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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. During 2006-2009 catches have been around 24,000 tons. Catches increased to 26 900 tons in 2010 and has been at that level until 2014 where catches increased to 31,000 tons. Catches increased further to 32 000 tons in 2015. Survey biomass in Div.0A increased in 2015 and is at a high level. Survey biomass in Div. 0B decreased between 2011 and 2013 but has been increasing since then. The biomass in Div. 1CD increased to a level slightly above average. Recruitment estimated from the Greenland shrimp survey increased and was above average and biomass increase to a level about average. A combined standardized CPUE series from Div. 0A + 1AB has been gradually increasing since 2002 but decreased slightly in 2015. A combined CPUE series from Div. 1CD+0B increased in 2015 and is now the highest in the time series. A combined standardized CPUE series from SA 0 and 1 has been increasing gradually since 1997 and was in 2015 at the highest level seen since 1990. CPUE series from the gill net fishery in Div. 0A and Div. 0B were at the highest level in the time series.

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 1995-2000 the advised TAC for the latter area was 11,000 tons but the TAC was fished almost exclusively in Div. 0B and Div. 1CD. In 2000 there was set an additional TAC of 4,000 tons for Div. 0A+1AB for 2001 and the TAC on 11,000 tons was allocated to Div. 0B and Div. 1CF. The TAC in Div. 0A+ Div. 1AB 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 by 5,000 tons to 13,000 tons. The total advised TAC remained at 24,000 tons in 2008 and 2009. In 2010 the TAC for Div. 0B+ Div. 1CF was increased by 3,000 tons to 14,000 tons and the total TAC for Subarea 0+1 was 27,000 tons. The TAC remained at 27,000 tons in 2011-2013. In 2014 the TAC was increased by 3,000 tons to 16,000 tons in in Div. 0A+ Div. 1AB and the total TAC for the area (excluding inshore areas in Div. 1A) is 30,000 tons. The TAC remained at 30,000 tons in 2015 and 2016 (Fig.1).

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 2,927 tons in 1989 to 11,633 tons in 1990. Catches remained at that level in 1991 but increased again in 1992 to 18,457 tons. During 1993-2000 catches have fluctuated between 8,250 and 11,750 tons. Catches increased to 13,760 tons in 2001 and further to 19,716 tons in 2005. In 2006 catches increased to 24,164, remained at that level in 2007 but decreased slightly to 22,071 tons in 2008. Catches increased again to 24,805 tons in 2009 and further to 26,934 tons in 2010 and catches remained at that level in 2011 – 2012 but increased to 28,062 tons in 2013 and further to 31,551 tons in 2014 and 31, 967 in 2015 (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 2006 was primarily due to an in increase in effort in Div. 0A and Div. 1A. The increase in catches between 2009 and 2010 was due to increased effort in Div. 0B and 1CD. The increase in catches between 2012 and 2013 was primarily due to increased effort in inshore areas in Div. 1D, while the increase in catches in 2014 was due to increased effort in Div. 0A and Div. 1A.

Catches in SA 0

In 1983 annual catches in SA 0 were about 4,500 tons. Catches then decreased to a level of 1,000 tons or lower, where they remained until they increased from 1,087 tons in 1989 to 9,753 tons in 1990. Catches decreased in 1991 to 8,745 tons, to increase again in 1992 to 12,788 tons. Catches then decreased gradually to 3,233 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 remained at that level in 2004 and 2005. Catches increased to 12,319 in 2006 but decreased slightly to 11,489 tons in 2007 and further to 10,432 tons in 2008. Catches increased again to 12,400 tons in 2009 and further to 13,225 tons in 2010. Catches decreased slightly in 2011 to increase again in 2012 to 13,331 tons. Catches remained at that level in 2013 (13,351 tons, excluding 315 tons taken in Cumberland Sound). Catches increased to 14,937 tons in 2014 and further to 15,447 in 2015 (Table 1). Catches from Cumberland Sound are not included in the estimates.

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 tons, 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 remained 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 5,257 tons in 2008. Catches increased again in 2009 to 6,627 tons and remained at that level in 2010 – 2013, - 6,314 tons in 2013. Catches increased again in 2014 to to 7,934 tons in 2014 and remained at that level in 2015 (7922 tons) (Table 1).

Trawlers took 4,143 tons of which 2,985 tons was taken by twin trawl and 3,722 tons was taken by gill net. The longline catches amounted to 7 ton. The fishery was prosecuted by Canadian vessels.

Catches in Div. 0B increased from the 2010-2013 level (7,000 tons) to 7,525 tons in 2015. 3,031 tons was taken by gill net, while 1,807 tons and 2587 tons were taken by single- and twin trawlers, respectively. 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 tons, decreased to 3,870 tons in 1993 and increased again in 1994 to 5,857 tons. During 1995-1999 catches were around 4,500-5,000 tons. Catches increased to 5,728 tons in 2000, remained at that level in 2001 and increased gradually to 9,495 tons in 2003 and remained 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 remained at that level in 2007 and 2008. In 2009 catches amounted to 12,405 tons and increased further to 13,709 tons in 2010 and remained at that level in 2011 and 2012. Catches increased to 14,711 tons in 2013 (Table 2) and further to 16,614 tons in 2014 and remained at that level in 2015 (16,520 tons). Almost all catches have been taken offshore. However, the inshore catches increased from 440 tons in 2012 to 1,289 tons in 2013 and further to 1,825 tons in 2014 primarily due to an increased effort inshore in Div. 1D. Inshore catches deceased slightly to 1527 tons in 2015 (Fig. 1).

Catches in Div. 1A (offshore)+Div.1B increased gradually from 575 tons in 2001 to 4,007 tons in 2003 and remained at that level in 2004-2005. Catches increased again in 2006 to 6,223 and remained at that level during 2007-2013 (6,500 tons in 2013) Catches increased to 7,985 tons in 2014 and remained at that level in 2015 (8,016 tons). All catches were taken off shore by trawlers from Faeroe Islands, Russia and Greenland except 150 inshore in Div. 1B.

Catches in Div. 1C-F (almost exclusively 1CD) have been stable around 5,600 tons during 2000 - 2009, but catches increased to 7,247 in 2010 due to increased effort. Catches remained at that level in 2011 and 2012 but increased to 8,227 tons in 2013 and remained at that level in 2014 (8,629 tons) and 2015 (8,520). Catches were taken by vessels from Greenland, Norway, EU-Germany and Russia. All offshore catches were taken by trawl in Div. 1CD. Inshore catches in Div. 1B-1F, increased from 400 tons in 2012 to 1,289 tons in 2013 and further to 1,807 tons in 2014 mainly due to increased effort in Div. 1D (1,211 tons in 2014) but decreased slightly in 2015 to 1,527 tons in 2015 (864 tons in Div. 1D).

Reported discards of Greenland halibut in the trawl fishery in SA 1 is small, normally < 1% of the total catch.

The by-catch estimated by observers on board was in 2015 6,7%, in the trawl fishery in Div. 0A , 3,1%, in the gill net fishery in Div. 0A, 16.3% in the trawl fishery in Div. 0B and 13,1% in the gill net fishery in Div. 0B, respectively. Greenland shark and skates were the dominant by-catch in the trawl fishery, while Roughhead grenadier and skates (in Div. 0A) were the most dominant species in the gill net catches (Table 3).

The by-catch in the trawl fishery in Div. 1CD was estimated from survey data to be 13% (in weight) of the Greenland halibut catches. *Macrourus berglax* was the most abundant by catch species and constituted 3.2 % of the weight of Greenland halibut catches followed by *Antiomora rostrata* (2.7%), *Alepocephalus agassizzi* (2.0 %) and *Hydrolagus affinis* (1.2%). None of the remaining species constituted more than 1% of the weight of the Greenland halibut catches. The by catch seem to have limited impact on the abundance of the by catch species (SCR 16/005).

2. Input data

2.1 Research trawl survey

Div. 1C-1D GHL-survey

Since 1997 Greenland has conducted stratified random bottom trawl surveys for Greenland halibut in September-October in NAFO Div. 1CD at depth between 400 and 1500 m. In 2013 only Div. 1D was covered by just 27 valid hauls (SCR 14/02). The proportion of the biomass found in Div. 1D has been varying during the years between 65 and 85%. Including survey data from 2014 the biomass (and abundance) in Div. 1C has been estimated by a GLM (model: lnbiomass= year*division) using data from 2010-2014 where the distribution of the biomass has been rather stable with 63-69% of the biomass found in Div. 1D. The Div. 1CD biomass and abundance in 2013 was estimated to 64 049.0 tons and $51.160*10^6$, respectively.

The biomass in Div. 1CD 400-1500 m was estimated at 78 445.5 tons in 2015 which is an increase from 58 424.6 tons in 2014 and the biomass is back at a level slightly above the average of the time series (71 000 tons). The gradual decrease in biomass seen since 2011 has hence stopped (Fig 2a, 2c). The abundance estimate in 2015 ($65.506*10^6$) was slightly below the average of the time series. The highest abundance was found between 800-1000 m in Div. 1C and 1000 and 1200 m in Div. 1D and he highest densities (in number) were found in Div. 1C 800-1000 m. (Fig. 2b). The overall length distribution was dominated by a mode at 51 cm, where the length distribution use to be monomodal with a mode around 47-50 cm (Fig. 2d).

Greenland deep sea survey in Baffin Bay (Div. 1A)

There has been no survey since 2010. Greenland has conducted surveys primarily aimed at Greenland halibut in the Baffin Bay in 2001, 2004 and 2010. The biomass and abundance of Greenland halibut was in 2010 estimated as 79 332 tons and $1.04*10^8$ specimens, respectively (SCR 11/10). The surveys did not cover the same areas but a comparison of the abundance and biomass in areas covered both in 2001 and 2010 showed a small increase in biomass from 46 521 tons in 2001 to 52 428 tons in 2010 while there was a decrease in abundance from 101.8 mill. in 2001 to 63.5 mill. in 2010. The biomass has hence been relatively constant while there were significantly more and smaller fish in 2001. The biomass in the area covered both in 2004 and 2010 was estimated to 47 244 tons and 38 632 tons, respectively while the abundance was estimated at 58.8 mill. and 54.4 mill., respectively. The length in 2010 ranged from 20 cm to 105 cm. The overall length distribution (weighted by stratum area) was totally dominated by a mode at 45 cm, while the mode was at 46 cm at depths > 800 m. Generally the length distributions in the deeper depth strata were dominated by a single mode and fish size increased with depth as seen in previous surveys.

Canadian deep sea surveys in Baffin Bay (Div. 0A) and Davis Strait (Div. 0B)

A stratified-random otter trawl survey was conducted in southern Div. 0A (0A-South) and Div. 0B in 2015. Canada has conducted nine surveys in 0A-South and six in Div. 0B since 1999.

The Div. 0A-South survey covered the southern strata (to approximately 72° N). The survey biomass indices were recalculated in 2014 based on a new stratification scheme (SCR 15/030). Biomass in Div. 0A-South has varied from 60,640 tons to 108,698 tons (Fig. 2f), however, this high estimate in 2012 is influenced by a very large set in the 601-800 m depth strata that comprises 23% of the survey area.

The estimate of biomass in 2015 in Div. 0A-South increased to 104,187 tons from 93,532 tons in 2014 (SCR 16/025) hence the increasing trend seen since 1999 continued. Abundance for Div. 0A-South was in 2015 estimated at 1.16×10^8 which is an increase compared to 2014 (1.07×10^8) (Fig. 2g). The overall length distribution in 2015 ranged from 6 cm to 81 cm with modes observed at 18, 33 and 42 cm. The proportion of fish <45cm increased to 76%, compared to 64% and 54% in 2012 and 2014, respectively.

The 2006 survey suffered from poor coverage in depths >1000 m relative to sets <1000 m which resulted in a lower overall mean biomass per km^2 and under-estimate of the biomass compared to previous and subsequent surveys. As a result the 2006 survey has been removed from the indices and further assessment.

In 2012 the survey also covered the northern part of Div. 0A from 73°N to 75°35'N, which had been surveyed previously in 2010 and 2004. The 2012 estimates of biomass and abundance were 82,669 t (S.E. 6695 t) and 9.4×10^7, respectively. This was a significant increase from previous estimates that ranged from 45,877 t to 46,689 t. This increase is due to the increase in survey area due to good weather and little ice in the northern strata in 2012 (SCR 13/033).

Biomass and abundance for Div. 0B in 2015 were 67,194 t and 5.9×10^7, respectively, both slightly greater than the 2014 and 2013 estimates (64,873 tons and 5.49×10^7 and 53,109 t and 5.1×10^7), respectively) (Fig. 2i, 2j) (SCR 16/025). Overall lengths in 2015 ranged from 6 cm to 96 cm with a mode at 48 cm, similar to that observed in previous Div. 0B surveys (Fig. 2k). 32% of fish were <45 cm, similar to that observed previously.

Greenland shrimp-fish-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. All biomass and abundance indices have been recalculated. The recalculation did not change the trends in the development of the different stocks. The trawl was changed in 2005 but the data have not been adjusted for that and the two time series are not directly comparable.

Estimated total trawlable biomass of Greenland halibut in the offshore areas (excluding Disko Bay) has during 2005-2014 fluctuated between 49,779 tons and 23,909 tons estimated in 2014. The biomass increased again in 2015 to 34,782 tons. The increase in biomass was mainly seen in Div. 1AN and 1BN.

The offshore abundance was estimated at 534 mill. in 2011 which was the highest in the time series. The abundance decreased to 187 mill. in 2012 which is the lowest in the 2005-2012 time series and not seen lower since 1997 although the figures are not directly comparable. The abundance increased again in 2013 to 521 mill to decrease again in 2014 to 232.4 mill. In 2015 the biomass increased to 318.3 mill. The increase in abundance was only seen in Div. 1BN.

Recruitment

A recruitment index was estimated for the entire survey area. By means of the Petersen-method ages 1, 2 and 3+ were separated in the survey catches.

To allow comparison of abundance throughout the time series, the 2005 to 2015 catches were ajusted by a conversion factors to adjust the new Cosmos trawl catches to the old Skjervoy trawl 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 mill. in 2001 (Fig. 3). During the 00' the recruitment was stable at around 300 mill. The number of one-year old peaked again in 2011 with 530 mill., which is the highest estimate in the time series. The recruitment decreased in 2012 where the 2011 year-class was estimated to 175 mill., the lowest estimate since 1996 and at the level of the early 90's. The recruitment increased again in 2013 where the 2012 year-class was estimated at 444 mill. to decrease again in 2014 where the 2013 year-class was estimated to 180 mill. The 2014-year-class is estimated to 376 mill. somewhat above the average for the time series (270 mill.). Almost all the one year old fish were found in Div. 1AS and Div. B and the distribution was somewhat more southern in 2015 compared to previous years (Fig. 3).

The offshore recruitment has been rather stable between 2003 and 2010. The recruitment increased to the highest level in the time series in 2011 to decrease to lowest level seen since 1997 (1996 year-class) in 2012. The offshore recruitment (2012 year-class) increased again in 2013 to the second largest in the time series to decrease again to 130 mill. in 2014. In 2015 the estimate increased again to the third largest level (334 mill.) in the time series (Fig. 4). The increase in recruitment between 2014 and 2015 was seen in Div. 1AS (*2) and Div. 1B (almost *10). 88.6% of the one-year-old fish was found in the off shore areas.

Greenland halibut in Disko Bay is believed to be recruited from a spawning area in the central part of the Davis Strait. The recruitment to Disko Bay has been decreasing between 2003 and 2008 but increased since then to the highest level seen since 2001 in 2011. Since then the recruitment has been gradually decreasing and was the second lowest in the time series in 2015. Only 11.4% of the recruitment ended up in Disco Bay in 2015, where the percentages usually have been well above 20 %.

Generally there is a steep decline between abundance at age 1 and age 2 and 3+ which also was observed in the 2015 survey

2.2 Commercial fishery data.

Length distribution

SA 0

Length distributions were available from the trawl, gill net and a small (7 tons) longline fishery in Div. 0A and from the trawl and gill net fishery in Div. 0B.

Modes in the gill net fishery have shifted gradually from 62 cm in 2013 to 58 cm in 2015, while it has been stable in the fishery in Div. 0B at 62-64 cm. The modes have been at 48-50 cm in the trawl fishery in both Div. 0A and 0B in recent years (Fig. 5).

SA1

Length frequencies were available from the Greenlandic and the Russian (SCS 16/07) trawl fishery in Div. 1AB and from the Greenlandic, Norwegian and Russian trawl fishery in Div. 1CD.

In Div. 1AB the mode was at 52 cm in both the Russian and Greenlandic trawl fishery and with more large fish than previously seen especially in the Russian fishery (Fig. 6 and 7). In recent years the trawl catches have been dominated by fish at 44-52 cm.

In Div. 1CD the catches by Norway had modes at 50 and 52 while the mode was at 52 cm in the Greenland fishery and 53 cm in the Russian fishery that caught more large fishy than seen previously years (Fig. 8, 9, 10). The catches seems to be composed of slightly larger fish than in previous years where the mode was around 47-50 cm.

Age distribution

There is considerable uncertainty about accuracy in the current age reading methods (see section in STACREC 2011 report) and the age reading procedure is currently under revision hence no age based analysis are presented.

Catch rate

The fleets used for standardization of catch rates are grouped according to NAFO's protocol:

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

SA0
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. A standardized catch rate is produced using a General Linear Model. The model was updated in 2016 with the 2015 data. Catches (t) and hours fished with values less than 10 were removed.

Div. 0A
In Div. 0A the standardized CPUE index has been increasing between 2010 and 2014 to the highest level seen since a small trial fishery in 1996. The CPUE decreased slightly in 2015, but is still at a high level (Fig. 12a) (Appendix 1). The decrease could also be seen in the un-standardized catch rates for both single and twin trawl gears (Fig. 11a).

Standardized CPUE for Gill nets has been increasing gradually between 2006 and 2011 and has been stable until 2014 but increased to the highest level in the time series in 2015 (Fig. 12b) (Appendix 4).

Un-standardized CPUE for gillnets has increased gradually from 5.36 t/100 nets in 2004 to 12.79 t/100 nets in 2011 but decrease to 11.8 t/100 nets in 2012 and stayed at that level in 2013 and 2014 but increased to a little less than 14 tons/100 net in 2015 (Fig. 11c).

