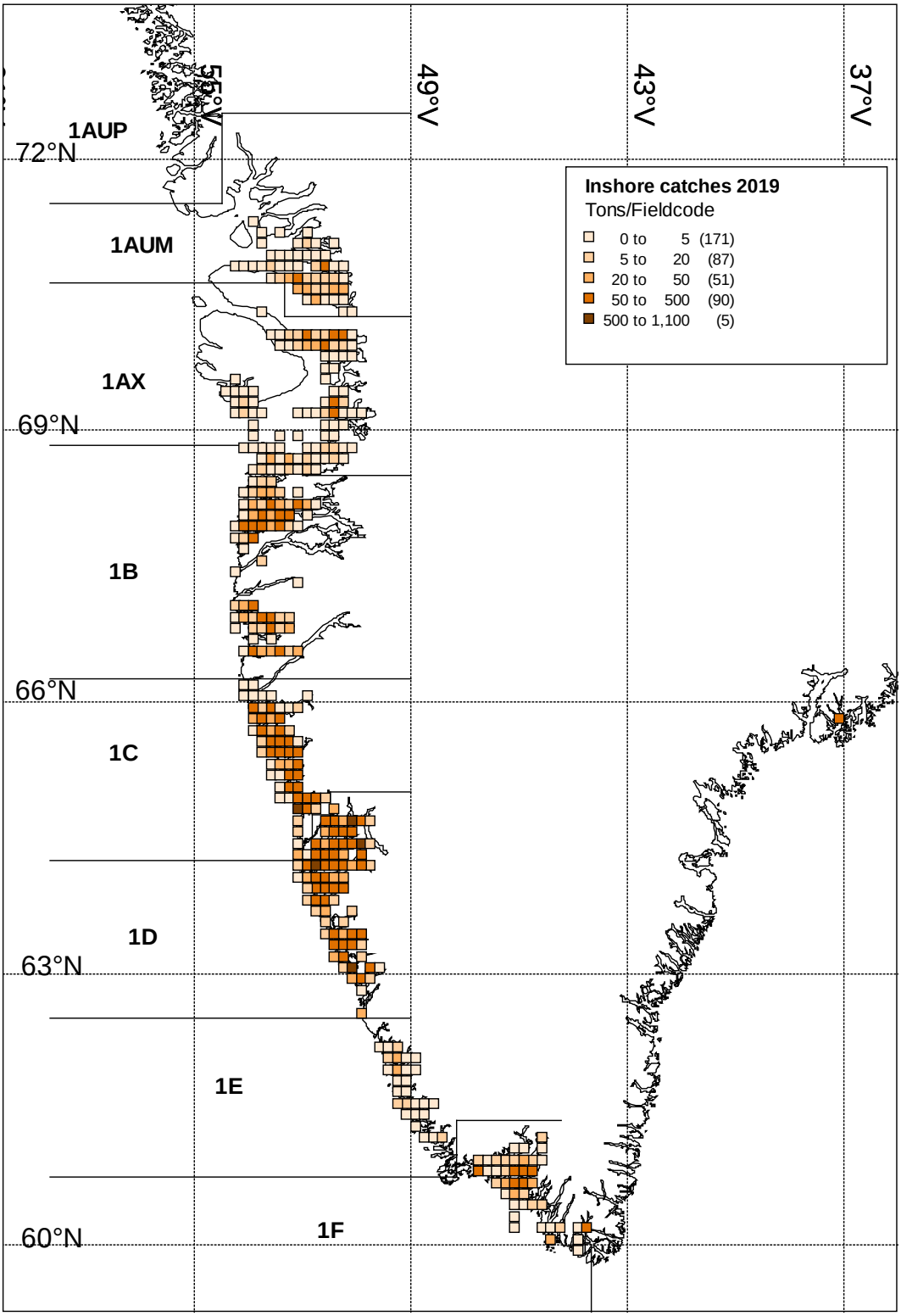

Figure 15.2.3. Distribution of commercial fishery along the coastline of West Greenland in total tonnes by field code.

