



Towards ecosystem-based fisheries management in Norway – Practical tools for keeping track of relevant issues and prioritising management efforts



Peter Gullestad^a, Anne Marie Abotnes^a, Gunnstein Bakke^a, Mette Skern-Mauritzen^b, Kjell Nedreaas^{b,*}, Guldborg Søvik^b

^a Directorate of Fisheries, Norway

^b Institute of Marine Research, Norway

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ABSTRACT

The present paper presents the practical implementation of the Ecosystem Approach to Fisheries Management (EAFM) in Norway. This involves defining management objectives and developing simple and efficient tools to achieve an overview of management needs and prioritise among these, while integrating broader conservation issues and ensuring stakeholder involvement. A new Marine Resources Act entered into force in Norway in 2009. By integrating conservation and sustainable use as basic principles, the law represents a paradigm shift in the management of Norwegian fisheries. The law indicates which concerns should be addressed, but neither how nor how often evaluations should take place. That is for management to decide. A management principle in the Marine Resources Act confers on the Ministry an obligation to evaluate whether continued fishing at the present scale is justifiable, or whether improved management is required to ensure sustainability. A Stock table, and a table of "Catches of data-poor species" constitute a comprehensive system for monitoring the management principle. Along with a Fisheries table, these tables establish a framework for developing an ecosystem-based fisheries management by providing a basis and tools for prioritising the needs of new and/or revised management measures.

1. Introduction

The overall objective of the Ecosystem Approach to Fisheries Management (EAFM), adopted by many governments and international organisations and included in agreements since the 1990s, is to sustain healthy marine ecosystems and the fisheries they support [1,9–13,20,22,8]. According to Pikitch et al. [20] EAFM should, in particular, (i) avoid degradation of ecosystems; (ii) minimise the risk of irreversible change to natural assemblages of species and ecosystem processes; (iii) obtain and maintain long-term socioeconomic benefits without compromising the ecosystem; and (iv) generate knowledge of ecosystem processes sufficient to understand the likely consequences of human actions.

The Ecosystem Approach to Fisheries (EAF) has been adopted by the FAO Committee on Fisheries (COFI) as the appropriate and practical way to fully implement the Code of Conduct for Responsible Fisheries [10,13]. The foremost purpose of the EAF process is to develop and implement an integrated set of arrangements and tools for

a fishery to generate more acceptable, sustainable, ecosystem concerned and beneficial community outcomes. Hence the word 'management' is not used in FAO's name of the approach. There are many different definitions of ecosystem-based approaches. All include the need to maintain the ecosystem resources for their sustainable use, and recognise that humans are an integral part of the process. It is hence a way of implementing management that involves a broad set of objectives and a participative and adaptive process. FAO [10,13] presents four main steps as one way forward in the process of planning and implementing EAF. These are: initiation and scope, identification of assets, issues and priorities, development of management system, and implementation, monitoring and performance review.

EAFM calls for a holistic management approach, and successful implementation of EAFM will ultimately depend on finding ways to manage scientific, administrative, and regulatory complexity, as well as effective communication, stakeholder engagement, and simplification [11,21]. Decisions on management objectives for the various species and stocks have turned out to be an important and integral part of the

* Corresponding author.

E-mail address: kjelln@imr.no (K. Nedreaas).

development of EAFM [11,22]. Different frameworks have been developed to meet these challenges, including the ERAEF (Ecological Risk Assessments for the Effects of Fishing) developed by Hobday et al. [15,16]. This framework, implemented for Australian fisheries management, includes an initial scoping phase to identify relevant fisheries and management objectives, followed by a comprehensive risk assessment of fisheries and the ecosystem components they affect (31 fisheries, > 1200 species, > 200 habitats). The risk is assessed in a systematic and hierarchical manner, ranging from qualitative assessments with minimal data requirements (level 1), to semi-quantitative assessments (level 2), and finally quantitative assessments with high data requirements (level 3).

In 2009, a new Marine Resources Act entered into force in Norway [3]. The previous act relating to fisheries focused mainly on the commercial exploitation of marine resources whereas the new act applies to all wild living marine resources and genetic material derived from them. Everything that lives in the marine environment – from virus to marine mammals and plants – is thus covered by the scope of application. The act states that its purpose is to ensure sustainable and economically profitable management of the resources, and several provisions describe conservation of biodiversity as an integral part of sustainable management. According to article 7 of the new act, it is mandatory for fisheries management to apply “an ecosystem approach, taking into account habitats and biodiversity” [3]. By integrating conservation and sustainable use as basic principles, the law represents a paradigm shift in the management of Norwegian fisheries.

