

— POLYCHAETE CORRAL —

An Experiment of Bioturbation Activities of a Polychaete

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Introduction:

Knowledge of benthic infaunal behavior has eluded many in the scientific community. Though more recent studies have been lacking, it is known that many burrowing species contribute to the important tasks of bioturbation and bioirrigation, which aid in the transportation of nutrients and dissolved oxygen within the sediment column. An experiment to observe bioturbation activities of benthic infauna was designed using a home-made "ant-farm." Three trials were conducted in the field to find the optimum conditions in which to observe invertebrate behavior *ex situ*. Subsequent monitoring of infaunal movement within the apparatuses successfully took place over the period of 13 days with no visible incidents of mortality.

Methods:

- Infauna and sediment were collected from the northeast Chukchi Sea using a van Veen grab (Image 1).
- The observation aquariums were constructed by cutting the tops off of a 2 liter bottle and inserting a 1 liter bottle within. The inner water bottle was filled with water and the bottles taped together to enhance stability of each aquarium.
- The space between the 1 and 2 liter bottles was then filled approximately 1/3 of the way with sea water and 2/3 with sediment treatments (Image 2).
- All 3 aquaria were kept in a cooler filled with seawater on the deck; water was circulated/aerated manually at least 3 times a day via a hose.
- A single, large polychaete worm, *Nephtys paradoxa*, became the main focus of the study.

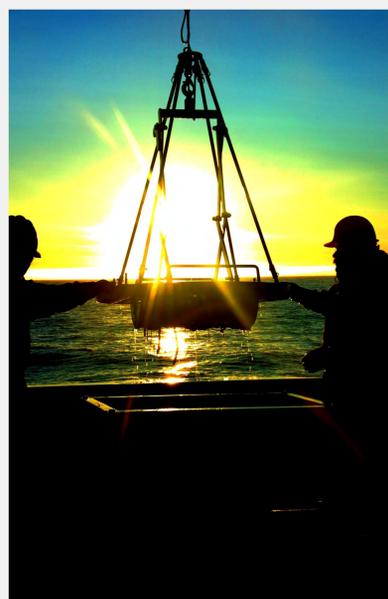


Image 1: Sipunculids dangle from the van Veen grab being retrieved from the northeast Chukchi Sea.

Results (continued):

- In the Trial 2 aquarium, a polychaete worm of the family Phyllodocidae was observed secreting thin layers of mucus, which it secreted throughout the entire aquarium, including around other inhabitants such as the worm *Nephtys paradoxa* (Image 5).
- Other polychaetes (from the families Sabellidae and Maldanidae) seemed to settle within the top layer of sediment and was not observed traveling deeper.
- The bivalve *Yoldia* sp. only buried beneath the first layer of natural sediment within each trial, and observed actively filtering sea water.

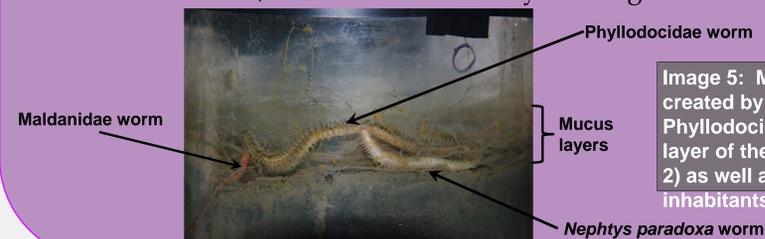


Image 5: Mucus layers created by the Phyllodocidae cover the top layer of the aquarium (Trial 2) as well as other inhabitants.

Trial 1:
Layers of colored sand varied in thickness and a surface layer of sediment (to provide nutrients and a familiar substrate for the organisms to burrow into)

Trial 2:
Sediment was placed directly into the bottle, filling it about 3/4's of the

Trial 3:
Sediment was layered between the sand layers.



Image 2: Sediment trials for which invertebrate behavior was examined.