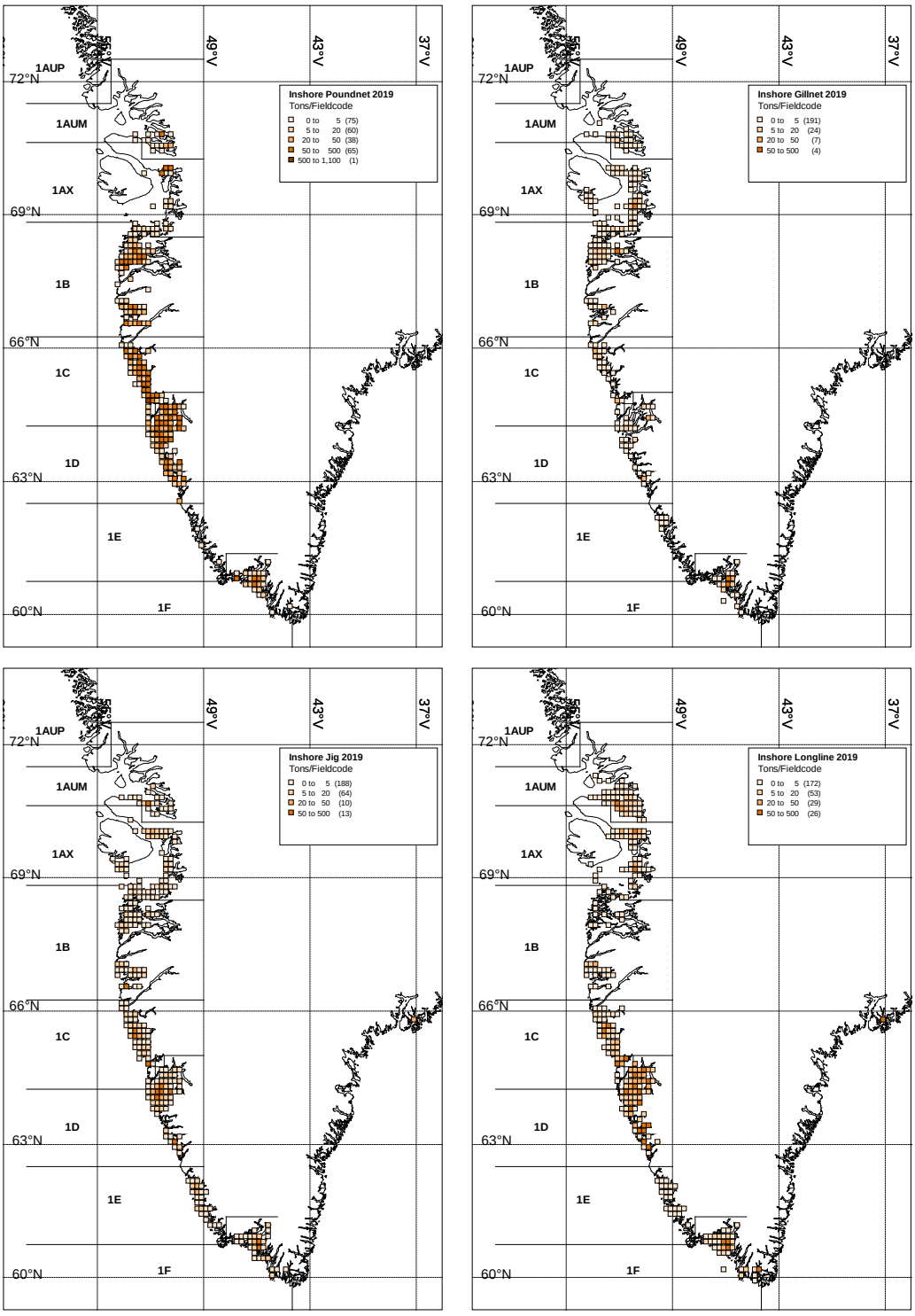

Figure 15.2.4 Distribution of the inshore commercial fishery by gear (tonnes/fieldcode).

