

Chapter 1

Introduction – Fisheries Management

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1.1 Why do we need this handbook?

Fisheries around the world make essential contributions to human well-being, providing basic food supplies, employment, livelihoods, recreational opportunities, sources of foreign currency or recreational opportunities for hundreds of millions of people. They are an integral component of communities and societies almost wherever humans have access to water bodies: oceans, seas, lakes and rivers. So far, so good, but a problem arises because, in addition to providing benefits for society, fisheries also have negative impacts which, if not sufficiently controlled, can not only destroy or diminish the benefits they provide but also lead to damage to the ecosystem with resulting negative impacts on other important goods and services for humans, including the conservation value of the ecosystems.

Fisheries management is the process that has evolved to ensure that fisheries operate in a manner that not only provides the immediate benefits but also does not result in excessive or irreversible damage to the exploited fish stocks or the diversity, integrity and structure of the ecosystem, so that the stocks and ecosystem will continue to provide the full range of benefits in the future. Fisheries management has been successful in some cases but it has become widely recognised in recent decades that there have also been many, many cases of failure. As a result, there is global concern about the state of most aquatic ecosystems and their ability to continue to provide benefits, not least the production of fish for human use.

There are many reasons for this widespread problem, including amongst others: scientific uncertainty; an inherent conflict between short-term social and economic needs and goals and the longer-term need for sustainability; poor management practices in the past, particularly the absence of long-term rights and failing to ensure that stakeholders participate in management; insufficient capacity within the management agencies and others. This guidebook is designed to contribute to addressing the problem of insufficient capacity within the management agencies by providing a broad overview of the different tasks and responsibilities that collectively make up fisheries management; to show how those tasks interact and fit together and to identify approaches to addressing some of the particular problems that make management as a whole more difficult. The book deals with capture fisheries and particularly with marine capture fisheries although much of the information presented here is also relevant to inland (freshwater) capture fisheries.

The chapters in this book clearly demonstrate that fisheries management is currently undergoing a marked and rapid transition, as fisheries managers and stakeholders respond in practice to the realisation that the conventional fisheries management that dominated much of the second half of the 20th century, although effective up to a point when properly applied, was

insufficient to ensure sustainable use of aquatic ecosystems. Instead, a wider approach is now being called for, one which goes under many different names. In this book, in accordance with the terminology used within the Food and Agriculture Organization of the United Nations (FAO), it is referred to as an ecosystem approach to fisheries (EAF). It would be wrong, however, to equate EAF itself with all the new insights and changes being implemented as the limitations of conventional fisheries management have been explored and revealed through a number of independent processes. Recognising this, EAF attempts to bring them all together. In summary, the new approach differs from the old in three key areas: (i) incorporation, into management objectives and actions, of the interactions between the fishery and the ecosystem as a whole, including both ecosystem and human well-being rather than considering only the target species; (ii) greater awareness of knowledge gaps and uncertainties in information available for decision-making and the need to take them into account and (iii) recognition of the fundamental need to involve the stakeholders in all aspects of management.

The new awareness is leading to changes in approach and practice, changes that not only build on the many necessary and successful aspects of conventional management but also adapt and supplement them. The changes are slow, lessons are still being learned and many additional ones still need to be revealed. As a result, there are a number of key areas in fisheries management where, at present, there are few successful models to emulate and where important practices have to be based more on theory than on tested experience. The chapters in this book attempt to address the new awareness and were written to reflect this new reality, presenting both the valid and essential elements of the conventional approach and the available knowledge on best practices for the new, wider approaches. Some chapters that the authors considered to be applicable to future developments conclude with a section entitled 'Synthesis and Outlook' in which they have presented their view of important new developments within the chapter topic, which may require changes and responses in management practices in the future.

1.2 What is fisheries management?

There is no clear and generally accepted definition of fisheries management and this in itself can cause problems in practice. Definitions can be dangerous if over-interpreted and we do not wish to get embroiled in a debate about exactly what fisheries management is or is not. We use here the working definition provided in the FAO Technical Guidelines on fisheries management (FAO, 1997) to provide a summary of the task of fisheries management:

The integrated process of information gathering, analysis, planning, consultation, decision-making, allocation of resources and formulation and implementation, with enforcement as necessary, of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and the accomplishment of other fisheries objectives.

At the outset it must be understood that in this definition, 'fisheries activities' and 'fisheries objectives' need to be understood within the framework of EAF. We therefore provide, up-front, first the rationale for EAF and then the definition, both taken from the FAO Technical Guidelines on EAF (FAO, 2003):

Rationale – The purpose of an ecosystem approach to fisheries is to plan, develop and manage fisheries in a manner that addresses the multiplicity of societal needs and desires, without

jeopardising the options for future generations to benefit from the full range of goods and services provided by marine ecosystems.

Definition – An Ecosystem Approach to Fisheries strives to balance diverse societal objectives, by taking account of the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries.

From all of these, it can be seen that fisheries management involves a complex and wide-ranging set of tasks, which collectively have the underlying goal of the achievement of sustained optimal benefits from the resources (Figure 1.1).

