Northwest Atlantic Fisheries Organization

Serial No. N5665 **NAFO SCR Doc. 09/30**

SCIENTIFIC COUNCIL MEETING – JUNE 2009

Assessment of the Greenland Halibut Stock Component in NAFO Subarea 0 + Division 1A Offshore + Divisions 1B-1F

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Abstract

The paper presents the background and the input parameters from research surveys and the commercial fishery to the assessment of the Greenland halibut stock component in NAFO Subarea 0 + Div. 1A offshore + Div. 1B-1F. Catches peaked at 18,000 tons in 1992 but have been stable around 10,000 tons during 1993-2000. Catches increased to 13,775 tons in 2001 and further to 18,725 tons in 2003 primarily due to increases in catches in Div. 0A and 1A. Catches have remained at that level in 2004 and 2005. Catches increased to 24,112 tons due to increased effort in 0A and 1AB and remained at that level in 2008 (22,380 tons). Survey trawlable biomass in Div. 1CD increased between 2003 and 2005 to 80,800 tons but decreased to 74,357 tons in 2007 to increase again to 83,465 tons in 2008, the highest in the time series. The biomass in the off shore area in the Greenland shrimp survey has been above average in recent years. A survey in Div. 0A estimated a biomass on 77,182 tons which is at he level seen in previous years survey. The recruitment of age one has been above average in resent years, but decreased in 2008 to a level below average. Length distributions in the commercial fishery have been stable in recent years. Standardized CPUE indices from Div. 0A+1AB has been stable since 2001. The combined standardized CPUE series from Div. 0B+1CD has been stable between 1990 and 2004 but has been increasing since then and was in 2008 the highest seen since 1989.

1. TAC, description of the fishery and nominal catches.

TAC

Between 1979 and 1994 a TAC was set at 25,000 tons for SA 0+1, including Div. 1A inshore. In 1994 it was decided to make separate assessments for the inshore area in Div. 1A and for SA 0 + Div. 1A offshore + Div.1B-1F. From 1995-2001 the advised TAC for the latter area was 11,000 tons. In 2000 there was set an additional TAC of 4,000 tons for Div. 0A+1AB for 2001. This TAC was in 2002 increased to 8,000 tons for 2003. Total advised TAC for 2004 and 2005 remained at 19,000 tons. In 2006 the advised TAC in Div. 0A+1AB was increased with further 5,000 tons to 13,000 tons. Total advised TAC remained at that level. - 24,000 tons - in 2008.

Catches in SA 0 + Div. 1A offshore + Div.1B-1F

During the period 1982-1989 nominal catches of Greenland halibut in SA 0 + Div. 1A offshore + Div.1B-1F fluctuated between 300 and 4,500 tons. Catches increased from 3,046 tons in 1989 to 10,537 tons in 1990. Catches stayed at that level in 1991 but increased again in 1992 to 18,457 tons. During 1993-2000 catches have fluctuated between 8,198 and 11,164 tons. Catches increased to 13,775 tons in 2001 and further to 19,716 tons in 2005. In 2006 catches increased to 24,155, remained at that level in 2007 but decreased slightly to 22,380 tons in 2008. (Fig. 1).

The increase in catches from 1989 to 1990 was due to a new trawl fishery by Canada and Norway and increased effort by Russia and Faeroe Islands in Div. 0B, while the increase from 1991 to 1992 was caused by a further increase in effort by Russia in Div. 0B and an increase in fishing activity in SA 1. The increase in catches between 2000 and 2003 and from 2005 to 2006 was primarily due to an in increase in effort in Div. 0A and Div. 1A. The distribution of catches between Div. 0A and Div. AB and Div. 0B and Div.1C-F has been stable in recent years.

Catches in SA 0

In 1983 annual catches in SA 0 were about 4,500 tons. Catches then dropped to a level of 1,000 tons or lower, where they remained until they increased from 907 tons in 1989 to 9,498 tons in 1990. Catches decreased in 1991 to 8,606 tons, to increase again in 1992 to 12,788 tons. Catches then decreased gradually to 3,183 tons in 1995 and fluctuated between 3,924 and 5,438 tons between 1996 and 2000. Until 2000 almost all catches in SA 0 were taken in Div. 0B. In 2001 a commercial fishery started in Div. 0A. Catches in SA 0 increased to 8,107 tons in 2001 and further to 9,201 tons in 2003 and stayed at that level in 2004 and 2005. Catches increased to 12,167 in 2006 but decreased slightly to 11,489 tons in 2007 and further to 10,800 tons in 2008 (Table 1).

The increase in catches seen since 2000 was mainly due to an increased effort in Div. 0A where catches increased from a level of about 300 ton, where they have been since 1996 (trial fishery not officially reported), to 3,073 tons in 2001 and further to 4,142 tons in 2003. Catches stayed at that level in 2004 and 2005. In 2006 catches increased to 6,634 tons due to increased effort, but decreased to 6,173 tons in 2007 and further to 5,093 tons in 2008.

The catches in Div. 0A in 2008 were taken by trawl (1,701 tons) and twin trawl (1,269 tons), while 2,124 tons was taken by gill net. The single trawl catches were more than doubled while the twin trawl catches were halved compared to 2006 and 2007. The gill net catches were reduced by approximately 600 tons compared to 2007. The long lines fishery in the area has apparently stopped. The fishery was prosecuted by Canadian vessels.

Catches in Div. 0B 2008 amounted to 5,706 tons which is at the level seen in recent years. Offshore gillnetters took 1,150 tons while single- and double trawlers took 1,780 tons and 2,848 tons, respectively. The small longline fishery in the area has apparently stopped in 2008. All catches were taken by Canadian vessels.

Catches in SA1

The catches in Subarea 1 (Div. offshore 1A + Div. 1B-1F) were below 2,500 tons during 1982-1991. In 1992 catches increased to 5,669, decreased to 3,870 tons in 1993 to increase again in 1994 to the 1992 level. During 1995-1999 catches were around 5,000 tons. Catches increased to 5,726 tons in 2000, stayed at that level in 2001 and increased further to 9,524 tons in 2003 and stayed at this level in 2004 and 2005. Catches increased to 11,945 tons in 2006 due to increased effort by Greenland in Div. 1AB. and stayed at that level in 2007 and 2008 (11,580 tons). Almost all catches have been taken offshore (Table 2). The inshore catches in 2008 in Div. 1B-1F amounted to 51 tons.

Catches in Div. 1AB (mainly in Div. 1A) increased gradually from 575 tons in 2001 to 3,963 tons in 2003 and stayed at that level in 2004-2005. Catches increased again in 2006 to 6,223 and stayed at that level during 2007-2008 (6,249 tons in 2008). All catches were taken off shore by trawlers from Faeroe Islands, Russia (SCS 09/12) and Greenland (SCS 09/17).

Catches in Div 1CD have been stable around 5,600 tons in recent years and was 5,361 tons in 2008. Catches were taken by vessels from Greenland (SCS 09/17), Norway, EU-Germany (SCS 09/11), Russia (SCS 09/12) and Faeroe Islands. Almost all catches offshore were taken by trawl except about 19 tons taken by a longliner. 51 tons were taken inshore in Div. 1B-1F, mainly by gill net.

2. Input data

2.1 Research trawl survey

Div. 1C-1D GHL-survey

Since 1997 Greenland has conducted stratified random bottom trawl surveys in September-October for Greenland halibut in NAFO Div. 1C-D at depth between 400 and 1500 m. In 2008 a total 70 hauls were made (SCR 09/16). The biomass and abundance of Greenland halibut in Div. 1C-D increased from 74 357 tons and $67.427*10^6$ individuals in 2007 to 83 465 tons and $72.004*10^6$ individuals in 2008 (Fig. 2ab). The increase in biomass was seen in all strata in Div. 1C and the shallow strata in Div. 1D, while biomass and abundance decreased slightly in stratum 1200-1400 m and 1400-1500 m in Div. 1D. The mean catch per km^2 swept increased from 1.48 tons in 2007 to 1.60 in 2008, which is the highest in the time series (Fig. 2c). The abundance has been rather stable since 2002 but showed a slight increase between 2007 and 2008 and is above average for the time series. The highest densities were found at 1000-1200 m in Div. 1C and 800-1400 m in Div. 1D. The overall length distribution in Div. 1CD was dominated by a mode at 47-49 cm.

Canadian deep sea survey in Baffin Bay (Div. 0A)

Canada has conducted surveys in the southern part of Div. 0A in 1999, 2001, 2004, 2006 and 2008. The biomass has increased gradually from 68,700 tons via 81,000 tons to 86, 200 tons in 2004. The biomass decreased to 52,271 tons in 2006 (Fig. 2d). However, the survey coverage was not complete and two of the four strata missed fell within the depths 1001-1500 m and accounted for 11,000 – 13,000 tons of biomass in previous surveys. Therefore, the 2006 estimates are considered to be lower than the most recent surveys but comparable to the estimate from 1999. Biomass and abundance were in 2008 estimated to be 77182 tons (S.E. 8465) and 1.16×10^8 (S.E. 1.1×10^7), respectively. Mean biomass per tow was 1.67 t/ km^2, higher than in 2006 and 1999 but lower than was observed in 2001 and 2004. Mean abundance per tow was 2598 per km^2, an increase over estimates in 2004 and 2006 but lower than was observed in 1999 and 2001. The overall length distribution ranged from 6 cm to 99 cm with a relatively flat top on the distribution (the mode stretched between 33 cm and 39 cm) and is most similar to that seen in 2006 and 1999. (SCR 09/26).

Greenland shrimp-survey

Since 1988 annual trawl surveys with a shrimp trawl have been conducted off West Greenland in July-September. The survey covers the area between 59°N and 72°30'N (Div. 1A-1F), from the 3-mile limit to the 600-m depth contour line. The survey area was restratified in 2004 based on better information about depths and all biomass and abundance indices have been recalculated. The recalculation did not change the trends in the development of the different stocks.

Estimated total trawlable biomass of Greenland halibut in the offshore areas (not including Disko Bay) has fluctuated between 9,258 and 31,100 tons during 1992 – 2007. In 2008 the biomass was estimated as 20,519 tons which is a minor increase compared to 18,882 tons in 2007 and above average for the time series which dates back to 1992. The abundance was estimated at 311 mill. which is at the level generally seen since 1999. The abundance decreased in Div. 1BN, the traditional nursery area, while it increased in Div. 1AN. As in almost all years most of the abundance was comprised of one-year-old fish (SCR 09/20).

In the inshore Disko Bay the biomass was estimated at 9,140 tons, which is the lowest level seen since 2002 and is well below the level seen during 2003-2006. The abundance was estimated as $50*10^6$ which is only 1/3 of the level in 2007 and the lowest estimate seen since 1998.

The biomass in the nursery area (1AS and 1B) was estimated at 10,236 tons compared to 12,522 in 2007. The abundance was estimated at 161 mill compared to 200 mill. in 2007.

Recruitment

A recruitment index was provided from the Greenland shrimp trawl survey. By means of the Petersen-method ages 1, 2 and 3+ were separated in the survey catches. The number of one-year-old fish in the total survey area including Disko Bay increased gradually from 1996 to a peak of 500 million in 2001. The number of one-year old fish estimated in 2008 was 251 mill which is a decrease compared to 337 mill. in 2007. The decline is caused by the

decline in abundance in inshore Disko Bay (Fig. 3).

Further, a recruitment index was provided from the off shore nursery area in Div. 1AS-1B. Catches were standardized as catch in number per hour as described in Bech (1995). Data were plotted by year classes to visualize the relative year class strength and development in relative abundance (Fig. 4). In recent years the allocation of stations in the shrimp trawl survey has been changed in order to minimize the variance in the estimation of biomass and abundance of shrimp. To minimize the effect of that the CPUE index has been recalculated using stations > 300 m only. This generally increases the mean number per tow but do not the trend in the index.

The recruitment index declined since the relatively large 1991 year-class, but the recruitment has been above the level in the 1980'. The recruitment increased again with the 1995-year class, which was the largest on record. The 1996 year-class seemed to be small but the recruitment has increased gradually until the 2000 year-class. Since then the recruitment has been around or a little above average. The recruitment of the 2007 year-class was estimated as 412 age-one caught per hour, some what below the average for the time series (559). In 2008 the abundance doubled in Div. 1AN and about half the abundance in the off shore area was found in this area. The abundance is mainly composed by 1 year old fish and these fish are not included in the recruitment index that only includes the traditional nursery area (1AS-1B). The off shore recruitment is hence probably underestimated (SCR 09/20).

In Disko Bay the recruitment has been good in recent years although the recruitment of year classes 2002-2005 has been gradually decreasing. The recruitment increased again in 2007 and the 2006 year class was the third largest on record. In 2008, the recruitment of the 2007 yea class was the lowest seen since 1993.

Generally there is a steep decline between CPUE at age 1 and age 2 and 3+ which also was observed in the 2008 survey. Further, it has been noted, that the year-classes estimated to be a very strong year-class at age 1 have not shown up in as a particularly strong year-classes at age 5-8 in the fishery catches or in the 1CD survey for Greenland halibut.

In order to get better information about age groups 2-5 (app. 20-42cm), and hence better information about the recruitment to the fishery, a number of fixed stations at depths > 600 m in Div. 1AB have been fished annually since 2006. In 2008 in total 1190 Greenland halibut were caught at 9 stations with depths between 662 and 898 m. The length ranged between 12 and 98 cm with a dominance of fish between 21 and 45 cm. Unfortunately there has been no aging of Greenland halibut from the Greenland surveys in 2008, but this corresponds probably to the ages 3-5, the ages which generally speaking are missing in the shrimp survey and the survey for Greenland halibut in Div. 1CD. The length distributions don't, however, show any clear trends in recruitment

SSB/Recruitment

The relation between the spawning stock in numbers (age 10+) in Div. 1CD, estimated from the joint Japan/Greenland survey and the Greenland halibut survey and recruitment, given as the number of fish age 1 in the total survey area, estimated from the Greenland shrimp trawl survey, is shown in Fig. 5. The over all recruitment of the 2007 year-class was the second lowest seen since the mid 90'. The decline in recruitment is caused by a decline in recruitment in inshore Disko Bay. Note that there was no survey in 1996.

2.2 Biological information

Maturity information for Greenland halibut from the NAFO Subarea 0 is updated with information from surveys conducted in 2006 and 2008 and trends re-examined with emphasis on Div. 0A. L_{50} estimates for Div. 0A Greenland halibut for the two most recent years (2006 and 2008) were slightly less than that from previous years (1999 and 2004). Most estimates for Div. 0A were higher than for Div. 0B for both males and females. The most recent data show that very few fish collected in the surveys are mature (the vast majority being immature for both sexes), results that are consistent with previous information available on maturity in Div. 0A.

2.3 Commercial fishery data.

Length distribution

SA 0

Length distributions were available from the gill net, single trawl and twin trawl fishery in Div.0A and 0B.

The catch in the gill net fishery in Div. 0A was dominated by a mode at 63 cm, similar to that seen in previous years. The length distributions in the single and twin trawl fishery were very similar with modes around 48 cm (Fig. 6a) as seen in previous years.

