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# The Precautionary Approach: A New Paradigm, or Business as Usual?

**pre•cau•tion** \ˈpri-ˈko-shən\ n [F *précaution*, fr. LL *praecaution-*, *praecautio*, fr. L *praecautus*, pp. of *praecavere* to guard against, fr. *prae-* + *cavere* to be on one's guard—more at HEAR] **1** : care taken in advance : FORESIGHT <warned of the need for ~> **2** : a measure taken beforehand to prevent harm or secure good : SAFEGUARD—**pre•cau•tion•ary** \-she-,ner-e\ *adj*

**approach** n **1 a** : an act or instance of approaching <the ~ of summer> **b** : APPROXIMATION <in this book he makes his closest ~ to greatness> **2 a** : the taking of preliminary steps toward a particular purpose <experimenting with new lines of ~> **b** : a particular manner of taking such steps <a highly individual ~ to language> **3** : a means of access : AVENUE<sup>1</sup>

## INTRODUCTION

The term Precautionary Approach has been receiving considerable attention in fisheries. It is a principal focus of recent scientific documents and technical guidelines for fishery management agreements, and it continues to be a focus of many workshops being held throughout the world. As

explained below, the Precautionary Approach is a protocol for ensuring that resource conservation takes precedence over other—usually short-term—objectives. But the need for conservation measures in the use of renewable resources like fisheries is nothing new. Hence the question asked by many people, including fishermen, managers, and scientists, is this: Are these simply buzzwords that will come and go, or does the Precautionary Approach represent something new that is needed now? In this feature, we explain what the Precautionary Approach is about and how it relates to contemporary fishery management needs in the United States and elsewhere.

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<sup>1</sup>The first definition of precaution, and the second definition of approach. By permission, from Merriam-Webster's Collegiate® Dictionary, Tenth Edition ©1998 by Merriam-Webster, Incorporated.

## Feature Article 1

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VICTOR R. RESTREPO

University of Miami

Miami  
Florida

PAMELA M. MACE

NMFS  
Office of Science and  
Technology

Silver Spring  
Maryland

FREDRIC M. SERCHUK

NMFS Northeast Fisheries  
Science Center

Woods Hole  
Massachusetts

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## THE CONSERVATION RECORD

It has long been recognized that fishery resources are not inexhaustible, and that management measures are needed to ensure that they are harvested in a sustainable manner. The concept of overfishing, and the need to avoid it or reverse its effects, achieved foremost prominence in the 1976 law that regulates marine fisheries in the U.S. Exclusive Economic Zone — the Magnuson Fishery Conservation and Management Act (MFCMA<sup>2</sup>). That Act's principal purpose is "to take immediate action to conserve and manage the fishery resources found off the coasts of the United States ..."

When the legislation became effective, several fishery resources were considered to be overfished, having declined "to the point where their survival is threatened," and the MFCMA sought to reverse this situation for those stocks, while preventing it in other stocks by managing all resources for optimal long-term use. To accomplish this, the MFCMA established eight regional fishery management councils and entrusted them with preparing fishery management plans that "will achieve and maintain, on a continuing basis, the optimum yield from each fishery." In addition, the MFCMA sought to encourage the development of the U.S. fishing industry by phasing out foreign fishing which was then perceived to be the main cause of overfishing.

Over 20 years have elapsed since the MFCMA came into effect, but many stocks remain overfished. Operational definitions of overfishing and rebuilding plans for overfished stocks have been formally required in Federal fishery management plans since 1989, but it is only in the last few years that stock recoveries have begun to materialize. In a 1998 report to Congress on the status of U.S. fisheries (NMFS, 1998), NOAA's National Ma-

rine Fisheries Service (NMFS) categorized 90 stocks as being overfished, 10 as approaching an overfished condition, 200 as not overfished, and 544 as having unknown status relative to overfishing (although the stocks of unknown status represent less than 3% of U.S. landings). Thus, of the 300 stocks whose status was known, 33% were either overfished or approaching an overfished condition (Figure 1). Many of the unknown stocks may be overfished as well, and NMFS expects that the percentage of overfished stocks will increase with planned amendments to almost all fishery management plans currently in progress.

