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An analyses of logbooks of Greenland Halibut Stock Component in NAFO Division 1A Inshore.

by

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Abstract

This paper presents an analyses of logbooks data of the commercial gillnet and longline fishery of Greenland halibut in NAFO Division 1A inshore. The majority of the inshore fishery is concentrated in the Disko Bay and the districts surrounding Uummannaq and Upernavik. Logbooks have been mandatory for vessels larger than 30'ft since 2008 and constitute the basic of the estimation of a gillnet and longline standardized CPUE-series for the Disko Bay, Uumannaq and Upernavik districts.

Introduction

Greenland halibut can be found in all waters around Greenland both offshore and inshore but the highest concentrations has always been found in NAFO division 1A inshore. The stock is considered to be recruited from the stock in the Davis Strait, but the adults appear resident in the fjords and are isolated from the offshore spawning stock (Riget and Boje, 1989). As a result, the inshore component probably does not contribute significantly to the spawning stock in the Davis Strait (Boje, 1994). In samples from Disko Bay <10% of females in the reproductive age, were mature during the assumed peak spawning period in spring (Simonsen and Gundersen 2005) and only sporadic spawning has been observed in the inshore area (Jørgensen and Boje, 1994). The inshore component is assumed not to be self-sustainable, but dependent on recruits and immigration from the offshore area (Bech, 1995).

Description of the fishery

Longline fishery constitutes the majority of the total landings. In the late 1990s, the first regulations limiting areas open to gillnet fishery were introduced, limiting gillnet fishery to the winter season. Competence to regulate seasons and areas open to gillnet fishery, was transferred to municipalities in 2004, and areas open to gillnet fishery has expanded since then. The gillnet fishery has for decades been regulated by a minimum mesh-size of 110 mm (half meshes) although increased illegal use of cod gillnets (80mm) used to target Greenland halibut has been observed since 2008. In 2017 the minimum meshsize was reduced to 95mm halfmesh. Licences requirements were introduced in 1998 and in 2008 TAC and quota regulations were introduced for the inshore fishery.

The fishery in the Disko bay has always been highly concentrated around the bank just south of Ilulissat and typically more than one third of the Disko Bay catches are from small area. Other important fishing grounds in the Disko Bay is the deep Kangia ice fjord (>900m) and the northern part of the Disko Day concentrated around the settlements Saqqaq and Qeqertaq and the ice fjord Torssukattak east of the settlements. The fishery in Uummannaq is scattered all over the fjord near settlements. Particular in the deep South-eastern part of the fjord from Uummannaq and towards East where depths of more than 1500 meters are common and large iceberg producing glaciers are located holds the

more important fishing areas. The Upernavik area consists of several large ice fjords, but the main fishing grounds are the deep Ikeq fjord (Upernavik Icefjord) and Gulteqarffik (Giesecke Icefjord) and the shallower fjords surrounding Upernavik and the settlements in the area. Use of gillnets have been prohibited in Upernavik, but derogations have been given for a fishery outside the Icefjords since 2002.

Logbook data

Logbooks have been mandatory for vessels greater than 30'ft (9,4 m) since 2008. Data on the all inshore landings are reported to the Greenland Fishery Licence Authority (GFLK). Factories receiving the catch gather information on the fishery, including effort and location on individual fishing events and send the data to GFLK on a weekly basis. For this analysis only data from vessels greater than 30ft was used.

Logbook CPUE

A general linear model (GLM) with year, month and boat as factors was applied to the longline and gillnet fishery logbook data since 2008. Only longline setting with more than 200 hooks and gillnets with catches between 50 and 200 kg/gillnet were included to omit obvious outlier values and limit the influence of data potential errors on the analysis. CPUE observations were log-transformed prior to the GLM analysis. Least-mean square estimates were used as standardized CPUE series.

Disko Bay

The longline logbook catch's in 2007 and 2008 were very low (Table 1) and were not included in the analyses. In most years the logbook catch constituted around 30% of the total longline catch (Table 1). The GLM model explained 24% of the total variation but was based on almost 20.000 observations (Appendix 1). The standardised log-CPUE series show a decreasing trend since 2009, and a substantial decrease in 2017 (Fig. 1). This fits well with countless reports of an unusually bad fishery in 2017 and decreasing landings in the Disko Bay. The months with low CPUE are typically in the periods with sea-ice coverage and the highest CPUE is found in the autumn and early winter likely related to the months with less glacier activity but before the sea-ice covers the fjords.

The gillnet logbook catch's constituted 32 to 54% of the total gillnet catch in the period from 2011 and onward (Table 1). The GLM model explained 27% of the total variation and is based on more than 7500 logbook observations (Appendix 2). The standardized gillnet log-CPUE series has seems to have decreased gradually since 2011 (Fig. 2) but may partly be influenced with changes in mesh size.

Uumannaq

The longline logbook catch's constituted around 15% except in 2007 when logbooks was not mandatory, and therefore omitted in the analyses (Table 2). In most years, the logbook longline catch constituted around 15% of the total longline catch which is related fewer logbook vessels in Uummannaq (Table 2). The GLM model explained 22% of the total variation and was based on almost 9000 longline settings. (Appendix 3). Initial years (2008-2010) were based on fewer observations and 2010 the CPUE is based on about 1000 observations per year. From 2011 the CPUE index decreased slightly but a sharp drop in CPUE is observed in 2017 (Fig. 3). Monthly variation in CPUE is somewhat different from the Disko bay and Upernavik likely related to wider fjords in the area and local Iceberg producing glaciers and Sea-ice conditions.

The gillnet logbook catch's constituted ca. 26 to 53% of the total gillnet catch in the period from 2011 to 2014 but decreased to about 7% in 2015 and 2016 (Table 2). The GLM model explained 27% of the total variation (Appendix 4). The gillnet CPUE is based on far fewer observations and difficult to interpret (Fig. 4). Only a few incidents of illegal use of fine meshed gillnets have been observed in Uummannaq. Changing regulations allowing 95mm gillnets may have influenced the 2017 CPUE values.

Upernavik

The longline logbook catch's constituted a significant part of the total landings already from 2007 and the CPUE is based on a high number of observations from 2007 (Table 3). The GLM model CPUE reveal a gradual decreasing CPUE with the most recent 3 years being among the lowest observed (fig 5).
The gillnet logbook catch's constituted ca. 20 to 37% of the total gillnet catch in the period from 2009 to 2014 but decreased to about 9% in 2015 and 2016 (Table 3). The GLM model explained 35% of the total variation (Appendix 6). Similar to the longline CPUE has the gillnet CPUE gradually decreased since 2009 and the 2016 and 2017 CPUE are among the lower observed (Fig. 6). In Upernavik, only a few incidents of illegal use of fine meshed gillnets have been observed but the regulation change allowing 95mm gillnets may have influenced the 2017 CPUE values. If that is the case the 2017 CPUE values would have been even lower and would therefore not have changed the perception of the decreasing trend.

Discussion

In general, the CPUE's explain little of the total variation in the data which is likely related to the highly fluctuation nature of an attracting passive gear like a longline. Sometimes you catch a lot and sometimes you don't. However, the longline CPUE analysis are based on several thousands of observations and therefore still highly significant. There are however several unknown factors that may influence the indices other than changes in the stock. Year to Year variation in local ice conditions can force vessels away from icefjords in the summer when glaciers are very active and seaice may force vessels to stay near the harbours during the winter. In such situations larger vessels may be forced away from inner fjords that normally have the highest concentrations of fish. The gillnet CPUE's may also have been influenced by the increasing use of illegal fine meshed 80mm gillnets (legal for cod) observed in the Disko Bay. Using more fine meshed gillnets will mean a greater overlap between the selection curve and the size distribution in the stock and therefore a more efficient gear. The use of finer meshed gillnets is a way for the fishermen to compensate for a decreasing stock (where larger fish have been lost and smaller fish remain) and maintain a higher CPUE. Local differences in the use of finer meshed gillnets also makes a direct comparison between areas difficult and may not be valid.

