

# I. Introduction

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The occurrence of cod in Greenland waters has been of an episodic character. Rink (1852 and 1857) refers to two periods in the first half of the 19<sup>th</sup> century, when cod seems to have been abundant at West Greenland and some commercial fishing took place both offshore by international vessels and inshore by Greenlanders. Bendixen (1930), Jensen and Hansen (1931) and Hansen (1949) reviewed the history of the cod fisheries in Greenland waters including those periods in the 19<sup>th</sup> century referred by Rink (1852, 1857). Horsted in Buch *et al.* (1994) reviewed evidence of occurrence of cod at West Greenland in the 17<sup>th</sup>–19<sup>th</sup> centuries and the fluctuations in occurrence and distribution of cod during the 20<sup>th</sup> century. Also Mattox (1973), in a very detailed study, reviewed fishing at West Greenland concentrating on the development of Greenland's own fisheries and fishing industry in the period 1910–66, i.e. just up to the time when Greenland started developing its offshore fisheries.

Fishing experiments at West Greenland at the beginning of the 20<sup>th</sup> century, carried out in 1906 by two Faroese vessels for the Royal Greenland Trade Directorate, gave disappointingly poor results so far as cod was concerned (Andreasen, 1906). The "Tjalfe" expedition in 1908 and 1909 under leadership of Adolf Jensen found virtually no cod in the offshore areas of West Greenland, although at some inshore localities, especially at the dwelling place Fiskenæsset (south of Nuuk/Godthåb), cod seemed to have occurred during summer and autumn in most years (Jensen, 1909a and b). At this and some other localities commercial fishing, and production of salted fish, started in 1911 and spread to other places in the following years.

Hansen (1949) reports that the international offshore fishery on the West Greenland banks by non-Greenlandic vessels increased with catches from 352 tons in 1925 to 14 312 tons in 1929 and as much as 43 060 tons in 1930, and fluctuated around that level until 1938. Figures for this period are, however, drastically revised in the present paper indicating that from 1925 to 1930 total annual landings of cod from West Greenland waters increased from about 3 000 tons to about 104 000 tons fluctuating thereafter in 1931–39 in the range between 63 000 and 133 000 tons (Table 1 and Fig. 1).

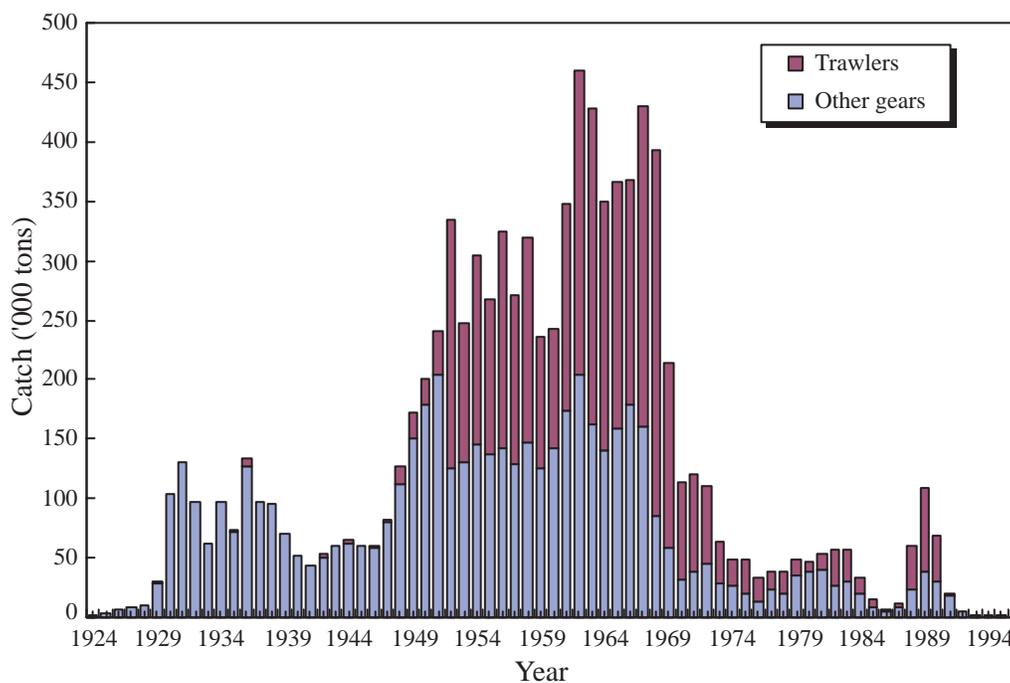


Fig. 1. Nominal catches of cod at West Greenland taken by trawls and by other gears, 1924–95. (Small catch values during 1911–23 were not plotted.)

