

SCIENTIFIC COUNCIL MEETING - JUNE 2007

Denmark/Greenland Research Report for 2006

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This report presents information on preliminary catch statistics from the commercial Greenland fishery in 2006. Furthermore, the report gives a brief overview over the research carried out in 2006 by the Greenland Institute of Natural Resources.

WEST GREENLAND (NAFO SUBAREA 1)

A. Status of the fisheries

Provisional statistics for the fisheries from 2003 to 2006 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 2006, the advised TAC for the entire stock was 152 167 tons: the Greenland authorities set a TAC for Subarea 1 of 138 000 tons, and a TAC for Div. 0A east of 60°30'W of 14 667 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 2006 shows a total removal of near 134 000 t.

The stock biomass, as indicated by survey and CPUE, has increased substantially since the late 1990s and reached its highest level in 2004, and although the survey index has decreased in 2005 and 2006, it is still at historically high levels. Biomass is estimated still well above B_{msy} and mortality by fishery and cod predation is well below Z_{msy} .

2. Greenland halibut

The total catches of Greenland halibut by Greenland vessels in NAFO Subarea 1 (excluding Div. 1A inshore) amounted to 7 960 tons in 2006. 5 530 tons were taken in Div. 1AB(north) and 1 986 tons were taken off shore in Div 1B (south) -1F, mainly in Div. 1D, while 444 tons was taken inshore in Div. 1B-1F. The offshore catches were

exclusively taken by trawlers (Fig. 1.).

The inshore fishery in Div. 1A in 2006 was concentrated in three areas in Disko Bay (12 114 tons), Uummannaq (4 984 tons) and Upernavik (4 132 tons). A minor fishery is also conducted in northernmost part of Greenland: Thule, where 14 tons is reported in 2006. 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 recent years in Div 1A 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). In Div. 1D the CPUE increased from 0.75 ton/hr in 2003 to 0.78 ton/hr in 2004 and further to 0.99 ton/hr in 2005 and stayed at that level in 2006 (1.02 tons/hr). A small trawler, new in the fishery, had increasing CPUE between 2005 and 2006 in Div. 1D and stable CPUE in Div. 1A,

3. **Cod**

The cod fishery in Greenland consist 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 2002 limited quotas have been allotted to Faeroese and Norwegian vessels and in 2005-2006 Greenland trawlers were allowed limited quotas for experimental cod fishery. Offshore catches of cod increased from 400 t in 2004 to 850 t in 2005. The offshore catches in 2006 amounted to 2,400 t distributed as: Long-line 485 t in East and 241 t in West Greenland; Trawl 1496 t in East and 167t in West Greenland. In addition 5t was landed as by-catch in fisheries targeting Greenland Halibut.

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 6000 tons in 2005. In 2006 the inshore catches amounted to 7400 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.

Greenland cod stocks are assessed by ICES see the North-western Working Group (NWWG) report, April 2007 and ACFM report 2007. Management considerations from the ACFM were that “Cod in Greenland derives from three stock components. Labelled 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.

The offshore Greenland spawning stock 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 63N. This area is limited in distribution compared to the extension of spawning grounds observed historically. Therefore management should ensure that these spawning components have maximum protection.

There have been improved recruitments since the end of the 1990s, although low compared to the recruitments before the stock became depleted. The size of the 2003 year-class is estimated at approximately a third of the 1984 year-class, which is the last strong year-class. Catches from both survey and exploratory fishery in 2006 are thus comprised of a number of age groups and the 2003 year-class is just entering the fishery in 2006. The distribution of the recent good year-classes is more easterly than observed in the 1980s. In order to allow these juvenile incoming year-classes to contribute to the spawning stock fishery should be prohibited.

The 2003 year-class show the characteristics usually associated with cod that have drifted from Iceland (associations with haddock of the same age and a southern distribution). In the past cod of Icelandic origin often migrated back to Iceland when mature. It is unknown which part of the Greenland populates originates from Icelandic cod.”

4. **Salmon**

The salmon caught in the West Greenland fishery are mostly (>90%) non-maturing ISW 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 ISW 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.

The North American stock complex of non-maturing salmon has declined to record levels and is in a tenuous condition. Despite the closure of Newfoundland commercial fisheries in 1992 and subsequently in Labrador in 1998 and Québec in 2000, sea survival of adults returning to rivers has not improved and in some areas has declined further. The abundance of maturing ISW salmon has also declined in many areas of eastern North America. Also the non-maturing ISW salmon from Southern Europe have been declining steadily since the 1970s, and the preliminary quantitative prediction of pre-fishery abundance for this stock complex is low for 2005.

In West Greenland total nominal catches in 2006 amounted to 21 tons. The stock complex at West Greenland is considered to be outside safe biological limits, and even in the absence of fishery at West Greenland in 2007 there is only a very small chance (<3%) for achieving stock conservation limits in the home waters, both in the North American and the European continents. The advice generated by ICES (WGNAS report 2007) 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.

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.

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 2006 was 287 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 2007) and the assessment covers the pelagic redfish in ICES Divisions Va, Vb, and XIV and in the NAFO Div. 1F, 2H and 2J.