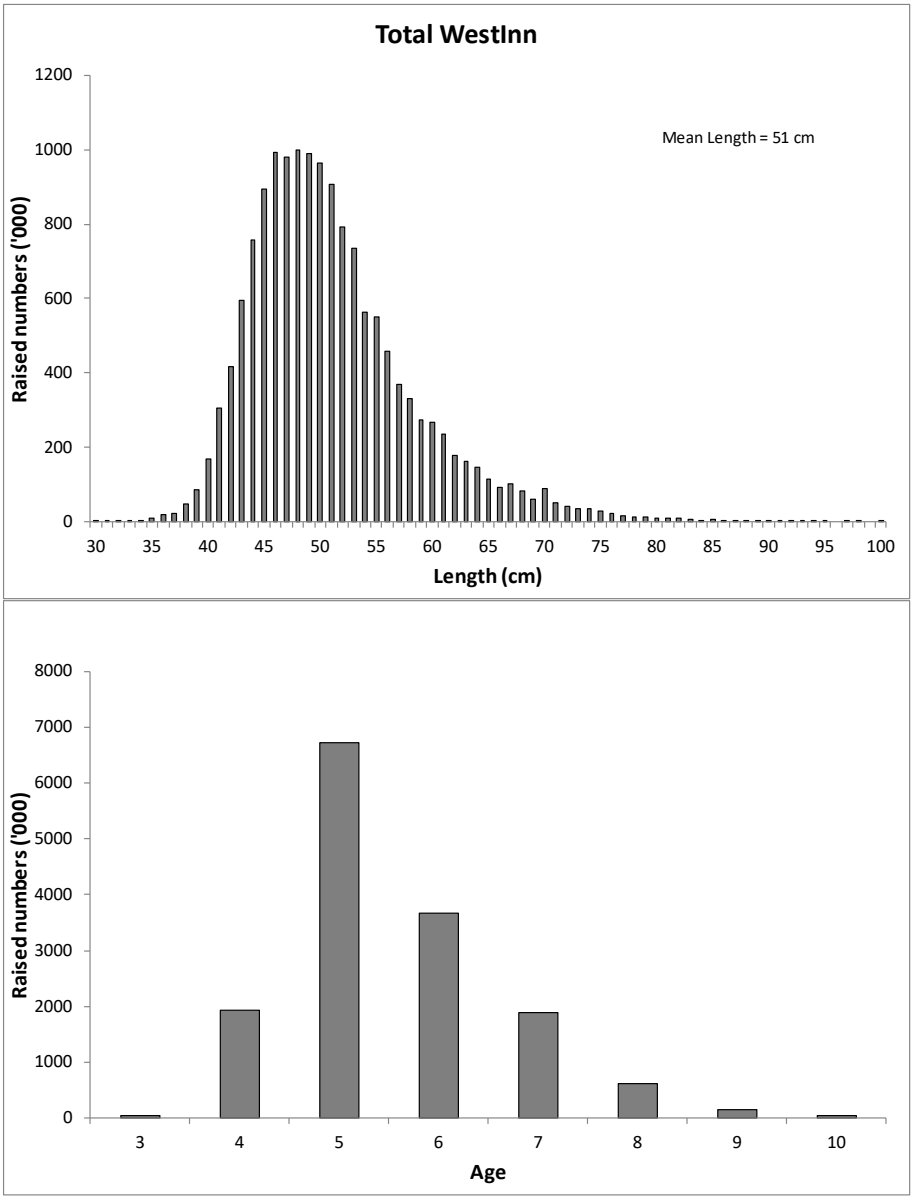

Figure 15.2.5. Total length and age distributions of inshore cod catches.

