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The Use of Fine-Meshed Bags for Sampling Juvenile Northern Shrimp (*Pandalus borealis*) in the West Greenland Bottom Trawl Survey

by

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Abstract

Length frequencies and catches of northern shrimp (*Pandalus borealis*) from juvenile bags used during the West Greenland Bottom Trawl Survey have been examined. The results indicate that the juvenile bags (mesh size: 6 mm) are adequate to sample the size range of the 1-group while estimates of the mean length of this age group based on trawl samples (mesh size: 20 mm in the cod-end) are biased. Trawl selection appears to be less important for the 2-group, which is incompletely sampled by juvenile bags when attached to the 20 mm cod-end of the trawl. Correlation between juvenile bag and trawl catches of age 1 northern shrimp was very poor. For both, high catch rates were found at the borders of the survey area and changes in the sampling procedure appears to be necessary in order to improve the reliability of abundance estimates for the 1-group.

Introduction

Juvenile bags for sampling small shrimp originally developed by Nilssen *et al*. (1986) have been used routinely by various countries, e.g. Faroe Islands (Nicolajsen and Brynjolfsson, 2001), Spain (Diaz, 2001) and Canada (Orr *et al*., 2001). In the studies fine-meshed bags have been placed either ahead or on the cod-end (20, 35 or 40 mm mesh size) of the trawl.

In the West Greenland Bottom Trawl Survey for northern shrimp conducted by the Greenland Institute of Natural Resources a mesh size of 20 mm in the cod-end of the trawl has been used since 1993 (Carlsson *et al*., 2000), and juvenile bags with a mesh size of 6 mm attached to the two sides of the twin cod-end were first introduced in 2000.

This paper compares catches and length frequencies of northern shrimp obtained from the juvenile bags and the trawl during the West Greenland Bottom Trawl Survey in NAFO Subareas 0+1 in the years 2000 to 2002.

Material and Methods

A detailed description of the survey design, area coverage, fishing practice and routine sample analysis applied in the past years of the West Greenland Bottom Trawl survey for northern shrimp is given in Kanneworff and Wieland (2001, 2002).

In addition to the routine sampling procedure, catches of northern shrimp were obtained from two juvenile bags with a base area of 0.016 m² (0.4 ∗ 0.4 m), a length of 1.6 m and a mesh size of 6 mm were attached to the cover of a 20 mm cod-end liner with one on each of the two sides of the twin cod-end of the trawl.

Valid catches with the juvenile bags were obtained for 29, 218 and 173 stations during the surveys in 2000, 2001and 2002, respectively (Fig. 1). Due to the limited area covered with the juvenile bags in 2000, the length frequencies were compared with those from corresponding trawl samples using average numbers per hour of trawling. For the 2001 and the 2002 survey, swept area estimates of abundance by length group in the entire survey area from the juvenile bag catches following the same procedure applied routinely to the trawl samples. The first age group was decomposed from the length distributions using Bhattacharya's method (Bhattacharya, 1967) and it's mean length and total abundance was estimated with the FiSAT software (Gayanilo *et al*., 1996).

Results and Discussion

Length distributions of northern shrimp comparing juvenile bag and trawl samples are shown in Fig. 2. The length distributions indicated that the lower size range of northern shrimp is not well covered by trawl samples. The mean lengths at age 1 estimated for the trawl samples were about 0.4 – 0.5 mm above the values obtained for the juvenile bags. The length frequencies demonstrate further that the juvenile bags when attached to 20 mm meshes of the cod-end liner do not sample the second age group representatively because shrimp of this size are mainly retained in the latter.

The juvenile bag and trawl catches of age 1 northern shrimp showed almost no correlation on a linear scale and only a very poor one on a log scale with all nil catches excluded (Fig. 3). Two reasons related to the sampling procedure could have been involved in this: 1) in the case of small trawl catches sorting shrimp from the conveyor belt instead of taken a subsample of about 2-4 kg (appr. 300- 600 individuals) already on deck may result in a loss of the smallest individuals, and 2) in the case of large trawl catches the meshes of the cod-end liner may be blocked preventing passage into the juvenile bags. For a couple of stations the ratio of juvenile bag and trawl catch of age 1 northern shrimp exceeded considerable it's average when the total trawl catch of northern shrimp was low (Fig. 4). This indicates that the first effect may be relevant in addition to trawl selection while the other appeared to be less important (Fig 4). Moreover, the mean ratio of all positive juvenile bag to trawl catches of the 1-group amounted to 0.08 which appears relative high considering the small base area of the juvenile bags compared to the trawl opening.

