

sociologists always deal in uncertainty. For example, most of the questions in the discipline point to gaps in knowledge about management of communities. What biologists say to managers about ranges of likely stock sizes becomes public discourse about exact stock sizes. Economists do the same thing by implying certainty in their models. Sociologists, in fact, seem most likely to deal with uncertainty.

Measuring the Unmeasurable: a Multivariate Interdisciplinary Method for Determining the Health of Fisheries

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Abstract

This paper describes an attempt to devise a multivariate, multi-disciplinary taxonomy of world fisheries that could be used to diagnose problems. The scheme might be useful in a triage of fisheries to determine where limited management resources might be focused to greatest effect.

Fisheries attributes are grouped into ecological, technological, economic and social categories. For each category, we chose fifteen to twenty attributes that are easily and objectively scored from readily available data, and that are likely to discriminate among fisheries. The selection of these attributes is important because they must remain fixed if future analyses are to be comparable. Candidate attributes are discussed.

A multivariate ordination (at this stage we used Principal Components Analysis, PCA) is then performed within each disciplinary set of attributes. The ordination scores are then brought together into an overall interdisciplinary analysis (also at this stage using PCA).

A preliminary analysis of a diverse set of world fisheries from commercial, subsistence, artisanal, industrial and recreational sectors is presented. Preliminary results suggest that the technique may be useful in objectively evaluating the health of fisheries.

Extracting useful data for an interdisciplinary overview entails delving into detailed studies in a range of disciplines, each of which has evolved its own ground rules, jargon and unstated assumptions. Ordination within each category here represents the disciplines. This may be approximate, as here, using simple ranking scale for attributes, or, after careful surveys and questionnaires have been carried out, made more precise. The hierarchical technique introduced here is designed to withstand robust disciplinary review at this first level of analysis, while re-ordinating the fisheries in interdisciplinary multivariate space at the second stage.

Discussion

Jake Rice

The method appears to be quite interesting but does not appear to adequately deal with issues like multi-species fisheries, multi-license fisheries where properties are common, or fisheries where individuals in boats fish for different species.

Daniel Pauly

Such issues can be dealt with by separating out component fisheries. For example, in Ghana fishers may take sardines some of the year, then fish in lagoons. These *two* fisheries can be separately examined.

Tony Pitcher

Whenever a different species (a target) is the focus of a gear, differentiation from other fisheries is implied.

Jon Schnute

What is the application of economic attributes? Some of them appear to be unrelated to fishery health *per se*, further how do the effects of international fishing manifest themselves?

Daniel Pauly

It should be remembered that the paper is based on the work of two teams; Tony Pitcher/Alida Bundy, focusing on large scale temperate fisheries, and Daniel Pauly/Dave Preikshot, concentrating on small scale artisanal fisheries, who developed this assessment tool after discovering a common approach in analysis. One goal for

the latter group is to see whether Malthusian overfishing can be diagnosed with such a method, requiring an assessment of local economic conditions. Also, it was hoped to see whether the fisheries could be tracked through time as they evolve. The different gross character differences of the fisheries studied by the two groups, such as many temperate versus few tropical boats, was hoped to provide useful contrast in results. Other attributes such as latitude and temperature may have overarching effects so the attributes presented are not a final list.

Carl Walters

There is a growing interest in regulators only monitoring prices of quotas. What this approach seems to do is capture lots of information on such trends. Can trends be captured thus allowing the tool to be used to predict events like fishery collapses?

Daniel Pauly

To be able to recover such information is definitely one of the goals of the project.

Politics and Fisheries

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Abstract

Traditional fisheries management, until the early 1960's was dominated by biologists, and scientific aspects of assessing stocks received most attention. The 1970's and 1980's were a period in which the economist and biologist dominated management debates; more recently sociologists have become more vocal.

The dominance of scientific involvement in the process of defining management measures and (lately) analyzing the less than successful record of many past efforts at fisheries management, may have led to the misconception that the performance of the scientific community (from creating theories to collecting and interpreting data) is to blame for most of the failures. I believe such conclusion reflects what has been a fundamental weakness in the past: the idea that fisheries management is basically a scientific process of assessing fish stocks and their sustainable yields in biological or

economic terms.

Fisheries management surely affects fish stocks, but is foremost a political process among humans (not unlike for example tax legislation), in which income and access to the fish resources is redistributed between fishermen, suppliers, consumers, processors, the State, the scientific community, foreigners and locals, etc.

It is often true that the economic and financial effects of management measures on each of those parties is difficult to determine; substantial uncertainty not only surrounds the biological aspects of many management measures, but equally the economic and social impact.

But fisheries management is a political process, in which political influence often determines whether something happens or not. The influence of each affected party depends on many factors and legislation, but in many countries raw political power largely determines the outcome of any attempt to introduce effective management systems. Hence, the key constraints to introduction of effective fisheries management is first, the lack of scientific and economic knowledge that could help define in more certain terms who gains and who loses. Secondly, it is lack of experience on the part of the Government in managing the political process, or the inability or unwillingness on the part of the authorities to muster sufficient political power to counterbalance heavyweight private interests who wish to maintain the status quo. Only when resources are very heavily overfished, and private pressure for some form of management, does a 'window of opportunity' exist to do something meaningful. However, if the situation is serious, uncertain long-term benefits and substantial short-term costs still limit the extent to which fundamental changes can be made and maintained. It is not by accident that historically fisheries display a boom-bust cycle; many factors, including technical and economic ones, encourage such a pattern.

If one reviews the New Zealand experience with ITQ's, or Japan's experience with coastal fisheries management, it becomes clear that these examples still are