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An Assessment of the Greenland Halibut Stock Component in NAFO Division 1A Inshore

by

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Abstract

This paper presents the assessment of Greenland halibut in the inshore part of NAFO Div. 1A. The area covers the fjords in the three distinctive geographical areas, Disko Bay, Uummannaq and Upernavik. Quality of the data provided from the commercial fishery has improved in recent years and a standardized logbook CPUE index is now included.

Disko Bay: Landings increased from about 2 000t in the mid 1980s and peaked in 2004 with landings of more than 12 000t. Landings then decrease and in 2011 landings were at 8 000t. Mean length in landings, decreased from 2001 in both the summer and the winter fishery, and have dropped to the lowest value observed in 2010 and 2011. However, the average length in the landings have increased with the most resent measurement from the winter fishery in 2012. The standardized logbook CPUE series reveals a decrease in CPUE in Disko bay of about 30 % from 2007 to 2011. The Gillnet survey targets the pre-fishery recruits between 35 and 50 cm. Both CPUE and NPUE decreased in 2006 and 2007, but the 2008 and 2010 gillnet CPUE and NPUE estimates were at average levels. The 2011 gillnet survey CPUE and NPUE indices were the highest recorded for all sizes (not shown) and for individuals < 50 cm. The survey Greenland shrimp fish trawl survey biomass and abundance indices decreased sharply from 2004, but stabilized in 2008 and 2009 and increased further in 2010 and 2011. The 2011 abundance index reached the highest value recorded, mainly caused by a strong 2009 year-class and a very strong 2010 year-class.

Uummannaq: Landings increased from 3 000t in the mid 1980s and peaked in 1999 at more than 8 000t. Since then, landings have been between 5 000t and 6 000t but increasing in the most recent years and in 2011 6 400 t was landed. Mean length in the landings decreased in the summer fishery after 2004 and in the winter fishery after 2007, but the most recent measurements from the winter fishery in 2012 reveals an average length almost at the average of the past decade. The standardized CPUE series reveals an increasing trend from 2007 to 2011. Abundance indices in the longline survey have fluctuated without trends for the entire time series 1993-2007.

Upernavik: Landings increased from the mid 1980s and peaked in 1998 at a level of 7 000t. Landings then decreased to a level of 4 000 to 5 000 t, but in have increased the recent years to more than 6000 t/yr. Mean length in landings remained stable since 1999, but decreased in 2010 and 2011. However, the mean length in the winter

fishery landings increased to about the average of the past decade in 2012. The standardized CPUE series reveals a decreasing trend from 2007 to 2011.

Introduction

The Greenland halibut stock component in Div. 1A inshore is considered to be recruited from the Davis Strait stock, but the adults appear resident in the fjords and are thus isolated from its spawning stock (Riget and Boje, 1989). As a result, the inshore component probably does not contribute to the spawning stock in the Davis Strait (Boje, 1994). In samples from Disko Bay <10% of females in the reproductive age, were mature during the assumed peak spawning period in spring (Simonsen and Gundersen 2005). Also in former times only sporadic spawning was observed in the inshore area (Jørgensen and Boje, 1994) and the inshore component is therefore not assumed to be self-sustainable, but dependent on recruits and immigration from the offshore area (Bech, 1995). Evidence that supported this stock structure caused in 1994 NAFO to separate the assessment and advice on the inshore stock components from the offshore component in the Davis Strait and Baffin Bay.

Description of the fishery and landings

The inshore fishery for Greenland halibut started in the beginning of the 1900 century and the main areas are Disko Bay, Uummannaq and Upernavik, all located in NAFO division 1A (Fig. 1). Landings were however less than 1000 t/yr prior to 1960 and during the 1970’s landings increased gradually to around 3 000t/yr. In the 1980’s and 1990’s landings increased further to above 20 000t/yr and peaked at the end 1990s at about 25 000t. Since then landings have varied from 17 000 t to 23 000t and in 2011 the landings were almost 21 000 t. The fishery is traditionally performed with longline from small open boats or by dog sledges. In recent decades larger vessels (>25 feet) have entered the fishery. In the middle of the 1980s gillnets were introduced to the inshore fishery, and were used more commonly in the following years. Longlines however still constitute 90-99 % of the total landings. In the late 1990s authorities introduced regulations limiting areas of gillnet fishery in order to limit effort. A total ban for gillnets has been in force since 2000. However, derogations have been given to this ban. Competence to lay down local rules have been given to Uummannaq and Upernavik municipalities in 2004, and areas where gillnet fishery is allowed has been expanded in all three municipalities. The gillnet fishery is regulated by a minimum mesh-size of 110 mm (half meshes), while there are no gear regulations on the longline fishery. Since 1998 regulations have restricted effort increase by means of licenses to land fish. TAC for inshore areas and stocks was introduced in 2008, and the TAC was set at 12 500tons for Disko Bay and 5 000tons for Uummannaq and Upernavik areas.

Disko Bay

Disko Bay is the area where Greenland halibut fishery developed in Greenland in the beginning of the 19’th century, and the major part of the catches in Greenland have traditionally been taken here. The landings in Disko Bay have increased continually until the late 1990s to about 10 500tons (Table 1 and fig 1). After a decline in 2001 to 7 052 tons, landings have increased again in 2002 and further in 2004 to a historic high of 12 857 tons. However, since 2006 landings have decreased sharply and in 2009 only 6 300t was landed. The Greenland halibut fishery is conducted in, and in front of an ice fjord (Kangia) in the immediate vicinity of Ilulissat, and in a fjord north of Ilulissat, Torssukattak (fig. 2). The winter fishery in Ilulissat Icefjord, Kangia, is a traditional fishery from the ice using longlines from dog sledges. The fishery near Ilulissat is conducted within a small area (2 nm^2) and consist of a mixture of gillnet and longline fishery. The majority of the landings in Disko Bay are caught within this area. The fishery in Ilulissat and the other two areas is carried out in all seasons but most often peak in summer (Fig. 3). It has been observed that the fish disappear from the area in mid July, where after the fishery moves to Torssukattak north of Ilulissat (Simonsen and Roepstorff, 2000). The fishery in Torssukattak is almost exclusively carried out in the period July - August. Fishery in this fjord is restricted by sea ice in spring.

Uummannaq

The landings in Uummannaq increased from a stable level of 3 000t in the mid 1980s and peaked in 1999 at a level of more than 8 000t. Landings then decreased and have since 2002 fluctuated between 5 000 and 6 000t. (Table 1 and fig. 1). The fishery in Uummannaq is scattered all over the fjord near settlements and particular in the south eastern part of the fjord (Fig. 2).

Upernavik

The landings in the Upernavik area increased from the mid 1980s and peaked in 1998 at a level of 7 000t. This was followed by a period of decreasing landings, but since 2002 landings have increased substantially and in 2009 and 2011 landings reached 6500t. (Table 1 and fig 1). The northernmost area consists of a large number of ice fjords. Fishery in this area started in the 1980s. The main fishing grounds are Upernavik Ice fjord and Giesecke Ice fjord. Use of gillnets have been prohibited in Upernavik but derogations have been given for a fishery outside the Icefjords since 2002.

Input data

Research Surveys

Longline survey

Prior to 1993 various longline exploratory surveys were conducted with research vessels. Due to variable survey design and gear, these surveys are not comparable. In 1993 a longline survey for Greenland halibut was initiated for the inshore areas of Disko Bay, Uummannaq and Upernavik. The survey was conducted annually covering two of three areas alternately, with approximately 30 fixed stations in each area (for further details see Simonsen *et al*. 2000). This survey has recently been evaluated and the main conclusions drawn are that the survey does not generate sufficient data for proper statistical analyses; this in combination with an almost unknown selectivity of the gear as well as catch efficiency, prevents use of survey results as anything other than indicative of overall stock trends, e.g. no information on year-class strength and population in absolute numbers. Therefore, a pilot study on using gillnet (multi-meshed) as survey gear have been performed since 2001. Parallel with the new gillnet survey the aim was to continue the longline survey. However in 2002, 2006 and 2007 no longline survey was conducted in Disko Bay. The change to gillnet survey has proven difficult in Uummannaq and Upernavik and the longline survey have been continued in these areas.

Gillnet survey

The main objective for using gillnets is a well-estimated selectivity and the possibility for targeting pre-fishery sized Greenland halibut, i.e. less than 50 cm. The survey has been conducted since 2001, with the research vessel 'Adolf Jensen' in Disko Bay. The location is chosen due to the known presence of pre-fishery recruits in combination with bottom topography (approx. 3-400 m depth of even clay bottom) that allows fishing with gillnets. In the northern areas, Uummannaq and Upernavik, gillnet surveys are not suitable in the proposed pre-fishery recruit areas. Only 8 stations were fished in the first survey year 2001, thereafter the number increased to about 50-60 (see Table 4). The surveyed area covers the proposed young fish areas in Disko Bay, off Ilulissat and the Icefjord and off the northern icefjord Torssukattak (table II,1 and fig II,1). Mesh sizes 46, 55, 60 and 70 mm (knot to knot) with twines 0.28, 0.40, 0.40 and 0.50 mm correspondingly, were used to target the fish size groups approximately 30 – 50 cm. Multi-gang gillnets being approx. 300 m were composed of 4 sections, one of each meshsize, with 2 m space between each section to prevent catchability interactions between sections. Soaktime is approx. 10 hours and fishing occurred both day and night. Stations were paired two and two, close to each other to allow for analysis of within station variability. The survey uses fixed positions of stations.

The gillnet survey uses 4 different mesh sizes, 46, 55, 60 and 70 mm, for which is assumed a bi-modal selection curve as shown in Appendix II, fig II,3. Gillnet selection curves are well-known to be skew and not characterized by a normal distribution. In order to account for catch of larger fish a bi-modal (Wilemanns wings) with a fixed selectivity on larger fish approach was chosen. The mesh sizes 46, 55, 60 and 70 mm was chosen in order to select fish in the length range 30 – 50 cm, i.e. pre-fishery recruits. From the selection curves in figure II,3, it is obvious that selection is nearly 100% in that length interval, thus it is assumed that the catches in this length range will reflect the fished population. When estimating the underlying relative population this selectivity curve is assumed.
Greenland halibut larger than 50 cm are abundant in the area, but seem mostly concentrated at the commercial fishing grounds in the immediate vicinity of Ilulissat and in the Icefjords, Kangia (Ilulissat Icefjord) and Torsukattak in the north. The gillnet survey do only cover the boundary of those commercial fishing grounds. Greenland halibut

smaller than 30 cm are occasionally abundant in the area, but are mostly recruited from offshore areas off Disko Bay and are thought to perform a stepwise migration towards the commercial fishing grounds near the icefjords.

Recruitment indices.

Greenland Institute of Natural Resources conducts annual trawl surveys with R/V “Pamiut” in June/July for shrimp and demersal fish. Since 1992 it has been extended to include the Disko Bay. Fish have been routinely measured, and Greenland halibut are disaggregated to ages 1-3 by the Petersen method. The CPUE for Greenland halibut (number per age per hour of ages 1-3) is estimated for the Disko Bay, using tows from depths >300m. The index is assumed indicative for recruitment to the Disko Bay fishable stocks only. Recruitment dynamics for the northern areas, Uummannaq and Upernavik are unknown.

Commercial fishery data

Landings data

Data on the inshore landings of Greenland halibut for Disko Bay and Uummannaq were obtained from Royal Greenland for the plants in Disko Bay and Uummannaq area, and Greenland Fishery Licence Control (GFLK). Data from Upernavik was obtained from Upernavik Seafood A/S and GFLK. The summer season was defined as June-November (both included) and the remaining months were classified as winter. Processed fish is normally converted to whole fish weight using a conversion factor set by the authorities. The conversion factor for gutted fish with head and tail are multiplied by a factor 1.10. The conversion factor for gutted fish without head and tail are 1.35.

Effort

Logbooks have been mandatory for vessels greater than 30’ft (9,4m), but voluntary logbooks from 2006 and 2007 were also available. Small boats, dog sledges and non factory vessels that land their catches are obligated to report data on area (field-code), gear and effort to the factory in which they land their catch, and this info is then reported to GFLK.

CAA -Catch at age

Age readings has been suspended since 2010 but the latest ALK and CAA data is presented in Appendix I.

Assessment

Commercial Fishery

Mean size in landings

Disko bay: Mean length in the Greenland halibut landings caught in summer are generally smaller than fish caught during winter, and winter average size in general shows higher inter annual variation (fig 4) The winter fishery in the Disko bay is highly dependent on ice coverage and access to the inner parts of the Kangia icefjord, where larger fish are accessible at greater depths, leading to the large difference in summer and winter fishery average length. Mean length in landings, decreased from 2001 in both the summer and the winter fishery, and have dropped to the lowest value observed in 2010 and 2011. However, the average length in the landings from the winter fishery has increased in 2012.

Uummannaq: Mean length in the landings have decreased slightly in the summer fishery since 2004 and the winter fishery since 2007 (fig 4). However, the mean length in the winter fishery landings increased to about the average of the past decade in 2012.

Upernavik: Mean length in landings remained stable since 1999, but decreased in 2010 and 2011. However, the mean length in the 2012 winter fishery landings increased to about the average of the past decade (fig 4).

Figure 5 gives the average length in the gillnet landings. Since gillnets are highly size selective the trends imply recent incidents of landings from gillnets were a smaller meshsize was used, and no conclusions on stock trends should be made on this analysis.

CPUE

Standardized CPUE series were produced on logbooks (figure 6). However, the model only explained 22 to 27 % of the variability in the data and only covers 5-30% percent of the total landings (see Appendix III for diagnostics). The 2006 estimates were based on very few logbooks in all areas, and can hardly be regarded representative. Likewise, the 2012 CPUE estimate should be regarded preliminary, since it is based on few logbooks provided within the first few months of 2012 and no correction for effect of month has been made. Also the CPUE series does not account for fishing grounds within the area and shifts in the distribution could also cause the increasing or decreasing trends.

Disko Bay: The standardized logbook CPUE series reveals a decrease in CPUE in Disko bay of about 30 % from 2007 to 2011.

Uummannaq: The standardized CPUE series reveals an increasing trend from 2007 to 2011.

Upernavik: The standardized CPUE series reveals a decreasing trend from 2007 to 2011.

Catch at age

For all three areas there has been a shift in exploitation pattern through the time series (fig 7). In the Disko Bay, exploitation of age-class 10 and younger has increased since 2002 to 90%. In the Uummannaq fjord exploitation of age 10 and younger has increased since 2006 to 80% and is at the same high level as in the 1990s. In Upernavik the exploitation of age-class 10 and younger is at a lower level than the end 1990s. However these tables have not been updated since 2009.

Mean weight-at-age

Mean weight at age for Greenland halibut in the three fishing areas are shown in Appendix I (figure I,1). The outliers in 1994 are considered to be due to errors in age readings or input data error. For the younger fish mean weight at age have varied in the sampled time series, but recent values are overall at same level as those in the beginning of the period.