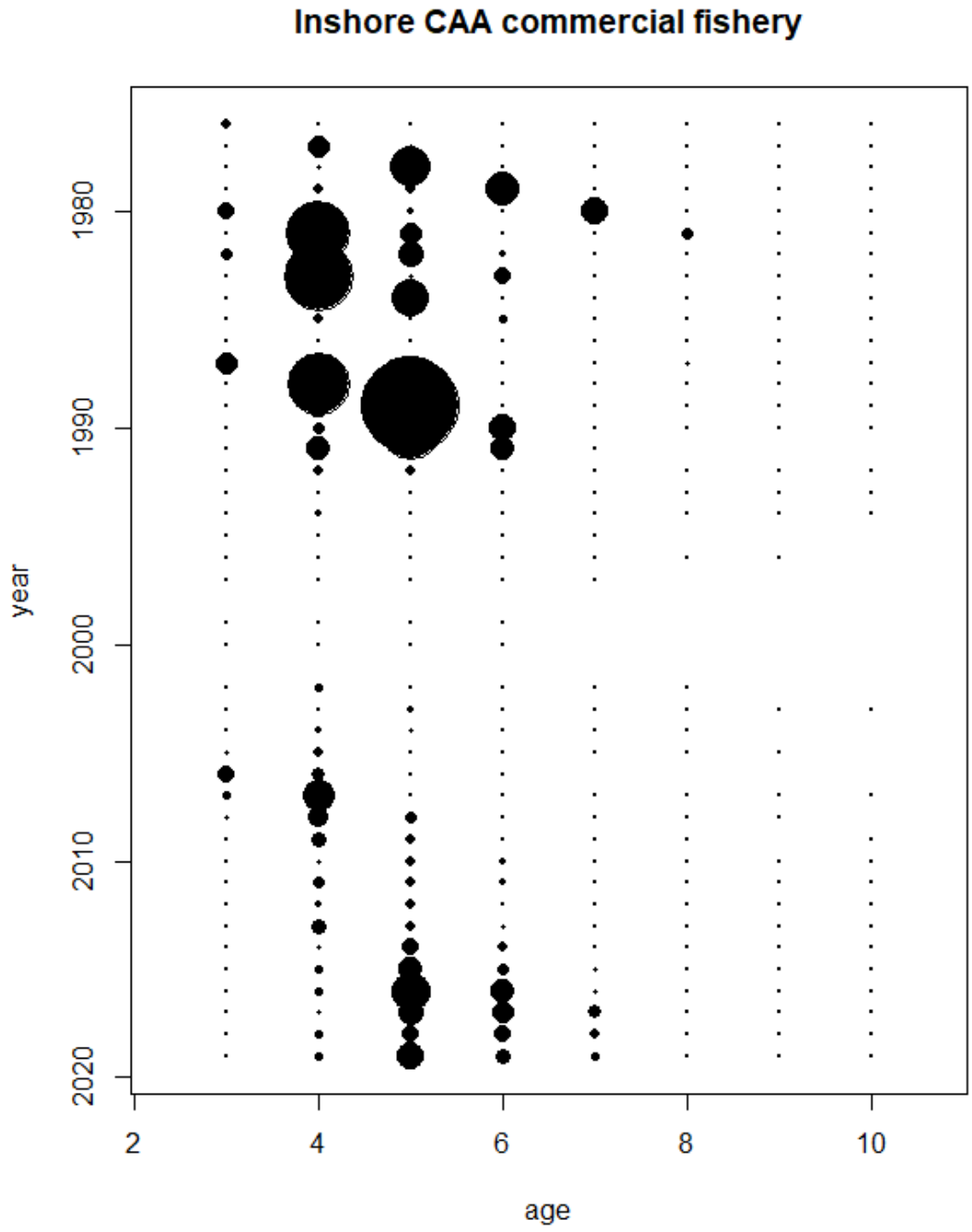

Figure 15.2.6. Catch at age in the commercial fishery in the West Greenland inshore area. Size of circles represents size of catch numbers.

