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Occurrence of *Pandalus montagui* in Trawl Survey Samples from NAFO Subarea 0+1

by

P. Kanneworff  
Greenland Institute of Natural Resources  
Box 2151, DK-1016 Copenhagen K., Denmark

**Abstract**

Stratified-random surveys have been carried out since 1988 in NAFO Subarea 1 and Division 0A as a component of the assessment of the stock of *Pandalus borealis* off West Greenland. *Pandalus montagui* has occurred frequently as by-catch in a large part of the surveyed area.

The temporal and spatial distribution of this species in West Greenland waters is discussed, and estimates of biomass are given based on swept area calculations. Large variations in biomass is indicated, but no clear trend can be seen. However, as the survey design has been made with reference to the distribution of *Pandalus borealis*, too few stations in the distribution area of *Pandalus montagui* have been applied to give reliable estimates of the biomass. Compared to the stock of *Pandalus borealis* *Pandalus montagui* occur in shallower water, mainly in depths between 150 and 250 meters.

**Introduction**

Since 1988, Greenland Institute of Natural Resources has conducted annual stratified-random trawl surveys in the distribution area of *Pandalus borealis* in Davis Strait. Occurrence of other species in the catches has been recorded, and this paper presents data on the 'tiger shrimp', *Pandalus montagui*, biomass estimates and composition of the fishable stock. Estimation of this biomass has been made earlier (Folmer, 1996), but major revisions of the survey database have been made since then (Carlsson, Kanneworff and Kingsley, 1999).

**Material and Methods**

The basic survey design has been constructed with reference to the distribution of the stock of *Pandalus borealis* as has the allocation of stations to the various strata. For the sampling period 1988 to 1997 trawl stations were allocated to strata proportionally to the area of the strata, but from 1998 station allocation has been weighted towards strata with observed high *P. borealis* densities (Carlsson & Kanneworff, 2000). Much effort has been spent through the years to obtain the best possible coverage of the large distribution area of this shrimp stock. The total area extending from Cape Farewell to 72°30'N (Fig. 1) covers about 125 000 km<sup>2</sup>, and about 150 stations (range: 137-230) per year have been taken. Many of the sampling sites shown in Fig. 1 are outside the survey area defined for *P. borealis*. These areas (depths below 150 meters) were included in the sampling scheme since 1991 to obtain information on occurrence and possible changes in the fish populations.

Through all the years the surveys have been conducted with 722 GRT trawlers (sister ships, however since 1991 with the same vessel), using a 3000/20-mesh *Skjervøy* bottom trawl with a twin cod-end. Mesh size in the cod-end was changed from 44 mm to 20 mm (stretched) in 1993 and the small meshed codend was used thereafter. Trawl doors were *Greenland Perfect* (apart from the survey in 1989) measuring 370\*250 cm and weighing 2420 kg. Trawl

geometry was measured with *Scanmar* acoustic sensors mounted on the trawl doors, and a *Furuno* trawley on the headrope.

In order to minimise the influence of daily vertical migrations of shrimp, trawling was carried out only between 0900 and 1900 UTC. The position (GPS) of the vessel at the beginning and end of each tow was used to measure the length of the track.

Swept area was calculated for each haul as the measured length of the trawl track multiplied by the mean width of the trawl as calculated from the measured door distance.

## Results and Discussion

The biomass calculations are based on catches per swept area unit, averaged over each stratum, assumed to represent mean densities. For each region (see Fig. 1) total biomass estimates are given in Table 1. The regions D (Disko area) and S (Julianehåb Bay) were not included in the survey area until 1991 and 1994, respectively. Also, the southern parts of region W (W6 and W7) were first included completely in 1993. Considering the observed distribution of the stock in the later years these changes in area coverage have obviously resulted in underestimating the stock size of the earlier years as long as no drastic change in the distribution of the stock is assumed.

As indicated in Fig. 2a and 2b *P. montagui* has occurred mainly in the areas around the shallow banks along the Greenland west coast and in the southern part of Disko Bay, while this species have been almost absent in the vast parts of the survey area in north and west. Although a fair amount of occurrences of *P. montagui* are recorded in shallow waters (i.e. <150 m) estimation of biomass has not been attempted, as the station coverage is considered to be too scattered in these areas. Folmer (1996), however, calculates a biomass for these shallow areas in a magnitude up to 23 % of the total estimated biomass.

