Ödsmål, Kville sn, Bohuslän

Hällristning
Fiskare från
bronsåldern

Rock carving
Bronze age
fishermen

MEDDELANDE från
HAVSFISKELABORATORIET · LYSEKIL
nr 188
Hydrografiska avdelningen, Göteborg

Observations along the Swedish coast and in the Deep Basins in the Baltic, 1974.

Hydrography of the Kattegat and the Skagerrak Area, Swedish Observations, 1974.

(Contribution to ICES "Annales Biologiques")

by Stig Fonselius and Artur Svansson

September 1975

Observations along the Swedish coast and in the Deep Basins in the Baltic 1974.

The series of hydrographic observations carried out by the Coast Guard are still too short for allowing any direct conclusions regarding salinity changes in the Baltic. No salt water inflows of importance seem to have occurred during 1974. The oxygen values in the bottom water of the Deep Basins have generally decreased during the year. No large scale formation of hydrogen sulfide has, however, been observed. From Fig. 1 it can be seen that only a minor inflow occurred into the Arkona Basin in May-June. During the autumn the salinty in the bottom water decreased again. Fig. 2 shows the oxygen conditions in the Arkona Basin. The values decreased after May and are below 3 ml/l in the high saline bottom water in November. From table it can be seen that oxygen values at 90 m in the Bornholm Basin in September and November were below 1 ml/l. In the Gotland Deep hydrogen sulfide was found in February and again in November. Fig. 3 shows the oxygen and hydrogen sulfide conditions in the Landsort Deep. The hydrogen sulfide formed in February-March disappeared during the year and in November no sulfide was found. All the figures have been drawn with help of observations by the Coast Guard and the research ships of the Fishery Board. The figures 4, 5 and 6 show maps of distribution of hydrogen sulfide in the Deep Basins of the Baltic during February, September and November. In the figures the areas with oxygen concentrations below 2 ml/l in the deep water, also are marked.

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Arkona Deep

55°00′N 14°05′E

Depth m	Temp. °C	S ‰	O_2 ml/l	pH	PO_4-P µgat/l	Tot.P µgat/l	Alkal. Mval/l	Si µgat/l	NO_3-N µgat/l	NO_2-N µgat/l	NH_4-N µgat/l	Tot.N µgat/l
						February 14						
000	2.70	8.152	9.31	8.26	0.45	0.66	1.52	16.5	2.6	0.11	0.51	12
010	2.71	8.162	9.31	8.26	0.45	0.76	1.53	17.0	2.7		0.84	
030	2.93	11.500	8.97	8.20	0.55	0.76	1.64	16.5	4.6	0.02	0.30	12
046	3.59	18.475	7.53	8.12	0.90	1.13	1.87	18.5	4.7	0.34	1.5	11
						June 11						
000	12.08	8.585	7.84			0.69						
010	11.28	8.599	8.03									
030	10.73	14.398	6.38									
045	10.44	17.924	13.65			1.17						
						September 10						
000	16.55	8.127	6.62	8.19	0.10	0.52	1.504	12.0				
010	16.56	8.128	6.61	8.25	0.11	0.57	1.532	11.5				
015	16.54	8.131	6.58	8.25	0.11	0.50	1.538	11.5				
030	16.53	8.159	6.62	8.24	0.11	0.51	1.553	11.5				
048	11.68	16.864	0.67	7.46	1.75	2.18	1.873	65.0				
						November 5						
000	7.81	7.849	8.04	8.09	0.37	0.64	1.484	11.5	0.80	0.38	0.36	10
010	7.80	7.829	8.07	8.13	0.35	0.62	1.484	11.5	0.80	0.41	0.34	9
030	8.46	8.143	7.80	8.12	0.38	0.53	1.504	11.5	1.02	0.45	0.34	13
048	12.58	14.004	2.54	7.52	1.68	1.76	1.713	38.0	8.45	0.13	0.42	23

Bornholm Deep

55°15′N 15°59′E

Depth m	Temp. °C	S ‰	O_2 ml/l	pH	PO_4-P µgat/l	Tot.P µgat/l	Alkal. Mval/l	Si µgat/l	NO_3-N µgat/l	NO_2-N µgat/l	NH_4-N µgat/l	Tot.N µgat/l
						February 14						
000	2.76	7.893	9.25	8.16	0.48	0.67	1.51	28.0	2.2	0.07	0.39	7
010	2.77	7.900	9.26	8.17	0.48	0.67	1.51	18.0	2.0		0.85	
030	2.74	8.098	9.16	8.17	0.49	0.64	1.49	17.5	2.6		0.28	
050	6.83	11.822	5.55	7.82	0.91	1.09	1.64	29.0	4.7	0.03	0.24	7
070	6.52	15.562	3.78	7.66	1.36	1.47	1.79	39.0	5.1		0.24	
086	6.17	16.428	2.58	7.56	1.68	1.84	1.81	50.0	4.8		0.39	
						June 12						
000	9.92	8.088	8.41			0.70						
010	9.94	8.053	8.45									
030	5.83	8.132	8.46									
050	4.73	8.970	7.42									
070	5.29	13.837	3.63									
090	5.83	16.058	1.07			2.07						
						September 10						
000	15.89	7.978	6.71	8.14	0.13	0.53	1.566	13.0				
010	15.90	7.977	6.71	8.20	0.13	0.51	1.574	11.0				
030	13.77	8.033	6.38	8.01	0.25	0.63	1.572	12.5				
050	6.11	8.659	6.65	7.83	0.49	0.52	1.574	14.0				
070	10.33	14.266	4.23	7.67	0.87	1.21	1.768	23.5				
091	6.19	15.993	0.32	7.30	1.67	2.02	1.839	56.5				

Bornholm Deep

55°15'N 15°59'E

Depth m	Temp. °C	S ‰	O_2 ml/l	pH	PO_4-P µgat/l	Tot.P µgat/l	Alkal. Mval/l	Si µgat/l	NO_3-N µgat/l	NO_2-N µgat/l	NH_4-N µgat/l	Tot.N µgat/l
					November 5							
000	7.99	7.827	7.92	8.05	0.39	0.60	1.489	11.5	1.16	0.36	0.49	12
010	8.01	7.795	7.89	8.10	0.39	0.57	1.489	11.5	0.88	0.36	0.49	
030	8.00	7.804	7.90	8.09	0.39	0.55	1.491	12.0	0.93	0.38	0.43	10
050	6.99	9.022	5.27	7.67	0.94	1.08	1.543	15.5	2.52	0.06	0.66	14
070	8.35	14.952	1.99	7.45	1.61	1.70	1.731	32.0	7.38	0.04	0.45	12
090	6.70	15.644	0.60	7.34	1.757	2.19	2.46	41.5	7.87	0.19	0.79	26

