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# THE HABITAT AND LIFE HISTORY OF *NAESA BIDENTATA* (ADAMS)

BY

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## INTRODUCTION

*Naesa* (= *Dynamene*) *bidentata* (Adams) is a sexually dimorphic isopod crustacean occurring commonly in the lower half of the intertidal zone in Britain (Omer-Cooper & Rawson, 1934). It has been recorded from a variety of habitats, such as amongst algae (Colman, 1940; Wieser, 1962), in rock crevices (Glynne-Williams & Hobart, 1952; Morton, 1954), and in both these habitats and also under stones (Marine Biological Association, 1957). Few of these records, however, give an indication of the size and state of sexual maturity of specimens found in each type of habitat. Present observations in South Wales revealed that there were distinct habitat preferences by *Naesa* of different sizes and that small specimens were found mainly amongst algae. Adult specimens, on the other hand, were most common in crevices and also in the empty shells of *Balanus perforatus* Bruguière. *Naesa* does not appear to have been recorded from barnacle shells in Britain, though specimens have been recorded from that habitat in Europe (Torelli, 1930; Fage, 1933). This paper illustrates the stage at which the change of habitat takes place and describes the breeding biology of this common crevice-dwelling species, from observations made on specimens kept in aquaria in empty barnacle shells.

## RESULTS

Fig. 1 gives length frequency histograms of specimens of *Naesa bidentata* collected during July and August 1961 from amongst algae, particularly *Fucus serratus* L., and also from rock crevices and the empty shells of *Balanus perforatus*. Specimens of up to 6 mm body length were clearly restricted to algae found in the lower levels of the shore, whilst only large specimens of 5 mm or more body length were found in crevices and in barnacle shells. Fully mature males and ovigerous females were recorded only in crevices and barnacles, but immature specimens of each sex occurred also amongst algae. The change of habitat evidently took place therefore during the early stages of sexual maturation.

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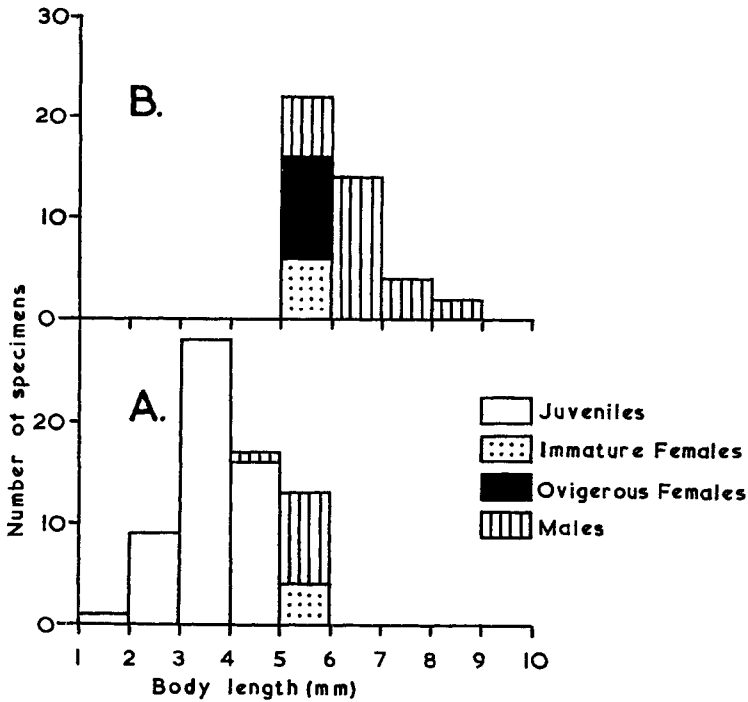


Fig. 1. Length frequency histograms of *Naesa bidentata* (Adams). A, from amongst algae; B, from crevices and barnacles.

Observations on the number and sex of specimens of *Naesa* in individual shells of *Balanus perforatus* showed that only one male was present within any one shell. Occasionally the male was found alone but in most cases there were up to five females accompanying each male. The females were always found near the base of the shell cavity, with the male blocking the shell aperture with the postero-dorsal surfaces of the abdomen and telson. Observations in aquaria showed that this was also the attitude of the male when immersed in water, when it could be seen to irrigate the barnacle cavity by directing the respiratory current of the pleopods through the barnacle aperture.

One shell of *Balanus perforatus* attached to a piece of rock and containing a male with five immature female *Naesa* was maintained in an aquarium for a period of several months from September 1962. The isopods were removed at intervals to examine the breeding condition of the females and the results of these observations are recorded in table I. During the first thirteen weeks in the aquarium the females were in the immature condition without oöstegites, though maturing eggs became visible beneath the greenish coloured cuticle towards the end of this period. By the sixteenth week four females had moulted to the ovigerous stage and the fifth specimen was in the process of moulting. In the ovigerous conditions specimens became much paler in colour, a brood pouch was formed by the appear-

ance of oöstegites, and the mouthparts became modified in the manner described by Hansen (1906). The mouthparts were apparently unable to function as feeding structures at this stage for they showed considerable loss of chitin, of spines and of setae, and the biting edges of the mandibles became blunt. The maxillipedes alone remained well developed and these were modified as a pair of lappets which served to create a current of water forwards across the eggs in the brood chamber. The embryos of one female matured and were released as juveniles by the eighteenth week, and those of two other females were released by the twenty-second week in the aquarium.

