Northwest Atlantic Fisheries Organization

Serial No. N5516 **NAFO SCS Doc. 08/11**

SCIENTIFIC COUNCIL MEETING - JUNE 2008

Denmark/Greenland Research Report for 2007

Compiled by

H. Siegstad
Greenland Institute of Natural Resources
P.P. Box 570, DK-3900 Nuuk, Greenland

This report presents information on preliminary catch statistics from the commercial Greenland fishery in 2007. Furthermore, the report gives a brief overview over the research carried out in 2007 by the Greenland Institute of Natural Resources.

WEST GREENLAND (NAFO SUBAREA 1)

A. Status of the fisheries

Provisional statistics for the fisheries from 2005 to 2007 are presented in Table 1. Additional information on the status of the fisheries is as follows:

1. Shrimp

The shrimp stock off West Greenland is distributed in Div. 0A and Subarea 1. The fishery is conducted by Greenland, EU and Canada. The Greenland and EU fishery exploits the stock in Subarea 1 (Div. 1A to 1F) in offshore and inshore areas (primarily Disko Bay). The Canadian fishery has been restricted to Div. 0A since 1981.

Three fleet components, one from Canada and two from Greenland (vessels above and below 80 GRT) participated in the fishery since the late-1970s. The Canadian fleet and the Greenland large-vessel fleet have been restricted by areas and quotas since 1977. The fishery by the Greenland small-vessel fleet was unrestricted until January 1997, when quota regulation was imposed. In 2007, the advised TAC for the entire stock was 134 000 tons: the Greenland authorities set a TAC for Subarea 1 of 134 000 tons, and a TAC for Div. 0A east of 60°30'W of 18 417 tons was set by the Canadian authorities for the same year. The use of a sorting grid to reduce by-catches of fish is mandatory for both the Greenland large-vessel fleet and the Canadian fleet (max. 22 mm bar distance in Greenland zone; max. 28 mm bar distance in the Canadian zone). Discarding of shrimp is prohibited

Overall annual catch increased from about 10 000 tons in the early 1970s to more than 105 000 tons in 1992. Moves by the Greenlandic authorities to reduce effort and fishing opportunities elsewhere for the Canadian fleet caused catches to decrease to about 80 000 tons by 1998. Since then total catches have increased. Logbook-reported catches in Greenland in 2007 shows a total removal of near 135 000 t.

Catch rates (CPUE) are high in historic terms, but the stock is being intensively fished in a shrinking area. Survey biomass, still moderately high, has nevertheless decreased markedly and uninterruptedly since 2003. Estimated numbers of small shrimp have decreased for 6 years, reaching now very low levels. Concerns about future recruitment expressed in previous years are in 2007 aggravated, and reinforced by indications of decreasing stock biomass and a narrow size spectrum. Recruitment has been low for a number of years and the stock is decreasing. Recent catch levels are not estimated to be sustainable. NAFO recommend catch of around 110 000 tons for 2008, and notes that catch would need to be reduced further in 2009.

2. **Greenland halibut**

The total catches of Greenland halibut by Greenland vessels in NAFO Subarea 1 (excluding Div. 1A inshore) amounted to 7 401 tons in 2007. 5 596 tons were taken off shore in Div. 1AB(north) and 1 651 tons were taken off shore in Div 1C -1F (south), mainly in Div. 1D, while 154 tons was taken inshore in Div. 1B-1F. The offshore catches were exclusively taken by trawlers (Fig. 1.), while the inshore catches were taken mainly by gill net. The inshore fishery in Div. 1A in 2007 was concentrated in three areas in Disko Bay (10 381tons) Uummannaq (5 318 tons) and Upernavik (4 876tons). A minor fishery is also conducted in northernmost part of Greenland: Thule, where 14 tons is reported in 2006, so far no catch reports for 2007 are available from that area. The fishery is conducted by long lines and gill nets.

