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A Preliminary Analysis of Size Distibutions of Northern Shrimp Taken in the Commercial Fishery in East Greenland.

by

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Abstract

A GLM model was used to analyse the variation in carapace length of northern shrimp taken in the east Greenland commercial fishery. The variables considered were year (1999–2000), latitude (N or S of 65°), sex, season, and the group of people doing the measuring: biological assistants of the Greenland Institute of Natural Resources (GN) or on-board observers. Shrimp recruited to the fishery at the same size whether north or south of 65°, but changed sex at greater length in the northern area; there were also more females in the catch in the north, so the overall mean size was about 4 mm longer. Shrimp were about 1 mm longer in 2001 than in 1999 or 2000. The mean lengths measured by the GN assistants were not different from those measured by the on-board observers.

Introduction

There is no regular survey of the shrimp stock in east Greenland, and therefore no survey data on size distribution. The fishery has a regulated mesh size, so samples only a portion of the stock. Samples are taken by on-board observers. Some samples are sexed and measured by the observers, others are frozen and measured later by staff of the Greenland Institute of Natural Resources (GN). This document presents a preliminary analysis of the size data obtained from these samples.

The fishery in the southern area off east Greenland is much larger than that in the northern area.

Methods

The data used referred to the east Greenland commercial fishery for northern shrimp in 1999 through 2001. By merging logbook information with data from measurement files cross-identified by the sample number, which indirectly referenced the ship, date and haul, samples from fishing in east Greenland were identified and classified as northern (north of 65°) or southern. Sample weights, catch weights, and counts of shrimp at each half-centimetre length increment were summed by month and year. Samples measured by shipboard observers were distinguished from samples measured by staff of the Greenland Institute of Natural Resources. The two groups measured different samples, and no comparisons were made of measurements by different people on a single sample.

The fishery from the southern area being larger, more data were available from it. 113 samples totalled 325 kg, compared with 61 samples totalling 158 kg from the northern area. The catches sampled totalled 62.4 tons in the northern area and 281 tons in the southern.

Months were used as observational units, and possible time-of-year effects were analysed by calendar quarter. Unbalanced analysis of variance was carried out using PROC GLM of SAS on mean and variance of carapace

length in mm. Effects that were expected to be significant were pushed into the model first, and effects to be tested afterwards.

Results and Discussion

There was no statistically significant difference on average between the samples measured by the observers and those measured by GN staff, either in mean or variance of carapace length, neither overall nor for either sex considered alone. The arbitrarily selected months for which the data are plotted in Fig 1 show that the data for individual months did not always agree well.

There was a statistically significant (p=1.4%) time-of-year effect by calendar quarter on mean length. The only significant component of this variation was lower mean lengths in the third quarter of the year for both sexes. This was apparently not a consequence of a seasonal sex change, as it applied also when the two sexes were combined. There was no consistent pattern of length variation in the other quarters.

Sex (of course) had a highly significant effect on mean carapace length (Table 1). Area was also highly significant (p<0.01%) overall and for the sexes separately: shrimps were significantly longer north of 65°, females on average by 2.8 mm and males by 2.2 mm. This would indicate that sex change occurs at greater length north of 65°. The variance of male length was higher north of 65° (p=4.6%)(Table 2). The variance of female length was a little bit less in the northern area, but the difference was not statistically significant. Overall, these results are consistent with recruitment to the fishery at a length determined by the permitted mesh size (cf Fig. 1) and sex change at some 5 mm longer in the northern area (cf Fig. 2), giving greater mean and variance of size in the northern males. Females live to be a little longer in the northern area that in the southern, so their mean length is greater and their variance in length a little less. However, in spite of sex changing at greater length, when the logit of the sex ratio was analysed, it was found that the proportion of females in the catch was significantly greater in the northern area (logit difference 1.4, p<0.03%). In the northern area, males average larger, females averaged larger, and there were more females in the catch, so the overall average length was about 4 mm longer than in the south.

Mean lengths for both sexes were about 1 mm less in 2001 than in the other two years, not statistically significant.

Conclusion

Significant structural differences exist between the shrimp stocks fished in the northern and the southern areas of the east Greenland shrimp grounds. The northern stock recruits to the fishery at about the same size but changes sex at, and lives to, larger sizes than the southern stock. At the same time, the fishery catch contains a significantly higher proportion of females. These differences were statistically significant. Otherwise, the stock seemed consistent over the years from 1999 to 2001. Size distributions varied little with season, although the slight variation observed might be consistent with possible sex change near mid-summer. Overall, there was no significant difference between data obtained by on-board observers and that measured by GN assistants.

Table 1. Significant effects on mean carapace length in the east Greenland commercial catch of northern shrimp in 1999–2001.

Variable*	Value	Effect (mm)	Std Error (mm)	t value	Sig.
Intercept		23.35	0.49	48.05	<0.01%
sex	f	4.69	0.26	18.37	<0.01%
area	ICES-N	2.55	0.29	8.94	<0.01%
season	fall	-0.99	0.34	-2.91	0.54%
yr	99	-1.20	0.53	-2.27	2.77%
yr	2000	-1.10	0.52	-2.12	3.93%

* default values: sex ‘male’, area ‘ICES-S’, season ‘other’, year = 2001.

Table 2. Significant effects on variance of carapace length in the east Greenland commercial fishery.

