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The Fishery for Northern Shrimp (*Pandalus borealis*) in Denmark Strait / off East Greenland 1978 – 2025.

by

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Abstract

Northern shrimp (*Pandalus borealis*) occurs off East Greenland from Cape Farewell to about 70˚N mainly in depths from 250 m and down to about 600 m. North of 65˚N the stock spans the adjacent Greenlandic and Icelandic economic zones. Prior to 2011 the stock was assessed as a single population by evaluation of fishery dependent data only. Since 2011 data from research survey was included in the assessment. The stock is managed by catch quotas in the Greenlandic zone. The fishery in the Icelandic zone ceased in 2006.

A multinational fleet of large factory trawlers exploited the stock taking annual catches between 11 500 tons and 14 000 tons from 1994 to 2003. From 2004 until 2016 annual catches decreased to a low level less than 600 tons, and has increase to 7 466 tons in 2023, dropped slightly in 2024. Catches for the first half of 2025 were 5 277 t. For 2024, the logbooks for one foreign vessel were not available and for 2025 the logbooks for two foreign vessels were not available. The catches are included in the total catches but not in the CPUE and effort. The recent catch rate index might not be a reliable index for the biomass from the entire East coast because of the concentrated fishing effort in a restricted area in these years.

Introduction

Northern shrimp (*Pandalus borealis*) occurs off East Greenland in ICES Divisions 14b and 5a. The stock is distributed from Cap Farewell, up through the Denmark Strait to about 70˚N in depths down to around 800 meters. Most shrimp biomass concentrations occur from 250-600 m. There is no evidence of distinct sub-populations, and the stock is assessed as a single population.

The exploitation of this stock began in the late 1970's initiated by Icelandic trawlers. It soon became a multinational fishery with annual catches increasing rapidly to more than 15 000 tons then catches fluctuated around 12 000 tons until 2003 (Table 1, Fig. 2A). Catches then decreased to 49 tons in 2016. Since then, annual catches have been increasing and peaked at 7 466 tons in 2023.

The fishery was originally conducted north of 65˚N on both sides of the territorial midline between Greenland and Iceland. However, in 1993 a fishery was also initiated in various smaller areas south of 65˚N extending south to the Cap Farewell but since 2013 no or very little fishing has been taken place south of 65˚N. Access to fishing grounds depends on ice conditions at certain times of the year. Since 2014 the fishing has been concentrated in a small area.

Greenland, EU, and Norway fleets have since 2014 participated in the fishery in the Greenlandic zone (see table 1 for details). The Faroe Island fleet participated in the fishery prior to 2010 and again in 2019-2021.Vessels taking part in the fishery are large factory trawlers in the range of 1000-4000 GRT. The fishery is managed by a Total Allowable Catch (TAC) in the Greenlandic EEZ. Icelandic vessels operate exclusively in the Icelandic EEZ. Annual catches in the Greenlandic zone from 1999 to 2005 accounted for 70-99 % of the total catches. No fishery has since 2006 been conducted in the Icelandic zone.

This paper presents and analyses data from the shrimp fishery off East Greenland to provide a basis for the assessment of the shrimp stock in this area, i.e. time series of catch, fishing effort, geographical distribution and CPUE based biomass indices and indices of harvest rate.

Materials and methods

Raw data

Logbooks from Greenland, Iceland, Faroe Islands and EU since 1980 and from Norway since 2000 supplied data on catch and effort (hours fished) on a haul-by-haul basis. From 1998 approximately 40% of all hauls were performed with double trawl and since 2004 more than 60% of all hauls were performed with double trawl. In 2025 22% of hauls were performed with single trawl, 62% of hauls with double trawl and 16% with triple trawl. Triple trawl was used by 1-6 vessels in 2020-2025. Initial inclusion of all three trawl types showed no significant difference, and it was therefore decided in this year's assessment to treat triple trawl as double trawl in the estimation of standardised CPUE indices. The catches in the Greenland EEZ were corrected for "overpacking" according to Hvingel (2003).

For this year's analysis some logbooks were not available. For 2024 the logbooks from one foreign vessel and for 2025 the logbooks from two foreign vessels were missig. Catches from these vessels are included in this document, based on catch report to GFJK, but it is not possible to included information on CPUE and effort. Based on information from the Greenland Fishery and Hunting Control (GFJK) the fishery is known to have taken in place in the same area as the rest of the fisheries. It is expected that the overall effort will increase when all logbooks are included, but unknown if there will be an impact on the overall CPUE.

Catches and corresponding effort were compiled by year, month, and areas north and south of 65°N. CPUE was calculated and applied to the total catch of the year to estimate the total annual effort. The geographical distribution of the fishery is shown by plotting the catch and effort by statistical units of 7.5' latitude and 15' longitude (Fig. 4a, b).

Catch rate indices

Three standardised CPUE indices were constructed: one for each of the areas north and south of 65°N and a combined index series representing the total area. The indices were based on logbook data from Greenlandic, Faroese, EU, and Norwegian vessels, operating exclusively in the Greenlandic zone and from the Icelandic fleet fishing exclusively in the Icelandic zone (north of 65°N). Until 2005 Norwegian fishery data was considered to have too sparse information on the different areas fished and data was therefore not included in the standardized catch rates calculations. In 2006 Norwegian fishery data was included in the catch rates calculations after a positive evaluation of new logbook data from the GFLK, where Norwegian fishery data has been recorded in standard format since 2000.

For the indices of the northern areas and the total areas involves a two-step process. In the first step multiplicative General Linear Modelling (GLM) were used to standardise the CPUE data from the Greenlandic zones separately. The "first step" was performed following the method described in Hvingel *et al.* (2000). The multiplicative models included the following variables: (1) individual vessel fishing power, (2) seasonal availability of shrimp, (3) spatial availability of shrimp, (4) annual mean CPUE and (5) single and double trawl. Input data were mean CPUE by vessel, area, month, trawl type and year. The calculations were done using the SAS statistical software (Anon., 1988). The main effects model was represented in logarithmic form:

$$\ln(CPUE_{mjkhi}) = \ln(u) + \ln(A_m) + \ln(S_j) + \ln(V_k) + \ln(G_h) + \ln(Y_i) + e_{mjkhi}$$

here $CPUE_{ijkhi}$ is the mean CPUE for vessel k, fishing in area m in month j and trawl type h during year i (k = 1,...,n; m = 1,...,a; j = 1,...,s; h = 1,2; i = 1,...,y); ln(u) is overall mean ln($CPUE$); A_m is effect of the m^{th} area; S_j is the effect of the j^{th} month; V_k is the effect of the k^{th} vessel; G_h is the effect of trawl type; Y_i is the effect of the i^{th} year; e_{mjki} is the error term assumed to be normally distributed N(0,σ^2/n), where n is the number of observations in the cell. A two levels trawl effect was introduced to account for the effect of twin trawling. The number of hauls was used as weighting factor. The standardised CPUE indices are the antilog of the year coefficient.

For the model pertaining to the Greenlandic zone 126 vessels were included in the analysis. Prior to 2022 only vessels which have fished for a minimum of three years in the area were included. The year*area cross-effect was calculated to give separate indices for the northern and southern areas.

In the Icelandic zone 126 different Icelandic vessels had been registered in the area from 1987 to 2005. Almost no fishery has been conducted in 2005 (21 tons) and there has been no or very little fishery since 2006. The 61 vessels qualifying for the index were collapsed into 18 groups consisting of 1-8 vessels of equal fishing power. The month effect was reduced to 6 levels. No area effect was included. A two levels trawl effect was introduced to account for the effect of twin trawling.

Results and diagnostically output from the GLM run show that data from the Icelandic zone in 2005 was unsuitable to further analyses and therefore not included. This analysis has not been repeated since 2006 (Siegstad and Hvingel 2006).

The index of the area south of 65°N
From this first step of calculations, the biomass index for the areas south of 65°N came directly as the 'year-area south' cross effect of the Greenlandic zone model (see appendix 1).

The combined index of the area north of 65°N
In the second calculation step the biomass index for the areas north of 65°N was derived by combining the year coefficients of the Icelandic zone model and the year effects for the northern areas in the Greenlandic zone model (i.e. the 'year-area north' cross effect, see appendix 1). A Monte Carlo Markov Chain (MCMC) sampling process was used to construct distributions of likelihoods of possible values of the combined index. This was done within the R using the rjags library programming framework in R (version 4.0.5, R Core Team, 2021). The individual CPUE series for the p^{th} fleet, μ_{pi}, was assumed to reflect an overall biomass series, Y_i, and a constant fleet coefficient, v_p, so that:

$$\mu_{pi} = v_p Y_i \exp(e_{pi})$$

The error, e_{pi}, were assumed distributed with mean zero and variance σ_{pi}^2. The error term was assumed that e_{pi}, have variances inversely proportional to the area of fishing ground, a_p, covered by fleet p. The factor, a_p, was taken to be the area of sea bottom between 150-600 m. Hence, σ_{pi}^2 was calculated by:

$$\sigma_{pi}^2 = \frac{cv_{pi}^2}{a_p}$$

Where cv_{pi} is the annual fleet specific coefficient of variation as calculated in the GLM-run. The area weighting factors, a_p, for the Greenlandic area north of 65° and the Icelandic zone were estimated to be 0.9 and 0.1, respectively.

The combined index of the total area
In a similar second calculation step a single combined index of the development of the population biomass in the whole area was derived by aggregating the overall year coefficients from the Greenlandic zone model (appendix 2) and the year coefficients from the Icelandic zone model (Siegstad and Hvingel 2006). This was also done by the method described above using an area-weighting factor of 0.875 for the Greenlandic zone data and thus 0.125 for the Icelandic zone data.

Harvest rate indices

Indices of harvest rate were calculated by dividing total annual catch of the area by the respective standardised CPUE indices.

Results and Discussion

Geographical distribution of the fishery

The fishery was originally conducted north of 65˚N in the Dohrn bank-Strede bank area on both sides of the territorial midline between Greenland and Iceland and on the slopes of Storfjord Deep. In 1993, a fishery was also initiated south of 65°N in various smaller areas extending south to the Cap Farewell. Since 2013, no or very little fishery has been conducted south of 65˚N (Table 2, Fig. 1).

Catch

As the fishery developed, catches increased rapidly to more than 15 000 tons in 1987-88 but declined thereafter to about 9 000 tons in 1992-93 (Fig. 1A, Table 1 and 2). Following the area expansion of the fishery south of 65˚N in 1993 catches increased again reaching 11 900 tons in 1994. From 1994 to 2003 catches fluctuated between 11 500 and 14 000 tons (Fig. 1A). In 2004 the catches started decreasing, from 10 000 tons in 2004 to 49 tons in 2016. The catches have since then increased to 7 466 tons in 2023 and dropped a bit in 2024. Catches were at 5 277 tons in the first half of 2025.

In the northern area the amount caught declined by about 85% from 1988 to 2001, i.e., from 15 000 tons to 2 200 tons (Fig. 1A, Table 2). Catches more than doubled in the period 2002-2004 (Table 2, Fig. 1A). Since 2012 the main part of the fisheries has taken place in the northern area.

