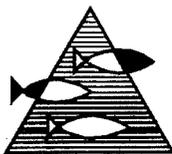


PROSJEKTRAPPORT

ISSN 0071-5638



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Distribusjon:

ÅPEN

HI-prosjektnr.:

91.02.2

Oppdragsgiver(e):

Oppdragsgivers referanse:

Rapport:

FISKEN OG HAVET

NR. 5 - 1998

Tittel:

DISTRIBUTION AND ABUNDANCE OF NORWEGIAN
SPRING SPAWNING HERRING DURING THE
SPAWNING SEASON IN 1998.

Senter:

Marine ressurser

Seksjon:

Pelagisk

Forfatter(e):

Arlil Slotte og Are Dommasnes

Antall sider, vedlegg inkl.:

10

Dato:

03.04.98

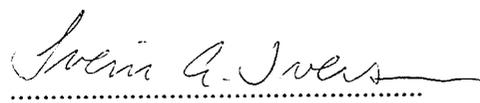
Sammen drag:

During the period 17.02. -23.03.98 the mature and spawning herring were distributed along the Norwegian coast from 57°N - 69°N. Between 61°N and 69°N the biomass and abundance estimates were 5,3 million tonnes and 22,5 billion individuals respectively, whereas between 57°N and 60°N the respective estimates were 77 thousand tonnes and 344 million individuals. The 1992 year class predominated with 47% whereas the 1991 year class comprised 30%. The proportion of the 1991 year class increased north of 62°N. Length specific somatic weight did not differ significantly with latitude. Spawning temperature decreased northwards and southwards from 62°N.

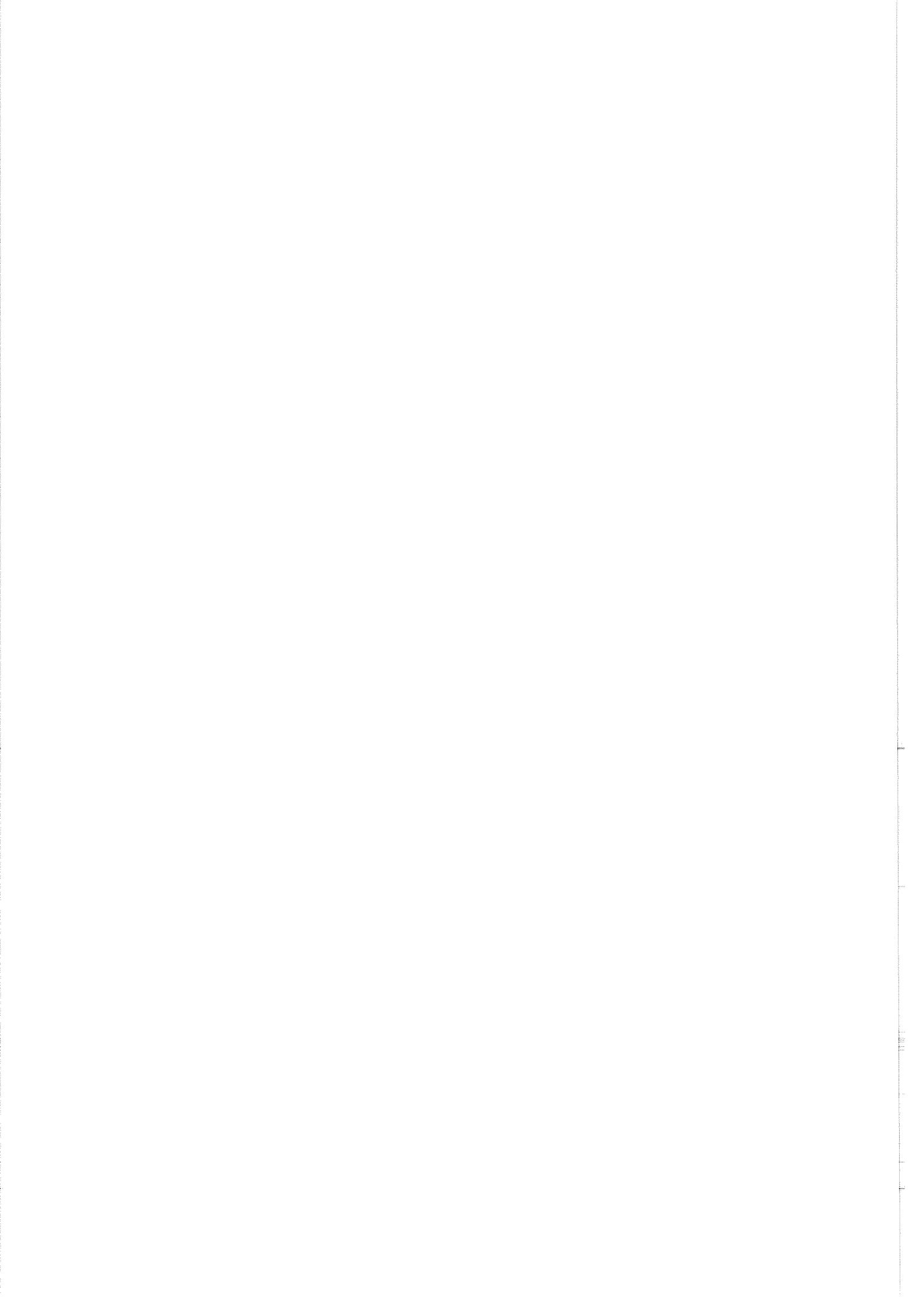
Emneord - engelsk:

