THE SKIMMER ON MARINE ECOSYSTEMS AND MANAGEMENT

Published on *Marine Ecosystems and Management (MEAM)* (https://meam.openchannels.org)

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From the Editor: MEAM's new electronic format: What do you think? [1]

Dear MEAM subscribers,

In the past few months, we have relaunched MEAM as an all-electronic, monthly newsletter with more applied, practitioner-focused content. We have also set up a new website (https://meam.openchannels.org [2]) with all the issues of MEAM dating back to our launch in 2007. We'd love to get your feedback on the new format and website and hear any suggestions you have for new features and improvements. Please send comments and suggestions to me at meam@openchannels.org. Thanks!

Best wishes for your work,

Sarah Carr

MEAM Editor

Management on the Move: Making EBM and MSP More Dynamic [3]

Ocean environments, ocean life, and ocean users are often highly mobile, but most ocean management techniques are not. This mismatch leads to ocean management that is, at times, ineffective, inefficient, or both. An emerging management approach – "dynamic ocean management" – could change that. Dynamic ocean management uses techniques that change in space and time, reflecting the actual or predicted movements of ocean life and ocean users rather than relying on traditional static measures such as fixed boundaries or seasons.

This dynamic approach has the potential to narrow the spatial and temporal scope of regulations and thus reduce the social impacts of regulations (e.g., managers would close a portion of a fishing ground rather than an entire fishery to avoid exceeding bycatch limits). Most applications of dynamic ocean management to date have involved the fishing and shipping industries. But there is the potential to expand the approach to regulation of alternative energy sources (including wind, solar, and tidal energy), oil and gas production, military operations, and even mobile marine protected areas. For instance, observations of marine mammals in an area could trigger holds on military training exercises, tidal power generation, or seismic exploration for oil and gas. [For more information on current and potential applications, see the references at https://www.openchannels.org/literature-library-top-lists/top-15-dynamic-ocean-management [4].]

Implementation of dynamic ocean management comes with tremendous information needs, however. Managers need to obtain and act on near real-time information on ocean ecosystems and users, then communicate changing management measures to those users. Dynamic ocean management is emerging now because recent advances in remote sensing, animal tracking, ship tracking, species distribution modeling, and mobile communications are enabling the rapid collection, transmission, and analysis of data. [See this month's EBM Toolbox [5] for a more in-depth overview of some of the new tools making dynamic ocean management possible.] One of the next hurdles dynamic ocean management needs to overcome is the development and acceptance of new legal instruments that would allow for rapid changes in management measures. In many cases, new legislative authority that focuses on outcomes (e.g., bycatch limits) rather than process (e.g., seasonal closures) will be needed. [For a deeper discussion of legal issues with dynamic ocean management implementation, see Hobday et al. 2014.]

MEAM spoke with two dynamic ocean management experts to learn more about how this new management approach relates to ecosystem-based management (EBM) and marine spatial planning (MSP) and ways marine conservation and management practitioners can start to make their work more dynamic. Alistair Hobday is a principal research scientist with Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) and is based in Hobart, Tasmania. Sara Maxwell is an assistant professor in the Department of Biological Sciences at Old Dominion University in Norfolk, Virginia, US. [Another dynamic ocean management expert Daniel Dunn of Duke University gives an overview of enabling technology in this month's EBM Toolbox [5].]

MEAM: So how does dynamic ocean management relate to EBM and MSP? Does it replace these types of management systems or integrate into them?

Hobday: Dynamic ocean management extends the "toolbox" of EBM and MSP. It can be considered an alternative to static spatial management approaches, particularly when the ocean conditions and species of interest are dynamic (i.e., move in space and time). Static management approaches (e.g., marine protected areas) may penalize ocean users by the MPAs' being too large and covering areas where at times a species of interest is not above some threshold of concern. Alternatively, static areas can be too small, penalizing the species by allowing risk-causing activities in areas we would prefer to protect. The dynamic approach allows the appropriate area to be selected for the time period of interest. Consistent with EBM and MSP, dynamic ocean management can utilize a range of data - from simple biological information through to social and economic information.

Maxwell: Dynamic ocean management does not replace EBM, MSP, or adaptive management – rather, it is an additional tool to implement them. Within the adaptive management framework, dynamic management is applied at the Implementation stage (see figure below, from Maxwell et al. 2015). For example, if managers are deciding what parts of a species habitat to protect (e.g., defining core protected habitat using habitat modeling) in the Adjust and Access phases of adaptive management, dynamic management comes into play by regularly determining where that core protected habitat is using decisions made earlier in the adaptive management process.

