



**SCIENTIFIC COUNCIL MEETING – NOVEMBER 2003**

An Update of the Assessment of the International Fishery for Shrimp (*Pandalus borealis*)  
in Division 3M (Flemish Cap), 1993-2003 in November 2003

by

U. Skuladottir

Marine Research Institute, Skulagata 4,  
P.O. Box 1390, 121 Reykjavik, Iceland

**Abstract**

The development of the international shrimp (*Pandalus borealis*) fishery in NAFO Division 3M is described. Various indices show that the stock is not declining. Female biomass is either increasing or stable depending on which index one looks at. The recruitment indices from the Faroese survey are difficult to interpret as one is showing recruitment above average and the other below. Nominal catch was 49 000 tons in 2002 as compared to 54 000 tons in 2001. The catch in 2003 is 46 000 tons to 1 October and is expected to reach 55 000 tons in the whole year of 2003.

The results from the ageing which is based on biological sampling shows a great number of three year olds per hour in 2002 and even greater number in 2003 of four year olds proving the 1999 year-class to be very strong as anticipated in last year's assessment.

**Introduction**

The fishery for northern shrimp at Flemish Cap began in the spring of 1993 and has since continued with estimated annual catches (as estimated by STACFIS) of approximately 27 000 to 48 000 in the years 1993 through 1996. After 1996 catches were lower or rising slowly from 25 000 tons in 1997 to 52-0 000 tons in 2000 and further to 54 000 tons in 2001, the highest in the series. Removals to October 2003 of about 46,000 tons are much higher than those reported for the same period in 2002 (38 000 tons). Vessels from as many as 19 nations have participated in this fishery since its beginning.

The development of the international shrimp (*Pandalus borealis*) fishery in NAFO Div. 3M is described. Various indices are listed with the purpose of tracking the status of the Flemish Cap shrimp stock. Among these the standardized CPUE an international database of observer samples is used on which ageing was carried out. The results from the ageing are presented as well as numbers/kgs per age based on either nominal catch or standardised CPUE. The indices of female stock are calculated from this using the standardized CPUE series. Moreover there are recruitment indices from the Faroese survey both from the main trawl and the juvenile bag. Last and not least, the female indices these are also obtained from the EU survey and the Faroese survey.

Background on the assessment and management of this resource since 1993 can be found in Parsons (1998), Skuladottir and Orr (2002) and NAFO Scientific Council Reports (2002).

**Material and Methods**

Shrimp were separated into 3 categories namely, males, primiparous females (including transitionals) and multiparous females according to the sternal spine criterion (McCrary, 1971), oblique carapace lengths were

measured using sliding callipers and grouped into 0.5 mm length-classes. These data form the International shrimp aging database as recommended Appendix II of the 1999 NAFO Scientific Council meeting on shrimp (NAFO, 1999). Modal analysis (MacDonald and Pitcher, 1979) was conducted on an individual month by month basis using each nation's catch, for weighting. This analysis provided the mean lengths and proportions at age and sex per month. The mean lengths were converted to mean weights using length weight relationships for the appropriate months to calculate the number caught (Skuladottir, 1997). An average length at age was calculated for the whole period, weighted by number caught each month and by nation. The mean lengths were then converted to weights using the length weight relationship for April-June. This was said to be the average weight for that particular year at age and sex.

Since the Canadian data (Parsons and Veitch 1996) were only available as annual results for the years 1993-1995, the following two equations were used for this period:

$$\begin{aligned} \text{For males and primiparous females for April and all year around: } & \ln y = 3.037 * \ln x - 7.549 \\ \text{For multiparous females in April-June:} & \ln y = 2.778 * \ln x - 6.689 \end{aligned}$$

Analyses for 1996 - 2001 also made use of the following:

$$\begin{aligned} \text{For multiparous females July:} & \ln y = 2.921 * \ln x - 7.144 \\ \text{For multiparous females August:} & \ln y = 3.111 * \ln x - 7.689 \\ \text{For multiparous females Sept-March:} & \ln y = 2.929 * \ln x - 7.085 \end{aligned}$$

## Results and Discussion

### COMMERCIAL FISHERY DATA

Catch per month is presented in Tables 1-3 as reported provisionally to NAFO. In those tables there does not seem to be much seasonality apart from there being very little catch usually in January. Most catch is taken in the period March to November. Catch has been gradually in the last years since the 1997 and 1998 low of 25 000 and 30 000 respectively to 54 000 tons in 2001 to decline to 49 000 tons in 2002. The catch is 46 320 tons in 2003 to 1 October and is expected to be at least 55 000 tons by the end of the year.

Logbook data from Canadian, Greenlandic, Icelandic, Faroese, and Norwegian and Russian vessels were available. A standardized CPUE series addressed different seasonality, fishing power (size of vessel) and gear (single, double and triple trawl). The multiplicative model which was run using SAS in November 2002 (Skuladottir and Orr, 2002) was now rerun, using the same data as in 2002 using an S-plus model (Gudmundsdottir, 2003). As the S-plus model for the series 1993-2002 gave the same results as the SAS model in 2002, it was considered feasible to run the multiplicative model for standardization of CPUE in S-plus for the whole series 1993-2003 (Gudmundsdottir and Nicolajsen, 2003). The results are shown in Fig. 2. The results are also in combination with the biological samples used to form a standardized female index, see below.