1. Abundance
2. Distribution
3. Spawning
4. Herring, *Clupea harengus L*


.....
Prosjektleder


.....
Seksjonsleder

R 5359



«Cruise report»

RV *Michael Sars* 17.02.-23.03.98

**Distribution and abundance of Norwegian spring spawning
herring during the spawning season in 1998**

by

Aril Slotte and Are Dommasnes

Institute of Marine Research, PO Box 1870, N-5024 Bergen, Norway

Participants

Dommasnes, Are	17.02 - 06.03, cruise leader
Gullaksen, Ole	17.02 - 06.03
Hansen, Kåre	27.02 - 23.03
Haugsdal, Annlaug	06.03 - 23.03
Hermansen, Eilert	06.03 - 21.03
Lauvås, Kåre	06.03 - 23.03
Meland, Elna	17.02 - 06.03
Molvær, Erling	17.02 - 23.03
Nygård, Jan Erik	17.02 - 27.02
Slotte, Aril	17.02 - 23.03, cruise leader from 06.03

Methods

Acoustical data were registered with a 38 kHz SIMRAD EK 500 echo sounder and echo integrator. In addition BEI, Bergen echo integrator system, was also applied in the interpretation the data. Integrator values were divided into herring and «other categories» based on the density and appearance of the registrations, target strength (TS) distribution and data from trawl catches. Based on the acoustic observations and age composition in the trawl catches the distribution area was divided into sub areas. Conversion of integrator readings (S_A) to number of herring was achieved by the following relation between target strength (TS) and total fish length (L):

$$TS(\text{db}) = 20.0 \cdot \log L - 71.9$$

The number of individuals (N) within a certain area (A) was given by:

$$N = 1/\sigma \cdot S_A \cdot A \text{ where } 1/\sigma = 10^6 \cdot 1,23 \cdot L^{-2}$$

The area A with positive integrator values was delimited after plotting the 1 n.m. integrator values attributed to herring along the survey lines. The mean integrator value (S_A) was the arithmetic mean of all positive values within the area A.

Results

The spawning grounds from 61°N to 69°N were surveyed during 17.02-09.03.98 (Fig. 1). The total spawning stock within this area was estimated to 5.3 million tonnes and 22.5 billion individuals, and more than half of this was distributed at the spawning grounds north of Møre (north of 64°N) (Fig. 2).

The traditional spawning grounds around Karmøy were surveyed 6 times during 14-22.03.98 (Fig. 3). The biomass decreased from 49 to 2 thousand tonnes during the investigation period. A day time estimate was approximately half of the night time estimate.

The traditional spawning grounds south of Karmøy, at Karlsmedgrunnen, Egersund, Siragrunnen and Lista, were surveyed 2 times, 15-16.03.98 and 20-21.03.98, and the total biomass was estimated to 28 and 19 thousand tonnes respectively (Fig. 4). During the first period the herring were most abundant at Karlsmedgrunnen and Egersund. However, the abundance at the southernmost grounds (Siragrunnen and Lista) increased during the second period, whereas the herring were more or less absent at Karlsmedgrunnen and Egersund. This suggests a southward movement between the investigation periods.

The 1992 year class predominated in the spawning stock with 47 %, whereas the 1991 year class comprised 30 % (Table 1). However, the age composition varied somewhat on a latitudinal scale (Fig. 5). The proportion of 1991 year class increased north of Møre, and of Vesterålen this year class predominated. The composition off Karmøy and farther south were similar to that observed off Møre-south, except for some increase in the 4 year olds (1994 year class). The herring were distributed close to bottom at the southern grounds, and sampling with trawl was difficult. Therefore purse seine samples from the ongoing fishery were included in order to get a better estimate of the age composition in the area.

Table 1. Numbers (N) in millions of individuals, biomass (B) in thousand tonnes, mean weight (W) in grams and mean length (L) in cm by age group in mature Norwegian spring spawning herring from the area 61°N-69°N and the period 17.02-09.03.98.

