

**REPORT OF THE REGIONAL
WORKSHOP ON THE
PRECAUTIONARY APPROACH
TO FISHERIES MANAGEMENT**

**25-28 February, 1997
Medan, Indonesia**

BAY OF BENGAL PROGRAMME

BOBP/REP/82

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THE PRECAUTIONARY APPROACH TO FISHERY MANAGEMENT

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Chennai, India
1999

PREFACE

This document reports on the proceedings and decisions of a four-day regional workshop on the "Precautionary Approach to Fishery Management" (referred to in the text as PA2FM), held from 25 February to 28 February, 1997, in Medan, North Sumatra, Indonesia. It was organized by the Directorate-General of Fisheries, Indonesia, and supported by the FAO and the Bay of Bengal Programme (BOBP).

The workshop was meant to clarify and discuss the implications of PA2FM and show how such an approach to management enables sustainable development of fisheries resources in BOBP member-countries and beyond. The workshop was expected to endow participants with practical skills and knowledge on PA2FM methods. The workshop was attended by 18 representatives from member-countries of the BOBP, and seven resource persons from within and outside the region.

The BOBP is a multi-agency regional fisheries programme which covers seven countries around the Bay of Bengal - Bangladesh, India, Indonesia, Malaysia, Maldives, Sri Lanka, Thailand. The Programme plays a catalytic and consultative role in developing coastal fisheries management in the Bay of Bengal to improve the conditions of small-scale fisherfolk in member-countries.

The BOBP is sponsored by the governments of Denmark and Japan. The executing agency is the FAO.

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1. WORKSHOP SUMMARY

(Reproduced from Buy of Bengal News, March 1997)

Some 25 experts from member-countries and the FAO took part in a Regional Workshop on the Precautionary Approach to Fisheries Management in Medan, Indonesia, held 25-28 February 1997. Here's a report on what the workshop discussed and decided

Don't wait for evidence of overfishing to promote fisheries management. Initiate management measures right away, even in the absence of documented evidence! That in sum is what the precautionary approach to fisheries management is all about.

The Medan Workshop on the Precautionary Approach to Fisheries Management was inaugurated by the Governor of North Sumatra Province. Speakers at the inaugural session included the Governor; the FAO Representative in Indonesia; Ms Ennie Soetopo of the Director-General of Fisheries; and Dr Kee-Chai Chong, BOBP's Programme Coordinator. An illuminating keynote address by Dr Serge Garcia of FAO was the highlight of the inaugural session.

Sessions that followed featured country presentations on fisheries management by representatives of the member countries, plus lively presentations by resource persons. Participants discussed many aspects of artisanal, commercial and industrial fisheries in the context of the precautionary approach to fisheries management.

The discussion made it clear that management arrangements for many of the region's fisheries are inadequate. Further, several coastal fisheries had in the past operated under traditional management systems. These had suffered decline and were no longer visible, but new arrangements had not been put in place. New fisheries management regimes effectively using the precautionary approach need to be formulated.

The point was made that better fisheries management is not synonymous with precautionary fisheries management. Management can be improved without following the precautionary approach.

There was some discussion on the basic question: "*What qualifies a fisheries management strategy, as precautionary?*" Participants agreed that at least some of the following characteristics should be present in a precautionary strategy:

- limited fishing access and allocation of user rights;
- production targets set lower than the maximum sustainable yield;
- formal fisheries management plans that include pre-arranged management responses to the achievement of targets or the surpassing of catch limits in the fishery;
- carrying out pilot projects or step-wise development rather than rapid, massive expansion;
- institution of adequate fishery research and monitoring systems, and feedback of data from these systems into the management process;
- learning from development mistakes of the past; learning from other countries.

Three working groups were formed to discuss these issues and in particular:

- how best to promote the precautionary approach;
- operationalisation of fisheries management;
- implications of the precautionary approach for small-scale fisheries.

The consensus of opinion among the three groups is summed up under three heads in what follows

Promoting the precautionary approach

Q. *Who takes decisions on precautionary management ?*

A: Government, whether Central, Regional or Provincial, is the main decision-maker.