ICES has in 2006 advised that no fishery should take place until clear indications of recovery of the stock. The next survey will be carried out in June/July 2007 and the state of the stock will be re-evaluated in August 2007.

The pelagic fishery on *S. mentella* in NAFO Div. 1F started in 1999. Total catches increased steadily until 2003 with catches on 26.000 tons Div. 1F (total for the entire stock was 160.000 tons). Catches in Div. 1F decreased thereafter and reported catches from in 2005 and 2006 was 16.260 and 12.939 tons respectively. The Greenland fleet has reported a total catch of pelagic *S. mentella* of 744 tons in 2006, 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. Greenland did not report any catches of grenadiers in SA1 in 2006. No forecast – the biological advice is “no direct fishery”.

8. **Snow Crab**

The fishery after snow crab is distributed in NAFO Div. 1, A-F and total catch by Greenland vessels (small vessels or inshore fleet and large vessels or offshore fleet) in the entire Subarea 1, decreased from approx. 15.000 tons in 2001 to 5.360 tons in 2005 and approx. 3.500 tons in 2006. During this period offshore catches for the large vessels,

estimated from logbooks, decreased from 4.200 tons to less than 600 tons and catches from the small vessels have fallen from approximately 10.600 tons to 4.600 tons.

Effort from the large-vessel fleet increased 5-fold from 1999 to 2002, while effort was unknown from the small-vessel fleet, due to the lack of logbooks information during this time. Preliminary catch figures for 2003 to 2006 are given in Table 1.

9. Scallops

Total catches of scallops in NAFO Subarea 1 amounted to 1.905 tons in 2006. A total quota for scallops was set at 2.220 tons in 2006. 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, with 8.754 tons in 2006. 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 2006. The time series of mid-June temperatures on top of Fylla Bank (st.2) was about 0.9°C above average conditions, while the salinity was the third lowest observed 0.35 below normal.

The inflow of Irminger Water to West Greenland waters seems to be normal or slightly above normal in 2006. 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 0.5°C above normal. The inflow of Polar Water to West Greenland Waters seems to be normal in 2006. The concentration of multi-year-ice (“Storis”) was about normal. West of Fylla Bank a clear cold Polar Water core was observed, which had higher temperatures than normal but about normal salinities. A low saline surface layer of Polar Water extending towards the interior of the Labrador Sea, which could be due to abnormal easterlies in the waters southwest of Greenland.

2. Biological Studies

a) Shrimp

The series of annual stratified-random trawl surveys initiated in 1988 was continued in 2006. In July-August approximately 220 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 484 000 tons in 2006. The decline in total biomass observed since 2003 occurred predominantly the in offshore area off southwest Greenland. However, the fishable biomass estimated for 2006 is still above long-term average.

The length distribution in 2006 indicates that progression of males to the female group is secured for the next year, but a low abundance of recruits at age 2 suggest that a decrease in fishable biomass will occur in the coming years.

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 2006 there were made 61 successful hauls in Div. 1CD (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 2006 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 conducted in the Disko Bay area. In 2006 a total of 44 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 patterned 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 survey has been focusing on the inshore areas near Sisimiut (NAFO Division 1B) and Nuuk (NAFO Division 1D). The gill-net abundance indices increase in 2006 for both areas and for both age 2 and 3 and the present indices are generally above the levels observed during the 1990's. The successive change of net materials during the recent years may however have contributed to the increased catch rates.

Since 1988, the Greenland Institute of Natural Resources has conducted an annual stratified random trawl survey at West Greenland. 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. The survey covers the offshore areas at West Greenland between 59°15'N and 72°30'N and the inshore area of Disko Bay from the 3 mile limit down to the 600 m. The survey area is divided into NAFO divisions and further subdivided into five depth strata (50-100, 101-150, 151-200, 201-400 and 401-600 m) on the basis of depth contour lines.

In 1992 the biomass decreased by more than 95 % to only 250 t and remained at this low level until recent years. Since 2001 a slight improvement was detected in the biomass index and in 2005 the biomass level increased tenfold compared to 2004, estimated to be close to 24 200 t. The 2005 survey biomass and abundance estimates were, however, heavily influence by a single atypical haul that accounted for more than 50% of the total biomass. In 2006 biomass and abundance indices were estimated at 16 400 tons and 45 mill. individuals. These values are lower than in 2005 (38% and 9 %, respectively). Both biomass and abundance was concentrated in the southernmost areas, i.e. 73% of the biomass and 63% of the abundance found in NAFO Div. 1F. The year-classes 2003 dominate the survey catches accounting for 63% of the total abundance.

d) **Snow Crab**

Annual monitoring program (trap survey) was initiated in 1997 in Disko Bay (Div. 1A) and Sisimiut (Div. 1B). In 2006 surveys were conducted in May/June with the research vessel "Adolf Jensen". Large and small meshed conical traps were 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 to fecundity studies.

An annual offshore trap survey was initiated in 2001 in Div. 1C and 1D and also conducted by the research vessel "Adolf Jensen". The scientific catch was treated similar to the already existing surveys.

