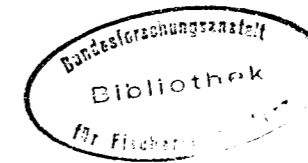


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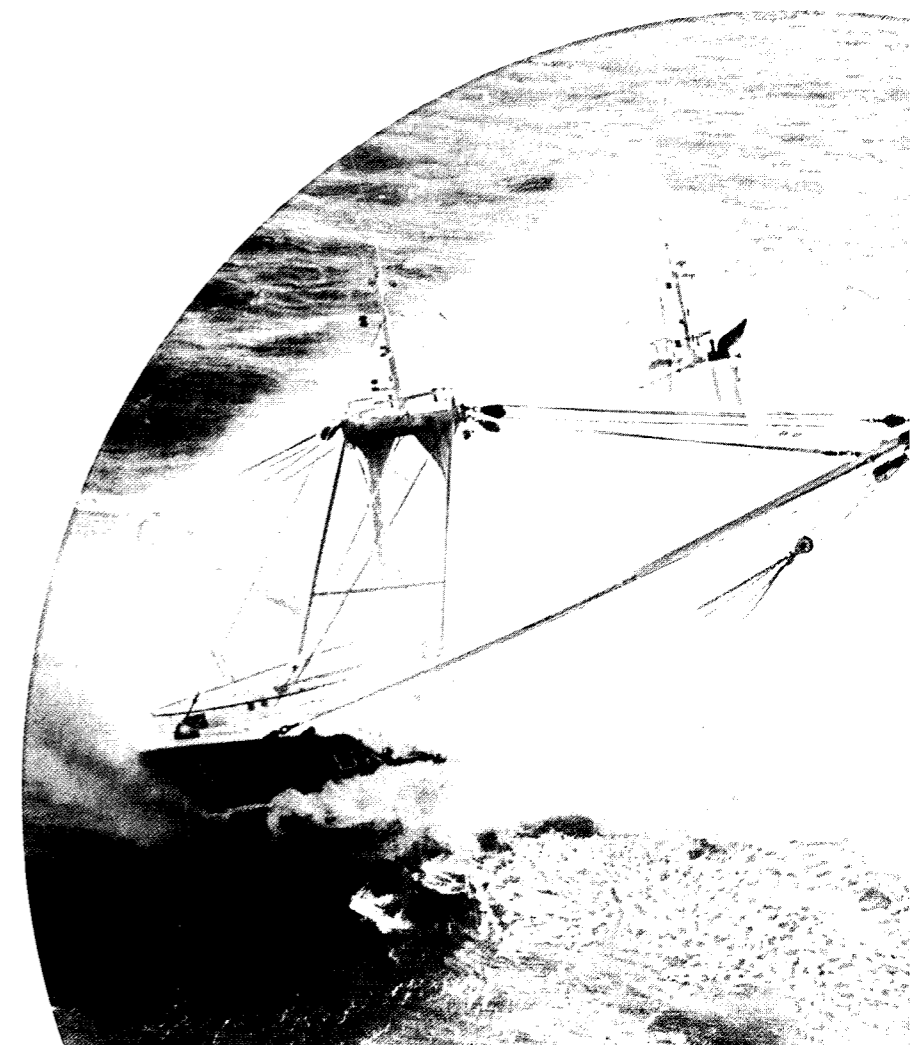
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Pelagic Fish Committee
Sess. P



THE USE OF THE MBAL CONCEPT IN MANAGEMENT ADVICE

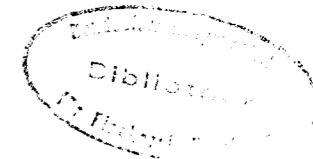
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THE USE OF THE MBAL CONCEPT IN MANAGEMENT ADVICE

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Abstract

Since the adoption by ACFM of the MBAL concept (minimum biologically acceptable level) as a corner stone of their management advice, several drawbacks of this approach have become apparent. Managers in some countries consider the MBAL as a management objective, rather than an emergency situation. The words "minimum biologically acceptable level" suggest that a situation in which most commercial stocks are at the MBAL is acceptable from a biological point of view. The fact that the corresponding fishing effort may have biologically unacceptable effects on non-commercial species is not clear from the management advice.

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1. THE USE OF THE MBAL CONCEPT IN MANAGEMENT ADVICE

Over the last two decades, biologists in ICES have spent a great deal of thought on the provision of management advice to fishery administrators. The basic assumption was that the fishing industry would be interested in high and stable catches of the more valuable age groups of a population. Discussions centered around the question which target fishing mortality would provide the best combination of yield-per-recruit, catch-per-unit-effort, and stability of catches. No precise optimum for the combination of these parameters could be defined, but it was commonly felt that the target fishing mortality should be somewhere in the range between F_{max} and $F_{0.1}$ (For a description of the various "biological reference points" see Anon., 1992a).