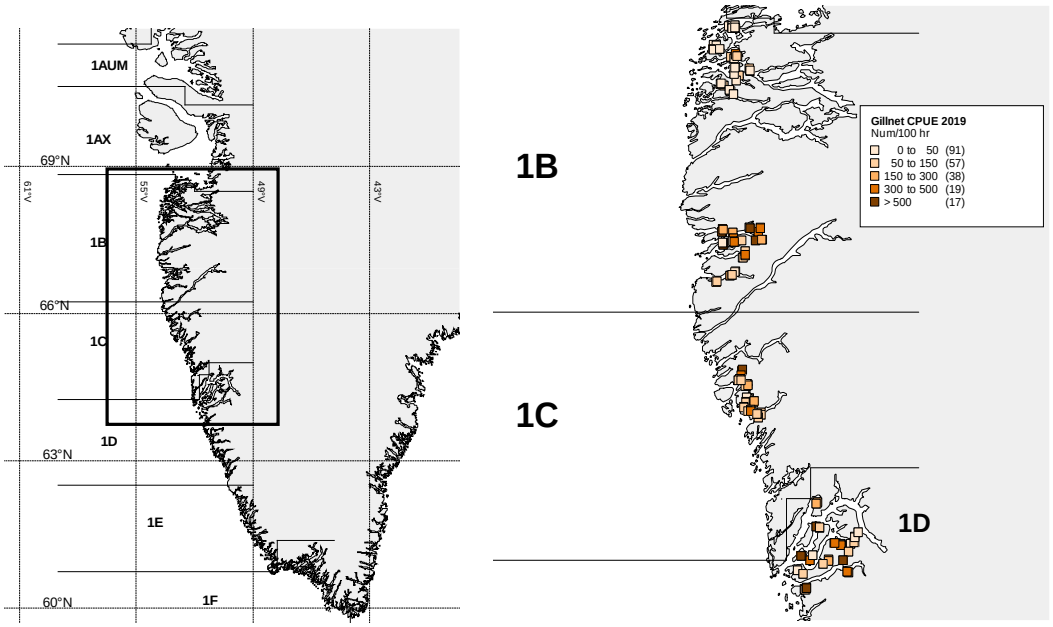

Figure 15.2.7. The inshore gill net survey area on the Greenland West coast. Survey catch rates are indicated on both as #caught/100h.

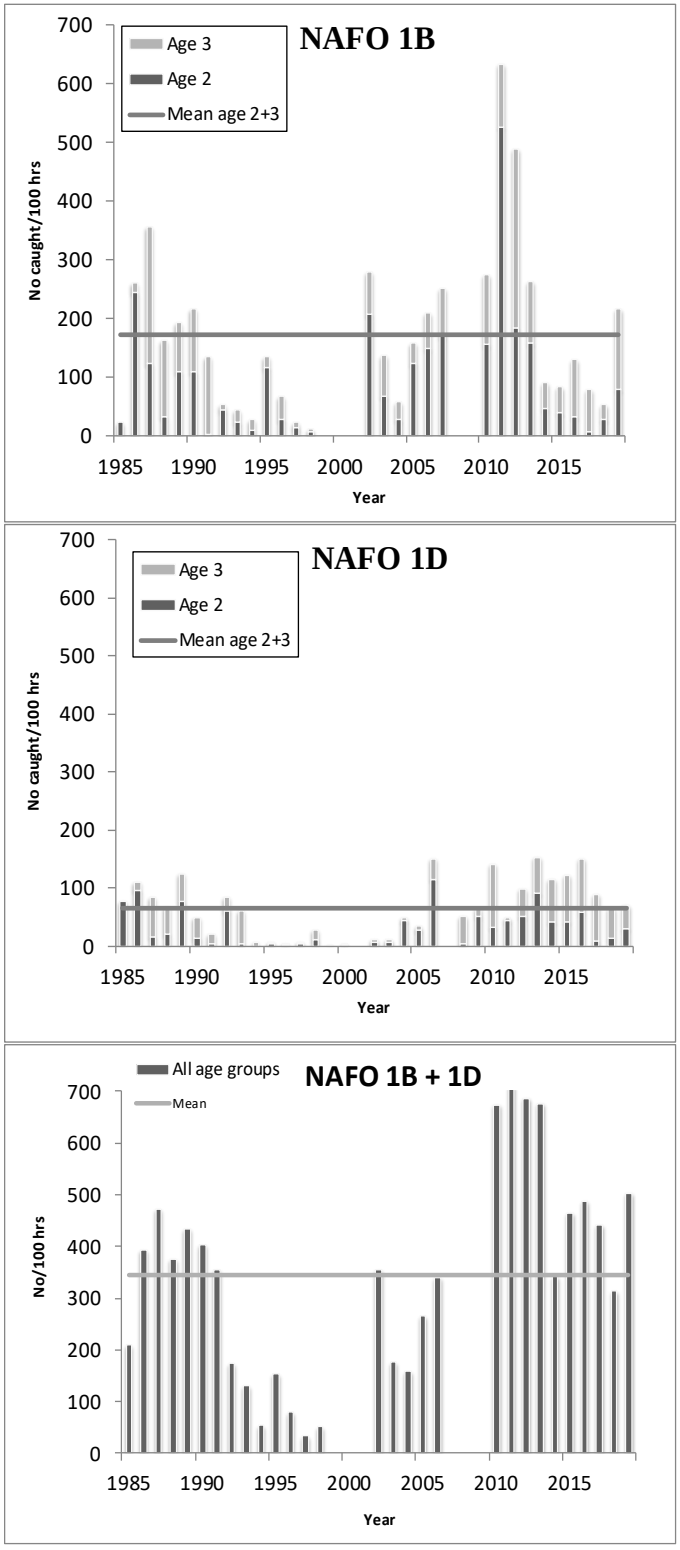

Figure 15.2.8: Recruitment indices (numbers caught/100 hr.) for ages 2 and 3 in 1B (top), 1D (middle) and all age groups (ages 1-8) 1B and 1D combined (lower) in West Greenland. Simultaneous surveys were not carried out 1999–2001 and 2007–2009.

