

CHEMICAL CHANGES IN SEA WATER OFF PLYMOUTH IN 1961

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Regular observations at International Hydrographic Station E1 (lat., $50^{\circ} 02' N.$, long., $4^{\circ} 22' W.$) were continued in 1961, and it is hoped that they will go on in the future although we have shown that they may not be typical of the area off Plymouth (Armstrong & Butler, 1962*b*). The observations in 1961 form part of some wider surveys, but we think it best to separate those for station E1 and to report them in the same form as has been used in recent years (Armstrong, 1954, 1955, 1957, 1958; Armstrong & Butler, 1959, 1960*a, b*, 1962*a*).

The methods of collection and analysis remain unchanged.

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RESULTS

Temperature and salinity

The vertical distribution of temperature during the year is shown in Fig. 1, and integral mean concentrations for the water column of 70 m in Table 1. The lowest surface temperature was $10.07^{\circ} C$ on 10 January; the highest was 16.15° on 19 July. There was a temperature difference of about $0.6^{\circ} C$ between the upper and lower levels in April, and by 24 May a marked thermocline at 12 m had developed. It persisted during the summer and though well marked on 12 September had gone by 31 October. The salinity changed slowly and fairly regularly during the year, being at its highest (35.33‰) on 21 February and decreasing during the spring and summer to 35.07‰ on 23 August, increasing thereafter. On 12 September the salinity of the upper 20 m was 35.12‰ , and that of the deeper water 35.10‰ , indicating the presence of two distinguishable water masses one above the other at the station.

Phosphate

The vertical distribution is shown in Fig. 2, and the integral mean concentrations in Table 1. The maximum found during the year was $0.44 \mu g$ atom P/l. on 10 January and 14 December. This is unusually low, similar figures having been recorded only in 1934 and 1935 (Cooper, 1938) and in 1948 and 1949 (Armstrong & Harvey, 1950). After the spring growth of

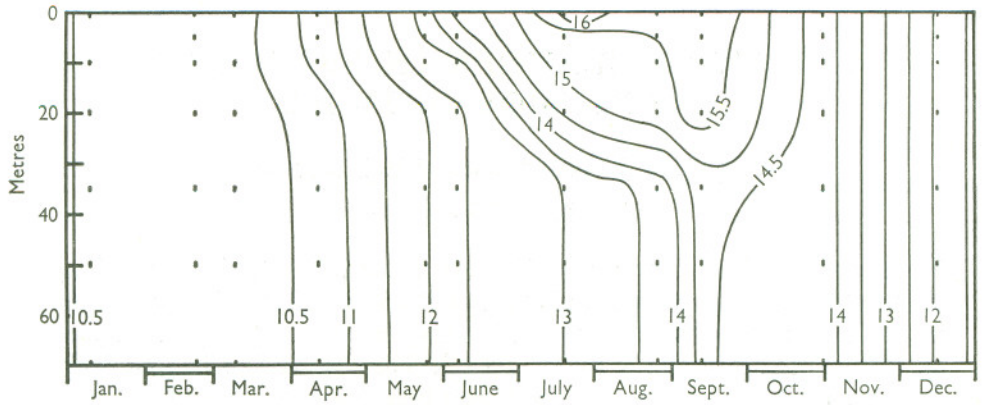


Fig. 1. Vertical temperature distribution at International Hydrographic Station E 1, 1961. Contour lines at 0.5°C intervals

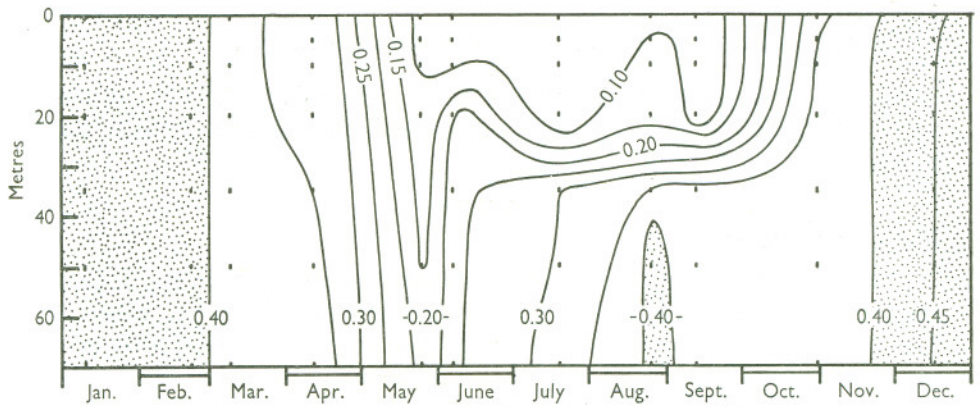


Fig. 2. Vertical distribution of phosphate at International Hydrographic Station E 1, 1961. Contour lines at 0.05 µg atom P/l. intervals.