\* [For convenience of presentation, all Tables in this publication are placed at the end of each section]

The evident increase of the cod stock and its spatial distribution at West Greenland was explained by Jensen (1939) as one of the biological consequences of the general warming of the Arctic and Subarctic regions in the 1920s.

During the World War II years 1940–45, catches fluctuated at a lower level, 44 000–85 000 tons with Portugal and Greenland being the only participants during 1941–45 (Table 1)

Annual catches of cod at West Greenland after World War II increased rapidly to culminate in 1962, when about 460 000 tons were taken (Table 2 and Fig. 1). The total nominal catch was still as high as 394 000 tons in 1968 but decreased sharply thereafter to reach only 33 000 tons by 1976. Temporary improvements since then have not prevented a further general decline of catch levels with landings since 1993 around 2 000 tons, the latest year considered being 1995. No immediate improvement in recruitment was then foreseen (in Anon., 1996).

Offshore trawl surveys at West Greenland indicate a decline in cod biomass of as much as 90% from 1989 to 1990, and the survey in 1993 indicated as little as about 360 tons biomass in the offshore survey area (in Anon., 1994). Adverse environmental conditions seem to be the main cause for the decline of the stock (Buch, MS 1998)

Less is known about occurrence of cod and of the cod fisheries in East Greenland waters (except for more recent years), but also there the occurrence of cod seems to be of an episodic character (Schmidt, 1931). Holm (1918, page 297) quoting Björn Johnsen's Grønlandske Annaler (Greenland Annals) reports of evidence of shoals of cod at Ammassalik in the late part of the 16<sup>th</sup> century. For the 20<sup>th</sup> century, Schmidt (1931), basing his observation on personal information from Governors of Ammassalik (Petersen and Hedegaard), comments that cod was first noticed there in 1912 and has become fairly common since 1923.

The exploitation of cod at East Greenland increased much when modern trawlers started fishing there in the mid-1950s (Table 3). Fishing was to a great extent carried out as a mixed fishery (cod and redfish). Throughout the period here considered, the total catch of cod at East Greenland was much lower than that at West Greenland. In most years it was within the 10 000–20 000 ton level, seldom reaching over 30 000 tons. A temporary improvement in catches took place around 1990, but since 1993 catches and observed biomass have been at a very low level. Thus, the cod stock at East Greenland has also been very much reduced in recent years.

The recent development of the cod stock at Greenland seems to be just the reverse of the development in the second decade of the century. This is apparent at least at West Greenland. Thus it could be stated that, ... *the cod epoch of the 20<sup>th</sup> century at West Greenland has come to an end...* It has probably been one of the longest lasting. Nobody knows when a new epoch will start. Certainly judging from the stock situation at East Greenland a new epoch is not just a matter of back-migration of cod from East Greenland. (The late Danish scientist Chr. Vibe, who died in June 1998, studied climatic variation in the Arctic and its influence on occurrence of various animals (Vibe, 1967) and in recent years has offered the opinion that the 21<sup>st</sup> century will be a cold period in the Arctic, but that there may be a period with improved cod stock in southern Greenland, especially in fjords at the beginning of the century (pers. comm. and a newspaper feature article, 1997)).

It therefore seems proper now to review the recent cod epoch at Greenland both from fisheries and from biological points of view. Considering that intermediate reviews were made, primarily those by Hansen (1949) on mainly the biological events up to World War II and by Mattox (1973) on the local fisheries development in Greenland up to 1966, the present contribution will focus on that part of the epoch which starts after World War II, although further summary reviews of the pre-war period will also be made when felt pertinent. Special attention will be paid to the Greenland fishery since the mid-1960s. Also the management of the fisheries will be considered and discussed.