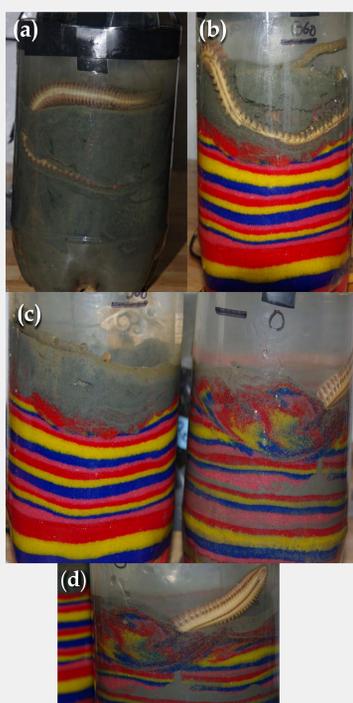


Image 3: a) *Nephtys* is shown burrowed within natural sediment; b) *Nephtys* is partially submerged within Trial 1; c) side-by-side comparison of Trials 1 & 3 shows the *Nephtys* burrowed to approximately the same depth within both trials; d) *Nephtys* is shown emerging from the top layer of Trial 3.

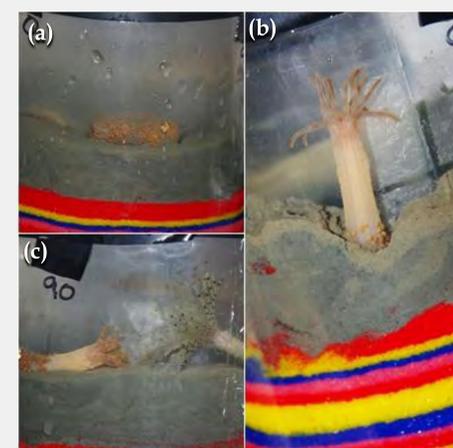


Image 4: A Cerianthid (burrowing) anemone initially placed on its side (a) was observed righting itself (b) and burrowed (c) over the course of a few days.

Results:

- *Nephtys paradoxa* burrowed deeper in the aquarium filled with natural sediment (Image 3a) compared to the experimental aquaria (with layered colored sand) where the worm burrowed to approximately the same depth (Image 3b & c).
- In all cases, the *Nephtys* emerged only to remain, for a majority of the time, on top of or partially submerged within the sediment (Image 3d).
- The worm was extremely active and escaped from the aquaria on a number of occasions.
- The *Nephtys paradoxa* was observed taking granules of sand into its proboscis and forcing the granules out mixing the colored sand layers (see video).
 - Recorded video also showed possible signs of avoidance between the *Nephtys* and other polychaetes and the bivalve *Yoldia* sp.
- Burrowing activity was reduced in the artificial sand of Trials 1 & 3 (Image 3). Greater activity was noted in natural sediment of Trial 2.
- In addition to this, a Cerianthid (burrowing) anemone initially placed on its side was seen to have righted and buried itself within the sediment over the course of a few nights (Image 4).

Discussion:

The experiment was successful in maintaining infaunal organisms in an aquarium and observing their behavioral responses to experimental sediments. The advantage of this particular design is that animal activities could be observed, photographed, and video recorded. There were no observed fatalities during the experiment.

Animals appeared to avoid the artificial substrates, preferring the natural substrates instead, and the large *Nephtys paradoxa* repeatedly escaped the aquaria. It is hypothesized that escaping animals may have felt cramped, may not like the feel of the plastic bottle, recognized the artificial substrate as a foreign environment, or were searching for a more substantial food source. A larger tank would be more appropriate for larger animals. Additionally, a tank with divided artificial and natural substrates (a choice experiment) would help to identify acceptable alternatives to artificially colored sand.

Photos and video evidence show that *Nephtys paradoxa* does contribute to bioturbation and bioirrigation of the sediment (Image 3c). Based on this evidence, the dense infaunal aggregations in the study area (Cochran et al., 2010 and Parris et al., 2010) suggest a high level of such activities in benthic communities of the northeastern Chukchi Sea.

Observed behavior of the invertebrates (e.g., the process of sediment intake by *Nephtys paradoxa* or the avoidance of the *Nephtys* by other infauna) are of great interest in understanding invertebrate interactions in the benthos. Further development of these aquaria may allow for greater insights into infauna

community ecology



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