Swept area estimates of survey abundance of age 1 northern shrimp were $10.2 * 10^6$ for the juvenile bag and $0.8 * 10^9$ for the trawl samples in 2001 and $8.4 * 10^6$ for the juvenile bag and $3.3 * 10^9$ for the trawl samples in 2002 (based on the age separation shown in Fig. 2a,b). It is noteworthy that the abundance index based on the trawl samples for 2002 is more than 3 times higher than that for 2001 while the juvenile bag index does not indicate such a change.

Both, juvenile bag and trawl catches in 2001 and 2002 indicated that age 1 northern shrimp was abundant only in some parts of the survey area, i.e. the Disko Bay, south from Disko Island and between the fishing banks and the coast off West Greenland, and especially in 2002 relative high catch rates were observed at the coastal limit of the survey area between 62 and 65°N (Figs. 5a,b).

Conclusions

The use of juvenile bags is essential to obtain reliable estimates of the mean length of age 1 northern shrimp, which is needed, e.g. for calculating growth. The juvenile bag data may further be used to study trawl selection in order to correct the length distribution from the trawl samples, which could improve estimates of mean length and abundance of the 2-group.

Age 1 northern shrimp is regularly detected in the trawl samples, in particular in years of high abundance, e.g. in 2000 (Kanneworff and Wieland, 2001). However, year class strength at this age might be estimated more accurately using juvenile bags, but in this case the size and the placement of the juvenile bags should be reconsidered in order to increase their catchability and to obtain larger and, presumably, less variable samples. A revision of the allocation of stations and the survey stratification appears further to be necessary in order to improve the area coverage and the reliability of the abundance estimate for this age group.

Acknowledgements

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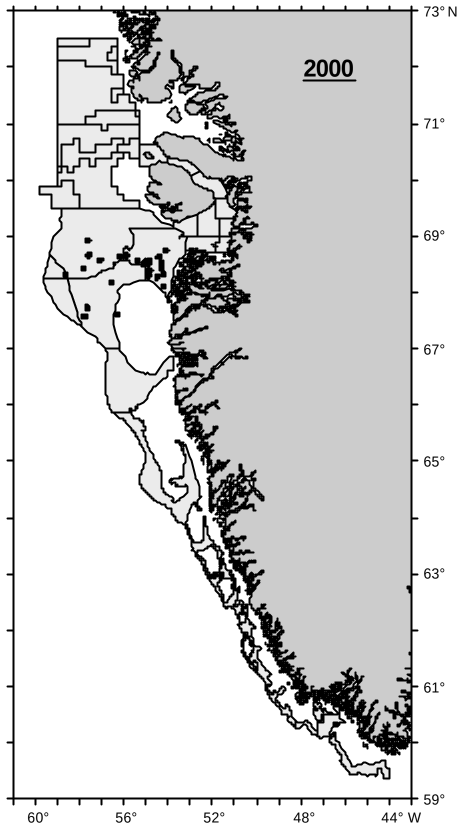