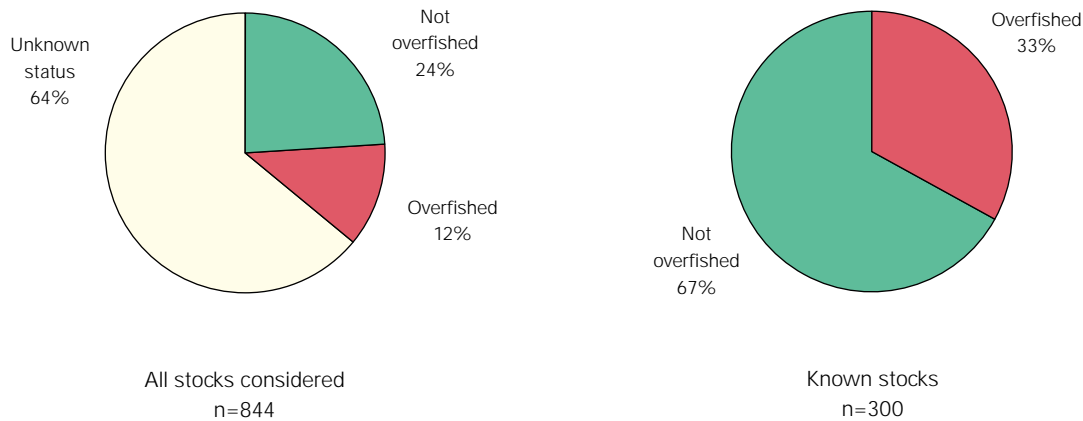
The United States is not alone in having a significant portion of its stocks in an overfished state. Based on data up to 1992, the Food and Agriculture Organization (FAO) of the United Nations (UN) estimated that of those stocks for which formal assessments were available, 44% were considered intensively to fully exploited, and 25% were considered overexploited, depleted, or recovering. Using a different classification system and considering the top 200 of the world's fisheries in 1994, FAO estimated that about 60% can be considered "mature" or "senescent."<sup>3</sup>

## WHAT IS THE PRECAUTIONARY APPROACH?

The Precautionary Approach has been proposed as a way of thinking about fisheries and making management decisions that can help prevent overfishing and rebuild depleted stocks. The Precautionary Approach is adapted from the Precautionary Principle. The latter aims to prevent irreversible damage to the environment by implementing strict conservation measures, even in the absence of scientific evidence that environmental degradation is being caused by human intervention. The Principle is rather rigid and implies an extreme form of reversal of the burden of proof (in its extreme, human actions would be considered harmful unless proven otherwise). If strictly applied to fisheries, the Principle would only al-

<sup>2</sup>The MFCMA has been amended many times, most recently during reauthorization by Congress in October 1996 through the Sustainable Fisheries Act. It is currently referred to as the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA).

<sup>3</sup>FAO reports and press releases can be found on the World Wide Web at <http://www.fao.org>



**Figure 1**  
Status of fisheries of the United States reported to Congress (NMFS, 1998).

low fishing in cases where it could be proven that fishing activities would not harm fishery resources or their ecosystems. The Precautionary Approach is a relaxation of the Principle, developed to deal with systems that are slowly reversible but often difficult to control, not well understood, and may be subject to changing environment and human values. Thus, the Precautionary Approach is particularly advocated for renewable resources like fisheries.