Catches in the southern area increased from 1 900 tons in 1993 (the first year of fishery in this area) to about 11 700 tons in 2001 (Fig. 1A). Since then, catches in the area south of 65˚N has been decreasing. No or very little fishing has been conducted in the southern area since 2012.

Fishing effort

The high increase in catches during the first ten-year period (1980s) was mainly driven by increased fishing effort and peaked in 1989 with nearly 120 000 hours (Fig. 1B, Table 2). The total effort gradually decreased and was at 327 hours in 2016, effort has since increase to 10 765 hours in 2024. Effort for the first half of 2025 was 10 154 hours.

The historic development of fishing effort spent in the northern area follows the one described for the total area closely – except for 2001, where a lot of effort shifted to the south.

In the southern areas, effort increased from about 10 000 hours in 1993 to 25 000 hours in 1997. In 1999 it reached a low of 7 500 hours but increased again to 20 000 hours in 2001. Since then, effort in the southern area has been declining and is at a low level (Fig. 1B, Table 2).

Catch rate

Catch rates (total area) decreased from 298 kg/hr to 109 kg/hr in the period 1981-1989 follow by increasing trend until 2009. From 2010 to 2015 unstandardized catch rates have continuously been declining to the lowest value of 117 kg/hr in the latest 2 decades (Fig. 1C, Table 2). Since 2016, the unstandardized catch rates increased considerably to 900 kg/hr in 2022. The unstandardized catch rates have since decrease and was for the first half of 2025 479 kg/hr, which was lower compared to 2024

Unstandardized catch rates in the northern area follow the same trend as the overall figure (Fig. 1C) except for the period 1993 to 2009 when catch rate in the southern area were considerably higher than in the northern area.

In the southern area, unstandardized catch rates increased considerably in the period 1993 to 1999 followed by a general decrease to 2008. The high catch rates observed in the years 2010 to 2012 are based on relatively few hauls.

Standardised catch rate indices

The CPUEs for the southern area in 2011 and from 2013 to 2025 were omitted from the GLMs because of no hauls or very low number of hauls (below 10) conducted.

Results of the two multiplicative models to standardise catch rates showed that all main effects and interaction between YEAR and AREA were highly significant ($p<0.001$). The R-squared of the models for Greenland with and without interaction between Year and areas were 70% and 66%, respectively (see appendix 1 and 2).

The combined CPUE index for the total area (Fig. 2, Table 3) show that the CPUE more than halved during the period 1987-1993. It has since increased, and the mean index values increased until the end of the 1990s and stabilized at a level one third above that of 1987. In the subsequent years, the CPUE index was fluctuating without a trend until 2009, where the index more than doubled compared to 1987. From 2010, the index decreased to a low level in 2014 not seen since the beginning of 1990s. In recent years, the index has increased considerably, except for 2021 where there was a drop likely related to a shift in fishing pattern cause by a late start to the fisheries. Usually, the highest CPUE values are found in the first three months of the year. The CPUE index peaked in 2022 and have since decreased, although it remains above the serial average. Since 2016 the fishing effort has been relatively small and carried out in a relatively small area.

The CPUE index series of the northern areas (Fig. 2, Table 3) is rather similar to that for the total area, except that during the period when the fishing area expands south of 65˚N the CPUE index was at a lower level. The recent years catch rates similarly to index for the total area has been obtained by a relative low fishing effort in a relatively small area.

The CPUE index series of the southern area (Fig. 2, Table 3) increased until 1999 and has since then fluctuated without a trend. No index for the southern area was calculated in 2011 and from 2013 to 2024.

Indices of harvest rate

The standardised effort i.e., the index of harvest rate, have shown a decreasing trend since the mid-1990s for the total area (Table 3, Fig. 3) reaching its lowest levels from 2016 to 2019 and a still at a historic low level. The separate indices for the Northern and Southern areas are also shown in Fig. 3 and they follow the trend seen for the total area. No standardised effort for the southern area was calculated for 2011 and from 2013 to 2024.

Conclusions

Total catches fluctuated around 12 000 tons from 1994 to 2003 (Table 1, Fig. 1A). Catches then decreased to 49 tons in 2016 followed by an increase to 7 466 tons in 2023 and remained at almost the same level in 2024. Catches in the first half of 2025 were 5 277 tons.

The combined CPUE index for the total area (Fig. 2, Table 3) indicated that the catch rate more than halved during the period 1987-1993. In the succeeding years, the catch rate increased until the end of the 1990s, stabilized at a level one third above that of 1987. From the late 1990s the CPUE index has been fluctuating without a clear trend until 2009, where the index more than doubled compared to 1987. The combined index decreased to the lowest level observed in 2015 followed by an increase to the highest index values in the time series in 2022. In 2021 the index value dropped to below the 2019 value. In 2021 the EU fleet commenced fishing in the area later than previous years due licenses being delay, this have impacted the fishing patterns in 2021. The index has been decreasing since 2023, but remains above the average for the whole period.

Since the mid-1990s harvest rate (standardized effort) has decreased, being at historical low level in the last six to seven years. The recent years index values have been based on historical low fishing effort in a relative limited area.

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Table 1. Catch (tons) of shrimp by the fishery in Denmark Strait/off East Greenland from 1978 to July 2025. Values for the fishery in the Greenland EEZ by EU, Faeroe Islands, France, Greenland, and Norway are corrected according to Hvingel 2003.

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
North of 65°N																			
EU (DK,EST,LTU)	-	0	878	727	926	255	554	442	626	703	554	454	476	450	199	138	250	302	26
Faroe Islands	-	0	5296	892	922	554	836	843	910	754	847	738	1029	1265	1355	689	462	931	995
France	-	0	63	442	518	364	626	803	976	1305	616	472	62	148	0	0	0	0	0
Greenland	-	0	250	1256	1395	1835	2815	3248	7232	8396	9304	7408	7580	5283	2496	1771	1326	2390	359
Iceland	363	485	759	125	0	43	742	1794	1150	1330	1431	1326	281	465	1750	2553	1514	1151	566
Norway	-	1001	3079	2522	2372	2161	2662	2566	2535	2586	2561	2601	3052	3146	3102	1831	2180	2402	1544
Total	363	1486	10325	5964	6133	5212	8235	9696	13428	15073	15313	12999	12480	10757	8901	6982	5731	7176	3490
South of 65°N																			
Denmark (EU)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	613	731	1167
Faroe Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	280	974	295	402
Greenland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1141	3603	2667	5295
Norway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	424	1011	720	1590
Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1904	6201	4412	8453
Total area																			
EU (DK,EST,LTU)	-	0	878	727	926	255	554	442	626	703	554	454	476	450	199	198	863	1033	1193
Faroe Islands	-	0	5296	892	922	554	836	843	910	754	847	738	1029	1265	1355	968	1436	1225	1397
France	-	0	63	442	518	364	626	803	976	1305	616	472	62	148	0	0	0	0	0
Greenland	-	0	250	1256	1395	1835	2815	3248	7232	8396	9304	7408	7580	5283	2496	2912	4929	5057	5655
Iceland	363	485	759	125	0	43	742	1794	1150	1330	1431	1326	281	465	1750	2553	1514	1151	566
Norway	-	1001	3079	2522	2372	2161	2662	2566	2535	2586	2561	2601	3052	3146	3102	2255	3190	3122	3133
Total	363	1486	10325	5964	6133	5212	8235	9696	13428	15073	15313	12999	12480	10757	8901	8886	11932	11588	11944
Total all areas	363	1486	10325	5964	6133	5212	8235	9696	13428	15073	15313	12999	12480	10757	8901	8886	11932	11588	11944
Advised TAC	-	-	-	-	4200	4200	4200	5000	-	-	-	100003	100003	100003	8000	5000	5000	5000	5000
Effective TAC[1]	-	-	-	8000	4500	5725	5245	6090	75255	75255	87255	90255	14100	14500	13000	9563	9563	9563	9563

[1]For Greenland zone only; no restrictions in Iceland zone

Table 1 (continued). Catch (tons) of shrimp by the fishery in Denmark Strait/off East Greenland from 1978 to July 2024. Values for the fishery in the Greenland EEZ by EU, Faeroe Islands, France, Greenland, and Norway are corrected according to Hvingel 2003.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
North of 65°N																		
EU (DK,EST,LTU)	85	401	793	459	72	816	861	482	304	618	421	389	892	1345	927	1411	1533	434
Faroe Islands	635	1268	867	956	214	1029	1062	894	615	342	319	612	1325	781	0	0	0	0
France	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
Greenland	105	646	614	115	650	638	695	578	454	223	802	14	844	426	183	481	170	175
Iceland	2856	1421	769	132	10	1231	703	411	29	0	0	0	0	0	0	0	0	0
Norway	797	1628	1783	2759	1291	1630	2861	2700	2613	2704	1771	1514	883	770	36	2	0	0
Total	4478	5364	4827	4420	2237	5344	6183	5065	4015	3887	3313	2529	3945	3323	1145	1893	1703	609
South of 65°N																		
Denmark (EU)	1657	1300	1095	1900	2473	2309	1827	1022	644	683	431	251	28	101	0	0	0	0
Faroe Island	656	138	453	340	2402	1013	303	255	176	227	169	14	28	0	0	0	0	0
Greenland	4701	3950	4966	5235	4943	4333	4194	3488	2737	316	638	0	447	178	53	215	3	0
Norway	2261	670	378	157	1855	1098	197	186	180	76	48	0	107	0	0	0	0	0
Total	9276	6057	6893	7632	11674	5985	6522	4951	3737	1302	1286	266	610	279	53	215	3	0
Total area																		
EU (DK,EST,LTU)	1742	1701	1888	2358	2545	2548	2688	1504	948	1301	852	640	920	1446	927	1411	1533	434
Faroe Islands	1292	1406	1321	1296	2616	1322	1365	1149	791	569	488	627	1354	782	0	0	0	0
France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Greenland	4806	4595	5581	5349	5593	4484	4890	4066	3191	539	1440	14	1292	605	236	696	173	175
Iceland	2856	1421	769	132	10	1231	703	411	29	0	0	0	0	0	0	0	0	0
Norway	3059	2298	2160	2917	3147	1743	3059	2886	2793	2780	1819	1514	990	770	36	2	0	0
Total	13754	11422	11719	12053	13911	11329	12705	10016	7752	5189	4599	2794	4555	3602	1199	2109	1706	609
Total all areas	13754	11422	11719	12053	13911	11242	12637	9985	7752	5189	4599	2794	4555	3602	1199	2109	1706	609
Advised TAC	5000	5000	9600	9600	9600	9600	9600	12400	12400	12400	12400	12400	12400	12400	12400	12400	12400	2000
Effective TAC[1]	9563	9563	10600	12600	10600	10600	10600	15043	12400	12400	12400	12400	12835	11835	12400	12400	12400	8300