Table 1. Disko bay logbooks data

Year	Total catch of Longline	No of Longline settings	Total longline logbook catch (t)	Total catch of gillnet	No of gillnet settings	Total gillnet logbook catch
2007		262				
2008		338				
2009		727			55	32
2010	7286	2035	1707 (23.4%)	1591	19	13 (0.8%)
2011	6043	2593	1764 (29.2%	1368	1063	698 (51.0%)
2012	6901	2766	2147 (31.1%)	996	456	321(32.3%)
2013	7545	3221	2461 (32.6%)	1524	1225	828 (54.3%)
2014	7193	2708	2175 (30.2%)	1979	1167	934 (47.2%)
2015	7129	2340	1674 (23.4%)	1546	1249	809 (52.3%)
2016	8104	2212	2104 (26.0%)	2655	1342	898 (33.8%)
2017	4465	1479	1052 (23.6%)	1944	1122	686 (35.3)

Table 2. Uumannaq logbooks data

Year	Total catch of Longline	No of Longline settings	Total longline logbook catch (t)	Total catch of gillnet	No of gillnet settings	Total gillnet logbook catch
2006		57	46			
2007		409	302			
2008		390	353			
2009		356	290			
2010	5617	466	389 (6.9%)	610		
2011	5046	691	762 (15.1%)	1179	355	353 (29.9%)
2012	5847	871	969 (16.6%)	357	172	188 (52.7%)
2013	6639	1254	1140 (17.2%)	369	131	159 (35.5%)
2014	7800	1190	1312 (16.8%)	407	92	106 (26.0%)
2015	7279	1179	1055 (14.5%)	962	63	71 (7.4%)
2016	9512	1305	1351 (14.2%)	792	89	78 (9.8%)
2017	8261	1254	1051 (12.7%)	788	161	211 (26.8)

Table 3. Upernavik logbooks data

Year	Total catch of Longline	No of Longline settings	Total longline logbook catch (t)	Total catch of gillnet	No of gillnet settings	Total gillnet logbook catch
2006		170	158			
2007		1932	1607			
2008		1849	1491			
2009		1819	1611		151	
2010	5443	2534	2114 (38.8%)	411	239	84 (29.7%)
2011	6176	2471	1992 (32.3%)	362	572	122 (33.7%)
2012	6204	2153	2136 (34.4%)	514	632	250 (69.1%)
2013	5606	1415	1235 (22.0%)	433	619	304 (57.5%)
2014	6964	1822	1820 (26.1%)	409	153	63 (15.4%)
2015	5491	996	827 (16.0%)	782	381	185 (23.6%)
2016	6954	896	730 (10.5%)	408	431	177 (43.4%)
2017	6365	1013	849 (13.4%)	418	463	184 (44.0%)

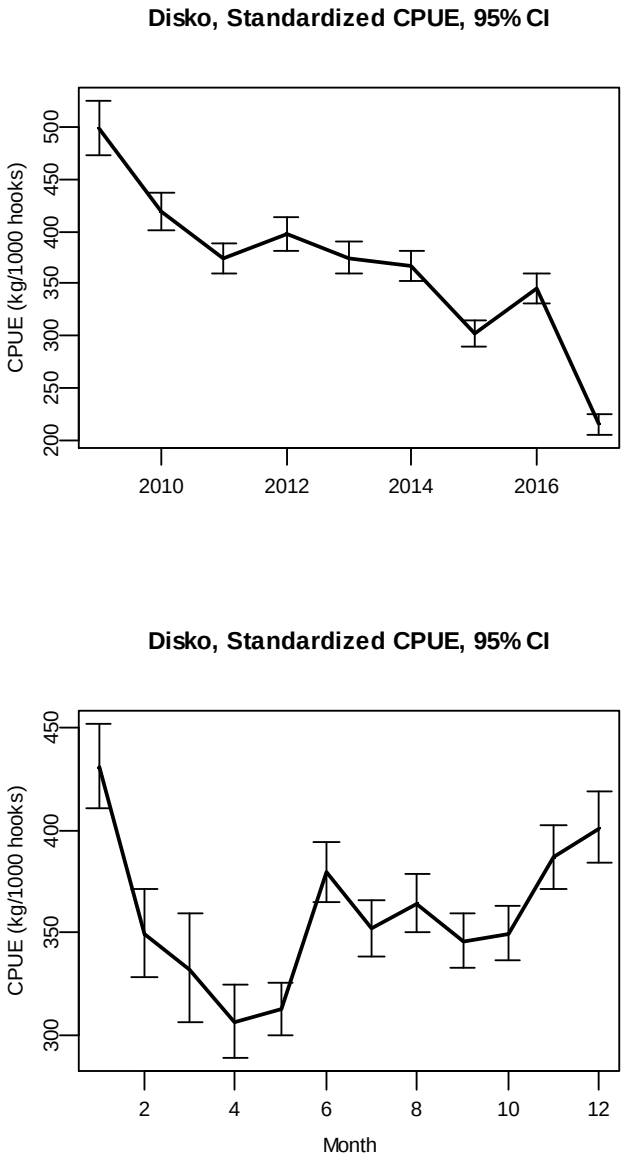

Fig. 1. Standardized mean and 95% CI of longline CPUE in Disko Bay.

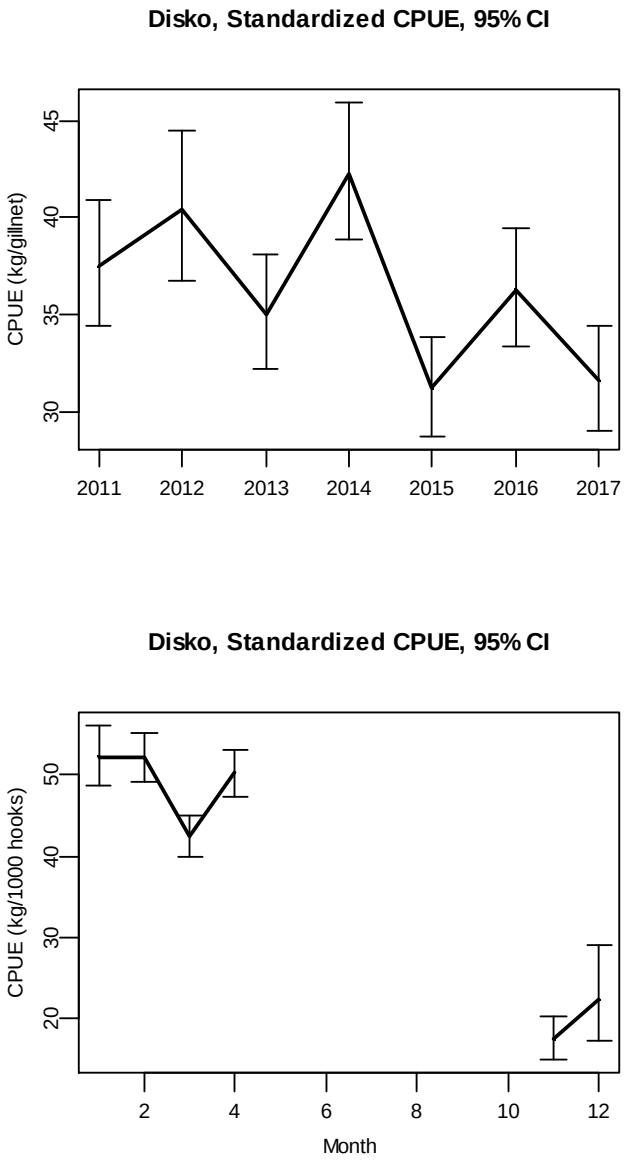

Fig. 2. Standardized mean and 95% CI of gillnet CPUE in Disko Bay.

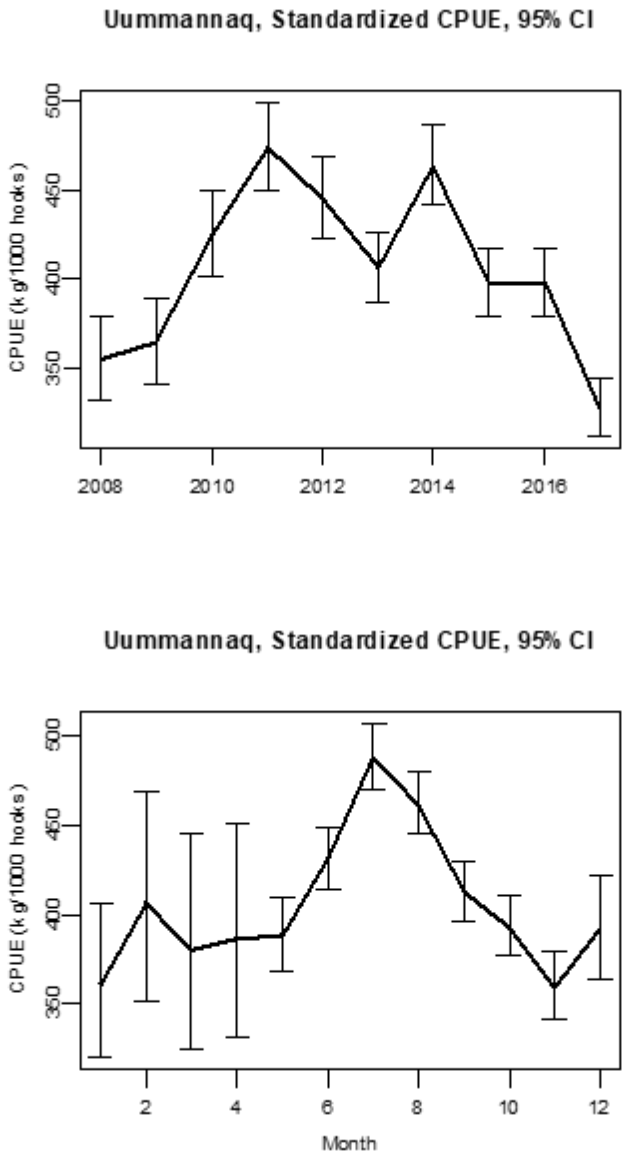

Fig. 3. Standardized mean and 95% CI of longline CPUE in Uumannaq.

