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The *Pandalus* Stock in the Barents Sea and Svalbard area

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Abstract

The shrimp fishery in the Barents Sea started in the early 1970s. The catch increased to 128 000 tons in 1984 and decreased to 43 000 tons in 1987. Since the catches have fluctuated between 40 and 80 thousand tons. Since 2002 the catches have been approximately 40 000 tons. There is no direct regulation of the stock. CPUE data from the Norwegian and Russian shrimp fleet as well as available survey indices indicate a decrease in the stock since 2003. Due to a brake in the survey series it is hard to give a good prognosis for the stock status in 2006, however, there are no signs of sudden recovery of the stock.

1. Description of the fisheries and their development in recent years

Norwegian vessels began to exploit the shrimp fisheries in the Barents Sea and Svalbard area in 1970. Russian vessels entered the shrimp fishery in 1974. The catches increased continuously until 1984 when the total catch reached a maximum of 128 000 tons. By that time vessels from other countries had entered the fishery. Since then, biomass and catch levels have fluctuated because there were different recruitments, cod consumption and effort in the fisheries due to price of shrimp. The catch peaked above 80 000 tons in 1990 and in 2000 but has decreased since to approximately 40 000 tons 2003 and 2004. The most important fishing ground is the Hopen area in the central Barents Sea.

The first vessels using double trawls entered the fishery in 1996. Since then the effort has increased continuously and in 2002 approximately 35 Norwegian vessels had the technology to use double trawl or even triple trawl. Since 2002 the majority of the catch is caught by double trawl.

In the Svalbard area the shrimp fisheries are regulated by number of effective fishing days and number of vessels by country. In the Barents Sea and Svalbard area, Norwegian rules are that the fisheries be regulated by fishing licences and since 1985 by smallest allowable shrimp size (maximum 10% of catch weight may be <15 mm carapace length, CL). However, the regulation by smallest allowable shrimp size is not considered to be an efficient management tool in the REZ due to the high predation of shrimp. In the Russian Economic Zone, a TAC is established each year by Russian authorities. Fishing grounds are closed if by-catch limits given as number of individuals in 10 kg of shrimp are exceeded. In 2004 the values of allowed by-catch are set at eight for the sum of cod and haddock, ten for redfish and three for Greenland halibut per catch of 10 kg shrimp.

Sorting grids in the shrimp trawls first became mandatory operating within the Norwegian 12 miles zone in February 1990. In October 1991 this directive was extended to apply to shrimp trawls used in all of the Norwegian EEZ. Finally, in 1993 the Joint Norwegian Russian Fisheries Commission agreed that the sorting grid was to be mandatory for all vessels conducting shrimp fishery in the Barents Sea and the Svalbard area (Anon., 1992).

2. Catch and effort data

2.1. Landings

Preliminary reported landings for all countries show a substantial decrease of landings from 82 816 tons in 2000 to approximately 60 000 tons in 2002 and 2001 and a further decrease to approximately 40 000 tons in 2003 and 2004 (Table 1, Fig. 1). Thereby the total landings have decreased to 50% in three years. The 2005 catch is believed to stay at the level of the last two years.

2.2. Discards

Since there is no TAC in the Barents Sea all catches are landed and it is believed that there are no discards of shrimp in the area.

2.3. Effort and CPUE

Catch, effort, and annual CPUE series for Norway and Russia are presented in Table 2. The CPUE series for both countries are given in Fig. 2. The Norwegian shrimp fleet has since late 1990s been upgraded both concerning vessels and the use of double and triple trawls. In the logbooks the use of these trawl types have been difficult to register and to make available for further use. This problem has now been overcome and a revised series of catch per unit of effort (new CPUE) and new effort have been given for Norway standardised as vessels 1 000-1 500 hp with single trawls. The Norwegian data show a peak in the effort in 2000 at the same level as the earlier peaks in 1985 and 1990. The Russian and Norwegian effort decreased in 2001 with a slight increase in 2002 followed by a further decrease in 2003 and 2004. The CPUE of the Russian fleet (vessels <1 300 hp) has fluctuated in accordance with the shrimp biomass (Fig. 2) and the revised Norwegian series show the same picture. It should be noted that the Russian fleet is also under development.

2.4. Sampling of landings

In 2002, 2003 and 2004 observers collected samples on board commercial Spanish vessels in the Svalbard zone (Cassas, 2005). Length and sex distribution data and data on by-catch of young fish were obtained. These data show a reduction of females from 33% in 2002 to 18% in 2003 and increased to 38% in 2004.