[1]For Greenland zone only; no restrictions in Iceland zone

Table 1 (continued). Catch (tons) of shrimp by the fishery in Denmark Strait/off East Greenland from 1978 to July 2024. Values for the fishery in the Greenland EEZ by EU, Faeroe Islands, France, Greenland, and Norway are corrected according to Hvingel 2003.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025[2]
North of 65°N											
EU (DK,EST,LTU)	402	49	178	547	1009	2059	2050	3343	2773	2709	1867
Faroe Islands	0	0	0	0	267	1113	59	0	0	0	0
France	-	-	-	-	-	-	-	-	-	-	-
Greenland	174	0	383	0	298	0	958	833	2921	2925	1746
Iceland	0	0	0	0	0	0	0	0	0	0	0
Norway	0	0	0	0	0	0	0	1347	1772	1693	1660
Total	576	49	561	547	1574	3172	3067	5523	7466	7327	5274
South of 65°N											
Denmark (EU)	0	0	0	0	2	0	0	0	0	0	0
Faroe Island	0	0	0	0	0	0	0	0	0	0	0
Greenland	0	0	0	0	0	0	0	0	0	0	3
Norway	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	2	0	0	0	0	0	3
Total area											
EU (DK,EST,LTU, GBR)	402	49	178	547	1011	2059	2050	3343	2773	2709	1867
Faroe Islands	0	0	0	0	267	1113	59	0	0	0	0
France	0	0	0	0	0	0	0	0	0	0	0
Greenland	174	0	383	0	298	0	958	833	2921	2925	1749
Iceland	0	0	0	0	0	0	0	0	0	0	0
Norway	0	0	0	0	0	0	0	1347	1772	1693	1660
Total	576	49	561	547	1576	3172	3067	5523	7466	7327[3]	5277[3]
Total all areas	576	49	561	547	1576	3172	3067	5523	7466	7327	5277
Advised TAC	2000	2000	2000	2000	2000	2000	3000	3000	2000	2500	1000
Effective TAC[1]	6100	5300	5300	4300	3384	4750	7000	6850	6850	7850	7550

[1]For Greenland zone only; no restrictions in Iceland zone

[2]Catch until June 30th

[3]Logbboks from one foreign vessel in 2024 and two vessels in 2025 were not available at the time of this analysis. Total catches have been provided by GFLK and are included in this table.

Table 2. Catch (tons), effort (hrs) and unstandardized Catch-Per-Unit-Effort (kg/hr) by trawlers fishing in Denmark Strait / off East Greenland in areas north and south of 65°N and total area. Logbooks from one foreign vessel in 2024 and two vessels in 2025 were not available, catches are included, but data on CPUE and Effort were not available.

	Area north			Area south			Total area		
Year	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1980	10325	37198	278				10325	37198	278
1981	5964	19986	298				5964	19986	298
1982	6133	23081	266				6133	23081	266
1983	5212	23855	219				5212	23855	219
1984	8235	34983	235				8235	34983	235
1985	9696	62911	154				9696	62911	154
1986	13428	61863	217				13428	61863	217
1987	15073	79881	189				15073	79881	189
1988	15313	109455	140				15313	109455	140
1989	12999	119629	109				12999	119629	109
1990	12480	72736	172				12480	72736	172
1991	10757	78714	137				10757	78714	137
1992	8901	68349	130				8901	68349	130
1993	6982	52381	133	1904	9335	204	8886	61003	146
1994	5731	31417	182	6201	18371	338	11932	49428	241
1995	7176	33953	211	4412	13157	335	11588	46927	247
1996	3490	27029	129	8453	24589	344	11944	51049	234
1997	4478	22175	202	9276	25992	357	13754	47519	289
1998	5364	20881	257	6057	10498	577	11422	31205	366
1999	4827	19388	249	6893	7449	925	11719	25742	455
2000	4420	17474	253	7632	10705	713	12053	28096	429
2001	2237	9822	228	11674	20435	571	13911	29933	465
2002	5344	20052	267	5985	8546	700	11329	22843	496
2003	6183	18053	342	6522	9317	700	12705	25295	502
2004	5065	15848	320	4951	8972	552	10016	27450	365
2005	4015	11249	357	3737	8003	467	7752	19255	403
2006	3887	10414	373	1302	2436	534	5189	12851	404
2007	3313	8976	369	1286	1974	651	4599	10949	420
2008	2529	6106	414	266	585	454	2794	6691	418
2009	3945	6500	607	610	617	989	4555	7117	640
2010	3323	10286	323	280	263	1062	3602	10550	341
2011	1145	3301	347	53	25	2136	1199	3326	360
2012	1893	6343	298	215	170	1267	2109	6513	324
2013	1714	8162	210	3	75	45	1717	8235	208
2014	622	4364	142	0	-	-	622	4374	142
2015	576	4573	126	0	-	-	576	4905	117
2016	49	327	150	0	-	-	49	327	150
2017	561	1633	344	0	-	-	561	1633	344
2018	547	1132	483	0	-	-	547	1132	483
2019	1574	1999	787	2	7	286	1576	2006	786
2020	3172	3727	851	0	10	20	3172	3737	849
2021	3067	4580	670	0	9	44	3067	4589	668
2022	5523	6132	901	0	1	0	5523	6133	900
2023	7466	9266	806	0	2	0	7466	9267	806
2024	7327	10765	660	0	0	0	7327	10765	660
2025*	5274	10139	480	3	15	200	5277	10154	479

*until June 30th

Table 3. Means and standard errors (se) of standardised CPUE and effort index values based on logbook information from trawlers fishing in Denmark Strait/off East Greenland in areas north and south of 65°N and total area. Logbooks from one foreign vessel in 2024 and two vessels in 2025 were not available, catches are included, but data on CPUE and Effort were not available.

	Area north				Area south				Total			
	Std.CPUE		Std. Effort		Std.CPUE		Std. Effort		Std.CPUE		Std. Effort	
Year	mean	se	mean	se	mean	se	mean	se	mean	se	mean	se
1987	1.00	-	1.00	-					1.00	-	1.00	-
1988	0.95	0.09	1.07	0.10					1.00	0.10	1.02	0.10
1989	0.67	0.06	1.28	0.12					0.68	0.07	1.27	0.13
1990	0.80	0.08	1.04	0.10					0.82	0.08	1.02	0.10
1991	0.69	0.07	1.03	0.10					0.71	0.07	1.01	0.10
1992	0.55	0.05	1.07	0.11					0.56	0.06	1.05	0.11
1993	0.45	0.05	1.03	0.10	1.00	-	1.00	-	0.54	0.06	1.10	0.12
1994	1.05	0.12	0.36	0.04	2.27	0.08	1.43	0.14	1.50	0.16	0.53	0.06
1995	0.88	0.09	0.54	0.06	1.91	0.09	1.22	0.11	1.18	0.13	0.65	0.07
1996	0.78	0.09	0.30	0.03	2.64	0.08	1.68	0.11	1.49	0.16	0.53	0.06
1997	1.06	0.14	0.28	0.04	2.54	0.08	1.92	0.13	1.81	0.20	0.50	0.06
1998	1.35	0.17	0.26	0.03	2.87	0.09	1.11	0.16	1.90	0.22	0.40	0.05
1999	1.16	0.15	0.28	0.04	3.73	0.11	0.97	0.10	2.13	0.25	0.37	0.04
2000	1.42	0.17	0.21	0.02	3.70	0.09	1.08	0.11	2.26	0.26	0.35	0.04
2001	1.25	0.18	0.12	0.02	2.74	0.08	2.24	0.10	2.24	0.26	0.41	0.05
2002	1.30	0.17	0.27	0.04	3.33	0.09	0.94	0.18	2.53	0.29	0.30	0.03
2003	1.19	0.14	0.35	0.04	2.85	0.09	1.20	0.08	1.93	0.22	0.44	0.05
2004	1.38	0.16	0.24	0.03	2.20	0.11	1.18	0.11	1.74	0.20	0.38	0.04
2005	1.30	0.16	0.20	0.02	2.81	0.11	0.70	0.13	1.95	0.24	0.26	0.03
2006	1.46	0.19	0.18	0.02	2.65	0.13	0.26	0.08	1.94	0.25	0.18	0.02
2007	1.26	0.16	0.17	0.02	2.94	0.15	0.23	0.03	1.66	0.21	0.18	0.02
2008	1.60	0.22	0.10	0.01	1.83	0.25	0.08	0.03	1.94	0.28	0.10	0.01
2009	2.33	0.31	0.11	0.01	3.53	0.23	0.09	0.02	2.71	0.37	0.11	0.02
2010	1.23	0.15	0.18	0.02	2.85	0.34	0.05	0.02	1.48	0.19	0.16	0.02
2011	1.35	0.21	0.06	0.01	-	-	-	-	1.58	0.26	0.05	0.01
2012	1.10	0.15	0.11	0.02	3.44	0.36	0.03	0.00	1.37	0.20	0.10	0.01
2013	0.73	0.09	0.16	0.02	-	-	-	-	0.92	0.13	0.12	0.02
2014	0.53	0.08	0.08	0.01	-	-	-	-	0.71	0.11	0.06	0.01
2015	0.49	0.08	0.08	0.01	-	-	-	-	0.64	0.11	0.06	0.01
2016	0.57	0.24	0.006	0.002	-	-	-	-	0.79	0.37	0.00	0.002
2017	1.01	0.21	0.037	0.008	-	-	-	-	1.15	0.27	0.03	0.01
2018	1.75	0.38	0.021	0.005	-	-	-	-	2.12	0.51	0.02	0.004
2019	2.93	0.53	0.036	0.006	-	-	-	-	3.35	0.66	0.03	0.006
2020	3.18	0.47	0.066	0.010	-	-	-	-	3.92	0.62	0.05	0.009
2021	2.47	0.40	0.082	0.013	-	-	-	-	3.01	0.52	0.07	0.012
2022	3.15	0.44	0.116	0.016	-	-	-	-	3.87	0.58	0.09	0.014
2023	2.54	0.35	0.195	0.027	-	-	-	-	3.13	0.47	0.16	0.024
2024	2.09	0.29	0.233	0.032	-	-	-	-	2.61	0.38	0.19	0.027
2025	1.52	0.22	0.230	0.032	-	-	-	-	1.88	0.28	0.13	0.020

