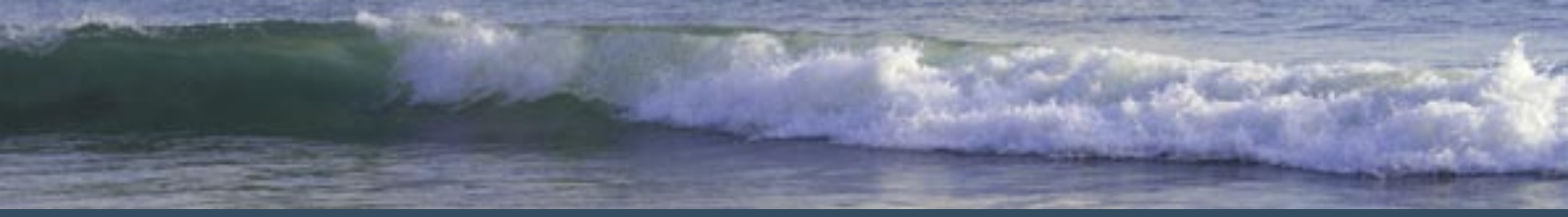

How can science contribute to an ecosystem approach to the South African small pelagic fishery?

Background

The application of the Ecosystem Approach to Marine Resources (EAMR) is a priority for the EUR-OCEANS network (see Fact Sheet 2). EAMR frameworks are adaptive, incremental and geographically specific. In this Fact Sheet we report on the implementation of the EAMR to the small pelagics fishery off South Africa.

The EAMR requires a sound scientific base to provide the means of assessing the ecosystem effects of fishing as well as the effectiveness of the various management strategies adopted in response to identified risks or effects. Ecological Risk Assessment was adopted in South Africa as a means of identifying and prioritising problems associated with selected fisheries in the Benguela region.

To illustrate how South Africa is moving toward an EAMR from the basis of biological research, selected ecological issues raised for the purse seine fishery for small pelagics (anchovy *Engraulis encrasicolus* and sardine *Sardinops sagax*) are examined. The indicators required to address these issues are identified and the scientific research or monitoring studies necessary to inform these indicators are proposed.

Biological or catch data are synthesised into useful indicators that enable changes and ecosystem responses to be followed in a manageable and formal way (e.g. through specific management measures). Technical management measures that may contribute to solving the issues are also suggested. This will contribute to a management strategy that optimizes social and economic benefits without compromising the integrity and sustainability of the resource and its supporting ecosystem.

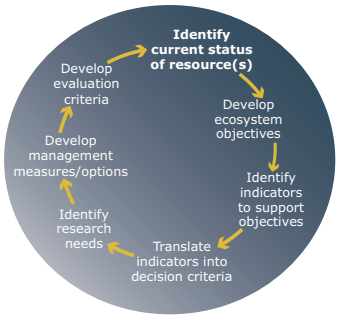

Diagram to show the different stages in the EAMR approach

The small pelagic fishery

South Africa's fishery for small pelagics developed off the west coast in the late 1940's and targeted primarily sardine *Sardinops sagax*. Catches of this species peaked at just over 400 000t in the early 1960's but declined rapidly thereafter, the collapse of the sardine stock being ascribed to over-fishing, a southward expansion of the fishing grounds, and variable recruitment. To compensate for reduced sardine catches, the fishery switched to smaller-meshed nets in 1964 to target anchovy *Engraulis encrasicolus*, which replaced sardine as the dominant component of sardine landings. Following an increase in sardine abundance arising from a management strategy that aimed to rebuild the sardine stock, catches of the two species have been at similar levels since the mid-1990s. Round herring *Etrumeus whiteheadi* is also targeted but to a lesser degree by the fishery.

Anchovy, *Engraulis encrasicolus*.
Photograph: Marine and Coastal Management, South Africa.

Sardine, *Sardinops sagax*.
Photograph: Marine and Coastal Management, South Africa.

Pelagic fishing vessel off the South African coast.
Photograph: J. Rademan.
Marine and Coastal Management, South Africa.

Almost all of the anchovy and round herring caught are reduced to fishmeal and oil in industrial-scale factories located on the west coast, whereas some sardine are canned or frozen for human consumption or as pet food or used as bait. Most of the anchovy catch is taken inshore off the west and south-west coasts, and is made up mainly of recruits of around 6 months old that are migrating from the west coast nursery grounds to the spawning grounds on the south coast. Catches of sardine have been made off both the west and south coasts, but in recent years the sardine population has shown an eastward shift and catches are now taken almost entirely off the south coast.

