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Standardized logbooks from the inshore longline fishery on Greenland halibut in the inshore part of Div. 1A

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Abstract

Since 2008, logbooks have been mandatory for vessels greater than 30'ft (9,4m). This paper presents the preliminary results of a standardized longline CPUE series using a log-linear model for the areas Disko bay, Uummannaq and Upernavik. The effects included were year, month and individual vessel. For future CPUE models a stratification of the area may improve the model, and interaction effects could also be investigated. The standardized index showed a relative stable development since 2006 for Uummannaq and Upernavik, while Disko Bay CPUEs decreased since 2007 from about 600 kg to about 350 kg per fishing effort.

Introduction

Greenland halibut has been targeted with longlines in the North-West Greenlandic fjord-systems for than 100 years. Landings were below 5 000 t annually until the 1980s, but since then landings have increased and have been around 20 000 t since 1997 (Nygaard and Boje, 2010). Historically, the fishery was mainly conducted by small open vessels, but along with the increase in landings larger vessels have increased their share of total landings. In 2006 – 2007 a voluntary logbook initiative was undertaken in the inshore fishery in West Greenland. Since 2008 logbooks were made mandatory for vessels greater than 9.4m in the inshore areas of Greenland. Both longlines and gillnets are used in the fishery, but since gillnet logbooks are only available since 2008, only longline data is used in this analysis. No report requirements are in place for the remaining fleet of smaller vessels except for information from landing slips. The objective of this paper is to provide a standardized CPUE series for the fleets in Div 1A that are subject to logbook requirements in order to develop a biomass index for the fjord stocks and also to provide information of fishing effort to improve the stock assessment for the fjord stocks.

Materials and Methods

Logbooks are available since 2006. However, very few logbooks are available from 2006 and no correction for the effect of month is performed for the 2011 estimate. Logbook data were extracted from the Greenland fisheries licence office database. Total catches was used from the logbooks e.g. including discards. Discarding rate varies considerably by season due to the use of discards for food to sledge-dogs in the winter fishery. Logbooks were

assigned to area on basis of their reported or calculated position. Logbooks were excluded if the fishing effort was less than 1 hour or more than 96 hours, or if longlines were reported with less than 100 hooks. Also a few observations of null catches were excluded.
CPUE was log transformed in order to normalize the frequency distribution. Standardization of the CPUE was conducted by a GLM (multi-additive) taking account of year, month and individual vessel. The GLM was conducted for each of the three inshore areas. Least squared log means was calculated from the model (taking account of all effects). The log means and upper and lower confidence limits (2*se) was retransformed to provide CPUE series in kg per hours effort. Data analyses was performed using the SAS statistical software (SAS 9.2).

Results

All effects contributed significantly to the overall model, although they only resulted in R squares of 0.23-0.30, so in total little variance was explained by the model (Table 1-3). A future definition of smaller sub-areas within each of the three areas might lead to a higher R square. The standardized indices are shown in Fig. 1-3. The CPUE series reveals different patterns in the three areas with a decreasing trends in the Disko bay, and stable trends in both Upernavik and Uummannaq. The percentage catch covered by the index, calculated as the summed weight of the reported catches used in the CPUE series to the total landings is indicated on the figures; it ranges in recent years from 5% to 30%, and is lower in Uummannaq than the other areas and the percentage covered has stabilized in the two northern areas

Discussion

The high variability between vessels may be caused by different vessel behaviour in relation to the scattered distribution of Greenland halibut. Greenland halibut are known to have extremely high densities in some areas particularly in the near vicinity of Icefjord areas. Vessel variability may therefore be caused by local differences in fishing grounds related to individual vessel behaviour. The best fishing grounds are most often occupied by vessels claiming to have historical rights and newcomers are therefore pressed to fish in the outskirts of these attractive grounds. Defining areas on a smaller scale in combination with interaction effects might improve the model.
Although, the 2006 and 2007 estimates were based on voluntary logbooks, the reporting system itself was similar throughout the time series. The 2006 estimates were however based on very few logbooks in all areas and can hardly be regarded representative. Likewise the 2011 estimate should be regarded preliminary and is based on logbooks in the first few months of 2011.

