



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

Serious Fun: Using Games to Advance Coastal and Marine Management

Games are often considered as simply a form of entertainment. However, they can play important roles in other activities as well. By applying an aspect of fun to education, for example, games can communicate messages in ways that pure instruction sometimes cannot. And by transforming problem-solving processes into games, novel solutions can often be found.

One of the best-known examples of this is from outside the marine field. In 2008, a team of biochemists and computer scientists from the University of Washington created Foldit (<http://fold.it>). Essentially a series of online puzzles, Foldit awards points to players for successfully "folding" protein structures into three-dimensional shapes. Scientific knowledge of these twisting structures, which are difficult for computers to model, can help drive an array of biochemical and biomedical discoveries. In a matter of days, Foldit players found the answer to a longstanding science puzzle, the structure of a protein important to AIDS research.

Not many games result in science breakthroughs like that. However, several games are being used in the coastal and marine management field to advance understanding of various strategies and concepts. MEAM briefly examines a few of these.

1. Marxan reserve design games

Purpose: To teach how Marxan works
www.uq.edu.au/marxan/resgame/index.html

When designing networks of marine reserves, planners typically face a challenge: they must protect various environmental features while minimizing the cost of that protection on resource users, like fishermen. Finding the right balance, the optimal solution, can be a complex process involving many ecological and social factors, and powerful software tools have been developed to support that process. Marxan, developed at the University of Queensland, is among the best-known of these tools.

Perhaps less well-known is that there are two games based on Marxan: one is used in classroom settings while the other is applied in planning workshops. The classroom game is a training tool for planners, focusing on the technical details of how Marxan works. The workshop game is a simplified version, giving stakeholders a chance to play with the tool and learn its basics. In both games, players compete to build a reserve system that protects all conservation features for the least cost.

"The games are useful in demonstrating the optimization algorithm and, to a lesser degree, reserve design concepts," says Matt Watts, research officer at the University of Queensland. He says he would like to see more games available as teaching tools. "The more blurred the distinction is between simulations [like Marxan] and games, the more engaging it becomes for the audience," he says.

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2. Go Fish, No Fish

Purpose: To introduce the concept of catch shares
www.edf.org/oceans/catch-share-design-center/go-fish-no-fish

Not all games have to be played on computers, of course. The game Go Fish, No Fish, which simulates the downsides of unmanaged fishing, is played on a table top. Players use their choice of materials - candy pieces, toys, or whatever is available - to represent target fish, bycatch, habitat, and other ecosystem features. Then the players progress through a series of fishing seasons, experimenting with various management strategies like no-take areas, catch limits, trip limits, territorial user rights, and ultimately catch shares.

The Environmental Defense Fund (EDF), which developed the game, has played it with fishery managers, fishermen, NGOs, policy makers, scientists, and other opinion leaders around the world. "We have seen a range of behaviors exhibited: from participants who want to maximize their economic outcomes to ones who are more conservative about how much fish to take," says Ashley Apel of EDF. "Regardless, participants always learn new insights into sustainable fisheries management, fisheries economics, or the fishing industry in general." She points to Belize, where EDF played the game with key government decision makers and the majority of the Belizean fishing fleet. Following the game, she says, the fisheries management system in two areas was changed from open-access to managed access, with territorial use rights provided to selected fishermen.

The game can be tailored to the situation in which it is played - such as including locally managed no-take areas in the Western Pacific, for example, or problems with bycatch in the EU, says Apel. There are simple and complex versions of the game, too, depending on the audience and other factors. "Instructions on the website are written for people to lead a game on their own without prior experience," she says.

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3. Trade-Off!

Purpose: To help stakeholders explore trade-offs in marine spatial planning

www.seaweb.org/resources/ebm/SeaWebsEBMCommunicationsProject.php

The board game Trade-Off!, developed in 2008, aims to prepare coastal stakeholders for marine spatial planning processes. It highlights the types of decisions that are typically made during spatial planning, such as where to site compatible activities and how to separate conflicting uses. Players must negotiate these decisions while assuming the roles of various stakeholder groups - compelling them to consider the situation from points of view beyond their own. The game was designed by SeaWeb, an environmental NGO, in collaboration with the Integration and Application Network at the University of Maryland Center for Environmental Science in the US.

"Trade-Off! helps participants recognize that marine spatial planning rarely gets to build on a 'clean slate'," says Kathleen Reaugh Flower, who led the game design process at SeaWeb. "You must consider complementary activities in your plan, and compromises need to be made between stakeholders."

The game has been used in association with real marine spatial planning efforts around the world, says Daria Siciliano, who now oversees Trade-Off! for SeaWeb. She says that players typically exhibit an unwillingness at first to make concessions, but peer pressure from other affected players/stakeholders often spurs more accommodating solutions. "This could be analogous to what happens in real-life discussions," says Siciliano.

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4. Where Rivers Meet the Sea, & other games

Purpose: To encourage students to care for marine ecosystems

<http://games.noaa.gov>

The US National Oceanic and Atmospheric Administration (NOAA) has created an online gateway to more than two-dozen web-based games on marine environmental issues. The target audience is children in elementary and middle school, encouraging them to care for coastal and marine ecosystems. Examples of games include Where Rivers Meet the Sea, which challenges players to restore an estuary, and Sea Turtles and the Quest to Nest, in which players protect sea turtle nesting beaches.

"We have designed the NOAA Games website as a portal to many environmental games developed by federal agencies and their partner organizations," says Peg Steffen, education coordinator for NOAA's National Ocean Service. The abovementioned estuary and sea turtle games were developed by NOAA in partnership with Montgomery College, and were evaluated in 2011 for classroom use. In the study, teachers applied their traditional instruction methods on estuaries and sea turtles with one class, and with a comparable class used the games instead. The results showed the games were as effective for learning as the traditional instruction methods.

The NOAA-designed games intentionally feature careers that pertain to coastal and ocean sciences - the goal being to inspire students' interest in those career paths, says Steffen. "Digital games can be powerful tools to learn the skills to succeed in the new global economy and to promote knowledge and behaviors of future environmental stewards," she says.

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Source URL: <https://meam.openchannels.org/news/meam/serious-fun-using-games-advance-coastal-and-marine-management-0>