The most widely accepted standard for what constitutes good management is the FAO Code of Conduct for Responsible Fisheries adopted by all FAO Member States in 1995 (FAO, 1995)

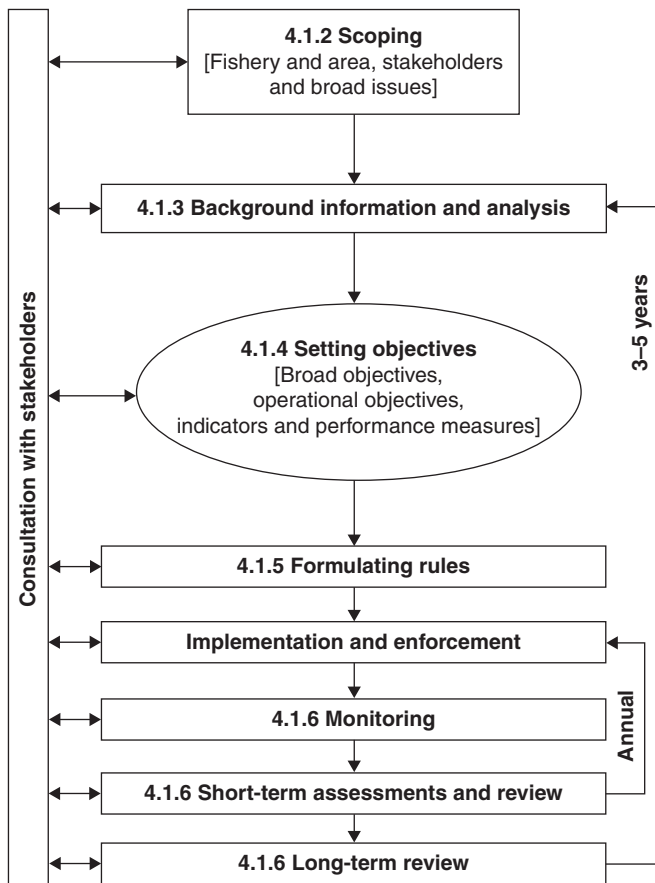


Figure 1.1 Process for developing and implementing a management plan. Evaluation and review should occur on a variety of time scales, for example as shown here, a tactical review of the management measures every year and a comprehensive strategic review every 3–5 years. From the FAO Technical Guidelines on EAF (FAO, 2003): the numbers shown at each step in the Figure refer to the relevant sections explaining the step in those Guidelines.

and referred to throughout this book as 'The FAO Code of Conduct'. The six substantive articles of the Code (Articles 6–12) outline the critical features of responsible fisheries (which, in the Code, are taken to include aquaculture), encompassing all the elements of the ecosystem approach. The FAO Code of Conduct is therefore used as the basis for best practice throughout the book and frequent reference is made to relevant Articles and paragraphs.

Effective fisheries management needs both strategic and tactical planning and implementation. Strategic management is linked to the policy goals and takes a long-term view of the fishery: what the policy goals are and how, in broad-based terms, they are to be achieved. Because of the long-term view and therefore high uncertainty about how conditions and circumstances may change over time, strategic management must be inherently adaptable. In contrast, tactical management deals with the short term, for example the next 3–5 years. It is therefore directly linked to the more specific operational objectives and requires the selection and implementation of clear and precise actions. For example, from the strategic perspective, a decision may have been made in a hypothetical case that the fishing is best controlled through regulation of fishing effort because the fishery is a multi-species fishery and monitoring of catches and enforcement of catch limits would be impossible with the available capacity. Tactical management would need to decide exactly how to measure effort, the maximum effort that could be allowed each year, and how to monitor and regulate the effort being applied.

1.3 The fisheries manager

1.3.1 Who is the fisheries manager and who is this book aimed at?

In fact, despite deliberately using the term in the title of this book, we suggest that in modern fisheries management, there is rarely a single individual who fulfils the functions of 'fisheries manager'. The head of the authority charged with managing fisheries, for example a Director of the Department of Fisheries, may have overall responsibility for implementing fisheries management. As such he or she will be accountable and responsible for the advice passed on from the Department to the political decision-maker or decision-makers and is likely to have an overall coordinating role for fisheries management. However, this individual is very unlikely to have sole responsibility for receiving information, formulating advice and making and implementing decisions. Those different functions will typically be delegated to other subdepartments and specialists within those subdepartments. In addition, as reflected in Paragraph 7.1.2 of the FAO Code of Conduct and a persistent theme throughout this book, fisheries management should also involve the legitimate interested parties in the management process. Indeed, in many cases the tasks of management are formally shared between government and the stakeholders. The importance and implications of such a comanagement approach are examined in various sections throughout this book.

The guidebook is therefore aimed at a broad audience but is intended, above all, to be a practical guide to those actively engaged in fisheries management. At the core of this group are those people charged with over-seeing and implementing fisheries management, be it at national, regional, local or individual fishery level. However, the editors and authors of this book hope that, by providing an holistic, integrated synopsis of fisheries management, the book will also be useful to the many others participating in different tasks and components of management – the fishers, the managers of fishing companies, conservationists, the range of

technical and scientific experts typically involved in management including natural scientists, economists, social scientists, lawyers and others.

The book is not, and could not be, designed to go into great technical and operational detail on each function or task, which would require a set of handbooks. Instead, it is intended to give a holistic picture of the different functions – how they should interact in the fisheries management process in order to develop appropriate objectives and integrated sets of management measures culminating in management plans and how to facilitate implementation of those plans. The fundamental premise of this book is that, like a car or boat engine, fisheries management is an integration of many different components and will not work properly unless all the individual components are not only functioning effectively themselves but also properly connected and synchronised with all the others.