It is estimated that the annual value of pelagic landings for the period 2001 - 2004 was approximately €82 million. The industry provides employment to approximately 4 500 full-time personnel, 2 500 seasonal workers and more than 700 fishers. The support service industries support a further 2 400 indirect jobs.

Management of the pelagic fishery is via an operational management procedure that aims to achieve an optimal trade-off between maximising overall catches of sardine and anchovy and minimising risk of resource collapse. Because anchovy and sardine school together as juveniles, directed fishing on anchovy recruits results in a bycatch of juvenile sardine, hence catches of the two species cannot be maximised simultaneously. Separate total allowable catches are set for anchovy and sardine, in addition to a total allowable bycatch set for juvenile sardine taken in anchovy-directed fishing. Additionally, a precautionary upper catch limit is set for round herring.

Applying the Ecosystem Approach to the South African small pelagics fishery

In implementing the EAMR in South Africa a range of indicators, issues, technical management approaches and potential for implementation are identified for each fishery. Each issue is classified and prioritised according to risk levels. The table below provides some examples of how the EAMR is being applied in the South African small pelagic fishery. For a detailed list of all the ecological issues considered in this fishery, please see the additional tables provided on: www.eur-oceans.org/KTU. Examples of the application of the EAMR to the fisheries for the South African hake fishery and the West Coast rock lobster fishery are also available on the website.

The Issue	Indicators	Research approaches	Technical management	Implementation
Impacts of removal of forage fish on species bound to breeding sites on land (i.e. seabirds)	Bird population sizes; breeding success (fledgling weight, fledglings raised per breeding pair, breeding proportion); seabird diet composition; spatial indicators (e.g. overlap of seabird foraging and pelagic fisheries)	Routine monitoring of seabird colonies; satellite tracking to assess foraging ranges; minimum realistic models; spatialised models of pelagic fish around seabird colonies Quantify and formalise the link between the pelagic fishery and seabirds; quantify functional responses of seabirds to small pelagic prey and identify thresholds below which there are serious negative implications for seabirds	Avoid populations falling below levels that exceed limit reference points according to IUCN conservation criteria by reducing TACs or closing areas within foraging ranges; allow sufficient escapement of forage fish for predators; avoid threshold levels of pelagic fish below which the implications for seabirds are detrimental	Good potential for implementation of management response/ability to manage
Poor understanding of decadal scale fluctuations in abundance of small pelagic fish and thus availability to fisheries	Biomass; catches; trophic replacement index; diet of predators (e.g. seabirds)	Develop indicators to track ecosystem changes; hindcast to pre-fishing period to provide information on ecosystem effects of fishing; develop expert system models to detect ecosystem changes (using indicators); compare ecosystem functioning over different periods and between systems; quantify trophic controls (bottom-up, top-down, wasp-waist); time-series analyses	Manage catches within productivity states/regimes, as identified using indicators of ecosystem state/ change **Benefit:** optimisation of catches while keeping the risk low that catch levels will accelerate stock decline	Fair potential for implementation of management response/ability to manage

Action points

South Africa has chosen a progressive and iterative strategy regarding the implementation of the EAMR, starting from identifying relevant issues and applying existing scientific knowledge, expertise and assessment. In its initial stage, for each important fishery the following needs are considered. These needs are common to the application of the EAMR in other areas:

- Identify the current status of the resource(s);
- Examine concerns regarding single-species, community or ecosystem based approaches (e.g. spatial issues or species interactions not taken into account in current management), and express them as ecosystem objectives;
- Identify indicators in support of these objectives;
- Translate ecosystem indicators into decision criteria (e.g. through definition of limit reference points);
- Identify research needs;
- Develop management options and measures to be taken with stakeholders participation; and
- Develop evaluation criteria for adopted management measures.

Fact Sheet composed by Lynne Shannon and Carl van der Lingen from Marine and Coastal Management, South Africa. This approach has been undertaken as part of the Benguela Current Large Marine Ecosystem (BCLME, see www.bclme.org) project to explore the feasibility of an Ecosystem Approach to Marine Resources in the Benguela region. For further information please contact: Lynne Shannon (Lshannon@deat.gov.za), or go to www.eur-oceans.org/KTU for background papers, additional case studies and in depth examination of issues raised. Other applications of the EAMR in the EUR-OCEANS region will be available in future Fact Sheets.

Fact Sheet by: EUR-OCEANS Knowledge Transfer Unit, hosted by the GLOBEC IPO at Plymouth Marine Laboratory.
For further information contact, Jessica Heard: jessh@pml.ac.uk or visit the Website: www.eur-oceans.org/KTU