

Integrating the Ecosystem Approach into Fisheries Advice

Background to the Ecosystem approach to fisheries management

Fisheries scientists are currently developing the tools that are needed to implement the EAF. At present, the ecosystem approach is not well defined and the approach will vary depending on local and regional differences between fisheries and between the ecosystems within which the fisheries are pursued. The underlying principles of the ecosystem approach have arisen over a considerable length of time from global scale consultations at the political and scientific scale.

The meaning of the terms "Ecosystem Management"; "Ecosystem Based Management"; "Ecosystem Approach to Fisheries" are still not universally defined and are progressively evolving. The justification of EAF is evident in the characteristics of an exploited ecosystem and the impacts resulting from fisheries and other activities. The rich set of international agreements of relevance to the EAF contains a large number of principles and conceptual objectives. Both provide a fundamental guidance and a significant challenge for the implementation of EAF. The available international instruments also provide the institutional foundations for EAF. The FAO Code of Conduct for Responsible Fisheries is particularly important in this respect and contains provisions for practically all aspects of the approach. One major difficulty of EAF lies precisely in turning the available concepts and principles into operational objectives from which an EAF management plan would more easily be developed.



The first most fundamental description of the ecosystem approach was formalised in the Stockholm Declaration in 1972. Here governments expressed the wish to work towards integrated, holistic, science based management employing decentralised, transparent decision making, involving local communities and users. These founding concepts have been reaffirmed over the past three dec-

ades in numerous declarations and agreements made within three strands of global ocean governance;

- (1) UN Convention on the Law of the Sea (UNCLOS)
- (2) UN Conference on Environment and Development (UNCED)
- (3) UN Food and Agricultural Organisation (FAO)

Principles of the Ecosystem approach to fisheries management

It is recognised that fisheries have the potential to alter the structure, biodiversity and productivity of marine ecosystems. Furthermore, natural resources should not be allowed to decrease below their level of maximum productivity. Recognising these factors, the ecosystem approach respects the following principles;

- fisheries should be managed to limit their impact on the ecosystem to the least extent possible
- ecological relationships between species must be maintained
- management measures should be compatible across the entire distribution of the resource (across jurisdictions and management plans)
- the precautionary approach should be applied because the knowledge on ecosystems is incomplete
- governance should ensure both human and ecosystem well being and equity

The ecosystem approach recognises that our ability to predict ecosystem behaviour is inadequate and accepts that all ecosystems have limits that when exceeded, can result in major ecosystem change – possibly irreversibly. Maintaining biological diversity (i.e. preventing the loss of certain species ; loss of big fish) is regarded as being of major importance to ecosystem functioning and productive fisheries as well as providing flexibility for future uses. Current management practices tend to give insufficient recognition to the fact that many components are intrinsically linked in the system in a complex flow of material, energy and information.

What Is Driving The Ecosystem Approach ?

Interest in an ecosystem approach to fisheries has been motivated by

- heightened awareness of the importance of interactions among fishery resources and between fisheries resources and the ecosystem in which they exist.
- recognition of the wide range of societal objectives for and values of fisheries resources and marine ecosystems within the context of sustain-

- able development
- poor performance of current management approaches as witnessed by the poor state of many of the worlds fisheries
- recent advances in science, which highlights knowledge and uncertainties about the functional value of ecosystems to humans (the goods and services they are capable of providing).

The need for a wider consideration of environmental and ecosystem issues in fisheries has been acknowledged by many and the principles and aspirations of the ecosystem approach have been well documented. Although a full implementation of agreed principles and aspirations might be difficult at this time, the status quo is not an acceptable option in the light of a growing understanding of the ecosystem and their uses by society.

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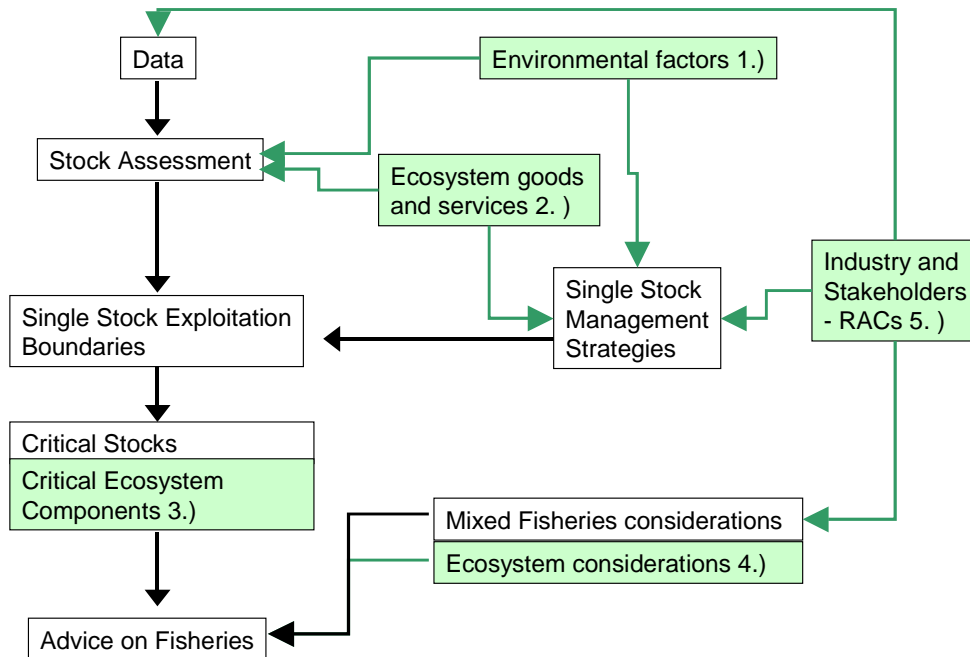
The ecosystem approach to fisheries encompasses the management of fisheries within the context of the whole ecosystem. Its definition by FAO is to “balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries”.

