

Exploration of the mesopelagic community using nets, acoustics, optics, and DNA White paper to NOAA Ocean Exploration and Research (OER)

Contact Information

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Willing to Attend Workshop?

(Yes/No) Yes, but remotely

Target Name(s)

Main Feature(s)/Area(s) of Interest: Our primary interest is exploring and quantifying the community of animals that live in the deep scattering layers (DSL) from 400 m to 2000 m depths using nets and acoustical, optical, environmental, and genetic sensors. The DSL is ubiquitous throughout the North Atlantic, but topographic features such as the New England Seamounts (Fig. 1) and mid-Atlantic ridge can modulate the spatial structure of the DSL.

Geographic Area(s) of Interest within the North Atlantic Ocean (Indicate all that apply)

Northwest: primary interest
North Central: secondary interest
Northeast: secondary interest
Southwest: NA
South Central: NA
Southeast: NA

Relevant Subject Area(s) (Indicate all that apply)

Biology: primary interest
Geology: NA
Chemistry: NA
Physical Oceanography: primary interest
Marine Archaeology: NA
Other: acoustical oceanography

Description of Topic or Region Recommended for Exploration

Brief Overview of Area or Feature: “The DSL” is an overarching term for a layer apparent in acoustic echograms that is present in the mesopelagic regions in all of the world’s oceans. This layer was extensively studied using acoustics, optics, and nets during and after WWII to characterize the DSL’s biological community. That interest waned until recently when commercial exploitation of the DSL as a source of protein is becoming technologically feasible and economically viable.

Brief Summary of Current State of Knowledge: Technological advances in acoustic and optical instrumentation have provided high resolution views of the DSL that upon close examination reveal a spatial structure that is vertically complex while remaining horizontally extensive (e.g., Fig. 1). The vertical migration of some of the layers in the DSL transports biomass from deep

waters to the sea surface providing an additional food source for predators (e.g., birds, small cetaceans) in low-nutrient pelagic regions. Recent estimates of the abundance and biomass in these layers have suggested an order of magnitude greater biomass than original estimates, suggesting that these layers may contain enough biomass for human exploitation. Genetic techniques and tagging technology (e.g., DTAGS) are beginning to elucidate the trophic dynamics of the DSL as food for apex predators such as beaked whales, tuna, and sharks. *Rationale for Future Exploration:* The “layers within layers” of the DSL are coarsely visible using hull-mounted acoustic systems and little is known about the species composition of these layers. Broadband acoustic systems, cameras, and eDNA samplers that can be towed in these layers will be critical for understanding migratory (or lack of) behavior and how the mesopelagic community is spatially structured. Acoustic diversity (i.e., acoustic backscattering patterns and features) may be an indicator of biological diversity, which can only be verified by nets, optical systems, and genetic samplers that directly sample the layers. We just completed a successful test and evaluation of the Deep-See system in August 2018 on the NOAA ship HB Bigelow. Deep-See is an acoustical, optical, environmental, and eDNA system that is towed at the depths of the DSL. With the newly installed 0.681 fiber optic cable, the Bigelow has the capability to tow an advanced system like Deep-See as well as sample the DSL with nets and water samples.

Relevant Partnerships (If Applicable)

Deep-See (Woods Hole Oceanographic Institution); Ocean Twilight Zone (Woods Hole Oceanographic Institution);

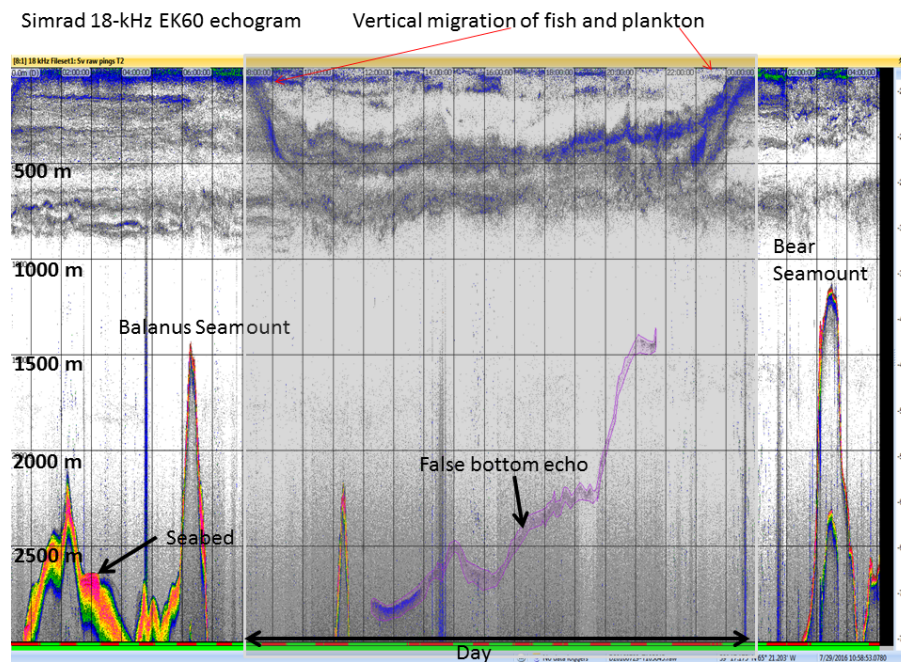


Figure 1. 18-kHz echogram along a transect from Balanus to Bear Seamounts on 28-29 July 2016. The seabed echo is the rainbow color feature near the bottom of the echogram and a false (aka “ghost”) echo is highlighted in purple. The acoustic scattering from about 400 to 1000 m is the DSL.