TUBE BUILDING RATE AND SUBSTRATE PREFERENCE IN THREE TEREBELLID WORMS

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INTRODUCTION

Terebellid worms, also known as spaghetti worms, are frequently found in shallow marine waters and mudflats worldwide. These fairly large and cephalized polychaetes are often characterized by extendible feeding tentacles and brightly colored brachial plumes that extend from their anterior region (Fig 1) (Fauchald & Jumars 1979, Rouse 2001). These long feeding tentacles are associated with a sessile benthic lifestyle as their flexibility and length allow for selective feeding on deposits of diatoms, unicellular algae, and various small invertebrate larvae living within the sediment (Grémare 1988).

Many species of terebellid worms use their tentacles to build tubes (Fig 1) (Fauchald & Jumars 1979, Rouse 2001), selecting low-density detrital matter as their construction material. To build a tube the tentacles produce mucus, which adheres to the particles allowing their extraction from the surrounding sediment. Using cilia along the ciliary grooves of each tentacle, terebellids transport particles to their mouth or down the length of their body for tube building. Their tubes vary in construction material, size, and shape (Grémare 1988). For example, the tube of the local species *Pista Pacifica* has a stiff chitonous tube, characterized by a frayed oral hood and can be up to 1 meter in length. Meanwhile, the local species *Thelepus crispus* builds extensive sediment tubes on rock surfaces in the intertidal (Harman 1969). In terms of tube building, selection pressure favors individuals that can build sturdy tubes efficiently as a tube offers protection from sunlight and predators (Duchêne 2004). In *Eupolymnia nebulosa*, the handling of smaller (lighter) particles is easier than the handling of larger (heavier) particles, so worms tend to select smaller particles in tube-building (Grémare 1988).

Based on this natural history, I hypothesize that large terebellid worms will build tubes faster than small worms while incorporating larger sediments into their tubes.

MATERIALS & METHODS

Seven terebellid worms of various sizes were collected from the mid-intertidal at Cape Blanco, Oregon. All were found under rocks and encased in large tubes constructed of large, shelly material. Large shell substrate was collected at Cape Blanco and fine sand substrate was collected from the Portside Mudflats so that worms could construct tubes in the lab. Worms were placed in a plastic container with mesh siding and sediment and were positioned next to an air stone in the saltwater table. They were allowed one week to acclimate themselves to the seawater table, a different environment from the intertidal. One week after collection each worm was placed in its own glass dish with three tablespoons of both the large-shell and fine substrates. Worms were labeled #1-6 and were placed in a plastic container with a steady flow of incoming freshwater and an air stone (Fig 2). Using the lid of the plastic container and a black plastic garbage bag, they were covered to reduce the amount of light in their environment. This was to imitate living under a rock. Also, the onset of light immediately induces reduction in activity for many terebellid worms (Grémare 1988), thus, the reduction in light via the garbage bag was used to enhance tube building.

All worm lengths and widths were measured in mm using vernier calipers. After the onset of the experiment, worm tubes were measured in a like manner every 6 hours for 24 hours. Tubes were disassembled after each measurement so that the initial rates of tube growth could be averaged. After this 24-hour period, tube width and length were measured as frequently as possible, making sure to record the time of measurement so rates could be calculated. During this time tubes were not disassembled. The type of sediment preference was also recorded for each worm.

RESULTS

Three worms built tubes (#1, 4, 5). The mean (±SD) rate of tube growth for the first three trials, between which tubes were disassembled, was 0.16 ± 0.04 mm/min, 0.16 ± 0.05 mm/min, and 0.09 ± 0.04 mm/min, respectively. When worms were allowed to continue building tubes for over two days, the overall rates of tube growth were 0.07 mm/min, 0.12 mm/min, and 0.04 mm/min for individuals 1, 4, and 5, respectively (Fig. 2). Worm 1 was intermediate in size with a length of 30 mm and a width of 4 mm. Worm 4 was the smallest with a length of 13 mm and a width of 2 mm. Worm 5 was the largest with a length of 65 mm and a width of 8 mm. The smaller worms (1 and 4) consistently built tubes out of fine substrate while the larger worm (5) used shell substrate for tube building. Decreases in tube length occurred for all three worms between 12:00 and 14:00 each day (Fig 3). The longest tube of 495 mm was made by the smallest individual (4), while the shortest tube (150 mm) was made by the largest individual (5).