Gotland Deep

57°20'N 20°03'E

Depth m	Temp. °C	S ‰	O_2 ml/l	pH	PO_4-P µgat/l	Tot.P µgat/l	Alkal. Mval/l	Si µgat/l	NO_3-N µgat/l	NO_2-N µgat/l	NH_4-N µgat/l	Tot.N µgat/l	H_2S µgat/l
						February 25							
000	2.40	7.700	9.48	8.28	0.46		1.57	13.0	1.8	0.05	0.44	--	
070	3.32	8.203	8.13	8.12	0.67		1.57	16.0	2.3		0.29		
100	5.28	11.542	0.82	7.48	2.21		1.73	56.0	5.0	0.01	0.23	--	
150	5.30	12.393	0.19	7.49	3.33		1.76	73.0	0.98		0.64		0
200	5.37	12.559	0	7.52	4.38		1.84	79.0	0.53		2.1		4.9
233	5.33	12.710	0	7.58	6.40		1.86	89.5	0.15		5.4		21.5
						June 28							
000	14.02	7.595	--			0.41							
080	4.89	10.533	1.49										
125	5.41	12.054	1.02										
150	5.46	12.368	0.43										
200	5.44	12.571	0.17										
240	5.54	12.629	0.25			6.61							
						September 11							
000	15.94	7.090	6.96	8.29	0.04	0.42	1.504	9.5					
070	4.02	9.269	3.21	7.33	1.53	1.73	1.635	34.5					
100	5.27	11.310	0.86	7.29	2.30	2.62	1.703	54.0					
150	5.45	12.341	0.44	7.22	2.78	2.96	1.747	64.0					
200	5.41	12.545	0.08	7.31	4.43	4.82	1.810	76.0					
240	5.53	12.689		7.37	7.38	8.04	1.852	88.0					

Gotland Deep

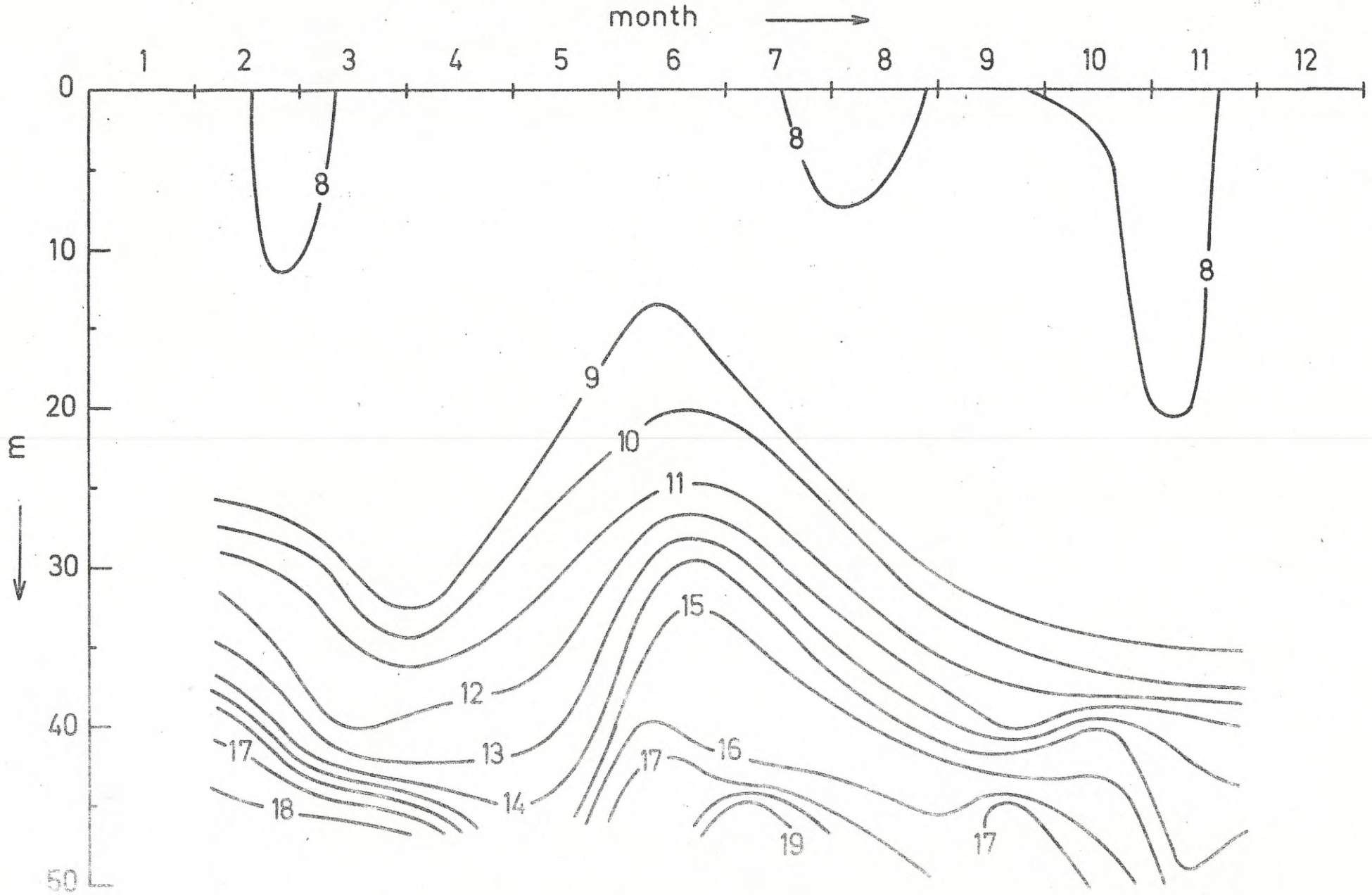
57°20'N 20°03'E

Depth m	Temp. °C	S ‰	O_2 ml/l	pH	PO_4-P µgat/l	Tot.P µgat/l	Alkal. Mval/l	Si µgat/l	NO_3-N µgat/l	NO_2-N µgat/l	NH_4-N µgat/l	Tot.N µgat/l	H_2S µgat/l
						November 7							
000	8.22	7.576	--	8.09	0.19	0.34	1.478	8.0	0.88	0.22	1.03	13.56	
070	4.78	10.391	1.43	7.31	2.02	2.14	1.589	40.0	6.68	0.04	0.63		
100	5.37	11.508	1.30	7.31	2.07	2.22	1.605	43.5	7.63	0.05	0.54	20.72	
150	5.46	12.349	0.31	7.28	2.74	2.86	1.659	42.0	3.71	0.05	0.75	17.28	
200	5.43	12.544	0	7.30	4.40	4.70	1.713	58.0	0.11	0.08	1.74	14.82	1.5
240	5.50	12.605	0	7.41	6.32	7.31	1.782	81.0	0.09	0.07	7.00	19.08	20.4