### RECRUITMENT

The Faroese survey provides two recruitment indices. Since 1997, a juvenile shrimp bag has been attached to the gear in the Faroese survey. The results are shown in Fig. 3 and Table 5 (Nicolajsen and Brynjólfsson, 2003). The abundance of two year olds obtained in the main trawl in the Faroese survey was observed for 7 years and is also shown in Fig. 3 and Table 5 (Nicolajsen, 2003).

The two indices do not agree in all years. In 1999 the juvenile bag showed a greater abundance of two-year-olds, which was not apparent in the main survey gear. The 1997 year-class is average or above average in the commercial catch. Both indices showed that the 1998 year-class was weak in 2000 and that the 1998 year-class had been weak in all years. During 2001, two-year-olds were abundant in both the main trawl and the juvenile bag. This the 1999 year-class which has turned out to be quite strong. The 2000 year-class appears to be small in both the main trawl and the juvenile bag. The 2001 year-class however could be bigger as it is prominent in the main trawl in 2003 although not well presented in the juvenile bag. The 2001 year-class is probably above average.

## FEMALE BIOMASS

A spawning stock biomass (SSB) index was calculated as kg/hr of primiparous (including transitionals) plus multiparous females from the international observer database and the standardized CPUE model (Gudmundsdóttir and Nicolajsen, 2003) (Fig. 4). This was compared to the results of the EU survey (Diaz, 2003) and Faroese survey biomass indices (Nicolajsen, 2003). The raw data are provided in table 6. Once again, each index was standardized to the mean of the series and shown in Fig. 4.

The spawning stock (female biomass) as determined from the EU survey biomass index gradually increased during the years prior to the fishery. This may have been due to a gradual increase in stock size after the cod biomass declined in the area. But this was also a reflection of the very strong 1987 year class, most of that were female during 1992. The index showed a decrease from 1994 through to 1997 then an increase during 1998. The SSB of EU survey has fluctuated and increased to a high peak in 2002 to decrease again in 2003. The female biomass from the Faroese survey indices have shown much the same trend as the EU although not fluctuating as much and appears to be rather stable since 1998. The female CPUE decreased from 1993 to 1997 then rose in 1998 and 1999, remaining stable to 2002 to rise considerably in 2003. The biomass indices have been corrected for the years 1988-2002 by a factor of 1.74 adjusting for the more efficient research vessel taken into use in 2003.

## AGE ASSESSMENTS

Age analysis was carried out on biological samples obtained from Canadian, Icelandic and Greenlandic vessels. Table 7 provides results of the age analyses (length and weight at age and sex are listed). This analysis allows the calculation of the number per hour caught and number caught per year (based on nominal catch and the CPUE model) by age group. It should be noted that there are difficulties in the aging once shrimp reach carapace lengths of 26 mm. For this reason, it is likely that 6 and 7 year olds are badly defined. As the modal analysis is quite flexible in fixing age groups the deviation method was used as a guide (Skuladottir, 2003) and sometimes the number of males were found to be three instead of four if that was used as a basis.

In Table 8 the calculated mean lengths are listed. The weights are calculated from the length weight relationship of April. In Table 10 number of shrimp caught are listed. Again the mean weight-at-age and sex group are calculated for the period January through September and the proportions are applied to the nominal catch every year to get the total number of shrimp caught every year.

Table 11 lists the number per hour harvested in the commercial fishery. This is also calculated from Table 7 by first calculating proportions of standardized per kg/hour for each age and sex class. The female part of the standardized CPUE is that of primiparous + multiparous which is presented in figure 4.

In 1993, the 1987 year class appeared as a very strong age 6+ cohort (approximately 12 000 animals / hr). The 1993 year class were two years old in 1995. It was strong in 1995 and 1996, but later the class appears to have decreased in strength resulting in fewer 4 and 5 year olds as might be expected. The 1996 year class was considered mediocre during 1998, but appeared stronger during 1999-2001. The EU survey is not in agreement with the commercial data as the 1995 year class appears to be a very strong year class. It is important to note that the 1998 year class is by far the weakest in the series, but appears to be numerous as 5 year old in 2003. This is probably due to incorrect ageing as it is difficult to assess the age of older shrimp. The 1999 year-class appears to be very strong and is the most abundant four year olds in the whole series in 2003. The 2000 year-class appears to be weak as 3 year olds in 2003 and the 2001 year-class appears to be about average.

## Summary

Catches of shrimp on the Flemish Cap have been maintained at a high level averaging about 45 000 tons for the last five years. The CPUE model indicated that there was a general decline between 1993 and 1996. Then beginning in 1997, catch rates began to increase and increased to 2003 similar to that in 1993. The SSB of the Faroese survey remained low during 1997 but showed an increasing trend to 2003 although not a noticeable as with the standardized female CPUE. The SSB of the EU survey also increased from 1997 to 2002. As the 74% increase in the estimate of biomass index of EU is considered unconvincingly high, the status of the 2003 SSB in EU survey will be unclear for the time being.

The 1999 year-class appears to be very strong, the 2000 year-classes is considered to be weak judging by its occurrence in the fishery in 2003. The 2001 year-class is considered to be about average.

### Acknowledgement

Appreciation is expressed to those who provided data for inclusion in this paper in advance of the 2002 November Meeting.

