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Research survey information regarding northern shrimp
(*Pandalus borealis*) in the Barents Sea

by

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Abstract

The geographical distribution of the stock in 2007 is similar to the previous years 3 year of the series (Fig. 3). The estimate of mean biomass increased by 45% from 2004 to 2006 and decreased again by 18% from 2006 to 2007 (Table 1, Fig. 4).

Overall size distributions (Fig. 5) indicate a relatively large amount of smaller shrimp in 2004, which apparently has fuelled the stock increase 2005-2007. Estimates of the abundance shrimp at 13-16mm CL supposed to start entering the fishery in 2008 decreased from 2004 to 2005 and remained stable thereafter (Fig. 6).

The new 'ecosystem survey' has not been calibrated to the 'shrimp survey' which was discontinued in 2004.

Introduction

Research surveys have been conducted to assess the stock status of northern shrimp, *Pandalus borealis*, in the Barents Sea. The main objectives were to obtain index values for stock biomass, abundance, recruitment and demographic composition. Recently (since 2004) the monitoring of a multitude of other ecosystem variables has been included in the joint Norwegian-Russian "Ecosystem survey" (www.imr.no).

Three time series exist: (1) The Norwegian shrimp survey 1982-2004 (ICES, 2002a, 2003b, 2005a), (2) The Russian shrimp survey 1984-2002 and 2005 (ICES 2006), (3) The joint Norwegian-Russian ecosystem survey.

This paper presents the Norwegian results regarding shrimp of the annual ecosystem surveys 2004-2007.

Methods

The ecosystem survey is conducted annually from August to October by 5 vessels covering the entire Barents Sea to the ice edge (Fig. 1). The bottom trawl used is a Campelen 1800 shrimp trawl with rockhopper ground gear. Mesh size in the cod-end was 22 mm with a 6 mm lining. Trawl settings are described in detail in a separate manual for rigging of trawl and trawl equipment (Engås, 1995).

Trawl geometry and behaviour of the trawl were monitored using *Scanmar* trawl sensors. *Steinshamn* trawl doors are used on the Norwegian vessels. “Strapping” – a rope 150-180 m in front of the doors locks the distance the trawl doors to approximately 50 m – is used. The towing time is 15 min. GPS positions were used to calculate towed distance. A speed sensor (symmetry) was used on all bottom hauls, giving information about the direction and amount of currents entering the trawl and making it possible to tow at the right speed and geometry in proportion to underwater crosscurrents by adjusting wires or warps to compensate a skewed trawl.

For the calculations done in this paper the data was stratified by depth and area similar to the stratification used for the 1982-2004 “shrimp survey” (Fig. 2). Evaluations of previous surveys, sampling strategies etc are reported in the ICES reports from AFWG 2002, AFWG 2003 and WGPAND 2004 (ICES, 2002a, 2003b, 2005a).

The catch in each tow divided by the swept area represents a sample of shrimp density in a stratum. From these samples the mean and standard error of the density in each stratum was calculated and multiplied by the area of the stratum to give an estimate of stratum biomass and abundance. Standard error was calculated as $B * 0.985$ Cochran (1977) for strata with only one tow. The means and their standard errors for the 16 strata were summed to give the overall values for the survey area.

Samples of 250-300 specimens are taken from each trawl haul, sorted by sexual characteristics, and measured to the nearest mm below (carapace length, cpl, as defined in Allen (1959); McCrary (1971). The length- and sex frequency distribution in the samples was weighted by total catch and stratum area to obtain estimates of the overall distribution.

Results

The geographical distribution of the stock in 2007 is similar to the previous years 3 year of the series (Fig. 3). The estimate of mean biomass increased by 45% from 2004 to 2006 and decreased again by 18% from 2006 to 2007 (Table 1, Fig. 4).

Overall size distributions (Fig. 5) indicate a relatively large amount of smaller shrimp in 2004, which apparently has fuelled the stock increase 2005-2007. Estimates of the abundance shrimp at 13-16mm CL supposed to start entering the fishery in 2008 decreased from 2004 to 2005 and remained stable thereafter (Fig. 6).

The new ‘ecosystem survey’ has not been calibrated to the ‘shrimp survey’ which was discontinued in 2004.

In the Barents Sea, the period 2001-2005 is the warmest five-year period observed since 1900. In 2007 the temperatures are still high, but lower than in 2006 especially in the western Barents Sea. Large areas had bottom temperatures of 1-1.5°C above average, and some smaller areas even around 2°C above average (Fig. 7).

