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The Fishery for Northern Shrimp (*Pandalus borealis*) off West Greenland, 1970-2005

by

Michael C.S. Kingsley and Carsten Hvingel

Greenland Institute of Natural Resources
Box 570, 3900 Nuuk, Greenland

Abstract

Northern shrimp (*Pandalus borealis*) occurs on the continental shelf off West Greenland in NAFO Divisions 0A and 1A–1F in depths between approximately 150 and 600 m. Greenland fishes the species in Subarea 1, Canada in Div. 0A; Canadian regulations set a separate shrimp TAC for the part of this Division lying east of 60°30'W (Canadian SFA 1). The species is assessed in these waters as a single stock and managed by catch control. The fishery has been prosecuted over time by four distinct fleets: Greenland small-vessel inshore; Greenland KGH offshore; Greenland recent offshore, and Canadian offshore.

Catches peaked in 1992 at 105 000 tons, but then decreased to around 80 000 tons by 1998 owing to management measures. Since then stepwise increases of catch quotas have been accompanied by increased catches. The provisional total catch in 2004, at 135 000 tons, was the highest on record. The Total Allowable Catch (TAC) in Greenland waters for 2005 is 134 000 tons, and for the Canadian fishery in the eastern part of Div. 0A 18 417 tons; however, Canadian catches in recent years have stayed at little over 6 000 tons in spite of much higher TACs.

The inshore fishery prosecuted by vessels below 80 GRT accounts for around 15% of the landings.

Reported discard and by-catch of other species are alike low.

Catch and effort data from logbooks was analyzed with standard linear models to create fleet-specific series of annual catch-per-unit-effort (CPUE) indices, standardized for changes in fleet composition and fishing power and for variation in the distribution of the fisheries. These were combined to give a single standard CPUE series as an index of total biomass. Standardized CPUE was variable, but on average moderately high, from 1976 through 1987, then fell to uniform lower levels until about 1997, since when it has continuously increased to its present record levels.

Introduction

Northern shrimp (*Pandalus borealis*) occurs on the continental shelf off West Greenland in NAFO Div. 0A and in Div. 1A-1F. The species is more or less continuously distributed from Cape Farewell to about 74°N, with the highest densities in depths between 150 and 600 m (Fig. 1). Within this habitat area, there is no evidence of sub-structure and since 1993 the species has been assessed as a single stock in these waters (Anon., 1993).

A fishery began in inshore areas in 1935. In 1970 a multinational offshore fishery started to develop and over the following 30+ years landings increased, to approximately 135 000 tons in 2004 (Fig. 2). From 1981 through 2004 the West Greenland fishery was limited to Greenlandic vessels in NAFO Subarea 1 and to Canadian vessels in NAFO Div. 0A, but pursuant to a new agreement on fisheries between the European Union (EU) and Greenland, a quota of 4 000 tons was allocated to EU vessels in 2005. Catch restrictions were first imposed in 1977 and the

fishery has since been managed by Total Allowable Catch (TAC). A system of Individual Transferable Quotas (ITQs) was introduced in 1991.

Two Greenlandic fleets fish in Subarea 1: an offshore fleet, at present consisting of 15 large factory trawlers (500-4 000 GRT), and a fleet of about 60 vessels below 80 GRT. The offshore fleet is restricted to offshore areas and by quotas. With a few exceptions vessels below 80 GRT were unrestricted until 1997, when catch regulation was introduced for this fleet as well. Since 1986 logbook recording of fishing activity has been mandatory for vessels above 50 GRT, and since 1997 logbooks have been available from all vessels. Gear restrictions in place are a mesh-size restriction of 44 mm stretched, and, for the offshore Greenlandic fleet for about the last 5 years, sorting grids with 22 mm spaces between the bars to reduce finfish by-catch. Nordmore grates are also required in the Canadian shrimp fishery in SFA 1 (Orr, pers. comm.).

The Canadian fleet fishes in the Canadian Exclusive Economic Zone, i.e. NAFO Div. 0A. Seventeen companies are licensed to fish in the area but in 1995-2004 on average only about 8 vessels (2 000-4 000 GRT) have participated. However, 11 vessels participated in 2002 and 12 in 2004. Catches are restricted by quotas. Vessel logs are available since 1979.

Material and Methods

The available data consists of logbook records giving time, date and position of the start and stop of each haul, and weights of catch, by-product, and discards, as well as other reporting records. Total catches were estimated from vessel logs and weekly reporting to Greenlandic authorities. Reported catches were converted to live weight including, for some past data, corrections for 'overpacking' and associated under-reporting (Hvingel, 2003). Logbook data was analyzed to show the spatial and temporal distribution of the fishery.

Corrected unstandardized effort was calculated using a factor 1.6 as a multiplier for logbook recorded effort by vessels using twin trawls. Mean unstandardized CPUE was total logbook catch divided by corrected unstandardized CPUE. Unstandardized effort was calculated by dividing total statistical catch by mean CPUE. Standardized effort was calculated by dividing total statistical catch by a standardized CPUE (see below). CPUE data from Greenlandic vessels above 50 GRT fishing in Subarea 1 and Canadian vessels fishing in Div. 0A east of 60°30'W were used in multiplicative models to calculate standardized annual catch-rate indices. Four separate index series covering four fleets were derived (Hvingel *et al*., 2000), and were then combined into a single series representing the total area. Annual CPUE indices for the total area cannot be derived from a single GLM (General Linear Model) run including all fleets as they had no or too little overlap either in time or in space and such a model therefore could not estimate relative fishing power of individual vessels. The four indices included the following variables: (1) vessel fishing power, (2) seasonal availability of shrimp, (3) spatial availability of shrimp and (4) annual mean CPUE. The calculations were done using the SAS statistical software (SAS Institute, 1988). The main criterion for including an individual vessel in either of the multiplicative models was three years of participation in the fishery covered by the index. Hauls by twin-trawls (two complete trawls towed simultaneously) were excluded from the analysis. The area definition used is based on distinct fishing grounds (Fig. 1). The multiplicative model was represented in logarithmic form either as:

$$\text{Model 1} \qquad ln(CPUE_{mjki}) = ln(A_m) + (S_j) + ln(V_k) + ln(Y_i) + \varepsilon_{mjki}$$

or with a MONTH*AREA interaction (see appendix 1) implying an annual migratory or behavioural pattern:

$$\text{Model 2} \qquad ln(CPUE_{mjki}) = ln(u) + ln(A_m) + ln(S_j) + ln(AS_{mj}) + ln(V_k) + ln(Y_i) + \varepsilon_{mjki}$$

where $CPUE_{mjki}$ is the observed (logbook) mean CPUE for vessel (or vessel class) k, fishing in area m in month j in year i; $ln(u)$ is overall mean ln(CPUE); Am is effect of the mth area; S_j is the effect of the j^{th} month; V_k is the effect of the k^{th} vessel; Y_i is the effect of the i^{th} year; ε_{mjki} is a variance assumed to be normally distributed as $N(0,\sigma^2/n)$ where n is the number of observations in the cell. The antilogarithms of the year effects have been used as standardized annual CPUE indices. Estimates of the vessel, month and area effects from a first run of the main effects model (Model 1) were compared. Levels within each variable were combined in subsequent analyses if the effect estimates did not differ by more than 5 percentage points; we note however that posterior grouping on the

basis of similar effects causes uncertainty to be underestimated. This was done to reduce the number of empty cells in the models. For further details on model construction and analysis see Hvingel *et al.* (2000).