### References

- Gudmundsdóttir, A., 2003. A short note on modelling in S-plus the standardized CPUE for northern shrimp (*Pandalus borealis*) in Division 3M. NAFO SCR Doc. 03/89, Serial No. N4931: 5p.
- Gudmundsdóttir, A., and A. Nicolajsen 2003. Standardized CPUE indices for shrimp (*Pandalus borealis*) in Division 3M (Flemish Cap) 1993-2003. NAFO SCR Doc. 03/89, Serial No. N4931: 8p.
- NAFO. 2002. Scientific Council Reports, 2002.
- Nicolajsen, A, 2002. Biomass estimate, growth, length and age distribution of the northern shrimp (*Pandalus borealis*) stock on Flemish Cap (NAFO Division 3M), in June 2003 NAFO SCR Doc. 03/87, Serial No. N4929: 12p.
- Nicolajsen, A, and S. Brynjolfsson, 2003. Young northern shrimp (*Pandalus borealis*) index for Flemish Cap (Division 3M), 2003. NAFO SCR Doc. 03/66, Serial No. N4893: 4p.
- McCrary, J.A. 1971. Sternal spines as a characteristic for differentiating between females of some Pandalidae. J. Fish. Res. Board Can. 28: 98-100.
- MacDonald P. D. M.. and T. J. Pitcher 1979. Age groups from size-frequency data: A versatile and efficient method of analysing distribution mixtures. . J. Fish. Res. Board Can. 36: 987-1011.
- Parsons, D.G., 1996. Report of the *Ad Hoc* working group on shrimp (*Pandalus borealis*) Division 3M NAFO SCS Doc. 96/19, Serial No. N2817: 7p.
- Parsons, D.G., 1998. The International Fishery for Shrimp (*Pandalus borealis*) in Division 3M (Flemish Cap), 1993 - 1998. NAFO SCR Doc. 98/92, Serial No. N3093: 12p.
- Del Rio, J.L., J.M. Casas and D. Gonzales Troncoso, 2003. Northern shrimp (*Pandalus borealis*) on Flemish Cap in June 2003. NAFO SCR Doc. 03/80, Serial No. N4921: 19p.
- Skúladóttir, U., 1997. The Icelandic shrimp fishery (*Pandalus borealis* Kr.) at Flemish Cap in 1993-1997. NAFO SCR Doc. 97/85, Serial No. N2931: 30p.
- Skúladóttir, U., 2003. An update of the Icelandic shrimp fishery (*Pandalus borealis* Kr.) at Flemish Cap in 1993-2003. NAFO SCR Doc. 03/83, Serial No. N4925: 20p.
- Skúladóttir, U. and D. Orr, 2002. The International Fishery for Shrimp (*Pandalus borealis*) in Division 3M (Flemish Cap), 1993 - 2002. NAFO SCR Doc. 02/163, Serial No. N4793: 17 p.

Table 1. Catch (tons) by nations and months as reported provisionally to NAFO in year 2001.

Nation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total by months	Year to date
Canada													294	294
Cuba										246	226	325	797	797
Estonia	217	311	1129	1345	1029	1041	1327		1133	774	891	241	9438	9638
EU/Denmark													0	0
EU/Spain			31		168			304		423			926	756
Faroe Is.		440	1443	1548	1548	2187		1238	508		624	570	10196	12280
France										157	126	125	408	408
Greenland													0	0
Honduras													0	0
Iceland		361	801	170		564	949	780	203	530	573	360	5291	5381
Japan									10	60	54	5	130	130
Latvia		102	418	327	346	545	284	314	189	172	80	213	2980	2984
Lithuania	4	116	212	221	213	389	473	284	241	236	215	89	2702	2782
Norway		565	566	966	1135	1872	2101		1336				968	13255
Poland													196	196
Portugal													0	0
Russia	375	563	872	865	895	424	344	130	276	349	377	430	5900	5687
Ukraine													44	348
USA										186		225	411	411
<b>Total</b>	<b>596</b>	<b>2458</b>	<b>5472</b>	<b>5462</b>	<b>5334</b>	<b>7132</b>	<b>5478</b>	<b>3050</b>	<b>3896</b>	<b>3132</b>	<b>3166</b>	<b>3392</b>	<b>48862</b>	<b>55187</b>

Table 2. Catch (tons) by nations and months as reported provisionally to NAFO in year 2002.

Nation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Year to date
Canada						8			8				16	16
Cuba								106	47				153	153
Estonia	316	1027	1286	1666	1325	1366	1692	1418	1041	1246	787	514	13674	13674
EU/Denmark													0	0
EU/Spain				54			368	339		70	211	13	1045	751
Faroe Is.	523	554	485	725	1901	1043	1043	1346	727	360	438	365	9110	8989
France							29			99	33		161	161
Greenland						347							347	680
Honduras													0	0
Iceland			524	564	748	818	301	587		804	454	406	5806	5755
Japan													0	180
Latvia		100	142	365	175	403	206	95	344	55			1885	1885
Lithuania		336	378	404	246	345	370	284	336	299	218	105	3321	3321
Norway		83		451	1362	1464	1694		1739		1123	329	8765	11554
Poland													0	0
Portugal													0	0
Russia	178	189	206			142	114	83	175	59			1146	1145
Ukraine													0	0
USA									96				96	96
<b>Total</b>	<b>8817</b>	<b>2289</b>	<b>3821</b>	<b>4229</b>	<b>5357</b>	<b>5946</b>	<b>5887</b>	<b>4258</b>	<b>4513</b>	<b>2792</b>	<b>3264</b>	<b>1732</b>	<b>44225</b>	<b>47880</b>

Table 3. Catch (tons) by nations and months as reported provisionally to NAFO in year 2003.