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Acknowledgements

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Table 1. Biomass estimates of shrimp by the Norwegian survey 1, 1982-2004 (means) and survey 2, 2004- 2007 (means and standard error). The two series are not inter-calibrated.

Year	Survey 1	Survey 2	SE
1982	327		
1983	429		
1984	471		
1985	246		
1986	166		
1987	146		
1988	181		
1989	216		
1990	262		
1991	321		
1992	239		
1993	233		
1994	161		
1995	193		
1996	276		
1997	300		
1998	341		
1999	316		
2000	247		
2001	184		
2002	196		
2003	212		
2004	151	129	23
2005		145	21
2006		188	28
2007		159	26

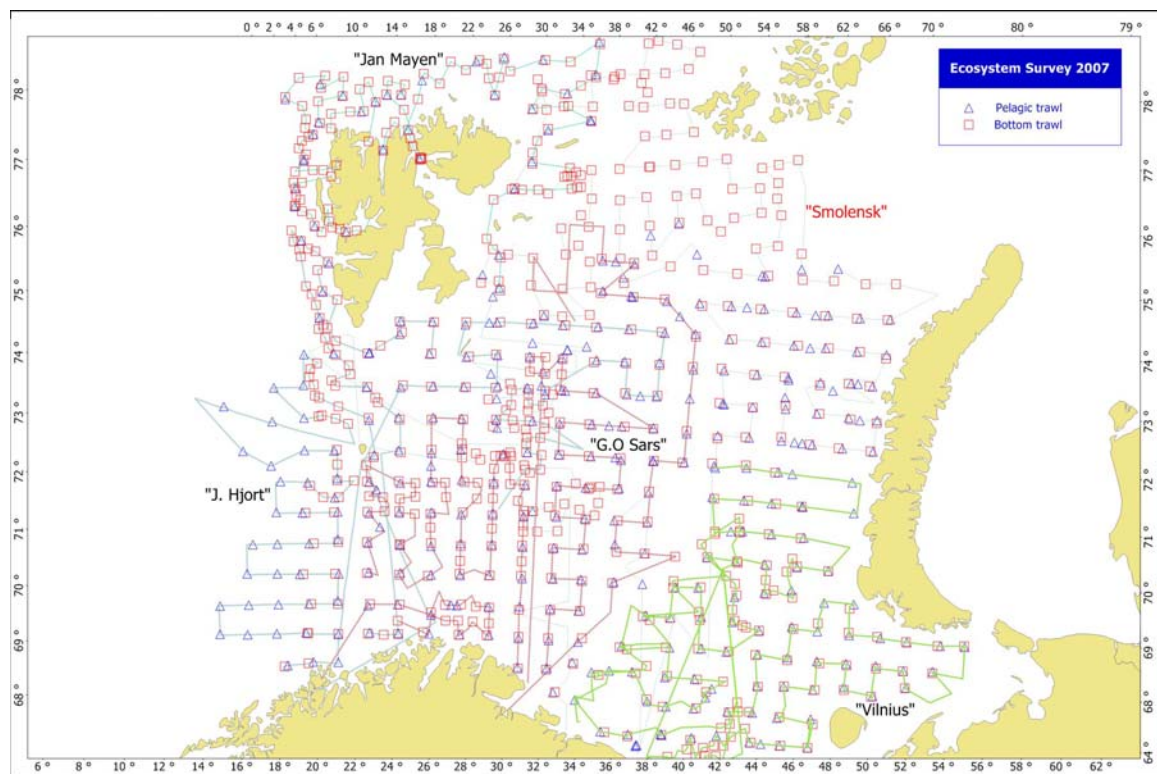


Fig. 1. Ecosystem survey trawl stations for R/V "G.O. Sars", "Johan Hjørt", "Jan Mayen", "Vilnius" and "Smolensk", August - October 2007.