Conclusion

Provision of logbook data to the inshore fishery for Greenland halibut improves the present data information to the assessment of the stocks. Although the present standardization shows a relative stability with the areas, Uummannaq and Upernavik, CPUEs have decreased in the period for Disko Bay. Further development of the model is required in order to improve the overall explanation of variance. One parameter could obviously be to include a sub-area effect within the three main areas. Also further filtering of the vessels included might improve the model, e.g. a categorization of vessel by total annual landings.

References

Nygaard R. & Boje J., 2010. An Assessment of the Greenland Halibut Stock Component in NAFO Division 1A Inshore. NAFO Scr. doc.10/43.

Table 1. DISKO BAY OUTPUT

INSH 1AX
The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	6	2006 2007 2008 2009 2010 2011
MD	12	01 02 03 04 05 06 07 08 09 10 11 12
VESSEL	65	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 (VESSEL NUMBERS HAVE BEEN REPLACED)

Number of Observations Read 3704
Number of Observations Used 3704

The GLM Procedure

Dependent Variable: LogCPUE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	80	313.763277	3.922041	14.29	<.0001
Error	3623	994.199609	0.274413		
Corrected Total	3703	1307.962886			

R-Square	Coeff Var	Root MSE	LogCPUE Mean
0.239887	8.539698	0.523845	6.134231

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	5	35.2488853	7.0497771	25.69	<.0001
MD	11	53.9268835	4.9024440	17.87	<.0001
VESSEL	64	224.5875082	3.5091798	12.79	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	5	28.8834604	5.7766921	21.05	<.0001
MD	11	39.7866487	3.6169681	13.18	<.0001
VESSEL	64	224.5875082	3.5091798	12.79	<.0001

Parameter		Estimate		Standard Error	t Value	Pr > |t|
Intercept		5.512263289	B	0.16010363	34.43	<.0001
YEAR	2006	0.163633116	B	0.18872782	0.87	0.3860
YEAR	2007	0.484800753	B	0.06572505	7.38	<.0001
YEAR	2008	0.270767861	B	0.06003756	4.51	<.0001
YEAR	2009	0.333986402	B	0.05130671	6.51	<.0001
YEAR	2010	0.144415842	B	0.04621188	3.13	0.0018
YEAR	2011	0.000000000	B	.	.	.
MD	01	0.307129722	B	0.04828817	6.36	<.0001
MD	02	0.279374383	B	0.05686049	4.91	<.0001
MD	03	-0.032987698	B	0.07836248	-0.42	0.6738
MD	04	-0.187105381	B	0.07340102	-2.55	0.0108
MD	05	-0.104981686	B	0.05688836	-1.85	0.0651
MD	06	0.110326093	B	0.04445167	2.48	0.0131
MD	07	0.030040231	B	0.04140231	0.73	0.4681
MD	08	0.105916298	B	0.04149408	2.55	0.0107
MD	09	0.076231265	B	0.04187914	1.82	0.0688
MD	10	0.041046811	B	0.04011840	1.02	0.3063
MD	11	-0.045434045	B	0.03961124	-1.15	0.2515
MD	12	0.000000000	B	.	.	.

