A Need for Marine Reserves

Rethinking approaches to marine fisheries management and conservation

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Introduction

Increased efficiency in fishing and transportation technologies since the industrial revolution have greatly increased pressures on marine resources worldwide and have led to the collapse of many fisheries. In response to this global phenomenon, the 'precautionary approach' was adopted by the UN in 1995 to try and establish sustainable management of fisheries around the world through two novel policy guidelines: the UN FAO Code of Conduct for Responsible Fisheries and the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks (MacGarvin 2002). The FAO Code of Conduct recommends the establishment of targets, limits and predetermination; the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks sets minimum standards for fisheries based on the concept of Maximum Sustained Yield (MSY) (MacGarvin 2002). The MSY approach sets allowable catch sizes based on the theoretical limit of harvest that can be sustained indefinitely.

While countries such as Canada have established fishing management practices that are even more conservative than those outlined by the UN/FAO (Lauck *et al.* 1998), they continue to be plagued by fisheries declines. The precautionary approach as outlined by the UN/FAO is an ineffective tool in the implementation of sustainable fisheries management because uncertainty associated with the models upon which management decisions are based encourage the overexploitation of marine resources. Any admission of uncertainty only encourages the fishing industry to demand quotas at the upper limit of the confidence interval, as science has not "proven" that lower quotas are necessary (Lauck *et al.* 1998).

Uncertainty in these models stems from a high degree of climate variability and its effect on marine ecosystems, and the inherent complexity of these ecosystems. Integration of minimum goals for the establishment of marine reserves into the precautionary approach would increase effectiveness of management strategies and address issues of scientific uncertainty by establishing a source of baseline data from which to observe natural variability and ecosystem structure.

Climate Variability

One source of uncertainty in fisheries management stems from the lack of understanding of how climate fluctuates, and how these fluctuations affect marine ecosystems. Traditionally, declines in fishing stocks are blamed on over-fishing (McFarlane *et al.* 2000), but natural and anthropogenic climate fluctuations and changes also influence marine population dynamics and distributions. Population dynamics and environmental conditions can be relatively stable on decadal scales, but shift abruptly during climate regime shifts (McFarlane *et al.* 2000). Understanding of these climate shifts is not well enough developed to even come to a consensus on their occurrence, let alone effectively predict their effects of fisheries.

For example, twenty years later, scientific consensus has yet to be achieved about the proposed occurrence of a climate shift in 1989 and the subsequent effect on fisheries stocks in the Pacific Northwest (McFarlane *et al.* 2000). Even if understanding of the effects of these climate shifts becomes great enough to be able to manage them by simply adjusting harvest rates, reaching a consensus among managers and fishermen and restricting fisheries in time to adjust to the impacts of shifting climate regimes may be insurmountable (McFarlane *et al.* 2000).

Complexity of Ecosystem

Another source of uncertainty limiting the effectiveness of the precautionary approach of fisheries management is the complexity of marine ecosystems. Ludwig *et al.* argue that the complexity of underlying biological and physical system precludes a reductionist approach to management (1993). The UN approach's practical emphasis remains on single stock management (MacGarvin 2002), and fails to take into consideration the multitude of interactions within the ecosystem. For example, traditional single species fisheries models have usually assumed that decreasing egg production will result in improving juvenile survival so that recruitment will not fall off rapidly during stock decline and will hence tend to stop the decline (Pauly *et al.* 2002). It is now understood that these interactions are more complex; adult predatory fish can control the abundance of potential predators and competitors of their juvenile offspring (Pauly *et al.* 2002).

Increased research efforts to obtain a more complete understanding of these interactions and therefore decrease uncertainty in management practices may not be effective. Lauck *et al.* argue that full understanding and predictability of anything as complex and unobservable as a marine ecosystem will forever remain a chimera (1998). Fishing limits the ability to research these interactions by increasing ecosystem pressures and pushing ecosystems to alternate stable states with different interactions.

Marine Reserves

Scientific understanding and consensus of fisheries is hampered by the lack of controls and replicates (Ludwig *et al.* 1993). The establishment of minimum standards for protected marine reserves would establish a source of baseline data that would aid in reducing uncertainty in managed fisheries while protecting valuable natural resources. The actual design and implementation of marine reserves would depend on what is known about the biological characteristics of each particular species or species complex (Lauck *et al.* 1998). The monitoring of populations within these protected zones would act as a control that could be used to separate the effects of natural climatic variability on fish stocks from the effects of over fishing. It would also preserve naturally occurring ecosystem structure by excluding fishing pressures, creating a reserve where the complexity of marine ecosystems can be further studied to improve fisheries management models. Reserves would eliminate the time lag between the consensus of reasons for fisheries collapses and management responses, and create "buffer" populations decreasing the risk of total population collapse (see Figure 1).

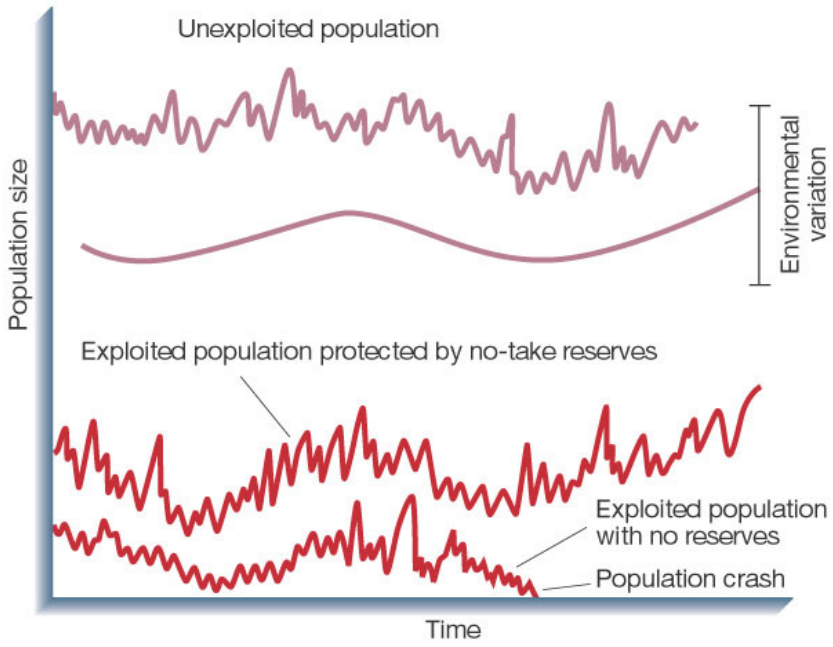

Figure 1. Environmental variation in exploited, exploited but protected and unexploited marine populations (Pauly *et al.* 2002).

Conclusion

The precautionary approach recommended by the UN and the FAO is an ineffective tool in moving towards sustainable fisheries practices. Even when more conservative fisheries practices are in place, uncertainty inherent in the models upon which management decisions are made is a barrier to reaching sustainable use of marine resources. The full implications of uncertainty have not been recognized in the design and implementation of fisheries management (Lauck *et al.* 1998). Setting minimum goals for the protection of marine reserves would facilitate the move towards truly sustainable fisheries practices by creating a source of baseline data from which a greater understanding of the highly complex marine ecosystem could be achieved.

Works Cited

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