

## 6.4.27 Shrimp (*Pandalus borealis*) in Division IIIa and Division IVa East (Skagerrak and Norwegian Deeps)

### 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			The stock was at an all time high in 2004, but has since then shown a decreasing trend.

The assessment consists of trends in LPUE and survey indices. The stock indicators show an increase since 1988 to an all time high in 2004 and subsequently declining, but remaining at an average level.

### Management objectives

There are no explicit management objectives for this stock.

### Reference points

No precautionary reference points have been established for this stock.

### Single-stock exploitation boundaries

*Exploitation boundaries in relation to precautionary considerations*

Because the stock appears to be at a relatively high level and recent catches have apparently been sustainable, ICES recommends that the total landings from IIIa and IVa East in the 2006 are not increased above the recent average landings (2003–2005) of 14 000 t.

### Management considerations

Data on bycatch recorded in logbooks are compiled by the working group, but these data include only the landed component. It is known 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. Sorting grids or other means of facilitating the escape of fish should be implemented in this fishery.

### 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.

*Changes in fishing technology and fishing patterns*

The Danish and the Norwegian fleets have undergone major restructuring in recent years. Within the last 5 to 10 years almost all Danish trawlers have started to fish with twin trawls. This change allows the individual vessels to increase the swept area (wing end to wing end) by approximately 50% without increasing demands to the vessel's engine capacity or noticeably increasing fuel consumption. Quantitative information on the gear changes in the Danish fleet are not available from the logbooks but have been approximated, based on information from fishers. No quantitative information was available for the Norwegian fleet.

### *The environment*

Strong fluctuations in the *Pandalus* stocks are frequently observed. Predator pressure, as well as the fact that the stock consists of only few age groups contributes significantly to such fluctuations. The natural mortality for *Pandalus* 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 consists of trends in two LPUE series and survey information. The LPUE series are a Norwegian LPUE (2000–2006) that is standardized by area, month and vessel and a Danish LPUE (1984–2005) that is standardized for technological development. The Norwegian shrimp survey has had large changes in recent years, both in terms of the timing of the survey, the gear used, and the vessel used. These changes mean that the series cannot be interpreted on a common scale and should be treated as four different surveys for the following sets of years: (1) 1984–2002, (2) 2003, (3) 2004–2005, and (4) 2006 (Figure 6.4.27.3).

#### *Comparison with previous assessment and advice*

Last year's assessment was based on a Bayesian stock production model. This model could not be applied for the current year because of a lack of manpower. The assessment this year is therefore based on trends in LPUE and survey information. The overall perception of the stock development is similar to last year. The advice is similar to last year.

### **Source of information**

Report of the NAFO/ICES *Pandalus* Assessment Group, Copenhagen, 25 October–2 November 2006 (ICES CM 2007/ACFM:37).

Year	ICES Advice	Single-Stock Exploitation Boundaries	Predicted Indgs corresp. to advice <sup>1</sup>	Predicted Indgs corresp. to Single-Stock Exploitation Boundaries <sup>1</sup>	Agreed TAC IIIa	Agreed TAC IIIa + IV	ACFM catches		
							Discards.	Landings	Total
1987	Not assessed						0.7	14.2	14.9
1988	Catches significantly below 1985–1986 <sup>3</sup>						0.8	12.2	12.9
1989	No advice				3.1 <sup>1</sup>		1.1	11.0	12.1
1990	F as F(pre-85) <sup>3</sup> ; TAC <sup>3</sup> ; No increase in F <sup>4</sup> ; TAC <sup>4</sup>		10.0		2.75 <sup>1</sup>		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 <sup>2</sup>		10.50	15.0	0.5	13.0	13.6
1993	Within safe biological limits		13 <sup>2</sup>		10.50	15.0	0.9	12.6	13.5
1994	Within safe biological limits		19 <sup>2</sup>		12.60	18.0	0.2	11.5	11.7
1995	Within safe biological limits		13 <sup>2</sup>		11.20	16.0	0.3	14.2	14.5
1996	No advice		11 <sup>2</sup>		10.50	15.0	0.3	14.2	14.5
1997	No advice		13 <sup>2</sup>		10.50	15.0	1.0	15.1	16.1
1998	No increase in F; TAC		19 <sup>2</sup>		13.16	18.8	0.4	15.4	15.8
1999	Maintain F		19 <sup>2</sup>		13.16	18.8	0.6	11.2	11.9
2000	Maintain F		<11.5 <sup>2</sup>		9.10	13.0	0.7	10.8	11.5
2001	Maintain F		13.4		10.15	14.5	0.7	11.0	11.7
2002	Long-term average landings		12.6		10.15	14.5	0.9	12.1	12.3
2003	Maintain F		14.7		10.15	14.5	0.9	13.3	14.6
2004	No increase in F <sup>5</sup>			15.3 <sup>5</sup>	10.71	15.69	1.8	15.4	17.2
2005	No increase in catch above recent level			~13 <sup>5</sup>	10.71	15.60	1.5	13.7	15.2
2006	No increase in catch above recent level			~13.5 <sup>5</sup>	11.2	16.2			
2007	No increase in landings above recent level			~ 14.0					

Weights in '000 t.