Gillnet survey

Overall CPUE and NPUE increased significantly from 2010 to 2011 (Fig. 8 upper panel). From the length related plot (Fig. 8 middle and lower panel) and the estimated population length distribution (Fig. 9) it is obvious that the increase is mainly due to the larger sizes, i.e. >50 cm and 35-50 cm. The distribution of the gillnet stations and their NPUE are provided in Appendix II (Table II,1 and fig II,1. The increase in 2011 NPUEs is seen to derive mainly from the northern area off Torssukateq, while near the main fishing grounds at Kangia the NPUEs have remained low. However, in 2011 the innermost stations that usually provide high NPUEs were not covered due to ice. But overall the increase in total NPUE and CPUE should be interpreted cautiously with the above considerations in mind.

From the estimated underlying population in figure 9, there is no obvious cohort trend. The high numbers of larger fish in 2011 seem not to have any origin in the previous years estimated populations. This may either be due to migration/movements of the larger fish in the area or more likely reflecting the uncertainty of the estimates.

Longline survey

Since 2001 when the gillnet survey was initiated, the longline survey has been restricted and the aim is to cover the Uummannaq area only by longline survey. In order to establish a calibration key between the gillnet and the longline surveys, both longline and gillnet settings were conducted in Disko Bay in 2004 and 2005. This allow an extension of the newly initiated gillnet survey index back in time (SCR 05/57).

Survey CPUE

Disko Bay

Apart from 2001 a longline survey was carried out in 2004-5 (Fig. 8). CPUE in 2004 and 2005 were similar high and above the average catch rate, at about same level as in 2001. Thus since 2001 catch rates are considerably higher than those obtained in the period 1993-2000 although not statistically significant. Length distributions of catches have since 2001 been narrower than prior to 2001 (fig 11). Using the relation between total catches and the survey index as an approximation for exploitation level, reveal that exploitation of the populations in 2006 and 2007 has doubled compared to 2005 (Fig. 12a).

Uummannaq

In Uummannaq mean size have been very stable in the time series of the longline survey. Mean length increased from 57 cm to 62 cm in 1998 decreased to 57 cm in 2003 and has been stable since then (Fig. 11). Catch rates have shown a considerable decrease from 1998/99 to 2003, but have since increased and stayed stable from 2004 to 2007 at about average of the time series (10). Distributions suggest that good year-classes are contributing to survey since 2003. Exploitation of the populations in Uummannaq has increased since the late 1990s and especially in 2003 and 2006 (Fig. 12b). No survey was conducted in 2008 to 2010 and the 2011 survey still awaits analysis.

Upernavik

The longline survey in Upernavik was not conducted from 2003 to 2009 and the 2010 and 2011 still awaits analysis.

Exploratory analytical assessments

Exploratory analytical assessments were conducted in the 2006 assessment of the Disko Bay area, by separable VPA, XSA and Survey based assessment (SURBA). The output showed a continuous increase in fishing mortality, but none was accepted as providing an accurate assessment an accurate assessment, but suggested that the continuous increase in catches is due to *increased recruitment in combination with an increased fishing mortality However; the assessment is unable to estimate the relative size of these two elements* (SCR 06/35).

Biomass and recruitment

The Greenland shrimp survey (GINR SFW)

Since 1988 annual trawl surveys with a shrimp trawl have been conducted off West Greenland in July-September (SCR 12/16). The survey covers the area between 59^{o}N and 72^{o}30'N (Div. 1A-1F), from the 3-mile limit to the 600-m depth contour line. The survey area was re-stratified 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 biomass of Greenland halibut in the Disko Bay increased until 2004 at more than 28 000t (fig 13). After 2004 the survey biomass and abundance indices decreased, but stabilized in 2008 and 2009 and increased further in 2010 and 2011 . The 2011 abundance index reached the highest value recorded, mainly caused by a strong 2009 year-class and a very strong 2010 year-class (fig 14).

Recruitment

A recruitment index was provided from the Disko Bay. 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. 15). 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 not the trend in the index. However, age 1 Greenland halibut is abundant at depths of 200-300 meters and the recruitment index may not fully cover ages 1 and 2.

Estimated length distributions (Fig. 14) from the Greenland shrimp/fish survey indicates that abundance at age one may be a poor indicator of recruitment in the inshore areas, since strong cohorts often reveal average strength at year 3. It is possible that if recruitment is above a certain threshold, it will meet its carrying capacity. An indicator of this is the fairly strong 2004 year-class that at age 3 was at about the same level as the weaker 2005 cohort at age 3 (~30cm).

Assessment results

Disko Bay

Landings have been declining since 2004, especially between 2006 and 2007 but increased in 2010 and 2011. Mean length in the landings have gradually been declining since 2001 to a record low in 2010 and 2011. The consistent decrease the logbook CPUE and in the decrease in mean length in the summer fishery landings indicate that the fishery is currently dependent on incoming year-classes entering the fishery. The CPUE should however be interpreted with some caution since only about 20% of the landings are covered in the logbooks. The gillnet survey CPUE and NPUE increased to the highest values observed in the short survey time series and the increase was particularly observed in the northern part of the area. However, the gillnet survey should be interpreted with caution. The trawl survey biomass and abundance indices decreased after 2004, but stabilized in 2008 and 2009 and increased further in 2010 and 2011 (fig 2.9). The 2011 abundance index reached the highest value recorded, mainly caused by a strong 2009 year-class and a very strong 2010 year-class. The increasing indices in both the Gillnet survey and the trawl survey and in the mean length in the winter landings indicate some recovery potential.

Uummannaq

The slowly decreasing trend in average length in the landings since 2004 could indicate greater dependence of incoming year-classes and a decreasing stock, but could however also be caused by large new incoming year-classes. The increasing logbook CPUE indicates an increasing stock. The index should however be interpreted with caution as little variance is explained and that only 5-15 % of the landings are covered by logbooks.

Upernavik

Landings have remained relatively stable after 2004 but increased in recent years to more than 6000 t. The CPUE index from the commercial fishery decreased from 2007 to 2011. The index should however be interpreted with some caution since little variance is explained and since only 20-30% of the landings are covered by the logbooks. However, the mean length in the 2012 winter fishery is at the same levels as in the past decade.

General Comments

An earlier study of the by-catch of Greenland halibut in the commercial shrimp fishery (Jørgensen and Carlsson, 1998) suggest that the by-catch is considerable and could have a negative effect on recruitment to the inshore stock component. However, sorting grids have since then been made mandatory in the shrimp fishery (since October 2000), but for the entire inshore shrimp fishery derogations have been given until recently.

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Table 1. Landings and Greenland halibut (‘000t) in Div. 1A inshore distributed on the main fishing areas: Disko Bay, Uummannaq and Upernavik.

	Disko Bay	Uummannaq	Upernavik	Unknown/other	Total in Div. 1A inshore:	STATLANT 21 SA1 Excl offsh. 1BCDEF	STACFIS SA1 Div 1A inshore
1987	2,3	2,9	1,6	0,4	7,2	6,7	7,2
1988	2,7	2,9	0,8	0,6	7,0	6,4	7,0
1989	2,8	2,9	1,3	0,6	7,5	6,9	7,5
1990	3,8	2,8	1,2	0,5	8,4	7,5	8,4
1991	5,4	3,0	1,5	0,0	9,9	9,2	9,9
1992	6,6	3,1	2,2	0,1	11,9	11,9	11,9
1993	5,4	3,9	3,8	0,0	13,1	13,2	13,1
1994	5,2	4,0	4,8	0,0	14,0	14,1	14,0
1995	7,4	7,2	3,3	0,0	17,9	17,0	17,0
1996	7,8	4,6	4,8	0,0	17,3	17,3	17,3
1997	8,6	6,3	4,9	0,0	19,8	20,8	19,8
1998	10,7	6,9	7,0	0,0	24,6	19,7	24,6
1999	10,6	8,4	5,3	0,1	24,3	24,3	24,3
2000	7,6	7,6	3,8	2,2	21,1	21,0	21,1
2001	7,1	6,6	3,2	0,0	16,9	16,5	16,9
2002	11,7	5,3	3,0	0,0	20,1	17,6	20,1
2003	11,6	5,0	3,9	0,0	20,5	21,5	20,5
2004	12,9	5,2	4,6	0,0	22,7	25,2	22,7
2005	12,5	4,9	4,8	0,8	22,9	21,6	22,9
2006	12,1	6,0	5,1	0,0	23,2	24,2	23,2
2007	10,0	5,3	4,9	0,0	20,6	0,0	20,6
2008	7,7	5,4	5,5	0,3	18,9	0,0	18,9
2009	6,3	5,5	6,5	0,0	18,3	0,0	18,3
2010	8,5	6,2	5,9	0,0	20,6	0,0	21,0
2011	8,0	6,4	6,5	0,0	20,9		20,9

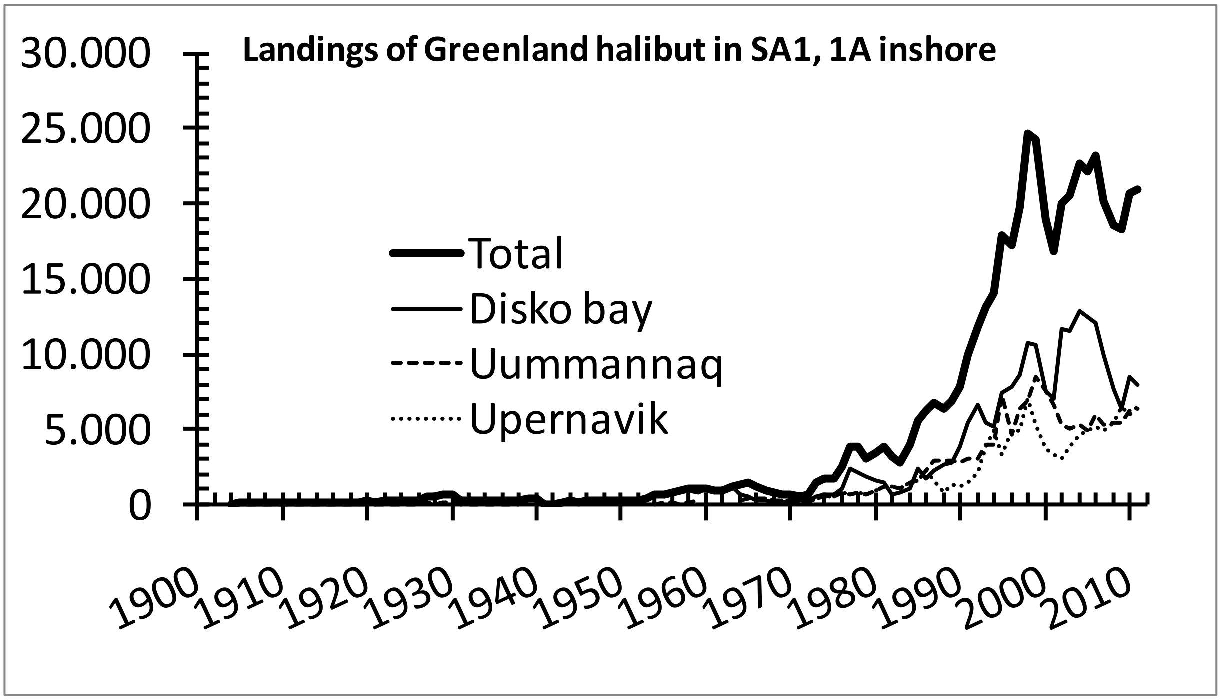


Fig. 1. Landings in NAFO Div. 1A since 1987 for the 3 main fishing areas. Data on landings from 2000-2007 are provisional. See also Table 1.

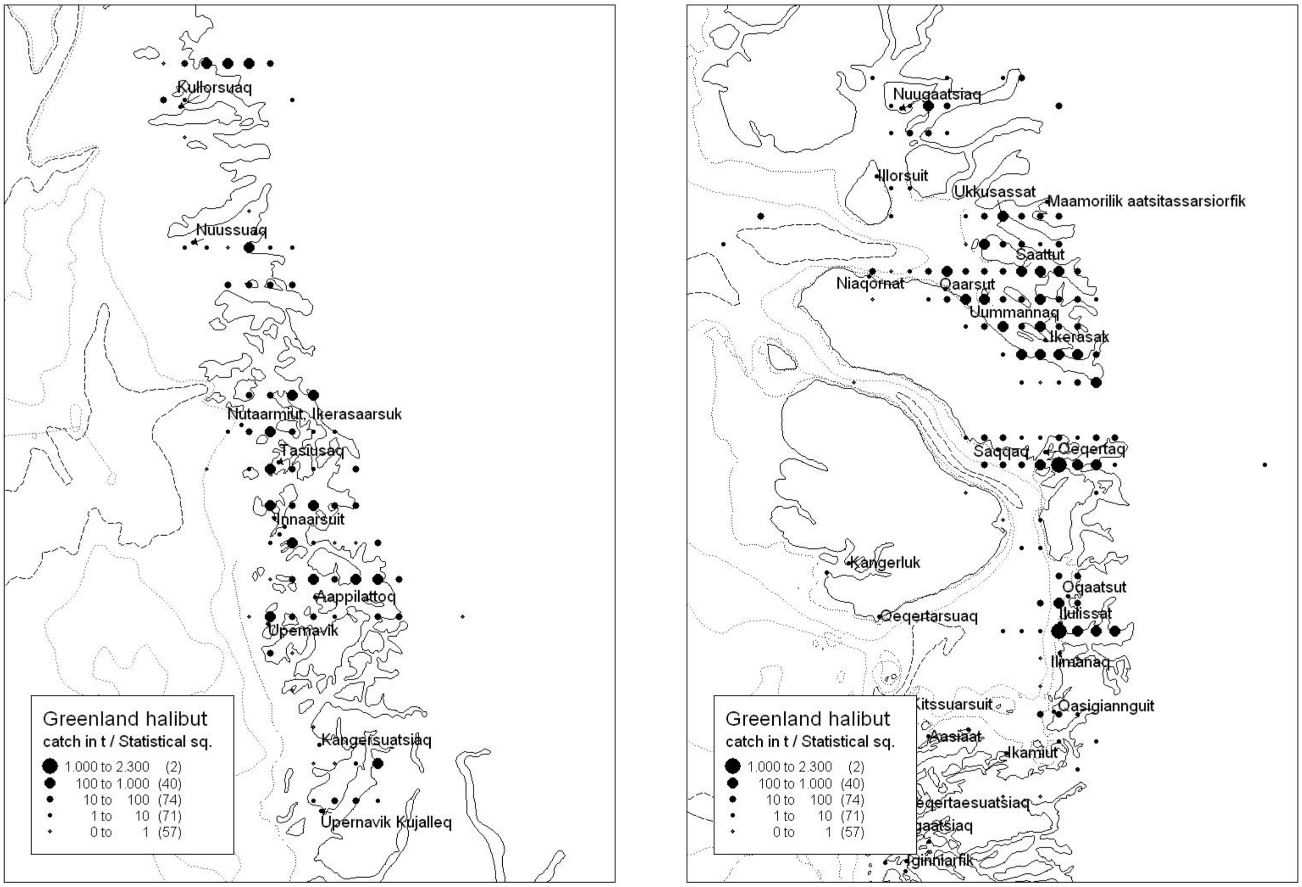


Fig. 2. Distribution of the inshore fishery for Greenland halibut in Div.1A Upernavik Area in 2007. Landings is shown in tonnes per statistical square (field-code defined as 1/32 x 3600 x cos(lat)). Catch statistics are provided by Upernavik Seafood, Royal Greenland and GFLK.