ICES provided its advice to management bodies through the Advisory Committee on Fishery Management (ACFM). The ACFM advice generally contained for each stock a number of catch options. If the scientists in ACFM could agree on an - arbitrarily chosen - target F somewhere in the optimum range, the TAC corresponding to this target F was recommended as a preferred catch option.

The provision of management advice by ICES was changed drastically in 1991. Some customer-organizations had criticised ACFM for assuming responsibilities for selecting management objectives, and the time scale at which these should be reached (Grainger and Serchuk, 1992). ACFM then formulated a new policy, which stipulated that the choice of management objectives and strategies was the sole responsibility for fishery managers (Anon., 1992a). Biologists in ICES should not express a preference for certain catch options any more, but only provide a number of catch options within "safe biological limits", together with the short-term consequences of each option for the stock. Only if stocks were below a "minimum biologically acceptable level" (MBAL) would ACFM recommend specific measures aimed at rebuilding the stock. MBAL was defined as the stock level below which the probability of poor recruitment increases as spawning stock size decreases (Serchuk and Grainger, 1992).

2. PRACTICAL PROBLEMS IN DEFINING THE MBAL FOR A PARTICULAR STOCK

The MBAL is directly related to the stock/recruitment relationship for a particular fish stock: MBAL is the minimum stock size that will provide average recruitment. There are few (if any) fish stocks for which the stock/recruitment relationship is sufficiently known to allow a definition of MBAL with any degree of precision. Recruitment is not only determined by parent stock size, but also by hydrographic conditions, food supply for larvae, and abundance of predators. For each combination of environmental parameters, a separate stock/recruitment relationship will apply. Therefore, each new study will come up with a new estimate for MBAL. Fisheries science will not be able to provide a unique value of MBAL for a particular stock, or to predict which MBAL will apply to the stock in future years.

If a fish stock is approaching the MBAL, managers will need a precise estimate of its position in order to justify the need for drastic conservation measures. If scientists are unable to provide such a precise estimate, adequate management action may be postponed until recruitment has actually declined for a number of years.

3. INTERPRETATION OF MBAL BY MANAGERS

There is obviously a risk of misinterpretation of MBAL by non-biologists. Fisheries managers and other people in the fishing industry have for years been used to receive biological advice that was aimed at rational exploitation of the stocks. For people outside the inner circles of ICES, it is not always clear that ACFM has drastically changed course in 1991, and that the advice now given does not refer to a certain optimum situation any more. Few managers seem to realise that the MBAL is an emergency situation that should be avoided at all costs; that it is a situation in which the industry is under immediate threat of sharp catch reductions.

Some managers may believe that the MBAL is just another target for stock management policies. The words "biologically acceptable" convey that meaning: if the situation is acceptable for biologists, then there should be nothing to worry about.

ACFM increases the confusion by loosely exchanging the term MBAL with a number of other, non-defined expressions that presumably carry the same meaning. Examples from a recent report (Anon., 1993a) are:

- minimum target level (Norwegian spring spawning herring)
- target minimum level (North Sea sole and plaice)
- lowest desirable level (North Sea cod and haddock)
- safe biological limit (Irish Sea cod, whiting, and plaice)

When using the words "desirable level" or "target level", one is definitely suggesting that the corresponding stock sizes may be used as management objectives.

An illustration of the way in which the new ACFM advice may be used by fishery administrators is given by the new national fisheries policy that has been adopted by the government of The Netherlands (Anon., 1993a). The Dutch administration now promotes a stock management policy in which the government is only responsible for keeping the stocks above the MBAL. This policy is called "biological fish stock management", since it is based on the minimum biological requirements set by ICES.

It is recognised that this policy may lead to fluctuating annual TACs. However, if the industry wants to stabilize annual catches, they should take the responsibility for "economical" (= rational) fish stock management. That means they should voluntarily reduce their catches below the official quotas.

4. ECOLOGICAL DRAWBACKS OF USING MBAL

A serious drawback of the MBAL concept is that it ignores ecosystem effects. In general, fishing activities affect the ecosystem in a number of ways. The most obvious effect is the reduction in stock size of the target species. Other direct effects are a reduction in stock size of non-target species that are taken as by-catch. Slow growing species with a low fecundity (e.g. rays, cetaceans) that are taken as by-catch, may be more vulnerable to high fishing pressure than the target species itself. In demersal fisheries, effects may be expected on the stocks of benthic organisms. Indirect effects of fisheries may occur through reduced food supply to predators. A full discussion of ecosystem effects of fisheries is given in Anon., 1992b.

