

CHEMICAL CHANGES IN SEA WATER OFF PLYMOUTH DURING 1959

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(Text-figs. 1-3)

Analyses of sea water collected during 1959 at the International Hydrographic Station E1 (lat. $50^{\circ} 02' N.$, long. $4^{\circ} 22' W.$) are given here in the same form as earlier reports (Armstrong, 1954, 1955, 1957, 1958; Armstrong & Butler, 1959, 1960). The methods of collection and analysis remain the same. Salinities were determined by the Government Chemist, Department of Scientific and Industrial Research. We wish once more to thank Lt.-Cdr. C. A. Hoodless, D.S.C. and the crew of R.V. 'Sarsia', and Capt. W. J. Creese and the crew of R.V. 'Sula' for help at sea.

RESULTS

Temperature and salinity

The vertical distribution of temperature during the year is shown in Fig. 1. The lowest surface temperature was $9.37^{\circ} C$ on 10 February; the highest was $18.13^{\circ} C$ on 11 August. The surface was appreciably warmer than the bottom in April, and by 12 May a well-marked thermocline at 14 m had developed. It varied between 15 and 23 m in depth during the summer, and vertical mixing was not complete even in October.

Some changes in salinity, suggestive of changes in water mass, occurred in September and October. In August the mean salinity in the water column was 35.07‰ with no significant variation with depth. This changed to 35.11 on 8 September, the increase being accountable to values of 35.19, 35.18 and 35.15 at 0, 5 and 10 m. The mean further increased to 35.19 on 13 October, with values of 35.21 and 35.23 at 50 and 70 m. At the same time mean temperature increased from 14.71 to $15.67^{\circ} C$ and silicate decreased from 3.39 to $3.00 \mu g$ atom Si/l.

Phosphate

The vertical distribution is shown in Fig. 2, and integral mean concentrations in Table 1. The winter maximum found in January and February was $0.50 \mu g$ atom P/l, which is somewhat lower than in the last 3 or 4 years. Consistently low values of $0.08-0.10 \mu g$ atom P/l. were found in the upper

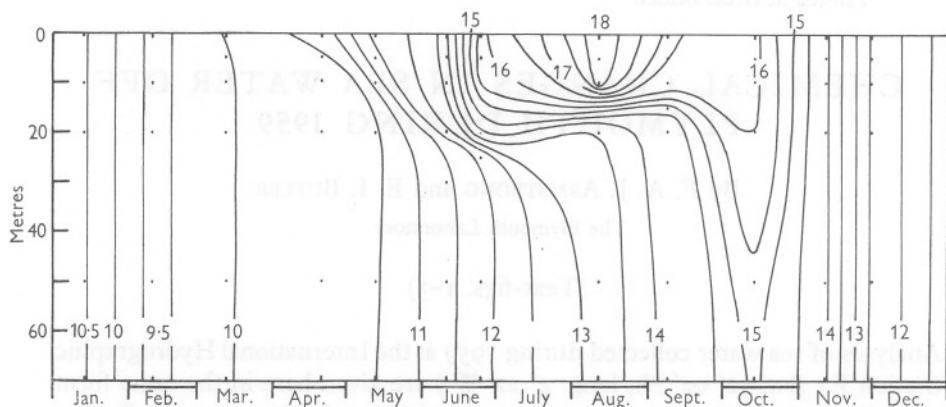


Fig. 1. Vertical temperature distribution at International Hydrographic Station E I, 1959. Contour lines at 0.5° C intervals.

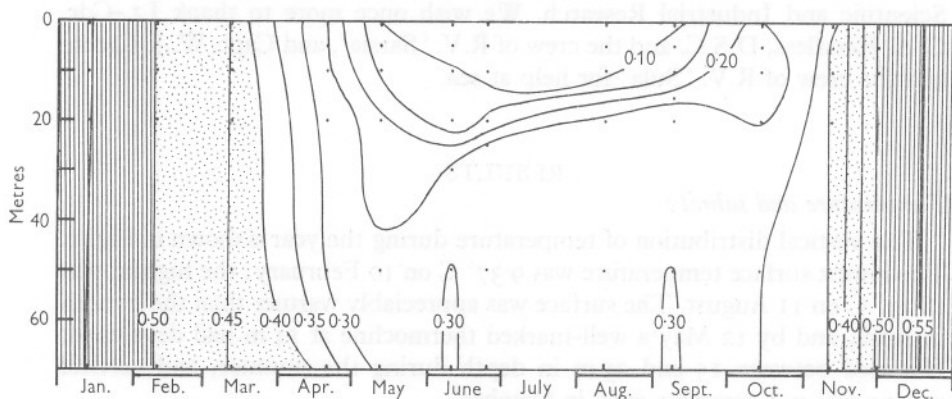


Fig. 2. Vertical distribution of phosphate at International Hydrographic Station E I, 1959. Contour lines at 0.05 µg atom P/l. intervals.

