The Larkin Lecture – Editor's note

The Larkin Lectures are named in honour and memory of Dr Peter Larkin, of the University of British Columbia at Vancouver, an urbane, popular and productive academic, whose insight of things fishy was tempered by a remarkable sense of both empathy and humour. Peter Larkin was the founder of the UBC Institute of Fisheries in the 1960s, a forerunner of today's Fisheries Centre. When Peter Larkin retired, and later when he passed away in 1996, his family, friends and colleagues contributed money to a Trust fund in his memory that sponsors the Larkin Lectures, which are held approximately biennially at the Fisheries Centre and which are published after passing peer review.

Dr Kevern Cochrane, who presents here the third Larkin Lecture, is a South African and a senior research officer at FAO, with special responsibility for the Caribbean and Southern Africa, which means he shuttles between Rome, Namibia and the Caribbean islands (it's a really hard job, but someone's gotta do it). He began his career as a fishery scientist in a human-made tropical lake, Lake Kariba in Zimbabwe. He spent time as a schoolteacher and as an aquatic resources scientist. Then, during turbulent times in South Africa under the apartheid regime, Dr Cochrane left science for a while and worked as a justice and reconciliation officer for the Episcopalian church. During that time, he worked particularly in the fields of provision of educational support to disadvantaged, black high school students and improving communication between different racial groups. Moving to the Sea Fisheries Research Institute in Cape Town, he worked on small pelagic fishes, was Head of Stock Assessment and Chair of the Benguela Ecology Programme, and played an important role in the early stages of the development of a new, more equitable fisheries policy in the period leading up to democratic government in South Africa.

The title of the paper includes the well-known fisher's expression 'the one that got away'. The origin of this phrase appears to be from *The Fisherwoman*, a 1930s poem by Dorothy Parker, the New York humorist famous for her sardonic wit.

The man she had was kind and clean,
And, well enough for every day,
But, oh dear friends, you should have seen,
The one that got away.

Tony J Pitcher

FISH and FISHERIES, 2000, **1**, 3–21

Reconciling sustainability, economic efficiency and equity in fisheries: the one that got away?

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Abstract

Concern about the global state of fisheries and fish resources has highlighted the three primary considerations in fisheries management: sustainable utilisation, economic efficiency and equity in access to resources. We appear to be failing in pursuit of all three goals. Living marine resources are particularly threatened by overfishing, leading to many of the world's fish stocks being heavily, fully or over exploited. Similarly, the economic diagnosis is that costs of fishing exceeded the value of the world's catch by about US$ 40 billion at the beginning of the decade. Statistics on equity are less available, but the necessary spread of limited access to fisheries frequently has the greatest impact on the small scale, traditional fisher.

This paper considers the reasons underlying the general failure of fisheries management and the solutions that are being proposed. Factors contributing to the problems include high biological uncertainty, conflict between the constraint of sustainability and social and economic priorities, poorly defined objectives, and institutional failures related to access rights and participation in management by the users. These issues point to the real complexity of fisheries management. It is argued that this complexity can be abused by all interest groups to avoid responsibility and to suit their own objectives. It is suggested that there are eight simple principles controlling fisheries management that are generally well-understood and, if properly considered in fisheries management systems, would lead to improved performances.

Responsible management will, however, only be effective if there is a genuine desire to achieve the objectives. Fishing capacity, frequently reflecting dependency of users on fisheries resources, is commonly in excess of the sustainable production of the resources. Excess dependency can preclude the political will to consider alternative strategies and only once it has been overcome, probably requiring solutions borrowed from outside fisheries, is effective management likely to be considered seriously. Thereafter, responsible management requires setting unambiguous objectives and management measures in co-operation with users and other interest groups. The agreed strategy must be included in legislation to ensure transparency and accountability and to constrain decision-makers. The performance of the strategy must be monitored and revised as necessary.

Keywords decision-making, fisheries management, institutions, sustainability, uncertainty.

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Received 1 June 1999
Accepted 3 Aug 1999

Introduction

The problems currently experienced in fisheries management throughout the world are widely recognised and have been very widely discussed. These problems occur in four realms: biological, ecological, economic and social.

Biological crisis

During this decade, awareness of the alarming status of many fisheries resources has grown. Ludwig *et al.* (1993) drew attention to collapses of fish stocks such as those of the Pacific salmon, the Californian sardine and the Peruvian anchoveta, and discussed possible causes. This paper was followed by a response from Rosenberg *et al.*(1993) who drew attention to the available data from fisheries in the United States and the European Union. These sources indicated that approximately 50% of assessed stocks in these waters were being over-utilised. The following year, in its biennial review, the FAO (1994) pointed out that analysis of global fish landings showed that there had been a reduction in the annual rate of increase in landings in the 1980s, and that in 1990 there had been for the first time a reduction in the global annual catch, which was approximately 3% less than it had been in 1989. This trend continued over the next few years and between 1990 and 1992, global landings fell by an average of 1.5% per year (Garcia and Newton 1997).

The signs of a serious problem are unmistakable. In their 1998 report to the Congress of the United States of America, the National Marine Fisheries Service (NMFS), stated that of the 300 species in their geographical area of responsibility for which there was an estimate of status, 90 (30%) were considered to be 'overfished', 10 (3%) to be 'approaching overfished condition' and 200 (67%) to be 'not overfished' (NMFS 1998). Equally importantly, they stated that the status of 544 species in this area was unknown. Statistics for 1990 from the European Commission show that in the waters of the European Union, 44 (57%) out of a total of 77 fish stocks were heavily exploited at that time, where they defined heavily exploited as 'yield will be maintained or increased by a reduction in

fishing mortality rate', and 5 (6%) as being depleted, which they defined as being in a condition where 'the mature fish left in the stock are insufficient to generate enough offspring for stock replenishment' (OECD 1997a). Other countries or regions are likely to show similar statistics. With the demand for fish for direct human consumption forecast to increase from 75–80 million tonnes in 1994/95 to 110–120 million tonnes by 2010 (FAO 1997a), without widespread and effective action the position will deteriorate further.

Ecological crisis

Many fisheries, particularly the larger fisheries, target one or a few species, although the vast majority of fisheries also take other species as bycatch, which may be retained or discarded. Apart from the indirect ecological impact of fisheries through altering the abundance and structure of the target population, fisheries also of course have direct ecological impacts. Stock assessment, however, is limited in both scientific capability and capacity and tends to focus on the target species, frequently neglecting the broader ecological impacts of fishing. While evidence of ecological impacts of fishing, such as trophic cascades, is difficult to assemble, there is increasing evidence that ecosystems can be significantly altered by fishing (Goñi 1998; Steneck 1998).

Two well-known cases of ecosystems apparently being altered by fishing are summarised by Hall (1999). One is the marked declines in abundance of most fish species in the Gulf of Thailand in response to trawling, coupled with the increase in abundance of some species, especially *Loligo* spp., apparently in response to declines in the abundance of competitors. The second, probably the better known example, is the seeming replacement of targeted and valuable groundfish species on the Georges Bank by skates and spiny dogfish, which are of little commercial value. Goñi (1998) suggested that fishing can affect ecosystems through direct effects on target species and bycatch species and physical impacts on the seabed, and through indirect effects transmitted through biological interactions, environmental effects of dumping and discarding and ghost fishing. While referring to the difficulties of identifying such effects and establishing causal relationships, she provided examples or suspected examples of each.