1.3.2 The demands of management

Although we may refer to fisheries management as a discreet job or task, in reality it is a process, a circular and multi-pronged process that never ends as long as the fishery continues (Figure 1.1). The fisheries manager, in the sense of the government authority as explained in the previous section, fulfils a key role in that process both as the representative of the management authority and as the facilitator of the process.

A glance at the contents pages of this book demonstrates that fisheries management is a multi-disciplinary process, requiring input from many different specialists. The manager can never be knowledgeable, an expert, on all of these but the best managers will have enough background in the different disciplines to understand the issues and potential solutions, to discuss them with the specialists and to be able to contribute, as a facilitator, to making decisions and resolving conflicts related to them. A good manager, therefore, will have at least a basic knowledge of the biology, ecology, stock assessment, economics, social dimensions, legal principles, monitoring, control and surveillance (MCS), and nature and characteristics of the fisheries and the stakeholders relevant to their mandate. Stakeholders and others involved in the management process would also benefit from such a ‘helicopter view’. This book attempts to help all of these reinforce their knowledge in these areas.

Going beyond the core contents of this book, a bit of psychology, public relations and political acumen will also help fisheries managers in difficult situations. Coupled with this, and at least as important, the effective manager should be a good leader and skilled in negotiation, communication and conflict resolution. However, he or she must also be an effective delegator and must rely on the specialists to provide specialist advice, not making the mistake of confusing or equating his or her own basic knowledge with expert opinion, or presuming to know the stakeholders’ views better than they do themselves.

Of course, the formally designated manager is also usually responsible for administering and managing an office or department, which will require skills in planning, project development and implementation, office management, organisation and administration, budgeting and financial planning and more. Fisheries management is not a task for someone who has settled into neutral gear mentally; it requires a dynamic, multi-skilled and widely informed ‘hybrid’. This may seem intimidating but is it too much to ask of someone who has been charged with managing and facilitating a process that has profound consequences not only for people and ecosystems today but also for generations to come?

1.4 Fisheries management and fisheries governance

The term ‘governance’ has become a common catchword in the field of sustainable development and, for example, the Plan of Implementation of the World Summit on Sustainable Development (WSSD) in 2002 stressed that good governance within each country and at the international level is essential for sustainable development. As with the term ‘fisheries management’, the word ‘governance’ is confusing to many and frequently understood simply to mean the same as management or, sometimes, everything outside formal management. Section 3.8 explains and discusses governance, defining it as ‘the whole of public as well as private interactions taken to solve societal problems and create societal opportunities’. It therefore includes management but is much wider than management. This guidebook is about management but recognises that good management will only be fully effective if it is being implemented within the wider environment of good governance. Fisheries managers need to be aware of the impacts and implications as well as the strengths and weaknesses of the governance regime in which the fisheries under their care are embedded and take measures accordingly. For example, in an environment characterised by good governance, self-motivated compliance with regulations is likely to be higher, meaning less rigorous enforcement should be required, than within an environment marked by poor governance.

1.5 Some working principles for fisheries management

The definitions of fisheries management and EAF provided in Section 1.2 reflect, perhaps above all, the problems of conflicts and uncertainty that so often confound attempts to manage fisheries effectively. The harsh reality is that these are fundamental features of most if not all fisheries and the manager needs to confront and address them in nearly all aspects of fisheries management. Key reasons why fisheries are dominated by conflict and uncertainty, and factors that will help to address them, can be seen by looking at the underlying principles in a fisheries system, where a fisheries system is one type of what is referred to in Chapter 3 as ‘a social–ecological system’. There are both benefits and risks in attempting to simplify a subject, and over-simplification can lead to the neglect of important details. However, simplification can facilitate understanding important principles and highlighting the broad areas that need attention. Arising from the considerations discussed earlier, the following key principles have been suggested and serve to focus attention on the starting points for effective fisheries management (after Cochrane, 2000).

1. The fishing sector consists of a number of dynamic components, also commonly interacting with other sectors through the ecosystem and biological resources, the stakeholders and the market. The overall evolution of the sector and its components is therefore hard to predict in the long term.
2. Fish stocks and communities are finite and biological production constrains the potential yield from a fishery.
3. Biological production of a stock is a function of the size and structure of the stock and of the ecological environment with which it interacts and is influenced by natural and human-induced changes in this environment.

4. Human consumptive demands on fish resources are fundamentally in conflict with the constraint of maintaining a suitably low risk to the resource. Further, modern technology provides humans with the means, and demand for its benefits provides the motivation to extract fish biomass at rates much higher than it can be produced.
5. In a multi-species fishery, which description encompasses almost all fisheries, it is impossible to maximise or optimise the yield from all species or stocks simultaneously.
6. 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).
7. The short-term dependency of society on a fishery will determine the relative priority of the immediate social and/or economic goals in relation to the longer-term goal of sustainable utilisation.
8. A sense of security of tenure and a long-term stake in the resource for those (individuals, communities or groups) with access ought to be most conducive to maintaining responsible fisheries.
9. Genuine participation in the management process by fully informed stakeholders is consistent with the democratic principle, facilitates identification of acceptable management systems and encourages compliance with laws and regulations.