The '1BCDEF index' largely covers the NAFO Div. 1B to 1F (area 1A was not included owing to misreporting from that area). 40 vessels were included providing data since 1987. These data were grouped into 10 areas (Area 4-13, Fig. 1). Based on an exploratory run of the main effects model (Model 1) the vessel effect was collapsed into 27 groups consisting of 1-3 vessels with similar fishing power. The month effect was reduced to 10 levels by grouping adjacent months with similar indices of relative shrimp availability. Areas 7 and 8 and area 9 and 10 were grouped. Compared with model 1, model 2 increased the degrees of freedom for the model by 32% — from 53 to 70 — but decreased the error mean square by about ¾ of 1%. The standard deviation of the difference in year-effect estimates between the two models was only about 0.5%. Model 1 without the month-area interaction was therefore preferred and was used.

The 'KGH index' is derived from catches in the early offshore fishery, executed by 7 sister trawlers (722 GRT) operated by the Kongelige Grønlandske Handel (KGH). This fishery only covered Div. 1A and part of Div. 1B and data from Areas 3, 4, 6 and 7 (Fig. 1) for the years 1976-1990 was considered for this index. The analyses for reducing variable levels showed that 6 of the seven vessels could be treated as a group in the subsequent analyses. The month variable could be reduced to 10 levels and areas 4, 6 and 7 combined. This analysis was not repeated and results from Hvingel (2004) were incorporated into the present analysis.

Data for the '0A index' is available since 1980. Div. 0A is small and is not subdivided for analysis. A first model for catch/effort ratios included (*inter alia*) vessel identity, tonnage class and horsepower. Tonnage class had no effect on catch effort ratios and was rejected, and horsepower had only small effect — even after tonnage class was thrown out — and was also rejected. Double- and single-trawl data was used in the analysis, the double-trawl effect being fitted by the GLM model and the data standardized to single trawl. The fleet was reduced by rejecting 22 vessels with reports from fewer than 3 years, leaving 22, and by grouping vessels with similar effects in a first GLM run into 14 groups with 1-6 vessels in each. The Division is fished from June through December but effort in June and December has been sparse, especially in recent years, so these two months were not used, and the months from August through November were placed in one group.

The 'small vessel index' is based on vessels below 80 GRT, which have exclusive access to the fishery in 'inshore' areas of West Greenland. This part of the fishery is confined to areas around Disko Island in Div. 1A and 1B shown as areas 1, 2 and 3 in Fig. 1. Comprehensive data are available since 1988 and 27 vessels were used in the model. The fishery is active from March-April to December. Vessels were placed in 9 groups each comprising 1-5 vessels of similar estimated fishing power. The 9 fishing months were placed in 5 groups by posterior inspection of their effects.

One unified series of standardized CPUE, covering 1976-2002, was derived by combining these four index series. A Monte Carlo Markov Chain (MCMC) sampling process was used to construct distributions of likelihoods of possible values of this combined index. This was done within the programming framework WinBUGS v.1.4, (www.mrcbsu.cam.ac.uk/bugs). 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:

$$\mu_{pi} = V_p Y_i \cdot \exp(\varepsilon_{pi})$$

The errors, ε_{pi}, were considered to be distributed with mean zero and with variance σpi^2 assumed 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, σpi^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 1BCD, KGH, 0A and small vessel indices were estimated to be 0.46, 0.36, 0.05 and 0.13.

Results and Discussion

Spatial and seasonal distribution

Northern shrimp are fished on the continental shelf of Greenland between 59°N and 74°N, mainly between 150 and 600 m depth, i.e. on the gullies between the offshore banks, in Disko Bay, and on the upper shelf break (Fig. 1). However, during the period of logbook recordings (since 1975) a substantial change in the relative importance of the different areas is indicated. From the mid-1970s until the early 1980s most of the effort was on the relatively wide shelf in Div. 1A and 1B. Divisions 1C and 0A were also fished, but almost no effort was applied in Div. 1D, 1E and 1F (Table 1). From about the mid-1980s, the fishery expanded southward into Div. 1D, and from the early 1990s, significant effort and landings were recorded also in Div. 1E and 1F, although they have small areas of shrimp habitat. The crude catch-effort ratios for Div. 1E and 1F are relatively high from the mid-1990s up to the most recent data.

The southward shift of the offshore fishery 1987-1998 could be summarized by a decreasing mean latitude of effort allocation. Indications of biomass distribution from the German groundfish survey (Rätz, 1997) and the Greenlandic trawl survey (Carlsson and Kanneworff, 1997) have also suggested that the fishery was tracking a southward shift in shrimp biomass, but development of gear that can trawl more effectively on the difficult grounds in the southern areas may also have been an important factor.

The distribution of the fishery has been fairly stable, but in the most recent years there are indications that both catch and effort in the southernmost areas have declined, and that the fishery has tended to move back northwards. Preliminary data for 2005 shows 22% of effort in Div. 1D-1F compared with 27% in 2000-2004 and 34% in 1995-99, and 19% of landings compared with 34% and 46% (Tables 2 and 3).

The fishery is active all year, but more so in summer and fall, when monthly landings are 2-3 times the winter minimum (Table 4). A dip in catches commonly occurs in August and September with another peak following in October. In Div. 0A the fishery usually begins in late June or early July and continues into late November, but most of the effort, and catch, comes in August–October.

Catch

Until 2003 catches of shrimp taken in the Greenland Exclusive Economic Zone (EEZ) were systematically under-reported owing to a prevalent practice of ‘over-packing’ accompanied by reporting of nominal package weight instead of true packed weight. Furthermore, even the nominal weight reported was that of the product, not the live weight of the catch from which it would have been produced, aggravating the problem. Since 1 January 2004 legislation has been in force to ban these practices with a view to ensuring that removals by fishing are reported as catch live weight. Earlier catch data has been revised to correct these biases, and also to correct for unreported catches (Hvingel, 2003).

In conjunction with the development of the offshore shrimp fishery total annual catch increased from about 10 000 tons in the early 1970s to more than 105 000 tons in 1992 (Fig. 2, Table 5). Measures by the Greenland Home Rule Government to reduce effort, as well as improved fishing opportunities elsewhere for the Canadian shrimp fleet, then reduced catches to about 80 000 tons in 1998. Since then increased annual quotas have been accompanied by increased catches.

Since the beginning of the 1970s catches in the inshore areas have been fluctuating between 8 000 and 23 000 tons (Table 5). Limited (no) access for vessels above 80 GRT was the only management constraint on inshore catches until 1997 when ITQs were instituted also for the small-vessel fleet. Inshore catches then decreased substantially while a major reorganization of the fleet took place. During most of the nineties the inshore fishery had accounted for 19-24% of the total catches, but in 1998 only 13% (10 500 tons) was taken inshore. In 1999 catches were back up near 20 000 tons. However, while the catches of the offshore fishery kept increasing the catches inshore have remained stable. Thus for the most recent three years the inshore fleet has taken 15% of the total Greenlandic catch. The Canadian catches in SFA 1 fluctuated between 1 700 and 5 400 tons between 1979 and 1983, then increasing from 2 100 tons in 1984 to record levels of around 6-7 000 tons in the late 1980s to the early 1990s (Table 5). Catches thereafter declined to around 1 000 tons in 1998 coincident with increased fishing

opportunities off Labrador. From the mid-1990s to the early 2000s catches in Div. 0A have accounted for less than 4% of the total catches off West Greenland. TACs for Div. 0A in recent years have been little less than 20 000 tons, (Table 5) but the catches have been steady at a little over 6 000 tons; the projection made in October of 2004 that catches in Div. 0A in that year would be about 6 000 tons was borne out.