Q. *What triggers the decision-making process ?*

A: The process is generally triggered by a Parliamentary initiative which in turn may be promoted by parliamentarians, fisheries associations, NGOs, fishery consultative committees, or day-to-day interaction between administrators and the fisherfolk community.

Q. *How do you introduce PA2FM? How do you convince decision-makers about the need for it? How can fishermen also be convinced?*

A: Some suggestions:

- Improve the information available and submitted to policy-makers;
- Use all opportunities of contact with management authorities to promote PA2FM. Examples: fisheries or resource crisis, rehabilitation projects, development planning etc.
- Use the media to advertise and publicise issues and reach parliamentarians.
- Promote longer-term concerns among fishery sector operators. Example: introduce fishing rights and allocations. This promotes secure access to resources. Long-term licensing is an option for industrial fisheries. These rights could be recognised by purely legal means (e.g. statutory local reef ownership) or by a system of paying nominal user fees for the right to fish. This would instill among fishers some feeling for the value of their ownership rights and make them defend of stand up for such rights.
- Where resources are depleted and coastal conflicts occur, community projects could seek to introduce PA2FM by
 - (a) devices such as artificial reefs to keep large-scale fishing out;
 - (b) organising local enforcement;
 - (c) strengthening local community organizations;
 - (d) integrating community support toward clean water supplies, alternative job creation etc. Such projects could create a climate receptive to PA2FM. Introducing such an approach before resources are degraded would be precautionary. A cap on fishery capacity should also be established.

Q: *What kind of information is required to convince decision-makers?*

A: Research concerning promotion of PA2FM is insufficient at present. Such research should address not only biological topics but also economics and social sciences. It should not only assess fisheries resources, deal with risk assessment and look at management options, but should also produce relevant and timely forecasts. The information produced should be systematically supplied to decision-makers and industry.

Systematic development of management plans will help institutionalise the information process. Such management plans should preferably be organized by area or by species groups, particularly for multi-species fisheries.

In the case of shared and trans-boundary stocks, problems and solutions are similar. But the Government then has an even more important role than it has with natural resources.

Q: *What are the analytical tools needed to generate the needed information?*

A: The role of fisheries models including bio- and socio-economic parameters, dealing with micro- and macro-economics, is important. The results generated by these models should be conveyed in a simple and effective way to decision-makers.

Institutionalising Fisheries Management

Q: Could you cite some successful fisheries management initiatives in your countries?

A: Three major areas have been identified for these initiatives:

- Banning non-eco-friendly fishing gears and methods;
- Strengthening legal frameworks to support management needs;
- Sound communication systems between government and the fishing communities.

Q: Are there innovative easy-to-implement management methods?

A: Difficulties in the way of management were identified.

- Political decisions inconsistent with technical advice;
- conflicts between large-scale and small-scale sectors;
- a lack of awareness on the need for resource management;
- non-compliance by fishers with fisheries laws and regulations;
- inadequate enforcement of laws;
- conflicting development / management objectives within Government;
- inadequate Government structures for management;
- inadequate legal instruments or frameworks to allow management;
- lack of credible information from statistical services;
- inadequate international co-operation to deal with trans-boundary problems.

Q. *Who manages fisheries? Who identifies the need for management?*

A: Government fisheries departments.

Q. *Who develops fisheries management policy?*

A: Fisheries departments with occasional external inputs.

Q. *How is the policy converted into laws, rules and regulations and by whom?*

A: Policies are given to legal drafting systems (Attorney General's Dept.) who convert departmental requirements into legal language. Laws have to be passed by government. Ministers and departments implement the regulations passed.

Q. *How are fishers and other stakeholders made aware of the needs, benefits and methods of fisheries management?*

A: Fisheries Department extension services are usually responsible for this. The approach followed is still top-down. Public awareness campaigns are launched, using media considered appropriate. It includes printed literature, comics, posters, radio, TV, video etc.