Monitoring of the shrimp catches is required due to the regulation protecting juvenile fish and shrimp through area closures. The Directorate of Fisheries in Norway has, during surveillance cruises conducted by commercial shrimp trawlers, collected data on length distributions in the shrimp catch since 1995. The Norwegian Coast Guard also samples some length data during inspections of shrimp catches. In 2002 the Institute of Marine Research established a reference fleet where fishermen take samples of the catch. One of the vessels included in the reference fleet is a part time shrimp trawler. The carapace length is measured on 300 individuals of shrimp in each sample. The sampling frequency will be further increased by more inspections conducted by the Coast Guard.

The catch was in 2000 dominated by shrimp aged four and five years (Fig. 3). The catch pattern moved towards three year olds in 2001. The catches in 2003 were again dominated by four year old shrimp of the 1999 year-class. The 1999 year-class entered the spawning stock in 2004.

3. Research Vessel Data

3.1. Trawl Surveys

In the Barents Sea and the Svalbard area, standard shrimp surveys were conducted by Norway in the period 1982-2004 and by Russia from 1984 to 2002 and in 2005 (Fig. 4.). However, during the 1990s, both surveys have suffered from reductions in survey time and in 2003 and 2004 no Russian shrimp survey was conducted while no Norwegian shrimp survey was conducted in 2005. However, a joint Norwegian-Russian ecosystem survey, also recording shrimp, was conducted in August-September covering the whole Barents Sea. This cruise will be conducted annually, but it will take three to four years before a new time-series reliable for the shrimp stock assessment is established. Resources for calibrating the spring shrimp cruise to the autumn ecosystem cruise are not available.

Evaluations of previous studies are reported in the ICES reports from AFWG 2002, AFWG 2003 and WGPAND 2004.

3.2. **Analysis of Survey Data**

3.2.1. **Swept area estimates of biomass**

There is a strong correlation between the Norwegian and the Russian survey results (Fig. 5). Biomass indices were highest during 1984, and have since fluctuated between 30% and 60% of this level with peaks in 1991 and 1998-1990 and low values below the long term mean in 1987-1988, 1994-1995 and 2001-2005. Norwegian bottom trawl surveys indicate a decrease in shrimp biomass in the Barents Sea and Svalbard of 29% from 2003 to 2004. The Russian surveys indicate a reduction of 36% from 2002 to 2005 (Bakanev *et al*.2005). Especially the important Hopen Deep and the Thor Iversen Bank area show an obvious reduction in biomass.

The recruitment index from the Norwegian surveys for one year old shrimp was low and the number of two and three year old shrimp reduced dramatically since 2003 (Fig. 6, Table 5).

3.2.2. **Natural mortality and predation**

Predation by cod is the main source of natural mortality. However, it should be noted that other fish species such as Greenland halibut (*Reinhardtius hippoglossoides*), long rough dab (*Hippoglossoides platessoides*), thorny skate (*Raja radiata*) and blue whiting (*Micromesistius poutassou*) also prey on shrimp (Dolgov 1997, Dolgova and Dolgov 1997. The methods used in estimating cod consumption are described by Bogstad and Mehl (1997), and dos Santos and Jobling (1995). In the Barents Sea, the annual consumption of shrimp was estimated to be above 280 000 tons throughout the period 1994–2001 (Fig. 7, Table 6). Shrimp consumption rates may, however, have been overestimated by as much as 37% (WP. Future shrimp assessments have to include cod as predator, it is important to identify and study possible problems with the cod consumption estimates.

4. **Assessment of the *Pandalus* Stock in the Barents Sea**

4.1. **Background**

The great plasticity in growth of shrimp and age at sex change, as well as a lack of biological data and length distributions from the catches, make it difficult to apply traditional analytical fishery assessment methods to the data.

Several models have been used in assessing shrimp in the Barents Sea and some of these are listed below:

Production models: Shaefer and Fox stock models and stock production model including predation (Stefánsson *et al*., 1994; Berenboim and Korzhev, 1997).
Catch at age analysis (cohort models): Single species virtual population analysis (VPA) and multi species virtual population analysis (Sparre, 1984; Bulgakova *et al*., 1995)). A length based biomass model for shrimp in the North-east Atlantic has been developed in 2005 (Sunnanå, 2005).

5. **Status of the Stock**

Norwegian and Russian CPUE (Table 2, Fig. 2) and Russian survey in 2005 and the Norwegian survey indices in 2004 (Tables 3 and 4) all indicate a decrease in the shrimp stock from 2002 to 2005. The survey index of 2004 shows a reduction of 29% since 2003, and is now on the lowest level since 1987. The spawning stock number is decreasing since 2002 (Fig. 7). The recruitment of one year old shrimp is low but stable over the last three years, and the three year old shrimp show a reduction since 2003 (Table 5 and Fig. 6).