 [6]

Integration of dynamic ocean management with adaptive management. From Maxwell et al., 2015.

MSP has traditionally made trade-offs between competing interests by treating the marine realm as static. Dynamic management allows for consideration of the oceans' variability.

Furthermore, managing ecosystems and conducting spatial planning in the context of climate change is a formidable challenge. Applying a flexible means of implementing management such as dynamic management allows managers to incorporate changes in marine environments into management plans.

MEAM: Can you give some examples of actual situations where EBM or MSP have become more dynamic?

Hobday: We recently reviewed nine examples where dynamic ocean management is used, eight of which were related to fisheries (see Lewison et al. 2015). For example, in the Eastern Australian longline tuna fishery, areas closed to limit bycatch were originally static (i.e., all waters south of a certain latitude). Since 2003, habitat areas of bycatch species have been identified every two weeks during the fishing season. Over time, managers have started using more complex boundaries that more closely match ocean habitats. In 2008, 88% of prediction reports delivered to managers led to direct management action (i.e., changing the location of boundaries) compared with only 28% in 2003.

Maxwell: For a non-fisheries example, on the US East Coast, NOAA regularly conducts aerial surveys for Atlantic right whales. When three or more whales are encountered in a region, a 'dynamic management area' is created for 15 days. To reduce ship strikes, ship captains are asked to either avoid these areas altogether or reduce speeds while transiting the areas. Similarly, off Cape Cod in the northeastern US, acoustic sensors are used to detect the presence of right whales in shipping lanes. When a whale is detected, vessels are asked to reduce speeds in the channel to reduce ship strike mortality.

MEAM: What are some feasible, near-term steps current EBM and MSP efforts can take to make their management systems more dynamic?

Hobday: In most cases, dynamic ocean management has been implemented in response to a crisis – such as the proposal to close a very large area to manage the risk of some activity. I have three main suggestions for managers thinking about proactively making their management systems more dynamic:

- Start by holding scoping meetings with stakeholders to discuss the benefits and limitations of dynamic ocean management in a particular system. This way you can focus on developing the best fitting dynamic ocean management scheme. But remember that these schemes do not have to be perfect to start with, since making adjustments is a feature of the management approach. In the case of the east Australian longline tuna fishery, improvements to model quality and performance were made each year between 2003 and 2012 then the same model has been used since then.
- While the focus is often on the technical development of a dynamic management approach (such as developing a model to predict where a species might be in each month of the year), the remaining steps – decision-making, implementation, and enforcement – are also critical. Work with specialists in information delivery, managers who will be making decisions, and agencies responsible for enforcement to ensure the regulatory and governance arrangements are also going to be suitable.
- The major cost of developing habitat models is the initial data collection. But for many high profile species (e.g., sharks, turtles, seabirds), sufficient tracking data may already exist to develop a habitat model. Obtaining this information can be difficult, but you can often find networks for sharing this sort of information.

Maxwell: One critical step to implementing dynamic management is to determine where incentives for dynamic management may exist to make it of interest to stakeholders, and which species/systems it may be advantageous for. Dynamic management will work particularly well with species (or species' life history stages) that tend to be highly aggregated and predictable, whether they are moving over large or small spatial scales. For example, in the New England scallop fishery, yellowtail flounder are a quota-managed bycatch species to which dynamic management has been applied. With assistance from University of Massachusetts Dartmouth School of Marine Science and Technology, fishermen have found that the location of yellowtail flounder the previous day is a good predictor of where they will be the next day. This has resulted in the fishery staying below its yellowtail flounder quota for several years in a row, allowing for scallop fishing across the entire season. It is important to note that applications of dynamic need not be complex. Reduction of yellowtail flounder bycatch in the scallop fishery utilizes fishermen-supplied bycatch information, email, and simple addition and is still an example of a remarkably successful dynamic management approach.

For more information

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References

Hobday, A.J. et al. 2014. Dynamic ocean management: Integrating scientific and technological capacity with law, policy and management. Stanford Environmental Law Journal 33(2): 125-165. Download the article for free at https://journals.law.stanford.edu/sites/default/files/stanford-environme... [7].