The length distribution from the gill net fishery in Div. 0B showed a mode at 65 cm. The mode has been around the mid 60' s in recent years. The length distributions in the single and twin trawl fishery were very similar with modes around 48-50 cm, for both types of gear, as seen in recent years (Fig. 6b).

SA1

Length frequencies were available from Greenland and Russian trawl fisheries in Div. 1A (SCR 09/13), from Greenland fisheries in Div. 1C, and from EU, Greenland, Russian (SCS 09/12) and Norwegian trawl fisheries in Div. 1D.

In Div. 1A the Russian catch composition showed a mode at 50 cm, but with more small fish than in Div. 1D. The mode was at 44-46 cm in the Greenland fishery. In recent years the trawl catches have been dominated by fish on 48-52 cm (Fig 7). The sex ratio in the Russian fishery was 1.2:1 males to females. Most of the fish were immature.

In Div. 1D the catches by Russia, Norway, EU-Germany and Greenland showed clear modes around 49-50 cm (Fig. a). The mode in catches has been within this range for several years. The sex ratio in the Russian catches was 1.8:1 males to females. 78.3% and 31.2% of the females were found in an early stage of maturing (SCR 09/13).

Age distribution

Catch at age was available from the Russian trawl fishery in Div. 1A and 1D based on a combined Div. 1A+1D key, with the majority of the samples from Div.1D. Age readings were based on scales. In Div. 1A ages 5-7 were dominating as in previous years (Fig. 9), while ages 8-9 were dominating in Div. 1D where thee also were more old fish in the catches compared to Div. 1A (Fig. 10). In recent year age 7 use to be dominating in the trawl fishery in Div. 1D (SCR 09/13).

No catch-at-age information was available from SA0, and the catch-at-age and mean-weight-at-age, in Table 3 and 4, respectively, has not been updated.

Catch rate

The fleets used for standardization of catch rates are grouped according to NAFO's protocol (Appendix 1-6):

Code for country.

2	CAN-MQ	Canada Maritimes & Quebec
3	CAN-N	Canada Newfoundland
5	FRO	Faroe Islands
6	GRL	Denmark Greenland
7	E/DNK	Denmark Mainland
8	E/FRA-M	France Mainland
9	FRA-SP	France St. Pierre et Miquelon
10	E/DEU	Federal Republic of Germany
14	JPN	Japan

15	NOR	Norway
16	E/POL	Poland
18	ROM	Romania
19	E/ESP	Spain
20	SUN	Union Soviet Socialist Republics
27	CAN-M	Canada Maritimes
28	CAN-Q	Canada Quebec
31	E/LVA	Latvia
32	E/EST	Estonia
33	E/LTU	Lithuania
34	RUS	Russia
38	EU	European Union
39	CAN	Canada
40	CAN-CA	Canada Central & Arctic

All vessels fishing in SA1 have been given the code 6 (Greenland).

Code for Trawl Gear:
Bottom otter trawl (charters),8,OTB*
Bottom otter trawl (side or stern not specified),10,OTB
Bottom otter trawl,12,OTB-2
Otter twin trawl,192,OTT

Code forTonnage:

0	Not known
2	0-49.9
3	50-149.9
4	150-499.9
5	500-999.9
6	1000-1999.9
7	2000 and over

Ex. Code 401927 is 40: Canada Central & Arctic, 192: Otter twin trawl, 7: Over 2000 Gross Tonnage

Div. 0A
The General Linear Model used to standardize trawl catch rates for Div. 0B was applied to data from Div. 0A in 2008. Vessel/gear classes with fewer than 5 occurrences in the database were removed as were records where catches (t) and hours fished were less than 10. The standardized CPUE index declined slightly in 2007 but increased again (Fig. 12a. This increase could also be seen in the un-standardized catch rates for both single and twin trawl gears (Fig. 11a). Trawl gear catch rates have been relatively stable over the past 8 years (Fig. 12a) (Appendix 1).

Div. 0B
There have been frequent vessel changes in this fishery over the years and the catch from single and double trawl gear was often aggregated as “otter trawl” catch when this gear was first introduced to the fishery in the early 2000s. Very few of the vessels operating in the fishery in 2008 have been in the fishery for more than 3 years. A standardized catch rate is produced using a General Linear Model. The model was updated in 2008; two vessel/gear classes were removed due to fewer than 5 occurrences in the database while one vessel/gear class was added due to the introduction of two Class 5 vessels to the fishery in 2006. Also, catches (t) and hours fished with values less than 10 were removed. The overall CPUE index increased to the highest observed level in 2008 (Fig. 12c). The increase was seen for both single and twin trawlers (Fig. 11b). The standardized catch rates for the past 4 years are higher than those seen in the early 2000s and have returned to levels observed in the early-mid 1990s (Fig. 12c). (Appendix 4).

SA1

Un-standardized catch rates were available for the Greenland trawl fishery in Div. 1A and 1D (SCS 09/17), and the EU-German fishery in Div. 1D (SCS 09/11). Further, catch rates were available from logbooks submitted to the Greenland authorities. Standardized catch rates were available from the trawl fishery in Div. 1AB and 1CD. Previously the fleets in the catch rate analysis have been grouped by nation, but information about gross tonnage is now available in the Greenland logbook database and the fleets are grouped based on size and gear according to NAFO's protocol. This has not changed the trends in the CPUE series but the SE and CV of the estimates have been reduced significantly. In the GLM model catches (t) and hours fished with values less than 10 are removed.

Div 1AB

Un-standardized catch rates from large (>2000 GT) trawlers in Div 1A have been relatively stable between 2001 and 2008 around 0.95 ton/hr. Catch rates decreased slightly for single trawlers while they increased slightly for twin trawlers between 2007 and 2008. CPUE for trawlers 1000-2000 Gross Tons single trawlers has been increasing since 2006 and is now slightly below the average for the time series (Fig.11c).

Standardized catch rate series, based on logbook data from the Greenland authorities, were available for the offshore trawl fishery in Div. 1AB for the period 2002-2008. Standardized catch rates in Div. 1AB has been declining in the last two years and was in 2008 at the level seen in 2006, but generally the catch rates have been rather constant (Fig. 12a, Appendix 2).

Div. 1CD

In Div. the EU-German catch rate increased from 691 ton/hr in 2007 to 830 ton/hr in 2008, which is the highest in the time series, that dates back to 1996. The un-standardized catch rates for all fleets (grouped by Gross Tonnage) increased between 2007 and 2008 and are now among the highest in the time series. The high catch rates for > 2000 GT single trawlers in 1988 and 1989 is from a single large vessel (4000 GT) and the decrease in catch rates in 2007 for large > 2000 GT twin trawlers was caused by a significant decrease in catch rates from one out of two vessel. Further, the estimate for > 2000 GT single trawlers in 2007 is based on one vessel new in the fishery (Fig.11d).

Standardized catch rate series, based on logbook data from the Greenland authorities, were available for the offshore trawl fishery in Div. 1CD for the period 1988-2008 (Fig.12b). Standardized catch rates in Div. 1CD decreased gradually from 1989-1997 but have shown an increasing trend since then and the catch rates also increased slightly between 2007 and 2008 (Appendix 5).

Standardized catch rates based on individual vessels show almost the same trend, but with the highest observed CPUE in 2008.

Combined Div. 0A-1AB

The combined Div. 0A+1AB) standardized CPUE series increased slightly between 2007 and 2008, but has been stable since 2001 (Fig. 12a) (Appendix 3).

Combined Div. 0B-1CD

The combined (Div. 0B+1CD) standardized CPUE series has been stable in the period 1990-2001, decreased somewhat in 2002 but has increased again since then, and was in 2006 at the highest level seen since 1989. CPUE decreased very slightly in 2007, but increased significantly in 2008 to the highest level seen since 1989 (The high catch rates seen in 1988 and 1989 is from a single very large trawler fishing in Div. 1CD) (Fig. 12d) (Appendix 6).

It is not known how the technical development of fishing gear, etc. has influenced the catch rates. There are indications that the coding of gear type in the log books is not always reliable, which also can influence the estimation of the catch rates. Further, due to the frequency of fleet changes in the fishery in both SA0 and SA1 and change in fishing grounds in Div. 0A and 1A, both the un-standardized and the standardized indices of CPUE should, however, be interpreted with caution.

3. **Assessment**

3.1 Yield per Recruit Analysis.

The level of total mortality has in 1994-1996 been estimated by means of catch-curves using data from the offshore longline fishery in Div. 1D. Z was estimated from regression on ages 15-21. A relative F-at-age was derived from the catch curve analysis, where the trawl, longline and gillnet catches were weighed and scaled to the estimated stock composition. In all three years STACFIS considered that the estimation of Z was based on too limited samples and represented too small a part of the fishery and that the outcome of the catch curve analysis was too uncertain to be used in the yield per recruit analysis. No age frequencies were available from the longline fishery in Div. 1D in 2008 fishery, and the catches only represented < 1 % of the total catches in the assessment area, hence no catch-curve analysis were made.

3.2 XSA.

Extended Survivors Analysis
An XSA has been run unsuccessfully several times during the 1990'ies, using a survey series covering 1987-1995 as tuning. STAFIS considered the XSA's unsuitable for an analytic assessment due to high log-catchability residuals and S.E.'s and systematic shift in the residuals by year. Further, a retrospective plot of F_{bar} showed poor convergence. In 1999 the XSA analyses was rerun including the latest two years surveys (1997-1998, new vessel and gear) but the outcome of the analysis did not improve.

An XSA analysis was run using the stock data for SA 0+1, calibrated with trawl survey data (age 5-15) from the Greenland deep sea surveys (1997-2001) in Div. 1CD. The assessment results are considered to be provisional due to problems with the catch-at-age data and the short time series, the assessment is, however, considered to reflect the dynamics in the stock. The rate of exploitation has been relative stable in recent years between 0.2-0.3 (F_{bar} 7-13). The input parameters to the analysis and the outcome of the analysis is given in (SCR 02/68)

The XSA was run again in 2003 with the 2002 survey and catch data and updated catch data from 2001 (very small changes). The assessment results are considered to be provisional due to problems with the catch-at-age data and the short time series. The assessment is, however, considered to some extend to reflect the dynamics in the stock. The rate of exploitation has been relatively stable in recent years between 0.2-0.3 (F_{bar} 7-13). The summary of the XSA is given in SCR (03/54).

The XSA was not run this year as no catch-at-age data were available for 2003-2008.

3.3 Spawning stock/recruitment relations.

A spawning stock/recruitment plot based on the available observations from the joint Japan/Greenland survey and the Greenland survey is shown in Fig.5. No further analysis of spawning stock recruitment relationships have been made due to few observations distributed on two different surveys, poor estimate of spawning stock biomass (survey trawls only take a very small proportion of the mature fish, poor estimates of ages of old fish, the survey covers only a restricted part of the area covered by the assessment, and knife edge maturity ogive was applied). Further, the age of the recruits is poorly estimated (the Petersen method).

3.4 ASPIC

ASPIC was run in 1999 with standardized CPUE data and a biomass index as inputs. Three CPUE series were available, one series covering Div. 0B during the period 1990-1998, one covering Div. 1CD during the period 1987-1998 and a series combining the two data sets. The biomass index was from 1CD and covered the period 1987-1995 and 1997-1998. Several runs showed that the combined CPUE series from Div. 0B+1CD fitted the total catch data best in terms of r^2 and "total objective function". Runs with biomass alone gave relatively bad fits in terms of "total objective function" and r^2 and the modeled population trajectory declining drastically over the period. Runs with the

CPUE series from 0B gave unrealisticly high B_{msy} and negative r^2. The run with the combined CPUE series showed, however, that sensitivity analysis should be run, because "the B1-ratio constraint term contributed to loss". Several runs with different realistic values for the constraint did not solve the problem. Further, the coverage index and nearness index was equal in all runs. Several runs with different constraints on r and MSY were tried but it did not change the outcome of the analysis. Removing the three first years from the input data gave negative r^2. To get measures of variance the run with the combined CPUE series was bootstrapped (500 re-samplings).

The results showed that estimated fishing mortalities 1987-1998 have been less than the (bias-reduced) estimate of F_{msy} (0.22) except for one year (1992). A number of essential parameters are quite imprecisely estimated (r, q, F_{msy}), and it is considered that the estimates of MSY and F_{msy} were not precise enough to be used.

The input parameters from 2000-2006 (catches, survey biomass index, and CPUE index) have varied little compared to 1999. An ASPIC was run in 2009, but the outcome of the analysis did not change significantly from the analysis in 1999, mainly because there is very little contrast in the input data.

3. 5. Estimation of relative F.

The present TAC for Div. 0B + Div 1C-F is 11 000 tons. Since 1992, catches have been around 5 500 tons in Div. 1CD and catches reached that level in Div. 0B in 2000. Survey results show that the distribution of biomass between Div. 0B and Div. 1CD is about 50:50. A relative F (F_r) (catch/survey biomass) estimated for Div. 1CD can therefore be used as a proxy for (F_r) for the whole of Div. 0B + Div. 1C-F, there being very little biomass or fishery in Div. 1EF

The mean F_r in Div. 1CD for 1992-2007 was 1.34 (STD 0.42, min 1.01 max 2.67) in relation to F_r in 2008. F_r was in 2008 the lowest seen since 1991. An increase in TAC of 10%, 25% and 50%, respectively will lead to an increase in F_r relative to F_r in 2008 to 1.13, 1.28 and 1.54, respectively, under the assumption that the biomass is evenly distributed between Div. 0B and Div. 1CD and that the biomass remains at the same level as in 2008 and the higher TAC is completely taken. The input to estimation of F_r is in Appendix 7.

F_r relative to Fr in 2008 with different TAC and F_r in percent in the mean of F_r 1992-2007 (1.34) in Div. 1CD.

	TAC	F_r	F_r relative to mean 1992-2007
Current	11 000	1	74.6%
10%	12 100	1.13	84.4%
25%	13 750	1.28	95.9%
50%	16 500	1.54	115.0%

4. Conclusion

Since catches peaked with 18,000 tons in 1992 they have been stable at around 10,000 tons until 2000. Since then catches have gradually increased to 19,954 tons in 2003 and they stayed at that level during 2004-2005. The TAC was increased by 5,000 tons in 2006 and catches increased to 24,155 and the TAC has hence been taken. The increase in catches has been due to increased effort in Div. 0A and Div. 1A. Catches stayed at that level in 2007, - 23,416 tons. But decreased slightly to 22,380 tons in 2008.

The biomass index in Div. 0A has been stable during 1999-2008. The standardized CPUE series for Div. 0A and Div.1AB has been stable since 2001. Length frequencies in the fishery has been stable in recent years

The biomass in Div. 1CD increased between 2003 and 2005, but decreased slightly during 2006-2007 but increased to a record high level in 2008. The biomass index has shown an increasing trend since 2000.

The biomass in the Greenland shrimp survey has been decreasing since 2004, but the decrease is mainly seen in inshore

Disko Bay. The biomass in the offshore area has been stable and above average both in the off shore area for the period 1992-2005.