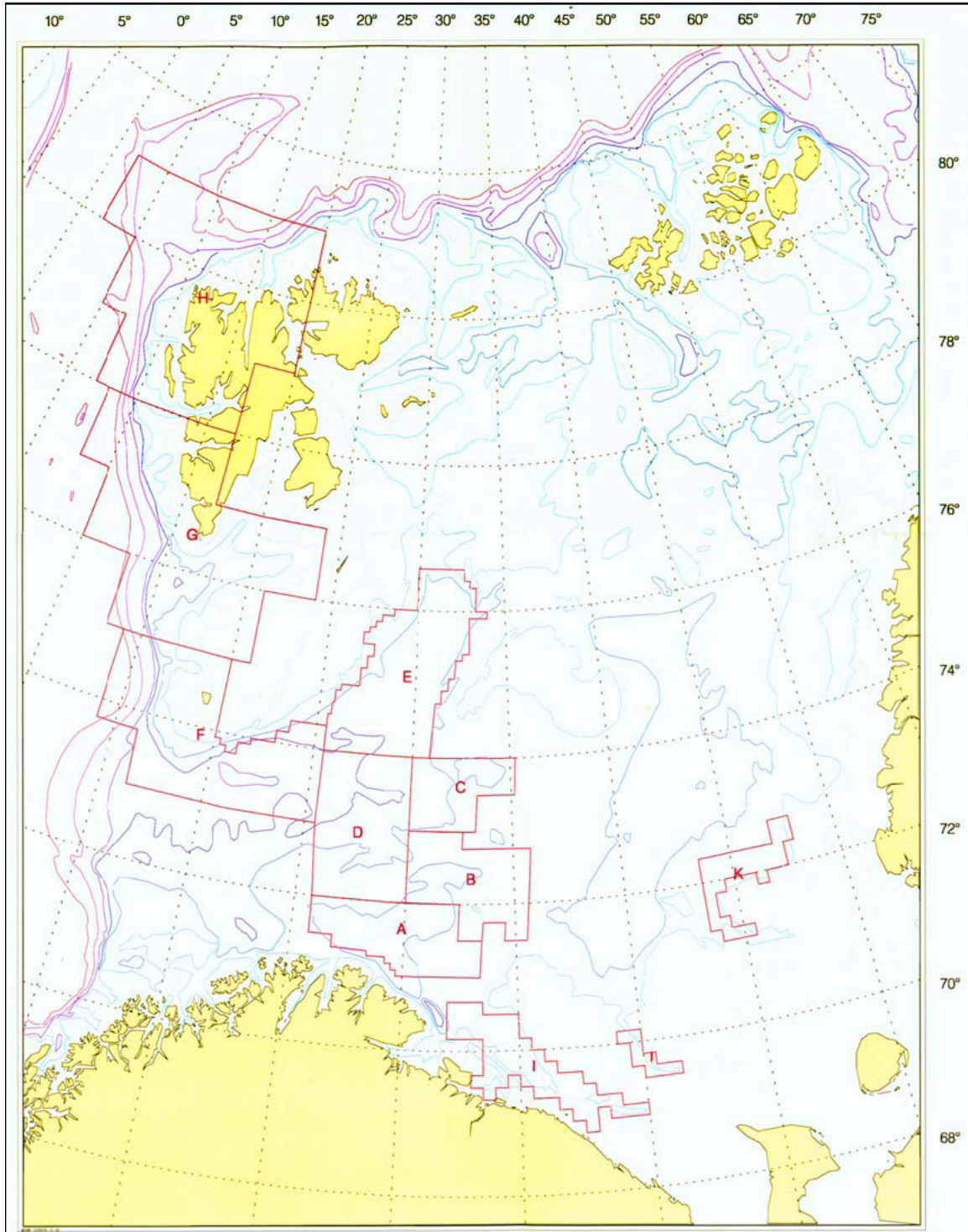


Fig. 2. Survey strata used in calculations: East Finnmark (A), Tiddly Bank (B), Thor Iversen Bank (C), Hopen (D) Barents Sea trench, (E), Bear Island (F), Storfjord Trench (G), Spitsbergen (H), Kola coast (I) and the Goose Bank (K).