Variable	Value	Effect (mm)	Std Error (mm)	t value	Sig.
Males					
Intercept		3.51	33.14%	10.59	0.01%
area	ICES-N	1.15	54.46%	2.1	4.57%
Females					
Intercept		3.87	0.35	11.21	0.01%
area	ICES-N	-0.55	0.57	-0.97	34.17%

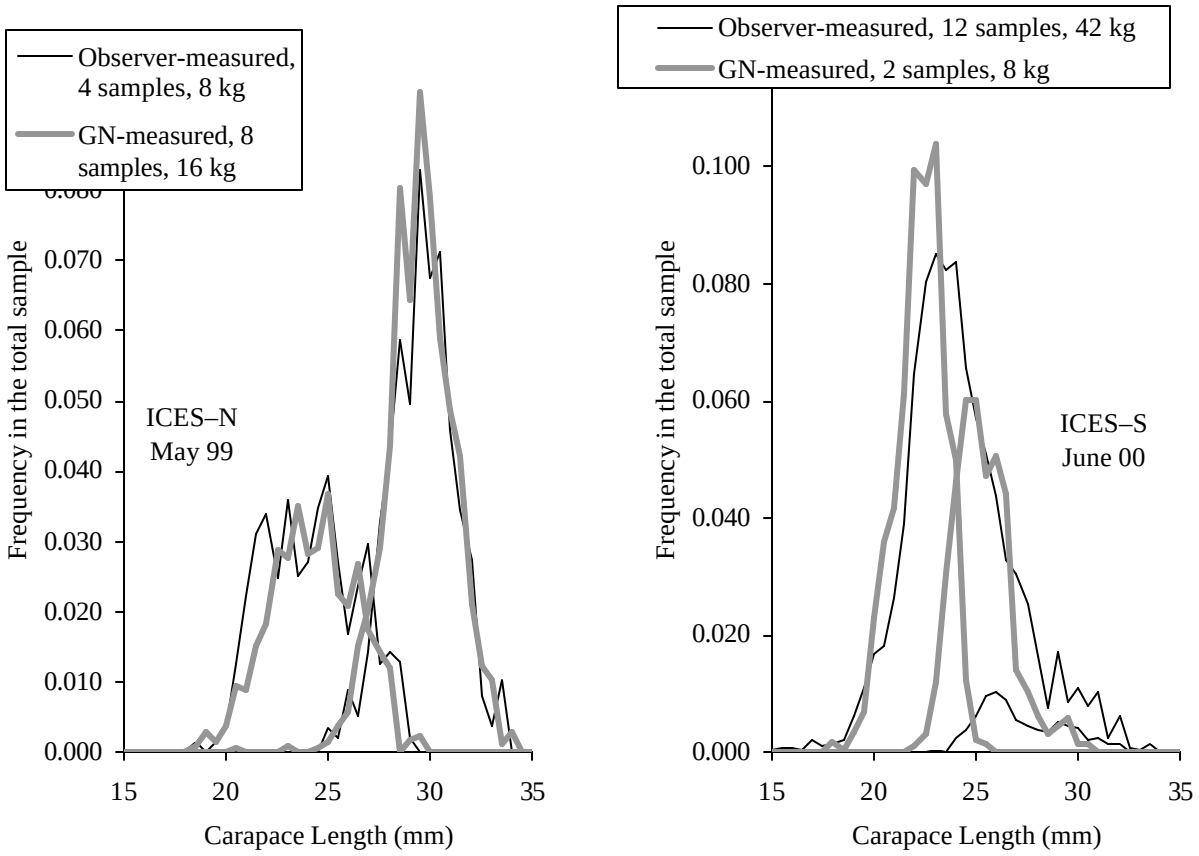

Fig. 1. Length distributions of aggregated shrimp samples from the east Greenland commercial fishery in 2 arbitrarily chosen months, May 1999 and June 2000, measured by on-board observers and GN biological assistants

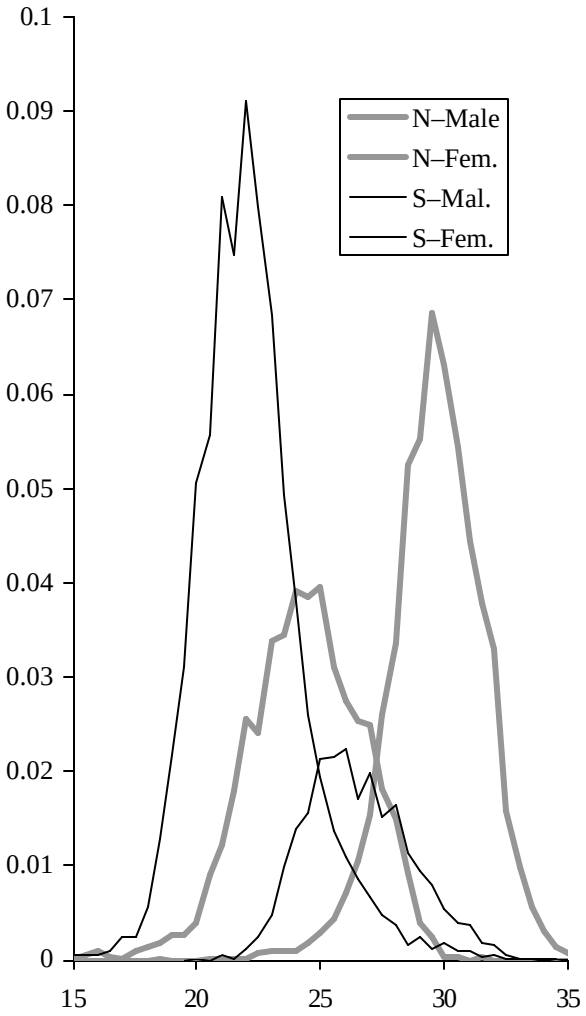

Fig. 2. Size distribution of northern shrimp from the commercial fishery in east Greenland north and south of 65° in 1999–2001.