Q. *How are stakeholders involved in the process of fisheries management?*

A: Most answers reflected the top-down nature of fisheries management in the region. Stakeholder involvement is in broad terms minimal. But there have been instances of particular groups playing a part.

Newer fisheries (less established) tend to have greater stakeholder involvement in their development and management.

Q. *Could you recommend changes in the process of institutionalising of fisheries management?*

A: The group suggested that action was needed in the following areas:

- * Public education and awareness - a multi-media campaign to alert the entire public (not just fisheries) to the value of marine resources and the way in which they are being misused or could be better used;
- * Cost/benefit analysis of what might happen if no action is taken, and the management system is allowed to drift;
- * The subject of traditional user rights generated heated discussion. Opinions varied. But the need was recognized to formalize traditional user rights, either by purely legal means (statutory local reef ownership) or by token or nominal payment for the right to fish.

Implications of PA2FM for Small-Scale Fisheries

A fishery can be broadly understood as small-scale if it has a reasonable number of the following characteristics:

- fishers have a good understanding of their ecosystem
- occupation is ecosystem-based

- simple technology
- low capital investment
- high skill intensity
- low occupational mobility
- multi-species/multi-gear fisheries
- highly seasonal occupation
- linked to agricultural and other coastal occupations
- dispersed habitats
- household level of activity
- owner/operators and labourers in others' boats
- near-shore fishing
- traditional fishers for several generations and recent arrivals

The technologies that small-scale fisheries have evolved over time would tend to be management-oriented because they are tuned to the local ecosystem; they are simple, with relatively low efficiency; they would be eco-friendly, because they have existed for generations without destroying the system. Thus small-scale fisheries are already in a way practising PA2FM, and should therefore be open to the idea.

Q: *Is there sufficient justification for promoting PA2FM among small-scale fisheries ?*

A: Small-scale fisheries are increasingly under stress and are displaying symptoms of stock stress, even depletion. There is reason from a resource management point of view to promote PA2FM.

More importantly, PA2FM is a subset of the Code of Conduct for Responsible Fisheries (CCRF) which all countries in the region have adopted. This code requires that we concern ourselves not only with the resources but also with people who work the resource. A section of the code obliges us to protect the artisanal sector.

Given the crowded nature of coastal areas and the intensity of small-scale fisheries in the region, the only real management option seems to be to reduce fishing effort. Whose effort needs to be reduced – small-scale, large-scale or both? Applying the principles of equity, fairness and right to livelihood, governments should require large-scale fisheries to move further off-shore – or even get out of fisheries and switch to non-fishery investment options.

But merely reducing the effort in the large-scale fisheries adjacent to the small-scale sector would not solve all problems. There would still be a need to promote PA2FM in the small-scale sector.

Given the scattered and dispersed nature of small-scale fisheries and the difficulties of enforcing management, the only feasible option would be to involve stakeholders in small-scale fisheries directly in decision making, monitoring, implementation and enforcement of management measures. This would require devolution of powers. But stakeholders, including government, should clearly decide what powers should be devolved and then spell out the rights and responsibilities of stakeholders.

Coastal areas are often treated like extended garbage bins, with everything finally finding its way to the coast. Given the dependence of fishers on the coastal ecosystem, they ought to have a say in coastal zone development and management.

Integrated coastal area management (ICAM) measures need to be introduced in a precautionary way. Small-scale fisheries too could use the precautionary approach to demand a key role in ICAM for fisheries and fishers.

Some Ideas on Follow-up Action Concerning PA2FM

The workshop identified follow-up actions concerning PA2FM for each country. They are as follows:

Bangladesh

- National-level studies and research, possibly with international donor support, to make management of certain fisheries more precautionary;
 - Awareness-building workshops with stakeholders, assisted by BOBP.
 - Greater effort to involve the private sector, especially the many high-calibre NGOs of Bangladesh, in fishery management efforts;
- Briefings for ministers and policy-makers on the need for fisheries management, and the benefits and means of the precautionary approach.

Indonesia

- Better coordination **among** the various Government departments involved in fisheries management, or whose activities have an impact on fisheries;
- More effort to manage fisheries on the basis of economic and social factors rather than simple production targets such as maximum sustainable yield.