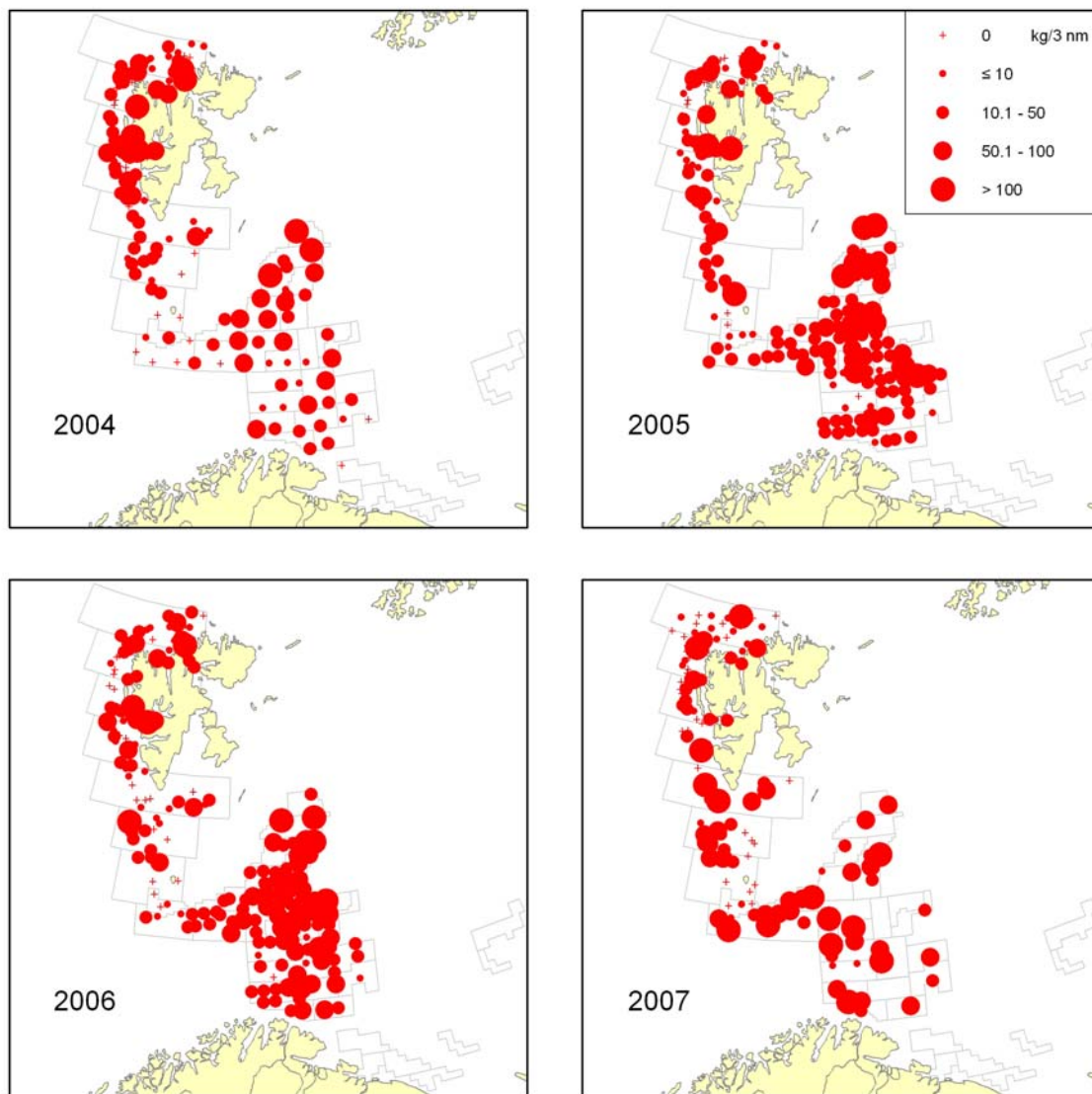


Fig. 3. Shrimp density (kg/3 nautical miles) by haul within the survey stratification scheme applied (the Ecosystem survey 2004-2007).