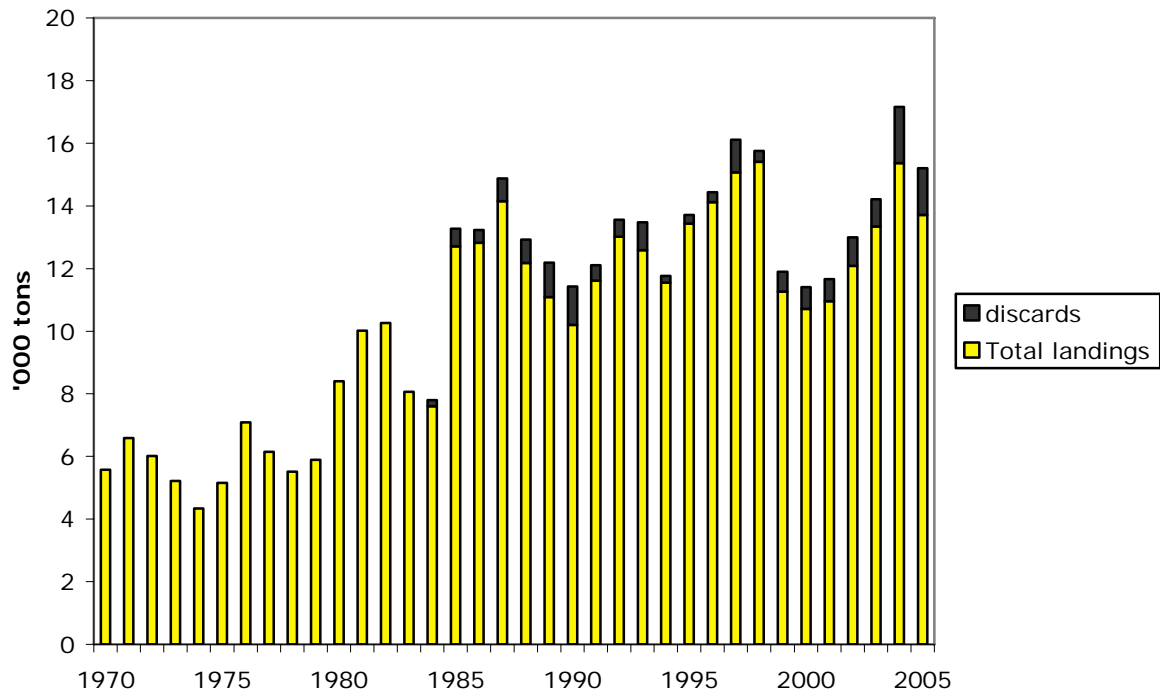
<sup>1</sup>EU zone only.

<sup>2</sup>Catch at *status quo* F.

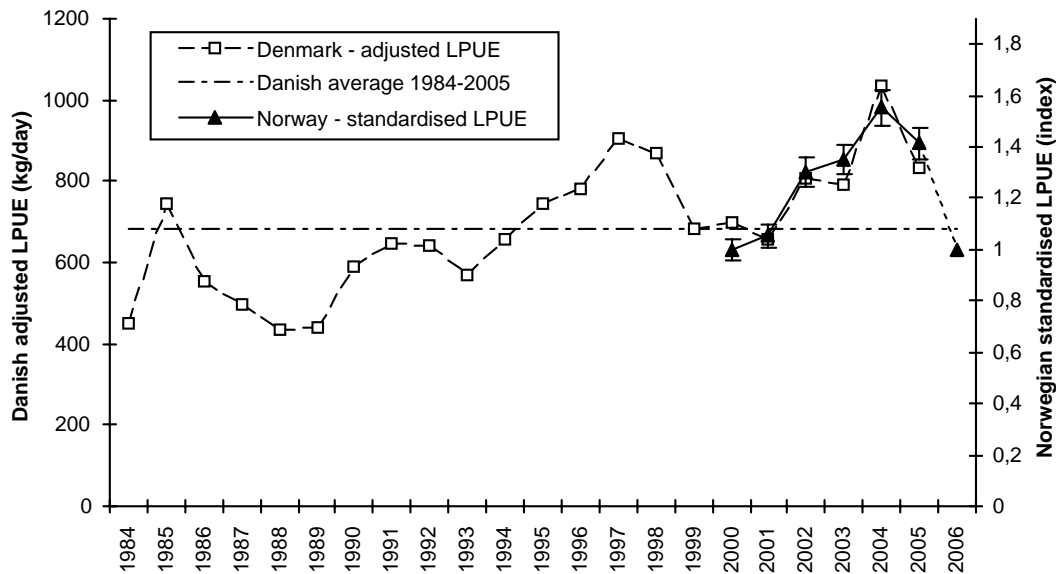
<sup>3</sup>IIIa.