As with the Principle, the reversal of the burden of proof still pertains in applying the Precautionary Approach. As such, it is recognized that: 1) all fishing activities have environmental impacts, and it is not appropriate to assume that these are negligible until proven otherwise, 2) although some fishing impacts may be potentially detrimental, this does not imply that all fishing should cease until all potential impacts have been evaluated and determined to be negligible, and 3) in cases where the likely impacts of fishing activities are uncertain, priority should be given to conserving the productive capacity of the fishery resources. According to FAO (1995a), the standard of proof to be used in decisions regarding authorization of fishing activities should be commensurate with the potential risk to the resource, while also taking into account the expected benefits of the activities.

The collapse of fish stocks in the United States and elsewhere has often been precipitated by the inability to implement timely conservation measures without irrefutable scientific proof of over-

fishing. That is, managers have frequently delayed, postponed, or failed to implement corrective management actions when scientific information on the status of stocks and the impacts of exploitation was not beyond doubt. A shift in the burden of proof is a natural remedy to reverse the situation.

As discussed below, it is difficult to define the Precautionary Approach succinctly, because it has so many components. However, the following sentence represents one attempt to do so:

IN FISHERIES, THE PRECAUTIONARY APPROACH IS ABOUT APPLYING JUDICIOUS AND RESPONSIBLE FISHERIES MANAGEMENT PRACTICES, BASED ON SOUND SCIENTIFIC RESEARCH AND ANALYSIS, PROACTIVELY (TO AVOID OR REVERSE OVEREXPLOITATION) RATHER THAN REACTIVELY (ONCE ALL DOUBT HAS BEEN REMOVED AND THE RESOURCE IS SEVERELY OVEREXPLOITED), TO ENSURE THE SUSTAINABILITY OF FISHERY RESOURCES AND ASSOCIATED ECOSYSTEMS FOR THE BENEFIT OF FUTURE AS WELL AS CURRENT GENERATIONS.

### INTERNATIONAL EVOLUTION

The United Nations Convention on the Law of the Sea of 1982 provided several mechanisms to promote responsible management of marine fisheries. However, not until the 1990's did work begin on developing a precautionary approach to fisheries management. In 1991, the FAO's Committee on Fisheries (COFI) requested the FAO to develop an International Code of Conduct for

Fisheries. Subsequently, FAO and the Government of Mexico sponsored an International Conference on Responsible Fishing, held in Cancun in May 1992. Resolutions formulated in Cancun were presented at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil in June 1992. The Rio meeting highlighted the importance of the Precautionary Approach in the Rio Declaration and Agenda 21. For example, Principle 15 of the Rio Declaration states that

“IN ORDER TO PROTECT THE ENVIRONMENT, THE PRECAUTIONARY APPROACH SHALL BE WIDELY APPLIED BY STATES ACCORDING TO THEIR CAPABILITIES. WHERE THERE ARE THREATS OF SERIOUS OR IRREVERSIBLE DAMAGE, LACK OF FULL SCIENTIFIC CERTAINTY SHALL NOT BE USED AS A REASON FOR POSTPONING COST-EFFECTIVE MEASURES TO PREVENT ENVIRONMENTAL DEGRADATION.”

Several binding and nonbinding agreements embodying the Precautionary Approach were developed and concluded during 1991–96. The most comprehensive of these is the FAO International Code of Conduct, completed in late 1995 (FAO, 1995b). The Code of Conduct addresses six key themes: 1) fisheries management, 2) fishing operations, 3) aquaculture development, 4) integration of fisheries into coastal area management, 5) post-harvest practices and trade, and 6) fisheries research. In total, there are 19 general principles and 210 standards in the Code. While the Precautionary Approach is integral to all themes, it is applied particularly to fisheries management:

“STATES SHOULD APPLY THE PRECAUTIONARY APPROACH WIDELY TO CONSERVATION, MANAGEMENT, AND EXPLOITATION OF LIVING AQUATIC RESOURCES IN ORDER TO PROTECT THEM AND PRESERVE THE AQUATIC ENVIRONMENT.”

The Code of Conduct also emphasizes that

“THE ABSENCE OF ADEQUATE SCIENTIFIC INFORMATION SHOULD NOT BE USED AS A REASON FOR POSTPONING OR FAILING TO TAKE CONSERVATION AND MANAGEMENT MEASURES.”