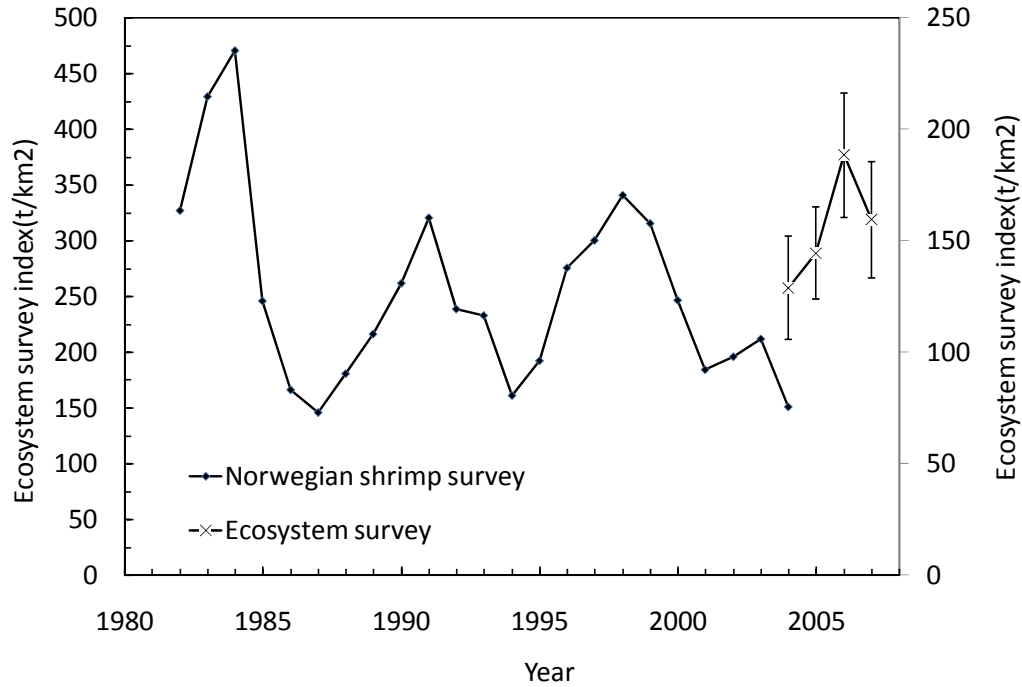


Fig. 4. Shrimp stock biomass indices of the Norwegian shrimp survey 1982-2004 and the joint Norwegian/Russian ecosystem survey estimates based on Norwegian data since 2004. (Note different scales on y-axis – the two series are not inter calibrated). Error bars are standard error.

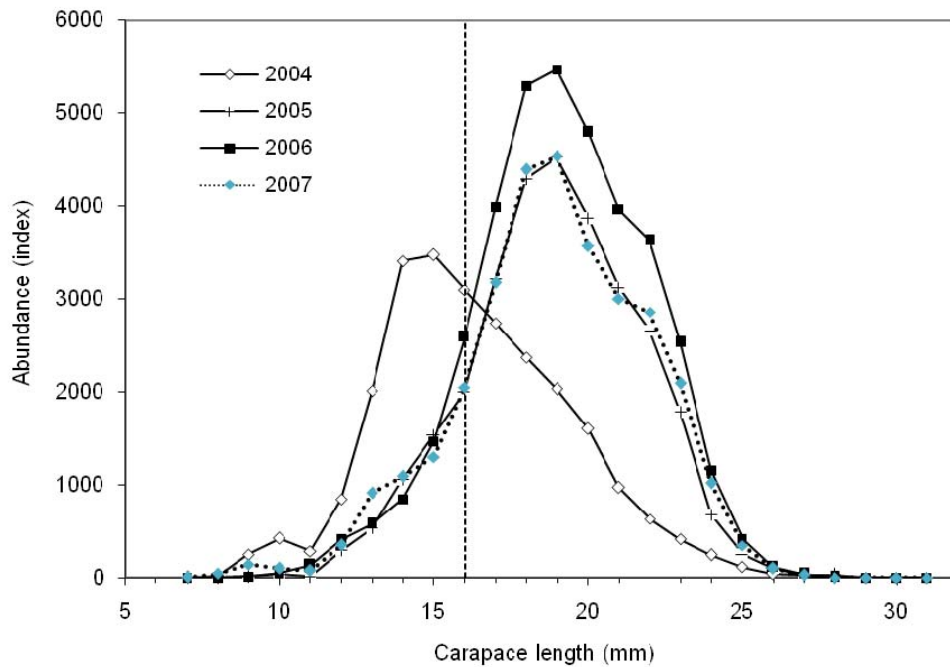


Fig. 5. Overall size distribution 2004-2007.