Nation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Year to date
Canada													0	0
Cuba													0	0
Estonia	602	392	1279	1318		1217	1506	1371	1169				8854	88290
EU/Denmark													0	0
EU/Portugal													0	0
EU/Spain				6	15	6	21		19				67	91
Faroe Is.	125	294	1087	1022	1239	1705	1380	1453	1253				9588	9625
France													0	0
Greenland						15	760						775	873
Honduras													0	0
Iceland		382	240	440	721	591	595	431	194				3594	3594
Japan													0	0
Latvia		254	530	480	425	319	363	247	245				2863	2898
Lithuania		87	289	453	382	365	450	338	292				2656	2656
Norway	165	306	1267	2305	2802	2985	2435		3074				14838	11867
Poland													0	0
Portugal													0	0
Russia				3									3	3
Ukraine							73	141	24				238	238
USA								162	215				377	377
<b>Total</b>	<b>892</b>	<b>1715</b>	<b>4682</b>	<b>6827</b>	<b>5184</b>	<b>7213</b>	<b>7583</b>	<b>4143</b>	<b>6485</b>				<b>43824</b>	<b>42512</b>

Table 4. Catch (tons) by nations as estimated by STACFIS.

Nation	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003*
Canada	3724	1041	970	906	807	484	490	618	<sup>1</sup> 295	<sup>4</sup> 16	
Cuba							119	45	<sup>1</sup> 797	<sup>4</sup> 153	
Estonia		1081	2092	1900	3240	5694	10835	13256	<sup>3</sup> 9650	<sup>2</sup> 14215	<sup>4</sup> 10290
EU/Denmark	800	400	200			437	235		<sup>4</sup> 92	<sup>4</sup> 359	
EU/Portugal	300		150		170	203	227	289	<sup>4</sup> 420	<sup>4</sup> 15	
EU/Spain	240	300	158	50	421	913	1019	1388	<sup>4</sup> 799	671	<sup>4</sup> 91
Faroe Is.	7333	6791	5993	8688	7410	9368	9199	7719	<sup>3</sup> 10228	<sup>2</sup> 8516	<sup>2</sup> 10209
Greenland	3788	2275	2400	1107	105	853	576	1636		<sup>2</sup> 684	<sup>4</sup> 873
Honduras	1265										
Iceland	2243	2300	7623	20681	6381	6572	9277	8912	<sup>2</sup> 5265	<sup>2</sup> 5741	<sup>2</sup> 3746
Japan									<sup>1</sup> 130		
Latvia		300	350	1940	997	1191	3080	3105	<sup>4</sup> 2990	<sup>4</sup> 1895	<sup>4</sup> 2898
Lithuania		1225	675	2900	1785	3106	3370	3595	<sup>1</sup> 2702	<sup>4</sup> 3321	<sup>4</sup> 2656
Norway	7183	8461	9533	5683	1831	1339	2975	2669	<sup>1</sup> 13291	<sup>4</sup> 11998	414939
Poland					288	148	894		<sup>1</sup> 209		
Russia		350	3327	4445	1090		1142	7078	<sup>1</sup> 5687	21148	<sup>2</sup> 3
France		75			150				<sup>1</sup> 408	<sup>4</sup> 161	
Ukraine									<sup>1</sup> 348		<sup>4</sup> 238
USA									<sup>1</sup> 411	<sup>4</sup> 96	<sup>4</sup> 377
<b>Total</b>	<b>26876</b>	<b>24599</b>	<b>33471</b>	<b>48300</b>	<b>24675</b>	<b>30308</b>	<b>43438</b>	<b>50311</b>	<b>53922</b>	<b>48979</b>	<b>46320</b>

- 1 NAFO Stalfant 21 A
- 2 From the fisheries biologist of respective countries
- 3 Assessed by Stacfis
- 4 Reported to NAFO provisionally

\* Provisional to 1 October

Table 5. Shrimp in Div. 3M. Recruitment indices of 2 year olds (numbers) in the Faroese survey.

Year	Main trawl	juvenile bag
1997	855	
1998	210	2532
1999	214	5683
2000	108	456
2001	1242	4377
2002	416	913
2003	1119	1337

Table 6. Shrimp in Div. 3M. Indices of female bi mass converted by coefficient 1.74 in 1988 to 20 EU survey, Faroese survey and standardized CPUE

Year	EU survey biomass	Faroese standardized Survey biomass	CPUE Kg/hour
1988	3270		
1989	2338		
1990	1975		
1991	9357		
1992	20084		
1993	11935		275.9
1994	4926		130.0
1995	7480		141.0
1996	7240		122.4
1997	6644	6731	122.5
1998	14120	12559	166.0
1999	15795	8863	204.4
2000	11436	10154	211.3
2001	15666	9374	176.3
2002	20355	11761	196.9
2003	10697	12402	252.7

Table 7. Mean weights at age and sex for the period January-September. Nominal catch for the whole year used for calculating proportion of weight and number caught at age and sex. Standardized CPUE for the whole year of single, double and triple trawl is used to calculate CPUE and abundance in numbers at age and sex group.

