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On the drift of sprat eggs and fry in the Skagerak and the north-eastern part of the North Sea.

by
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This investigation is based on material collected during the summers of 1959, 1960 and 1961. (Figure 1). Hydrographical observations were made down to the bottom at stations 5 to 10 nautical miles apart, and plankton samples were obtained using an egg net 1 metre in diameter. Two plankton haules were made on each position.

The vertical distribution of the water-masses off the coast of Western Norway is represented by a section occupied in 1959 from Slotterøy to the west. Figure 2. (The northernmost section in Figure 1).

In the uppermost 30-50 m the water is of low salinity and phosphate content, and is relatively warm and saturated with oxygen.

This surface-layer is separated from the deeper water masses by a thermocline, below which , above the edge of the North Sea plateau, a core of extremely warm and salt Atlantic water is found, which has a high content of oxygen (% O_2) and low phosphate content relative to the corresponding depths on the stations nearest to the coast. The figure also shows the distribution of percentage of this extremely salt and warm Atlantic Water. The transition between this core of Atlantic Water and the water masses closer to the coast is sudden, indicating that these two water bodies must recently have come into contact without having had much time to mix. The boundary between the two masses is found 20-30 nautical miles from the coast.

This core of Atlantic water may be followed along the western and southern side of the Norwegian Channel into the Skagerak, and is evidently present in a section across the centre part of Skagerak (Figure 3). Because of mixing with less saline waters the salinity in the core has decreased by 0,2 ‰, whereas the water masses below the transition layer close to the coast have increased somewhat in salinity. Otherwise the main features are similar to those occuring in the other section.

In all the sections, the 34 ‰ isohaline runs parallel to the thermo-

cline, and is found just below it. In Figure 4 is given the mean salinity between the depth of this isoline and the bottom or 250 m, and , in its broad features, the horizontal distribution of the percentage of extreme Atlantic water. The main movements of the deeper water masses,as deduced from the distribution of the properties discussed, is also indicated. This picture of the water movements is in good accordance with earlier statements (for example Eggvin,1940).

As shown in Figure 5, the conditions in 1960 were similar to those in 1959, the salinity in the core of Atlantic Water having a little lower maximum value in the section from Slotterøy.

On the station 410, in the warm core above the edge of the North Sea plateau, the current was measured in 10, 50, 75, 100 and 145 m from an anchored ship in 1961. Figure 6. (Section no. 3 from north on Figure 1).

In the upper 10 m layer both south and north going strong current-components appeare, whereas the nett transport of water in the warm core and at the bottom is clearly to the south.

The current pattern shown is valid only for the principal movements, the actual conditions being much more complicated.

As clearly outlined by Tait (1937), the surface current pattern in the North Sea is characterized by a number of Eddies. In order to provide more informations on the movement in the upper layers, especially in the Skagerak, drift-bottles were released at selected localities in 1960 and 1961. (Figure 7). The date of liberation is given on each position. The figure at the point of recovery indicates the number of days drift. Five bottles were liberated at each position.

In 1960 80 % of the drifters were recovered. The possible drift is indicated. The minimum velocity is computed to be 10-15 nautical miles a day.

64 % of the drifters liberated in 1961 are returned. Only points of release and recovery are indicated.

The drift of the bottles due to the effect of the wind is not fully analysed. However, some of the recoveries are in good accordance with the current pattern given by Tait, for example that off the west coast of Denmark in 1961.

In the inner part of Skagerak the drift seems to indicate an anti-clockwise eddy. (See especially the 1961 experiment).

The spawning grounds of sprats are known to be found, among others, in Kattegat, Skagerak and off the western coast of Europe. The eggs and larvae drift with the currents up to the fjords in the Western Norway.

Investigations in the Skagerak and off the western coast of Norway on the distribution of eggs and fry has been carries out for several years. Every time the area has been examined, a distribution corresponding to that in Figure 8 is found. In spite of the sections outside Western Norway being normally occupied four times during a summermonth, only a few fry (larvae) have been caught here in relation to what would be expected. A possible explanation may be that the eddy mentioned causes the fry to remain in Skagerak for so long a time that when they reach Western Norway they have grown big enough to escape from the nets used.

References:

Eggvin, Jens, 1940: "The Movement of a Cold Water Front". Report on Norwegian Fishery and Marine Investigations, Vol. VI, No. 5. Bergen 1940.

Tait, J. B., 1937: "The Surface Water Drift in the Northern and Middle Areas of the North Sea and in the Faroe-Shetland Channel". Fishing Board for Scotland. Scientific investigations, No. I, Edinburgh 1937.