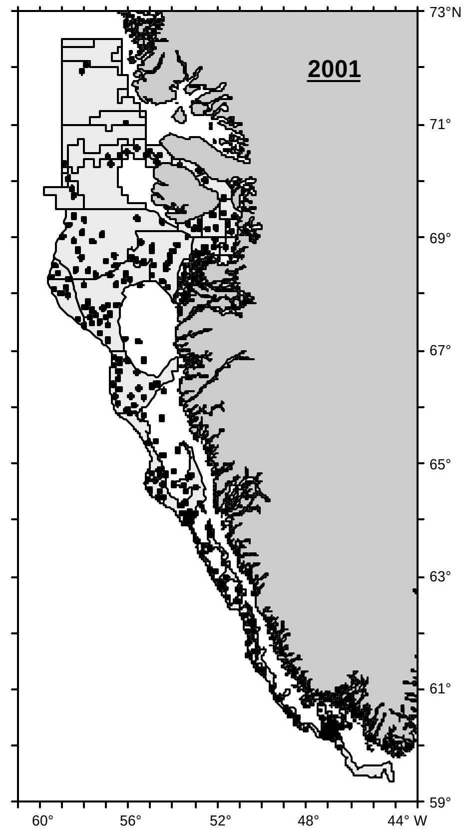

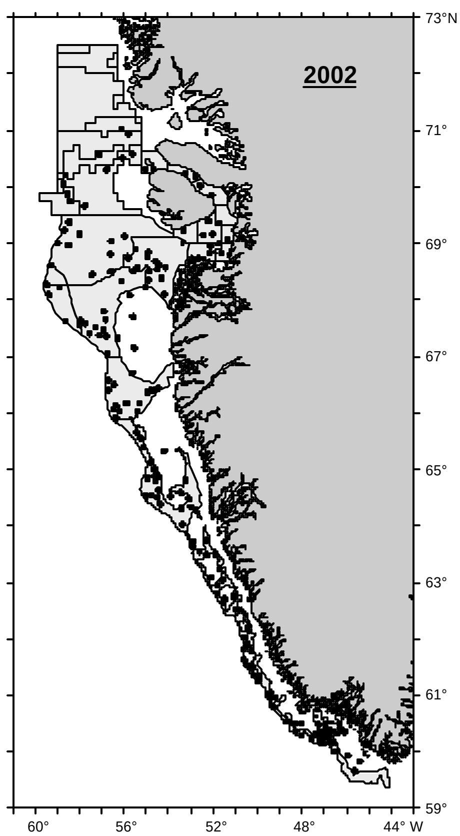

Fig. 1. Locations of comparative sampling conducted with juvenile bag and

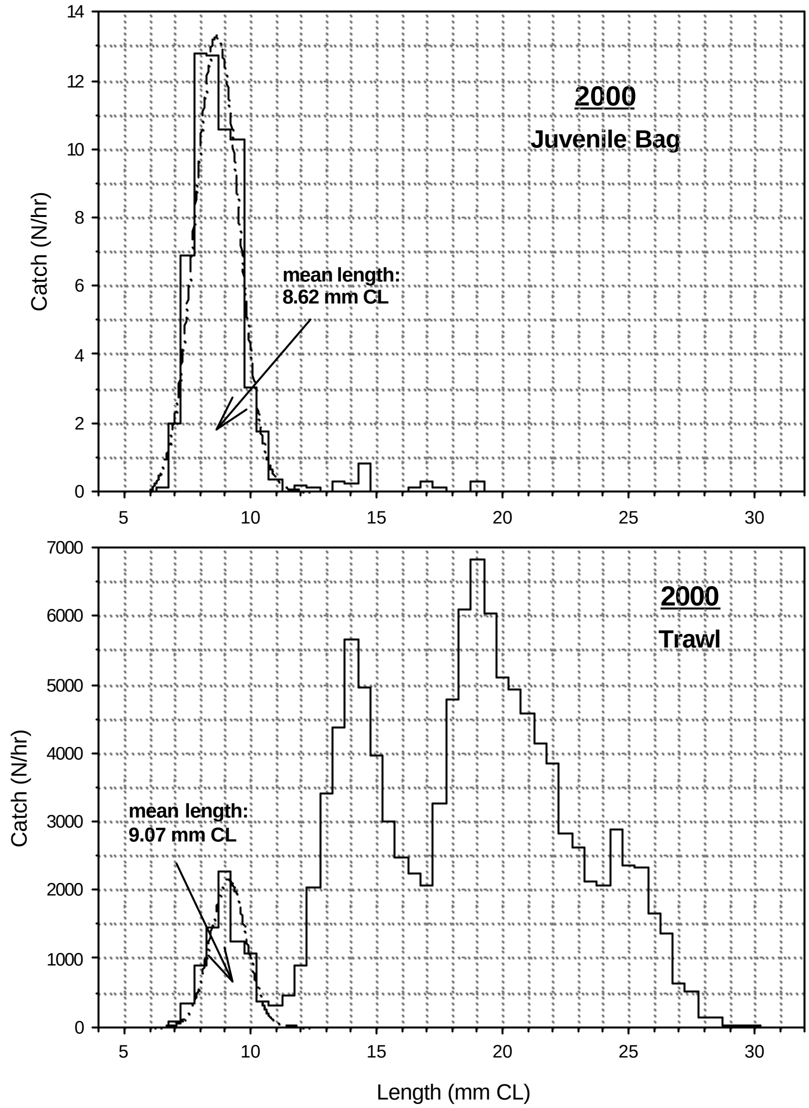

Fig. 2a. Comparison of northern shrimp length frequencies from juvenile bag and trawl