<b>1993</b>									
Sex	Age	Mean CL mm	Prop. by no.	Mean weight g	Prop. by weight	Nominal catch 26876 tons	kg/hr 386.3	No./hour	Number ( '000'000)
Males	1	10.4	0.0041	0.646	0.00265	9	0.1	190	13.2
Males	2	16.8	0.1148	2.772	0.31823	1023	14.7	5306	369.2
Males	3	20.7	0.2146	5.225	1.12129	3606	51.8	9919	690.2
Males	4	24.0	0.1156	8.188	0.94653	3044	43.8	5343	371.8
Primip.	5	26.0	0.2619	10.441	2.73450	8794	126.4	12106	842.3
Multip.	6+	26.5	0.2890	11.189	3.23362	10400	149.5	13358	929.4
<b>Total</b>			1.0000		8.35681	26876	386.3	46222	3216.1
<b>1994</b>									
Sex	Age		Prop. by no.	Mean weight g	Prop. by weight	Nominal catch 24599 tons	kg/hr 223.7	No./hour	Number ( '000'000)
Males	1								
Males	2	16.4	0.1817	2.576	0.46806	1670	15.2	5894	648.1
Males	3	20.4	0.3629	4.998	1.81377	6470	58.8	11772	1294.5
Males	4	22.9	0.0854	7.101	0.60643	2163	19.7	2770	304.6
Primip.	5	25.7	0.1944	10.08	1.95955	6990	63.6	6306	693.5
Multip.	6+	26.9	0.1756	11.664	2.04820	7306	66.4	5696	626.4
<b>Total</b>			1		6.89601	24599	223.7	32438	3567.1
<b>1995</b>									
Sex	Age		Prop. by no.	Mean weight g	Prop. by weight	Nominal catch 33471 tons	kg/hr 258.7	No./hour	Number ( '000'000)
Males	1								
Males	2	15	0.4516	1.965	0.88739	6079	47.0	23909	3093.5
Males	3	20.3	0.2714	4.924	1.33637	9154	70.8	14369	1859.1
Primip.	4	22.2	0.0507	6.462	0.32762	2244	17.3	2684	347.3
Primip.	5	25.3	0.0962	9.611	0.92458	6333	48.9	5093	659.0
Multip.	6+	26.2	0.1301	10.84	1.41028	9660	74.7	6888	891.2
<b>Total</b>			1		4.88625	33471	258.7	52942	6850.0
<b>1996</b>									
Sex	Age		Prop. by no.	Mean weight g	Prop. by weight	Nominal catch 48300 tons	kg/hr 239.4	No./hour	Number ( '000'000)
Males	1								0.0
Males	2	15.3	0.0622	2.066	0.12860	1011	5.0	2425	489.4
Males	3	20.0	0.6076	4.728	2.87283	22585	111.9	23675	4776.9
Primip.	3	21.4	0.0379	5.788	0.21921	1723	8.5	1476	297.7
Primip.	4	24.8	0.1511	9.034	1.36509	10732	53.2	5888	1187.9
Multip.	3	22.2	0.0063	6.799	0.04274	336	1.7	245	49.4
Multip.	4	24.8	0.0474	9.296	0.44108	3468	17.2	1849	373.0
Multip.	5	26.6	0.0574	11.306	0.64930	5105	25.3	2238	451.5
Multip.	6	28.8	0.0300	14.167	0.42486	3340	16.6	1168	235.8
<b>Total</b>			1		6.14372	48300	239.4	38963	7861.7

Table 7. Continued

<b>1997</b>									
Sex	Age		Prop. by no.	Mean weight g	Prop. by weight	Nominal catch 24675	kg/hr 250.1	No./hour	Number ('000'000)
Males	1	10.4	5.5E-05	0.910	0.0002	1			0.9
Males	2	15.7	0.0522	3.201	0.16714	650	6.6	2058	203.1
Males	3	19.0	0.4092	4.117	1.68462	6552	66.4	16127	1591.3
Males	4	22.3	0.2089	6.633	1.38567	5389	54.6	8234	812.4
Primip.	3	20.6	0.0029	5.237	0.01498	58	0.6	113	11.1
Primip.	4	24.3	0.1724	8.390	1.44630	5625	57.0	6794	670.4
Multip.	3	19.1	0.0025	5.018	0.01240	48	0.5	97	9.6
Multip.	4	24.2	0.0488	9.570	0.46737	1818	18.4	1925	189.9
Multip.	5	25.6	0.0845	10.631	0.89822	3493	35.4	3330	328.6
Multip.	6	28.3	0.0171	14.350	0.24558	955	9.7	675	66.6
Multip.	7	29.3	0.0015	15.070	0.02232	87	0.9	58	5.8
Total			1		6.34481	24675	250.1	39411	3889.6
<b>1998</b>									
Sex	Age	CL mm	Prop. by no.	Mean weight g	Prop. by weight	Nominal catch 30308	Kg/hr 308.44	No./hour	Number ('000'000)
Males	2	14.90	0.0596	1.923	0.11460	581	5.9	3072	301.9
Males	3	18.75	0.3462	3.868	1.33904	6783	69.0	17848	1753.7
Males	4	21.23	0.2321	5.642	1.30929	6633	67.5	11964	1175.6
Primip.	4	23.17	0.1399	7.355	1.02911	5213	53.1	7214	708.8
Primip.	5	25.87	0.0218	10.287	0.22439	1137	11.6	1125	110.5
Multip.	3	18.56	0.0025	4.160	0.01020	52	0.5	126	12.4
Multip.	4	23.51	0.0359	8.02	0.28781	1458	14.8	1850	181.8
Multip.	5	25.17	0.1083	9.7	1.05035	5321	54.2	5583	548.6
Multip.	6	26.47	0.0484	11.15	0.53946	2733	27.8	2494	245.1
Multip.	7	29.07	0.0054	14.47	0.07848	398	4.0	280	27.5
Total			1.0000		5.98273	30308	308.4	51555	5065.9
<b>1999</b>									
Sex	Age	CL mm	Prop. by no.	Mean weight g	Prop. by weight	Nominal catch 43438	kg/hr 320.41	No./hour	Number ('000'000)
Males	1	6.0	0.0001	0.122	0.00001	0	0.0	5	0.7
Males	2	14.5	0.0467	1.769	0.08268	591	4.4	2462	333.8
Males	3	17.6	0.2773	3.176	0.88073	6291	46.4	14610	1980.7
Males	4	21.0	0.2253	5.490	1.23680	8834	65.2	11869	1609.1
Males	5	22.3	0.0003	6.560	0.00187	13	0.1	15	2.0
Primip.	4	22.07	0.0758	6.348	0.48118	3437	25.4	3994	541.4
Primip.	5	24.22	0.1327	8.418	1.11680	7977	58.8	6990	947.6
Multip.	3	18.25	0.0009	3.970	0.00361	26	0.2	48	6.5
Multip.	4	22.00	0.0207	6.672	0.13820	987	7.3	1091	147.9
Multip.	5	24.18	0.1259	8.674	1.09238	7802	57.6	6635	899.5
Multip.	6	26.42	0.0932	11.06	1.03086	7363	54.3	4911	665.7
Multip.	7	29.57	0.0011	15.171	0.01638	117	0.9	57	7.7
Total			1.0000		6.08151	43438	320.4	52687	7142.8