Ecosystem effects of fishing will increase proportionally with fishing effort. The optimum situation from an ecosystem point of view is a reduction of fishing effort to zero.

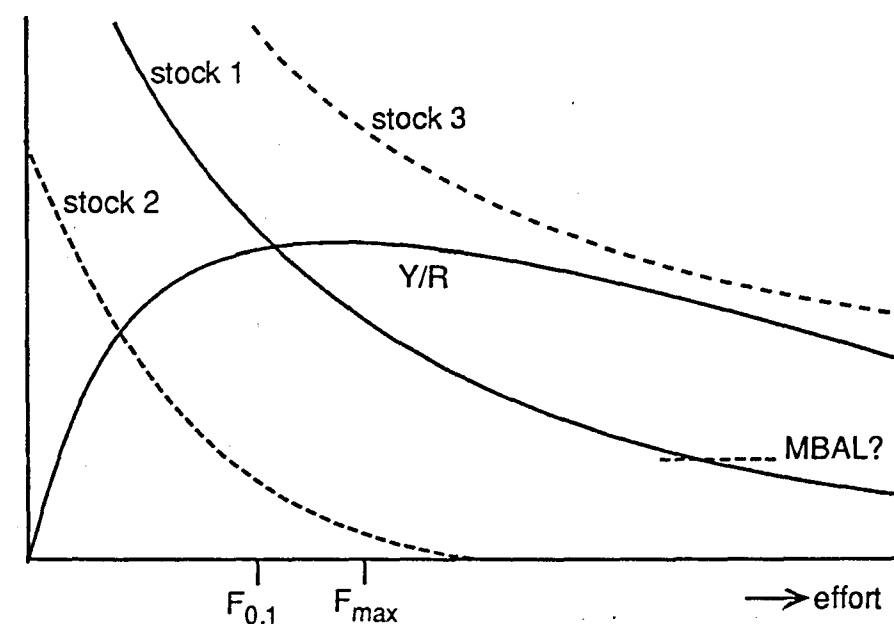


Figure 1. Effect of different levels of fishing effort on yield/recruit of target species (Y/R), stock size of target species (stock 1), and stock sizes of by-catch species (stock 2 and stock 3).

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The present management advice given by ACFM suggests that any management choice is "biologically acceptable" as long as it keeps the stock of the target species above MBAL. In a worst case scenario, this might result in a situation where a number of major stocks are reduced more or less permanently to the MBAL. This will result in drastic, possibly irreversible changes in the composition of the ecosystem. From an ecological point of view, this situation will be far from "acceptable".

5. SUGGESTIONS FOR A BIOLOGICALLY ACCEPTABLE ADVICE

The management advice presently given by ACFM is inadequate from an ecological point of view. It does not object to levels of fishing effort that have more impact on the ecosystem than is necessary for taking the maximum harvest from the resource.

Fishing is one of the ways in which man is using the marine environment. ICES is presently formulating general guidelines for the management of this environment. The Advisory Committee on Marine Pollution (ACMP) has set up a framework for the development of such policies (Anon., 1992b). They consider an activity which affects the environment as a "justified practice" if the benefits to society outweigh the (environmental) costs. One of the conditions under which a "justified practice" would be allowed, is the minimisation of environmental changes as far as practical.

If the above policy is applied to fisheries (which generally is considered a "justified practice"), it means that the annual catch should be taken with a minimum effect on the ecosystem. Therefore, when ICES is advising on fisheries management, it should clearly indicate how the ecological costs of taking a certain harvest can be minimised.

Admittedly, our knowledge of ecosystem effects of fishery is still limited at present. Yet, this may not be an excuse for not taking any action. Based on our present knowledge, specific recommendations concerning maximum fishing effort may already be given. This is the first step in incorporating ecological considerations into the management advice. The second step involves the detailed analysis of all ecosystem effects of the various fisheries. This will be a long-term project, spanning several decades. The two steps will be outlined in more detail below.

Step one

Rather than postponing management decisions until all ecosystem effects of each fishery have been fully quantified, one should start by cutting out impacts on the ecosystem that are clearly unnecessary. We already know that a large fraction of the fishing effort deployed at the moment does not contribute to higher catches, but only increases the impact on the ecosystem. There is no justification for allowing this surplus fishing effort to continue. The ICES Study Group on Ecosystem Effects of Fishing Activities has identified effort reduction as an extremely effective means of reducing side effects of fishing (Anon., 1992b)

In the exploitation of marine resources, the relationship between sustainable yield and total effort is normally dome-shaped. Beyond a certain effort, the long-term yield does not increase any further, or even decreases. This is the well-known yield/recruit curve in fisheries research (Figure 1). The fishing mortality that corresponds to the maximum sustainable yield of the target species is called F_{max} . Increasing fishing mortality beyond this point does not result in as sustained increase in average catch. Economically, there is no sense in exploiting a stock beyond F_{max} .

