LENFEST OCEAN PROGRAM

A research project
March 2018

SUPPORTING SCIENCE AND COMMUNICATING RESULTS.

holgs, iStock

BENCHMARKS FOR ECOSYSTEM ASSESSMENT: INDICATORS FOR PRACTICAL ECOSYSTEM-BASED FISHERIES MANAGEMENT

Attempts to operationalize Ecosystem-Based Fisheries Management (EBFM) have highlighted at least three major challenges:

- Recognizing when a marine ecosystem is compromised – as exhibited by reduced resilience, diminished productivity, or disrupted species relationships – or is at serious risk of becoming compromised;
- Implementing EBFM in ways that are suitable for multiple fisheries, operating in diverse ecosystems and under different fisheries management systems; and
- Identifying which indicators can help deliver the most useful scientific information into those fisheries management systems.

These challenges stem in part from continued scientific disagreement over which indicators best reflect ecosystem structure and function, which can then be used to assess the overall state of an ecosystem. Thus the Lenfest Ocean Program and the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO) are supporting Drs. Beth Fulton and Keith Sainsbury to work with a team of researchers to develop practical indicators for ecosystem structure and function, along with guidelines for applying those indicators in a variety of ecosystems and management contexts.

The need for indicators of ecosystem structure and function

Ecosystem structure refers to the components of an ecosystem, such as species and habitats, and the network of relationships between them, such as predator-prey relationships. Ecosystem function refers to the biological, geochemical, and physical processes that occur within this structure, such as fish production or decomposition of organic material. Sustained structure and function results in important attributes, such

> **"EBFM IS CHALLENGING TO PUT INTO PRACTICE. WE WILL NOT JUST IDENTIFY ECOSYSTEM INDICATORS, BUT FOLLOW THROUGH TO APPLICATION BY DEVELOPING GUIDELINES FOR THEIR USE IN MANAGEMENT."**
>
> – Beth Fulton

Cover photo: Fishing boats, Valparaiso, Chile

Top left: Crabs at the fish market, southwest India

Top right: Trawlers, Perth, Australia

Bottom: Fishing equipment, Dutch Harbor, Alaska

as an ecosystem that is resilient to perturbation, which can then provide benefits to people. Indicators of structure and function are measures that provide information about the condition of an ecosystem, how it changes over time, and the likely causes of change. For example, total exploited biomass, often used to express the health of a fishery, may also be an indicator of the degree to which ecosystem structure is altered by human activity or natural disturbance.

Reliable indicators of structure and function provide the scientific basis for assessing the status of an ecosystem, including how commercial fisheries interact with the rest of the ecosystem. Such assessments are important for EBFM because they would help managers gauge the sustainability of different harvest policies, detect when an ecosystem is on an undesirable path, and evaluate options to avoid those paths. Assessments also help managers interpret whether undesirable states or trends are caused by humans or nature, or some combination of both.

However, identifying and selecting the appropriate ecosystem indicators, or suites of indicators, for management is challenging. They must capture the complexity of a system but be simple enough to be easily and routinely monitored. Furthermore, the appropriate indicators may differ greatly across ecosystems and management contexts, and there is little to no guidance on which ones might work in specific settings using readily obtainable data.

The research approach

Drs. Fulton and Sainsbury will collaborate with researchers, managers, and policymakers in four countries to provide guidance for selecting indicators of ecosystem structure and function, and operationalizing EBFM in a diversity of contexts. The project will take place in the following four stages:

1. Developing candidate ecosystem indicators

The research team will start by consolidating indicator options based on existing scientific efforts to develop ecosystem indicators. During this stage, they will work to define the candidate indicators on which to base ecosystem assessments, and identify insights on how to develop new indicators.

2. Collaborating with managers and policymakers

Drs. Fulton and Sainsbury will convene an advisory committee composed of a manager, a policymaker, and a scientist from nations associated with four case study regions: Bering Sea, Alaska, U.S.A.; marine waters off southeast Australia; marine waters off southwest India; and the Humboldt Current upwelling system in Chile (see Figure 1).

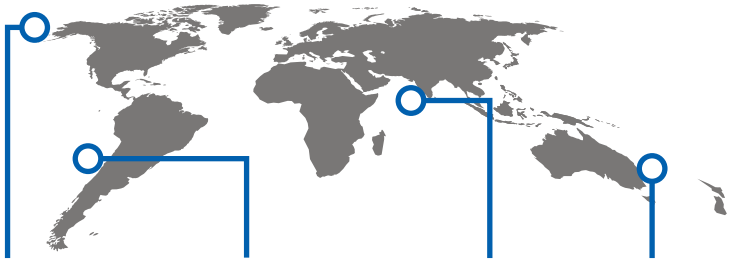
The researchers selected these regions because they differ in ecosystem structure, food production focus, and fisheries management approaches. The regions also share an interest in ecosystem management, as well as regulatory systems that are amenable to EBFM guidelines and practices.