catches with fitted normal distributions and mean lengths for age 1 in 2000.

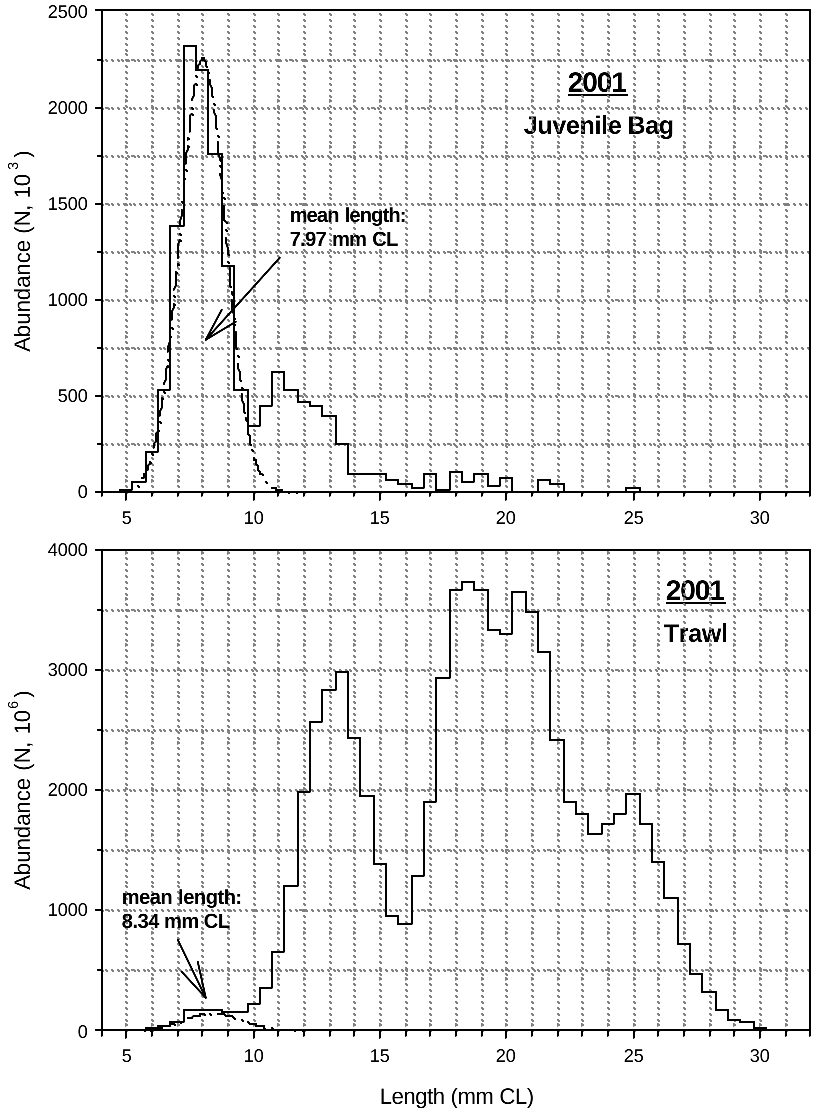

Fig. 2b. Comparison of northern shrimp length frequencies from juvenile bag and trawl catches with fitted normal distributions and mean lengths for age 1 in 2001.