The recruitment of age-one in the entire survey area decreased to the lowest level seen since 1997, but the decline in recruitment was mainly seen in Disko Bay. A recruitment index for the off shore nursery areas showed that the 2007 year class was a little below average, but the recruitment is probably underestimated.

Length compositions in the commercial catches have been stable in recent years.

A standardized CPUE series from Div. 0B has been increasing since 2002 and was the highest on record in 2008. In Div 1CD standardized catch rates have been increasing since 1997 and the CPUE also increased between 2007 and 2008 and is now the highest seen since 1989. The combined catch rate for Div. 1CD+0B has showed very little variation during the period 1988-2004, but with an increasing trend since the and the 2008 estimate is the highest seen since 1989.

5. Biological reference points

Yield per recruit analysis or other age-based methods are not available, for estimating biological reference points. Biomass indices and CPUE series are relatively short and show little variability and are not useful for estimating reference points.

6. References

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Table 1. Greenland halibut catches (metric tons) by year and country for Subarea 0 (Split on Div. 0A and 0B) from 1987 to 2005. Minor (300 ton or less) catches from Div. 0A are included in some of the 0B catches prior to 2001.

	Year																				
Count.	87	88	89	90	91	92	93	94	95	96	97	98	99	00[e]	01[c]	02[d]	03[f]	04	05	06	07	08
0A																						
CAN															2628	3561	4142	3751	4209	6634	6173	5093
POL															445							
0B																						
CAN		2		589	256	2624	592	402	1889	2354	3868	3924	4267	5438	5034	3910	5059	5771	5789	5533	5316	5706
EST							631															
FRO	388	963	596	2252	2401	463	1038			578	452											
JAP				113	232	337	252	600	1031	500												
LAV							84															
NOR			282	5016[b]	3959		373															
RUS		59	29	1528	1758	9364	4229[a]	3674	261	854												
TOT	388	1024	907	9498	8606	12788	7199	4676	3181	4286	4320	3924	4257	5438	8107	7471	9201	9522	9998	12167	11489	10800

[a] The Russian catch is reported as area unknown, but has previously been reported from 0B
[b] Double reported as 10031 tons
[c] Excluding 445 tons double reported, and 2 tons reported by error
[d] Excluding 782 tons reported by error
[e] STACFIS estimate
[f] excluding 2 tons reported by error

Table 2. Greenland halibut catches (metric tons) by year and country for Subarea 1 (Split on Div. 1AB and Div. 1CD) from 1987 to 2008. The Greenland catches are excl. inshore catches in Div. 1A. Offshore catches in Div. 1A prior to 2001 are negligible.

Coun.	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
1AB																						
GRL															340[c]	1619[c]	3558[c]	3500[c]	3363[bc]	5530[bc]	5596[bc]	5524[bc]
RUS															85	279	259	241	549	565	575	570
FRO														96	150	150	146[b]	153	125	128	125	125[b]
NOR																						
EU																	73[e]	141[e]				
1CD																						
GRL	1646	605	841		933	191	186	872	1399	1876	2312	2295	2529[a]	2657[b]	2022	2284	2059	2102	2380[b]	2430[b]	1805[b]	1480[b]
FRO				54	123	151	128	780			127	125	116	147	155	150	135	150	149	147	150	150[b]
JPN	856	1576	1300	985	673	2895	1161	820	323													
NOR					611	2432	2344	3119	2472	1785	1893	1338	1360	1590	1550	1734	1423	1364	1456[b]	1379[b]	1441[b]	1452[b]
RUS							5		296	254		543	552	792	829	654	1328	1214	1147	1222	689	763
EU							46	266	527	455	446	350	330	444[b]	537[b]	536	543[d]	665[f]	549	544	1516	1516
Total	2502	2181	2141	1039	2340	5669	3870	5857	5017	4370	4778	4651	4887	5726	5668	7406	9524	9530	9718	11945	11897	11580

[a] Excluding 7603 tons reported by error
[b] Reported to the Greenland authorities
[c] Offshore catches
[d] Including 2 tons taken in an experimental fishery
[e] Spanish research fishery
[f] Includes 131 tons taken in Spanish research fishery
[g] Excludes 1366 tons reported from Div. 1A by error

Table 3. Catch-at-age in numbers. Not updated for 2003 - 2008.

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
AGE																
5	2	1	1	4	20	53	241	254	152	151	41	71	262	415	69	570
6	31	29	36	87	318	678	651	862	522	530	311	372	1092	1106	978	1975
7	182	190	244	592	1742	2967	2422	2472	1628	1818	1556	677	1759	1677	3212	4252
8	296	354	409	1711	2679	4311	2356	1692	940	1575	2110	1187	1174	1144	1802	1791
9	193	245	212	1356	1418	2604	1048	954	558	660	1042	900	672	772	1154	617
10	77	115	75	711	533	951	590	294	259	306	438	572	375	501	776	476
11	40	80	47	359	221	398	224	183	228	160	232	422	234	443	503	347
12	18	61	48	195	144	231	130	159	188	127	118	205	184	291	273	149
13	10	58	44	189	108	158	72	125	104	64	96	153	172	178	101	209
14	9	46	42	115	60	85	59	58	80	57	21	98	95	68	50	75
15	6	35	26	67	36	45	37	55	85	39	13	19	61	75	21	168
16	3	15	12	17	6	23	26	34	41	36	12	4	37	17	10	74
17	4	4	1	3	2	1	4	10	18	13	0	0	18	4	5	23
+gp	2	1	0	0	0	0	2	7	10	22	0	0	7	6	3	49
TOT	873	1234	1197	5406	7287	12505	7862	7159	4813	5558	5994	4688	6166	6717	8957	10917
TONS	1295	2605	2207	10540	10982	18070	11423	10144	8270	8982	9101	8693	9691	10689	13184	15136

Table 4. Catch weights at age (kg) Not updated for 2003-2008.

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
AGE																
5	0.29	0.29	0.29	0.33	0.34	0.33	0.58	0.43	0.49	0.52	0.36	0.50	0.54	0.53	0.48	0.48
6	0.51	0.51	0.51	0.54	0.54	0.56	0.72	0.62	0.66	0.69	0.55	0.74	0.70	0.72	0.67	0.70
7	0.74	0.74	0.74	0.79	0.79	0.80	0.96	0.91	0.94	0.94	0.86	1.00	0.98	1.00	0.91	0.96
8	1.08	1.08	1.08	1.10	1.12	1.13	1.26	1.26	1.34	1.38	1.27	1.24	1.28	1.29	1.30	1.30
9	1.41	1.42	1.42	1.52	1.57	1.59	1.80	1.72	1.81	1.91	1.83	1.54	1.66	1.71	1.76	1.85
10	1.97	2.05	2.00	2.11	2.27	2.28	1.43	2.19	2.37	2.48	2.38	2.22	2.25	2.26	2.29	2.20
11	2.58	2.80	2.68	2.94	3.22	3.02	3.25	2.73	2.89	3.18	3.01	3.08	2.74	2.84	2.91	2.82
12	3.52	3.88	3.73	3.90	4.24	4.02	4.10	3.43	3.62	4.04	3.84	3.84	3.68	3.59	3.51	3.32
13	4.64	5.01	4.87	4.96	5.50	5.33	5.26	4.48	4.44	5.05	4.93	4.74	4.73	4.23	4.31	3.93
14	5.79	6.16	6.20	6.26	6.82	6.76	6.17	5.75	5.61	5.95	5.69	6.04	5.58	5.19	5.60	5.20
15	6.61	7.44	7.65	7.96	8.33	7.76	7.42	6.58	6.65	7.34	6.79	6.60	6.68	5.85	6.09	5.38
16	7.99	8.88	9.36	9.90	9.89	8.58	8.04	7.36	7.77	8.64	8.00	13.45	7.75	7.32	7.08	7.02
17	9.56	9.86	9.56	11.86	9.56	11.95	9.24	9.42	10.19	9.18			9.08	5.60	8.94	8.61
+gp		11.33					10.25	11.15	11.00	11.10			11.10	9.00	11.22	10.97

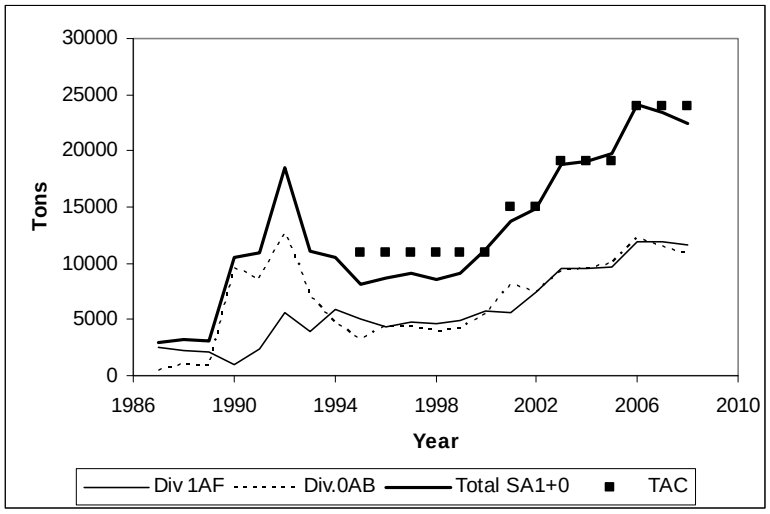


Fig. 1. Catches in SA0 and Div. 1A offshore + Div. 1B-1F and recommended TAC. For TAC before 1995 see text.

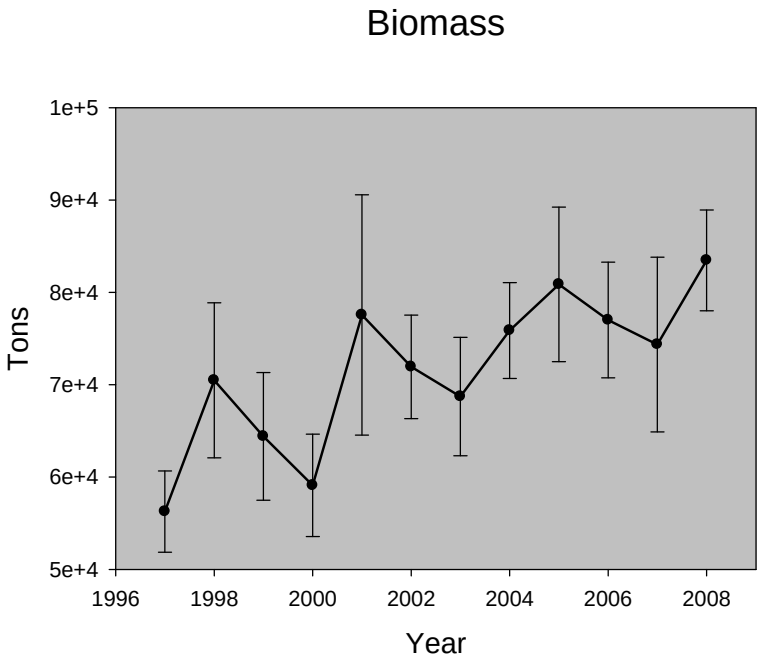


Fig 2a. Biomass with S.E. from the Greenland deep sea survey in Div. 1CD.

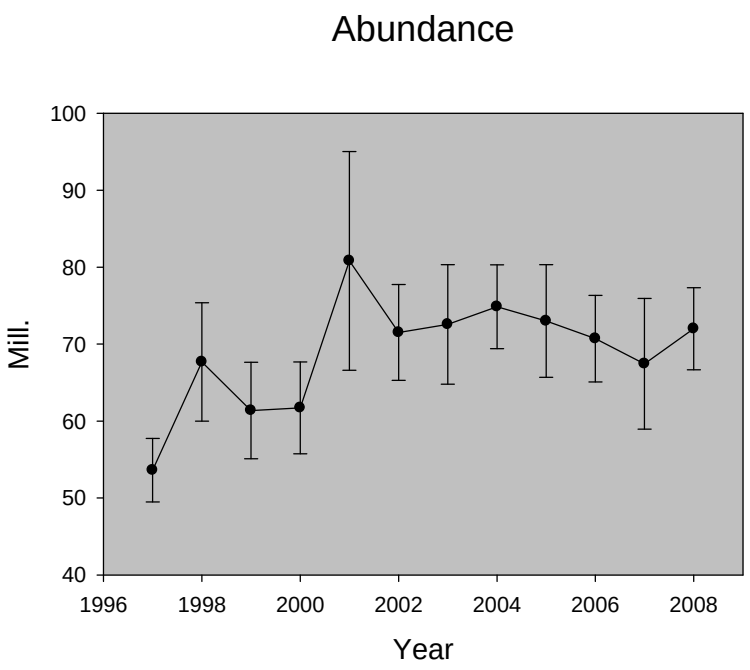


Fig 2b. Abundance with S.E. from the Greenland deep sea survey in 1CD.

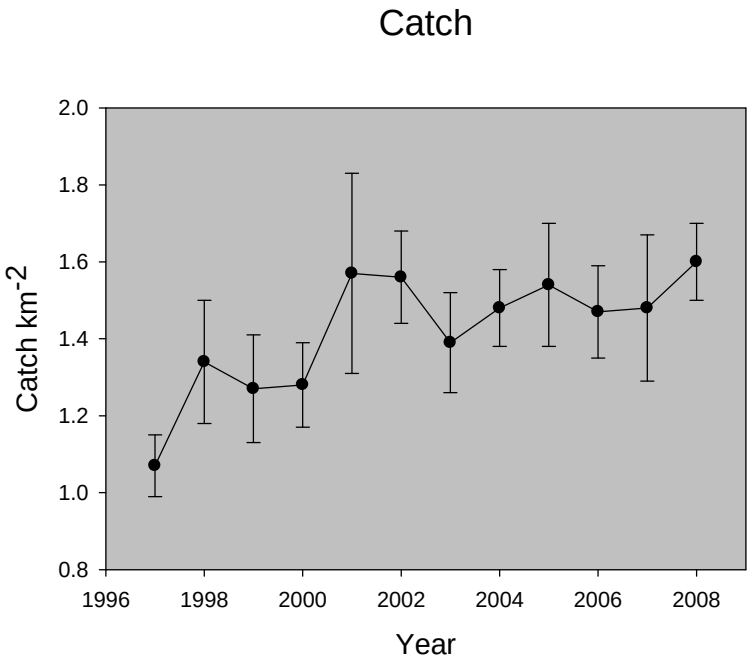


Fig 2c. Mean catch per km^2 swept with S.E. in the Greenland deep sea survey in Div. 1CD.

