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Observations on the re-establishment and tube construction by adults of the polychaete *Lanice conchilega*

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The re-establishment of adult *Lanice conchilega* washed out from the sediment was studied in the laboratory in calm and wave conditions. Worms left in their tubes on the sand surface buried and built new tubes within 48 hours. In still water the fringe of the new tube was thinner and extended to all directions, while under a wave regime the individual branches were thicker and positioned perpendicularly to the direction of the waves.

The polychaete *Lanice conchilega* (Pallas, 1766) is a dominant species of European intertidal and shallow subtidal sands, with densities that may exceed 3000 individuals/m^2 (Ropert, 1996) reaching a maximum of 20,000 individuals/m^2. It builds a very characteristic tube, made from cemented sand grains and shell breccia. The top of the tube usually projects out of the sediment and carries a ragged fringe. *Lanice conchilega* is of high ecological importance since its dense populations affect sediment properties (Jones & Jago, 1993) and oxygen transport (Foster & Graf, 1995), and they alter the composition of benthic communities (Zühlke, 2001). Recruitment occurs through settlement of pelagic larvae; therefore, the pattern of recruitment is a function of larval supply (Strasser & Pieloth, 2001). However, it was suggested that on some occasions, a high abundance of intertidal populations is maintained by transfer and recruitment by adults from offshore (Ropert, 1996). The present paper describes two experiments designed to investigate the ability of adult *L. conchilega* to re-establish themselves, when washed out from the sediment, and to record the activity of the worm during the process.

In the first experiment, re-establishment of *Lanice conchilega* was studied by means of a Perspex 'sandwich' measuring $23\times23\times1\,cm^3$. This was filled to within 2 cm of the top with sand and submerged in a tank with constantly aerated seawater. Individual worms, extracted from the sediment with their tubes, which measured 8 to 10 cm in length, were placed on the surface of the sand in the 'sandwich'. A camera connected to a time-lapse system and flash was set up in front of the 'sandwich' and pictures were taken at 5 min intervals. The experiment was repeated with five worms.

As soon as a worm in its tube was left on the sand in the 'sandwich' (Figure 1A) it began to elongate the tube, bending the opening at the same time towards the sand surface (Figure 1B). Sand grains were collected for this purpose from the sand surface by the tentacles. During this process the anterior part of the body also came out of the tube, sometimes as far as the gills, situated on the second, third and fourth segments. When the mouth of the tube was brought into contact with the surface of the sediment the worm began to dig into it (Figure 1C) with its prostomium and the contracted tentacles. The particles removed, were forcibly ejected, by a jet of water, to the sand surface where they formed a small mound (Figure 1D). Secreted mucus helped to maintain temporarily the passage to the surface through which the grains were moved. The ejection of sand and clearing of the passage was also facilitated by some of the tentacles, which were expanded and contracted periodically. As the worm penetrated the sediment it rotated about its long axis and lined the surrounding sediment with mucus, to form a new tube. When the animal reached the desired depth it bent and turned inside its new tube, so that the head came upwards, and started building the freestanding trunk section and the fringe (Figure 1E). The old tube remained loosely attached to the newly constructed part. Disturbance of the sediment layers was observed only at the immediate vicinity of the digging worm. The duration of each phase differed between individuals, but they all had started to dig into the sediment within 30 min from the beginning of the experiment. After 12 h they had all started to build the freestanding part of the tube and after 48 h they had completed the fringe.

In the second experiment, the ability of *Lanice conchilega* to re-establish itself in moving water was investigated using a wave tank, approximately 1.5 m long by 1.0 m wide and 0.5 m deep. Waves were produced by the oscillation of a hinged board linked to an eccentric. Natural sand, cleared from *L. conchilega*, was put in the tank where ripples and a slope were formed by the wave action. Another tank, with the same type of sand but without waves, was used as a control. Ten worms in their tubes were placed on the surface of the sand in each tank. As in the previous experiment, they all had built tubes slightly projecting above the surface of the sand after 12 h, and after 48 h they had completed the new tubes. However, the form of the fringes was different under the two regimes. Those produced under calm conditions (Figure 2A) were much thinner and extended to all directions, while under the wave regime (Figure 2B) the individual branches were thicker and occurred roughly in two parallel planes perpendicular to the direction of the waves.