India

- Communicate the idea of precaution in fishery management to State Governments and other Government departments;
- Further study the relationship between newly-mechanised and traditional fisheries in order to develop better means of conflict resolution through improved management;
- Introduce management arrangements in all fishery-related sectors, particularly inland fisheries, that are seriously impacted by irrigation, power generation and other schemes that divert water courses.

Thailand

- Make greater use of public hearings and other forms of consultation to develop and manage fisheries;
- Revise fishery regulations and laws with a view to incorporating more precautionary aspects;

- Reduce fishing effort in coastal areas by confining larger vessels to offshore zones, or through vessel buy-back schemes;
- Use inter-departmental committees to promote more responsible attitudes in other sectors that impact fisheries;
- Incorporate the precautionary approach into rehabilitation programmes for damaged fisheries.

Sri Lanka

- Take advantage of new enlightened attitudes and policies throughout Government to introduce the precautionary approach into general thinking;

Make better use of new environmental laws to mitigate damage to habitats by development projects in the coastal zone;
- Introduce precautionary ideas among youth associations in order to raise awareness of responsible fisheries use among them, and influence the thinking of older generations.

Maldives

- Incorporate precautionary concepts into manpower training activities;

Conduct surveys and pilot projects in support of fisheries development;

Promote inter-sectoral cooperation;

Improve data collection systems. Strictly enforce provisions by which fishing vessels provide catch data.
- Promote the concept of a broad stock assessment programme to look at the resources of the Indian Ocean, with emphasis on shared resources.

Malaysia

- Conduct seminars to explain the precautionary approach to fisheries extension staff and State Governments. BOBP assistance is required.
- Develop marine education kits for school children;

Discuss the idea of strengthening regional cooperation in this area by incorporating a strong precautionary thrust into a possible next phase of the Bay of Bengal Programme.

- S. R. Madhu.

2. WORKSHOP PROSPECTUS

Workshop Rationale

Unmanaged fisheries exploitation cannot continue unchecked if fisheries are to be protected for future generations of fisherfolk. Of the 200 fisheries monitored by the FAO's Department of Fisheries, a third has been overfished or depleted. The overfishing problem was first highlighted in developed countries: It spread during the 1960s - 1980s to many of the world's oceans. The problem also plagues the seas of developing countries where no entry restrictions are in force, where development objectives are not explicitly related to resource potential and sustainability, and where deficiencies in production statistics make accurate monitoring of stocks difficult.

In most countries, no serious attempt has been made to contain fishing effort and fish processing capacity. In addition, demand for fish continues to rise because of population increases and improved standards of living. By the year 2010, there will be a demand-supply shortfall of at least 30 million tons. The promise of aquaculture in supplementing this supply is uncertain. Environmental problems, technology and limits of carrying capacity require that aquaculture be managed sustainably. The gap between supply and demand will continue to drive prices up and aggravate the pressures on resources. In all recent international fora on fisheries, countries have agreed that overfishing should be avoided and corrected when it occurs. But they recognize that there are definite constraints to improving fisheries management under the present fisheries exploitation and management regimes.

Countries have also recognized that fisheries management cannot take place in a vacuum. It has to have the active support and commitment of the people, especially the fishing communities and other stakeholders – those who need fisheries for their survival as well as those who have capital and wield political clout.

The Precautionary Approach to Fisheries Management (PA2FM) requires that fisheries should and must be managed, no matter how much information is available. It seeks to compensate for lack of information by associating people more forcefully in the decision-making process. It also recognises that the status quo is not an acceptable option. It is indeed the status quo that has resulted in the present overfishing. Nor should one wait for evidence of overfishing to initiate management. To put it in another way, the status quo calls for management only in the event of demonstrated overfishing; PA2FM urges fisheries management right now, even in the absence of documented evidence of overfishing.

Governments in the Bay of Bengal region are addressing the problem of overfishing, if not as satisfactorily, at least for inshore fisheries. The "precautionary approach" may apply primarily to offshore resources - where several fishery administrations believe that significant under-exploited resource potential exists, and consequently promote new investment.