In keeping with the integrated nature of fisheries ecosystems, these principles cannot be seen in isolation in considering how best to manage fisheries: their implications and consequences overlap, complement and confound each other, which is what makes fisheries management so demanding and challenging. Nevertheless, the consequences of the principles for fisheries give rise to the fundamental nature and tasks of fisheries management and hence to the general structure of this handbook.

1.6 An objective-driven process

Throughout this book, the word ‘goal’ is used to describe a broad aim. The term ‘objective’ is used to mean the object of an action, or what is intended to be achieved. Describing an objective will typically require a more precise description of the desired end point than for a goal. An objective must include explicit statements against which progress can be measured and it is helpful to think in terms of SMART objectives, that is, objectives should be Specific, Measurable, Achievable, Relevant and Time-bound. A goal may therefore be, for example, to harvest a particular stock sustainably. One of the objectives necessary to achieve this goal could be to ensure that fishing mortality does not lead to a reduction in the biomass of the stock below the biomass capable of producing maximum sustainable yield.

The over-riding goal of fisheries management could be summarised as the long-term sustainable use of the fisheries resources (e.g. the FAO Code of Conduct, Paragraph 7.2.1). Achieving this requires a proactive approach and should involve actively seeking ways to optimise the benefits derived from the resources available. This rarely happens in reality, though, and fisheries management is still most commonly practised as a reactive activity in which decisions are made and actions taken largely in response to problems or crises. A number of years ago, it was proposed by John Pope, the author of Chapter 9 of this book, that

the unspoken goal of most fisheries managers was to achieve ‘minimum sustainable whinge’. This was a deliberate take on the well-known reference point of maximum sustainable yield and suggested that fisheries managers would commonly try to find solutions to problems that gave enough to each group of stakeholders to stop them complaining. The crisis decisions from such reactive management are then commonly attempts merely to solve the immediate problems without properly considering the broader perspective and the longer-term objectives. Such an approach may succeed in the short term to keep levels of dissatisfaction amongst stakeholders sufficiently low to avoid major conflict, but it is extremely unlikely to result in the best long-term use of the resources being exploited by the fishery.

The first step in proactive fisheries management has to be identifying the objectives for the fishery, in other words to determine, from the combined perspective of all stakeholders, what can be considered the optimal benefits for a particular fishery, group of fisheries or ecosystem. The goals for the fishery sector as a whole, usually stated in the fisheries policy, would be the starting point for this (Figure 1.2) but will need to be translated into specific objectives for each fishery, group of fisheries and ecosystem. In fisheries and in this book, these specific objectives are referred to as operational objectives and it should be possible for

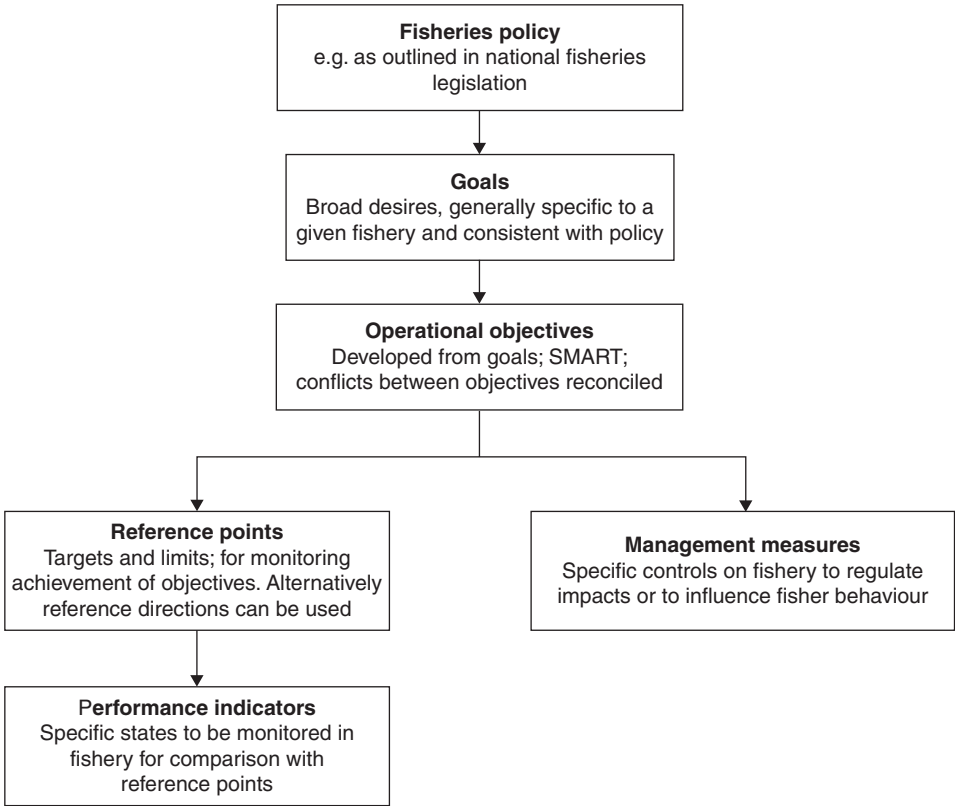


Figure 1.2 The hierarchical relationships between the different intentions (policy, goals and objectives), standards (reference points and indicators) and actions (management measures). Collectively these make up the management strategy and would be described in the management plan.

any observer, including the manager, to establish whether or not they are being achieved and hence whether or not the management strategy is appropriate and being successfully implemented. Operational objectives should also be used as the foundation for reference points (see Chapter 12), which are essentially the operational objectives expressed in a way that can be estimated or simulated in a fisheries' assessment (Figure 1.2). Once operational objectives have been agreed upon, a management strategy can be developed, including the suite of different management measures required to achieve those objectives.