Landsort Deep

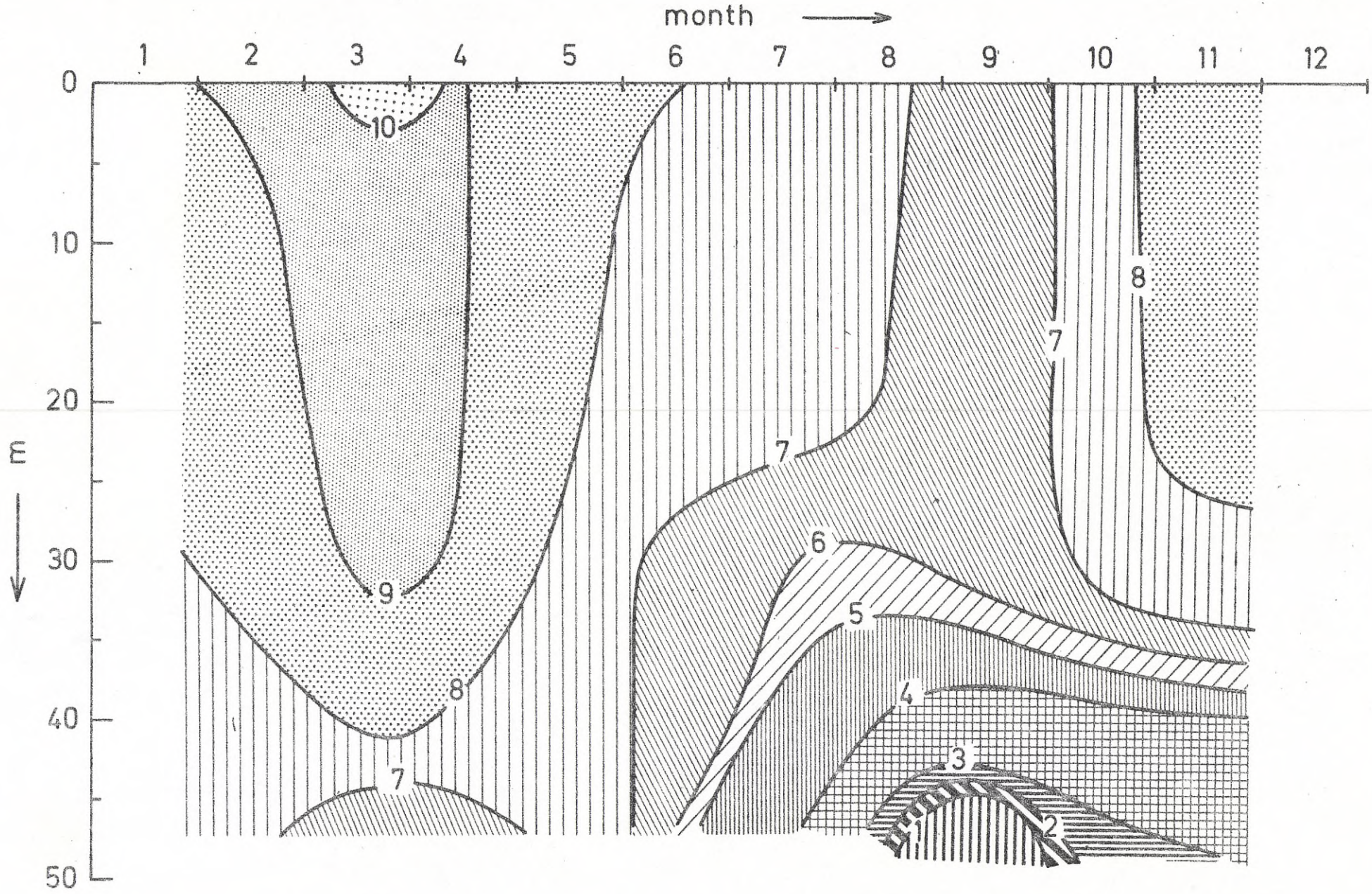
58°35′N 18°14′E

Depth m	Temp. °C	S ‰	O_2 ml/l	pH	PO_4-P µgat/l	Tot.P µgat/l	Alkal. Mval/l	Si µgat/l	NO_3-N µgat/l	NO_2-N µgat/l	NH_4-N µgat/l	Tot.N µgat/l	H_2S µgat/l
						February 20							
000	1.80	7.336	9.55	8.37	0.53	0.71		18.0	2.7	0.09	0.48	3	
070	4.05	8.179	6.81	7.95	0.92	1.01	1.56	20.0	3.0		0.24		
100	4.65	10.516	0.44	7.58	2.84	2.94	1.66	59.5	2.3		0.29		
150	4.77	10.851	0.11	7.42	2.98	3.09	1.67	63.0	1.3		0.27		
200	4.82	10.932	0.16	7.42	3.00	2.98	1.69	64.0	0.81		0.27		0
440	4.87	11.047	0	7.42	3.70	4.10	1.70	67.5	0.04		2.4		6.7
						September 13							
000	12.17	6.971	7.40	7.99	0.22	0.56	1.399	19.5					
070	4.14	9.371	2.45	7.34	1.91	2.20	1.632	42.5					
150	4.91	11.048	0.17	7.22	2.84	3.10	1.708	62.0					
200	4.99	11.178	0.22	7.23	2.82	3.15	1.706	62.5					
440	5.09	11.330	0	7.31	5.95	7.53	1.826	69.0					24.0
						November 21							
000	8.55	7.085	7.97	8.04	0.29	0.48	1.435	10.5	2.7		0.43	15	
070	4.95	9.210	3.16	7.44	1.77	1.96	1.564	33.5	2.0		0.21		
100	4.77	10.488	0.75	7.31	2.65	2.83	1.626	48.5	2.3		0.36		
150	4.90	10.963	0.25	7.31	2.78	2.16	1.641	51.5	1.4		0.30		
200	4.96	11.089	0.24	7.27	2.96	3.17	1.662	54.0	0.1		0.54		0
440	4.06	11.278	0.28	7.31	3.14	3.52	1.662	54.0	0.7		0.67	10	0



The distribution of Salinity in the Arkona Basin 1974 (S‰)

Fig. 1



The distribution of Oxygen in the Arkona Basin 1974 (ml/l)

Fig. 2

Fig. 3

The distribution of oxygen and hydrogen sulfide in the Landsort Deep 1974 (ml/l)