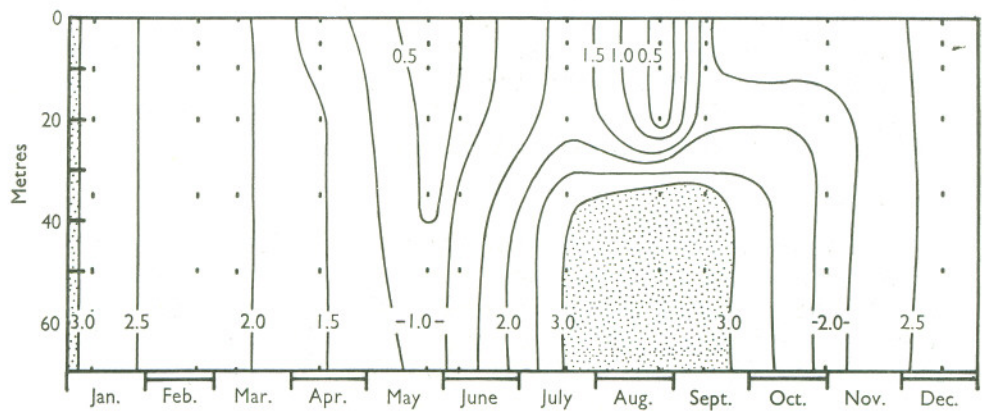


Fig. 3. Vertical distribution of silicate at International Hydrographic Station E 1, 1961. Contour lines at 0.5 µg atom Si/l. intervals.

phytoplankton very low values were found on 24 May (integral mean $0.13 \mu\text{g}$ atom P/l.). Low values in the upper layers persisted until 12 September. By 31 October the water column was uniform and concentrations increased until the end of the year.

Total phosphorus

Values for January, February and March are given in Table 1. The maximum of $0.53 \mu\text{g}$ atom P/l. in January and February was unusually low, although slightly lower figures had been found in 1948 and 1949, the first two years in which this determination was made.

TABLE 1. INTEGRAL MEAN CONCENTRATIONS IN WATER COLUMN AT STATION E1, 1961

Date	Salinity (‰)	Phosphate (μg atom P/l.)	'Total P' (μg atom P/l.)	Silicate (μg atom Si/l.)
10 Jan.	35.38 ₀	0.44	0.53	3.15
21 Feb.	35.33 ₀	0.42	0.53	1.95
9 Mar.	35.32 ₁	0.37	0.43	2.07
11 Apr.	35.26 ₄	0.35	—	1.49
24 May	35.15 ₀	0.13	—	0.43
6 June	35.10 ₉	0.20	—	1.09
19 July	35.09 ₈	0.22	—	2.51
23 Aug.	35.06 ₉	0.30	—	2.07
12 Sept.	35.11 ₀	0.26	—	2.70
31 Oct.	35.23 ₂	0.36	—	1.92
14 Dec.	35.30 ₈	0.44	—	2.66

Silicate

The vertical distribution is shown in Fig. 3 and the integral mean concentrations in Table 1. The maximum found was $3.15 \mu\text{g}$ atom Si/l. in January. Low values throughout the water column were found in May; these gave the unusually low integral mean concentration of $0.43 \mu\text{g}$ atom Si/l. After this, silicate was very low in the upper layers during the summer (except in July) but high in the deeper water. On 31 October silicate was slightly higher in the uppermost 20 m than below, although the water column appeared to be uniform in its other properties. It will be seen in Table 1 that the total in the column was less than in September.

Integral mean concentrations

The spring decreases were: phosphate $0.21 \mu\text{g}$ atom P/l., silicate, $2.72 \mu\text{g}$ atom Si/l. The decrease in phosphate is an unusually small one.

SUMMARY

The results of analysis of sea water samples from the International Hydrographic Station E1 ($50^{\circ} 02' \text{N.}$, $4^{\circ} 22' \text{W.}$) are given in graphical form and as integral mean values for the water column of 70 m. Winter maximum values

(in January) of $0.44 \mu\text{g}$ atom phosphate P/l. and $0.53 \mu\text{g}$ atom 'Total' P/l., with $3.15 \mu\text{g}$ atom Si/l. were found. The phosphate and 'total' phosphorus concentrations were unusually low. The spring decreases were $0.21 \mu\text{g}$ atom P/l. and $2.72 \mu\text{g}$ atom Si/l.

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