The objectives for a fishery must encompass the bio-ecological, social, economic and governance dimensions of the fishery. Before they can actually be applied in fisheries management as operational objectives, any conflicts among different objectives would need to be identified and suitable and acceptable compromises found, so that the reconciled set of operational objectives can be simultaneously achieved. For example, it is very unlikely that management strategies that aim to maximise net incomes will also maximise employment opportunities. In setting objectives for a fishery with both goals, some compromise between them would have to be agreed upon before they could be expressed as operational objectives and an effective set of management measures devised to achieve them.

All of this may sound complex, but in reality is no more than most people do in order, for example, to develop a budget for their personal finances. Most of us have realistic but imprecisely expressed hopes and needs for our lifestyle as well as knowledge of the nature of the resource (in this case our net income). These hopes and needs are the goals of our budget but they will all compete for the same resource, our net income, so there are conflicts that need to be resolved. Therefore we have to modify our goals and express them more precisely: we develop operational objectives in which we specify what we can realistically achieve in terms of food, housing, education, etc. Thereafter, we need to decide on our budgeting strategy in order to meet those objectives: what type and quantities of food and clothing should we be buying; what type of housing can we consider; can we consider a regular visit to a distant relative, etc.

Clearly, our operational objectives must be consistent with the yield that we can expect from the resource (our income). Normally, the process of developing realistic objectives will require trade-offs and most of us find, for example, that we cannot allocate as much for entertainment or travel as we would like and at the same time make our rental or mortgage payments. Therefore priorities are established and compromises made until eventually we arrive at realistic objectives that balance our desires with our income and that provide a good guide on how to manage our finances from month to month and in the longer term. At the end of this, we should have a feasible financial management strategy that, barring totally unexpected events, will have a predictable outcome. If we have done our calculations correctly and responsibly, the strategy should mean we enjoy a reasonable lifestyle without being sued for bankruptcy. This is little different from the basic task, and overall hope, of the fisheries manager.

1.7 Management plans, measures and strategies

There is a lot of terminology floating around in fisheries management that, unless clearly understood, can cause further confusion in an already confusing environment. This book, of necessity, makes use of a lot of it. For example, in addition to the words goals and operational

objectives, the terms management plans, management measures and management strategies will crop up on many occasions. Chapters 7–10 each address different types of management measure. It is possible that in some hypothetical case, perhaps some single species fishery, the objectives for the fishery could be achieved by a single management measure, such as a specified total allowable catch (TAC). In practice, however, a number of management measures, for example encompassing all of gear regulations, area and time closures, input and output controls, and a system of user rights will be necessary to achieve the operational objectives. The goals, operational objectives and the sum of all these management measures are referred to as a management strategy. It should be noted that an effective management strategy should not contain so many management measures that compliance and enforcement become so difficult as to be practically impossible.

Once the operational objectives have been agreed upon, the manager needs to monitor how the fishery is performing and this requires the use of reference points: quantitative or qualitative descriptions of a target to be aimed for (e.g. average annual yield) or limits to be avoided (e.g. more than 10% unemployment in the fishery). If there is insufficient information to determine reference points, reference directions may be useful guides. Performance indicators, discussed in depth in Chapter 12, show the manager where the fishery system is in relation to the reference points. Performance indicators are pointers, for example the biomass of the stock or the average annual income of the fishers, that reveal the status of, trends and variations in key elements of a system. Indicators and reference points should be linked directly to operational objectives (Figure 1.2) because they serve the function of informing the manager as to how well the fishery is performing in relation to the specified objectives.

All of these goals, objectives, measures and strategies should be described in the management plan as described in Chapter 16.

1.8 The structure of this guidebook

Fisheries are social–ecological systems that exist in order to provide human benefits, and the task of the fisheries manager is to ensure that the fisheries under his or her mandate achieve their goals. Fisheries systems are invariably inherently complex in both the social and the ecological domains and as a result, the task of fisheries management is equally complex with many different facets, requiring a wide range of processes, methods and types of expertise. The task of the fisheries manager and of all those participating in fisheries management is to bring together, consider and integrate all of these different aspects to arrive at optimal solutions.

The danger arising from the complexity of the task is that one or a few aspects of fisheries management will tend to dominate whereas other aspects will be neglected. For example, at the advisory level, we have seen the disproportionate prominence given to single-species biological approaches in the recent past leading to unbalanced scientific advice whereas, often in the same systems, disproportionate weight has frequently been given to short-term social and economic considerations in flawed decision-making processes. Sometimes, ‘magic bullets’ have been promoted and implemented as the single key to successful management. Stock assessment, community-based management (CBM), individual transferable quotas (ITQs), marine protected areas (MPAs) and territorial use rights in fisheries (TURFs) are all management measures that have at times been promoted in this way. However, while each of these will have a role to play in certain situations, there is no such magic bullet and the hard but

not insurmountable reality is that fisheries management must be approached and practiced in a manner that brings together and combines the many different measures and components into a whole, balanced and functioning unit.