By-catch and discard

The reported discard of shrimp has remained less than 1% (weight) of total catch throughout the period 1975-2004 (Tables 6 and 7). The discard of fish has shown a slightly increasing trend from about 1 to 3% of total catch in the years 1987-1998. The introduction of observers on all offshore vessels in 1991 has most likely contributed to this development by increasing the incentive to report discard. An improved market for smaller shrimp may have offset the corresponding effect of observers on the reported discard of shrimp. In the most recent years registered annual discards of fish have been around 1% of total shrimp catch. Sorting grids with 22 mm grid spacing are mandatory for stern trawlers.

From 1995 to 2003 reports have included overall annual catches of *P. montagui* in the range of about 100 to 1 000 tons (Table 6), which can be landed outside the quota on *P. borealis*. However, landings can be classified as *montagui* while including up to 70% *borealis*, so it has been possible to land substantial unrecorded catches of borealis. Therefore it is difficult to use the reporting of *P. montagui* in the catches to infer changes in the targeting strategy of the fishery or as an indication of the availability of this species. However there were indications of increased biomass of *P. montagui* in the mid-1990s (Kanneworff, 2003).

Effort

From 1975, when the offshore fishery was well established, through 1984 annual unstandardized effort showed a slightly increasing trend from about 75 000 hr to about 93 000 hr (Fig. 3). In the subsequent years the offshore fleet was considerably enlarged and effort went up by almost a factor of three reaching 250 000 hr in 1991-1992. Unstandardized effort has since decreased as a result of management measures, reduced activity in Div. 0A (Table 1) and a generally increased fishing efficiency. The increase in the overall unstandardized effort reported, in particular in Div. 1A from 1996 to 1997 (Fig. 3), is due to the addition of logbooks from vessels below 50 tons to the database (introduction of new logbook system). In 2003 about 125 000 hauling hours were registered and in 2004 slightly more at about 130 000. For 2005, on the data available up to September, the pooled standardized CPUE index has increased by about 8% over the 2004 value.

The trajectory of the standardized effort time series agrees with that of the unstandardized (Table 8). After 1992, when it reached its highest value, standardized effort decreased steadily — overall by about 35% — to a minimum in 1998-2000. It then increased temporarily to a maximum in 2002 and has since returned to the levels of 1998-2000.

Catch per unit of effort

The unified standardized CPUE index is an aggregate of four individual indices (Table 5) derived by GLM methods for the four fleets (Appendices 1-3). All fleets included in the analysis exploit(ed) mainly shrimp greater than 16 mm cpl. The CPUE indices are therefore indicative of the stock of females and older males combined. The overall combined index (Fig. 4) fluctuated without trend by a factor of 2 between 1976 and 1987. It then dropped precipitously to the lowest levels in the series in 1990-91, and stayed fairly flat until 1997. Since then the index has increased continuously, reaching a new maximum in 2005 (on partial data). The median index value for 2003, using the complete set of data for the year, was slightly lower than the value reported in Hvingel (2003) based on partial data for the year, and the value reported here for 2004 is. The estimated median value for 2004 was compared to the 2003 median value and is the highest of the time series. The standardisation method used accounts for the increase in efficiency from renewal of the fleet but does not account for the technological improvements, which result from upgrading of older vessels. However, the YEAR*VESSEL term had low importance in the individual models which suggested that this term could be ignored and the YEAR-effect therefore interpreted as a biomass indicator. Still, the standardized CPUE time series is expected to give a slightly optimistic view of the stock development (for further discussion of the CPUE index as a stock indicator, see Hvingel *et al*., 2000).

Catch composition (from Hvingel, 2004)

The mean size of shrimp caught decreased during the 1990s. In Subarea 1 it declined by 3 mm cpl. from 1991 to 1999 corresponding to a mean individual weight reduction of about 30%. Mean shrimp size caught in the Canadian fishery in Div. 0A showed a similar declining trend since 1981. In spite of these changes, the proportions of female shrimp in the catches seemed relatively stable in the late 1990s. The decrease in size may be partly due to better market prices for small shrimp along with a thorough restructuring of the Greenlandic offshore fleet during this period, leaving most vessels with a big enough quota to make 'high-grading' less profitable. However, the decline of shrimp size in the catches was temporarily reversed in 2000, with the appearance of a relatively high proportion of females. The length distribution for 2000 showed a large peak of female shrimp at around 25 mm cpl.

The data from 2001 did not indicate an equally good catch quality. The length distribution showed a dominant peak of male shrimp at around 20 mm cpl. The female component was less prominent, but all sizes normally present in the catches were represented. For 2002 only three samples were available and therefore the size composition of the catch was uncertain. However, no major changes from the previous year were indicated. Catch compositions for 2003-2005 have not been evaluated owing to sparse — or no — sampling.

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Table 1. Annual catch, effort and CPUE of the shrimp fishery on the West Greenland shelf by NAFO Divisions. Data from logbooks, weighted up to annual total catch.

