

UNDERWATER OBSERVATIONS ON ROCKS OFF STOKE POINT AND DARTMOUTH

By G. R. Forster

The Plymouth Laboratory

THE LOWER LIMIT OF *LAMINARIA* AND OTHER ALGAE

In the vicinity of the Stoke Point rocks which lie $\frac{1}{4}$ mile offshore, plants of *Laminaria*—*L. hyperborea* (Gunn.) Fosl.—disappear below approximately 17 m, from low-water spring tide level. This limit, described in the preliminary note (Forster, 1954, this *Journal*, Vol. 33, pp. 341-4) has been confirmed during five dives in the same area in August 1954. The lower limit of *Dictyopteris membranacea* (Stackh.) Bate, which largely replaces *Laminaria*, has not yet been fully determined, but in fairly broad gulleys it fades out at 25 m and is followed by purely animal growths. Twenty-five metres is, therefore, probably close to its lower limit for this particular area.

In contrast, at the East Blackstone which is $\frac{1}{2}$ mile offshore near Dartmouth, the *Laminaria* only penetrated to 5-6 m. It was followed, down to 8 m, by scattered plants of *Dictyota dichotoma* (Huds.) Lamour., and very sparse red algae chiefly *Heterosiphonia plumosa* (Ellis) Batt. Closer inshore, and in Torbay, *Saccorhiza polyschides* (Lightf.) Batt. apparently replaced the *Laminaria hyperborea*. The lower limit of *Saccorhiza* was not observed, but at two separate positions it became very sparse by 6 m. These observations were made during nine dives in September 1954.

THE SESSILE FAUNA

The results obtained in 1953 from Stoke Point rocks have been confirmed during 1954, and further dives made to slightly greater depths. From the end of the *Laminaria* zone at 17 m down to 25 m, the rocks are often fairly flat with a series of widely separate ridges about 2 m high, running roughly north and south. The sea bottom, viewed from 3 or 4 m away, appeared as a dark brown field of *Dictyopteris* relieved by large yellow clumps of *Cliona celata* Grant (non-boring form) and pink sea-fans, *Eunicella verrucosa* (Pallas). There were roughly two *Cliona* and three *Eunicella* colonies per 10 sq.m.

Beyond 25 m the rocks were sometimes irregular, forming gulleys and pockets with a bottom of coarse sand. The gully walls from 25 to 28 m, though not steeply sloping, were devoid of algae. Here the fauna was composed chiefly of Coelenterata and Bryozoa. *Corynactis viridis* Allman, though still common, was not as abundant as it was on vertical gully walls at 18-20 m, when the algae were also excluded. Both *Alcyonium glomeratum* (Hassall) and

Epizoanthus wrightii (H. and S.) also occurred frequently, the latter with numerous bright orange and yellow polyps forming patches of up to approximately 1 sq.m in area. A few colonies of *Sertularella gayi* (Lamouroux) appeared for the first time, this species being common on the Eddystone trawling grounds in 45–65 m. The chief Bryozoa were erect forms, *Cellaria fistulosa* (L.), *Flustra papyracea* (Ellis & Solander), with scattered colonies of *Lepralia foliacea* (E. & S.).

The sessile rock fauna at the E. Blackstone was considerably different from that of Stoke Point rocks. From 4.5 to 6 m, very approximately, on vertical or overhanging rock faces small mussels (*Mytilus* sp.) were abundant. The small white anemone *Actinothoë sphyrodeta* (Gosse) occurred commonly both with the *Mytilus* and in patches on its own.

From 6 m down to 18 m, which was the lower limit reached, the following species were very common: *Nemertesia* (*Antennularia*) *antennina* (L.), *Tubularia indivisa* L., *Sertularella gayi* (hydroids); *Scrupocellaria scruposa* (E. & S.), *Cellaria fistulosa*, *Flustra papyracea* (Bryozoa); and *Antedon bifida* (Pennant). No zonation of these species with depths was observed; the rock surface being covered over considerable areas either by the hydroids, the Bryozoa, or *Antedon* or combinations of these groups especially hydroids and Bryozoa. There were also small patches of *Actinothoë*, groups of *Metridium senile* (L.), numerous *Caryophyllia*—*C. smithi* Stokes, cup coral—and the ubiquitous *Corynactis*, though only scattered polyps. Only two *Eumicella* and one *Axinella*—*A. polyplodes* (Schmidt)—were seen and may, therefore, be taken as rare.

One dive was made at the E. Cod Rock near Berry Head. In contrast to the igneous rock of E. Blackstone, this rock was composed of limestone. At a depth of 6–7 m the rock surface was honeycombed by the boring mollusc *Hiatella arctica* (L.). Besides *Antedon*, *Alcyonium digitatum* L., and *Mytilus* sp., which were common, there were also many anemones usually inhabiting *Hiatella* burrows. The anemones were *Tealia felina* (L.) and *Cereus pedunculatus* (Pennant). *Metridium* was present in smaller numbers and growing normally on the rock.

DISCUSSION

During the diving the water was found to be much more turbid between Dartmouth and Torbay than near Stoke Point, where during a calm spell of weather the bottom can be seen clearly at a depth of 11 m, whereas in Torbay even during a prolonged period of offshore winds the comparable limit was only 2–3 m. The shallow penetration of the algae at the E. Blackstone and nearby is clearly the result of growing in more continually turbid water. With the fauna, however, only *Sertularella*, *Flustra* and *Cellaria* were common to both areas. The contrast in the fauna between the two areas was not simply an alteration in the life zones of various species, but the species themselves

were mostly different. Much of the E. Blackstone fauna was not unfamiliar, since *Nemertesia* (Antennularia), *Actinothoë*, *Mytilus* sp. and *Antedon* are rather common species in Plymouth Sound. Both the Sound and the Dartmouth-Torbay area are sheltered from the prevailing west and south-west winds, and thus from the more violent wave action; but they also differ from the Stoke Point area in the greater turbidity of the water. Thus the change in the sessile fauna may not be solely related to wave action.

It was surprising to find the sea so much more turbid in the sheltered Dartmouth-Torbay area than in the exposed Stoke Point area, as the reverse had been expected. Although this situation might possibly be attributed merely to the sea-bed being largely mud in Torbay but sand beyond the rocks at Stoke Point, it seems more reasonable to assume that the turbidity does not arise *in situ* but results from a continual replacement of water containing suspended material. For Torbay itself has extremely weak tidal streams and is very well sheltered from wave action except from the east. In September 1954, when the observations were made, there had been no strong east wind for at least two months; so unless the water was being replaced one would expect it to have been much clearer than at Stoke Point where any south-westerly gale turns the sea cloudy for several days. Dr L. H. N. Cooper suggests that the turbidity may originate in the violent water mixing which takes place off Portland Bill, 40 miles to the eastward.

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SUMMARY

A description is given of the commonest sublittoral algae and sessile animals found on rock at Stoke Point Reef and at the E. Blackstone rock near Dartmouth to a maximum depth of 28 m. The E. Blackstone fauna resembled that of Plymouth Sound. The marked change which has been found is ascribed to the greater turbidity of the water near Dartmouth and the increased shelter from wave action.