From this perspective, arguably the most disturbing statistic produced by the NMFS (1998) is that the status of 544 species is unknown, a statistic probably representative of the state of knowledge in most fishing nations.

Economic crisis

Fisheries exist to meet social and economic demands and one would expect to find that the impact on the resources has resulted in a measurable economic (or social) benefit. However, the evidence suggests that the expected benefits have not been in the form of economic gain. Christy (1997), using and supplementing information from the FAO, estimated that the gross revenues from the total global marine landings in 1989 was US$ 70 billion. However, he also estimated that the operating costs of marine fisheries were in the order of US$ 92 billion and that the capital costs (the annual cost of having capital tied up in fisheries) were approximately US$ 32 billion, giving a total deficit of US$ 54 billion that year. These figures included the revenue and costs of the former USSR fleet, which has changed dramatically since that time. If the total support to the USSR fleet is removed from the calculations (but retaining the revenues), the deficit still remains at US$ 41 billion. Christy also estimated that about US$ 21 billion in rents was being dissipated, leading to a total wastage of approximately US$ 60 billion per year.

Both a symptom and a cause of the economic crisis is the extent of subsidisation in fisheries around the world. It has been estimated that subsidies in fisheries currently amount to about US$ 16 billion, including state contributions to, for example, the costs of building fishing boats and the costs of fisheries management (World Bank reportcited in Milazzo 1998).

Social crisis

Fisheries are rarely seen as simply tools for generating economic returns and the role of fisheries as a source of employment, particularly in rural or more remote areas, has also widely been given high priority as, for example, in South-East Asia (Bailey 1994), Norway (OECD 1997a), South Africa (Cochrane *et al.* 1997) and Japan (Kalland 1996).

One of the major features of fisheries in recent decades has been the introduction of modern fishing technologies and also the increasing globalisation of trade. Both of these have led to increasing industrialisation and urbanisation of fisheries which has resulted in a shift of power and influence from the fishers to the retailers (Friis 1996). These changes,

coupled with widespread depletion of resources, have had substantial adverse implications for small-scale, rural fishers in many regions. In the North Atlantic and Mediterranean, there has been a ''decline in the quality of life and standard of living'' of many fishing communities (Crean and Symes 1996). Bailey (1994) reported that in South and South-East Asia, larger companies have, in recent years, gained increasing shares of the catches and that employment opportunities in fisheries have shifted to the urban areas. In addition to reducing such opportunities in the rural areas, Bailey stated that this trend also reduced employment opportunities for women who traditionally play important roles in processing, marketing and distributing the catch. These trends have led to a feeling of ''hopelessness and despair or feeling of anger among fishermen, especially small scale [fishermen]'' (Chong 1994).

Causes of the crises

Put together, the scenario above suggests that fisheries management is failing at a global level in all three of its fundamental goals; those of ensuring sustainable use of resources and ecosystems, of providing social benefits, and of achieving economic efficiency. As with the crises themselves, the underlying causes can be placed into four categories: high biological uncertainty, the conflict between ecological constraints and social and economic priorities, poorly defined objectives, and institutional weaknesses, particularly relating to decision-making and co-responsibility. The discussion below uses some examples of apparent good practices, but it mainly uses examples of apparent errors to demonstrate problems and possible olutions. Most of these examples refer to specific countries. It is to be stressed that no comparisons between countries are intended and these examples, taken from the available literature, are far more a reflection of the availability of information than of the relative merits of different management agencies.

Biological uncertainty

If there is one feature of marine capture fisheries that sets them apart from other resource management systems, it is the high level of uncertainty associated with the dynamics of and observations on the resources themselves. While the growth and productivity of any fish population is a function of its biological characteristics and of its magnitude and age structure at a given time, populations frequently also demonstrate very high variability, driven by variability in the environment. This variability may include short-term random variability and the longer-term trends in environmental conditions. One consequence of this is that high natural variability hides the effects of exploitation (Ludwig *et al.* 1993).

The South African pelagic fishery in recent years has demonstrated how these two sources of uncertainty can hinder management. The fishery consists of separate, directed fisheries for sardine and for anchovy, linked by the bycatch of juvenile sardine in the anchovy fishery. Substantial inter-annual variability in both of these two short-lived species normally creates difficulties for management and the fishery, and this has been compounded in recent years by what appears to be a shift in dominance from anchovy to sardine. This has led to a substantial increase in the bycatch of juvenile sardine in the anchovy fishery. Uncertainty about the future relative status of the two stocks, and hence how best to develop the fishery in the medium- to long-term, led to industry pressure to attempt to maximise yields from both simultaneously. This pressure was acceded to on several occasions and led to suboptimal utilisation of the resources and probably to excessive fishing mortality on sardine (Cochrane *et al.* 1998).

The problems of uncertainty in the dynamics of the resource (process uncertainty; Francis and Shotton 1997) are magnified by difficulties in observing and measuring abundance and important population rates in wild aquatic populations. This is referred to as observation uncertainty by Francis and Shotton (1997) and, with process uncertainty, feeds into model and estimation uncertainty, compounding the imprecision of assessment results. Walters and Maguire (1996) described some of the problems in estimating the size and productivity of the northern cod off Newfoundland. These included uncertainty about the relationship between commercial CPUE and abundance, exacerbated by changes in the composition of the commercial fishery. As commercial CPUE is undoubtedly the most widely used index of fish abundance, this problem is fundamental to almost all fisheries' assessments. They also referred to problems inherent in independent survey estimates, stating that for many stocks we do not have the knowledge to devise adequate surveys. The cost of independent surveys for many, and probably most, stocks is also prohibitive.

A comprehensive review of stock assessment methods undertaken by the National Research Council of the USA spelled out the implications of biological uncertainty for assessing the status of stocks (NRC 1998). Through simulations, they found that sophisticated stock assessments could still result in marked over- or under-estimation of true stock size over a number of years, and that most of the estimates obtained in their investigation ''exceeded true values [of exploitable biomass] by more than 25%''. They made several recommendations to minimise such errors and to optimise management decisions in the face of these errors, but they were unable to suggest ways to overcome the basic problems that are not likely to be resolved in the foreseeable future, even given generous funding for research. Fisheries management has to cope with large uncertainty even when provided with the best scientific support available. The implications of this for fisheries management are addressed in the precautionary approach to fisheries (FAO 1996).

When one starts to consider ecosystem management, where biological interactions are even less well understood than many population dynamic processes, uncertainty explodes. Notwithstanding the undeniable inertia of bureaucratic organisations, it is probably awareness of this enormous uncertainty which has, to date, resulted in ongoing preoccupation amongst managers and scientists with single-species approaches and a reluctance to take broader views. However, the pressure to consider ecosystem implications of fisheries management is growing, as evidenced by its direct and indirect emphasis in the Code of Conduct (FAO 1995).