The ecosystem effect of the fishery is represented by the changes in stock biomass, shown in the same graph. Actually, the ecosystem effect is not limited to changes in the stock of the target species; there will also be changes in the stocks of by-catch species (dotted lines). It is seen from Figure 1 that the various stocks continuously decline with increasing fishing effort.

There is already a wide political consensus that one of the main objectives of fisheries management should be the harvesting of fish with a minimum impact on the ecosystem. Therefore, there is no justification for exploiting stocks at fishing mortalities above F_{max} . Increasing F beyond this point results both in economical and ecological losses.

In the range of fishing mortalities between zero and F_{max} , fishery administrators have to select a target F that represents an acceptable balance between economic yield and environmental costs. At low fishing mortalities, there is a substantial increase in sustainable yield for an increment in F . The incremental economic results decrease when F is approaching F_{max} . The ecological impact of the fishery increases steadily over the entire range. Considering the unfavourable "cost/benefit ratio" for the last increments towards F_{max} , it is advisable to choose a target F that is somewhat lower than F_{max} . The traditional $F_{0.1}$ will be a good choice.

As a first step towards incorporating ecological aspects in the biological management advice, ACFM should only present catch options for the range of fishing mortalities between zero and F_{max} . Higher fishing mortalities are not acceptable from a biological point of view. Where appropriate, biologists should indicate that the $F_{0.1}$ option presents a good compromise between high catch levels and low ecological impact.

Step two

The next step will be to extend the advice with quantitative data on specific ecological effects of each fishery. The collection of this type of data will be a costly and time-consuming project.

Fisheries are using a large variety of gears and exploitation methods, each of which will have a different effect on the various species in the ecosystem. Moreover, the effects of a certain fishery upon a certain element in the ecosystem may be difficult to quantify because of interaction between fisheries, interaction between species, and changing hydrographic conditions.

However, as the results of these studies gradually become available, fishery managers may introduce a number of technical measures aimed at reducing the impact of fishing on non-target species. The results will also allow them to consider the need for a further reduction of F on the target species, in view of food requirements of predator species.

6. TO ADVISE OR NOT TO ADVISE

Responding to criticism from fishery administrators, ACFM in 1991 decided no longer to include recommended or preferred catch options in their management advice. In this way, they hoped to avoid arbitrary choices that could not be defended on the basis of purely scientific arguments. Instead of recommending an arbitrary optimum, they provided a wide range of options without indicating a certain preference. Of course there had to be a limit to the freedom of managers in selecting TAC options. In an attempt to draw such a "last defence line", ACFM formulated the principle of the minimum biologically acceptable level. If managers reduced stocks below this level, ACFM would leave its neutral position and advise specific (and drastic) reductions in fishing effort.

In its new policy, ACFM replaced an arbitrary optimum by an even more arbitrary minimum. The MBAL has no specific biological meaning (it is an economical criterion rather than a biological one) and it can be determined less accurately than the optimum fishing mortalities that were advised previously. As indicated in this paper, a reduction of stocks to the MBAL may have serious ecological consequences. It is misleading, therefore, to use the words "biological acceptable" for such a situation.

It appears that ACFM may have retreated too far in defence against the criticism that they were restricting the freedom of managers. The present advice is too neutral and leaves more freedom to managers than is justifiable on biological grounds. The new advice may be interpreted by managers as a license to relax existing restrictions on fishing effort until stocks have been reduced to the MBAL. This is obviously not the intention of the biological advice. From a biological point of view, there is no justification in allowing fishing mortalities to rise or continue above F_{max} . Consequently, such options should not be included in the biological advice.

Regardless of the complaints uttered by administrators, biologists do have the task of advising responsible management objectives. This is what society has expected them to do in the past, and will expect them to do in future. Of course there is a certain range from which responsible management objectives can be chosen. Within this range, each option has different socio-economic consequences, and a different ecological price. Administrators are correct in saying that it is not an exclusive job for biologists to select the best option within this range. They are not correct, however, when they claim that this job is entirely within their own province.

Obviously, the selection of the best objective from an overall point of view is a task for combined working groups of administrators and biologists. Until such joint working groups have defined new objectives for stock management, there is a need for interim biological guidelines. The MBAL is not adequate for this purpose; more precise indications should be given as to what level of fishing mortality would provide the best combination of high and stable catches and low ecological costs. Without such clear guidelines, management decisions will be based merely on short-term economical and political considerations. It is fairly predictable what the results of such a management policy will be.