	Catch ('000 tons)							Effort ('000 hr's)							CPUE (kg/hr)						
Year	0A	1A	1B	1C	1D	1E	1F	0A	1A	1B	1C	1D	1E	1F	0A	1A	1B	1C	1D	1E	1F
1975	0.0	0.0	44.6	2.0	0.0	0.0	0.0	-	0.0	70.5	3.6	0.0	0.0	0.0	-	-	632	551	-	-	-
1976	0.4	0.0	54.7	6.3	0.0	0.0	0.0	-	0.1	70.1	8.0	0.1	0.8	1.1	-	-	780	785	-		40
1977	0.5	0.2	47.8	3.1	0.1	0.0	0.0	-	0.5	67.8	4.4	0.5	0.0	0.0	-	357	705	691	253	-	-
1978	0.1	0.5	40.9	0.5	0.2	0.0	0.0	-	1.4	80.7	1.3	0.8	0.0	0.0	-	382	507	416	259	-	-
1979	1.7	4.8	35.7	0.5	0.0	0.0	0.0	7.3	6.7	64.1	1.5	0.1	0.0	0.0	236	719	557	348	112	-	-
1980	2.7	14.6	35.0	3.3	0.3	0.0	0.0	10.4	21.2	53.3	4.9	0.5	0.0	0.0	262	690	655	668	596	-	
1981	5.3	5.7	37.5	5.3	0.0	0.0	0.0	17.6	11.2	66.4	10.4	0.1	0.0	0.0	301	511	564	510	409	-	-
1982	2.1	0.8	43.2	8.2	0.0	0.0	0.0	6.7	1.7	65.7	13.5	0.1	0.0	0.0	309	472	657	604	388	-	-
1983	5.4	0.5	40.5	9.4	0.5	0.0	0.0	17.4	0.9	69.5	17.8	0.9	0.0	0.0	311	559	582	528	531	-	614
1984	2.1	1.2	30.4	17.0	2.1	0.0	0.0	7.7	2.7	51.1	28.4	2.7	0.0	0.1	280	431	595	598	785	-	47
1985	3.1	8.1	35.5	14.9	4.7	0.0	0.0	18.2	28.7	66.2	25.6	8.7	0.0	0.0	169	282	536	580	540	-	-
1986	3.0	26.3	32.4	9.2	6.0	0.0	0.0	6.7	54.2	55.2	14.1	9.6	0.1	0.1	445	485	586	649	624	273	-
1987	6.1	19.4	43.7	7.3	1.3	0.0	0.0	11.1	54.4	67.9	10.7	4.2	0.0	0.0	550	357	644	685	324	-	
1988	5.9	12.4	47.5	7.1	0.5	0.0	0.1	10.7	40.9	94.3	14.7	2.0	0.0	1.0	550	302	504	486	267	-	153
1989	7.2	16.3	33.7	12.9	10.0	0.0	0.5	17.0	47.5	77.6	30.5	19.8	0.0	4.2	426	344	435	422	507	-	111
1990	6.2	12.2	30.0	22.7	12.4	0.0	0.5	13.8	42.3	77.4	56.1	30.8	0.0	2.8	446	288	387	405	403	-	165
1991	6.8	12.7	32.8	18.8	19.6	0.6	0.2	19.6	37.1	89.9	52.6	49.2	0.7	1.3	346	341	365	357	398	824	191
1992	7.5	16.3	32.8	19.9	23.4	5.0	0.6	16.6	49.4	76.1	48.0	51.7	7.8	1.3	451	330	431	415	452	642	497
1993	5.5	7.6	36.2	15.8	18.1	4.5	3.2	12.2	23.0	82.0	41.3	44.3	8.0	7.6	450	331	442	383	410	559	425
1994	4.8	7.3	33.6	15.9	19.9	7.0	4.2	15.3	23.4	84.0	40.9	42.7	9.6	9.3	312	313	401	390	467	736	450
1995	2.4	6.9	27.1	15.5	22.0	8.6	4.9	7.8	21.0	69.0	33.8	40.8	12.3	7.9	303	331	393	458	539	696	624
1996	2.6	5.4	22.4	16.8	23.3	8.3	5.3	8.4	18.5	51.0	35.0	39.3	11.8	9.1	312	293	439	481	594	700	579
1997	0.5	7.4	20.1	11.5	22.6	8.5	7.6	0.9	44.0	53.4	24.0	39.2	11.6	12.6	597	167	377	477	576	730	605
1998	0.9	4.5	22.6	13.5	21.1	8.7	9.0	2.0	20.1	48.8	25.4	34.2	10.6	13.5	472	226	463	532	618	817	671
1999	2.0	9.1	28.3	14.6	19.0	8.3	10.8	4.1	34.4	58.3	22.5	27.0	9.2	12.9	504	263	485	650	704	902	839
2000	1.6	14.8	28.7	14.8	18.8	6.9	11.3	2.0	36.3	50.8	20.1	25.9	7.6	14.0	811	409	565	737	727	909	810
2001*	3.6	14.5	27.3	17.1	20.8	8.0	11.6	4.2	41.2	48.9	21.1	27.3	7.7	11.8	868	351	558	810	760	1029	980
2002*	6.2	15.4	43.3	26.5	25.0	8.5	10.3	6.9	42.1	58.2	27.5	28.1	7.0	10.4	901	366	743	963	888	1216	989
2003*	6.3	14.2	42.7	24.9	23.2	8.1	10.9	5.8	33.1	41.8	17.2	17.5	5.3	10.2	1081	427	1021	1447	1327	1510	1061
2004*	6.7	13.2	52.0	31.8	23.4	5.4	9.1	8.7	33.6	50.9	18.1	13.2	2.8	11.3	766	394	1022	1759	1766	1931	813
2005**	-	9.1	69.5	30.5	13.6	2.7	8.6		18.1	53.8	14.6	7.6	2.7	14.1		506	1292	2087	1780	985	612

*Preliminary; **Partial.

Table 2. Distribution (%) of landings of northern shrimp between Divisions in NAFO Subarea 1 by 5-year period.

	Period						
Division	75-79	80-84	85-89	90-94	95-99	00-04	05
A	4.7	9.3	23.5	12.8	8.2	12.2	6.8
B	91.8	72.1	56.0	38.2	29.1	33.6	51.8
C	3.3	17.4	13.9	21.5	17.2	20.0	22.8
D	0.2	1.3	6.4	21.5	26.1	19.0	10.2
E	0.00	0.00	0.0	4.0	10.2	6.2	2.0
F	0.0	0.00	0.2	2.1	9.3	9.0	6.4

Table 3. Distribution (%) of fishing effort[1] for northern shrimp between Divisions in NAFO Subarea 1 by 5-year period.

	Period						
Division	75-79	80-84	85-89	90-94	95-99	00-04	05
A	4.2	9.3	30.6	16.0	16.8	25.1	16.3
B	91.9	71.4	49.9	37.6	32.8	33.8	48.5
C	3.4	18.1	12.6	21.9	16.2	14.0	13.2
D	0.5	1.1	6.0	20.0	21.0	15.1	6.9
E	0.1	0.0	0.0	2.4	6.5	4.1	2.4
F	0.1	0.0	0.9	2.1	6.7	7.8	12.7

[1] Uncorrected trawl time.

Table 4. Shrimp catch on the West Greenland shelf by month 1987-2005, summed from vessel logs and weighted up** to total catch.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	5778	736	0	0	144	10870	10507	11626	11345	8316	2017	77
1977	3062	3145	2229	2780	3724	5575	6030	5096	4259	6398	5719	3597
1978	971	366	152	777	5826	6623	6150	6360	4490	3585	3539	3479
1979	2428	540	5245	6444	6184	5252	4298	3904	2352	1563	3007	1617
1980	4651	5066	4942	5892	7203	7561	6656	5226	5500	2508	0	686
1981	3564	3555	2964	4279	7157	4844	7016	7153	4560	3165	3468	2103
1982	3422	709	1	2441	8342	7738	6784	7803	4738	6907	4239	1168
1983	37	247	577	2029	7655	7838	9260	6855	5952	6785	5625	3357
1984	45	495	4426	7258	7825	8538	8069	3973	2117	4141	4487	1431
1985	2109	3513	5362	3419	5318	7221	6889	9117	6051	8733	6047	2429
1986	3337	3154	3553	5311	4689	9087	8759	7702	9164	14529	4648	2935
1987	2979	1731	4748	6167	7616	8168	9707	10340	7869	10724	4970	2911
1988	2318	2913	3589	7443	7636	7663	8835	8384	9110	7529	5412	2785
1989	2513	3029	4344	7873	6499	10264	13482	9722	7014	7757	4771	3403
1990	4097	4286	4952	8453	9011	8972	8997	8225	7393	7087	7957	4540
1991	4103	3653	4056	3834	6416	9439	11591	9941	8654	10243	11233	8326
1992	4695	3591	6037	6724	8463	11196	11442	10880	11384	13591	10274	7210
1993	2639	3164	4357	5950	7670	7991	8703	9658	10352	12584	11009	6937
1994	4321	3905	6566	8553	7342	7165	9656	9408	10678	11705	7942	5565
1995	3851	5268	7792	10378	8138	7800	8526	8722	8318	8091	6496	4009
1996	4028	6409	7885	9144	8873	8793	8842	9446	8570	6118	3302	2684
1997	3634	5995	6273	6562	7664	8185	9514	8061	7882	7277	5035	2047
1998	8625	6421	5896	9980	10439	10506	10306	5018	5423	3545	2578	1758
1999	5025	5643	7375	8133	9369	8564	11077	8738	8370	8202	6619	5077
2000	4397	6464	7418	9028	9643	11314	11474	8495	7857	6854	8295	5773
2001*	4281	5463	6239	5755	8611	11179	12529	11996	9915	10965	8152	7697
2002*	8814	5975	7984	11474	12308	12234	15670	14700	12419	11494	12711	9372
2003*	8646	8063	10716	11949	12834	11324	10803	11293	13733	11852	10974	7948
2004*	8037	8617	8867	12349	14083	13915	12614	10083	15148	14177	12697	11167
2005**	10510	8588	12505	14576	14906	12878	12606	5344				

* Provisional;
** 2005 partial data; log-book catches as reported, not weighted up.