Social and economic priorities

As a source of supply of benefits, fisheries are globally and locally important. At the global level, the fisheries of the world employ, directly or indirectly, approximately 200 million people (Garcia and Newton 1997). Of these, approximately 28 million are employed directly in fisheries (FAO 1999). The total fish catch in 1995 was approximately 91 million tonnes, with an additional 21 million tonnes coming from aquaculture (FAO 1997a). Of this, in the vicinity of 80 million tonnes of the catch was used for direct human consumption with the balance being used mainly for production of fishmeal and fish oil (FAO 1997a). This catch generates a complex network of commercial activity and about one third of the world's fish catch is traded internationally (Garcia and Newton 1997) with the value of international fish trade in 1994 at US$ 47 billion. Approximately 85% of fish imports, by value, were into developed countries (FAO 1997a).

At a local level, fisheries provide food and livelihoods. In Canada, the dependence on fisheries was sharply felt when some 25 000 fishermen and 10 000 workers became redundant with the collapse of the Canadian east coast cod fishery (Matthews 1995). Similarly, in many countries of South and South-East Asia, small-scale fisheries are very important providers of employment (Bailey 1994). The total number of people directly employed in small-scale fisheries has been estimated at over 12 million (Pauly 1997).

The biological and ecological crises discussed above are driven by this social and economic importance, and the precedence frequently given to social and economic priorities over resource conservation priorities is one of the recognised problems in fisheries management (e.g. Corten 1996; Parsons and Beckett 1997; Cochrane *et al.* 1998). Noonan (1998) wrote ''In the heavily industrialised European fisheries, socioeconomic considerations are paramount'', and this situation is very common in other regions as well.

While this discussion has set social and economic priorities together in opposition to the goal of biological sustainability, social and economic goals are themselves frequently seen as being in conflict in fisheries management, and there are widespread accusations that powerful economic interests are frequently given priority over social considerations. Referring again to the Canadian cod fishery, Matthews (1995) argued that the national government had made a deliberate choice to favour economic rationalisation over ''social considerations concerning local communities''. Arguing in broader terms, Symes (1996) stated that policy making systems increasingly favour the bigger companies with more money and McGoodwin (1990) suggested that large-scale fisheries have enjoyed much greater government support than the small-scale sector. A common hierarchy would therefore appear to be giving highest priority to economic interests and lowest priority to protecting sustainability.

Poorly defined objectives

Related to the conflict between conservation and socioeconomic objectives, is the fact that the

objectives of fisheries are frequently only poorly defined at best, and even when defined are unlikely to be defined in any considered operational manner. This has been widely discussed (e.g. Hilborn *et al.* 1993; Olver *et al.* 1995; Pikitch *et al.* 1997). The problem of conflicting objectives was probably the major contributor to the damaging departures from a management procedure for the South African pelagic fishery even though this is a relatively simple fishery with two stocks and two heavily overlapping major user groups (Cochrane *et al.* 1998). The problem multiplies as the number of user or interest groups increases (Jentoft and McCay 1995; Pikitch *et al.* 1997; Cochrane 1999). In the European Union, it has been suggested that it would be impossible to obtain immediate agreement amongst the different partners of the Common Fisheries Policy on the objectives for their fisheries (Laurec and Armstrong 1997).

The problem also increases multiplicatively as the number of species being harvested increases. Pikitch (1988) stated that it is impossible to optimise the yield of each species separately in a multispecies fishery and that some compromise is required. However, she went on to state that the very limited knowledge on multispecies interactions probably means that maximisation or optimisation of objectives is impossible.

In the absence of clear and unambiguous objectives, it is impossible for fisheries managers to know what is expected from them, and the likely response is to make decisions based on immediate crises and short-term, poorly considered objectives.

Institutional weaknesses

The final contributory cause to the crisis in fisheries management is that of failures within the structures of fisheries management itself, i.e. in the institutions of fisheries management where an institution is considered to include the rules that govern fisheries management, the process of fisheries management and the organisations that practise fisheries management (OECD 1997b).

The two most important institutional features influencing the effectiveness of fisheries management around the world are the access regime and the extent of user participation in the process. Fisheries management in the past has been characterised by open access and a government-controlled top-down approach (e.g. Pearse 1994 and Symes 1996). The problems of open access are well understood and include the inevitability of resource over-exploitation (unless other controls are in place) and unavoidable economic inefficiency. The dominance of open access regimes in fisheries has been an important contributory factor to the current poor state of fish stocks and fisheries (Pearse 1994). As a result, many countries have implemented or begun to implement systems of limited access (Rosenberg *et al.* 1993). Without attempting to prescribe the system, the FAO Code of Conduct for Responsible Fisheries (FAO 1995) calls for fishing effort to be commensurate with the productivity of the stock, for only authorised fishers to be allowed to fish, and for a system which promotes suitable economic conditions. These guidelines imply a system of limited access. The issue has been so widely discussed that it is unlikely that any agency currently managing a fishery under open access is doing so unaware of the biological, social and economic implications of the approach.

The principles of sharing responsibility in fisheries management are also generally well understood. OECD (1997b) summarise these succinctly and suggest that while top down approaches reduce costs associated with consultation (which are not trivial, as discussed by Cochrane 1999 and Healey and Hennessey 1998), they lead to poor communication, suboptimal management decisions, and high levels of dissatisfaction amongst fishers, all leading to poor compliance with laws and regulations. The prevalence of top-down systems has tended to isolate fisheries management agencies and officers from the fishers, leading to a lack of legitimacy of the former (and therefore their regulations) in the eyes of the user, and hence to poor compliance and co-operation (Jentoft 1989). This has contributed to serious problems in the management of many fisheries, including examples in Canada (Parsons and Beckett 1997), the European Union (Laurec and Armstrong 1997; Noonan 1998) and South Africa (Hutton *et al.* 1997).

Complexity in fisheries management

These problems and the many examples of their occurrence illustrate the complexity of fisheries systems, which, embodied as uncertainty, is most usually given as the underlying reason for the failure of fisheries management, as discussed above. This complexity makes it extremely difficult in most cases to determine the precise cause or causes of failure in any specific case. Walters and Maguire (1996) listed a number of possible causes of the

collapse of the Canadian cod stocks, and, within a subset of these causes, Parsons and Beckett (1997) referred to the possible reasons for fishing mortality exceeding expected levels in the Canadian groundfish fishery. Cochrane *et al.* (1998) referred to the unresolved question of the exact cause of the collapse of the Benguela sardine population in the 1960s and 1970s. Overall, the position was summarised by Ludwig *et al.* (1993), ''There have been a number of spectacular failures to exploit resources sustainably, but to date there is no agreement about the causes of these failures.''

This underlying complexity in fisheries and fisheries management cannot be denied, and, particularly at the level of biological and ecological uncertainty, precise prediction is impossible. However, this complexity has also been exploited, whether deliberately or unintentionally, by many fisheries decision-makers to support decisions to continue over-exploiting the stock. In the South African pelagic fishery, Cochrane *et al.* (1998) wrote of the industry seeing their choice as between a bird in the hand or two in the bush, and opting for the former. Hilborn *et al.* (1993) referred to the common experience of decision-makers selecting the most optimistic scenario when presented with a range of options.

