ABSTRACT FORM (for new projects only)

Project Title: 901700 Acoustical Ocean Ecology

PI	Project Manager	Lead Scientist	Lead Engineer
Kelly Benoit-Bird	Chad Waluk	Kelly Benoit-Bird	[Enter Engineer here]

(Indicate individuals appropriate for your project. Not all projects need all four positions filled in.)

Project Description: Patchiness, or the spatial variability in biomass at relatively small scales, is a key feature driving animal behavior, biogeochemical cycles, trophodynamics, and ecosystem structure. To address the role of heterogeneity in ecosystems, this research will focus on simultaneously addressing three challenges: 1) the development of methods and approaches for quantifying patterns in the biota and 2) identifying the processes underlying observed patterns, and 3) understanding the consequences of biotic patterns on ecosystem processes. The proposed research provide new ways to visualize the variability in the abundance, distribution, and activity of biota in the water column by leveraging and building upon existing MBARI investments with the goal order to enhance understanding of the fluctuations and fate of forage species and their predators from the surface to the upper bathypelagic.

Recent work has shown that the fine-scale spatial distribution of prey determines the suitability of the food supply for predators. However, our understanding of the biological and physical drivers of the aggregation of forage species remains limited. Using vessel-based (Paragon and/or other small vessel) acoustic sampling, profiled cameras, underway CTD measurements, and remote sensing, we will begin to unravel how krill and schooling fish respond to topography and intra-seasonal variation in upwelling (Partners: Ryan and Figurski). Quantifying these driving forces is critical for predicting the state of the ecosystem, understanding predator-prey dynamics, and following the fate of carbon. This basic research will allow us to further our aims of further developing acoustic measurements and classification approaches and will provide an important base for future research with other platforms and directly ties to the larger scale studies being undertaken by Chavez and others

One key component of aggregation formation is the attraction of animals to others (e.g., schooling and swarming). We seek to further the development of the Dorado mapping AUV for water column applications (Partners: Caress and Thomas). We will deploy the AUV in areas identified to have aggregations of forage species to measure their shape characteristics and internal organization and how these features change with environmental influences including predator attacks. In addition to providing key new information on forage species behavior, this study is a good test case for biotic sampling with the mapping AUV which other researchers hope to exploit in more challenging arenas including the deep sea (Smith) and demersal habitats (Hobson).

There is a long-held view that the volume beyond the ocean's photic zone as largely homogenous, both physically and biologically, in the horizontal plane. Yet, visual observations MBARI's ROV program, and acoustic surveys at depth are challenging these views. We seek to take advantage of both of these approaches, leveraging MBARI's longstanding investments in technology and expertise in midwater (Partner: Robison). We propose to deploy a commercially available broadband echosounder with two transducers to cover frequencies extending from 50 to 150 kHz on Ventana in collaboration with the midwater ecology group in Monterey Bay and/or Hawaii. The acoustic system will be oriented forwards, paralleling a high-resolution camera to allow overlapping fields of view close to the ROV. These unprecedented in situ acoustical-optical measurements will greatly aid interpretation of other acoustic data, quantify the avoidance or attraction of animals relative to the survey platform, and provide a quantitative view of the spatial distribution of organisms in midwater.