Table of each nation's output of the cod fishery at Greenland is supplied (Table 4 and Fig. 2).

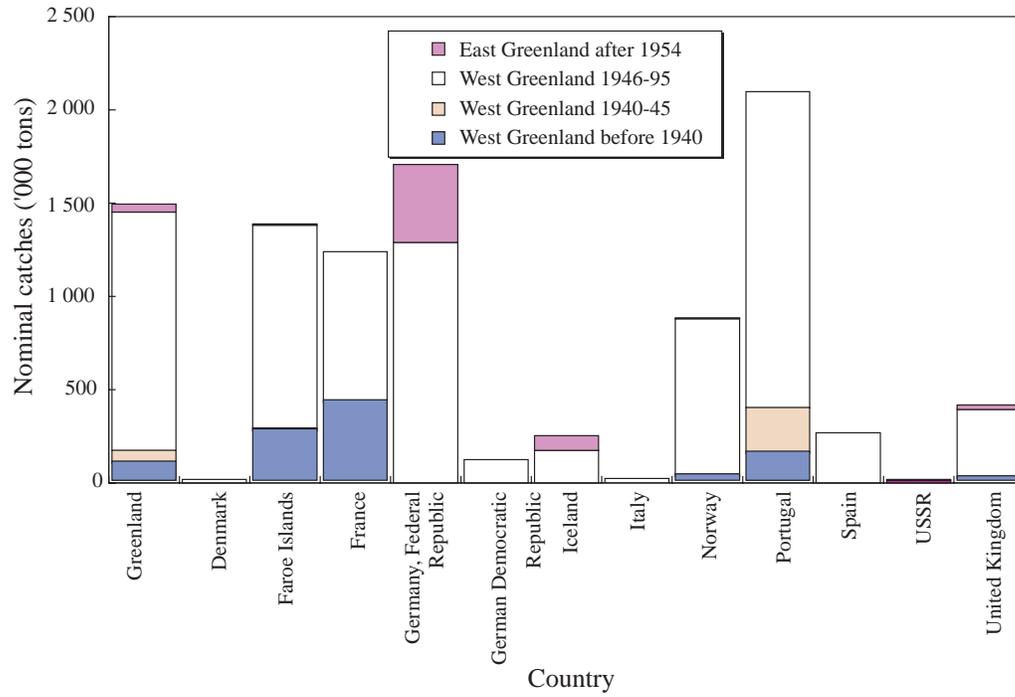


Fig. 2. Various national catches of cod at Greenland 1911–95. (small catches by Canada, Japan, Poland and USA not included).



Tables 1–4

TABLE 1. Nominal catches (tons) of cod at West Greenland 1911–45 by country and gear. Includes estimates as mentioned in the text. MIS = miscellaneous, OTB = bottom otter trawl, LLS = set long-line, DV = dory vessels (Portugal).

Year	Greenland MIS	Denmark MIS	Faroe Isl. MIS	Canada LLS	France LLS	Germany OTB	Iceland LLS	Norway LLS	United Kingdom		Portugal LLS (DV)	Total		Grand Total
									LLS	OTB		MIS	OTB	
1911	19											19	0	19
1912	5											5	0	5
1913	66											66	0	66
1914	60											60	0	60
1915	98											98	0	98
1916	193											193	0	193
1917	154											154	0	154
1918	441											441	0	441
1919	501											501	0	501
1920	454											454	0	454
1921	508											508	0	508
1922	602											602	0	602
1923	690											690	0	690
1924	843											843	0	843
1925	1024	20	429					200	422			1043	0	1043
1926	2224		2880		700			1000	122			2895	0	2895
1927	3570		3359		700			750	368			6676	0	6676
1928	4163		1570		700			3000	601			7997	0	7997
1929	7080	100	12294		8235	147			1528			10034	0	10034
1930	9658	30	29696		46560	123			3303			29237	147	29384
1931	9054		25086	50	81438			89	3517	15010		104257	123	104380
1932	9232		18022		59892			236	1719	10678		129912	0	129912
1933	8238		21647		18447			125	372	7404		96505	0	96505
1934	9468		30256		33663			603	576	13760		62589	0	62589
1935	7526		20965		27903			603	564	14600	1211	97590	0	97590
1936	7174	141	19169		80973		50	3175	443	15800	6221	72161	1211	73372
1937	6961	159	29081		44169	138		2546	1003	13200		126925	6221	133146
1938	5492	42	30364		27807			6975	854	24000		97119	138	97257
1939	7161		30562					14445		17800		95534	0	95534
1940	8026		16722							26400		69968	0	69968
1941	8622									35000		51148	0	51148
1942	12027									38600	2214	43622	0	43622
1943	13026									47400		50627	2214	52841
1944	13385									49000	2627	60426	0	60426
1945	14289									45800		62385	2627	65012
TOTAL	172034	492	292102	50	431187	408	50	33747	15392	397476	4841	1342530	12681	1355211