Commercial fisheries data. CPUE data, based on logbooks reported to the Greenland authorities, were available from four Greenland trawlers. The CPUE for the large trawlers that have participated in the fishery in resent years in Div 1AB increased from 0.87 ton/hr in 2003 to 0.95 ton/hr 2004 and further to 1.1 ton/hr. in 2005 and stayed at that level in 2006 (1.06). CPUE was back at the 2004 level, 0.96 ton/hr, in 2007. In Div. 1CD the CPUE increased gradually from 0.75 ton/hr in 2003 to 0.99 ton/hr in 2005 and stayed at that level in 2006 (1.02 tons/hr). CPUE decreased to 0.90 ton/hr in 2007. The decrease was caused by a reduction on about 30% compared to 2006 for one of the trawlers. The other trawler showed and increase in CPUE compared to 2006.

A small trawler, relatively new in the fishery, had increasing CPUE between 2005 and 2006 in Div. 1CD and stable CPUE in Div. 1AB, In 2007 CPUE in 1CD decreased to slightly above the 2005 level. CPUE in Div. 1AB also showed a decrease.

3. **Cod**

Cod in Greenland derives from three stock components, labeled by their spawning areas: I) an offshore Greenland spawning stock, II) inshore West Greenland fiords spawning populations, and III) Icelandic spawned cod that drift to Greenland with the Irminger current. It is not feasible to sample and assess stock status of the various stock components are assessed together and the stocks are assessed by ICES see the North-western Working Group (NWWG) report, April 2008 and ACFM report 2008. Management considerations from the ACFM were that "A multi-annual management plan should include monitoring the trajectory of the stock, clearly stating specified reopening criteria, and monitoring the fishery when it is reopened. The cod fishery in Greenland consists of two components, an offshore fishery and an inshore fishery.

The offshore fishery completely collapsed in 1993. From 1994 to 2001 no directed offshore cod fishery has taken place. From 2001 catches increased steadily and offshore catches amounted to 4841 tons in 2007. Catches is distributed as: long-line 441 tons in East Greenland and 32 tons in West Greenland; trawl 2780 tons in East Greenland and 1588 tons in West Greenland. The inshore cod fishery at West Greenland is since 1992 assumed to be based on self-sustained fjord populations. From 1993 to 2001 the inshore catches were low – in the range 500-2 000t. Inshore catches have since increased to reach 7388 tons in 2006. In 2007 the inshore catches amounted to 11693 t. The catches were taken all along West Greenland from NAFO Div. 1A to 1F. Catches were highest between June and September which is the main period of the pound-net fishery.

The offshore Greenland spawning component has not been fished during the last 15 years. Surveys and exploratory fishery now suggest dense concentrations of large spawning cod in East Greenland north of 63°N. The area is limited in distribution compared to the spawning grounds observed historically. Recruitments in the offshore area have improved since the end of the 1990s although it is still low compared to the recruitments before the stock was depleted. Inshore spawning occurs in many fiords and recruitment has increased in recent years in the areas surveyed. Recruitment is now well above the lows observed in the late 1990's. The landings by the coastal fleet component have increased by a factor of ten over the last decade".

4. **Salmon**

The salmon caught in the West Greenland fishery are mostly (>90%) non-maturing 1SW salmon, most of which are destined to return to home waters in Europe or North America as MSW fish if they survive. The abundance of non-maturing 1SW salmon has declined steadily during the last 30 years both in the Southern European and the North American continental areas. The percentage of North American salmon in the West Greenland catch has averaged approximately 70% from 2000 to 2006. In 2007 the percentage of NA salmon is 82%.