Apart from unexplained high figures for 1995 and 1998 the total biomass estimates have been fairly stable over the years since 1992 (Table 1). A very low biomass - presumably somewhat underestimated - is indicated for the first four years in the survey period. Compared to the estimates of *Pandalus borealis* (Carlsson & Kannevorff, 2000) the biomass of *P. montagui* is generally at a much lower level, however, as the survey design and the coverage of the strata was directed towards the distribution of *P. borealis* the calculated biomasses of *P. montagui* might be severely underestimated in certain strata. Probably of the same reason, the calculated variances of the mean estimates are very high.

Compared to the *P. borealis* stock *P. montagui* occur in shallower areas with around 75 % of the biomass in depths between 150 and 200 meters (overall mean). The corresponding proportion of *P. borealis* is only 3%. In some years, however, relatively high proportions of the *P. montagui* biomass have been recorded in depth strata between 200 and 300 meters (Table 2). Also these observations might have been influenced by the described changes in the sampling coverage.

## Conclusion

The main distribution area of *Pandalus montagui* in the west Greenland area is observed to be in depths between 100 and 250 meters around the shallow banks from 60°N to 69°N. Large variations both in the depth distribution and in the estimated biomasses from year to year are observed, but due to the variations in the material no clear trends can be seen. Compared to the biomass estimates of *P. borealis* the biomass estimates of *Pandalus montagui* have normally been 1-2 % of the former, apart from two years with higher values (9 and 5 %, respectively).

## References

- Carlsson, D.M. and P. Kannevorff, 2000. Stratified-random trawl survey for Northern shrimp (*Pandalus borealis*) in NAFO Subarea 0+1, in 2000. NAFO SCR Doc. 00/78. Serial No. N4335.
- Carlsson, D.M., P. Kannevorff and M.C.S. Kingsley, 1999. Stratified-random trawl surveys for Northern Shrimp (*Pandalus borealis*) in NAFO Subarea 0+1, in 1999. NAFO SCR Doc. 99/109. Ser. No. N4189.

Folmer, O., 1996. Occurrence of striped Shrimp (*Pandalus montagui*) along the west coast of Greenland from 1988 to 1996. NAFO SCR Doc. 96/113. Ser. No. N2810.

Table 1. Estimates of *Pandalus montagui* biomass (tons) in Regions (see Fig. 1) for 1988-2000. The overall standard errors and error coefficients of variation are also given.

Year	Region					All		
	C	D	N	W	S	Biomass	SE	ECV
1988	0	-	0	48	-	48	1406	2930
1989	0	-	0	116	-	116	1722	1485
1990	0	-	0	8	-	8	42	529
1991	0	11	0	132	-	143	100	70
1992	0	61	0	2050	-	2111	1281	61
1993	0	6	0	1561	-	1567	938	60
1994	0	22	0	587	2050	2659	3995	150
1995	0	0	0	18820	9	18829	10271	55
1996	1	4	1	2906	0	2912	978	34
1997	0	4	0	3343	0	3347	2158	65
1998	0	1	0	14314	473	14788	11510	78
1999	0	31	0	5000	0	5031	3736	74
2000	0	86	0	2034	565	2685	1161	43

Table 2. Distribution (in percent) of *P. montagui* biomass in depth strata, 1988-2000. The figures represent regions C and W only, as the other regions have no depth strata defined.