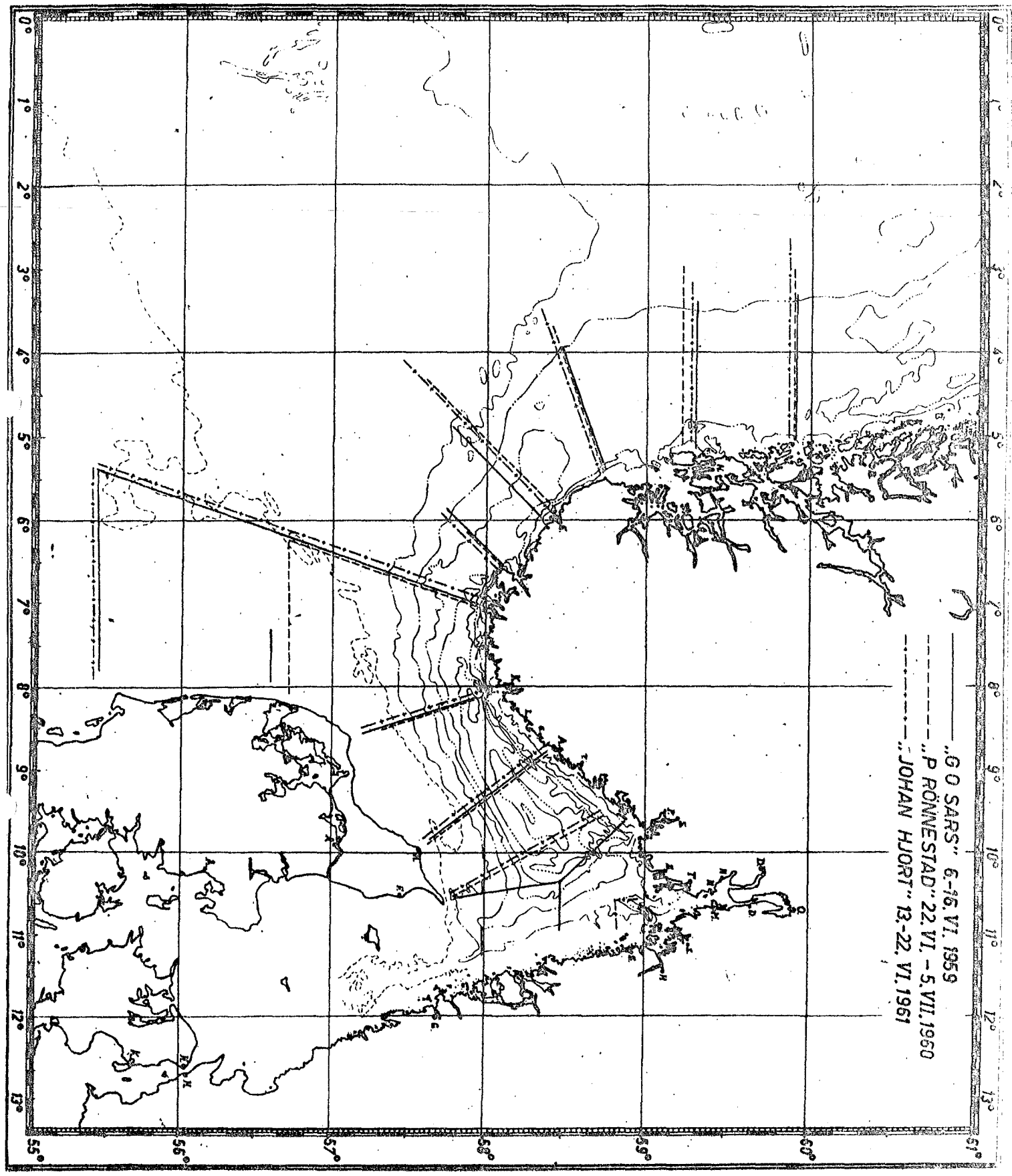


Fig. 1. The investigated area.