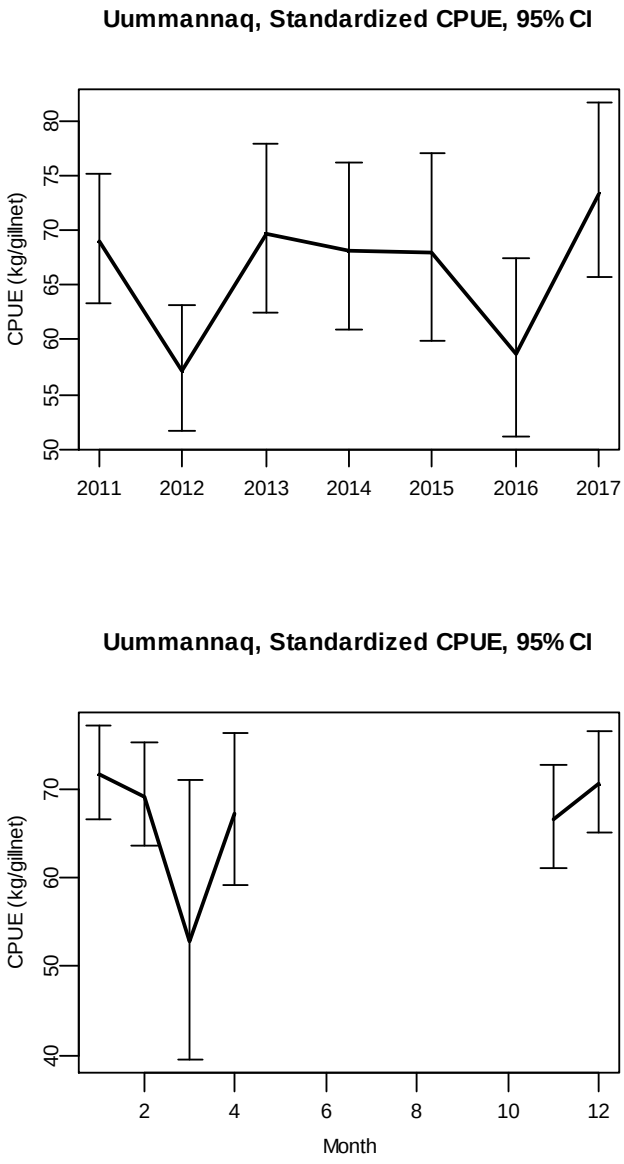

Fig. 4. Standardized mean and 95% CI of gillnet CPUE in Uumannaq.

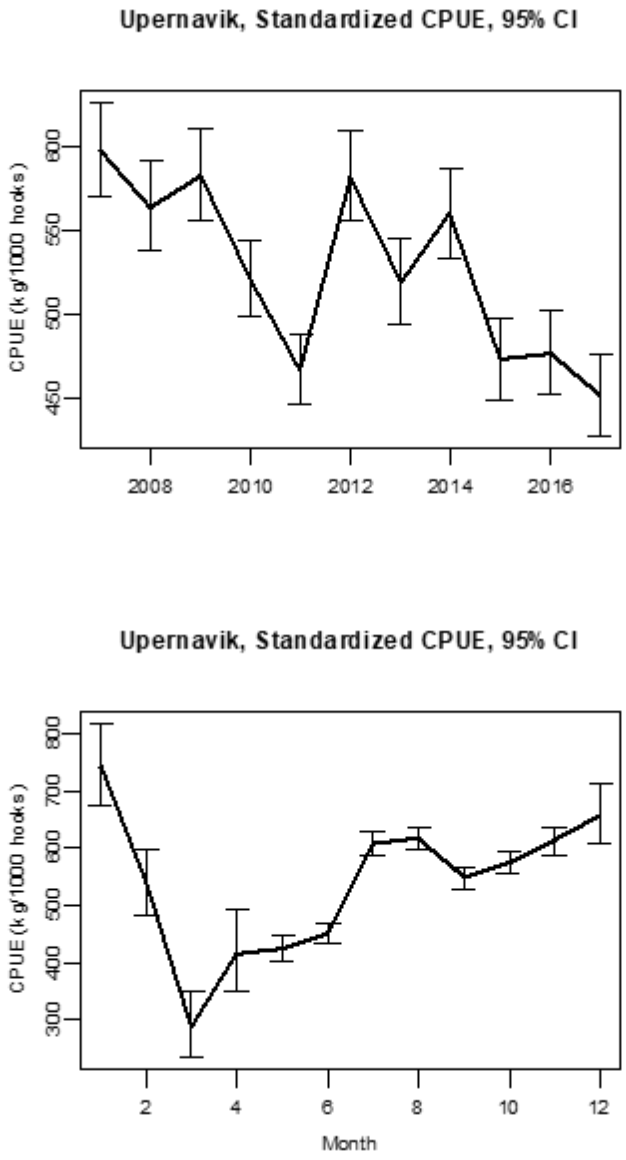

Fig. 5. Standardized mean and 95% CI of longline CPUE in Upernavik.

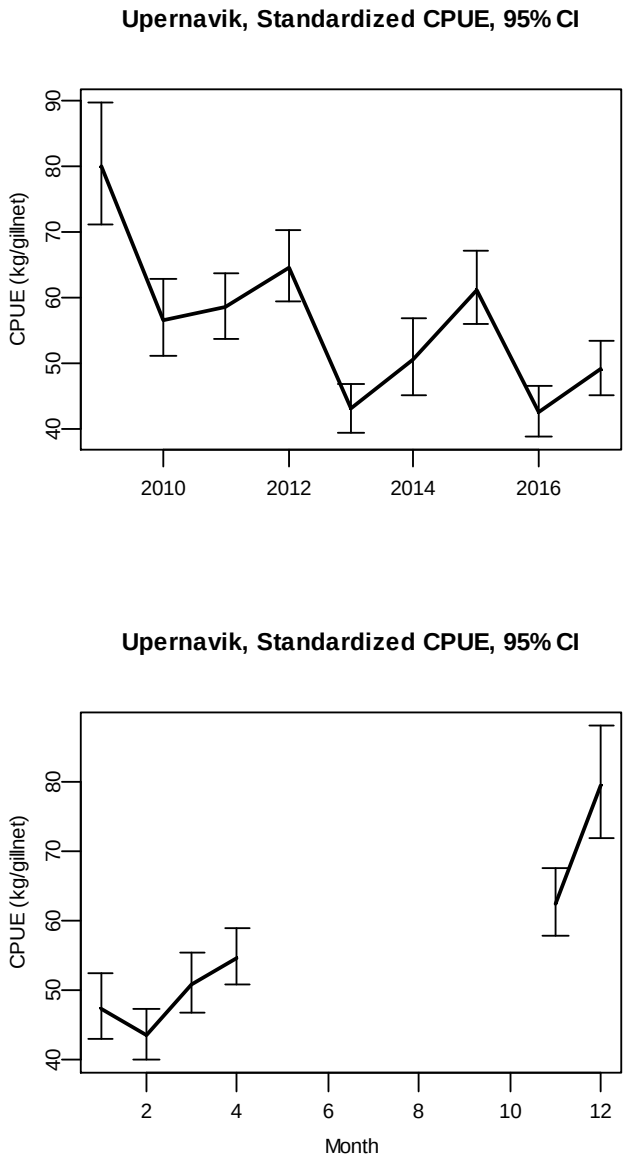

Fig. 6. Standardized mean and 95% CI of gillnet CPUE in Upernavik.