This guidebook is intended to demonstrate how fisheries management should be practiced as such a system. By definition, it is no easy task to describe a complex system, so how best can the fisheries management system be described? As editors, we struggled with this problem but in the end fell back on the tried and tested, but by no means perfect, method of breaking the task down into its major components. Therefore this book has been divided into a number of chapters (17 in total), each written by an expert or experts in that field and covering the major components of fisheries management. In addition to this introduction, the chapters are divided into six Parts: Part I covers the primary dimensions or features of fisheries management; Part II, the legal environment and institutional structure; Part III, the measures and tools available for managing fisheries; Part IV, the information that the manager will need for making good decisions; and Part V, some key aspects and aids for implementing fisheries management. Finally in Part VI, Chapter 17, we attempt to extract some key lessons from this book as a whole and to forecast changes and developments that can be anticipated in fisheries and fisheries management in the future.

The danger of such a fragmented approach is that it could fail to demonstrate clearly the linkages and necessary interactions between the different components – how they work together as a well-tuned engine. We and the other authors hope that we have avoided or at least minimised this risk in this guidebook by indicating, in each chapter, the linkages and interactions with the others and by showing, in the introductory and concluding chapters, how they all come together. As a result, none of the chapters should be seen as a remote island in a lonely sea but more as a vibrant hub within a busy network. Some chapters by their nature reflect the wholeness of fisheries management: most obviously and importantly of those is Chapter 16 on fisheries management plans. Other chapters that are also fundamentally multi-dimensional include those on institutional structure, partnerships, indicators and reference points, use of scientific information and on small-scale fisheries. We urge the reader to read this book in the same integrated manner as the editors and authors have attempted to assemble it.

1.8.1 The key dimensions of fisheries management

In Part I, Chapters 2–4 describe the fundamental dimensions of fisheries. These dimensions characterise a fishery and without them fisheries would not exist. The first of these dimensions, addressed in Chapter 2, encompasses the fish resources and the ecosystems in which they exist. This chapter explains why knowledge of the natural resources is essential for effective management and highlights the key properties and processes of the resources and ecosystem that influence their productivity and resilience. Recognising the necessity of pursuing an ecosystem approach in fisheries management, it includes discussion on the importance of habitat protection, interactions between species and of the state of the ecosystem as a whole. Climate change is identified as one of the several issues that are likely to have far-reaching impacts on fisheries in the future.

Chapter 3 looks at a fundamental human dimension and discusses the social aspects of fisheries management. It emphasises that fisheries management is really ‘people management’ and adopts an interdisciplinary, social–ecological approach to examine the social dimension. Major topics covered include the still common problem of open-access in fisheries and how

to deal with it where it occurs as well as the need to re-evaluate conventional science-based approaches to management and, instead, to understand fisheries as dynamic social–ecological systems that will never be completely understood but which we nevertheless need to manage. For such management to succeed a number of fundamental changes will be required and the chapter discusses, amongst other topics, the contribution of fishers' knowledge and the importance of ensuring that the management authority adopts a suitable institutional framework, in particular to enable genuinely participatory management.

As a means for survival and growth, human societies are heavily involved in and dependent on economics, that is, the 'production, consumption and transfer of wealth'.¹ Chapter 4, therefore, examines fishing as an economic activity. It starts by considering how failures in the market have contributed to failures in fisheries management and examines fishing as a production process and the influences of opportunity costs. It also considers, from an economic perspective, the very difficult but widespread problems associated with open-access to fisheries. The chapter goes on to use a bio-economic approach to consider the economics of fisheries and how this knowledge and understanding can contribute to effective management. It explores the economics underpinning fisheries within the context of development, considering the relationships between fisheries and poverty and how management decisions can influence this relationship.

1.8.2 The legal and institutional framework

Fisheries management is possible only in the presence of a suitable and functioning legal framework. Chapter 5 examines the legal aspects of fisheries management, working from the premise that fisheries law, nested in more general law, should enable, facilitate and support fisheries management. The chapter discusses national and international fisheries law and the relationship between them. Using a comparative approach, it considers the principle sources of the law and how the legal framework influences the administrative and management functions of a fisheries management agency and the powers, rights and functions that it prescribes. It also gives particular attention to the significance of the legal framework for the MCS functions and responsibilities of a management agency and manager.

In Chapter 3 it was stressed that fisheries management is about managing people and Chapter 6 develops this point through consideration of the practical ways in which management must be organised and explicitly allocated to the public and private institutions to ensure that the roles and responsibilities of the different stakeholders can be properly implemented. The chapter defines the formal fisheries manager as the natural person invested by the state with the responsibility for the exploitation of the aquatic resources, and explores the differing legal environments and institutional frameworks in which the manager may have to operate according to the principles adopted by the state, or regional body, in which he or she is working.

