

## Identity of Breeding Temperatures in Southern and Northern Hemisphere Species of *Mytilus* (Lamellibranchia)

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MUSSELS OF THE GENUS *Mytilus* are distributed throughout the temperate seas of the world and are among the most conspicuous animals of the shore and shallow seas. The Australian representative, *Mytilus planulatus* Lamarck, is one of the commonest bivalve molluscs of this region, and in many respects exhibits a marked similarity to the northern *M. edulis* Linné. This similarity is not only in general appearance, size, and vertical distribution, but seems to extend even to the temperature requirements for successful settlement. *M. planulatus* occurs throughout southern Australia, Tasmania, and New Zealand. On both east and west coasts of the Australian mainland, the northern limit of distribution is about 32° S. latitude, although outlying populations may be found a little further north. Fremantle on the west coast and Port Stephens on the east may be considered the northernmost strongholds of *M. planulatus*; the mean monthly summer temperatures being 23.4° C. and 24.6° C. respectively. *M. edulis* ranges throughout the northern hemisphere; Hutchins (1947) has shown that its southern limit of distribution corresponds approximately with the maximum monthly mean (summer) of 80° F. (26.6° C.).

The information presented here was obtained during the course of marine fouling

investigations on the east coast of Australia. The type of collector used has been described by Allen and Wood (1950). In each of the five years in which investigations were made, the season of settlement was clearly defined. Settlement in Port Jackson, New South Wales, began in June or early July, and terminated late in December. Settlement outside this season is almost unknown. In April 1947 a few juveniles were found, but in view of the amount of information now available this occurrence is considered adventitious. Figure 1 shows the counts of young *M. planulatus* settled on plates which were exposed for 14 days at The Spit, Port Jackson, in 1949. No settlement took place prior to July 8 nor after December 9, which gives a season extending from midwinter through spring to early summer. Temperatures ranged from 12.3° C. on June 24 (the minimum for the year) and 15.1° C. on July 8 to 21.3° C. on December 9, the end of the last fortnight during which settlement took place.

For this season of settlement there is a striking parallel in the northern mussel, *Mytilus edulis* L., as reported by Engle and Loosanoff (1944). Their observations were made at Milford Harbor, Connecticut, U.S.A., which is in approximately 41° N. latitude. Settlement of *M. edulis* took place there from June to August (Fig. 2), the peak being from the middle of June to the middle of July in 1942. During this period the temperatures ranged from about 12.5° C. on June 1, when

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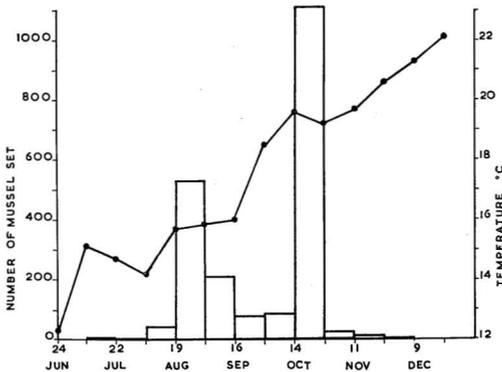


FIG. 1. The number of young *Mytilus planulatus* settling at The Spit, Port Jackson, New South Wales during the breeding season 1949.

settlement commenced, to over 22° C. when the main season of settlement ended at the beginning of August. The season of settlement is much shorter than that of *M. planulatus*, but the range of temperatures over which settlement is successfully achieved is almost identical. The season of settlement in both *M. edulis* and *M. planulatus* corresponds to a temperature range of about 12.5° C. to about 19° C. with relatively insignificant settlement above 22° C.

This statement is strengthened by information from several sources. Graham and Gay (1945) found that the season of attachment of *M. edulis* to test panels at Oakland, California, was only from March to May. Temperatures were rising from 14° C. at the beginning of March to about 19.5° C. in May (*op. cit.* fig. 1, p. 376). Further evidence that the higher temperature imposes a limit to breeding is the fact that *M. planulatus* has a longer breeding season in the colder waters of Victoria than it does in Port Jackson. Miss J. H. Macpherson of the National Museum of Victoria states (personal communication) that she found young mussels in the plankton all the year round, and that "there is a lull about June to September, but even in this period there are a few breeding." In Port Phillip, where these observations were made,

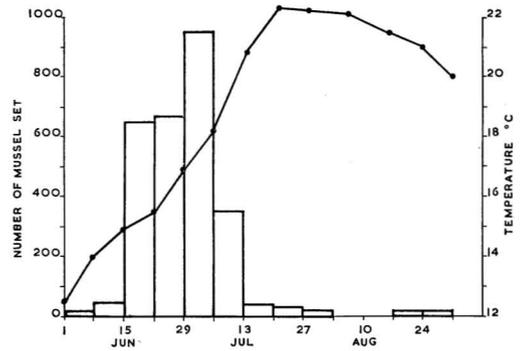


FIG. 2. The number of young *Mytilus edulis* settling at Milford Harbor, Connecticut during the breeding season 1942. (After Engle and Loosanoff, 1944, figs. 1, 3.)

temperatures for this June–September period are usually below 12° C., while the summer temperatures only occasionally reach 20° C., and rarely exceed this figure. Ralph and Hurley (1952) found an extended season of attachment for *M. planulatus* at Port Nicholson, Wellington, New Zealand, where maximum temperatures did not exceed 19° C.

The evidence supports the view that the season of settlement of the two species is governed to a great extent by minimum and maximum temperatures which are almost identical for both species, and that outside the limits mentioned little, if any, reproduction occurs. Breeding appears to be initiated by a rise of temperature to about 12°, and to continue as long as the upper limit of about 19° is not exceeded. However, the attainment of this upper limit seems to inhibit further breeding, as settlement does not recommence when the temperatures drop once more to the breeding range. This may be indicative of an innate breeding rhythm which, in some localities, is modified by the seasonal temperature trends. Also this apparent spring breeding may occur only when these organisms are approaching the tropic-ward limit of their geographic range.

The species *M. planulatus* and *M. edulis* are very similar in appearance and the additional

evidence of similarity in their ecology suggests that the relationship between the two species may be closer than is at present acknowledged. It would be of interest to discover whether the genus as a whole displays such a uniformity or whether other species differ in their breeding behaviour. Although these data are very incomplete, they are presented, not only to draw attention to this interesting question, but also in the hope that other workers may be able to furnish additional information.

## REFERENCES

- ALLEN, F. E., and E. J. F. WOOD. 1950. The biology of fouling in Australia. *Austral. Jour. Mar. Freshwater Res.* 1(1): 92-105.
- ENGLE, J. B., and V. L. LOOSANOFF. 1944. On season of attachment of larvae of *Mytilus edulis* Linne. *Ecology* 25(4): 433-40.
- GRAHAM, H. W., and H. GAY. 1945. Season of attachment and growth of sedentary marine organisms at Oakland, California. *Ecology* 26(4): 375-386.
- HUTCHINS, L. W. 1947. The bases for temperature zonation in geographical distribution. *Ecol. Monog.* 17(3): 325-335.
- RALPH, P. M., and D. E. HURLEY. 1952. The settling and growth of wharf-pile fauna in Port Nicholson, Wellington, New Zealand. *Victoria Univ. Col., Zool. Pubs.* No. 19: 1-22, figs. 1-4.