Lewison, R.L. et al. 2015. Dynamic Ocean Management: Identifying the Critical Ingredients of Dynamic Approaches to Ocean Resource Management. Bioscience: doi:10.1093/biosci/biv018. Download the article for free at http://centerforoceansolutions.org/publications/dynamic-ocean-management... [8].

Maxwell, S.M. et al. 22015. Dynamic ocean management: Defining and conceptualizing real-time management of the ocean. Marine Policy 58: 42–50. Download the article for free at www.sciencedirect.com/science/article/pii/S0308597X15000639 [9].

Learn more about dynamic ocean management

- Check out the dynamic ocean management session at Ocean Sciences 2016 in New Orleans, Louisiana, US (21-26 February 2016): Dynamic Ocean Management: Managing at Finer Scales for Mobile Ocean Resources https://agu.confex.com/agu/os16/preliminaryview.cgi/Session9332 [10]
- Find key publications, including examples of dynamic ocean management in action, at https://www.openchannels.org/literature-library-top-lists/top-15-dynamic-ocean-management [11].

The EBM Toolbox: The Tools Behind Dynamic Ocean Management [12]

By Daniel Dunn

Editor's note: The goal of The EBM Toolbox is to promote awareness of tools for facilitating EBM and MSP processes. It is brought to you by the EBM Tools Network (www.ebmtools.org [13]), a voluntary alliance of tool users, developers, and training providers.

Dynamic ocean management aims to move toward real-time management of marine resources so they are managed at scales more closely aligned with their variability and use. This approach to management is still in its infancy, and few end-to-end tools exist to support its application in any given field. Tools used for dynamic ocean management to date have focused on: 1) reducing the time required to collect and upload data and transmit management products and 2) automating data processing and model development to allow for rapid updating of management products. Some examples of tools currently being used in shipping and fishing applications are below.

Data collection and data upload

The tools used for data collection and upload depend largely on the industry attempting to employ dynamic management. Information on shipping traffic is conveyed in near real time by automatic identification systems (AIS). To allow near real-time capture and uploading of fisheries data, fishermen and managers have turned to mobile apps such as Digital Deck [14], eCatch [15], mFisheries [16], Deckhand [17], and iAngler [18]. [*Editor's Notes: Read more about how these apps work in the EBM Toolbox column "From Paper to Digital - The Mobile App Revolution in Fisheries" (MEAM 7:3 Dec13-Jan15;* https://meam.openchannels.org/node/5310 [19]*).*]

Data processing

Dynamic management products such as habitat maps are developed during data processing through the use of geographic information systems (GIS) and/or custom automated analyses. Examples of custom automated analyses include habitat models used in the Eastern Australian longline tuna fishery and gridded heatmaps of bycatch used in the US East Coast scallop fishery. However, some online data warehouses (e.g., iOBIS.org [20], OBIS-SEAMAP [21], wildlifetracking.org [22], Movebank [23], OzTrack [24], and seabirdtracking.org [25]) have begun to offer value-added products that include data ingestion from satellite and cell phone tags, filtering, sampling of oceanographic variables, and track mapping. These products can then be developed into full dynamic management products using other tools such as Marine Geospatial Ecology Tools (MGET) [26]. MGET can generate gridded heatmaps for grid-based closures, habitat suitability maps, and move-on rules that temporarily close part of a fishery when a catch or bycatch threshold is reached.

Data delivery and implementation

The primary mechanism for delivered dynamic management products to users is email or daily updates to a website. For example, Turtlewatch [27] provides a daily map of sea surface temperatures with an outline of the area corresponding to higher probability of interaction with loggerhead sea turtles. Mobile apps have also been developed to deliver content and aid implementation of dynamic management measures. WhaleAlert [28] and eCatch [15] are examples of frequently used apps that deliver real-time information to the shipping and fishing industries to help avoid unwanted interactions.

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Dispatches from the Field: 21 October 2015. Corsica, in 'the sea at the center of the Earth' [29]

By Tundi Agardy, Contributing Editor, MEAM. Email: tundiagardy@earthlink.net

We're in wild and rugged Corsica, smack dab in the middle of the Pelagos Marine Sanctuary, in what the ancients called 'the sea at the center of the Earth' – the Mediterranean. The sea is roiling, not only from being whipped by the wind, but also from the abundant life below the surface. For all those who think of the Mediterranean as overdeveloped, stripped of resources over the millennia, it might come as a surprise that there are still productive, wild places, harboring marine biodiversity of global significance. Similarly it might surprise people to learn that in this region known for conflict and conquest, for prizing old world tradition over innovation, some of the most exciting and progressive cooperative marine management in the world is unfolding.