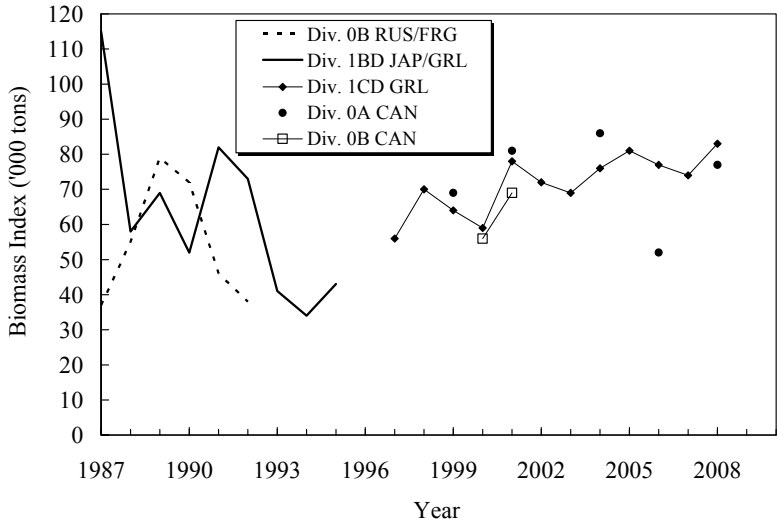


Fig. 2d. Biomass estimates from various surveys in SA 0 and 1. Note that the survey in Div. 0A in 2006 had incomplete coverage (see text).

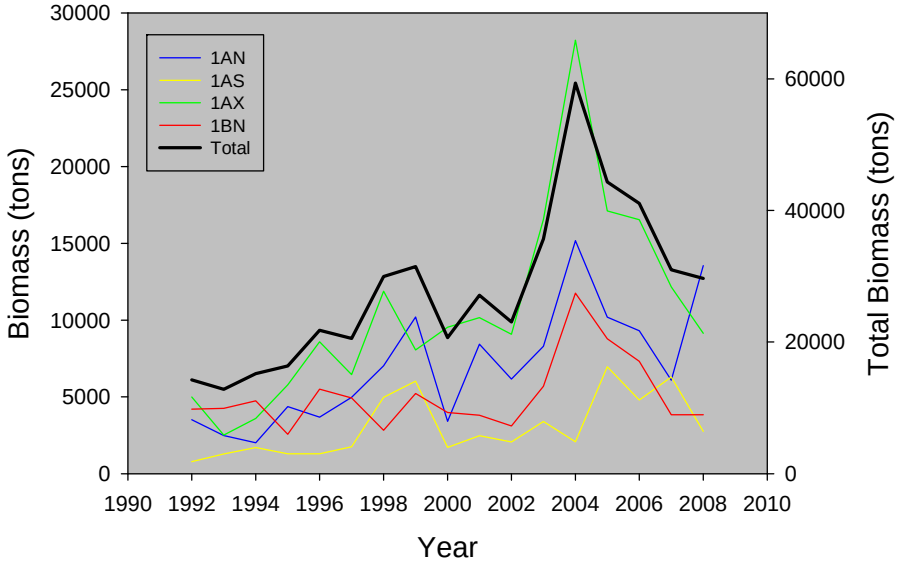


Fig. 2e. Biomass estimates from the Greenland shrimp survey by most important Divisions and in total. Div. 1AX is inshore Disko Bay.

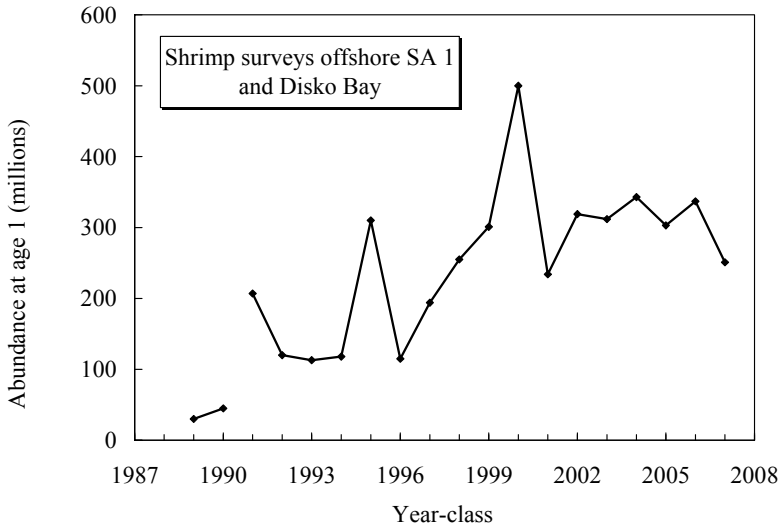


Fig.3. Abundance of age-one Greenland halibut in the entire area covered by the Greenland shrimp survey including inshore Disko Bay and Div. 1AN (North of 70°N)

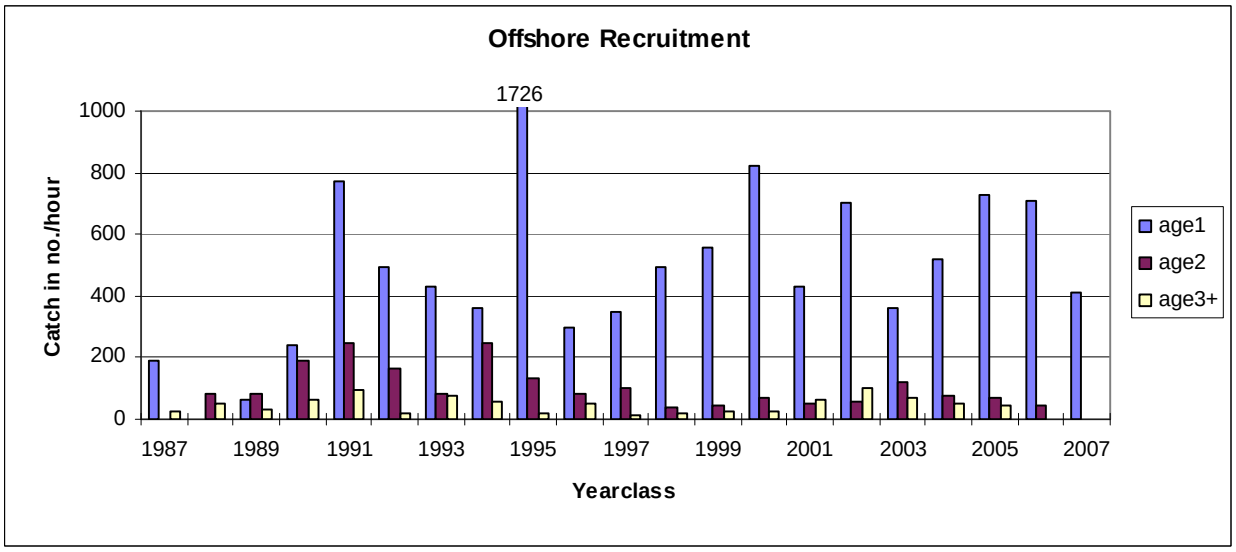


Fig. 4. Year-class strength of Greenland halibut of ages 1-3+ in number per hour trawled in the offshore nursery area (Div 1AS-1B, depths 300-600 m).

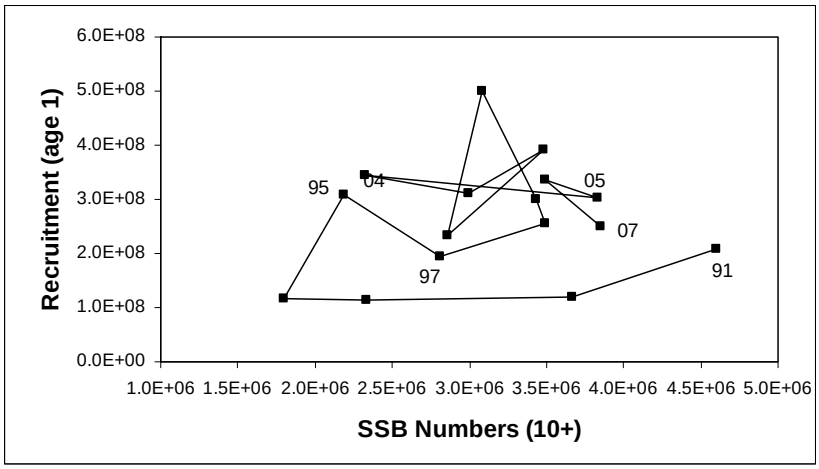


Fig. 5. Spawning stock in numbers (ages 10+ in Div.1CD from the joint Japan/Greenland survey and the Greenland survey (1997-2007) plotted vs. number of fish age 1 the following year estimated from the Greenland shrimp trawl survey including the Disko Bay. Figures denote year class. Note there was no deep sea survey in 1996.

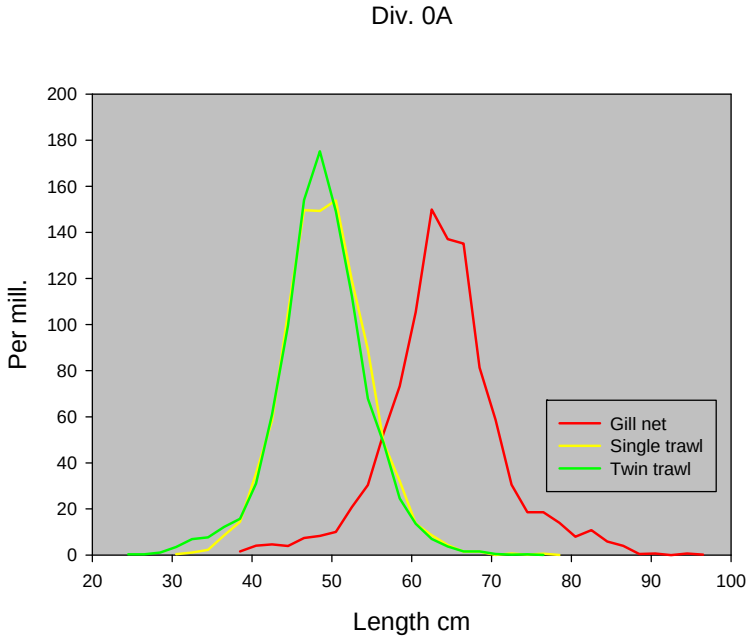


Fig.6a. Length distribution from the fishery in Div 0A in 2008 in per mill ., 2 cm groups

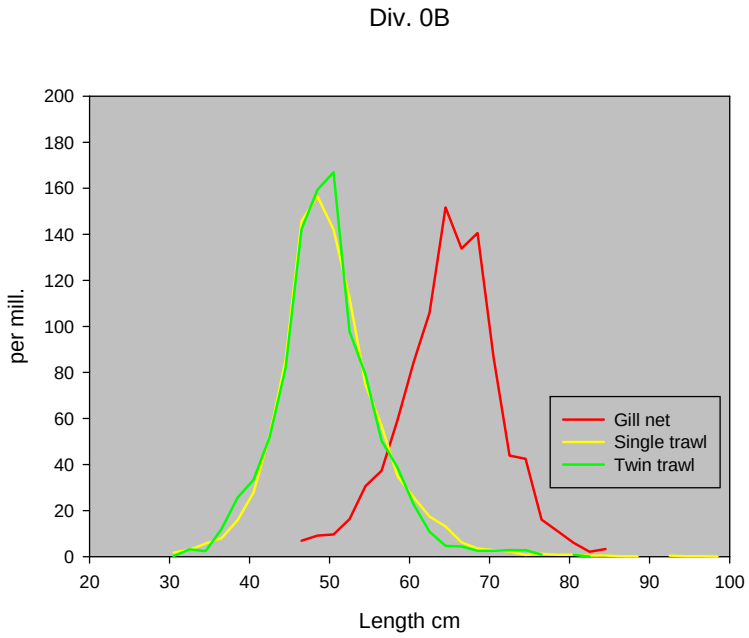


Fig.6b. Length distribution by gear from the fishery in Div 0B 2008 in per mill ., 2 cm groups

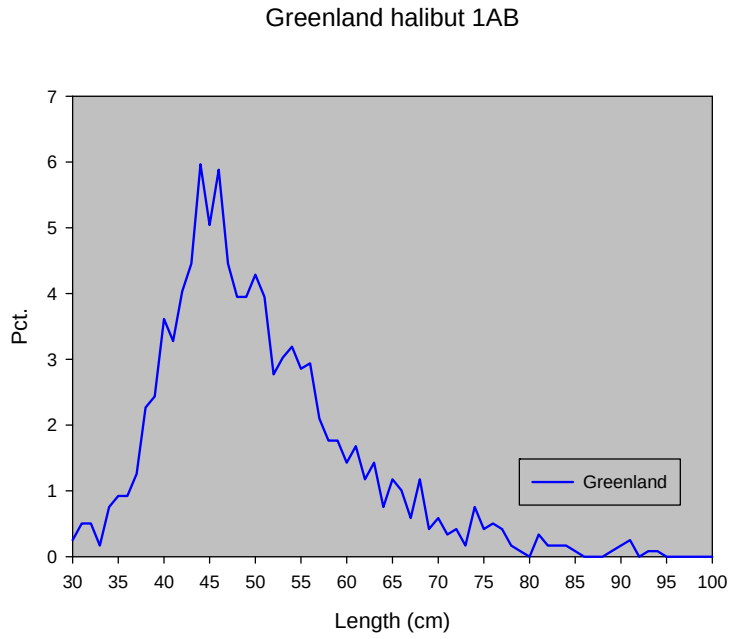


Fig. 7. Length distribution in the Greenland trawl fishery in Div. 1A in 2008 in percent, 1-cm groups.

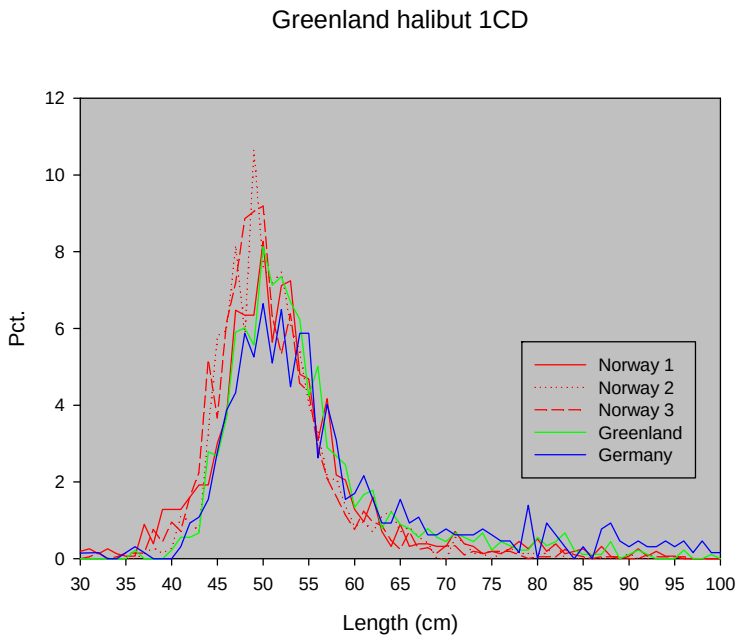


Fig. 8. Length distribution in the EU-Germany, Norway and Greenland trawl fishery in Div. 1D in 2008.in percent, 1-cm groups.