	Age													
	4	5	6	7	8	9	10	11	12	13	14	15	Total	
N	381.19	1905.59	10640.54	6708.39	1279.81	434.52	130.01	39.07	0.00	175.51	0.00	804.97	22499.60	
%	1.69	8.47	47.29	29.82	5.69	1.93	0.58	0.17	0.00	0.78	0.00	3.58	100.00	
B	76.40	358.93	2332.40	1615.83	367.70	131.42	40.65	10.71	0.00	62.83	0.00	294.94	5291.81	
W	200	188	219	241	287	302	313	274		358		366		
L	30.0	29.6	30.9	31.8	33.5	34.8	34.7	36.0		36.3		37.0		

There were no clear latitudinal trends in the condition of the herring (Fig. 6). Although the herring at the southern grounds were sampled at a later time and had migrated up to 1500 km longer distance than the herring farther north, their length specific somatic weight was not significantly lower. This indicates that the initial condition in the wintering area in Vestfjorden was higher in herring undertaking long migrations than in herring undertaking short migrations.

There were some clear latitudinal trends in depth specific temperatures during 17.02-22.03.98 (Fig. 7). Temperature decreased northwards and southwards from 62°N. The majority of the herring off Møre and northwards, spawned at depths between 150-200 m. Consequently, the eggs were fertilised at 8-9°C off Møre, at 7-8°C at Haltenbanken and Sklinnabanken and at 6-7°C of Vesterålen. At the southernmost grounds (south of 61°N) the majority of the herring spawned at depths below 75 m, i.e. at a mean temperature below 6°C.

Conclusions

The distribution and abundance of the stock during the spawning season in 1998 indicate a somewhat northward displacement of the spawning activities compared to earlier years. More than half of the stock chose to spawn north of Møre this year. In addition the biomass at the southern grounds was reduced from the estimated 210 thousand tonnes in 1997 to less than 80 thousand tonnes in 1998. An explanation to the distribution pattern in 1998 could be the decrease in body condition (length specific weight) from 1997 to 1998, which ultimately may have reduced the migration potential of the stock.

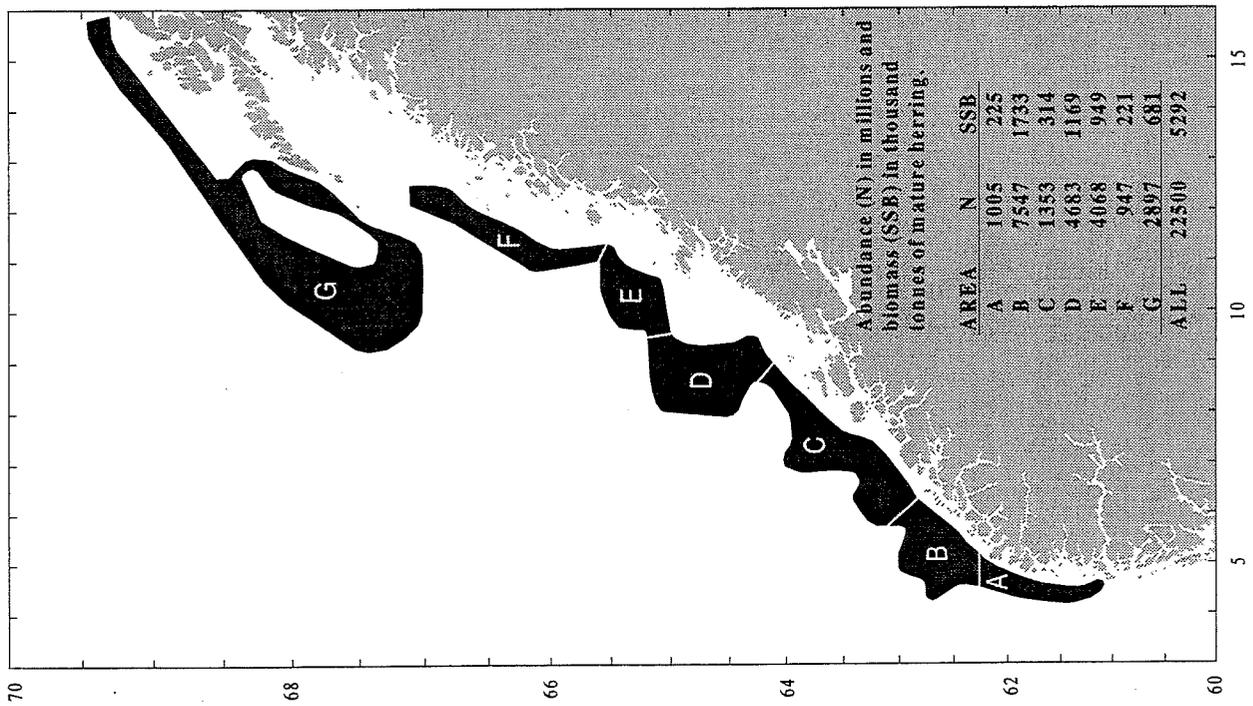


Fig. 2. Distribution areas, abundance and biomass of Norwegian spring spawning herring during an acoustical survey with RV Michael Sars 17.02.-09.03.98