The strong 1999 and 2000 year-classes did not contribute to the assumed increase in shrimp biomass in 2004. These originally strong year-classes seem to have been a target of predators and the shrimp fishery as young shrimp.

Preliminary catch data indicate a catch of approximately 42 000 tons for 2005 and the stock does not seem to allow higher catches in 2006.

6. Recommendations on further work

- It is highly recommended that the Russian and Norwegian shrimp survey time series is re-established;
- If the shrimp surveys are not conducted, calibrations against the ecosystem survey should be conducted;
- Scientists should further evaluate the procedures used in estimating the shrimp consumed by cod and give reliable consumption numbers;
- Length and sex data from commercial catches should be provided by all nations involved in the fishery;
- Authorities should enforce the accurate completion of logbook data in Norway, especially the use of single, double and triple trawls;
- Work on developing and evaluating assessment methods should be continued;
- Catch and effort statistics should be delivered to the ICES by all countries involved in the shrimp fishery in the Barents Sea and the Svalbard area

7. By-catch in the shrimp fishery

Young Northeast Arctic cod, haddock, redfish and Greenland halibut are caught as by-catch in Norwegian shrimp fisheries. The cod by-catch is estimated based on commercial shrimp catch statistic, logbook data, surveys and surveillance data from 1983-2002 (Aijad *et al*., 2004).

Especially one and two year old cod are subject to this fishery due to overlapping in the distribution of shrimp and cod in the central area of the Barents Sea and around Svalbard. Cod by-catch in shrimp fishery is regulated by area closures since 1983 (Aschan, 1999; Aschan, 2000). In 1983, 3 juvenile cod and haddock were allowed as by-catch pr 10 kg of shrimp. As a result of the introduction of the sorting grid in 1995 the number of cod and haddock allowed as by-catch increased to 10. The results show that the numbers of cod taken as by-catch varied between quarter and between years. Northeast Arctic cod by-catch rates in stay around 1% of the annual shrimp landing recent years. The weight and number of individuals of other by-catch species does not exceed the estimates for cod. However strong year-classes of haddock may reach the same values as cod.

8. References

Ajiad A., A. Aglen, and K. Nedreaas. 2004. Cod by-catch mortality from the Barents Sea shrimp fishery 1983-2002. ICES Arctic Fisheries Working Group, WD 24.

Anon., 2003. ICES, Report Arctic Fisheries Working Group, sect.9.

Anon., 2004. ICES, Report Pandalus Assessment Working Group, sect. 7.

Aschan, M. 1999. Bioeconomic analyses of by-catch of juvenile fish in the shrimp fisheries. Fiskeriforskning Report 24/1999.

Aschan, M. 2000. Working document on by-catch in the shrimp fishery in the Barents Sea. Fiskeriforskning Preliminary Report, Tromsø, March 2000.

Bakanev S., B. Berenboim, and P. Lubin. 2005. Results of the Russian stratified trawl survey for the northern shrimp (*Pandalusborealis*) in the Barents sea and the Spitzbergen, 1984-2005. *NAFO SCR Doc*., No. 86.

Berenboim, B. I., A. Yu. Lysy, and V. Z. Salmov. 1986. Soviet investigations on shrimp (*Pandalus borealis*) in the Barents Sea and Spitsbergen area in May 1985. *ICES C.M. Doc*., No. 1986/K:11.

Berenboim, B. I., S. G. Mukhin, and G. K. Sheveleva. 1989. Soviet investigations of shrimp *Pandalus borealis* in the Barents Sea and off the Spitsbergen in 1988. *ICES C.M. Doc*., No. 1989/K:14.

Berenboim, B. I., S. G. Mukhin, and G. K. Sheveleva. 1990. Soviet investigations of shrimp *Pandalus borealis* in the Barents Sea and off the Spitsbergen in 1989. *ICES C.M. Doc*., No. 1990/K:4.

Berenboim, B., S. Mukhin, and K. Sunnanå. 1992. Results from Norwegian and Soviet investigations of shrimp *Pandalus borealis* in the Barents Sea. *ICES C.M. Doc*., No. 1992/K:14.

Berenboim, B., and V. Korzhev. 1997. On possibility of using Stefansson's production model to assess the northern shrimp (*Pandalus borealis*) stock in the Barents Sea. *ICES C.M. Doc*., No. 1997/Y.