<sup>4</sup>Norwegian Deep.

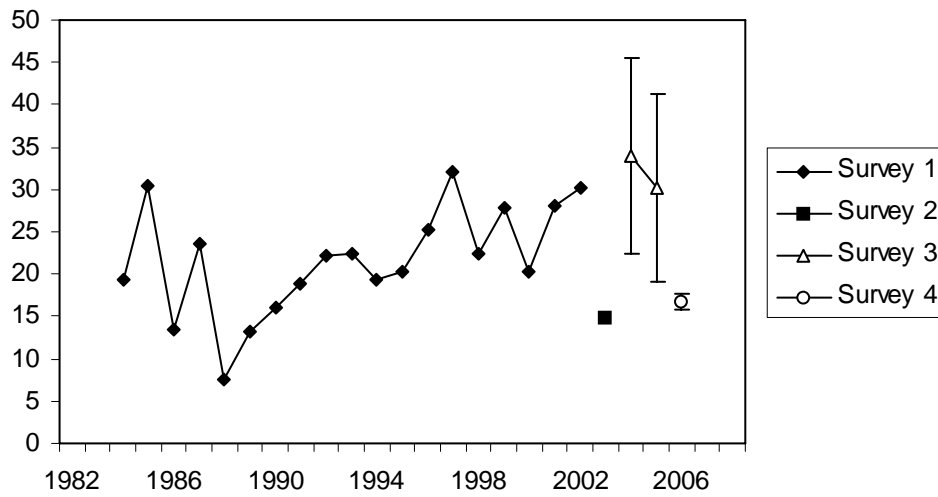
<sup>5</sup>Single-stock boundaries and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.



**Figure 6.4.27.1** *Pandalus* in IIIa and IVa. Landings and discards as estimated by ICES.



**Figure 6.4.27.2** *Pandalus borealis* in IIIa and IVa. Trend in Danish and Norwegian LPUE. The 2006 value for the Norwegian LPUE is based on the first quarter only.



**Figure 6.4.27.3** *Pandalus borealis* in IIIa and IVa. Trends in Norwegian shrimp survey biomass. The four surveys are not calibrated to a common scale. Survey 1: October–November 1984–2002 with Campelen trawl; Survey 2: October–November 2003 with shrimp trawl 1420; Survey 3: May–June 2004–2005 with Campelen trawl; Survey 4: February 2006 with Campelen trawl.

**Table 6.4.27.1** *Pandalus borealis* landings from Divisions IIIa (Skagerrak) and IVa (eastern part) as estimated by ICES.

Year	Denmark	Norway	Sweden	Total landings	Estimated discards	Agreed TAC	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	200		7805
1985	4498	6646	1571	12715	558		13273
1986	4866	6490	1463	12819	414		13233
1987	4488	8343	1322	14153	723		14876
1988	3240	7661	1278	12179	750		12929
1989	3242	6411	1433	11086	1107		12193
1990	2479	6108	1608	10195	1226		11421
1991	3583	6119	1908	11610	497		12107
1992	3725	7136	2154	13015	541	15000	13556
1993	2915	7371	2300	12586	889	15000	13475
1994	2134	6813	2601	11548	214	18000	11761
1995	2460	8095	2882	13437	275	16000	13713
1996	3868	7878	2371	14117	318	15000	14436
1997	3909	8565	2597	15071	1039	15000	16110
1998	3330	9606	2469	15406	348	18800	15753
1999	2072	6739	2445	11256	639	18800	11895
2000	2371	6118	2225	10714	687	13000	11401
2001	1953	6895	2108	10956	701	14500	11657
2002	2466	7318	2301	12085	908	14500	12993
2003	3244	7715	2389	13348	868	14500	14216
2004	3905	8998	2464	15367	1797	15690	17164
2005	2952	8507	2257	13716	1483	15600	15199

\*) Swedish landings have been corrected for loss in weight due to boiling.