Div. 0B
In Div. 0B the overall trawl CPUE index increased to the highest observed level in 2009 but declined gradually between 2009 and 2012. Since the then the CPUE has been increasing and was in 2015 well above the average for the time series (Fig. 12d) (Appendix 5). The un-standardized catch rates also increased between 2014 and 2015 especially for single trawl (Fig. 11b).

The standardized CPUE for gill net in Div. 0B has been increasing since 2007 and was in 2015 at the highest level in the time series (Fig. 12f) (Appendix 8).

Un-standardized CPUE for gillnets remained relatively stable at 3-4 t/100 nets from 2003 to 2008, then increased to 6.54 t/100 nets in 2010. In 2011 the CPUE dropped slightly to 5.98 t/100 nets to increase again in 2012 to 6.7 t/100 net, the highest level in the time series but CPUE decreased slightly in 2013 to increase again to about 7.7 t/100 net and further to 8.5 tons/100 net (Fig. 11d).

SA1

Un-standardized catch rates were available for the Greenland and Russian trawl fishery in Div. 1AB and 1CD (SCS 16/0 7 and 16/10). Further, catch rates were available from logbooks submitted by all countries to the Greenland authorities. Standardized catch rates were available from the trawl fishery in Div. 1AB and 1CD. Until 2008 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 that take most of the catch in Div. 1AB have been relatively stable since 2005 around 0.93 ton/hr but showed a slight increase between 2009 to 2010 and increased substantially between 2010 and 2011 to 1.4 ton hr^{-1} and 1.3 ton hr^{-1} for single trawlers and twin trawlers, respectively. Since the CPUE has declined gradually in 2012 and 2013, but increased again in 2014 to the highest level in the time series to decrease slightly in 2015 (Fig. 11e).

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 2002-2015. Standardized catch rates in Div. 1AB has been declining between 2006 and 2008 but has been increasing since then and was in 2011 on the highest level in the time series. The CPUE decreased slightly in 2012 and 2013 but was in 2014 back at the high level seen in 2011. Trawl CPUE decreased slightly in 2015 but is still at a high level (Fig. 12a, Appendix 2).

Div. 1CD

The un-standardized catch rates for all trawlers fishing in Div. 1CD increased between 2011 and 2012, except for trawlers > 2000 tons trawlers. The catch rates increased significantly for > 2000 tons single trawlers in 2013 and the smaller single trawlers also showed an increase, while the twin trawlers showed minor decreases between 2012 and 2013. The catch rates for all three types of trawlers (> 2000 t single and twin trawlers and 1000-2000 t single trawlers) increased in 2014 and increased further significantly in 2015and is now at the highest level seen 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 vessels (Fig.11f).

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 1988-2015 (Fig.12c). Standardized catch rates in Div. 1CD decreased gradually from 1989-1997 but have shown an increasing trend since then. CPUE decreased between 2009 and 2010 but increased again in 2011-2014. In 2015 the standardized trawl CPUE increase significantly to by far the highest level in the time series. (Fig. 12c) (Appendix 6).

Combined standardized catch rate in Div. 0A-1AB

The combined Div. 0A+1AB standardized CPUE series has been relatively stable with an increasing trend since 2002 but decreased slightly in 2015. The 2015 estimate is, however, still at high level. (The values from 1996 and 1997 are from trial fisheries with small catches) (Fig. 12a) (Appendix 3).

Combined standardized catch rate in Div. 0B-1CD

The combined Div. 0B+1CD standardized CPUE series has been stable in the period 1990-2004. The CPUE gradually increased to peak in 2009. CPUE decreased slightly between 2009 and 2010 to increase again in 2011. The combined CPUE has been gradually increasing since 2012 and was in 2015 at the highest level seen in the time series. The high catch rates seen in 1988 and 1989 are from a single very large trawler fishing in Div. 1CD (Fig. 12e) (Appendix 7).

Combined standardized trawl catch rate for SA 0+1
The combined catch rate has been gradually increasing since 1997 and was in 2015 at the largest level seen since 1989 (Fig 12g).

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, both the un-standardized_and the standardized indices of CPUE should, however, be interpreted with caution.

The fishermen have in recent years started to bait the gill nets so the chance in CPUE in recent years should be interpreted with caution.

3. **Assessment**

A Greenland halibut age determination workshop in 2011 concluded that there is considerable uncertainty about accuracy in the current age reading methods (see section in STACREC 2011 report) and the age reading procedure is currently under revision hence no age based analysis are up dated.

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 a 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 Yield per Recruit Analysis has been attempted in recent years due to lack of age data.

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 were 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 had been relatively 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 are 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 were considered to be provisional due to problems with the catch-at-age data and the short time series. The assessment was, however, considered to some extent to reflect the dynamics in the stock. The rate of exploitation had 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 has not been run in recent years as no catch-at-age data were available for 2003-2015.

3.3 Relative F

A relative F was estimated from the catches and the swept area biomass estimates from Div. 1CD (Off Shore Catch/Biomass) (Fig. 13). F has fluctuated between 0.02 and 0.17 but has been relatively stable around 0.08 since during 1997- 2011, but F increased to 0.11 in 2012 due to a decline in the estimated biomass. F remained at that level in 2013 and 2014 despite a decrease in biomass, due to a relative increase in the inshore catches that are not include because the survey does not cover inshore areas. In 2015 the relative F decreased to 0.09 due to an increase in biomass

A relative F cannot be estimated in SA0 because a large fraction of the catches are taken by gill nets that generally catch larger fish than the commercial trawl and the trawl surveys. The trawl fishery seems, however, not to affect the catch rates in the gill net fishery that has been stable in recent years.

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.

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 and the data series were relatively short.

The ASPIC Fox model was tested again in 2012. Three different formulations were run: 1) one was with the 0B + 1CD CPUE series and the 0B +1CD catch for 1988-2011; 2) with two 1CD survey series (1988-1995 and 1997-2011) and 1CD catch (1988-2011); and 3) one 1CD survey series (1997-2011) and 1CD catch (1988-2011). The first formulation using CPUE resulted in a poor fit of observed and estimated values, with low r-square (.319) and low nearness index (.369). The logistic fit failed in the second formulation. The third formulation resulted in an unbelievably high MSY with F of 0. The estimate of catchability (q) was also extremely low. The model fit was not robust to changes in model parameters. Given that there is little variation in this time series and it is still relatively short (1997-2015) for a long lived species like Greenland halibut this model was not accepted.

3.6 Estimates of MSY from Catches and resilience

A simple Schaefer model was tested on the Greenland halibut stock offshore in NAFO SA 0 and 1 in 2014. The minimum data required for this model is a catch time series and a measure of the resilience of the species. Other input parameters that had to be guessed were the carrying capacity, the biomass as a fraction of the carrying capacity at both the beginning and end of the time series, and the growth rate. MSY was estimated to be between 19 000 and 23 000 t. Sensitivity tests showed that the estimation of MSY was heavily dependent on the guess of especially the biomass at the end of the time series and the growth rate. The model was consider to be indicative and results were not used for the advice.

3.7 A survey approach to estimate catch level of Greenland halibut in SA 0+1.

The assessment of Greenland halibut in Subarea 0 and 1A (offshore)+1B-F relies on several fishery independent survey indices. The application of the ICES guidance on data limited stocks (DLS) method 3.2 (ICES 2012a and 2012b, ICES 2014) as the basis for the approach for advice on SA0+1 Greenland Halibut could be helpful in providing TAC advice.

ICES has developed and tested an empirical approach that uses the trend in the stock response to fishing pressure (ICES 2012a, Jardim et al. 2015). The empirical basis was given a generic expression $C_{y+1}=Catch_{recent}*r$:

$Catch_{recent}$ is the average catch over some period,

r is the trend in development of the stock (normally SSB) over some period (e.g. 7 year time frame, r=mean of recent 3 year/mean of next 4 years).

Managers should determine the level of risk (change cap and precautionary buffer) but ICES has provided some guidance for those cases where management input is not available. A 20% change cap, used to limit the rate at which the TAC would change at any one time was recommended. However, it may be possible to consider a higher change cap when the stock is declining. A precautionary buffer or reduction factor (e.g. 20%) would be applied to r given certain stock conditions relative to reference points (e.g. if the stock is over-harvested or below target reference points).

Advice should not be made annually; it would apply over some period of time (e.g. 2-3 years) to allow for the delay between action (change in catch) and response (state of the stock). There would be interim assessments and advice on TAC could be given in interim years if a sudden change in stock status is observed.

In the case of Greenland halibut in Subarea 0 and 1 we are not able to estimate SSB (due to survey trawl selectivity). However, we have stock abundance indexes based on surveys that are used to assess the status of two portions of the stock area, Div. 0A-1AB (0A-south survey) and Div. 0B-1C-F (1CD survey). Given the long-lived life-history of Greenland halibut and the mixed gear nature of the fishery it was determined that a 7 survey time frame for the calculation of r would be most appropriate. It was noted that the precautionary factor need not apply in the case of SA0+1A (off shore) and 1B-F Greenland halibut given the stock is near the B_{msy} proxy and therefore well above B_{lim} and there have been several recent years with good recruitment.

There are seven surveys available from Div. 0A-South and Div. 1CD combined that cover a 14 year period 2001, 2004, 2008, 2010, 2012, 2014 and 2015 (the 2006 survey has been excluded due to very poor coverage).

Rate of increase (r) is estimated based on the mean biomass estimate from 2012, 2014, 2015 over the mean estimates from 2001, 2004, 2008, 2010 i.e r=1.077 (Fig. 14).

4. Conclusion

Since catches peaked with 18,000 tons in 1992 and they have been stable at around 10,000 tons until 2000. Since then catches have gradually increased to 32,000 tons in 2015 together with an increase in TAC. The TAC has generally been taken in all years since 2000.

Div. 0A+1AB

Biomass in Div. 0A increased between 2014 and 2015 and is at a high level.

The standardized CPUE index for Div. 0A has been increasing since 2010 and is in 2014 at the highest level seen since 2001 but decreased slightly in 2015. CPUE in Div. 1AB was at its highest level in 2014 but decreased slightly in 2015. The combined Div. 0A+1AB standardized CPUE series has been gradually increasing since 2002 and the CPUE is at the highest level since 2001 in 2014 but decreased slightly in 2015.

Standardized CPUE for gill nets has been stable during 2009-2014 but increased in 2015.

Length frequencies in the fisheries in Div. 0A and Div. 1AB have been stable in recent years.

Div 0B+1C-F.

The biomass in Div. 1CD has been decreasing gradually from an all-time high in 2011to the lowest estimate since 1997 in 2014 but was back at level above the average for the time series in 2015

Estimated total biomass of Greenland halibut in the offshore areas estimated in the Greenland shrimp survey has been fluctuating without clear trend during 2005-2014. The biomass was at an average level in 2015

Division 0B was surveyed again in 2013 – 2 015. The biomass decreased between 2011 and 2013, but has shown an increasing trend since then.

Standardized CPUE rates in Div. 1CD have generally been increasing since 2002 and increased further in 2015 the highest level in the time series. The CPUE in Div.0B has been increasing since 2012. The combined Div. 0B+1CD standardized CPUE series has been increasing since 2011 and is now at the highest level in the time series.

The standardized CPUE for gill net in Div. 0B has been increasing since 2007 and was in 2015 at the highest level in the time series.

Length compositions in the commercial catches in 1CD have been stable in recent years.

SA 0+1

The offshore recruitment (age one) has been rather stable between 2003 and 2010 and the recruitment increased to the highest level in the time series in 2011 but have fluctuated since then with several years with good recruitment. The recruitment in 2015 was well above the average of the time series.

A standardized CPUE index for all trawlers fishing in SA 0+1 has been increasing between 2002 and 2006 and has been fluctuating at a high level since then. The 2015 estimate is the highest seen since 1989.

The combined biomass estimate from Div. 0A-South+Div. 1CD has been relatively stable since 2001 with an increasing trend in recent years and the biomass is well above $B_{lim.}$

5. Biological reference points

Yield per recruit analysis or other age-based methods are not available, for estimating biological reference points.

There is no accepted analytical model so quantitative estimation of reference points is not possible. SC has recormeded that a proxy of B_{lim} should be estimated based on the survey indexes that are used as the primary basis for advice for this stock.

A preliminary proxy for B_{lim} was set as 30% of the mean of survey biomass for 1997-2012 in a combined proxy for Div. 0A-South+1CD (Fig. 14).

B_{msy} is not known for this stock. If it is assumed that the stock is at or close to B_{msy} the B_{lim} should according to Report of the NAFO Study Group on Limit Reference Points Lorient, France, 15-20 April, 2004 (SCS 04/12) be set at 30% of B_{msy}. If the stock increases B_{lim} should be increased accordingly.

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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 2015. 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]	4	5	6	7	8	9	10	11	12[h]	13[h]	14[h]	15[h]
0A																													
CAN							681		82	576	3		517		2628	3561	4142	3751	4209	6634	6173	5257	6627	6390	6260	6365	6314	7934	7922
POL															445														
TOT 0A							681		82	576	3		517		3073	3561	4142	3751	4209	6634	6173	5257	6627	6390	6260	6365	6314	7934	7922
0B																													
CAN		2	180	844	395	2624	592	402	1859	2354	3868	3924	4267	5438	5034	3910	5059	5771	5789	5585	5318	5175	5622	6835	6865	6966	7037	7003	7525
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	600																			
TOT 0B	388	1024	1087	9753	8745	12788	7199	4676	3151	4032	4320	3924	4267	5438	5034	3910	5059	5771	5789	5585	5318	5175	5622	6835	6865	6966	7037	7003	7525
TOT 0AB	388	1024	1087	9753	8745	12788	7880	4676	3233	4608	4323	3924	4784	5438	8107	7471	9201	9522	9998	12219	11491	10432	12249	13225	13125	13331	13351	14937	15447

[a] The Russian catch is reported as area unknown, but has previously been reported from Div. 0B
[b] Double reported as 10031 tons
[d] Excluding 782 tons reported by error
[e] STACFIS estimate
[f] excluding 2 tons reported by error
[h] excluding catches from Cumberland Sound

Table 2. Greenland halibut catches (metric tons) by year and country for Subarea 1 (Split on Div. 1AB and Div. 1CF) from 1987 to 2015. The Greenland catches are excl. inshore catches in Div. 1A. Offshore catches in Div. 1A prior to 2000 are negligible.

	Year																												
Coun.	87	88	89	90	91	92	93	94	95	96	97	98	99[a]	0	1	2	3[g]	4	5	6	7	8	9	10	11	12	13	14	15
1AB																													
GRL															340[c]	1619[c]	3558[c]	3500[c]	3363[c]	5530[c]	5596[c]	5524[c]	6094[c]	5682[c]	5722[c]	5810[c]	5865[c]	7333[c]	7366
RUS															85	279	259	241	549	565	575	570	517	654	648	546	546	550	548
FRO														96	150	150	117	153	125	128	125	149	124	126	102	103	102[h]	102	102
EU																	73[e]	141[e]											
TOT 1AB														96	575	2048	4007	3908	4037	6223	6296	6243	6735	6462	6472	6459	6513	7985	8016
1CF																													
GRL	1646	605	540	841	933	191	186	872	1399	1876	2312	2295	2529	2659	2012	2284	2059	2102[b]	2380[b]	2430[b]	1805[b]	1888	1457	2491	2493	2712	3514	4072	3906
FRO				54	123	151	128	780			127	125	116	147	150	150	135	150	149	147	150	184	149	152					
JPN	855	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	1441	1452[b]	1501	1572	1720	1743	1496	1464	1503
RUS							5		296	254		543	552	792	829	654	1328	1214	1147	1222	689	763	1056	1214	865	1231	1223	1224	1215
EU							46	266	527	455	446	350	330	444[b]	537[b]	536	543[d]	665[f]	549	544	1516	1517	1511	1818	1824	1784	2017	1869	1880
TOT 1CD	2501	2181	1840	1880	2340	5669	3870	5857	5017	4370	4778	4651	4887	5632	5078	5358	5488	5495	5681	5722	5601	5804	5670	7247	6902	7470	8211	8629	8504
Total	2501	2181	1840	1880	2340	5669	3870	5857	5017	4370	4778	4651	4887	5728	5653	7406	9495	9403	9718	11945	11897	12047	12404	13709	13374	13929	14763	16614	16520

[a] Excluding 7603 tons reported by error

[b] Reported to the Greenland Fisheries License Control Authority. Statlant 21A data from Div. ICD from Greenland during 2004-2007 include double reported catches.

[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

[h] Reported from Div. 1D

Table 3. By-catch of selected species (tons) by gear and Div. in the Canadian Greenland halibut fishery..

	0A		0B	
Species	**Trawl**	**Gillnet**	**Trawl**	**Gillnet**
Greenland halibut (*R. hippoglossoides*)	3266.0	3331.9	2321.7	458.8
Greenland shark (*S. microcephalus*)	160.4	.5	267.3	.3
Black Dogfish (*C. fabricii*)			3.0	3.2
Skates sp.	2.2	32.8	21.9	.2
Spinytail skate (*R. spinicauda*)	18.8	2.6	11.5	.4
Arctic skate (*A. hyperborea*)	7.7	5.5		
Thorny skate (*A. radiata*)	3.2	2.7		
Grenadier sp.			3.0	.3
Roughhead grenadier (*M. berglax*)	3.9	28.2	20.6	36.1
Roundnose grenadier (*C. rupestris*)	6.9	2.0	7.1	7.0
American Plaice (*H. platessoides*)	1.0	.2		
Atlantic Cod (*G. morhua*)	.1	6.5		
Blue Hake (*A. rostrata*)			5.5	.6
Threebeard Rockling (*G. ensis*)	1.6	.1	4.0	
Redfish (Sebastes)	1.0	10.9	2.0	3.4
Northern wolffish (*A. denticulatus*)	7.2	2.1	27.7	2.4
Striped wolfish (*A. lupus*)		.4		
Spotted wolffish (*A. Minor*)	1.0	.1		
Spiny crab (*N. grimaldii*)				1.5
King crab (*L. maja*)				1.9
Sea Stars (Asteroidea)	2.0	.2		
Sponge (Porifera)	1.3	.2	1.0	.3
TOTAL BY-CATCH	219.4	102.7	378.6	60.0
BYCATCH % of Greenland Halibut catch	6.7	3.1	16.3	13.1

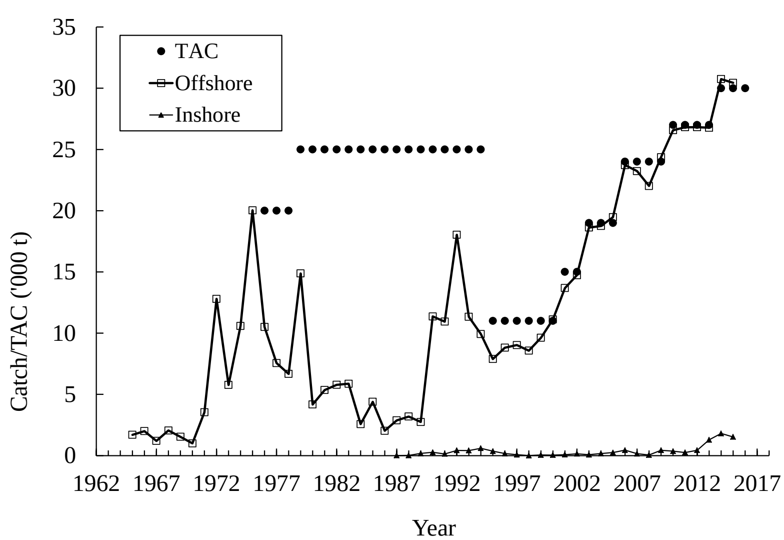

Fig. 1. Catches in SA0 and Div. 1A offshore + Div. 1B-1F and recommended TAC. For TAC before 1995 see

text.