TABLE I

Observations on five female *Naesa bidentata* (Adams) kept with an adult male in an empty shell of *Balanus perforatus* Bruguière in an aquarium

Date	Condition of females	Temperature °C
18 Sept. 1962	5 immature, without brood pouch and with unmodified mouthparts	17.5
13 Nov. 1962	as above	16.5
20 Dec. 1962	as above, but maturing eggs visible beneath the cuticle	16.2
9 Jan. 1963	4 with modified mouthparts and with fully formed brood pouches filled with eggs (one killed and preserved) 1 half-moulted to brood pouch stage, with eggs visible beneath cuticle (killed and preserved)	
23 Jan. 1963	2 with developing embryos, 1 with fully formed juveniles which were swimming free	c. 15.0
7 Feb. 1963	2 with well developed embryos and carcass of third lying free in the vessel	
18 Feb. 1963	Another ejected carcass in vessel. Last female just alive in barnacle (see text) and with all juveniles released	13.5

As might be expected from the modification of the mouthparts there was no evidence that the females (or even the male, with its unmodified mouthparts) emerged to feed during the observations. Moreover, ovigerous females seemed to undergo considerable reduction of their body tissues, so that when the juveniles had been released from the brood pouch the parent was almost completely transparent, with little evidence of body contents. One such female was observed to be alive only because it showed periodic ventilation movements of the modified maxillipedes and pleopods. Furthermore, since carcasses of such females were found outside the barnacle it seems that they died soon after the release of juveniles and were ejected by the male. The male was still alive at the end of the experiment.

## DISCUSSION

Accounts of the ecological distribution of intertidal isopods are often generalized and relatively little is known of the factors which limit their distribution. Discussions of some limiting factors have been given recently for various species of *Idotea* (cf. Naylor, 1955) and two species of *Jaera* (cf. Naylor, Slinn & Spooner, 1961), and the present results help to define the ecological distribution of *Naesa bidentata*. To judge from the wide variety of habitats described for *Naesa* in the literature (see p. 212) it seems reasonable to suppose that the species generally shows a change of habitat during the early stages of sexual maturation, as has been described above. Fage (1933) certainly records young specimens from amongst algae and adults from *Balanus perforatus* on the French coast. The specific nature of the adult habitat, however, presumably varies according to the availability of suitable crevices or large empty barnacle shells. *Balanus perforatus*, for instance, which provides suitable shelter for *Naesa* in southern Britain and on the continent, is a subtropical species (Patel & Crisp, 1960) which does not occur in northern Britain. *Naesa*, on the other hand, does occur in northern Britain (Omer-Cooper & Rawson, 1934) where the adults perhaps more generally occur in crevices or under stones.

The change of habitat by maturing *Naesa* and the suggestion (p. 214) that adults do not feed is of interest in relation to physiological observations by Wieser (1962) who found that small *Naesa* had a much higher feeding rate than "adults". He concluded that "the question remains unanswered as to whether this is an artefact or whether it indicates actual differences in behaviour between adults and juveniles". In fact, Wieser's specimens were all collected from amongst algae at Plymouth so, unless the life history is different in that locality, it is possible that the "adult" males and females were really immature specimens which were about to take refuge in barnacles or crevices for reproduction. A falling off in the rate of feeding of these forms might be expected if, as seems likely (p. 214), they do not feed at all once they occupy the adult habitat. Moreover, a high feeding rate might be expected in juveniles since at least the adult females seem to exist solely on resources built up in the young stages. This would certainly be in keeping with the suggestion that young specimens of *Naesa* may follow the receding tide in order to be able to feed at all states of tide (Wieser, 1962).

The elaborate modification of the mouthparts which occurs in ovigerous *Naesa* also occurs in several other genera of the Sphaeromatidae as well as in other groups of isopods (Hansen, 1906). It is clear that there is much more to be learned of the ecological distribution of these forms, together with information of the histological and physiological changes associated with this type of sexual dimorphism.

## RÉSUMÉ

Nous avons vu que les jeunes stades de *Naesa bidentata* (Adams) se rencontraient le plus habituellement sur les algues, tandis que les adultes sont le plus souvent dans les anfractuosités des rochers, sous les pierres et dans les loges vides de balanes. Dans les coquilles vides de *Balanus*

*perforatus* Bruguère on a trouvé jusqu'à cinq femelles, immatures, qui deviendront plus tard ovigères, accompagnant un seul mâle. Les adultes ne se nourrissent apparemment pas et les femelles semblaient subir une résorption des tissus internes jusqu'à leur mort et leur expulsion par le mâle, après que les jeunes avaient été libérés de la poche incubatrice.

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