

6.4.16 Northern shrimp (*Pandalus borealis*) in Division IIIa and Division IVa East (Skagerrak and Norwegian Deep)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Unknown	Unknown	Undefined	NA	

In the absence of defined reference points, the state of the stock cannot be evaluated with regard to biological reference points. The state of the stock is uncertain. Lpues and survey indices do not show any significant change in stock biomass from 2006 to 2008. The recruitment index in 2008 seems to be lower than in the two preceding years.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No reference points have been established for this stock.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

The new data available for this stock (landings, lpue, and survey indices) give no reason to change the advice from 2007. The advice on this stock for the fishery in 2009 is therefore the same as the advice given in 2007 for the 2008 fishery: “total landings from Divisions IIIa and IVa East [...] should not increase above the recent average landings (2003–2006) of 15 000 t.”

Management considerations

Sorting grids should be mandatory in this fishery in all areas to minimize bycatch. When sorting grids are not used, bycatch species may constitute up to 20% of the landed catch (Table 6.4.16.1) of which saithe and cod are the dominating species. In addition, the shrimp survey indicates that deep-sea species such as Argentines, roundnose grenadier, rabbitfish, and sharks are frequently caught in shrimp trawls in the deeper parts of Skagerrak and the Norwegian Deep. A narrow bar spacing in sorting grids would reduce bycatches of juvenile fish.

The management of this stock should address the discarding of small shrimps, which occurs mainly due to high-grading as a consequence of restrictive TACs. At present the estimated discards amount to around 11% of the total catch (Table 6.4.16.2).

All vessels, including the increasing number of small Norwegian vessels (<11 m), should be required to fill in and deliver logbooks.

Ecosystem considerations

Shrimp is an important part of the diet for many predators including cod, saithe, and other species.

Factors affecting the fisheries and the stock

Regulations and their effects

The main regulation tool is a TAC, which is not fully fished by all countries. High-grading (discarding of medium-sized low-value shrimp) is only documented for the Swedish fishery and corrected for in the total catch data. Swedish high-grading is reported to be due to quota limitations.

Changes in fishing technology and fishing patterns

The number of Danish shrimp vessels has decreased from 191 in 1987 to only 12 in 2007. Mainly small trawlers have left the fishery, with the mean size of the vessels having increased from 20 to 26 m. The efficiency of the gear in the Danish shrimp fishery has increased due to twin trawl technology and increasing trawl sizes.

In the Norwegian fleet the number of small vessels (10–10.99 m) has increased, and this size class is now the most numerous, as a licence to fish is not required for vessels <11 m. In contrast to previous years, quantitative information on gear changes in the Norwegian fleet has become available from interviews with ship owners.

The Swedish fishery has shown an increasing use of trawls equipped with sorting grids.

The environment

The natural mortality for *Pandalus borealis* in Divisions IIIa and IVa East is likely to be substantially higher than the fishing mortality and is dependent on the abundance of predators.

Scientific basis

Data and methods

The assessment is based on the evaluation of both Danish (1987–2007) and Norwegian (2000–2008) standardized lpues, standardized effort (total catch/ Danish lpue), and the survey indices of recruitment and biomass.

Uncertainties in the assessment

The assessment is indicative of trends only.

The estimate of Danish lpue is based on fishing trips where the landing value of *Pandalus* catches was at least 50% of the landing value of all species. This threshold has been explored and does not increase the uncertainties in the assessment.

Comparison with previous assessment and advice

Since 2006 assessments have been qualitative only and based on standardized lpues and survey trends. In 2006 and 2007 only Danish lpues were used in the assessment, because of low coverage of the Norwegian logbook data. However, in 2008 Norwegian lpue data have been included in the assessment.