Year	Depth strata			
	150-200	200-300	300-400	400-600
1988	86.7	7.7	5.0	0.5
1989	44.6	55.2	0.1	0.1
1990	23.6	76.4	0.0	0.0
1991	12.4	82.7	4.9	0.0
1992	5.4	94.2	0.4	0.0
1993	0.4	78.4	1.6	19.6
1994	81.6	11.2	0.0	7.2
1995	85.8	4.7	9.5	0.0
1996	42.0	57.7	0.3	0.0
1997	68.7	31.1	0.0	0.1
1998	84.9	13.6	1.4	0.0
1999	83.4	16.0	0.5	0.0
2000	62.2	34.6	3.0	0.2

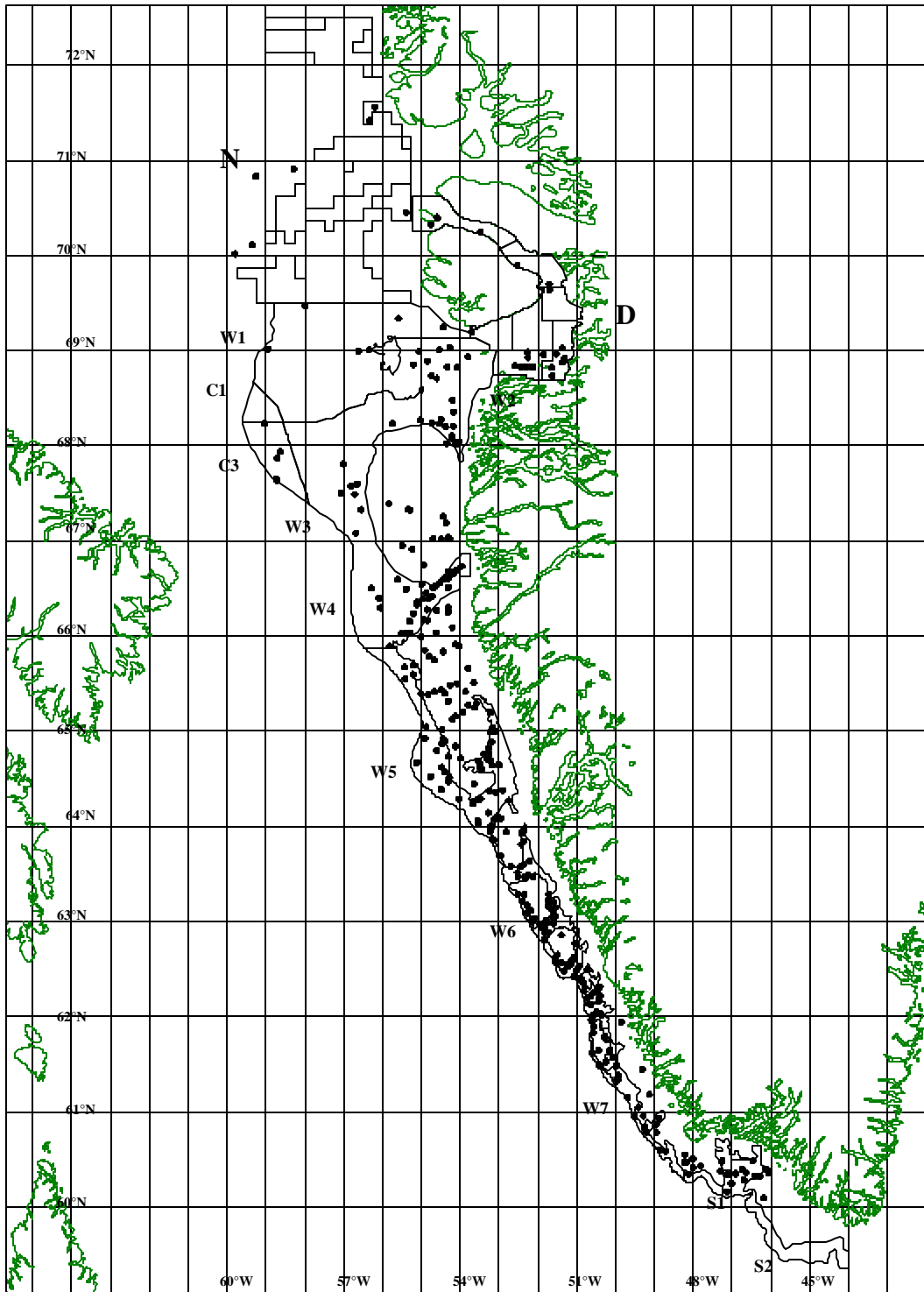


Fig. 1. Areas surveyed in 1988-2000. Stratification scheme for *Pandalus borealis* and sampling sites with occurrence of *Pandalus montagui* are indicated.