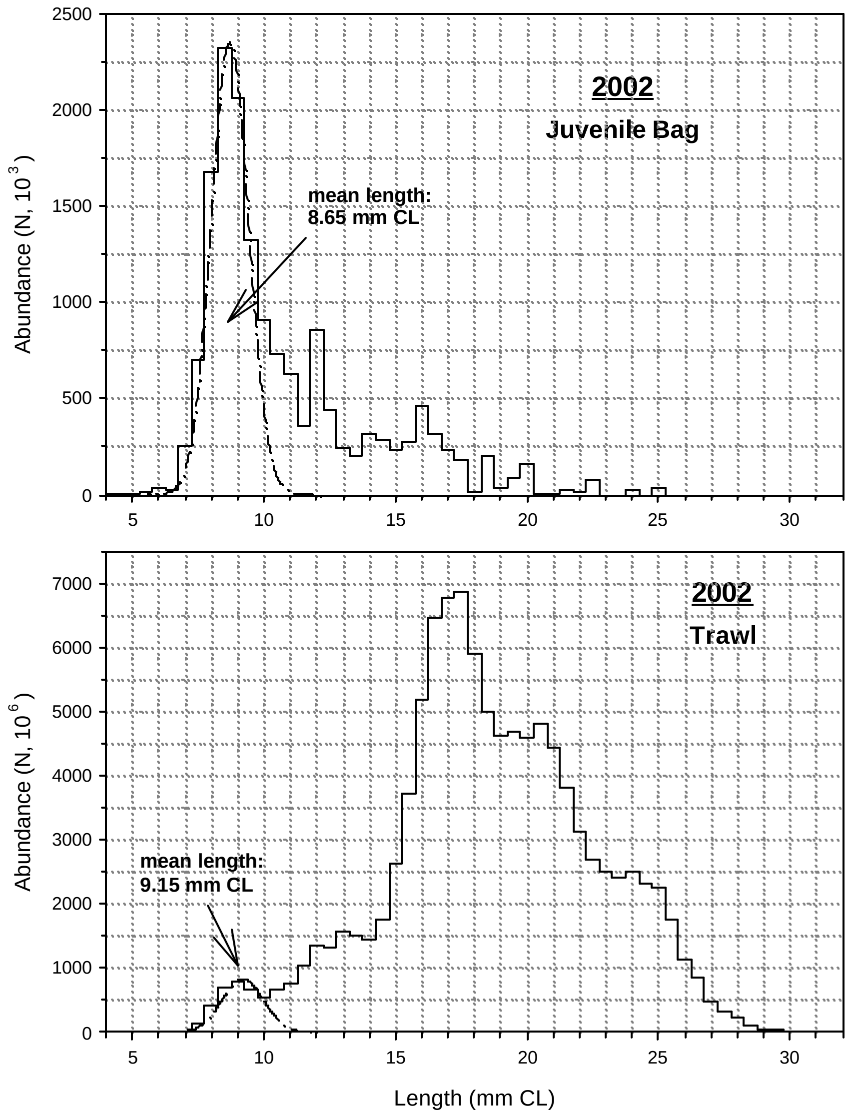

Fig. 2c. Comparison of northern shrimp length frequencies from juvenile bag and trawl catches with fitted normal distributions and mean lengths for age 1 in 2002.