The GLM Procedure

Dependent Variable: LogCPUE

Parameter		Estimate		Standard Error	t Value	Pr > |t|
VESSEL	1	1.094906031	B	0.16422042	6.67	<.0001
VESSEL	2	0.215368258	B	0.24029459	0.90	0.3702
VESSEL	3	0.066018507	B	0.22233193	0.30	0.7665
VESSEL	4	0.279480757	B	0.22019634	1.27	0.2044
VESSEL	5	0.254571813	B	0.16195870	1.57	0.1161
VESSEL	6	0.329247796	B	0.17785597	1.85	0.0642
VESSEL	7	0.460190613	B	0.16181627	2.84	0.0045
VESSEL	8	0.265910633	B	0.18435284	1.44	0.1493
VESSEL	9	0.529352355	B	0.19666288	2.69	0.0071
VESSEL	10	0.372008509	B	0.17990824	2.07	0.0387
VESSEL	11	0.513235172	B	0.16793995	3.06	0.0023
VESSEL	12	-0.212787496	B	0.16206982	-1.31	0.1893
VESSEL	13	0.181308602	B	0.16246804	1.12	0.2645
VESSEL	14	-0.051216853	B	0.20060915	-0.26	0.7985
VESSEL	15	0.379705955	B	0.16337749	2.32	0.0202
VESSEL	16	0.392316396	B	0.18335574	2.14	0.0324
VESSEL	17	0.446646068	B	0.16240133	2.75	0.0060
VESSEL	18	0.696942829	B	0.16699801	4.17	<.0001
VESSEL	19	0.271750608	B	0.15751201	1.73	0.0846
VESSEL	20	0.436738478	B	0.16559767	2.64	0.0084
VESSEL	21	0.112097033	B	0.28358778	0.40	0.6927
VESSEL	22	0.523090479	B	0.15722744	3.33	0.0009
VESSEL	23	0.226359500	B	0.16065176	1.41	0.1589
VESSEL	24	0.273849993	B	0.15840410	1.73	0.0839
VESSEL	25	0.259797913	B	0.16061370	1.62	0.1059
VESSEL	26	0.224578620	B	0.15945896	1.41	0.1591
VESSEL	26	0.604210294	B	0.15948733	3.79	0.0002
VESSEL	27	0.247827314	B	0.16163120	1.53	0.1253
VESSEL	28	0.171755724	B	0.17244282	1.00	0.3193
VESSEL	29	0.494733819	B	0.18334903	2.70	0.0070
VESSEL	30	0.731752861	B	0.15819039	4.63	<.0001
VESSEL	31	0.877891096	B	0.23520751	3.73	0.0002
VESSEL	32	0.030934309	B	0.28093285	0.11	0.9123
VESSEL	33	0.529726461	B	0.23965122	2.21	0.0271
VESSEL	34	0.413129767	B	0.19380225	2.13	0.0331
VESSEL	35	0.679416501	B	0.18159188	3.74	0.0002
VESSEL	36	0.495547715	B	0.40080731	1.24	0.2164
VESSEL	37	0.064205753	B	0.54813389	0.12	0.9068
VESSEL	38	0.490188091	B	0.24255041	2.02	0.0434
VESSEL	39	0.318461773	B	0.27921227	1.14	0.2541
VESSEL	40	0.305802139	B	0.19181862	1.59	0.1110
VESSEL	41	0.223198224	B	0.17852490	1.25	0.2113
VESSEL	42	0.570539056	B	0.16165095	3.53	0.0004
VESSEL	43	0.179949081	B	0.21442089	0.84	0.4014
VESSEL	44	0.367853287	B	0.18070247	2.04	0.0419
VESSEL	45	0.625214784	B	0.18068693	3.46	0.0005
VESSEL	46	0.531286431	B	0.18824614	2.82	0.0048
VESSEL	47	0.405604982	B	0.17695857	2.29	0.0220
VESSEL	48	0.301392158	B	0.16137349	1.87	0.0619
VESSEL	49	-0.172378309	B	0.16010172	-1.08	0.2817
VESSEL	50	0.480614774	B	0.17811572	2.70	0.0070
VESSEL	51	0.553107797	B	0.15815086	3.50	0.0005
VESSEL	52	0.655235150	B	0.16173447	4.05	<.0001
VESSEL	53	0.530069504	B	0.17374341	3.05	0.0023
VESSEL	54	-0.063726755	B	0.34229771	-0.19	0.8523
VESSEL	55	0.527269835	B	0.15980470	3.30	0.0010
VESSEL	56	0.713145089	B	0.18370180	3.88	0.0001
VESSEL	57	0.500013431	B	0.24966567	2.00	0.0453
VESSEL	58	0.427239438	B	0.40724239	1.05	0.2942
VESSEL	59	-0.347021394	B	0.28525270	-1.22	0.2239
VESSEL	60	0.132398427	B	0.19555104	0.68	0.4984
VESSEL	61	0.175168335	B	0.15940996	1.10	0.2719
VESSEL	62	0.280649772	B	0.17717217	1.58	0.1133
VESSEL	63	-0.006923367	B	0.21149907	-0.03	0.9739
VESSEL	64	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	LogCPUE LSMEAN	Standard Error	Pr > |t|
2006	6.07168431	0.18299159	<.0001
2007	6.39285194	0.05000161	<.0001
2008	6.17881905	0.04087153	<.0001
2009	6.24203759	0.02995113	<.0001
2010	6.05246703	0.02340919	<.0001
2011	5.90805119	0.04260073	<.0001