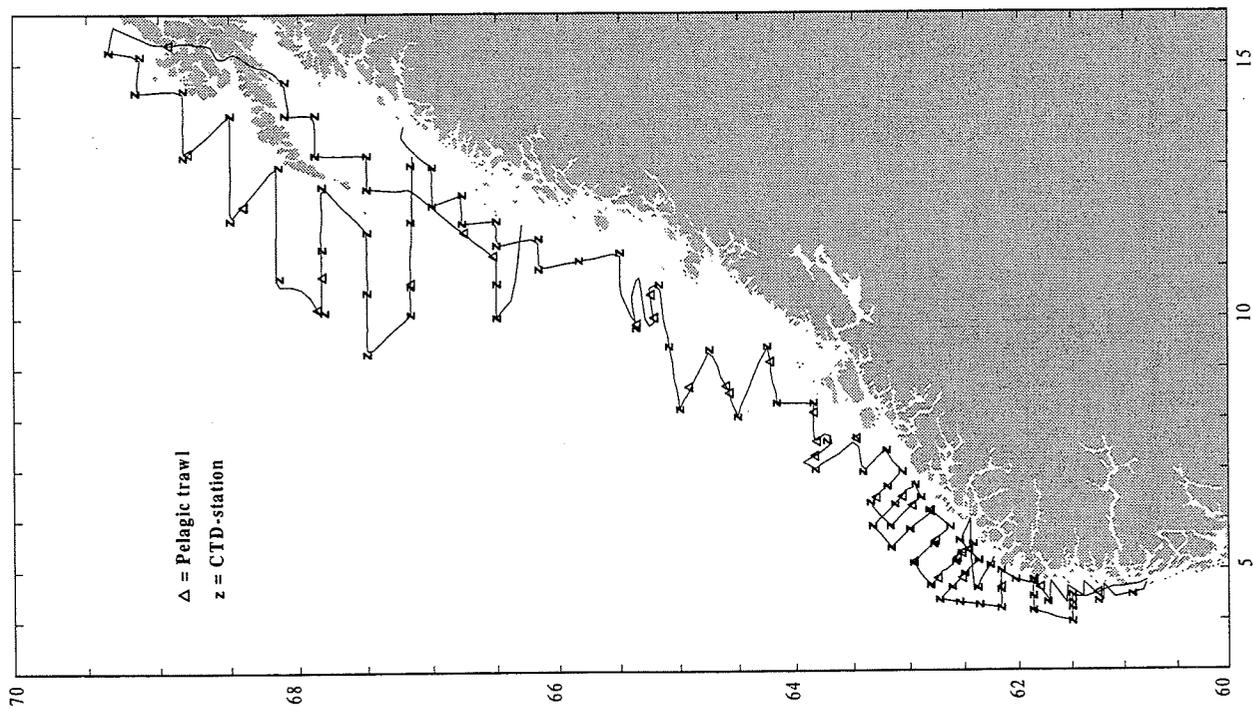


Fig. 1. Cruise tracks, CTD stations and trawl stations during an acoustical survey with RV Michael Sars 17.02.-09.03.98

