

Perspective: Marine ecosystem-based management and wicked problems require incrementalism, not command and control

By Jon Hare, NOAA Fisheries

Editor's note: Jon Hare is the Science and Research Director of NOAA's Northeast Fisheries Science Center in Woods Hole, Massachusetts, in the US. He oversees science related to NOAA Fisheries mission in the Northeast region (Maine to North Carolina) including marine fisheries, aquaculture, protected species, habitat, and ecosystem science. NOAA Fisheries is also actively engaged in managing multiple ocean use and deploying climate ready science and management.

In 2016 I made a career change from scientist to scientific administrator in NOAA Fisheries. Omission is to provide advice supporting fisheries, aquaculture, marine mammals, endangered species, and habitats *"backed by sound science and an ecosystem-based approach to management"*. I brought a natural scientist's perspective to ecosystem-based management, emphasizing understanding the components of an ecosystem and then providing this understanding to managers as scientific advice.

The year after my career change, DeFries and Nagendra (2017) described ecosystem management as a *'wicked problem'*. What they described felt like my day-to-day: working with fishers to reduce the risk of entanglement to North Atlantic Right Whales; providing advice on how to balance the needs of offshore wind-energy development, commercial and recreational fishing, and wildlife conservation; and working to bring climate and ecosystem information into fisheries management.

By reading about and discussing the role of science in informing management, I came to realize that my perspective represented an assimilated culture, rooted in a policy making paradigm termed the *"rational comprehensive"* approach. Using this approach, institutions and trained professionals oversee and conduct comprehensive planning and decision-making to address complex problems (aka *"command-and-control"* as described by Holling and Meffe (1996)).

The *"wicked-problem"* concept calls for a different approach to management and decision-making, termed incrementalism. The idea recognizes that many problems are too complex for full understanding, let alone allowing clearly defined steps and comprehensive decision-making to develop and implement one-time solutions. Incrementalism holds that each stakeholder (including scientists) has a different perspective of the issues and that decision-making represents a compromise among these different perspectives. The approach provides for continued work on a problem and implements decisions stepwise with the participation of all stakeholders.

The idea of complex socio-ecological systems is very much related to incrementalism and *"wicked problems"*. Ostrom (2009) established a framework whereby knowledge is gathered on both the natural and human components of a complex system and their interactions. This knowledge is then used incrementally to manage the complex system toward desired outcomes.

These ideas resonated with me. I could see the value of incrementalism: fisheries management in the US has many elements of incrementalism largely as a result of the Regional Fishery Management Council structure. Additionally, I could see that fisheries are inseparable from the larger complex socio-ecological system. I also could see the rational-comprehensive approach throughout our science and management structures and processes – working to define problems in isolation and develop one-time solutions. I realized that from my position on the frontlines of science and management, I have the opportunity to apply incrementalism and to apply the concepts of complex socio-ecological systems. As a start, I came up with 10 lessons to carry forward in my efforts to provide advice *"backed by sound science and an ecosystem-based approach to management"*.

1. Accept that fisheries are complex socio-ecological systems (explicitly acknowledging humans are part of ecosystems)
2. Strengthen existing adaptive management processes and institutions
3. Encourage and engage in participatory science (co-learning)
4. Question inertia
5. Respect all perspectives
6. Recognize fishers as knowledge experts

7. Always consider the scale of the problem
8. Be open to changing your mind and adjusting your perspective
9. Read, listen, and discuss broadly
10. Publish and communicate results of science and management

These lessons are geared toward ecosystem approaches to management in marine ecosystems. However, the *wicked-problem*” concept, incrementalism, complex socio-ecological systems, and these 10 lessons are generally applicable to practitioners of ecosystem-based management in any system. If you are interested, these ideas are more fully explored in a [Food for Thought Article published in the ICES Journal of Marine Science in 2020](#)

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