Table 2. UPERNAVIK OUTPUT

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	6	2006 2007 2008 2009 2010 2011
MD	12	01 02 03 04 05 06 07 08 09 10 11 12
VESSEL	64	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 (VESSEL NUMBERS HAVE BEEN REPLACED)

Number of Observations Read 7657
Number of Observations Used 7657
INSH 1AUP

The GLM Procedure

Dependent Variable: LogCPUE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	79	1123.045454	14.215765	42.57	<.0001
Error	7577	2530.269226	0.333941		
Corrected Total	7656	3653.314679			

R-Square	Coeff Var	Root MSE	LogCPUE Mean
0.307405	8.783793	0.577876	6.578890

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	5	90.3951995	18.0790399	54.14	<.0001
MD	11	72.5052204	6.5913837	19.74	<.0001
VESSEL	63	960.1450338	15.2403974	45.64	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	5	40.7097582	8.1419516	24.38	<.0001
MD	11	53.0201087	4.8200099	14.43	<.0001
VESSEL	63	960.1450338	15.2403974	45.64	<.0001

Parameter		Estimate		Standard Error	t Value	Pr > |t|
Intercept		6.618259016	B	0.14568663	45.43	<.0001
YEAR	2006	0.266470626	B	0.11306847	2.36	0.0185
YEAR	2007	0.020956423	B	0.10163531	0.21	0.8366
YEAR	2008	-0.028119515	B	0.10201399	-0.28	0.7828
YEAR	2009	-0.021915907	B	0.10174051	-0.22	0.8295
YEAR	2010	-0.168920288	B	0.09876040	-1.71	0.0872
YEAR	2011	0.000000000	B	.	.	.
MD	01	-0.086797415	B	0.09928870	-0.87	0.3820
MD	02	-0.197784330	B	0.08388158	-2.36	0.0184
MD	03	-0.911102359	B	0.13192563	-6.91	<.0001
MD	04	-0.539994548	B	0.20322191	-2.66	0.0079
MD	05	-0.340925511	B	0.07695477	-4.43	<.0001
MD	06	-0.230701609	B	0.06302876	-3.66	0.0003
MD	07	-0.000522372	B	0.06072155	-0.01	0.9931
MD	08	-0.010659529	B	0.06010116	-0.18	0.8592
MD	09	-0.056705496	B	0.06038609	-0.94	0.3477

MD	10	-0.047295834 B	0.06063361	-0.78	0.4354
MD	11	-0.036988787 B	0.06075494	-0.61	0.5427
MD	12	0.000000000 B	.	.	.