DISCUSSION

I hypothesized that larger terebellid worms would build tubes at a faster rate and with larger sediments than smaller worms because they are able to feed more and feed faster with larger tentacles. My results, however, refute parts of this hypothesis. The largest terebellid built the smallest tube at the slowest rate (Fig. 3). Since this worm consistently used the large shell for shell building, the rate could suggest that the pickup and removal of shell was much more energetically costly than the pickup and removal of fine sediment. Mucus at the tips of terebellid tentacles has weak adhesive properties; the handling of large (heavier) particles thus uses more energy in building tubes (Grémare 1988). However, even though this is more energetically costly for the worm, building a tube at a slower rate will still result in a sturdy shell tube. Sturdiness may be more important for fitness than the time it takes to build the tube (Rouse 2001). If the rate is associated with particle size, another component that may result in a slower rate for the largest worm is the particle size of the shell substrate. It could be that with more area between particles there are larger food items present in the substrate, thus more time gets spent digesting and processing.

However, when tubes were taken apart after six hour intervals, the rate of tube growth for all three worms was almost identical (Fig 3). This trend suggests that tube growth is an important factor for any terebellid that is exposed, as protection is a necessity. Differences may also be due to different species present; unfortunately I was not able to identify all worm species, except *Thelepus crispus* (the largest).

The decreases in tube length between 12:00-14:00 PDST could be due to light sources. Even though a garbage bag was used to reduce light input, during this time (12:00-14:00), light intensity is the highest. The terebellid worm, *Eupolymnia nebulosa* shows that with the onset of light, immediate reduction in activity follows. This indicates that light acts as an exogenous cue controlling activity rhythms (Grémare 1988), and in this case the rate of tube building.

This exploratory didn't take into account many of the environmental stresses in a rocky intertidal community, such as predation, wave action, and changes in salinity. In further studies of the rate of tube building, it would be interesting to see how the rate changes with environmental stressors. I would have also liked to have more worms and have been able to monitor the worms for a longer period of time. I would imagine that the story of terebellid tube growth would become more telling if these factors were taken into account.

LITERATURE CITED

Duchêne, J.C. 2004. Early recognition of sediment during settlement of *Eupolymnia nebulosa* (Polychaeta: Terebellidae) larvae. *Marine Biology* 145: 79-85.

Fauchald, K. and P.A. Jumars. 1979. The Diet of Worms: A Study of Polychaete Feedng Guilds. *Oceanogr. Mar. Biol. Ann. Rev.* 17: 193-284.

Grémare, A. 1988. Feeding, tube-building and particle-size selection in the terebellid polychaete *Eupolymnia nebulosa. Marine Biology* 97: 243-252.

Harman, O. 1969. Atlas of the Sedentariate Polychaetous Annelids from California. University of Southern California, Los Angeles, CA.

Rouse, G.W. and F. Pleijel. 2001. Polychaetes. Oxford University Press, Oxford, New York.

FIGURES

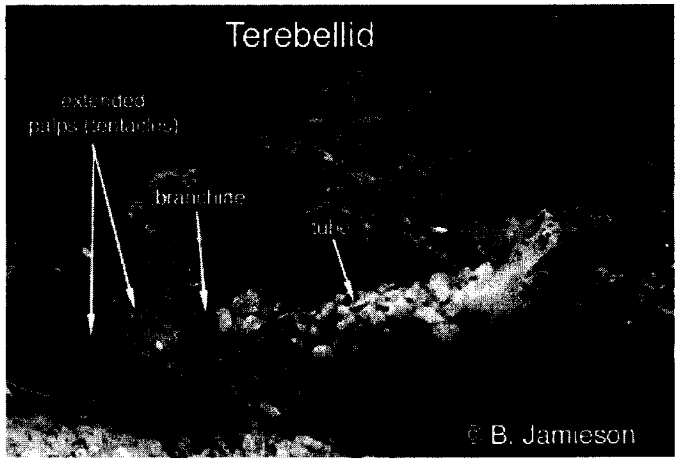

Fig 1: A terebellid in its tube showing major structures used for tube-building.