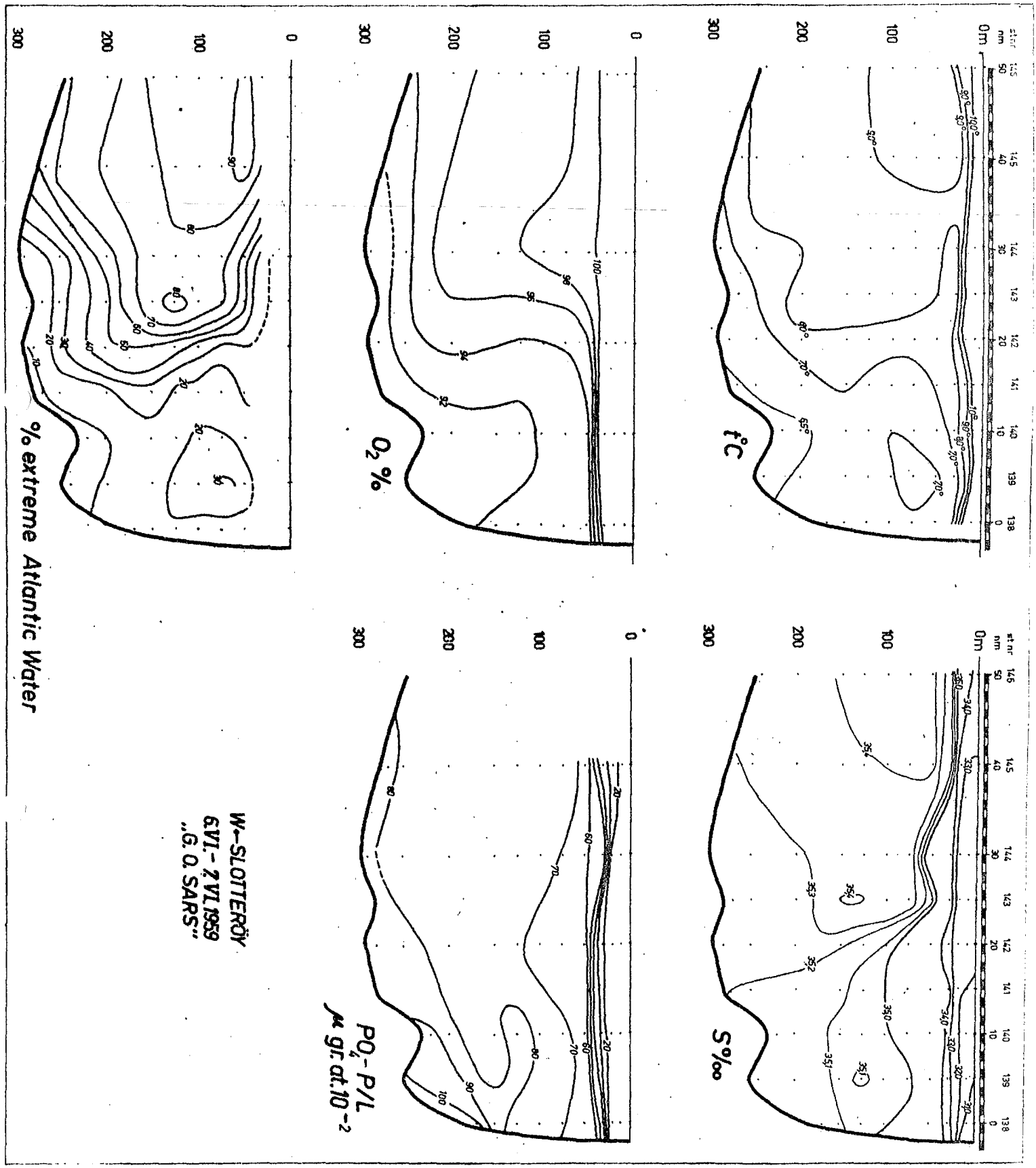


Fig. 2. Section west of Slotterøy (Western Norway).

