

ACOUSTIC INSTRUMENTATION FOR THE OBSERVATION OF BIOMASS AND SIZE-STRUCTURE OF ZOOPLANKTON AND THEIR TEMPORAL VARIABILITY

Sharon L. Smith and Harry A. DeFerrari
Rosenstiel School of Marine and Atmospheric Science
University of Miami
4600 Rickenbacker Causeway
Miami, Florida 33149
Telephone: 305-361-4819
Fax: 305-361-4765
Email: ssmith@rsmas.miami.edu

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LONG TERM GOALS

Many of the highly productive ecosystems of the world ocean are strongly forced physically and exhibit maxima in biomass and growth of zooplankton during bursts of phytoplankton growth. The role of the physical environment in shaping the community of zooplankton is difficult to study and can best be addressed in interdisciplinary studies using new instrumentation for quantifying biological response variables. Improved resolution of temporal and spatial variability of biomass of zooplankton and the physical environment are necessary steps before we obtain full understanding of mesoscale ecosystem questions.

OBJECTIVES

It is essential to continue improving the acoustic technology for observing zooplankton because its power is in the extended (in time primarily) and intensive (in space primarily) nature of the data it generates. We need both the capability for making long-term observations of plankton on continental shelves and for obtaining the data in real-time. We anticipate an instrument or set of instruments that are deployed over the continental shelf off Florida which broadcast their data daily allowing us to make additional measurements of important processes such as grazing and growth in a select and focused way.

Major advances in acoustical measurements have come about by applications of pulse compression techniques to problems of low frequency acoustics. Tomographic studies now underway routinely detect signals at ranges of up to 5000 kilometers. Without phase coherent processing and pulse compression, ranges would be reduced to about 50 kilometers. We believe that similar orders of magnitude improvements in the range of acoustic remote sensing instrumentation will come about by the application of pulse compression techniques to the high frequency problems. In theory, a new pulse compression scheme in use at the University of Miami has no side lobes and should

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increase the range in operation of a typical ADCP by a factor of 100. The critical factor in realizing this improvement in performance is knowledge about the randomizing effect of propagation through the real ocean. Such information can only be obtained by measurements at sea. This work is supported by ONR Biological Oceanography.

APPROACH

The development will be a two step process. In the first step, we will obtain the instruments, deploy a mooring, and develop the capability for collecting and analyzing real-time data. In the second step, we will use the real-time information to study processes of zooplankton, zooplankton biomass variations, and zooplankton community size-structure over the Florida continental shelf.

WORK COMPLETED

The instrumentation funded in this DURIP award have been ordered. We expect delivery before the end of November.

RESULTS

We do not have any results yet.

IMPACT

The proposed instrumentation will provide the basic ocean measurement suite to test signal processing concepts at sea. If successful, the method will have application to the problem of mine countermeasures and many other types of acoustic measurements in the ocean. If we are successful in improving both the multifrequency and acoustic Doppler current profilers for the measurement of zooplankton biomass in the sea, they should become widely used in all types of ecological investigations. The need for sensors which can be moored or used routinely on a CTD is great.

TRANSITIONS

Following our initial use of the acoustic Doppler current profiler to estimate biomass of zooplankton in the Middle Atlantic Bight (Flagg and Smith, 1989), the instrument has been used by us in several other projects and by others in various regions including Antarctica. We have gained substantial understanding of zooplankton variability on the mesoscale from all these various efforts, understanding that would never have been possible with net tows.

RELATED PROJECTS

At the present time, NOAA is funding interdisciplinary investigations of Florida Bay and several agencies including NOAA and EPA are involved in restoration of the marine environment of south Florida. Earlier studies, the Southeast Fisheries and Caribbean Recruitment project (SEFCAR), have found that the small eddies which are associated with the Florida Current and coastal current off the Florida Keys are an important factor in the movement of larval fish over the coral reefs. Moored sensors such as we expect to perfect with this DURIP equipment would contribute significantly to investigations of coastal ecosystems.

REFERENCES

Flagg, C.N. and S.L. Smith. 1989. On the use of the acoustic Doppler current profiler to measure zooplankton abundance. *Deep-Sea Research*, 36, 455-474.