



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

Mapping Human Activities and Impacts on the Ocean: Interviews with Two Practitioners

Marine spatial planning (MSP) aims to organize the use of marine space in a way that balances demands for development with the need to protect ocean ecosystems. By allocating specific human activities to particular areas, MSP can help reduce user conflicts (when there is spatial overlap among uses) as well as conflicts between uses and important natural areas.

For such planning to take place, information is needed on where human uses are currently happening, and ideally what impacts those uses are having. As MSP receives greater attention from management institutions worldwide, the need to map existing human uses of the ocean is increasing, too.

Below, MEAM talks with practitioners about two projects that assessed human activity in the oceans. One mapped human uses in waters off eastern Canada to inform future MSP efforts. The other measured the cumulative impact of human activities in oceans worldwide, for potential application to global or regional planning projects.

Mapping human uses as a baseline tool

Published by Canada's Department of Fisheries and Oceans (DFO) in 2007, the *Grand Banks of Newfoundland: Atlas of Human Activities* provides planners with detailed maps of human activities on the Grand Banks, a group of underwater plateaus southeast of the province of Newfoundland and Labrador. The activities include fisheries for more than 24 species, oil and gas production, maritime traffic, oceanographic research, submarine cables, and military waste disposal. The atlas is available at www.dfo-mpo.gc.ca/Library/336890.pdf.

Sigrid Kuehnemund is section head for integrated management in DFO's Newfoundland and Labrador region, which managed the atlas project:

MEAM: How is the atlas being used?

Sigrid Kuehnemund: The atlas is the only comprehensive spatial depiction of the array of human activities occurring on the Grand Banks of Newfoundland during a specific time period (2000-2003). This publication allows government agencies and stakeholders to develop a better understanding of the spatial extent of activities, areas of overlap, and potential user conflicts. This is useful as a baseline tool for marine spatial planning purposes as a means of implementing integrated management in the Placentia Bay - Grand Banks Large Ocean Management Area.

DFO has also been using the atlas as an information source to aid in assessing threats from human activities to valued ecosystem components. This is done both at the Large Ocean Management Area scale and at the finer scale of Ecologically/Biologically Significant Areas.

MEAM: What were the main challenges DFO faced in producing the atlas?

Kuehnemund: The most significant challenge was timely acquisition of the numerous data sets required to represent all of the themes defined in the scope of the project. Much of the data came from within DFO, but considerable information had to be tracked down from outside sources. This was achieved through effective communication: the objectives of the atlas were clearly explained to all data-providers to ensure data requirements were met and that maps could be produced as quickly as possible. As part of the quality-control/quality-assurance process, these lines of communication were also invaluable for review purposes, allowing data-providers additional input on the final product.

MEAM: Considering that uses of the ocean can change over time, how often will the atlas need to be updated to maintain its usefulness for planning?

Kuehnemund: A five-year timeframe [for revision] seems reasonable given the level of effort involved in data acquisition, time required for new data sets to be developed, and availability of resources and time. Integrated management is a continuous process of planning, monitoring, and evaluation. As a contribution to planning, spatial depiction of human activities can be a component of monitoring that can be revisited as part of the evaluation of the integrated management plan. The integrated management plan objectives will inform what spatial updates may be required.

MEAM: Most of the data in the atlas are relatively recent, from 2000-2003. Is there a role for older, more historical data on human uses in a project such as this?

Kuehnemund: Given the time and resources available to acquire and map the data associated with this very labor-intensive project, it was decided to display recent activities since that would be most manageable. It was also in keeping with the concept of the atlas as a planning tool for the immediate future. The production of this atlas is a starting point that can serve as a historical record as integrated management moves forward.

For more information: Sigrid Kuehnemund, Fisheries and Oceans, St. John's, Newfoundland and Labrador, Canada. E-mail: Sigrid.Kuehnemund@dfo-mpo.gc.ca

Mapping human impacts

To the extent it has been implemented, marine spatial planning has generally been based on maps of current human uses of the ocean: for example, this activity is happening here and that activity is happening there. In contrast Ben Halpern, a biologist with the National Center for Ecological Analysis and Synthesis at the University of California at Santa Barbara, led a project to measure the extent to which human activities are impacting the oceans.