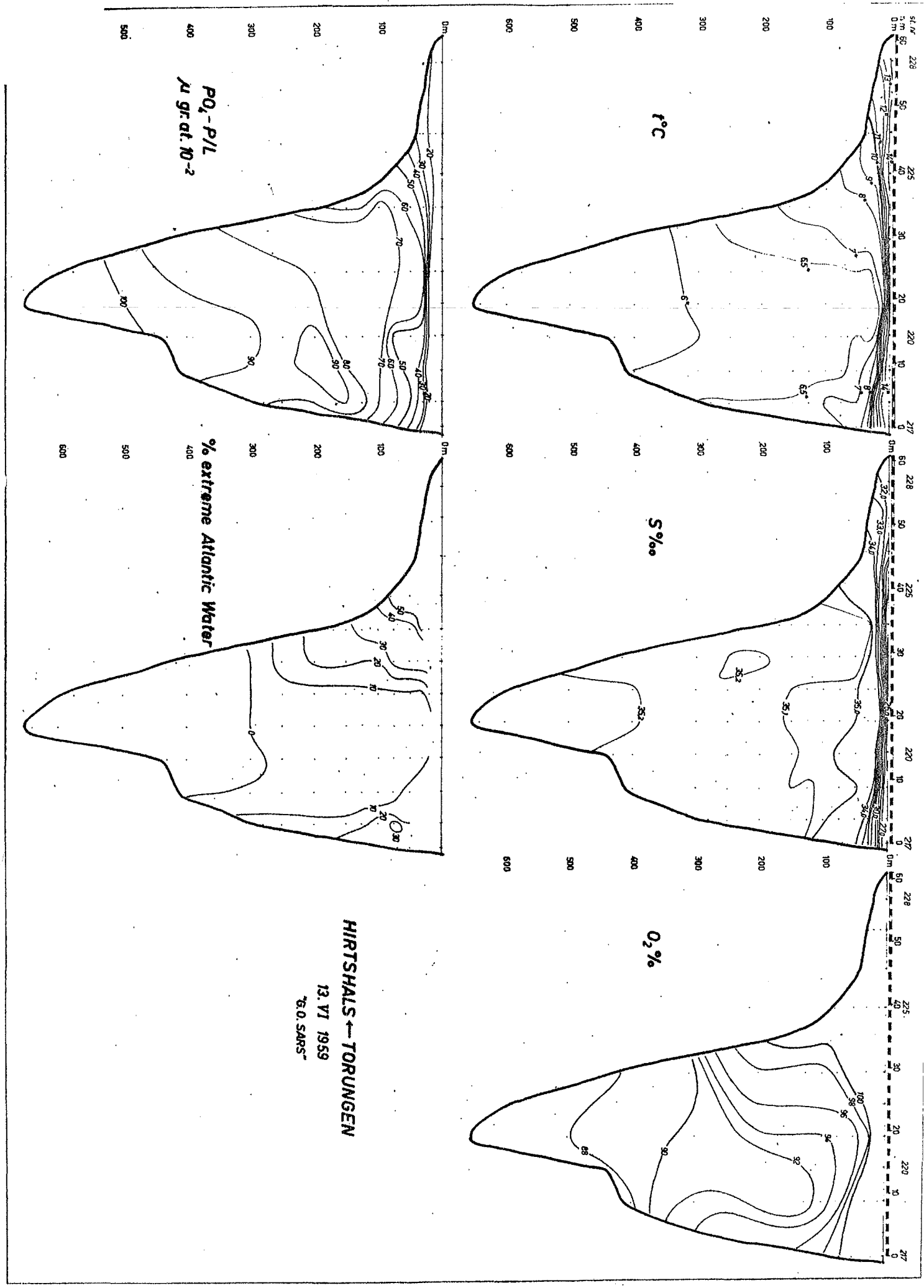
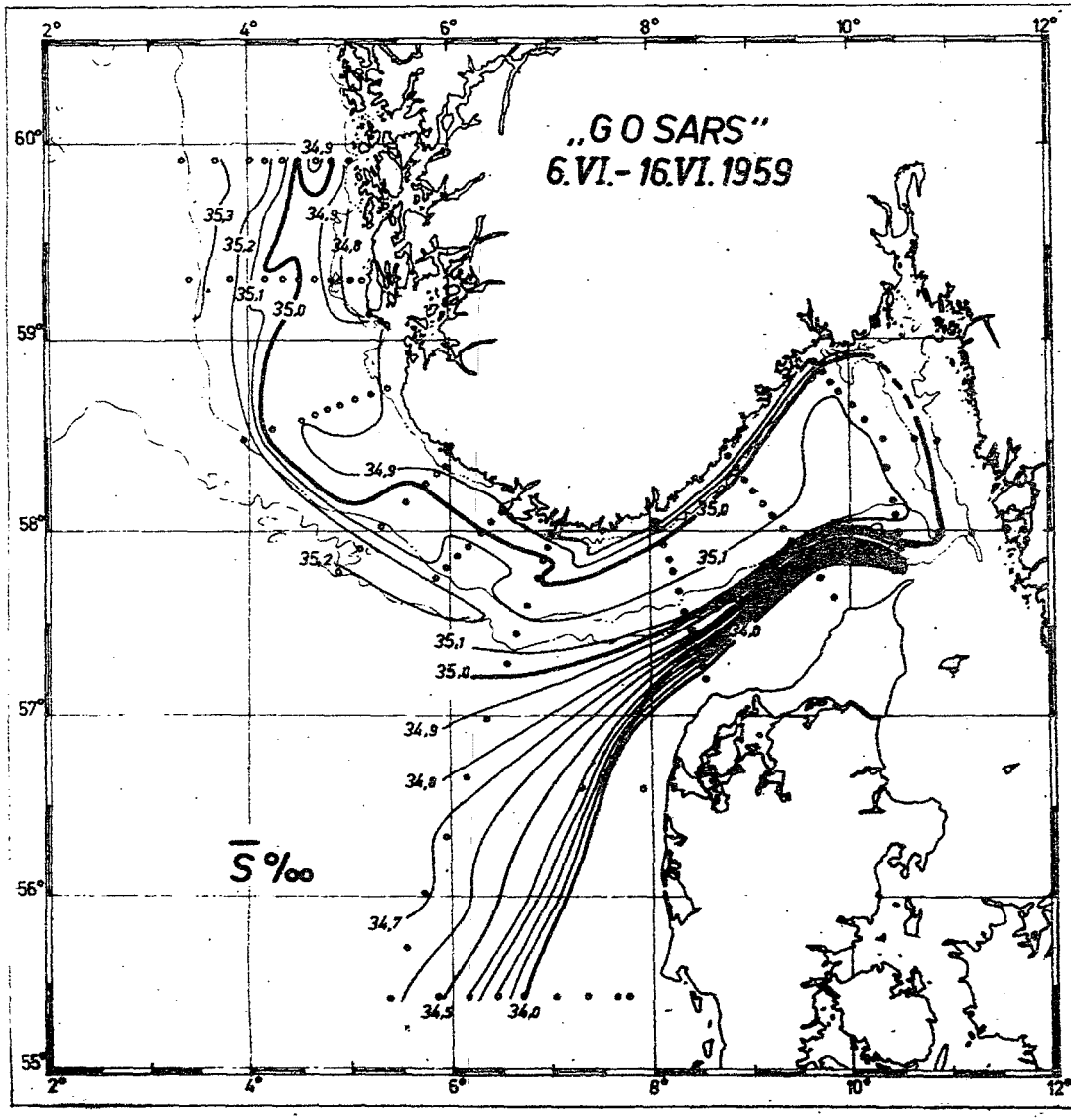