Table 5. Catch, effort and CPUE statistics for the shrimp fishery on the West Greenland shelf, 1970.2005.

Year	TAC (t)			Catch (t)					Effort			CPUE				
				SA 1			Div. 0A		SA 1	Div. 0A	Total	Total	SA 1	Div. 0A	Avge	Std Avge
	SA 1*	Div. 0A	Total	Offshore	Inshore	Total	Offshore	Total	Unstd. ('000 hr's)			Std. (index)	Unstd. (kg/hr)			(1976=1)
1975	no	no	no	36977	9570	46547	0	46547	74.2	-	74	-	628	-	628	-
1976	no	no	no	52993	8030	61023	392	61415	80.1	-	80	1.00	762	-	766	1.00
1977	-	-	36000	42578	8580	51158	457	51615	73.1	-	73	0.93	699	-	706	0.90
1978	-	1000	41000	33835	8360	42195	122	42317	84.2	-	84	0.98	501	-	503	0.70
1979	-	2000	31500	32852	8250	41102	1732	42834	72.4	7.3	80	1.10	568	236	537	0.63
1980	-	2500	32000	44916	8250	53166	2726	55892	80.0	11.6	92	1.18	665	235	610	0.77
1981	35000	5000	40000	40295	8250	48545	5284	53829	88.2	16.6	105	1.20	551	318	514	0.73
1982	34800	5000	39800	43979	8250	52229	2064	54293	81.1	6.7	88	0.95	644	309	619	0.94
1983	34625	5000	39625	42553	8250	50803	5413	56216	89.0	17.4	106	1.12	571	311	528	0.82
1984	34925	5000	39925	42414	8250	50664	2142	52806	85.0	7.7	93	1.12	596	280	570	0.77
1985	42120	6120	48240	54889	8250	63139	3069	66208	129.1	18.2	147	1.34	489	169	449	0.80
1986	42120	6120	48240	65623	8250	73873	2995	76868	133.4	6.7	140	1.46	554	445	549	0.86
1987	40120	6120	46240	64222	7613	71836	6095	77931	137.1	11.1	148	1.24	524	550	526	1.02
1988	40120	6120	46240	56479	11256	67735	5881	73616	152.9	10.7	164	1.75	443	550	450	0.69
1989	45245	7520	52765	58890	14546	73436	7235	80671	179.6	16.9	196	2.22	409	428	411	0.59
1990	45245	7520	52765	62800	14993	77793	6177	83970	209.5	13.8	223	2.38	371	446	376	0.57
1991	46225	8500	54725	66818	17884	84701	6788	91489	230.8	19.6	250	2.59	367	346	365	0.58
1992	44200	8500	52700	75341	22653	97994	7493	105487	234.2	16.6	251	2.73	418	451	421	0.63
1993	40600	8500	49100	65894	19627	85522	5491	91013	206.1	12.2	218	2.43	415	450	417	0.61
1994	42300	8500	50800	68109	19930	88039	4766	92805	209.8	15.3	225	2.52	420	312	412	0.60
1995	39500	8500	48000	66955	18072	85027	2361	87388	184.7	7.8	193	2.23	460	303	454	0.64
1996	63922	8500	72422	62368	19095	81463	2632	84095	164.6	8.4	173	2.13	495	312	486	0.64
1997	64600	8500	74800	62743	14868	77611	517	78128	184.9	0.9	186	2.02	420	597	421	0.63
1998	60729	7650	68379	69156	10406	79562	933	80495	152.7	2.0	155	1.84	521	472	520	0.71
1999	71000	9350	80350	71197	18948	90145	2046	92191	164.4	4.1	168	1.97	548	504	547	0.76
2000	71000	9350	80350	72291	23133	95424	1588	97012	154.6	2.0	157	1.84	617	811	619	0.86
2001'	82000	12040	94040	79174	19981	99156	3625	102781	158.1	4.2	162	2.01	627	868	633	0.83
2002'	91150	12040	103190	107271	21636	128906	6247	135153	173.3	6.9	180	2.24	744	901	750	0.98
2003'	101000	14167	115167	105051	18794	123845	6291	130136	125.2	5.8	131	2.03	989	1081	993	1.05
2004'	135352	18417	153769	115384	19671	135055	6699	141754	129.9	8.7	139	1.82	1040	766	1022	1.27
2005''	134000	18417	152417	115384	18616	134000	18417	152417	110.9	-	-	1.85	1208	-	-	1.34

Notes: * in 1981–1995 quotas applied to the offshore area only; ' preliminary; '' projected from logbook data available and assuming the quota will be caught.

Table 6. Discards of shrimp and fish and landed catch reported as *P. montagui* in the shrimp fishery in NAFO Subarea 1.

	P. borealis		**Fish**		***P. montagui***
Year	discard (tons)	discard (%)	discard (tons)	discard (%)	landed (tons)
1975	0	0.0	0	0.0	0
1976	0	0.0	0	0.0	0
1977	0	0.0	23	0.0	0
1978	0	0.0	27	0.1	0
1979	0	0.0	151	0.4	0
1980	0	0.0	186	0.3	0
1981	0	0.0	725	1.5	0
1982	0	0.0	788	1.5	0
1983	0	0.0	964	1.9	0
1984	0	0.0	1311	2.6	0
1985	149	0.2	1501	2.4	0
1986	110	0.1	1639	2.2	0
1987	182	0.3	885	1.2	0
1988	209	0.3	1067	1.6	0
1989	197	0.3	1403	1.9	0
1990	263	0.3	126l	1.6	0
1991	407	0.5	2053	2.4	0
1992	335	0.3	2162	2.2	0
1993	250	0.3	1906	2.2	0
1994	331	0.4	2671	3.0	5
1995	476	0.6	2700	3.2	562
1996	324	0.4	2712	3.3	773
1997	310	0.4	2327	3.0	422
1998	314	0.4	2183	2.7	1253
1999	197	0.2	0	0.0	4
2000	265	0.3	678	0.7	302
2001*	382	0.4	1120	1.1	881
2002*	649	0.5	1274	1.0	225
2003*	643	0.5	1298	1.0	974
2004*	722	0.5	990	0.7	767
2005**	636	0.5	698	0.5	213

** partial data; * provisional data.

Table 7. Catches* (tons) of fish (Agnatha, Chondrichthyes, and Teleosts) in Canadian SFA1 (NAFO Div. 0A east of 60°30'W).

