Northwest Atlantic Fisheries Organization

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NAFO Precautionary Approach Framework

Introduction

This document summarizes the major features of the NAFO Precautionary Approach Framework proposed by the Scientific Council in 2003. A revised framework was developed at the NAFO Scientific Council Workshop on the Precautionary Approach to Fisheries Management during 31 March-4 April 2003 as described in SCS Doc. 03/05 (NAFO, 2003). The framework proposed at the Workshop was subsequently reviewed at the June and September 2003 Scientific Council meetings and was adopted by Scientific Council after some revisions. The framework includes a more flexible set of management strategies and courses of action as well as reference point definitions that take account of the agreed roles and responsibilities of the Scientific Council and the Fisheries Commission as given in FC Doc. 98/2 (NAFO, 1998). This is in keeping with a global trend of revision and modification of PA frameworks, with the objectives of increasing the transparency of the methods underlying the frameworks and increasing the negotiation space defined within the frameworks (Shelton *et al*., 2003). The framework also addresses many of the concerns of managers contained in the 2002 Report of the Working Group of Technical Experts on the Precautionary Approach as stated in FC Doc. 02/12 (NAFO, 2002).

Evaluation of Existing Scientific Council PA Framework

The existing framework (Fig. 1) was developed by the Scientific Council in 1997 and presented in SCS Doc. 97/12 (Serchuk *et al*., 1997), and has been discussed in several Joint Scientific Council/Fisheries Commission Meetings. Some progress has been made, for example, in the definition of roles of scientists and managers in the PA process (Table 1).

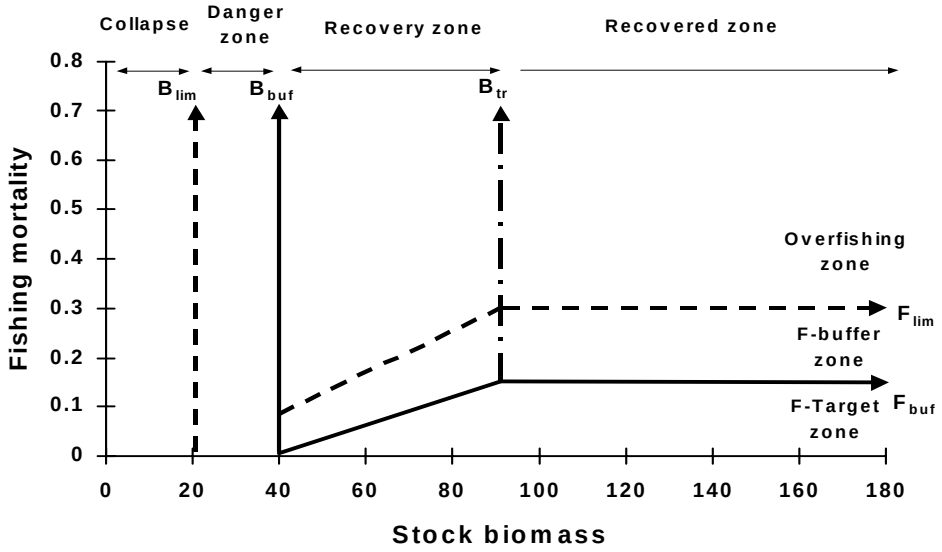

Fig. 1. Schematic depicting the essential features of the Precautionary Approach Framework proposed by the Scientific Council in 1997.

Table 1. Roles of Scientific Council and Fisheries Commission (from FC Doc. 98/02).

Scientific Council	Fisheries Commission
1. Determine status of stocks. 2. Classify stock status with respect to biomass/fishing mortality zones. 3. Calculate limit reference points and security margins. 4. Describe and characterize uncertainty associated with current and projected stock status with respect to reference points 5. Conduct risk assessments.	1. Specify management objectives, select target reference points, and set limit reference points. 2. Specify management strategies (courses of actions) for biomass/fishing mortality zones. 3. Specify time horizons for stock rebuilding and for fishing mortality adjustments to ensure stock recovery and/or avoid stock collapse. 4. Specify acceptable levels of risk to be used in evaluating possible consequences of management actions.

However, the framework was never formally adopted by the Fisheries Commission. Concerns expressed by managers include:

- Prescribed harvest control rules (no fishing) below B_{lim} or B_{buf}
- A fishing mortality limit at F_{msy}
- The perception of a linear decrease in fishing mortality from the biomass target to the biomass buffer
- No consideration of the desirability for stable TACs
- No consideration of multi-species situations

Proposed NAFO Precautionary Approach Framework

The following is the proposed revised NAFO Precautionary Approach Framework developed at the 2003 Scientific Council Workshop on the Precautionary Approach to Fisheries Management as modified by the Council at the June and September 2003 Meetings. For stocks where the Scientific Council can conduct risk analyses, the security margins (F_{buf} and B_{buf}) will be based on the risk levels specified by the Fisheries Commission. For stocks where risk analyses are not possible, the Fisheries Commission will specify the security margins.