Readers may be familiar with the Pelagos Sanctuary for Mediterranean Marine Mammals, the world's first marine protected area with a high seas component, decreed jointly by France, Italy, and

Monaco in 2002. This large reserve was created in recognition of the surprisingly high abundance of marine mammals in this part of the Mediterranean, a fact noted by Monaco's Prince Rainier as he gazed from his palace balcony at waters churning with life. It was he who spearheaded the Pelagos designation. And in the intervening years, many more marine conservation champions have taken up the baton to study and safeguard the fin, sperm, and beaked whales; dolphins; and other species that congregate to feed in the food-rich frontal-driven upwelling systems.

There is a problem with Pelagos, however. The boundaries that once captured this marine mammal diversity hotspot no longer encompass all of the most critical habitats. Fin whales in particular are spending much of their time outside the reserve, in dynamic frontal systems and critical feeding areas only newly identified. Thus the Pelagos Sanctuary no longer serves some of the very organisms it was established to protect.

Remarkable promise for cooperation

This is where it gets complicated, and also where there is tremendous promise for seeing remarkably innovative marine conservation – for the Mediterranean is a region extraordinarily sophisticated, and extraordinarily cooperative in its approach to science and management. Scientists from all corners who work on Mediterranean ecology, oceanography, geology, and social sciences come together periodically under the umbrella of CIESM (the International Commission for the Scientific Exploration of the Mediterranean Sea[30]). Similarly on the management front, MedPAN (Network of Marine Protected Area Managers in the Mediterranean[31]) brings MPA managers from across the region together to exchange ideas, participate in trainings, and promote capacity building. And the Mediterranean Action Plan [32], a UNEP Regional Seas Convention Secretariat, unites all 21 riparian countries and the EU for joint priority-setting, mapping, management, and monitoring towards common ecological objectives, in true EBM fashion.

Within the boundaries of Pelagos, whales are protected by cutting edge technology REal time Plotting of CETaceans – REPCET [33]) that delivers real time information about their whereabouts to captains of the many high speed ferries and cargo ships that travel through the sanctuary. All well and good, but what about those whales that feed outside the boundaries of the much-respected Pelagos Sanctuary?

Fortunately, whale researchers from Italy, France, Spain, UK, and the US (and likely other places as well) have pooled their knowledge about the ecology of marine mammals in the Mediterranean and come to consensus on the factors that seem to drive the movements of many of the target species. For instance, Arianna Azzellino, working with marine mammalogists from Tethys Research Institute [34] in Milan, has developed a model that uses oceanographic information to predict where these animals will spend their time feeding. Planners can use this information to identify priority conservation areas that are dynamic and move with the whales, creating protection beyond Pelagos. As these areas are identified, an expanded REPCET system could not only to verify model predictions, but also alert ships passing through these dynamic areas that whales are present in droves.

I have the great good fortune to be working with numerous Mediterranean conservationists to explore how these cutting edge scientific findings and tools can best be harnessed. Adaptive management of the region's marine mammals, flagship and umbrella species that they are, will have great chances for success only because of the commitment Mediterranean countries, scientists, and maritime users have for the same goal – keeping Mediterranean waters roiling with life.

[Editor's note: See the textbox "'The First High-Seas MPA' - The Pelagos Sanctuary for Mediterranean Marine Mammals" in the September 2003 issue of MPA News[35] *for an explanation of why the Pelagos sanctuary can be considered a high seas MPA.]*

Other coverage of the Pelagos Sanctuary

- "MMPAs in the Mediterranean, and lessons from the Pelagos Sanctuary" by Giuseppe Notarbartolo di Sciara of the Tethys Research Institute: http://depts.washington.edu/mpanews/MPA121.pdf [36]
- "Pushing forward the Pelagos Sanctuary and the conservation of marine mammals in the Mediterranean Sea" by Giuseppe Notarbartolo di Sciara of the Tethys Research Institute: https://www.openchannels.org/blog/disciara/pushing-forward-pelagos-sanctuary-and-conservation-marine-mammals-mediterranean-sea [37]

Notes & News: USD$100 million being raised to increase coastal resilience of SIDS · Help from Hollywood for communicating science · Database integrates global ocean currents · US federal agencies employing EBM · MSP quality management · MSP Insights [38]

