Processa æquimana Paulson in the North Sea

In a recent communication Cattley and Harding[1] reported the presence of an exotic cladoceran, *Penilia avirostris*, off the Dutch coast. We can now report the occurrence of larvæ indistinguishable from the larvæ of the decapod *Processa æquimana* Paulson[2] in the southern North Sea. Although we have not observed any of the adults of *P. æquimana*, the larvæ are so distinctive that there is little doubt that this species is now present and actively reproducing in the North Sea. It has previously been found only in the Red Sea[2], Suez Canal[3] (larva only) and, recently, at Naples[4].

The larvæ have been recognized in our collections from 1946 onwards, and there is reason for believing that the numbers in the North Sea increased each year during 1946–48. They are by no means uncommon. The continuous plankton recorder , alone, collected more than thirty specimens in 1948. In comparison, in our post-war material, the larvæ of *P. edulis* are rare and those of *P. canaliculata* have not been observed in the southern North Sea.

Much of our material has come from the south-west Dogger Bank region, and there are several records south of this. Larvæ have been obtained during July–November with a maximum in August–September.

Ships returning from the Middle East during the War, with empty holds, may well have brought these exotic species to the North Sea in water ballast. Such a transportation is believed to have happened in the past, notably in the cases of *Biddulphia sinensis* and *Eriocheir sinensis*. The former case is particularly appropriate since one of the tropical areas in which it is common is the Red Sea.

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A New Method of Ciliary Feeding in the Brachiopod *Neothyris lenticularis*

The Pygocaulian Brachiopod *Neothyris lenticularis* possesses sets of ciliated filaments similar to those in other invertebrate filter feeders. Studies on this form, however, have shown that the method of feeding is very different from that in other ciliary feeders —Lamellibranchs[1], certain sedentary Gastropods[2], Cryptocephalous Polychætes[3], Tunicates and *Amphioxus*[4], Entoproct and Ectoproct Polyzoa[5,6] and *Crania*[7]. There are two fundamental points of difference, namely, the function of the filaments and the direction of beat of the cilia on the filaments.

In the groups of ciliary-feeding animals referred to above, the rows of filaments, in lying between the ingoing and outgoing currents, function as a 'sieve plate'. In *N. lenticularis* they fulfil the function of lamellæ which serve to delimit an inhalant chamber as a system of channels, surrounded by an exhalant chamber. The inhalant chamber consists of two lateral gutters, formed by the lateral arms of the lophophore, and a single spiral channel of decreasing cross-section, formed by the oral disk and spiral arm. The exhalant chamber is that part of the mantle cavity not occupied by the lophophore, and opens anteriorly at the median anterior region of the gape.

The differentiation of the cilia on the filaments of *N. lenticularis* into lateral and frontal rows is similar in form to that of molluscs, ascidians, etc. In these forms the lateral cilia beat at right angles to the filaments, thus creating the main current. The frontal cilia beat towards the food grooves, carrying particles abstracted from the current. In *N. lenticularis* both sets of cilia beat in the same direction, that is, towards the distal tips of the filaments and away from the food grooves. The function of the lateral and frontal cilia is primarily that of cleansing. The lateral cilia, by their close apposition, serve to reduce to a minimum the inter-filamentar spaces. In this way also the lamellar nature of the rows of filaments is increased.

As a result of these basic points of divergence, certain features in the functioning of the feeding mechanism of *N. lenticularis* are noted, and a theory is given of the mode of selection of food particles.

(1) The lateral cilia cannot create a current, therefore a current is initiated in the region of maximum ciliary beat in one direction. This 'weighting' of ciliary beat occurs in the median region of the mantle cavity, where the action of the cilia lining the mantles combines with that of the cilia lining the spiral arm in directing a current of water through the anterior opening of the shell.

(2) The course of this current is a necessary result of the form and disposition of the lophophore within the mantle cavity. To replace the volume of water which is being discharged in the exhalant current, a constant supply of water is drawn in by way of the lateral inhalant openings, despite the fact that the cilia lining the inhalant chamber beat towards the tips of the filaments. The inhal nt currents pass between the dorsal and ventral filaments, travel in a posterior direction following the brachial membrane of the lateral arms and converge in the region of the mouth. The current then flows into the blind channel forming the spiral. To maintain any velocity in a blind channel of decreasing cross-section, water must be exuded along its length. Thus, water is pushed out between the tips of the filaments along the length of the channel into the exhalant chamber. In other words, there is a continual leakage from the inhalant chamber into the exhalant chamber as the current flows round the spiral channel.

(3) Within the spiral arm, as a result of its form and relationship to other structures, a centrifugal force operates which leads to the sorting and collecting of food particles. As soon as the ingoing current has passed through the comparatively narrow inhalant opening, its speed is reduced and heavier particles in suspension drop on to the filaments and are passed to the mantle edge by the lateral and frontal cilia. Lighter particles remain in suspension in the current as it flows in a posterior direction along the brachial membrane of the lateral arms, and following this membrane, turns medially into the oral disk, from which it flows in an anterior direction into the spiral channel. If a change of direction is imposed upon a fluid travelling at any velocity, a centrifugal force will come into operation. Thus there is a tendency