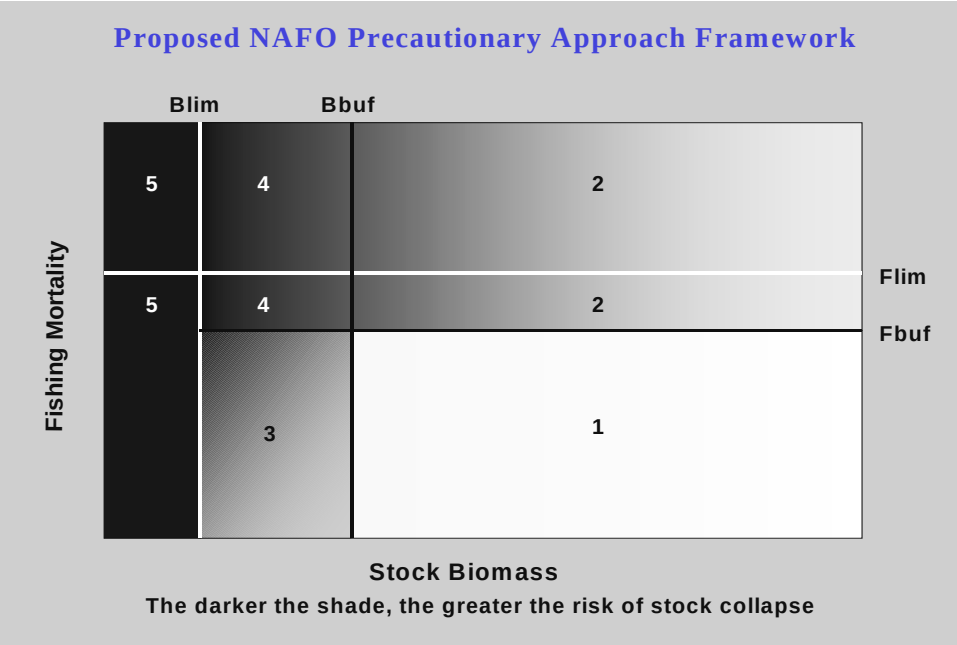

Fig. 2. Schematic depicting a revision to the proposed NAFO PA framework adopted by the Scientific Council in September 2003.

Fishing Mortality Reference Points

F_{lim} = A fishing mortality rate that should only have a low probability[1] of being exceeded. F_{lim} cannot be greater than F_{msy}. If F_{msy} cannot be estimated, then an appropriate surrogate may be used instead.

F_{buf} = A fishing mortality rate below F_{lim} that is required in the absence of analyses of the probability that current or projected fishing mortality exceeds F_{lim}. In the absence of such analyses, F_{buf} should be specified by managers and should satisfy the requirement that there is a low probability[1] that any fishing mortality rate estimated to be below F_{buf} will actually be above F_{lim}. The more uncertain the stock assessment, the greater the buffer zone should be. In all cases, a buffer is required to signify the need for more restrictive measures.

When the stock is above B_{buf} and fishing mortality is below F_{buf}, a flexible fishing mortality rate will be selected by managers to achieve desired management objectives, subject only to the constraints defined by the limit and buffer reference points. In particular, a target F should be chosen to ensure that there is a low probability[1] that F exceeds F_{lim}, and a very low probability[2] that biomass will decline below B_{lim} within the foreseeable future[3].

Stock Biomass Reference Points

B_{lim} = A biomass level, below which stock productivity is likely to be seriously impaired, that should have a very low probability[2] of being violated.

B_{buf} = A stock biomass level above B_{lim} that is required in the absence of analyses of the probability that current or projected biomass is below B_{lim}. In the absence of such analyses, B_{buf} should be specified by managers and should satisfy the requirement that there is a very low probability[2] that any biomass estimated to be above B_{buf} will actually be below B_{lim}. The more uncertain the stock assessment, the greater the buffer zone should be. In all cases, a buffer is required to signify the need for more restrictive measures.

Management strategies and courses of action are as follows:

Management Strategies and Courses of Action (Time horizons and acceptable risk levels specified by managers)	
Zone 1	**Safe Zone**: Select and set fishing mortality from a range of F values that have a low[1] probability of exceeding F_{lim} in a situation where stock biomass (B) has a very low[2] probability of being below B_{lim}. In this area, target reference points are selected and set by managers based on criteria of their choosing (e.g. stable TACs; socio-economic considerations).
Zone 2	**Overfishing Zone**: Reduce F to below F_{buf}.
Zone 3	**Cautionary F Zone:** The closer stock biomass (B) is to B_{lim}, the lower F should be below F_{buf} to ensure that there is a very low[2] probability that biomass will decline below B_{lim} within the foreseeable future[3].
Zone 4	**Danger Zone:** Reduce F to below F_{buf}. The closer stock biomass (B) is to B_{lim}, the lower F should be below F_{buf} to ensure that there is a very low[2] probability that biomass will decline below B_{lim} within the foreseeable future[3].
Zone 5	**Collapse Zone**: F should be set as close to zero as possible.

