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A Provisional Assessment of the International Fishery for Shrimp (*Pandalus borealis*) in Division 3M (Flemish Cap), 1993-2005

by

U. Skúladóttir

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. The standardized CPUE was significantly lower in 2004 as compared to 2003. The standardized CPUE is not yet available for the whole year 2005. A provisional CPUE of Iceland alone January to July shows a CPUE about average in 2005 and a deal higher than in 2004 which was very low. Indices of female stock calculated from an international data base and standardized CPUE showed a decrease from 2003 to 2004. No data are as yet available for year 2005. First indications on female biomass from the EU survey 2005 show that the female biomass is the same as in 2003 and 2004. The recruitment indices from the Faroese survey were not available after 2003 as the survey was discontinued. Recruitment as judged from the 2 year olds in the commercial fishery was very good in 2004. No measure of recruitment has been obtained as yet from the 2005 fishery. Nominal catch was 47 000 tons in 2004 as compared to the peak catch of about 62 000 tons in 2003. The catch to 1 August in 2005 is about 8 000 tons compared to 18 000 tons at the same time last year.

1. 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 52 000 tons in 2000 and further to 62 200 tons in 2003, the highest in the series. Removals to August 2005 of about 8 000 tons are much lower than those reported for the same period in 2004 (18 000 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 has been carried out in the past. Moreover there were recruitment indices from the Faroese survey both from the main trawl and the juvenile bag that were however discontinued after 2003. Last and not least there are female indices obtained from the Faroese survey to year 2003 and the EU survey to year 2005.

Background on the assessment and management of this resource since 1993 can be found in Parsons (MS 1998), Skuladottir and Orr (MS 2002) Skuladottir and Gudmundsdottir (MS 2004) and NAFO Scientific Council Reports (2004).

2. **Catch**

Catch of shrimp by months is listed in Tables 1-3 for the years 2003, 2004 and 2005. Those are provisional numbers as reported to STACFIS every month. If a month is not reported at the right time but later the missing catch figure will still be included in the "year to date" figure at the right hand side of the table. Nominal catch by years is presented in Table 4 and Fig. 1. In the most recent years the total catch is listed as the total catch as reported to NAFO provisionally by month. Sometimes STACFIS had to estimate the catches.

3. **CPUE**

An Icelandic CPUE calculated as that of a standard size of trawl (3 000 meshes) is shown as this has provisional data for year 2005 (Table 5 Fig. 2). The CPUE has increased to about average for the period January to July from the low 227 kg/hr in 2004. The standardized Catch per unit of effort CPUE (Fig. 3) is lifted from last years' assessment paper (Skuladottir and Gudmundsdottir, MS 2004). These were calculated by using a multiplicative model based on data presented by 6 nations.

4. **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 table 6 (Nicolajsen and Brynjolfsson, MS 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 Table 6 (Nicolajsen, MS 2003).

The two indices do not agree in all years. During 2001, two year olds were abundant in both the main trawl and the juvenile bag. This is 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 was above average in the fishery in 2004. As the Faroese survey has not taken place since 2003 a series of two year olds in the commercial fishery is presented (Table 7). The 2002 year-class appears to be one of the strongest. This substantiated by the occurrence of one year olds in the EU survey in 2003 and also the two year olds in the EU survey 2004 (Casas *et al*., MS 2004).

5. **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 (Skuladottir and Gudmundsdottir, MS 2004). This was compared to the results of the EU survey (Casas, pers. comm., 2005) and the Faroese survey biomass indices (Nicolajsen, MS 2003). The data are provided in Table 8.

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 biomass indices of the EU surveys have been corrected for the years 1988-2002 adjusting for the more efficient research vessel R/V *Vizconde de Eza* taken into use in year 2003 (Casas pers. comm., 2005). The data for the years 2003-2005 are without any conversion. 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 female biomass of EU survey has fluctuated between 1998 and 2001 and increased to a high peak in 2002 to decrease again in 2003-2005 to the level of 1998-2001. The female CPUE decreased from 1993 to 1997, increased to 1999 fluctuating to 2002 to increase considerably in 2003. After this in the years 2004, the female CPUE index decreased to the level of the years 1998-2002.