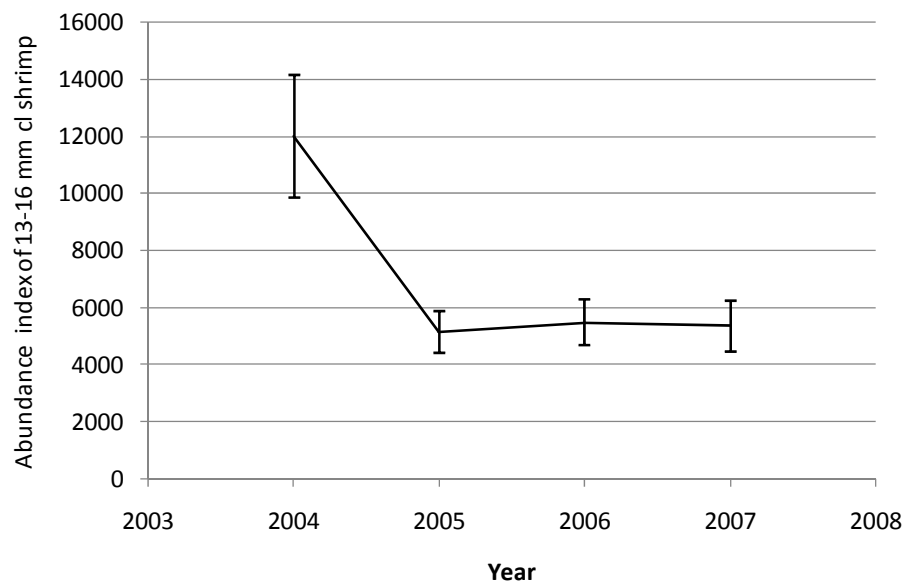


Fig. 6. Estimated number of shrimp at size 13-16 mm CL. Error bars are standard error.

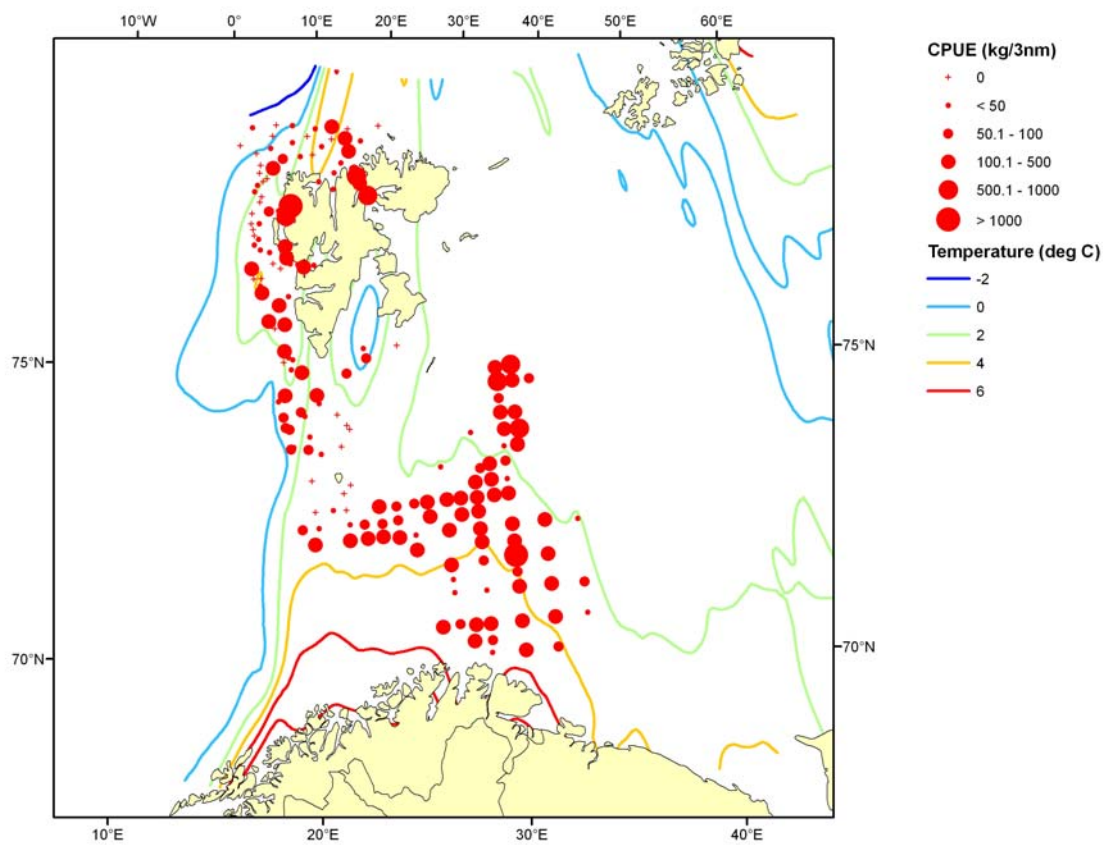


Fig. 7. Bottom temperature profile from the 2007 Ecosystem survey and survey catch of shrimp(kg/3 nautical miles).