The Ecosystem Approach to Management (EAM) seeks to manage human activities in ways that sustain the functioning of ecosystems, including humans as part of the system.

Conserving biodiversity in the oceans is an essential part of EAM, but biodiversity contributes to the present functioning of marine systems as well as the long-term adaptability of systems to environmental change that results from the interaction of natural and anthropogenic forcing. Since human impacts are virtually unavoidable and patterns of impact are acceptable (the managers’ viewpoint). Conversely, from the scientific perspective, what patterns of biodiversity maintain functionality and adaptability, and how do we measure these?

We are synthesizing data from surveys and experiments in the Stellwagen Bank National Marine Sanctuary (SBNMS) and the Gulf of Maine to understand how the local landscape affects biodiversity patterns and ecological processes within the sanctuary (which is heavily used), how the bank interacts with the surrounding environment (inputs and outputs), and in what ways the results scale to the larger Gulf of Maine. To the extent possible, we present results in the form of ecosystem services, but caution that many important attributes and processes may not equate easily into this framework.

**HERE WE PRESENT FOUR SNAPSHOTS OF ONGOING WORK.**

**SPATIALLY EXPLICIT PATTERNS AND PROCESSES WITHIN THE SANCTUARY**

We are constructing a spatially-explicit model of processes that drive ecosystem services in the Stellwagen Bank Marine Sanctuary, including the role of advective and multibeam acoustic inputs and outputs. High spatial resolution is needed to characterize some aspects of the system, and we are using cells of 30 m on a side. Even in a well-studied system, biological data will be rare (a few % of the cells), but the framework helps encourage and guide the design and interpretation of sampling.

**ADVECTION**

A high-resolution finite volume circulation model (FV-COM) is used to depict climatological zones of input and output to/from the sanctuary—in this case using 15-day periods in mid summer. Sources and fates of propagules are obvious topics of interest, but nutrients, holoplankton and contaminants are among the others. Models can be run for specific areas of particular interest where knowledge is high, but for many taxa, informal approximations of larval duration will have to suffice.

**FISH GUILD ANALYSIS**

We have analyzed fisheries demersal trawl survey data by guilds (n=14 taxa). We show differences in guild abundance between seasons and between decades. The guilds (and changes between the two decades) are dominated by just a few species. The area has been fished for > 200 years, and the fish communities altered. An analysis of the functioning of this ecosystem should include an evaluation of current and recent status, as well as an estimation of what the system might have looked like historically (bison, P.B, migration, local foraging, etc.).

**BOULDER HABITAT**

Species dominance curves from three photographic transects in boulder reef stations inside (BI) and outside (BO) a fisheries closed area in the sanctuary. Sixty photographs were analyzed per area and satisfy ICE and ACE diversity estimators (EstimateS software) for adequately sampling species richness. Boulder ridges harbor many species not found elsewhere. Many of these species are comparitively rare, and require different conservation and monitoring strategies from the abundant ones. (LH-life history).

**CLIMATE CHANGE (DRIVERS)**

- Temperature
- Stratification
- Seasonal length
- pH
- Plankton community composition (isotopic and size composition) and dynamics

**HUMAN EFFECTS (DRIVERS)**

- Physical effects on geomorphology, organisms, sediment chemistry (from fishing, pipelines, cables, wrecks)
- Biological removals (genetic, behavioral and trophic effects, community composition)
- Chemical effects
- Noise
- Traffic

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