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Denmark/Greenland Research Report for 2004

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This report presents information on preliminary catch statistics from the commercial Greenland fishery in 2004. Furthermore, the report gives a brief overview over the research carried out in 2004 by the Greenland Institute of Natural Resources.

**WEST GREENLAND (NAFO SUBAREA 1)**

**A. Status of the fisheries**

Provisional statistics for the fisheries from 2001 to 2004 are presented in Table 1. Additional information on the status of the fisheries is as follows:

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 2004, the advised TAC for the entire stock was 130 000 tons. In 2004 the Greenland authorities set a TAC for Subarea 1 of 135 000 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

Until 2003 catches of shrimp taken in SA 1 have been reported without accounting for "overpacking" – the amount of surplus weight in packaging – or the difference between the product weight and live weight. Advised and actual TACs have been set in the same units as used within the reporting practice. January 1st 2004 new legislation should be enforced to ensure that total removals by fishing are reported in units of live weight. To allow management advice derived from the stock assessment to be stated in the units of the future catch reporting, a correction of the input catch data series was performed (Hvingel, 2003)

Overall annual catch has increased from about 10 000 tons in the early 1970s to more than 105 000 tons in 1992. Restrictions by the Greenlandic authorities to reduce effort, and fishing opportunities elsewhere for the Canadian fleet resulted in catches decreasing to about 80 000 tons in 1998. Since then overall catches have increased. The projected catch of 2004 is expected to be around 141 000 tons based on data through October 2004.

In 2002 a quantitative assessment framework (Hvingel and Kingsley, 2002) based on a biological model of shrimp stock dynamics was adopted by STACFIS and Scientific Council. Short-term (1-year) and medium-term (ten-year) projections of stock development are made for five levels of annual catch: 110, 120, 130, 140 and 150 thousand tons under the assumption that the cod stock remain at its current low level. The associated risk of transgressing the reference parameters maximum sustainable yield level of biomass ( $B_{MSY}$ ) and mortality ( $Z_{MSY}$ ) are estimated. The stock is evaluated as being in good condition, and supportive of the current level of exploitation (Anon., 2004).

## 2. Greenland halibut

The total catches of Greenland halibut by Greenland vessels in NAFO Subarea 1 (excluding Div. 1A inshore) amounted to 5 720 tons in 2004. 3 555 tons were taken in Div. 1AB and, 2 077 tons were taken off shore mainly in Div. 1D and 88 tons was taken inshore in Div. 1B-1F. The catches were almost exclusively taken by trawlers, but a gillnetter also participated in the fishery (Fig. 1.).

The inshore fishery in Div. 1A was concentrated in three areas Disko Bay (12 857), Uummannaq (5 241 tons) and Upernavik (4 573 tons). A minor fishery is also conducted in northernmost part of Greenland: Thule, where 13 tons is reported in 2004. 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 the three Greenland trawlers. The CPUE for the two trawlers that have participated in the fishery in recent years increased from 0.87 ton/hr in 2003 to 0.95 ton/hr 2004 in Div. 1A and from 0.71 ton/hr to 0.78 ton/hr in Div. 1CD, respectively. The third trawler was new in the fishery and had lower catch rates than the other two.

Length frequency data were available from the trawl fishery.

## 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 2004 are estimated to close to 5 000 tons where the two northern NAFO Divisions (1A and 1B) are accounting for approximately 40% of the total inshore landings.

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 2004. In 2005 logbooks are implemented in the inshore fishery and information will be available from 2006.

Greenland cod stocks are assessed by ICES, see the North-western Working Group (NWWG) report, April 2005 and ACFM report 2005. Management considerations from the NWWG was "There is strong evidence for a significant increase in the cod stock abundance in medium term, not only from a single strong recruiting year-class but also from increased growth rates and earlier maturation probably enhanced by continued favorable environmental conditions. 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."

## 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 homewaters in Europe or North America as MSW fish if they survive. The abundance of non-maturing 1SW salmon has declined steadily during the recent 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 2004.

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 (486 000 fish).

In West Greenland total nominal catches in 2004 amounted to 15 tons. The geographical distribution of the reported catches differed from all recent years with catches in NAFO Div. 1A and 1B approximately 27% of the catch and less than 15% of the landings reported from NAFO Div. 1F. In the last few years approximately 50% of the catch was in NAFO Div 1F. Based on the information on the landing reports, the temporal distribution of the catches differed from recent years. In 2004, catch was distributed relatively evenly across the weeks, perhaps even increasing in weeks 44 and 45. In the last few years, reported catches decreased during the season.

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. 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 minor chance for achieving stock conservation limits in the home waters, both in the North American and the European continents.