TABLE 2. Nominal catches (tons) of cod at West Greenland 1946-95 by country and by gear. Includes estimates as mentioned in the text. MIS = miscellaneous, OTB = bottom otter trawl, GNS = set gillnets, LLS = set long-lines, DV = dory vessels, ("") = indicates that there may have been some catches by OTB but likely very little and included in MIS.

Country Gear	Greenland MIS	Greenland OTB	Denmark MIS	Faroe Island MIS	Faroe Island OTB	Canada OTB	France MIS	France OTB	Fed. Rep. of Germany OTB	German Dem. Rep. OTB	Iceland OTB	GNS	Italy OTB	Japan OTB	Norway MIS	OTB
Year																
1946	15262			2716			5106								500	
1947	18029			7900			14180								2299	
1948	18675		2365	18668			30384								703	
1949	17050		4187	21984			35560				50				18750	
1950	21173		6307	35730			31200				1533				36216	2053
1951	18200		6414	41232			25976				19069		1630		53673	300
1952	16726			32916	18786	679		36000	2750		64093		2620		23947	4368
1953	22651			16103	16960			23976	2688		18241		2120		33977	5391
1954	18698			17115	14245			64095	1475		3377		4415		38508	10745
1955	19787			17344	18467			34121	7248		9180		2000		39076	3900
1956	21028			13904	17871			30461	29082		8994		2400		39257	1709
1957	24593			11693	21172			27194	10537		9719		1600		18237	1668
1958	25802			19285	24267			23720	29910	607	9636		1100		33273	3195
1959	27577			21916	16399			30379	17413	35	468		1700		25674	937
1960	27009			25347	25290			21014	23791	69	4896		32		30990	793
1961	33965			32518	23888			39623	83552	2200	11035				41904	1584
1962	35380			55482	37208			52974	124900	10000	1156				31917	3144
1963	23269			48068	29718			36188	136794	22984	3881				28821	8783
1964	21986			40463	25016			34797	94539	15092	2473				25803	7480
1965	24322			44949	20759			40091	104731	12980	3973		1251		30960	11720
1966	29076			46769	17759			41409	82224	8734	1965				29108	22913
1967	27524			41664	22017			43348	138502	8603	119				30277	28151
1968	20587			22763	23043	8		46587	133217	28449		268		60	22794	2911
1969	21592			18344				25165	78560	9850		365		5	15138	2240
1970	15613			7733				4740	40667	2061					6293	4020
1971	13506			16440				4108	40916	3154					11331	20209
1972	14648			9949				5515	16833	77					3094	9650
1973	9622			4499				38	5944						2825	411
1974	8838			4911					1681						1683	
1975	6557			5355					10842						4	
1976	5174			3390	70				5842							
1977	13999			7346					2609							
1978	19679								1057							
1979	35590			38				139	1344							
1980	38571								1024							
1981	39703								417							
1982	26664								8139							
1983	28652			1339					10158							
1984	19958			4499					8941							
1985	8441			4210					2170					13	5	
1986	5302			1247					41					54	1	
1987	14604			3882					55					11	2	
1988	22829			29306					6574					33	1	
1989	38529			53623					12892					10	7	
1990	28799			30017					7515						948	
1991	18312			1926	51				96							
1992	5727				1											
1993	1926															
1994	2115															
1995	1710															
Total	994819	290058	19273	715873	372987	687	142406	665682	1287670	124895	173858	633	23268	186	691101	154255

TABLE 2. (Continued).