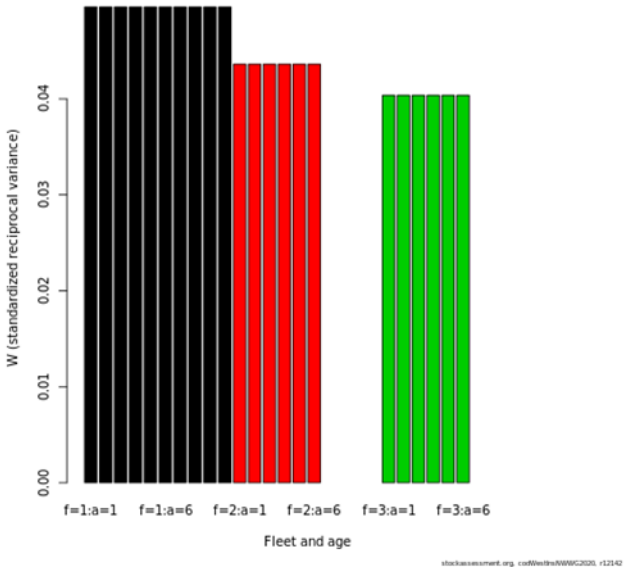

Figure 15.6.1: Standardized reciprocal variance from left to right: catches, 1B survey and 1D survey.

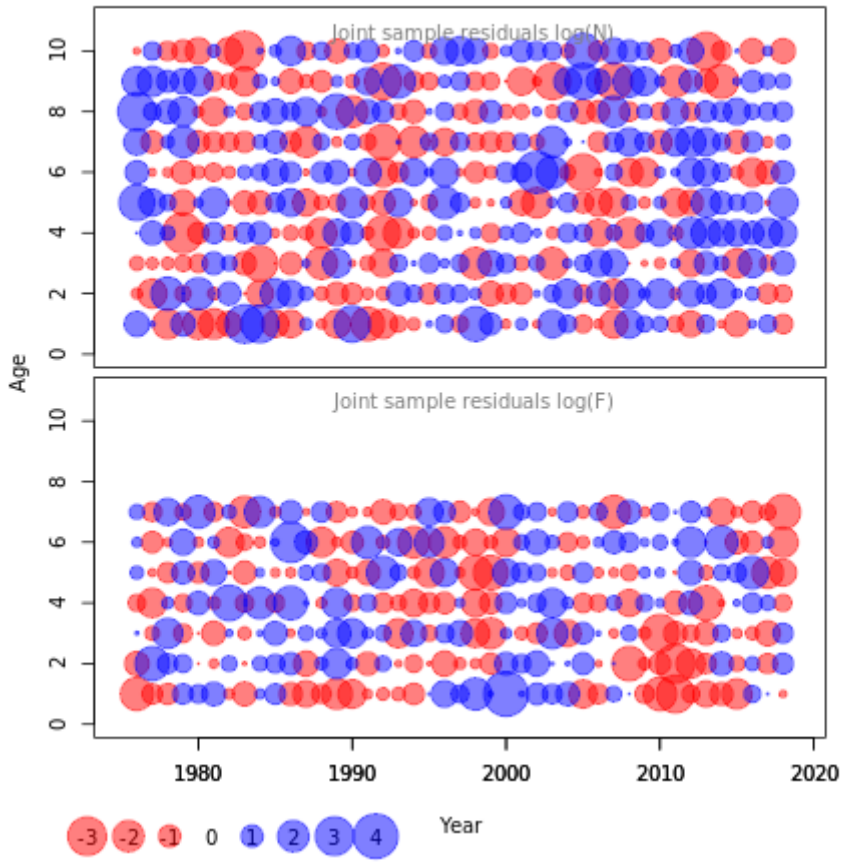

Figure 15.9.1: Normalized residuals derived from the SAM base run. Blue circles indicate positive residuals (observation larger than predicted) and filled red circles indicate negative residuals.

