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Are catch shares compatible with ecosystem-based management? Experts respond

Governments around the world are striving to implement ecosystem-based management (EBM) for their marine environments. At the same time, there is a trend toward applying catch shares to manage fisheries. Catch shares are systems in which the privilege to harvest a specific area or portion of a fishery's total catch is assigned to particular individuals or groups. (More details are in the box at the end of this article, "[Common types of catch shares](#)".) According to one study, 20-25% of global landings by volume and 15-20% by value are now managed under catch shares (http://catchshares.edf.org/sites/catchshares.edf.org/files/Global_Catch_Share_Fisheries_Map.pdf).

With the growing popularity of catch shares as a management tool, questions on how well this tool combines with others - like EBM - have emerged. EBM, for example, moves away from single-species or single-sector management and toward approaches that consider ecosystems as a whole. Catch shares, meanwhile, have primarily focused on allocation of single species - although there are increasing examples of multi-species fisheries, too, that have used catch-share programs.

In this issue of MEAM, we examine what opportunities exist for EBM and catch shares to complement one another. We posed the question:

"Can catch shares promote EBM?"

...to a diverse panel of experts including fishers, fisheries managers, social scientists, ecologists, and conservation professionals. What emerged was a wide variety of responses, reported below.

To MEAM, their responses suggest that one answer to the question is, "It depends." The devil is in the details. A well-designed and well-implemented catch share system may indeed be able to play an important role in fisheries management in an EBM system. On the other hand, an ill-designed and -implemented system may be an obstacle to achieving EBM goals.

Furthermore, we recognize that the wording of our poll question could be flipped. As suggested by some of the responses below, it may be just as important to consider how EBM (and its tenets of ecological and human sustainability) can be used to promote good catch share programs as vice versa.

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Catch shares can indirectly support some goals of EBM. In my view, two of the biggest benefits of catch shares are reducing the "race to fish" and fostering collaboration among fishing participants. This has led to quite a bit of innovation on bycatch and discard reduction. For instance, the real-time monitoring of bycatch that is currently happening in the US and Canadian trawl fisheries is possible only because of the catch share system. The ability to conduct "test tows" to minimize unwanted bycatch is a direct consequence of ending the race to fish. Finally, the ability and incentives to invest in research to avoid interactions with threatened/endangered species are enhanced in catch shares. In fact, I see few successful examples on this score outside of catch share fisheries.

That being said, I don't see catch shares assisting with other goals of EBM, such as managing trade-offs and dealing with cumulative effects of anthropogenic stressors.

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In my view, it's all about incentives. Therefore the question becomes, do catch shares incentivize good environmental stewardship? In theory, allocating rights incentivizes good resource stewardship. However, in the case of catch rights, the incentives apply to stewardship of the targeted stock, and not necessarily the greater ecosystem. By contrast, fishers and catch share owners often see an incentive to degrade the greater environment in order to maximize catches, and hence maximize value of the catch right.

Perhaps the best example of this is shellfish or demersal fisheries in which fishers in the past have been incentivized to clear complex benthic habitat to reduce the likelihood of net fouling and provide greater soft sediment habitat for target species. Hence, unless right-holders perceive that protecting aspects of the greater environment will increase the productivity of target stocks and hence catch-rates, or somehow add value or minimize loss of value to the allocated right, then there is no obvious incentive through which the allocation of catch rights will lead to better overall environmental outcomes.

The challenge therefore becomes how to create these economic incentives. Ideas that have been put forward include economic penalties or effective taxes for fishing over high value habitat [and potentially damaging that habitat]. This would incentivize fishers not to fish in particular spatial areas that have been deemed worthy of more protection. Economic penalties for bycatch are also common, although these can create the perverse incentive of dumping bycatch.

It is not difficult to argue that catch rights on their own do not directly incentivize good environmental stewardship. However, there are possible ways to add incentives into the rights that drive the desired stewardship outcomes (<http://onlinelibrary.wiley.com/doi/10.1111/j.1467-2979.2011.00442.x/abstract>).

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Catch shares support EBM by aligning fishermen's incentives with the protection of marine ecosystems through a system of rights, responsibilities, and rewards. By giving fishermen the privilege or right to harvest a secure area or share of the catch, fishermen are responsible for protecting fish stocks and marine ecosystems and are rewarded by stable and healthy populations.