6. **Summary**

Catches of shrimp on the Flemish Cap have been maintained at a high level averaging about 48 000 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 spawning stock biomass also decreased between 1993 and 1994. The survey SSB of the Faroese survey remained low during 1997 but showed an increasing trend to 2003. The SSB of the EU survey also increased from 1997 to 1998 to remain rather stable in the years 1999-2001, increased to 2002 to decrease again in 2003-2005 to the level of the period 1998-2001. The 2001 and 2002 year-classes are considered to be above average.

7. **Acknowledgement**

Appreciation is expressed to those who provided data for inclusion in this paper in advance of the 2005 September Meeting.

8. **References**

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Table 1. 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**	
Cuba													**0**	**81**
Estonia	602	392	1279	1318		1217	1506	1371	1169	883			**9737**	**12732**
EU/Denmark													**0**	
EU/Portugal													**0**	
EU/Spain				6	15	6	21		19	33	26	11	**137**	**161**
Faroe Is.	125	294	1087	1022	1239	1705	1380	1453	1253	952	851	501	**11862**	**12622**
France													**0**	
Greenland						15	760						**775**	**873**
Honduras													**0**	
Iceland		382	240	440	721	591	595	431	194	376	312	306	**4588**	**4588**
Japan										73	29	15	**117**	**116**
Latvia		254	530	480	425	319	363	247	245	159	192		**3214**	**3453**
Lithuania		87	289	453	382	365	450	338	292	402	333	353	**3744**	**3744**
Norway	165	306	1257	2305	2402	2995	2435		3074		1234	680	**16853**	**22874**
Poland													**0**	
Portugal													**0**	
Russia				3									**3**	**3**
Ukraina							73	141	24				**238**	**238**
USA								162	215	245		6	**628**	**628**
Total	**892**	**1715**	**4682**	**6027**	**5184**	**7213**	**7583**	**4143**	**6485**	**3123**	**2977**	**1872**	**51896**	**62113**

Table 2. Catch (tons) by nations and months as reported provisionally to NAFO in year 2004.

Nation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**	**Year to date**
Canada													**0**	
Cuba	95	2	178	218	241								**734**	**969**
Estonia	50	829	510	971			1214	1063	1318	1684	1571	1436	**10646**	**13455**
EU/Denmark													**0**	
EU/Portugal													**0**	
EU/Spain				22	528	570		222	233	249	265	47	**2136**	**2724**
Faroe Is.	26		60	227	434	564	455	491	324	369	654	449	**4053**	**4932**
France									72	188	135	28	**423**	**423**
Greenland													**0**	
Honduras													**0**	
Iceland		272	290	360		356	476	456	284	296	403	326	**3519**	**3519**
Japan													**0**	
Latvia			305	240	267	154	73	444	398				**1881**	**2332**
Lithuania	203	529	410	443	576	790	604	462	538	247			**4599**	**4802**
Norway		579			369	447		2319	1591	1553	1493	522	**8873**	**10743**
Poland		93	242	62						173	204	352	**1126**	**1124**
Portugal													**0**	
Russia										288	252	114	**654**	**654**
Ukraina						147	132	35					**314**	**314**
USA			153	180			287	32					**652**	**952**
Total	**374**	**2304**	**2148**	**2723**	**2415**	**3028**	**3241**	**5524**	**4758**	**5047**	**4977**	**3274**	**39610**	**46943**

Table 3. Catch (tons) by nations and months as reported provisionally to NAFO in year 2005.

