Mismanagement of Marine Fisheries

ALAN LONGHURST examines the proposition, central to fisheries science, that a fishery creates its own natural resource by the compensatory growth it induces in the fish, and that this is sustainable. His novel analysis of the reproductive ecology of bony fish of cooler seas offers some support for this, but a review of fisheries past and present confirms that sustainability is rarely achieved. The relatively open structure and strong variability of marine ecosystems is discussed in relation to the reliability of resources used by the industrial-level fishing that became globalised during the twentieth century. This was associated with an extraordinary lack of regulation in most seas, and a widespread avoidance of regulation where it did exist. Sustained fisheries can only be expected where social conditions permit strict regulation and where politicians have no personal interest in outcomes despite the current enthusiasm for ecosystem-based approaches or for transferable property rights.

ALAN LONGHURST began his career in fisheries science, but is best known as a biological oceanographer, being the first Director of the Southwest Fisheries Science Center of the US NMFS in La Jolla, California, and later the Director-General of the Bedford Institute of Oceanography in Nova Scotia, Canada. He produced the first estimate of global plant production in the oceans using satellite imagery, and also quantified vertical carbon flux through the planktonic ecosystem. More recently, in reaction to disastrous Canadian management of NW Atlantic cod stocks, he has offered a number of critical reviews of several aspects of fishery management science. He retired in 1995 and now divides his time between South West France and Nova Scotia.

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Preface

A flood of introspection has overtaken fishery science in recent years, and it would be easy to conclude that everything worth writing had already been written. But the recent literature generally avoids criticism of the central and ancient axiom that fisheries are sustained by the density-dependent increase in growth that is provoked by fishing: what has come to be referred to rather inexactly as surplus production. Uncritical acceptance of this axiom then permits the assumption that fishing ought to be sustainable, provided only that appropriate economic and stock management methods are employed. On the other hand, the recent literature has also been characterised by analyses of the present situation of fish stocks that can only be described as alarmist, and which have been widely reported in the press and other media.

Confidence in the theoretical underpinning of fishing has nevertheless been confirmed at recent international meetings of administrators and natural and social scientists, gathered to discuss the crisis in world fisheries. A review of the documents presented at meetings such as the 1995 Rome Consensus on World Fisheries, or the 2004 World Fisheries Congress, reveals few expressions of doubt concerning theoretical sustainability of fisheries. Instead, the participants call for actions 'to eliminate overfishing, rebuild fish stocks, minimise wasteful fishing practices, develop sustainable aquaculture, rehabilitate fish habitats, and develop fisheries for new and alternate species based on principles of scientific sustainability and responsible management'. Note the use of the loaded term 'overfishing' (which I shall largely eschew) and the fact that this text lies at the heart of the Food and Agriculture Organisation (FAO) Code of Conduct for Responsible Fisheries.[1] Similar conclusions concerning the unquestioning adherence to the axiom may be drawn from quite different discussion groups, such as the scientific forum organised by the Royal Society in London in 2004 on 'Fisheries: past,

present and future'; there, too, the participants appear not to have seriously questioned the sustainability of fishing, and the theoretical basis of fishery science, provided only that social, economic and some ecological processes could be factored into management.

I learned something of the depth of this conviction among the hierarchy of such organisations when I was invited to lecture at the ICES[2] Centennial meeting in 2001, and proposed the somewhat provocative title '*Fish stock management is an unsolved ecological problem*'. The organisers clearly found that this title reflected an insufficiently positive attitude on my part towards the corpus of fishery science, and agreed to it only conditionally – I was asked to reserve part of the time that had been allocated to my lecture for a formal rebuttal . . .

The arguments of this book continue those of my ICES lecture and suggest that, given the perfectly evident problems that plague the fishing industry everywhere, our response – whether as natural or social scientists – remains insufficiently critical of the central assumption that commercial fishing is sustainable and that catches may be taken indefinitely at levels that are satisfactory for all categories of fishing, from industrial to artisanal. By extension, it is also generally assumed that stocks may be managed sustainably to provide yields either at maximal or at economically optimal yields.

Every book about fishery management that you have ever consulted was based on some version of this conjecture, and most of them assumed that it was so obviously true that no alternative was discussed. Although contrary suggestions are so rare as to be effectively invisible, they do exist: one pillar in the edifice of fishery science, the concept of a maximum sustainable yield (MSY), has recently been described as no more than 'policy camouflaged as science'.[3] So nothing is as simple as it seems to be on the surface!

The assumption of surplus production of fish stocks is usually supported by reference to population models that ignore the interaction of the stock with other biota with which it shares its complex and dynamic natural habitat; Daniel Pauly, however, has suggested that an 'ability to produce a surplus that we can share, year for year, is an emergent property of marine ecosystems, contingent on their continued existence as complex entities'.[4] Because it invites us to think not only about fish, but also about their habitat, this is a much more interesting way of saying the same thing as Pieter Korringa in 1976, who suggested that there is a surplus available to be taken from every fish stock, because catching this surplus is only like 'taking the interest on the capital. On that basis we can manage the fishery. It is a good interest: about

20% increase in fish weight per year. You don't make that everywhere.'[5] Korringa's remarks were made during the period when fisheries scientists had perfect confidence that their simple population models were a sufficient response to the problem of computing the allowable catch for each stock. He went on to express great confidence in the system of regulation and policing that existed in the North Sea at that time. Pauly probably has no such confidence, but nevertheless suggested that fishing should be sustainable at levels of exploitation useful to us: his short statement shall serve as the text for my argument in this book.

