Integrated decision support tools to inform small scale fisheries management

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Summary

Small-scale fisheries management is hindered by a lack of scientific and management design guidance. This can promote unsustainable practices, resulting in poor fisheries performance. Fish Forever is a global initiative to improve small-scale fisheries management through the implementation of a spatial management approach that combines marine reserves with Territorial User Rights for Fishing ('TURF-Reserves'). To provide technical guidance for the design and implementation of TURF-Reserves, we developed three user-friendly decision support toolkits, consisting of guidance manuals, workbooks and models, and detailed agendas for stakeholder workshops. Toolkit guidance is based on best practices and qualitative information, as well as data-limited assessment methodologies and models for fisheries with quantitative data. The toolkits facilitate the development of goals and priorities for fisheries management, evaluation of alternative spatial designs for TURF-Reserves, and design of harvest control rules in data-limited contexts. We present examples from Indonesia, the Philippines, and Brazil, where we have piloted these toolkits.

Introduction

While small-scale fisheries are important for local economies and food security around the world, many are poorly managed or unmanaged due to a lack of scientific and management design guidance. This management vacuum has led to unsustainable fishing (Costello *et al*. 2012), which in turn adversely impacts supporting ecosystems, economic development, and community integrity. To address this issue, the Environmental Defense Fund, Rare, and the Sustainable Fisheries Group at the University of California—Santa Barbara designed Fish Forever, a global initiative to improve the management of small-scale fisheries through the implementation of spatial rights-based management that combines marine reserves with Territorial User Rights for Fishing, creating 'TURF-Reserves.'.

TURF-Reserves combine the benefits of exclusive access derived from the TURF framework with the conservation and fisheries enhancement benefits from marine reserves (Christy 1982; Halpern *et al*. 2009), providing synergistic benefits from the two management strategies (Gaines *et al*. 2010). Fish Forever works with communities across the developing tropics to establish these community-managed areas. In order to fulfill its mission of empowering communities to manage their fisheries sustainably and productively, Fish Forever has developed a suite of three practical toolkits that guide communities through a scientifically-driven design and implementation process.

Materials and Methods

To develop the toolkits, we identified key information gaps in the design and implementation of TURF-Reserves. All three toolkits are user-friendly and presented in accessible formats. We identified

the lack of specific goals and priorities at Fish Forever sites as a risk to successful implementation, so we developed the Fisheries Landscape and Goal Setting (FLAGS) toolkit to identify threats, goals, and priorities. The FLAGS toolkit provides detailed agendas for facilitated stakeholder discussions, along with Excel-based workbooks. The design of TURF-Reserve systems requires consideration of numerous factors that affect their optimal size and location; the TURF-Reserve Design toolkit uses an Excel-based model to help stakeholders evaluate trade-offs between ecological and economic outcomes associated with different spatial configurations. Finally, because effective TURF-Reserve systems require management that limits fishing mortality to sustainable levels, we developed the Adaptive Fisheries Assessment and Management (AFAM) toolkit to guide users in the iterative process of monitoring and assessing fishery performance and implementing adaptive management based on assessment outcomes. The toolkit also provides a suite of Excel-based workbooks for use in data-limited assessment methods.

Here we discuss our experience deploying the toolkits with three case studies: the use of the FLAGS toolkit in Cururupu, Brazil, to identify key threats to the fishery; the TURF-Reserve Design toolkit in Ayoke Island in the Philippines to compare alternative TURF-Reserve design options; and the AFAM toolkit in Karimunjawa National Park, Indonesia, to assess the status of a grouper species.

Results and Discussion

In Cururupu, the FLAGS toolkit has been used to identify and assess the magnitude of fishing and non-fishing threats to the community's target species. In subsequent steps, the community will determine which desired goals are realistic given the threat analysis and other site conditions, prioritize species and habitats for management, and discuss trade-offs between different goals.

In Ayoke Island, local knowledge informed habitat maps and species life history information that served as inputs to the TURF-Reserve Design Toolkit, which illustrated the trade-offs between fish abundance, harvestable biomass, and profits in different TURF-Reserve design proposals. The trade-offs will now inform the community's design selection process, which will take sociopolitical, economic, and ecological objectives into account.

In Karimunjawa, the AFAM Toolkit provided a framework for conducting six data-limited stock assessment methods on the squaretail coral grouper (*Plectropomus areolatus*), indicating that overfishing was likely occurring. Through an iterative process of data collection, assessment, and interpretation, the AFAM Toolkit provided potential management solutions, including implementation of a TURF and a minimum size limit for the speargun and trap fisheries.

The three toolkits developed by Fish Forever provide easy-to-use decision support tools based on cutting-edge science and established best practices. The toolkits empower local communities to manage their fisheries by defining community goals, analyzing tradeoffs between TURF-Reserve design options, and setting appropriate harvest control rules to achieve their goals.

References

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