Year	Fish Catch	Shrimp	Percent
1979	186	1732	10.7
1980	360	2726	13.2
1981	899	5284	17.0
1982	232	2064	11.2
1983	140	5413	2.6
1984	230	2142	10.7
1985	403	3069	13.1
1986	868	2995	29.0
1987	701	6095	11.5
1988	737	5881	12.5
1989	1840	7235	25.4
1990	1341	6177	21.7
1991	2512	6788	37.0
1992	2454	7493	32.7
1993	1426	5491	26.0
1994	1479	4766	31.0
1995	368	2361	15.6
1996	610	2632	23.2
1997	67	518	12.9
1998	155	933	16.6
1999	132	2046	6.5
2000	35	1588	2.2
2001	87	3625	2.4
2002	205	6247	3.3
2003	316	6291	5.0
2004	349	6699	5.2

Table 8. Standardized (1990=1) CPUE series for 4 fleets fishing northern shrimp in West Greenland waters and a combined standardized (1976=1) CPUE series for the fishery.

	1BCD		KGH		Small ves.		0A		Combined		
Year	mean	se	mean	se	mean	se	mean	se	25%	median	75%
1976	-	-	1.66	0.15	-	-	-	-	0.84	1.00	1.19
1977	-	-	1.56	0.09	-	-	-	-	0.80	0.90	1.01
1978	-	-	1.23	0.07	-	-	-	-	0.64	0.70	0.77
1979	-	-	1.11	0.07	-	-	-	-	0.58	0.63	0.70
1980	-	-	1.34	0.08	-	-	1.56	0.60	0.70	0.77	0.86
1981	-	-	1.27	0.07	-	-	1.20	0.13	0.67	0.73	0.80
1982	-	-	1.61	0.10	-	-	1.21	0.24	0.83	0.94	1.06
1983	-	-	1.42	0.09	-	-	-	-	0.73	0.82	0.92
1984	-	-	1.34	0.08	-	-	-	-	0.69	0.77	0.85
1985	-	-	1.43	0.08	-	-	0.42	0.20	0.73	0.80	0.89
1986	-	-	1.49	0.09	-	-	-	-	0.77	0.86	0.96
1987	1.78	0.09	1.79	0.11	-	-	0.97	0.15	0.95	1.02	1.10
1988	1.17	0.03	1.47	0.09	1.28	0.06	0.96	0.10	0.67	0.69	0.70
1989	1.02	0.02	1.09	0.07	1.05	0.04	0.90	0.05	0.58	0.59	0.60
1990	1.00	-	1.00	-	1.00	-	1.00	-	0.57	0.57	0.57
1991	1.02	0.02	-	-	0.89	0.03	0.85	0.04	0.57	0.58	0.59
1992	1.13	0.02	-	-	0.94	0.03	0.96	0.05	0.62	0.63	0.64
1993	1.06	0.02	-	-	1.03	0.03	0.98	0.05	0.60	0.61	0.62
1994	1.08	0.02	-	-	0.88	0.03	0.70	0.04	0.59	0.60	0.61
1995	1.18	0.02	-	-	0.89	0.03	0.75	0.05	0.62	0.64	0.65
1996	1.22	0.03	-	-	0.87	0.03	0.68	0.04	0.63	0.64	0.66
1997	1.21	0.03	-	-	0.85	0.02	0.97	0.13	0.62	0.63	0.65
1998	1.32	0.03	-	-	1.01	0.04	0.69	0.07	0.69	0.71	0.73
1999	1.47	0.04	-	-	1.05	0.03	0.91	0.07	0.74	0.76	0.79
2000	1.53	0.05	-	-	1.38	0.04	1.18	0.11	0.83	0.86	0.89
2001	1.57	0.05	-	-	1.22	0.04	1.29	0.10	0.80	0.83	0.87
2002	1.78	0.05	-	-	1.52	0.05	1.52	0.10	0.94	0.98	1.03
2003	1.92	0.06	-	-	1.55	0.05	1.68	0.11	0.99	1.05	1.10
2004	2.93	0.10	-	-	1.72	0.05	1.26	0.08	1.19	1.27	1.35
2005	3.18	0.00	-	-	1.80	0.07	-	-	1.22	1.34	1.48

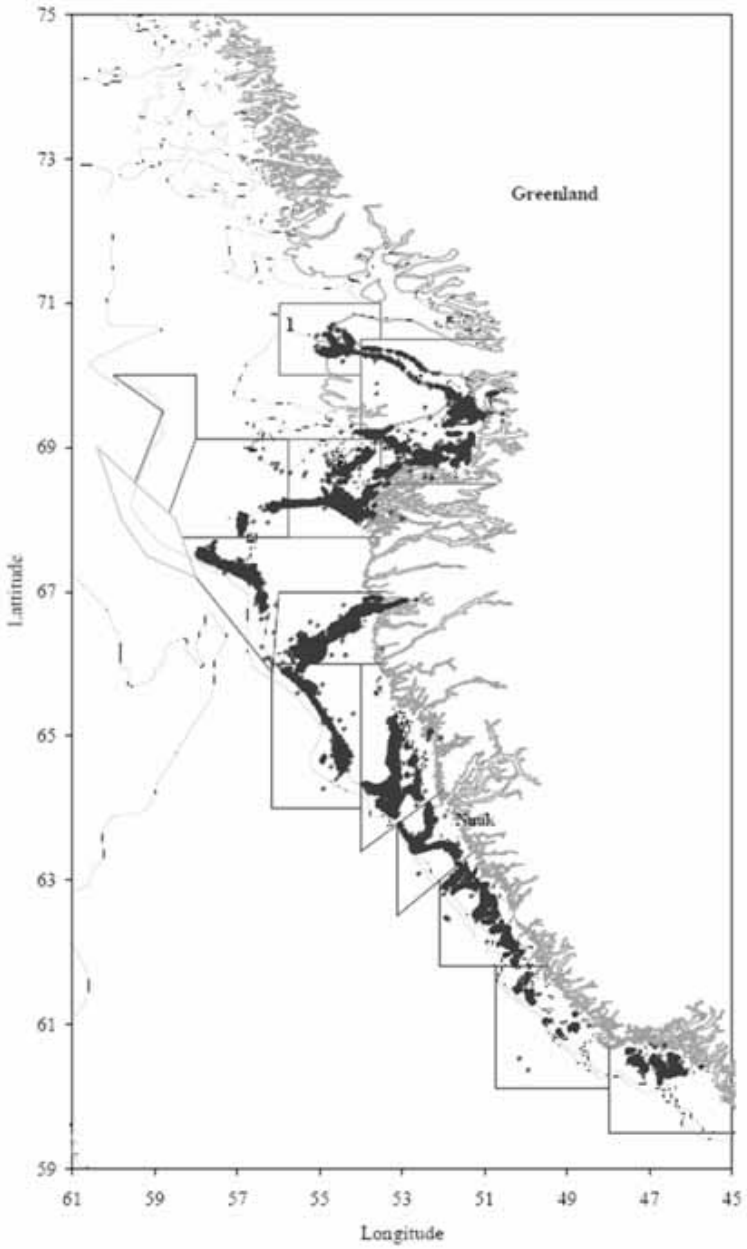

Fig. 1. Distribution of the shrimp fishery in NAFO Subarea 1 in 2004, showing subdivisions used for statistical (GLM) analyses.

