Brief for GSDR 2015

Healthy oceans, healthy people, healthy economies: Integrating fisheries management and protected areas for environmental, economic, and social benefits

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Summary:

- Globally, 4.3 billion people rely on ocean and coastal resources for food, income, and recreation.
- The Blue Economy, or economic benefits derived from the ocean, can be vastly improved with explicit consideration for the health of marine ecosystems
- Catch share fisheries management improves the sustainability and socioeconomic production of fisheries over other fisheries management schemes.
- Reforming fisheries in tandem with implementing marine protected areas (MPAs) can both improve ecosystem health *and* economic well-being of coastal communities
- Effective governance -- developed at the appropriate scale with clear goals, fair laws, and community involvement -- is critical for realizing benefits.
- Science must also be integrated into the decision-making process to inform and adapt management plans as needed.
- Sustainable development of fisheries resources through the use of catch shares and MPAs, as well as continued investment in science to inform decision-making, can improve the economic, social, and environmental health of our ocean and coasts.

Introduction

Ocean and coastal resources are increasingly recognized as critical to sustaining life and livelihoods across the globe. Seafood provide 4.3 billion people with 15-20% of their protein intake, and fisheries, aquaculture, recreation, tourism, and other coastal industries provide income that supports an estimated 660 to 820 million people (HLPE 2014). Many nations are seeing the 'Blue Economy' – or economic benefits derived from the ocean – as a viable pathway to economic development and poverty alleviation. Incorporating explicit environmental goals into this strategy, such as ending overfishing and restoring ecosystem health, enables economic progress by aligning short- and long-term outcomes, and reflects how an improved environment can also improve the economy. The current draft of the UN Sustainable Development Goals considers Oceans and Coasts an economically and environmentally important area that can help to improve ecosystem health and socioeconomic well-being of coastal communities, particularly in developing countries (Goal #14).

Over the past 15 years, new marine management schemes have emerged, supported by science and integrating physical, biological, and human dimensions of ecosystems (Pew Oceans Commission 2003, FAO 2003). This promising framework is known as a marine ecosystem approach to management and is increasingly considered to be essential for sustainable marine development (e.g. Ruckelshaus et al. 2008, Curtin and Prellezo 2010). Here we will review the science behind an emerging marine ecosystem management approach - the implementation of paired secure-access fisheries and conservation areas - that integrates economic, social, and environmental health, the three pillars of sustainable development.

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Well-designed secure-access fishing programs can promote sustainable fisheries and prosperous local economies.

Close to 80% of global fish stocks are either fully exploited or overexploited (FAO 2014) yet unsustainable fishing continues despite international recognition that these fisheries are critical for food security and coastal economic stability (e.g. via the 1995 FAO Code of Conduct for Sustainable Fisheries, FAO 2014, HLPE 2014). However, replacing unsustainable fisheries management programs with catch share programs, a form of secure-access fisheries management, has shown great promise to improve both socioeconomic and environmental health around the globe (Costello et al. 2008, Chu et al. 2009, Jardine and Sanchirico 2012, Mace et al. 2013). There are two primary types of catch shares – quota-based systems and space-based systems. Quota-based systems, also known as Individual Fisheries Quotas (IFQs), allocate a certain portion of the fish harvest to individuals. Space-based systems, known as Territorial User Rights for Fisheries (TURFs), allocate a specific area of the coast or ocean to users, who then have the right to extract from that area. TURFs are often co-managed by both the government and the local community, who work together to set extraction levels and enforce regulations. In both forms of secure access, fishers have a direct stake in the output of their fishery as well as an incentive to comply with regulations. Notably, a comprehensive review of 11,135 fisheries showed that fisheries managed with IFQs showed a 51% reduction in collapsed fisheries compared to those managed without secure-access methods (Costello et al. 2008). However, the success of catch share programs depends on robust data and planning (Chu et al. 2009). For example, a sustainable Total Allowable Catch for a given fishery is dependent on the quality of local stock assessments, and effective governance and enforcement are critical for the success of the fishery (Costanza et al. 1998, Chu et al. 2009).

Marine protected areas can also help to address plummeting fisheries.