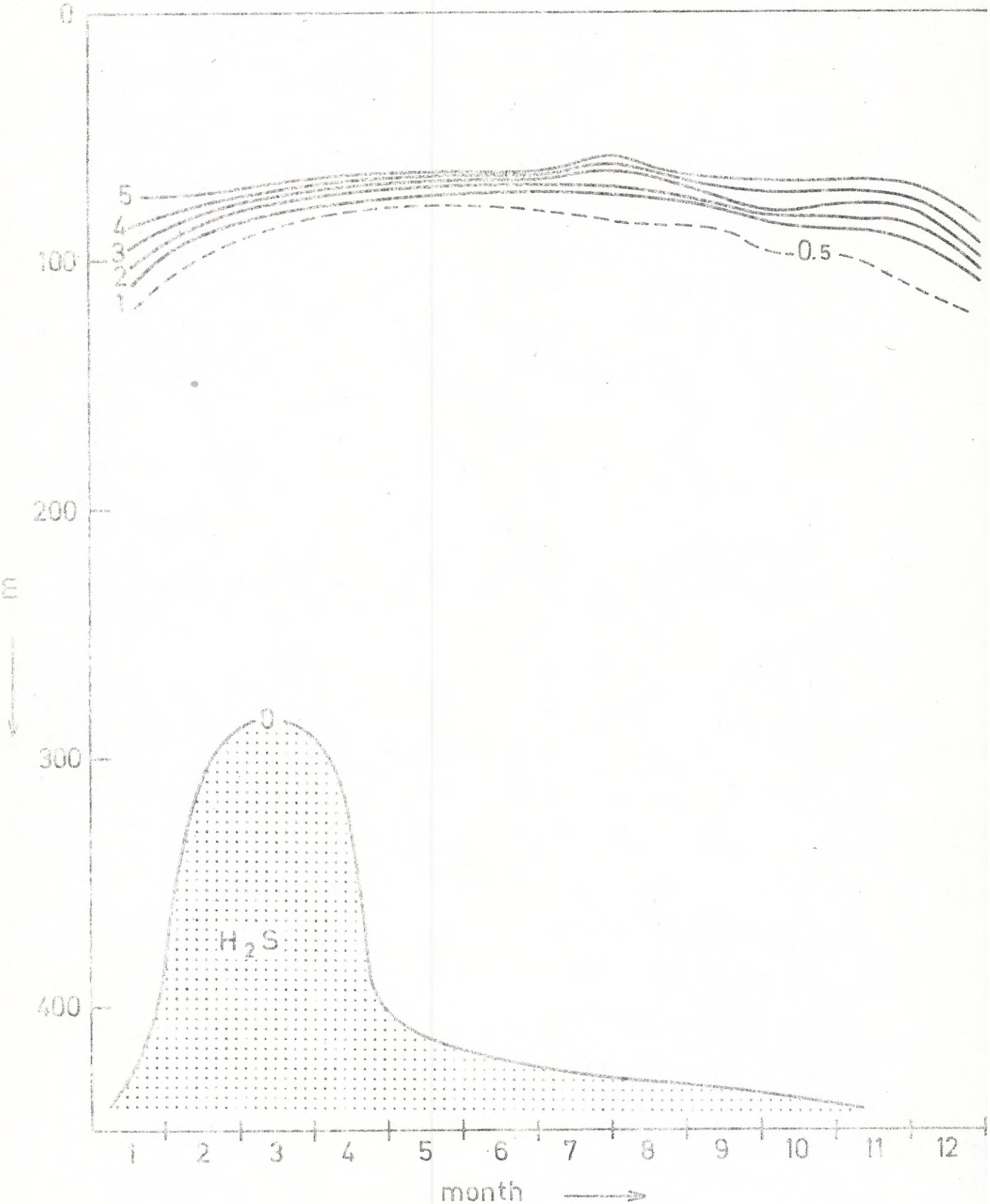


Fig. 4

R/V THETIS 1974 02 13 – 1974 02 28

Cruise track and stations

---- Oxygen concentration less than 2 ml/l

Area with hydrogen sulfide containing water

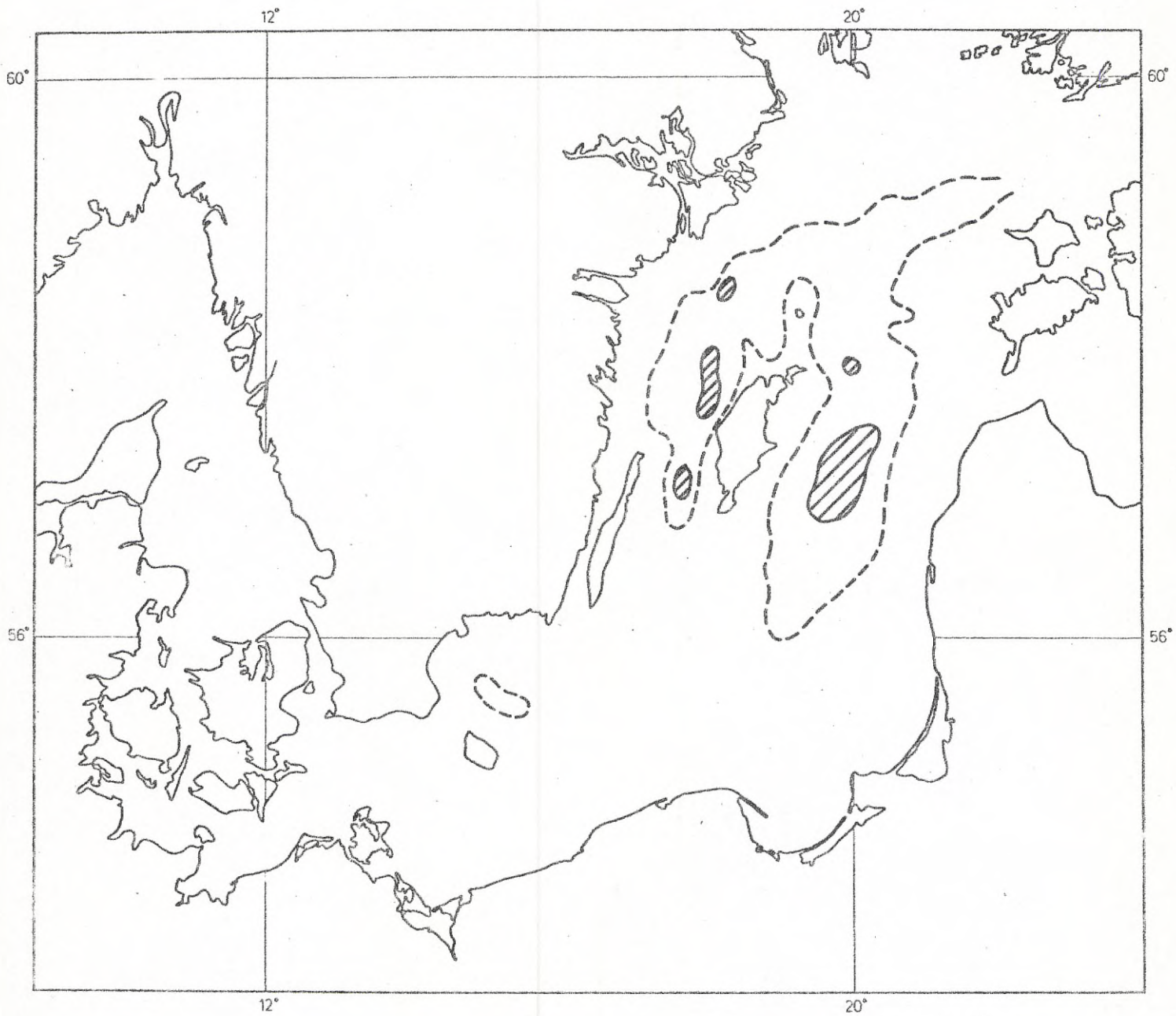