Appendix 1

Disko logline GLM (log-CPUE ~ intercept + Year + Month + Boat)

```
lm(formula = lcpue ~ Year + Month + Boat)

Residuals:
    Min      1Q  Median      3Q     Max
-5.7484 -0.2475  0.0402  0.3007  2.9674

Coefficients:
                     Estimate Std. Error t value Pr(>|t|)
(Intercept)           6.2685145  0.0529134 118.467  < 2e-16 ***
Year2010             -0.1753239  0.0228394  -7.676 1.71e-14 ***
Year2011             -0.2887595  0.0224027 -12.890  < 2e-16 ***
Year2012             -0.2266140  0.0222536 -10.183  < 2e-16 ***
Year2013             -0.2871932  0.0219583 -13.079  < 2e-16 ***
Year2014             -0.3081451  0.0226333 -13.615  < 2e-16 ***
Year2015             -0.5030778  0.0229878 -21.885  < 2e-16 ***
Year2016             -0.3704590  0.0233895 -15.839  < 2e-16 ***
Year2017             -0.8435677  0.0252627 -33.392  < 2e-16 ***
Month2               -0.2095794  0.0312822  -6.700 2.15e-11 ***
Month3               -0.2603839  0.0402432  -6.470 1.00e-10 ***
Month4               -0.3407646  0.0299031 -11.396  < 2e-16 ***
Month5               -0.3208698  0.0208902 -15.360  < 2e-16 ***
Month6               -0.1270086  0.0196438  -6.466 1.03e-10 ***
Month7               -0.2021387  0.0199073 -10.154  < 2e-16 ***
Month8               -0.1678054  0.0204069  -8.223  < 2e-16 ***
Month9               -0.2194242  0.0202272 -10.848  < 2e-16 ***
Month10              -0.2084314  0.0201744 -10.331  < 2e-16 ***
Month11              -0.1073246  0.0207755  -5.166 2.42e-07 ***
Month12              -0.0710892  0.0220088  -3.230 0.001240 **
BoatAG                0.5471078  0.2558983   2.138 0.032530 *
BoatAJ                0.0811903  0.0498513   1.629 0.103403
BoatAK                0.2876343  0.1016981   2.828 0.004684 **
BoatAK                0.0623391  0.0884789   0.705 0.481089
BoatAN               -0.0062982  0.0581605  -0.108 0.913767
BoatAN                0.1861135  0.0540736   3.442 0.000579 ***
BoatAN                0.2802585  0.0594154   4.717 2.41e-06 ***
BoatAN                0.1529764  0.0696173   2.197 0.028004 *
BoatAN                0.3413389  0.1659775   2.057 0.039744 *
BoatAN                0.1694637  0.1306413   1.297 0.194589
BoatAN               -1.0819184  0.5053017  -2.141 0.032275 *
BoatAN                0.2559796  0.0531364   4.817 1.47e-06 ***
BoatAP                0.3142943  0.1003878   3.131 0.001746 **
BoatAR                0.0864958  0.1150883   0.752 0.452324
BoatBA                0.3105015  0.1843296   1.684 0.092103 .
BoatBJ                0.2648633  0.0704316   3.761 0.000170 ***
BoatCE               -0.2760004  0.0765376  -3.606 0.000312 ***
BoatDO               -0.2573797  0.1524679  -1.688 0.091409 .
BoatER               -0.3129147  0.2104240  -1.487 0.137013
BoatER                0.0292747  0.1958429   0.149 0.881176
BoatGE                0.0310419  0.0683760   0.454 0.649842
BoatGA               -0.0139410  0.0537706  -0.259 0.795431
BoatHE                0.0630849  0.1139301   0.554 0.579780
BoatIL                0.2903615  0.0518469   5.600 2.17e-08 ***
BoatIN                0.2147253  0.1086125   1.977 0.048057 *
BoatIP                0.1332675  0.1588620   0.839 0.401542
BoatIV                0.1611058  0.0729102   2.210 0.027141 *
BoatJE                0.1799880  0.0641976   2.804 0.005058 **
BoatJE                0.1336169  0.0647702   2.063 0.039132 *
BoatJE                0.2478994  0.0485316   5.108 3.29e-07 ***
BoatJE                0.0606363  0.0552625   1.097 0.272549
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BoatJO               0.4415447  0.0510894   8.643  < 2e-16 ***
BoatJO              -0.0679072  0.2559251  -0.265 0.790750
BoatJO              -0.4659195  0.2942773  -1.583 0.113377
BoatJO              -0.2711031  0.3588875  -0.755 0.450019
BoatJO               0.0269775  0.1838941   0.147 0.883369
BoatJO               0.0184895  0.1958992   0.094 0.924806
BoatJO               0.3166836  0.5052697   0.627 0.530823
BoatJO               0.2271280  0.1193413   1.903 0.057031 .
BoatJO              -0.0296103  0.1588506  -0.186 0.852130
BoatJO               0.3375948  0.1585297   2.130 0.033222 *
BoatJO               0.0570868  0.1959379   0.291 0.770786
BoatJO               0.1660132  0.2560305   0.648 0.516726
BoatJO              -0.2775918  0.5052347  -0.549 0.582716
BoatJO              -1.5985597  0.5051837  -3.164 0.001557 **
BoatJO               0.2500005  0.2943374   0.849 0.395687
BoatJO               0.8273461  0.3588382   2.306 0.021142 *
BoatJO               0.3228460  0.5052347   0.639 0.522829
BoatJO               0.2522427  0.2558924   0.986 0.324274
BoatJO              -0.1912564  0.5052241  -0.379 0.705021
BoatJO               0.0700924  0.2940919   0.238 0.811624
BoatJO               0.0469374  0.1524649   0.308 0.758194
BoatJO               0.4342991  0.1659311   2.617 0.008868 **
BoatJO              -0.0442743  0.1958333  -0.226 0.821140
BoatJO               0.0770122  0.1959192   0.393 0.694263
BoatJO               0.1341660  0.5052241   0.266 0.790583
BoatJO               0.2587825  0.2299272   1.125 0.260392
BoatJO              -0.0883100  0.2940740  -0.300 0.763952
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BoatJO               1.3381388  0.5052241   2.649 0.008089 **
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BoatJA               0.9067191  0.2111564   4.294 1.76e-05 ***
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BoatKU               0.1095039  0.0508278   2.154 0.031220 *
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BoatKA               0.0563935  0.2297189   0.245 0.806080
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BoatLA               0.2858192  0.0613804   4.657 3.24e-06 ***
BoatLE               0.1776344  0.0870182   2.041 0.041230 *
BoatLI               0.0006919  0.0637767   0.011 0.991345
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BoatNE              -0.3274038  0.1188571  -2.755 0.005882 **
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BoatNI              -0.2099392  0.0979385  -2.144 0.032078 *
BoatNI               0.6891836  0.0501647  13.738  < 2e-16 ***
BoatNI               0.0432897  0.1075802   0.402 0.687398
BoatNI              -0.0557248  0.5052894  -0.110 0.912186
BoatNO               0.0448231  0.0611588   0.733 0.463630
BoatNO               0.0744554  0.0523460   1.422 0.154935
BoatNO              -0.0721765  0.0964462  -0.748 0.454252
BoatNU               0.0430523  0.0704849   0.611 0.541338
BoatNU               0.0446346  0.3587061   0.124 0.900974
BoatNU              -0.1657652  0.1378325  -1.203 0.229124
BoatNU               0.6459552  0.0801551   8.059 8.14e-16 ***
BoatNU               0.2702605  0.0817126   3.307 0.000943 ***
BoatNU              -0.0041980  0.0638922  -0.066 0.947614
BoatNU              -0.0520836  0.0873436  -0.596 0.550977
BoatNU               0.4213070  0.0496876   8.479  < 2e-16 ***
BoatNU               0.6537103  0.1250290   5.228 1.73e-07 ***
BoatNU               0.3366675  0.0828047   4.066 4.81e-05 ***
BoatOV               0.2473935  0.0933541   2.650 0.008054 **
BoatPA               0.2278243  0.0499523   4.561 5.13e-06 ***
BoatPA               0.1700953  0.0507161   3.354 0.000798 ***
BoatPI               0.2231215  0.1318637   1.692 0.090650 .
BoatPI               0.4976119  0.0530987   9.371  < 2e-16 ***
BoatPI              -0.1079725  0.0552557  -1.954 0.050709 .
BoatPI              -0.5110637  0.1662591  -3.074 0.002116 **
BoatQA               0.2310045  0.0832344   2.775 0.005519 **
BoatQI               1.3130361  0.2940398   4.466 8.03e-06 ***
BoatQV               0.0084428  0.2944050   0.029 0.977122
BoatQA               0.4549700  0.0621036   7.326 2.46e-13 ***
BoatRE               0.3417767  0.1657078   2.063 0.039171 *
BoatRI               0.1358344  0.0537790   2.526 0.011552 *
BoatRA               0.1576560  0.0551454   2.859 0.004255 **
BoatSA               0.1865034  0.0487160   3.828 0.000129 ***
BoatSA               0.0820804  0.1123739   0.730 0.465141
BoatSA               0.1227022  0.0577692   2.124 0.033682 *
```

```
BoatSE               -0.1668833  0.0909031  -1.836 0.066396 .
BoatSE                0.2031055  0.0586397   3.464 0.000534 ***
BoatSO               -0.3600135  0.2566555  -1.403 0.160719
BoatSU               -0.2709156  0.0622021  -4.355 1.33e-05 ***
BoatTA                0.4108089  0.2946222   1.394 0.163225
BoatTI                0.0605346  0.0508158   1.191 0.233568
BoatUI                0.5496739  0.0498359  11.030  < 2e-16 ***
BoatUL                0.4451755  0.1655903   2.688 0.007185 **
BoatAA                0.0372249  0.0965408   0.386 0.699806
BoatAA                0.5788938  0.2561018   2.260 0.023807 *
BoatAA                0.4893343  0.2944590   1.662 0.096567 .
BoatAA                0.3749865  0.0494068   7.590 3.35e-14 ***
BoatAA                0.2963190  0.2106549   1.407 0.159545
BoatAA                0.1958009  0.0510563   3.835 0.000126 ***
BoatAA                0.4483406  0.1107817   4.047 5.21e-05 ***
BoatAA               -0.0605359  0.1663482  -0.364 0.715928
BoatAA                0.0469541  0.0535311   0.877 0.380423
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.503 on 19887 degrees of freedom
Multiple R-squared:  0.2407,    Adjusted R-squared:  0.2333
F-statistic: 32.66 on 193 and 19887 DF,  p-value: < 2.2e-16
```