Combining 17 global data sets on human-related impacts (from fishing to maritime traffic to atmospheric pollution and climate change), the project found that no area of the oceans is unaffected by anthropogenic influence. A large fraction of the oceans (41%) is "strongly affected" by multiple drivers, according to the study, which produced color-coded maps to show areas of high, medium, and low cumulative impacts. The project website is www.nceas.ucsb.edu/globalmarine.

Halpern says the process and maps offer flexible tools for regional and global efforts to allocate conservation resources, implement ecosystem-based management, and inform marine spatial planning:

MEAM: In your view, should MSP be based on human impacts rather than human uses?

Ben Halpern: This question gets at a really important distinction. Maps of human uses - or, in other words, the "footprint" of human uses - provide important information on what happens where (and how much), but not whether the uses actually have any consequence for the marine ecosystems. Ecosystems and species have very different vulnerabilities to different human uses, so not all human uses lead to ecosystem change. Impact maps provide you all of this information, and marine spatial planning needs all of it.

Practically, MSP has two planning objectives: to separate incompatible uses (e.g., oil extraction and trawl fishing) and to ensure sustainable use and ecosystem health within each zone. The latter objective requires an understanding of how ecosystems actually respond (or do not respond) to human uses so that we can assess changes in overall ecosystem health.

MEAM: You have written that your framework can be applied to local- or regional-scale planning. Have any planners at that scale approached you?

Halpern: Yes. We have completed two regional-scale analyses, one for the west coast of the U.S. and Baja California (Mexico), and one for the Northwestern Hawaiian Islands. We are also working on analyses for the state of Massachusetts and for the Great Lakes. All of these projects have been supported or encouraged by planning agencies and organizations. An independent effort used our framework at a very local scale for the north end of San Francisco Bay.

The tools we have developed were designed for use by anyone, and so anyone could apply the tools. But there are lots of issues that emerge when conducting these analyses at a new location. We are happy to help advise new projects, either informally or in a collaborative capacity, and encourage people interested in pursuing these kinds of analyses to contact us.

MEAM: In your model, the highest possible score - in terms of impact on the oceans - is 90.1. Yet you describe any score over 15.5 as "very high", and only a tiny number of cells score higher than 50. Is there a possibility that some people might look at the low relative scoring and conclude that the oceans are actually not very impacted in general?

Halpern: Our translation of cumulative impact scores into ocean condition was done by ground-truthing our results to independent estimates of overall ocean health from around the world. So while 15.5 might seem low compared to the global maximum (90.1), these independent measures of ocean health tell us that scores higher than 15.5 mean the overall ocean health there is really bad (i.e., very high impact). Cumulative impact scores in the 50s, 60s, and up to 90.1 are places on the planet that are truly trashed.

For more information: Ben Halpern, NCEAS, University of California, Santa Barbara, US. E-mail: halpern@nceas.ucsb.edu

BOX: More examples of mapping ocean uses

Beaufort Sea Integrated Ocean Management Planning Atlas (2009)

Illustrates activities in the Beaufort Sea Large Ocean Management Area (LOMA), off Canada's Arctic coast.
www.beaufortseapartnership.ca/documents/BeaufortSeaAtlas.pdf

California Ocean Uses Atlas Project (ongoing)

Mapping human uses in waters off the coast of California.
http://mpa.gov/science_analysis/atlas.html

Atlas of the Patagonian Sea: Species and Spaces (2009)

Illustrates the use of the Patagonian Sea by animal species, not humans. (The sea spans from southern Brazil to southern Chile.) The atlas uses satellite-tracking data from 16 species of marine animals, and is intended to inform regional policy on fisheries and maritime transportation.
www.marpatagonico.org/libro/download.php?file=sintesis-mar-patagonico.pdf

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