Blue Guardians to provide technical and financial assistance to increase coastal resilience of SIDS

Blue Guardians is a new international partnership of Small Island Developing State (SIDS) governments, private sector technology and data providers, philanthropic foundations, multi-lateral development organizations, and conservation NGOs. The partnership is committed to providing the geospatial data, information and planning tools, technical assistance, and financial support SIDS need to develop national climate resilience strategies. It also provides an associated pipeline of investment projects to increase coastal resilience to climate change, marine and fisheries conservation, and renewable energy. Blue Guardians is raising a US $100 million multi-donor trust fund to provide participating islands with technical assistance, data acquisition, and natural resource management. Learn more at www.businesswire.com/news/home/20150928006358/en/Blue-Guardians-Partnership-Established-Protect-Oceans-Improve#.Vh_1lH6rRMw [39].

Hollywood filmmaker's book helps scientists communicate their work

The marine-scientist-turned-Hollywood-filmmaker Randy Olson has released a new book Houston, We Have a Narrative. The book describes some of the things scientists do wrong when communicating their work to non-scientists and provides a simple method "And, But, Therefore" for scientists to build stories about their work. The book is available for purchase at www.amazon.com/Houston-We-Have-Narrative-Science/dp/022627084X [40].

New database integrates global ocean currents

The US National Oceanic and Atmospheric Administration has released the Global Ocean Currents Database, which integrates ocean currents observations from a variety of instruments with different methods, resolutions, and spatial and temporal variability. The database has a tailored web application that allows users to search for ocean currents data by platform types and/or spatial and temporal ranges of interest. Access the database free of charge at www.nodc.noaa.gov/gocd [41].

Study finds US federal agencies employing EBM practices and principles

A new paper "The status of marine and coastal ecosystem-based management (EBM) among the network of U.S. federal programs" published in Marine Policy summarizes the status of EBM for a number of US federal programs, including ones that oversee fisheries, offshore energy development, and species protection. The federal programs that were surveyed for the study employed a relatively high number of EBM best management practices and principles. The authors found substantial differences, however, in perceived and effective performances across programs, with programs that focus on the management and stewardship of natural resources for the common good ("management programs") showing a higher level of integration of EBM approaches than programs that provide information to advance the management and stewardship of natural resources for the common good ("non-management programs"). The authors provide suggestions for further integration of EBM principles into federal programs including more and better integration of human dimension components in management planning processes and activities. The paper is available free of charge at www.sciencedirect.com/science/article/pii/S0308597X15002122 [42].

Report provides guidance for quality management of MSP processes

The International Council for Exploration of the Sea (ICES) has released a report "Marine Spatial Planning Quality Management System" that provides a clear structure for setting up a marine spatial planning (MSP) process. The structure provides guidance on what should be incorporated when designing and managing an MSP process and sub-processes, as well as information that should be included at different stages of a process from a quality management perspective. The report is available free of charge at www.ices.dk/sites/pub/Publication%20Reports/Cooperative%20Research%20Report%20(CRR)/crr327/Marine%20Spatial%20Planning%20Quality%20Management%20System%20CRR%20327.pdf [43].

Insights from marine spatial planning symposium available

The 2015 International Marine Spatial Planning Symposium "Sharing Practical Solutions" held on 6 October 2015, in Narragansett, Rhode Island, US, was live-streamed to viewers worldwide and recorded. The program included insights from the keynote speaker Jeff Grybowski, chief executive officer of the US' first wind farm, and the sharing of experiences and lessons learned from ocean planning practitioners from around the US as well as Canada and the UK. View videos of the proceedings at http://rhody.crc.uri.edu/msp15 [44].

From the Archives: How Conservationists, Industry, and Government All View Risk Differently, and What This Means for EBM (MEAM October-November 2009, Issue 3:2) [45]

Editor's Note: From the Archives *calls attention to past MEAM articles whose perspectives and insight remain relevant.*

This article by Jake Rice, former senior national advisor for ecosystem sciences with Canada's Department of Fisheries and Oceans, discusses how conservationists, industry, and government managers exhibit different types of risk aversion to management errors – "misses" and "false alarms" - and how understanding these differences can lead to more constructive dialogues.

Read the article at https://meam.openchannels.org/news/meam/how-conservationists-industry-and-government-all-view-risk-differently-and-what-means-ebm [46].

Printer-friendly version [47] PDF version [48]

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