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# Collaborative nowcasting of seascape dynamics to develop models for accurate estimates of past and future availability of fish to fisheries and fisheries indepdent surveys.

John P Manderson

Distributions and abundances of marine resource species are changing rapidly in response to climate driven changes in hydrography and hydrodynamics. As a result accurate models of seascape dynamics are essential tools for understanding changes in the availability of fish to fisheries and fisheries independent surveys used develop harvest quotas. Uncertainties are usually greater in the ecological components of seascape models than in oceanographic components. Gaps in the information available for calibrating species resource selection functions are largely responsible for the uncertainties. These gaps can filled by co-developing a crowd-sourced "macro-ecology" with fishing industry-science partners within the domain operational integrated ocean observation systems IOOS, along with more traditional fishery independent surveys and investigations of physiological, trophic, and movement ecology. I describe the early development of a field research program initiated by industry-science partners in the Northeast US that combines nowcasting of seascape dynamics with the crowd-sourcing of real time monitoring of ocean processes and catch during fishing operations. The goal of the program is to use fishery dependent understanding of the ecosystem as well as fishery dependent data to continuously refine models that can be applied in population assessments and tactical management in a rapidly changing, spatially dynamic marine ecosystem. The models should allow industry partners to reduce collateral damage to the ecosystem while increasing economic efficiencies of harvesting allocated quotas. The program is intended to produce accurate operational models for hindcasting and forecasting at a fraction of the cost possible using traditional methods.

**Keywords:** Nowcasting seascape dynamics, fishing industry-science partnerships, Fishery Dependent Monitoring, Macroecological field methods, model development, Integrated Ocean Observing System.

**Contact author:** John P Manderson. North East Fisheries Science Center, Highlands New Jersey, USA. Email: john.manderson@noaa.gov

Models of seascape dynamics are essential for understanding and forecasting effects of climate forcing on availability of fish populations to fisheries and assessment surveys and

the consequences of interactions between space and time based management strategies and seascapes dynamics.

populations models

Develop a field ecology at the scale of the regional ecosystems in collaborations with fishing industry experts who have access and knowledge and who will ultimately develop quotas and regulations

Ownership of the tools used to manage them

Tremendous advances in oceanographic observing and modeling systems over the last decade have led to unprecedented developments in the nature of information available to marine science. While improvements in observational technologies and networks have garnered much attention, remarkable developments in forecasting the ocean have received much less focus. Exploiting this new predictive skill to improve scientific understanding, generate advice, and aid in the management of marine resources is emerging as one of the new challenges of marine science.
The potential for predicting the ocean far exceeds that of the atmosphere. The slow-dynamics (and therefore "long-memory") of the ocean mean that anomalies can persist for months or longer and can thus be used as the basis for simple persistence forecasts. State-of-the-art global climate prediction systems can increase forecast skill above persistence, adding further value and allowing for higher forecast skill at longer lead times. Moreover, in some areas, most notably in the Northeast Atlantic (but also potentially in the North Pacific and Southern Ocean), statistically meaningful predictive skill of variables such as sea surface temperature has been demonstrated out to five years or more.
Translating these predictions of the physical environment into biological outcomes, on the other hand, is not straightforward. Fisheries scientists, for example, have been trying to understand the links between physics and biology to generate predictions of variables, such as recruitment, for close to a century with limited success. Nevertheless, spatial distributions and the timing of key events, which have received less focus, are often tightly linked to the physical environment and may have management relevant applications.
This session aims to provide an overview of marine forecasting at seasonal-to-decadal scales, a scientific field that is still in its infancy, and allow researchers to share their experiences of developing prediction systems for marine resource management. It is also an opportunity for those involved in advice and management of these systems to get an overview of a rapidly emerging field and consider how this new knowledge can be used to benefit human societies.
We welcome contributions that address all aspects of prediction in marine ecosystems, including:

- What aspects of the marine physical (and chemical) environment can be predicted? For what variables and over what time and space scales does predictability exist? How does the predictability arise?
- What aspects of the marine biological environment can be predicted? What biological responses are the most predictable and why?
- Do we need to have mechanistic understanding or can useful predictions be predicated on the basis of correlative relationships?
- How do we assess the quality (skill) of a prediction?
- What can be learned from biological predictions already being made on the climatic (centennial) time-scales? Where are there similarities and where are there differences?
- How do we use predictions of biological outcomes in pre-existing advice and management structures? What structures are required to take advantage of this new knowledge? How can these estimates be incorporated into management strategy evaluations?
- How do we make predictions with a frequency and timeliness that is appropriate for end-users?
- Does predictive knowledge have a value in the management of marine systems? How can we quantify the value of such knowledge?
- Case studies of existing and proposed predictive systems
- Needs for future research, advisory and management structures

Authors submitting abstracts to this theme session are also encouraged to submit their manuscripts to the associated “Research Topic” hosted by Frontiers in Marine Science. More information can be found here.