INSH 1AUP
The GLM Procedure

Dependent Variable: LogCPUE

Parameter		Estimate	Standard Error	t Value	Pr > |t|
VESSEL	1	-1.661802532 B	0.15015866	-11.07	<.0001
VESSEL	2	-1.019316856 B	0.41877034	-2.43	0.0150
VESSEL	3	-0.611613037 B	0.11759942	-5.20	<.0001
VESSEL	4	0.125053205 B	0.09546744	1.31	0.1903
VESSEL	5	-0.198453940 B	0.17961575	-1.10	0.2692
VESSEL	6	0.024140817 B	0.10435296	0.23	0.8171
VESSEL	7	-1.377777505 B	0.18009204	-7.65	<.0001
VESSEL	8	-0.050012870 B	0.09965409	-0.50	0.6158
VESSEL	9	-0.161212298 B	0.09638687	-1.67	0.0945
VESSEL	10	0.300211217 B	0.18002024	1.67	0.0954
VESSEL	11	0.105981005 B	0.10685074	0.99	0.3213
VESSEL	12	-0.224569122 B	0.09785643	-2.29	0.0218
VESSEL	13	0.032631640 B	0.34554510	0.09	0.9248
VESSEL	14	0.134116373 B	0.09732554	1.38	0.1682
VESSEL	15	-1.295180692 B	0.12063916	-10.74	<.0001
VESSEL	16	-0.057029847 B	0.10748265	-0.53	0.5957
VESSEL	17	0.468246218 B	0.11807450	3.97	<.0001
VESSEL	18	-0.783698698 B	0.16854316	-4.65	<.0001
VESSEL	19	-0.481559853 B	0.15339868	-3.14	0.0017
VESSEL	20	-0.766460362 B	0.41876079	-1.83	0.0672
VESSEL	21	0.159005341 B	0.09574126	1.66	0.0968
VESSEL	22	0.226692133 B	0.23688548	0.96	0.3386
VESSEL	23	0.606461846 B	0.09690769	6.26	<.0001
VESSEL	24	0.317249314 B	0.13368963	2.37	0.0177
VESSEL	25	-0.025797889 B	0.22388105	-0.12	0.9083
VESSEL	26	0.433952539 B	0.10146203	4.28	<.0001
VESSEL	27	-3.023554891 B	0.13415003	-22.54	<.0001
VESSEL	28	-0.067626893 B	0.12715898	-0.53	0.5949
VESSEL	29	0.194771873 B	0.09645869	2.02	0.0435
VESSEL	30	0.152232709 B	0.09606474	1.58	0.1131
VESSEL	31	0.032129638 B	0.12595758	0.26	0.7987
VESSEL	32	0.080479845 B	0.09754301	0.83	0.4094
VESSEL	33	0.082511859 B	0.11278378	0.73	0.4644
VESSEL	34	-0.153657566 B	0.25311203	-0.61	0.5438
VESSEL	35	-0.166727126 B	0.19681050	-0.85	0.3969
VESSEL	36	-0.237210174 B	0.09459857	-2.51	0.0122
VESSEL	37	0.377940734 B	0.14403681	2.62	0.0087
VESSEL	38	0.026237343 B	0.14811263	0.18	0.8594
VESSEL	39	-0.199968306 B	0.09526704	-2.10	0.0358
VESSEL	40	0.450561754 B	0.09621631	4.68	<.0001
VESSEL	41	0.077179967 B	0.13331913	0.58	0.5627
VESSEL	42	0.096692525 B	0.09589688	1.01	0.3133
VESSEL	43	0.516619647 B	0.09951867	5.19	<.0001
VESSEL	44	0.123307818 B	0.10562301	1.17	0.2431
VESSEL	45	-0.624453195 B	0.11232040	-5.56	<.0001
VESSEL	46	0.202801434 B	0.13544739	1.50	0.1344
VESSEL	47	0.224048827 B	0.09557006	2.34	0.0191
VESSEL	48	0.273017814 B	0.12494974	2.19	0.0289
VESSEL	49	0.308400565 B	0.11347989	2.72	0.0066
VESSEL	50	0.094688520 B	0.10418989	0.91	0.3635
VESSEL	51	0.291183283 B	0.17049445	1.71	0.0877
VESSEL	52	0.101836624 B	0.10260344	0.99	0.3210
VESSEL	53	-0.004719924 B	0.10209467	-0.05	0.9631
VESSEL	54	0.725502565 B	0.39751004	1.83	0.0680
VESSEL	55	0.100540890 B	0.10030680	1.00	0.3162
VESSEL	56	-0.011417915 B	0.11501077	-0.10	0.9209
VESSEL	57	-0.300496165 B	0.20443782	-1.47	0.1416
VESSEL	58	-0.113517436 B	0.13060697	-0.87	0.3848
VESSEL	59	0.097798275 B	0.12719578	0.77	0.4420
VESSEL	60	0.700799019 B	0.15832510	4.43	<.0001
VESSEL	61	0.012328554 B	0.09851530	0.13	0.9004
VESSEL	62	0.299286297 B	0.09899994	3.02	0.0025
VESSEL	63	0.116254706 B	0.58483211	0.20	0.8424
VESSEL	64	0.000000000 B	.	.	.

