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Denmark/Greenland Research Report for 2005

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This report presents information on preliminary catch statistics from the commercial Greenland fishery in 2005. Furthermore, the report gives a brief overview over the research carried out in 2005 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 2005 are presented in Table 1. Additional information on the status of the fisheries is as follows:

1. **Shrimp**
2.

The shrimp stock off West Greenland is distributed in Div. 0A and Subarea 1. The fishery is conducted by Greenland and Canada. The Greenland 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 2005, the advised TAC for the entire stock was 130 000 tons. In 2005 the Greenland authorities set a TAC for Subarea 1 of 135 000 tons, and a TAC for Div. 0A east of 60o30'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 2005 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, 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 5 743 tons in 2005. 3 361 tons were taken in Div. 1AB and, 2 132 tons were taken off shore in Div 1B-1F, mainly in Div. 1D while and 250 tons was taken inshore in Div. 1B-1F. The offshore catches were exclusively taken by trawlers (Fig. 1.).

The inshore fishery in Div. 1A was concentrated in three areas Disko Bay (12 451), Uummannaq (4 856 tons) and Upernavik (4 839 tons). A minor fishery is also conducted in northernmost part of Greenland: Thule, where 13 tons is reported in 2005, while 748 tons was taken in an unknown inshore 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 two large Greenland trawlers that have participated in the fisher in a recent years. The CPUE 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. 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.

3. Cod

The inshore cod fishery at West Greenland is since 1992 assumed to be based on self-sustained fjord populations. From 1993-1995 catches decreased dramatically from about 2 000 tons yearly to the historic low in 1998 with 326 tons. In recent years catches has increased again. Preliminary catch statistics for 2005 are estimated to close to 6.000t.

In the inshore fishery (vessels below 40 GRT) pound nets are responsible for about 50% of the inshore catch, handline, longline and set gillnets are accounting for 30%. Peak fishing time is June and July where more than 50% of the catches are taken. A commercial pound net CPUE series is available since 1992 (total catch from pound nets pr day / total number of poundnet landings pr day). The CPUE decreases from 1994 until 1998 and levels off in 1999. No data on commercial CPUE is available from 2000 to 2005.

Greenland cod stocks are assessed by ICES see the North-western Working Group (NWWG) report, April 2006 and ACFM report 2006. Management considerations from the NWWG were that "No direct fishing should take place on the stock and maximum protection of juvenile cod is required to increase the recovery potential of the stock. Given the fishing possibilities of the stock, a recovery plan urgently needs to be developed. Such multi-annual harvest plan needs to account not only the stock dynamics but also needs to incorporate the ecological interaction with the shrimp stock and its exploitation as well as temperature effects."

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 2005.

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 1SW salmon has also declined in many areas of eastern North America. Also the non-maturing 1SW 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 2005 amounted to 14 tons. Over the last couple of years, total catches in northern NAFO divisions (1A and 1B) have been higher (approximately 27% of total catch) than in previous years. Catches from the more southerly divisions 1C, 1D, 1E and 1F fluctuated around levels that have been observed in recent years. Based on the information on the landing reports, the temporal distribution of the reported landings varies annually. In 2005, catches were lower in the first weeks of the season, then increased considerably and steadily declined thereafter as the season progressed. It is difficult to interpret if the temporal distribution of reported catches represents changes in reporting practice in stock distribution or fishing effort.

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 2006 there is only a very small chance (<5%) for achieving stock conservation limits in the home waters, both in the North American and the European continents. The advice generated by ICES 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 290 tons in 2004 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. No new data for catches in 2005.

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 redfish (unspecified) taken, as by-catches in 2004 and 2005 were approximately 400 tons, however this is considered an underestimate. There was no reported catches of Golden redfish in 2004 and 2005. There is no forecast for golden and deep-sea redfish stocks 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 2006) and the assessment covers the pelagic redfish in ICES Divisions Va, Vb, and XIV and in the NAFO Div. 1F, 2H and 2J.

The pelagic fishery on *S. mentella* inWest Greenland NAFO Div. 1F started in 1999. In 2005 a total of16.260 tons has been reported from NAFO 1F. The Greenland fleet has reported a total catch of pelagic *S. mentella* of1.431 tons, mainly caught in ICES Divisions.

The structure of the pelagic and demersal stocks of deep-sea redfish (*S. mentella*) in the North Atlantic remains poorly known, but further research is currently being carried out. The stock structure of *S.mentella* has been discussed within a special working group (ICES SGSIMUR WG) in 2004. ACFM concluded to maintain the current advisory units until more information becomes available: a demersal unit on the continental shelf in ICES Divisions Va, Vb, and XIV and a pelagic unit in the Irminger Sea and adjacent areas (V, VI, XII, and XIV). This latter unit also includes pelagic redfish in the NAFO Convention Area.

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. The total catch in 2005 in SA1 was 3 tons. 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 about 14.000 tons in 2001 to approximately 6.500 tons in 2004 and 2005. During this period offshore catches for the large vessels, estimated from logbooks, decreased from 4.200 tons to less than 500 tons and catches from the small vessels have fallen from approximately 10.000 tons to 5.500 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 2001 to 2004 are given in Table 1.