Fig. 3. Section Torungen near Arendal-Hirtshals (Skagerak). Norwegian coast to the right.



a. Mean salinity between the depth of the 34 ‰ isohaline and 250 m on bottom.

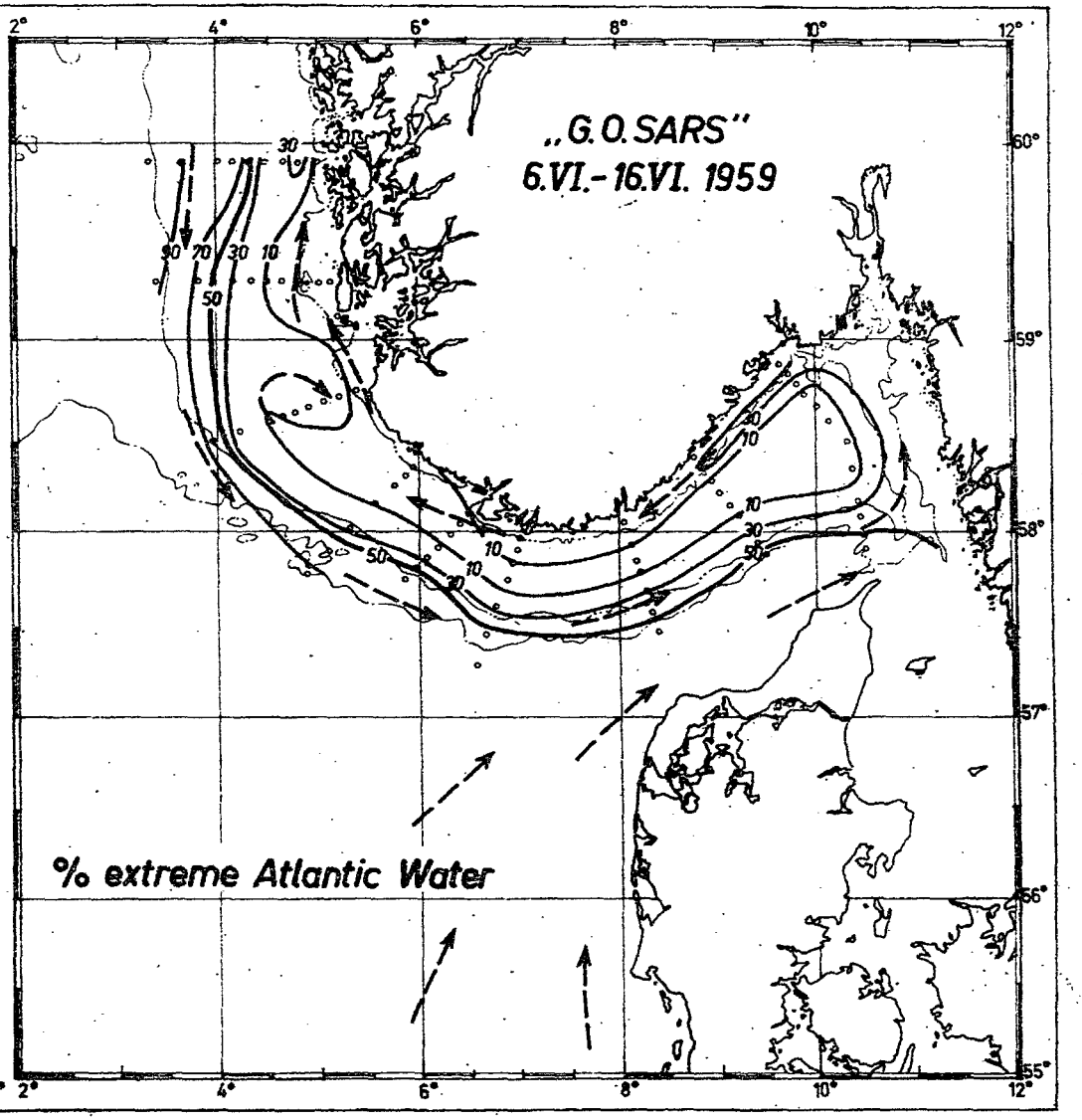


Fig.4 b. Percentage of extreme Atlantic water between the transition layer and 250 m depth or the bott[illegible]. Arrows: current direction.