Fig. 5

R/V ARGOS 1974 09 09 – 1974 09 19

Cruise track and stations

---- Oxygen concentration less than 2 ml/l

Area with hydrogen sulfide containing water

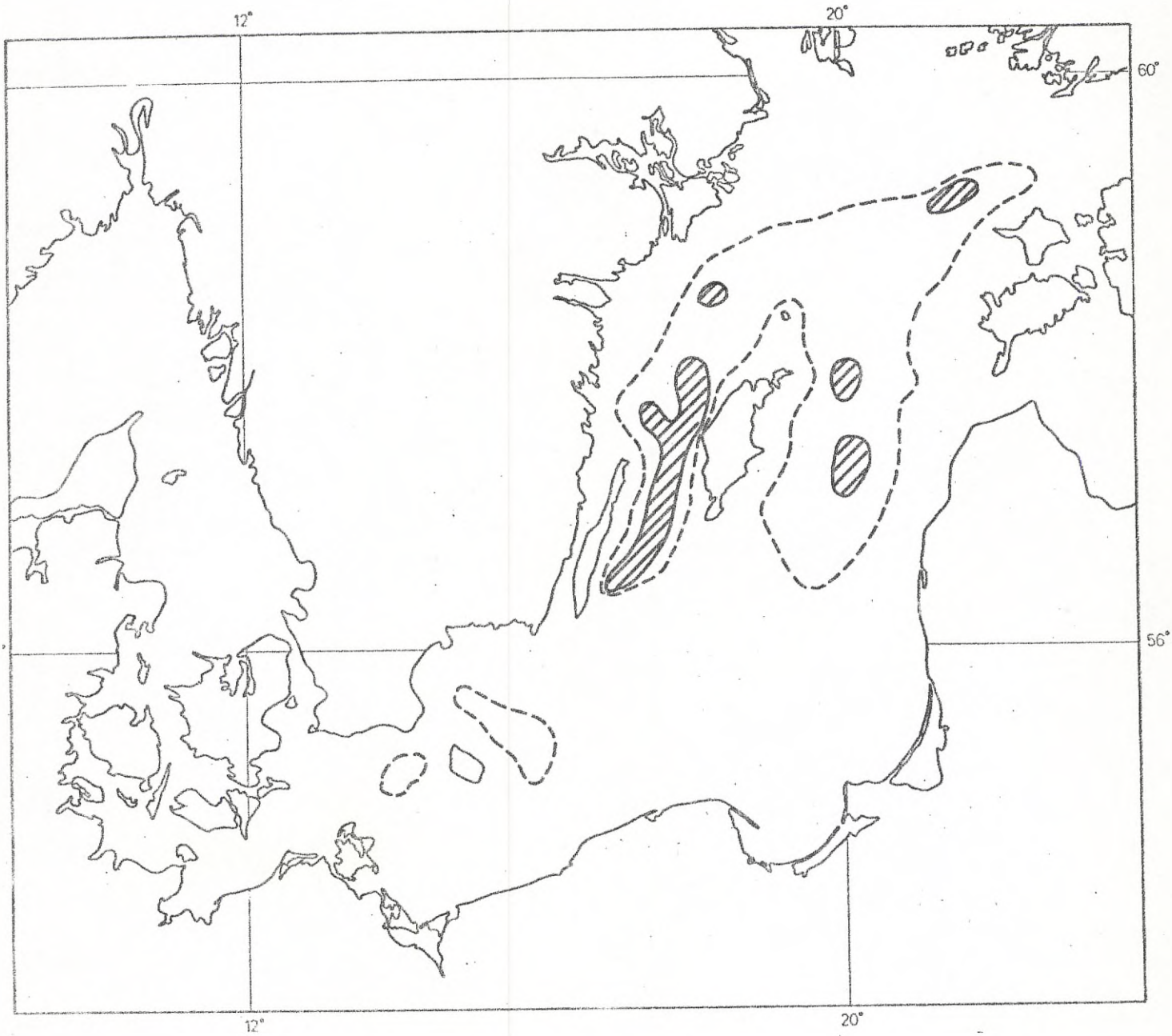
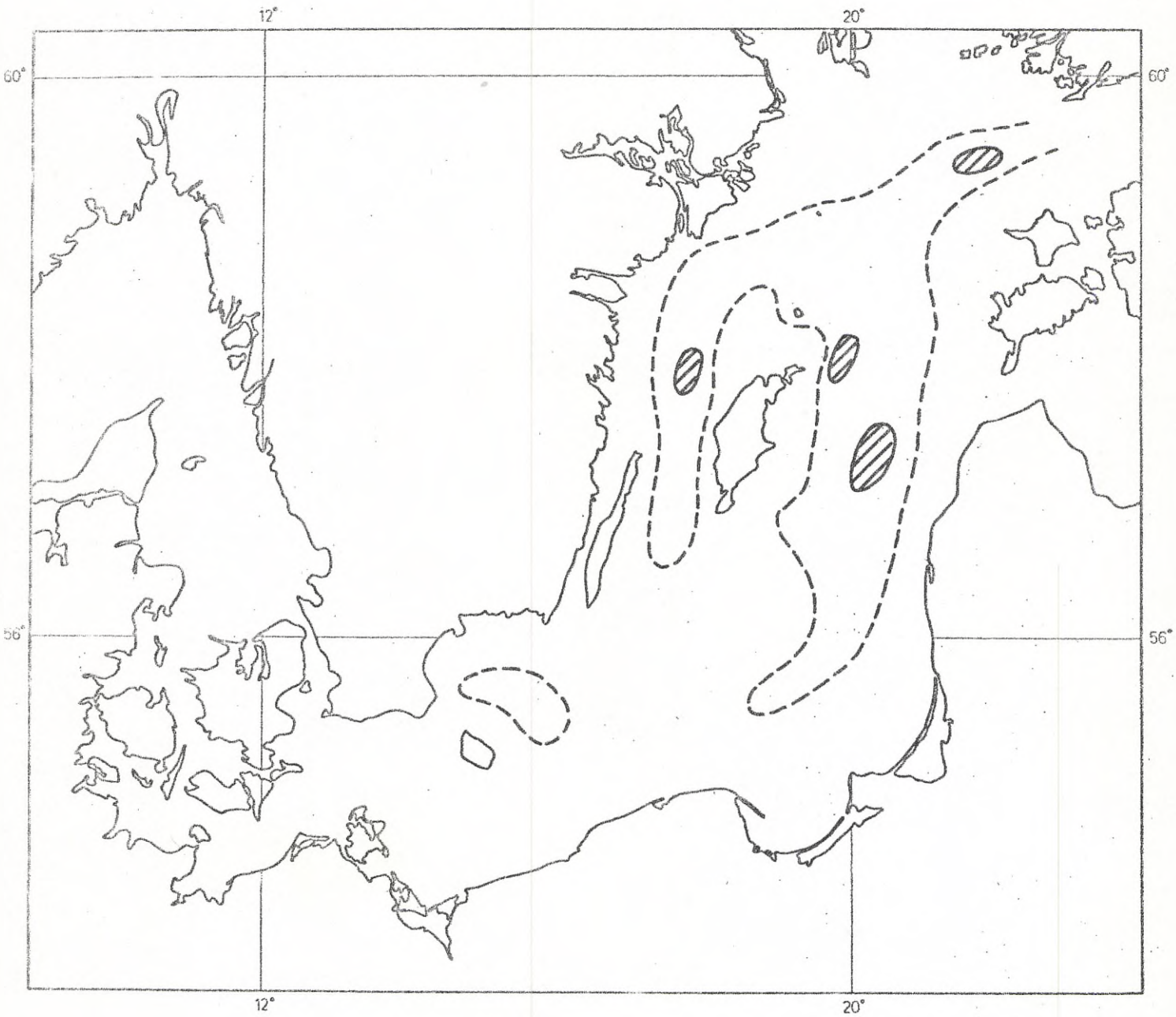