Berenboim, B. I., A. V. Dolgov, V. A. Korzhev, and N. A. Yaragina. 2001. The impact of cod on the dynamics of Barents Sea shrimp (*Pandalus borealis*) as determined by multispecies models. *J. Northw. Atl. Fish. Sci*., **27**: 1–7.

Bogstad, B., and S. Mehl. (MS) 1997. Interactions Between Cod (*Gadus morhua*) and Its Prey Species in the Barents Sea. *Forage Fishes in Marine Ecosystems*. Proceedings of the International Symposium on the Role of Forage Fishes in Marine Ecosystems. *Alaska Sea Grant College Program Report*, No. 97-01: 591-615. University of Alaska Fairbanks.

Bulgakova, T., D. Vasilyev, V. Korzhev, and V. Tretyak. 1995. The results of multispecies analysis for the Barents Sea fishery community (cod, capelin, shrimp and herring). *ICES C.M. Doc*., No. 1995/D:14.

Casas J. M. 2004. The Spanish NE Arctic Shrimp Fishery in 2003. ICES WGPAND, WD 02; 4 p.

Casas J. M. 2005. The Spanish NE Arctic Shrimp Fishery in 2004. *NAFO SCR Doc*., No. 96, Serial No. N5202.

Dolgov A. V. 1997. Distribution, abundance, biomass and feeding of thorny skate, *Raja radiata*, in the Barents Sea. *ICES C.M. Doc*., No. 1997/GG: 04.

Dolgova N. V., and A. V. Dolgov. 1997. Stock status and predation of long rough dab (*Hippoglossoides platessoides*) in the Barents and Norwegian Seas. (In: International Symposium on the Role of Forage Fishes in Marine Ecosystems, Anchorage, Alaska 13–16 November 1996.

dos Santos, J., and M. Jobling. 1995. Test of a food consumption model for the Atlantic cod. *ICES J. Mar. Sci*., 52: 209-219.

Stefánsson, G., U. Skúladóttir, and G. Pétursson. 1994. The use of a stock production type model in evaluating the offshore *Pandalus borealis* stock of North Icelandic waters, including the predation of Northern shrimp by cod. *ICES C.M. Doc*., No. 1994/K:25.

Sparre, P. 1984. A computer program for estimation of food suitability coefficients from stomach content data and multispecies VPA. *ICES C.M. Doc*., No. 1984/G25: 60 pp.

Table 1. Nominal shrimp catches (t) by country (Sub-areas I and II combined). Data were provided by ICES and Working Group members.

Year	Norway	Russia	Others	Total
1970	5508	0	0	5508
1971	5116	0	0	5116
1972	6772	0	0	6772
1973	6921	0	0	6921
1974	8008	0992	0	9000
1975	8197	0	2	8199
1976	9752	0548	0	10300
1977	6780	12774	4854	24408
1978	20484	15859	0	36343
1979	25435	10864	390	36689
1980	35061	11219	0	46280
1981	32713	10897	1011	44621
1982	43451	15552	3835	62838
1983	70798	29105	4903	104806
1984	76636	43180	8246	128062
1985	82123	32104	10262	124489
1986	48569	10216	6538	65323
1987	31353	6690	5324	43367
1988	32021	12320	4348	48689
1989	47064	12252	3432	62748
1990	54182	20295	6687	81164
1991	39663	29434	6156	75253
1992	39657	20944	8021	68622
1993	32663	22397	806	55866
1994	20116	7108	1063	28287
1995	19337	3564	2319	25220
1996	25445	5747	3320	34512
1997	29079	1493	5164	35736
1998	44792	4895	6103	55790
1999	52612	10765	12292[2]	75669
2000	55333	19596	8241[3]	83170
2001	43021	5875	8136[4]	57032
2002	48799	3802	8105[5]	60706
2003	34652	2776	2340[5]	39768
2004[1]	36188	2400	5002[6]	43590

[1] Preliminary data
[2] Catches reported by Estonia, Faroe Islands, Germany, Greenland, Iceland, Lithuania, Portugal Spain and UK(Eng.Wal.NI)
[3] Catches reported by Estonia, Faroe Islands, Iceland, Lithuania, Portugal, Spain and UK.
[4] Catches reported by Estonia, Faroe Islands, Lithuania, Portugal, Spain and UK
[5] Catches reported by Estonia, Faroe Islands, Lithuania, Spain and UK
[6] Catches reported by Estonia, Faroe Islands, Lithuania, Spain and Portugal

Table 2. Catch (t), effort (h) and CPUE (kg/h) data in ICES sub-areas I, IIa and IIb. Norwegian data based on log books from all vessels and scaled to the level of vessels fishing with single trawl at the size of between 1 000 hp and 1 500 hp. Russian data based on daily reports from vessels smaller than 1 300 hp.