The advisory committee will work with the research team to identify the most promising indicators, or those that could be readily applied in their regions and what challenges would need to be overcome in the context of local conditions and objectives. They will provide guidance on existing regulatory frameworks and how best to operationalize the findings, ensuring the indicators can be adopted into existing fisheries management programs.

> **"WE WILL ENGAGE WITH SCIENTISTS, MANAGERS, AND POLICYMAKERS FROM CASE STUDY REGIONS ALL OVER THE WORLD SO THAT WE EXAMINE A VARIETY OF ECOSYSTEMS, CULTURES, AND MANAGEMENT SYSTEMS."**
>
> – Keith Sainsbury

Figure 1

CASE STUDY REGIONS



Bering Sea, Alaska, U.S.A.

The U.S. catches about $1 billion worth of seafood here every year. Managers must balance sustaining employment and protection of species and habitats.

Humboldt Current system, Chile

These waters have some of the highest catch rates globally. Fisheries in Chile are a mix of large-scale industrial operations and artisanal boats.

Marine waters off southwest India

Much of India's catch comes from this productive upwelling area. Major management objectives are food security, employment, and sustainability.

Marine waters off southeast Australia

Productivity is relatively low. Catch rates are light to moderate, though some stocks are recovering from past overfishing.

3. Testing the robustness of indicators and ecosystem assessments

The research team will use a range of existing and new ecosystem models to test the performance of the most promising indicators across different ecosystem types, target species, levels of selectivity, and levels of fishing intensity. The models will also be applied under a range of environmental scenarios, such as climate change or coastal eutrophication. Informed by the outcomes of these simulations, the research team will be

able to define thresholds and benchmarks for ecosystem structure and function. The researchers will then use the models to explore the robustness of ecosystem assessments and potential EBFM management approaches for multi-species fisheries.

4. Applying the indicators in the case study regions

Finally, the research team will test the utility and robustness of the indicators using data and models from the case study regions. This step will help the research team and the advisory committee explore how managers in those regions may use and monitor the indicators, along with any potential barriers to use. Testing indicator utility and robustness will also help form the basis for practical guidance on how indicators could inform management and potential EBFM approaches.

The research team will conduct the project through to 2020. They will hold two meetings per year, each of which will include a meeting with the advisory committee. The research team will also hold workshops with a broader set of stakeholders, such as industry, NGOs, and additional management agencies.

RESEARCH TEAM

- Kerim Aydin, Program Manager, Alaska Fisheries Science Center, USA
- Beth Fulton, Principal Senior Research Scientist, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
- Mauricio Gálvez, Jefe de División de Investigación Pesquera, Instituto de Fomento Pesquero (IFOP), Chile
- K. Sunil Mohamed, Principal Scientist, Central Marine Fisheries Research Institute, India
- Keith Sainsbury, Professor Marine System Management, University of Tasmania, Australia

ADVISORY COMMITTEE

- James Findlay, Chief Executive Officer, Australian Fisheries Management Authority (AFMA), Australia
- Beth Fulton, Principal Senior Research Scientist, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
- Ignatious Mandro, Joint Director of Fisheries (Aquaculture), Fisheries Department of Kerala, India
- Carlos Montenegro, Jefe Departamento Evaluación de Pesquerías, Instituto de Fomento Pesquero (IFOP), Chile
- P. Paul Pandian, Fisheries Development Commissioner, Ministry of Agriculture and Farmers Welfare, India
- Ian Thompson, First Assistant Secretary, Sustainable Agriculture, Fisheries and Forestry Division, Department of Agriculture and Water Resources, Australia
- Bill Tweit, Special Assistant, Washington Department of Fish and Wildlife, USA

Contact

For any questions, please contact Emily Knight, Manager, Lenfest Ocean Program, at eknight@lenfestocean.org. To learn more about this research and stay up to date on our latest projects, follow us on Twitter @lenfestocean or sign up for our newsletter at lenfestocean.org.

901 E Street NW,
Washington DC 20004

E info@lenfestocean.org
P 202.540.6389

lenfestocean.org

SUPPORTING SCIENCE AND COMMUNICATING RESULTS.