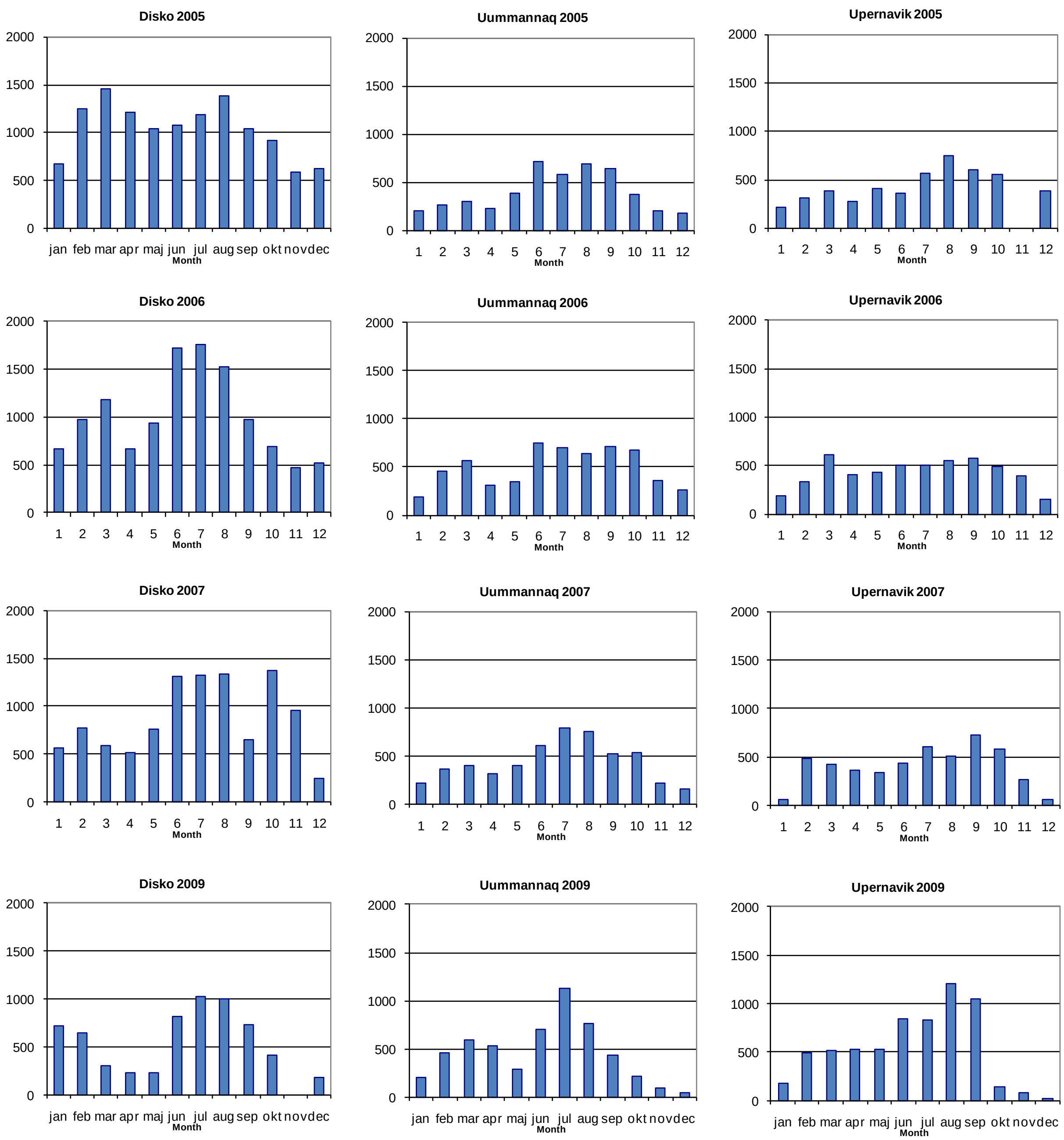


Fig. 3. Landings (t) in NAFO Div.1A inshore by month and area since 2005 (2008, 2010 and 2011 missing).

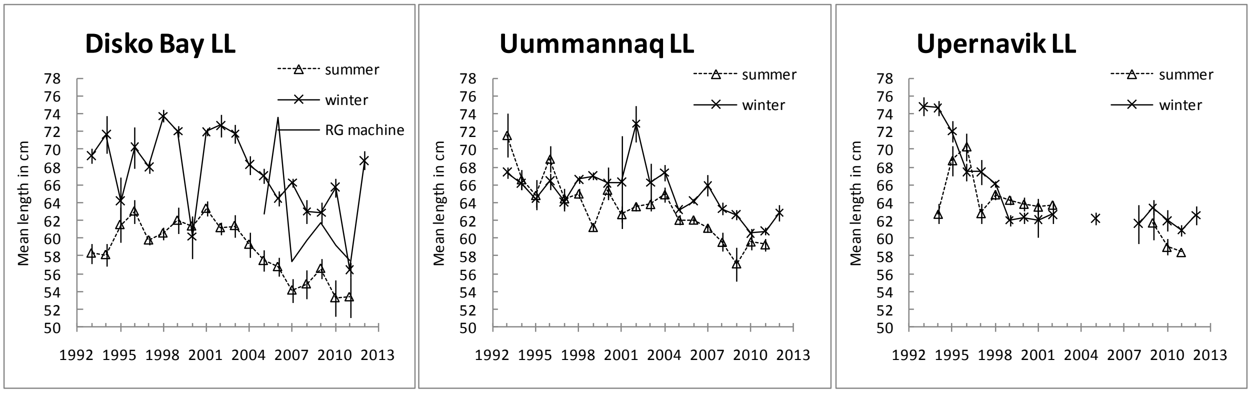


Fig. 4. Longline mean length in landings from Ilulissat, Uummannaq and Upernavik with 95% conf. Int. RG machine average length calculated via average weights provided via the sorting machine located at the Royal Greenland factory in Ilulissat.

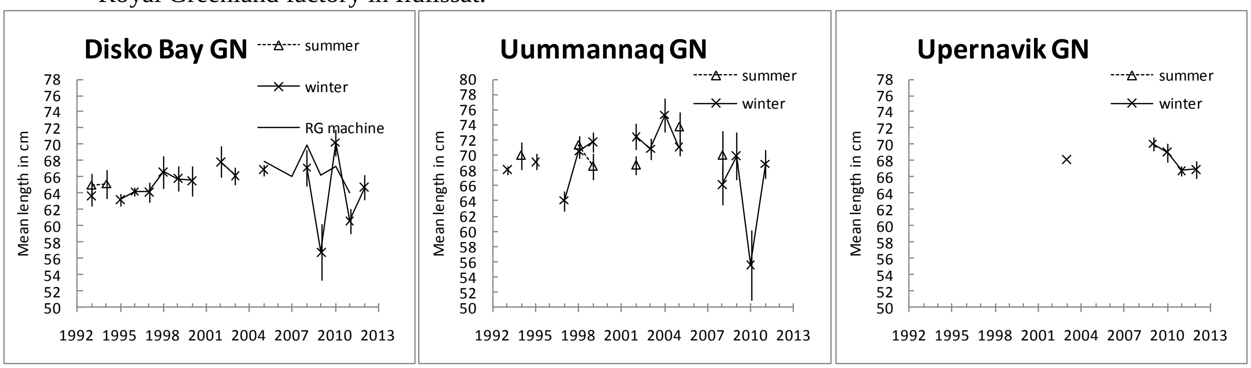


Fig. 5. Gillnet mean length in landings in Ilulissat, Uummannaq and Upernavik with 95% conf. Int.

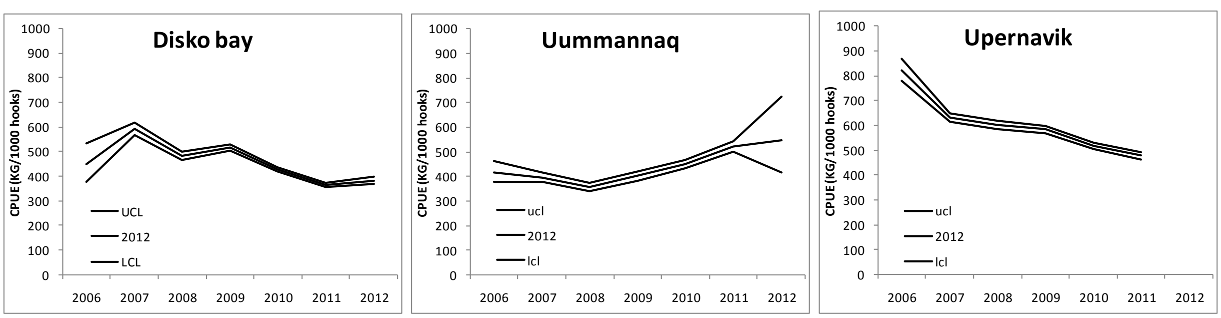


Fig 6. Standardized CPUE series for for commercial LongLine catches.

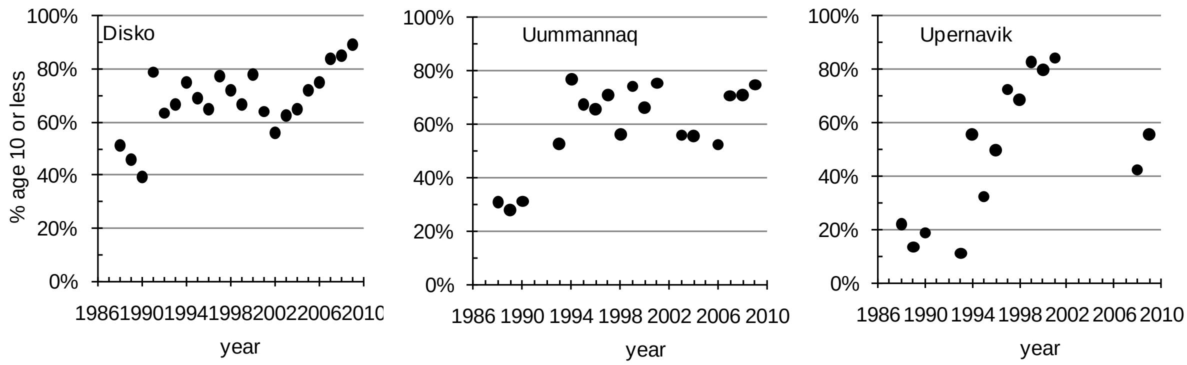


Fig. 7. The development in exploitation of the *age 10 and younger* expressed as percentages of those age groups in commercial landings by year (No update since 2009).

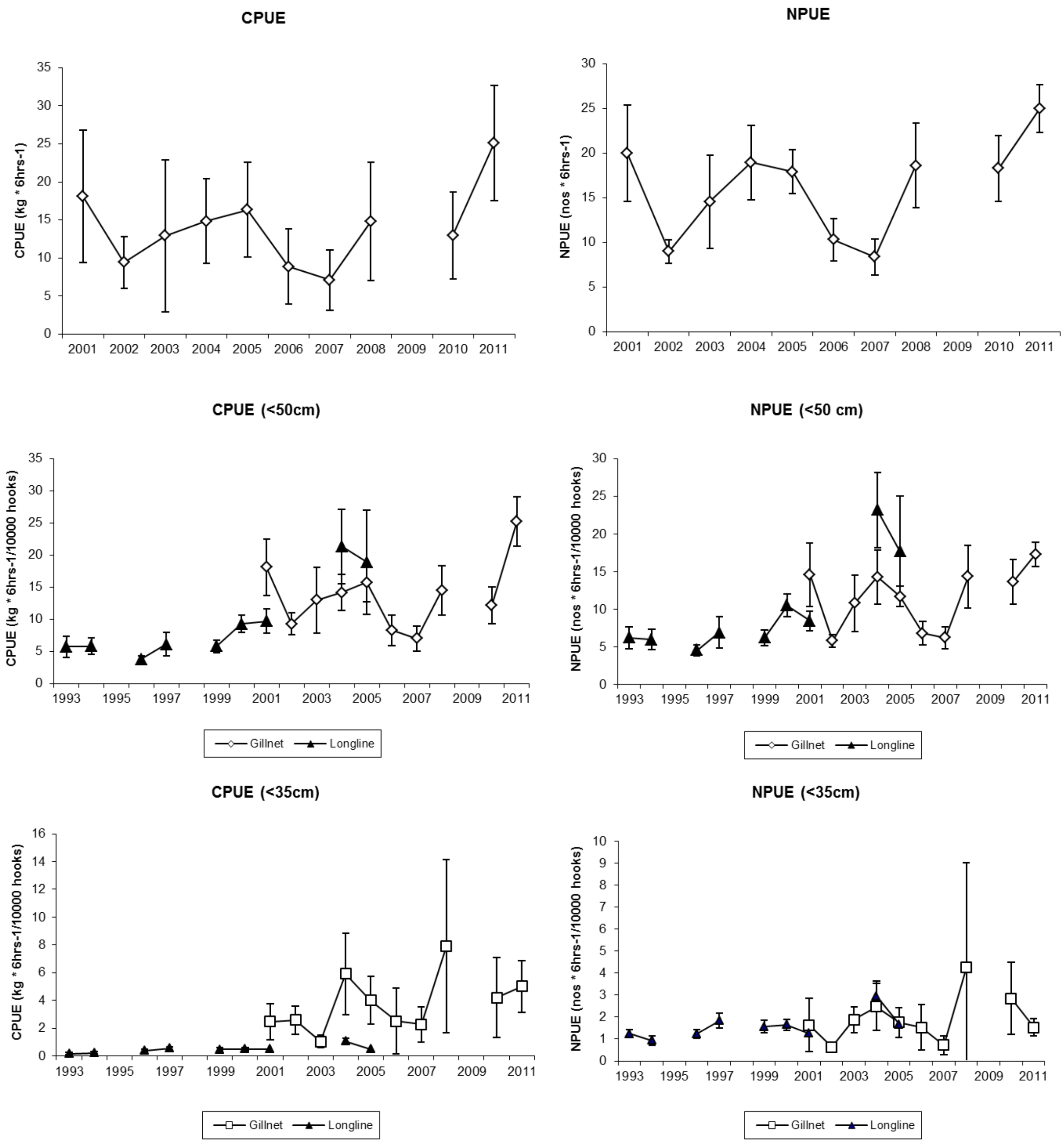
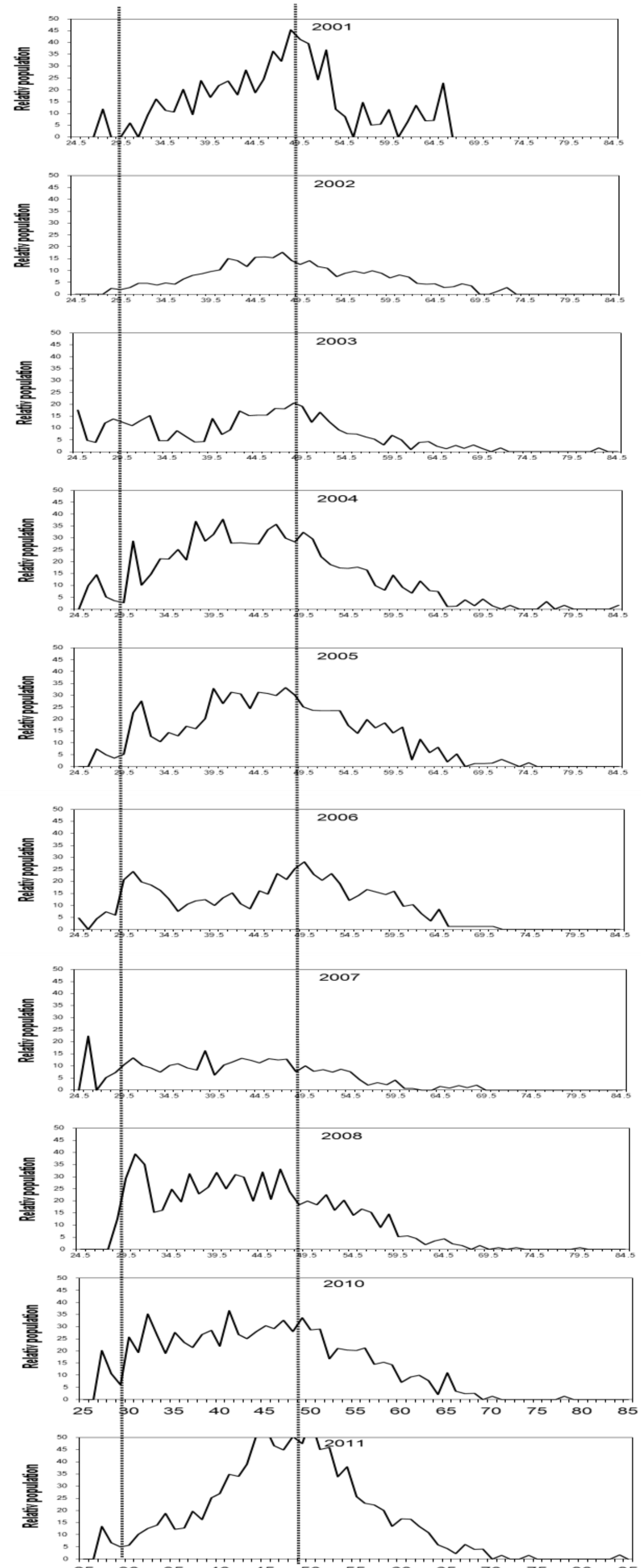