Nation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Total**	**Year to date**
Canada													**0**	
Cuba	150	174	186	321									**831**	**1043**
Estonia													**0**	
EU/Denmark													**0**	
EU/Portugal													**0**	
EU/Spain		126	124	130	136	9	282						**807**	**1126**
Faroe Is.	242	147	173	347	302	343	143						**1697**	**1975**
France							126						**126**	**126**
Greenland													**0**	
Honduras													**0**	
Iceland			311	394	456		443						**1604**	**2072**
Japan													**0**	
Latvia													**0**	
Lithuania													**0**	
Norway													**0**	**184**
Poland													**0**	
Portugal													**0**	
Russia			2	41	212	13							**268**	**268**
Ukraina													**0**	
USA		57	353	297									**707**	**1188**
Total	**392**	**504**	**1149**	**1530**	**1106**	**365**	**994**	**0**	**0**	**0**	**0**	**0**	**6040**	**7982**

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

Nation	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003***	**2004***	**2005***
Canada	3724	1041	970	906	807	484	490	618	1 295	4 16			
Cuba							119	46	1 797	4 153	81	4 969	4 1043
Estonia		1081	2092	1900	3240	5694	10835	13256	3 9850	2 14215	4 12732	4 13455	
EU													4 1126
EU/Denmark	800	400	200			437	235		4 92	4 359			
EU/Portugal	300		150		170	203	227	289	4 420	4 15			
EU/Spain	240	300	158	50	421	913	1019	1388	4 799	671	4 161	4 2724	
Faroe Is.	7333	6791	5993	8688	7410	9368	9199	7719	3 10228	2 8516	2 12676	4 4932	4 1975
Greenland	3788	2275	2400	1107	105	853	576	1636		2 684	4 873		
Honduras	1265												
Iceland	2243	2300	7623	20681	6381	6572	9277	8912	2 5265	2 5741	2 4695	2 3567	4 2072
Japan									1 130		116		
Latvia		300	350	1940	997	1191	3080	3105	4 2990	4 1885	4 3453	4 2332	
Lithuania		1225	675	2900	1785	3106	3370	3595	1 2702	4 3321	4 3744	4 4802	
Norway	7183	8461	9533	5683	1831	1339	2975	2669	1 13291	4 11624	4 22765	4 10743	4 184
Poland					2 824	148	894	2 1692	1 209			4 1124	4
Russia		350	3327	4445	1090		1142	7078	1 5687	2 1148	2 3	4 654	4 268
France		75			150				1 408	4 161		4 423	4 126
Ukraina									1 348		4 238	4 314	4
USA									1 411	4 96	4 628	4 952	4 1188
Total	**26876**	**24599**	**33471**	**48300**	**25211**	**30308**	**43438**	**52003**	**53922**	**48605**	**62165**	**46991**	**7982**

1 NAFO Statlant 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. Nominal catch for the whole year and some averages calculated from the Icelandic logbooks to show trends in CPUEs and size of trawl. In calculations of CPUE the effort of twin trawls is multiplied by 1.9.

Year	Nominal Catch Tons	Twin trawls % of catch	Mean trawl size No. of meshes January-July	Unstandardized CPUE January-July	**CPUE at size 3000 trawl January-July**	Mean trawl size No. of meshes January-Sept	Unstandardized CPUE January-Sept	CPUE at size 3000 trawl January-Sept.
1993	2 243	43.4	3063	373	**363**	3102	356	344
1994	2 300	54.4	2994	238	**240**	2951	216	219
1995	7623	38.2	2779	254	**283**	2733	228	251
1996	20681	42.9	2803	206	**218**	2813	198	211
1997	6483	53.4	2780	188	**192**	2921	198	203
1998	6572	74.8	3016	288	**294**	2974	264	266
1999	9217	70.6	3441	280	**252**	3402	276	243
2000	8978	81.4	3528	287	**245**	3528	282	240
2001	5301	63.0	3571	328	**290**	3518	325	289
2002	5741	73.6	3713	370	**305**	3713	363	294
2003	4695	92.6	3949	367	**302**	4004	358	291
2004	3567	98.9	4460	320	**227**	4460	332	250
2005	2072	99.0	4460	386	**260**			
Mean 93-2004	7357	66	3341	292	**268**	3343	283	258

Table 6. 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
Mean	595	2550

Table 7. Shrimp in Div. 3M. Recruitment ment indices of 2 year olds (numbers per standardized hour) in the commercial fishery.