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

INSH 1AUP

The GLM Procedure
Least Squares Means

YEAR	LogCPUE LSMEAN	Standard Error	Pr > |t|
2006	6.60282097	0.05648779	<.0001
2007	6.35730676	0.03168554	<.0001
2008	6.30823082	0.03196368	<.0001
2009	6.31443443	0.03095013	<.0001
2010	6.16743005	0.02914566	<.0001
2011	6.33635034	0.09788425	<.0001

Table 3. UUMMANNAQ OUTPUT

INSH 1AUM

The GLM Procedure

Class Level Information

Class	Levels	Values
YEAR	6	2006 2007 2008 2009 2010 2011
MD	12	01 02 03 04 05 06 07 08 09 10 11 12
VESSEL	36	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 (VESSEL NUMBERS HAVE BEEN REPLACED)

Number of Observations Read 1758
Number of Observations Used 1758

INSH 1AUM

The GLM Procedure

Dependent Variable: LogCPUE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	51	204.3864752	4.0075779	11.38	<.0001
Error	1706	600.6304054	0.3520694		
Corrected Total	1757	805.0168806			

R-Square	Coeff Var	Root MSE	LogCPUE Mean
0.253891	9.550999	0.593354	6.212485

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	5	5.7939628	1.1587926	3.29	0.0058
MD	11	37.8569298	3.4415391	9.78	<.0001
VESSEL	35	160.7355825	4.5924452	13.04	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	5	5.1520697	1.0304139	2.93	0.0123
MD	11	27.1194715	2.4654065	7.00	<.0001
VESSEL	35	160.7355825	4.5924452	13.04	<.0001

Parameter		Estimate		Standard Error	t Value	Pr > |t|
Intercept		5.959411467	B	0.17372617	34.30	<.0001
YEAR	2006	0.173451628	B	0.16920643	1.03	0.3055
YEAR	2007	0.020232168	B	0.13806293	0.15	0.8835
YEAR	2008	-0.066074895	B	0.14024133	-0.47	0.6376
YEAR	2009	0.062043848	B	0.13921429	0.45	0.6559
YEAR	2010	0.100630597	B	0.12701150	0.79	0.4283
YEAR	2011	0.000000000	B	.	.	.
MD	01	0.244451342	B	0.14754594	1.66	0.0977
MD	02	0.024383136	B	0.14011378	0.17	0.8619
MD	03	0.011555805	B	0.14546471	0.08	0.9367
MD	04	0.040287336	B	0.15459913	0.26	0.7944
MD	05	-0.372863813	B	0.12145478	-3.07	0.0022
MD	06	-0.018120674	B	0.09659182	-0.19	0.8512
MD	07	0.205647845	B	0.08912558	2.31	0.0212
MD	08	0.081218956	B	0.09029785	0.90	0.3685
MD	09	-0.010534260	B	0.08974057	-0.12	0.9066

MD	10	-0.143563998 B	0.09620572	-1.49	0.1358
MD	11	-0.111850485 B	0.09603733	-1.16	0.2443
MD	12	0.000000000 B	.	.	.