Source of information

Report of the NAFO/ICES *Pandalus* Assessment Group, ICES Headquarters, Copenhagen, 22–30 October 2008 (ICES CM 2008/ACOM:11).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted lndgs corresp. to advice ¹	Predicted lndgs corresp. to single-stock exploitation boundaries ¹	Agreed TAC Division IIIa	Agreed TAC Div. IIa + IIIa + IV	ICES catches		
							Discards.	Landings	Total
1987	Not assessed						0.7	14.2	14.9
1988	Catches significantly below 1985–1986 ³						0.8	12.2	12.9
1989	No advice				3.1 ¹		1.1	11.1	12.1
1990	F as F(pre-85) ³ ; TAC ³ ; No increase in F ⁴ ; TAC ⁴		10.0		2.75 ¹		1.2	10.2	11.4
1991	No increase in F; TAC		12.0		8.55		0.5	11.6	12.1
1992	Within safe biological limits		15 ²		10.50	15.0	0.5	13.0	13.6
1993	Within safe biological limits		13 ²		10.50	15.0	0.9	12.6	13.5
1994	Within safe biological limits		19 ²		12.60	18.0	0.2	11.5	11.7
1995	Within safe biological limits		13 ²		11.20	16.0	0.3	13.4	14.5
1996	No advice		11 ²		10.50	15.0	0.3	14.1	14.5
1997	No advice		13 ²		10.50	15.0	1.0	15.1	16.1
1998	No increase in F; TAC		19 ²		13.16	18.8	0.4	15.4	15.8
1999	Maintain F		19 ²		13.16	18.8	0.6	11.3	11.9
2000	Maintain F		<11.5 ²		9.10	13.0	0.7	11.0	11.5
2001	Maintain F		13.4		10.15	14.5	0.74 ⁶	11.3	11.7
2002	Long-term average landings		12.6		10.15	14.5	0.9 ⁶	12.5	13.4
2003	Maintain F		14.7		10.15	14.5	0.9 ⁶	13.8	14.7
2004	No increase in F ⁵			15.3 ⁵	10.71	15.7	1.8 ⁶	15.9	17.7
2005	No increase in catch above recent level			~13 ⁵	10.71	15.6	1.5 ⁶	14.2	15.7
2006	No increase in catch above recent level			~13.5 ⁵	11.2	16.2	1.2 ⁶	14.2	15.3
2007	No increase in landings above recent level			~14.0 ⁵	11.62	16.6	1.7 ⁶	13.5	15.2
2008	No increase in landings above recent level			~15 ⁵	11.62	16.3			
2009	Same advice as last year			~15 ⁵					

Weights in '000 t.

¹ EU zone only.

² Catch at *status quo* F.

³ Division IIIa.

⁴ Division IVa East.

⁵ Single-stock boundaries and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

⁶ Discards due to Swedish high-grading and Norwegian discards of non-marketable shrimp <15 mm CL (from 2007).