Table 7. Continued

<b>2000</b>									
Sex	Age	CL mm	Prop. by no.	Weight g	Prop. by weight	Nominal catch 50311	kg/hr 353.2	No./hour	Number ( <sup>0</sup> 000 <sup>0</sup> 000)
Males	2	13.18	0.0133	1.326	0.01759	161	1.1	851	121.2
Males	3	17.25	0.3283	3.035	0.99630	9104	63.9	21058	2999.7
Males	4	19.98	0.2488	4.692	1.16750	10669	74.9	15962	2273.8
Males	5	21.90	0.0049	6.200	0.03048	279	2.0	315	44.9
Primip.	4	21.00	0.0686	5.458	0.37453	3422	24.0	4402	627.1
Primip.	5	24.31	0.0902	8.514	0.76796	7018	49.3	5786	824.2
Multip.	3	18.32	0.0029	4.012	0.01174	107	0.8	188	26.7
Multip.	4	21.93	0.0564	6.613	0.37277	3406	23.9	3616	515.1
Multip.	5	24.33	0.1280	8.825	1.12945	10321	72.5	8210	1169.5
Multip.	6	26.08	0.0559	10.703	0.59786	5463	38.4	3583	510.4
Multip.	7	29.32	0.0028	14.32	0.03954	361	2.5	177	25.2
Total			1.0000		5.50573	50311	353.2	64150	9137.9
<b>2001</b>									
Sex	Age	CL mm	Prop. by no.	Mean weight g	Prop. by weight	Nominal catch 53922	kg/hr 350.2	No./hour	Number ( <sup>0</sup> 000 <sup>0</sup> 000)
Males	2	15.23	0.1040	2.058	0.21403	2035	13.2	6422	988.7
Males	3	17.78	0.1393	3.292	0.45858	4360	28.3	8602	1324.3
Males	4	20.82	0.3925	5.315	2.08614	19833	128.8	24236	3731.4
Males	5	21.76	0.0095	6.081	0.05777	549	3.6	587	90.3
Primip.	4	21.48	0.0293	5.848	0.17135	1629	10.6	1809	278.6
Primip.	5	24.02	0.1147	8.204	0.94100	8946	58.1	7083	1090.4
Multip.	4	20.50	0.0240	5.484	0.13179	1253	8.1	1484	228.5
Multip.	5	23.24	0.1111	7.769	0.86314	8206	53.3	6860	1056.2
Multip.	6	25.13	0.0666	9.652	0.64282	6111	39.7	4112	633.2
Multip.	7	26.93	0.0090	11.701	0.10531	1001	6.5	556	85.6
Total			1.0000		5.67192	53922	350.2	61750	9507.1
<b>2002</b>									
Sex	Age	CL mm	Prop. by no.	Mean weight g	Prop. by weight	Nominal catch 48979	kg/hr 354.8	No./hour	Number ( <sup>0</sup> 000 <sup>0</sup> 000)
Males	1	12.05	0.0003	1.011	0.00030	3	0.0	21	2.9
Males	2	15.43	0.0605	2.142	0.12959	1249	9.0	4224	583.2
Males	3	18.14	0.5095	3.497	1.78172	17176	124.4	35574	4911.6
Males	4	20.57	0.0681	5.124	0.34894	3364	24.4	4755	656.5
Primip.	4	20.32	0.0458	4.94	0.22625	2181	15.8	3198	441.5
Primip.	5	23.04	0.0675	7.231	0.48809	4705	34.1	4713	650.7
Multip.	3	19.42	0.0009	4.718	0.00425	41	0.3	63	8.7
Multip.	4	22.17	0.0598	6.818	0.40772	3930	28.5	4175	576.5
Multip.	5	24.11	0.1430	8.6	1.22980	11855	85.9	9984	1378.5
Multip.	6	25.69	0.0430	10.266	0.44144	4255	30.8	3002	414.5
Multip.	7	28.25	0.0017	13.359	0.02271	219	1.6	119	16.4
Total			1.0001		5.08082	48979	354.7	69828	9640.9