9. **Scallops**

Total catches of scallops in NAFO Subarea 1 amounted to 1.399 tons in 2005, which is a decrease from 2004. A total quota for scallops was set at 2.120 tons in 2005. All catches are taken in inshore areas in Div. 1A, 1B, 1C and 1D. Catches from fishing grounds around Disko (1A) have decreased from app. 1.000 tons in the late 1990'ies to less than 10 tons in 2005. Due to the discovery of new fishing grounds, particularly near Sisimiut (1B), total catches have not been affected this decrease.

10. **Lumpfish**

Total catches of lumpfish in NAFO Subarea 1 increased from 1.200 tons in 2000 to almost 9.000 tons in 2005. 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. **Hydrographic Studies**

A survey of oceanographic stations along the West Greenland standard sections was carried out in 2005. The time series of mid-June temperatures on top of Fylla Bank (st.2) was record high 2°C above average conditions, while the salinity was slightly higher than normal. West of Fylla Bank (st.4) at intermediate depths (150–400 m) the salinities and temperatures was among the highest observed yet. The mean (400–600 m) salinity west of Fylla Bank (st.4) was 0.1 above normal and the temperature 0.4°C above normal. This indicates above normal inflow of Irminger Water in 2005 but far from the high inflow observed in 2004.

The temperature of the Polar Water was high compared to normal years, the front between Polar Water and Irminger Water was week and the multi-year-ice ("Storis") was absent, indicating a reduced inflow of Polar Water to the West Greenland area in 2005. Pure Irminger Water was observed at the Cape Farewell and Cape Desolation sections, and Modified Irminger Water could be traced north to the Fylla Bank section. The inflow of Irminger Water to West Greenland waters seems to be above normal.

2. **Biological Studies**

a) **Shrimp**

The series of annual stratified-random trawl surveys initiated in 1988 was continued in 2005. In July-August approximately 190 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. Since then an increasing trend has been observed. The 2003–2004 values were the hitherto highest of the series. The estimate for 2005

was 21–24% lower than these two, but larger than that for 2002 (by 13%) and all earlier years. The proportion of females in 2005 was above average.

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 2005 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 2005 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 2005 a total of 47 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**

The series of annual gill-net surveys initiated in 1985 with a main target group of age 2-3 cod. Between 1996 and 2000 the recruitment index was very low. The overall survey results for 2005 indicate an increase of the recruitment index in division 1B to a level that is above average (1985-2005). The recruitment index for division 1D decreased some for age group 2 and is still considered at a very low level.

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 59º15'N and 72º30'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.

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 tons. Abundance was estimated to be 45 millions individuals, which is the highest number in the time series (1992-2005), and this is mainly caused by a high abundance of age 2 cod.

d) **Snow Crab**

Annual monitoring program (trap survey) was initiated in 1997 in Disko Bay (Div. 1A) and Sisimiut (Div. 1B). In 2005 surveys were conducted in May/June with the research vessel "Adolf Jensen". 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.

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 2005. Details are being reported to JCCM and NAMMCO. Studies of minke whale, fin whale and humpback whale continued in 2005. 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 2002, 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.

g) **Acoustic/pelagic trawl survey off West Greenland for Capelin and polar cod survey**

In September/October 2005 an acoustic/pelagic trawl survey has been conducted in the offshore areas in West Greenland from 73°N to about 60° N. The survey included also some fjords. The results are based on acoustic (38 Khz and 120 KHz) data, CTD data, pelagic trawl-" groundtruthing", and sampling with a bongo net. Data were collected during E/W transects spaced at about 22 nautical miles between a distance of approximately 3 nautical miles from the coast and the 400 m isobath. Along transects two separate teams of observers identified and counted marine mammals and sea birds.

Preliminary results indicate that East Greenland Current water was present throughout the entire survey area to 73°N, while the influence of the warm Atlantic water began to decline around 67-68°N. A very strong thermo cline (3-4°C) still persisted in the northern half of the study area, while it was much less pronounced and even absent in places in the southern part of the investigated area.

Generally polar cod (*Boreogadus saida*) and amphipods (*Themisto sp.)* where found in the northernmost part of the survey area (73-70° N).

Capelin (*Mallotus villosus*) was virtually absent on the banks but present in fjords and near shore areas (between 70-60° N). The capelin biomass in these fjords and near shore areas was estimated to be between 170-200 thousand tons. A preliminary analysis of size distributions in the obtained samples indicates that most of the oldest and largest fish (next year's spawning component) as well as the 0-group were missing in the survey area during the investigated period. Capelin observed in the fjords and near shore areas was 1 and 2 years old.

Krill (mostly *Meganyctiphanes norvegica*) were found in scattered aggregations between 69° and 62° N with a slightly increased prevalence between 63° and 62° N. Juvenile cod (*Gadus morhua*) (0-group), occasionally mixed with 0-group redfish (*Sebastes sp.*), occurred in fairly high densities between the Narsalik and Nanortalik banks (61°-60°N).