## 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.

## 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 were 443 tons, however this is considered an underestimate. There was no reported catches of Golden redfish in 2004. There are 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 2005) 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* in West Greenland NAFO Div. 1F started in 1999. In 2004 a total of 19.847 tons has been reported from NAFO 1F, of these Greenland fleet only accounted for 60 tons. The Greenland fleet has reported a total catch of pelagic *S. mentella* of 3.169 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 2004 in SA1 was 7 tons. No forecast – the biological advice is “no direct fishery”.

## 8. Snow Crab

The fishery after snow crab is distributed in NAFO Div. 1A, 1B, 1C, 1D and 1E and total catch by Greenland vessel in entire Subarea 1, decreased from about 14 000 tons in 2001 to 7.179 tons in 2003. Offshore catches estimated from logbooks amounted 2 887 tons in 2003 was 26% reduction of the 2002 catch level. In 2003 inshore catches, estimated by landings statistics, was reduced with 33% to 4 302 tons in the same period. Effort in offshore areas is four double from 1999 to 2002, while efforts figure is unknown from inshore areas, due to the lack of logbooks information from 1999 to 2002. Preliminary catch figures for 2001 to 2003 are given in Table 1. Only preliminary data are available for 2004, but catches is expected to be at the same level as the 2003 level.

## 9. Scallops

Total catches of scallops in NAFO Subarea 1 amounted to 2 345 tons in 2004, which is a small decrease from 2003. A total quota for scallops was set at 2 320 tons in 2004. 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 1990s to around 100 tons in 2004. 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 8 800 tons in 2003. Catches decrease slightly in 2004 to 8 100 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. Hydrographic Studies

A survey of oceanographic stations along the West Greenland standard sections was carried out in 2004. The time series of mid-June temperatures on top of Fylla Bank was about 1.5°C above average conditions, while the salinity was slightly higher than normal. The mean (400-600 m) salinity west of Fylla Bank (st. 4) was record high and the temperature 0.9°C above normal. This indicates high inflow of Irminger Water. The temperature of the Polar Water was high compared to normal years and the front between Polar Water and Irminger Water week indicating a reduced inflow of Polar Water to the West Greenland area in 2004. Pure Irminger Water was observed from Cape Desolation to the Fylla Bank section, and Modified Irminger Water could be traced as far north as the Maniitsoq (Sukkertoppen) section. The inflow of Irminger Water to West Greenland waters seems to be high.

### 2. Biological Studies

#### a) Shrimp

The series of annual stratified-random trawl surveys initiated in 1988 was continued in 2004. In July-August 187 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.

During the period of stratified random surveys in the offshore areas of shrimp distribution, biomass estimates have been relatively stable until 1998 fluctuating around 250 thousand tons, apart from somewhat lower values in 1991, 1995 and 1997. Since 1998 a significant increase is observed, and the 2003 and 2004 values are the highest of the time series. The index of total abundance of shrimp in 2004 is down by 20% compared to the previous year, but still one of the highest values of the series. The proportion of females in 2004 was above the average of the values recorded.

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 1997-2004 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 2004 there were made 51 successful hauls in Div. 1CD (Fig. 2) and 62 hauls in Div. 1A (Fig. 3).

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 2004 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 2004 a total of 52 gillnet settings were made along 4 transect. 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. Survey results from 2002 and 2003 show an increased recruitment index for Div. 1B, which was the first sign of recovery since the 1993 year-class. However, in 2004 a decrease was observed in the same area. In the more southern division (NAFO 1D) an increase was observed for the age groups 2 and 3. No juvenile cod survey was conducted in 2001 due to technical problems.

Since 1988, Greenland Institute of Natural Resources has annually conducted a bottom trawl survey off West Greenland. The main purpose of the survey is to evaluate the biomass and abundance of Northern shrimp (*Pandalus borealis*), but data on most fish species have been recorded. The biomass-indices for cod were estimated to 4 000-9 000 tons in 1988-1990. In 1992 the biomass decreased with more than 95% to only 250 tons and 653 000 individuals and remained at this low level until recent years. The 2004 survey indicates some improvement in the abundance of age 1 cod. Abundance indices in 2004 were estimated to 6.5 million individuals and biomass to 2400 tons, which is the highest estimate in the Greenland ground fish survey. Compared to the German survey, which has been conducted since 1982, total cod abundance in 2004 is still less than 5% of the record high abundance in 1987. However, as age group 1, cod abundance in West Greenland water in 2004 is estimated to be 63% of the last large year-class (the 1984 year-class) estimated as age 1 in 1985. Indicating that a new large year-class could enter the offshore water in West Greenland.

d) **Snow Crab**

Annual monitoring program (trap survey) was initiated in 1997 in Disko Bay (Div. 1A) and Sisimiut (Div. 1B). In 2003 survey were conducted in May/June with the research vessel "*Adolf Jensen*". On the survey baited traps with large and small mesh are used. All snow crab were enumerated by sex, carapace width, chela height, abdomen width, carapace condition and development stages were determined. Females were sampled in relation fecundity studies.