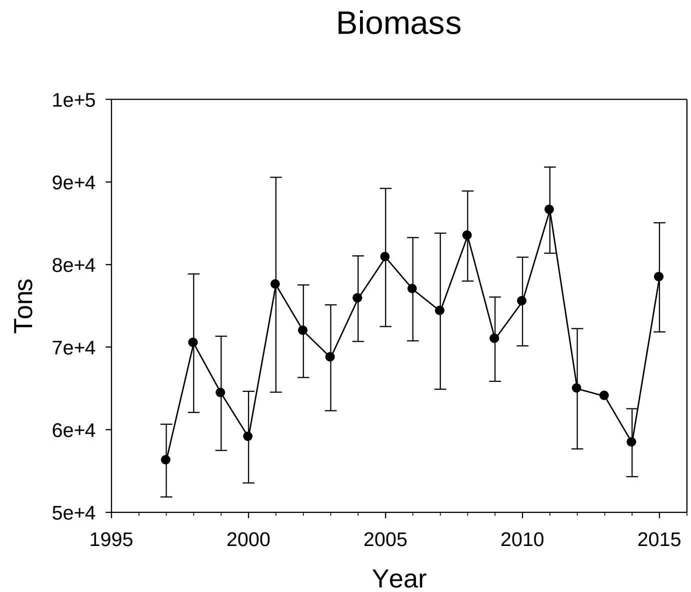

Fig. 2a. Biomass index with S.E. from the Greenland deep sea survey in Div. 1CD.

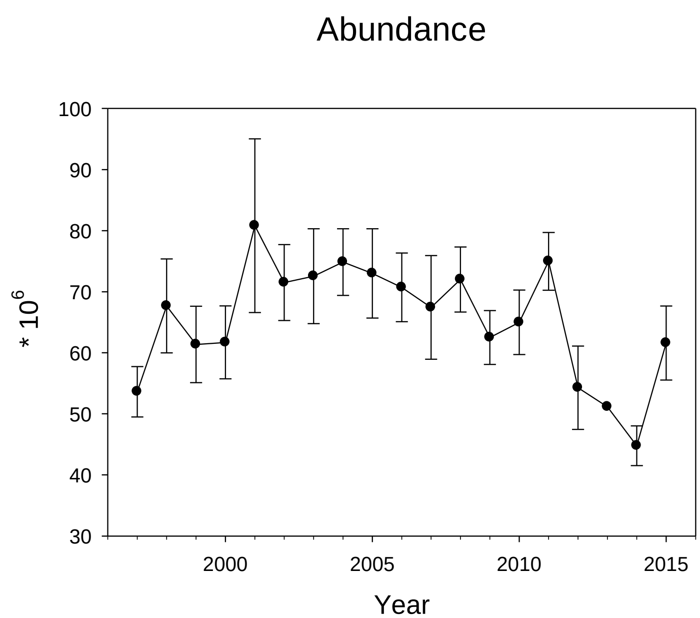

Fig. 2b. Abundance with S.E. from the Greenland deep sea survey in 1CD.

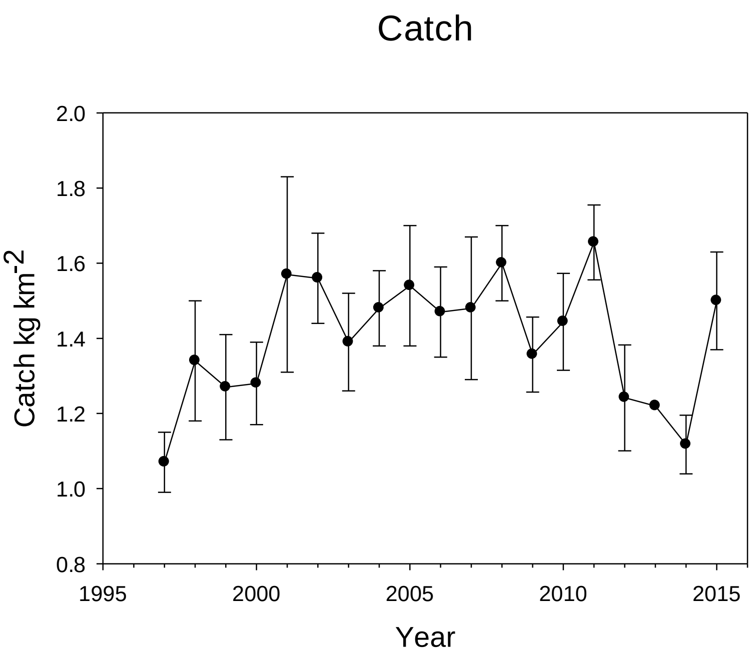

Fig. 2c. Mean catch per km^2 swept with S.E. in the Greenland deep sea survey in Div. 1CD.

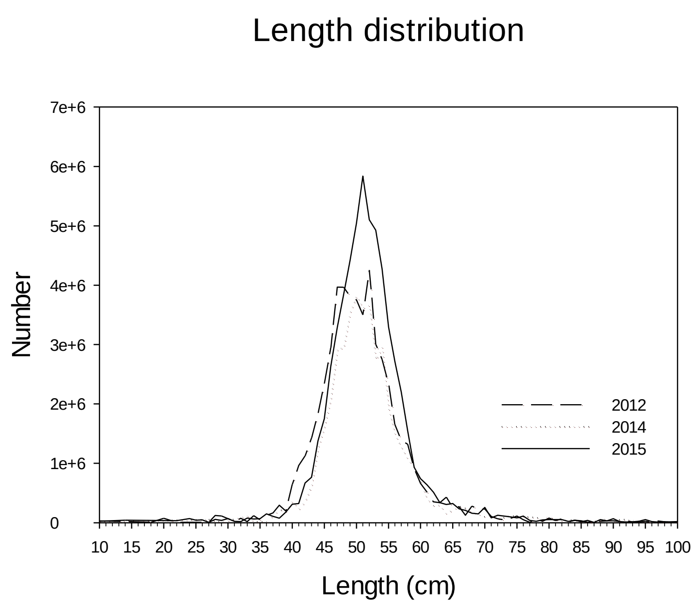

Fig. 2d. Overall length distribution of Greenland halibut in numbers (weighted by stratum area) in Div. 1CD by year No data from 2013..

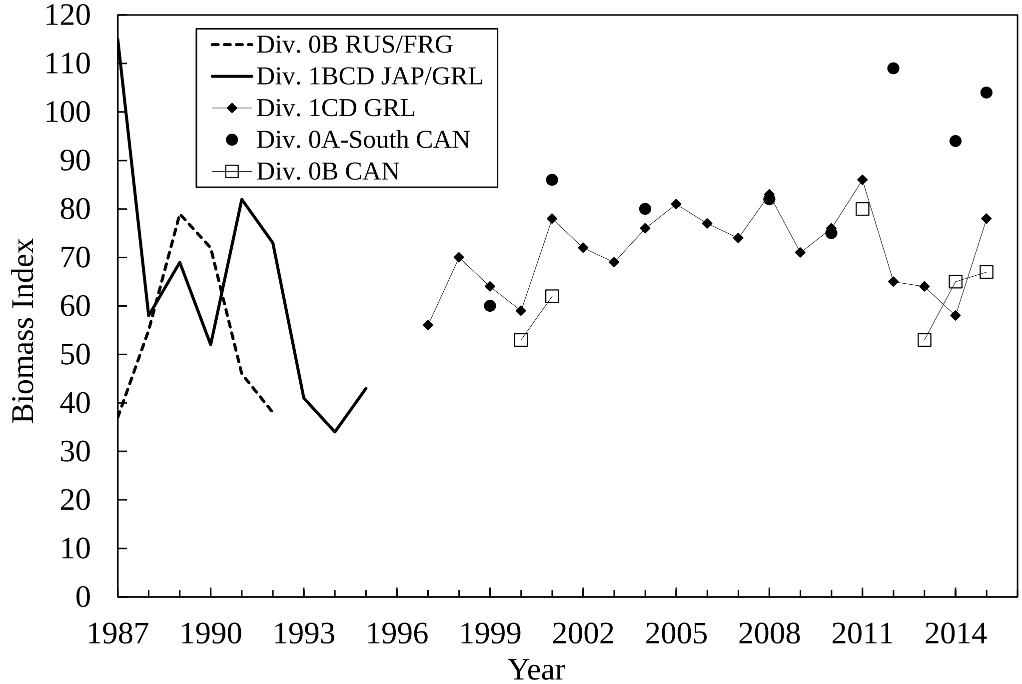

Fig. 2e. Biomass estimates from various surveys in SA 0 and 1. Survey estimates from Div. 0A does not include surveys in the northern part in 2004, 2010,.2012 and 2014. No survey in 2013. Note that the survey in Div. 0A in 2006 had incomplete coverage (see text).

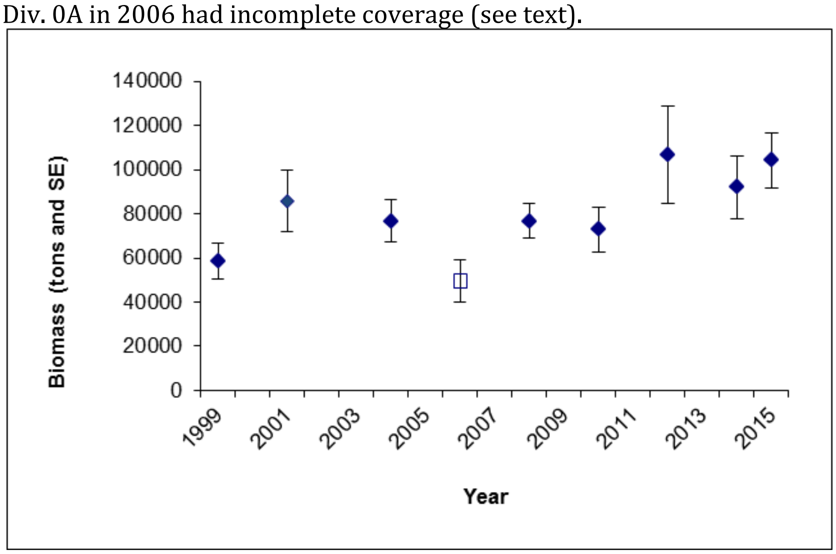

Fig. 2f. Biomass estimates for Greenland halibut in Div. 0A (South) with SE.

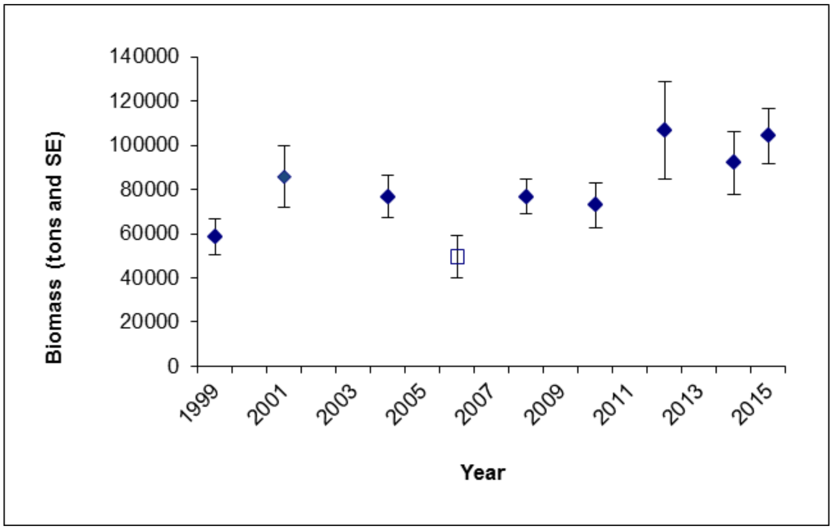

Fig. 2g. Aabundance estimates for Greenland halibut in Div. 0A (South) with SE.

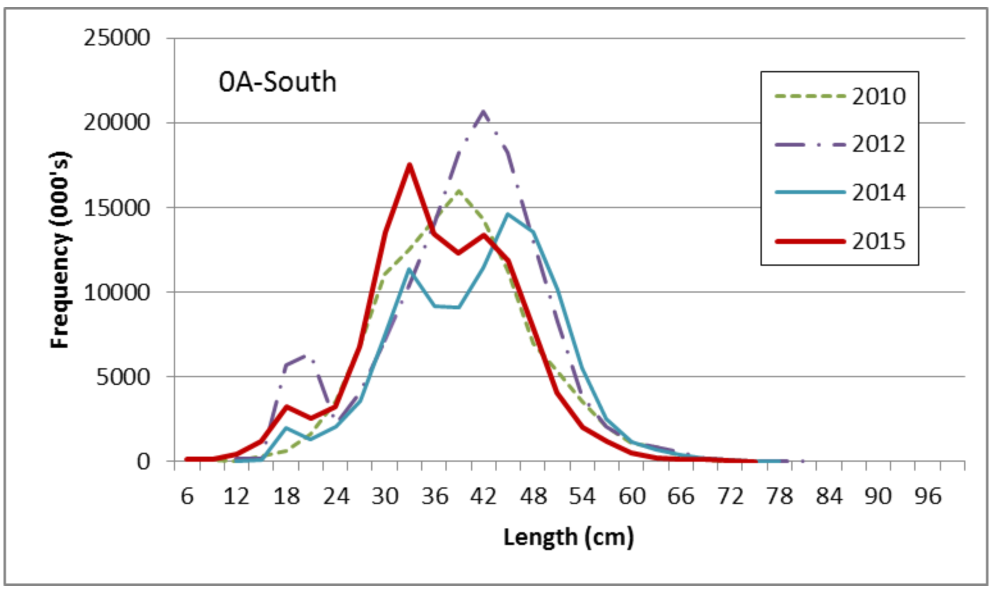

Fig. 2h. Abundance at length for the Greenland halibut in NAFO Division 0A-South, 2010 to 2015 (weighted by stratum area).

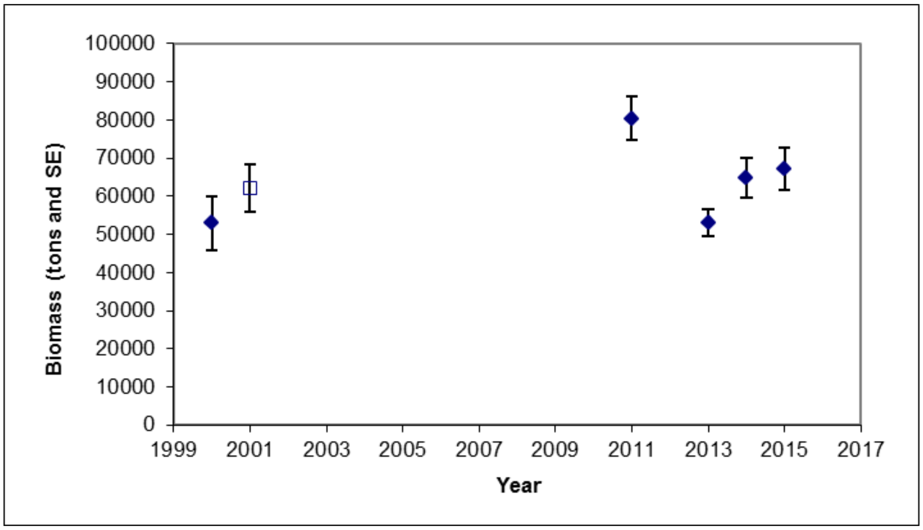

Fig. 2 i. Biomass estimates from Div. 0B with S.E. by year. 2001 was incomplete.

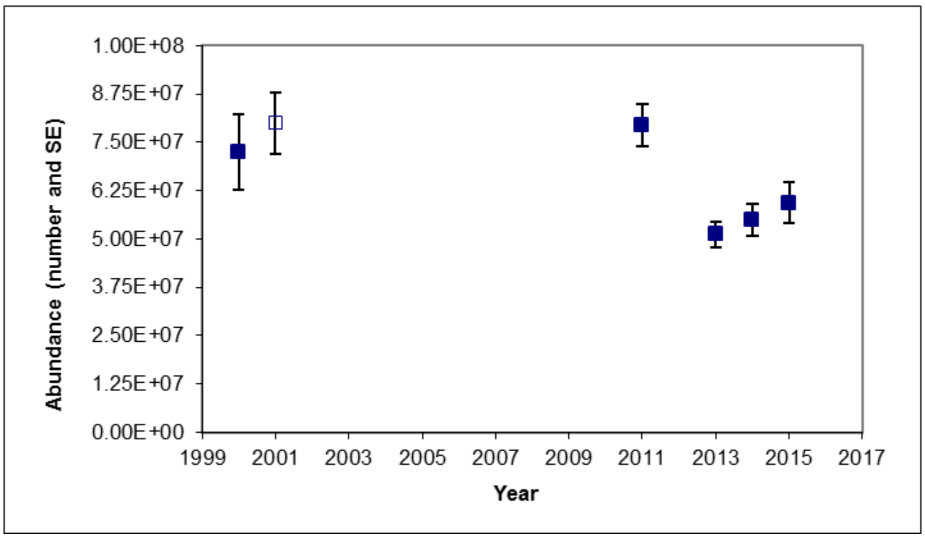

Fig. 2j. Abundance estimates from Div. 0B with S.E. by year. 2001 was incomplete.