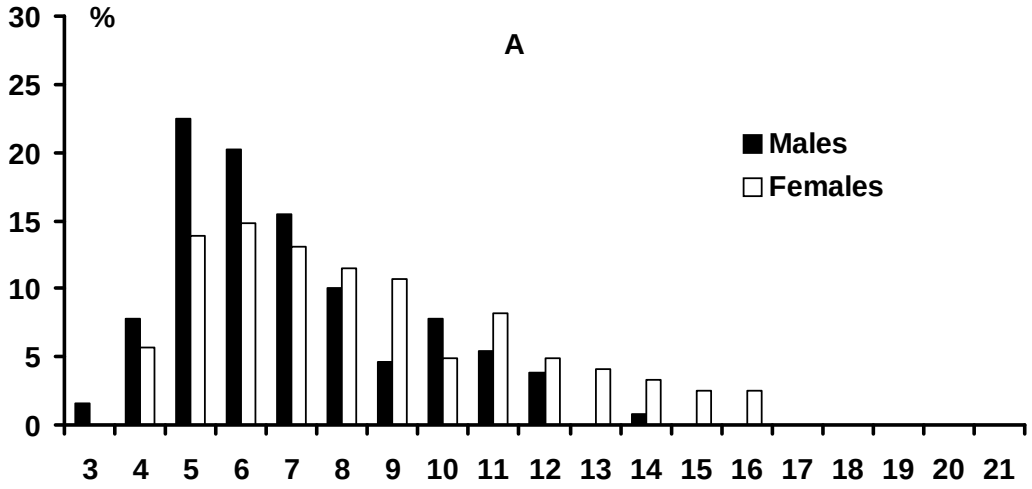


Fig. 9. Age distribution in the Russian Trawl fishery in Div. 1A.

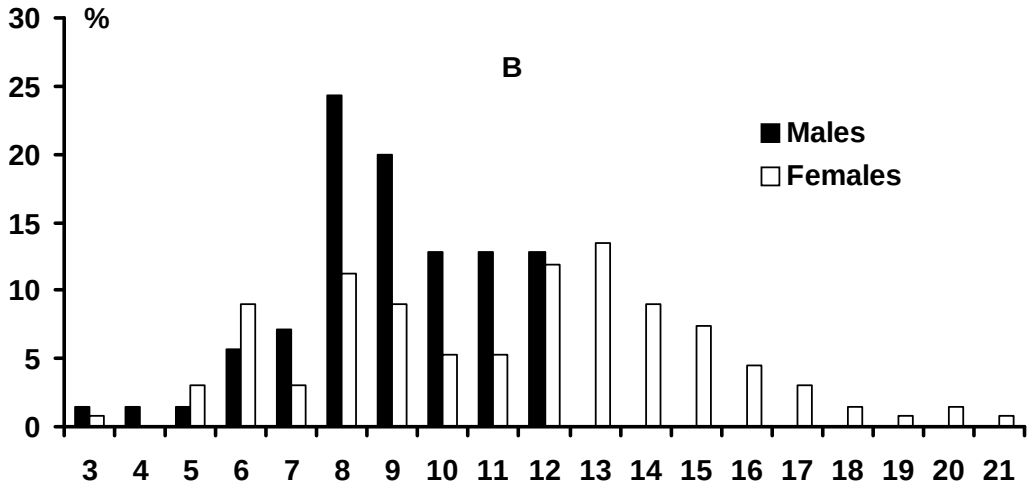


Fig. 10. Age distribution in the Russian trawl fishery in Div. 1D.

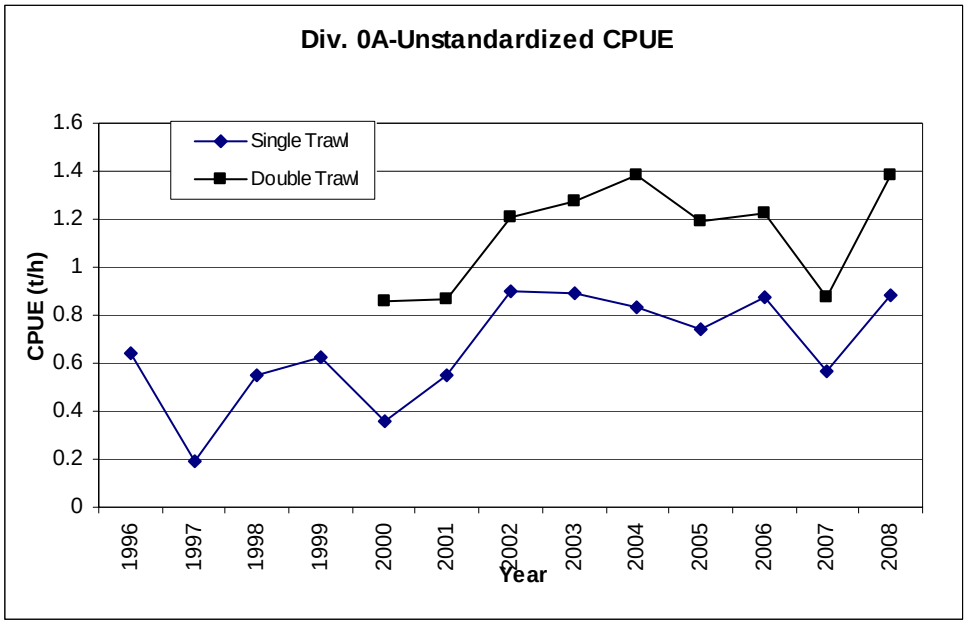


Fig. 11a. Un-standardized CPUE from the trawl fishery in Div. 0A

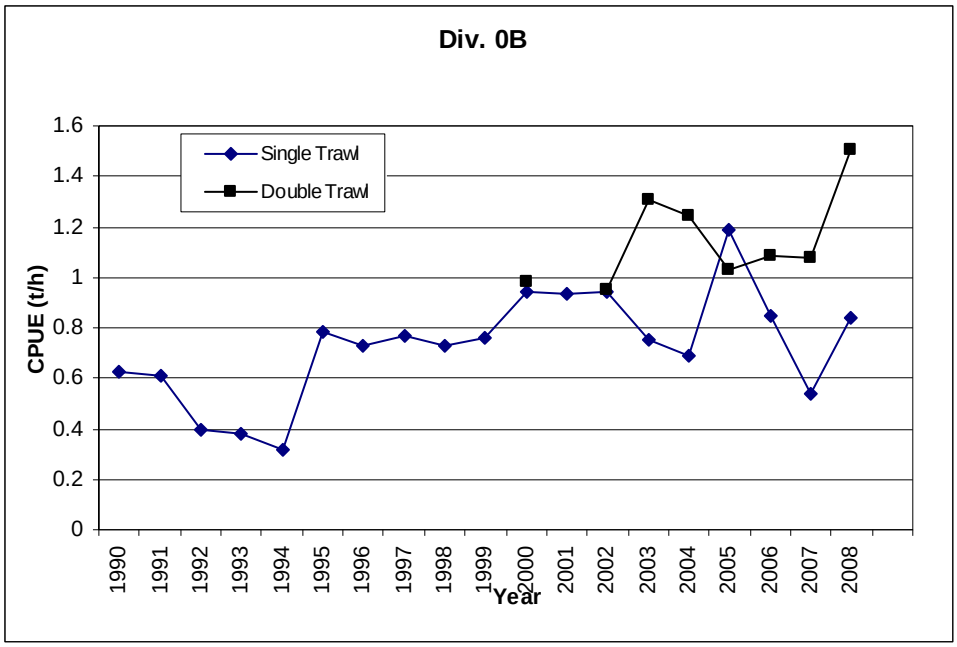


Fig. 11b. Un-standardized CPUE from the trawl fishery in Div. 0B

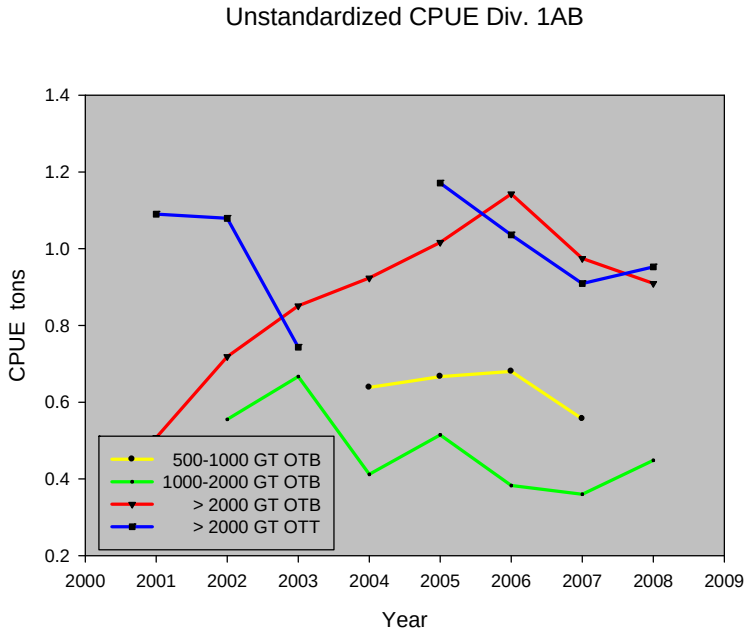


Fig. 11c. Unstandardized trawl CPUE series from Div. 1AB.

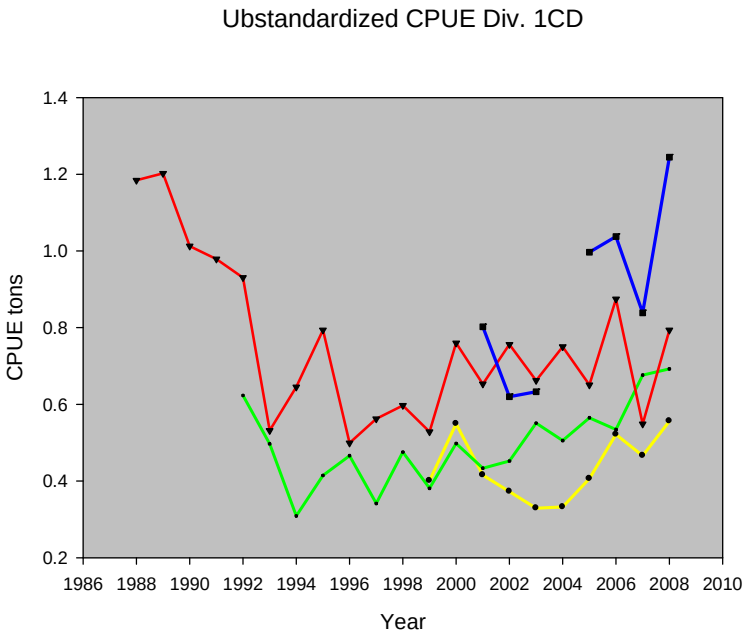


Fig. 11d. Unstandardized catch rates from different fleets fishing in Div. 1CD.

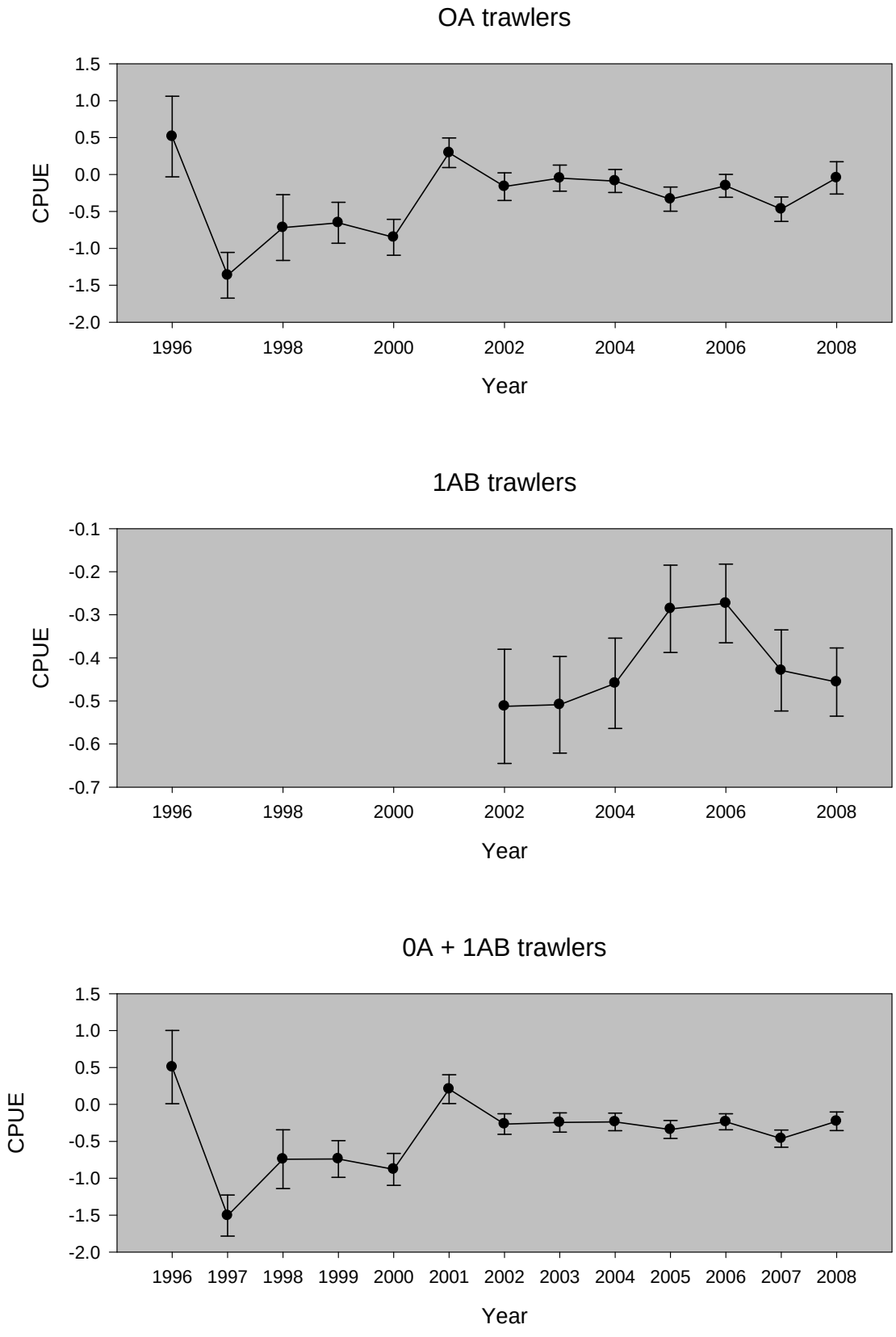
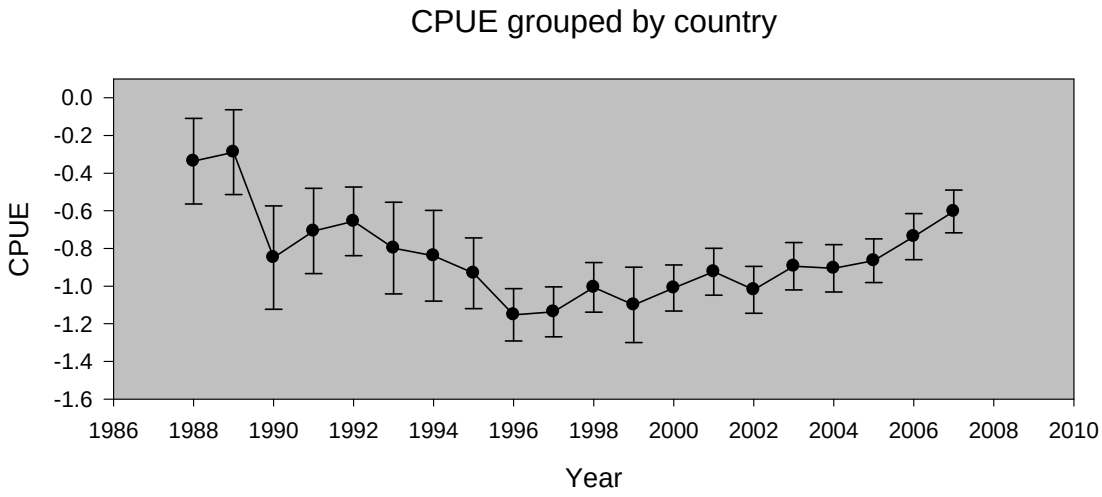
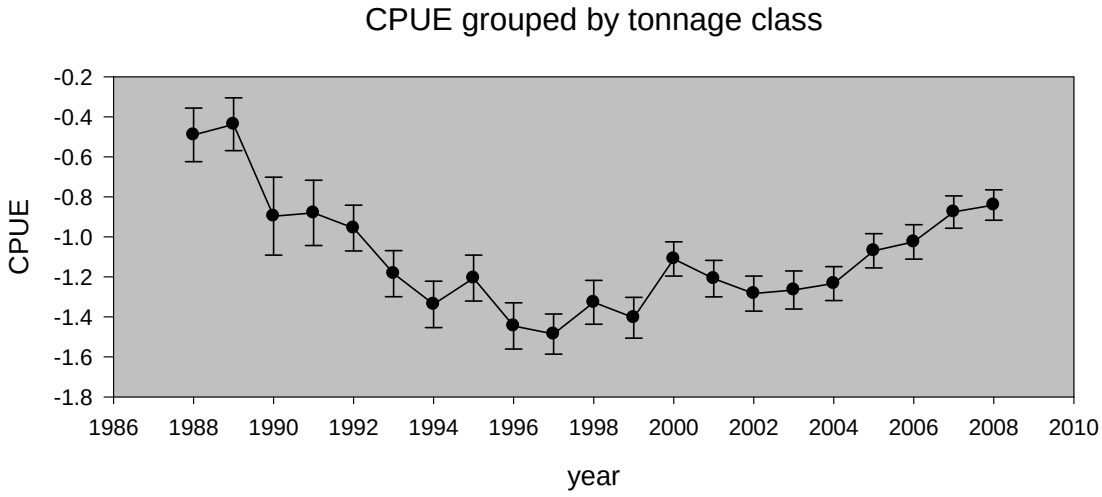