* Until July

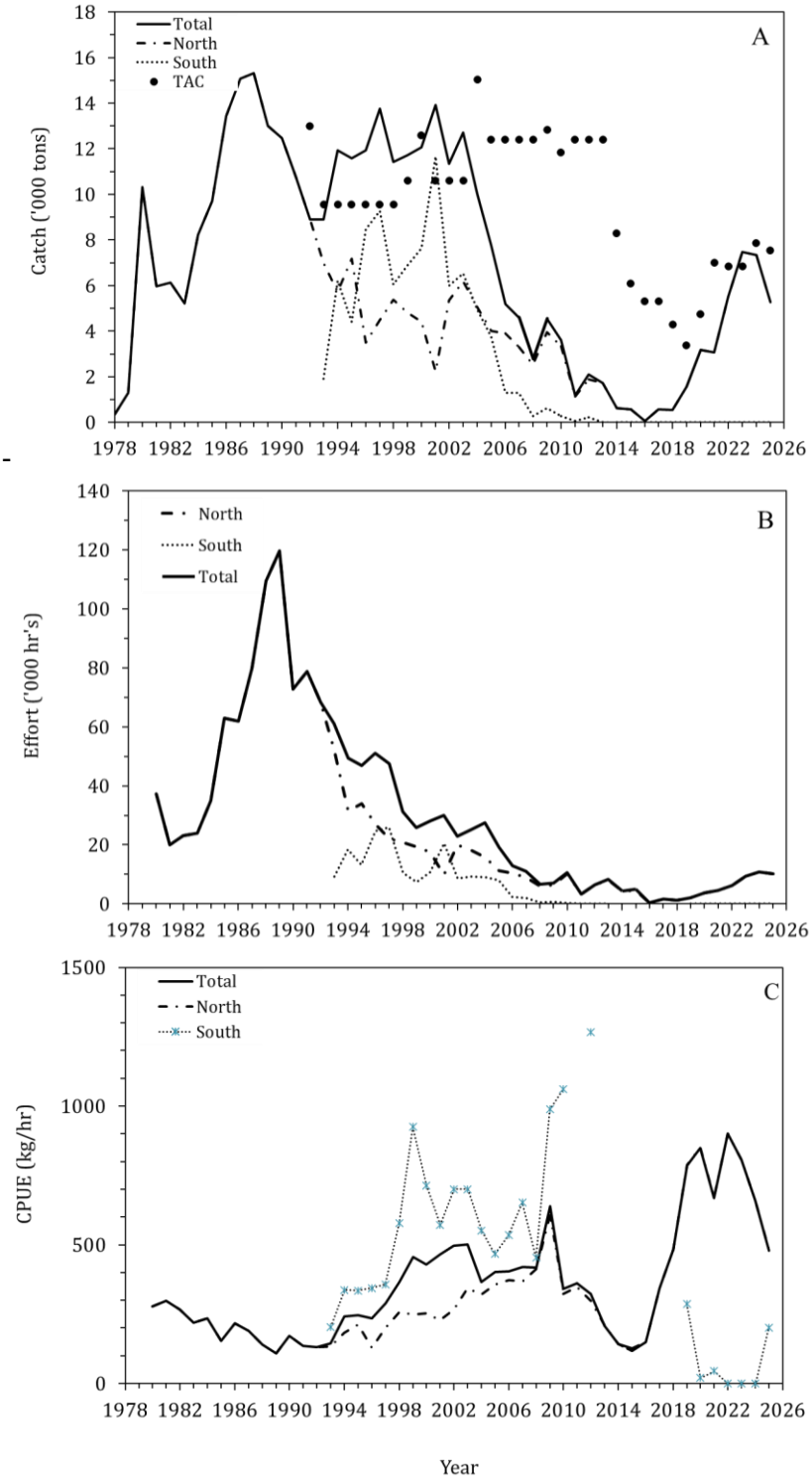

Figure 1. Catch (A), fishing effort (B) and catch-per-unit-effort (C) by shrimp trawlers fishing in Denmark Strait/off East Greenland. Series are given for the areas north and south of 65°N and overall. (Data for 2025 is part-years data, until June 30th). Catch (A) include all catches, effort and CPUE are based on available logbooks. Logbooks from one foreign vessel in 2024 and two foreign vessels in 2025 were not available at the time of the analysis, catch are included in the catch figure but no information on CPUE and effort where available.

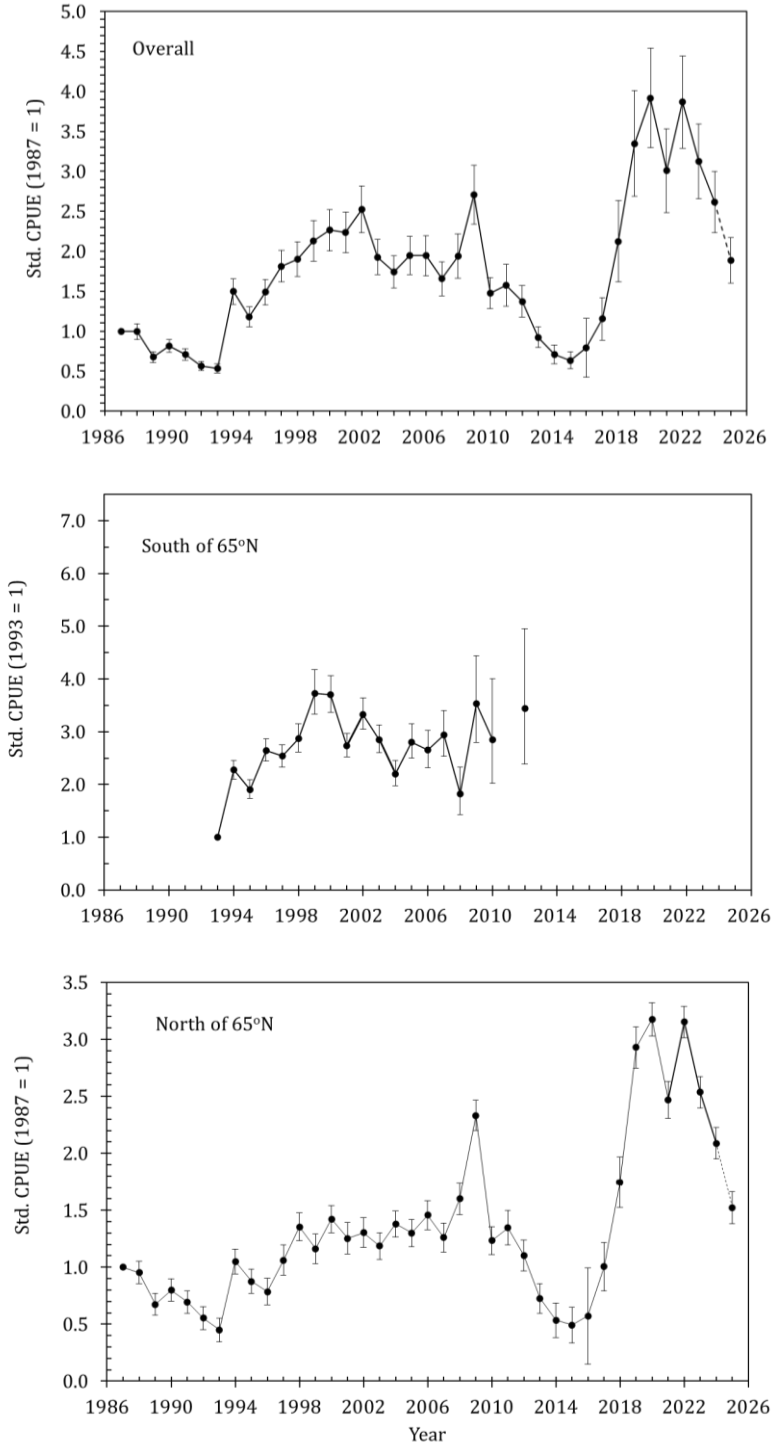

Figure 2. Standardized Catch-Per-Unit-Effort indices of the shrimp fishery in Denmark Strait and off East Greenland in the areas south of 65°N, overall fishery north of 65°N (both in Greenland and Iceland EEZ), and overall standardized CPUE for the stock (Estimates for 2025 are based on data until June 30th). No index for the southern area has been calculated since 2012 due to a low number of hauls (less than 10 each year).

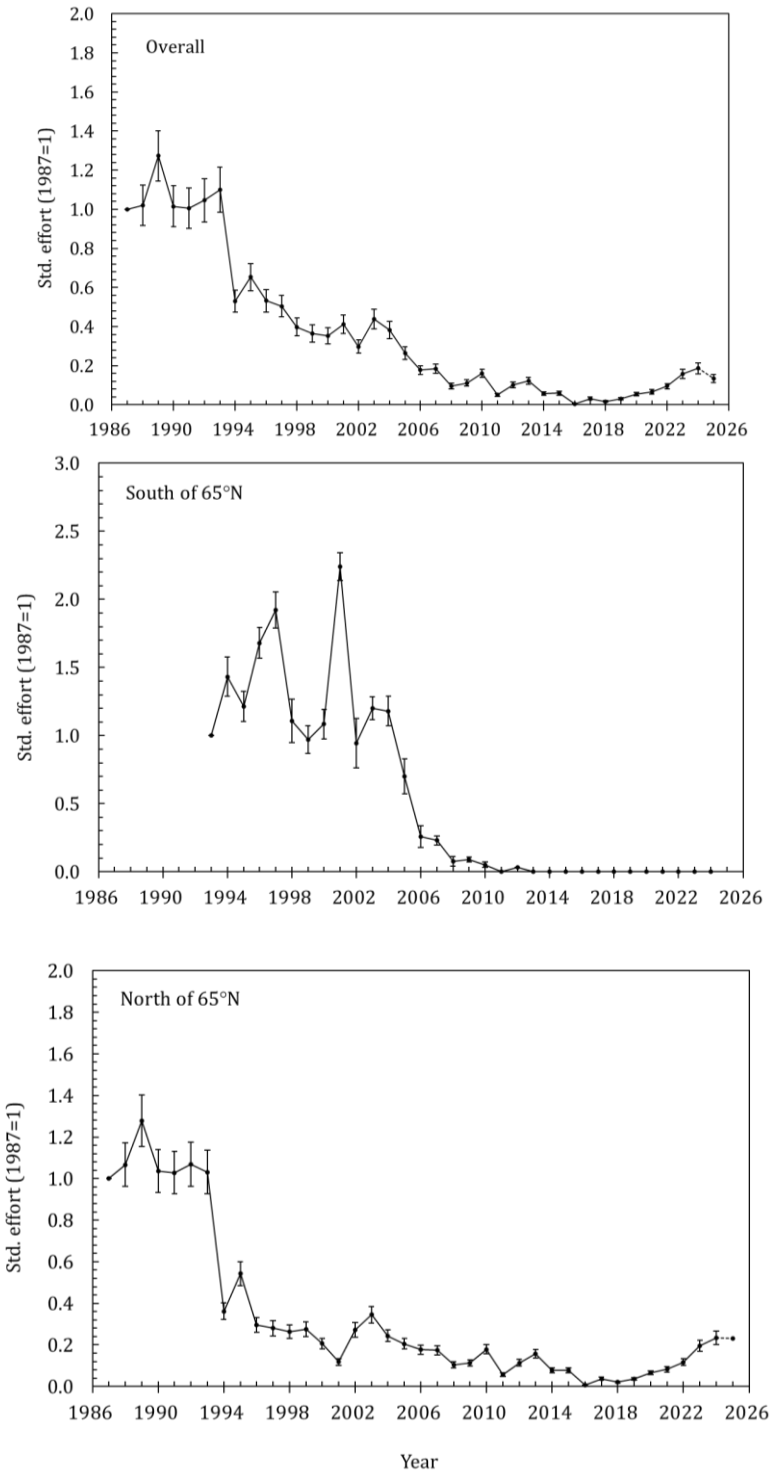

Figure 3. Standardised effort indices of the shrimp fishery in Denmark Strait and off East Greenland in the areas north of 65°N, south of 65°N and overall (Estimates for 2025 are based on data until June 30th).