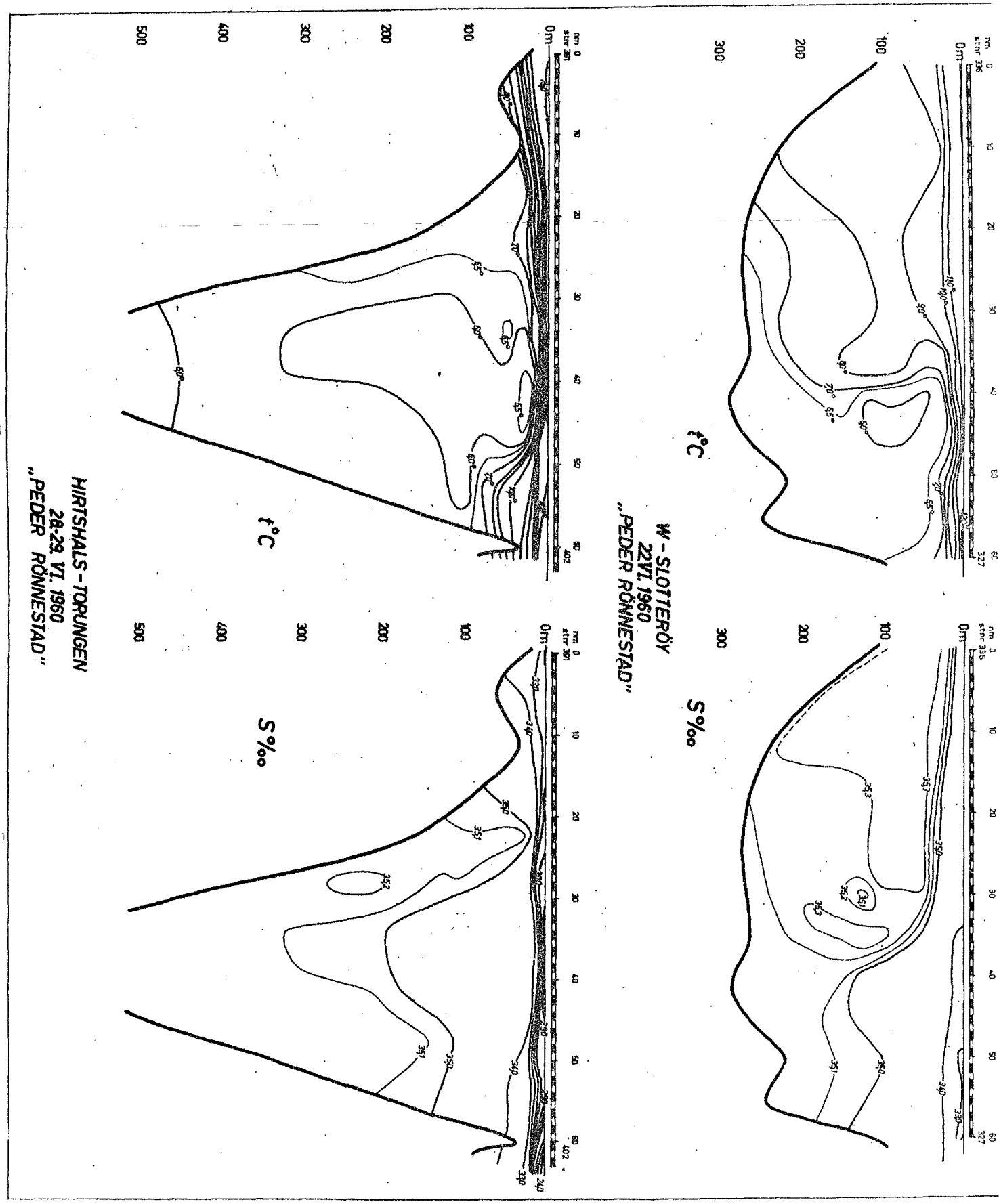
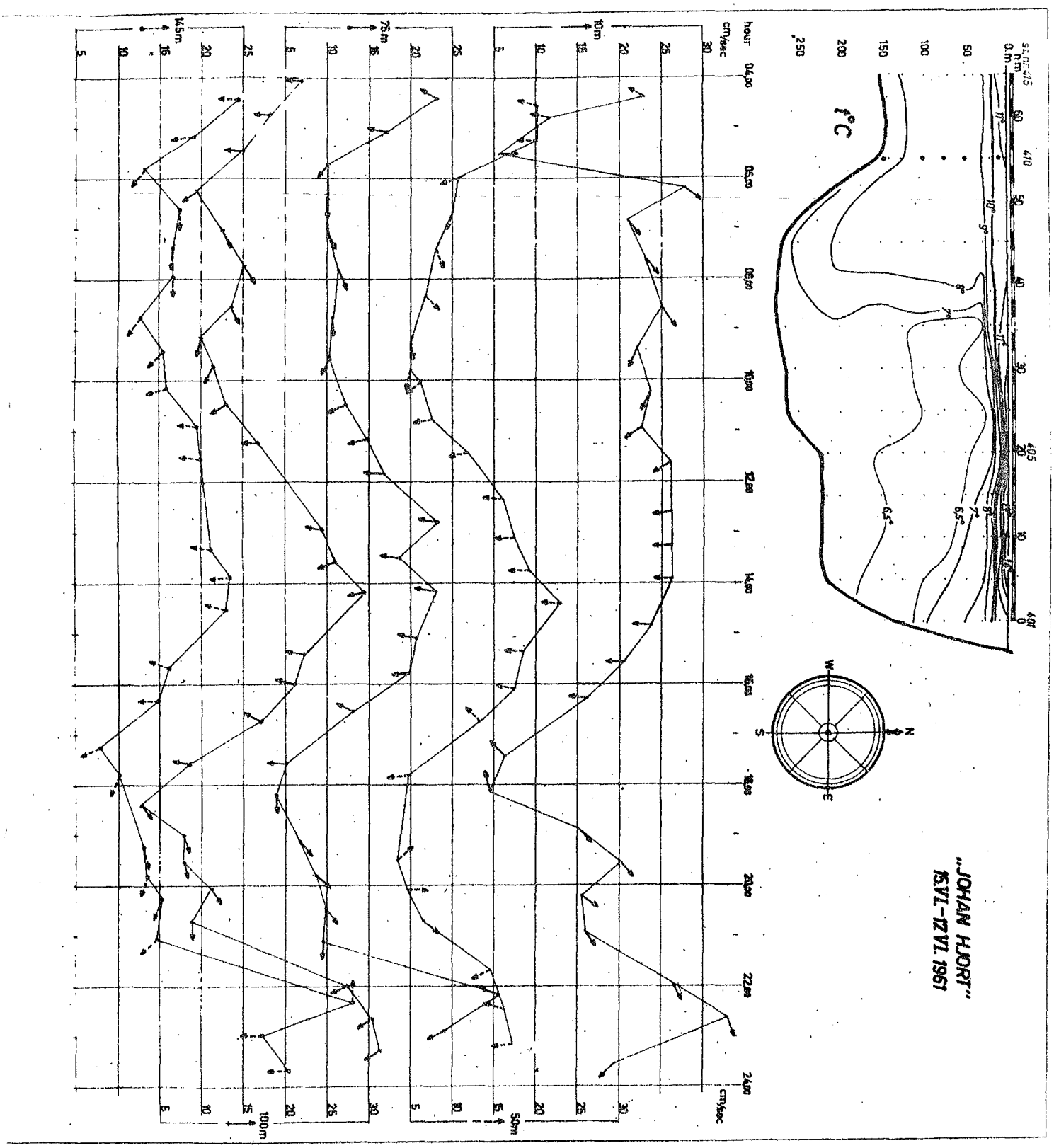