In West Greenland total nominal catches in 2007 amounted to 25 tons. The advice generated by ICES (WGNAS report 2008) is in response to terms of reference posed by the North Atlantic Salmon Conservation Organization (NASCO), pursuant to its role in international management of salmon. NASCO's present management is directed towards reducing exploitation to increase spawning escapement to allow river-specific CLs to be achieved. It is not possible to evaluate the extent to which the objectives of any significant management measures for the West Greenland Commission have been achieved, as an assessment of the status of the stocks for the North American Commission in 2007 was not performed. A full assessment is scheduled to occur in 2009 and the extent to which the objectives of any significant management measures for the West Greenland Commission have been achieved can be evaluated at that time. The North American stock complex is the primary contributor to the West Greenland fishery.

5. **Capelin**

The capelin fishery in West Greenland is carried out inshore and in the spawning season only (May-July). The main part of the catches amounted a total of 72 tons in 2006 is produced as whole frozen fish for bait and local consumption, while a smaller part is dried and stored as food for sledge dogs in the winter season. The majority of the catches were taken in Div. 1A. There are no data from catches in 2007.

6. **Redfish**

Two species of redfish of commercial interest occur off West Greenland inshore and offshore, golden redfish (*Sebastes marinus* L.) and deep-sea redfish (*Sebastes mentella* Travin). Relationships to other North Atlantic redfish stocks are unclear.

Redfish catches in West Greenland are reported as redfish (unspecified, mainly by-catch), golden redfish and beaked redfish (pelagic redfish). Reported catches of Golden redfish in 2007 was 114 tons. There is no forecast for golden and deep-sea redfish stocks in West Greenland and the advice from NAFO is "no direct fishery".

Pelagic redfish

The aggregations of pelagic redfish *S. mentella* found in the NAFO Convention Area belong to the same stock of pelagic redfish from the Irminger Sea. The stock is assessed by ICES (NWWG report 2008) and the assessment covers the pelagic redfish in ICES Divisions Va, Vb, and XIV and in the NAFO Div. 1F, 2H and 2J. ACFM has advised for 2009 that catches of pelagic *S. mentella* are set at 20 000 t as a starting point for the adaptive part of the management plan.

The pelagic fishery on *S. mentella* in NAFO Div. 1F started in 1999. Since 2000, significant catches were taken in NAFO Divisions 1F and 2J, up to 32 000 t (20% of total catches) in 2003. In 2007, however, only 5 600 t (9% of the total catches) were taken in the NAFO area. The Greenland fleet has reported a total catch of pelagic *S. mentella* of 1961 tons in 2007, mainly caught in ICES Divisions.

7. **Grenadiers**

There are two species of grenadiers of commercial interest in Greenland: roundnose grenadier and roughead grenadier. All catches are, however, reported as roundnose grenadier. The catch reported is taken as by-catch in the Greenland halibut fishery. 10 tons grenadier has been reported in 2007 from the inshore fisheries in NAFO Div. 1A and around 20 tons in the offshore fishery for Greenland halibut in SA1. No forecast – the biological advice is "no direct fishery".

8. **Snow Crab**

The snow crab stock for the fisheries is distributed in the Div. 0A along the west coast of Greenland. The fishery is conducted mainly by Greenland vessels and only one vessel from EU. The EU fishery is restricted to the offshore areas of West Greenland.

Since 2004, the crab resource has been managed in 6 areas (from North to South: Upernavik, Uummannaq-Disko Bay, Sisimiut, Maniitsoq-Kangaamiut, Nuuk-Paamiut and Narsaq-Qaqortoq). The fishing fleet is made up of two components; small vessels (less than 75 GRT), which have exclusive rights for fishing inshore within the basis-line as well as offshore. Small vessels are, however, restricted to fishing in only 1 management area during the year. Large vessels (greater than 75 GRT) may only fish in all offshore areas (outside the basis-line), but not within the "Crab Boxes". Total allowable catch (TAC) restrictions have been imposed since 1995, but have only limited the catch in some areas since 2004.

The number of vessels with licenses to participate in the snow crab fishery increased from 1999 to 2002 from approximately 120 vessels to 374 vessels. Since then the number of both large and small vessels have decreased substantially as the abundance of the resource has also declined. From 2004 to 2007 the number of active license holders in all management areas decreased by 55%.