	Norway					**Russia**		
Year	Catch	Effort	New effort	New CPUE	CPUE	Catch	Effort	CPUE
1980	20386343	110931	97521	209	177			
1981	21408206	99546	87840	244	195	2341	8100	289
1982	30051346	151531	134066	224	210	4966	20400	243
1983	50402819	219820	198459	254	264	13223	48000	276
1984	54555088	222259	202629	269	230	33403	118900	281
1985	56589376	249235	230428	246	204	27974	110900	252
1986	32211588	208964	200133	161	139	7912	33500	236
1987	17191941	155672	150964	114	101	3818	23900	160
1988	20803268	188194	181581	115	118	9010	61600	146
1989	33774681	242843	236601	143	131	7928	53500	148
1990	39722191	267423	263021	151	160	17126	94500	181
1991	32922182	193227	194172	170	152	15532	74100	210
1992	36449102	173105	179101	204	187	13025	57000	229
1993	27376408	131157	124522	220	178	11390	60000	190
1994	11655050	70782	68551	170	136	4521	27500	164
1995	10448220	71846	70901	147	145	3347	26100	128
1996	15220910	83940	84941	179	169	5680	35300	161
1997	22459952	105850	124851	180	154	1507	7600	198
1998	36642443	126807	153809	238	256	4900	21212	231
1999	45136902	155683	197202	229	257	6238	30900	202
2000	48462353	173265	237431	204	238	12204	71784	170
2001	41174895	117239	182490	226	256	2484	16609	150
2002	48321355	118029	223616	216	265	3745	21773	172
2003	30199816	79528	151352	200	270	2775	16390	127
2004	31661402	77843	165394	191	296	2400	23301	103

Table 3. Indices of shrimp biomass from Norwegian surveys in the years 1982-2002 by main areas.

Main	A	B	C - Thor	D - Bear	E	F	G	H	Total	Sum.
Area	East Finnmark	Tiddly Bank	Iversen Bank	Island Trench	Hopen	Bear Island	Storfjord Trench	Spits-bergen		A,B,C, E
Strata	38078	6 - 7	10 - 12	5, 8, 9, 13	14 - 18, 24	19 - 22/ 31 - 40	41 - 50	51 - 70		
1982	35	34	44	53	66	56	17	22	327	179
1983	40	57	61	53	112	52	21	33	429	270
1984	40	51	64	60	141	66	20	29	471	296
1985	23	17	27	18	96	31	17	17	246	163
1986	10	7	13	25	57	34	10	10	166	87
1987	29	13	18	23	31	10	9	13	146	91
1988	26	18	18	36	32	24	13	14	181	94
1989	41	17	13	17	33	53	22	20	216	104
1990	31	13	25	42	58	43	27	23	262	127
1991	22	28	22	54	120	44	21	10	321	192
1992	18	22	33	37	62	38	14	15	239	135
1993	17	19	32	29	85	20	12	19	233	153
1994	19	8	13	15	52	33	9	12	161	92
1995	10	10	11	17	83	33	16	13	193	114
1996	21	8	26	26	110	42	21	22	276	165
1997	24	34	20	34	116	44	12	16	300	194
1998	18	24	41	26	120	72	12	28	341	203
1999	17	19	23	21	169	31	21	16	316	227
2000	14	29	25	26	102	29	10	12	247	170
2001	18	10	30	15	61	25	10	17	184	118
2002	11	18	28	16	86	18	9	10	196	143
2003	15	17	36	12	94	15	8	16	**213**	162
2004	**14**	**24**	**22**	**13**	**46**	**14**	**7**	**11**	**151**	106
% 03/02	34	-3	30	-22	9	-19	-12	60	9	14
% 04/03	-4	38	-39	6	-51	-3	-8	-33	-29	-35

Table 4. Indices of shrimp biomass (1000 t) from Russian survey in the 1984-2002 and 2005 by main areas. Catchability of 0.182 is used in the estimate.