The approach of the fisheries science community has been to emphasise communication and explicit expression of uncertainty as being a foundation of improved fisheries management (e.g. Hilborn *et al.* 1993). The consideration of uncertainty has become a major theme of fisheries science, as exemplified by many of the papers already referred to and, for example, the ICES symposium Confronting Uncertainty in the Evaluation and Implementation of Fisheries-Management Systems (Cape Town, November 1998). However, by increasing both communication and the scientific pursuit of uncertainty, both of which are essential in appropriate measure, there is a tendency to increase complexity in the management process itself. Bureaucratic expansion and increasing calls for further research are certain results, and are possibly out of proportion to probable returns in the form of greater management success (Healey and Hennessey 1998; Cochrane 1999). These two directions also bypass the fundamental cause of over-exploitation, i.e the priority given to short-term socioeconomic needs. Hence, while communication and consideration of uncertainty are fundamental to successful fisheries management, they will not in themselves solve the problems.

A new emphasis on simplicity: eight principles of fisheries management

Fisheries systems are complex. The underlying complexity in the dynamics of fish stocks (and even more so of fish communities) in their highly variable environments, coupled with the complexity of the local, international and global socioeconomic networks and systems into which they enter as commodities, creates dynamics that are impossible to predict with confidence or precision. However, to focus on this complexity masks the fact that the principles of fisheries management are well understood and can accommodate this complexity. If these principles are followed with a genuine desire to attain clearly defined and agreed objectives, fisheries management should on average be successful or at least markedly more successful than current performances.

The preceding discussion, and the vast amount of literature that it attempts to encapsulate, has revealed a number of basic principles which underlie effective fisheries management (Table 1). In very brief terms, so as to avoid immediately being blinded by complexity, these principles attempt to highlight the key considerations in devising or improving fisheries management systems. They address the factors affecting growth and productivity of fish populations, emphasising the variability and uncertainty that surrounds this. They draw attention to the fundamental conflict between use and minimising risk to a stock or community. This conflict means that solutions to fisheries management problems are always trade-offs between desirable goals, and are never ideal solutions. This need for compromise becomes even more marked in multispecies fisheries where the number of conflicting goals increases multiplicatively with increasing number of species. The problem of uncertainty is inherent to fisheries management and the precautionary approach (FAO 1996) considers ways of ensuring sustainable and effective management in the face of uncertainty. This is summarised in Principle V (Table 1) as decreasing the yield taken (as a proportion of the theoretical maximum) as uncertainty increases. In order to translate such caution into operational terms, it is necessary to develop harvesting strategies that are robust to the major uncertainties (Butterworth *et al.* 1997; NRC 1998). Of course, the cost of such caution is in economic and social benefits that would have been attainable with greater knowledge (Cochrane 1999).

Table 1 The eight broad principles governing effective fisheries management.

I	Fish stocks and communities are finite and biological production constrains the potential yield from a fishery.
II	Biological production of a stock is a function of the size of the stock and is also a function of the ecological environment and is influenced by natural or human-induced changes in this environment.
III	Human consumptive demands on fish resources are fundamentally in conflict with the constraint of maintaining a suitably low risk to the resource. Ever-developing modern technology provides humans with the means, and demand for its benefits provides the motivation, to extract fish biomass at rates much higher than can be produced.
IV	In a multispecies fishery, a description that encompasses almost all fisheries, it is impossible to maximise or optimise the yield from all fisheries simultaneously.
V	Uncertainty pervades fisheries management and hinders informed decision-making. The greater the uncertainty, the more conservative should be the approach (i.e., as uncertainty increases, realised yield as a proportion of estimated maximum average yield should be decreased).
VI	The short-term dependency of society on a fishery will determine the relative priority of the social and/or economic goals in relation to sustainable utilisation.
VII	A sense of ownership and a long-term stake in the resource for those individuals, communities or groups with access are most conducive to maintaining responsible fisheries.
VIII	Genuine participation in the management process by fully informed users is consistent with the democratic principle, facilitates identification of acceptable management systems, and encourages compliance with laws and regulations

The principles draw attention to the fact that where there are pressing human demands or needs, for example to satisfy economic interests or for food or employment from fisheries, these will almost invariably take precedence over longer-term goals, including that of sustainability. A fundamental need in fisheries management is therefore to address the question of dependence on fish resources and to reduce it to a level where other goals and objectives are likely to be considered. The last two principles draw attention to institutional features of effective management: the need for those utilising a resource to have a long-term stake in that resource, encouraging a sense of stewardship and responsibility; and for all legitimate users to be involved in fisheries management. Implicit in Principle VIII, requiring fully informed stakeholders, is the need for transparency, as well as the need for the management agency to be proactive in disseminating information.

Of course, one can add detail and qualification to these principles. For example, under Principle I, one could discuss variability, time scales of variability, the relationships between growth, mortality and production, how best to estimate different parameters and variables, and many of the other rules of population dynamics. Under Principle VII, one could discuss the relationships between transferability of rights and improved efficiency, the relationship between homogeneity and the number of rights' holders and the efficiency of limited access systems, or the value of social sanctions as opposed to purely legal sanctions. Under each of the principles a number of subprinciples and sub-subprinciples could be added and each plays an important role in guiding fisheries managers as they attempt to fulfil their responsibilities. The Code of Conduct for Responsible Fisheries includes 46 separate paragraphs dealing with different aspects of fisheries management (FAO 1995) and RAPFISH, a system designed to appraise the sustainability status of fisheries, includes 37 attributes related to the ecological, economic, sociological and technological aspects of fisheries (Pitcher and Preikshot 1999). These two examples demonstrate the level of complexity of fisheries and that the eight principles in Table 1 reflect only a low level of resolution. Although the principles do not provide exact solutions, they do encapsulate the essential elements of fisheries management. It is suggested that these principles provide a functional framework sufficient to steer decision-makers in the correct direction once they have determined clear and attainable objectives.

Failures in fisheries management

Where fisheries management has failed to achieve the ends expected of it by some, it has generally failed because one or more of these principles has been knowingly over-looked or inadequately considered (e.g. Cochrane *et al.* 1998; Corten 1996; Rosenberg *et al.* 1993; Noonan 1998; Matthews 1995), and not because the principle was insufficiently understood or because the indicators in the fishery were grossly misinterpreted. One possible exception to this assertion that violations have been intentional rather than unintentional, is that of the Canadian cod. Walters and Maguire (1996) demon-

strated the errors in assessment of the stock that contributed to the collapse of the fishery, demonstrating that there was a measure of error in this case. However, even here, Charles (1998) described the lack of a precautionary approach in the management of the fishery, driven by a desire to ''avoid disrupting harvesting activity'' and the requirement for the scientists to prove a conservation crisis before appropriately conservative management action would be taken. This suggests a high level of intention in addition to any error, a situation that is probably the norm rather than the exception in fisheries management throughout the world.

This argument of deliberate choice does not only apply to the question of sustainability. In the same manner, where social benefits, including equity, have been forsaken in the pursuit of economic efficiency, this has been a deliberate choice. The literature on the social and economic impacts of different systems of resource allocation is extensive (e.g. McGoodwin 1990; Matthiason 1992; Squires *et al.* 1995; Pálsson & Helgason 1996) and, in general, policy makers can adapt a system of access rights and fishing approaches to cater for the specified objectives. Experiences in the OECD countries gave strong support to the theoretical expectations from the use of individual catch quotas (OECD 1997b). These included enhanced ability to control exploitation, generation of resource rent and reductions in the number of participants in a fishery. Introducing an unfettered individual transferable quota (ITQ) system can be expected to generate greater economic efficiency, but only at the expense of employment opportunities. Similarly, an open access system in an environment of limited employment opportunities, or allowing effort in excess of sustainable levels, may avoid having to make hard decisions about excluding people now, but the cost will be steadily eroding incomes for the fishers as the resource base is depleted.