Table 7 continued

2003									
Sex	Age	CL mm	Prop. by no.	Mean weight g	Prop. by weight	Nominal catch 55000	kg/hr 421.96	No./hour	Number ( <sup>1</sup> 000 <sup>1</sup> 000)
Males	1	9.96	0.0003	0.566	0.00017	2	0.0	21	2.7
Males	2	15.15	0.0653	2.026	0.13230	1209	9.3	4580	597.0
Males	3	17.80	0.1161	3.306	0.38383	3509	26.9	8143	1061.4
Males	4	20.43	0.3777	5.021	1.89643	17337	133.0	26491	3453.0
Primip.	4	21.65	0.0959	5.985	0.57396	5247	40.3	6726	876.7
Primip.	5	24.14	0.0913	8.338	0.76126	6959	53.4	6404	834.7
Multip.	3	19.96	0.0006	4.678	0.00281	26	0.2	42	5.5
Multip.	4	21.94	0.0551	6.625	0.36504	3337	25.6	3865	503.7
Multip.	5	24.44	0.1321	8.936	1.18045	10792	82.8	9265	1207.7
Multip.	6	26.32	0.0655	10.984	0.71945	6577	50.5	4594	598.8
Multip.	7	29.36	0.0000	14.874	0.00047	4	0.0	2	0.3
Total			0.9999		6.01615	55000	422.0	70133	9141.4

Table 8. Shrimp. Mean length (oblique carapace length mm) at age

Age gr.	1993	1994	1995	Agegr.	1996	1997	1998	1999	2000	2001	2002	2003
1	10.4			1		10.44					12.05	9.96
2	16.8	16.4	15	2	15.25	15.73	14.9	14.49	13.18	15.23	15.43	15.15
3	20.7	20.4	20.3	3	20.54	19.01	18.75	17.59	17.32	17.78	18.14	17.81
4	24	22.9	22.2	4	24.7	23.32	22.09	21.34	20.46	20.84	21.06	20.81
5	28	25.7	25.3	5	24.8	25.56	25.29	24.2	24.27	23.66	23.76	24.32
6+	26.5	26.9	26.2	6	26.6	28.33	26.47	26.42	26.08	25.13	25.69	26.32
				7	28.8	29.26	29.07	29.57	29.32	26.93	28.25	29.36

Table 9. Shrimp. Mean weight at age for the period January to September based on international data base.

Age gr.	1993	1994	1995	Agegr.	1996	1997	1998	1999	2000	2001	2002	2003
1	0.646			1		0.910					1.011	0.966
2	2.772	2.576	1.965	2	2.066	2.270	1.923	1.639	1.326	2.058	2.142	2.026
3	5.225	4.998	4.924	3	4.79	4.130	3.815	3.069	3.044	3.292	3.499	3.312
4	8.188	7.101	6.462	4	8.945	7.671	6.439	6.347	5.122	5.359	5.659	5.363
5	10.441	10.080	9.611	5	9.296	10.631	9.800	8.602	8.641	7.913	8.161	8.691
6+	11.189	11.654	10.840	6	11.306	14.350	11.150	11.060	10.703	9.652	10.266	10.984
				7	14.167	15.070	14.470	15.100	14.32	11.701	13.359	14.874

Table 10. Shrimp. Number (000,000) of shrimp caught annually, based on the ageing of international samples in the period January to September.

Age gr.	1993	1994	1995	Agegr.	1996	1997	1998	1999	2000	2001	2002	2003
1	13.2			1		0.9		0.7			2.9	2.7
2	369.2	646.1	3093.5	2	489.4	203.1	301.9	333.8	121.2	968.7	583.2	597.0
3	690.2	1294.5	1869.1	3	5124.1	1612.1	1766.2	1987.2	3026.5	1324.3	4920.2	1066.9
4	371.8	304.6	347.3	4	1561.0	1672.8	2066.2	2298.5	3415.9	4238.4	1674.5	4833.4
5	842.3	693.5	669.0	5	451.5	328.6	659.1	1849.2	2038.7	2237.0	2029.2	2042.4
6+	929.4	626.4	891.2	6	235.8	66.6	245.1	665.7	510.4	633.2	414.5	598.8
				7		5.8	27.5	7.7	25.2	66.6	16.4	0.3
Total	3216.1	3667.1	6660.1		7661.8	3689.9	5066.0	7142.8	9137.9	9507.2	9640.9	9141.5

Table 11. Shrimp. Number of shrimp caught per hour (Standardized CPUE) annually, based on the ageing of international samples in the period January to September.

Age gr.	1993	1994	1995	Agegr.	1996	1997	1998	1999	2000	2001	2002	2003
1	189			1				5			21	21
2	5306	5894	23809	2	2425	2058	3072	2462	851	6422	4224	4580
3	9919	11772	14369	3	25396	16338	17974	14658	21246	8501	35637	8186
4	5343	2770	2684	4	7736	16953	21028	16954	23860	27529	12128	37082
5	12106	6306	5093	5	2238	3330	6707	13640	14311	13943	14697	15669
6+	13358	5696	6888	6	1169	675	2494	4911	3583	4112	3002	4594
				7		58	280	57	177	556	119	2
Total	46221	32438	52943		38964	39412	51555	52687	64148	61163	69828	70133

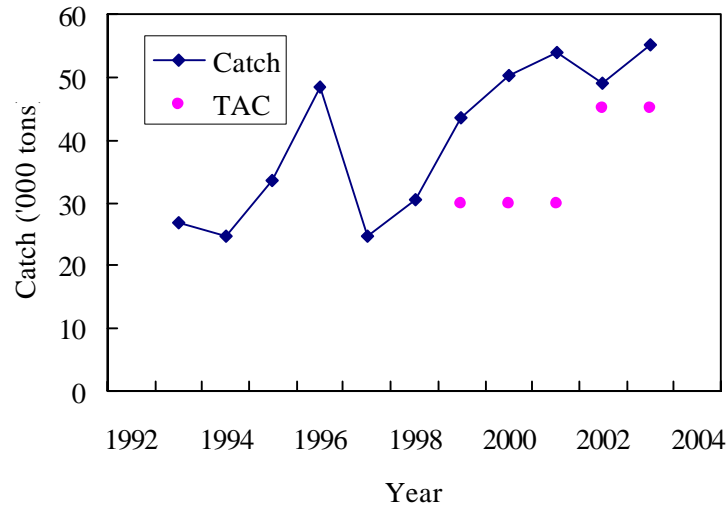


Fig. 1. Shrimp in Div. 3M: catches (2003 projected to end of the year).

