

# **The Big Picture: A “Fishery System Approach” Links Fishery Management and Biodiversity**

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## **ABSTRACT**

Biodiversity has not been a prominent consideration in conventional fishery management, even though biological concerns and the concept of ‘sustainability’ are long-established in fisheries. This is because traditionally, the focus of management has been on determining the harvest of fish that can be taken as a ‘sustainable yield’ and then restricting the catch of fish to within this limit. Typically missing from the analysis have been (1) interactions of fishing with the broader marine ecosystem, and (2) interactions of the fishery with the broader coastal economy and coastal communities. Accordingly, there is a need to move toward a ‘big picture’ perspective, a ‘Fishery System Approach’, in which fisheries are understood and managed in the context of marine ecosystems and coastal human systems, thereby addressing the needs of both biodiversity conservation and integrated management of multiple ocean uses. This paper elaborates on these themes, exploring the duality of the Ecosystem Approach and the Livelihood Approach as means to move toward sustainable, resilient fishery systems, ones in which biodiversity values can be more fully included.

**Keywords :** Fishery Management, Biodiversity, Fishery System Approach, Ecosystem Approach, Livelihood Approach, Sustainability, Resilience.

## **INTRODUCTION: LIMITATIONS OF CONVENTIONAL FISHERY MANAGEMENT**

With the Convention on Biological Diversity, new legislation to protect endangered species, and various other initiatives, fishery managers in many jurisdictions are increasingly obliged to ‘deal with’ biodiversity. Such considerations have been far from the forefront of conventional fishery management, with biodiversity an aspect of marine conservation that has received little attention within the theory of fishery management or within its practice. This is perhaps surprising, given that biological elements play a major role in fishery management, and a longstanding ‘science of sustainability’ lies at the heart of fishery science, but it can be explained through examining how fishery management developed.

Conventional fishery management had an historical focus on the single-species concept of the *sustainable yield* – determining a harvest compatible with the reproductive potential of the fish, that can be taken this year and every year into the future. This balancing of present-day benefits and future rewards is along the lines of the concept of ‘sustainable development’, but has been inherent in fishery management long before the latter term appeared (Schaefer, 1954; Beverton and Holt, 1957; World Commission on Environment and Development, 1987). Indeed, this

conception of fishery sustainability is well entrenched, and its lengthy history combined with its rather narrow definition have had a negative impact in limiting the scope of fishery management. The manifestations of this are as follows...

First, the above places too much attention on physical and economic *outputs* from the fishery, and too little on sustaining key *processes* underlying the fishery. Some of these processes relate to health of the aquatic ecosystem, and the integrity of ecological interactions, while others deal with the human components of the fishery – social, cultural, economic, community and institutional. The lack of attention to processes, and to the environment around the fishery, has been reinforced by a single-minded focus in many industrial fisheries on managing by Total Allowable Catch. Such a focus unfortunately creates a false sense that if the catches of individual targeted species are controlled, the entire fishery system will be healthy.

Second, the historical focus of conventional fishery management on single-species *sustainable yield* (and its present-day manifestation in terms of TACs) has led to overly-narrow conceptions of ‘sustainable development’ and of fishery sustainability. In reality, sustainable fisheries involve more than sustainable yields and sustainable profits to the fishers. A related shortcoming of the sustainable yield focus is the value it places on stability. There is an increasing realization that a healthy fishery requires not just sustainability but also *resilience* – the capability of a system to absorb and ‘bounce back’ from perturbations (shocks) caused by natural or human actions. Such resilience is a crucial ingredient of ecosystems, fishing communities, and fishery management systems. Yet, as Holling (1973) noted, a fishery managed to produce the same ‘yield’ year after year – even if apparently ‘sustainable’ – is unlikely to build up the resilience that reflects the capability, built up over time, to respond to fluctuations and changes.

## MOVING FORWARD: A FISHERY SYSTEM APPROACH

Thus, there are some significant limitations of conventional fishery management and its single-species *sustainable yield* focus. Yet given the evolution of thinking on fishery sustainability, as described above, and the corresponding development of fishery management, it is not surprising that biodiversity conservation lies outside the usual bounds of such management. Furthermore, conventional fishery management has created an inertia that is difficult to overcome. When new imperatives come along, as with the need to deal with biodiversity, the response is often in the form of incremental measures – in this case, seeing biodiversity conservation as one more factor or constraint for fishery managers to take into account. This incremental approach might make sense if in fact fishery management had been generally successful in the past, a ‘proven’ approach that just needs fine-tuning. Yet the reality is that failures in fishery management have been numerous, harming both the natural ecosystems and the human communities dependent on the fishery. It is thus reasonable to ask whether management of fisheries can be ‘fixed’ through an incremental approach, whether biodiversity and other ‘new’ considerations can be properly incorporated within a conventional framework, or whether new directions may be needed.

The argument here is for a fundamental broadening of the perspective in fishery management, to what can be called a Fishery System Approach (Charles 1998, 2001). Such an approach counters an overly-narrow perspective both on the ecosystem side and on the human side of the fishery, taking a ‘big picture’ perspective that incorporates aspects of the ecosystem and biophysical environment within which the target fish stocks live, as well as the fishing communities and socioeconomic environment within which the fishers live. Indeed, a Fishery System Approach

has as a key element the Ecosystem Approach, a means to deal with ecosystem impacts and interactions that counters the tendency (at least in industrial fisheries) to focus on individual fish stocks while inadequately dealing with the natural environment around those stocks. This implies that (1) when managing a fish stock, we keep in mind interactions with other stocks or species, and with the marine habitat, (2) when monitoring and managing fishing activity, we take into account not only impacts on the target fish stocks, but on non-target species and the ecosystem as well, and (3) when dealing with any human uses of the ocean, we manage broadly for ecosystem health. All this has the potential to rectify the lack of attention paid to biodiversity within conventional fishery management.