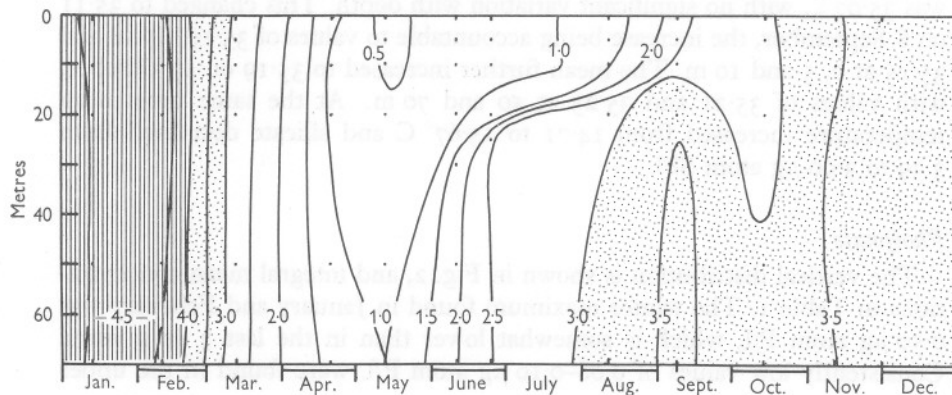


Fig. 3. Vertical distribution of silicate at International Hydrographic Station E I, 1959. Contour lines at 0.5 µg atom Si/l. intervals.

10 m from May to September. The vertical distribution did not become uniform until 11 November.

Total phosphorus

Determinations made in January, February and March showed the highest values in January. The value 1.36 for the ratio of 'total' to 'inorganic' phosphorus was again unusually high, being the same as in 1958 (Armstrong & Butler, 1959).

Silicate

Vertical distribution is shown in Fig. 3, and integral mean concentrations in Table 1. The winter maximum found was 4.83 $\mu\text{g atom Si/l.}$ in January, and is the highest value recorded since 1950 when the present series of observations started. Silicate had decreased very considerably throughout the water column by 12 May but summer values were not as low as might have been expected, since the summer was unusually sunny. In fact, silicate increased each month during June to September.

TABLE 1. INTEGRAL MEAN CONCENTRATIONS IN WATER COLUMN AT STATION E1, 1959

Date	Phosphate ($\mu\text{g/atom P/l.}$)	Total P ($\mu\text{g atom P/l.}$)	Silicate ($\mu\text{g atom Si/l.}$)
13 Jan.	0.50	0.68	4.83
10 Feb.	0.50	0.63	4.62
12 Mar.	0.45	0.61	2.83
20 Apr.	0.29	—	1.06
12 May	0.22	—	0.68
10 June	0.23	—	1.54
24 June	0.22	—	1.99
11 Aug.	0.23	—	2.67
8 Sept.	0.28	—	3.39
13 Oct.	0.27	—	3.00
11 Nov.	0.36	—	3.59
1 Dec.	0.50	—	3.74

Integral mean concentrations

Some of the values have been discussed. The spring decreases were: phosphate 0.28 $\mu\text{g atom P/l.}$, silicate 4.15 $\mu\text{g/atom Si/l.}$

SUMMARY*

The results of analysis of sea water samples from the International Hydrographic Station E1 during 1959 are given in graphical form and as integral mean values for the water column of 70 m. The winter maximum values were found in January. The spring decreases of nutrients were: phosphate 0.28 $\mu\text{g atom P/l.}$, silicate 4.15 $\mu\text{g atom Si/l.}$

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TABLE I. MEAN CONCENTRATIONS OF WATER PHOSPHATE AND SILICATE IN SEA WATER OFF PLYMOUTH, 1950-1958

Year	Phosphate (µg/l)	Silicate (µg/l)
1950	1.2	1.5
1951	1.1	1.4
1952	1.3	1.6
1953	1.4	1.7
1954	1.5	1.8
1955	1.6	1.9
1956	1.7	2.0
1957	1.8	2.1
1958	1.9	2.2

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SUMMARY

The trends in water of sea water sampled from the International Hydrographic Station 111 during 1950-1958 are given in terms of total and available phosphorus and the water-soluble form. The seasonal maximum values were found in January. The range in water-soluble water phosphate was ...