Fig. 8. Catch rates from gillnet survey in Disko bay (1A) in weight (CPUE) and numbers (NPUE). Upper panel: CPUE and NPUE for catches including all lengths, Mid-panel: CPUE and NPUE for fish < 50 cm, incl. calibrated longlinesurvey catches prior to 2006. Lower panel: CPUE and NPUE for fish < 35 cm, incl. calibrated longlinesurvey catches prior to 2006.

Fig 9 Gillnet survey in Disko bay. Estimated relative population assuming a Wilemans Wings selectivity curve in 2001 to 2011. The dashed lines indicate the length interval 30-50 cm where fully selection is assumed.



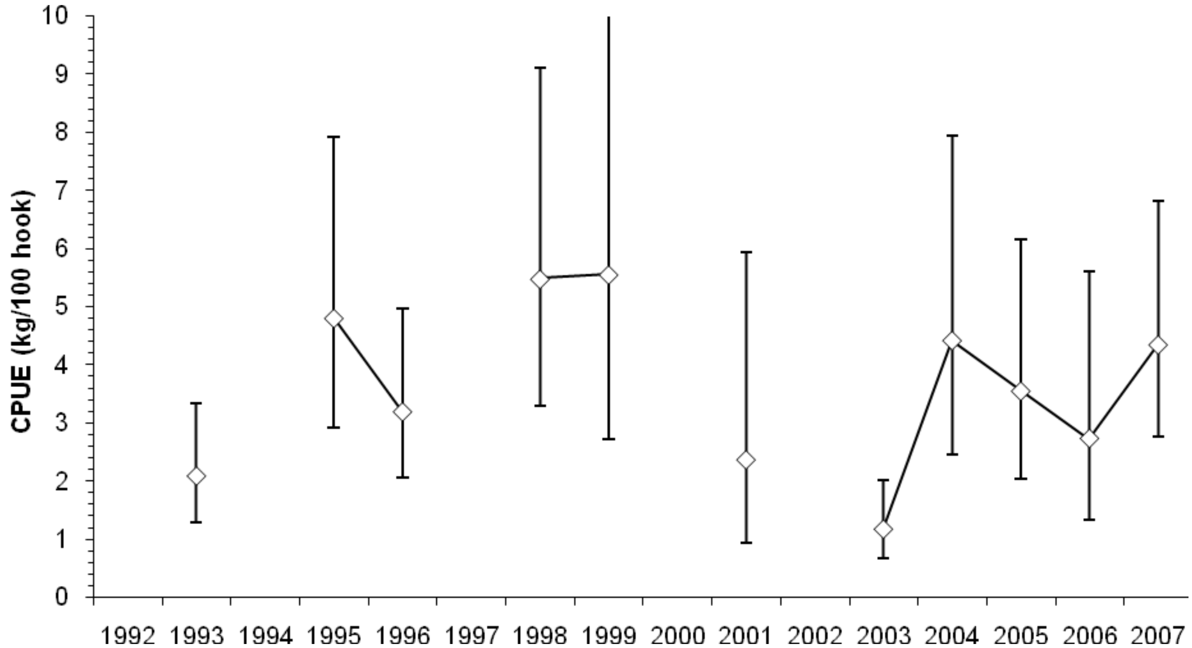


Fig. 10. Longline survey index for Uummannaq 1993-2007. 95% CI indicated. (No Survey since 2007)

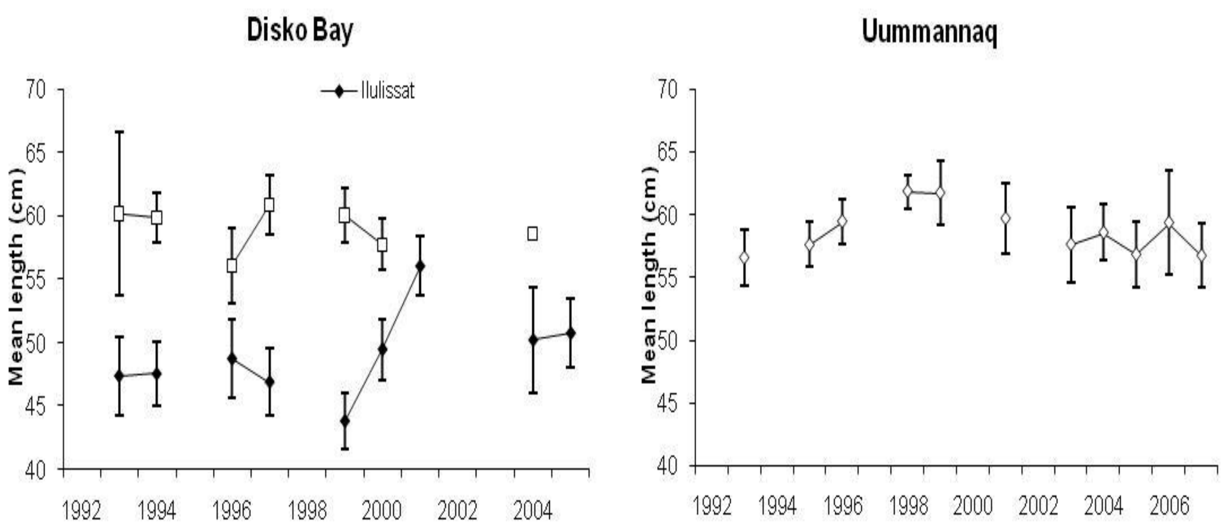


Fig. 11. Mean length for longline surveys conducted since 1993. 95% CI indicated. (No survey since 2007)

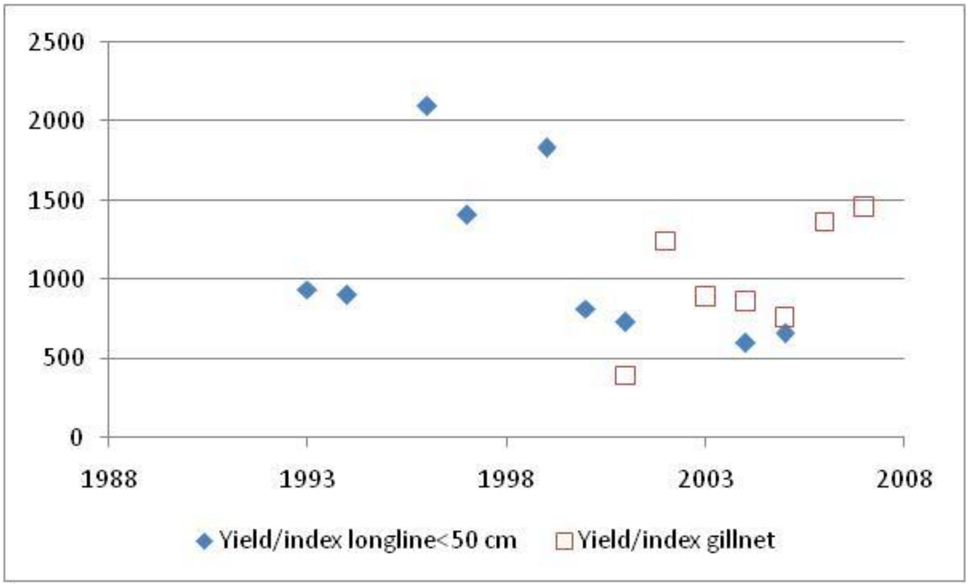


Fig. 12a.Exploitation proxy (Landings/standardized survey index) for Ilulissat for Gillnet survey catch rates and longline survey catch rates. Not updated in recent years

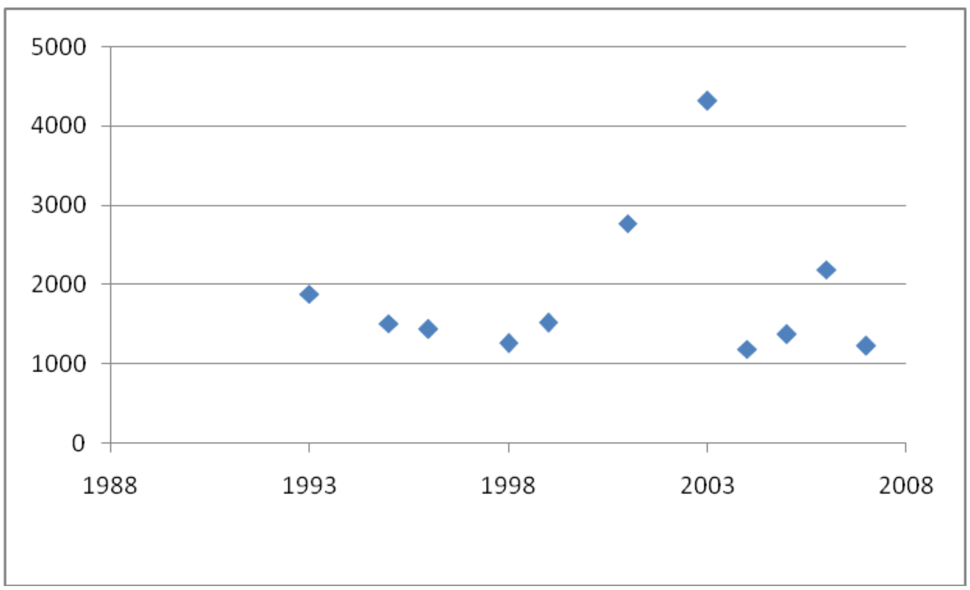


Fig. 12b. Exploitation proxies (Landings/standardized survey index) for Uummannaq. Not updated in recent years

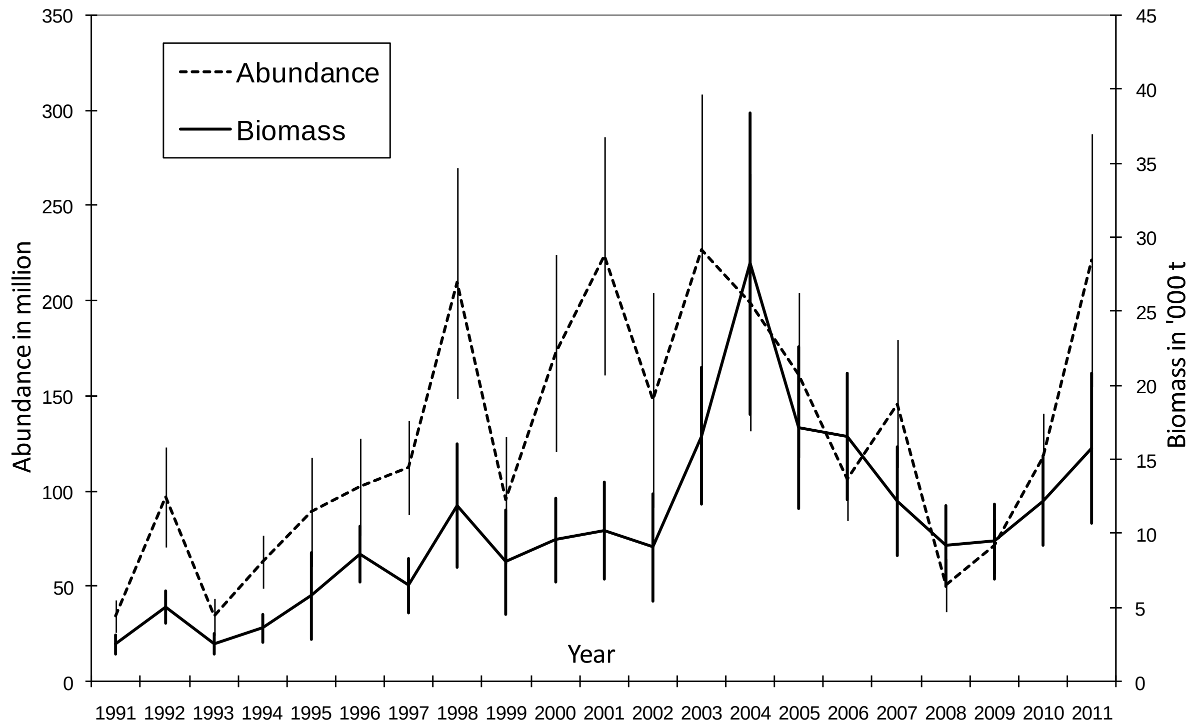


Fig. 13. Abundance in million and Biomass in kt ('000 t) indices of Greenland halibut from the Paamiut trawl survey in Disko Bay. In 2005 a new survey trawl was introduced, but the 2005-2011 catch figures have been adjusted to the old gear according to (Rosing and Wieland, 2005).