Fig 12a. Standardized CPUE series from trawlers in 0A, Div. 1AB and 0B+1AB combined with +/- S.E.





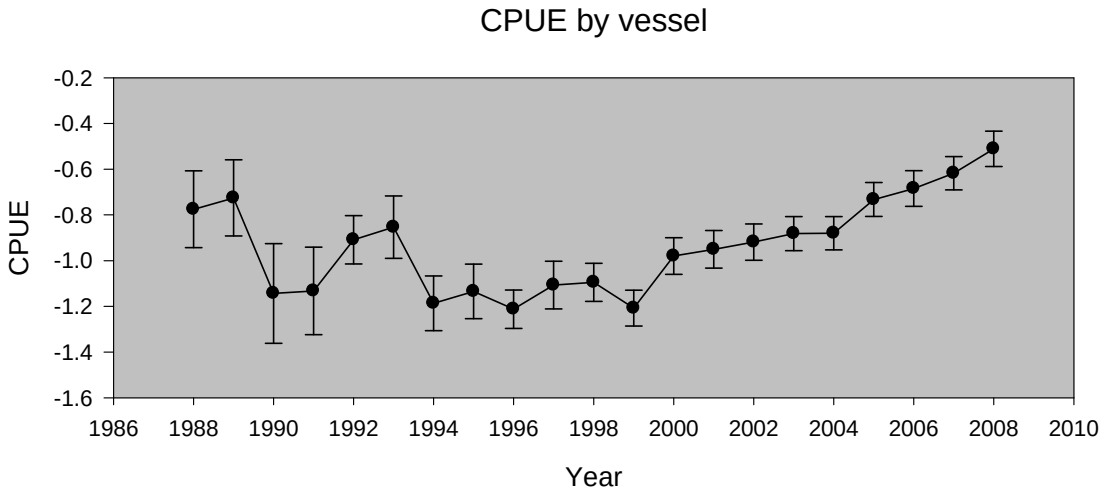


Fig. 12b. Standardized trawl CPUE index from trawlers in Div. 1CD with +/- S.E.. Grouped by county as in previous years, grouped by tonnage class according to NAFO's classification and standardized by vessel .

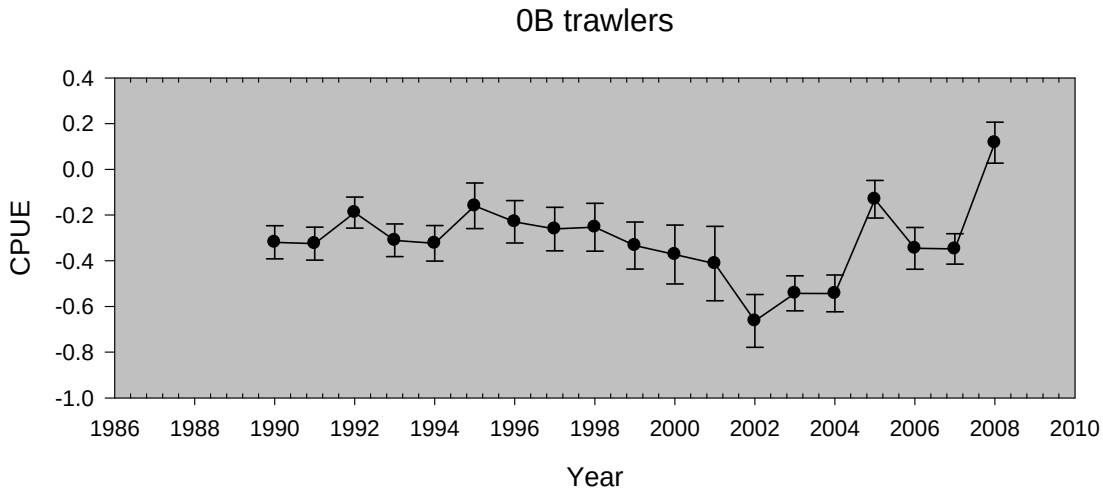


Fig 12c. Standardized CPUE series from trawlers in Div. 0B with +/- S.E.

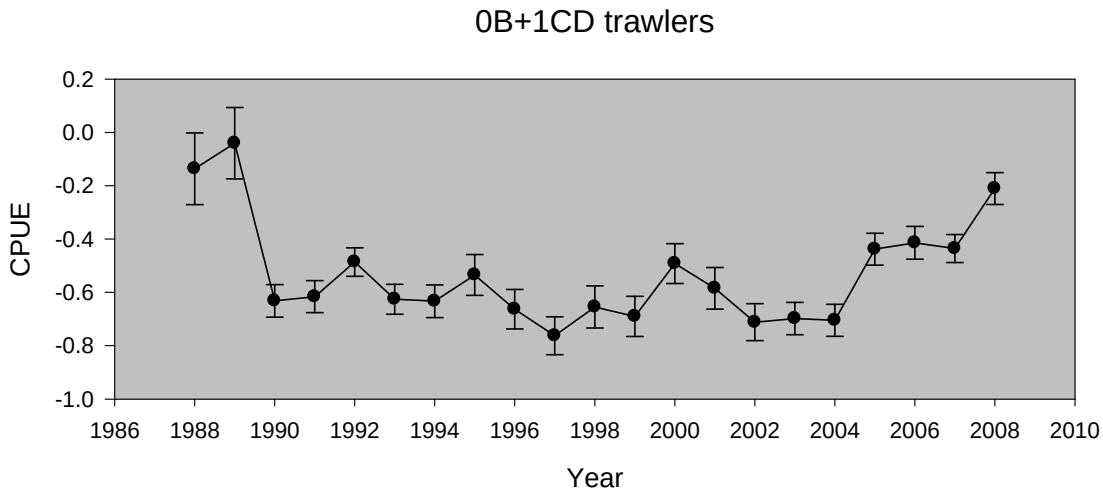


Fig. 12d. Combined standardized trawl CPUE index from trawlers in Div. 0B +1CD with +/- S.E.

Appendix 1. Standardized CPUE index from trawlers in Div. 0A

```
                Greenland halibut, 0A trawlers                          1
                                          16:33 Monday, June 8, 2009

                           The GLM Procedure

                         Class Level Information

Class       Levels  Values

year            13  1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
                    2007 2008

md               6  7 8 9 10 11 12

kode            18  2126 2127 5127 15127 16127 21926 21927 31126 31926
                    31927 32125 33126 40126 40127 51926 51927 401926 401927


                  Number of Observations Read         130
                  Number of Observations Used         130

                    Greenland halibut, 0A trawlers                      2
                                          16:33 Monday, June 8, 2009

                           The GLM Procedure

Dependent Variable: lcph

 Source                     DF       Sum of Squares   Mean Square  F Value  Pr > F

 Model                      34   22.40096486    0.65885191     3.73  <.0001

 Error                      95   16.76224123    0.17644464

 Corrected Total           129   39.16320609

            R-Square     Coeff Var      Root MSE     lcph Mean

            0.571990     -294.8160      0.420053     -0.142480

 Source                     DF     Type I SS   Mean Square  F Value  Pr > F

 year                       12    9.81137970    0.81761498     4.63  <.0001
 md                          5    3.15679896    0.63135979     3.58  0.0052
 kode                       17    9.43278620    0.55486978     3.14  0.0002

 Source                     DF   Type III SS   Mean Square  F Value  Pr > F

 year                       12    7.12456418    0.59371368     3.36  0.0004
 md                          5    2.00646829    0.40129366     2.27  0.0532
 kode                       17    9.43278620    0.55486978     3.14  0.0002

                                                 Standard
Parameter                 Estimate                 Error    t Value    Pr > |t|

Intercept              0.878681640 B      0.33724598       2.61      0.0107
year       1996        0.560232115 B      0.62076247       0.90      0.3691
year       1997       -1.318715571 B      0.37478584      -3.52      0.0007
year       1998       -0.673261074 B      0.47913536      -1.41      0.1632
year       1999       -0.608113453 B      0.32815757      -1.85      0.0670
year       2000       -0.804184239 B      0.30392721      -2.65      0.0095
year       2001        0.340026370 B      0.32526192       1.05      0.2985
year       2002       -0.117180991 B      0.27481512      -0.43      0.6708
year       2003       -0.002757069 B      0.25984866      -0.01      0.9916
year       2004       -0.041570537 B      0.25682637      -0.16      0.8718
year       2005       -0.288218968 B      0.25333071      -1.14      0.2581
year       2006       -0.106165176 B      0.20254910      -0.52      0.6014
year       2007       -0.423339830 B      0.18546878      -2.28      0.0247
year       2008        0.000000000 B       .                .          .
md         7          -0.408868687 B      0.34260133      -1.19      0.2357
md         8          -0.639975078 B      0.31890828      -2.01      0.0476
```

Greenland halibut, 0A trawlers 3
16:33 Monday, June 8, 2009

The GLM Procedure

Dependent Variable: lcph

Parameter		Estimate		Standard Error	t Value	Pr > |t|
md	9	-0.575856793	B	0.30717265	-1.87	0.0639
md	10	-0.534774263	B	0.30123821	-1.78	0.0791
md	11	-0.761233098	B	0.29770213	-2.56	0.0121
md	12	0.000000000	B	.	.	.
kode	2126	-0.343114347	B	0.23464012	-1.46	0.1470
kode	2127	-0.235699577	B	0.19162267	-1.23	0.2217
kode	5127	-1.344778107	B	0.52773852	-2.55	0.0124
kode	15127	0.291597913	B	0.37176249	0.78	0.4348
kode	16127	-1.380467046	B	0.39079041	-3.53	0.0006
kode	21926	0.030035740	B	0.37905450	0.08	0.9370
kode	21927	-0.001170231	B	0.19824801	-0.01	0.9953
kode	31126	-0.895884730	B	0.42524032	-2.11	0.0378
kode	31926	0.029020806	B	0.25763672	0.11	0.9106
kode	31927	-0.174370181	B	0.23981099	-0.73	0.4689
kode	32125	-1.433448848	B	0.39079041	-3.67	0.0004
kode	33126	-1.317529797	B	0.42572915	-3.09	0.0026
kode	40126	-0.433035628	B	0.29741394	-1.46	0.1487
kode	40127	-0.447346398	B	0.16885894	-2.65	0.0094
kode	51926	0.441124089	B	0.46745557	0.94	0.3477
kode	51927	-0.834808181	B	0.39079041	-2.14	0.0352
kode	401926	0.170141545	B	0.25293894	0.67	0.5028
kode	401927	0.000000000	B	.	.	.