Area-based catch shares, or Territorial Use Rights for Fishing (TURFs), allocate secure, exclusive fishing areas to fishermen. Because TURF participants benefit directly from a healthy ocean within their area, they are motivated to conserve and protect it. Several TURFs around the world were even developed and implemented with specific environmental goals in mind. The Os Miñarzos Marine Reserve of Fishing Interest, a TURF located off the coast of Galicia, Spain, was implemented to help recover fish stocks and protect biodiversity. Within the TURF lie two no-take reserves designed to protect highly productive spawning and breeding grounds. Since implementation, fishermen have reported increased and larger catches. In Japan, fishermen have voluntarily established more than 1000 marine protected areas along the coast and many have specifically been designated to support fish stocks in their TURFs.

Well-designed catch share programs are increasing catch limit compliance and driving reductions in bycatch and discarded fish. In addition they are protecting and restoring marine habitats, while also meeting socio-economic goals like increasing revenues, stabilizing jobs, and reducing fishing expenses for fishermen. These programs not only support EBM but are vital to preserving the health and sustainability of our oceans and marine habitats.

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Implementing EBM involves defining policy goals and recognizing trade-offs. In fisheries, catch shares can be used as a distributional tool once trade-offs are determined. Given clear policy goals, thoughtfully designed programs where outcomes are monitored and evaluated, and management approaches that can be modified to mitigate undesirable outcomes, catch shares can support EBM.

Regrettably, goal setting in fisheries has often been an afterthought, with monitoring of socio-economic outcomes rare. Choices about what ecosystem services should be sustained, what tradeoffs must be made, and how services are best distributed across communities should inform EBM implementation. Otherwise, it is unlikely that EBM will succeed. These issues become more complex at broader marine planning scales where multiple jurisdictions come into play over a broader set of interests.

In the Northeast USA, social scientists have developed socio-economic fishery performance measures that track outcomes of firms and fishery-dependent communities. In two catch share fisheries (the Northeast groundfish "sectors" and the Mid-Atlantic ITQ tilefish fishery), these measures connect socio-economic performance to ecosystem performance, allowing evaluations of the efficacy of management programs in achieving objectives. Ultimately, while catch shares can be an integral part of EBM in some fisheries, successful implementation of EBM depends on many other factors, including the distribution of benefits and costs.

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The value and promise of transitioning to a management approach that recognizes the complex interactions between and among ecosystem components is that it allows for more effective evaluation of tradeoffs and better-informed decisions when setting harvest levels. The EBM approach does not eliminate the need to set and strictly enforce science-based catch limits for individual stocks. In fact, doing this is a prerequisite for effective EBM.

So the question becomes how best to effect these individual catch limits within an EBM context. Clearly, open-access directed fisheries often result in enormous inter-annual variability in fishing effort and instability for commercial harvesters, which makes this approach incompatible with effective EBM. Once a fishery operates under a well-informed, responsible catch cap and has transitioned to a limited access program to allow for better management, then allocation or catch shares are the most effective way to allow harvesters and fishing businesses the stability and flexibility to operate successfully within the system.

Catch share management does not, by itself, promote or encourage EBM. It can serve as a key component of a comprehensive EBM approach, by facilitating the adherence to a catch limit - which can both help to end overfishing and support rebuilding depleted resources. The critical catch share design elements necessary to achieve this are: 1) comprehensive catch accountability; 2) annual quota-setting including real-time information and explicit consideration of ecosystem relationships; and 3) measures to provide fishing businesses and communities opportunities to build stability and resilience by securing diverse fisheries access.

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Twenty-five years ago, I started out as a commercial fisher in the Hauraki Gulf of New Zealand. I paid \$35 for my license to fish for snapper (*Lateolabrax orientalis*) by demersal longline and joined a fleet of about 20 vessels working out of the town of Coromandel. There was a Total Allowable Catch for the fishery, and in theory, the fishery would be closed when this limit was reached. In practice, however, this never happened, and snapper stocks in the Gulf were grossly over-fished for years.

Five years into my fishing career, the NZ Government introduced Individual Transferable Quotas for recognized commercial fishers, defined as those who held a valid license and landed more than five tons of fish per year. This definition had the effect of disenfranchising the majority of Maori fishers, most of whom caught more than five tons but distributed their catch around their local community before selling the surplus.

Fast-forward to 2013. Snapper stocks have (to an extent) recovered, but the local commercial fishing industry has all but collapsed. No more than half-a-dozen vessels work out of Coromandel, and the local processing plant has closed. The fundamental reason for this is that any fisher who does not own quota now has to rent catch entitlement from a quota owner at 30-40% of the value of the fish caught. Quota ownership has steadily moved from individual fishers to large companies, which use more environmentally damaging fishing methods such as Danish seining and bottom trawling. Owner-operators are now a rarity in the Hauraki Gulf. This experience demonstrates that ITQs do not necessarily promote EBM and can have harmful social and ecological consequences even if the target stock shows signs of recovery.