As examples, the nature of access rights in the Common Fisheries Policy (CFP) of the European Union also has social implications that are broadly predictable. Sandberg (1996) argued that the continuation of the CFP in its present form, with common fishing grounds, will result in the disappearance of fishing communities as they have existed in the past, under the development of a totally industrialised fishery. As referred to above, Matthews (1995), Symes (1996) and McGoodwin (1990) argued that governments had shown clear preferences for large-scale and economic interests over the social concerns of their small-scale counterparts. McGoodwin (1990) did not lay all the blame for this at the door of the decision-makers who he suggested were ''no less constrained than the fishers by the immense economic, political and legal forces...'' (p. 84), of which he suggested market forces have been the most influential.

The priority given by the decision-makers to social and economic goals over the goal of sustainability, and the widespread priority given to economic interests over social, are therefore attributable to the decision-makers. Where there is criticism of these choices, primary responsibility for the choice must lie with the decision-maker, and not be attributed to uncertainty or ignorance. In most cases this responsibility begins with the elected political leader. An approach common to many nations is reflected by the words of an elected government minister in one fishing nation ''It is the role of the minister and not of public servants to make policy decisions affecting the fishery'' (Hutchings *et al.* 1997). Whether or not the minister, or equivalent, does actually make the decisions in practice or whether these are made by senior bureaucrats or committees, the responsibility commonly lies at the level of the political head (see discussion of accountability in Pinkerton and Weinstein 1995). The reasons for the failure of fisheries management and the search for improvements must therefore focus on this political realm, and address the question of whether the priorities have been appropriate in each case and whether the best decisions were made given the selected objectives. Excessive focusing on the scientific issues and on uncertainties are distractions from the core problem and, as argued by Symes (1996) and Cochrane *et al.* (1998), may even be used by the decision-makers to avoid their own responsibilities.

A typical decision-making structure is shown in Fig. 1. Just where in this hierarchy actual responsibility for final decision-making lies varies from country to country. Jentoft and McCay (1995) demonstrated a wide-range of focal points of responsibility amongst 12 developed and democratic countries. In South Africa, the elected Minister is responsible but has usually taken the advice of his advisory committee (e.g. Cochrane *et al.* 1998). In Canada, the elected official is similarly responsible (Hutchings *et al.* 1997). Hilborn *et al.* (1993) indicate that in California, the final decision is made by the Pacific Fishery Management Council, appointed by the governor of the state. However,

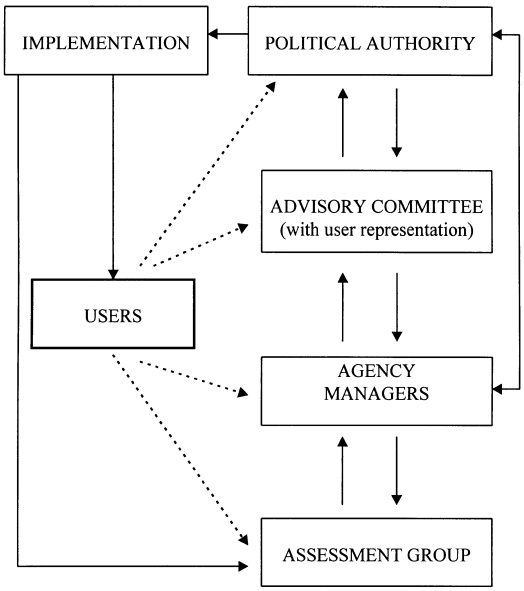

Figure 1 A typical decision-making structure in fisheries management based on that of South Africa (e.g. see Cochrane *et al.* 1998). Here, users are taken to include both consumptive and nonconsumptive users, and the stakeholders include all five groupings shown in the figure. The details and resolution vary (e.g. see Hilborn *et al.* 1993; Lane & Stephenson 1998) but the five different groupings and roles are generally represented in some form in modern fisheries management. Solid arrows indicate formal flows of communication and broken arrows informal communication.

wherever actual responsibility is, what is important is knowing where responsibility for the final decisions lies, knowing the policy and legislative framework within which decisions are taken, and knowing the rationale for each decision.

While it is suggested here that many of the failures attributed to fisheries management have been deliberate political choices, the role played by scientists has contributed to an environment in which poorly defined objectives, poor implementation and a lack of accountability have been able to proliferate. Cochrane *et al.* (1998) suggested that the fisheries scientists, which included all the authors of that publication, who provided advice for the South African pelagic fishery allowed themselves to be pressured, albeit reluctantly, into providing scientific justification for total allowable catches (TACs) set higher than they would have recommended in the absence of socioeconomic pressures. There have been reports of similar problems in other countries (e.g. Hutchings *et al.* 1997). Scientific endorsement, even if unintentional, has also been claimed to have occurred in the conflict between social and economic concerns. Symes (1996) argued that science was used to justify a system of control based on TACs and quotas that, he suggested, both protected the policy-makers from having to clarify their objectives and protected the interests of capital. He also pointed out that the system of ITQs, which certainly finds great favour amongst fisheries scientists, benefits mainly those with capital and easy access to it. Similarly, accusations of favouring the large-scale industry over the small-scale fishers in the Canadian cod disaster have been levelled at the scientists (Matthews 1995).

Probably even more common is the problem of scientists utilising uncertainty as a means to avoid making strong recommendations. An example of this is the accusation from the House of Lords in Great Britain that scientists of ICES were providing ''heavily qualified advice'' and their suggestion that ''scientific professionalism is currently providing an excuse for political compromise''. This same group called on scientists to provider clearer and stronger advice, including drawing attention to clear trends (Masood 1996). Reflecting a similar desire to avoid taking responsibility, Jentoft and McCay (1995) reported complaints from scientists in Norway that they were being compelled to advise on desirable biomass target levels.

Of course, scientists have also been accused of the opposite, of having too much confidence in their results and of putting forward results without adequate emphasis on uncertainty (e.g. Finlayson 1994). It is a fine line that needs to be followed, but it is consistent with the principles of scientific study. The task of the scientist providing advice for fisheries management is to ensure that the information provided, including uncertainties, is objective and constitutes the best estimates realistically possible, and that they are conveyed to and understood by the decision-makers. Included in this process is the need to ensure that this information is neither under- nor over-valued by the decision-makers.

While it is the responsibility of the scientist to reflect the genuine uncertainty in any estimates or forecasts (Hilborn *et al.* 1993; Francis and Shotton 1997), there may also be personal advantages for natural or human scientists working in fisheries assessment should they emphasise uncertainty and complexity. These advantages may encourage excessive emphasis in order to reinforce their own power and role by

nurturing a 'guru' image and to help to create additional opportunity for research funds. In addition, they simultaneously absolve themselves of responsibility, or at least minimise their responsibility, by emphasising the uncertainty in their analyses.

