From single species to ecosystem-based management: prospects for effective biodiversity conservation

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ABSTRACT

Political commitment to the transition from single species to ecosystem-based fisheries management is ubiquitous, and consistent with commitments to sustainable development. Ecosystem-based management provides a framework for managers to take account of a greater range of fisheries impacts on biodiversity than the single species approach. With the adoption of ecosystem-based management, operational objectives for biodiversity conservation can be set based on existing scientific knowledge. However, the achievement of these objectives will not be straightforward, since the ecosystem-based approach is likely to be compromised by the same factors that have compromised single-species management, principally the difficulties of simultaneously achieving economic, social and economic sustainability. The introduction of tenure may provide a solution, but meeting biodiversity conservation objectives that do not provide short-term benefits to fishers will involve high short-term costs. The likelihood of Governments meeting these costs will depend on the extent of societal support for biodiversity conservation. Moreover, economic incentives, coupled with regulation and enforcement will also be needed to ensure biodiversity conservation. This requires a degree of top down and centralised management, and the capacity for such management is greatest in wealthy countries. In most poorer countries, the move towards sustainability and improved biodiversity conservation will still be hampered by the relatively high social and economic costs of reducing fishing capacity, unless wealthier countries intervene to provide transitional support and alternate sources of food and income.

INTRODUCTION

Most of the world's major fisheries have been managed on a stock by stock basis. It is widely accepted that this approach to management has not maximised the social, economic or ecological benefits from fisheries and has not led to the sustainable use of biodiversity. In recent years, managers have sought to develop and implement an ecosystem-based approach to fisheries management (synonymous with the ecosystem approach to fisheries, hereafter referred to as EAF). The adoption of this approach reflected political commitments to sustainable development and its purpose was to plan, develop and manage fisheries in a manner that addressed the multiple needs and desires of societies, without jeopardising the options for future generations to benefit from the full range of goods and services (including, of course, non fisheries benefits) provided by marine ecosystems (FAO 2003). The widespread adoption of an EAF provides a framework for setting management objectives that account for the effects of fisheries on biodiversity, that is the direct and indirect effects of fishing on the variety, quantity and distribution of genes, populations, species, communities and ecosystems. Here, I consider the current impacts of fishing on biodiversity and whether the EAF is likely to lead to improved biodiversity conservation.

FISHERIES IMPACTS ON BIODIVERSITY

The effects of fisheries on biodiversity have been widely reviewed elsewhere and can broadly be categorised as effects on target species, effects on genetic structure, effects on bycatch species, effects on communities and food webs and effects on habitat (reviews: Dulvy et al., 2003; Gislason & Sinclair 2000; Hall 1999; Jennings & Kaiser 1998; Kaiser & de Groot, 2000; Law 2000; Sinclair & Valdimarsson, 2003). With single species management, operational objectives usually related to controlling the effects of fishing on target species. The EAF provides a framework for setting operational objectives relating to fishing effects on all other aspects of biodiversity.

The extent of fishing effects on biodiversity is underestimated due to a limited capacity for research and monitoring and a focus on large conspicuous and economically valuable taxa (Dulvy, this meeting; Heip, this meeting). More research effort is now focused on description of fishing effects on biodiversity, but rather less on the development of solutions. Research in both areas is required, but given the unsustainable fishing effects described, a greater emphasis on solutions is warranted. In researching solutions, the experience gained from single-species management should not be overlooked (even though the learning process has been difficult and often characterised by failure).

I conclude that existing scientific knowledge is sufficient to set operational objectives relating to many aspects of biodiversity conservation (and see Rice, this meeting). Given the negative impacts of fishing on biodiversity that are known, and the World Summit on Sustainable Development (WSSD, 2002) commitment to halt biodiversity loss by 2010, it is unnecessary to wait for more complete knowledge before setting such objectives.