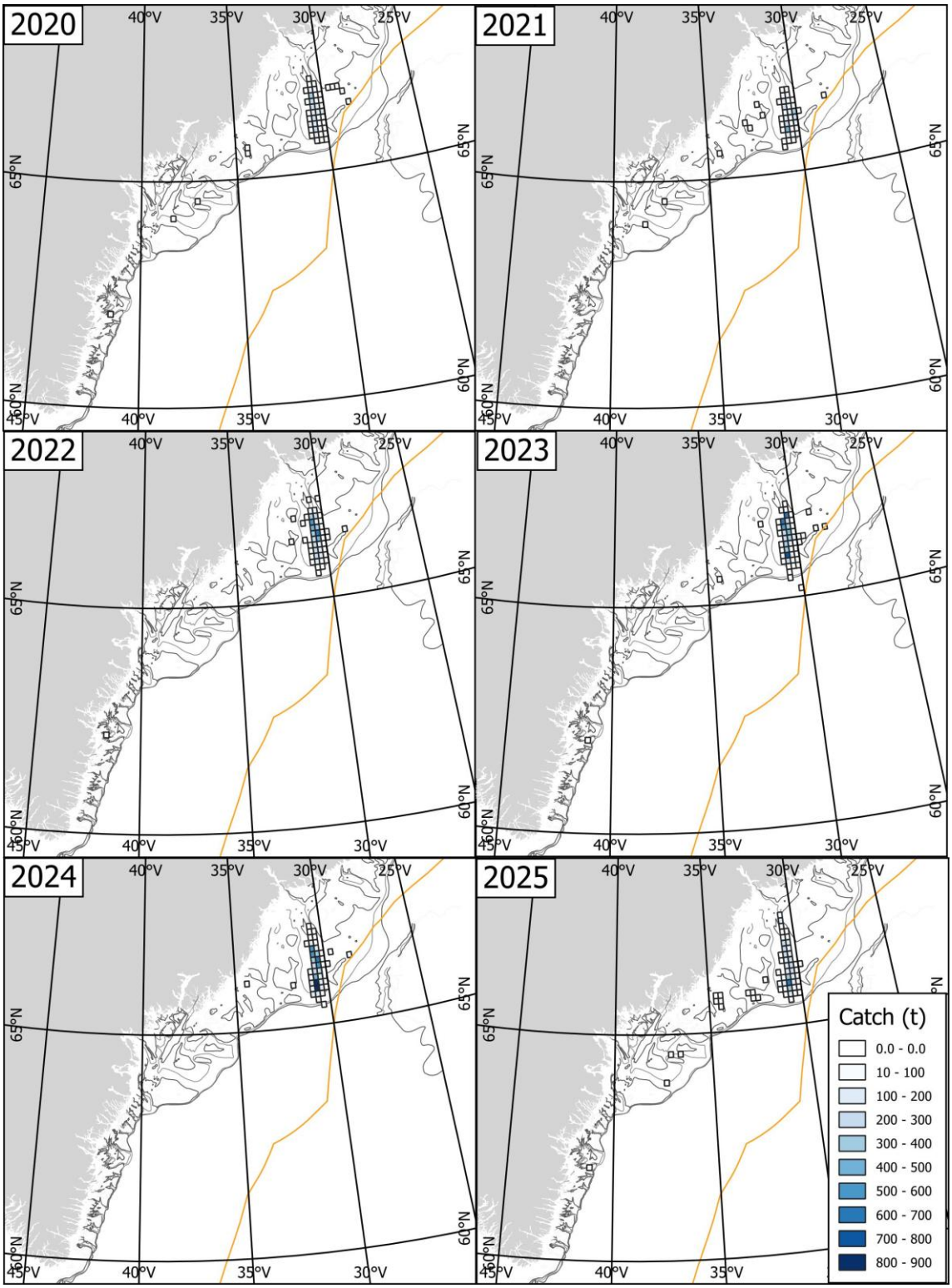

Figure 4a. Thematic mapping of different levels of catch in the shrimp fishery in Denmark Strait/off East Greenland 2020-2025 (2025 until July. 2024 does not including data for one foreign vessels and 2025 does not include data from two foreign vessels). Grey lines show depths of 200, 300, 400 and 600 m. Yellow line shows EEZ boundary.

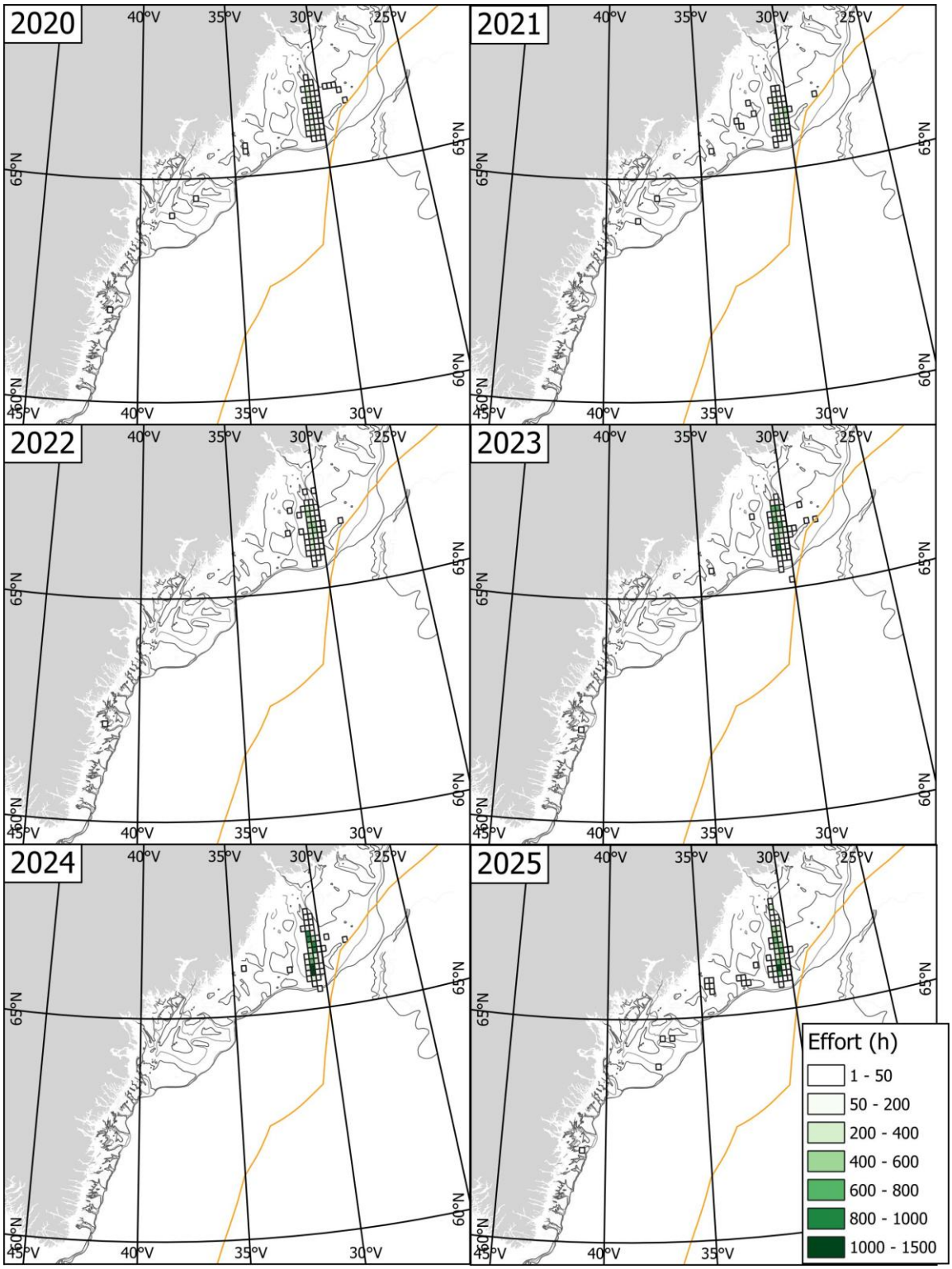

Figure 4b. Thematic mapping of different levels of effort in the shrimp fishery in Denmark Strait/off East Greenland 2020-2025 (2025 until July. 2024 does not including data for one foreign vessels and 2025 does not include data from two foreign vessels). Grey lines show depths of 200, 300, 400 and 600 m. Yellow line shows EEZ boundary.

Appendix 1. Results and diagnostical outputs from GLM run of model for standardising CPUE in the Greenlandic zone including the area effect. Data from Greenlandic, Faeroese, Norway and EU vessels.

The SAS System

The GLM Procedure

Class Level Information

Class	Levels	Values
BAAD	117	E001 E002 E003 E004 E005 E006 E007 E008 E009 E010 E011 E012 E013 E014 E015 E017 E018 E019 E020 E021 E022 E023 E024 E025 E026 E027 E028 E029 E030 E031 E032 E033 E034 E035 E036 E037 E038 E039 E040 E041 E042 E043 E044 E045 E046 E047 E048 E049 E050 E051 E052 E053 E054 E055 E056 E057 E058 E059 E060 E061 E062 E063 E064 E065 E066 E067 E068 E069 E070 E071 E072 E073 E074 E075 E076 E077 E078 E079 E080 E081 E082 E083 E085 E086 E087 E088 E089 E090 E091 E092 E093 E094 E096 E099 E100 E101 E102 E103 E104 E105 E106 E10 7 E1 08 E109 E110 E113 E114 E116 E117 E118 E119 E121 E122 E123 E124 E125 E126
YEAR	39	1987 1988 1989 1990 1991 1992 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 9999
MONTH	12	1 2 3 4 5 6 7 8 9 10 11 12
AREA	2	21 22
X	2	2 9

Number of Observations Read	3712
Number of Observations Used	3712

The SAS System

The GLM Procedure

Dependent Variable: LNCPUE

Weight: Hauls

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	185	63363.26001	342.50411	45.37	<.0001
Error	3526	26620.75584	7.54985		
Corrected Total	3711	89984.01585			

R-Square	Coeff Var	Root MSE	LNCPUE Mean
0.704161	211.3605	2.747698	1.300006

Source	DF	Type I SS	Mean Square	F Value	Pr > F
BAAD	116	39008.35042	336.27888	44.54	<.0001
YEAR*AREA	57	19571.36544	343.35729	45.48	<.0001
MONTH	11	4747.27861	431.57078	57.16	<.0001
AREA	0	0.00000	.	.	.
X	1	36.26553	36.26553	4.80	0.0285

Source	DF	Type III SS	Mean Square	F Value	Pr > F
BAAD	116	10386.66211	89.54019	11.86	<.0001
YEAR*AREA	56	13866.26157	247.61181	32.80	<.0001
MONTH	11	4738.00790	430.72799	57.05	<.0001
AREA	1	1101.01366	1101.01366	145.83	<.0001
X	1	36.26553	36.26553	4.80	0.0285