The Code of Conduct is a voluntary, nonbinding agreement. However, it contains sections that are similar to those in two recently concluded binding agreements: 1) the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (the Compliance Agreement), and 2) the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (officially abbreviated as the UN Implementing Agreement or UNIA, but commonly referred to as the Straddling Stocks Agreement) (UN, 1995).

The Compliance Agreement was adopted by FAO Conference in November 1993. It specifies the obligations of Parties whose vessels fish on the high seas, including the obligation to ensure that such vessels do not undermine international fishery conservation and management measures. The Compliance Agreement is considered to be an integral part of the Code of Conduct. The United States implemented the Compliance Agreement through the High Seas Fishing Vessel Compliance Act of 1995 (16 U.S.C. 5550 et. seq.).

The Straddling Stocks Agreement, negotiated over a similar period as the FAO Code of Conduct and now in the process of being ratified, contains nearly identical language as the Code on many issues, including the Precautionary Approach and General Principles for the conservation and management of living marine resources. Although the Straddling Stocks Agreement is strictly applicable to straddling fish stocks and highly migratory fish stocks, much of it is also relevant to fishery resources within national exclusive economic zones. Indeed, the Straddling Stocks Agreement is being used as the basis for developing precautionary approaches to fisheries management in many individual countries, as well as in several intergovernmental organizations such as the Northwest Atlantic Fisheries Organization (NAFO) and the International Council for the Exploration of the Sea (ICES).

## SCOPE OF THE PRECAUTIONARY APPROACH

The Precautionary Approach to fisheries management is multifaceted and broad in scope. As stated by FAO (1995a), it applies at all levels of fisheries systems: development planning, management, research, technology development and transfer, legal and institutional frameworks, fish capture and processing, fisheries enhancement, and aquaculture. FAO's Technical Guidelines on the Precautionary Approach to Capture Fisheries and Species Introductions (FAO, 1995a) groups the elements of the Precautionary Approach into three categories: 1) fisheries management, 2) fisheries research, and 3) fisheries technology. The Precautionary Approach to fisheries management requires avoidance of overfishing, restoration of already overfished stocks, explicit specification of management objectives including operational targets and constraints (e.g. target and limit reference points), taking account of uncertainty by being more conservative, avoidance of excess harvest capacity, establishment of rules for controlling access, data reporting requirements, development of sound management planning processes involving extensive consultation, and effective systems for monitoring and enforcement. Research in support of precautionary management should be designed to provide accurate and complete data and analyses of relevance to fisheries management, to develop operational targets and constraints, to provide scientific evaluation of the consequences of management actions, to incorporate uncertainty into assessments and management, and to promote multidisciplinary (biological, economic, and social) research. In terms of fisheries technology, the Precautionary Approach primarily involves the promotion of research to evaluate and improve existing technologies and encourage development of appropriate new technologies, particularly those that will prevent damage to the environment, improve economic and social benefits, and improve safety.

## KEY ELEMENTS OF PRECAUTIONARY MANAGEMENT STRATEGIES

Following completion of the Code of Conduct and FAO's technical guidelines on the Precautionary Approach, the facets of the Precautionary Approach that have received by far the most attention are: 1) definitions of overfishing incorporating target and limit reference points, 2) formulation of decision rules that stipulate in advance what actions will be taken to prevent overfishing and promote stock rebuilding, and 3) incorporation of uncertainty by using a risk-averse approach to calculate targets, constrain fishing mortality, and rebuild stock biomass. These facets have been the focus of numerous workshops conducted by intergovernmental organizations (e.g. ICES, NAFO, North Atlantic Salmon Conservation Organization (NASCO), and the International Commission for the Conservation of Atlantic Tunas) as well as national governments, including the United States. They will also be the focus of the remainder of this article.