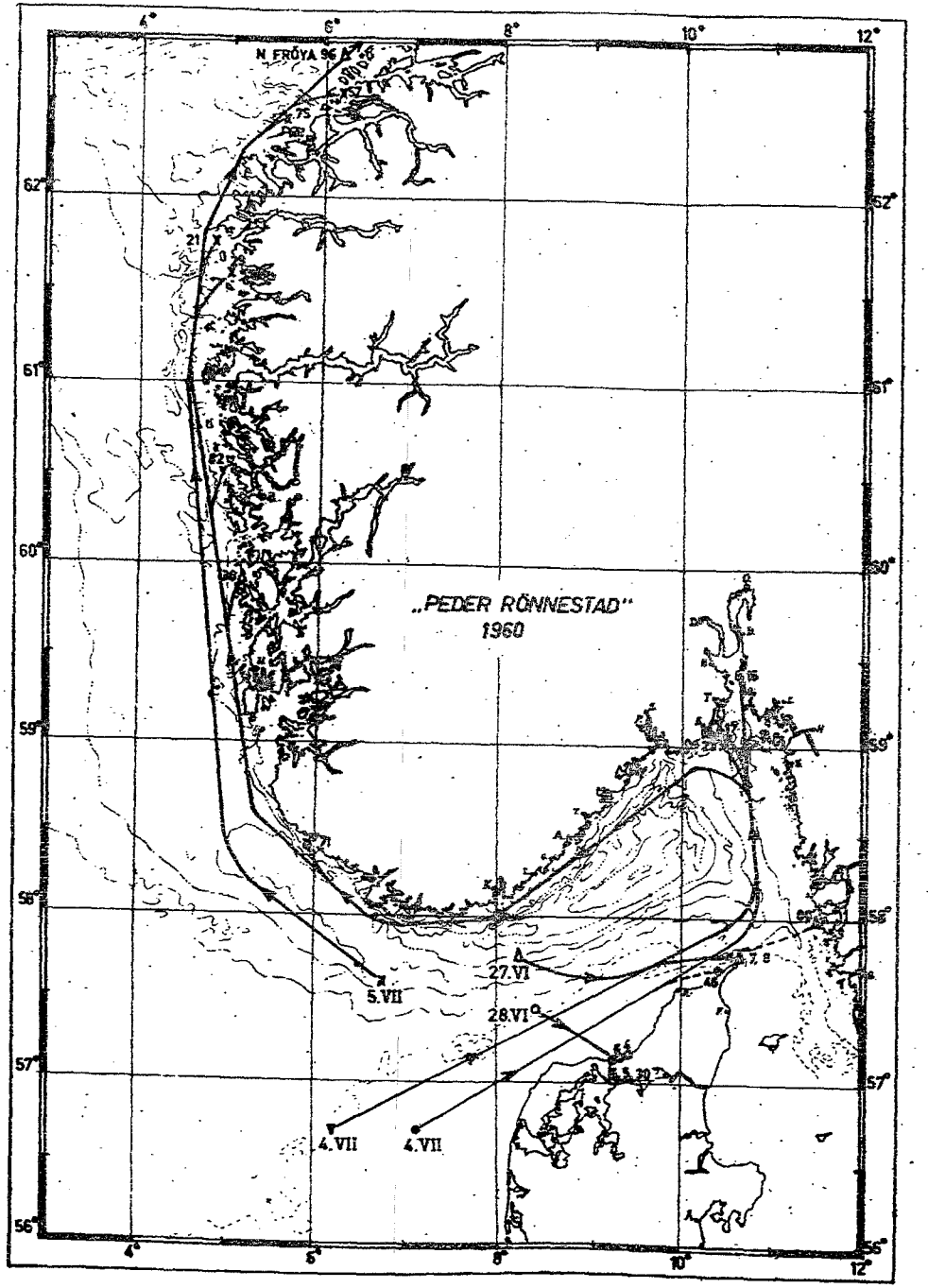