Key features of the framework include:

[1] low probability might be defined as # 20%, but the actual level should be specified by managers
[2] very low probability might be defined as # 5-10%, but the actual level should be specified by managers
[3] foreseeable future might be defined as 5-10 years, but the actual time horizon should be specified by managers

- There must be a very low probability[2] that management actions result in projected biomass dropping below B_{lim} within the foreseeable future[3]. Below B_{lim}, fishing mortality should be kept as close to zero as possible.

- The fishing mortality limit should be no higher than F_{msy}. There should be a low probability[1] that realized fishing mortality will exceed F_{lim}.

- Fishing mortality targets are flexible, as long as they remain in Zone 1 of Fig. 2.

- If a stock assessment generates a current or projected biomass with some probability distribution, operationally the biomass distribution would be evaluated against B_{lim}. In other words, a risk analysis will provide the probability that current or projected biomass is below $B_{lim.}$ If no probability distribution of biomass is available, but a value for B_{lim} exists, Fisheries Commission should establish a buffer zone (B_{buf}), against which the biomass would be evaluated. The same procedure should be used to establish a fishing mortality buffer (F_{buf}). If biomass is in the zone between B_{lim} and B_{buf}, action to reduce F below F_{buf} is required to ensure that there will be a very low probability[2] that biomass declines below B_{lim} in the foreseeable future[3].

The revised framework attempts to address the managers' concerns as follows:

1) Prescribed harvest control rules (no fishing) below B_{lim} or B_{buf}

   The new framework allows fishing below B_{buf}, subject to constraints such as ensuring a very low probability[2] that biomass will fall below B_{lim} in the foreseeable future[3]. However, below B_{lim}, fishing mortality should be as close to zero as possible.

2) A fishing mortality limit at F_{msy}:

   Reasons for continuing to advise that $F_{lim} = F_{msy}$ are:

   - Perhaps most importantly, F_{msy} as a limit is in conformance with the Precautionary Approach as described in several United Nations agreements (in particular, Annex II of the United Nations Straddling Stocks Agreement).

   - Fishing somewhat below F_{msy} results in a relatively small loss in average catch, but a large increase in average biomass (which, in turn, results in a decreased risk to the fish stock, an increase in CPUE, and a decrease in the costs of fishing).

   - Traditional bio-economic models indicate that the fishing mortality associated with maximum economic yield (F_{mey}) is usually considerably less than F_{msy}.

   - Ensuring no major stock is fished harder than the single-species F_{msy} has often been recommended as a good first step towards ecosystem-based management (NRC, 1999; Mace, 2001). Ecosystem-based management will likely require even more conservative fishing mortality targets than "traditional" single-species-based management.

3) The perception of a linear decrease in fishing mortality from the biomass target to the biomass buffer:

   - There is a range of options open to managers in this part of the framework (for example, no reduction in F is prescribed if stock biomass is above B_{buf} and F is below F_{buf}). Managers also decide on the levels of B_{buf} and F_{buf} in those cases where the risk of biomass being below B_{lim} or the risk of fishing mortality being above F_{lim} cannot be provided.

4) No consideration of the desirability for stable TACs:

   - This is a difficult concept to capture in a simple schematic such as Fig. 2; however, considerable flexibility exists for managers in setting target F levels. Stable TACs are easier to achieve if the fishery remains in Zone 1. Furthermore, maintenance of biomass well above B_{lim} will minimize the instability caused by fishery closures.

5) No consideration of multi-species situations:

- Although the proposed PA Framework is focused on single species, ensuring that no individual species is fished harder than the single-species F_{msy} has frequently been suggested as a first step towards satisfying several important and common ecosystem objectives (NRC, 1999; Mace, 2001; Sissenwine and Mace, 2003) In addition, two other aspects of multi-species management were considered in the proposed revision of the PA Framework. First, the de-emphasis of B_{msy} avoids the problem of the impossibility of maintaining all stocks in a multi-species assemblage simultaneously at their respective single-species B_{msy} levels. Second, by replacing the requirement that fishing mortality be zero when biomass is below B_{lim} with a requirement that fishing mortality to be as close to zero as possible in this situation, there is now recognition of the need for a certain amount of flexibility to account for technical interactions that result in unavoidable by-catch of depleted species.

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