Parameter	Estimate		Standard Error	t Value	Pr > |t|
Intercept	1.231628154	B	0.49240349	2.50	0.0124
BAAD E001	-1.202469356	B	0.50635895	-2.37	0.0176
BAAD E002	-1.125988308	B	0.50763859	-2.22	0.0266
BAAD E003	-1.088342998	B	0.49351821	-2.21	0.0275
BAAD E004	-1.141784286	B	0.50461249	-2.26	0.0237
BAAD E005	-1.170884750	B	0.50658926	-2.31	0.0209
BAAD E006	-0.833414774	B	0.50226058	-1.66	0.0971
BAAD E007	-1.016764343	B	0.50068242	-2.03	0.0424
BAAD E008	-0.835153472	B	0.49473026	-1.69	0.0915
BAAD E009	-0.759044770	B	0.50273524	-1.51	0.1312
BAAD E010	-1.030910831	B	0.49095038	-2.10	0.0358

Parameter	Estimate		Standard Error	t Value	Pr > |t|
BAAD E011	-1.030492039	B	0.49471389	-2.08	0.0373
BAAD E012	-0.854218898	B	0.53590013	-1.59	0.1110
BAAD E013	-0.978172805	B	0.50577266	-1.93	0.0532
BAAD E014	-0.918605072	B	0.49211894	-1.87	0.0620
BAAD E015	-0.944606170	B	0.49374000	-1.91	0.0558
BAAD E017	-0.789476960	B	0.49579234	-1.59	0.1114
BAAD E018	-0.866945926	B	0.49482013	-1.75	0.0799
BAAD E019	-0.766035251	B	0.51605601	-1.48	0.1378
BAAD E020	-0.920080436	B	0.50480696	-1.82	0.0684
BAAD E021	-0.502607727	B	0.49963749	-1.01	0.3145
BAAD E022	-0.866825749	B	0.49293953	-1.76	0.0788
BAAD E023	-0.680159660	B	0.52093039	-1.31	0.1918
BAAD E024	-0.736973236	B	0.48965683	-1.51	0.1324
BAAD E025	-0.472929264	B	0.49762901	-0.95	0.3420
BAAD E026	-0.487346942	B	0.50409721	-0.97	0.3337
BAAD E027	-0.668944939	B	0.49063808	-1.36	0.1728
BAAD E028	-0.810711673	B	0.50867634	-1.59	0.1111
BAAD E029	-0.776719014	B	0.49383356	-1.57	0.1158
BAAD E030	-0.735290549	B	0.49429996	-1.49	0.1370
BAAD E031	-0.687640164	B	0.49050348	-1.40	0.1610
BAAD E032	-0.676022505	B	0.49170898	-1.37	0.1693
BAAD E033	-0.684701145	B	0.62279203	-1.10	0.2717
BAAD E034	-0.708235195	B	0.50233038	-1.41	0.1587
BAAD E035	-0.159424588	B	0.49469322	-0.32	0.7473
BAAD E036	-0.507756717	B	0.51260064	-0.99	0.3220
BAAD E037	-0.644413204	B	0.49150196	-1.31	0.1899
BAAD E038	-0.434635553	B	0.49535848	-0.88	0.3803
BAAD E039	-0.343280607	B	0.49290894	-0.70	0.4862
BAAD E040	-0.307664124	B	0.49232213	-0.62	0.5321
BAAD E041	-0.424980602	B	0.49730902	-0.85	0.3929
BAAD E042	-0.383966132	B	0.49248533	-0.78	0.4356
BAAD E043	-0.541341586	B	0.49024721	-1.10	0.2696
BAAD E044	-0.473725448	B	0.48885571	-0.97	0.3326
BAAD E045	-0.538643732	B	0.49663342	-1.08	0.2782
BAAD E046	-0.571251217	B	0.49324579	-1.16	0.2469
BAAD E047	-0.518597285	B	0.49132625	-1.06	0.2913
BAAD E048	-0.508063691	B	0.49075716	-1.04	0.3006

Parameter	Estimate		Standard Error	t Value	Pr > |t|
BAAD E049	-0.601374280	B	0.48999234	-1.23	0.2198
BAAD E050	-0.273050376	B	0.49413193	-0.55	0.5806
BAAD E051	-0.527656318	B	0.49196552	-1.07	0.2835
BAAD E052	-0.491177927	B	0.49311017	-1.00	0.3193
BAAD E053	-0.417885450	B	0.50413167	-0.83	0.4072
BAAD E054	-0.501640652	B	0.49163130	-1.02	0.3076
BAAD E055	-0.291067694	B	0.49563719	-0.59	0.5571
BAAD E056	-0.137358585	B	0.48817050	-0.28	0.7784
BAAD E057	-0.415038976	B	0.49457734	-0.84	0.4014
BAAD E058	-0.350642528	B	0.50673596	-0.69	0.4890
BAAD E059	-0.162483412	B	0.51657480	-0.31	0.7531
BAAD E060	-0.314192311	B	0.49140686	-0.64	0.5226
BAAD E061	-0.263382111	B	0.48723709	-0.54	0.5888
BAAD E062	-0.356696248	B	0.49066862	-0.73	0.4673
BAAD E063	-0.296927000	B	0.49588039	-0.60	0.5494
BAAD E064	-0.294772566	B	0.49191952	-0.60	0.5491
BAAD E065	-0.326883387	B	0.49986555	-0.65	0.5132
BAAD E066	-0.407387001	B	0.50625253	-0.80	0.4210
BAAD E067	-0.991470079	B	0.62433228	-1.59	0.1124
BAAD E068	-0.359597481	B	0.50018041	-0.72	0.4722
BAAD E069	-0.239423392	B	0.49111560	-0.49	0.6259
BAAD E070	-0.142470813	B	0.48928108	-0.29	0.7709
BAAD E071	-0.193494661	B	0.48946010	-0.40	0.6926
BAAD E072	-0.238738616	B	0.49508211	-0.48	0.6297
BAAD E073	-0.335521301	B	0.50045240	-0.67	0.5026
BAAD E074	-0.182966771	B	0.49082659	-0.37	0.7093
BAAD E075	-0.093520718	B	0.49288923	-0.19	0.8495
BAAD E076	-0.196294521	B	0.49240595	-0.40	0.6902
BAAD E077	-0.080332719	B	0.50051253	-0.16	0.8725
BAAD E078	-0.076384192	B	0.49024039	-0.16	0.8762
BAAD E079	0.095874285	B	0.51699386	0.19	0.8529
BAAD E080	-0.143275639	B	0.49971493	-0.29	0.7743
BAAD E081	-0.036232508	B	0.49426568	-0.07	0.9416
BAAD E082	0.009519458	B	0.52346284	0.02	0.9855
BAAD E083	0.025023661	B	0.50115827	0.05	0.9602
BAAD E085	-0.928549305	B	0.50775308	-1.83	0.0675
BAAD E086	-0.470392545	B	0.54340419	-0.87	0.3867

Parameter	Estimate		Standard Error	t Value	Pr > |t|
BAAD E087	-0.089646928	B	0.52760877	-0.17	0.8651
BAAD E088	-1.123304693	B	0.54017492	-2.08	0.0376
BAAD E089	-1.123535519	B	0.52089242	-2.16	0.0311
BAAD E090	-0.887336852	B	0.55175585	-1.61	0.1079
BAAD E091	-0.944281177	B	0.56688933	-1.67	0.0959
BAAD E092	-1.237909407	B	0.54621512	-2.27	0.0235
BAAD E093	-1.827276777	B	0.72293001	-2.53	0.0115
BAAD E094	-0.787714353	B	0.53610952	-1.47	0.1418
BAAD E096	-0.811607518	B	0.51435989	-1.58	0.1147
BAAD E099	-1.332599532	B	0.52481208	-2.54	0.0112
BAAD E100	-0.737132766	B	0.88355637	-0.83	0.4042
BAAD E101	-0.287842484	B	0.52217980	-0.55	0.5815
BAAD E102	0.101922917	B	0.52430331	0.19	0.8459
BAAD E103	-0.345242822	B	0.52590348	-0.66	0.5116
BAAD E104	-0.632123219	B	0.52310190	-1.21	0.2270
BAAD E105	-0.358098812	B	0.57599873	-0.62	0.5342
BAAD E106	-0.893020526	B	0.59155693	-1.51	0.1312
BAAD E107	-0.677751924	B	0.55351294	-1.22	0.2209
BAAD E108	-1.142341034	B	0.51869721	-2.20	0.0277
BAAD E109	0.518038949	B	0.53582120	0.97	0.3337
BAAD E110	-0.552197609	B	0.52213183	-1.06	0.2903
BAAD E113	-0.882996674	B	0.60472449	-1.46	0.1443
BAAD E114	-0.320754456	B	0.52328256	-0.61	0.5399
BAAD E116	-1.104061368	B	1.66068142	-0.66	0.5062
BAAD E117	0.930898670	B	1.08938664	0.85	0.3929
BAAD E118	-1.327616311	B	0.56621896	-2.34	0.0191
BAAD E119	-1.359524463	B	0.55242077	-2.46	0.0139
BAAD E121	0.102665776	B	0.50028694	0.21	0.8374
BAAD E122	-0.151805670	B	0.50242786	-0.30	0.7626
BAAD E123	0.066224260	B	0.51210111	0.13	0.8971
BAAD E124	0.046107083	B	0.58508495	0.08	0.9372
BAAD E125	-0.065677395	B	0.69314139	-0.09	0.9245
BAAD E126	0.000000000	B	.	.	.
YEAR*AREA 1987 21	0.482526650	B	0.07374231	6.54	<.0001
YEAR*AREA 1988 21	0.288781917	B	0.06950499	4.15	<.0001
YEAR*AREA 1989 21	-0.097255651	B	0.06797108	-1.43	0.1526
YEAR*AREA 1990 21	0.092399540	B	0.06805411	1.36	0.1746