Fig. 5. Upper part: Section off Western Norway.
Lower part: Section in Skagerak.



6. Upper part: Section from Jæren (Western Norway) to the SW.
Lower part: Current at station no.410. Horizontal axes: time G.M.T.
Vertical axes: Velocity, cm/sec. Arrow: Current direction.



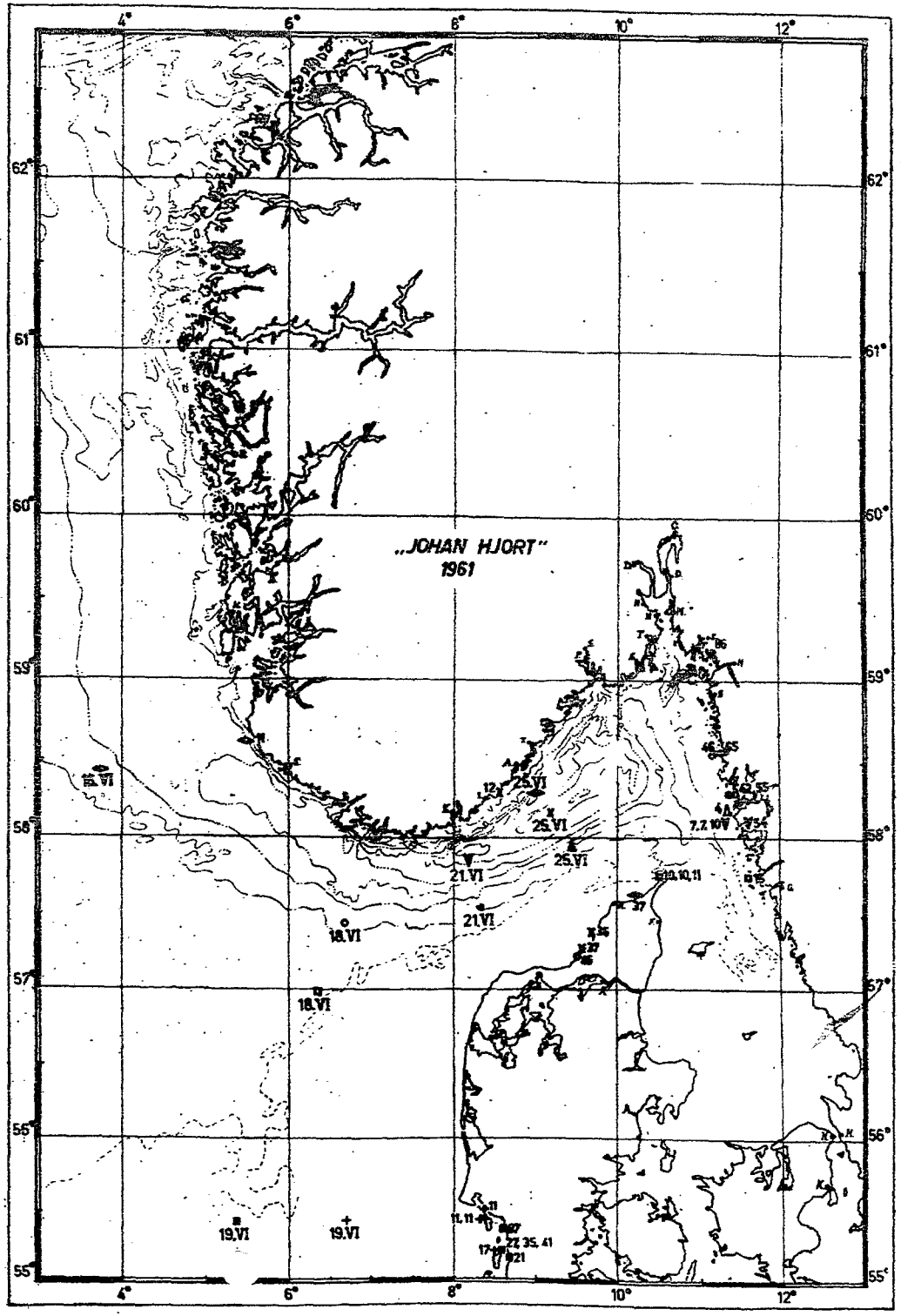


Fig.7.Drift-bottle experiments 1960 and 1961.
(See the text).

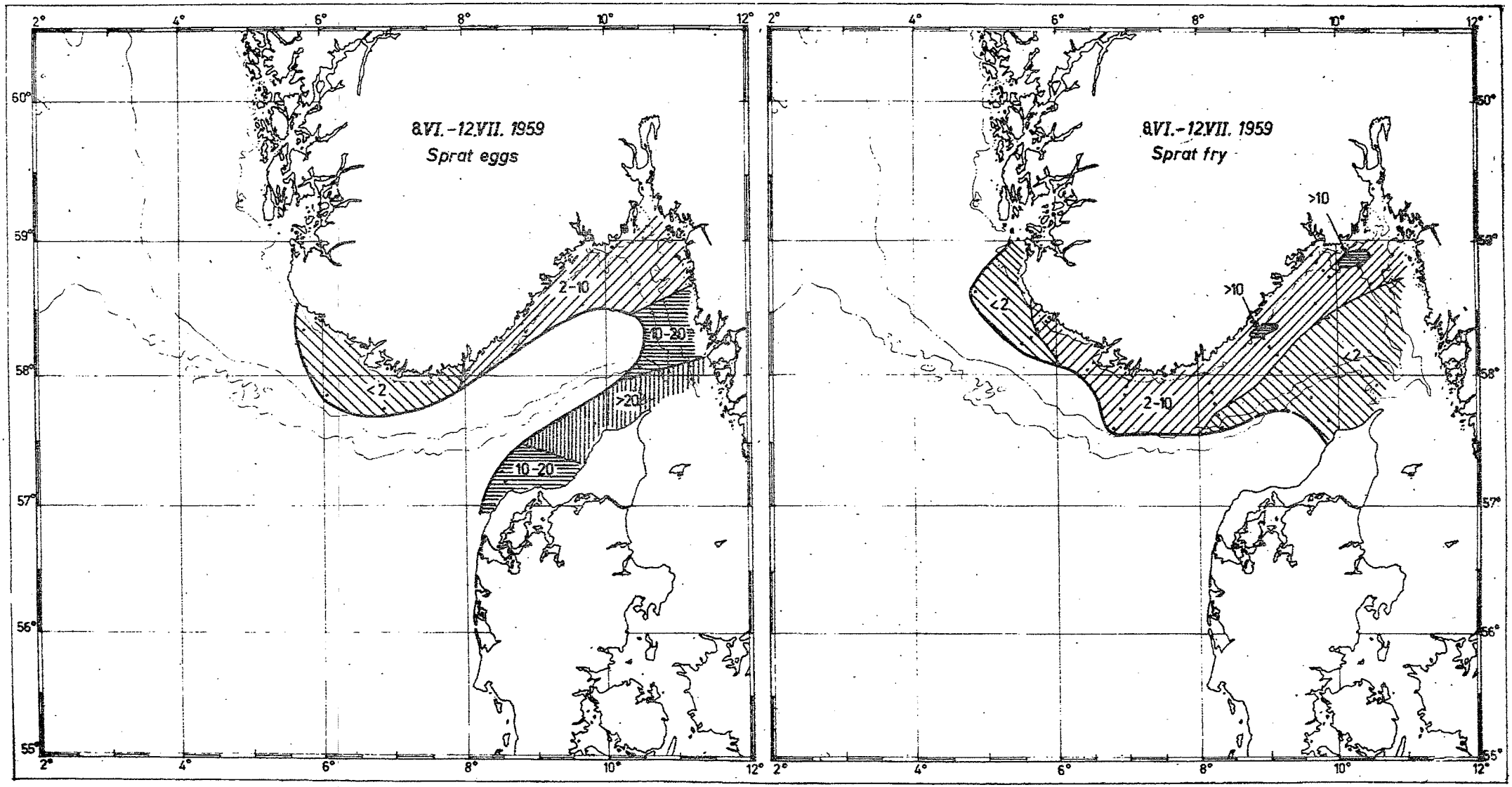


Fig. 8. Distribution of sprat eggs and larvae. Numbers of eggs/larvae pr. hauls are indi ted.