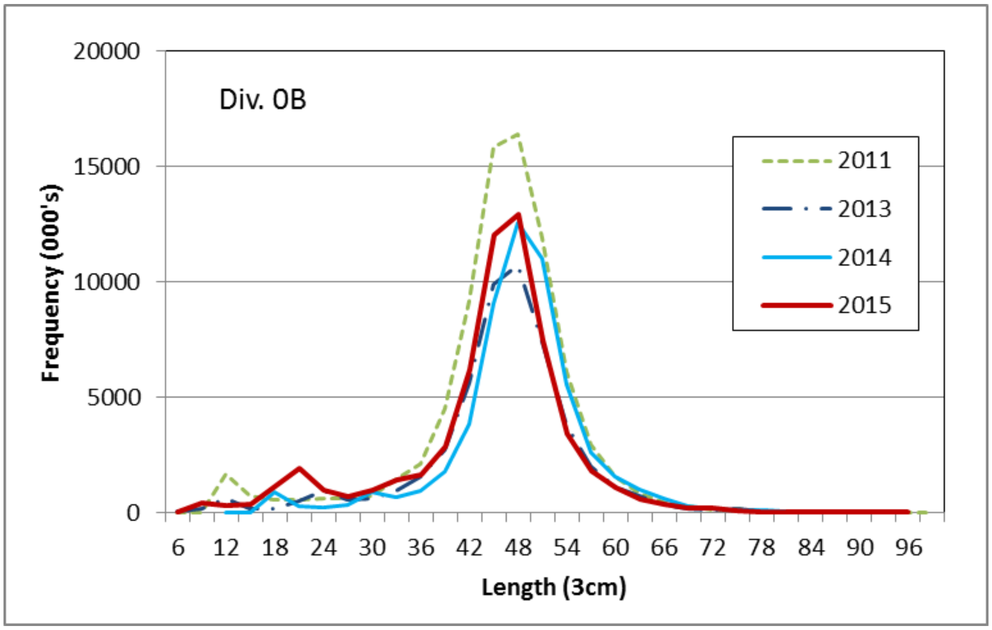

Fig. 2k. Overall length distribution from Div. 0B weighted by area and year.

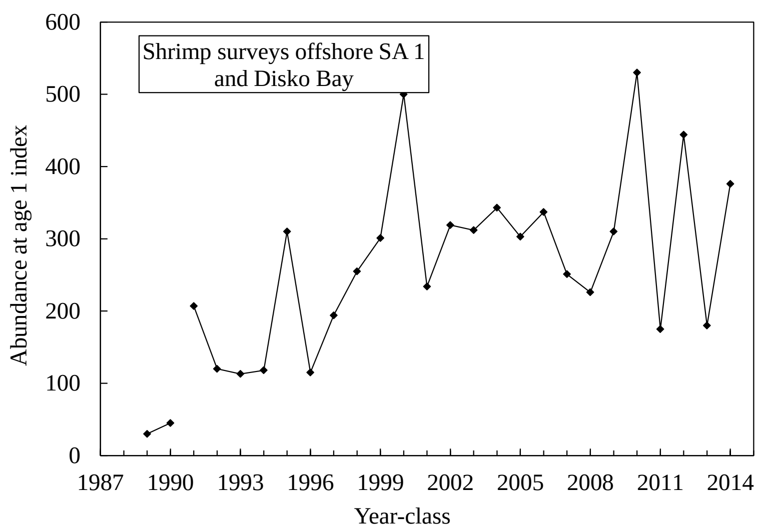

Fig. 3. Abundance of age-one Greenland halibut in the entire area covered by the Greenland shrimp survey including inshore Disko Bay and Div. 1AN (North of 70°37.5'N) adjusted for change in survey gear in 2005.

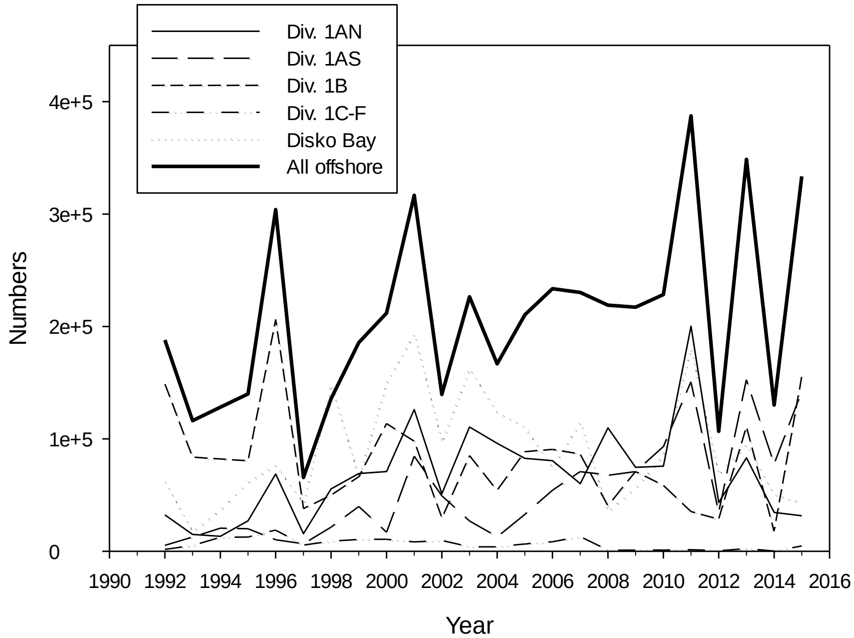

Fig 4. Number of one-year old Greenland halibut by division and year.

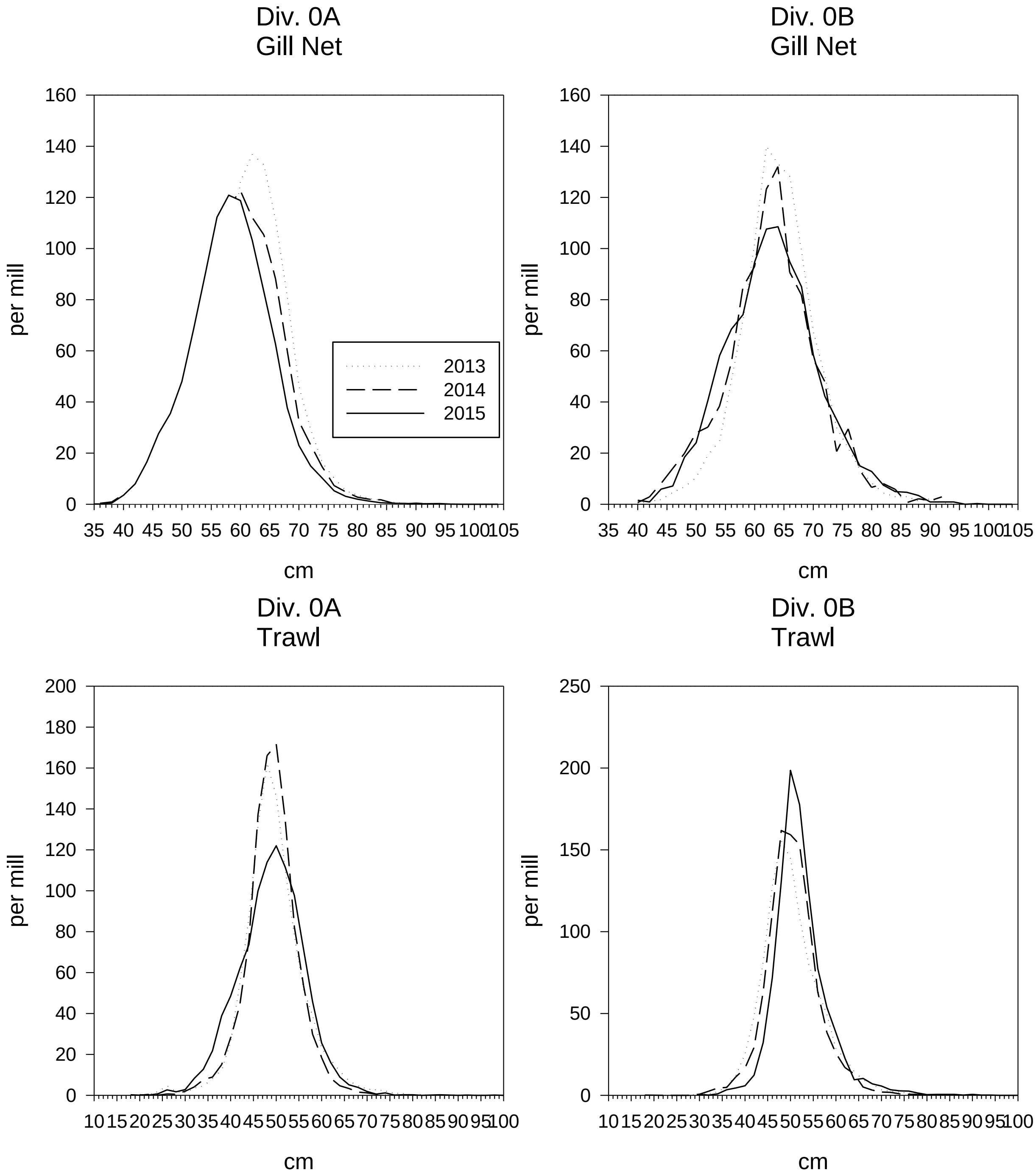

Fig. 5. Length distribution from the fishery in Subarea 0 in 2013-2015 in per mill., 2 cm groups.

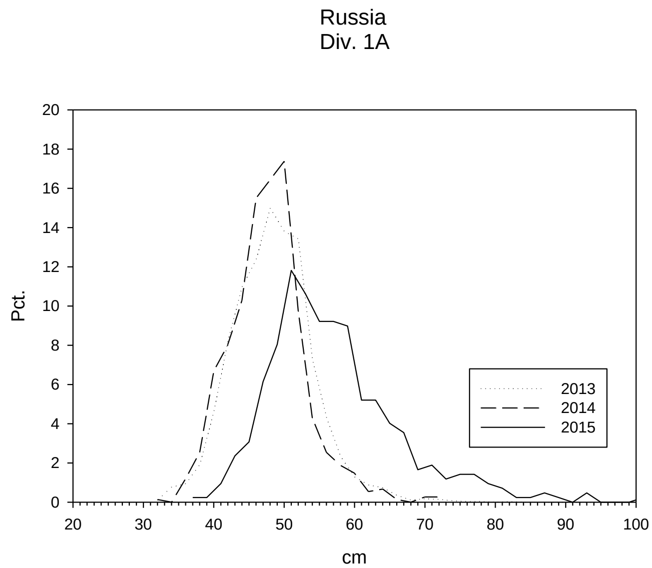

Fig. 6. Length distribution in the Russian trawl fishery in Div. 1A in 2013 -2015 in percent, 2-cm groups.

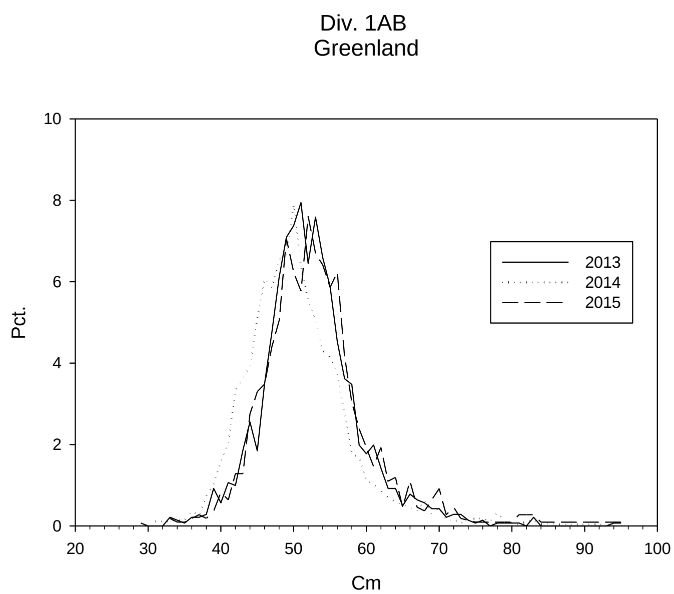

Fig. 7. Length distribution in the Greenland trawl fishery in Div. 1A in 2013-2015 in percent, 1-cm groups.

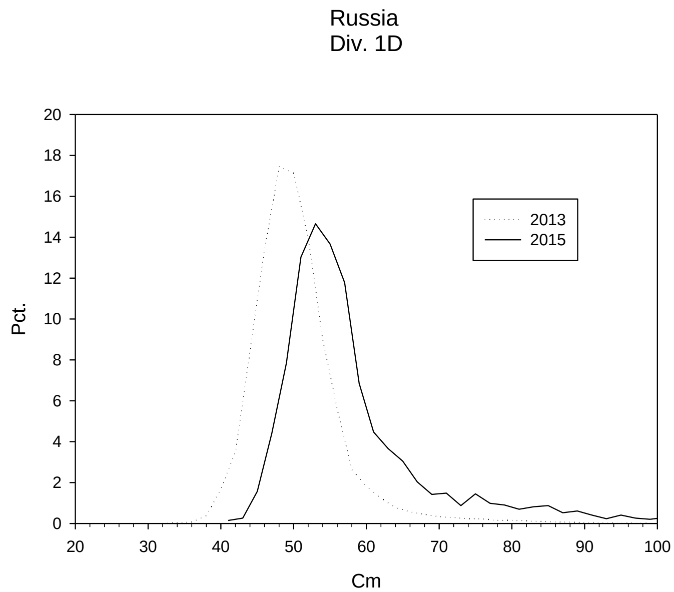

Fig. 8. Length distribution in the Russian trawl fishery in Div. 1CD in 2013 and 2015 in percent, 2-cm groups. No data from 2014.

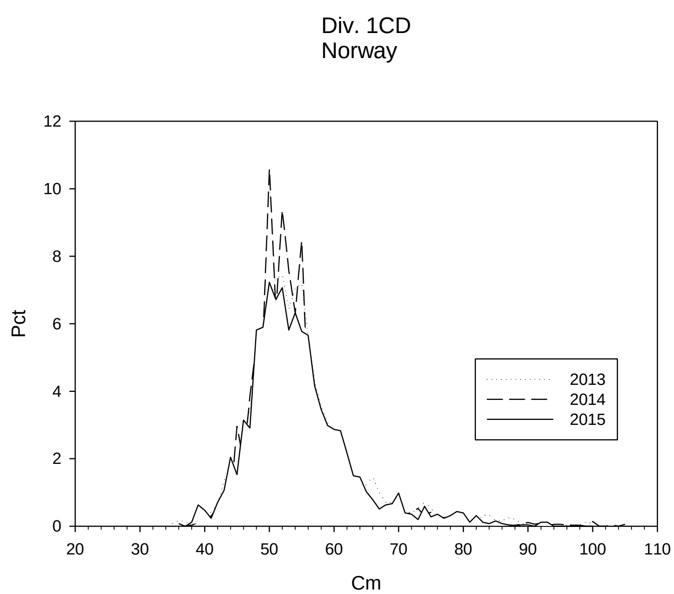

Fig. 9. Length distribution from the Norwegian Trawl fishery in Div. 1D in 2013-2015 in percent, 1-cm groups.

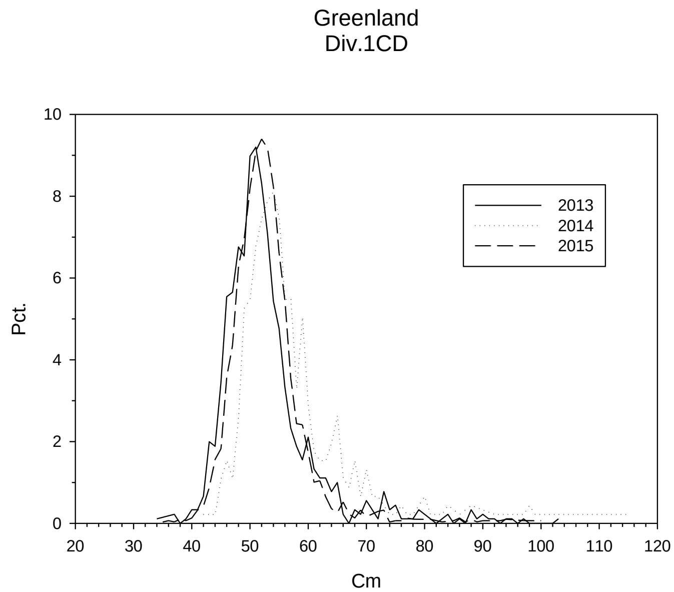

Fig. 10. Length distribution from the Greenland trawl fishery in Div. 1D in 2013-2015 in pct., 1-cm groups..

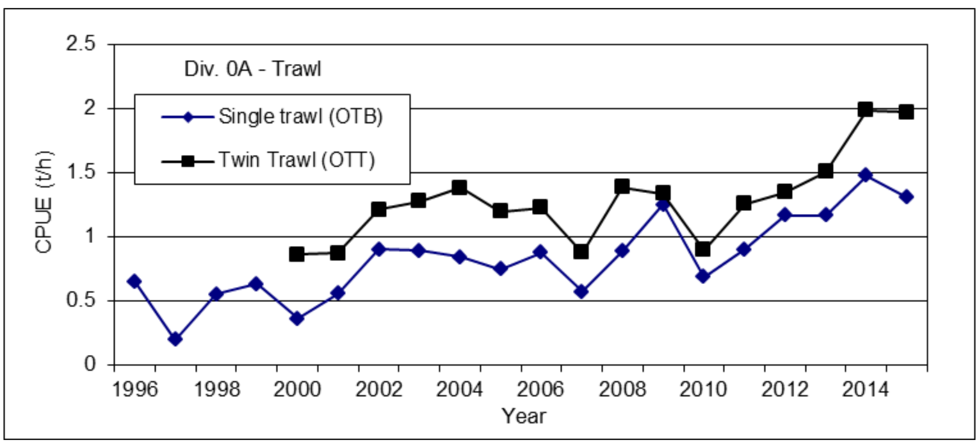

Fig. 11a. Un-standardized CPUE from the trawl fishery in Div. 0A.