The total catch in NAFO Subarea 1 peaked in 2001 with approximately 15.000 tons. From 2001 to 2007 total catch decreased approximately 86% to 2.000 tons (table 1). Most of the landings are based on fishery in the management areas Disko Bay-Uummannaq, Sisimiut and Nuuk-Paamiut. The total fishing effort (trap hauls) has declined by 81% since 2001 (from 3,416 to 665 thousand trap hauls during 2001-2006). The decline has been mostly due to a declining number of participants in the fishery. Preliminary and incomplete logbook data for 2007 shows total effort is 240 thousand trap hauls.

9. Scallops

Total catches of scallops in NAFO Subarea 1 amounted to 1.304 tons in 2007. A total quota for scallops in 2007was set at 2.220 tons. All catches are taken in inshore areas in Div. 1A, 1B, 1C and 1D. New fishing grounds near Sisimiut (1B) was found in 2003 and quota for two new areas was introduced in 2004.

10. **Lumpfish**

Total catches of lumpfish in NAFO Subarea 1 increased from 1.200 tons in 2000 to almost 9.000 tons in 2003. Catches has remain on this level since until 2006. Catches in 2007 decreased to 2.977 tons. Catches are taken in inshore areas in Div. 1A, 1B, 1C, 1D, 1E and 1F. The fishery is conducted over a short time period of one to two months and over a vast coastline from 59° N to 72° N.

B. **Special Research Studies**

1. **Environmental Studies**

a. **Hydrography Studies**

A survey of oceanographic stations along the West Greenland standard sections was carried out in 2007. The time series of mid-June temperatures and salinities on top of Fylla Bank (st.2) show only slightly above average conditions indicating normalization relative to the recent extreme warming.

The presence of Irminger Water in the West Greenland waters is above normal in 2007. Pure Irminger Water was observed at the sections off Cape Farewell and Cape Desolation, and Modified Irminger Water could be traced north to the Maniitsoq section. The waters of Atlantic origin were warmer than normal, but their salinities were just above normal. The mean (400–600 m) salinity west of Fylla Bank (st.4) was only slightly above normal while the temperature was 0.4°C above normal. However, mean temperatures and salinities for the same depth interval for Maniitsoq and Sisimiut were among the highest observed consistent with the large scale settings in the Subpolar North Atlantic. As for the Irminger Water, the presence of Polar Water is also slightly above normal in 2007. The extension of multi-year-ice (“Storis”) encountered during the survey was about normal. West of Fylla Bank a clear cold Polar Water core was observed, which had about normal temperature and salinity, but further north west of “Sukkertop Banke” and “Store Hellefiskebanke” the surface temperatures was colder than normal.

2. **Biological Studies**

a) **Shrimp**

The series of annual stratified-random trawl surveys initiated in 1988 was continued in 2006. In July-August 212 research trawl hauls were made in the major parts of the distribution area of the West Greenland shrimp stock, including areas in Subarea 0 and the inshore areas in Disko Bay and Vaigat.

The survey biomass indices indicated a fairly stable stock size from 1988 to 1997. Survey estimates of total biomass of Northern shrimp off West Greenland showed little variation over the initial ten-year period, but after a comparatively low estimate of 178 000 tons in 1997 the biomass increased steadily to 598 000 tons in 2003.

This record high value was followed by continuous decline to 350 000 tons in 2007. The decline in total biomass observed since 2003 occurred predominantly the in offshore area off southwest Greenland.