Appendix 2

Disko gillnet GLM (log-CPUE ~ intercept + Year + Month + Boat)

```
lm(formula = lcpue ~ Year + Month + Boat)

Residuals:
    Min      1Q  Median      3Q     Max
-5.3005 -0.3680  0.0930  0.4828  1.9486

Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)         3.378621   0.286710  11.784  < 2e-16 ***
Year2012            0.074266   0.045968   1.616 0.106221
Year2013           -0.068009   0.035459  -1.918 0.055151 .
Year2014            0.118741   0.036485   3.255 0.001141 **
Year2015           -0.183739   0.036610  -5.019 5.32e-07 ***
Year2016           -0.032869   0.036145  -0.909 0.363186
Year2017           -0.171943   0.040788  -4.216 2.52e-05 ***
Month2             -0.001897   0.030072  -0.063 0.949709
Month3             -0.211351   0.030718  -6.880 6.44e-12 ***
Month4             -0.039952   0.030130  -1.326 0.184887
Month11            -1.108822   0.080156 -13.833  < 2e-16 ***
Month12            -0.856034   0.136769  -6.259 4.09e-10 ***
BoatAJ              0.484816   0.293939   1.649 0.099113 .
BoatAN             -1.281770   0.522636  -2.453 0.014209 *
BoatAN              0.854003   0.291043   2.934 0.003353 **
BoatAN              0.748399   0.308694   2.424 0.015357 *
BoatAN              0.156454   0.315725   0.496 0.620233
BoatAN              1.037807   0.374466   2.771 0.005595 **
BoatAN              1.091483   0.308742   3.535 0.000410 ***
BoatAQ             -0.014208   0.606699  -0.023 0.981317
BoatAR              0.872553   0.301339   2.896 0.003795 **
BoatBJ              0.138064   0.345690   0.399 0.689620
BoatGA              0.230374   0.301381   0.764 0.444656
BoatIL              1.163893   0.293314   3.968 7.31e-05 ***
BoatIV              0.367372   0.473634   0.776 0.437982
BoatJE              0.834655   0.302024   2.764 0.005732 **
BoatJE             -0.056388   0.304931  -0.185 0.853295
BoatJE              0.727569   0.290849   2.502 0.012387 *
BoatJO              1.113627   0.347355   3.206 0.001351 **
BoatJO              0.575968   0.348162   1.654 0.098107 .
BoatJU              0.851188   0.302834   2.811 0.004955 **
BoatJU              0.706697   0.326286   2.166 0.030351 *
BoatJU              0.911334   0.294610   3.093 0.001986 **
BoatJU              0.868805   0.297407   2.921 0.003496 **
BoatKA              0.390967   0.292359   1.337 0.181170
BoatKA              0.159817   0.473357   0.338 0.735655
BoatKA             -1.109049   0.306489  -3.619 0.000298 ***
BoatKR              0.879850   0.344183   2.556 0.010597 *
BoatKU              0.361188   0.294165   1.228 0.219545
BoatKA              1.437901   0.807186   1.781 0.074891 .
BoatL.              0.921107   0.291263   3.162 0.001571 **
BoatLA              0.574394   0.296025   1.940 0.052374 .
BoatLE              0.383812   0.309950   1.238 0.215642
BoatLA              0.475068   0.288858   1.645 0.100085
BoatMA              0.873777   0.289508   3.018 0.002552 **
BoatMA              0.101860   0.374460   0.272 0.785615
BoatMA              0.988207   0.309094   3.197 0.001394 **
BoatMA              0.973447   0.292504   3.328 0.000879 ***
BoatMA              0.163149   0.298335   0.547 0.584487
BoatMI              0.722174   0.291156   2.480 0.013146 *
BoatMI              0.600009   0.310388   1.933 0.053262 .
```

```
BoatMI               -0.093671   0.403767  -0.232 0.816551
BoatNA                0.656074   0.326146   2.012 0.044298 *
BoatNÂ               -0.046402   0.288779  -0.161 0.872347
BoatNA                0.603269   0.315927   1.910 0.056233 .
BoatNI                0.400883   0.299180   1.340 0.180306
BoatNI                1.352144   0.448913   3.012 0.002604 **
BoatNI                0.601581   0.292623   2.056 0.039834 *
BoatNI                0.330118   0.298176   1.107 0.268275
BoatNO                0.895562   0.366816   2.441 0.014651 *
BoatNO                0.192522   0.295191   0.652 0.514296
BoatNU                1.347560   0.351419   3.835 0.000127 ***
BoatNU                0.878460   0.345365   2.544 0.010992 *
BoatNU                0.891708   0.306006   2.914 0.003579 **
BoatNU                1.064866   0.341485   3.118 0.001826 **
BoatNU                0.417988   0.338002   1.237 0.216258
BoatNU                1.446334   0.404059   3.580 0.000346 ***
BoatNU                0.788560   0.290703   2.713 0.006691 **
BoatOV                1.001157   0.336275   2.977 0.002918 **
BoatPA                1.007528   0.294202   3.425 0.000619 ***
BoatPA                0.669597   0.290818   2.302 0.021336 *
BoatPI                1.323816   0.292837   4.521 6.26e-06 ***
BoatPI                1.248727   0.336285   3.713 0.000206 ***
BoatPI               -0.190352   0.367377  -0.518 0.604378
BoatQA                1.468267   0.292497   5.020 5.29e-07 ***
BoatRI                0.479273   0.293885   1.631 0.102971
BoatRA                0.266877   0.808554   0.330 0.741359
BoatSA               -0.034471   0.290737  -0.119 0.905623
BoatSA                0.815775   0.305907   2.667 0.007675 **
BoatSE                0.216021   0.304425   0.710 0.477973
BoatSE                0.466619   0.301063   1.550 0.121207
BoatSO                1.383599   0.444146   3.115 0.001845 **
BoatSU               -0.199150   0.808288  -0.246 0.805391
BoatTI                0.116433   0.312798   0.372 0.709731
BoatUI                0.963972   0.290097   3.323 0.000895 ***
BoatAA                0.862323   0.289278   2.981 0.002883 **
BoatAA                1.301422   0.289181   4.500 6.89e-06 ***
BoatAA                1.248130   0.290266   4.300 1.73e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.7549 on 7537 degrees of freedom
Multiple R-squared:  0.2711,    Adjusted R-squared:  0.2627
F-statistic: 32.23 on 87 and 7537 DF,  p-value: < 2.2e-16
```