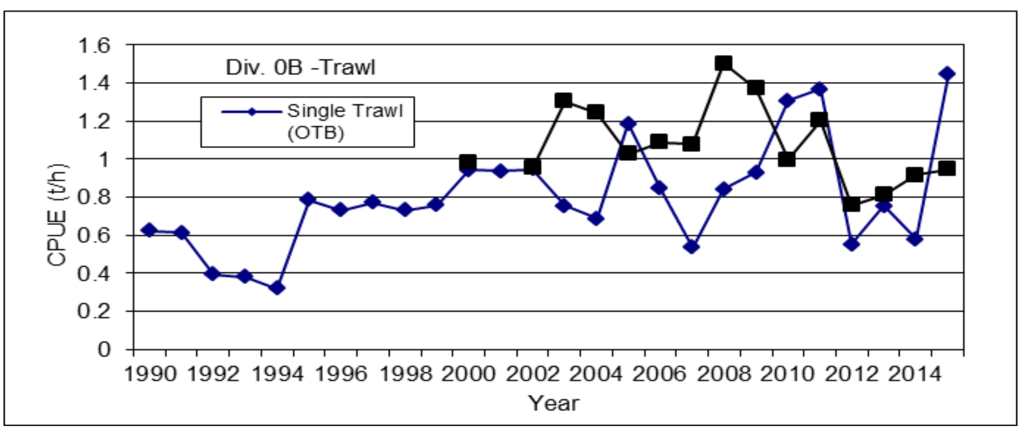

Fig. 11b. Un-standardized CPUE from the trawl fishery in Div. 0B.

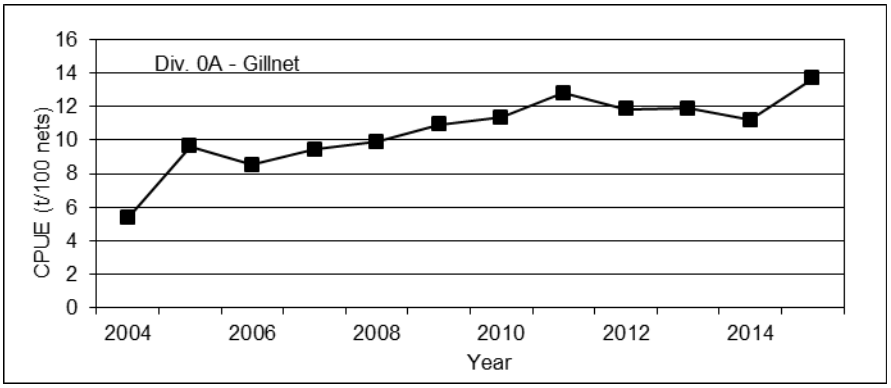

Fig. 11c. Un-standardized CPUE from the gillnet fishery in Div. 0A.

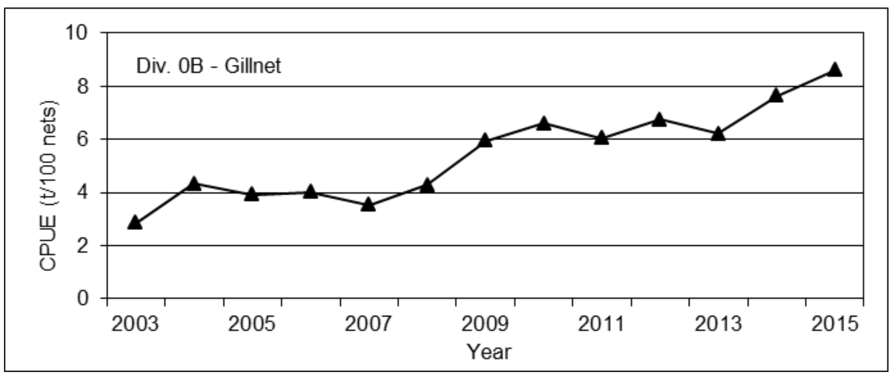

Figure 11d. Unstandardized CPUE from the gillnet fishery in Div. 0B.

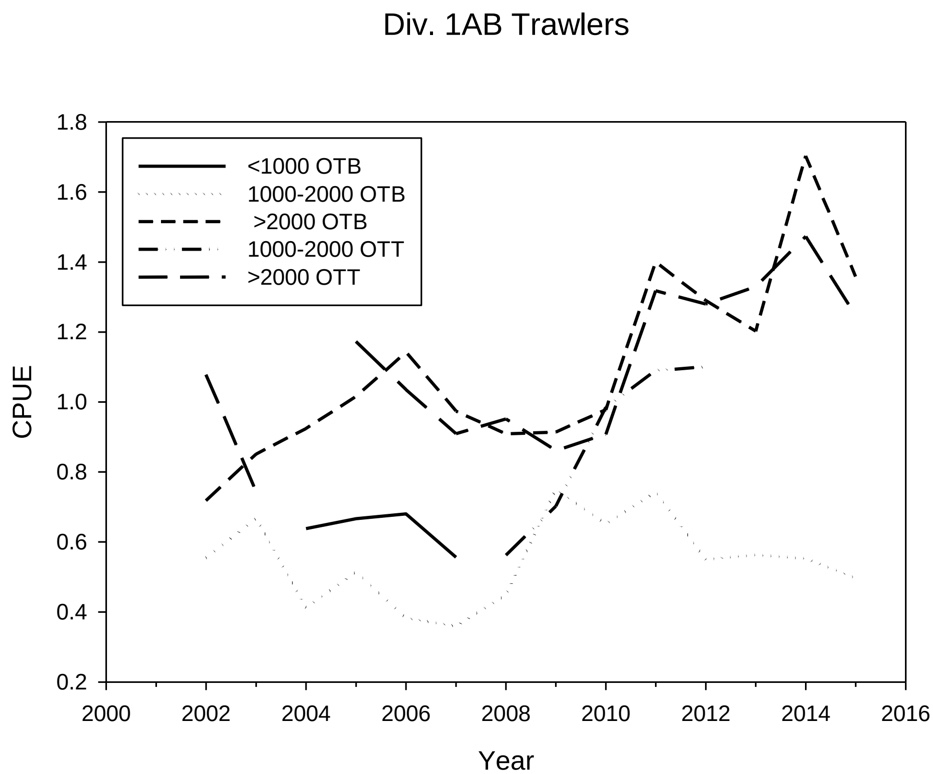

Fig. 11e. Unstandardized trawl CPUE series from Div. 1AB.

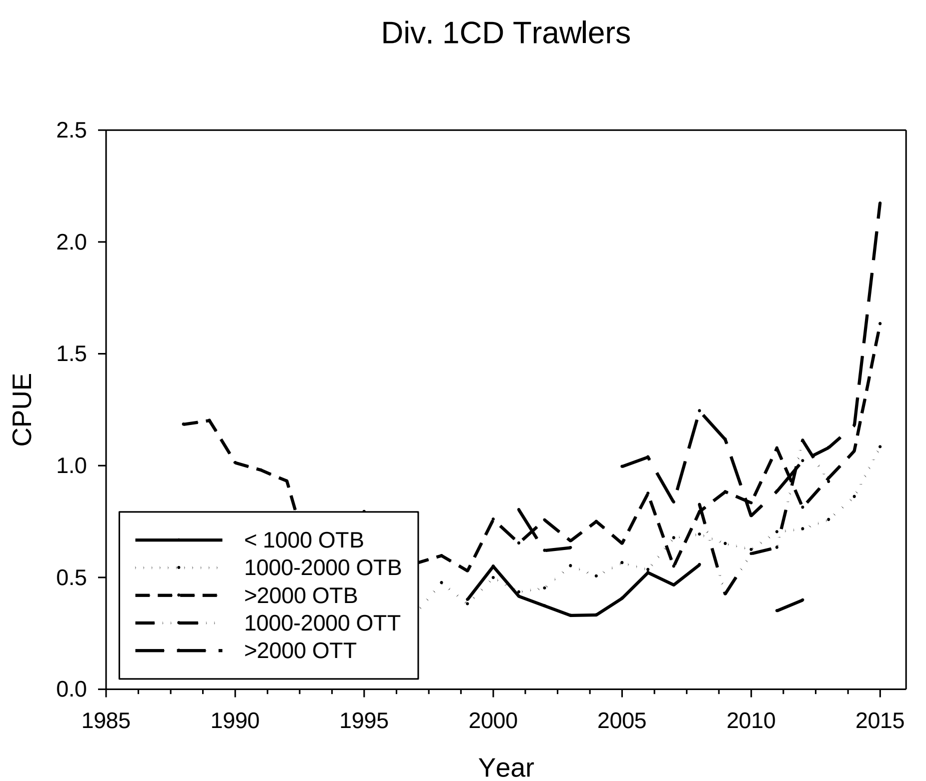

Fig. 11f. Unstandardized catch rates from all fleets fishing in Div. 1CD.

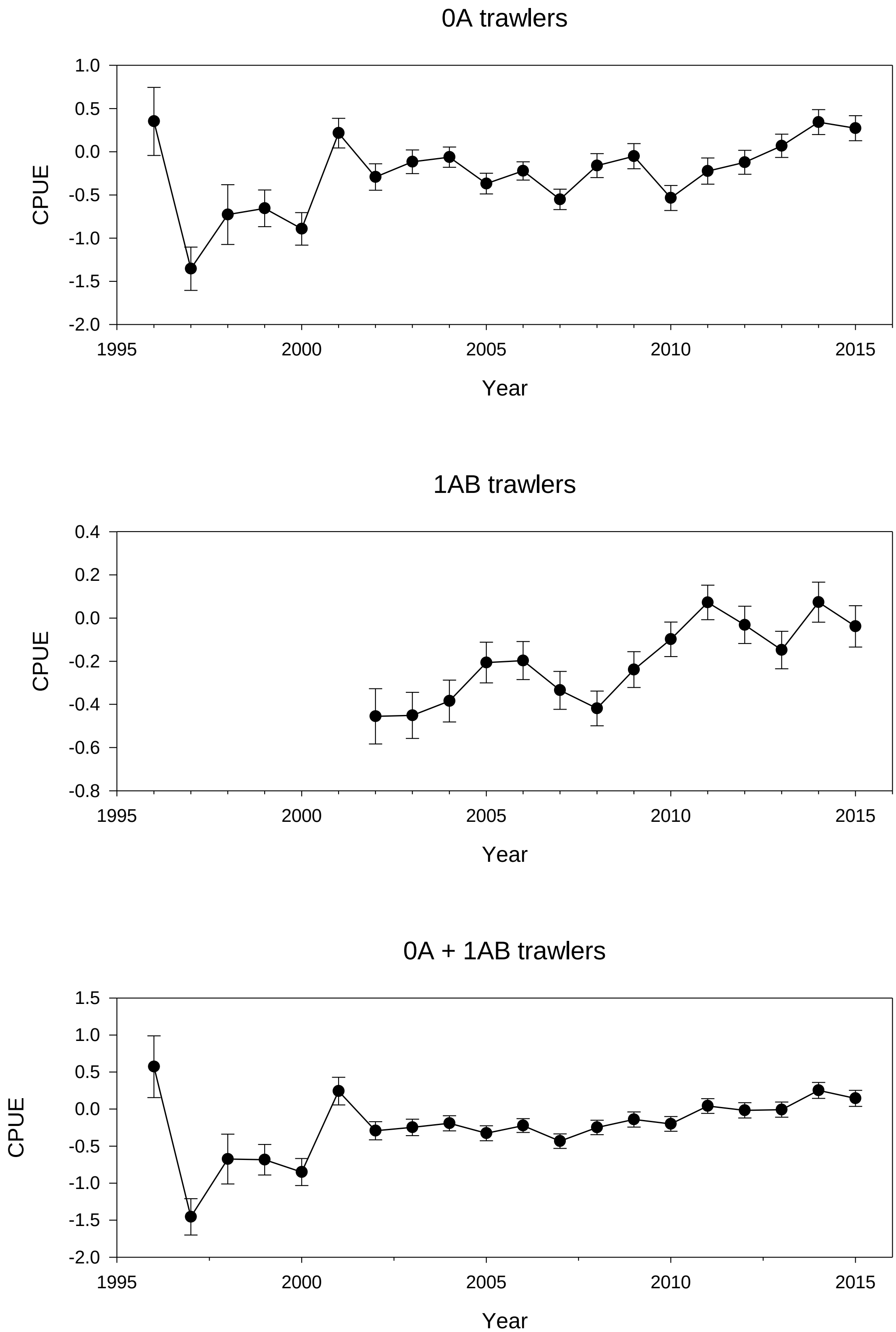

Fig. 12a. Standardized CPUE series from trawlers in 0A, Div. 1AB and 0B+1AB combined with +/- S.E.

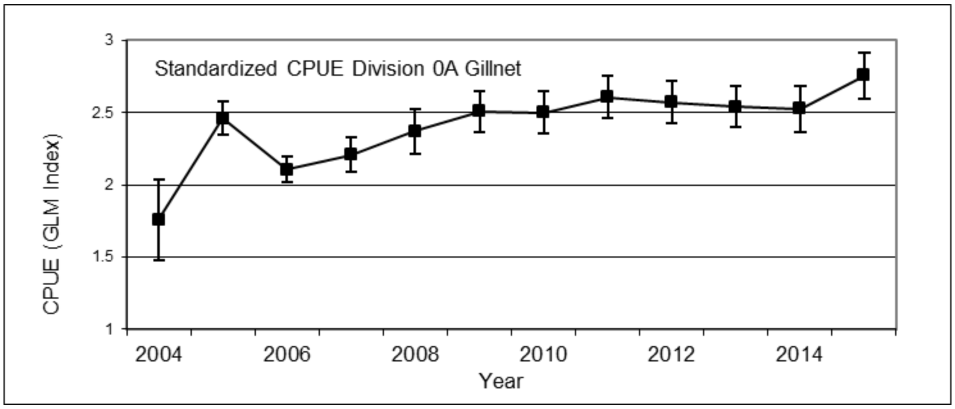

Fig 12b. Standardized CPUE series from gill net in Div. 0A with +/- S.E

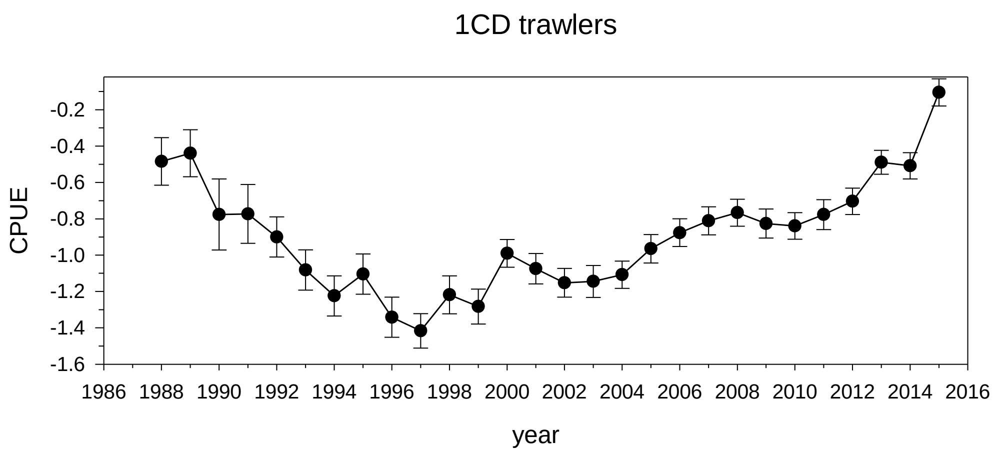

Fig. 12c. Standardized trawl CPUE index from trawlers in Div. 1CD with +/- S.E..

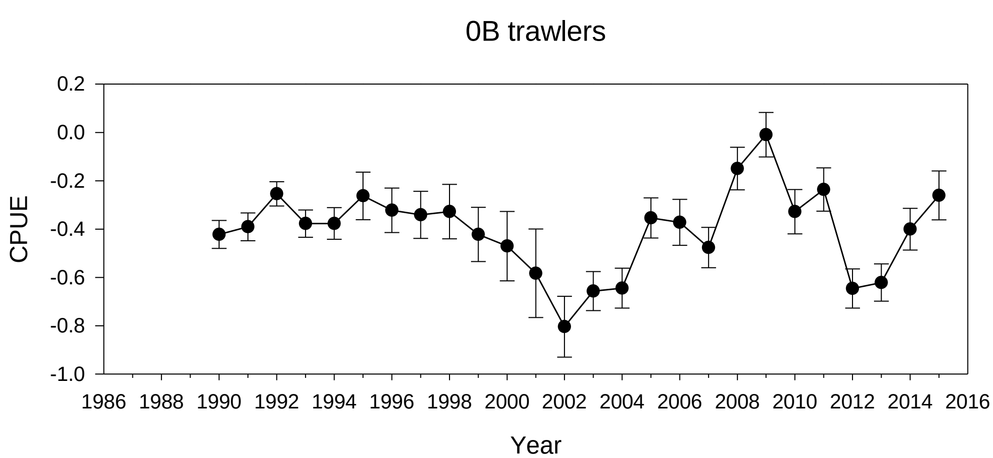

Fig 12d. Standardized CPUE series from trawlers in Div. 0B with +/- S.E.

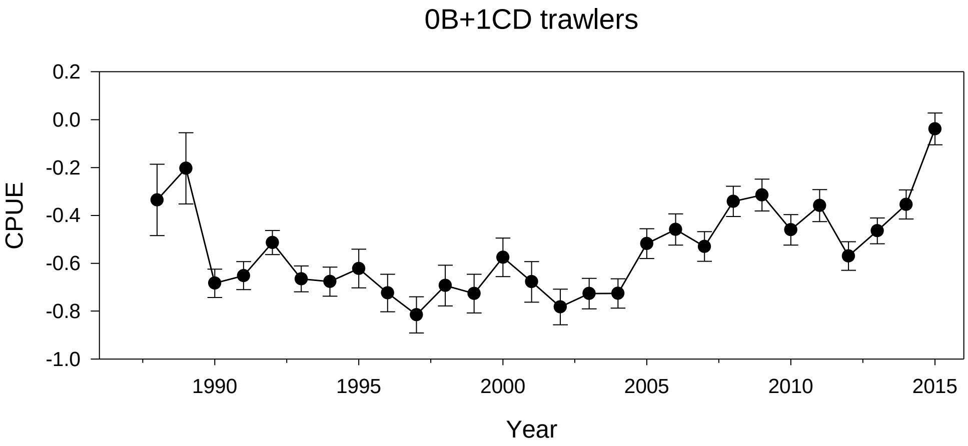

Fig. 12e. Combined standardized trawl CPUE index from trawlers in Div. 0B +1CD with +/- S.E.