Marine protected areas (MPAs)—areas where marine environments are protected from development or extraction at various levels— are a widely used and valued strategy for conserving marine resources, biodiversity, and ecosystem function (Lubchenco et al. 2003). Extensive research on MPAs, particularly no-take marine reserves, demonstrates their utility for increasing density and biomass of target and non-target species, preserving biodiversity, and improving fisheries output (Cotê et al. 2001, Micheli et al. 2004, Lester et al. 2009). These benefits increase when connected networks of reserves are designed to link habitat for fish and other organisms in the fluid environment of the ocean (Grorud-Colvert et al. 2014). Bioeconomic analysis of commercial fishing, recreational fishing, and tourism show that, together, the economic and biological benefits of well-managed MPAs far outweigh the cost of implementing the MPA by increasing economic activity in a local area (Sala et al. 2013), which can improve food security, employment, social surplus value, and overall welfare (Reithe et al. 2014).

Research shows that combining secure-access systems with MPAs can increase the benefits for economic and environmental health.

Though it might seem restricting extraction from ocean areas would negatively affect the local economy, reforming fisheries in tandem with implementing no-take marine reserves can both improve ecosystem health *and* economic well-being of coastal communities (Costello and Kaffine 2010, Sala et al. 2013, Afflerbach et al. 2014, Reithe et al. 2014). Fisheries output can improve due to the 'spilling over' of greater numbers of fish from inside marine reserves (Halpern et al. 2009, Vandeperre et al. 2011), producing fish that are available for harvest and are larger and more valuable to the

market (Sanchirico et al. 2006, Costello and Polasky 2008). For example, across seven sites in the Mediterranean, catch per unit effort increased significantly over time for fisheries adjacent to MPAs (Vandeperre et al. 2011). Fisheries enhancement can lead fishing co-operatives managed by catch-share programs to establish their own MPAs as a way to better manage the productivity of their stocks; e.g. communities have created their own paired TURF-reserve systems in Fiji, Brazil, and Mexico (Afflerbach et al. 2014). The combination of fisheries management and conservation objectives can be achieved through coupled catch-shares and MPAs that are implemented by a well-coordinated secure-access fishery (Costello and Kaffine 2010).

Effective governance is critically important to ensure the benefits derived from pairing catch shares and MPAs.

Management schemes are most successful when the institutional goals are clear, fair and effective laws are in place, and there is community buy-in (Christie and White 2007). Traditional knowledge, management, and governance schemes can play an important role and can positively impact and supplement sustainable fisheries practice (Aswani 2005). Governance also occurs at a variety of scales, from local to regional, and it is important to match the scale of governance to the scale of the resource. For example, a TURF-managed surf clam fishery in Chile did not improve the harvest like it was intended, despite a high degree of coordination and cooperation between the local community and government in establishing and enforcing the TURF (Aburto et al. 2014). The collapse was attributed not to poor governance, but to high natural variability of reproduction and settlement of the surf clam in the TURF-reserve area. The local governance approach, though successful, was not matched with the regional scale at which the clam reproduced, thus the management scheme was ineffective.

Integrating scientific information to better understand the ecosystem, and thus improve management and governance decisions, is essential for successful marine ecosystem management.

Empirical data from ecological and socioeconomic systems help to determine the effectiveness of management approaches and support adaptive management. In the case of the surf clam fishery, a better understanding of the natural history of the species *before* implementing the local TURF-reserve would have helped to develop a governance structure with the appropriate scale (Aburto et al. 2014). Biological and ecological information can play a strong role in informing and establishing all types of fisheries management programs. Due to the integrated nature of marine ecosystem management, considering the ecosystem as a whole and recognizing its inherent complexity requires decision-making based on the precautionary principle, which scientific assessment can help to inform (Pikitch et al. 2004). Refinement of ecosystem indicators makes the use of science in management increasingly accessible and affordable (Link 2005, Livingston et al. 2005), and thus helps mandate and support evidence-based decision-making.

Conclusion

Ocean and coastal resources are vitally important for securing food and income for billions of people, and play a critical role in our global environmental health**.** Cutting-edge biological and economic research show viable ways to manage fisheries and other coastal resources in order to simultaneously improve the economy and ecosystem health and biodiversity. Pairing catch share-based management with marine conservation through MPAs is one promising way forward. Not only does this approach explicitly consider both socioeconomic and environmental priorities that are critical for sustainable development, but it is adaptable to many types of fisheries resources and governance

schemes. Both developed and developing countries have seen benefits from implementation of catch shares and MPAs. However, benefits are best realized when combined with good biological and ecological understanding of the resource, strong governance in place to set the regulations, and an established means of enforcement.

Work at the international policy level, including the Sustainable Development Goals, can establish a precedent for implementing economic and ecologically-viable development methods. New, innovative approaches to ocean management, and continued investment in science and its use in management and policy decisions, are key to healthy oceans, healthy people, and healthy economies.

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