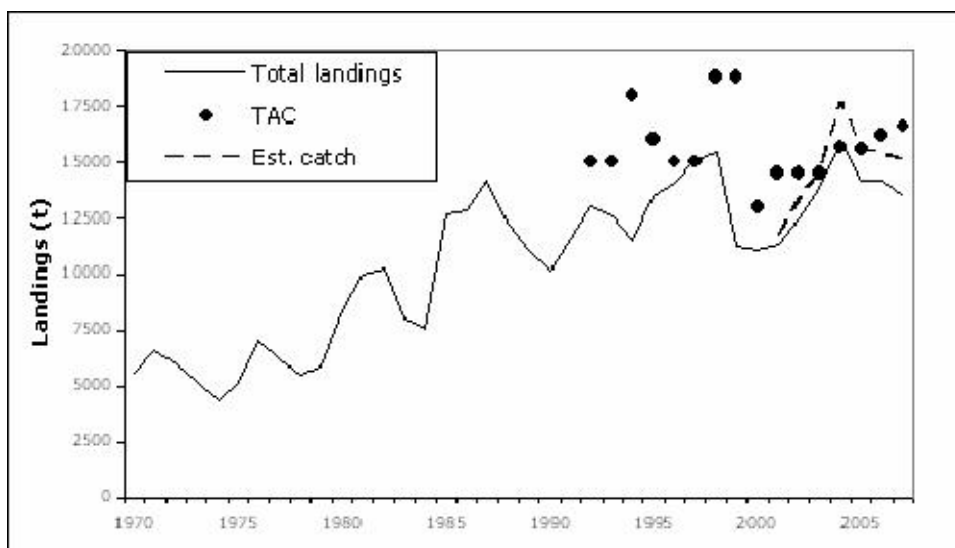


Figure 6.4.16.1 *Pandalus borealis* in Divisions IIIa and IVa East. Landings, TAC, and catches as estimated by ICES.

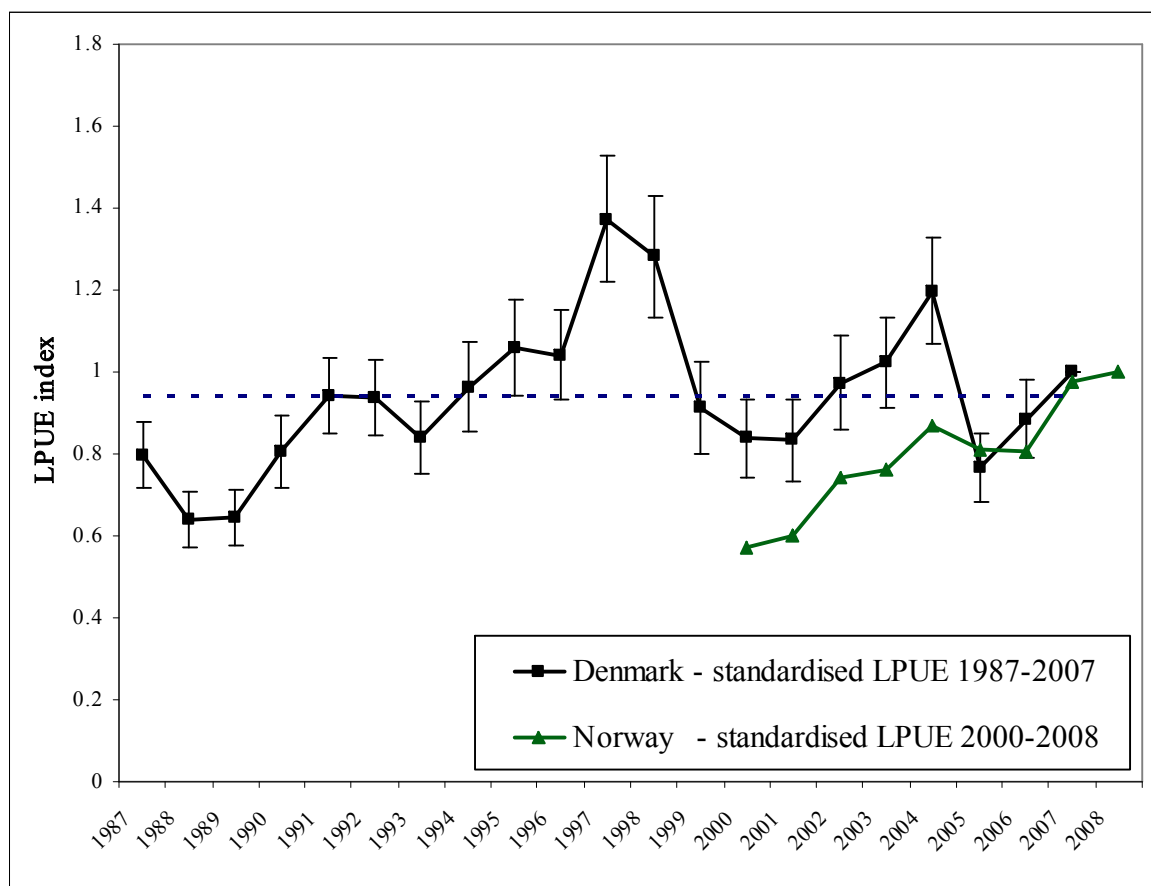


Figure 6.4.16.2 *Pandalus borealis* in Divisions IIIa and IVa East. Danish and Norwegian standardized lpues. Error bars are standard errors. Danish 2008 data are not included due to problems with data extraction. Dotted line shows the Danish long-term mean = 0.94.