Appendix 3

Uumannaq logline GLM (log-CPUE ~ intercept + Year + Month + Boat)

```
lm(formula = lcpue ~ Year + Month + Boat)

Residuals:
    Min      1Q  Median      3Q     Max
-4.6716 -0.2413  0.0213  0.2701  2.8338

Coefficients:
                     Estimate Std. Error t value Pr(>|t|)
(Intercept)          6.199e+00  6.992e-02  88.654  < 2e-16 ***
Year2009             2.640e-02  3.678e-02   0.718 0.472973
Year2010             1.812e-01  3.569e-02   5.077 3.91e-07 ***
Year2011             2.912e-01  3.274e-02   8.894  < 2e-16 ***
Year2012             2.283e-01  3.135e-02   7.282 3.56e-13 ***
Year2013             1.364e-01  3.034e-02   4.494 7.07e-06 ***
Year2014             2.688e-01  3.074e-02   8.744  < 2e-16 ***
Year2015             1.157e-01  3.087e-02   3.749 0.000179 ***
Year2016             1.158e-01  3.093e-02   3.742 0.000183 ***
Year2017            -7.865e-02  3.167e-02  -2.483 0.013031 *
Month2               1.189e-01  9.168e-02   1.297 0.194770
Month3               5.118e-02  9.843e-02   0.520 0.603074
Month4               6.945e-02  9.607e-02   0.723 0.469743
Month5               7.375e-02  6.317e-02   1.167 0.243041
Month6               1.792e-01  6.052e-02   2.961 0.003074 **
Month7               3.021e-01  6.013e-02   5.024 5.17e-07 ***
Month8               2.465e-01  6.033e-02   4.086 4.42e-05 ***
Month9               1.333e-01  6.094e-02   2.188 0.028711 *
Month10              8.539e-02  6.080e-02   1.405 0.160200
Month11             -3.516e-03  6.317e-02  -0.056 0.955621
Month12              8.158e-02  6.847e-02   1.191 0.233502
BoatAJ              -2.707e-01  2.651e-01  -1.021 0.307200
BoatAK              -1.678e+00  4.563e-01  -3.677 0.000238 ***
BoatAK              -5.639e-01  5.707e-02  -9.881  < 2e-16 ***
BoatAK              -3.227e-01  3.986e-02  -8.097 6.38e-16 ***
BoatAN              -2.906e-01  4.173e-02  -6.964 3.55e-12 ***
BoatAN              -3.450e-01  6.148e-02  -5.611 2.08e-08 ***
BoatAN              -6.295e-01  1.089e-01  -5.779 7.75e-09 ***
BoatAN              -3.311e-01  6.743e-02  -4.910 9.28e-07 ***
BoatAN              -1.757e-01  3.679e-02  -4.775 1.82e-06 ***
BoatAN              -3.527e-02  3.613e-02  -0.976 0.329011
BoatAR              -5.121e-01  1.636e-01  -3.129 0.001758 **
BoatBJ              -2.731e-01  3.676e-02  -7.429 1.19e-13 ***
BoatDO              -1.113e-01  3.399e-02  -3.275 0.001061 **
BoatER              -6.206e-02  6.476e-02  -0.958 0.337923
BoatGA              -1.054e+00  2.315e-01  -4.551 5.41e-06 ***
BoatIL              -4.624e-01  2.308e-01  -2.003 0.045162 *
BoatIN              -2.174e-01  3.346e-02  -6.498 8.60e-11 ***
BoatIP              -1.689e+00  1.415e-01 -11.939  < 2e-16 ***
BoatJE              -8.162e-02  5.320e-02  -1.534 0.125009
BoatJE              -7.194e-01  1.177e-01  -6.111 1.03e-09 ***
BoatJO              -1.384e+00  2.293e-01  -6.035 1.66e-09 ***
BoatJO               1.655e-01  2.642e-01   0.626 0.531019
BoatJU              -2.695e-01  5.794e-02  -4.652 3.34e-06 ***
BoatJU              -2.285e-01  5.565e-02  -4.105 4.07e-05 ***
BoatJU              -7.210e-02  3.590e-02  -2.008 0.044653 *
BoatJU              -1.200e-01  2.640e-01  -0.454 0.649604
BoatKA              -4.268e-01  4.407e-02  -9.684  < 2e-16 ***
BoatKA              -7.303e-01  4.555e-01  -1.603 0.108923
BoatKR              -3.436e-01  1.545e-01  -2.224 0.026148 *
BoatKU              -7.028e-01  8.344e-02  -8.423  < 2e-16 ***
BoatKA              -2.636e-01  5.667e-02  -4.651 3.35e-06 ***
```

```
BoatL.              -2.597e-01  8.146e-02  -3.188 0.001438 **
BoatLA              -2.935e-01  3.841e-02  -7.641 2.38e-14 ***
BoatLE              -9.962e-01  1.880e-01  -5.300 1.19e-07 ***
BoatLI              -4.327e-02  2.304e-01  -0.188 0.851040
BoatLA              -2.896e-01  1.291e-01  -2.243 0.024936 *
BoatM.              -5.270e-01  1.022e-01  -5.155 2.59e-07 ***
BoatMA              -5.882e-01  8.189e-02  -7.184 7.34e-13 ***
BoatMA              -1.230e+00  1.038e-01 -11.845  < 2e-16 ***
BoatMA              -3.821e-01  3.387e-02 -11.281  < 2e-16 ***
BoatMI               1.042e-01  1.347e-01   0.773 0.439361
BoatMI              -4.618e-01  1.176e-01  -3.926 8.69e-05 ***
BoatMI              -5.947e-01  9.240e-02  -6.436 1.29e-10 ***
BoatNA              -8.452e-01  4.553e-01  -1.856 0.063431 .
BoatNA              -1.032e+00  1.293e-01  -7.982 1.61e-15 ***
BoatNA              -1.413e+00  1.298e-01 -10.883  < 2e-16 ***
BoatNA              -4.651e-05  7.566e-02  -0.001 0.999510
BoatNE              -3.619e-01  3.658e-02  -9.892  < 2e-16 ***
BoatNI              -5.646e-01  4.723e-02 -11.956  < 2e-16 ***
BoatNI              -7.054e-01  1.635e-01  -4.315 1.61e-05 ***
BoatNI              -4.798e-01  1.635e-01  -2.935 0.003349 **
BoatNI               1.331e-02  8.422e-02   0.158 0.874391
BoatNI              -4.625e-01  5.856e-02  -7.899 3.15e-15 ***
BoatNO              -7.850e-01  1.169e-01  -6.715 1.99e-11 ***
BoatNO              -3.617e-01  4.133e-02  -8.750  < 2e-16 ***
BoatNU              -5.330e-03  6.327e-02  -0.084 0.932864
BoatNU              -3.750e-01  9.897e-02  -3.789 0.000152 ***
BoatNU              -2.283e-01  1.294e-01  -1.765 0.077640 .
BoatNU              -3.796e-01  6.995e-02  -5.427 5.90e-08 ***
BoatNU              -2.462e-01  1.144e-01  -2.153 0.031367 *
BoatOV              -6.875e-01  1.743e-01  -3.945 8.04e-05 ***
BoatPA              -1.001e+00  7.250e-02 -13.811  < 2e-16 ***
BoatPA              -3.331e-01  1.745e-01  -1.909 0.056240 .
BoatPI               2.737e-02  1.171e-01   0.234 0.815196
BoatPI              -7.112e-01  5.022e-02 -14.162  < 2e-16 ***
BoatQA              -3.242e-01  3.374e-02  -9.609  < 2e-16 ***
BoatQI              -1.256e-01  3.349e-02  -3.750 0.000178 ***
BoatQA              -2.746e-01  2.641e-01  -1.040 0.298477
BoatRE              -2.314e-01  6.916e-02  -3.345 0.000825 ***
BoatRI              -4.884e-01  8.598e-02  -5.680 1.39e-08 ***
BoatSA              -3.578e-01  4.102e-02  -8.722  < 2e-16 ***
BoatSA              -2.059e-01  5.973e-02  -3.447 0.000569 ***
BoatSO              -6.076e-01  5.690e-02 -10.678  < 2e-16 ***
BoatSU              -8.165e-01  3.228e-01  -2.529 0.011451 *
BoatTU              -2.514e-01  4.554e-01  -0.552 0.580942
BoatUI              -1.139e-01  8.214e-02  -1.387 0.165434
BoatUL              -1.084e-01  3.586e-02  -3.023 0.002513 **
BoatAA              -3.982e-02  3.439e-02  -1.158 0.246978
BoatAA              -2.403e-01  4.403e-02  -5.457 4.97e-08 ***
BoatAA              -3.549e-01  6.393e-02  -5.551 2.92e-08 ***
BoatAA              -4.593e-01  8.388e-02  -5.476 4.47e-08 ***
BoatAA              -3.457e-01  8.680e-02  -3.983 6.86e-05 ***
BoatAA              -9.673e-01  8.949e-02 -10.810  < 2e-16 ***
BoatAA              -5.509e-01  7.102e-02  -7.757 9.67e-15 ***
BoatAA              -2.699e-01  8.006e-02  -3.370 0.000754 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.4541 on 8850 degrees of freedom
Multiple R-squared:  0.2336,    Adjusted R-squared:  0.2245
F-statistic: 25.69 on 105 and 8850 DF,  p-value: < 2.2e-16
```