Country Year	Poland OTB	MIS (DV)	Portugal OTB	Spain OTB	USSR OTB	LLS	UK OTB	USA OTB	MIS	Total	OTB	Grand Total	Estimates for assessment when differing from grand total	Footnotes
1946		35000		1000		73			58657		1000	59657		
1947		37924		1000		93		62	80425		1062	81487		
1948		41930		1000		16		13942	112741		14992	127733		
1949		52361		1000				20640	149892		23173	173065		
1950		48227	14291	1000		367		2377	179220		21351	200571		
1951		58033		2000		58		12965	203586		36954	240540		
1952		51965	14468	7055		26		58372	125580		208691	334271		
1953		57421	7975	3519				34351	130152		117516	247668		
1954		70664	42835	2202				18859	144985		159833	304818		
1955		60818	42882	7451				5044	137025		130693	267718		
1956		68713	57073	31550				1603	142902		180743	323645		
1957		74702	37080	22875				9565	129225		141410	270635		
1958		69078	43676	26995				9377	147438		172483	319921		
1959		49867	16868	13723				74	125034		110208	235242		
1960	10	58936	7313	3936				1490	142282		100554	242836		
1961		65688	2064	1332					174075		173516	347591		
1962	484	80693	10961	3400					203472		257186	460658		
1963	273	61562	1631	478				5053	161720		267035	428755		
1964	92	52229	985	744					140481		209257	349738		
1965	38	57946	2737	650					158177		208540	366717		
1966	799	73357	2053	3573				224	178310		189896	368206		
1967	623	60474	2237	10664				570	159939		269540	429479		
1968	861	18461	14294	21689				1950	84873		308727	393600		
1969	354	2429	13370	23780				21	57868		156887	214755		
1970		2075	6632	18802				849	31714		81790	113504		
1971		4990	1305	22086				59	38956		82224	121180		
1972		8485	12951	12951				1021	44413		66204	110617		
1973		8324	7	10235				493	28362		34580	62942		
1974		10081	85	5897				1266	26924		21210	48134		
1975		4940		4017				159	19920		27991	47911		
1976		2495		2090				155	13884		19402	33286		1
1977		1052						1086	24080		13916	37996		1
1978									19683		18848	38531		1
1979									35628		12277	47905		1
1980									38571		8291	46862		1
1981									39703		13753	53456		
1982									26664		30342	57006		
1983									29991		26486	56477		
1984									19963		13453	33416		
1985									8442		6434	14876		
1986									5304		1299	6603		
1987									14605		3970	18575		2
1988									22836		36817	59653		2,3
1989									38529		70295	108824		3
1990									29747		39214	68961		
1991									18312		2023	20335		
1992									5727		0	5727		
1993									1926		0	1926		
1994									2115		0	2115		
1995									1710		0	1710		
Total	3534	1350920	342822	268694	13444	633	369548	478	3925658	4092066	8006829	163441*		

1) The Scientific Council of NAFO considered the actual catches to be much higher than those recorded in ICNAF/NAFO Stat. Bull. and used the estimates listed here for its stock assessment.  
 2) Figures for Greenland 1987 (MIS and OTB) and 1988 differ from those in Stat. Bull. They are from vessels monthly reports to Greenland authorities. An official correction to NAFO seems never to have worked out.  
 3) The ICES Working Group on Cod Stocks off East Greenland considered that some catches (3 000 tons for 1988; 2 741 tons for 1989) reported as taken at East Greenland were, in fact, taken at West Greenland (Div. 1F). (Anon., 1989 and 1990, respectively).  
 \* Total difference between estimates and reported catches (not sum of estimates).

TABLE 3. Nominal catches (tons) of cod at East Greenland 1954-95 by country. (+ Catch less than 1/2 ton).