Main Area	**A East Finmark**	**B Tiddly Bank**	**C-Thor Iversen Bank**	**E Hopen**	**F Bear Island**	**G Storfiord Trench**	**H Spits-bergen**	**I Kola coast**	**K Goose Bank**	**Total**	**Sum. A,B,C,E**
Strata	1-4	6,7,1s	10-12,25	14-18	38-40, 43-45	48-50	53-55,58-60, 63-65,58-70	2s-6s	7s-8s		
1984	38	137	99	254				133		661	528
1985	14	45	74	255		6	46	19	9	468	388
1986	9	19	44	140		42	127	9	9	399	212
1987	16	17	59	107	45	36	27	25	14	346	199
1988	14	31	39	49		22	29	36	13	233	133
1989	70	128	57	132	6	60	25	105	20	603	387
1990	90	195	119	259	14	110	30	196	15	1028	663
1991	90	153	104	541	9	70	27	155	43	1192	888
1992	80	153	92	409				65	77	876	734
1993	45	91	159	382	9		58	37	111	892	677
1994	4	35	48	255	21			14	27	404	342
1995	5	28	15	80	33	53		16	18	248	128
1996	20	98	127		21			67	108	441	245
1997	26	108	130	341				108	52	765	605
1998	14	106	136	172				108	41	576	427
1999	43	139	107	523				93	61	966	812
2000	29	73	109	328	9	39		72	141	800	539
2001	11	52	105	185	19	14	13	14	55	468	353
2002	30	129	198	353	15	39	51	70	105	980	710
2005	23	103	126	203	31	54	30	29	58	656	455
% 02/01	173	148	89	91	-21	179	292	400	91	109	101
% 05/02	-23	-20	-36	-42	107	38	-41	-59	-45	-33	-36

Table 5. Shrimp in the Barents Sea defined as index of numbers in size groups according to carapace length at age and number of egg bearing females contributing to the recruitment (SSN) in the Norwegian Barents sea survey (whole mm).

CL (mm)	<9	9<cl<13	13<cl<17	17<cl<19	>19mm	
year	1	2	3	4	5+	SSN
1990		8	192	357	567	131
1991		59	213	391	756	123
1992		84	308	291	567	109
1993		44	355	316	405	101
1994		23	186	221	250	30
1995	0,4	20	238	233	307	9
1996	0,2	27	335	374	367	25
1997	0,5	22	372	511	440	47
1998	0,8	9	374	517	567	51
1999	1,3	12	192	357	510	111
2000	2,6	33	147	278	559	66
2001	2,1	20	138	138	410	61
2002	1,1	22	218	295	390	165
2003	0,5	19	254	249	362	110
2004	0,7	5	106	198	295	75

Table 6. Biomass indices for shrimp from the Norwegian surveys, biomass estimate for cod (age 3 years and older) and the shrimp consumed by the cod in the Barents Sea.

Year	Cod (3+)	Shrimp index	Shrimp consumed
1984	818	471	436
1985	957	246	155
1986	1292	166	142
1987	1120	146	191
1988	913	181	129
1989	891	216	132
1990	963	262	194
1991	1560	321	188
1992	1910	239	373
1993	2355	233	315
1994	2149	161	516
1995	1815	193	362
1996	1700	276	341
1997	1526	300	311
1998	1221	341	326
1999	1097	316	256
2000	1108	247	461
2001	1393	184	284
2002	1593	196	230
2003	1815	212	230
2004	1749	151	250

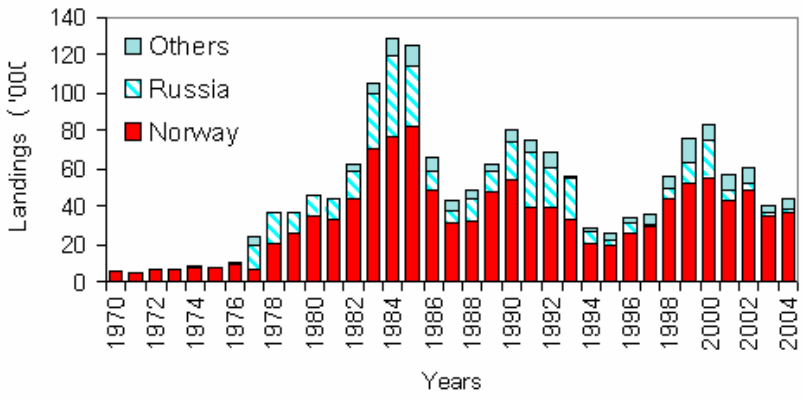

Fig. 1. Shrimp landings from ICES areas I, IIa and IIb by Norway, Russia and other countries in the period 1970–2003