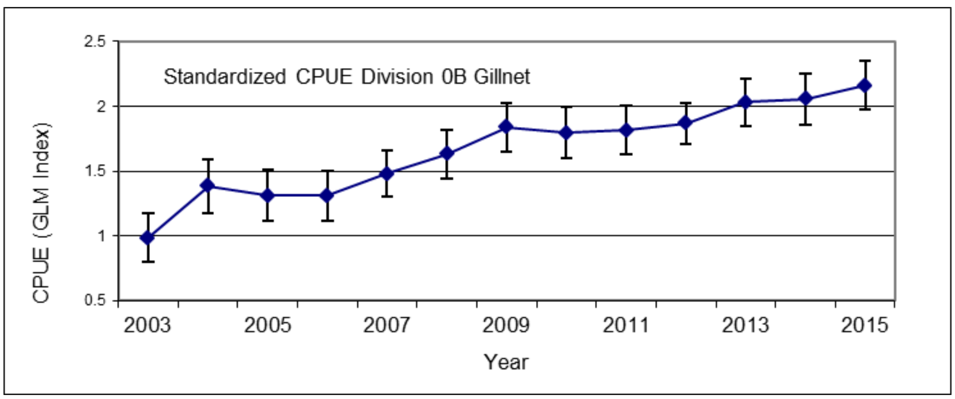

Fig 12f. Standardized CPUE series from gill net in Div. 0B with +/- S.E

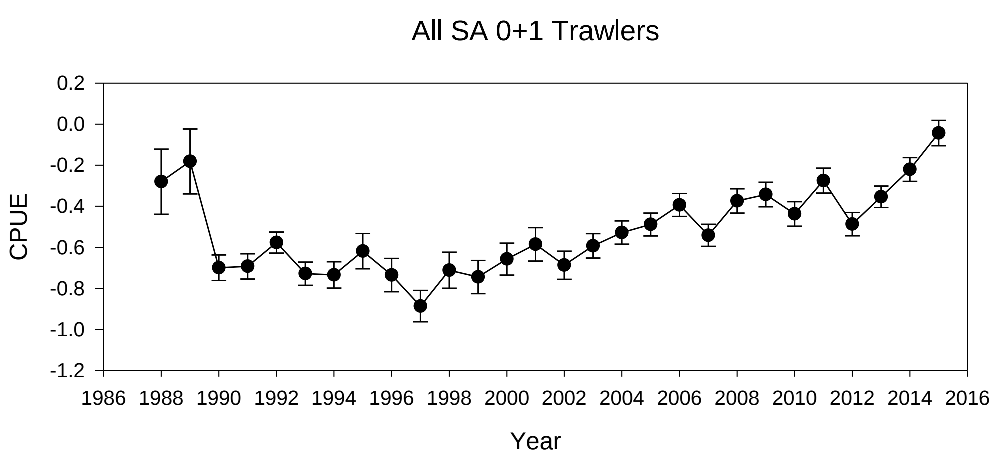

Fig. 12g.Combined standardized trawl CPUE index from trawlers in SA 0+1with +/- S.E

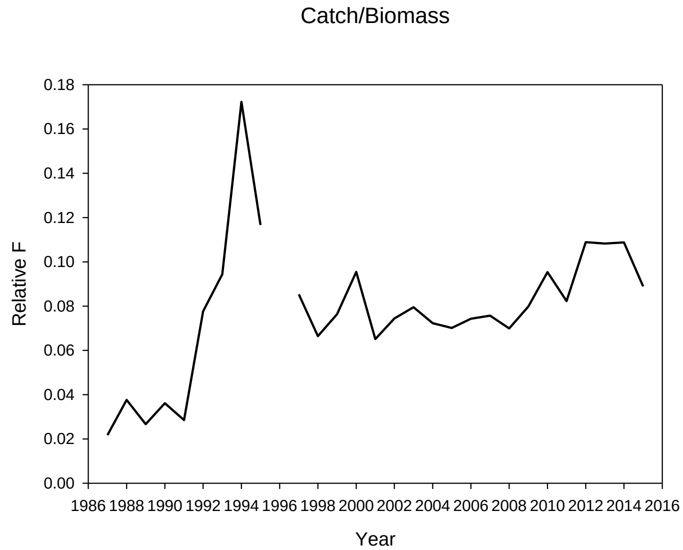

Fig 13. Relative F (off shore catch/swept area biomass) in Div.1CD.

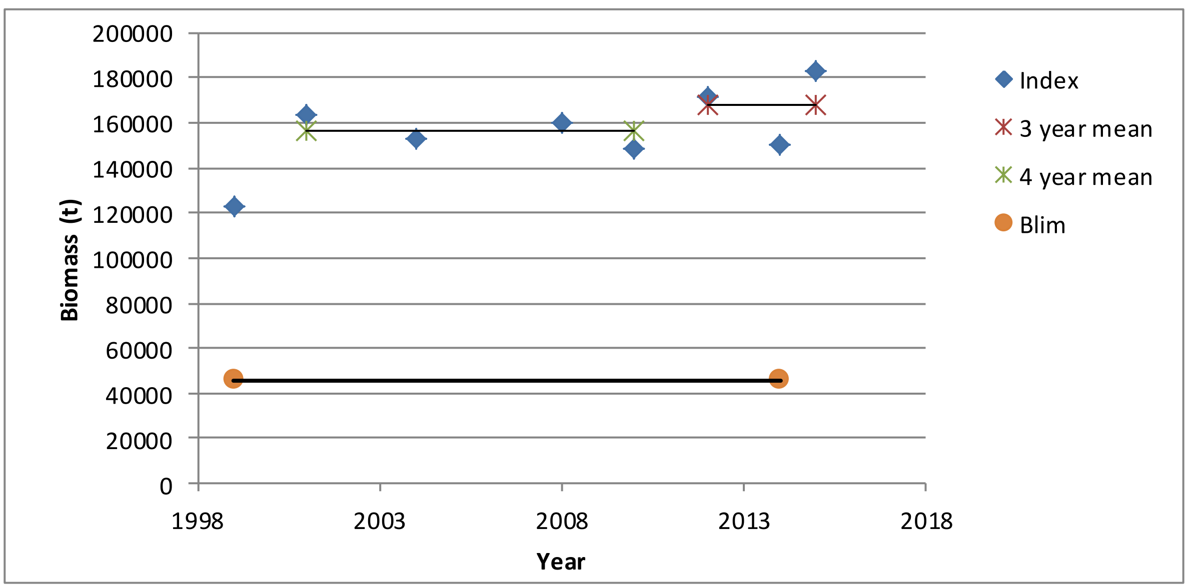

Fig 14. Index of combined surveys 1CD + 0A surveys.

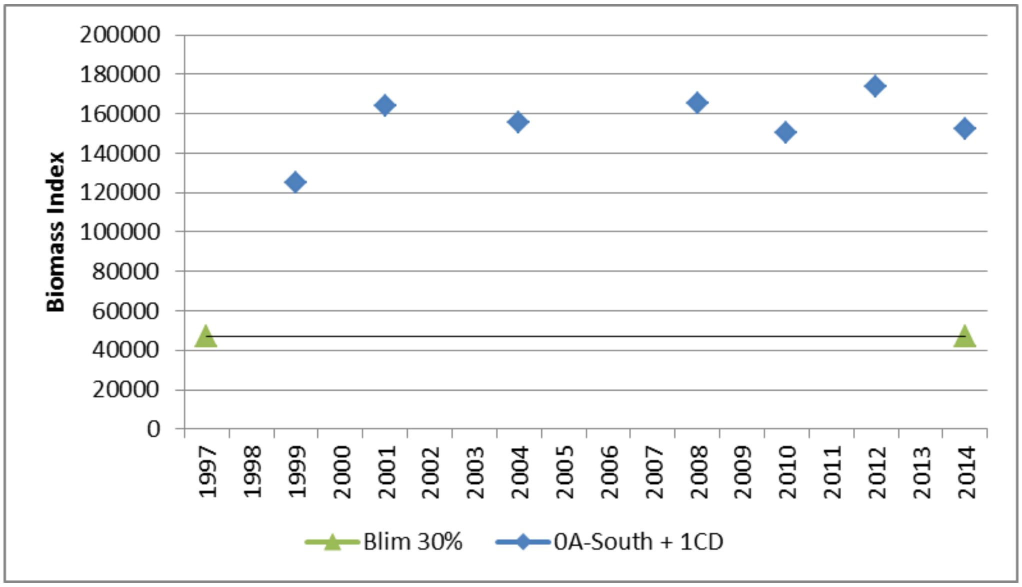

Fig. 15. Biomass trends in Div. 0A + Div. 1CD and $B_{lim.}$

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

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The GLM Procedure

Class Level Information

Class	Levels	Values
Year	20	1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
md	5	7 8 9 10 11
kode	5	2126 2127 5127 21926 21927

Number of Observations Read 169
Number of Observations Used 169

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The GLM Procedure

Dependent Variable: lcph

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	27	25.31032833	0.93741957	8.61	<.0001
Error	141	15.34340107	0.10881845		
Corrected Total	168	40.65372940			

R-Square	Coeff Var	Root MSE	lcph Mean
0.622583	3162.358	0.329876	0.010431

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Year	19	16.78472135	0.88340639	8.12	<.0001
md	4	3.48393380	0.87098345	8.00	<.0001
kode	4	5.04167318	1.26041830	11.58	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Year	19	14.65428483	0.77127815	7.09	<.0001
md	4	2.63304827	0.65826207	6.05	0.0002
kode	4	5.04167318	1.26041830	11.58	<.0001

Parameter		Estimate		Standard Error	t Value	Pr > |t|
Intercept		0.409323562	B	0.13061559	3.13	0.0021
Year	1996	0.078770736	B	0.47118501	0.17	0.8675
Year	1997	-1.626433581	B	0.26840145	-6.06	<.0001

Year	1998	-0.999642363 B	0.35423222	-2.82	0.0055
Year	1999	-0.927645684 B	0.22602256	-4.10	<.0001
Year	2000	-1.164824537 B	0.20414361	-5.71	<.0001
Year	2001	-0.057223617 B	0.22557819	-0.25	0.8001
Year	2002	-0.564674550 B	0.17268978	-3.27	0.0014
Year	2003	-0.388332317 B	0.16418175	-2.37	0.0194
Year	2004	-0.334755960 B	0.15779998	-2.12	0.0356
Year	2005	-0.641110436 B	0.15521287	-4.13	<.0001
Year	2006	-0.494349714 B	0.14092567	-3.51	0.0006
Year	2007	-0.823844469 B	0.14342306	-5.74	<.0001
Year	2008	-0.433193919 B	0.16063257	-2.70	0.0079
Year	2009	-0.324215896 B	0.16493821	-1.97	0.0513
Year	2010	-0.807549082 B	0.16704359	-4.83	<.0001
Year	2011	-0.496159319 B	0.17338467	-2.86	0.0049
Year	2012	-0.394966080 B	0.16169675	-2.44	0.0158
Year	2013	-0.203821105 B	0.15749795	-1.29	0.1977

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The GLM Procedure

Dependent Variable: lcph

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Year	2014	0.070621881 B	0.16663114	0.42	0.6723
Year	2015	0.000000000 B	.	.	.
md	7	0.342253427 B	0.10575047	3.24	0.0015
md	8	0.207450717 B	0.08801627	2.36	0.0198
md	9	0.273081511 B	0.08086221	3.38	0.0009
md	10	0.360936654 B	0.07733863	4.67	<.0001
md	11	0.000000000 B	.	.	.
kode	2126	-0.382474628 B	0.10657861	-3.59	0.0005
kode	2127	-0.279728683 B	0.05912902	-4.73	<.0001
kode	5127	-1.264985177 B	0.38783357	-3.26	0.0014
kode	21926	0.060075133 B	0.11303006	0.53	0.5959
kode	21927	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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The GLM Procedure
Least Squares Means

Year	lcph LSMEAN	Standard Error	Pr > |t|
1996	0.35141609	0.39381617	0.3737
1997	-1.35378823	0.25112571	<.0001
1998	-0.72699701	0.34515515	0.0370
1999	-0.65500033	0.21218443	0.0024
2000	-0.89217918	0.18839313	<.0001
2001	0.21542174	0.17124193	0.2105
2002	-0.29202920	0.15299392	0.0583
2003	-0.11568696	0.13691461	0.3996
2004	-0.06211061	0.11727306	0.5972
2005	-0.36846508	0.11987249	0.0025
2006	-0.22170436	0.10596565	0.0382
2007	-0.55119912	0.11852638	<.0001

2008	-0.16054857	0.13905841	0.2502
2009	-0.05157054	0.14509295	0.7228
2010	-0.53490373	0.14428877	0.0003
2011	-0.22351397	0.15154638	0.1425
2012	-0.12232073	0.13880268	0.3797
2013	0.06882425	0.13464714	0.6100
2014	0.34326723	0.14446487	0.0188
2015	0.27264535	0.14509295	0.0623

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

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The GLM Procedure

Class Level Information

Class	Levels	Values
year	14	2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
MD	8	1 6 7 8 9 10 11 12
kode	5	6125 6126 6127 61926 61927

Number of Observations Read 178
Number of Observations Used 178

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The GLM Procedure

Dependent Variable: lcph

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	24	21.38329604	0.89097067	13.92	<.0001
Error	153	9.79259182	0.06400387		
Corrected Total	177	31.17588786			

R-Square	Coeff Var	Root MSE	lcph Mean
0.685892	-137.3449	0.252990	-0.184200

Source	DF	Type I SS	Mean Square	F Value	Pr > F
year	13	4.31407305	0.33185177	5.18	<.0001
MD	7	2.50886864	0.35840981	5.60	<.0001
kode	4	14.56035434	3.64008859	56.87	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
year	13	4.63638968	0.35664536	5.57	<.0001
MD	7	3.54582119	0.50654588	7.91	<.0001
kode	4	14.56035434	3.64008859	56.87	<.0001

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		0.4157100937 B	0.27864268	1.49	0.1378
year	2002	-.4169289848 B	0.13705650	-3.04	0.0028
year	2003	-.4124971450 B	0.11784592	-3.50	0.0006
year	2004	-.3462456464 B	0.11230296	-3.08	0.0024
year	2005	-.1673090674 B	0.11078719	-1.51	0.1331
year	2006	-.1582989177 B	0.10853368	-1.46	0.1467
year	2007	-.2963530006 B	0.10518122	-2.82	0.0055
year	2008	-.3802456394 B	0.10333927	-3.68	0.0003
year	2009	-.2002722157 B	0.10044383	-1.99	0.0479
year	2010	-.0598558197 B	0.10060768	-0.59	0.5528
year	2011	0.1109038210 B	0.10450705	1.06	0.2903
year	2012	0.0069592958 B	0.10374131	0.07	0.9466
year	2013	-.1092541059 B	0.10136846	-1.08	0.2828
year	2014	0.1122619271 B	0.10588205	1.06	0.2907

year	2015	0.0000000000 B	.	.	.
MD	1	0.1463097280 B	0.37444100	0.39	0.6965
MD	6	-.3360392119 B	0.32447748	-1.04	0.3020
MD	7	-.5533897609 B	0.27175057	-2.04	0.0434
MD	8	-.2702328874 B	0.26715252	-1.01	0.3134
MD	9	-.2267403390 B	0.26625570	-0.85	0.3958
MD	10	-.0914659862 B	0.26632275	-0.34	0.7317
MD	11	-.0443569552 B	0.26758373	-0.17	0.8686
MD	12	0.0000000000 B	.	.	.
kode	6125	-.4330959718 B	0.08218120	-5.27	<.0001
kode	6126	-.6882538771 B	0.05410295	-12.72	<.0001
kode	6127	-.0052827649 B	0.05285280	-0.10	0.9205
kode	61926	-.2847034235 B	0.07935044	-3.59	0.0004
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.

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The GLM Procedure
Least Squares Means

year	lcph LSMEAN	Standard Error	Pr > |t|
2002	-0.45547553	0.12785988	0.0005
2003	-0.45104369	0.10689486	<.0001
2004	-0.38479219	0.09704347	0.0001
2005	-0.20585561	0.09451678	0.0309
2006	-0.19684546	0.08839718	0.0274
2007	-0.33489954	0.08802051	0.0002
2008	-0.41879218	0.08015782	<.0001
2009	-0.23881876	0.08304708	0.0046
2010	-0.09840236	0.07982638	0.2196
2011	0.07235728	0.07986441	0.3664
2012	-0.03158724	0.08630158	0.7149
2013	-0.14780065	0.08667965	0.0902
2014	0.07371539	0.09263789	0.4274
2015	-0.03854654	0.09565159	0.6875

Appendix 3. Standardized CPUE index from trawlers in Div. 0A+1AB.

