records to this are those for Stranraer and Kirkcolm in Loch Ryan[1], about 55 miles to the south.

In view of the interest attached to the well-documented[1] rate of spread of this barnacle, search has been made at intervals since 1955 for further specimens on the Isle of Cumbrae; but none was seen until September 3, 1959, when two specimens were found on the exposed tip of Keppel Point, about 525 m. north-east of Connell's find. The two *Elminius*, which were left *in situ*, had settled about 3 m. apart, near mean tide-level, on rock among large *Balanus balanoides*; both specimens were small (3·5 and 3·6 mm. mean diameter, September 29) and presumably had settled during the summer of 1959.

Since it is believed that cross-fertilization is obligatory in *Elminius* and that in consequence individuals separated by a distance exceeding 5 cm. cannot breed[1], much larger settlements are required before the species can become fully established here.

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Oct. 14.

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Mass Rearing of Barnacle Cyprids in the Laboratory

Interest in laboratory experiments on ships' fouling organisms is increasing, yet attempts to rear barnacle larvæ to cyprid stage have generally met with only limited success[1–6]. It therefore seems appropriate to place on record a reliable rearing method, which has been developed here to provide material in connexion with experiments on the use of ultrasonic antifouling equipment. The barnacle mostly used was *Elminius modestus*, as this important fouling organism produces nauplii all the year round. As a result of many series of experiments the following simple technique was evolved.

All sea water used is first pasteurized by heating to 60° C. and then cooled to room temperature. Masses of ripe embryos are dissected out of adult barnacles and placed in a dish of sea water on the side remote from the light. Stage I nauplii soon hatch from a proportion of the egg masses and swim rapidly to the lighted side of the dish, tending to leave behind Protozoa that may have been introduced with the egg masses. From the lighted side the nauplii are pipetted into 1 or 3 l. 'Pyrex' Berzelius beakers of sea water to give a larval density not exceeding 300 per l. *Skeletonema costatum* (Plymouth Collection No. 106), cultured in standard Erdschreiber medium[7], is used as food. Actively growing culture is added at a density of 200–500 cells per mm.[3] at the beginning of the experiment. The diatoms tend to settle to the bottom, but gentle stirring with a glass rod once a day is generally found to resuspend them sufficiently, particularly as the nauplii are able to feed on them while they are on the bottom. The vessels are covered and kept on a laboratory bench where they receive north daylight. No change of water or vessel is carried out and growth of the food plant usually makes good the quantity consumed, but excess food should always be present and more diatoms are added whenever necessary. Considerable fluctuations of temperature are tolerated. At a temperature of about 22° C. cyprids of *Elminius* appear after six days and have been obtained at all months of the year.

More than 90 per cent of the stage I nauplii eventually reach cyprid stage in such a culture and 80 per cent or more of these settle if provided with a suitable substratum. These figures contrast with the overall survival to the settled state of 16·3 and 12·7 per cent recently reported for individually reared larvæ of *Balanus eburneus* and *B. amphitrite* var. *denticulata*, respectively[4,5]. The main reasons for the failure of previous workers to obtain consistently high yields are probably contamination of cultures with other organisms, especially ciliates, overcrowding or stale or wrong food.

Although gentle bubbling of air from a glass jet has often been used to help keep the food suspended, careful experiments show that results with *Elminius* in bubbled vessels are no better than in stagnant cultures where satisfactory conditions have been established. There is thus no support for the idea recently put forward[8] that agitation of the water is necessary for ecdysis to be successful. Similarly, penicillin and streptomycin, which have been recommended in culturing oyster larvæ[9], do not produce significantly better results when added to healthy cultures, although they help in poor culture conditions where many larvæ have died.

Besides *Elminius* the cyprids of *Verruca stroemia*, *Chthamalus stellatus*, *Balanus amphitrite* var. *denticulata*, *B. perforatus*, *B. balanoides*, *Acasta spongites* and *Pyrgoma anglicum* have all been reared in large numbers. The larvæ of the two latter species are being described. Other plant cultures have been used as food with varying success and their relative values are being tested. Already it is clear that *Elminius* grows and survives better when fed on *Skeletonema* than on *Phaeodactylum*. Japanese workers have also found *Skeletonema* suitable as food for barnacle larvæ[10]. *Chthamalus stellatus*, however, though capable of being reared satisfactorily on the small flagellate, *Isochrysis galbana*, has not been reared successfully on *Skeletonema* and therefore seems to show a difference from Balanidae with which the fine setulation of the larval limbs in *Chthamalus* is probably correlated. The use of liver or egg extract as food[11] has not been tried, but would obviously need a procedure entailing frequent water changes to remove decomposing food.

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