NOTE: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

Greenland halibut, 0A trawlers 4
16:33 Monday, June 8, 2009

The GLM Procedure
Least Squares Means

year	lcph LSMEAN	Standard Error	Pr > |t|
1996	0.51436616	0.54636966	0.3489
1997	-1.36458153	0.30888849	<.0001
1998	-0.71912703	0.44539329	0.1097
1999	-0.65397941	0.27733620	0.0204
2000	-0.85005019	0.24243981	0.0007
2001	0.29416041	0.20007443	0.1448
2002	-0.16304695	0.18747259	0.3867
2003	-0.04862302	0.17729344	0.7845
2004	-0.08743649	0.15579809	0.5760
2005	-0.33408492	0.16376230	0.0441
2006	-0.15203113	0.15448083	0.3275
2007	-0.46920579	0.16523495	0.0055
2008	-0.04586596	0.21913768	0.8347

Appendix 2. Standardized CPUE index from trawlers in Div. 1AB

Greenland halibut, 1AB trawlers 107
09:18 Wednesday, May 6, 2009

The GLM Procedure

Class Level Information

Class	Levels	Values
year	7	2002 2003 2004 2005 2006 2007 2008
MD	7	6 7 8 9 10 11 12
kode	5	6125 6126 6127 61926 61927

Number of Observations Read 78
Number of Observations Used 78

Greenland halibut, 1AB trawlers 108
09:18 Wednesday, May 6, 2009

The GLM Procedure

Dependent Variable: lcph

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	16	8.05988576	0.50374286	8.21	<.0001
Error	61	3.74225617	0.06134846		
Corrected Total	77	11.80214193			

R-Square	Coeff Var	Root MSE	lcph Mean
0.682917	-77.10778	0.247686	-0.321221

Source	DF	Type I SS	Mean Square	F Value	Pr > F
year	6	0.26705489	0.04450915	0.73	0.6307
MD	6	1.50019866	0.25003311	4.08	0.0017
kode	4	6.29263221	1.57315805	25.64	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
year	6	0.52002951	0.08667158	1.41	0.2244
MD	6	1.57196460	0.26199410	4.27	0.0012
kode	4	6.29263221	1.57315805	25.64	<.0001

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		0.0844576922 B	0.26106163	0.32	0.7474
year	2002	-.0562461277 B	0.13589964	-0.41	0.6804
year	2003	-.0527587711 B	0.11687902	-0.45	0.6533
year	2004	-.0029151017 B	0.11234308	-0.03	0.9794
year	2005	0.1700456815 B	0.11033170	1.54	0.1284
year	2006	0.1825062227 B	0.10847868	1.68	0.0976
year	2007	0.0267708489 B	0.10589611	0.25	0.8013
year	2008	0.0000000000 B	.	.	.
MD	6	-.3090391442 B	0.37138323	-0.83	0.4086
MD	7	-.4386039257 B	0.28466881	-1.54	0.1285
MD	8	-.3115550488 B	0.26992069	-1.15	0.2529
MD	9	-.2355909858 B	0.26808371	-0.88	0.3830
MD	10	-.0180291105 B	0.26822394	-0.07	0.9466
MD	11	-.0027901869 B	0.27032624	-0.01	0.9918
MD	12	0.0000000000 B	.	.	.
kode	6125	-.4638014205 B	0.09020377	-5.14	<.0001

Greenland halibut, 1AB trawlers 109
09:18 Wednesday, May 6, 2009

The GLM Procedure

Dependent Variable: lcph

Parameter		Estimate		Standard Error	t Value	Pr > |t|
kode	6126	-.7422064060	B	0.08866706	-8.37	<.0001
kode	6127	-.0531084603	B	0.08249067	-0.64	0.5221
kode	61926	-.5042348974	B	0.16894395	-2.98	0.0041
kode	61927	0.0000000000	B	.	.	.

NOTE: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

The GLM Procedure
Least Squares Means

year	lcph LSMEAN	Standard Error	Pr > |t|
2002	-0.51240273	0.13259259	0.0003
2003	-0.50891537	0.11225161	<.0001
2004	-0.45907170	0.10482840	<.0001
2005	-0.28611092	0.10136040	0.0064
2006	-0.27365038	0.09120573	0.0039
2007	-0.42938575	0.09416043	<.0001
2008	-0.45615660	0.07926028	<.0001

Appendix 3. Standardized CPUE index from trawlers in Div. 10A+1AB

Greenland halibut, 0A+1AB trawlers 9
16:33 Monday, June 8, 2009

The GLM Procedure

Class Level Information

Class	Levels	Values
year	13	1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
MD	7	6 7 8 9 10 11 12
kode	23	2126 2127 5127 6125 6126 6127 15127 16127 21926 21927 31126 31926 31927 32125 33126 40126 40127 51926 51927 61926 61927 401926 401927

Number of Observations Read 208
Number of Observations Used 208

Greenland halibut, 0A+1AB trawlers 10
16:33 Monday, June 8, 2009

The GLM Procedure

Dependent Variable: lcph

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	40	28.80275903	0.72006898	5.07	<.0001
Error	167	23.72007144	0.14203636		
Corrected Total	207	52.52283048			

R-Square	Coeff Var	Root MSE	lcph Mean
0.548386	-179.8871	0.376877	-0.209508

Source	DF	Type I SS	Mean Square	F Value	Pr > F
year	12	6.72649710	0.56054143	3.95	<.0001
MD	6	2.71683603	0.45280601	3.19	0.0055
kode	22	19.35942590	0.87997390	6.20	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
year	12	6.32824466	0.52735372	3.71	<.0001
MD	6	1.84561859	0.30760310	2.17	0.0487
kode	22	19.35942590	0.87997390	6.20	<.0001

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		0.693059422 B	0.24353454	2.85	0.0050
year	1996	0.733839171 B	0.53468148	1.37	0.1718
year	1997	-1.277683737 B	0.29465666	-4.34	<.0001
year	1998	-0.514032214 B	0.40379242	-1.27	0.2048
year	1999	-0.510584472 B	0.25652939	-1.99	0.0482
year	2000	-0.651292055 B	0.22826424	-2.85	0.0049
year	2001	0.436055522 B	0.25255184	1.73	0.0861
year	2002	-0.037434123 B	0.15274896	-0.25	0.8067
year	2003	-0.015906636 B	0.13568297	-0.12	0.9068
year	2004	-0.009292478 B	0.12958476	-0.07	0.9429
year	2005	-0.111022348 B	0.12730975	-0.87	0.3844
year	2006	-0.007068095 B	0.11714269	-0.06	0.9520
year	2007	-0.235024732 B	0.11218328	-2.10	0.0377
year	2008	0.000000000 B	.	.	.
MD	6	-0.630028692 B	0.45139110	-1.40	0.1646
MD	7	-0.486766832 B	0.24513846	-1.99	0.0487

Greenland halibut, 0A+1AB trawlers 11
16:33 Monday, June 8, 2009

The GLM Procedure

Dependent Variable: lcph

Parameter		Estimate		Standard Error	t Value	Pr > |t|
MD	8	-0.578091986	B	0.22926348	-2.52	0.0126
MD	9	-0.503528647	B	0.22444172	-2.24	0.0262
MD	10	-0.390764962	B	0.22245462	-1.76	0.0808
MD	11	-0.575486471	B	0.22128644	-2.60	0.0101
MD	12	0.000000000	B	.	.	.
kode	2126	-0.337754718	B	0.16532452	-2.04	0.0426
kode	2127	-0.281634364	B	0.14919704	-1.89	0.0608
kode	5127	-1.440931668	B	0.46294349	-3.11	0.0022
kode	6125	-0.561839284	B	0.14914184	-3.77	0.0002
kode	6126	-0.929800719	B	0.14764022	-6.30	<.0001
kode	6127	-0.282757695	B	0.13901907	-2.03	0.0435
kode	15127	0.287554621	B	0.28921270	0.99	0.3215
kode	16127	-1.424902003	B	0.33893470	-4.20	<.0001
kode	21926	0.018501935	B	0.30597684	0.06	0.9519
kode	21927	-0.023986610	B	0.15240803	-0.16	0.8751
kode	31126	-0.882882693	B	0.33919955	-2.60	0.0101
kode	31926	0.036700052	B	0.18562091	0.20	0.8435
kode	31927	-0.188547061	B	0.18570380	-1.02	0.3114
kode	32125	-1.477883806	B	0.33893470	-4.36	<.0001
kode	33126	-1.336105453	B	0.37127966	-3.60	0.0004
kode	40126	-0.439250670	B	0.25317993	-1.73	0.0846
kode	40127	-0.469306428	B	0.15120440	-3.10	0.0022
kode	51926	0.477545751	B	0.40379295	1.18	0.2386
kode	51927	-0.879243139	B	0.33893470	-2.59	0.0103
kode	61926	-0.708380028	B	0.25015807	-2.83	0.0052
kode	61927	-0.138164849	B	0.13987039	-0.99	0.3247
kode	401926	0.179452878	B	0.21170071	0.85	0.3978
kode	401927	0.000000000	B	.	.	.

NOTE: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

Greenland halibut, 0A+1AB trawlers 12
16:33 Monday, June 8, 2009

The GLM Procedure
Least Squares Means

year	lcph LSMEAN	Standard Error	Pr > |t|
1996	0.50508079	0.49626193	0.3103
1997	-1.50644212	0.27831717	<.0001
1998	-0.74279060	0.39803348	0.0638
1999	-0.73934285	0.24862152	0.0034
2000	-0.88005044	0.21663612	<.0001
2001	0.20729714	0.19536378	0.2902
2002	-0.26619250	0.13819425	0.0558
2003	-0.24466502	0.13052176	0.0626
2004	-0.23805086	0.11942326	0.0479
2005	-0.33978073	0.12169189	0.0058
2006	-0.23582648	0.10805642	0.0305
2007	-0.46378311	0.11652049	0.0001
2008	-0.22875838	0.12663105	0.0726

Appendix 4. Standardized CPUE index from trawlers in Div. 0B

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                    Greenland halibut, 0B trawlers                    13
                                              14:32 Sunday, June 7, 2009

                            The GLM Procedure

                         Class Level Information

Class       Levels  Values

year            19  1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000
                    2001 2002 2003 2004 2005 2006 2007 2008

md              12  1 2 3 4 5 6 7 8 9 10 11 12

kode            18  2126 2127 3125 5126 5127 14124 15126 15127 20126 20127
                    21926 21927 31926 31927 40126 40127 401926 401927


                  Number of Observations Read         510
                  Number of Observations Used         510

                       Greenland halibut, 0B trawlers                    14
                                              14:32 Sunday, June 7, 2009

                            The GLM Procedure

Dependent Variable: lcph

 Source                     DF       Sum of Squares   Mean Square  F Value  Pr > F

 Model                      46   132.5385149     2.8812721    43.00  <.0001

 Error                     463    31.0264190     0.0670117

 Corrected Total           509   163.5649339

            R-Square     Coeff Var      Root MSE     lcph Mean

            0.810311     -39.86740      0.258866     -0.649318

 Source                     DF     Type I SS   Mean Square  F Value  Pr > F

 year                       18   79.91859201    4.43992178    66.26  <.0001
 md                         11    9.15449374    0.83222670    12.42  <.0001
 kode                       17   43.46542916    2.55678995    38.15  <.0001

 Source                     DF   Type III SS   Mean Square  F Value  Pr > F

 year                       18    6.00239391    0.33346633     4.98  <.0001
 md                         11    7.71194755    0.70108614    10.46  <.0001
 kode                       17   43.46542916    2.55678995    38.15  <.0001

                                          Standard
Parameter                Estimate             Error    t Value    Pr > |t|

Intercept           0.1752626237 B      0.11420113       1.53      0.1255
year      1990       -.4360270714 B      0.11192031      -3.90      0.0001
year      1991       -.4419225718 B      0.11134245      -3.97      <.0001
year      1992       -.3061758542 B      0.10657208      -2.87      0.0043
year      1993       -.4271821582 B      0.11036659      -3.87      0.0001
year      1994       -.4406032609 B      0.11396879      -3.87      0.0001
year      1995       -.2765183198 B      0.13105480      -2.11      0.0354
year      1996       -.3463161317 B      0.12360943      -2.80      0.0053
year      1997       -.3778895855 B      0.12346119      -3.06      0.0023
year      1998       -.3697384045 B      0.12810100      -2.89      0.0041
year      1999       -.4501679901 B      0.12487534      -3.60      0.0003
year      2000       -.4892117724 B      0.14887637      -3.29      0.0011
year      2001       -.5290115770 B      0.17793803      -2.97      0.0031
year      2002       -.7798901153 B      0.13149675      -5.93      <.0001
year      2003       -.6594023471 B      0.10409136      -6.33      <.0001
year      2004       -.6598524820 B      0.10586176      -6.23      <.0001

                    Greenland halibut, 0B trawlers                    15
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14:32 Sunday, June 7, 2009

The GLM Procedure

Dependent Variable: lcph

Parameter		Estimate		Standard Error	t Value	Pr > |t|
year	2005	-.2475835196	B	0.10664417	-2.32	0.0207
year	2006	-.4626676671	B	0.12564212	-3.68	0.0003
year	2007	-.4651171382	B	0.10863474	-4.28	<.0001
year	2008	0.0000000000	B	.	.	.
md	1	0.0677674708	B	0.11314008	0.60	0.5495
md	2	0.3267068657	B	0.23239033	1.41	0.1604
md	3	0.1543686122	B	0.28212810	0.55	0.5845
md	4	0.1394998154	B	0.09275249	1.50	0.1333
md	5	0.4045459168	B	0.07215465	5.61	<.0001
md	6	0.0251861366	B	0.07429284	0.34	0.7348
md	7	-.2483721719	B	0.06119147	-4.06	<.0001
md	8	-.1540345153	B	0.05664428	-2.72	0.0068
md	9	-.2369275036	B	0.05389114	-4.40	<.0001
md	10	-.2883317633	B	0.05127095	-5.62	<.0001
md	11	-.1449975588	B	0.05147501	-2.82	0.0051
md	12	0.0000000000	B	.	.	.
kode	2126	-.2234591901	B	0.15040281	-1.49	0.1380
kode	2127	0.0611329601	B	0.13211886	0.46	0.6438
kode	3125	-.7845394649	B	0.16153569	-4.86	<.0001
kode	5126	-.0826810311	B	0.17708369	-0.47	0.6408
kode	5127	0.1387092866	B	0.14733302	0.94	0.3470
kode	14124	-.4056786352	B	0.15091078	-2.69	0.0074
kode	15126	0.3518029071	B	0.15295697	2.30	0.0219
kode	15127	0.3296852958	B	0.16492578	2.00	0.0462
kode	20126	-.7176181539	B	0.14410137	-4.98	<.0001
kode	20127	-.7355186714	B	0.14888225	-4.94	<.0001
kode	21926	0.0658730038	B	0.25644349	0.26	0.7974
kode	21927	0.5785797301	B	0.17463191	3.31	0.0010
kode	31926	-.3746205798	B	0.29935846	-1.25	0.2114
kode	31927	0.3504319546	B	0.13359894	2.62	0.0090
kode	40126	0.1240409317	B	0.23231526	0.53	0.5936
kode	40127	-.2997015418	B	0.15770083	-1.90	0.0580
kode	401926	0.5033275927	B	0.19644139	2.56	0.0107
kode	401927	0.0000000000	B	.	.	.