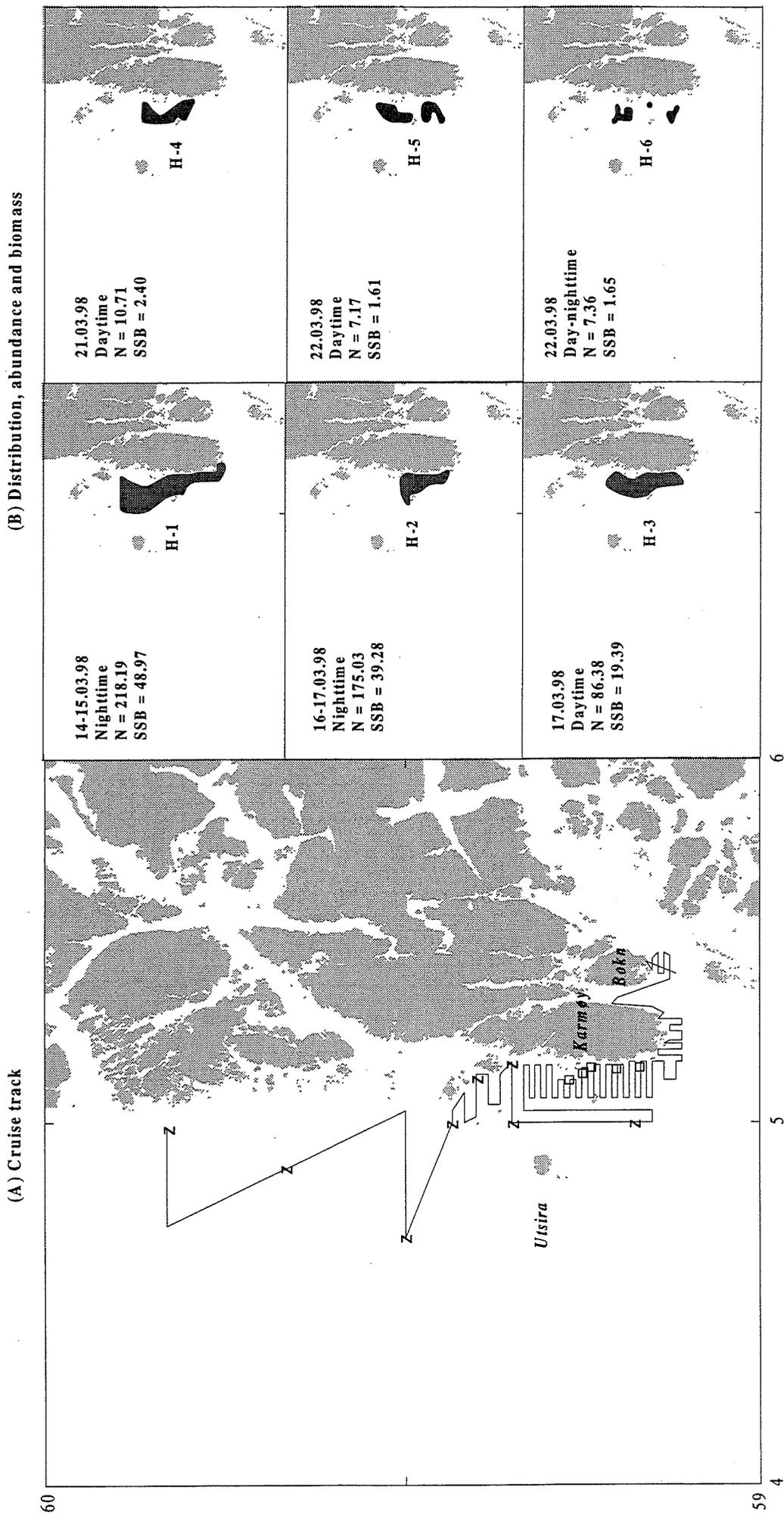
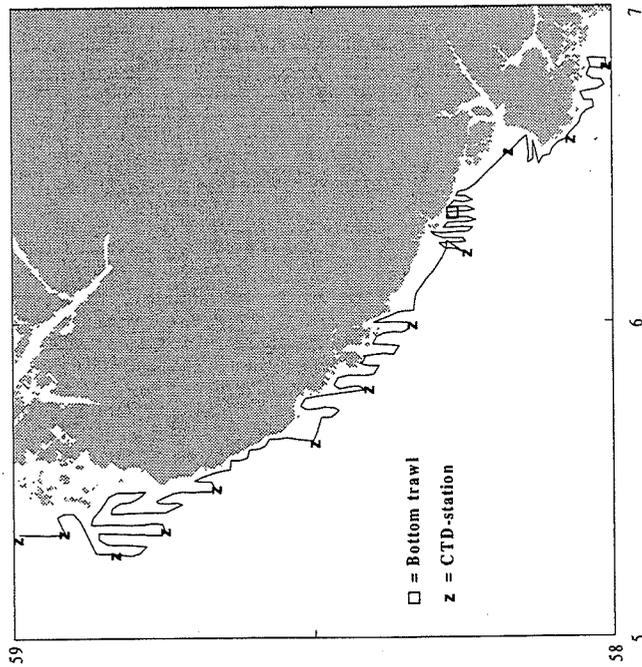
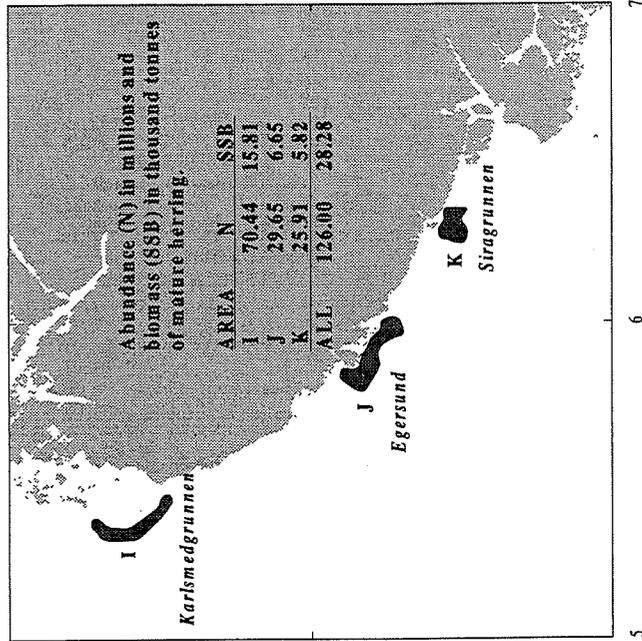


Fig. 3. (A) Cruise track (the part to the west and south of Karmøy was repeated six times) and (B) distribution areas of herring with estimates of abundance (N) in millions and biomass (SSB) in thousand tonnes, during an acoustical survey with RV Michael Sars 13.-23.03.98.