The experiments described proved the ability of *L. conchilega* to re-establish itself when washed out of the sediment. It is possible that worms in their tubes extracted from the sediment during storms are carried to certain places on the beach by the sorting activity of the waves causing a patchy distribution. Since, after re-establishment, the old tube remains attached to the new, the appearance of such tube formations might be considered as a sign of adult transport.

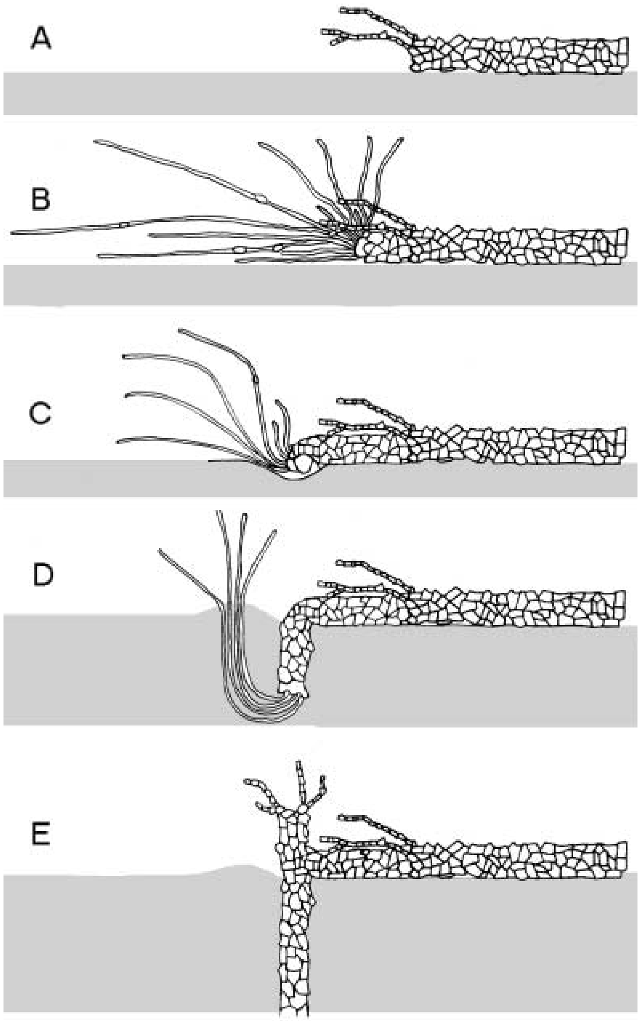

Figure 1. Sequence of burrowing and construction of a new tube by *Lanice conchilega*.

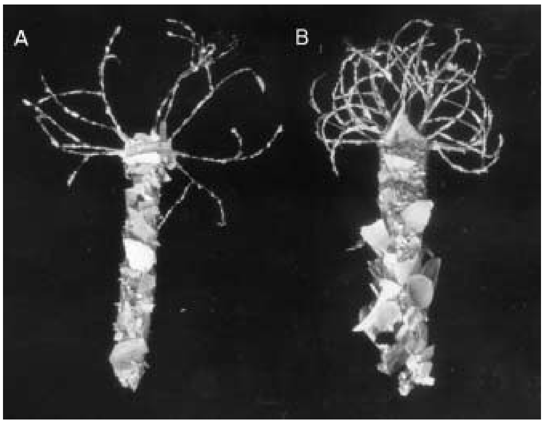

Figure 2. *Lanice conchilega* fringes constructed under (A) calm and (B) wave conditions.

Seilacher (1951) first noticed that *Lanice conchilega* builds its fringe with the greatest surface area exposed to the direction of the main current, while Ziegelmeir (1969) demonstrated experimentally that the fringe becomes most uniformly perpendicular to the current as the velocity increased from 15 to 60 mm/sec. The present experiments confirmed the above orientation of the fringe and, in addition, they showed a difference in its size. It may be interesting to study the construction of fringes in nature, under various weather conditions. Comparison of fringes built simultaneously on different beaches could give some indication of the exposure and wave action.

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