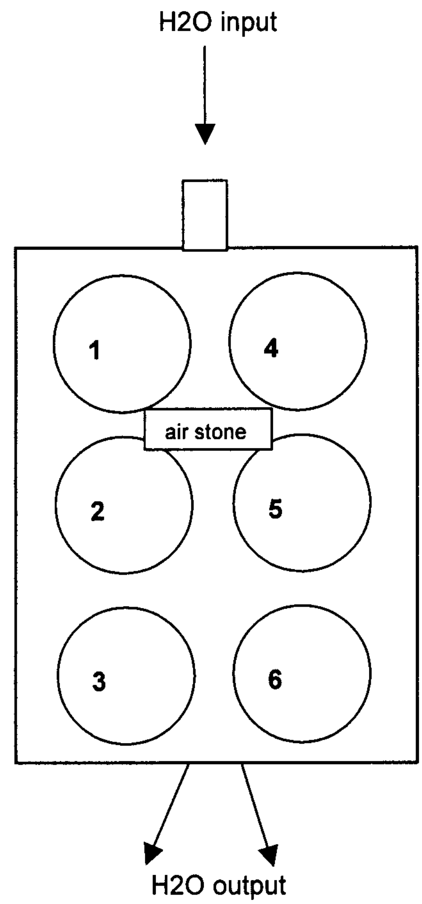

Fig 2: Exploratory set-up. Each worm was placed in an individual glass dish within a plastic container. Fresh seawater and oxygen were constant.

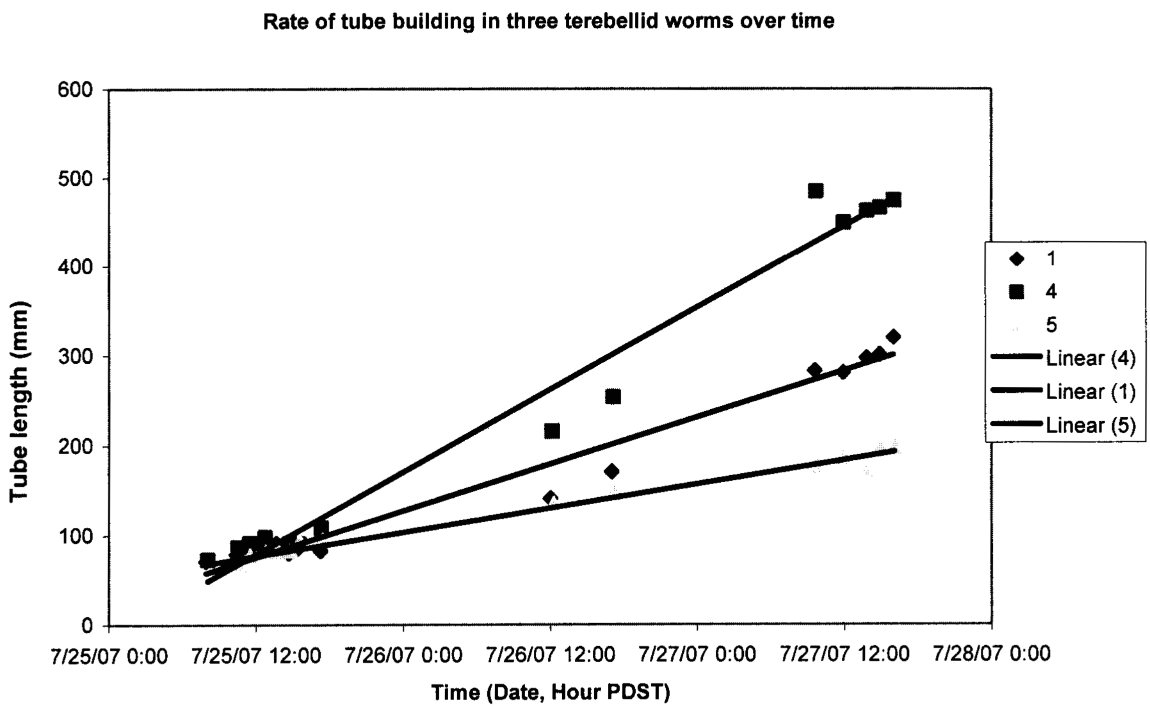

Fig 3: Rate of tube building in three terebellid worms over a three day period. 4 is the largest worm while 5 is the smallest worm.