FAILINGS OF SINGLE SPECIES MANAGEMENT

In general terms, single species management has often led to unsustainable exploitation because social, economic and ecological objectives could not be met simultaneously (FAO, 2002a). In particular, no parties were willing to pay the high short term costs of reducing capacity and thus to make the transition to sustainability. In a review of the more specific drivers leading to unsustainability, FAO (2002a) identified the key drivers as inappropriate incentives and market distortions, high demand for limited resources, poverty and lack of alternatives to fishing, complexity and inadequate knowledge, lack of governance, and interactions of the fishery sector with other sectors and the environment

In single-species management, ecological science advice usually played a small role in the decision making process. Necessary actions to ensure ecological sustainability were identified but, to avoid high short term costs, managers often accepted the *status quo*. As a result, fishing pressure typically exceeded levels that would result in sustainability and fishing had additional and unsustainable impacts on biodiversity. One relatively comprehensive analysis suggests that 47% of the world's main stocks or species groups are fully exploited, while 18% are overexploited and 10% are severely depleted or recovering from depletion, while 25% of stocks are under- or moderately exploited (FAO 2002b).

POSSIBILITIES FOR ECOSYSTEM-BASED MANAGEMENT

Requirements to protect ecosystems from the wider impacts of fishing, and to adopt an EAF, have now been written into most of the key policy documents relating to marine environmental management (Rice 2005; Sainsbury and Sumaila 2003). In adopting the EAF and seeking to introduce biodiversity conservation objectives, it is necessary to consider whether an EAF can nullify the main failings of single species management and lead to improved biodiversity conservation.

The very high short term costs associated with moving towards sustainability will be common to both single species management and the EAF. Commitment to meeting these costs will principally determine whether an ecosystem-based approach can contribute to reducing the rate of biodiversity loss. It should not be assumed that taking account of the ecosystem will automatically lead to more willingness to pay these costs than at present. Effectively, the EAF is as vulnerable to the factors that encourage unsustainability as single species management.

If the main problems that lead to unsustainability can be overcome, through commitment to funding the transition from overcapacity to appropriate capacity and introducing tenure systems (Hilborn, 2004), then the status of target stocks should improve and the effects of fishing on biodiversity are likely to be reduced. However, there will still be effects on biodiversity that compromise commitments made at WSSD (e.g. ICES, 2001). In these cases, better biodiversity conservation cannot be expected without strong societal support, economic incentives that favour conservation and effective monitoring and enforcement. That is, the conservation of biodiversity will require some top down centralised management and implementation of such management is likely to be more effective in wealthier countries

INFORMATION NEEDS FOR DECISION MAKERS

Despite the headline impacts of fisheries on conspicuous or target species, fishing effects on most aspects of diversity are difficult to monitor. If operational objectives that relate to biodiversity conservation can be set, then it is a feature of almost any management system that management and Government will want to know about progress in relation to objectives. However, the resources to do this will be negligible and most monitoring programmes are not expected to demonstrate changes in most aspects of biodiversity on time-scales of 5 years and less (Nicholson & Jennings, 2004). In many cases, such as monitoring trends in abundance in rare offshore fish species, trends would typically not be detected until 15 years or more of monitoring had been completed. In part, the low power of surveys to detect trends is a function of the historic depletion of species (Maxwell & Jennings, 2005).

If Governments need short term information on progress towards biodiversity conservation targets, they will need indirect measures of the effectiveness of management to supplement longer term measurements of biodiversity. This can be achieved by adopting pressure indicators (in this context the distribution and intensity of fishing) for which short term reference directions and targets would be set based on knowledge of the link between the pressure and impact (Nicholson & Jennings, 2004). This is an essential but not necessarily easy way to work, for managers cannot easily see the results of their policies despite the cost.

CONCLUSIONS

The political commitment to the implementation of an EAF has the potential to further marine biodiversity conservation. The EAF provides a framework for incorporating a wide range of

biodiversity conservation objectives into management plans. Many fishing effects on biodiversity are already known to compromise sustainability. The extent of these fishing effects is underestimated due to a limited capacity for research and monitoring and a focus on large conspicuous and economically valuable taxa. Within an EAF framework, existing research does, however, provide the basis for setting biodiversity conservation objectives, and many of the policy instruments and management tools to support achievement of the objectives already exist but may not be used.

Despite the shift from single species to ecosystem based management we have not resolved a practical means of addressing social, economic and ecological objectives simultaneously. Principally, this is due to a lack of willingness to bear the short-term costs associated with moving towards sustainability. However, as the profile of biodiversity conservation continues to increase, so society may exert more pressure on Governments to set operational objectives for biodiversity conservation and to bear the high short-term costs of meeting them. Thus the prospects for biodiversity conservation are better in countries where Governments can bear these costs. Even if management is implemented, Governments will get little short-term feedback to judge policy success or failure- unless targets for pressure are set in addition to targets for impacts.

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