Numbers for shrimp at age 2 from the research trawl survey peaked in 2001, but have since continually decreased, have been below average since 2003, and in 2007 have reached a record low, at about 7% of the 2001 peak and 15% of the series mean. Prospects for recruitment to the fishable stock are bleak.

b) **Greenland halibut**

A Greenland offshore trawl survey for Greenland halibut was initiated in 1997. The survey is a continuing of the joint Japanese/Greenland survey carried out in the period 1987-95. In 1997-2005 the survey covered NAFO Div. 1C and 1D between the 3 nm line and the 200 nm line or the midline against Canada at depths between 400 and 1500 m. In 2001 the survey area was expanded to include NAFO Div. 1B-1A (to 74°N) and in 2004 a survey was conducted in the northern part of the Baffin Bay (73°N-77°N) (Div. 1A) at depths down to 1500 m. In 2007 there were made 50 successful hauls in Div. 1CD.

During the survey Greenland halibut were tagged with floy-tags in the southern Baffin Bay area in order to investigate the relationship between Greenland halibut in Baffin Bay and Davis Strait. In total 8257 Greenland halibut were tagged. 383 were tagged in the inshore area Vaigat, 6063 at two positions west of Disko Island (Div. 1A) and 1811 off Canada in the southern part of Div. 0A. About 3200 specimens were also injected with $SrCl_2$ in the stomach cavity. $SrCl_2$ is incorporated in the otoliths and it should hence be possible to investigate growth of otoliths (See SCR this meeting).

A longline survey for Greenland halibut in the inshore areas of Disko Bay, Uummannaq, and Upernavik was initiated in 1993. No longline survey was conducted 2002 due to technical problems. In 2007 the longline survey was conducted in Uummannaq, and a gillnet and longline calibration survey was conducted in Disko Bay.

Since 2001 a gillnet survey was initiated in the Disko Bay area. In 2007 a total of 30 gillnet settings were made along 4 transects. Each gillnet was compiled of 4 different nets, each with a different mesh size (46, 55, 60 and 70 mm stretch meshes). The distribution pattern showed a markedly higher density of Greenland halibut in the mouth of the ice fjords.

c) **Cod survey**

A survey using gangs of gill nets with different mesh-sizes has been developed and used since 1985 with the objective of assessing the abundance of age 2 and age 3 cod in the inshore areas. The indices in all areas (NAFO 1B, 1D and 1F) are generally above the levels observed during the 1990's.

An annual stratified random trawl survey has been conducted since 1988 in West Greenland between 59º15'N and 72º30'N and the inshore area of Disko Bay from the 3 mile limit down to the 600 m. The main purpose of the survey is to evaluate the biomass and abundance of the Northern shrimp (*Pandalus borealis*), but since 1992 data on fish species have been included.

Until 2001 the survey biomass of cod was below 1,000 tons but increased to about 2,300tons in 2004 and continued to increase thereafter. In 2007 biomass and abundance indices were estimated at 28,488 tons and 52.5 mill individuals, corresponding to +16% and -23% when compared to the 2006 values. Since 2005 then the biomass and abundance has been dominated by the 2003 and the 2005 year-classes. The 2005 year-class size is measured at 33% of the 2003 year-class, measured at age 2. The two dominating year-classes differ with respect to distribution. The 2003 year-class was almost exclusively found in the most southern area of NAFO Div. 1F whereas the 2005 year-class appears rather evenly distributed along West Greenland. The very southern distribution of the 2003 year-class is similarly reflected in the commercial fisheries that almost entirely took place in Div. 1F.

d) **Snow Crab**

Annual monitoring program (trap survey) was initiated in 1997 in Disko Bay (Div. 1A) and Sisimiut (Div. 1B). Since 2001 annual offshore trap survey has been conducted in more southern areas in West Greenland (Div. 1C

and 1D). Large and small meshed conical traps are used. All snow crab were enumerated by sex, carapace width and carapace condition. The chelae height was measured in males and the abdomen width in females, respectively for maturity determination. Egg development stage in females was also determined and females were sampled in relation fecundity studies.

The objective of both monitoring programs is to assess the abundance of snow crab in inshore and offshore waters of Greenland. Results from this survey are presented in the Technical Report Series of the Greenland Institute of Natural Research.

