Closing recreational fishing areas for shorter times could benefit fish and fishermen

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A new model that accounts for the many impacts of recreational fishing could help policy makers determine the best management strategy. Image credit: US Fish and Wildlife Service

(PhysOrg.com) -- A new model that analyzes the complex factors involved in recreational fishing has shown that modeling can lead to some unforeseen results. Among the model's surprising conclusions is that, under low fishing pressure in a coral reef ecosystem, closing fishing areas for two months instead of six months can result in larger fish stocks and better fishing opportunities. The model, which simulates the impact of recreational fishing on fish stocks, the economic welfare of recreational anglers, and the surrounding coral reef environment, by incorporating a variety of factors and feedback effects, could be useful for formulating the best strategy for managing recreational fishing areas.

“I think the main message is that resource managers and policy makers need to ensure that decisions are supported by modeling and analysis that is grounded on empirical facts,” coauthor Atakelty Hailu from the University of Western Australia told *PhysOrg.com*.

Hailu and coauthor Lei Gao, also from the University of Western Australia, will publish their study in an upcoming issue of *Ecological Economics*. As the researchers note in their study, recreational fishing continues to increase, and in some areas accounts for greater fish extraction than commercial fishing activities. For example, in 2008 in the Gascoyne Bioregion in Western Australia, recreational anglers caught 56 tonnes of spangled emperor while commercial fishers caught just 7 tonnes.

In their study, the researchers developed a model that integrates six individual models: these models estimate the location, frequency, duration, and seasonality of an angler’s fishing trip; the angler’s expected catch; and the interactions among the fish and their coral reef environment. The researchers then applied this integrated model to evaluate different fishing site closure strategies for three recreational fishing sites at the Ningaloo Marine Park in Western Australia. The goal was to strike a careful balance between providing opportunities to enrich the experience and increase the economic value of recreational anglers while minimizing the impact on the fish stock and the natural environment.

The researchers used their model to simulate three different site closure strategies: no closure, a two-month closure for one of three fishing sites at Ningaloo, and a six-month closure for one of three fishing sites at Ningaloo. They ran the simulations for low and high levels of fishing pressure, where high pressure was defined as twice the number of anglers per square kilometer at all fishing sites. They performed 50 replications for each experiment for a 25-year period (from 2010 to

2035), and averaged the results for each experiment.

The researchers found that the level of fishing pressure significantly affects the outcomes of the strategies. For a low pressure scenario, the two-month closure strategy results in increased fish stock, comparable fish extraction, and negligible economic reduction compared to the no-closure strategy. However, the six-month closure strategy does not provide the same benefits, mainly because fishing increases at the two open sites for a longer time than for the two-month closure case, so the fish stock does not recover as quickly at the open sites.

For a high pressure scenario, the six-month closure strategy had advantages over both the two-month closure strategy and the no-closure strategy. The higher fishing demand quickly leads to an overall decline in fish stocks at all three sites, and the six-month closure time gives the fish stock at the closed site more time to recover than the two-month closure time. However, the fish stock is lower than for the low pressure scenario, and the overall catch level is still much lower than for the low pressure scenario.

Overall, the results show that the effects of management strategies can be very different from what one might expect without the benefit of integrated modeling. The researchers attribute the unexpected results to the fact that the model can account for the delicate balance and feedback effects involved in this multi-faceted system, which are difficult to account for without the model. They hope that, in the future, resource managers use integrated models like this one to develop and defend management strategies, which are often subjects of controversy.

“From a technical point of view, the work is a very good practice to deliver better management options for addressing complex issues through integrated modeling of socio-economic and biophysical processes,” Gao said. “It brings forth several new ideas, such as using

econometrically estimated models to drive agent behavior."

Hailu added that they are working on expanding the number of sites, and the model could be adjusted to analyze a wider variety of situations.

"The framework is set, and it is possible to develop similar models for other natural resource management problems to take into account the complexity of the interaction between economic and biophysical features," Hailu said.

More information: Lei Gao and Atakelty Hailu. "Evaluating the effects of area closure for recreational fishing in a coral reef ecosystem: The benefits of an integrated economic and biophysical modeling." *Ecological Economics*. To be published.