Year	Greenland	Faroe Islands	Fed. Rep. Germany ICES XIV	Germany ICES XII	German Dem. Rep.	Iceland	Japan	Norway	Poland	UK	USSR	Total	Estimates for assessment when differing from total	Footnotes
1954						4321						4321		
1955			3645			1490						5135		
1956	37		12092			758						12887		
1957	197		8468			1788						10453		
1958	882		5919			4099				15		10915		
1959	607	543	12598			5385				45		19178		
1960	1609	425	19069			2543				268		23914		
1961	1199	1221	15021			1381				868		19690		
1962	903		14299			298				1815		17315		
1963	904		13877			1804				775	5697	23057		
1964	1120		30623			2846				988		35577		
1965	887		10965			4713				932		17497		
1966	880		7786			3977				227		12870		
1967	753		12117			10474				1383	5	24732		
1968	628		8323			6723				27		15701		
1969	627		12635			4473						17771		
1970	501		13930			5461			841	140	36	20907		
1971	533		25644			5680			419	28	312	32616		
1972	279		21592			3195			318	184	137	26629		
1973	191	924	9262		8	1446			17	661		11752		
1974	68	652	2309		15	3009			1	499		6553		
1975	224	581	1552		326	785		1864	18	575		5925		1
1976	372	440	7075			3133		364		1514	127	13025		2
1977	1833	1407	3564			25		537		1393	16	8775	18000	2
1978	1347	6	3936			13		17		43		7827	26000	2
1979	2755		1062	2465		3						8974	34000	2
1980	1778		3193	6254		19						11244	12000	3
1981	890	292	7367	1831		1						10381	16000	3
1982	898		8940	11091								20929	27000	3
1983	438	368	8238	4334								13378		
1984	1051		7035	34				794				8914		
1985	106		2006									2112		
1986	509	86	4063				97					4755		4,7
1987	1476		5358			1	74					6909		4,7
1988	345	12	12049			9	42					12457	9457	5,7
1989	3870	40	10613				94			1293		15910	14669	6,7
1990	4490		26419				129	12		2458		33508		7
1991	6677	9	8557				18	836		5499		21596		7
1992	1283		5893			22		1030		2995	126	11349		
1993	198		164					597		176		1135		
1994	73	1	24					43		296		437		
1995	29		22			1		+		232		284		
Total	43447	7174	387304	31163	349	79876	454	6094	1614	25329	6490	589294	60629*	

1) Total includes 2 tons by Canada.

2) Estimates for assessment include estimates of unreported catches (Anon., 1981).

3) Estimates for assessment include estimates of discards (Anon., 1981b, 1982 and 1983).

4) Figures listed under Japan were vessels chartered by Greenland.

5) 3 000 tons reported taken at East Greenland are considered caught at West Greenland (Anon., 1989).

6) 2 741 tons reported taken at East Greenland are considered caught at West Greenland, while 1 500 tons caught in other ICES areas are considered caught at East Greenland (Anon., 1990).

7) Figures for Japan are based upon vessels' weekly reports to Greenland authorities, see also footnote 4.

\* Total difference between estimates and reported catches (not sum of estimates).

TABLE 4. Summarized national catches of cod at Greenland in the 20<sup>th</sup> century to the end of 1995. Nominal catches ('000 tons). (+ = catch below 500 tons.)

Country	West Greenland			Sub total	East Greenland	Grand Total
	Before 1940	1940–45	1945–95		After 1954	
Greenland	103	69	1279	1451	43	1494
Denmark	+	0	19	19	0	19
Faroe Islands	275	17	1089	1381	7	1388
Canada	+	0	1	1	+	1
France	431	0	808	1239	0	1239
Germany, Fed. Rep.	+	0	1288	1288	418	1706
German Dem. Rep.			125	125	+	125
Iceland	+	0	174	174	80	254
Italy	0	0	23	23	0	23
Japan	0	0	+	+	+	+
Norway	34	0	845	879	6	885
Poland	0	0	4	4	2	6
Portugal	155	247	1694	2096	0	2096
Spain	0	0	269	269	0	269
USSR	0	0	13	13	6	19
United Kingdom	23	0	370	393	25	418
USA	0	0	+	+	0	+
Total	1022	333	8002	9357	589	9946