Fig. 6

R/V ARGOS 1974 11 04 – 1974 11 22
Cruise track and stations

---- Oxygen concentration less than 2 ml/l

Area with hydrogen sulfide containing water



Hydrography of the Kattegat and the Skagerrak area 1974

In the Figures 1 and 2 results of daily measurements at Bornö station (58°22.85′N 11°35.05′E) in the Gullmar fiord are presented as deviations in temperature and salinity from the mean values 1931-1960. The mean annual deviations at 5 m depth were +0.2 ‰S and +0.5°C.

Temperature, salinity and total phosphorus were measured five times at position 58°17′N 11°02′E at 10 depths.

The Skagerrak Deep (M6) was visited only once during the year (Table 1). There is a slight rise of temperature and oxygen in relation to conditions 1973.

Total phosphorus was measured once a day at the Danish lightvessel Läso Nord simultaneously with the ordinary hydrographic work. Table 2 presents monthly means and standard deviations.

Table 3 shows the oxygen saturation values at a station Fladen in N. Kattegat. The deep minimum occurred in September but there was a secondary minimum in November.

Since August 1974 there is a project of determining transports of water and matter through a section Frederikshavn - Göteborg. The secondary oxygen minimum from Fladen is confirmed and shown to be present during late October and early November.

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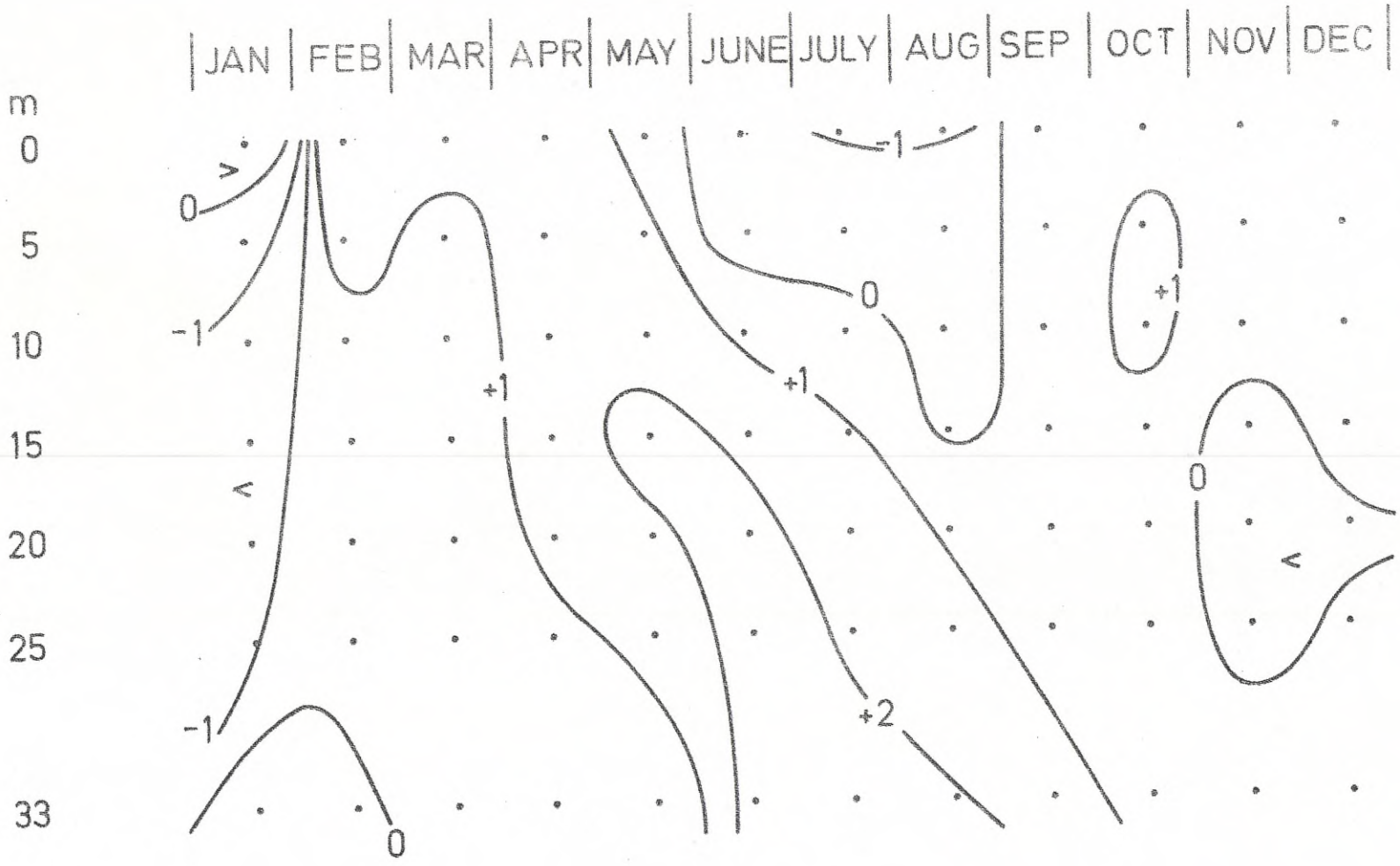
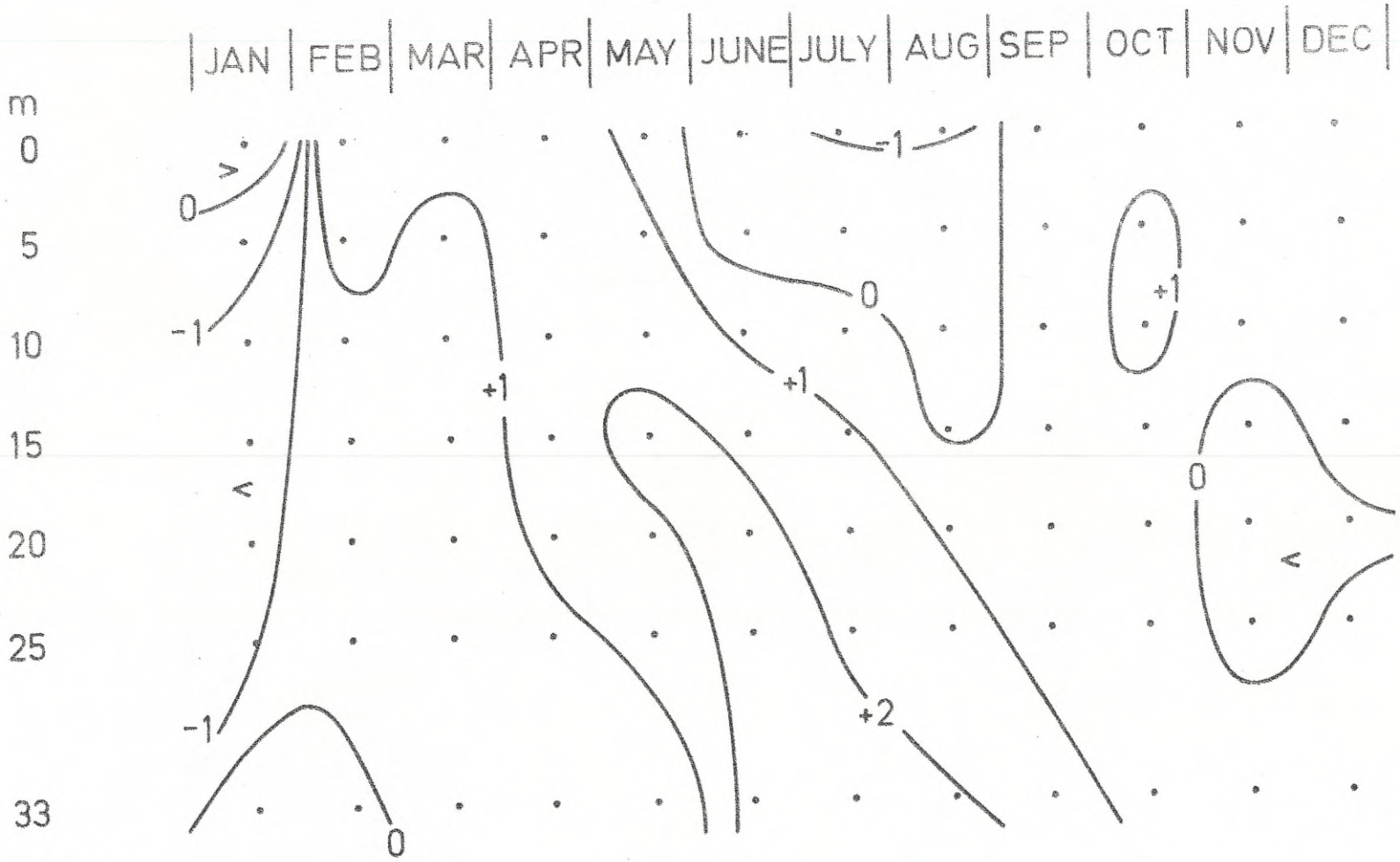