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The GLM Procedure

Dependent Variable: LogCPUE

Parameter		Estimate	Standard Error	t Value	Pr > |t|
VESSEL	1	-1.033198236 B	0.19293389	-5.36	<.0001
VESSEL	2	-1.006030797 B	0.18894393	-5.32	<.0001
VESSEL	3	0.232333090 B	0.12329015	1.88	0.0597
VESSEL	4	-0.005435757 B	0.23523928	-0.02	0.9816
VESSEL	5	0.377652982 B	0.10006818	3.77	0.0002
VESSEL	6	0.167924295 B	0.08907128	1.89	0.0596
VESSEL	7	0.304180806 B	0.31743961	0.96	0.3381
VESSEL	8	2.382475498 B	0.18337770	12.99	<.0001
VESSEL	9	0.628319605 B	0.11822759	5.31	<.0001
VESSEL	10	-0.137485990 B	0.35264822	-0.39	0.6967
VESSEL	11	0.000362052 B	0.42558465	0.00	0.9993
VESSEL	12	0.325750335 B	0.30513103	1.07	0.2859
VESSEL	13	-0.075936436 B	0.14564079	-0.52	0.6022
VESSEL	14	0.086068293 B	0.12963325	0.66	0.5068
VESSEL	15	-0.098009229 B	0.14516470	-0.68	0.4997
VESSEL	16	0.291322629 B	0.12669647	2.30	0.0216
VESSEL	17	0.132938306 B	0.07897173	1.68	0.0925
VESSEL	18	0.248491686 B	0.11939481	2.08	0.0376
VESSEL	19	-0.015660337 B	0.12007136	-0.13	0.8962
VESSEL	20	0.445310952 B	0.08427166	5.28	<.0001
VESSEL	21	-0.171005798 B	0.09800787	-1.74	0.0812
VESSEL	22	0.016334834 B	0.10834607	0.15	0.8802
VESSEL	23	0.218556807 B	0.15333430	1.43	0.1542
VESSEL	24	-0.324173428 B	0.13870719	-2.34	0.0195
VESSEL	25	0.144344889 B	0.59933527	0.24	0.8097
VESSEL	26	-0.350730442 B	0.18895064	-1.86	0.0636
VESSEL	27	0.109478645 B	0.13288769	0.82	0.4101
VESSEL	28	0.307308331 B	0.08422593	3.65	0.0003
VESSEL	29	0.110289093 B	0.09704391	1.14	0.2559
VESSEL	30	-0.447400077 B	0.44743062	-1.00	0.3175
VESSEL	31	0.266865327 B	0.09271520	2.88	0.0040
VESSEL	32	0.300515998 B	0.12996985	2.31	0.0209
VESSEL	33	0.364478945 B	0.11046912	3.30	0.0010
VESSEL	34	-1.536733518 B	0.42564627	-3.61	0.0003
VESSEL	35	-0.620798952 B	0.30668803	-2.02	0.0431
VESSEL	36	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	LogCPUE LSMEAN	Standard Error	Pr > |t|
2006	6.17426693	0.11003114	<.0001
2007	6.02104747	0.05518010	<.0001
2008	5.93474040	0.05828223	<.0001
2009	6.06285915	0.05476241	<.0001
2010	6.10144590	0.04730560	<.0001
2011	6.00081530	0.11992415	<.0001