(A) Cruise track



(B) Distribution, abundance and biomass 15-16.03.98



(C) Distribution, abundance and biomass 20-21.03.98

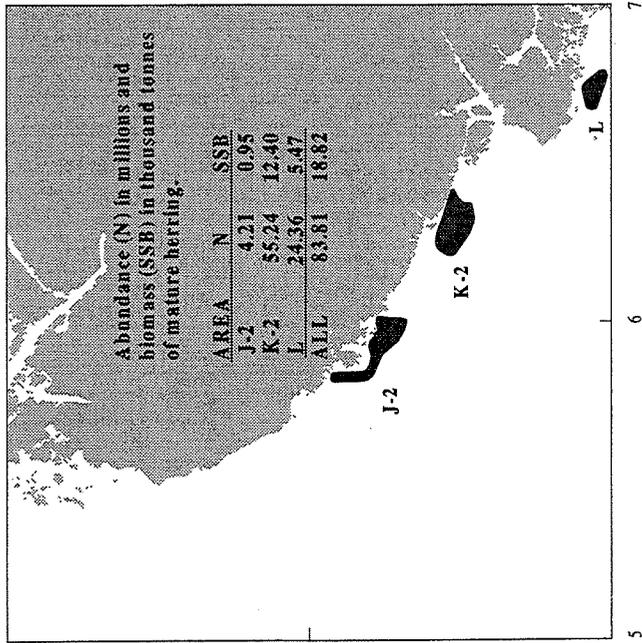


Fig. 4. (A) Cruise track, CTD-stations and trawl stations during an acoustical survey with RV Michael Sars 15-16.03.98. The cruise track was repeated 20-21.03.98. Distribution areas of herring with estimates of abundance and biomass during 15-16.03 (B) and 20-21.03 (C).

