



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

Perspective: Ocean tipping points and the language of change

Editor's note: Carrie Kappel is lead principal investigator of the Ocean Tipping Points collaborative, and a center associate at the National Center for Ecological Analysis and Synthesis (NCEAS) at the University of California Santa Barbara (UCSB). Ben Halpern is a co-principal investigator on Ocean Tipping Points and director of UCSB's Center for Marine Assessment and Planning; he is also a professor at UCSB's Bren School of Environmental Science & Management.

By Carrie Kappel and Benjamin Halpern

Tipping points occur when small shifts in human pressures or environmental conditions bring about large, sometimes abrupt changes in a system - whether in a human society, a physical system, an ecosystem or our planet's climate.

A diverse collaboration among natural and social scientists, law and policy experts, managers, indigenous peoples and other stakeholders called the Ocean Tipping Points project (oceantippingpoints.org) is finding that the tipping point concept provides a valuable toehold into cooperative ecosystem-based science and management. Viewing and describing ecosystem change through the lens of ocean tipping points provides a simple, powerful and common language for communication among these diverse groups and their different ways of knowing the ecosystem. It brings our attention to the ecosystem level. And it focuses attention on how the influences of multiple stressors cascade through an ecosystem via human and species interactions.

Across the world's oceans, we have witnessed dramatic ecosystem shifts in diverse habitats, including coral reefs, pelagic systems, seagrass beds, and kelp forests, among others. Many of those changes persist today. These socio-ecological systems often remain locked in regimes that are less productive, less desirable, and less manageable for people. Reversing the shifts and restoring degraded ecosystems have proven difficult and costly. Understanding the complex interactions among humans, climate, and marine food webs that lead to ocean tipping points has also been challenging.

Promising new research

New scientific research aimed at understanding and perhaps even predicting socio-ecological system change has emerged in recent years. This science, including its underlying concepts about ecosystem tipping points, has the potential to help society avoid the negative consequences of surprising shifts in marine ecosystems, and more generally advance the goals of ecosystem-based management.

Despite these advances, it can be difficult for scientists, managers, traditional ecological knowledge holders and other community members to come to a shared understanding about something as complex, hard to observe, and multi-faceted as ecosystem change. Given differences in values and experiences, each group may pay attention to different aspects of the socio-ecological system.

Differences between how scientists and non-scientists recognize species distinctions can lead to very different perceptions of species diversity and species' decline. As a simple example, on the Pacific Coast of the US, two very similar-looking fish - bocaccio and greenstriped rockfish - underwent very different population trends between 1977-2001. While bocaccio declined, greenstriped rockfish increased. A significant proportion of fishermen (about 40%, according to a survey) were unable to differentiate the two species. As a result, these fishermen might not have recognized the potential extinction risk to bocaccio as its decline was masked by the increase in the other species.

Furthermore, shifting baselines - where individual perspectives on what a "normal" ecosystem should look like change over time as the system changes - make it hard for different groups to agree on how much a system has changed and which changes matter. Deciding on an appropriate baseline can be especially tricky when you are working across diverse cultures with different historical reference points and cultural and institutional memory (e.g., of indigenous and European origins). Differences in training and language (such as scientists' jargon or policymakers' acronyms) compound the communication challenge, and scientific uncertainty clouds the picture. This inability to speak the same language about the changes we have observed, their impacts, and potential actions that could be taken impedes successful marine management.

Applying the concept of tipping points to site management

In British Columbia, Canada, we are working to bring the concept of tipping points to the Gwaii Haanas National Marine Conservation Area Reserve and Haida Heritage Site, which is co-managed by the Haida Nation of indigenous people and the federal government of Canada. Here we are partnering with managers and local experts to integrate traditional ecological knowledge with data on multiple fisheries and non-fisheries species, their interactions, oceanographic conditions, and human use to understand dramatic changes that have been observed in the nearshore pelagic ecosystem.

The various groups involved have at times struggled to overcome differences in their perception of the ecosystem and the accompanying communication challenges. However, they are coming together to try to understand historic and potential future tipping points in their marine ecosystem. Our partner from the Council of the Haida Nation, Cindy Boyko, explains, "Gwaii Haanas is important to me as a Haida woman; it holds the stories of who we are as a people. As caretakers of Haida Gwaii, our ancestral homeland, understanding what has already happened and what to watch for will be key in figuring out how to manage effectively in the future."

In Gwaii Haanas and more generally, the tipping points concept helps illuminate and make concrete two ideas that are central to modern management but often contentious or confusing for different groups: risk assessment and precautionary management. In a system that responds nonlinearly to increasing pressures, risk also rises in a nonlinear fashion. As you approach the tipping point, the probability of dramatic ecosystem change rises sharply, and so does the attendant risk of impacts to society and the cost of mitigating those risks.

The more precisely you know the threshold and the more confident you are in your ability to maintain conditions at a given point along the curve, the closer you can get to the threshold.* However, if the threshold is uncertain or prone to shifting, or if the outcomes of your management actions cannot be known precisely, then precaution is

warranted. Nowhere is the precautionary principle more valuable than in this case, where the risks rise steeply with increasing pressure on the ecosystem. Carefully analyzing the costs and benefits of crossing the tipping point can help you set an appropriate precautionary buffer.

Perhaps all of us in the ocean science and management communities have witnessed surprising changes in the places that we know and care about, and that common experience gives us a place to begin a conversation. Changes in ecosystems affect people. They not only affect the places people care about, but also the services that sustain us. Providing clear ways to talk about the costs and benefits of these changes that resonate across social, cultural, and political lines is essential to better managing these systems. Not every system experiences a tipping point as change occurs, but many do, and the concept and language around tipping points has proven a powerful way for diverse groups to understand and communicate about ecosystem change. Much work remains to be done, of course, to translate these ideas and emerging science into change on the water. But sometimes progress simply requires finding the right words.

* Note: The Ocean Tipping Points project uses the terms *threshold* and *tipping point* interchangeably.

For more information:

Carrie Kappel, NCEAS, Santa Barbara, California, US. Email: kappel@nceas.ucsb.edu

Source URL: <https://meam.openchannels.org/news/skimmer-marine-ecosystems-and-management/perspective-ocean-tipping-points-and-language-change#comment-0>