Appendix 4

Uumannaq gillnet GLM (log-CPUE ~ intercept + Year + Month + Boat)

```
lm(formula = lcpue ~ Year + Month + Boat)

Residuals:
     Min       1Q   Median       3Q      Max
-2.24127 -0.22685  0.02841  0.25034  1.33662

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   4.67183    0.06470  72.206  < 2e-16 ***
Year2012     -0.18923    0.05306  -3.566 0.000379 ***
Year2013      0.01015    0.05499   0.185 0.853600
Year2014     -0.01237    0.05712  -0.217 0.828555
Year2015     -0.01591    0.06017  -0.264 0.791477
Year2016     -0.16026    0.08276  -1.936 0.053098 .
Year2017      0.06122    0.06215   0.985 0.324869
Month2       -0.03429    0.03817  -0.898 0.369299
Month3       -0.30318    0.14922  -2.032 0.042433 *
Month4       -0.06472    0.07635  -0.848 0.396828
Month11      -0.07230    0.05132  -1.409 0.159236
Month12      -0.01566    0.04947  -0.316 0.751734
BoatAN       -0.99996    0.13426  -7.448 2.02e-13 ***
BoatAN       -0.51157    0.16162  -3.165 0.001595 **
BoatAN       -0.03585    0.42197  -0.085 0.932307
BoatAN       -0.09599    0.06811  -1.409 0.159080
BoatAN       -0.53448    0.12509  -4.273 2.11e-05 ***
BoatBJ       -0.77996    0.16393  -4.758 2.24e-06 ***
BoatDO       -0.42960    0.08457  -5.080 4.49e-07 ***
BoatIN       -0.77116    0.09511  -8.108 1.47e-15 ***
BoatJU       -0.20990    0.14115  -1.487 0.137317
BoatJU       -0.28451    0.06919  -4.112 4.24e-05 ***
BoatKA       -0.28386    0.14801  -1.918 0.055418 .
BoatKR       -0.03274    0.16675  -0.196 0.844368
BoatKA       -0.66246    0.24496  -2.704 0.006959 **
BoatLA       -0.22832    0.08952  -2.551 0.010902 *
BoatM.       -0.47514    0.12509  -3.798 0.000154 ***
BoatMA       -0.34902    0.09208  -3.790 0.000159 ***
BoatNA       -0.57842    0.21282  -2.718 0.006682 **
BoatNE       -0.37478    0.10669  -3.513 0.000463 ***
BoatNO       -0.09098    0.07295  -1.247 0.212642
BoatNU       -0.57339    0.17852  -3.212 0.001360 **
BoatNU       -1.01754    0.17852  -5.700 1.57e-08 ***
BoatNU       -0.25442    0.13661  -1.862 0.062839 .
BoatOV       -0.11706    0.18357  -0.638 0.523829
BoatQA       -0.22261    0.09783  -2.276 0.023078 *
BoatQI       -0.02893    0.06804  -0.425 0.670835
BoatRE       -0.15850    0.12509  -1.267 0.205433
BoatRI        0.04401    0.16897   0.260 0.794551
BoatSA       -0.45497    0.11488  -3.960 8.00e-05 ***
BoatUL       -0.36996    0.07965  -4.645 3.85e-06 ***
BoatAA       -0.24136    0.18029  -1.339 0.180969
BoatAA       -0.56980    0.15996  -3.562 0.000385 ***
BoatAA       -0.03897    0.18569  -0.210 0.833817
BoatAA       -0.37451    0.13295  -2.817 0.004942 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.4075 on 1018 degrees of freedom
Multiple R-squared:  0.253,     Adjusted R-squared:  0.2208
F-statistic: 7.838 on 44 and 1018 DF,  p-value: < 2.2e-16
```