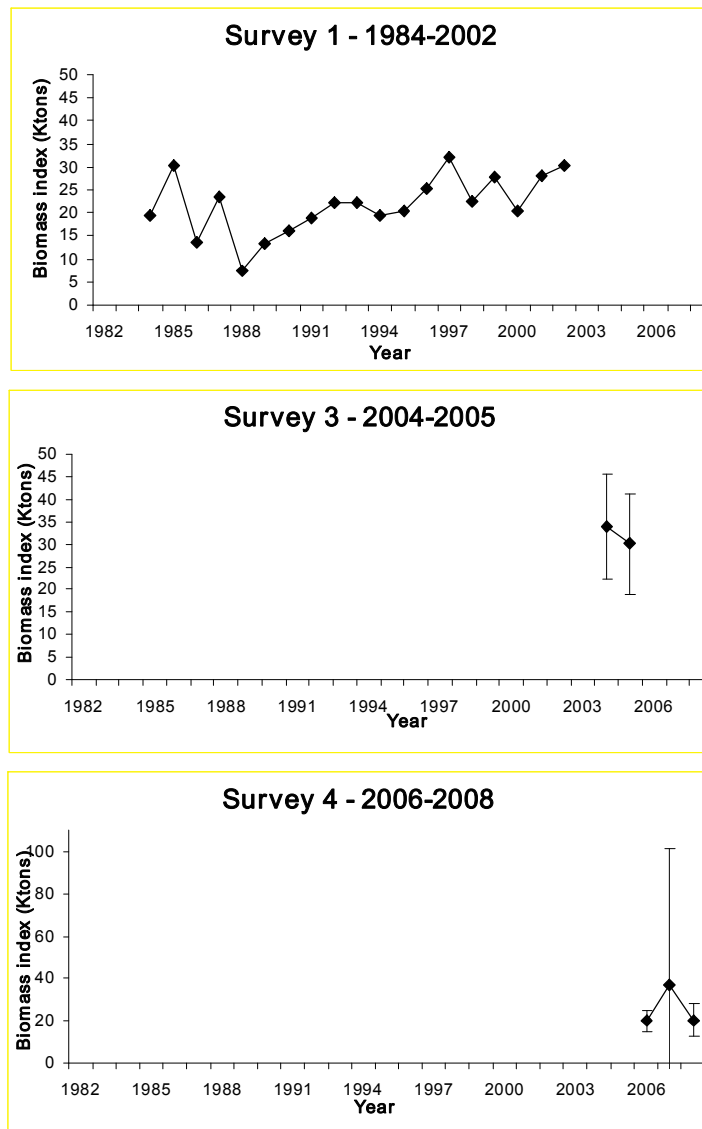


Figure 6.4.16.3

Pandalus borealis in Divisions IIIa and IVa East. Estimated survey biomass indices from 1984 to 2008. The four surveys are not calibrated to a common scale. Standard errors (error bars) have been calculated for the 2004–2008 surveys. Survey 1: October/November 1984–2002 with Campelen-trawl; Survey 2: October/November 2003 with shrimp trawl 1420 (not shown); Survey 3: May/June 2004–2005 with Campelen trawl; Survey 4: February 2006–2008 with Campelen trawl.

