Innovations in fisheries management

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The purpose of this document is to briefly lay out some innovations in fisheries management that have been researched by the Sustainable Fisheries Group (SFG) at UC Santa Barbara. This is not intended to be a comprehensive list of fisheries management reforms, nor is it specifically tailored to answer the complex challenges of managing trans-boundary tuna stocks. For each project we will (1) briefly introduce the management innovation, (2) suggest challenges or future work that may be necessary to adapt the concepts to managing trans-boundary species such as tuna in the Coral Triangle, and (3) provide citations for SFG's work in the area.

Marine Protected Areas

In their strictest form, Marine Protected Areas (MPAs) close certain geographic areas of the ocean to all fishing. While obviously attractive for conservation, their effect on fisheries is not as well established. SFG's research on MPAs focuses on spatial modeling to (1) predict the effects of any given MPA network on conservation and economic outcomes and (2) optimize the design of MPAs to achieve desired objectives. Much of our work is grounded in California where we have been involved in a process to establish a state-wide network of MPAs. Key issues surrounding the design of MPA networks include the extent and dynamics of larval dispersal and adult movement, fishing pressure and management regulations outside MPAs, and the relative weight society places on conservation versus fishery objectives.

On the surface, MPAs may not appear to be a preferred management instrument for highly-migratory species such as tuna. But it is worth considering the geographic scale of MPAs that would be required to have a conservation impact for such species. It is possible that very large MPAs could simultaneously achieve conservation objectives for tuna and mitigate some of the classical overharvesting problems associated with trans-boundary stocks. One reason to be optimistic is that no-take MPAs are relatively cheap to monitor (compared to monitoring the catch of other countries). In principle, placing large MPAs over international boundaries or the high seas can possibly have the benefit of reducing territorial disputes, and may reduce the incentive to overharvest.

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Individual Transferable Quotas

Individual Transferable Quotas (ITQs) allocate a fixed percentage of the scientifically determined total allowable catch (TAC) to individuals, firms, or cooperatives. Those entities "own" their shares in perpetuity – when the TAC is large, their fractional share is large, and when the TAC is small, their harvest is low. This means that ITQ owners want the fish stock to grow over time because they will earn a higher income from harvest in the future, creating a strong incentive for sustainable fishing. Importantly, there is a strong role for science in an ITQ program – program participants want the catch to be set appropriately. If the catch is too large, the future value of the catch is jeopardized and the asset price decreases. Our work on ITQs has primarily focused on the global efficacy of this particular management system. Around 2% of global fisheries (though up to 25% by volume) use this system, with considerable success. We have found these stocks much less likely to collapse, and much higher in value than comparable fisheries managed with systems that induce a race to fish among participants. However, we have also found that ITQ systems can have shortcomings such as their cost to implement and their inability to deal with spatially heterogeneous habitat and metapopulations and food web dynamics.

In principle, ITQs are a natural fit for the management of migratory tuna stocks. Often, good stock information is available, which helps scientists set reasonable total allowable catches. However, a critical requirement for a successful ITQ program is that quota owners are able to monitor each other's catch. If overharvesting is difficult to detect (e.g. country A cannot directly observe how many fish country B is catching), then economic models would predict potentially severe illegal harvest and stock collapse.

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Costello C., Lynham J., Lester S., Gaines S. (2010) Economic incentives and global fisheries sustainability. *Annual Reviews in Natural Resource Economics* **in press: available online**.

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TURFs with MPAs

While ITQs provide a "property right" over a fraction of the TAC, TURFs may be used to provide a property right over a spatial area for harvesting. On a large scale, a country's EEZ could be viewed as a TURF. On a smaller scale, individuals or cooperatives may have exclusive rights to harvest in a particular area of the ocean (e.g. in Chile, Mexico, or Japan). When a TURF completely contains the fish harvested within its boundaries, and when the people managing the TURF are sufficiently coordinated, we expect TURFs to lead to positive economic and ecological outcomes. But most species contain a long-distance larval dispersal phase and/or a migrating adult stock, so the first condition is likely not met. This "dispersal externality" may cause TURFs to fail. Our work on this issue addresses this fundamental issue and explores (1) how TURFs can be designed to minimize (or eliminate) this problem and (2) whether MPAs can be sited in strategic locations amidst TURFs to overcome the spatial externality. The answer is that MPAs and TURFs can have synergistic effects – designing a spatial fisheries management system that incorporates both approaches can often achieve economic and conservation goals simultaneously.

The challenges noted above for using MPAs to manage migratory stocks clearly apply to tuna. To be practical, both TURFs and MPAs would need to be large to have any appreciably positive effect on managing a highly migratory species. If fishing effort could be capped or limited within each TURF, this approach may gain additional traction.

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Cooperatives as "Sectors"

Cooperatives can form for a number of reasons including but not limited to marketing, harvest coordination, gear coordination, supply chain, and scientific information sharing. One condition that appears to be necessary for a cooperative to form is some kind of exclusivity (exclusive access to the resource) – fishermen only formally cooperate when the gains from cooperation can be captured by themselves. An innovative management approach involves formally allowing one or more cooperatives to form, and then to allocate a share of the TAC to each cooperative. In this way, the cooperative serves as a "sector," where fishermen self-select in, or out, of the cooperative. We analyzed this kind of fishery management system in Chignik, Alaska, a salmon fishery that used this system from 2002-2005 with great success.

While this approach has not been used in very many fisheries, we see no reason it could not be applied more broadly. For example, the "cooperative" unit could be several fishermen, several sectors, or several countries. In any case, many of the concerns raised above still apply (observability of catch is the key one) for migratory stocks, and the opt-in structure has to be designed so it does not disadvantage those who opt out, as was the case in the Chignik salmon fishery.

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Fisheries Certification and Industry-Driven Reform

There is a growing trend for consumers to demand seafood from sustainable sources. To the extent that this demand translates into higher prices or expanded markets, there may be industry pressure to ensure that their fisheries are managed in a demonstrably sustainable way. While the link between consumer demand and industry reform is often tenuous, new approaches may hold promise. Even completely in the absence of regulatory reform, fish buyers with monopsony power may be able to place certain "sustainability" requirements on the fish they purchase. If done successfully, those buyers may be able to facilitate sustainability certification for their sourced seafood, and thus directly affect reform of fishing practices.

A key challenge is “leakage” where strict requirements by one processor are simply relaxed by another, resulting in no net change in fisheries practice. This would seem to be a problem with tuna where catch monitoring is difficult. One caveat is if the large monopsony buyers could collaborate on these restrictions, and thus reform the industry en masse. Another option worth considering is to couple this industry pressure with other conservation measures, such as MPAs, to facilitate sustainability certification. While this approach has, to our knowledge, not been formally analyzed, it may hold tremendous promise for fisheries reform.