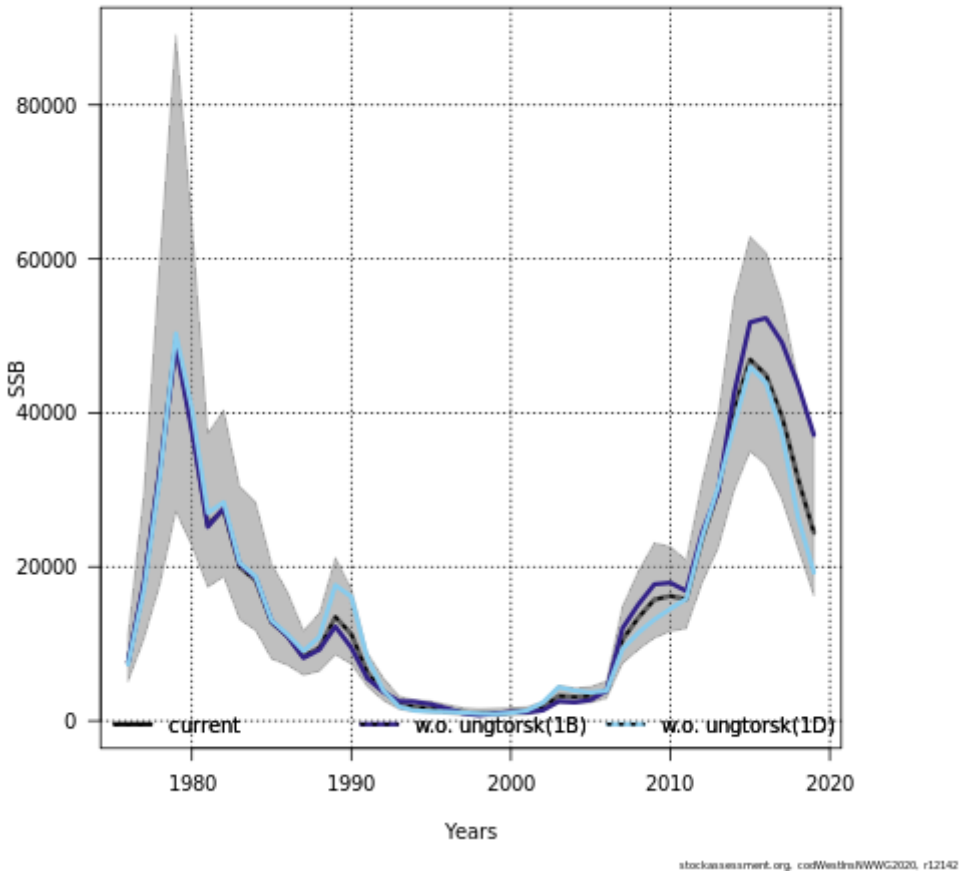

Figure 15.9.2: Analytical retrospective plots of spawning stock biomass. Mohn's rho is given in the upper right corner.