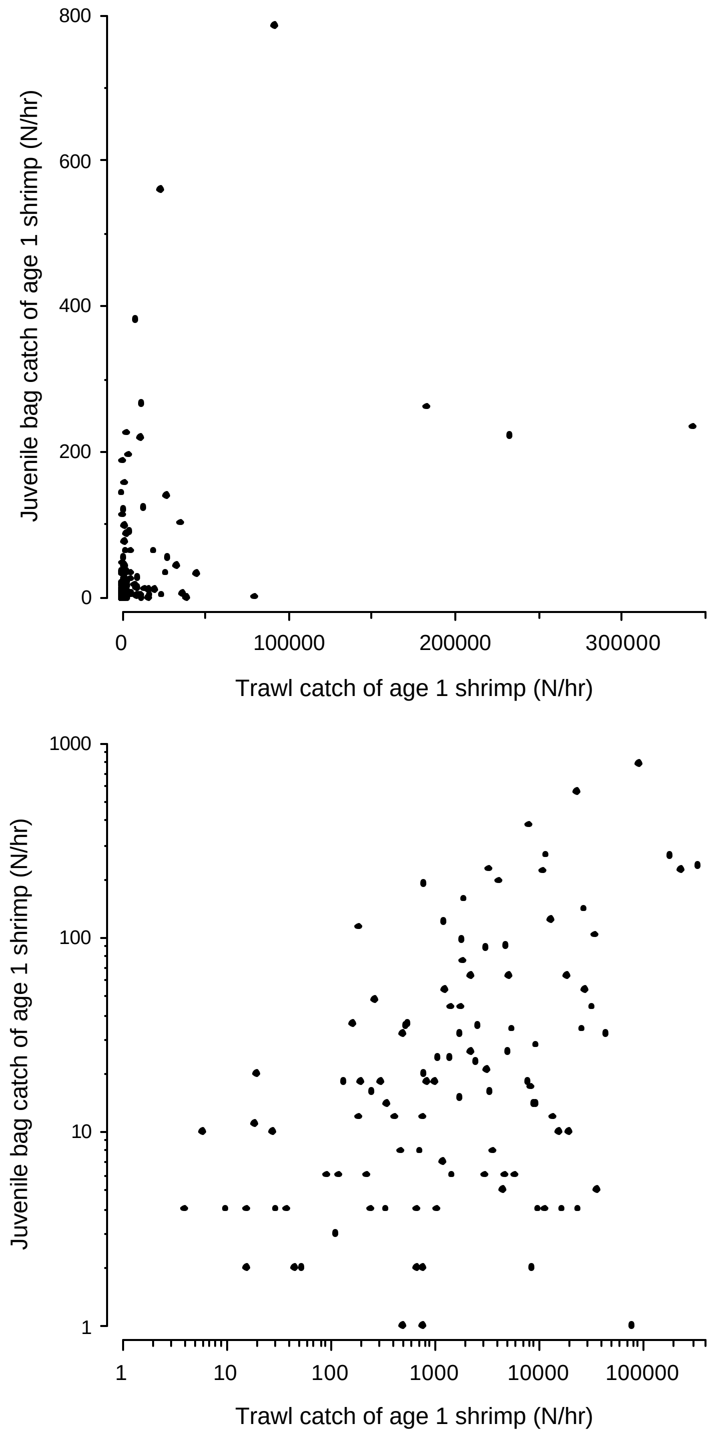

Fig. 3. Comparison of catches (in numbers per hour trawling) of northern shrimp at age 1 obtained with the juvenile bag and retained in the cod-end of the trawl.

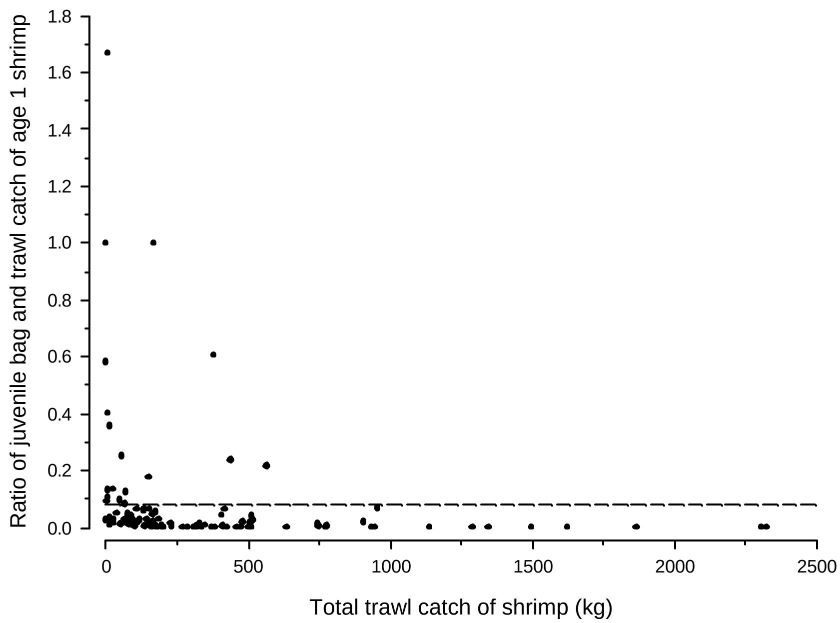

Fig. 4. Effects of total catch of northern shrimp on the efficiency of the juvenile bag for sample the 1-group. Only stations with positive catches for both, the juvenile bag and the trawl, were considered. Dashed line indicates mean ratio of numbers of age 1 northern shrimp retained in the juvenile bag and in the cod-end of the trawl.