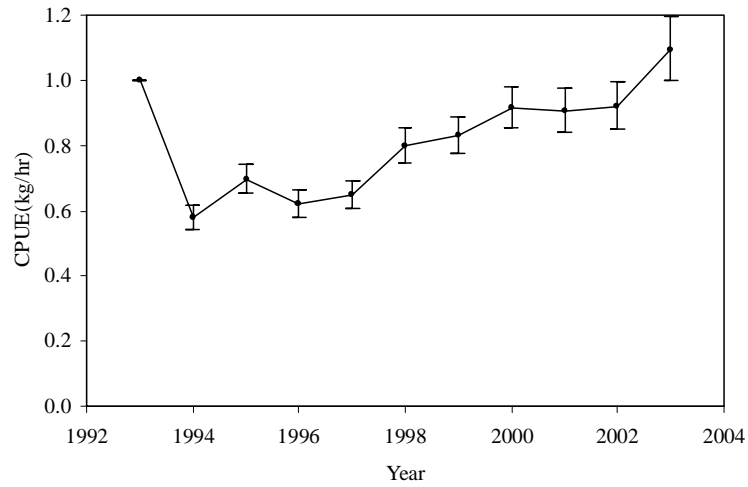


Fig. 2. Shrimp Div. 3M: The standardized CPUE of shrimp on Flemish Cap between 1993-2003. The model was standardized to 1993, June, single trawl and Icelandic catch-per-unit data.

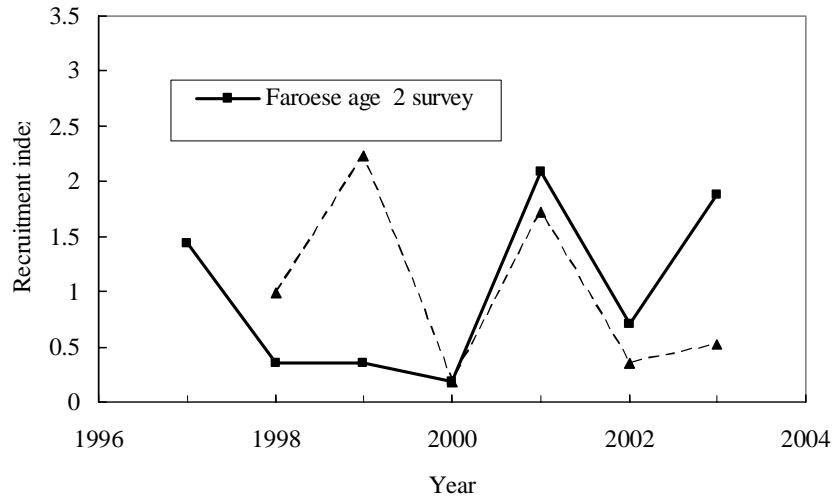


Fig. 3. Shrimp in Div. 3M: abundance indices at age 2 from the Faroese survey and from the juvenile bag. Each series was standardized to its mean.

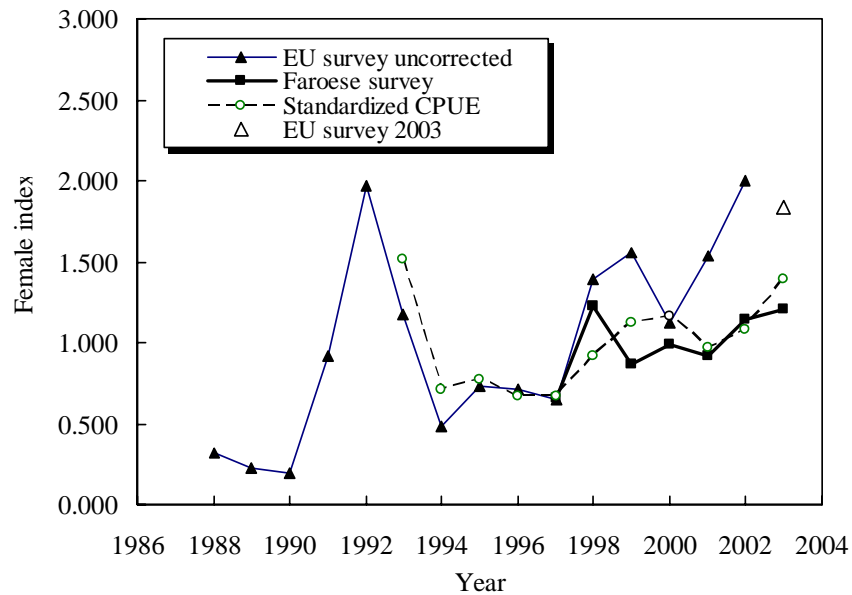


Fig. 4. Shrimp in Div. 3M: female biomass index from EU trawl surveys, 1988-2003, Faroese survey, 1997-2003 and standardized female CPUE, 1993-2003. Each series was standardized to the mean of that series.