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Catch shares may not be the best management option for every fishery, but where appropriate and properly implemented, they are expected to promote EBM. The granting of limited access privileges and individual fishing quotas (IFQs) associated with catch shares can eliminate the "race for fish", reduce overinvestment and overcapacity, reduce or eliminate overfishing, improve profits, and improve fishermen's safety. These achievements are well in line with EBM objectives.

However, catch shares can also have significant negative effects that can be detrimental for ecosystem health and the socioeconomic wellbeing of fishing communities. High grading (bringing only the highest quality fish to shore and throwing away the rest) is one of the damaging ecosystem effects usually associated with IFQs. Also, IFQs are typically single-species oriented, making multispecies or ecosystem approaches difficult or unviable.

The initial allocation of IFQs is usually the most difficult socioeconomic aspect in the implementation of catch shares. It involves the privatization of an otherwise public resource and its transfer to a few selected initial recipients, frequently without proper consultation or sharing of economic returns and benefits with society. Other problems to be avoided are the concentration of shares in few hands, the impoverishment and eventual displacement of traditional local fishing communities, and the transfer of the wealth generated by the fishery to the newly created catch shares owners sector, which may be outside the fishery sector and even outside the fishing country when shares are transferable. To retain this wealth, some countries limit transferability of shares to nationals or national fisheries entrepreneurs, boat owners, or fishermen.

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If (i) healthy and (ii) sustainable eco- and human systems are understood to be those that exhibit a strong tendency to persist in a fairly unchanged form, I have found in my research that catch shares in fisheries generally promote such healthy and sustainable eco- and human systems compared to many (perhaps most) alternatives.

With secure, long-lasting catch shares, the holders of these shares have a vested interest as well as some power to manipulate the aquatic ecosystem to maximize the value of their catch shares. This generally implies restoring the stock sizes of species that have been negatively affected by previous fishing activity (under most alternative management systems), reducing stock fluctuations, and reducing the risk of serious shocks to the ecosystem, thus promoting ecosystem health and sustainability.

Catch shares also increase the flow of sustainable economic benefits from the fishery (be it recreational or commercial) and thus promote (in a certain sense) healthier and more sustainable human societies. Note that catch shares may in many cases substantially alter the human fishing societies that developed under the previous fisheries management system (as they will the aquatic ecosystem). The previous human system (as well as the ecosystem) was probably not healthy and sustainable in the above sense anyway for a number of reasons including excessive fishing and the attraction of (and possibly environmental impact from) other human economic activities not subject to the same environmental constraints.

BOX: Common types of catch shares

The term "catch shares" refers to fisheries management systems that allocate a secure privilege to harvest a specific area or portion of a fishery's total catch to individuals, groups, or communities. Catch shares come in many forms with many acronyms. Some of the most common types and terms are:

- **Individual Quotas (IQs):** programs that allocate the right to harvest a portion of a fishery's total allowable catch (TAC) to an individual. Individual Transferable Quotas (ITQs) are IQs that can be bought, sold, or transferred to other individuals.
- **Community Quotas:** programs that allocate the right to harvest a portion of the fishery's total allowable catch (TAC) to a community.
- **Territorial Use Rights for Fisheries (TURFs):** programs that allocate the right to harvest a secure area to an individual, group, or community.

BOX: Designing ecologically sound catch share programs

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Environmental Defense Fund (EDF) recently released a toolkit with an updated Catch Share Design Manual that gives fishery managers and fishers the resources they need to design fishery management programs that support the health and sustainability of marine ecosystems.

One of the most important steps in designing a catch share program that meets ecological goals is to define and quantify the available resource. This is the case whether the management goal is rebuilding depleted fish stocks or reducing bycatch of non-target species. For this step, the manual outlines key questions that help users select species and stocks to include in the program, identify the appropriate spatial range of the program, and set appropriate mortality controls. These actions prevent overfishing and help maintain marine ecosystem balance by ensuring that catch is appropriately limited and all sources of fishing mortality are included.

Since many fisheries managers and stakeholders do not have access to the resources needed to fully assess fish stocks, particularly in developing countries, the toolkit also includes a guide to science-based management of data-limited fisheries. This supplement to the Catch Share Design Manual outlines a systematic approach that fishery managers can use to conduct quick and relatively inexpensive science-based assessments - enabling fisheries around the world to take an important step toward effective, ecologically sound management.

The guide, along with the entire toolkit, is available at <http://catchshares.edf.org/resources/toolkit>

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