NOTE: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

The GLM Procedure
Least Squares Means

year	lcph LSMEAN	Standard Error	Pr > |t|
1990	-0.31921537	0.07254464	<.0001
1991	-0.32511087	0.07226473	<.0001
1992	-0.18936416	0.06783417	0.0055
1993	-0.31037046	0.07169605	<.0001
1994	-0.32379156	0.07757800	<.0001
1995	-0.15970662	0.09977829	0.1101
1996	-0.22950443	0.09271754	0.0137
1997	-0.26107789	0.09477460	0.0061
1998	-0.25292671	0.10443202	0.0158
1999	-0.33335629	0.10300967	0.0013
2000	-0.37240007	0.12847911	0.0039
2001	-0.41219988	0.16303516	0.0118
2002	-0.66307842	0.11567903	<.0001
2003	-0.54259065	0.07700444	<.0001
2004	-0.54304078	0.08076945	<.0001
2005	-0.13077182	0.08279034	0.1149
2006	-0.34585597	0.09150548	0.0002
2007	-0.34830544	0.06652359	<.0001
2008	0.11681170	0.08953153	0.1926

Appendix 5. Standardized CPUE index for trawlers in Div.1CD.

```
                    Greenland halibut, 1CD trawlers                    49
                                          09:18 Wednesday, May 6, 2009

                          The GLM Procedure

                       Class Level Information

Class       Levels  Values

year            21  1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998
                    1999 2000 2001 2002 2003 2004 2005 2006 2007 2008

MD              12  1 2 3 4 5 6 7 8 9 10 11 12

kode             6  6124 6125 6126 6127 61926 61927


                 Number of Observations Read         221
                 Number of Observations Used         221

                    Greenland halibut, 1CD trawlers                    50
                                          09:18 Wednesday, May 6, 2009

                          The GLM Procedure

Dependent Variable: lcph

                                  Sum of
 Source                    DF       Squares   Mean Square  F Value  Pr > F

 Model                     36   42.96778375    1.19354955    18.04  <.0001

 Error                    184   12.17382323    0.06616208

 Corrected Total          220   55.14160699


            R-Square     Coeff Var      Root MSE     lcph Mean

            0.779226     -43.76581      0.257220     -0.587719


 Source                    DF     Type I SS   Mean Square  F Value  Pr > F

 year                      20   15.35142208    0.76757110    11.60  <.0001
 MD                        11    8.41972637    0.76542967    11.57  <.0001
 kode                       5   19.19663531    3.83932706    58.03  <.0001


 Source                    DF   Type III SS   Mean Square  F Value  Pr > F

 year                      20   10.10497084    0.50524854     7.64  <.0001
 MD                        11    5.69706562    0.51791506     7.83  <.0001
 kode                       5   19.19663531    3.83932706    58.03  <.0001


                                          Standard
 Parameter              Estimate             Error    t Value    Pr > |t|

 Intercept           0.281314561 B      0.09768958       2.88      0.0045
 year      1988      0.350426579 B      0.14434309       2.43      0.0162
 year      1989      0.403742860 B      0.13803351       2.92      0.0039
 year      1990     -0.055630571 B      0.19651755      -0.28      0.7774
 year      1991     -0.039153765 B      0.16521371      -0.24      0.8129
 year      1992     -0.115138065 B      0.12087172      -0.95      0.3421
 year      1993     -0.342830499 B      0.11879613      -2.89      0.0044
 year      1994     -0.496480535 B      0.11848900      -4.19      <.0001
 year      1995     -0.365215951 B      0.11859008      -3.08      0.0024
 year      1996     -0.604267088 B      0.11806812      -5.12      <.0001
 year      1997     -0.645264589 B      0.10542559      -6.12      <.0001
 year      1998     -0.486361137 B      0.11303542      -4.30      <.0001
 year      1999     -0.563026107 B      0.10613053      -5.31      <.0001
 year      2000     -0.269399419 B      0.10022563      -2.69      0.0078
 year      2001     -0.367981637 B      0.09615014      -3.83      0.0002
 year      2002     -0.442548630 B      0.09357137      -4.73      <.0001

                    Greenland halibut, 1CD trawlers                    51
                                          09:18 Wednesday, May 6, 2009
```

The GLM Procedure

Dependent Variable: lcph

Parameter		Estimate		Standard Error	t Value	Pr > |t|
year	2003	-0.424720815	B	0.09938183	-4.27	<.0001
year	2004	-0.392304973	B	0.09178812	-4.27	<.0001
year	2005	-0.228711739	B	0.09384930	-2.44	0.0158
year	2006	-0.184374411	B	0.09216962	-2.00	0.0469
year	2007	-0.034986272	B	0.09491761	-0.37	0.7129
year	2008	0.000000000	B	.	.	.
MD	1	-0.485508951	B	0.13160723	-3.69	0.0003
MD	2	-1.040406997	B	0.16700764	-6.23	<.0001
MD	3	-0.950784199	B	0.27472644	-3.46	0.0007
MD	4	-0.470986062	B	0.20383002	-2.31	0.0220
MD	5	-0.351612303	B	0.12520197	-2.81	0.0055
MD	6	-0.609372356	B	0.11676055	-5.22	<.0001
MD	7	-0.521034467	B	0.09144719	-5.70	<.0001
MD	8	-0.361046868	B	0.07745611	-4.66	<.0001
MD	9	-0.182328128	B	0.06809261	-2.68	0.0081
MD	10	-0.227942228	B	0.06458230	-3.53	0.0005
MD	11	-0.170276655	B	0.06528930	-2.61	0.0099
MD	12	0.000000000	B	.	.	.
kode	6124	-2.556655138	B	0.17934101	-14.26	<.0001
kode	6125	-0.542800933	B	0.07524286	-7.21	<.0001
kode	6126	-0.459212785	B	0.07203004	-6.38	<.0001
kode	6127	-0.126952152	B	0.07327001	-1.73	0.0848
kode	61926	-0.362980566	B	0.20352591	-1.78	0.0762
kode	61927	0.000000000	B	.	.	.

NOTE: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

The GLM Procedure
Least Squares Means

year	lcph LSMEAN	Standard Error	Pr > |t|
1988	-0.49063406	0.13408861	0.0003
1989	-0.43731778	0.13233160	0.0011
1990	-0.89669121	0.19471619	<.0001
1991	-0.88021440	0.16310922	<.0001
1992	-0.95619870	0.11465075	<.0001
1993	-1.18389114	0.11502067	<.0001
1994	-1.33754117	0.11550621	<.0001
1995	-1.20627659	0.11497699	<.0001
1996	-1.44532772	0.11505476	<.0001
1997	-1.48632523	0.10038005	<.0001
1998	-1.32742177	0.11001747	<.0001
1999	-1.40408674	0.10194722	<.0001
2000	-1.11046006	0.08553915	<.0001
2001	-1.20904227	0.09120684	<.0001
2002	-1.28360927	0.08772047	<.0001
2003	-1.26578145	0.09537802	<.0001
2004	-1.23336561	0.08481276	<.0001
2005	-1.06977237	0.08517121	<.0001
2006	-1.02543505	0.08625438	<.0001
2007	-0.87604691	0.08072710	<.0001
2008	-0.84106064	0.07626316	<.0001

Appendix 6. Combined Standardized CPUE index for trawlers in Div. 1CD and Div. 0B.

```
                    Greenland halibut, 0B+1cD trawlers                  17
                                                  14:32 Sunday, June 7, 2009

                              The GLM Procedure

                           Class Level Information

Class       Levels  Values

year            21  1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998
                    1999 2000 2001 2002 2003 2004 2005 2006 2007 2008

MD              12  1 2 3 4 5 6 7 8 9 10 11 12

kode            24  2126 2127 3125 5126 5127 6124 6125 6126 6127 14124
                    15126 15127 20126 20127 21926 21927 31926 31927 40126
                    40127 61926 61927 401926 401927


                  Number of Observations Read         731
                  Number of Observations Used         731

                    Greenland halibut, 0B+1cD trawlers                  18
                                                  14:32 Sunday, June 7, 2009

                              The GLM Procedure

Dependent Variable: lcph

 Source                     DF       Sum of Squares   Mean Square  F Value  Pr > F

 Model                      54   167.1301739     3.0950032    40.11  <.0001

 Error                     676    52.1614183     0.0771619

 Corrected Total           730   219.2915922

            R-Square     Coeff Var      Root MSE     lcph Mean

            0.762137     -44.04352      0.277780     -0.630695

 Source                     DF     Type I SS   Mean Square  F Value  Pr > F

 year                       20   69.42167084    3.47108354    44.98  <.0001
 MD                         11   16.63327085    1.51211553    19.60  <.0001
 kode                       23   81.07523223    3.52501010    45.68  <.0001

 Source                     DF   Type III SS   Mean Square  F Value  Pr > F

 year                       20   10.47810803    0.52390540     6.79  <.0001
 MD                         11    6.98547546    0.63504322     8.23  <.0001
 kode                       23   81.07523223    3.52501010    45.68  <.0001

                                                 Standard
Parameter                 Estimate                 Error    t Value    Pr > |t|

Intercept              0.187837780 B      0.11868064       1.58      0.1140
year      1988         0.074114084 B      0.14096104       0.53      0.5992
year      1989         0.170055146 B      0.13945821       1.22      0.2231
year      1990        -0.421377207 B      0.07911257      -5.33      <.0001
year      1991        -0.405814766 B      0.07872627      -5.15      <.0001
year      1992        -0.275810678 B      0.07265174      -3.80      0.0002
year      1993        -0.415477892 B      0.07514263      -5.53      <.0001
year      1994        -0.422768484 B      0.07848909      -5.39      <.0001
year      1995        -0.324254756 B      0.08982144      -3.61      0.0003
year      1996        -0.452784756 B      0.08704986      -5.20      <.0001
year      1997        -0.552226239 B      0.08428039      -6.55      <.0001
year      1998        -0.444412340 B      0.08981276      -4.95      <.0001
year      1999        -0.479570848 B      0.08602947      -5.57      <.0001
year      2000        -0.281267782 B      0.08826218      -3.19      0.0015
year      2001        -0.374363331 B      0.08813365      -4.25      <.0001
year      2002        -0.501512748 B      0.08038880      -6.24      <.0001
```

Greenland halibut, 0B+1cD trawlers 19
14:32 Sunday, June 7, 2009

The GLM Procedure

Dependent Variable: lcph

Parameter		Estimate		Standard Error	t Value	Pr > |t|
year	2003	-0.487916943	B	0.07434248	-6.56	<.0001
year	2004	-0.494368039	B	0.07333364	-6.74	<.0001
year	2005	-0.227544779	B	0.07453673	-3.05	0.0024
year	2006	-0.203737157	B	0.07786925	-2.62	0.0091
year	2007	-0.224930642	B	0.07478323	-3.01	0.0027
year	2008	0.000000000	B	.	.	.
MD	1	-0.266407032	B	0.08794122	-3.03	0.0025
MD	2	-0.546801278	B	0.14054624	-3.89	0.0001
MD	3	-0.373583852	B	0.20981171	-1.78	0.0754
MD	4	-0.029781879	B	0.08737929	-0.34	0.7333
MD	5	0.188147575	B	0.06493269	2.90	0.0039
MD	6	-0.167528527	B	0.06546798	-2.56	0.0107
MD	7	-0.292954182	B	0.05258492	-5.57	<.0001
MD	8	-0.183261428	B	0.04751951	-3.86	0.0001
MD	9	-0.189733561	B	0.04420258	-4.29	<.0001
MD	10	-0.234438491	B	0.04227819	-5.55	<.0001
MD	11	-0.125206410	B	0.04286340	-2.92	0.0036
MD	12	0.000000000	B	.	.	.
kode	2126	-0.222599579	B	0.14314209	-1.56	0.1204
kode	2127	0.031689630	B	0.12672966	0.25	0.8026
kode	3125	-0.931729412	B	0.15724966	-5.93	<.0001
kode	5126	0.026725405	B	0.16985585	0.16	0.8750
kode	5127	0.136378826	B	0.13551807	1.01	0.3146
kode	6124	-2.461699512	B	0.21416503	-11.49	<.0001
kode	6125	-0.562248928	B	0.13133866	-4.28	<.0001
kode	6126	-0.406051417	B	0.12734098	-3.19	0.0015
kode	6127	-0.049439251	B	0.12712682	-0.39	0.6975
kode	14124	-0.457418407	B	0.14057204	-3.25	0.0012
kode	15126	0.286111161	B	0.14336961	2.00	0.0464
kode	15127	0.259574091	B	0.15812476	1.64	0.1011
kode	20126	-0.761955531	B	0.13203463	-5.77	<.0001
kode	20127	-0.781659308	B	0.13700516	-5.71	<.0001
kode	21926	0.416952675	B	0.24649504	1.69	0.0912
kode	21927	0.559198933	B	0.17328001	3.23	0.0013
kode	31926	-0.190836135	B	0.31106774	-0.61	0.5398
kode	31927	0.350343703	B	0.13411402	2.61	0.0092
kode	40126	-0.138092728	B	0.23596542	-0.59	0.5586
kode	40127	-0.316812892	B	0.16891115	-1.88	0.0611
kode	61926	-0.266255653	B	0.22813500	-1.17	0.2436
kode	61927	0.071908147	B	0.13839686	0.52	0.6035
kode	401926	0.295832098	B	0.19093007	1.55	0.1217
kode	401927	0.000000000	B	.	.	.

Greenland halibut, 0B+1cD trawlers 20
14:32 Sunday, June 7, 2009

The GLM Procedure

Dependent Variable: lcph

NOTE: The X'X matrix has been found to be singular, and a generalized inverse was used to solve the normal equations. Terms whose estimates are followed by the letter 'B' are not uniquely estimable.

Greenland halibut, 0B+1cD trawlers 21
14:32 Sunday, June 7, 2009

The GLM Procedure
Least Squares Means

year	lcph LSMEAN	Standard Error	Pr > |t|
1988	-0.13618073	0.13442457	0.3114
1989	-0.04023967	0.13377959	0.7637
1990	-0.63167202	0.06102509	<.0001
1991	-0.61610958	0.05996339	<.0001
1992	-0.48610549	0.05317997	<.0001
1993	-0.62577270	0.05624032	<.0001
1994	-0.63306330	0.06113000	<.0001

1995	-0.53454957	0.07658523	<.0001
1996	-0.66307957	0.07422855	<.0001
1997	-0.76252105	0.07122402	<.0001
1998	-0.65470715	0.07894953	<.0001
1999	-0.68986566	0.07505126	<.0001
2000	-0.49156259	0.07476527	<.0001
2001	-0.58465814	0.07796578	<.0001
2002	-0.71180756	0.06930252	<.0001
2003	-0.69821176	0.06076872	<.0001
2004	-0.70466285	0.05981555	<.0001
2005	-0.43783959	0.05974619	<.0001
2006	-0.41403197	0.06170701	<.0001
2007	-0.43522545	0.05242680	<.0001
2008	-0.21029481	0.05965340	0.0005

Appendix 7. Estimation of relative F in Div. 1CD.

Biomass and catches from Div. 1CD

Year	SM Biomass*1000		Catch	F relative to 2008	Catch/biomass	% of mean
1987	115		2502	0.337	0.022	
1988	58		2181	0.582	0.038	
1989	69		2141	0.480	0.031	
1990	52		1039	0.309	0.020	
1991	82		2340	0.442	0.029	
1992	73		5669	1.202	0.078	
1993	41		3870	1.461	0.094	
1994	34		5857	2.667	0.172	
1995	43		5017	1.806	0.117	
1996		Paamiut biomass*1000	4370	no survey	#DIVISION/0!	
1997		56	4778	1.321	0.085	
1998		70	4651	1.029	0.066	
1999		64	4887	1.182	0.076	
2000		59	5630	1.477	0.095	
2001		78	5093	1.011	0.065	
2002		72	5358	1.152	0.074	
2003		69	5488	1.231	0.080	
2004		76	5495	1.119	0.072	
2005		81	5681	1.086	0.070	
2006		77	5722	1.151	0.074	
2007		74	5601	1.172	0.076	
2008		83	5361	1.000	0.065	74.7
		83	10% increase	6050	1.129	0.073	84.4
		83	25% increase	6875	1.282	0.083	95.9
		83	50% increase	8250	1.539	0.099	115.0

Current TAC 11 000 tons split equally between 0B and 1CD

Mean F 1992-2007	1.338
STD	0.421
Min	1.011
Max	2.667