Parameter	Estimate		Standard Error	t Value	Pr > |t|
YEAR*AREA 1991 21	-0.083233369	B	0.06641799	-1.25	0.2102
YEAR*AREA 1992 21	-0.309599967	B	0.06901375	-4.49	<.0001
YEAR*AREA 1994 21	0.347146612	B	0.08486010	4.09	<.0001
YEAR*AREA 1994 22	0.821558626	B	0.07730340	10.63	<.0001
YEAR*AREA 1995 21	0.170350694	B	0.07662785	2.22	0.0263
YEAR*AREA 1995 22	0.644979154	B	0.09329954	6.91	<.0001
YEAR*AREA 1996 21	0.064614961	B	0.09201269	0.70	0.4826
YEAR*AREA 1996 22	0.972002060	B	0.07901493	12.30	<.0001
YEAR*AREA 1997 21	0.422194291	B	0.11771999	3.59	0.0003
YEAR*AREA 1997 22	0.930503181	B	0.08257894	11.27	<.0001
YEAR*AREA 1998 21	0.749591451	B	0.10525684	7.12	<.0001
YEAR*AREA 1998 22	1.053759863	B	0.09287214	11.35	<.0001
YEAR*AREA 1999 21	0.535778588	B	0.10888226	4.92	<.0001
YEAR*AREA 1999 22	1.316716771	B	0.11270319	11.68	<.0001
YEAR*AREA 2000 21	0.682338439	B	0.09196315	7.42	<.0001
YEAR*AREA 2000 22	1.308121863	B	0.09319922	14.04	<.0001
YEAR*AREA 2001 21	0.535732390	B	0.11400063	4.70	<.0001
YEAR*AREA 2001 22	1.006414473	B	0.08064018	12.48	<.0001
YEAR*AREA 2002 21	0.531368434	B	0.11331925	4.69	<.0001
YEAR*AREA 2002 22	1.203799944	B	0.08883368	13.55	<.0001
YEAR*AREA 2003 21	0.501590843	B	0.09102115	5.51	<.0001
YEAR*AREA 2003 22	1.048217488	B	0.09084021	11.54	<.0001
YEAR*AREA 2004 21	0.649804059	B	0.08632839	7.53	<.0001
YEAR*AREA 2004 22	0.790085092	B	0.10861885	7.27	<.0001
YEAR*AREA 2005 21	0.568073203	B	0.09285762	6.12	<.0001
YEAR*AREA 2005 22	1.032393799	B	0.11383522	9.07	<.0001
YEAR*AREA 2006 21	0.680803159	B	0.09855315	6.91	<.0001
YEAR*AREA 2006 22	0.975748947	B	0.13285442	7.34	<.0001
YEAR*AREA 2007 21	0.534713811	B	0.09832342	5.44	<.0001
YEAR*AREA 2007 22	1.076905382	B	0.14641814	7.35	<.0001
YEAR*AREA 2008 21	0.769105962	B	0.11107444	6.92	<.0001
YEAR*AREA 2008 22	0.602142528	B	0.24554765	2.45	0.0142
YEAR*AREA 2009 21	1.148446645	B	0.10360747	11.08	<.0001
YEAR*AREA 2009 22	1.260612690	B	0.22992601	5.48	<.0001
YEAR*AREA 2010 21	0.513751649	B	0.09465018	5.43	<.0001
YEAR*AREA 2010 22	1.046974779	B	0.34057627	3.07	0.0021
YEAR*AREA 2011 21	0.590841260	B	0.12834950	4.60	<.0001

Parameter	Estimate		Standard Error	t Value	Pr > |t|
YEAR*AREA 2012 21	0.397563048	B	0.10919022	3.64	0.0003
YEAR*AREA 2012 22	1.235405865	B	0.36431792	3.39	0.0007
YEAR*AREA 2013 21	-0.018934584	B	0.10343030	-0.18	0.8548
YEAR*AREA 2014 21	-0.332147235	B	0.12639836	-2.63	0.0086
YEAR*AREA 2015 21	-0.416614573	B	0.13086199	-3.18	0.0015
YEAR*AREA 2016 21	-0.477408306	B	0.37773411	-1.26	0.2064
YEAR*AREA 2017 21	0.267026367	B	0.18873083	1.41	0.1572
YEAR*AREA 2018 21	0.815634019	B	0.19353916	4.21	<.0001
YEAR*AREA 2019 21	1.353265390	B	0.15721801	8.61	<.0001
YEAR*AREA 2020 21	1.450154910	B	0.12298371	11.79	<.0001
YEAR*AREA 2021 21	1.191082605	B	0.13677091	8.71	<.0001
YEAR*AREA 2022 21	1.446449427	B	0.11272954	12.83	<.0001
YEAR*AREA 2023 21	1.229287886	B	0.11226693	10.95	<.0001
YEAR*AREA 2024 21	1.033791874	B	0.11159601	9.26	<.0001
YEAR*AREA 2025 21	0.717881789	B	0.11497556	6.24	<.0001
YEAR*AREA 9999 21	-0.523945037	B	0.07175525	-7.30	<.0001
YEAR*AREA 9999 22	0.000000000	B	.	.	.
MONTH 1	0.335464867	B	0.02870028	11.69	<.0001
MONTH 2	0.316661366	B	0.02848780	11.12	<.0001
MONTH 3	0.191428144	B	0.02944721	6.50	<.0001
MONTH 4	0.161658330	B	0.03416197	4.73	<.0001
MONTH 5	0.072758771	B	0.03850132	1.89	0.0589
MONTH 6	-0.107124198	B	0.07025848	-1.52	0.1274
MONTH 7	0.337955139	B	0.07122557	4.74	<.0001
MONTH 8	0.065920905	B	0.05186012	1.27	0.2038
MONTH 9	-0.264841011	B	0.05001435	-5.30	<.0001
MONTH 10	-0.257872843	B	0.04294400	-6.00	<.0001
MONTH 11	-0.265288919	B	0.03650121	-7.27	<.0001
MONTH 12	0.000000000	B	.	.	.
AREA 21	0.000000000	B	.	.	.
AREA 22	0.000000000	B	.	.	.
X 2	0.062859802	B	0.02868105	2.19	0.0285
X 9	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.

Appendix 2. Results and diagnostical outputs from GLM run of model for standardising CPUE in the Greenlandic zone not including the area effect. Data from Greenlandic, Faeroese, Norway and EU vessels.

The SAS System

The GLM Procedure

Class Level Information

Class	Levels	Values
BAAD	124	E001 E002 E003 E004 E005 E006 E007 E008 E009 E010 E011 E012 E013 E014 E015 E016 E017 E018 E019 E020 E021 E022 E023 E024 E025 E026 E027 E028 E029 E030 E031 E032 E033 E034 E035 E036 E037 E038 E039 E040 E041 E042 E043 E044 E045 E046 E047 E048 E049 E050 E051 E052 E053 E054 E055 E056 E057 E058 E059 E060 E061 E062 E063 E064 E065 E066 E067 E068 E069 E070 E071 E072 E073 E074 E075 E076 E077 E078 E079 E080 E081 E082 E083 E084 E085 E086 E087 E088 E089 E090 E091 E092 E093 E094 E096 E097 E098 E099 E100 E101 E102 E10 3 E1 04 E105 E106 E107 E108 E109 E110 E111 E112 E113 E114 E115 E116 E117 E118 E119 E121 E122 E123 E124 E125 E126
YEAR	46	1980 1981 1982 1983 1984 1985 1986 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 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 9999
MONTH	12	1 2 3 4 5 6 7 8 9 10 11 12
X	2	2 9

Number of Observations Read	4321
Number of Observations Used	4321

The SAS System

The GLM Procedure

Dependent Variable: LNCPUE

Weight: Hauls

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	180	70240.9055	390.2273	44.08	<.0001
Error	4140	36648.1004	8.8522		
Corrected Total	4320	106889.0059			

R-Square	Coeff Var	Root MSE	LNCPUE Mean
0.657139	217.8181	2.975264	1.365940

Source	DF	Type I SS	Mean Square	F Value	Pr > F
BAAD	123	44409.17608	361.05021	40.79	<.0001
YEAR	45	22436.54545	498.58990	56.32	<.0001
MONTH	11	3343.48804	303.95346	34.34	<.0001
X	1	51.69592	51.69592	5.84	0.0157

Source	DF	Type III SS	Mean Square	F Value	Pr > F
BAAD	123	17661.08303	143.58604	16.22	<.0001
YEAR	45	22761.30947	505.80688	57.14	<.0001
MONTH	11	3358.14535	305.28594	34.49	<.0001
X	1	51.69592	51.69592	5.84	0.0157

Parameter	Estimate		Standard Error	t Value	Pr > |t|
Intercept	1.636619592	B	0.53047232	3.09	0.0020
BAAD E001	-1.473442190	B	0.54600052	-2.70	0.0070
BAAD E002	-1.178504349	B	0.54889640	-2.15	0.0318
BAAD E003	-1.082483923	B	0.53396541	-2.03	0.0427
BAAD E004	-1.065939693	B	0.54177433	-1.97	0.0492
BAAD E005	-1.038186446	B	0.54819505	-1.89	0.0583
BAAD E006	-1.016579122	B	0.54326744	-1.87	0.0614
BAAD E007	-0.974319701	B	0.54166009	-1.80	0.0721
BAAD E008	-0.943572581	B	0.53511593	-1.76	0.0779
BAAD E009	-0.929597696	B	0.54388616	-1.71	0.0875
BAAD E010	-0.928914453	B	0.53101419	-1.75	0.0803
BAAD E011	-0.906375829	B	0.53532209	-1.69	0.0905
BAAD E012	-0.900643355	B	0.57954175	-1.55	0.1202
BAAD E013	-0.851542697	B	0.54729272	-1.56	0.1198

Parameter	Estimate		Standard Error	t Value	Pr > |t|
BAAD E014	-0.844154095	B	0.53232969	-1.59	0.1129
BAAD E015	-0.814688845	B	0.53425963	-1.52	0.1274
BAAD E016	-0.779226225	B	0.54558859	-1.43	0.1533
BAAD E017	-0.769896108	B	0.53643164	-1.44	0.1513
BAAD E018	-0.774021040	B	0.53533616	-1.45	0.1483
BAAD E019	-0.770080653	B	0.55216553	-1.39	0.1632
BAAD E020	-0.763462874	B	0.54625115	-1.40	0.1623
BAAD E021	-0.750439504	B	0.53975113	-1.39	0.1645
BAAD E022	-0.735058101	B	0.53289392	-1.38	0.1679
BAAD E023	-0.731411914	B	0.56321096	-1.30	0.1941
BAAD E024	-0.709608058	B	0.52997196	-1.34	0.1807
BAAD E025	-0.651761269	B	0.53826823	-1.21	0.2260
BAAD E026	-0.628126461	B	0.54548871	-1.15	0.2496
BAAD E027	-0.654272200	B	0.53088495	-1.23	0.2179
BAAD E028	-0.639012418	B	0.54774496	-1.17	0.2434
BAAD E029	-0.634244841	B	0.53436904	-1.19	0.2353
BAAD E030	-0.622703844	B	0.53489059	-1.16	0.2444
BAAD E031	-0.606502950	B	0.53065988	-1.14	0.2531
BAAD E032	-0.593094524	B	0.53203376	-1.11	0.2650
BAAD E033	-0.603560665	B	0.67114401	-0.90	0.3685
BAAD E034	-0.583395751	B	0.54358980	-1.07	0.2832
BAAD E035	-0.308822720	B	0.53545185	-0.58	0.5641
BAAD E036	-0.536765233	B	0.55486131	-0.97	0.3334
BAAD E037	-0.534439681	B	0.53180406	-1.00	0.3150
BAAD E038	-0.496700023	B	0.53618794	-0.93	0.3543
BAAD E039	-0.492528236	B	0.53344332	-0.92	0.3559
BAAD E040	-0.483580932	B	0.53270706	-0.91	0.3640
BAAD E041	-0.486649565	B	0.53817742	-0.90	0.3659
BAAD E042	-0.466904122	B	0.53303788	-0.88	0.3811
BAAD E043	-0.484863362	B	0.53057217	-0.91	0.3608
BAAD E044	-0.438870089	B	0.52910043	-0.83	0.4069
BAAD E045	-0.445413975	B	0.53600746	-0.83	0.4060
BAAD E046	-0.445923227	B	0.53372404	-0.84	0.4035
BAAD E047	-0.439032505	B	0.53161254	-0.83	0.4089
BAAD E048	-0.420932842	B	0.53097600	-0.79	0.4280
BAAD E049	-0.410591502	B	0.53002050	-0.77	0.4386
BAAD E050	-0.374718932	B	0.53474397	-0.70	0.4835

