How can we manage fish stocks with limited or uncertain information?

Marine Theme Objective: Science for integrated Marine Management

What's the problem?

Assessing the status of fish stocks and providing advice to ensure their long-term sustainability relies on data collected directly from fish catches and through research surveys. However, the outputs of our main assessment methods are open to uncertainty when these data are limited or values describing fish population characteristics (e.g. growth) are difficult to accurately determine (e.g. due to natural variability or limited sampling). This means that existing information may be inadequate to answer questions posed by initiatives such as the World Summit on Sustainable Development. Additionally, development of an ecosystem approach to fisheries management means that an understanding of the impacts of fishing on stocks of species not formally assessed by scientists, and therefore considered as 'data limited', (examples are sharks and rays) is becoming increasingly important (Figure 1). How can we provide robust advice where current methods cannot deliver due to a limited understanding of biology and catch rates?

What are the aims of the project?

The main aim of this four year project, which started April 2008, is to develop and test methods for stock assessment and management, including - but not limited to - data poor situations, that will provide robust stock status estimates and management advice for a wider variety of stocks, fisheries and management regimes. It will not be constrained to the current EU/ICES process, but look worldwide at alternative approaches, develop methods for stocks of UK relevance, and test their performance through simulation.

Under the precautionary approach, management of data limited stocks would require minimal catches in the face of a lack of scientific evidence. This is designed to minimise the risk to the stock and therefore protect the fishers' long term future livelihoods.

By developing approaches to evaluate the status of species which cannot usually be assessed through current assessment methods, and adapting approaches for managing those species, the research aims to improve overall management of the seas' resources.

Figure 1: Hammerhead shark Sphyrna zygaena, an example of a data limited species, on display at Vigo fish market (Source: Jim Ellis Cefas Crown Copyright).

Which policy areas will the research inform?

As noted in Defra's Fisheries 2027 document, 'A sustainable fisheries sector is essential for delivering the Government's vision of clean, healthy, safe, productive and biologically diverse oceans and seas…. Fisheries, for which data or scientific understanding are insufficient, are managed adaptively and in line with a precautionary approach.' To this end, the project will provide tools for better fisheries management, including improved understanding of the status of stocks where information is uncertain.

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What are the results from the project and how will they be used?

The aim of the project is to identify alternative assessment and management approaches appropriate for situations where data are limited. To help achieve this aim, the project will undertake a number of work packages:

1. The first work package involves evaluating existing knowledge and best practice within data limited fisheries around the world. Significant progress has been made in delivering this task and related publications have been submitted to scientific journals.

2. The second work package involves identifying contrasting case studies, and a draft list has been discussed with Defra MFScU. These case studies include:

- Deep sea fisheries management.
- Shark and ray by-catch around the UK.

This range of case studies allows the testing of different methodologies, as well as identifying whether they are effective and robust for species with different life history characteristics (e.g. fast growing/short lived species, through to slow growing/long lived species). This allows the project to develop recommendations that are more generic than would be possible using species-specific case studies alone. It also links with a new EU Framework research project developing a framework for deep sea fisheries management.

3. This work package aims to identify and test methods to assess and provide management decisions for fisheries that are appropriate for the level of understanding available. The case studies are formulated to allow testing of candidate approaches using computer simulation techniques.

4. In situations where data are limited or assumptions must be made, the result will often be increasingly uncertain outputs from assessment (Figure 2). In the fourth work package, we will look at ways of providing better estimates of the resulting uncertainty to allow managers to make more informed decisions.

5. The fifth work package examines the costs and benefits of alternative approaches. For example, there is a trade-off between collecting detailed information, and the level of improvement in advice and management performance that can be gained. This work package aims to provide advice on whether alternative approaches may be cost effective.

The project, which will run until March 2012, will disseminate its findings through scientific publications, meetings and conferences.

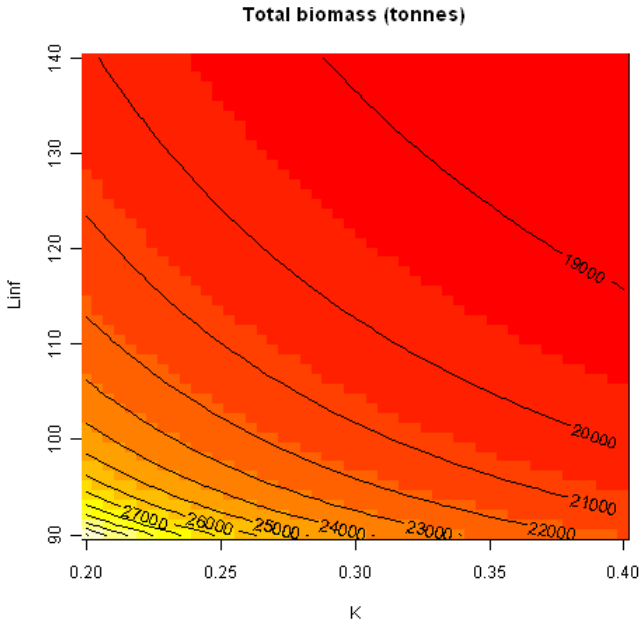

Figure 2: Plot showing how total biomass estimates from a standard length-based stock assessment method is strongly affected by assumed values of the biological growth parameters (L_{inf}, the maximum length of the species; and K, the growth rate). Uncertainty in the values of these parameters makes assessment results, and hence management advice, very uncertain. Developing stock assessment methods for data poor situations is one of the aims of the project. (Source: Cefas Crown Copyright).

Where can I find further information about this and related research?

For further information on the project, please contact Dr Finlay Scott at Cefas, Lowestoft (finlay.scott@cefas.co.uk). Further information can also be found at www.cefas.co.uk).

Alternatively, please contact Defra's Marine and Fisheries Science Unit: marinescience@defra.gsi.gov.uk.

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