The opportunity to blame failures on uncertainty is also to the advantage of the other role players illustrated in Fig. 1. Greater uncertainty reduces the responsibility of all players and gives greater freedom through avoiding the constraints of rigid objectives. Making fisheries management work towards any one or a combination of sustainability, equity and economic efficiency may not be a priority to all and, for example, the political cost to a senior decision-maker of attempting to resolve a fisheries management problem by excluding a large number of fishers from their livelihood may outweigh the political benefits of solving it, especially as the costs are likely to be more immediate than the benefits. Such an option may therefore not be supported by the responsible political authority (Caddy 1999). As suggested by the House of Lords (*op. cit.*), uncertainty can be used to avoid such hard decisions.

Responsible fisheries management under the eight principles

The above can be summarised as suggesting that while there is much real uncertainty in fisheries management, the general principles, and their implications, are relatively simple. The major problems therefore are found in the decision-making process and the priorities of the different role players, including in some cases the general public.

If this premise is correct, then what can be done to ensure that fisheries management does achieve its goals? At this point, I should clarify that different nations, cultures and individuals will apply different relative priorities to biological, economic and social goals. I therefore make no attempt to set such priorities here. A country has control of its own exclusive economic zone (EEZ) and within that may choose its own priorities. However, the 1982 UN Convention on the Law of the Sea (UNCLOS) states in Article 61.2 that ''The coastal State, taking into account the best scientific evidence available to it, shall ensure . . . that the maintenance of the living resources in the EEZ is not endangered by overexploitation.'' Hence coastal states have a legal obligation to manage their fisheries for sustainability. This was reaffirmed in 1995 when the Code of Conduct for Responsible Fisheries was unanimously adopted by the FAO Conference. The Code emphasises sustainability as a basic goal in fisheries management and it is therefore reasonable to assume that sustainability is accepted, at least in theory, as an important consideration in most fishing nations.

With reference to the relative priority of social and economic goals, UNCLOS simply requires that ''The coastal State shall promote the objective of optimal utilisation of the living resources'' (Article 62.1). However, the Code of Conduct goes further, albeit gently, and states that ''. . . due recognition should be given, as appropriate, in accordance with national laws and regulations, to the traditional practices, needs and interests of indigenous people and local fishing communities which are highly dependent on fishery resources for their livelihood.'' (Para. 7.6.6).

Whatever the national objectives, fisheries management should be effective in achieving these objectives, even if at a low level of precision compatible with the power of fisheries assessment (Healey and Hennessey 1998). At the same time as striving for improved forecasting ability, scientists, politicians, users and other interest groups need to accept fully the responsibility for decision-making with the best information available. Whatever management decisions are made, they should be made deliberately and in full knowledge of the alternatives and the costs and benefits associated with the chosen path (Caddy and Griffiths 1995).

The process shown in Fig. 2 is suggested as a framework for ensuring effective and accountable management. The process is iterative and the sequence is therefore a guide more than a recipe. It suggests that effective and accountable management begins with the political will at all levels to achieve it. Thereafter, the socioeconomic environment in which fishing effort can be reduced as necessary must be established, the operational objectives must be set in a transparent and participatory manner, and these same objectives must be entrenched in legislation or regulations prior to their implementation,

The role of the global climate in facilitating or hindering the development of political will is also important. UNCLOS sets an international legal framework within which countries should operate. In addition, UNCLOS has since been supplemented by the FAO Compliance Agreement (Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas) and the UN Fish Stocks Agreement

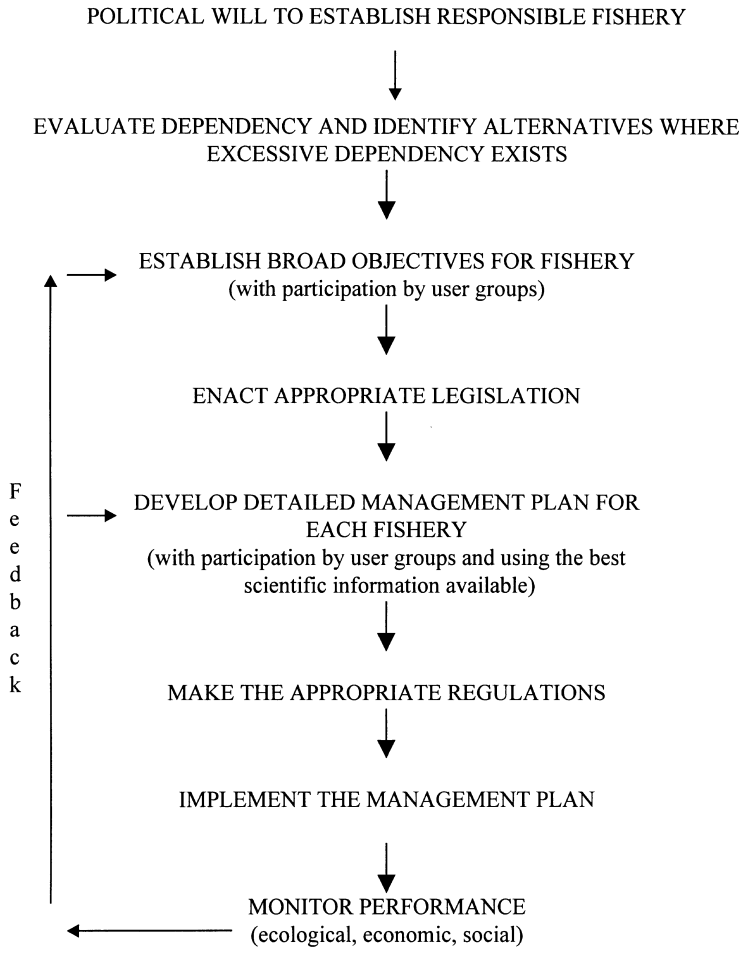

Figure 2 Key steps in promoting effective and accountable fisheries management.

(Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks). While not binding, the FAO Code of Conduct (FAO 1995) also provides overarching principles which member countries have agreed to implement in their fisheries.

Political will and the problem of dependency

The primary level at which clear objectives should be sought is that of national policy or legislation. Frequently, this is vague and of little value to actual implementation. Hersoug (1996) wrote "...the practical goals... given by the politicians are usually very general and normally presented without explicit priorities, so that fisheries managers are left with great discretionary powers." In a specific example, Olver *et al.* (1995) pointed out that while the Canadian courts have emphasised the responsibility of the federal government for conservation, as reflected in the Fisheries Act, no clear definition of conservation in fisheries has been developed. As a result, the relative priority of conservation in relation to social and economic priorities remains unclear.

Nevertheless, policy does set the context for more specific directives. Many states achieve such general prioritisation without difficulty, and the internationally accepted Code of Conduct for Responsible Fisheries (FAO 1995) and the widely supported precautionary approach (FAO 1996) achieve this level of specification.

Problems tend to be experienced at the next level, where general policy needs to be turned into decisions and actions, frequently with some cost incurred either by excluding some fishers completely or by reducing the income of many. Political will is necessary to move to this level in fisheries management, and dependency on the resources may become

the politically over-riding factor in determining whether this will exists (Laurec and Armstrong 1997; Parsons and Beckett 1997; Cochrane *et al.* 1998).