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.

e) **Marine mammals**

Studies of white whale and narwhal continued in 2006. Details are being reported to JCCM and NAMMCO. In 2006 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 2003, 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 2006 two Greenland vessels was engaged in shrimp fishery at Grand Bank (NAFO Div. 3L) and reported catch from 3L amounted to 414 tons. 728 tons was reported from Flemish Cap (NAFO Div. 3M).

References

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Ribergaard, M.H. and Buch, E. 2007. Oceanographic Investigations off West Greenland 2005. *NAFO Scientific Council Documents 07/01*

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Table 1. Estimated catches (tons) by Greenland vessels at West Greenland (NAFO Subarea 1) in 2004-2006.

Species	NAFO SA				
	Div. 1A, B, C, D, E, F			Div 3M	Div 3L
	Estimated catch 2004*	Estimated catch 2005*	Estimated catch 2006*	Catch 2006	Catch 2006
American Plaice	0	0	nd		
Arctic char	18	10	54		
Atlantic halibut	0,3	0	14		
Atlantic salmon	15	14	21		
Atlantic cod	4.975	6.118	7.567		
Capelin	290	71	72		
Crabs	6.295	5.360	3.482		
Greenland cod	963	1.080	1.085		
Greenland halibut	28.473	28.139	31.160		
Grenadiers	7	3	20		
Haddock	0	nd	nd		
Lumpfish	8.199	8.960	8.754		
Polar cod	3	23	2		
Redfish (unspecified - bycatch mainly)	443	400	nd		
Pelagic redfish	3.169	1.431	744		
Redfish golden	170	179	287		
Saithe	0	0	0		
Scallops	2.345	1.399	1.905		
Shark	3	1	nd		
Shrimp (P.boreallis)	121.429	131.630	126.964	728	414
Shrimp (P.montagui)	800	nd	nd		
Skate	9	nd	nd		
Wolffishes	342	248	644		
Fish not specified	663	nd	nd		
Sum total	178.611	185.066	182.775	728	414

* Catch figures from recent years are provisional.

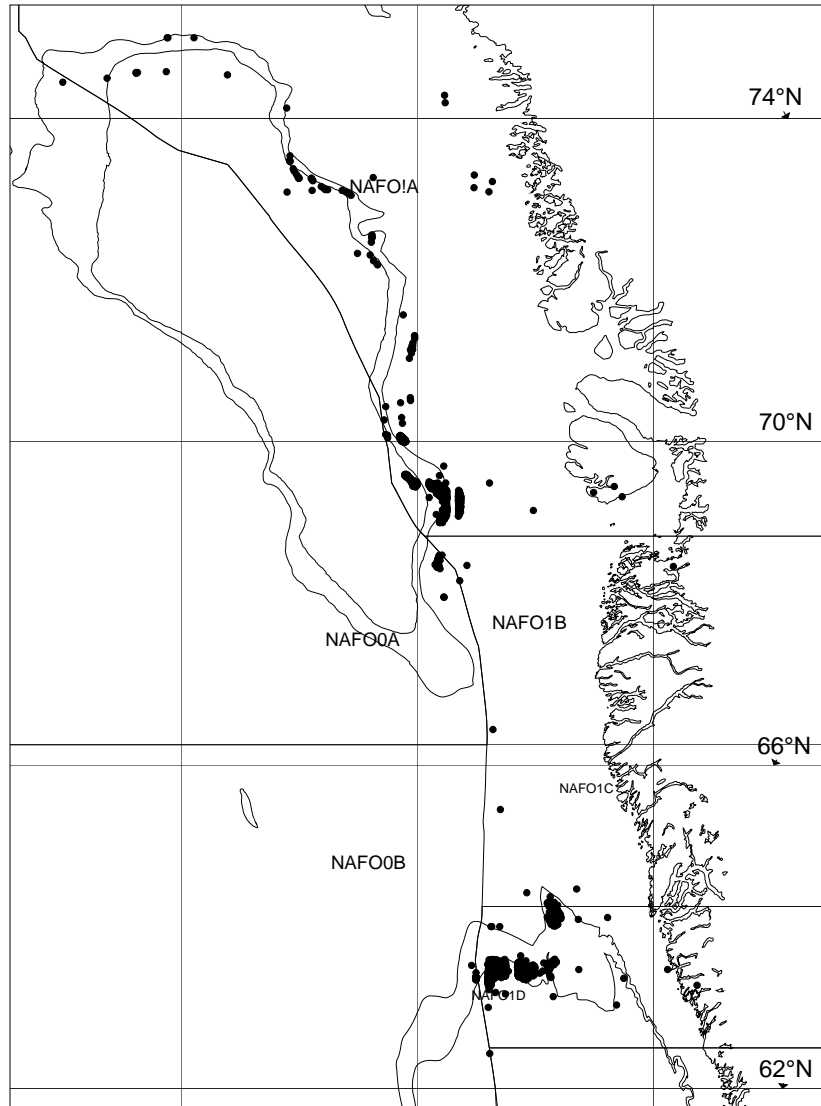


Fig. 1. Distribution of the offshore fishery for Greenland halibut in SA 1 in 2006. All nations.