An annual offshore trap survey was initiated in 2001 in Div. 1D and 1E conducted by the research vessel "*Paamiut*". The scientific catch was treated similar to the inshore survey.

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 2004. Details are being reported to JCCM and NAMMCO. Studies of minke whale, fin whale and humpback whale continued in 2003. 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.

### **GREENLAND FISHERY IN OTHER NAFO SUBAREAS**

A. **Status of the fisheries**

In 2004 one Greenland vessels was engaged in shrimp fishery at Grand Bank (NAFO Div. 3L) and reported catch from 3L amounted to 294 tons.

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- HVINGEL, C., and M. C. S. KINGSLEY, 2002. A framework for the development of management advice on a shrimp stock using a Bayesian approach. *NAFO SCR Doc.*, No. 158, Serial No. N4787.

**Table 1.** Estimated catches (tons) by Greenland vessels at West Greenland (NAFO Subarea 1) in 2001-2004.

Species	NAFO SA					
	Div. 1A, B, C, D, E, F				Div 3M	Div 3L
	Estimated catch 2001*	Estimated catch 2002*	Estimated catch 2003*	Estimated catch 2004*	Catch 2004	Catch 2004
American Plaice	4	0	0	0		
Arctic char	20	20	0	18		
Atlantic halibut	1	1	0	0,3		
Atlantic salmon	43	9	9	15		
Atlantic cod	1.680	3.698	5.215	4.948		
Capelin	13	43	41	290		
Crabs	14.247	10.271	6.642	6.367		
Greenland cod	1.152	939	1.288	963		
Greenland halibut	19.111	23.814	26.636	28.473		
Grenadiers	22	21	37	7		
Haddock	0	0	0	460		
Lumpfish	3.216	5.872	8.832	8.199		
Polar cod	11	38	4	3		
Redfish (unspecified - bycatch mainly)	305	422	312	443		
Redfish beaked (pelagic redfish)	124	124	1.561	60		
Redfish golden	27	65	166	0		
Saithe	0	0	0	356		
Scallops	1.593	2.459	2.528	2.345		
Shark	<i>nd</i>	<i>nd</i>	0	3		
Shrimp ( <i>P. boreallis</i> )	99.156	125.894	135.465	131.849	0	294
Shrimp ( <i>P. montagui</i> )	609	206	924	800		
Skate	<i>nd</i>	<i>nd</i>	12	9		
Wolfishes	75	118	393	334		
Fish not specified	589	584	475	663		
Sum total	141.998	174.598	190.540	186.605		294

\* Catch figures from recent years are provisional.