It may be even more important to apply the precautionary approach to protection of the fishery habitat and access to responsible fisheries technologies.

People's Participation Needed

Poverty and deprivation among small-scale fishing communities in the coastal zone are as bad as ever. In fact, their circumstances are worsening in spite of four decades of development intervention. People's

participation in decision-making and implementation is recommended for improved management for at least two reasons: 1) Management will be implemented better and have a better chance of success, with "people's participation". 2) The Workshop is about the "precautionary approach": It is likely that people concerned with fisheries will think "precautionally" – they would want to conserve resources and opportunities for their children and grandchildren.

It is hoped that the Workshop helps to improve the capacity of participants to address ways and means to meet basic necessities of the fishing community for a decent standard of living, while considering explicitly the realism of the assumptions made above. The maintenance of a civil society, community stability, and law and order depends on a just or equitable distribution of benefits of development from a growing economy, within the present generation (intra-generational equity) and between generations (inter-generational equity). The Workshop should help clarify these concepts and, hopefully, translate them into operational guidelines. It is significant that small-scale fishermen, interviewed over time, seem averse to their children following in their footsteps; they are trying their best to educate their children to enable them to leave the fisheries.

Purpose

The purpose of the Workshop is to clarify and discuss the implications of the PA2FM and show how such an approach to management, and to sustainable development of the fisheries resources in BOBP member countries and beyond, will work. It is expected that the familiarization made possible during the Workshop will endow the participants with practical skills and knowledge on the methods of PA2FM.

Orientation and Procedures

Country papers will highlight and review each country's experiences, and lessons learned from their past, and ongoing programmes in fisheries management. The papers will in particular identify the sources of uncertainty about the fisheries and their potential impact. They will match the characteristics of the present management systems about the fisheries with the guidelines on PA2FM prepared by FAO, the Government of Sweden and other international bodies. Their presentations will also deal with the levels of awareness of their fishing communities about fisheries management, including their trust or confidence in governments' management effort.

Before arriving for the Workshop, participants would have already worked through the series of questions 'sent out to them by the Workshop organisers.

On the basis of equal time for presentation and discussions, the Workshop will introduce, clarify and deliberate on the Precautionary Approach to Fisheries Management during the first two days. Emphasis will be given to drawing out the short-and long-term implications of the PA2FM and the ensuing dilemma between current and deferred/delayed production and consumption. Can the interests of the present and future generations be balanced and harmonized? The use of discount rates in resource development investments that harm or promote sustainability will also be highlighted.

The third day is open for Workshop participants to discuss the practical implications of PA2FM in the context of each individual country's fisheries situation. How can the PA 2FM be adapted to each country? Various scenarios will be presented of the likely fisherfolk population, ranging from growth to decline.

On the fourth day, participants will be given opportunities to present their views on their government's interests and commitment to implement PAZFM in their respective country and how it can be applied to ongoing projects. Participants are requested to bring case studies to the Workshop.

Participants will analyse the operational implications of PAZFM, and difficulties in implementing it, and how the fisherfolk community will respond to the more rigorous participatory management initiatives they will introduce. Other participants will be requested to react, and suggest creative ways to resolve these difficulties. They will similarly help to identify the roles of governments and fishing communities in managing their resources.

Participants

National staff responsible for fisheries management and enforcement of fisheries at the national and local grassroot levels, Interested NGOs can also send their staff to the Workshop at their own cost. The number of participants is limited to 30.

outputs

1. Country programmes on PA2FM and creative strategies to promote the PA2FM idea with respective governments.
2. Acquired skills and knowledge on
 - strategy to implement PA2FM
 - promoting stakeholder and community involvement in FM
 - factors that can influence the successful implementation of PA2FM.
3. Meeting the participating governments' major national and regional needs for a workable fisheries management scheme, regime or mechanism.
4. Developed sense of entitlement and ownership on the part of fishers of the waters and aquatic resources they have exploited for generations and relied on for livelihood security.