## LIMIT AND TARGET REFERENCE POINTS

Limit and target reference points are signposts, usually expressed in terms of fishing mortality rates or stock biomass, that provide benchmarks with which to compare the state of the stock and status of exploitation and which can be used to guide fisheries management. Limit reference points set boundaries that are designed to constrain exploitation within safe biological limits so that stocks retain the ability to produce maximum sustainable yield. Target reference points identify desired outcomes for the fishery and are therefore intended to meet management goals and objectives. The basic idea of using reference points in a Precautionary Approach to fisheries management is that targets should be set sufficiently below limits so that the limits will be avoided with high probability and targets will be attained on average.

The United States had already made substantial progress in addressing overfishing prior to the development of the Precautionary Approach. In

1989, NMFS published guidelines (§50 CFR Part 602, Guidelines for the preparation of fishery management plans under the MFCMA) (commonly referred to as the 602 Guidelines) interpreting National Standard 1 of the MFCMA with respect to overfishing. The 602 Guidelines provided a formal definition of overfishing:

“OVERFISHING IS A LEVEL OR RATE OF FISHING MORTALITY THAT JEOPARDIZES THE LONG-TERM CAPACITY OF A STOCK OR STOCK COMPLEX TO PRODUCE [MAXIMUM SUSTAINABLE YIELD] ON A CONTINUING BASIS.”

The 602 Guidelines required that all fishery management plans (FMP's) be amended to include measurable definitions of overfishing for each stock or stock complex covered by that FMP. In most FMP's, this directive was interpreted as a requirement for defining recruitment overfishing which was generally specified in terms of a limit fishing mortality. A review by Rosenberg et al. (1994) of more than 100 such definitions concluded that most definitions were biologically sensible and at least neutrally conservative in protecting against recruitment overfishing, although there was room for improvement especially in terms of the linkage to management actions. The most common definitions of recruitment overfishing were fishing mortality rates associated with either 20% or 30% of the maximum spawning biomass per recruit (i.e.  $F_{20\%}$  and  $F_{30\%}$ , see Appendix 4).

Once overfishing definitions were developed and accepted, fishery management councils were required to develop and implement rebuilding plans for overfished stocks. Many of these plans were well underway, and some stocks had even been proclaimed "rebuilt" when the Act (MSFCMA) was reauthorized in 1996 (Sustainable Fisheries Act, Public Law 104-297). The MSFCMA introduced several new requirements for specifying objective and measurable criteria for determining overfishing and also introduced new or revised definitions for a number of terms related to limits and targets. Most notably, the MSFCMA redefined optimum yield to be no greater than maximum sustainable yield (Table 1). The new definition of optimum yield also included

the protection of marine ecosystems as a national benefit to be considered in setting targets. In addition, the MSFCMA incorporated the definition of overfishing first presented in the 1989 Guidelines, and mandated that specific remedial actions be taken to prevent overfishing and rebuild overfished stocks.

The treatment of MSY as a management constraint in the MSFCMA is consistent with Annex II of the U.N. Straddling Stocks Agreement (UN, 1995) which states:

“THE FISHING MORTALITY RATE WHICH GENERATES MAXIMUM SUSTAINABLE YIELD SHOULD BE REGARDED AS A MINIMUM STANDARD FOR LIMIT REFERENCE POINTS.”

In May 1998, NMFS published new National Standard Guidelines (Federal Register, Vol. 63, No. 840, p. 24212-24327, May 1, 1998) that interpret the amended Act (Table 1 and the definition of overfishing) and directed that fishery management plans be amended to require "status determination criteria" that include separate parts for both the act of overfishing and the condition of being overfished:

“EACH FMP MUST SPECIFY, TO THE EXTENT POSSIBLE, OBJECTIVE AND MEASURABLE STATUS DETERMINATION CRITERIA FOR EACH STOCK OR STOCK COMPLEX COVERED BY THAT FMP AND PROVIDE AN ANALYSIS OF HOW THE STATUS DETERMINATION CRITERIA WERE CHOSEN AND HOW THEY RELATE TO REPRODUCTIVE POTENTIAL. STATUS DETERMINATION CRITERIA MUST BE EXPRESSED IN A WAY THAT ENABLES THE COUNCIL AND THE SECRETARY TO MONITOR THE STOCK OR STOCK COMPLEX AND DETERMINE ANNUALLY WHETHER OVERFISHING IS OCCURRING AND WHETHER THE STOCK OR STOCK COMPLEX IS OVERFISHED. IN ALL CASES, STATUS DETERMINATION CRITERIA MUST SPECIFY BOTH OF THE FOLLOWING: (i) A MAXIMUM FISHING MORTALITY THRESHOLD OR REASONABLE PROXY THEREOF. ... THE FISHING MORTALITY THRESHOLD MUST NOT EXCEED THE FISHING MORTALITY RATE OR LEVEL ASSOCIATED WITH THE RELEVANT MSY CONTROL RULE. EXCEEDING THE FISHING MORTALITY THRESHOLD FOR A PERIOD OF 1 YEAR OR

1976 MFCMA

1996 MSFCMA

**Table 1**  
Definitions of optimum yield in the Fishery Conservation and Management Act (emphasis added).

"... the amount of fish –

(A) which will provide the greatest overall benefit to the Nation, with particular reference to food production and recreational opportunities; and

(B) which is prescribed as such on the basis of the maximum sustainable yield from such fishery, **as modified by** any relevant economic, social, or ecological factor."

"... the amount of fish which –

(A) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine eco-systems;

(B) is prescribed as such on the basis of the maximum sustainable yield from the fishery, **as reduced by** any relevant economic, social, or ecological factor; and

(C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery."

MORE CONSTITUTES OVERFISHING. (ii) A MINIMUM STOCK SIZE THRESHOLD OR REASONABLE PROXY THEREOF. ... SHOULD THE ACTUAL SIZE OF THE STOCK OR STOCK COMPLEX IN A GIVEN YEAR FALL BELOW THIS THRESHOLD, THE STOCK OR STOCK COMPLEX IS CONSIDERED OVERFISHED."

GREATER UNCERTAINTY REGARDING THE STATUS OR REPRODUCTIVE CAPACITY OF THE STOCK OR STOCK COMPLEX CORRESPONDS TO A GREATER CAUTION IN SETTING TARGET CATCH LEVELS."

### HARVEST CONTROL RULES AND REBUILDING

The MSFCMA does not explicitly require that OY (the target) be set safely below MSY (the limit), which is what would be expected using a Precautionary Approach. However, the National Standard Guidelines published in May 1998 recommend that the fishery management councils "adopt a Precautionary Approach" to fisheries management characterized by:

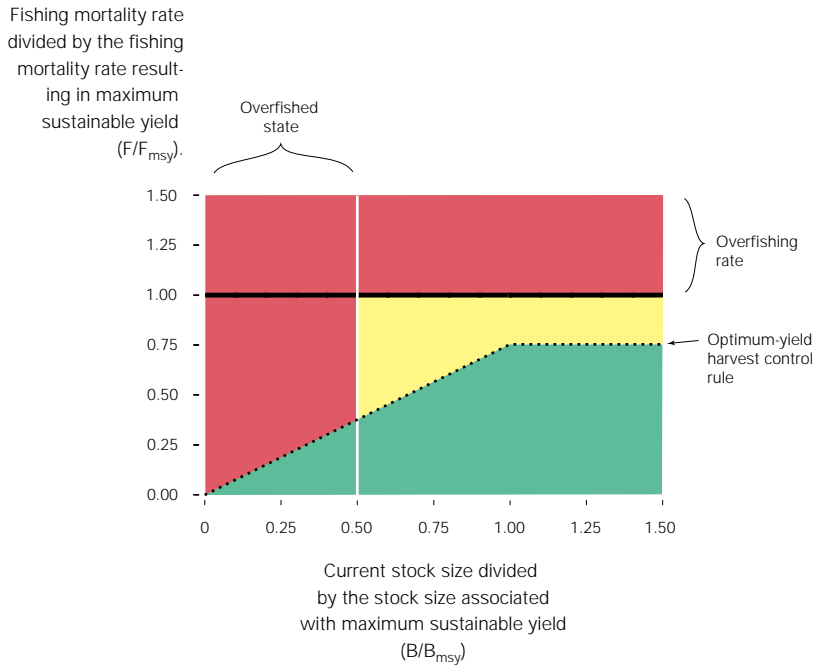
Harvest control rules (also called decision rules) are preagreed protocols for controlling fishing activities with respect to stock status and the limit and target reference points. For example, a harvest control rule might specify how the fishing mortality rate (or, equivalently, the allowable catches) should vary as a function of the size of the stock.