It is my intention to examine, as critically as I can, our central assumption concerning surplus production, and the consequences of stock management procedures that are based on that assumption. This will require a rather more wide-ranging examination than has usually been the case in analysis of the sustainability concept, even that of the recent and masterly essay by Sidney Holt.[6] It will be necessary to discuss how fish, their food organisms and their predators respond to the physical forcing of their non-linear environment, and the curiously neglected significance of some aspects of their reproduction, nutrition and growth must also be addressed. As shall become clear, this discussion is intended to suggest that reliance on simple population analysis may lead to erroneous conclusions concerning population growth potential.

However, another thread of my argument is quite different from the analysis of the biology and ecology of fish: it is that we can understand the many failures of fishery management only by understanding the social, economic and political climate in which sustainable fishery management is attempted. Perhaps the problems of understanding the ecology of exploited species, of measuring the state of each stock in near-real time, and of setting appropriate catch limits are all trivial compared with the resolution of political interference in setting quotas, of vote-swapping in international fishery commissions and of cheating on regulations by fishermen at sea; further, as I shall point out, very large regions of the ocean are effectively lawless and here fishery management is, and will probably continue to be in our lifetimes, totally ineffectual. I shall suggest that to concentrate attention only on the scientific issues arising from fishing wild stocks, and to ignore the social, economic and political context within which fishing occurs, is to ensure the loss of natural resources.

Although my intention is to expose the present reduced state of marine fish stocks and the consequences of their management (where there is any), you should not expect any insistence concerning what must be changed in order to repair the obvious damage that industrial

fishing has caused to fish stocks and their habitat: the polemics I will leave to the many other people who are less doubtful than I am about the abilities of an exploding human population to manage its future rationally.[7]

This book is one very small outcome of the unexpected collapse of what appeared to be the well-managed cod stocks of the Grand Banks and of other NW Atlantic regions in the late 1980s. Although I was not then working on fisheries problems, I was sufficiently close to those events to be very shocked by them: at that time, I was employed by the same Canadian federal department that had the responsibility to manage the fishery, although I was engaged quite differently – on research into the ecology of the pelagic production system of the open ocean in relation to carbon flux. But the realisation that a defining moment in fisheries science had occurred, and had occurred right on our doorstep, made it inevitable that I should start to think again about fishery management, even after so long a period of involvement in the problems of pelagic ecology.

It is probably appropriate to explain why a biological oceanographer might choose to become involved in the controversies now swirling around the fishery science community. At the start of my career in the early 1950s, I was recruited to one of the six tropical fisheries laboratories that were then operated by the Colonial Office in London: ours was the now long-forgotten West African Fisheries Research Institute, located in Freetown, Sierra Leone. Each of these six laboratories was decently equipped, with access to a sea-going research ship, and staff were encouraged to study the ecology of the near-pristine fish stocks and marine environment that lay off their respective coasts: the whole enterprise was directed by C.H. Hickling, herring biologist, in London. I spent several years investigating and mapping the benthic invertebrate communities and their ecology from the mangroves to the shelf-edge, and from Sierra Leone to the Gambia. Later, I turned to studies of the bionomics of demersal fish, simply because I inherited much unworked data from research on demersal resources off Sierra Leone.

These studies were continued in the laboratories of the Federal Fisheries Service in Lagos, where my Nigerian colleagues and I undertook the gamut of primary research appropriate to trawl-fisheries: mesh-escapement experiments, and investigations of the growth and reproductive biology of the half-dozen species of fish that were dominant in the landings, together with their age-specific diets; we also established a simple system for examining and monitoring the local oceanographic regime. We made proposals to the relevant federal Ministry concerning

mesh regulations and minimum landed sizes, as well as for marine protected areas, where we considered that trawling should be banned to protect stocks for artisanal canoe fishermen. We also surveyed the demersal fish and shrimp resources the length of the Nigerian coastline, and ran a line of stations down to the equator in the international EQUALANT oceanographic survey. They were busy days!

Without that grounding in fisheries science during the heady days of the mid-twentieth century when it seemed that all the answers to fisheries management were coming to hand, I would not have had the courage to undertake this work. Without the assistance of many colleagues and friends I certainly could not have completed it: I am especially grateful to John Caddy, John Field, Bob Francis, Sidney Holt, Peter Koeller, Daniel Pauly, Gary Sharp, Michael Sinclair and many others for stimulating discussions about sustainability and management options in the fisheries. My text was improved by the comments of an anonymous reviewer.

ENDNOTES

1. Chuenpagdee, R. and A. Bundy (eds.) (2005) Innovation and outlook in fisheries: papers presented at the 4th WFC. *Research Reports, Fisheries Center, UBC* **(13)** 113 pp.
2. International Council for the Exploration of the Seas, with headquarters in Copenhagen, is the doyen of international fisheries organisations.
3. Finley, C. (2007) The social construction of fishing. Paper presented at the Oregon State University Conference '*Pathways to Resilience*', April, 2007.
4. This was on the occasion of his receiving the well-deserved International Cosmos Prize in Osaka, as reported in the *Sea Around Us Project Newsletter* (**32**) 1–4.
5. Korringa, P. (1976) In *Biology and the Future of Man.* Paris: University of Paris, p. 202.
6. Holt, S (2006) The notion of sustainability. In *Gaining Ground*, Ed. D. Lavigne. Limerick: IFAW, pp. 43–81.
7. An excellent example of this type of review is given by Pauly, D. *et al.* (2002) Towards sustainability in fisheries. *Science* **418**, 689–95.