Traditionally ICES has advised on single species exploitation boundaries. However in recent years there has been a move towards a more integrated advice structure, where mixed fisheries considerations as well as issues on by-catch are included in the advice. Currently ICES is working on adapting this advice process further to provide fisheries management as part of an integrated management strategy of human exploitation in the marine environment.

The working group on ecosystem effects of fishing activity (WGECO) proposed a way of how the advisory process through ICES may be expanded to include ecosystem considerations. In figure 1 white boxes represent a flow-chart of how the fisheries advice is currently developed. Green boxes identify ecosystem based components which could be introduced into the current system to provide more environmentally aware and holistic approaches to contemporary and future fisheries management advice. The following text gives explanatory notes on the various components proposed for the incorporation of ecosystem considerations into the advisory process. Case studies where fisheries management already include ecosystem based approaches are also discussed.

1. Incorporating environmental factors into stock assessment.

It has long been recognised that the environment influences the dynamics of fish stocks. These influences can be direct or indirect. Directly, physical variables such as sea surface temperature or circulation pattern affect the re-



Adapted from WGECO 2005

Fig. 1 Incorporating the ecosystem approach into fisheries management advice.

cruitment, growth and survivorship of a stock. Indirectly, environmental conditions can affect the spatial and temporal distribution of target species and their by-catch, thus influencing their availability to certain fleets. To a certain extent variations in recruitment or mean weights that result from environmental forcing are incorporated in many stock assessments although the exact mechanisms involved may not be full understood. However, for parameters such as natural mortality or maturity often fixed long term values are applied and the short term variability that results from the changing environment is not taken into considerations.



In the case where strong environmental dependencies have been established, the knowledge of the environmental state should be incorporated into the assessment and projections for the stock as part of the ecosystem based approach. In the first instance this can take the form of harvest control rules conditional to environmental factors. A step further is to devise management strategies that are adaptable to longer term environmental variations like regime shifts and climate change.

Case studies – Baltic Herring & Bay of Biscay Anchovy

In Baltic Herring, a strong dependency between the year-class strength and the severity of the winter has been established. Hence recruitment predictions are based on water temperature in April at the onset of spawning and the abundance of zooplankton in May, when larvae hatch. In Bay of Biscay Anchovy it has been shown that upwelling and stratification strongly impacts on larval survival. However when attempting to predict recruitment using environmental indices these were not considered sufficiently reliable to estimate the population one year in advance.

Currently, only a few ICES working groups incorporate environmental variables into stock assessment. The problem with incorporating environmental indicators into stock assessment is that it is not providing the numerical accuracy that is believed to be needed to include them into the advice. Furthermore the environmental indica-

tors are often not collected at the same spatial or temporal scale as fisheries data, resulting in a mismatch between the data sets. As a result of this, for most stocks assessed by ICES, environmental influences are considered but there is a reluctance to incorporate them into the stock assessment process. There is a need to develop management strategies that are robust enough to deal with the uncertainty associated with this type of data and have triggers in response to indicators on the state of the environment..

2. Ecosystem goods and services

Each fish forms a building block within the ecosystem. It interacts with the other ecosystem components through a number of processes such as competition and predation. Removal of one or more of these building blocks inevitably affects the other ecosystem components. There are few examples within current stock assessment practices where the harvesting of one stock is adjusted to accommodate the predation needs of another stock.

Case Study: Arctic Cod & Capelin

In Arctic cod, mortality is adjusted for cannibalism in the stock assessment model, while the predation pressure of Cod is included in the mortality estimates of Capelin.

These are examples of the incorporation of ecosystem services provided by exploited fish stocks onto other commercially exploited fish. However in a more holistic ecosystem based management it should also be considered how the removal of this part of the food chain affects higher predators- such as sea birds and cetaceans.

3. Critical stocks and critical ecosystem components

Certain ecosystem components are at risk from fishing activity. These include all species that are targeted or caught as by catch; discarded or incidentally injured. It also includes any species that utilises the habitat that is modified or destroyed during the fishing process. If their biomass has declined to such critical levels that they are listed as endangered or threatened under conservation order then, in ecosystem-integrated management, this should warrant priority in their protection.