"TARGET REFERENCE POINTS, SUCH AS OY, SHOULD BE SET SAFELY BELOW LIMIT REFERENCE POINTS [I.E., THE OVERFISHING DEFINITIONS] ..."

"A STOCK OR STOCK COMPLEX THAT IS BELOW THE SIZE THAT WOULD PRODUCE MSY SHOULD BE HARVESTED AT A LOWER RATE OR LEVEL OF FISHING MORTALITY THAN IF THE STOCK OR STOCK COMPLEX WERE ABOVE THE SIZE THAT WOULD PRODUCE MSY."

"CRITERIA USED TO SET TARGET CATCH LEVELS SHOULD BE EXPLICITLY RISK AVERSE, SO THAT THE

The 1996 MSFCMA definition of optimum yield instructs that target catch levels for overfished stocks need to allow for rebuilding to the MSY level (Table 1). More specifically, the MSFCMA requires the fishery management councils to take remedial action to end overfishing and rebuild overfished stocks to MSY levels very rapidly (generally in 10 years or less). The definition of optimum yield does not provide much guidance for cases in which an overfished condition is being approached from the opposite direction (i.e. from a healthy stock condition). However, both the



**Figure 2**

Hypothetical example illustrating limit and target harvest control rules. The limit (thick horizontal line) defines overfishing as any fishing mortality rate ( $F$ ) higher than that which maximizes long-term yield ( $F_{msy}$ ). In the example, the stock is said to be overfished when its stock size ( $B$ ) falls below one-half of the MSY stock size level ( $1/2 B_{msy}$ , vertical white line). The example target (dashed line) is intended to achieve high yields while avoiding overfishing: At “healthy” stock sizes, i.e. at or above the  $B_{msy}$  level, the target fishing mortality is set 25% below the limit; if the stock is below the  $B_{msy}$  level, the target fishing mortality is reduced monotonically so as to allow for rebuilding back to  $B_{msy}$ .

MSFCMA and the National Standards Guidelines define overfishing as a level or rate of fishing mortality that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis. Under a Precautionary Approach, this implies that target catch levels should decrease monotonically when a stock is below its MSY level to avoid imperiling the stock’s productivity.

Figure 2 depicts an example of limit and target harvest control rules that are compatible with the National Standard Guidelines. The limit (solid line) is used to decide what level of fishing mortality indicates “overfishing,” and when the stock is in an “overfished condition.” The harvest (target) control rule (dashed line) is designed to maintain a balance between achieving high yields and avoiding overfishing; if the stock size is below its MSY level, the decreasing target fishing mortality allows for rebuilding back to the MSY level. Specifying limit and target harvest control rules that are compatible with the National Standard Guidelines can be a complicated exercise that should take into account the biology of the stock(s), the characteristics of the fisheries (e.g. gear

selectivity), the ability to assess the stock’s status and productivity, and the relative importance to be assigned to the various management objectives. Restrepo et al. (1998) provide technical guidance for defining limit and target harvest control rules that are in accordance with the Guidelines, and where, in the spirit of the Precautionary Approach, resource conservation takes precedence over other management objectives.