In the present paper, the practical implementation of EAFM in Norway is considered. While including several of the same steps, and similar consequence scores as in the ERAEF framework [15,16], the Norwegian framework is simpler but found to be efficient. It includes defining management objectives and some simple tools to achieve an overview of management needs and prioritise among these where development of new or revised management measures are most urgently needed, while integrating broader conservation issues and ensuring high stakeholder involvement on a regular basis. The practical implementation of EAFM is thus designed to meet the obligations of article 7 along with others included in the same section of the act, such as the precautionary approach.

2. Management of the economically most important marine resources in an ecosystem-based context

Over the last 20–30 years, there has been a dramatic change in the management of the economically most important marine fisheries resources, resources accounting for approximately 90% of total Norwegian first hand value [13,22]. Most of these stocks are trans-boundary, Norway sharing its management responsibilities with neighbouring coastal states. The International Council for the Exploration of the Sea (ICES) provides annual advice on Total Allowable Catch (TAC), based on extensive effort in fish stock monitoring and stock assessments. Based on long-term framework agreements, the relevant coastal states – bilaterally or multilaterally as appropriate – conduct annual negotiations where issues like next year's TACs, access to waters, sharing and exchange of quotas, technical regulations, reporting and control, and joint research programs are on the agenda.

The fisheries on the Norwegian share of these stocks are subject to comprehensive national regulations. At the annual Regulatory Meeting in November, discussions with stakeholders on details of next year's regulations take place, before the Director General of Fisheries presents her final proposals for the Minister's decision. The annual regulatory cycle (Fig. 1) with stakeholder participation has been in place since the 1970's, its scope now broadened by the provisions of the new act to include ecosystem and biodiversity related issues.

The setting of TACs based on precautionary management strategies and harvest control rules have since the turn of the century contributed

to rebuilding depleted stocks and laid the foundation for improved profitability in fisheries [13,22]. Extensive efforts have also been directed towards improving exploitation patterns and reducing discards and other sources of unwanted mortality [12].

By closing the commons, terminating subsidies and introducing pervasive structural measures, Norway has succeeded in reducing the fishing fleet and halting the growth in fishing capacity [22]. The reduction in number of fishermen and vessels has helped increase productivity and profitability for those remaining in the industry. The industry's economic sustainability is thus considerably strengthened [13]. On the other hand, shrinking numbers of vessels and fishermen have reduced the industry's role in maintaining rural settlement and employment. However, departure from fishing has so far occurred in a period of generally low unemployment and good alternative job opportunities in Norway.

Further development to optimise management of the economically most important stocks in an ecosystem-based context will go along four parallel and inter-connected tracks:

- Increase economic output through further improvements in exploitation patterns and reduction of all forms of incidental and unwanted mortality.
- Optimise long-term economic yield through improvements and revisions of management strategies and harvest control rules.
- Incorporate additional ecosystem considerations as new scientific knowledge becomes available concerning multispecies interactions, effects of fishing on benthic habitats, effects of by-catch of fish, seabirds and marine mammals, etc.
- Keep fisheries profitable through structural policy measures that allow a continued gradual reduction in number of vessels as fishery efficiency increases.

These four bullet points summarise the practical approach to ecosystem-based management of the resources that are of greatest economic importance for the Norwegian fishing industry. The four tracks are inter-connected, and trade-offs have to be identified and agreed as part of the management process such as identification of and including ecosystem consequences of decisions related to the first two bullet points. The third bullet point includes assessment and management decisions regarding economically less important and unimportant species, or habitats. The management of these species follows a different track than the “TAC machine” for the data rich, commercially important species.

3. Management objectives of commercially less important species

In the last three decades, the Norwegian focus has been on rebuilding the economically most important fish stocks. Species of minor economic significance have not been subject to the same research and management efforts. Some of these resources are in a depleted state. As part of the development towards ecosystem-based fisheries management, more attention is now directed towards resources of low economic significance. This widening of focus has taken place since the turn of the millennium. However, the movement is not towards a management regime similar to that used for resources of greater national economic importance. The most important reason for this is that it will not pay as the costs of research, monitoring, management and control needed to optimise yield would exceed the surplus value obtained from an optimally managed stock. Furthermore, in contrast to the large oceanic fish stocks, exploited by a limited number of registered, commercial fishing vessels, the smaller stocks are often coastal resources, exploited in part by a large and unknown number of recreational fishers. Hence, the management and control tasks are significantly more challenging and costly. In accordance with the Precautionary Approach, limited information necessitates a more

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