Appendix 5

Upernavik longline GLM (log-CPUE ~ intercept + Year + Month + Boat)

```
lm(formula = lcpue ~ Year + Month + Boat)

Residuals:
    Min      1Q  Median      3Q     Max
-7.5411 -0.2695  0.0391  0.3165  2.7619

Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)         6.537379   0.067362  97.048  < 2e-16 ***
Year2008           -0.057612   0.017799  -3.237 0.001211 **
Year2009           -0.024442   0.019221  -1.272 0.203538
Year2010           -0.137117   0.017804  -7.702 1.41e-14 ***
Year2011           -0.246399   0.018038 -13.660  < 2e-16 ***
Year2012           -0.026782   0.018377  -1.457 0.145032
Year2013           -0.139371   0.020057  -6.949 3.80e-12 ***
Year2014           -0.064478   0.019123  -3.372 0.000748 ***
Year2015           -0.233021   0.023032 -10.117  < 2e-16 ***
Year2016           -0.225516   0.024026  -9.386  < 2e-16 ***
Year2017           -0.278451   0.023858 -11.671  < 2e-16 ***
Month2             -0.318247   0.068101  -4.673 2.99e-06 ***
Month3             -0.949286   0.108916  -8.716  < 2e-16 ***
Month4             -0.578749   0.100159  -5.778 7.67e-09 ***
Month5             -0.558012   0.050743 -10.997  < 2e-16 ***
Month6             -0.495164   0.047777 -10.364  < 2e-16 ***
Month7             -0.197058   0.047280  -4.168 3.09e-05 ***
Month8             -0.182942   0.047167  -3.879 0.000105 ***
Month9             -0.302329   0.047157  -6.411 1.48e-10 ***
Month10            -0.254023   0.047468  -5.351 8.83e-08 ***
Month11            -0.188859   0.047970  -3.937 8.28e-05 ***
Month12            -0.119333   0.059541  -2.004 0.045060 *
BoatAG              0.231912   0.065141   3.560 0.000372 ***
BoatAK             -0.292785   0.312047  -0.938 0.348117
BoatAK              0.101216   0.079049   1.280 0.200414
BoatAN              0.019166   0.060848   0.315 0.752782
BoatAN              0.419006   0.064918   6.454 1.11e-10 ***
BoatAN              0.250846   0.082921   3.025 0.002489 **
BoatAN              0.468428   0.075943   6.168 7.05e-10 ***
BoatAN              0.028533   0.177258   0.161 0.872119
BoatAN              0.415444   0.065736   6.320 2.68e-10 ***
BoatAN              0.382248   0.084528   4.522 6.16e-06 ***
BoatAN              0.388248   0.071703   5.415 6.21e-08 ***
BoatAP              0.580660   0.096888   5.993 2.10e-09 ***
BoatAQ              0.616828   0.059509  10.365  < 2e-16 ***
BoatAQ              0.313328   0.067694   4.629 3.71e-06 ***
BoatAR              0.568530   0.063690   8.926  < 2e-16 ***
BoatAR             -0.169794   0.075523  -2.248 0.024572 *
BoatAR              0.519444   0.065218   7.965 1.75e-15 ***
BoatAR              0.084112   0.170591   0.493 0.621974
BoatBJ              0.005368   0.115168   0.047 0.962827
BoatCE             -1.007070   0.091540 -11.001  < 2e-16 ***
BoatDO              0.214296   0.078428   2.732 0.006294 **
BoatEL              0.444414   0.062324   7.131 1.03e-12 ***
BoatER              0.350615   0.064296   5.453 5.01e-08 ***
BoatER              0.613394   0.153084   4.007 6.18e-05 ***
BoatHA              0.303821   0.077267   3.932 8.45e-05 ***
BoatHA              0.653485   0.057813  11.303  < 2e-16 ***
BoatHA              0.349705   0.059512   5.876 4.27e-09 ***
BoatHI              0.560028   0.057918   9.669  < 2e-16 ***
BoatIN              0.327323   0.070471   4.645 3.43e-06 ***
```

```
BoatIP          -0.311016   0.086937  -3.577 0.000348 ***
BoatJE           0.612258   0.088100   6.950 3.78e-12 ***
BoatJE           0.034948   0.244855   0.143 0.886505
BoatJU           0.414615   0.196852   2.106 0.035198 *
BoatJU           0.238017   0.062890   3.785 0.000154 ***
BoatJU           0.249669   0.066745   3.741 0.000184 ***
BoatJU           0.057234   0.152915   0.374 0.708195
BoatJU          -0.229827   0.074433  -3.088 0.002020 **
BoatJA          -0.711861   0.177990  -3.999 6.37e-05 ***
BoatKA           0.322378   0.064477   5.000 5.79e-07 ***
BoatKA          -0.416138   0.311780  -1.335 0.181986
BoatKA           0.397671   0.058165   6.837 8.34e-12 ***
BoatKU           0.320026   0.097698   3.276 0.001056 **
BoatKU          -0.217000   0.126581  -1.714 0.086489 .
BoatKA           0.175647   0.152543   1.151 0.249557
BoatL.           0.569377   0.097241   5.855 4.84e-09 ***
BoatLA           0.500943   0.075486   6.636 3.31e-11 ***
BoatLY          -1.040912   0.148299  -7.019 2.31e-12 ***
BoatLA           0.482380   0.208675   2.312 0.020808 *
BoatM.           0.331526   0.120046   2.762 0.005757 **
BoatMA           0.096831   0.058373   1.659 0.097165 .
BoatMA          -0.507639   0.148382  -3.421 0.000625 ***
BoatMA           0.349724   0.126729   2.760 0.005792 **
BoatMA          -0.830604   0.534594  -1.554 0.120270
BoatMI           0.406470   0.061464   6.613 3.87e-11 ***
BoatNA           0.741100   0.063897  11.598  < 2e-16 ***
BoatNA           0.676096   0.113616   5.951 2.72e-09 ***
BoatNA           0.458549   0.057819   7.931 2.30e-15 ***
BoatNE           0.897082   0.244680   3.666 0.000247 ***
BoatNI          -0.209747   0.075208  -2.789 0.005294 **
BoatNI           0.390732   0.089324   4.374 1.22e-05 ***
BoatNI           0.551826   0.059491   9.276  < 2e-16 ***
BoatNI           0.119897   0.056963   2.105 0.035320 *
BoatNI           0.284422   0.244302   1.164 0.244349
BoatNI           0.748071   0.071993  10.391  < 2e-16 ***
BoatNI           0.155593   0.058407   2.664 0.007729 **
BoatNO          -0.104178   0.131667  -0.791 0.428823
BoatNO           0.385205   0.069033   5.580 2.44e-08 ***
BoatNU           0.729223   0.085951   8.484  < 2e-16 ***
BoatNU           0.004842   0.057958   0.084 0.933421
BoatNU           0.203162   0.067695   3.001 0.002693 **
BoatNU           0.082946   0.115055   0.721 0.470965
BoatOL           0.262007   0.093109   2.814 0.004898 **
BoatOV           0.680083   0.117866   5.770 8.05e-09 ***
BoatPA           0.253991   0.311853   0.814 0.415394
BoatPI           0.502595   0.076523   6.568 5.24e-11 ***
BoatPI          -0.187984   0.077202  -2.435 0.014903 *
BoatQA           0.215243   0.129038   1.668 0.095321 .
BoatQI           0.373983   0.064285   5.818 6.07e-09 ***
BoatQU           0.443934   0.148259   2.994 0.002754 **
BoatRE           0.375831   0.069726   5.390 7.13e-08 ***
BoatRA          -0.220935   0.271904  -0.813 0.416487
BoatSA           0.263107   0.224234   1.173 0.240666
BoatSU           0.611100   0.379997   1.608 0.107815
BoatSV           -0.481730   0.140629  -3.426 0.000615 ***
BoatTH           0.265508   0.148380   1.789 0.073570 .
BoatTI          -0.461975   0.379861  -1.216 0.223936
BoatTU           0.066841   0.057678   1.159 0.246526
BoatTU           0.747601   0.058593  12.759  < 2e-16 ***
BoatTU           0.866094   0.324299   2.671 0.007577 **
BoatUL          -0.081755   0.133810  -0.611 0.541220
BoatUL           0.456663   0.102534   4.454 8.49e-06 ***
BoatUU           0.260048   0.076207   3.412 0.000645 ***
```

```
BoatAA                0.359646   0.118513   3.035 0.002411 **
BoatAA               -0.529358   0.534503  -0.990 0.322004
BoatAA                0.349256   0.058800   5.940 2.91e-09 ***
BoatAA                0.155511   0.075568   2.058 0.039615 *
BoatAA                0.307889   0.534503   0.576 0.564603
BoatAA               -1.274998   0.119823 -10.641  < 2e-16 ***
BoatAA                0.300407   0.074207   4.048 5.18e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.5313 on 18779 degrees of freedom
Multiple R-squared:  0.2514,    Adjusted R-squared:  0.2466
F-statistic: 52.54 on 120 and 18779 DF,  p-value: < 2.2e-16
```

Appendix 6

Upernavik gillnet GLM (log-CPUE ~ intercept + Year + Month + Boat)

```
lm(formula = lcpue ~ Year + Month + Boat)

Residuals:
    Min      1Q  Median      3Q     Max
-4.1490 -0.2819  0.0156  0.3173  1.7809

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)      3.91407    0.11875  32.960  < 2e-16 ***
Year2010        -0.34423    0.06307  -5.458 5.15e-08 ***
Year2011        -0.31073    0.05447  -5.705 1.26e-08 ***
Year2012        -0.21362    0.05417  -3.944 8.18e-05 ***
Year2013        -0.61911    0.05758 -10.753  < 2e-16 ***
Year2014        -0.45563    0.06661  -6.841 9.22e-12 ***
Year2015        -0.26564    0.05768  -4.606 4.26e-06 ***
Year2016        -0.62971    0.05861 -10.744  < 2e-16 ***
Year2017        -0.48867    0.05757  -8.488  < 2e-16 ***
Month2          -0.08519    0.03936  -2.164 0.030498 *
Month3           0.07111    0.04048   1.757 0.079068 .
Month4           0.14347    0.03936   3.645 0.000271 ***
Month11          0.27807    0.04438   6.266 4.15e-10 ***
Month12          0.51889    0.05370   9.663  < 2e-16 ***
BoatAN           1.15734    0.23298   4.967 7.10e-07 ***
BoatAN           1.23026    0.17560   7.006 2.92e-12 ***
BoatAQ           0.68377    0.13327   5.131 3.04e-07 ***
BoatAR           0.66531    0.20391   3.263 0.001113 **
BoatEL          -0.63060    0.20436  -3.086 0.002046 **
BoatER           0.37560    0.12028   3.123 0.001807 **
BoatHA           0.39180    0.10946   3.580 0.000349 ***
BoatHA           0.14531    0.21241   0.684 0.493962
BoatHI           0.51412    0.10441   4.924 8.86e-07 ***
BoatJU           0.26675    0.11706   2.279 0.022739 *
BoatJA           0.47092    0.51605   0.913 0.361545
BoatKL          -0.20886    0.11046  -1.891 0.058724 .
BoatLA           0.25888    0.37140   0.697 0.485824
BoatMA           0.54968    0.11321   4.855 1.25e-06 ***
BoatNA          -0.44672    0.51650  -0.865 0.387150
BoatNA           0.31116    0.11801   2.637 0.008406 **
BoatNI           0.38644    0.23157   1.669 0.095244 .
BoatNI          -0.21057    0.20894  -1.008 0.313612
BoatNI           0.32758    0.10443   3.137 0.001722 **
BoatNI           0.53600    0.14433   3.714 0.000207 ***
BoatNI           0.13598    0.10462   1.300 0.193764
BoatNU           0.12489    0.10682   1.169 0.242384
BoatNU          -0.19255    0.10582  -1.820 0.068892 .
BoatTU          -0.25717    0.11561  -2.224 0.026178 *
BoatUL           1.13526    0.15681   7.240 5.48e-13 ***
BoatAA           0.74588    0.11243   6.634 3.75e-11 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.505 on 3601 degrees of freedom
Multiple R-squared:  0.3516,    Adjusted R-squared:  0.3446
F-statistic: 50.07 on 39 and 3601 DF,  p-value: < 2.2e-16
```