## RISK AVERSION

The concept of risk aversion has a long theoretical tradition in fisheries, although it is not frequently applied in practice. Risk-averse management means that when there is greater uncertainty regarding the status or productive capacity of a stock, greater caution is used in setting target catch levels. In the context of the Precautionary Approach, risk-aversion is the mechanism for reversing the burden of proof.

For example, consider the case in which managers wished to define the average OY as landings close to MSY, MSY being a limit reference point (not to be exceeded with any substantial probability) and OY being the target reference point (to be achieved on average). A risk-averse Precautionary Approach would set OY below MSY as a function of uncertainty, viz: the greater the uncertainty, the greater the distance between the two. In this example, only in the case of perfect knowledge (for both MSY and stock status) and perfect compliance could OY be set exactly at MSY. In the example of Figure 2, the 25% difference between the limit and target at high stock sizes provides for a safety margin to guard against uncertainty in perceived stock status, in implementation of management controls, and in natural abundance fluctuations.

Scientific analyses underpin the Precautionary Approach in that they are the basis for determining reference points, assessing stock abundance and exploitation levels, quantifying uncertainty, and assessing the risk associated with different management options. The second National Standard in the MSFCMA states that:



"CONSERVATION AND MANAGEMENT MEASURES SHALL BE BASED UPON THE BEST SCIENTIFIC INFORMATION AVAILABLE."

To the extent that scientific research can reduce uncertainties, the distance between targets and limits can be reduced when using a Precautionary Approach to management.

### CONCLUSION

Taken individually, elements of the Precautionary Approach, such as the need to be proactive, management based on reference points, and risk-averse decision making, are not novel, although all elements have seldom, if ever, been applied in combination. What the Precautionary Approach does is integrate these and other elements into a formal operational framework for decision making (or, in the dictionary definition of approach, "a particular manner of taking such steps"). The particular order in which those steps should be taken under the Precautionary Approach is that conservation constraints should be met before other objectives. At face value, this does not sound like anything new. However, the reality of the fisheries management experience in most instances to date is that short-term objectives have generally taken precedence over long-term ones.

There are two other aspects of the Precautionary Approach that, while they may not be completely novel, challenge the notion that it may be possible to equate adherence to the Precautionary Approach with business as usual. The first is the notion of MSY-based reference points as limits to be avoided, rather than targets to be achieved (or exceeded). Although this is not a rigid requirement of the Precautionary Approach, it is specifically suggested in Annex II of the Straddling Stocks Agreement (UN, 1995), and is being seriously considered by ICES, NAFO, NASCO, and the U.S. Government. It is also consistent with the MSFCMA. Second, the Precautionary Approach is an explicit and detailed attempt to articulate the need for, and means of, bringing to fruition the paradigm shift that is currently in progress. It is apparent that fisheries are in transition from a paradigm of "it is not possible to overexploit ma-

rine resources" to one of "it is not acceptable to overexploit marine resources," but that at the global level this transition is only in its infancy. Completion of this transition will require a change in business as usual by all levels of participants in fishing operations and decisionmaking; i.e. politicians, managers, scientists, fishermen, and consumers. For most players, a complete change in mind-set is needed to be proactive rather than reactive, to put conservation objectives ahead of short-term gain, to proceed with caution, to treat fishing as a privilege (with associated obligations and responsibilities) rather than a birthright, to reject the status quo when it is obvious that the status quo is not viable in the long term and, perhaps most importantly, to realize and accept the fact that only a limited number of participants can derive a livelihood from capture fishing. Advances that are already in progress must be taken seriously; for example, 1) the specification of limit reference points that will constrain fishing within safe biological limits, 2) the establishment of management targets that are explicitly risk-averse, and 3) reversal of the burden of proof.

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