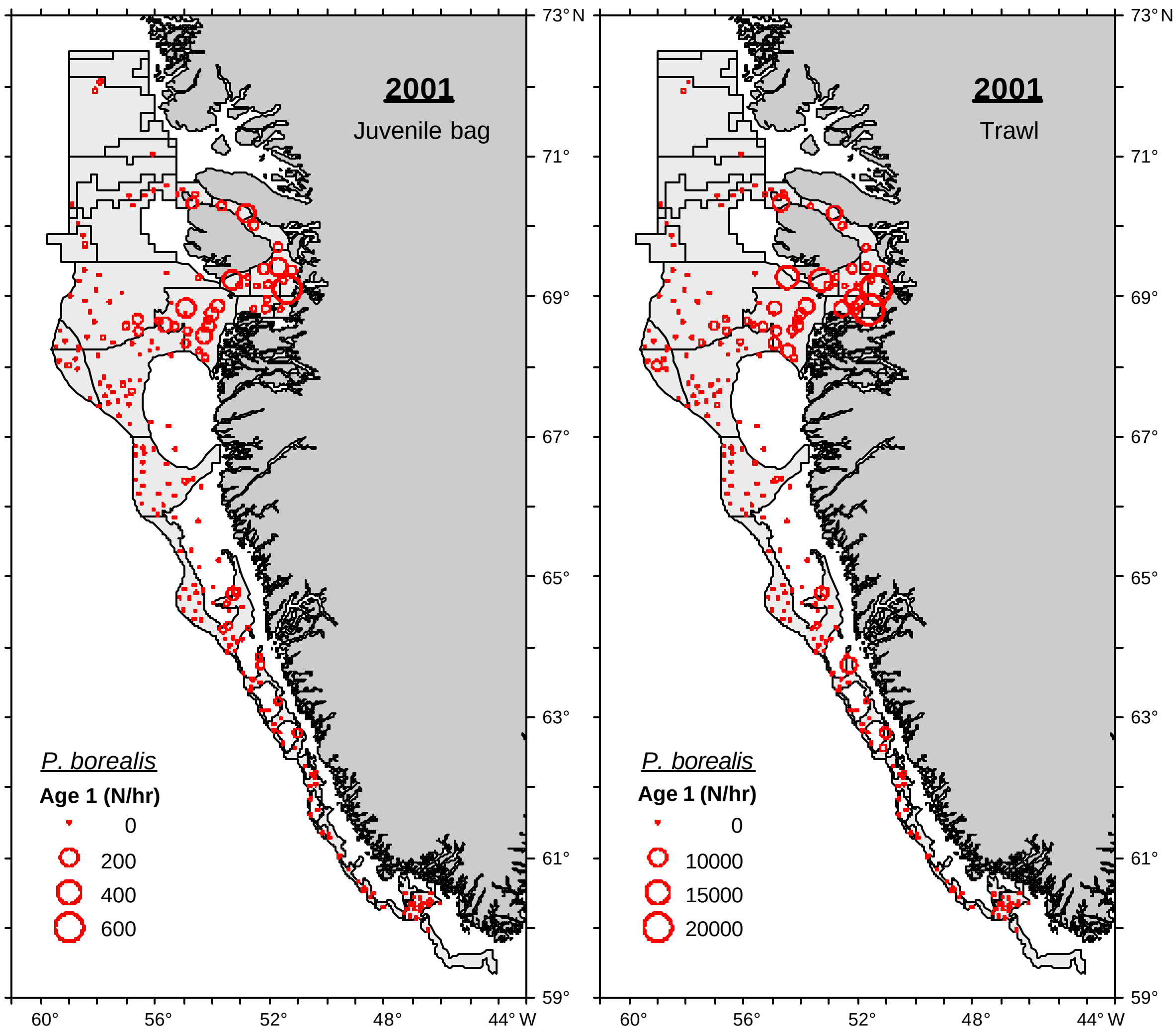

Fig. 5a. Distribution of age 1 northern shrimp in 2001 based on juvenile bag and trawl catches (in numbers per hour trawling).