As long as there are no acceptable alternative sources of employment and livelihood available to fishers, or a subset of the fishers, there will be extremely strong resistance to any changes that result in some of them losing access. This problem is particularly acute in developing countries where opportunities for alternatives are likely to be very low and where unemployment rates are already high. Parsons and Beckett (1997) suggested that CAN$ 1.75 billion was spent over 5 years on those affected by the closure of the cod fishery, and the 1997 Report of the Auditor General of Canada reported that CAN$ 3 billion had been spent, up to that time, during the 1990s in supporting the industry (Anon 1997). It seems highly improbable that it would have been possible to close the Canadian east coast cod fishery without this financial cushion.

While many developed countries can afford to buy out their fishers, this is not an option for most developing countries. In the absence of social welfare, a more likely scenario for the Canadian cod fishery would have been no decision to close the fishery and instead a gradual attrition of resource and active fishers would have taken place as the latter remained fishing as long as possible until forced to consider alternatives by impossibly low incomes. Under such a scenario, a government would not have to take as much responsibility, or blame, as they would through proactively closing the fishery and leaving people without livelihoods.

The particular difficulties faced by developing countries are recognised in the Code of Conduct, in which Article 5 is dedicated to 'Special Requirements of Developing Countries'. This calls for assistance, including financial and technical assistance, to be provided to developing countries to assist them in meeting their need to develop responsible fisheries. These needs must include finding alternative sources of livelihood for those who will be displaced from fisheries where effort is reduced to achieve sustainability. Solutions that do not adequately achieve this will either fail or will simply result in similar problems arising elsewhere.

The question of dependency is not just relevant to developing countries and the fact that the world's fishing capacity is some 53% greater than that required to take the global catch and that in 1996 the European Union was planning a 40% reduction in its fleet give an indication of the magnitude of the problem (Economist, 23 May 1998). Seen in this manner, as a consequence of individuals and countries relying on fisheries as a source of livelihood, the primary solution for the problems of fisheries management becomes the same as those for the global problems of, for example, improving conditions for the estimated 828 million people in the world who are chronically undernourished (FAO 1998) or reducing the rate of deforestation in the world (e.g. see World Bank 1996). McGoodwin (1990) reached the same conclusion when he suggested that fisheries management ''is actually an arena in which diverse societal, political and market interests participate in an age-old struggle for the allocation and control of scarce resources.'' (p86). The solutions to the fundamental problem of excess dependency of fisheries lie mainly outside fisheries, in alternative opportunities. Features such as complexity and uncertainty in fishery systems are thus highlighted as being only secondary contributors to failures in fisheries.

Operational objectives, legislation and regulation

In any given fishery, if the problem of excessive dependency cannot be resolved, then achieving any specific goals related to, for example, sustainability, economic efficiency or social upliftment will remain secondary, and the most likely trend will be a decline over time in resource productivity, social benefits and economic performance. Only once feasible solutions to the issue of dependency have been identified and progress made in implementing them, is it possible to consider seriously developing and realising more detailed operational objectives. When this point is reached, the operational objectives need to be clear, measurable and attainable, both so that interest groups have no doubt about the intentions behind them and can dispute them if necessary, and so that the effectiveness of the management strategy can be assessed by all stakeholders, and improvements made as required.

There are examples of attempts to ensure clear, operational goals in fisheries legislation. In New Zealand, the Fisheries Act of 1996 requires the responsible Minister to set a total allowable catch which maintains a stock at or above that level generating maximum sustainable yield, or that will result in stocks below that level moving towards it. Such a precise statement of purpose is operationally

far more effective than a general requirement to promote or pursue sustainable fisheries.

The Namibian legislation provides a good example related to social policies. In a Policy Statement issued by the Namibian Ministry of Fisheries and Marine Resources on 23 June 1993 and revised on 8 July 1993, it is stated that when considering exploitation rights and allocation of quotas, consideration will be given to:

> ''(a) whether or not the applicant is a Namibian citizen; (b) where the applicant is a company, whether or not the beneficial control of the company is vested in Namibian citizens; ... (e) the advancement of persons in Namibia who have been ... disadvantaged by discriminatory laws or practices ... before the independence of Namibia; ...''

In promoting the policy objective of benefiting all Namibians, the Policy Statement also states that the duration of rights will vary from, in summary, 10 years for Namibian owned vessels with significant investments in vessels or onshore processing facilities, to seven years for ventures with less than 51% Namibian ownership but with onshore investments, to four years for companies which do not have investments. Further incentives and advantages are given to Namibians through stock quota levies that are decreased by 50% or 67% for Namibian vessels (Oelofsen, personal communication).

These regulations provide clear and unambiguous translation of broad policy objectives into operational rules. Under such circumstances, the rules are transparent and, if there is dissatisfaction, they can be challenged and debated. In their implementation, it should be immediately apparent if they are being transgressed at any stage during fisheries management. Clear and unequivocal laws and regulations are much more likely to lead to achieving objectives than are broad statements of intent, which leave room for individual or group influence on interpretation each time they are applied.

Developing management plans

For fisheries management to be effective, the objectives must be clear and attainable and should be reflected in easily accessible legislation or regulations. However, as discussed under the section *Institutional weaknesses*, above, and embodied in Principle VIII of Table 1, the objectives, and management measures designed to achieve these objectives, forming the core of the management plan should be determined with participation of all legitimate users or interest groups and by making use of the best available information. The use of such information helps to ensure that the objectives for the fishery reflect the true biological, social and economic context, and that the measures selected to achieve these objectives are the most likely and appropriate to do so (Caddy and Griffiths 1995). Participation by all legitimate interest groups contributes to ensuring that the best available information is used. It brings a range of different experiences and perspectives to the selection process, and also helps to ensure that the objectives and measures selected are widely supported. Under these conditions they are likely to enjoy a high level of compliance, requiring a minimum of external enforcement (Jentoft 1989).

The decision-making process should be iterative and formal and a possible structure and form for decision-making, similar to those of Caddy (1999), Cochrane *et al.* (1998), and Lane and Stephenson (1998), is shown in Fig. 3. The most important features of this process are that: it should be based on objectives, which should also be derived in a similar process; it should receive and consider the best information available on all aspects of the fishery; different management options should be compared in terms of performance attributes (which should reflect the objectives); and interest-group participation should be an integral and formal part of the process.

The question of who should be involved in user participation and how this should occur has been addressed by Pinkerton and Weinstein (1995) and Jentoft and McCay (1995). The latter suggested that many different institutional designs have worked in different contexts. Pinkerton and Weinstein (1995) provided very useful guidelines on the characteristics of communities and management systems that have been successful. Most pertinent to this discussion, they suggested that successful management systems have in common: mechanisms of accountability, mechanisms for effective management, mechanisms for equitable representation, and mechanisms for adaptation.

A further feature of the process shown in Fig. 3 is that it occurs on a variety of time scales, with short-term iterations occurring over periods of days while a management strategy is being devised, feedback on the success of the strategy taking place on a time-scale typically of one year, and a full revision of objectives and reappraisal of the management strategy taking place every 3–5 years (e.g. see FAO 1997b).