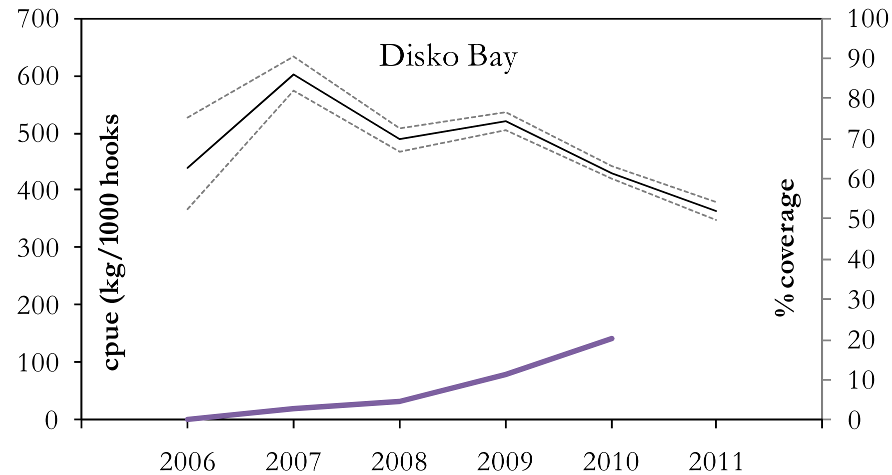

Fig 1 Disko bay GLM: logcpue=overall mean + year + vessel

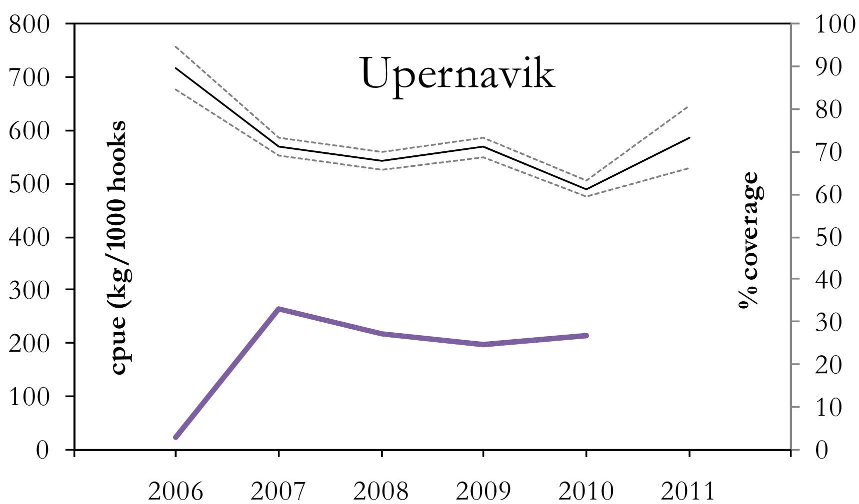

Fig 2 Upernavik GLM: logcpue=overall mean + year + vessel

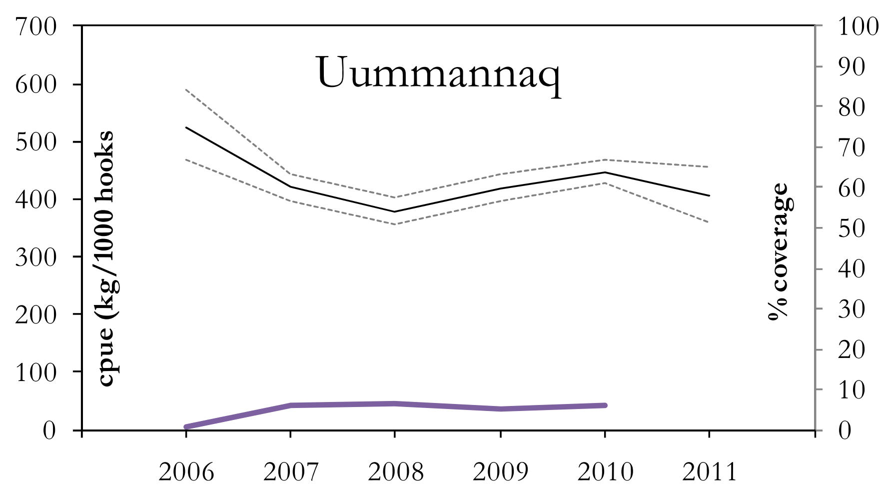

Fig3 Uummannaq GLM: logcpue=overall mean + year + vessel