Year	No.per hour
1993	5306
1994	5894
1995	23909
1996	2425
1997	2058
1998	3072
1999	2462
2000	851
2001	6422
2002	4228
2003	4552
2004	8823
Mean	5834

Table 8. Shrimp in Div. 3M. Indices of female biomass in the EU survey, Faroese survey and the commercial fishery standardized CPUE. The indices in the EU survey were converted for the years 1988-2002 to that of the new vessel R/V Vizconde de Eza, the same as measured in 2003-2005 (personal communication from Casas, 2005).

Year	EU survey female biom.	Faroese Survey biomass	Standardized CPUE Kg/hour
1988	4.525		
1989	1.359		
1990	1.363		
1991	6.365		
1992	15.472		
1993	6.923		275.9
1994	2.923		130.1
1995	4.857		146.6
1996	5.132		122.6
1997	4.885	6731	122.4
1998	11.444	12559	165.6
1999	13.669	8863	204.3
2000	10.172	10154	211.3
2001	13.336	9374	176.3
2002	17.091	11761	197.1
2003	11.589	12402	235.4
2004	12.081		187.3
2005	11.642		
Mean	9.673	10263	181.2

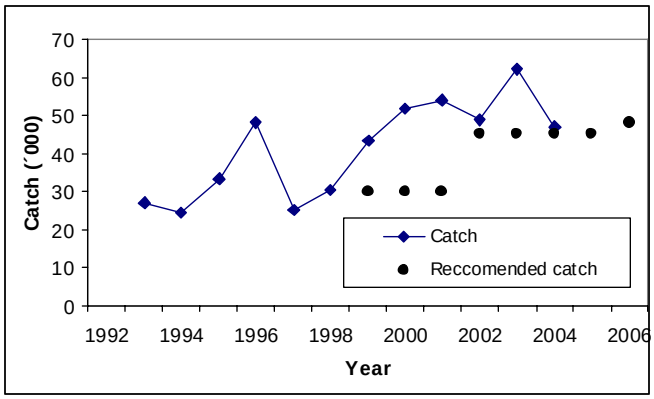

Fig. 1. Shrimp in Div. 3M: catches.

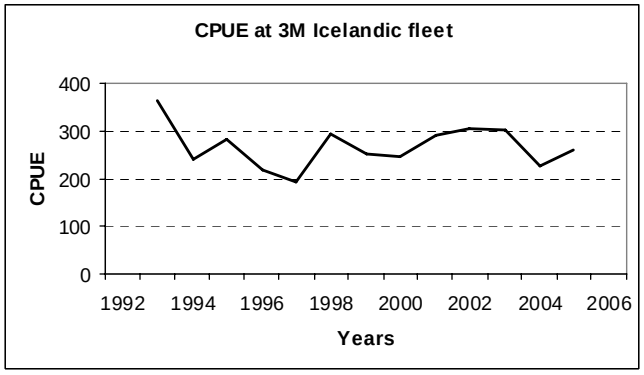

Fig. 2. Shrimp in Div. 3M: CPUE from the Icelandic fleet for the months January-July CPUE is standardized to the trawl of 3 000 meshes circumference. The effort for double trawl is multiplied by 1.9 when comparing CPUE for single and double trawls.

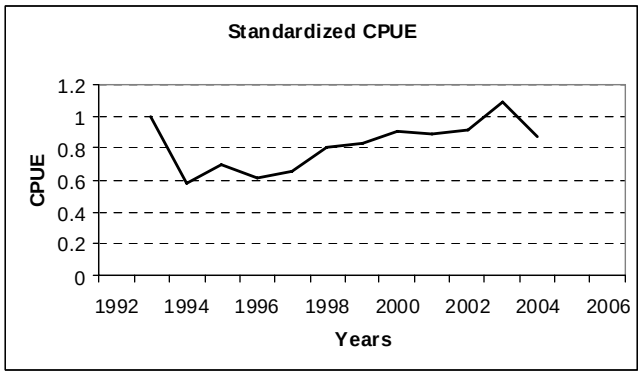

Fig. 3. Shrimp Div. 3M: the standardized CPUE of shrimp on Flemish Cap, 1993-2004.