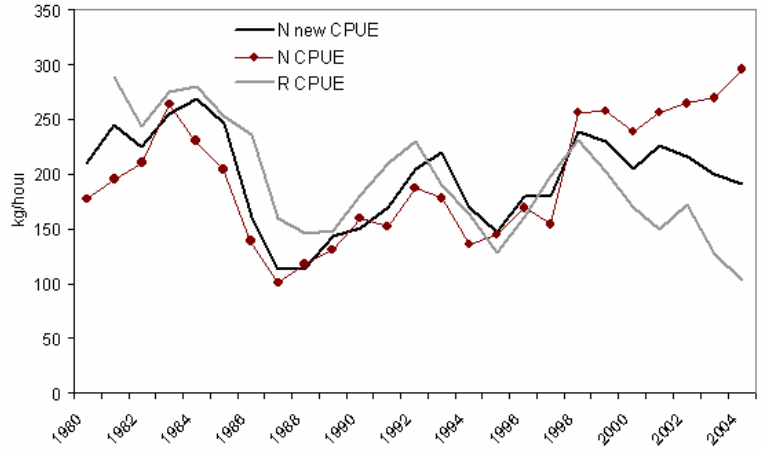

Fig. 2. Un standardised Norwegian CPUE (N- CPUE), standardised CPUE to vessels with 1 000-1 550 hp and single trawl (N-new CPUE) and Russian CPUE (R-CPUE) for ICES areas I, IIa and IIb.

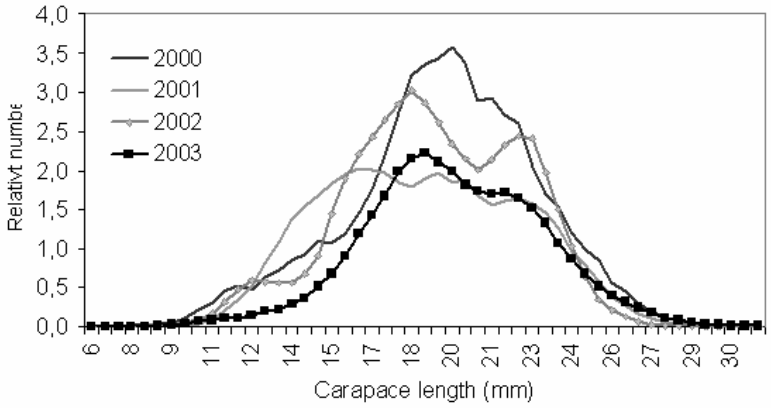

Fig. 3. Length distribution in Norwegian shrimp catches in 2000 to 2003.