GREENLAND FISHERY IN OTHER NAFO SUBAREAS

A. Status of the fisheries

In 2005 one Greenland vessels was engaged in shrimp fishery at Grand Bank (NAFO Div. 3L) and reported catch from 3L amounted to 282 tons. 7 tons was reported from Flemish Cap (NAFO Div. 3M).

References

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Table 1. Estimated catches (tons) by Greenland vessels at West Greenland (NAFO Subarea 1) in 2002-2005.

	Div. 1A, B, C, D, E, F				Div 3M	Div 3L
Species	Estimated catch 2002*	Estimated catch 2003*	Estimated catch 2004*	Estimated catch 2005*	Catch 2005	Catch 2005
American Plaice	0	0	0	0		
Arctic char	20	0	18	nd		
Atlantic halibut	1	0	0,3	0		
Atlantic salmon	9	9	15	14		
Atlantic cod	3.698	5.215	4.975	6.118		
Capelin	43	41	290	nd		
Crabs	10.271	6.642	6.367	6.500		
Greenland cod	939	1.288	963	1.080		
Greenland halibut	23.814	26.636	28.473	28.637		
Grenadiers	21	37	7	3		
Haddoc	0	0	0	nd		
Lumpfish	5.872	8.832	8.199	8.960		
Polar cod	38	4	3	nd		
Redfish (unspecified - bycatch maily)	422	312	443	400		
Redfish beaked (pelagic redfish)	124	1.561	60	0		
Redfish golden	65	166	0	0		
Saithe	0	0	0	nd		
Scallops	2.459	2.528	2.345	1.399		
Shark	*nd*	0	3	nd		
Shrimp (P.boreallis)	125.894	135.465	131.849	134.000	7	282
Shrimp (P.montagui)	206	924	800	nd		
Skate	nd	12	9	nd		
Wolffishes	118	393	334	300		

Fish not specified	584	475	663	nd		
Sum total	174.598	190.540	185.816	189.429	7	282

* Catch figures from recent years are provisional.

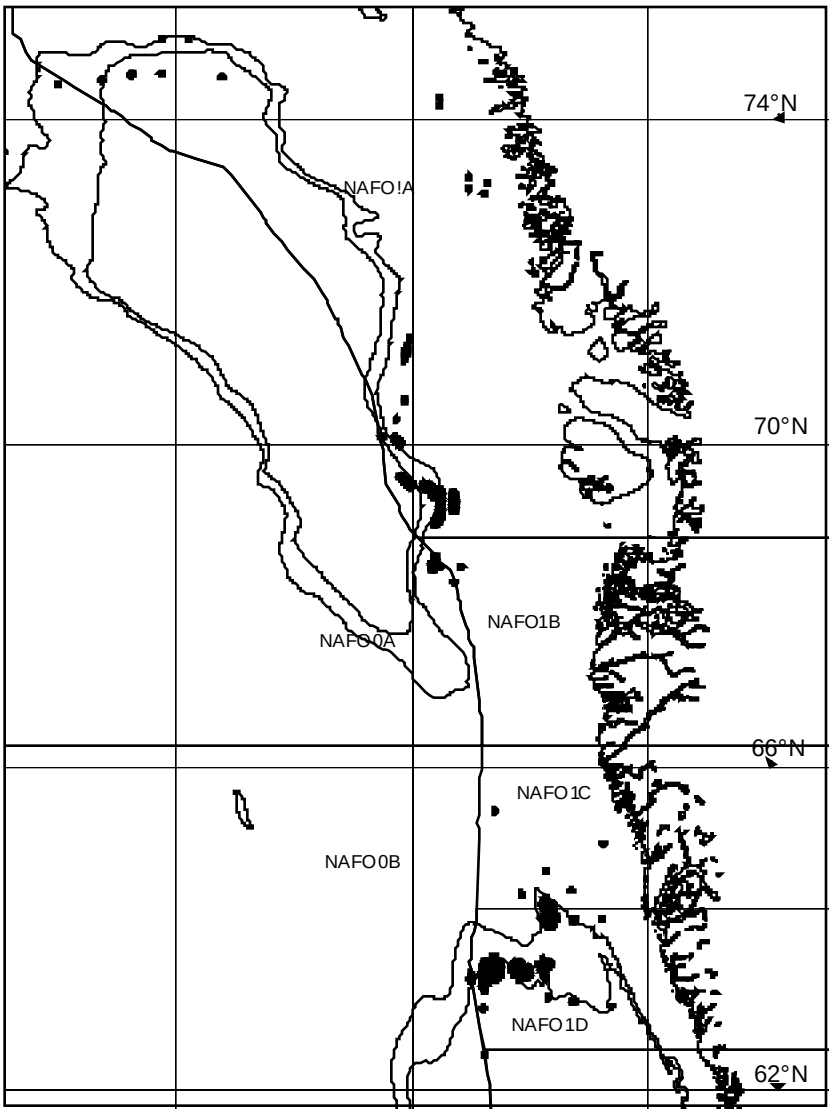

Fig. 1. Distribution of the offshore fishery for Greenland halibut in SA 1 in 2005.