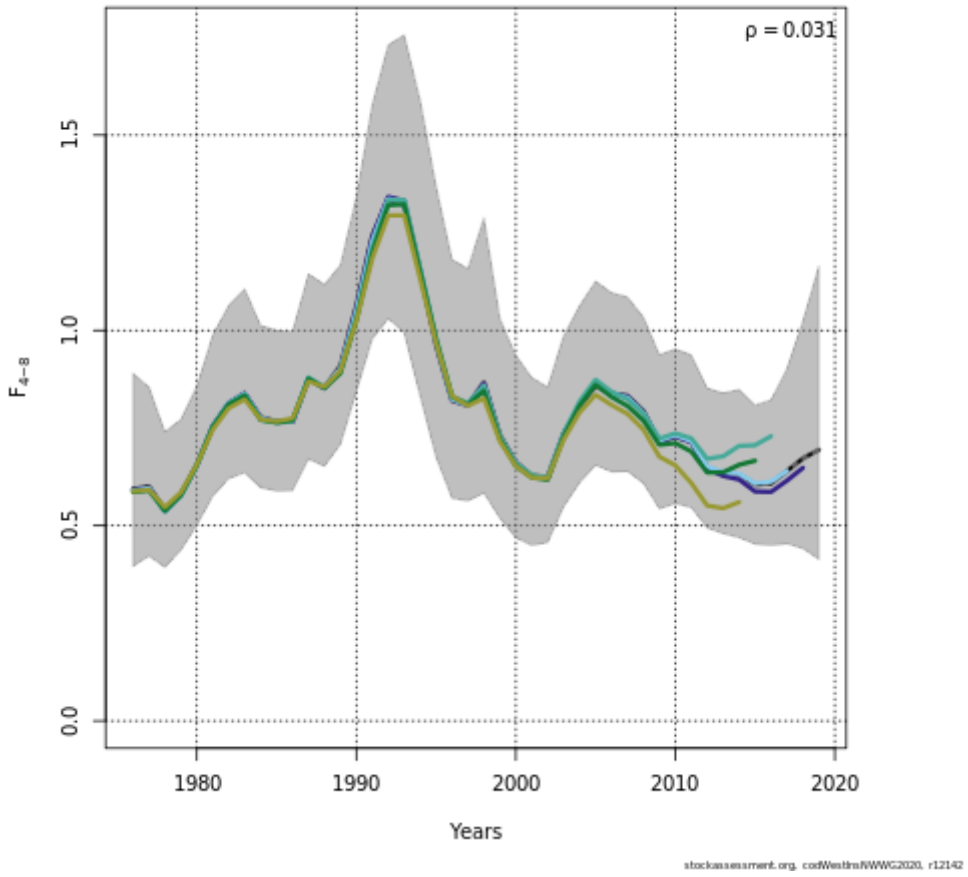

Figure 15.9.3: Analytical retrospective plots of fishing mortality. Mohn's rho is given in the upper right corner.

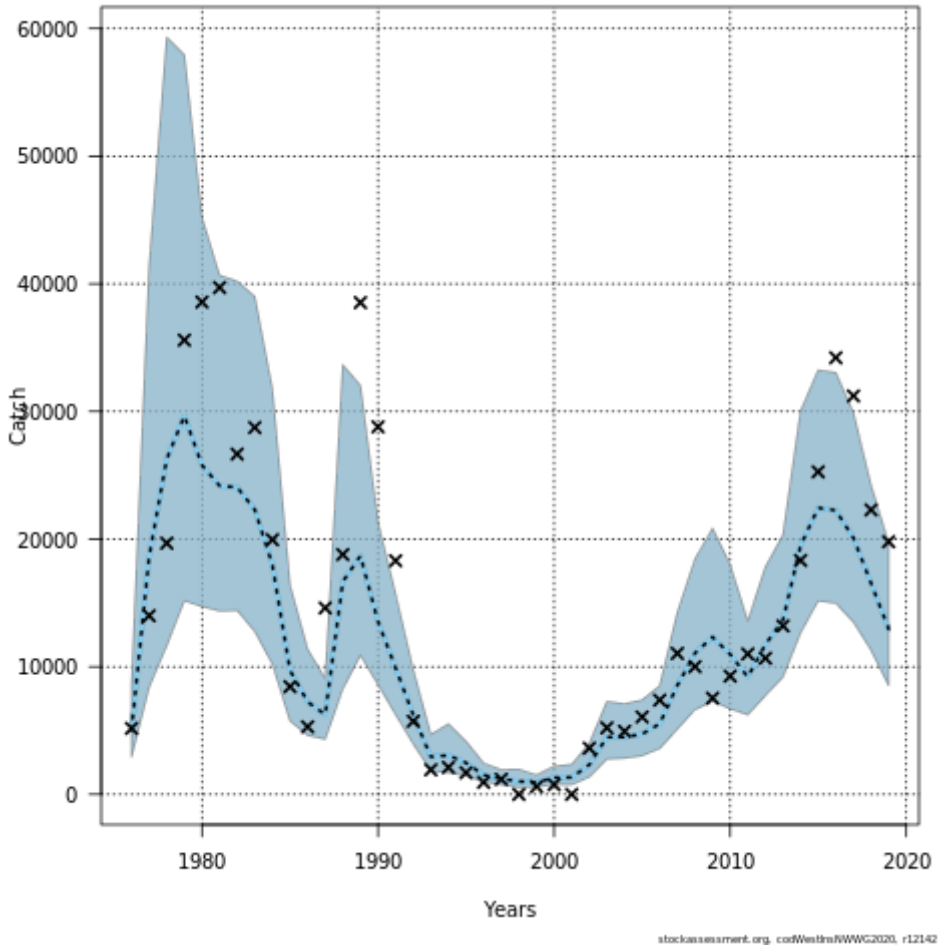

Figure 15.9.4: Estimated (line) and observed catch (x). Estimated catch is shown with 95% confidence intervals.