Case Study: Basking shark and Spurdog

The inclusion of critical stocks in the management strategy would prioritise the protection of listed species such as basking shark or spurdog over the exploitation of other fish stocks. Basking sharks are now legally protected in some territorial waters and EC regulation prohibits the removal of their shark fin, however they are still subjected to fishing mortality through by-catch and discarding.

In the same category falls the protection of vulnerable habitats such as coral reefs.

Case Study: Deepwater corals *Lophelia*

Deepwater corals *Lophelia* have been included in the list of endangered habitats under the OSPAR convention. Therefore their protection against the damage of fishing activity is being prioritised. Certain areas where these coral beds have been mapped are protected through their designation as SACs, and the prohibition of fishing with ground gear through legislation by the EU (EC reg 1568/2005) and NEAFC.



4. Ecosystem considerations

Fishing activity does not just affect the abundance of the target stock but also any species that are caught as by-catch, species that are dependant on the target stock through trophic relations, and the biota that utilises the physical habitat that is modified by fishing activity. Under the *ecosystem consideration component* the effects of fishing on other ecosystem components should be included in the advise, as they are for mixed fisheries considerations. Management decision can then be made on the trade offs of exploitation vs. ecosystem impact. These decisions should not only take into considerations the economical gain through the exploitation of the resource but also the economical cost or repairing damage done to the ecosystem. What decisions are taken depends on the management objectives for this habitat and this is a societal issue. However they will result in a list of prioritisation that will be incorporated into the advise and can include technical measures that restrict the use of certain metiers, closed areas for selected gear types or the setting of discard limits. The challenges for ICES are that the management objectives for a habitat would be regional rather than population based.

Case Study: Razor Clams east coast of Ireland

The harvesting of razor clams is carried out by hydraulic dredging and the techniques used cause considerable incidental damage and disturbance to razor clams and associated fauna. As a consequence the scientific advise is to devise methods to control the damage carried out on the fauna, such as abolishing the prohibition for diving as a method for a more selective and ecofriendly method of harvesting.

5. Industry and other stakeholders

The industry and other stake holder component facilitates the introduction of a human dimension to the ecosystem based management through the use of stakeholder based consultation and incorporation of fishermen's knowledge in development of advice. Industry and stakeholders are involved in the setting up of single species management strategies but also in the decisions for trade offs between multi species exploitations and ecosystem considerations. Furthermore, their involvement in management decisions will increase their willingness to implement and comply with the resulting regulations.

Case Study : Regional Advisory Councils in the CFB.

In EU waters stakeholder participation is carried out through the Regional Advisory Councils which are made up of representatives from the fishing industry, environmental organisations and observers from the commission and governmental organisations. The environmental organisations include groups focussing on general species conservation (World Wide Fund for Nature, Marine Conservation Society) and the protection of particular ecosystem components such as sea bird and mammal groups. These RAC's have an advisory role to the commission and their dialogue with science is vital for improvement of fisheries data but also to give them more empowerment in the management of resources.



The Nature of Advice

So how does the ICES advice look if it is to be given within the ecosystem context? Firstly, it will come as regional advice with a fleet based element. The calculation of stock parameters such as growth, recruitment and survivorship should also differ regionally with a varying degree of environmental forcing. It further needs to include the influence and demands of other ecosystem components that are affected by the fishing process and this again would strongly depend on the eco-region for which the advice is given. Finally, the advice delivered to clients would incorporate a strong dialogue between scientists and the stakeholders.

For this to happen, ICES faces major challenges. In order to give regional rather than population based advice fisheries data requires a higher spatial resolution than is currently used. Data on the various components of the ecosystem need to be more integrated. However, due to their data-limited nature, mechanisms need to be developed to incorporate qualitative indicators that allow giving directions and trends rather than precise numerical values. Furthermore management strategies need to be robust enough to deal with the uncertainty that is associated with the various ecosystem components and their interactions.

Final Comments

- The Marine Institute regards the ecosystem approach as a key consideration in the future development of fisheries management advice.
- The previous chapter reflects one of the main impacts that fishing has had on the ecosystem in the last twenty years already where we are fishing down the food web.
- Adopting the Ecosystem Approach is a long and difficult process but the initial steps have already begun. FSS fisheries research surveys are now all multidisciplinary and collect data on the ecosystem in addition to the biological parameters of fish species. One of the key feature if we want to progress with the Ecosystem Approach is the integration of different data sets. Projects aiming to integrate fisheries data with environmental data sets are in place and are being further developed.
- The future of fisheries depends on the way in which the two fundamental concepts of fisheries management and ecosystem management and their respective stakeholders, will join efforts or collide. Scientists, managers and industry have to work together in order to succeed in the development and implementation of ecosystem based fisheries management.



References:

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