BORNÖ 1974

Temperature Deviations °C

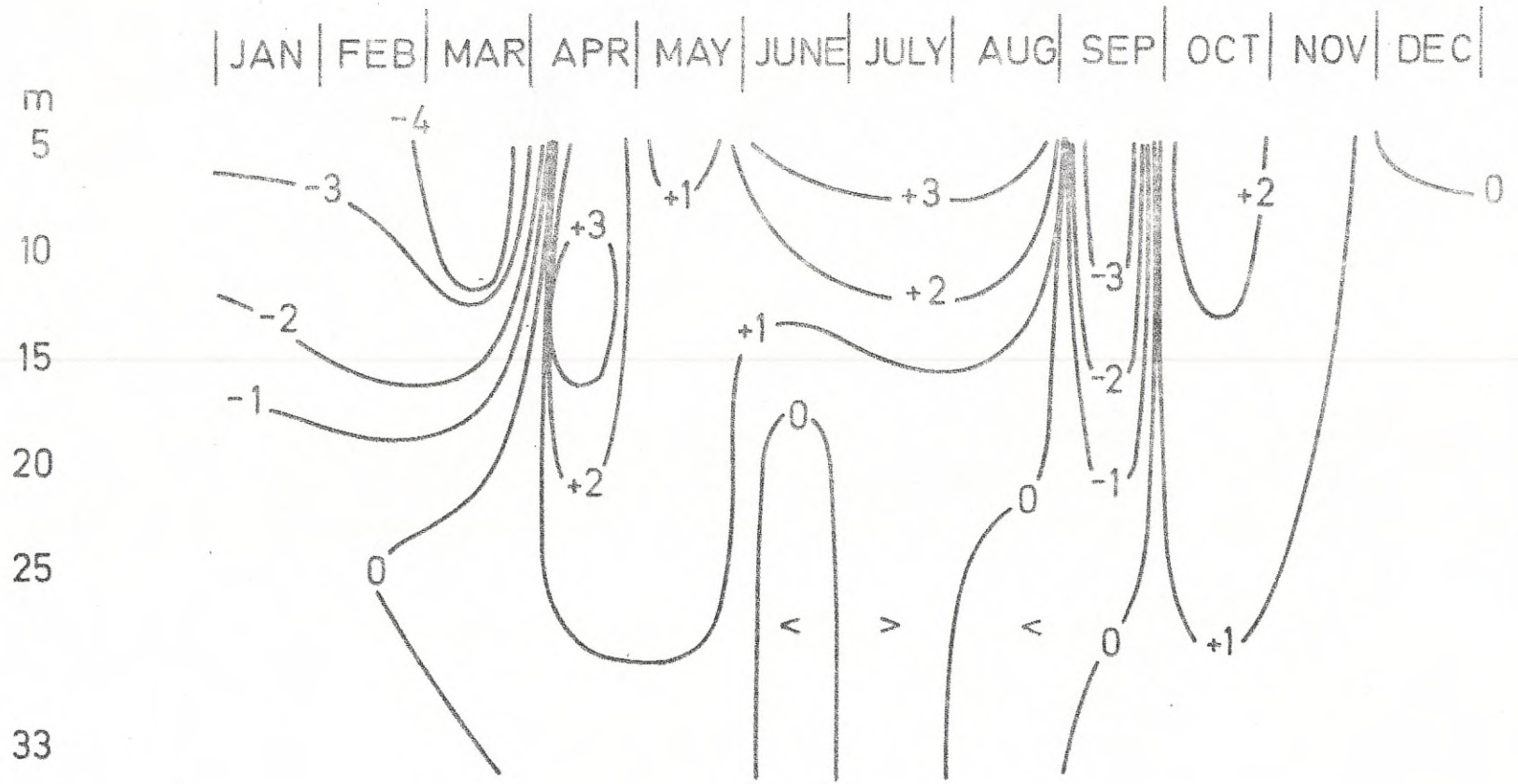
Fig. 1



BORNÖ 1974

Temperature Deviations °C

Fig. 1



BORNÖ 1974

Salinity Deviations ‰

Fig. 2

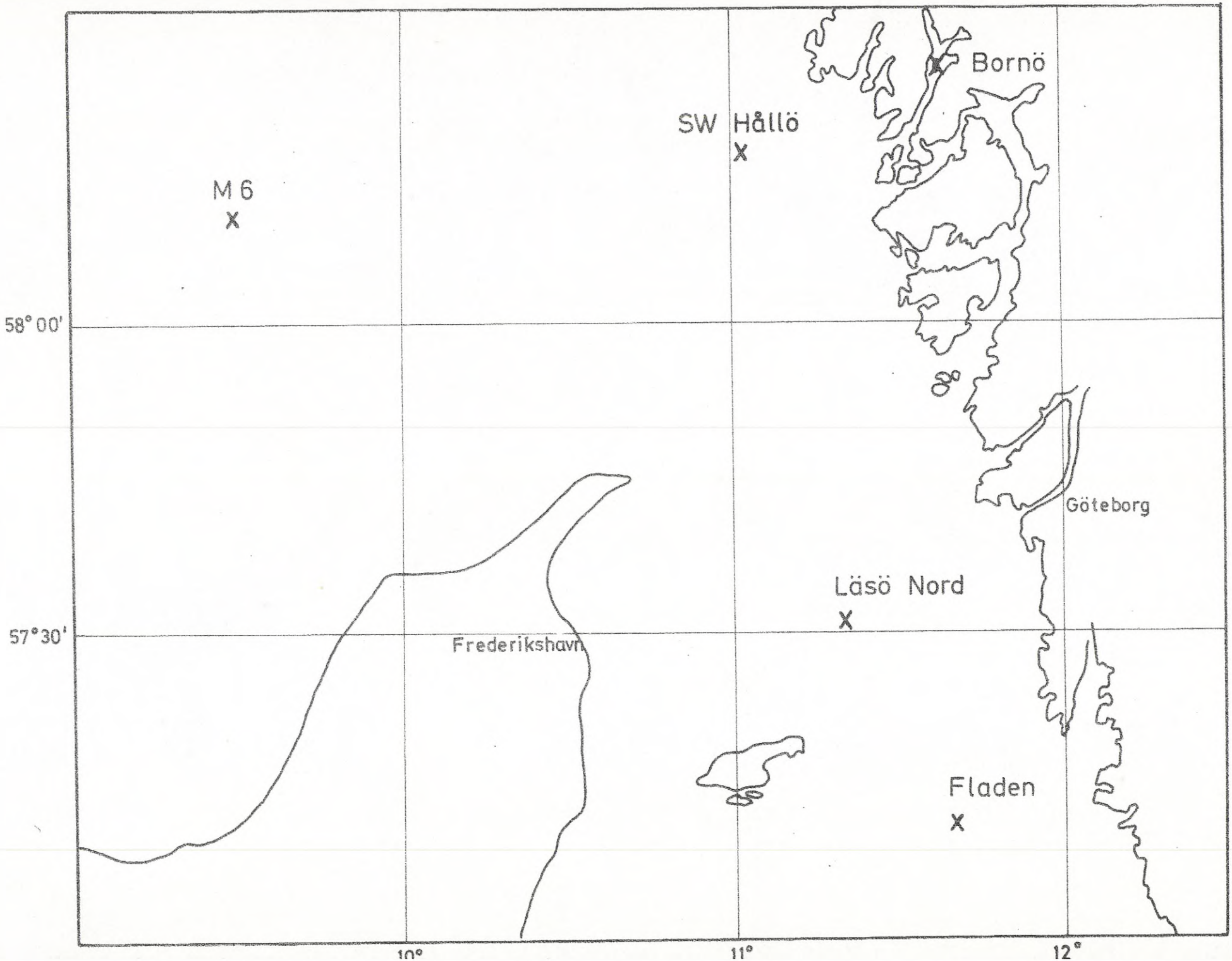

Bornö
SW Hållö
M 6
58° 00'
Göteborg
Läsö Nord
57° 30'
Frederikshavn
Fladen
10°
11°
12°

Table 1

M 6

58°10′N 09°30′E

Depth m	Temp. °C	S ‰	O_2 ml/l
	August 22		
200	6.18	35.092	7.64
300	6.14	35.141	6.45
400	5.99	35.142	6.49
500	5.95	35.143	6.44
600	5.89	35.138	6.02

Table 2

Total Phosphorus in µgat/l at 57°32′N 11°19.5′E (Läsö Nord)

	August		September		October		November		December	
Depth m	Mean	Std.dev.	Mean	Std.dev.	Mean	Std.dev.	Mean	Std.dev.	Mean	Std.dev.
0	0.65	0.11	0.82	0.23	0.67	0.08	0.86	0.35	0.91	0.07