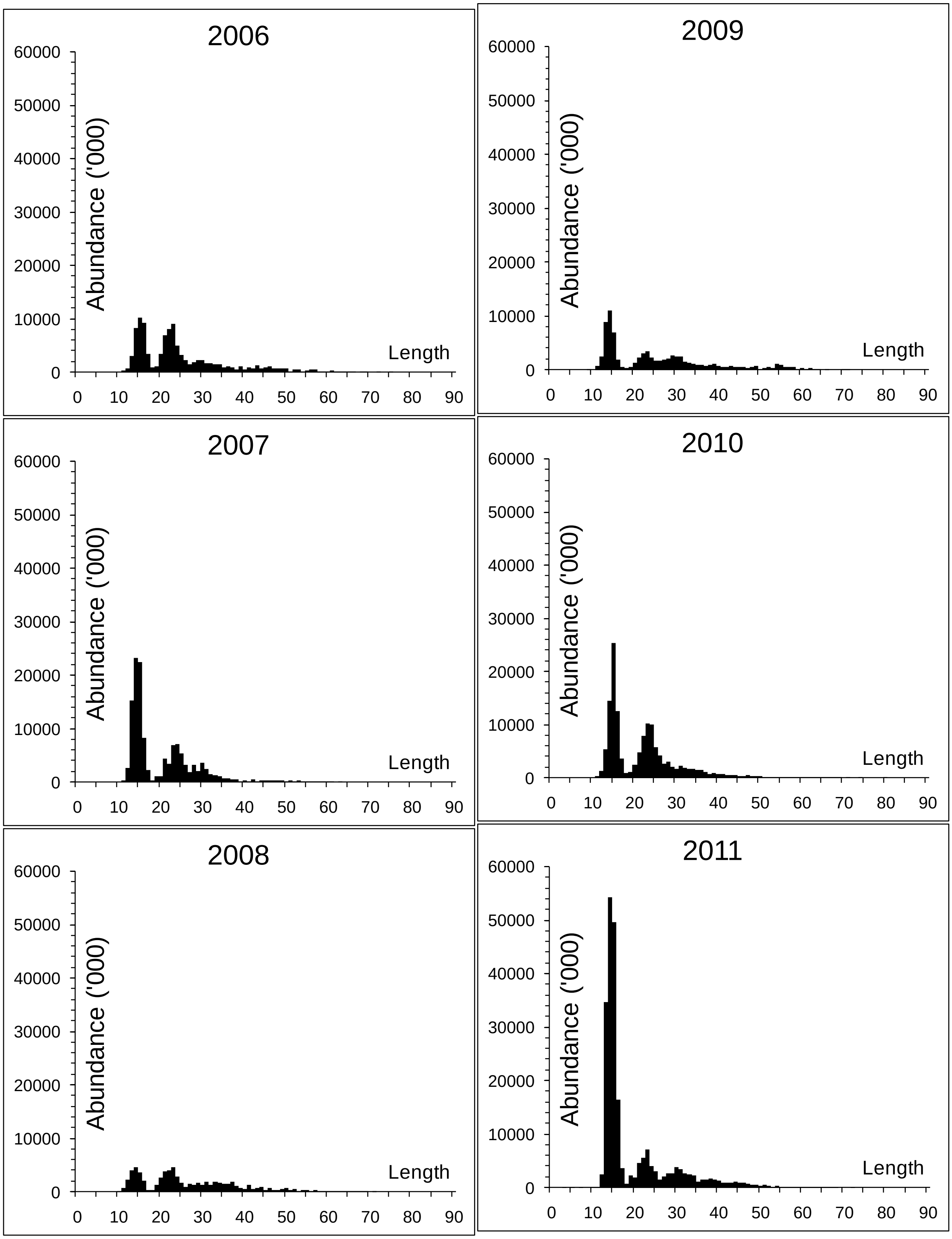


Fig . 14. Length distributions in Disko bay from the Greenland shrimp fish survey (GINR SFW) since 2005 (Non. calibrated values).

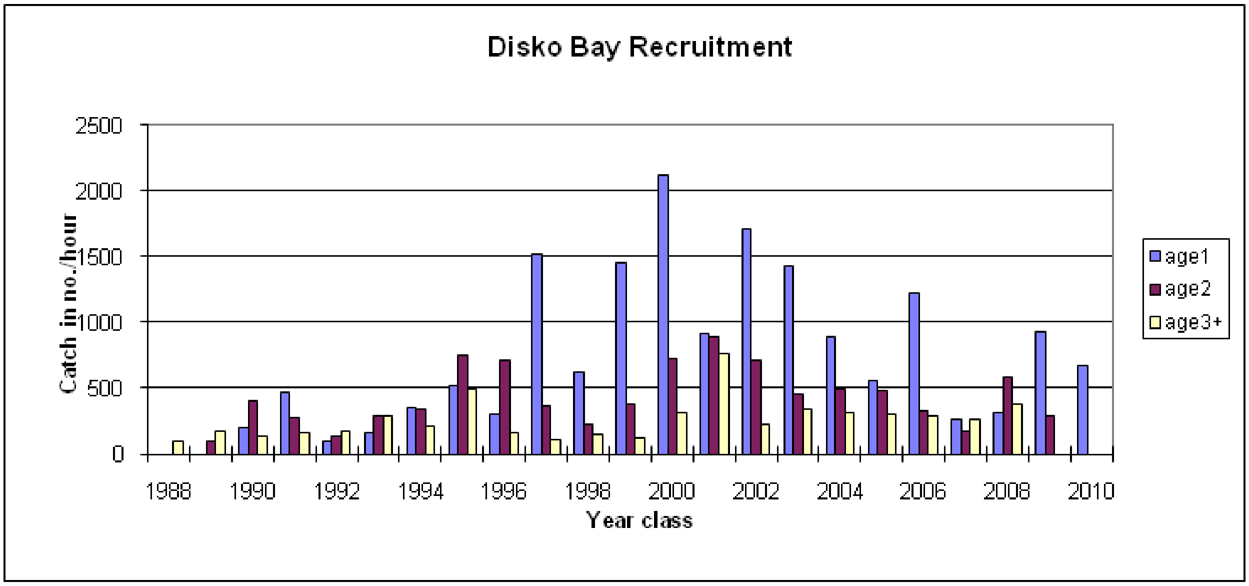


Fig. 15. Catch in number per hour of Greenland halibut at age 1, 2 and 3+ in the inshore Disko Bay. In 2005 a new survey trawl was introduced, but the 2005-2007 catch figures have been adjusted to the old figures according to Nygaard et al. (SCR 08/28) .

Apendix I

Table I,1. Summary of the Age-length keys used for 2009. Age readings are from Disko bay area only.

	Age													
Length	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16+
5-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-24	20	0	0	0	0	0	0	0	0	0	0	0	0	0
25-29	41	19	2	0	0	0	0	0	0	0	0	0	0	0
30-34	17	37	9	0	0	0	0	0	0	0	0	0	0	0
35-39	0	20	23	1	1	0	0	0	0	0	0	0	0	0
40-44	2	6	39	10	3	0	0	1	0	0	0	0	0	0
45-49	0	0	10	43	30	2	0	0	0	0	0	0	0	0
50-54	0	0	0	5	52	25	3	0	0	0	0	0	0	0
55-59	0	0	0	0	11	36	12	7	0	0	0	0	0	0
60-64	0	0	0	0	3	12	23	17	6	1	0	0	0	0
65-69	0	0	0	0	0	4	12	17	10	7	1	0	0	0
70-74	0	0	0	0	0	1	0	7	21	22	14	4	2	0
75-79	0	0	0	0	0	0	0	0	10	7	14	6	4	1
80-84	0	0	0	0	0	0	0	0	2	4	7	12	4	0
85-89	0	0	0	0	0	0	0	0	0	1	5	4	2	1
90-94	0	0	0	0	0	0	0	0	0	2	2	1	0	2
95-99	0	0	0	0	0	0	0	0	0	0	1	1	1	2
100-104	0	0	0	0	0	0	0	0	0	0	0	0	1	4
105-109	0	0	0	0	0	0	0	0	0	0	0	0	0	5
110-114	0	0	0	0	0	0	0	0	0	0	0	0	0	5

– Indicates = insufficient sampling,
[1] Samples were collected, but age readings were postponed.

Table I,2. Disko bay Catch at age of Greenland halibut.

age/year		4	5	6	7	8	9	10	11	12	13	14	15	16+	Total
1988		0	0	1	9	59	182	173	132	73	63	65	38	33	828
1989		0	0	0	0	14	106	121	94	49	33	39	31	41	528
1990		0	0	0	1	24	141	185	188	126	80	59	42	44	890
1991		5	5	11	279	806	535	333	238	76	45	67	57	44	2501
1992		34	92	122	332	476	390	451	532	309	140	92	18	0	2988
1993		7	15	62	280	479	339	280	240	122	91	112	75	86	2188
1994		0	3	15	112	281	539	396	190	91	50	45	41	36	1799
1995		0	0	0	45	459	639	798	463	185	127	27	36	27	2806
1996		0	8	1	47	323	941	651	454	273	145	75	44	69	3031
1997		0	0	21	132	646	1113	1168	607	185	69	19	10	6	3976
1998		0	0	74	397	775	944	1248	754	346	132	68	27	6	4770
1999		1	4	41	360	619	836	1028	786	426	136	72	29	2	4340
2000		0	9	98	535	729	780	636	478	223	52	28	12	1	3583
2001		1	15	33	224	390	521	450	485	280	78	33	31	16	2557
2002		0	2	54	283	561	771	421	575	393	398	175	112	0	3745
2003		0	2	64	425	722	1.187	610	847	422	158	146	135	89	4808
2004		0	2	56	409	691	1083	634	730	311	144	130	152	89	4431
2005		1	48	287	516	703	868	423	481	213	100	97	122	83	3943
2006		0	10	211	882	1001	1008	522	582	231	105	89	125	85	4852
2007		0	2	56	459	1073	754	749	151	94	4	166	126	60	3694
2008		0	2	46	363	825	552	548	105	66	2	114	86	40	2751
2009	0	1	26	199	904	962	515	337	147	79	55	40	26	13	3303
2010[1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011[1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

– Indicates = insufficient sampling,
[1] Samples were collected, but age readings were postponed.

Table I,3. Uummannaq CAA

age/year		4	5	6	7	8	9	10	11	12	13	14	15	16+	Total
1988		0	0	1	5	20	52	121	143	121	96	49	23	17	648
1989		0	0	0	2	9	35	98	120	99	76	38	19	20	516
1990		0	0	1	3	15	47	108	121	101	82	42	20	21	561
1991		-	-	-	-	-	-	-	-	-	-	-	-	-	-
1992		-	-	-	-	-	-	-	-	-	-	-	-	-	-
1993		0	0	9	45	200	202	142	138	104	158	93	28	20	1139
1994		0	0	24	105	226	271	346	139	105	34	12	0	3	1265
1995		0	0	6	217	564	601	413	414	219	138	49	28	22	2671
1996		1	0	6	76	308	279	286	232	142	69	28	11	15	1453
1997		0	0	0	69	377	793	702	460	206	75	32	10	6	2732
1998		0	0	0	0	235	566	657	586	355	138	39	15	5	2595
1999		8	70	218	554	596	690	789	526	295	131	42	12	4	3935
2000		0	19	86	357	441	543	669	487	311	170	68	24	8	3184
2001		0	65	113	674	507	315	492	303	178	121	60	28	12	2868
2002		-	-	-	-	-	-	-	-	-	-	-	-	-	-
2003		0	3	21	127	360	321	235	220	158	78	145	150	94	1911
2004		0	1	10	105	197	249	198	163	118	82	103	78	59	1364
2005		1	17	101	108	192	142	115	109	74	58	80	67	50	1115
2006		1	32	12	47	243	70	284	127	324	49	108	9	9	1315
2007		3	40	181	221	340	273	192	149	94	64	82	71	56	1767
2008		4	46	203	249	381	304	213	166	104	71	91	79	63	1974
2009[1]	0	3	9	25	238	525	470	415	243	157	90	42	20	11	2248
2010[2]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011[2]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

– Indicates = insufficient sampling,
[1] based on winter length freq only).
[2] Samples were collected, but age readings postponed.

Table I,4. Upernavik Catch at age of Greenland halibut. “–“ indicates insufficient or missing sampling.

age/year	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	Total
1988	0	0	0	0	0	6	33	55	80	74	68	62	31	22	431
1989	0	0	0	0	0	2	16	34	59	66	69	73	40	31	390
1990	0	0	0	0	0	2	17	41	62	57	52	48	25	17	321
1991	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1992	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1993	0	0	0	0	0	2	16	86	252	268	143	95	40	46	948
1994	0	0	0	2	51	188	316	217	239	154	155	51	23	0	1396
1995	0	0	0	0	13	55	84	128	133	147	117	103	45	42	867
1996	0	0	3	0	16	114	359	275	238	206	151	90	48	39	1539
1997	0	0	4	25	142	428	500	430	278	175	67	37	19	8	2111
1998	0	0	0	116	343	538	535	505	410	275	112	84	39	10	2968
1999	0	14	55	172	449	619	566	343	229	138	51	36	16	5	2679
2000	0	0	2	108	420	446	302	160	133	116	48	38	17	9	1800
2001	0	0	28	144	404	422	258	103	104	87	36	14	9	3	1611
2002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2008	0	0	4	65	197	429	274	788	372	135	10	6	0	6	2284
2009	0	0	11	48	275	513	497	472	315	220	121	60	42	5	2580
2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

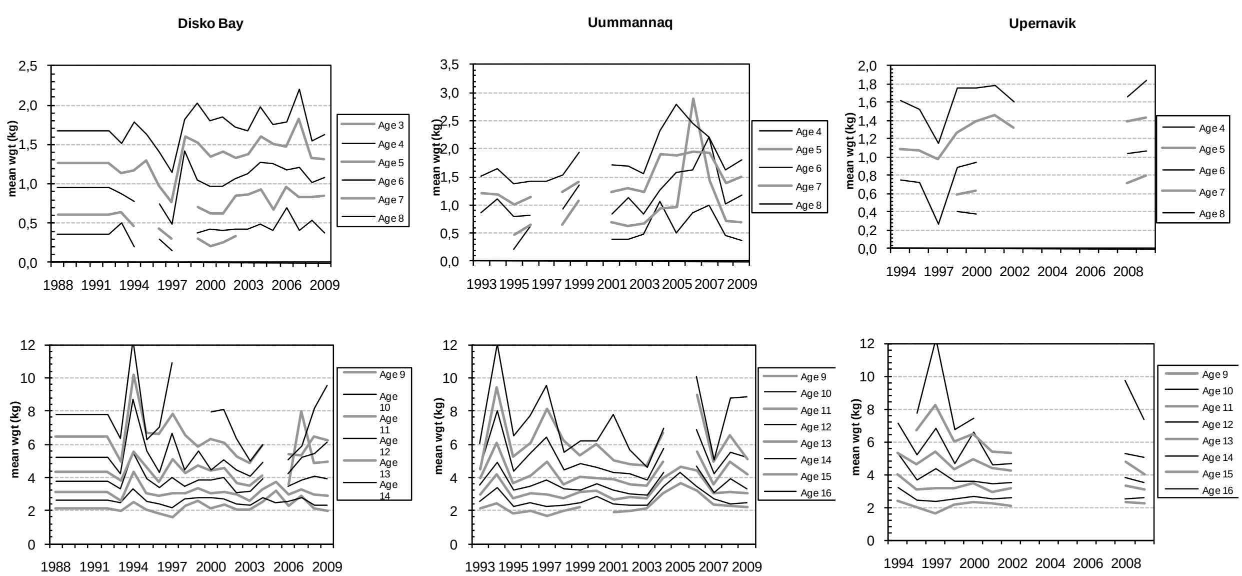


Fig. I,1. Weight at age for the three areas Disko Bay, Uummannaq and Upernavik (No update since 2008).