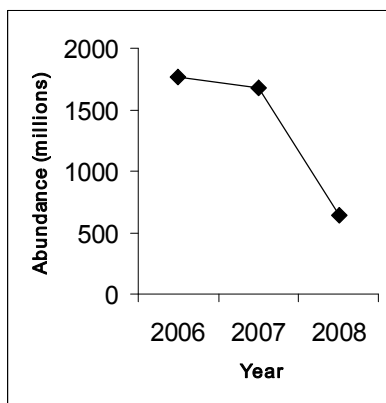


Figure 6.4.16.3 *Pandalus borealis* in Divisions IIIa and IVa East. Recruitment indices 2006–2008. The recruitment index is calculated as the abundance of age 1 shrimp (the first mode in the length–frequency distribution).

Table 6.4.16.1 *Pandalus borealis* in Divisions IIIa and IVa East. Bycatch in the shrimp fishery in 2007. Combined data from Danish and Swedish logbooks, and Norwegian landings (t).

Species:	Division IIIa, no grid		Division IIIa, grid		Division IVa East, no grid	
	Total (t)	% of total catch	Total (t)	% of total catch	Total (t)	% of total catch
<i>Pandalus</i>	10044	88.5	611	99.1	2272	80.9
Norway lobster	56	0.5	3	0.5	39	1.4
Angler fish	48	0.4	0	0.0	77	2.7
Whiting	10	0.1	0	0.0	3	0.1
Haddock	60	0.5	0	0.0	28	1.0
Hake	21	0.2	0	0.0	19	0.7
Ling	34	0.3	0	0.0	30	1.1
Saithe	405	3.6	0	0.0	185	6.6
Witch flounder	102	0.9	0	0.0	3	0.1
Norway pout	35	0.3	0	0.0	0	0.0
Cod	313	2.8	2	0.3	99	3.5
Other market fish	228	2.0	0	0.0	55	2.0

Table 6.4.16.2 *Pandalus borealis* in Divisions IIIa and IVa East. Landings (in tonnes) as estimated by ICES.

Year	Denmark	Norway	Sweden	Total landings	Estimated SW high-grading	Estimated NO discards	TAC	Estimated catch
1970	1102	1729	2742	5573				
1971	1190	2486	2906	6582				
1972	1017	2477	2524	6018				
1973	755	2333	2130	5218				
1974	530	1809	2003	4342				
1975	817	2339	2003	5159				
1976	1204	3348	2529	7081				
1977	1120	3004	2019	6143				
1978	1459	2440	1609	5508				
1979	1062	3040	1787	5889				
1980	1678	4562	2159	8399				
1981	2593	5183	2241	10017				
1982	3766	5042	1450	10258				
1983	1567	5361	1136	8064				
1984	1800	4783	1022	7605				
1985	4498	6646	1571	12715				
1986	4866	6490	1463	12819				
1987	4488	8343	1322	14153				
1988	3240	7661	1278	12179				
1989	3242	6411	1433	11086				
1990	2479	6108	1608	10195				
1991	3583	6119	1908	11610				
1992	3725	7136	2154	13015			15000	
1993	2915	7371	2300	12586			15000	
1994	2134	6813	2601	11548			18000	
1995	2460	8095	2882	13437			16000	
1996	3868	7878	2371	14117			15000	
1997	3909	8565	2597	15071			15000	
1998	3330	9606	2469	15406			18800	
1999	2072	6739	2445	11256			18800	
2000	2371	6444	2225	11040			13000	
2001	1953	7266	2108	11327	375		14500	11702
2002	2466	7703	2301	12470	908		14500	13378
2003	3244	8178	2389	13811	868		14500	14679
2004	3905	9544	2464	15913	1797		15690	17710
2005	2952	8959	2257	14168	1483		15600	15651
2006	3061	8669	2488	14218	1186		16200	15404
2007	2380	8686	2445	13511	1124	526	16600	15161

Swedish and Norwegian (2000–2007) landings have been corrected for loss in weight due to boiling.