In 2007 surveys in Div. 1A and 1B were conducted in May/June with the research vessel "Adolf Jensen". Results suggest that the resource show signs of minor recovery of the stock in some of the management areas, however over all the stock is situated still at a low level. An exception is in the northern part of Disko Bay where decreasing trends has been observed. Recruitment prospects are at a low level in all areas.

e) **Marine mammals**

Studies of white whale and narwhal continued in 2007 and details are being reported to JCCM and NAMMCO. In 2007 also studies of minke whale, fin whale and humpback whale continued. Monitoring study on large cetaceans is being reported to IWC. Studies of harp and hooded seals are being reported to the Joint ICES/NAFO Working Group on Harp and Hooded Seals.

f) **Special studies**

A Ph.D. project, initiated in 2004, is studying the reproductive potential of snow crab in the coastal waters of West Greenland. The present study will use existing data and data collected in fieldwork surveys in Div. 1A, 1B and 1D. Exploited and non-exploited stocks will be examined as well as temperature effects. Life history traits will be related to aspects of snow crab reproductive potential at three study sites: Disko Bay (north), Sisimiut (middle) and Nuuk (south). The study will contribute to a better understanding of the reproductive potential in the snow crab fisheries resource, and provide essential base line information for adaptive management and conservation strategies.

GREENLAND FISHERY IN OTHER NAFO SUBAREAS

A. **Status of the fisheries**

In 2007 one Greenland vessels was engaged in shrimp fishery at Grand Bank (NAFO Div. 3L) and reported catch from 3L amounted to 452 tons. 0 tons was reported from Flemish Cap (NAFO Div. 3M).

References

Anon. 2007. Scientific Council Reports. Northwest Atlantic Fisheries organization. Dartmouth Canada 2007.

Ribergaard, M.H. and Buch, E. 2008. Oceanographic Investigations off West Greenland 2007. *NAFO Scientific Council Documents* **08/03**

JØRGENSEN, O.A. , 2008. Survey for Greenland Halibut in NAFO Divisions 1C-1D, 2007**.** *NAFO SCR Doc.*, No. 07/xx, Serial No. NXXX.

Table 1. Estimated catches (tons) by Greenland vessels at West Greenland (NAFO Subarea 1) in 2004-2007.

	NAFO SA				
	Div. 1A, B, C, D, E, F			Div 3M	Div 3L
Species	Estimated catch 2005*	Estimated catch 2006*	Estimated catch 2007*	Catch 2007	Catch 2007
American Plaice	0	nd	nd		
Arctic char	10	54	nd		
Atlantic halibut	0	14	nd		
Atlantic salmon	15	22	25		
Atlantic cod	6,118	7,813	13,313		
Capelin	71	72	nd		
Crabs	5,360	3,482	2,488		
Greenland cod	1,080	1,085	309		
Greenland halibut	28,139	31,160	27,976		
Grenadiers	3	20	30		
Haddoc	nd	nd	nd		
Lumpfish	8,960	8,754	2,977		
Polar cod	23	2	nd		
Redfish (unspecified - bycatch maily)	400	nd	nd		
Pelagic redfish	1,431	744	1,961		
Redfish golden	179	287	114		
Saithe	0	0	5		
Scallops	1,399	1,905	1,304		
Shark	1	nd	nd		
Shrimp (P.boreallis)	131,630	126,964	127,543	0	452
Shrimp (P.montagui)	nd	nd	nd		
Skate	nd	nd	nd		
Wolffishes	248	644	603		
Fish not specified	nd	nd	nd		
Sum total	185,067	183,022	178,648		452

* Catch figures from recent years are provisional.