Appendix II

Table II,1 . Number of gillnet settings by stat. square in gillnet survey in Disko Bay since 2001.

Square	Year									
	2001	2002	2003	2004	2005	2006	2007	2008	2010	2011	Total
LD027			2	2					2	2	8
LE027			2	2					2	2	8
LF027			2	2		2	2				8
LF028			2	2		2		2	2	1	11
LG024			2	1							3
LG025				3		2				1	6
LG026		1		2		2				2	7
LG027	4	7	6	5	6	5	4	6	6	4	53
LG028	2	2	1	1	1	3	1		1	1	13
LH026		2	1		1	1		2	2	2	11
LH027		5	3	3	3	3		3	3	4	27
LH028	2	1	9	6	8	4	1	7	9	6	53
LJ026		3	2	2		4	2	3	2	3	21
LJ028		5	3	5	4	4	4	4	4	4	37
LK029		5	4	2	4	2	4		2	2	25
LL029		1	1		2		1				5
LM027								1			1
LM029		2	2		2						6
LM030		2	2		2						6
LM031		2	2		2						6
LN024		2	2	2	2	2			2	2	14
LN025		5	3	4	3	4	4	1	4	4	32
LN026		4	2	2	3	2	5	3	3	5	29
LN027		2	2	2	2	2		1	2	1	14
LN028		2	1	2	2			2		2	11
LP024		2					2		2	2	8
Total	8	55	56	50	47	44	30	35	48	50	423

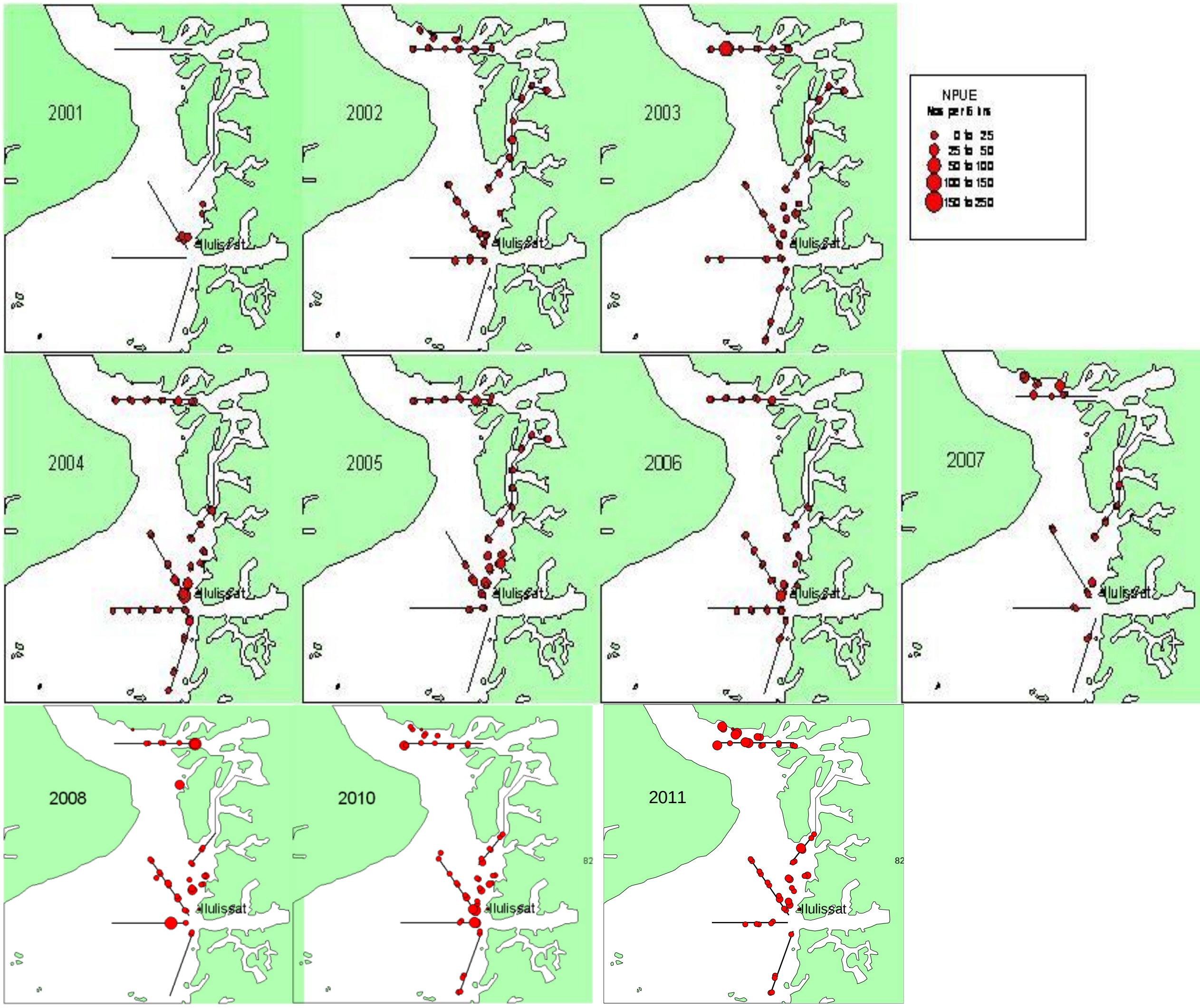


Fig. II,1. Gillnet survey in Disko Bay 2001-2011. NPUE distribution (Nos G.halibut per 6 hrs of setting).

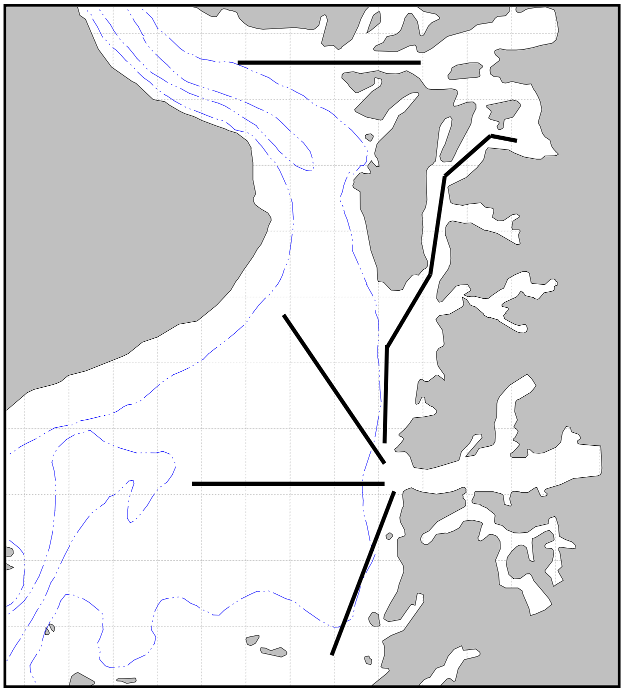


Fig. II,2 5. Map of area in Disko Bay for gillnet survey. Lines are transects along which fixed stations are positioned.

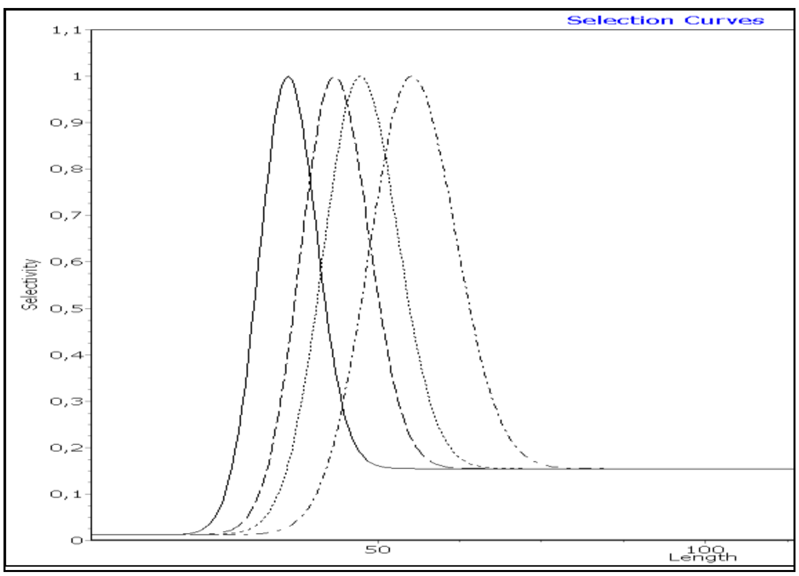


Fig II,3. Assumed selectivity curve applied to gillnet survey catches (Wilemans wings).

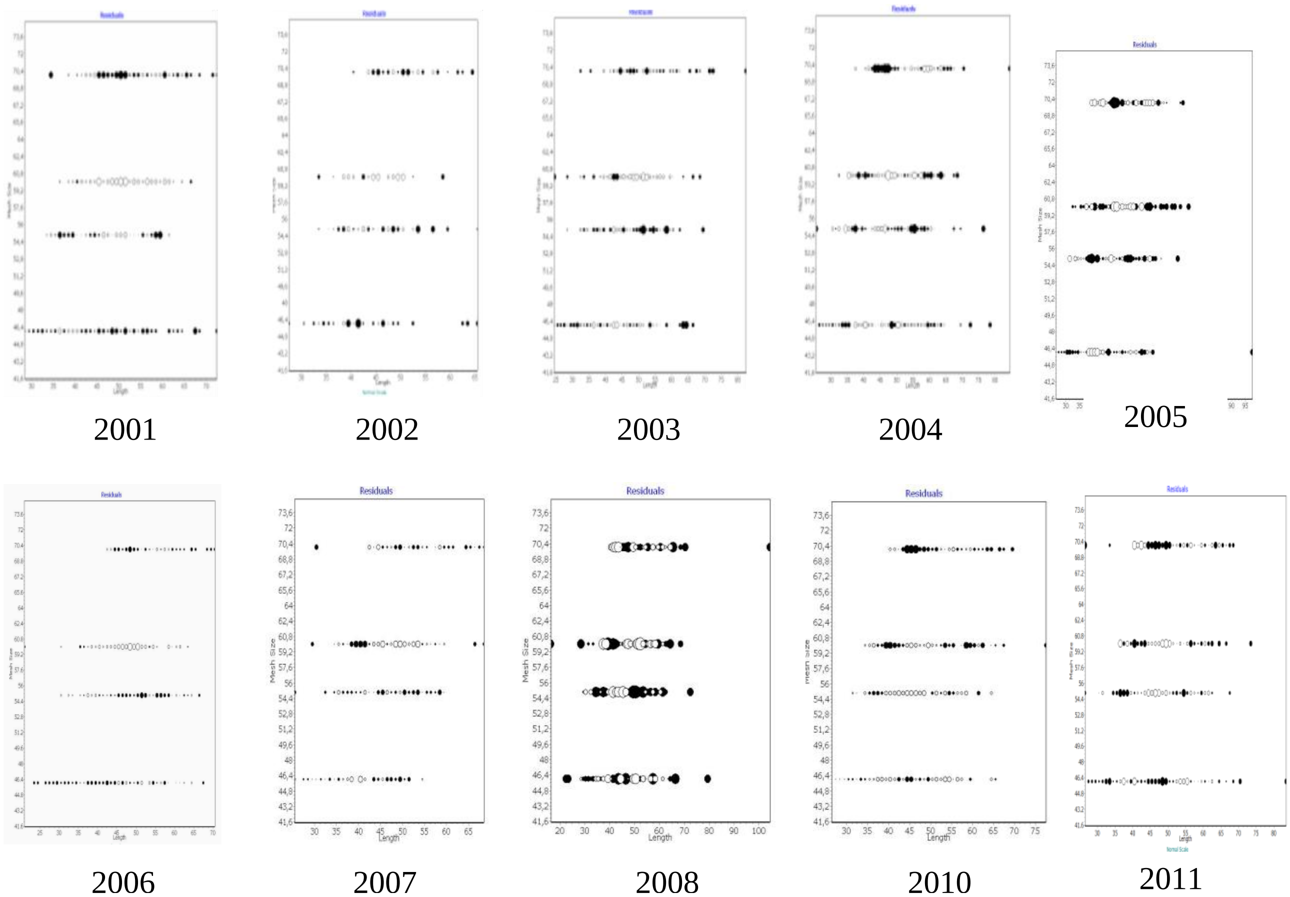


Fig. II,4. Residuals for each meshsize (y-axis) by length (x-axis) from the selectivity model (Wilemans Wings) 2001-2011.

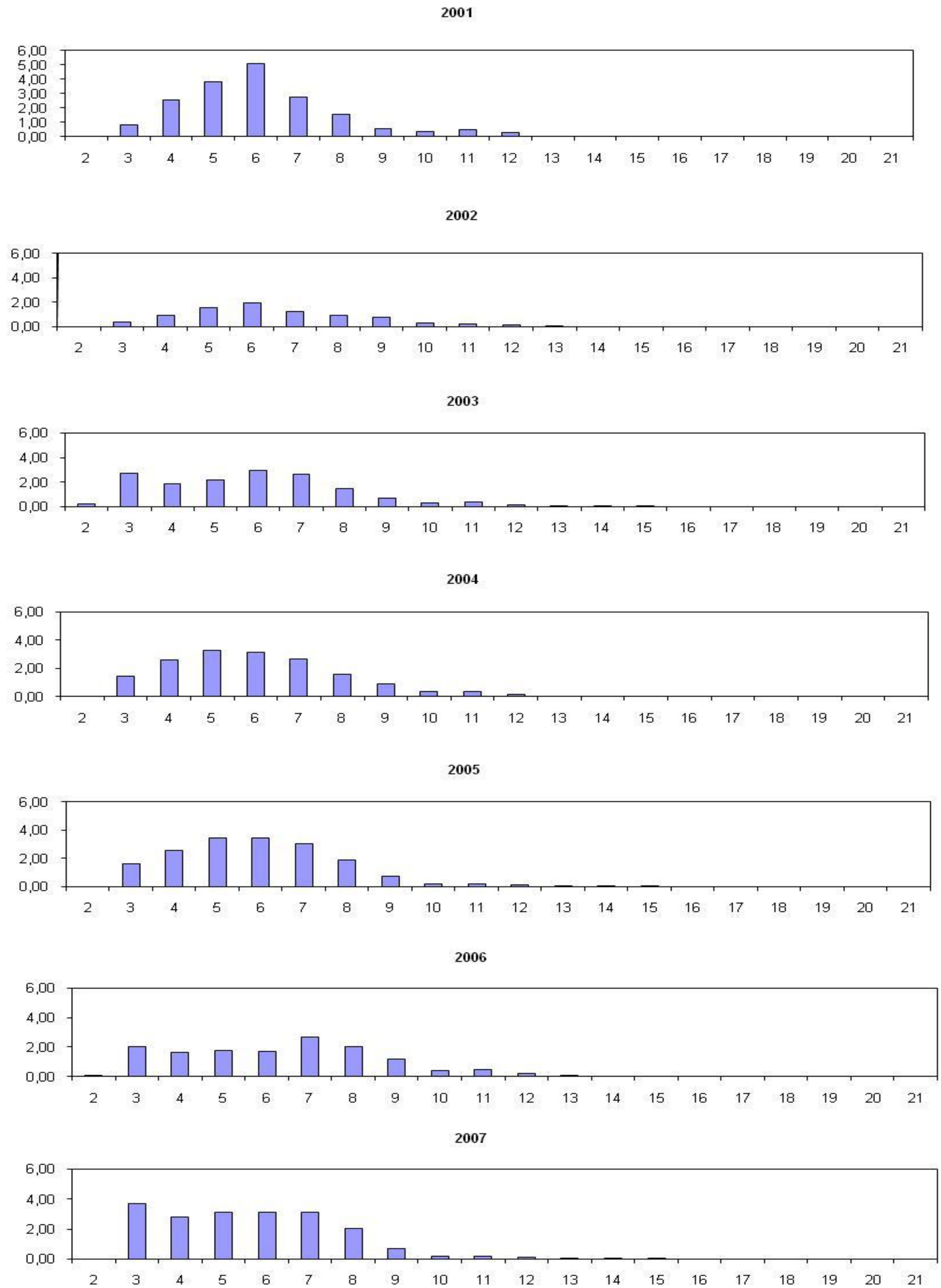


Fig.II,5. Gillnet survey in Disko bay. Abundance (estimated relative population) by age.