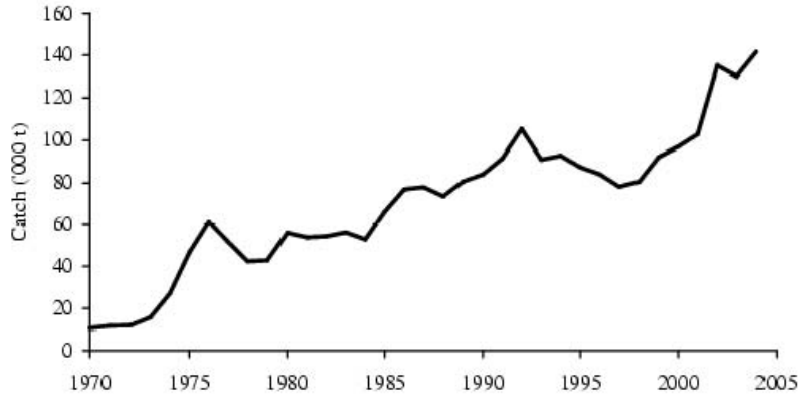

Fig. 2. Catches in the West Greenland shrimp fishery, 1970–2005.

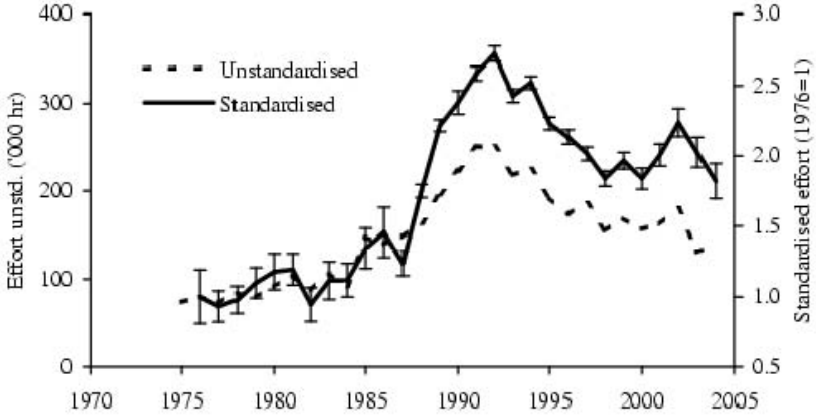

Fig. 3. Fishing effort applied in the West Greenland shrimp fishery.

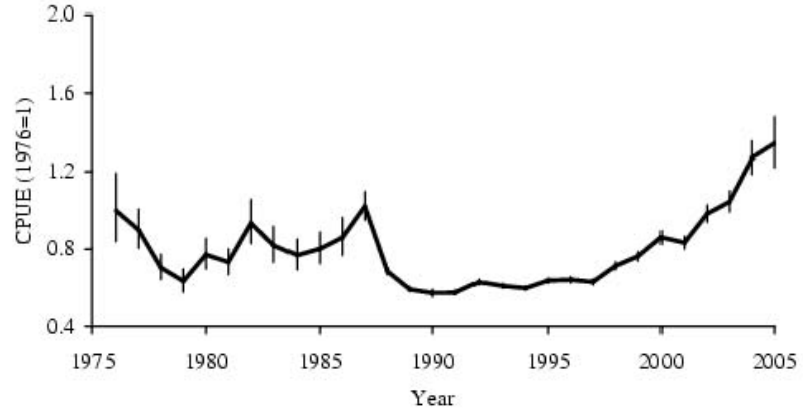

Fig. 4. Catch per unit of standardized effort in the West Greenland shrimp fishery, 1976-2005.

APPENDIX: Output from a run of SAS Proc. GLM for the Greenland offshore fleet.

```
                                   The SAS System                    09:13 Monday, October 10, 2005   27
                                  The GLM Procedure
                               Class Level Information

Class   Levels  Values
VESSEL    27    AAAA  BBBB  CCCC  DDDD  EEEE  FFFF  GGGG  HHHH  IIII  JJJJ  OUIQ  OUKV  OVZM  OWLQ  OWUD  OWVM  OYBZ  OYCZ  OYFF  OYKK  OYPK
                OYRK  OYRT  OZMA  OZWQ  OZWR  ZZZZ
YEAR      19    87  88  89  91  92  93  94  95  96  97  98  99  100 101 102 103 104 105 109
MONTH     4     2   7   11  12
AREA      7     4   5   6   10  11  12  13

                          Number of Observations Read      9687
                          Number of Observations Used      9687
                                   The SAS System                    09:13 Monday, October 10, 2005  28
                                  The GLM Procedure

Dependent Variable: LNCPUE
Weight: HAULS

                  Source               DF      Sum of Squares       Mean Square     F Value    Pr > F
                  Model                53         53573.39306        1010.81874      312.27    <.0001
                  Error              9633         31182.26397           3.23703
                  Corrected Total    9686         84755.65703

                                       R-Square         Coeff Var       Root MSE        LNCPUE Mean
                                       0.632092         90.28793        1.799173        1.992706

                  Source               DF         Type I SS          Mean Square          F Value      Pr > F
                  VESSEL               26       44353.38420          1705.89939           527.00      <.0001
                  MONTH                 3        1268.51035           422.83678           130.63      <.0001
                  AREA                  6        1074.08268           179.01378            55.30      <.0001
                  YEAR                 18        6877.41584           382.07866           118.03      <.0001

                  Source               DF       Type III SS          Mean Square          F Value      Pr > F
                  VESSEL               26       13299.07775           511.50299           158.02      <.0001
                  MONTH                 3        1198.60611           399.53537           123.43      <.0001
                  AREA                  6         698.64774           116.44129            35.97      <.0001
                  YEAR                 18        6877.41584           382.07866           118.03      <.0001

                                                                     Standard
                       Parameter              Estimate                 Error         t Value         Pr > |t|

                       Intercept           1.214439545  B   0.04682174          25.94           <.0001
                       VESSEL    AAAA      0.582729674  B   0.03589632          16.23           <.0001

   VESSEL  BBBB      0.376055281 B    0.03796888      9.90     <.0001
   VESSEL  CCCC      0.423850134 B    0.03622827     11.70     <.0001
   VESSEL  DDDD      0.509473809 B    0.03612053     14.10     <.0001
   VESSEL  EEEE      1.105938854 B    0.03855824     28.68     <.0001
   VESSEL  FFFF      0.209667485 B    0.04110662      5.10     <.0001
   VESSEL  GGGG      0.938789686 B    0.03643739     25.76     <.0001
   VESSEL  HHHH      0.660764936 B    0.03815361     17.32     <.0001
   VESSEL  IIII      1.157525138 B    0.03540432     32.69     <.0001
```