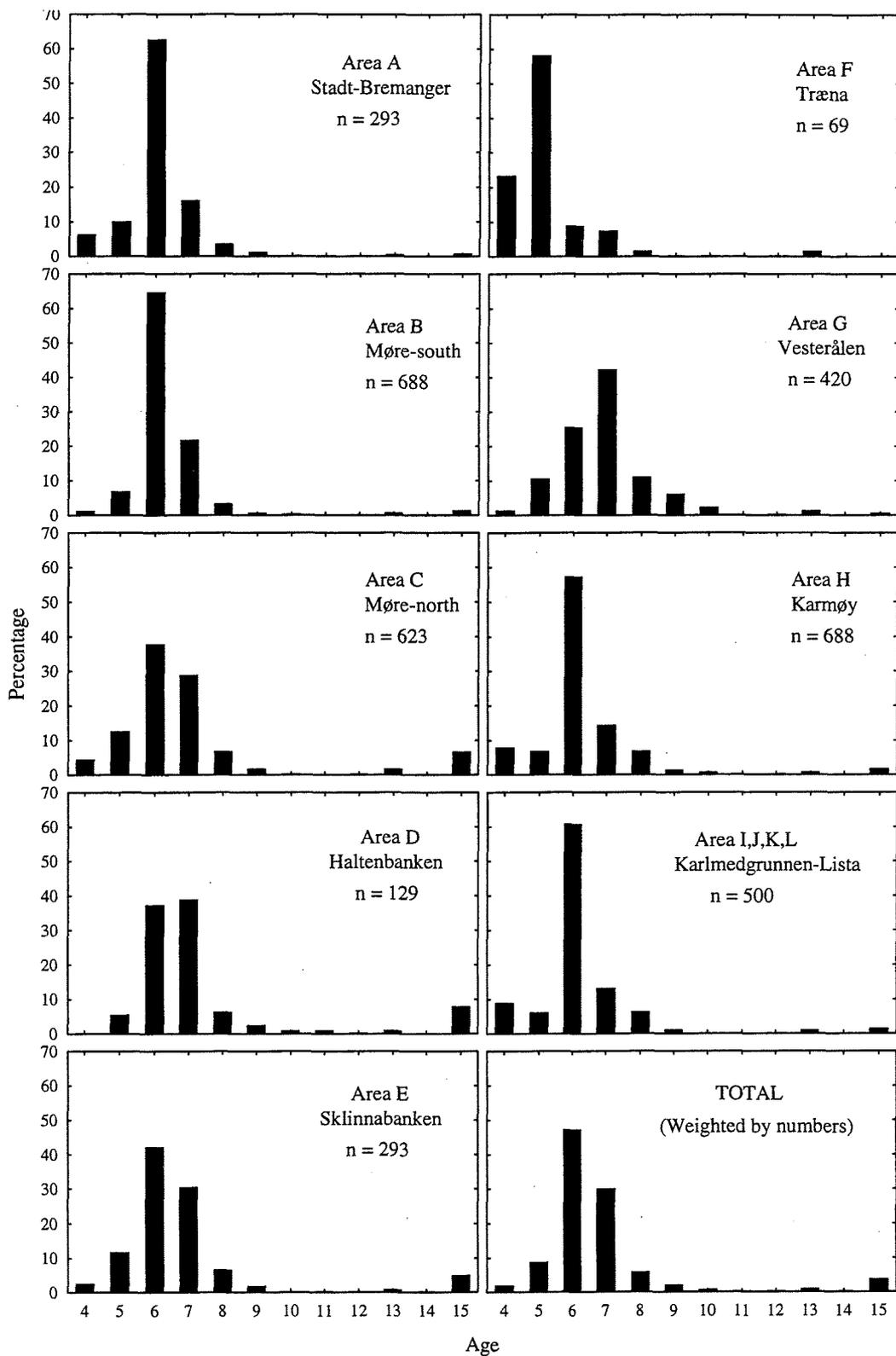


Fig. 5. Age composition of herring by distribution area (see Figs. 2-4). Age composition in the total spawning stock was only estimated from the herring distributed within areas A-G.

