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Zooplankton and Micronekton Distribution and Interaction with Predators at the Northwest Atlantic Shelf Break and its Canyons

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LONG-TERM GOALS

Our long-term goal is to address the interaction of physical and biological processes determining the distribution, abundance, community composition, and association with predators, including marine mammals, seabirds, and fish, of zooplankton and micronekton at the northwest Atlantic continental shelf break and its canyons, inclusive of the role of inter-annual variability and the effects of Gulf Stream warm-core rings. In the mid- to long-term, we anticipate addressing these topics via inter-disciplinary projects integrating our work on lower trophic levels with that of colleagues with expertise in physical oceanography, ocean acoustics, and bio-physical modeling.

OBJECTIVES

In advance of such a broader inter-disciplinary effort, we have multiple valuable datasets already available that can be mined to inform future fieldwork, including top predator visual survey data, depth-stratified net samples, and multi-frequency acoustic data collected at the New England shelf break and its canyons in 2005 and 2009-2012. These existing data were all collected under small awards internal to WHOI for pilot work or as unfunded add-ons to other cruises or ships-of-opportunity, and have thus remained largely un-analyzed.

The specific objective of this project is to work up these existing samples and datasets in order to provide a synthesis of spatial and inter-annual patterns of variability in zooplankton and micronekton at New England shelf break canyons, and, where feasible, associations with marine mammals and other predators.

APPROACH

We will process net samples for the lengths, abundance, and biomass of different zooplankton taxa, and combine these with analyses of the multi-frequency acoustic data in order to infer the taxonomic composition of scattering features and quantify the horizontal extent and vertical position of zooplankton and micronekton aggregations and layers. Together, the net and acoustic data will then be used in order to compare zooplankton and micronekton distribution, abundance, and community

composition within and between the three sampled canyons and time periods (2005, 2009-2012). Particular attention will be paid to inter-annual variability, the influence of warm-core rings and hydrographic conditions, and differences between canyons (e.g., between Hudson Canyon, which is an extension of the Hudson River channel, and Veatch and Atlantis Canyons, which are not associated with rivers). Next, statistical analyses will be conducted of the associations between the multi-specific assemblages of top predators, especially marine mammals, observed during a 2010 cruise with canyons, environmental conditions, and estimates of the abundance and horizontal and vertical distribution of lower trophic levels derived from acoustics and nets.

WORK COMPLETED

This award started on June 15, 2012, and to date we have begun the process of assembling data and samples for analysis. Fieldwork in August and September associated with other projects prevented us from making additional progress.

RESULTS

We have no results to report as yet.

IMPACT/APPLICATIONS

As noted above, in the longer term, we anticipate developing an inter-disciplinary research effort address ecosystem dynamics at shelf break canyons. We envisage linking such an effort to both the ONR Ocean Acoustics Shelf break/Slope/Canyon Field Experiment planned for 2016-2017 and to the NSF Ocean Observatory Initiative's Pioneer Array scheduled to be operational by 2014. The present project and resulting synthesis of patterns of variability in zooplankton/micronekton distribution at New England shelf break canyons and associations with higher predators will provide key information to generate future hypotheses and guide the development of such a broader effort.

RELATED PROJECTS

The top predator survey data to be analyzed here were collected as an unfunded add-on to a Woods Hole Sea Grant award to the present PIs from the 2010-2012 omnibus. The net sample and acoustic data were collected under a series of small projects through funds internal to WHOI.