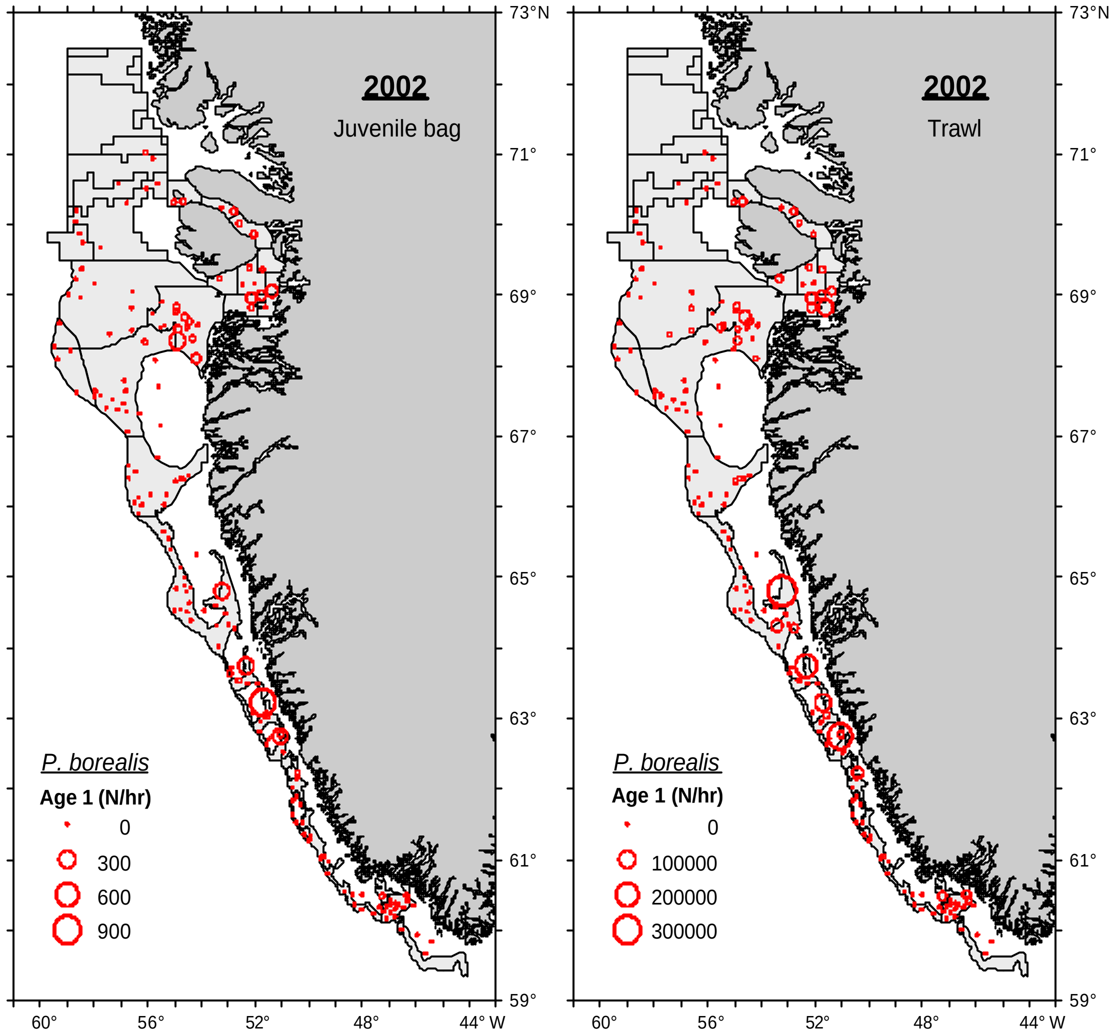

Fig. 5b. Distribution of age 1 northern shrimp in 2002 based on juvenile bag and trawl catches (in numbers per hour trawling).