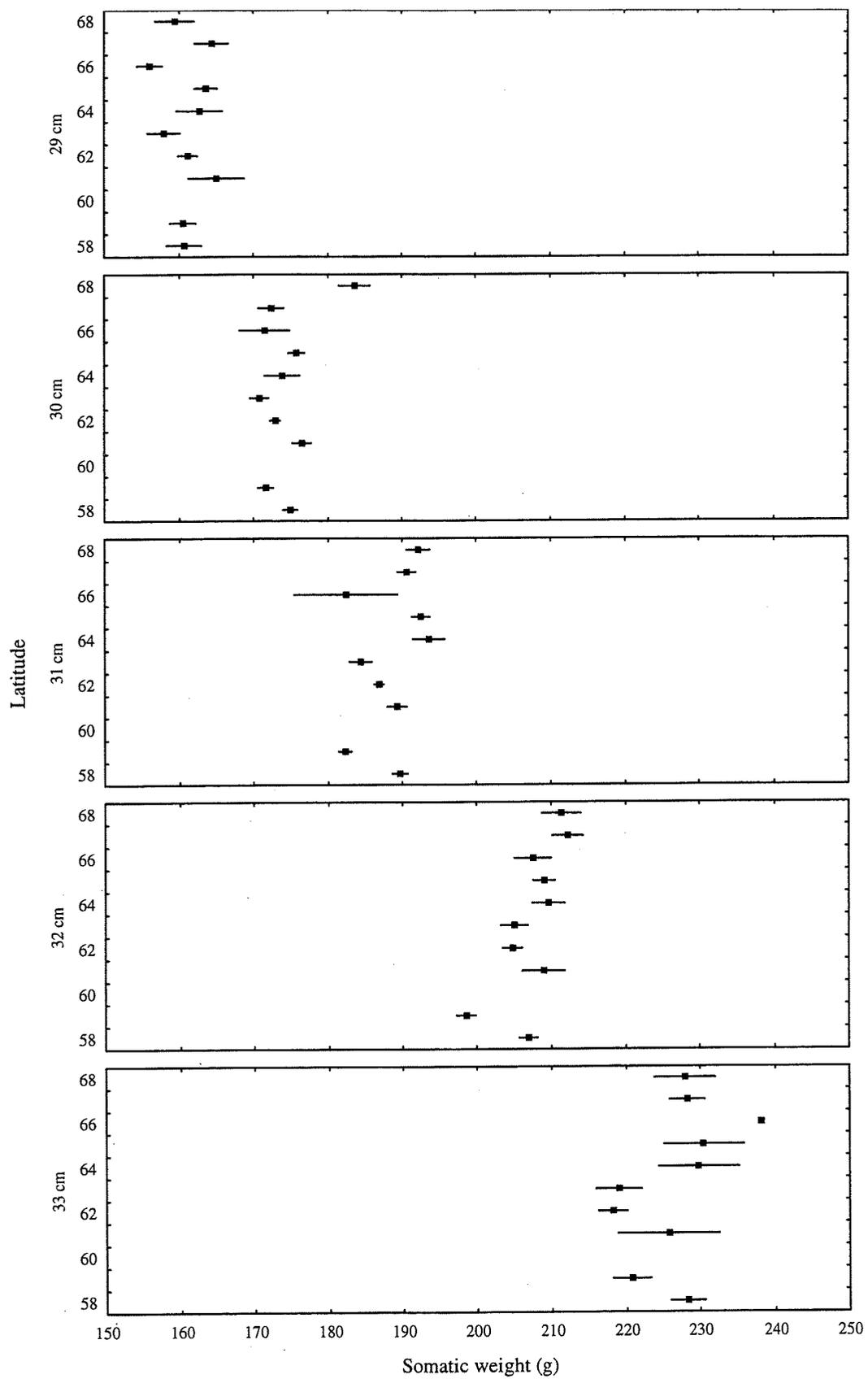


Fig. 6. Length specific somatic weight (total weight-gonad weight) by latitude in herring sampl within the period 17.02-22.03.98. Mean values \pm SE are given.

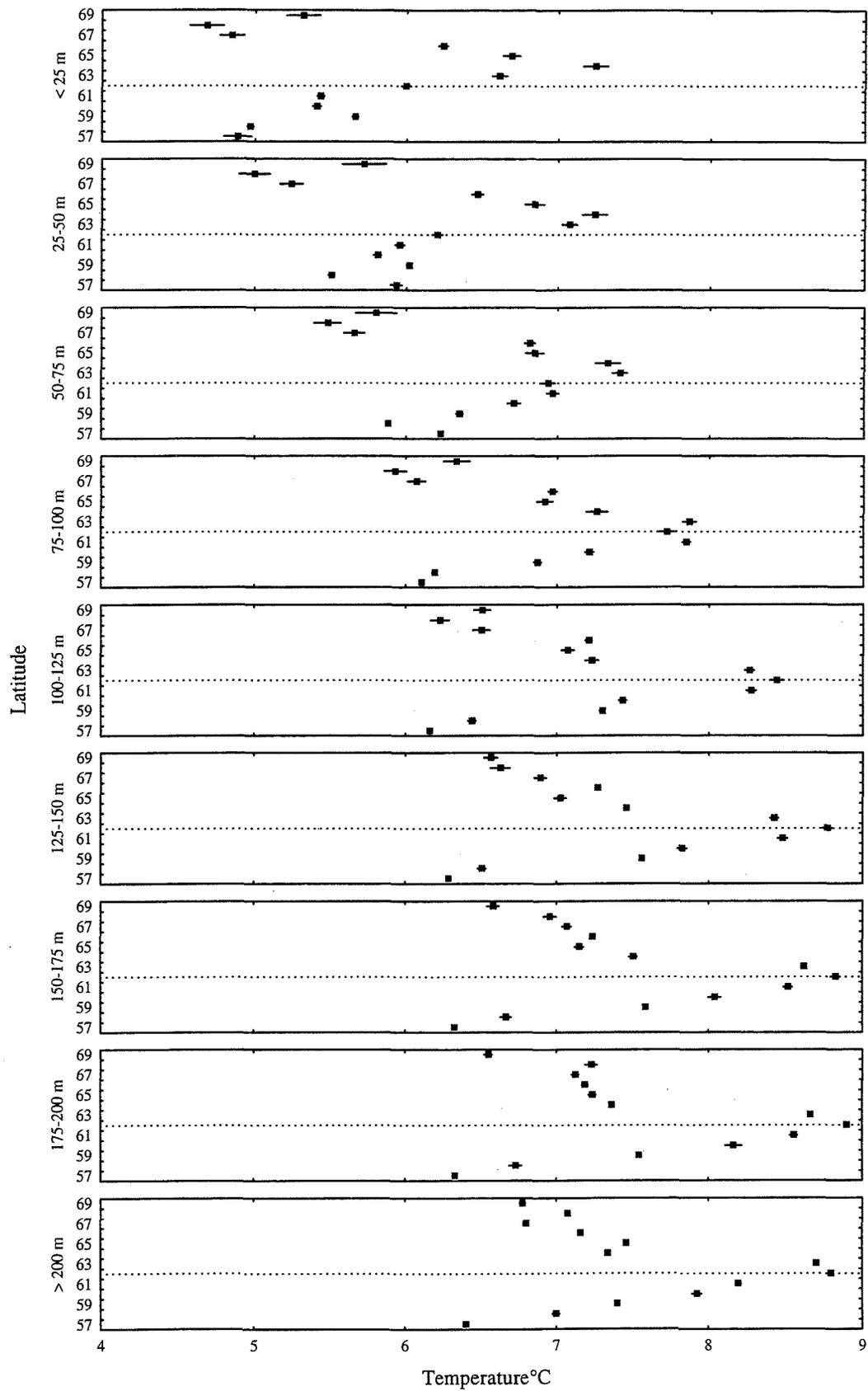


Fig. 7. Latitude versus temperature within 25 m depth intervals. Data from CTD stations from a survey with RV Michael Sars 17.02.-20-03.98. Mean values \pm SE are given.