Duration : 25-28 February 1997

Proposed Venue : Medan, North Sumatra, Indonesia

Possible Resource Persons

1. Dr Serge Garcia, Director, Fishery Resources Division, FAO, Rome, Italy.
2. Dr Robert Gillett. USA.
3. Dr Chris Francis, National Institute of Water and Atmospheric Research, New Zealand
4. Dr John Kurien, Associate Professor, Centre for Development Studies, Trivandrum, India
5. Dr Kee-Chai CHONG, Programme Coordinator, BOBP, FAO, India

Proposed Workshop Content

Session I: Recent Perspectives and Trends in Fisheries Management (after 1990) in BOBP Member Countries

This session will present recent perspectives and trends in fisheries management in BOBP member and non-member countries. It will also review emerging trends and new developments in the respective national fisheries management plans and regimes. The session will cover

- Identification of Problems
- Conflicts in Fishing
- Conventional Fisheries Management Systems
- Successes (Benefits) and Weaknesses/Failures (Costs) of Fisheries Management
- Recent Perspectives, Emerging Trends and New Developments in Fisheries Management
- Management Criteria and Targets under Conventional Fisheries Management System

Session II: Promoting Responsible Fisheries

This session will introduce the need for fisheries management, and benefits and approaches that would flow from a more responsible approach to fisheries management. In particular, reference will be made to the Code of Conduct for Responsible Fisheries. Topics to be covered are:

- Role and Presentation of Scientific Advice on the Precautionary Approach to Fisheries Management
- Practical Implications for a Precautionary Approach to Fisheries Management
- Assistance to BOBP Member and Non-Member Countries in Applying the Code of Conduct on Responsible Fisheries and Technical Guidelines on the Precautionary Approach to Fisheries Management
- Fisheries in Integrated Coastal Area Management

Session III: Data Requirements to Implement the Precautionary Approach to Fisheries Management

This session will present the data needed to implement the Precautionary Approach to Fisheries Management. It will consider the practical problems and implications of decision-making in a data-poor setting. This session will highlight:

- Management Guidelines and Reference Points
- Sources of Risk and Uncertainty
- Time Horizon for Precaution.

Session IV: Guidelines for the Practical Implementation of the Precautionary Approach to Fisheries Management.

This session will elaborate on the following topics:

- Identification of new issues in fisheries management, local, national and regional
- Concept of Precautionary Approach
- Requirements for Precaution
- Economic Implications of Precaution
- Operationalizing the Precautionary Approach to Fisheries Management (Practical Implications)
- Intra- and Inter-Generational Equity.
- Management Criteria and Targets under PA2FM
- Management Reference Points
- Control Rules and Conservation Safeguards
- Strategies for Precautionary Approach to Fisheries Management
- Access to Responsible Fisheries Technologies
- Control on the Development and Proliferation of Irresponsible Fisheries Technology
- Management Mechanisms and Practices – Management Councils/Panels/Bodies

3. AGENDA

Day One: 25 February 1997 (Tuesday)

08.00 - 09.00	Registration
09.00 - 10.00	Opening Ceremony
09.00	Welcome Address by Dr Kee-Chai Chong, Programme Coordinator, BOBP/FAO
09.15	Objectives of the Regional Workshop by Ms Ennie Soetopo, Chief, Sub-Directorate of Programme & Project Aid, Directorate-General of Fisheries, Indonesia
09.25	Address by FAO Representative in Indonesia - Dato'Wahid Abdul Jalil
09.40	Inaugural Address by Bapak Raja Inal Siregar, Governor of North Sumatra
10.30 - 12.00	"Uncertainty and Risk in Fisheries and their Management : A New Challenge" - Keynote Address by Dr Serge Garcia, Director, Fishery Resources Division, FAO Rome

Session I

Presentation of Country Papers

13.00 - 13.30	Bangladesh
13.30 - 14.00	India
14.00 - 14.30	Indonesia
14.30 - 15.00	Malaysia
15.30 - 16.00	Maldives
16.00 - 16.30	Sri Lanka
16.30 - 17.00	Thai land
17.00 - 18.00	Discussion
20.00 - 23.00	Dinner Reception and Cultural Show hosted by Governor of North Sumatra