VESSEL	JJJJ	0.536222880	B	0.03680079	14.57	<.0001
VESSEL	OUIQ	0.818484997	B	0.04641074	17.64	<.0001
VESSEL	OUKV	1.185733725	B	0.03812393	31.10	<.0001
VESSEL	OVZM	1.024821782	B	0.07395600	13.86	<.0001
VESSEL	OWLQ	0.122941972	B	0.05583869	2.20	0.0277
VESSEL	OWUD	0.462314058	B	0.04089924	11.30	<.0001
VESSEL	OWVM	0.280194857	B	0.05046602	5.55	<.0001
VESSEL	OYBZ	0.868118027	B	0.04024753	21.57	<.0001
VESSEL	OYCZ	0.834049981	B	0.05204109	16.03	<.0001
VESSEL	OYFF	0.932525252	B	0.05269435	17.70	<.0001
VESSEL	OYKK	0.728655046	B	0.03886780	18.75	<.0001
VESSEL	OYPK	1.205954335	B	0.07479787	16.12	<.0001
VESSEL	OYRK	0.776322200	B	0.03898395	19.91	<.0001
VESSEL	OYRT	0.610597100	B	0.04388771	13.91	<.0001
VESSEL	OZMA	0.938847165	B	0.06286253	14.93	<.0001
VESSEL	OZWQ	1.393311026	B	0.05609037	24.84	<.0001
VESSEL	OZWR	1.253279802	B	0.07474312	16.77	<.0001
VESSEL	ZZZZ	0.000000000	B	.	.	.
MONTH	2	0.086378676	B	0.01860995	4.64	<.0001
MONTH	7	0.189921429	B	0.01042187	18.22	<.0001
MONTH	11	0.063656297	B	0.01120439	5.68	<.0001
MONTH	12	0.000000000	B	.	.	.
AREA	4	-0.296723194	B	0.03343428	-8.87	<.0001
AREA	5	-0.439825619	B	0.03768329	-11.67	<.0001
AREA	6	-0.243532541	B	0.03300578	-7.38	<.0001
AREA	10	-0.305257957	B	0.03126221	-9.76	<.0001
AREA	11	-0.227925484	B	0.03159009	-7.22	<.0001
AREA	12	-0.104181696	B	0.03813348	-2.73	0.0063
AREA	13	0.000000000	B	.	.	.
YEAR	87	0.579087000	B	0.04746508	12.20	<.0001
YEAR	88	0.156988675	B	0.02395464	6.55	<.0001
YEAR	89	0.024571154	B	0.02043283	1.20	0.2292
YEAR	91	0.022205532	B	0.01879581	1.18	0.2375
YEAR	92	0.119709037	B	0.01935527	6.18	<.0001
YEAR	93	0.061499731	B	0.01941014	3.17	0.0015
YEAR	94	0.080180220	B	0.01932948	4.15	<.0001
YEAR	95	0.163830077	B	0.02014063	8.13	<.0001
YEAR	96	0.199304989	B	0.02177683	9.15	<.0001
YEAR	97	0.187377914	B	0.02314731	8.10	<.0001
YEAR	98	0.279257312	B	0.02485946	11.23	<.0001
YEAR	99	0.384741848	B	0.02500177	15.39	<.0001
YEAR	100	0.428464153	B	0.02975640	14.40	<.0001
YEAR	101	0.447981341	B	0.02960612	15.13	<.0001
YEAR	102	0.574265622	B	0.02964588	19.37	<.0001
YEAR	103	0.654310832	B	0.03172676	20.62	<.0001
YEAR	104	1.074011130	B	0.03325108	32.30	<.0001
YEAR	105	1.156668860	B	0.04548797	25.43	<.0001
YEAR	109	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: Output from a run of SAS Proc GLM for the Canadian fleet fishing in SFA 1.

Class Level Information

Class	Levels	Values
YEAR	22	1980 1981 1982 1985 1987 1988 1989 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2090
MONTH	5	7 9 10 11 13
Cvf	14	101058 101597 105795 126453 134608 134993 154641 17009 176085 176119 4037 4043 4046 9158909
GEAR	2	2 91

Number of Observations Read 524
Number of Observations Used 524

Dependent Variable: LNCPUE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	39	6099.347825	156.393534	54.66	<.0001
Error	484	1384.719527	2.860991		
Corrected Total	523	7484.067352			

R-Square	Coeff Var	Root MSE	LNCPUE Mean
0.814978	27.77319	1.691446	6.090212

Source	DF	Type I SS	Mean Square	F Value	Pr > F
MONTH	4	731.887644	182.971911	63.95	<.0001
cvf	13	2951.645227	227.049633	79.36	<.0001
YEAR	21	2109.713682	100.462556	35.11	.0001
GEAR	1	306.101272	306.101272	106.99	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
MONTH	4	111.679379	27.919845	9.76	<.0001
cvf	13	1005.429983	77.340768	27.03	<.0001
YEAR	21	1374.729503	65.463310	22.88	<.0001
GEAR	1	306.101272	306.101272	106.99	<.0001

Dependent Variable: LNCPUE

Parameter		Estimate		Standard Error	t Value	Pr > |t|
Intercept		6.125969221	B	0.04868841	125.82	<.0001
MONTH	7	0.116980498	B	0.03332004	3.51	0.0005
MONTH	9	0.059770388	B	0.02790286	2.14	0.0327
MONTH	10	-0.015488245	B	0.03000540	-0.52	0.6060
MONTH	11	-0.099766397	B	0.03352185	-2.98	0.0031
MONTH	13	0.000000000	B	.	.	.
Cvf	101058	0.179195599	B	0.05012657	3.57	0.0004
Cvf	101597	0.195759884	B	0.04673239	4.19	<.0001
Cvf	105795	0.450262088	B	0.08271525	5.44	<.0001
Cvf	126453	0.119258797	B	0.08077016	1.48	0.1405
Cvf	134608	-0.135148845	B	0.06220941	-2.17	0.0303
Cvf	134993	-0.206372023	B	0.02973067	-6.94	<.0001
Cvf	154641	-0.614089707	B	0.09004919	-6.82	<.0001
Cvf	17009	-0.479638426	B	0.10834938	-4.43	<.0001
Cvf	176085	0.129199985	B	0.03819842	3.38	0.0008
Cvf	176119	0.075113490	B	0.06835198	1.10	0.2723

Cvf	4037	-0.709130176	B	0.14358715	-4.94	<.0001
Cvf	4043	-0.429673203	B	0.06820589	-6.30	<.0001
Cvf	4046	-0.316664506	B	0.04268996	-7.42	<.0001
Cvf	99158909	0.000000000	B	.	.	.
YEAR	1980	0.443109730	B	0.32615590	1.36	0.1749
YEAR	1981	0.182625292	B	0.10225475	1.79	0.0747
YEAR	1982	0.190664645	B	0.17992409	1.06	0.2898
YEAR	1985	-0.863056009	B	0.39243939	-2.20	0.0283
YEAR	1987	-0.032179163	B	0.14833776	-0.22	0.8284
YEAR	1988	-0.044764915	B	0.09541421	-0.47	0.6392
YEAR	1989	-0.107177013	B	0.05671897	-1.89	0.0594
YEAR	1991	-0.164006369	B	0.05144267	-3.19	0.0015
YEAR	1992	-0.041782434	B	0.05270754	-0.79	0.4283
YEAR	1993	-0.018680803	B	0.05290191	-0.35	0.7242
YEAR	1994	-0.352198182	B	0.05266431	-6.69	<.0001
YEAR	1995	-0.292858982	B	0.07026424	-4.17	<.0001
YEAR	1996	-0.392592235	B	0.05764809	-6.81	<.0001
YEAR	1997	-0.035361693	B	0.12585165	-0.28	0.7788
YEAR	1998	-0.368896099	B	0.09255976	-3.99	<.0001
YEAR	1999	-0.094706249	B	0.06919097	-1.37	0.1717
YEAR	2000	0.165585911	B	0.08960687	1.85	0.0652
YEAR	2001	0.255233968	B	0.07150064	3.57	0.0004
YEAR	2002	0.420743130	B	0.06117213	6.88	<.0001

Standard Parameter		Estimate		Error	t Value	Pr > |t|
YEAR	2003	0.516693365	B	0.06520164	7.92	<.0001
YEAR	2004	0.234486624	B	0.05966766	3.93	<.0001
YEAR	2090	0.000000000	B	.	.	.
GEAR	2	0.365118821	B	0.03529880	10.34	<.0001
GEAR	91	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.