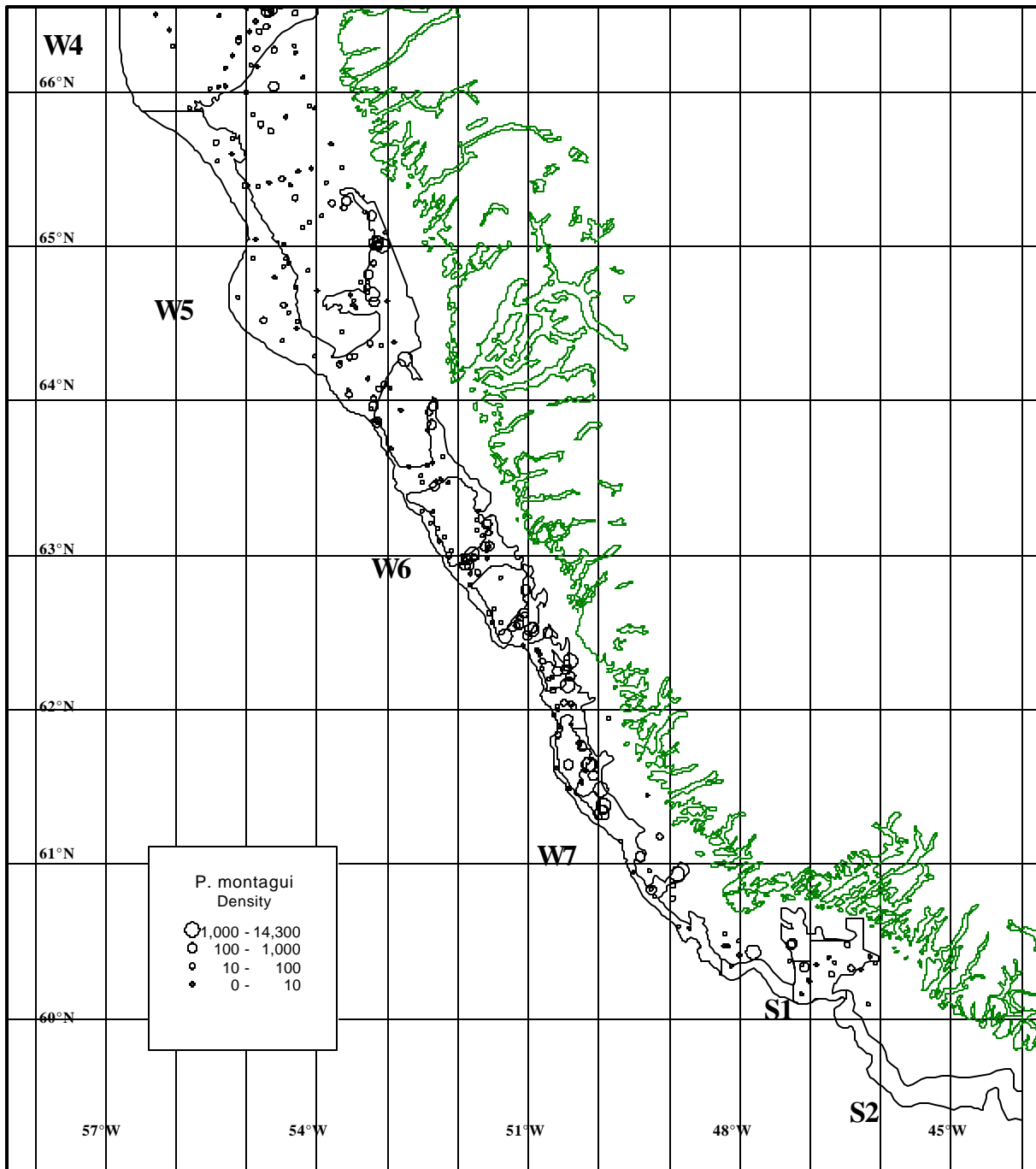


Fig. 2a. Observed densities (kg/km<sup>2</sup>) of *Pandalus montagui* in survey trawl hauls 1988-2000, southern part. Stations with zero catches are not indicated.