Parameter	Estimate		Standard Error	t Value	Pr > |t|
BAAD E051	-0.387840850	B	0.53219431	-0.73	0.4662
BAAD E052	-0.382130846	B	0.53305084	-0.72	0.4735
BAAD E053	-0.394042848	B	0.54571973	-0.72	0.4703
BAAD E054	-0.362889470	B	0.53188473	-0.68	0.4951
BAAD E055	-0.297756571	B	0.53579578	-0.56	0.5784
BAAD E056	-0.136303645	B	0.52851740	-0.26	0.7965
BAAD E057	-0.259925293	B	0.53433332	-0.49	0.6267
BAAD E058	-0.252864136	B	0.54824041	-0.46	0.6447
BAAD E059	-0.128950895	B	0.55228529	-0.23	0.8154
BAAD E060	-0.283280288	B	0.53199827	-0.53	0.5944
BAAD E061	-0.177987844	B	0.52744114	-0.34	0.7358
BAAD E062	-0.174338141	B	0.53070080	-0.33	0.7425
BAAD E063	-0.163985023	B	0.53388745	-0.31	0.7587
BAAD E064	-0.109468337	B	0.53196530	-0.21	0.8370
BAAD E065	-0.096520344	B	0.53984770	-0.18	0.8581
BAAD E066	-0.063333197	B	0.54369656	-0.12	0.9073
BAAD E067	-0.032059300	B	0.62138001	-0.05	0.9589
BAAD E068	-0.300594194	B	0.54148448	-0.56	0.5788
BAAD E069	-0.035246935	B	0.53097449	-0.07	0.9471
BAAD E070	-0.021298893	B	0.52938277	-0.04	0.9679
BAAD E071	0.012493416	B	0.52941659	0.02	0.9812
BAAD E072	-0.050718508	B	0.53454795	-0.09	0.9244
BAAD E073	0.031378406	B	0.53783263	0.06	0.9535
BAAD E074	0.054350650	B	0.53081194	0.10	0.9185
BAAD E075	0.091754533	B	0.53277049	0.17	0.8633
BAAD E076	0.102459553	B	0.53216732	0.19	0.8473
BAAD E077	0.080098775	B	0.53969751	0.15	0.8820
BAAD E078	0.154764865	B	0.53008520	0.29	0.7703
BAAD E079	0.159660240	B	0.55944456	0.29	0.7754
BAAD E080	0.134073315	B	0.53804217	0.25	0.8032
BAAD E081	0.253457866	B	0.53247269	0.48	0.6341
BAAD E082	0.320260588	B	0.55940388	0.57	0.5670
BAAD E083	0.492760473	B	0.53520184	0.92	0.3573
BAAD E084	1.768217563	B	1.79741120	0.98	0.3253
BAAD E085	-0.930079924	B	0.54850768	-1.70	0.0900
BAAD E086	-0.491480129	B	0.58833394	-0.84	0.4036
BAAD E087	-0.067091745	B	0.57120453	-0.12	0.9065

Parameter	Estimate		Standard Error	t Value	Pr > |t|
BAAD E088	-1.664830911	B	0.58221267	-2.86	0.0043
BAAD E089	-1.272662342	B	0.56327582	-2.26	0.0239
BAAD E090	-0.922389955	B	0.59698878	-1.55	0.1224
BAAD E091	-1.209158347	B	0.61286412	-1.97	0.0486
BAAD E092	-1.453279324	B	0.58920318	-2.47	0.0137
BAAD E093	-1.999064284	B	0.78101675	-2.56	0.0105
BAAD E094	-1.033800119	B	0.57930981	-1.78	0.0744
BAAD E096	-0.785022148	B	0.55686466	-1.41	0.1587
BAAD E097	0.485283281	B	1.79810528	0.27	0.7873
BAAD E098	0.666433681	B	3.02205183	0.22	0.8255
BAAD E099	-1.194551881	B	0.56791626	-2.10	0.0355
BAAD E100	-1.090376202	B	0.95535282	-1.14	0.2538
BAAD E101	-0.128666677	B	0.56502731	-0.23	0.8199
BAAD E102	0.299157593	B	0.56734102	0.53	0.5980
BAAD E103	-0.211374046	B	0.56910897	-0.37	0.7103
BAAD E104	-0.662589271	B	0.56634880	-1.17	0.2421
BAAD E105	-0.196020133	B	0.62335412	-0.31	0.7532
BAAD E106	-0.726513142	B	0.64024123	-1.13	0.2565
BAAD E107	-0.491526283	B	0.59901553	-0.82	0.4119
BAAD E108	-0.992465040	B	0.56130690	-1.77	0.0771
BAAD E109	0.605408043	B	0.58009215	1.04	0.2967
BAAD E110	-0.485647044	B	0.56530647	-0.86	0.3903
BAAD E111	1.435038586	B	3.02204571	0.47	0.6349
BAAD E112	-0.545058701	B	0.97170207	-0.56	0.5749
BAAD E113	-0.882766072	B	0.65473498	-1.35	0.1776
BAAD E114	-0.510428688	B	0.56583935	-0.90	0.3671
BAAD E115	-0.971377757	B	0.59903627	-1.62	0.1050
BAAD E116	-1.025370844	B	1.79806073	-0.57	0.5685
BAAD E117	1.049946251	B	0.73056054	1.44	0.1507
BAAD E118	-1.203753567	B	0.61273303	-1.96	0.0495
BAAD E119	-1.407665190	B	0.56299086	-2.50	0.0124
BAAD E121	0.178441218	B	0.54165979	0.33	0.7418
BAAD E122	-0.209639283	B	0.54401157	-0.39	0.7000
BAAD E123	0.170389331	B	0.55444432	0.31	0.7586
BAAD E124	0.169821032	B	0.63348189	0.27	0.7887
BAAD E125	-0.065277333	B	0.75054779	-0.09	0.9307
BAAD E126	0.000000000	B	.	.	.

Parameter	Estimate		Standard Error	t Value	Pr > |t|
YEAR 1980	0.403794500	B	0.27417036	1.47	0.1409
YEAR 1981	0.404309077	B	0.25552215	1.58	0.1137
YEAR 1982	-0.051635069	B	0.57967913	-0.09	0.9290
YEAR 1983	0.225955077	B	0.30852436	0.73	0.4640
YEAR 1984	0.752094769	B	0.25142752	2.99	0.0028
YEAR 1985	0.235635716	B	0.12140303	1.94	0.0523
YEAR 1986	0.286261062	B	0.06919327	4.14	<.0001
YEAR 1988	-0.181711144	B	0.04820295	-3.77	0.0002
YEAR 1989	-0.598748257	B	0.04864231	-12.31	<.0001
YEAR 1990	-0.383358290	B	0.04856584	-7.89	<.0001
YEAR 1991	-0.545407045	B	0.04885130	-11.16	<.0001
YEAR 1992	-0.777860902	B	0.05431920	-14.32	<.0001
YEAR 1993	-0.825143483	B	0.05469564	-15.09	<.0001
YEAR 1994	0.233103795	B	0.05676022	4.11	<.0001
YEAR 1995	-0.011317670	B	0.05610835	-0.20	0.8402
YEAR 1996	0.239886841	B	0.05767163	4.16	<.0001
YEAR 1997	0.472184295	B	0.06325263	7.47	<.0001
YEAR 1998	0.563771426	B	0.06974101	8.08	<.0001
YEAR 1999	0.668744167	B	0.07769472	8.61	<.0001
YEAR 2000	0.664475328	B	0.06894069	9.64	<.0001
YEAR 2001	0.634791508	B	0.06773056	9.37	<.0001
YEAR 2002	0.775817302	B	0.07292323	10.64	<.0001
YEAR 2003	0.516333057	B	0.06927158	7.45	<.0001
YEAR 2004	0.398202795	B	0.07327922	5.43	<.0001
YEAR 2005	0.487604945	B	0.07892031	6.18	<.0001
YEAR 2006	0.483414506	B	0.08459555	5.71	<.0001
YEAR 2007	0.324271897	B	0.08655237	3.75	0.0002
YEAR 2008	0.476903969	B	0.10393335	4.59	<.0001
YEAR 2009	0.810535465	B	0.09686881	8.37	<.0001
YEAR 2010	0.207306129	B	0.08864664	2.34	0.0194
YEAR 2011	0.257272729	B	0.13006607	1.98	0.0480
YEAR 2012	0.128050868	B	0.10604311	1.21	0.2273
YEAR 2013	-0.264246678	B	0.10024737	-2.64	0.0084
YEAR 2014	-0.539863074	B	0.12719819	-4.24	<.0001
YEAR 2015	-0.651716627	B	0.13188649	-4.94	<.0001
YEAR 2016	-0.689980809	B	0.40565008	-1.70	0.0890
YEAR 2017	-0.092935375	B	0.19740185	-0.47	0.6378

Parameter	Estimate		Standard Error	t Value	Pr > |t|
YEAR 2018	0.514873362	B	0.20398235	2.52	0.0116
YEAR 2019	0.992873896	B	0.16326355	6.08	<.0001
YEAR 2020	1.170059999	B	0.12313148	9.50	<.0001
YEAR 2021	0.900428272	B	0.13945311	6.46	<.0001
YEAR 2022	1.163195359	B	0.11109923	10.47	<.0001
YEAR 2023	0.949966019	B	0.11033397	8.61	<.0001
YEAR 2024	0.771120922	B	0.10872648	7.09	<.0001
YEAR 2025	0.442126229	B	0.11303113	3.91	<.0001
YEAR 9999	0.000000000	B	.	.	.
MONTH 1	0.203942920	B	0.02905907	7.02	<.0001
MONTH 2	0.203999490	B	0.02898251	7.04	<.0001
MONTH 3	0.115403912	B	0.03002748	3.84	0.0001
MONTH 4	0.150806333	B	0.03479039	4.33	<.0001
MONTH 5	0.008163355	B	0.03967569	0.21	0.8370
MONTH 6	-0.063002753	B	0.07289082	-0.86	0.3874
MONTH 7	0.415094922	B	0.06796103	6.11	<.0001
MONTH 8	0.153352196	B	0.05035125	3.05	0.0023
MONTH 9	-0.240030997	B	0.05106474	-4.70	<.0001
MONTH 10	-0.259028154	B	0.04326390	-5.99	<.0001
MONTH 11	-0.226861163	B	0.03635310	-6.24	<.0001
MONTH 12	0.000000000	B	.	.	.
X 2	-0.072155621	B	0.02985847	-2.42	0.0157
X 9	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.