1.8.3 The fishery manager's toolbox

The motor mechanic repairing a car or outboard engine has a limited set of tools for the task and most readers will have experienced the frustration of finding that you do not have the

¹From the compact Oxford English Dictionary, <http://www.askoxford.com/?view=uk>

correct spanner (wrench), screwdriver or some other gadget for a particular job. At best, not having the right tool will lead to minor delays, at worst it can lead to serious damage to the car, the amateur mechanic or both. Fisheries managers also have a set of tools at their disposal and need to ensure that they use the best one for the job or they will encounter similar problems, but of much greater scale, to those experienced by the hapless mechanic. Regrettably, selecting and applying the correct tool is a much more demanding task for the fisheries manager than for the mechanic. In Part III, this guidebook takes a broad view of what can be considered a 'tool' and explores not only the approaches that can be used to regulate direct impacts of the fishery on the resources and ecosystems but also tools that can assist in modifying the behaviour and actions of the fishers and other stakeholders.

Starting with the tools to regulate impacts, Chapter 7 focuses on regulation of fishing gear and describes the range of fishing gears used around the world, their catching principles, construction, operation and the species for which they are typically used. It goes on to examine gear selectivity and ecosystem effects of the different types of fishing gear in relation to size and composition of species, habitat effects and other impacts on the environment. This information is used to compare the performance of different gears against each attribute.

Fishing takes place in specific localities at specific times and Chapter 8 examines regulation of where and when fishing can take place as a measure to facilitate achieving some management objectives. It first answers the question of why a manager would want, or need, to use spatial or temporal measures and elaborates a number of objectives they could contribute to achieving. These include biological, ecological and social objectives. It considers the advantages and disadvantages of using area and time restrictions and then presents a number of case studies in which they have been successfully applied. Finally, it outlines the practical steps that are necessary for implementation of the measures.

Whatever other management measures are in place, ultimately the key factor determining whether or not harvest of a resource is sustainable will be the number (or biomass) of fish caught in relation to the population size or biomass as a whole. Gear restrictions and time and area regulations can all contribute to regulating this proportion but they will almost always need to be coupled with direct measures to regulate the amount of fishing. Such direct measures can be either restrictions on the intensity of use of fishing gear (called input controls) or direct limits on the amount of fish actually caught (called output controls). Chapter 9 deals with these two approaches and, as was the case with Chapter 7, starts by raising and answering the question of why one would use them, the answer to which is linked directly to the fishery management objectives. The chapter goes on to consider how to implement catch and effort controls, the structures required for their implementation and the problems that are commonly encountered in their use. It also provides some examples.

No matter what tools and measures are decided upon, their ultimate success depends on compliance and this is heavily dependent on the attitude of the fishers. Again, we come to the point of 'people management'. Chapter 10 addresses use rights in fisheries, a tool that is now recognised to be critical for effective fisheries management, or a potentially critical constraint if the manager does not get it right. This chapter also starts with asking the question of why use rights are relevant to the fisheries manager. In practice, use rights already exist in many fisheries, although these are not always formally recognised by the authorities, and the chapter stresses the need to consider any existing schemes before beginning to implement a new one or to make changes. Different types of use rights are described followed by consideration of the different attributes of use rights including the nature of the rights-holder, the allocation process, the duration of the right and whether or not they should be transferable. The

degree of success, or failure, of a system of use rights for the fisheries sector will be heavily dependent on choosing the best set of properties for the case in hand.

Finally in Part III, Chapter 11 describes the importance of partnerships in fisheries management. For convenience, partnerships are included in this guidebook as a tool but they are, in fact, much more than this and should be seen as a core property or essential attribute of successful fisheries management. Despite this, as presented in the chapter, partnerships in fisheries at present are more the exception than the rule. The author warns that partnerships must be carefully designed for each situation and that partnerships will not be successful under all conditions. The author also explains that many lessons have been learned from experience and good information is now available on the conditions and circumstances under which partnerships are likely to succeed. This chapter summarises that knowledge and provides guidance on how to implement effective partnerships under different conditions.

1.8.4 Information: knowing what is happening and using it to inform decisions

It is a fundamental principle of any management decision and action that it needs to be based on the best available information. Fisheries are no exception to this principle but the complexity and high degrees of uncertainty that are so common in fisheries management frequently make it very difficult to implement. In Part IV, Chapters 12 and 13 address approaches to ensuring that the best available information is used and in a suitable manner to support decision-making.

Indicators, or measures of the state of key elements in a system, are essential for monitoring and communicating the state of the fishery being managed. Chapter 12 explains the evolution of the demand for information and the place of indicators in that demand. It explains a process for developing a system of indicators and examines the various functions of indicators in fisheries management: representation, measurement, audit and control, and reporting and communication. It examines the various types of indicators that can be used and the way in which they can be organised. Finally, it outlines some of the main challenges associated with development and application of indicators, including reaching a suitable compromise between the need for simplicity and the conflicting need for realism in a system of indicators, the need to institutionalise the set of indicators, capacity limitations and information gaps and uncertainty.

Chapter 13 discusses the use of scientific information, in a broad sense, in fisheries management. The need to use the best available information as a basis for management decisions and actions is a fundamental requirement of the precautionary approach and of good management in general. The chapter explores the role of information in fisheries management, how it should feed into the management process and the different types of knowledge that are typically available in fisheries. Even in the best studied and monitored fisheries, uncertainty is a major problem and taking this into account in decision-making is essential for success. The chapter describes a range of different methods that can be used to generate relevant information. It goes on to describe some approaches for presenting information and the importance of taking a responsive, or adaptive, approach to management.