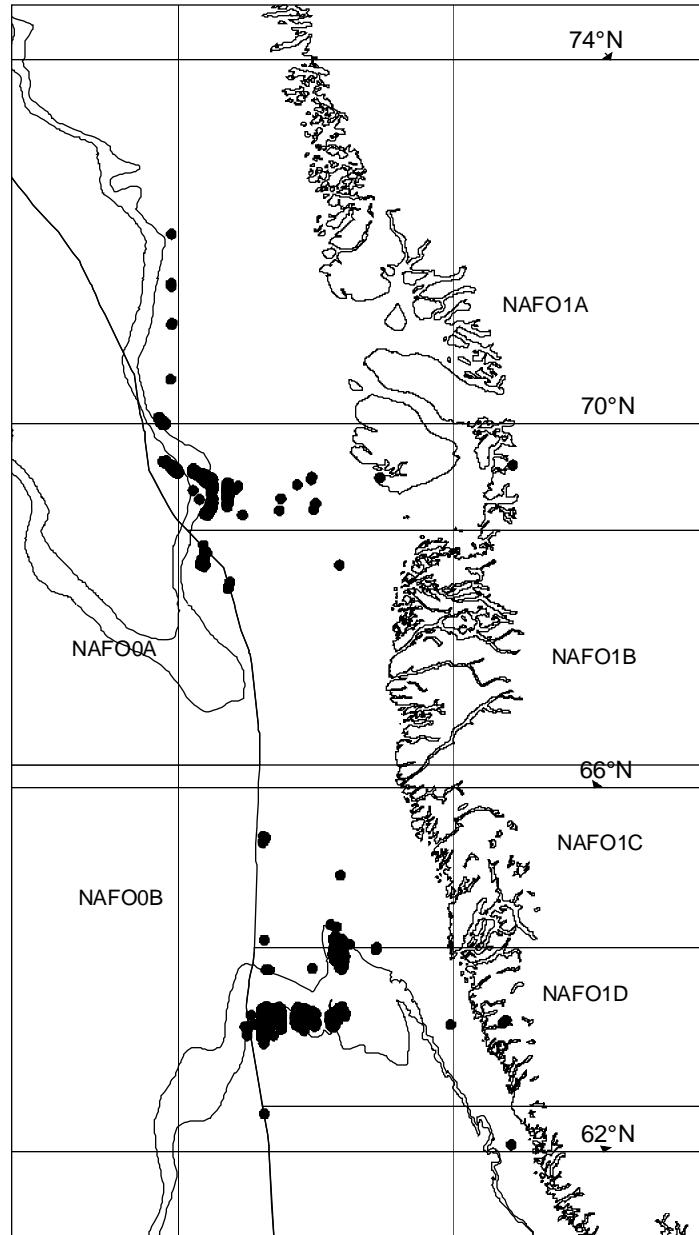


Fig. 1. Distribution of the offshore fishery for Greenland halibut in SA 1 in 2004.

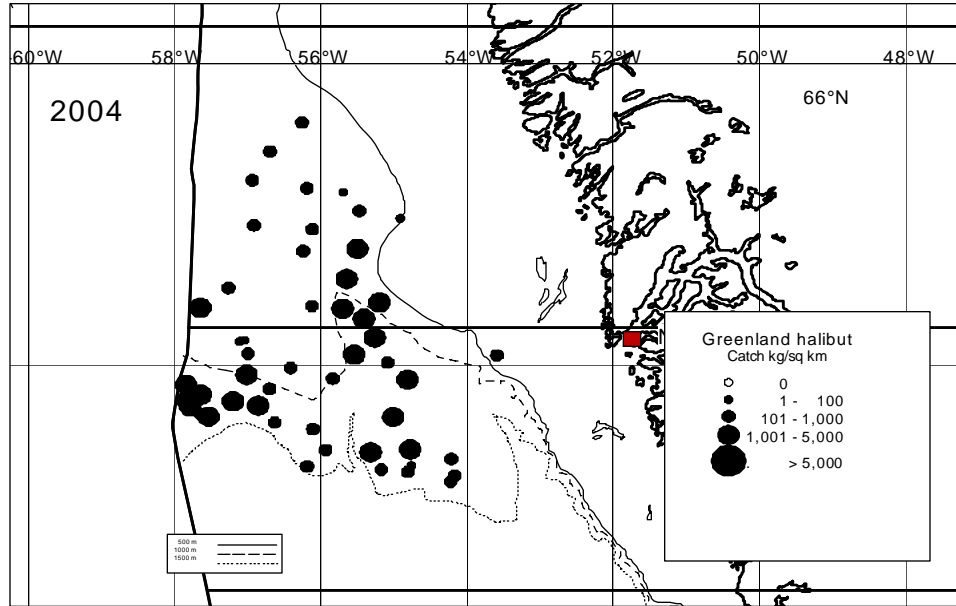


Fig. 2. Distribution of stations and catch of Greenland halibut in the Greenland deep-sea survey in Div. 1CD in 2004.

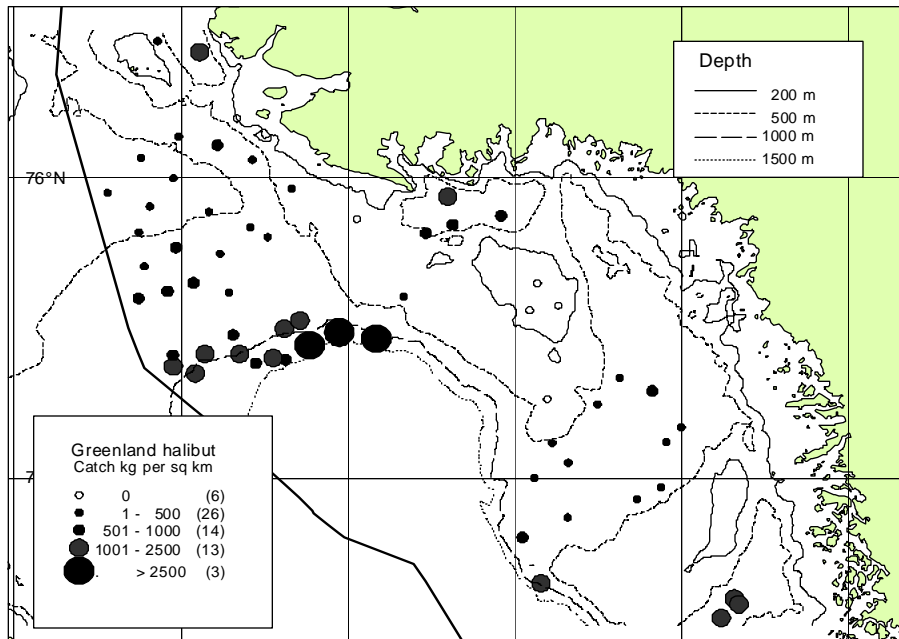


Fig. 3. Catches of Greenland halibut in a bottom trawl survey in Baffin Bay in 2004.