5	0.61	0.08	0.85	0.25	0.73	0.11	0.81	0.13	0.97	0.43
10	0.67	0.21	0.80	0.24	0.77	0.09	0.84	0.08	0.94	0.15
15	0.58	0.08	0.80	0.25	0.81	0.14	0.82	0.09	0.90	0.08
20	0.52	0.11	0.83	0.36	0.80	0.12	0.80	0.09	0.93	0.09
30	0.50	0.16	0.83	0.47	0.83	0.16	0.79	0.11	0.94	0.09
38	0.51	0.11	0.81	0.28	0.93	0.30	0.81	0.12	0.95	0.10

Table 3

Percentage Oxygen Saturation at 57°11.5′N 11°40′E (Fladen)

Depth m	Feb. 13	Mar. 15	Apr. 10	May 13	June 11	Aug. 5
30	106	95	91	88	100	92
40	100	96	92	86	96	77
50	99	94	91	86	88	68
60	100	94	90	86	85	61
70	99	95	91	85	84	67

	Sep. 2	Sep. 4	Sep. 9	Oct. 24	Nov. 4	Dec. 12
30	99	87	97	79	79	89
40	90	72	97	81	83	93
50	70	67	95	82	79	93
60	67	63	84	80	76	92
70	67	58	69	80		93