Report Documentation Page

Form Approved OMB No. 0704-0188

1. REPORT DATE **30 SEP 2002**	2. REPORT TYPE	3. DATES COVERED **00-00-2002 to 00-00-2002**

4. TITLE AND SUBTITLE
Nutritional Control of Bioturbation in Marine Sediments

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Darling Marine Center, University of Maine,,Walpole,,ME, 04573

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
We focus on the role played by food quality in controlling sediment mixing by benthic animals in coastal sediments. We hypothesize that a threshold level of food abundance controls whether or not significant mixing can occur, that this threshold is driven by protein concentrations, and regional differences in mixing among coastal regions may therefore be explained by differences in protein contents.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**3**	

Nutritional Control of Bioturbation in Marine Sediments

Lawrence M. Mayer
Darling Marine Center, University of Maine
Walpole, ME 04573
phone (207) 563-3146 ext 237 fax (207) 563-3119 email lmayer@maine.edu
http://www.ume.maine.edu/~marine/mayer.htm

Peter A. Jumars
Darling Marine Center, University of Maine
Walpole, ME 04573
phone (207) 563-3146 ext 242 fax (207) 563-3119 email jumars@maine.edu
http://www.ume.maine.edu/~marine/jumars/paj.html

Award Number: N000140210653

LONG-TERM GOALS

We focus on the role played by food quality in controlling sediment mixing by benthic animals in coastal sediments. We hypothesize that a threshold level of food abundance controls whether or not significant mixing can occur, that this threshold is driven by protein concentrations, and regional differences in mixing among coastal regions may therefore be explained by differences in protein contents.

OBJECTIVES

1. Determine the threshold concentrations of sedimentary food at which marine benthic invertebrates can obtain nutrition and hence ingest sediments profitably.

2. Reassess feeding modes of various deposit feeders to establish feeding patterns that can be put into bioturbation models.

3. Test if nutritional threshold concentrations control the styles, depth distributions and seasonality of bioturbation at two types of field sites representative of many coastal areas.

APPROACH

Our approach begins with laboratory studies of animal growth and feeding style in response to varying protein contents of sediments upon which they feed. We will work with a variety of feeding types of benthic invertebrates, providing sediments engineered to vary protein levels while minimizing artifacts due to particle selection. Ultrasound will be tested as a means for determining feeding modes and rates. This lab work will be supplemented by field surveys of mixing intensity in a temperate and sub-tropical coastal region, which will use both spatial and temporal variations in food abundance to provide field tests of the results found in the laboratory component of the study. The chemical work on food engineering and analysis and measurement of various chemical parameters in the cores will be performed in L. Mayer's lab. P. Jumars lab will be responsible for raising animals in the laboratory and assessing their growth, plus determination of biotic variables in field samplings. Bioturbation will be assessed by both PI's, with help from D. Shull (Gordon College) and in collaboration with B. Boudreau (Dalhousie U.).

WORK COMPLETED

We are developing methods to vary protein loadings on glass beads that allow homogeneous particle populations. Nonporous beads were found to have insufficient surface area at the silt size range to hold sufficient protein for our anticipated protein loadings. We have therefore successfully bound proteins to porous glass beads that will allow sufficient protein loadings to be obtained. Intraparticle pore sizes of 50nm will allow sufficient acceess to the protein substrate by animal enzymes. We fed these beads to several species of spionid polychaetes in preliminary experiments.

A preliminary survey of several estuarine sites for the following year's field work was conducted in summer of 2002.

RESULTS

Our survey of estuarine sites convinced us to establish an offshore site for next year's field program, owing to excessive food levels inshore. We are hopeful that seasonal variations in food delivery at the deeper offshore site will allow us to find seasonal protein levels below the hypothesized threshold levels of food required for deposit feeding. This choice will also reduce the ability of the well-known temperature impact on mixing rates to confound our food-based hypothesis.

While sufficient protein loadings were achieved on beads, preliminary feeding experiments suggest potential unpalatability of derivatized beads. We are following up those preliminary experiments with more detailed observations and additional manipulations.

IMPACT/APPLICATIONS

Should a threshold food level prove to be important in controlling bioturbation, then preduction of macrofaunal mixing of marine sediments, both temporally and spatially, will become somewhat more predictable. The nature of the mixing process, and its impact on particle movement within the sediment column, will also become more predictable from an understanding of local species composition, production and detrital processing.