BoFEP Working to Develop Ocean Health Index for Bay of Fundy

The Bay of Fundy Ecosystem Partnership is getting closer to achieving its goal of developing an environmental health index (EHI) for the area stretching between the U.S. border and the Musquash Estuary.

The aim of the BoFEP project is to establish a baseline from which to monitor environmental shifts and provide researchers and policy makers with a practical measure of ecosystem health. Scott Kidd is the primary BoFEP researcher working on the project. "The index will help us set specific targets for management," Kidd says. "If the Bay were to score lower than the global average, the number could help create a sense of urgency amongst both policy makers and the public."

In 2013, BoFEP held a workshop to discuss the various EHI methodologies in order to determine which one would best suit the Bay of Fundy. Participants recommended the Ocean Health Index (OHI), a peer-reviewed method that has been successfully applied to over 200 other coastal zones. The OHI provides a framework for assessing the status of environmental indicators (or goals) and grading each with a numerical score. The individual goal scores are then added together to produce an overall score for the area.

The method requires a short list of goals. For the BoFEP project, researchers considered both the availability of relevant data and the aspects identified as meaningful to the coastal communities of southwest New Brunswick. In January 2015, BoFEP received funding from Environment Canada's Gulf of Maine initiative to pursue five goals including sense of place, food provision, coastal livelihoods and economies and biodiversity.

Table 1: Short list of goals and descriptions for BoFEP's OHI project, as outlined by Scott Kidd at BoFEP annual general meeting in November, 2015.

GOAL	DESCRIPTION
Sense of place	Captures the aspects of the coastal and marine system that people value as part of their cultural identity.
Food provision	Measures the amount of seafood sustainably harvested in a given economic zone or region.
Coastal livelihoods and economies	Aims to maintain the coastal and ocean-dependent livelihoods (jobs) and productive coastal economies (revenues) while also maximizing livelihood quality (relative wages).
Clean waters	This OHI goal scores highest when the contamination level from nutrients, chemicals, pathogens and marine debris is zero.
Biodiversity	Accesses the conservation status of species based on the best available global data.

Each individual goal is further divided into subgoals, as indicated in Table 2. The scores are calculated using four dimensions: present status, trend, resilience and pressures. Trend, resilience and pressure data combine to show the likelihood of the goal being delivered in the future. For example, the likelihood that the number of coastal jobs will remain steady over the next year. "The data itself comes from a variety of sources," says Kidd. "The 'Economic Impact of the New Brunswick Ocean Sector 2003-2008' report was the main source of our economic data, while the Department of Fisheries and Oceans supplied most of the fisheries statistics needed for the food provision goal." Researchers relied solely on outside sources of information in order to minimize the potential for bias.

Table 2: Sub-goals and corresponding data required for BoFEP's list of OHI goals, as outlined by Scott Kidd at BoFEP annual general meeting in November, 2015.

GOAL	SUB-GOALS	DATA REQUIRED FOR PRESENT STATUS CALCULATIONS
Sense of place	1. Iconic species 2. Special places	1. List of ocean-dwelling iconic species, COSEWIC ranking of species 2. MPA within 3 nautical miles, total near-shore area within 3 nautical miles, MPA within 3-200 nautical miles, total exclusive economic zone area within 3-200 miles, terrestrial MPA within 1 mile of the coast
Food provision	1. Fisheries 2. Aquaculture	1. Single species current biomass at sea, single species biomass at MSY, single species current fishing mortality, fishing mortality at MSY, mean weight of each species caught across all years, what percentage of total catch is from assessed species 2. Yield for each species harvested, government desired yield, total area used for aquaculture, total available area, government desired and or projected increase in yield
Coastal livelihoods and economies	1. Livelihoods 2. Economies	1. Number of jobs in each sector, per capita average annual wage for each sector, provincial employment rate, per capita annual provincial wage 2. Revenue for each sector, provincial GDP
Clean waters	1. Pathogens 2. Nutrients 3. Chemicals 4. Trash	1. Beach closure data 2. Nutrient plumes from watersheds 3. Gulfwatch data 4. Pounds of trash collected on national shoreline during clean-up day

GOAL	SUB-GOALS	DATA REQUIRED FOR PRESENT STATUS CALCULATIONS
Biodiversity	1. Species 2. Habitat	1. List of all IUCN Global Marine Species Assessment species in MRPA, list of any other species using IUCN criteria, division of MRPA into 0.5 degree cells, total area of MRPA 2. Current condition of salt marshes verses pre-industrialized condition/extent (current condition not yet evaluated, may need to rely on extent), current condition of sea grasses verses extent in 1950-1960, current condition of sand dunes verses utilized pressures, current condition of soft bottoms verses utilized pressures, condition of rockweed

While the overall score provides researchers with a better understanding of the health of the ecosystem, individual goal scores are just as useful, providing decision makers with a means of identifying areas (both geographic and thematic) most in need of improvement. In 2014, the global OHI score was 70, although regional OHI data shows Canada scores significantly higher than 70 in the areas of artisanal fishing opportunities, coastal protection, coastal livelihoods and economies, clean waters and biodiversity. Researchers are eager to see how the Bay of Fundy ranks in their own short list of important categories.

However, the process of applying the Ocean Health Index is proving to be more challenging than anticipated. Each individual goal score is based on data from a variety of indicators, and the data used to score goals elsewhere in the world does not always line up with Canadian equivalents. In some cases, the methodology calls for data that is just not available to researchers in this area. "In those instances, we decided to use the global OHI data for Canada and scale it so as to reflect this part of New Brunswick," says Kidd. The process is time consuming, but once the project is completed it will be much easier to replicate elsewhere in Canada. "If someone on the west coast wanted to apply the OHI methodology, they could look at what we did and how we accounted for the discrepancies among data sets and just sub in the information specific to B.C."

Food provision has proven to be the most difficult goal so far, with several sub-categories of data still outstanding. "The goal requires an extremely large data set, with information dating back to the 1970s and earlier," explains Kidd. The team requested the information from the Department of Fisheries and Oceans, but it takes time to compile it. "Also, the way DFO monitors stocks, sustainability and catch efforts differs from the OHI methodology, so we needed someone who specializes in fisheries population biology to look at that data and the methodology and work the two together."

And the challenge is not just acquiring, interpreting and scaling the information. "Even after the data is collected, the method requires a lot of complex math to score the individual goals," says Kidd. However, he stresses that the issue lies not with the method, but with the inherent complexity of ecosystems themselves. "I have no doubt that the methodology is sound. The Ocean Health Index is a peer-reviewed method, and that is a big factor in why we chose it. The OHI framework is recognized by the scientific community as a a workable methodology for accessing ocean and coastal zone health."

Despite the difficulties, BoFEP has made a great deal of progress on the project, acquiring most of the current status and trend data needed to go forward. A computer programmer was hired to help with the more difficult computations, enabling researchers to progress to the final stages of the project. Over the next few months, the team will be working to acquire the remaining pressure and resilience data needed to score their shortlist of goals by March 2016. "The first one is the hardest," says Kidd. "But it's worth it. Developing an OHI for this area will allow researchers to distill information into an answer that is both simple and easy to communicate. By making the format more accessible, we hope to improve the quality of future decisions about the Bay of Fundy."