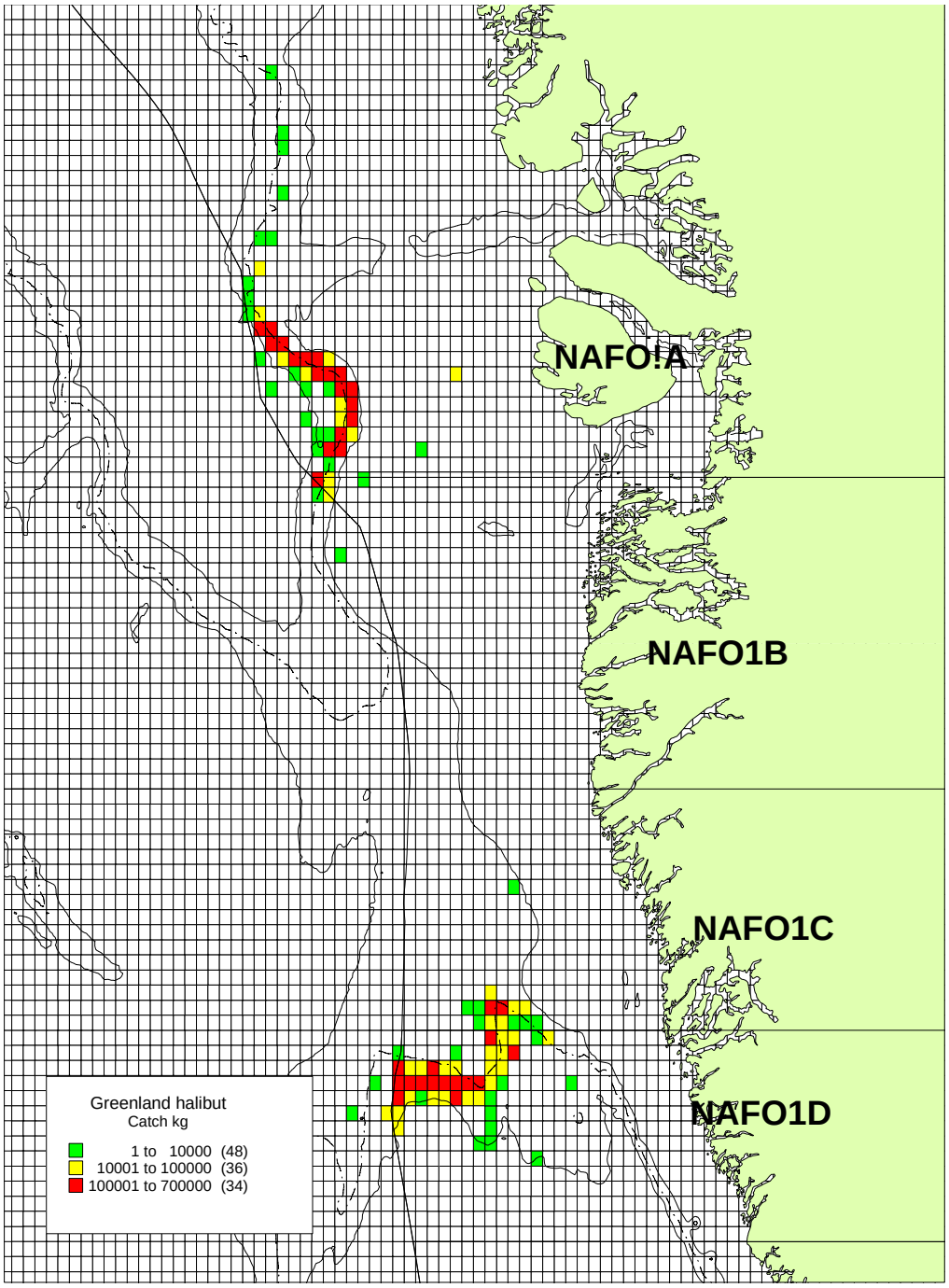

Fig. 1. Distribution of the offshore catches of Greenland halibut in SA 1 in 2007 by statistical square. All nations.