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The GLM Procedure

Class Level Information

Class	Levels	Values
year	20	1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
MD	8	1 6 7 8 9 10 11 12
kode	10	2126 2127 5127 6125 6126 6127 21926 21927 61926 61927

Number of Observations Read 347
Number of Observations Used 347

Greenland halibut, 0A1AB trawlers 14:12 Sunday, June 5, 2016 30

The GLM Procedure

Dependent Variable: lcph

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

Model	35	42.61710146	1.21763147	11.65	<.0001
Error	311	32.49652638	0.10449044		
Corrected Total	346	75.11362784			

R-Square	Coeff Var	Root MSE	lcph Mean
0.567368	-361.5423	0.323250	-0.089409

Source	DF	Type I SS	Mean Square	F Value	Pr > F
year	19	15.24229937	0.80222628	7.68	<.0001
MD	7	2.47102258	0.35300323	3.38	0.0017
kode	9	24.90377950	2.76708661	26.48	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
year	19	16.13372896	0.84914363	8.13	<.0001
MD	7	2.44661394	0.34951628	3.34	0.0019
kode	9	24.90377950	2.76708661	26.48	<.0001

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		0.447770878 B	0.34539746	1.30	0.1958
year	1996	0.428116622 B	0.44940130	0.95	0.3415
year	1997	-1.598602758 B	0.24598093	-6.50	<.0001
year	1998	-0.819349988 B	0.33534967	-2.44	0.0151
year	1999	-0.828345563 B	0.20477951	-4.05	<.0001
year	2000	-0.994081174 B	0.18047553	-5.51	<.0001
year	2001	0.098080391 B	0.20336101	0.48	0.6299
year	2002	-0.436912210 B	0.12008530	-3.64	0.0003
year	2003	-0.390747900 B	0.10928789	-3.58	0.0004
year	2004	-0.336229755 B	0.10406363	-3.23	0.0014
year	2005	-0.470100532 B	0.10231673	-4.59	<.0001
year	2006	-0.366776557 B	0.09562679	-3.84	0.0002
year	2007	-0.577307203 B	0.09629385	-6.00	<.0001
year	2008	-0.392074677 B	0.10102173	-3.88	0.0001
year	2009	-0.284330308 B	0.10005867	-2.84	0.0048
year	2010	-0.343974364 B	0.10065196	-3.42	0.0007
year	2011	-0.102378655 B	0.10451865	-0.98	0.3281
year	2012	-0.161009405 B	0.10159722	-1.58	0.1140
year	2013	-0.152070287 B	0.09915810	-1.53	0.1261
year	2014	0.108244535 B	0.10405927	1.04	0.2990
year	2015	0.000000000 B	.	.	.
MD	1	0.308252153 B	0.47245639	0.65	0.5146
MD	6	-0.175561097 B	0.40893181	-0.43	0.6680
MD	7	-0.258584563 B	0.33776779	-0.77	0.4445
MD	8	-0.174750533 B	0.33504225	-0.52	0.6023
MD	9	-0.123358467 B	0.33450994	-0.37	0.7125
MD	10	-0.002880070 B	0.33458817	-0.01	0.9931
MD	11	-0.186086472 B	0.33536683	-0.55	0.5794
MD	12	0.000000000 B	.	.	.
kode	2126	-0.142827997 B	0.10035433	-1.42	0.1557
kode	2127	-0.102028395 B	0.06443432	-1.58	0.1143
kode	5127	-1.272650028 B	0.38116730	-3.34	0.0009
kode	6125	-0.344856854 B	0.09812785	-3.51	0.0005
kode	6126	-0.668974610 B	0.06858300	-9.75	<.0001
kode	6127	-0.025514512 B	0.06661388	-0.38	0.7020
kode	21926	0.313371032 B	0.10461262	3.00	0.0030
kode	21927	0.182559585 B	0.06270602	2.91	0.0039
kode	61926	-0.209155200 B	0.09830290	-2.13	0.0342
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.

Greenland halibut, 0A1AB trawlers 14:12 Sunday, June 5, 2016 31

The GLM Procedure
Least Squares Means

year	lcph LSMEAN	Standard Error	Pr > |t|
1996	0.57225867	0.41674152	0.1707
1997	-1.45446071	0.24525687	<.0001
1998	-0.67520794	0.33581785	0.0452
1999	-0.68420351	0.20601315	0.0010
2000	-0.84993913	0.18141756	<.0001
2001	0.24222244	0.18598234	0.1937
2002	-0.29277016	0.12274628	0.0177
2003	-0.24660585	0.11109281	0.0272
2004	-0.19208771	0.10152781	0.0594
2005	-0.32595848	0.10097704	0.0014
2006	-0.22263451	0.09294697	0.0172
2007	-0.43316515	0.09793733	<.0001
2008	-0.24793263	0.09762387	0.0116
2009	-0.14018826	0.10236039	0.1718
2010	-0.19983231	0.09939305	0.0452
2011	0.04176339	0.09942011	0.6747
2012	-0.01686736	0.10291151	0.8699
2013	-0.00792824	0.10230175	0.9383
2014	0.25238658	0.10708138	0.0190
2015	0.14414205	0.10867632	0.1857

Appendix 4. Standardized CPUE index from Gill nets in Div. 0A

The GLM Procedure

Class Level Information

Class	Levels	Values
Year	12	2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Month	5	7 8 9 10 11
CGT	3	40413 40414 40415

Number of Observations Read	63
Number of Observations Used	63

Dependent Variable: lcpue

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	17	2.50135854	0.14713874	2.22	0.0166
Error	45	2.97737456	0.06616388		
Corrected Total	62	5.47873310			

R-Square	Coeff Var	Root MSE	lcpue Mean
0.456558	11.19838	0.257223	2.296969

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Year	11	1.67749298	0.15249936	2.30	0.0244
Month	4	0.54747051	0.13686763	2.07	0.1008
CGT	2	0.27639505	0.13819752	2.09	0.1357

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Year	11	2.07569238	0.18869931	2.85	0.0064
Month	4	0.48525093	0.12131273	1.83	0.1390
CGT	2	0.27639505	0.13819752	2.09	0.1357

Parameter	Estimate		Standard Error	t Value	Pr > |t|
Intercept	2.608961395	B	0.17655950	14.78	<.0001
Year 2004	-0.996993896	B	0.29376730	-3.39	0.0014
Year 2005	-0.296301257	B	0.16806827	-1.76	0.0847
Year 2006	-0.650769075	B	0.16660027	-3.91	0.0003
Year 2007	-0.546606151	B	0.16784027	-3.26	0.0021
Year 2008	-0.385086598	B	0.18188441	-2.12	0.0398
Year 2009	-0.248052430	B	0.17413152	-1.42	0.1612
Year 2010	-0.254095549	B	0.17413152	-1.46	0.1515
Year 2011	-0.146861093	B	0.17413152	-0.84	0.4035
Year 2012	-0.184391563	B	0.17413152	-1.06	0.2953
Year 2013	-0.215154830	B	0.17413152	-1.24	0.2230
Year 2014	-0.230219838	B	0.18188441	-1.27	0.2121
Year 2015	0.000000000	B	.	.	.
Month 7	-0.101038742	B	0.13348171	-0.76	0.4530
Month 8	0.141370144	B	0.10089880	1.40	0.1680
Month 9	0.172067453	B	0.09859625	1.75	0.0878
Month 10	0.155067483	B	0.09937958	1.56	0.1257
Month 11	0.000000000	B	.	.	.
CGT 40413	0.319308459	B	0.21397000	1.49	0.1426

CGT 40414	-0.103375515	B	0.10852089	-0.95	0.3459
CGT 40415	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.

Least Squares Means

Year	lcpue LSMEAN	Standard Error	Pr > |t|
2004	1.75743841	0.27811685	<.0001
2005	2.45813105	0.11507337	<.0001
2006	2.10366324	0.08960696	<.0001
2007	2.20782616	0.12154790	<.0001
2008	2.36934571	0.15785819	<.0001
2009	2.50637988	0.14431473	<.0001
2010	2.50033676	0.14431473	<.0001
2011	2.60757122	0.14431473	<.0001
2012	2.57004075	0.14431473	<.0001
2013	2.53927748	0.14431473	<.0001
2014	2.52421247	0.15785819	<.0001
2015	2.75443231	0.15785819	<.0001

Appendix 5. Standardized CPUE index from trawlers in Div. 0B

Greenland halibut, 0B trawlers 14:12 Sunday, June 5, 2016 16

The GLM Procedure

Class Level Information

Class	Levels	Values
Year	26	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
md	10	1 4 5 6 7 8 9 10 11 12
kode	12	2126 2127 3125 5126 5127 14124 15126 15127 20126 20127 21926 21927

Number of Observations Read 637
Number of Observations Used 637

Greenland halibut, 0B trawlers 14:12 Sunday, June 5, 2016 17

The GLM Procedure

Dependent Variable: lcph

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	45	181.4313674	4.0318082	44.61	<.0001
Error	591	53.4127683	0.0903769		
Corrected Total	636	234.8441357			

R-Square Coeff Var Root MSE lcph Mean

0.772561 -54.92739 0.300628 -0.547318

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Year	25	112.7392551	4.5095702	49.90	<.0001
md	9	21.2134438	2.3570493	26.08	<.0001
kode	11	47.4786686	4.3162426	47.76	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Year	25	11.14864081	0.44594563	4.93	<.0001
md	9	18.76139312	2.08459924	23.07	<.0001
kode	11	47.47866860	4.31624260	47.76	<.0001

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		0.382473966 B	0.09736911	3.93	<.0001
Year	1990	-0.161186487 B	0.11781006	-1.37	0.1718
Year	1991	-0.129799647 B	0.11910799	-1.09	0.2763
Year	1992	0.006624708 B	0.11387877	0.06	0.9536
Year	1993	-0.116310286 B	0.11820667	-0.98	0.3255
Year	1994	-0.115907141 B	0.12339394	-0.94	0.3479
Year	1995	-0.001803029 B	0.14228135	-0.01	0.9899
Year	1996	-0.061402262 B	0.13276064	-0.46	0.6439
Year	1997	-0.080116055 B	0.13278796	-0.60	0.5465
Year	1998	-0.066633332 B	0.13848698	-0.48	0.6306
Year	1999	-0.161275336 B	0.13506131	-1.19	0.2329
Year	2000	-0.209683351 B	0.16403230	-1.28	0.2016
Year	2001	-0.321963831 B	0.19806406	-1.63	0.1046
Year	2002	-0.542989248 B	0.14701993	-3.69	0.0002
Year	2003	-0.395752129 B	0.11177352	-3.54	0.0004
Year	2004	-0.383625728 B	0.11355422	-3.38	0.0008
Year	2005	-0.093059069 B	0.11375389	-0.82	0.4136
Year	2006	-0.111458918 B	0.13104439	-0.85	0.3954
Year	2007	-0.215382708 B	0.12261903	-1.76	0.0795
Year	2008	0.111271804 B	0.11241453	0.99	0.3227
Year	2009	0.251181067 B	0.11536739	2.18	0.0299
Year	2010	-0.067070872 B	0.11620080	-0.58	0.5640
Year	2011	0.024612614 B	0.11470967	0.21	0.8302
Year	2012	-0.384887918 B	0.10740309	-3.58	0.0004
Year	2013	-0.360518666 B	0.10782323	-3.34	0.0009
Year	2014	-0.139602937 B	0.11112437	-1.26	0.2095
Year	2015	0.000000000 B	.	.	.
md	1	0.000646532 B	0.10832126	0.01	0.9952
md	4	0.160967929 B	0.09311569	1.73	0.0844
md	5	0.414048927 B	0.06744561	6.14	<.0001
md	6	-0.162383427 B	0.06462451	-2.51	0.0122
md	7	-0.411482417 B	0.05850413	-7.03	<.0001
md	8	-0.306218653 B	0.05699632	-5.37	<.0001
md	9	-0.360095130 B	0.05549936	-6.49	<.0001
md	10	-0.387988546 B	0.05277706	-7.35	<.0001
md	11	-0.252746682 B	0.05310072	-4.76	<.0001
md	12	0.000000000 B	.	.	.
kode	2126	-0.607408655 B	0.09297727	-6.53	<.0001
kode	2127	-0.355410370 B	0.04146399	-8.57	<.0001
kode	3125	-1.139905225 B	0.11070077	-10.30	<.0001
kode	5126	-0.514537639 B	0.14513052	-3.55	0.0004
kode	5127	-0.263495053 B	0.08836509	-2.98	0.0030
kode	14124	-0.801695913 B	0.09694423	-8.27	<.0001
kode	15126	-0.036851269 B	0.09948789	-0.37	0.7112
kode	15127	-0.069093670 B	0.12422917	-0.56	0.5783
kode	20126	-1.110854244 B	0.08003400	-13.88	<.0001
kode	20127	-1.129242152 B	0.09147046	-12.35	<.0001
kode	21926	-0.122550287 B	0.13998923	-0.88	0.3817
kode	21927	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, 0B trawlers 14:12 Sunday, June 5, 2016 18

The GLM Procedure
Least Squares Means

Year	lcph LSMEAN	Standard Error	Pr > |t|
1990	-0.42182471	0.05773167	<.0001
1991	-0.39043787	0.05761813	<.0001
1992	-0.25401351	0.05021404	<.0001
1993	-0.37694851	0.05630894	<.0001
1994	-0.37654536	0.06566283	<.0001
1995	-0.26244125	0.09846900	0.0079
1996	-0.32204048	0.09208267	0.0005
1997	-0.34075428	0.09747086	0.0005
1998	-0.32727155	0.11268936	0.0038
1999	-0.42191356	0.11230025	0.0002
2000	-0.47032157	0.14364514	0.0011
2001	-0.58260205	0.18303334	0.0015
2002	-0.80362747	0.12569211	<.0001
2003	-0.65639035	0.08057672	<.0001
2004	-0.64426395	0.08260272	<.0001
2005	-0.35369729	0.08297381	<.0001
2006	-0.37209714	0.09508113	0.0001
2007	-0.47602093	0.08336181	<.0001
2008	-0.14936642	0.08797350	0.0901
2009	-0.00945715	0.09203772	0.9182
2010	-0.32770909	0.09166852	0.0004
2011	-0.23602561	0.08950709	0.0086
2012	-0.64552614	0.08121607	<.0001
2013	-0.62115689	0.07711578	<.0001
2014	-0.40024116	0.08620331	<.0001
2015	-0.26063822	0.10121157	0.0103

Appendix 6. Standardized CPUE index for trawlers in Div.1CD.

Greenland halibut, 1CD trawlers 09:19 Thursday, May 26, 2016 23

The GLM Procedure

Class Level Information

Class	Levels	Values
year	28	1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
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 349
Number of Observations Used 349

Greenland halibut, 1CD trawlers 09:19 Thursday, May 26, 2016 24

The GLM Procedure

Dependent Variable: lcph

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

Model	43	72.53067447	1.68675987	23.68	<.0001
Error	305	21.72244277	0.07122112		
Corrected Total	348	94.25311725			

R-Square	Coeff Var	Root MSE	lcph Mean
0.769531	-63.72713	0.266873	-0.418774

Source	DF	Type I SS	Mean Square	F Value	Pr > F
year	27	40.75077467	1.50928795	21.19	<.0001
MD	11	7.97187017	0.72471547	10.18	<.0001
kode	5	23.80802964	4.76160593	66.86	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
year	27	27.19020114	1.00704449	14.14	<.0001
MD	11	5.62146056	0.51104187	7.18	<.0001
kode	5	23.80802964	4.76160593	66.86	<.0001

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		0.782884650 B	0.08318565	9.41	<.0001
year	1988	-0.379307976 B	0.14460052	-2.62	0.0092
year	1989	-0.334393495 B	0.13828405	-2.42	0.0162
year	1990	-0.671452539 B	0.20165960	-3.33	0.0010
year	1991	-0.668163101 B	0.16889058	-3.96	<.0001
year	1992	-0.795342226 B	0.12082945	-6.58	<.0001
year	1993	-0.977252723 B	0.12084944	-8.09	<.0001
year	1994	-1.119593553 B	0.12058485	-9.28	<.0001
year	1995	-0.999839932 B	0.12071818	-8.28	<.0001
year	1996	-1.237046777 B	0.12031469	-10.28	<.0001
year	1997	-1.312262481 B	0.10645478	-12.33	<.0001
year	1998	-1.113686792 B	0.11495523	-9.69	<.0001
year	1999	-1.178285185 B	0.10794619	-10.92	<.0001
year	2000	-0.885623597 B	0.10177886	-8.70	<.0001
year	2001	-0.970094666 B	0.09733148	-9.97	<.0001
year	2002	-1.047779845 B	0.09448476	-11.09	<.0001
year	2003	-1.040265249 B	0.10107561	-10.29	<.0001
year	2004	-1.003169261 B	0.09332795	-10.75	<.0001
year	2005	-0.860140167 B	0.09424912	-9.13	<.0001
year	2006	-0.771571011 B	0.09279472	-8.31	<.0001
year	2007	-0.706391240 B	0.09444852	-7.48	<.0001
year	2008	-0.661512228 B	0.09015691	-7.34	<.0001
year	2009	-0.720907639 B	0.09505403	-7.58	<.0001
year	2010	-0.733997104 B	0.08886725	-8.26	<.0001
year	2011	-0.671842800 B	0.09630122	-6.98	<.0001
year	2012	-0.598617315 B	0.08921885	-6.71	<.0001
year	2013	-0.384176467 B	0.08607060	-4.46	<.0001
year	2014	-0.403588978 B	0.08704617	-4.64	<.0001
year	2015	0.000000000 B	.	.	.
MD	1	-0.277721682 B	0.08114407	-3.42	0.0007
MD	2	-0.645766322 B	0.09503284	-6.80	<.0001
MD	3	-0.673020177 B	0.16850773	-3.99	<.0001
MD	4	-0.331427570 B	0.20781672	-1.59	0.1118
MD	5	-0.177097149 B	0.10831527	-1.64	0.1031
MD	6	-0.316430960 B	0.08151221	-3.88	0.0001
MD	7	-0.339466969 B	0.06871959	-4.94	<.0001
MD	8	-0.289052468 B	0.06241618	-4.63	<.0001
MD	9	-0.173003108 B	0.05786743	-2.99	0.0030
MD	10	-0.169578053 B	0.05425005	-3.13	0.0019
MD	11	-0.096869954 B	0.05363911	-1.81	0.0719
MD	12	0.000000000 B	.	.	.
kode	6124	-2.489741986 B	0.17887717	-13.92	<.0001

kode	6125	-0.565766395 B	0.06287496	-9.00	<.0001
kode	6126	-0.375220483 B	0.05043418	-7.44	<.0001
kode	6127	-0.046544870 B	0.05205651	-0.89	0.3720
kode	61926	-0.103820256 B	0.09647148	-1.08	0.2827
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	-0.48405853	0.13062151	0.0003
1989	-0.43914404	0.12894239	0.0007
1990	-0.77620309	0.19571519	<.0001
1991	-0.77291365	0.16201479	<.0001
1992	-0.90009277	0.11077502	<.0001
1993	-1.08200327	0.11048057	<.0001
1994	-1.22434410	0.11052884	<.0001
1995	-1.10459048	0.11055274	<.0001
1996	-1.34179733	0.11030989	<.0001
1997	-1.41701303	0.09470122	<.0001
1998	-1.21843734	0.10445251	<.0001
1999	-1.28303573	0.09559664	<.0001
2000	-0.99037415	0.07669831	<.0001
2001	-1.07484522	0.08312056	<.0001
2002	-1.15253039	0.07903643	<.0001
2003	-1.14501580	0.08804930	<.0001
2004	-1.10791981	0.07489306	<.0001
2005	-0.96489072	0.07835473	<.0001
2006	-0.87632156	0.07656441	<.0001
2007	-0.81114179	0.07702470	<.0001
2008	-0.76626278	0.07389967	<.0001
2009	-0.82565819	0.07959969	<.0001
2010	-0.83874765	0.07297743	<.0001
2011	-0.77659335	0.08210023	<.0001
2012	-0.70336786	0.07257672	<.0001
2013	-0.48892702	0.06602646	<.0001
2014	-0.50833953	0.07203379	<.0001
2015	-0.10475055	0.07435383	0.1599

Appendix 7. Standardized CPUE index for trawlers in Div. 1CD and Div. 0B.