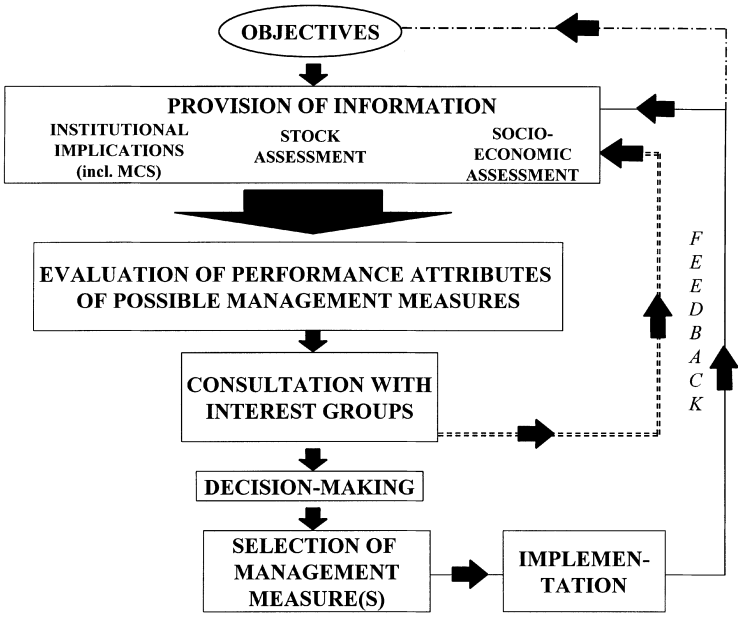

Figure 3 Process for decision-making in setting operational objectives and determining suitable management measures within an idealised management process (reproduced from Cochrane 1999 with permission from ICES *Journal of Marine Science*). In co-management, the users and possibly other interest groups would also be involved in decision-making. Decision-making occurs on a variety of time scales, e.g. over days or weeks (double broken-line), annually (solid line) and less frequently (e.g. every 3–5 years; dashed line).

Implementation and review

The process above should facilitate the development of appropriate and widely accepted objectives, and of a management strategy that is also widely supported and is appropriate to achieve the objectives. This is essential for responsible management but is rarely sufficient. It should help to maximise compliance and hence minimise the need for enforcement, although Hersoug (1996) explained how, even though there may have been agreement on a management plan, as soon as it is implemented the different stakeholders will again begin to try to pursue their own objectives. In the South African pelagic fishery, despite extensive consultation, the objectives agreed to between the fishing industry and management agency did not resolve the fundamental conflict between the sardine and anchovy fishing interests. As a result, in implementation the effectiveness of the agreed management procedure was severely compromised (Cochrane *et al.* 1998).

This phenomenon, referred to by Hersoug (1996) as the 'battle of implementation', points to the unavoidable need for enforcement, even in the most democratically managed fishery. Equally importantly, it demonstrates the need to review periodically the objectives and management strategy for a fishery (Figs 2 & 3). Fisheries are dynamic systems made up of dynamic subsystems, and management strategies and their objectives and control measures may rapidly become obsolete. Three to five years is probably a suitable guideline for any management plan (Butterworth *et al.* 1997; FAO 1997b).

Identification of the reasons for failures to achieve the objectives and of the accountability of all role players for any failures in performing their tasks should be important parts of these reviews. Clearly, this requires independent audits of the performance of management bodies.

The decision-making process also does not guarantee that a consensus decision will be made, and some conflicts may not be able to be resolved by the affected parties amongst themselves. Cochrane *et al.* (1998) suggested that the two major conflicting groups in the South African pelagic fishery did not confront the major issue which, the authors suggested, was that the structure of the industry was inappropriate for the composition and productivity of the pelagic resource community at that time. Under such circumstances, it is necessary for the responsible authority to determine a solution that is judged to be in the best interests of the majority of stakeholders or the country, then to be prepared to both enforce it and be accountable for it. This will often require a hard decision with costs as well as benefits and, again, demonstrates the difficult role of the responsible authority. The clearly specified objectives and management measures embodied in legislation should, however, provide both the justification for and the imperative to the authority for these decisions.

Conclusions

Fisheries management is frequently argued to be highly complex and this complexity is commonly invoked as a reason for the widespread failure of fisheries management. Scientists of all relevant disciplines contribute to this perception by, for example, emphasising the uncertainties inherent in many of the subsystems of fisheries management, particularly the ecological subsystem. Without denying the complexity of these subsystems, this paper has argued that the theory of fisheries management is derived from eight basic principles which are simple in concept, widely understood and implementable. While the many uncertainties in fisheries mean forecasting in fisheries management is likely to be very imprecise, one of these principles refers to the precautionary approach and indicates that uncertainty can be dealt with by appropriate caution.

While still conveying inherent uncertainties, scientists – particularly natural scientists – could facilitate wider adoption of responsible fisheries management by emphasising the simplicity and clarity of the principles of management. They should endeavour to cope with and reduce the uncertainties in their assessments and so highlight signals and trends in their information.

The widespread failure of fisheries management cannot be claimed to result from a failure to understand the issues and considerations. Instead, it is suggested that this failure is more commonly a consequence of a deliberate choice to give priority to some issues above others. This choice is usually made by the designated decision-maker and is usually a political decision. It is therefore at this level that many of the failures of fisheries management need to be investigated. However, it must also be recognised that the underlying reason why so many decision-makers have allowed fisheries to reach a state of biological, ecological, economic and social crisis is the problem of excessive dependency on fisheries, and the social and political difficulties of denying access for people, especially those who have traditionally enjoyed access to fish resources, and of finding alternative sources of livelihoods for them.

The difficulties in resolving this underlying dependence on fisheries should not be under estimated, particularly in developing countries where alternative opportunities may be extremely limited and where there will be no or only limited social welfare. However, it should also be recognised that this is not always the underlying reason for failure and, as reflected in examples above, decision-makers have not always been considering the welfare of those whose livelihoods are most dependent on fish resources.

As stated earlier, there is no single, appropriate policy for all fisheries and the details of social and economic priorities will vary considerably from country to country. If fisheries management is to be effective, and if all role players in a fishery are to be accountable to the public for their decisions and actions, then these political considerations and the approach to dealing with them in fisheries need to be explicitly identified and clearly and transparently stated. This is best achieved by setting clear and unambiguous objectives, which are both measurable and attainable, by establishing the management strategy and control measures that are considered best able to meet these objectives, and then by incorporating the strategy and measures into laws and regulations. In this way, the priorities and measures are transparent to all, removing the opportunity for unsanctioned departure by decision-makers (intentional or unintentional) from an agreed strategy. Such transparency also facilitates identification of where differences in opinion actually lie, either with the priorities and objectives or with the management measures selected to attain them, and therefore focuses debate at the appropriate target rather than directing it all at the level of implementation.

Finally, to address the question posed in the title of this paper, it is incorrect to suppose that achieving a balance between sustainability, economic efficiency and equity has eluded the fisheries managers of the world. It would be far more correct to say that such a balance is yet to be pursued seriously.

Acknowledgements

My thanks are due to John Caddy and Serge Garcia of FAO, two anonymous referees, and Tony Pitcher and Chuck Hollingworth of *Fish and Fisheries* for helpful comments on an earlier version of this manuscript.

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