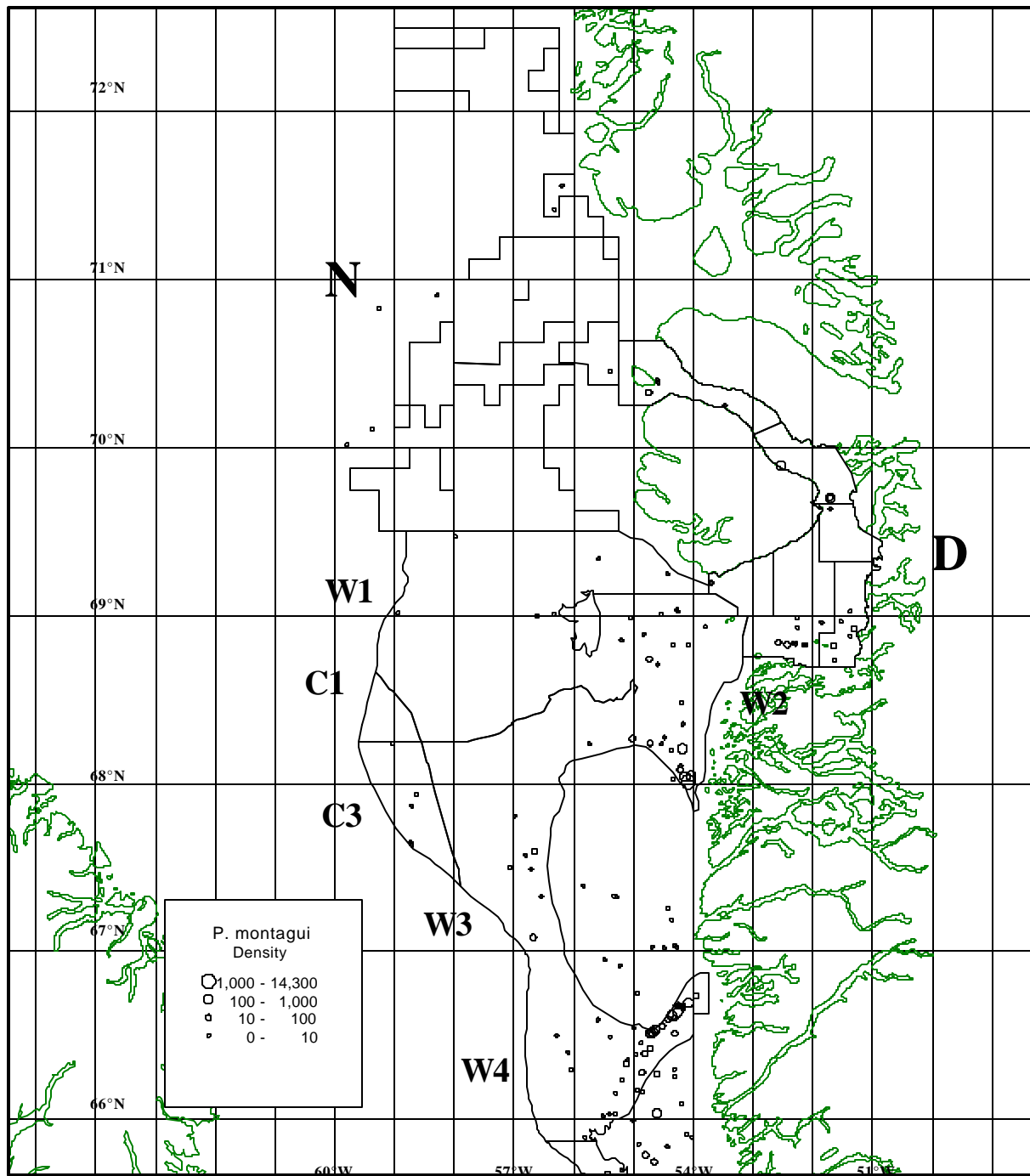


Fig. 2b. Observed densities (kg/km<sup>2</sup>) of *Pandalus montagui* in survey trawl hauls 1988-2000, northern part. Stations with zero catches are not indicated.