Greenland halibut, 0B1CD trawlers 14:12 Sunday, June 5, 2016 23

The GLM Procedure

Class Level Information

Class	Levels	Values
year	28	1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
MD	12	1 2 3 4 5 6 7 8 9 10 11 12
kode	18	2126 2127 3125 5126 5127 6124 6125 6126 6127 14124 15126 15127 20126 20127 21926 21927 61926 61927

Number of Observations Read 986
Number of Observations Used 986

Greenland halibut, 0B1CD trawlers 14:12 Sunday, June 5, 2016 24

The GLM Procedure

Dependent Variable: lcph

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	55	238.6693053	4.3394419	42.86	<.0001
Error	930	94.1534953	0.1012403		
Corrected Total	985	332.8228006			

R-Square	Coeff Var	Root MSE	lcph Mean
0.717106	-63.40585	0.318183	-0.501819

Source	DF	Type I SS	Mean Square	F Value	Pr > F
year	27	123.0603207	4.5577897	45.02	<.0001
MD	11	30.1898876	2.7445352	27.11	<.0001
kode	17	85.4190970	5.0246528	49.63	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
year	27	20.64476872	0.76462106	7.55	<.0001
MD	11	20.34401739	1.84945613	18.27	<.0001
kode	17	85.41909700	5.02465276	49.63	<.0001

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		0.590114812 B	0.08063453	7.32	<.0001
year	1988	-0.296563181 B	0.15796434	-1.88	0.0608
year	1989	-0.164636880 B	0.15679317	-1.05	0.2940
year	1990	-0.645012067 B	0.08613361	-7.49	<.0001
year	1991	-0.612887806 B	0.08648943	-7.09	<.0001
year	1992	-0.474524011 B	0.07946776	-5.97	<.0001
year	1993	-0.626718038 B	0.08233783	-7.61	<.0001
year	1994	-0.637984587 B	0.08655938	-7.37	<.0001
year	1995	-0.583219957 B	0.09954449	-5.86	<.0001
year	1996	-0.685663063 B	0.09601247	-7.14	<.0001
year	1997	-0.777237745 B	0.09301706	-8.36	<.0001
year	1998	-0.654574573 B	0.09913441	-6.60	<.0001

year	1999	-0.688084078 B	0.09497172	-7.25	<.0001
year	2000	-0.536379374 B	0.09785309	-5.48	<.0001
year	2001	-0.639026090 B	0.09792570	-6.53	<.0001
year	2002	-0.744275932 B	0.08968675	-8.30	<.0001
year	2003	-0.688014029 B	0.08141799	-8.45	<.0001
year	2004	-0.687594568 B	0.08024065	-8.57	<.0001
year	2005	-0.479180329 B	0.08093425	-5.92	<.0001
year	2006	-0.420088480 B	0.08452348	-4.97	<.0001
year	2007	-0.491013861 B	0.08324185	-5.90	<.0001
year	2008	-0.302866740 B	0.07923725	-3.82	0.0001
year	2009	-0.276286621 B	0.08240845	-3.35	0.0008
year	2010	-0.421339393 B	0.07981166	-5.28	<.0001
year	2011	-0.320246745 B	0.08216726	-3.90	0.0001
year	2012	-0.530910590 B	0.07677720	-6.91	<.0001
year	2013	-0.425645029 B	0.07559980	-5.63	<.0001
year	2014	-0.315565865 B	0.07747551	-4.07	<.0001
year	2015	0.000000000 B	.	.	.
MD	1	-0.149574824 B	0.07121232	-2.10	0.0360
MD	2	-0.571315420 B	0.10536444	-5.42	<.0001
MD	3	-0.446491016 B	0.19373838	-2.30	0.0214
MD	4	0.071194911 B	0.08792973	0.81	0.4183
MD	5	0.318749603 B	0.05984207	5.33	<.0001
MD	6	-0.220444946 B	0.05471524	-4.03	<.0001
MD	7	-0.371903590 B	0.04796670	-7.75	<.0001
MD	8	-0.274510345 B	0.04562818	-6.02	<.0001
MD	9	-0.273182755 B	0.04370894	-6.25	<.0001
MD	10	-0.287988648 B	0.04156233	-6.93	<.0001
MD	11	-0.181262784 B	0.04177089	-4.34	<.0001
MD	12	0.000000000 B	.	.	.
kode	2126	-0.423608182 B	0.09695847	-4.37	<.0001
kode	2127	-0.234234803 B	0.05832413	-4.02	<.0001
kode	3125	-1.090291348 B	0.11370640	-9.59	<.0001
kode	5126	-0.115458565 B	0.14371946	-0.80	0.4220
kode	5127	0.017968184 B	0.08276108	0.22	0.8282
kode	6124	-2.545222014 B	0.20666075	-12.32	<.0001
kode	6125	-0.710766095 B	0.07128588	-9.97	<.0001
kode	6126	-0.428573068 B	0.05867859	-7.30	<.0001
kode	6127	-0.094850191 B	0.06021933	-1.58	0.1156
kode	14124	-0.578377251 B	0.09313671	-6.21	<.0001
kode	15126	0.163539983 B	0.09819390	1.67	0.0962
kode	15127	0.132818212 B	0.12492615	1.06	0.2880
kode	20126	-0.886869994 B	0.07434835	-11.93	<.0001
kode	20127	-0.894872346 B	0.08539787	-10.48	<.0001
kode	21926	0.024354804 B	0.14412286	0.17	0.8658
kode	21927	0.068024078 B	0.06127714	1.11	0.2672
kode	61926	-0.139186192 B	0.11305373	-1.23	0.2186
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.

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The GLM Procedure
Least Squares Means

year	lcph LSMEAN	Standard Error	Pr > |t|
1988	-0.33509834	0.14911582	0.0249
1989	-0.20317204	0.14884792	0.1726
1990	-0.68354723	0.05950193	<.0001
1991	-0.65142297	0.05881735	<.0001
1992	-0.51305917	0.05007685	<.0001
1993	-0.66525320	0.05420728	<.0001
1994	-0.67651975	0.06096896	<.0001
1995	-0.62175512	0.08124288	<.0001
1996	-0.72419822	0.07862434	<.0001
1997	-0.81577291	0.07542918	<.0001
1998	-0.69310973	0.08512112	<.0001
1999	-0.72661924	0.08103962	<.0001
2000	-0.57491453	0.08029771	<.0001

2001	-0.67756125	0.08481118	<.0001
2002	-0.78281109	0.07445583	<.0001
2003	-0.72654919	0.06382043	<.0001
2004	-0.72612973	0.06171591	<.0001
2005	-0.51771549	0.06234320	<.0001
2006	-0.45862364	0.06535025	<.0001
2007	-0.52954902	0.06161882	<.0001
2008	-0.34140190	0.06299596	<.0001
2009	-0.31482178	0.06639472	<.0001
2010	-0.45987455	0.06357034	<.0001
2011	-0.35878191	0.06660410	<.0001
2012	-0.56944575	0.05966233	<.0001
2013	-0.46418019	0.05407259	<.0001
2014	-0.35410103	0.06056376	<.0001
2015	-0.03853516	0.06662525	0.5631

Appendix 8. Standardized CPUE index for Gill net in Div. 0B.

The GLM Procedure

Class Level Information

Class	Levels	Values
Year	13	2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Month	7	5 6 7 8 9 10 11
CGT	2	40413 40414

Number of Observations Read	110
Number of Observations Used	110

Dependent Variable: lcpue

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	19	14.94607454	0.78663550	9.17	<.0001
Error	90	7.72273750	0.08580819		
Corrected Total	109	22.66881204			

R-Square	Coeff Var	Root MSE	lcpue Mean
0.659323	16.48166	0.292930	1.777311

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Year	12	11.47056909	0.95588076	11.14	<.0001
Month	6	3.46383688	0.57730615	6.73	<.0001
CGT	1	0.01166858	0.01166858	0.14	0.7132

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Year	12	10.60590929	0.88382577	10.30	<.0001
Month	6	3.43359973	0.57226662	6.67	<.0001
CGT	1	0.01166858	0.01166858	0.14	0.7132

Parameter	Estimate		Standard Error	t Value	Pr > |t|
Intercept	2.044157278	B	0.18449945	11.08	<.0001
Year 2003	-1.174409959	B	0.15056109	-7.80	<.0001
Year 2004	-0.777275091	B	0.16354625	-4.75	<.0001
Year 2005	-0.847603726	B	0.15568948	-5.44	<.0001
Year 2006	-0.848678703	B	0.15056109	-5.64	<.0001
Year 2007	-0.681609529	B	0.13174555	-5.17	<.0001
Year 2008	-0.529355463	B	0.13884219	-3.81	0.0003
Year 2009	-0.321596835	B	0.13854903	-2.32	0.0225

Year 2010	-0.364760152	B	0.14794800	-2.47	0.0156
Year 2011	-0.344307706	B	0.13808869	-2.49	0.0145
Year 2012	-0.289762035	B	0.13326893	-2.17	0.0323
Year 2013	-0.130336594	B	0.13262268	-0.98	0.3284
Year 2014	-0.103164454	B	0.14855294	-0.69	0.4892
Year 2015	0.000000000	B	.	.	.
Month 5	0.477266474	B	0.16714446	2.86	0.0053
Month 6	0.099640757	B	0.16626431	0.60	0.5505
Month 7	-0.059605667	B	0.16660334	-0.36	0.7214
Month 8	0.274978285	B	0.16876626	1.63	0.1067
Month 9	0.257189846	B	0.16912177	1.52	0.1318
Month 10	0.171050981	B	0.18443058	0.93	0.3562
Month 11	0.000000000	B	.	.	.
CGT 40413	-0.114920265	B	0.31163916	-0.37	0.7132
CGT 40414	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.

Least Squares Means

Year	lcpue LSMEAN	Standard Error	Pr > |t|
2003	0.98664728	0.19114930	<.0001
2004	1.38378215	0.20647652	<.0001
2005	1.31345352	0.19763735	<.0001
2006	1.31237854	0.19114930	<.0001
2007	1.47944771	0.17771943	<.0001
2008	1.63170178	0.18623027	<.0001
2009	1.83946041	0.18747688	<.0001
2010	1.79629709	0.19533355	<.0001
2011	1.81674954	0.18739191	<.0001
2012	1.87129521	0.15753428	<.0001
2013	2.03072065	0.18102897	<.0001
2014	2.05789279	0.19583436	<.0001
2015	2.16105724	0.18739191	<.0001

Appendix 9. Standardized CPUE index for trawlers in SA 0+1.

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The GLM Procedure

Class Level Information

Class	Levels	Values
year	28	1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
MD	12	1 2 3 4 5 6 7 8 9 10 11 12
kode	18	2126 2127 3125 5126 5127 6124 6125 6126 6127 14124 15126 15127 20126 20127 21926 21927 61926 61927

Number of Observations Read 1218
Number of Observations Used 1218

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The GLM Procedure

Dependent Variable: lcph

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	55	288.9124452	5.2529535	45.51	<.0001
Error	1162	134.1231548	0.1154244		
Corrected Total	1217	423.0356000			

R-Square	Coeff Var	Root MSE	lcph Mean
0.682951	-83.95316	0.339742	-0.404680

Source	DF	Type I SS	Mean Square	F Value	Pr > F
year	27	164.6857767	6.0994732	52.84	<.0001
MD	11	19.9426656	1.8129696	15.71	<.0001
kode	17	104.2840028	6.1343531	53.15	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
year	27	26.4139006	0.9782926	8.48	<.0001
MD	11	14.4792733	1.3162976	11.40	<.0001
kode	17	104.2840028	6.1343531	53.15	<.0001

Parameter		Estimate		Standard Error	t Value	Pr > |t|
Intercept		0.523572378	B	0.07215861	7.26	<.0001
year	1988	-0.236850407	B	0.16503790	-1.44	0.1515
year	1989	-0.138127694	B	0.16391350	-0.84	0.3996
year	1990	-0.656238022	B	0.08419326	-7.79	<.0001
year	1991	-0.649516293	B	0.08467452	-7.67	<.0001
year	1992	-0.533122410	B	0.07524914	-7.08	<.0001
year	1993	-0.685061496	B	0.07948669	-8.62	<.0001
year	1994	-0.691385637	B	0.08491073	-8.14	<.0001
year	1995	-0.575238311	B	0.10022072	-5.74	<.0001
year	1996	-0.692041734	B	0.09486588	-7.29	<.0001
year	1997	-0.843238957	B	0.09044401	-9.32	<.0001
year	1998	-0.668094454	B	0.09803981	-6.81	<.0001

year	1999	-0.701261889 B	0.09080583	-7.72	<.0001
year	2000	-0.614027342 B	0.09160874	-6.70	<.0001
year	2001	-0.542146134 B	0.09168623	-5.91	<.0001
year	2002	-0.643813220 B	0.08047345	-8.00	<.0001
year	2003	-0.549347765 B	0.07366939	-7.46	<.0001
year	2004	-0.484765631 B	0.07274973	-6.66	<.0001
year	2005	-0.445325439 B	0.07154252	-6.22	<.0001
year	2006	-0.350264079 B	0.07165692	-4.89	<.0001
year	2007	-0.498329764 B	0.07028271	-7.09	<.0001
year	2008	-0.330672519 B	0.07159249	-4.62	<.0001
year	2009	-0.299391868 B	0.07280428	-4.11	<.0001
year	2010	-0.394171688 B	0.07251518	-5.44	<.0001
year	2011	-0.231688668 B	0.07316679	-3.17	0.0016
year	2012	-0.443603268 B	0.07007748	-6.33	<.0001
year	2013	-0.310690656 B	0.06919114	-4.49	<.0001
year	2014	-0.177464674 B	0.07096253	-2.50	0.0125
year	2015	0.000000000 B	.	.	.
MD	1	-0.143666177 B	0.07533962	-1.91	0.0568
MD	2	-0.547702045 B	0.11081086	-4.94	<.0001
MD	3	-0.448552623 B	0.20406070	-2.20	0.0281
MD	4	-0.021589527 B	0.09284885	-0.23	0.8162
MD	5	0.265791488 B	0.06310170	4.21	<.0001
MD	6	-0.239703081 B	0.05764963	-4.16	<.0001
MD	7	-0.298670090 B	0.04818876	-6.20	<.0001
MD	8	-0.186401847 B	0.04468950	-4.17	<.0001
MD	9	-0.158374038 B	0.04280815	-3.70	0.0002
MD	10	-0.158039243 B	0.04170014	-3.79	0.0002
MD	11	-0.171199595 B	0.04246305	-4.03	<.0001
MD	12	0.000000000 B	.	.	.
kode	2126	-0.272560367 B	0.07419385	-3.67	0.0003
kode	2127	-0.202099822 B	0.04794217	-4.22	<.0001
kode	3125	-1.111039088 B	0.11381134	-9.76	<.0001
kode	5126	-0.039350782 B	0.14818367	-0.27	0.7906
kode	5127	0.015497308 B	0.07862741	0.20	0.8438
kode	6124	-2.485972049 B	0.21443372	-11.59	<.0001
kode	6125	-0.643641526 B	0.06409705	-10.04	<.0001
kode	6126	-0.473422364 B	0.05161894	-9.17	<.0001
kode	6127	-0.083022912 B	0.05229360	-1.59	0.1126
kode	14124	-0.549495057 B	0.09176129	-5.99	<.0001
kode	15126	0.169707057 B	0.09740601	1.74	0.0817
kode	15127	0.160468930 B	0.12788949	1.25	0.2098
kode	20126	-0.858314473 B	0.06881434	-12.47	<.0001
kode	20127	-0.870109390 B	0.08229613	-10.57	<.0001
kode	21926	0.255994748 B	0.08756802	2.92	0.0035
kode	21927	0.121193415 B	0.04893026	2.48	0.0134
kode	61926	-0.178242185 B	0.08447476	-2.11	0.0351
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.

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The GLM Procedure
Least Squares Means

year	lcph LSMEAN	Standard Error	Pr > |t|
1988	-0.28030963	0.15834319	0.0769
1989	-0.18158691	0.15813886	0.2511
1990	-0.69969724	0.06214052	<.0001
1991	-0.69297551	0.06154842	<.0001
1992	-0.57658163	0.05120322	<.0001
1993	-0.72852071	0.05639913	<.0001
1994	-0.73484485	0.06399226	<.0001
1995	-0.61869753	0.08591072	<.0001
1996	-0.73550095	0.08104009	<.0001
1997	-0.88669817	0.07645675	<.0001
1998	-0.71155367	0.08768592	<.0001
1999	-0.74472111	0.08057819	<.0001
2000	-0.65748656	0.07760385	<.0001

2001	-0.58560535	0.08154609	<.0001
2002	-0.68727244	0.06874496	<.0001
2003	-0.59280698	0.05929470	<.0001
2004	-0.52822485	0.05637234	<.0001
2005	-0.48878466	0.05565595	<.0001
2006	-0.39372330	0.05606994	<.0001
2007	-0.54178898	0.05367738	<.0001
2008	-0.37413174	0.05891580	<.0001
2009	-0.34285109	0.06005810	<.0001
2010	-0.43763091	0.05982844	<.0001
2011	-0.27514789	0.06063537	<.0001
2012	-0.48706249	0.05696070	<.0001
2013	-0.35414987	0.05218241	<.0001
2014	-0.22092389	0.05792840	0.0001
2015	-0.04345922	0.06188676	0.4827