1.8.5 Management implementation

Getting the preparation and planning right for any complex activity is critical but of little or no value unless the plan is implemented effectively. If all the planning has been done

thoroughly, using the best available information, and the key stakeholders have bought into it, there is a high likelihood that the plan will succeed. However, plans are never perfect and circumstances, particularly in fisheries, are usually very dynamic and can change rapidly from 1 year to the next or even from 1 day to the next. Recent alarm about climate change, volatility of fuel prices and currencies, and soaring food prices are all indicative of rapid change that impacts most, if not all, fisheries. Implementation must, therefore, be as proactive and responsive as planning, and as robust to uncertainties.

Much of the implementation is in the hands of the stakeholders rather than the managers and in most economies governments do not interfere in the activities of the stakeholders provided they are being executed in accordance with the prevailing law and regulations and codes of ethics. Legal behaviour is not always the case, however, and fisheries are frequently particularly susceptible to illegal activities that can undermine management plans and obstruct the honest stakeholders from achieving their objectives. A key task of the fisheries authority, and therefore of the fishery manager, is to ensure that all fishing activities take place according to the plan as reflected in law and regulations. Effective enforcement falls within the domain of monitoring, control and surveillance (MCS), which is addressed in Part V by Chapter 14. The chapter describes how MCS fits into the broader frame of fisheries management and explains how an MCS system can and should be designed to suit different types of fishery, the management measures being applied in the fishery, and the human and financial resources available for MCS. MCS can also be implemented at each of the different stages during the fishing process. All of these considerations are brought together to provide general overviews of the effectiveness, advantages and disadvantages of different MCS components for different purposes. The chapter also provides guidance on how to plan an MCS system that is best suited to the specific needs and circumstances under consideration.

1.8.6 The special case of small-scale fisheries

This guidebook is intended to cover all types of fisheries, from small-scale, artisanal fisheries in developing countries to technology-intensive, large-scale fisheries in well-resourced developed countries. However, at least until recently, the fisheries on the high value, commercial end of this spectrum have received the greatest attention in almost all countries around the world, whereas small-scale fisheries have been relatively, and in some cases completely, neglected. As a result, the methods that have been developed and the lessons learned have been strongly skewed towards those high-value fisheries, which usually target only one or a few species. Consequently, despite the many failures and the remaining uncertainties, there is a well-developed and tested framework for effective management of this type of fishery and commonly the human and financial resources necessary to implement the framework are or could be available.

The ‘high-tech’ model, however, cannot be directly transferred to small-scale fisheries which are frequently marked by greater ecological, social and operational complexity but, perversely, commonly much fewer financial resources and capacity for management. In recognition of this problem, Chapter 15 on small-scale fisheries highlights the unique features of small-scale fisheries and the implications of those features for management. It starts by describing their global importance and goes on to discuss their characteristics and contributions to national and global political economies. Thereafter it considers the specific characteristics and requirements for management of this class of fishery including the

common objectives underpinning them, broad management approaches, suitable institutional arrangements and management planning. It also discusses the needs and approaches to build capacity for improving management of these important fisheries.

1.8.7 Where it all comes together: the management plan

Strong emphasis is placed on management planning throughout this guidebook, reflecting not only its central importance but also the reality that effective, proactive planning is still badly neglected in many fisheries around the world. As revealed in the subsequent chapters, fishery management planning has to address and integrate many different facets of the fishery, and the management plan is the instrument that brings them all together and specifies how the fishery is to be conducted. Chapter 16 addresses management plans, starting with a description of what they should contain and who should design them, followed by outlining the major steps and a timetable for developing a management plan, and then presents some of the considerations in implementing a management plan. Fisheries are inherently dynamic and conditions and objectives can change rapidly. For a fisheries plan to remain relevant and effective, it needs to be adjusted to address changes in the fishery and a regular review of any management plan is therefore essential. The chapter provides important elements of a review process and strategy. It also addresses the need to be consistent with principles of ecologically sustainable development (also reflected in EAF) in a management plan and points out some of the issues that this will need to cover. Finally, to illustrate the key features of the chapter, it provides some examples of fishery management plans that have been developed for a number of fisheries around the world.

1.8.8 What the future holds: emerging issues and challenges

This book concludes with Chapter 17, which begins by presenting an historical perspective on fisheries. It examines the evolution of fisheries and fisheries management from the beginning of the 20th century, when the impacts of exploding technological development on fish and fisheries were beginning to be felt, through the expansion phase during the second half of the last century into the contemporary period of 'fisheries reform'. This background helps to explain the current crisis and modern approaches to resolving it. The chapter then explores the emerging best practices, drawing on the conclusions and perspectives presented in the preceding chapters. It finishes with an attempt to look further ahead and considers how fisheries management may evolve in the future. It does so by considering three possible governance scenarios: the (hopefully) extremes of a totally market-driven world and a world dominated by governance chaos. These are contrasted with the third, best-case, scenario of a transformed world.

On that forward-looking note, we wish you enjoyable reading and hope that you find ideas and information in this book that will assist you in whatever task or tasks you face in the challenging world of fisheries and their management.

Sources and recommended reading

Each chapter provides a list of sources and recommended reading as well as potentially useful websites for the subject it addresses. Therefore, only a few 'core' references and recommended works are provided here.

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