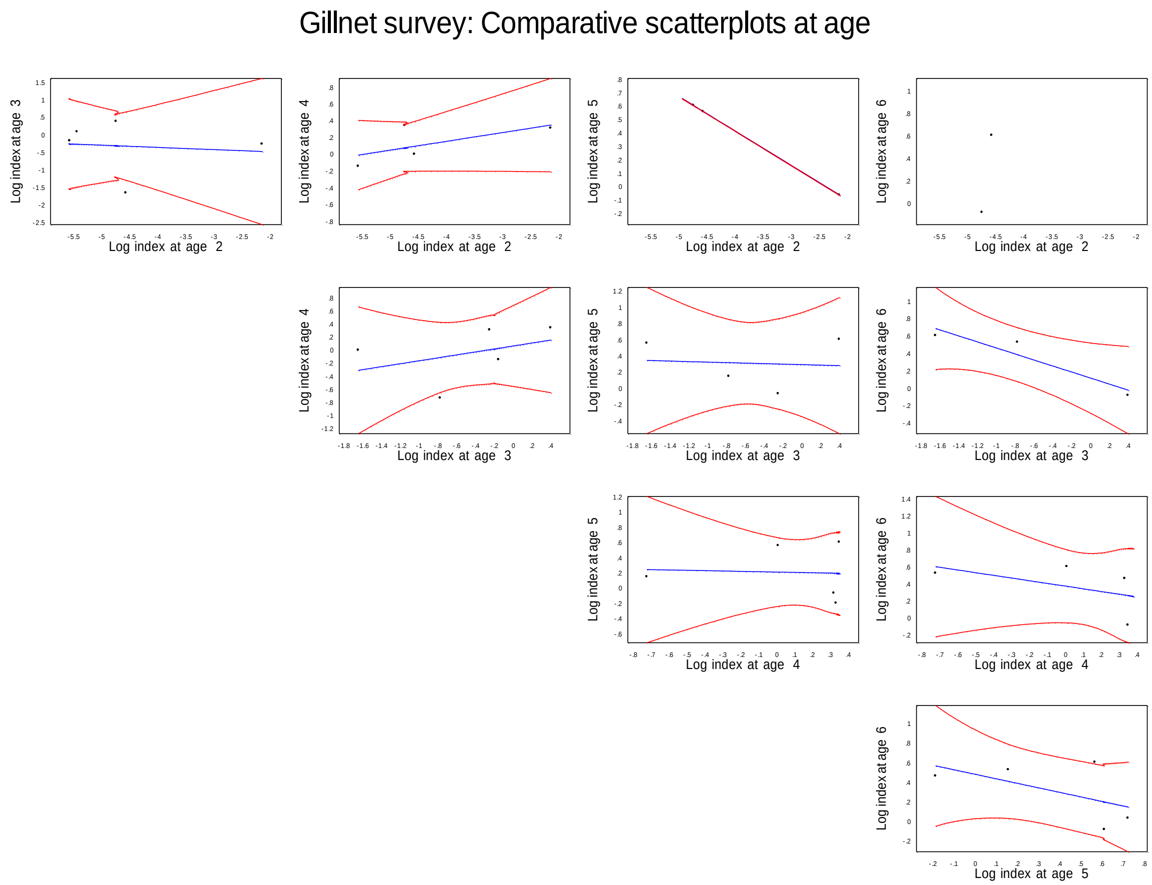


Fig. II,6. Gillnet survey in Disko Bay. Plots of comparative cohorts

Appendix III

DISKO bay Logbook CPUE GLM

DIVISION YEAR

Frequency	2006	2007	2008	2009	2010	2011	2012	Total
INSH 1AX	9	269	337	730	2030	2446	359	6180
Total	9	269	337	730	2030	2446	359	6180

INSH 1AX

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	7	2006 2007 2008 2009 2010 2011 2012
MD	12	01 02 03 04 05 06 07 08 09 10 11 12

VESSEL numbers has been deleted

Number of Observations Read	6180
Number of Observations Used	6180

Dependent Variable: LogCPUE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	Model
	87	441.854187	5.078784	19.72	<.0001	
Error	6092	1568.651725	0.257494			
Corrected Total	6179	2010.505911				

R-Square	Coeff Var	Root MSE	LogCPUE Mean
0.219773	8.348666	0.507438	6.078078

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	6	72.1573394	12.0262232	46.70	<.0001
MD	11	76.8028932	6.9820812	27.12	<.0001
FTJ_ID	70	292.8939542	4.1841993	16.25	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	73.9940813	12.3323469	47.89	<.0001
MD	11	56.3828587	5.1257144	19.91	<.0001
FTJ_ID	70	292.8939542	4.1841993	16.25	<.0001

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		5.639653004 B	0.15221056	37.05	<.0001
YEAR	2006	0.156578476 B	0.17806053	0.88	0.3792
YEAR	2007	0.437624542 B	0.05537886	7.90	<.0001
YEAR	2008	0.231569345 B	0.04783338	4.84	<.0001
YEAR	2009	0.297804108 B	0.04061842	7.33	<.0001
YEAR	2010	0.115086092 B	0.03598353	3.20	0.0014
YEAR	2011	-0.050797706 B	0.03481136	-1.46	0.1446
YEAR	2012	0.000000000 B	.	.	.
MD	01	0.194397610 B	0.03657597	5.31	<.0001
MD	02	0.146317557 B	0.04358743	3.36	0.0008
MD	03	-0.095113247 B	0.06288092	-1.51	0.1304
MD	04	-0.196578899 B	0.04791361	-4.10	<.0001
MD	05	-0.184365490 B	0.03678055	-5.01	<.0001
MD	06	0.054159313 B	0.03271899	1.66	0.0979
MD	07	-0.051432852 B	0.03145675	-1.64	0.1021
MD	08	0.021297126 B	0.03158349	0.67	0.5001
MD	09	-0.057010427 B	0.03199699	-1.78	0.0748
MD	10	-0.110147249 B	0.03175794	-3.47	0.0005
MD	11	-0.136385023 B	0.03465901	-3.94	<.0001
MD	12	0.000000000 B	.	.	
FTJ_ID	0001	0.955142022 B	0.15247020	6.26	<.0001
FTJ_ID	0002	0.184205781 B	0.21803360	0.84	0.3982
FTJ_ID	0003	0.028694327 B	0.20086011	0.14	0.8864
FTJ_ID	0004	0.303373016 B	0.21265942	1.43	0.1538
FTJ_ID	0005	0.372730112 B	0.15211371	2.45	0.0143
FTJ_ID	0006	0.252885862 B	0.15797001	1.60	0.1095
FTJ_ID	0007	0.449902680 B	0.15203810	2.96	0.0031
FTJ_ID	0008	0.602785912 B	0.17487815	3.45	0.0006
FTJ_ID	0009	0.266916036 B	0.17543902	1.52	0.1282
FTJ_ID	0010	0.409064311 B	0.15328728	2.67	0.0076
FTJ_ID	0011	0.359820463 B	0.16375039	2.20	0.0280
FTJ_ID	0012	0.371964732 B	0.15801457	2.35	0.0186
FTJ_ID	0013	-0.207422633 B	0.15602049	-1.33	0.1837
FTJ_ID	0014	0.177934395 B	0.15670834	1.14	0.2562
FTJ_ID	0015	-0.014802783 B	0.19267994	-0.08	0.9388
FTJ_ID	0016	0.327370756 B	0.15357485	2.13	0.0331
FTJ_ID	0017	0.490112000 B	0.17368155	2.82	0.0048
FTJ_ID	0018	0.434282120 B	0.15688291	2.77	0.0057
FTJ_ID	0019	0.547934762 B	0.15351207	3.57	0.0004
FTJ_ID	0020	0.252568780 B	0.15023866	1.68	0.0928
FTJ_ID	0021	0.383363099 B	0.15478921	2.48	0.0133
FTJ_ID	0022	0.160069228 B	0.24379534	0.66	0.5115
FTJ_ID	0023	0.429660170 B	0.14988135	2.87	0.0042
FTJ_ID	0024	0.316172870 B	0.15135624	2.09	0.0368
FTJ_ID	0025	0.271197493 B	0.15311131	1.77	0.0766
FTJ_ID	0026	0.294894040 B	0.15155231	1.95	0.0517
FTJ_ID	0027	0.251015395 B	0.15138552	1.66	0.0973
FTJ_ID	0028	0.600509782 B	0.15152233	3.96	<.0001
FTJ_ID	0029	0.285948560 B	0.15192335	1.88	0.0599
FTJ_ID	0030	0.268936766 B	0.16050904	1.68	0.0939
FTJ_ID	0031	0.430051399 B	0.15583697	2.76	0.0058
FTJ_ID	0032	0.680703484 B	0.15054301	4.52	<.0001
FTJ_ID	0033	0.621768648 B	0.15653376	3.97	<.0001

FTJ_ID	0034	0.093223842 B	0.18986042	0.49	0.6234
FTJ_ID	0035	0.857027558 B	0.22711012	3.77	0.0002
FTJ_ID	0036	0.014316033 B	0.19047189	0.08	0.9401
FTJ_ID	0037	0.582860557 B	0.23200577	2.51	0.0120
FTJ_ID	0038	0.269260679 B	0.18512424	1.45	0.1459
FTJ_ID	0039	0.461576047 B	0.18757713	2.46	0.0139
FTJ_ID	0040	0.678286955 B	0.17520410	3.87	0.0001
FTJ_ID	0041	0.555534354 B	0.38812154	1.43	0.1524
FTJ_ID	0042	0.071146006 B	0.16779322	0.42	0.6716
FTJ_ID	0043	0.032181333 B	0.52998160	0.06	0.9516
FTJ_ID	0044	-0.247908000 B	0.32867806	-0.75	0.4507
FTJ_ID	0045	0.455147449 B	0.23358550	1.95	0.0514
FTJ_ID	0046	0.347498636 B	0.27041766	1.29	0.1988
FTJ_ID	0047	0.434333687 B	0.16566005	2.62	0.0088
FTJ_ID	0048	0.236347908 B	0.16895092	1.40	0.1619
FTJ_ID	0049	0.667164354 B	0.15224436	4.38	<.0001
FTJ_ID	0050	0.329390607 B	0.16706366	1.97	0.0487
FTJ_ID	0051	0.518976659 B	0.16502646	3.14	0.0017
FTJ_ID	0052	0.311068336 B	0.15981774	1.95	0.0517
FTJ_ID	0053	0.465124625 B	0.16285821	2.86	0.0043
FTJ_ID	0054	0.408929995 B	0.17097067	2.39	0.0168
FTJ_ID	0055	0.311741619 B	0.15387529	2.03	0.0428
FTJ_ID	0056	-0.164874195 B	0.15300222	-1.08	0.2813
FTJ_ID	0057	0.299024830 B	0.16023716	1.87	0.0621
FTJ_ID	0058	0.639861483 B	0.15116281	4.23	<.0001
FTJ_ID	0059	0.628867457 B	0.15238982	4.13	<.0001
FTJ_ID	0060	0.560985796 B	0.16815889	3.34	0.0009
FTJ_ID	0061	0.165134823 B	0.15802478	1.04	0.2961
FTJ_ID	0062	0.551305292 B	0.15256979	3.61	0.0003
FTJ_ID	0063	0.708921354 B	0.17691376	4.01	<.0001
FTJ_ID	0064	0.553147526 B	0.24171218	2.29	0.0221
FTJ_ID	0065	0.546256104 B	0.23315902	2.34	0.0192
FTJ_ID	0066	-0.342615727 B	0.27496007	-1.25	0.2128
FTJ_ID	0067	0.106219155 B	0.18377142	0.58	0.5633
FTJ_ID	0068	0.240044619 B	0.15215269	1.58	0.1147
FTJ_ID	0069	0.295278972 B	0.17129230	1.72	0.0848
FTJ_ID	0070	0.078689268 B	0.18766933	0.42	0.6750
FTJ_ID	0071	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.