At the same time, a Fishery System Approach extends the spirit of the Ecosystem Approach by adding the equivalent on the human side. This helps counter an excessive focus in conventional fishery management on those doing the fishing, and neglect of the two-way interaction of fishery management with the social and economic environment around the fishers – including fishing communities and households. For example, when conventional management focuses on a target fish stock and the fishers catching that stock (e.g., in managing the fishery through a Total Allowable Catch), not only might biodiversity considerations (such as non-target species) be neglected, the health of fishing households and communities on the human side may also receive too little attention.

The equivalent of the Ecosystem Approach on the human side may be the Livelihoods Approach, a perspective that expands beyond “fishery jobs” *per se* to emphasize the entirety of individual, household or community sources of well-being and livelihood (income). A positive example of applying a Fishery System Approach might lie in the development of marine protected areas, where an ecosystem approach broadens the focus beyond any given fish stock, and equivalently a ‘big picture’ understanding from the human side serves to address impacts of the MPA on the local community, and the involvement of that community, among other goals.

A Fishery System Approach can also help broaden the perspective on sustainability in fisheries. We can see the long-term well-being of fishery systems as requiring a reasonable balance among a number of sustainability components (Charles 1994, 2001). *Ecological Sustainability* includes the need to maintain fish stocks at ‘sustainable yields’, but also the need for suitable ecosystem capacity and quality. Similarly, *Socioeconomic Sustainability* deals with economic performance of fishers but also involves a broader consideration of overall social and economic welfare, aggregated across the fishery and including sustainable net benefits and distributional equity. These components are complemented by *Community Sustainability* (maintaining or enhancing the well-being, cohesiveness, and long-term health of human communities in the fishery) and *Institutional Sustainability* (maintaining financial, administrative and organizational capability over the long-term).

## SOME CHALLENGES

While the desirability of a Fishery System Approach may be clear, significant negative inertia remains in fishery management. Here we consider just two aspects of that inertia...

“*The System Works*”. First, there is a strong tendency in fishery management to believe that “the system works”, that while there may have been problems in the past (such as fishery collapses!), those problems have been fixed and the management system is working now. There may be a

need for relatively small incremental changes to improve things, but nothing drastic. This reflects an unfortunate type of over-confidence inherent in the ‘Fallacy of Controllability’ (Charles 2001, 2004), an immodest belief that more can be controlled in the fishery than is in fact possible. A belief that ‘the system works’ seems to be a recipe for future disasters.

“*A Dead Fish is a Dead Fish*”. Second, a ‘slogan’ that on the surface is a bland truism – there is no doubt that the statement is true – is used to convey a faulty message, that it does not matter how a fish is killed in fishing (only that it is indeed killed). In other words, any method of fishing is the same ecologically as any other, if it results in the same catch of fish. In reality, of course, how we fish does indeed matter. The various ways of fishing have varying effects on other species and on fish habitat – as is obvious if one looks at the use of dynamite or cyanide versus other means of fishing on coral reefs. A broader perspective on fishery management could not fail to take into account the relative impacts of the various fishing gears on the ocean habitat. While certainly any fishing gear can pose conservation problems if used improperly, we know that there are differential impacts of gears even if all are used ‘properly’. Specifically, evidence has accumulated of the impacts of bottom trawling on the ocean bottom, the food chain, and ocean productivity – see, for example, Watling and Norse (1998). Such impacts can affect the future productivity of the fishery, but can also have direct impacts on biodiversity – which, as noted earlier, is not something that traditionally attracted much attention in fishery management.

Certainly these and other reflections of the inertia inherent in conventional fishery management need to be addressed to make a Fishery System Approach as effective as possible.

## CONCLUSION

A key lesson from history is that:

Fishery sustainability will remain elusive unless  
more attention is paid to what happens beyond the fishery.

A Fishery System Approach offers the potential to move beyond the conventional approach to fishery management, to broaden into a ‘big picture’ that links the Ecosystem Approach with the Livelihood Approach. In practice, this means that fishery management decision making must include more voices – such as that of biodiversity conservation, on the one hand, and of coastal communities on the other hand. The idea is to build in these key elements, not merely as ‘constraints’ on the fishery but as legitimate objectives of society. To this end, we can learn from efforts to implement Integrated Coastal Management and watershed management, as these necessarily involve taking a broad multi-voiced perspective.

In reality, it is not clear that moving to the broader perspective will be possible within current institutions. A classic ‘fishery agency’ may not be able to deal properly with the sustainability of marine ecosystems and coastal communities, or with fully incorporating biodiversity and human dimensions around fisheries. This could be especially the case if that fishery agency is embedded within a department or ministry of agriculture or natural resources. Thus there may be a need for changes in government structure, perhaps investigating the creation of Ministries or Departments of Oceans, within which fisheries are managed, together with other ocean uses, and the health of the oceans is protected as well. This is a model utilized for integrated forest management, where forestry is but one use of the forest, and biodiversity and other environmental values are (at least

in theory) prominently incorporated. Certainly challenges arise in forest management, but it is at least a model to explore as we move into an era in which biodiversity receives greater attention.

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