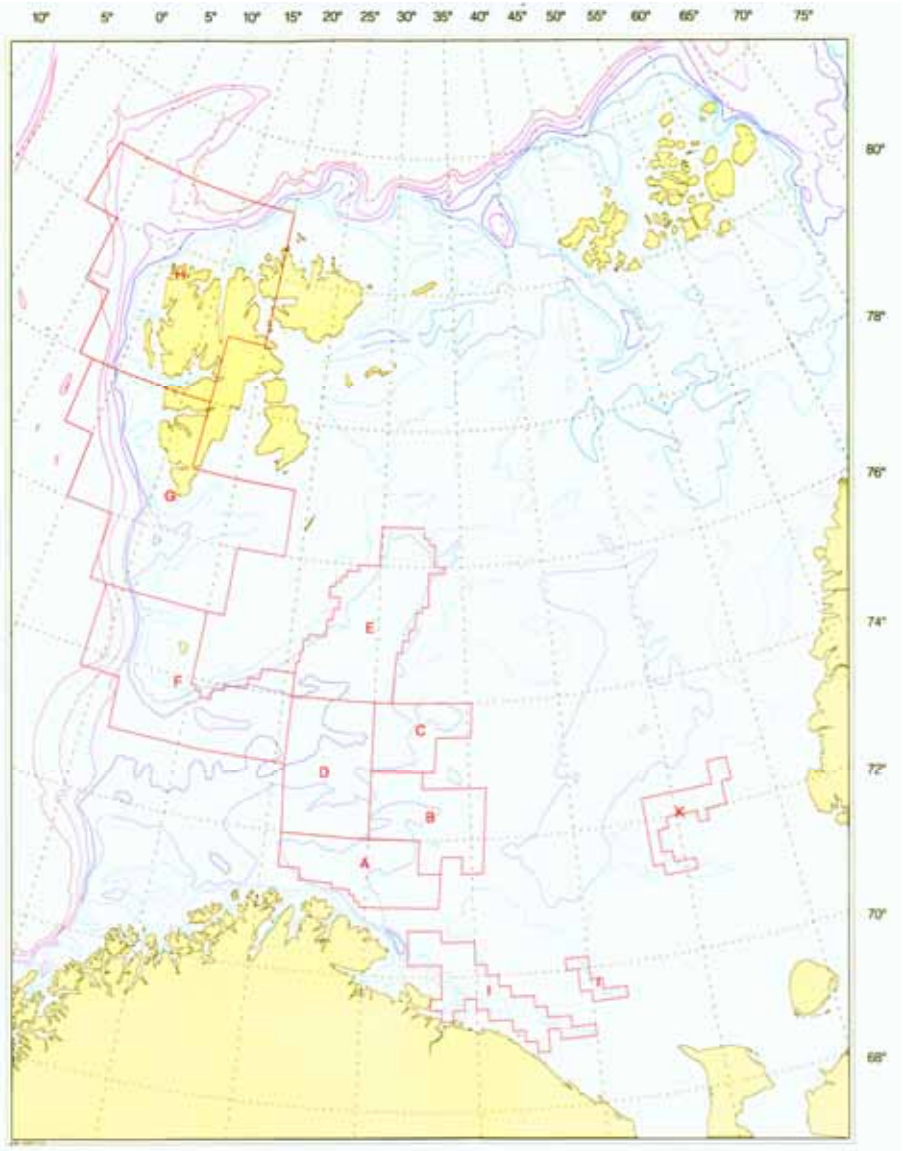

Fig. 4. Survey strata are combined to 9 larger areas marked with letters A to K. East Finnmark (A), Tiddly Bank (B), Thor Iversen Bank (C), Hopen (E), Bear Island (F), Storfjord Trench (G), Spitsbergen (H), Kola coast (I) and the Goose Bank (K) (Anon., 2003a).

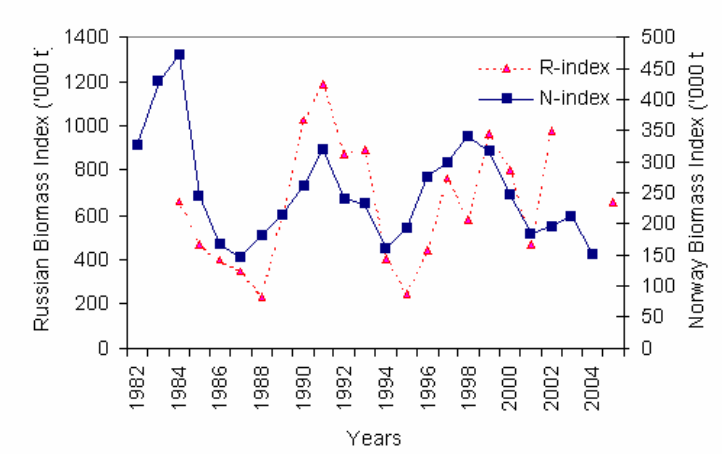

Fig. 5 Shrimp biomass indices from Norwegian and Russian surveys in the Barents Sea and Spitsbergen area in 1982-2005.

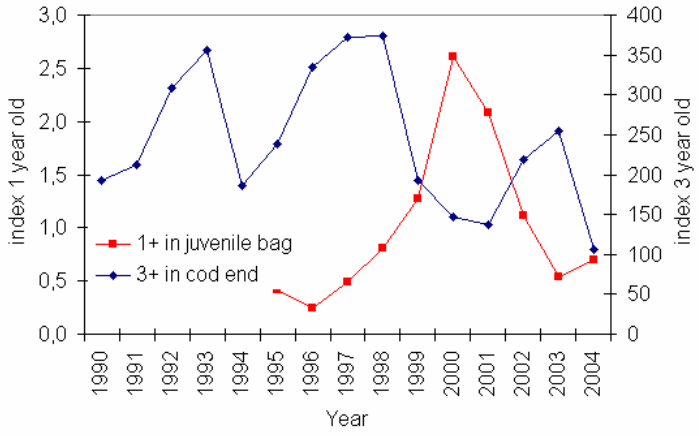

Fig. 6. Index for one and three year old shrimp in the Norwegian Survey 2003.

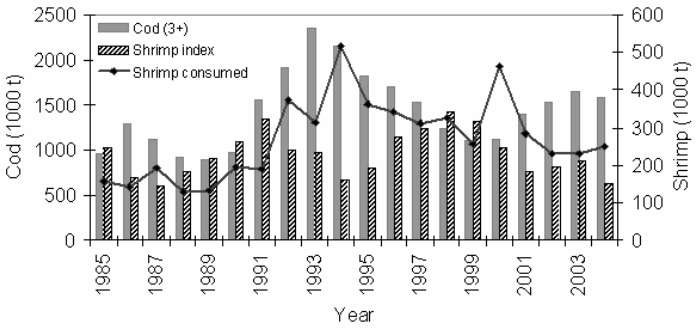

Fig. 7. Biomass indices for shrimp from the Norwegian surveys, biomass estimate for cod (age 3 years and older) and the shrimp consumed by the cod in the Barents Sea.