INSH 1AX

The GLM Procedure
Least Squares Means

YEAR	LogCPUE LSMEAN	Standard Error	Pr > |t|
2006	6.10362066	0.17505533	<.0001
2007	6.38466673	0.04512672	<.0001
2008	6.17861153	0.03582026	<.0001
2009	6.24484629	0.02576518	<.0001
2010	6.06212828	0.01962678	<.0001
2011	5.89624448	0.01919412	<.0001
2012	5.94704219	0.03486208	<.0001

INSH 1AUM

The FREQ Procedure

Table of DIVISION by YEAR

DIVISION   YEAR

Frequency	2006	2007	2008	2009	2010	2011	2012	Total
INSH 1AUM	57	443	391	355	468	644	7	2365
Total	57	443	391	355	468	644	7	2365

INSH 1AUM

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	7	2006 2007 2008 2009 2010 2011 2012
MD	12	01 02 03 04 05 06 07 08 09 10 11 12

VESSEL numbers has been deleted

Number of Observations Read	2365
Number of Observations Used	2365

The GLM Procedure

Dependent Variable: LogCPUE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	59	250.092772	4.238861	13.00	<.0001
Error	2305	751.322693	0.325953		
Corrected Total	2364	1001.415465			

R-Square	Coeff Var	Root MSE	LogCPUE Mean
0.249739	9.104423	0.570923	6.270835

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	6	27.2045734	4.5340956	13.91	<.0001
MD	11	31.0713170	2.8246652	8.67	<.0001
FTJ_ID	42	191.8168817	4.5670686	14.01	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	6	24.6700652	4.1116775	12.61	<.0001
MD	11	26.0740053	2.3703641	7.27	<.0001
FTJ_ID	42	191.8168817	4.5670686	14.01	<.0001

Standard

Parameter		Estimate		Error	t Value	Pr > |t|
Intercept		6.533175114	B	0.37692861	17.33	<.0001
YEAR	2006	-0.272511864	B	0.30039759	-0.91	0.3644
YEAR	2007	-0.326597008	B	0.28647350	-1.14	0.2544
YEAR	2008	-0.428642341	B	0.28725538	-1.49	0.1358
YEAR	2009	-0.309816850	B	0.28744527	-1.08	0.2812
YEAR	2010	-0.199080413	B	0.28464581	-0.70	0.4844
YEAR	2011	-0.049272603	B	0.28399759	-0.17	0.8623
YEAR	2012	0.000000000	B	.	.	.
MD	01	0.004831515	B	0.11855357	0.04	0.9675
MD	02	-0.005840680	B	0.12462365	-0.05	0.9626
MD	03	-0.143517439	B	0.13025139	-1.10	0.2706
MD	04	-0.120139804	B	0.13398478	-0.90	0.3700
MD	05	-0.416134981	B	0.10892249	-3.82	0.0001
MD	06	-0.016514405	B	0.08993666	-0.18	0.8543
MD	07	0.150737296	B	0.08285686	1.82	0.0690
MD	08	0.045161191	B	0.08418981	0.54	0.5917
MD	09	0.008700434	B	0.08431214	0.10	0.9178
MD	10	-0.043708800	B	0.08540288	-0.51	0.6088
MD	11	-0.114019949	B	0.09122879	-1.25	0.2115
MD	12	0.000000000	B	.	.	.
FTJ_ID	0001	-0.774749800	B	0.26397285	-2.93	0.0034
FTJ_ID	0002	-0.599578470	B	0.61849243	-0.97	0.3324
FTJ_ID	0003	-1.253431295	B	0.28991050	-4.32	<.0001
FTJ_ID	0004	-0.006346695	B	0.24943262	-0.03	0.9797
FTJ_ID	0005	-0.160501988	B	0.32269667	-0.50	0.6190
FTJ_ID	0006	0.179637792	B	0.24596115	0.73	0.4653
FTJ_ID	0007	-1.052719471	B	0.42324602	-2.49	0.0129
FTJ_ID	0008	-0.076774049	B	0.24036651	-0.32	0.7494
FTJ_ID	0009	0.073399337	B	0.37830351	0.19	0.8462
FTJ_ID	0010	2.161825929	B	0.28693703	7.53	<.0001
FTJ_ID	0011	0.416933847	B	0.24789834	1.68	0.0927
FTJ_ID	0012	-0.337219475	B	0.40943109	-0.82	0.4102
FTJ_ID	0013	-0.165483132	B	0.46979466	-0.35	0.7247
FTJ_ID	0014	0.159905152	B	0.37312016	0.43	0.6683
FTJ_ID	0015	-0.486189195	B	0.25548405	-1.90	0.0572
FTJ_ID	0016	-0.062905492	B	0.24515626	-0.26	0.7975
FTJ_ID	0017	-0.338182804	B	0.26685082	-1.27	0.2052
FTJ_ID	0018	0.010501508	B	0.24972195	0.04	0.9665
FTJ_ID	0019	-0.084583215	B	0.23940492	-0.35	0.7239
FTJ_ID	0020	0.113416088	B	0.25069468	0.45	0.6510
FTJ_ID	0021	-0.251782832	B	0.25307544	-0.99	0.3199
FTJ_ID	0022	0.169725768	B	0.23929985	0.71	0.4782
FTJ_ID	0023	-0.346513312	B	0.24480957	-1.42	0.1571
FTJ_ID	0024	-0.207514656	B	0.24984607	-0.83	0.4063
FTJ_ID	0025	-0.220675174	B	0.25133888	-0.88	0.3800
FTJ_ID	0026	-0.076915080	B	0.25530914	-0.30	0.7632
FTJ_ID	0027	0.094058909	B	0.26183988	0.36	0.7195
FTJ_ID	0028	-0.298210471	B	0.24982150	-1.19	0.2327
FTJ_ID	0029	-1.452168643	B	0.27749332	-5.23	<.0001
FTJ_ID	0030	0.271373021	B	0.32962274	0.82	0.4104
FTJ_ID	0031	-0.182492987	B	0.25141478	-0.73	0.4680
FTJ_ID	0032	-0.078985289	B	0.25038887	-0.32	0.7524
FTJ_ID	0033	0.089884218	B	0.24026344	0.37	0.7084
FTJ_ID	0034	-0.116204139	B	0.24202852	-0.48	0.6312
FTJ_ID	0035	-0.172705726	B	0.25413667	-0.68	0.4968
FTJ_ID	0036	0.115197355	B	0.24101798	0.48	0.6327
FTJ_ID	0037	0.039622597	B	0.24418037	0.16	0.8711
FTJ_ID	0038	0.079943174	B	0.24601782	0.32	0.7452
FTJ_ID	0039	-1.683725918	B	0.46978652	-3.58	0.0003
FTJ_ID	0040	-0.839941040	B	0.37211244	-2.26	0.0241
FTJ_ID	0041	0.078877998	B	0.29004370	0.27	0.7857
FTJ_ID	0042	-0.112065566	B	0.24172668	-0.46	0.6430
FTJ_ID	0043	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.

INSH 1AUM

The GLM Procedure
Least Squares Means

YEAR	LogCPUE LSMEAN	Standard Error	Pr > |t|
2006	6.03473240	0.10119709	<.0001
2007	5.98064725	0.04679661	<.0001
2008	5.87860192	0.04941917	<.0001
2009	5.99742741	0.04719363	<.0001
2010	6.10816385	0.04160016	<.0001
2011	6.25797166	0.04033301	<.0001
2012	6.30724426	0.27895825	<.0001

INSH 1AUP

The FREQ Procedure

Table of DIVISION by YEAR

DIVISION / YEAR Frequency	2006	2007	2008	2009	2010	2011	Total
INSH 1AUP	168	1922	1861	1824	2434	2228	10437
Total	168	1922	1861	1824	2434	2228	10437

INSH 1AUP

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	6	2006 2007 2008 2009 2010 2011
MD	12	01 02 03 04 05 06 07 08 09 10 11 12

VESSEL numbers has been deleted

Number of Observations Read	10437
Number of Observations Used	10437

INSH 1AUP

The GLM Procedure

Dependent Variable: LogCPUE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	87	1152.932175	13.252094	41.91	<.0001
Error	10349	3272.238438	0.316189		
Corrected Total	10436	4425.170613			

R-Square	Coeff Var	Root MSE	LogCPUE Mean
0.260540	8.613535	0.562307	6.528176

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	5	179.8875079	35.9775016	113.78	<.0001
MD	11	93.9501553	8.5409232	27.01	<.0001
FTJ_ID	71	879.0945113	12.3816128	39.16	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	5	96.4481239	19.2896248	61.01	<.0001
MD	11	70.5037564	6.4094324	20.27	<.0001
FTJ_ID	71	879.0945113	12.3816128	39.16	<.0001

Parameter		Estimate		Standard Error	t Value	Pr > |t|
Intercept		6.084292997	B	0.06576146	92.52	<.0001
YEAR	2006	0.543296545	B	0.04947137	10.98	<.0001
YEAR	2007	0.280453063	B	0.01986063	14.12	<.0001
YEAR	2008	0.231647704	B	0.02022965	11.45	<.0001
YEAR	2009	0.200561129	B	0.02025143	9.90	<.0001
YEAR	2010	0.078225638	B	0.01799394	4.35	<.0001
YEAR	2011	0.000000000	B	.	.	.

MD	01	0.078551221	B	0.07085012	1.11	0.2676
MD	02	-0.209016927	B	0.07640503	-2.74	0.0062
MD	03	-0.920934121	B	0.12594158	-7.31	<.0001
MD	04	-0.555234698	B	0.19602756	-2.83	0.0046
MD	05	-0.292517351	B	0.06062776	-4.82	<.0001
MD	06	-0.267908515	B	0.05462686	-4.90	<.0001
MD	07	-0.059778657	B	0.05312520	-1.13	0.2605
MD	08	-0.067987987	B	0.05261916	-1.29	0.1964
MD	09	-0.152119627	B	0.05272119	-2.89	0.0039
MD	10	-0.130524849	B	0.05315772	-2.46	0.0141
MD	11	-0.043336616	B	0.05335489	-0.81	0.4167
MD	12	0.000000000	B	.	.	.
FTJ_ID	0001	0.340899610	B	0.25502708	1.34	0.1813
FTJ_ID	0002	-1.311521622	B	0.12519865	-10.48	<.0001
FTJ_ID	0003	-0.673240479	B	0.40034975	-1.68	0.0927
FTJ_ID	0004	-0.238963319	B	0.08522869	-2.80	0.0051
FTJ_ID	0005	0.410826194	B	0.05125562	8.02	<.0001
FTJ_ID	0006	0.170363501	B	0.15740680	1.08	0.2791
FTJ_ID	0007	0.316472726	B	0.06189403	5.11	<.0001
FTJ_ID	0008	-1.018056928	B	0.15714977	-6.48	<.0001
FTJ_ID	0009	0.680508385	B	0.39998379	1.70	0.0889
FTJ_ID	0010	0.245004067	B	0.05797116	4.23	<.0001
FTJ_ID	0011	0.155631867	B	0.05000734	3.11	0.0019
FTJ_ID	0012	0.652364317	B	0.15718039	4.15	<.0001
FTJ_ID	0013	0.444424499	B	0.07031661	6.32	<.0001
FTJ_ID	0014	0.216981736	B	0.05026047	4.32	<.0001
FTJ_ID	0015	0.280115449	B	0.12962049	2.16	0.0307
FTJ_ID	0016	0.376780191	B	0.32785278	1.15	0.2505
FTJ_ID	0017	0.490936099	B	0.05367484	9.15	<.0001
FTJ_ID	0018	-0.914981677	B	0.08920346	-10.26	<.0001
FTJ_ID	0019	0.287347621	B	0.07095845	4.05	<.0001
FTJ_ID	0020	0.820564406	B	0.08315024	9.87	<.0001
FTJ_ID	0021	-0.449807533	B	0.14399610	-3.12	0.0018
FTJ_ID	0022	-0.109104821	B	0.12852408	-0.85	0.3960
FTJ_ID	0023	-0.377636172	B	0.40028907	-0.94	0.3455
FTJ_ID	0024	0.467094575	B	0.05007387	9.33	<.0001
FTJ_ID	0025	0.595509575	B	0.21762771	2.74	0.0062
FTJ_ID	0026	0.908620629	B	0.05017815	18.11	<.0001
FTJ_ID	0027	0.702757090	B	0.10554221	6.66	<.0001
FTJ_ID	0028	0.452363506	B	0.12972967	3.49	0.0005
FTJ_ID	0029	0.406201745	B	0.12717413	3.19	0.0014
FTJ_ID	0030	0.814118863	B	0.05798959	14.04	<.0001
FTJ_ID	0031	-0.730469471	B	0.07694862	-9.49	<.0001
FTJ_ID	0032	0.279030208	B	0.09691099	2.88	0.0040
FTJ_ID	0033	0.608572366	B	0.05051649	12.05	<.0001
FTJ_ID	0034	0.456028851	B	0.05139591	8.87	<.0001
FTJ_ID	0035	0.374287697	B	0.09549614	3.92	<.0001
FTJ_ID	0036	0.413982087	B	0.04876857	8.49	<.0001
FTJ_ID	0037	0.409879292	B	0.06905491	5.94	<.0001
FTJ_ID	0038	0.211606710	B	0.16783887	1.26	0.2074
FTJ_ID	0039	0.237960512	B	0.17580361	1.35	0.1759
FTJ_ID	0040	0.085430945	B	0.05022538	1.70	0.0890
FTJ_ID	0041	0.735752888	B	0.11713690	6.28	<.0001
FTJ_ID	0042	0.465158206	B	0.08049181	5.78	<.0001
FTJ_ID	0043	0.120178108	B	0.05126267	2.34	0.0191
FTJ_ID	0044	0.810132393	B	0.04965957	16.31	<.0001
FTJ_ID	0045	0.388766598	B	0.08470053	4.59	<.0001
FTJ_ID	0046	0.448779410	B	0.05147196	8.72	<.0001
FTJ_ID	0047	0.806973687	B	0.05526426	14.60	<.0001
FTJ_ID	0048	0.440771651	B	0.06414901	6.87	<.0001
FTJ_ID	0049	-0.143521342	B	0.07115856	-2.02	0.0437
FTJ_ID	0050	0.572208604	B	0.10757087	5.32	<.0001
FTJ_ID	0051	0.515011106	B	0.05049833	10.20	<.0001
FTJ_ID	0052	0.307845446	B	0.07660509	4.02	<.0001
FTJ_ID	0053	0.640919446	B	0.09494637	6.75	<.0001
FTJ_ID	0054	0.673074287	B	0.07498035	8.98	<.0001
FTJ_ID	0055	0.482392104	B	0.06346761	7.60	<.0001
FTJ_ID	0056	0.601907326	B	0.09947488	6.05	<.0001
FTJ_ID	0057	0.514224945	B	0.06074805	8.46	<.0001

FTJ_ID	0058	0.057043847 B	0.11790341	0.48	0.6285
FTJ_ID	0059	0.355290869 B	0.06326527	5.62	<.0001
FTJ_ID	0060	1.015212094 B	0.37861459	2.68	0.0073
FTJ_ID	0061	0.461494808 B	0.05636791	8.19	<.0001
FTJ_ID	0062	0.399007142 B	0.07003959	5.70	<.0001
FTJ_ID	0063	-0.092072656 B	0.10378067	-0.89	0.3750
FTJ_ID	0064	0.106406949 B	0.18392318	0.58	0.5629
FTJ_ID	0065	0.375420201 B	0.08953543	4.19	<.0001
FTJ_ID	0066	0.446143483 B	0.09743144	4.58	<.0001
FTJ_ID	0067	1.007299869 B	0.12066035	8.35	<.0001
FTJ_ID	0068	0.282190063 B	0.05036143	5.60	<.0001
FTJ_ID	0069	0.556247912 B	0.05300093	10.50	<.0001
FTJ_ID	0070	0.566723640 B	0.15221832	3.72	0.0002
FTJ_ID	0071	0.329712943 B	0.07554731	4.36	<.0001
FTJ_ID	0072	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.

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nos of logbooks per year

The GLM Procedure

Least Squares Means

YEAR	LogCPUE LSMEAN	Standard Error	Pr > |t|
2006	6.71107191	0.05305711	<.0001
2007	6.44822843	0.02807605	<.0001
2008	6.39942307	0.02823823	<.0001
2009	6.36833649	0.02744728	<.0001
2010	6.24600100	0.02557550	<.0001
2011	6.16777537	0.02700812	<.0001