Day Two: 26 February 1997 (Wednesday)

Session II

Recent Perspectives and Trends in Fisheries Management in Asia

(Chair: Mr John Fitzpatrick)

08.30 - 09.00	Overview of Fisheries Management in Indonesia, Past Present and Future Mr Sukotjo Adisukresno, Director, Directorate of Resources Management, DGF, Indonesia
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- 09.00 - 09.30 Government Decision-Making under Uncertainty: A Case for Fisheries Management – Dr Yohanes Widodo, Scientist, Central Research Institute for Fisheries, AARD, Indonesia
- 09.30 - 10.00 Overview of Fisheries Management in Asia : Past, Present and Future – Dr Nik Mustapha Raja Abdullah, Associate Professor/Head, Department of Natural Resource Economics, Universiti Pertanian Malaysia
- 10.30 - 11.00 U.S. Experience in Implementing Precautionary Approach to Fisheries Management – Dr Stanly Wang, National Marine Fisheries Service, USA.

Session III**Promoting Precaution and Responsibility in Fisheries***(Chair.. Dr Serge Garcia)*

- 11.00 - 12.00 Overview and Practical Implications of Precautionary Approach to Fisheries Management and Code of Conduct for Responsible Fisheries to Small-Scale Fisheries – Dr Gary Preston, Gillett and Preston Associates, Noumea, New Caledonia
- 13.00 - 14.00 Operationalisation and Implementation of Code of Conduct for Responsible Fisheries – Dr John Kurien, Associate Professor, Centre for Development Studies, Trivandrum, India
- 14.00 - 15.00 Plenary Discussions and Clarifications
- 15.30 - 17.30 Group Discussion (Worksheets/guidelines to be provided)
- 20.00 - 23.00 Dinner reception hosted by BOBP-FAO/UN

Day Three: 27 February 1997 (Thursday)**Session IV****Data and information Requirements to Implement the Precautionary Approach to Fisheries Management and Code of Conduct for Responsible Fisheries** *(Chair: Dr John Kurien)*

- 08.00 - 08.45 Management Guidelines and Reference Points in Fisheries Management – Dr Kee-Chai Chong, Programme Coordinator, BOBP
- 08.45 - 09.20 Role and Presentation of Scientific Advice on Operationalization and Implementation of the Code of Conduct for Responsible Fisheries: Mr John Fitzpatrick, FAO, Rome, Italy
- 09.30 - 10.15 Supporting Fisheries Management in Asia : Information and Research Network – Ms Yong-Ja Cho, Information Consultant, Bangkok, Thailand.
- 10.45 - 11.30 Identification of Unresolved and New Issues in Fisheries Management Dr John Kurien, CDS, India and Dr Kee-Chai Chong, BOBP, India.
- 11.30 - 12.30 Plenary Discussions and Clarifications

4. LIST OF PARTICIPANTS

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5. KEYNOTE ADDRESS

THE PRECAUTIONARY PRINCIPLE : ITS IMPLICATIONS IN CAPTURE FISHERIES MANAGEMENT*

by **S.M.Garcia**

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Dr Serge Garcia 's keynote address was delivered extempore, and illustrated with a number of overhead slides he had prepared for the workshop. Since no record of his extempore address is available, we are reproducing a paper on "The precautionary principle" prepared by Dr Garcia for the journal "Ocean and coastal management", with the kind permission of both Dr Garcia and the publishers of the magazine. We are also reproducing a few of the overhead slides Dr Garcia used at the workshop.

Conservation and management both stem from value judgements made by society, not science.

R.L. Edwards (1988)**

Abstract

This paper attempts to clarify the research, management and legal implications of a potential application of the precautionary principle to capture fisheries, particularly in the international context. In the process, the paper also looks at related issues such as the burden of proof, the use of best available scientific evidence and technology, the reliance on prior scientific consensus, assimilative capacity and acceptable levels of impacts. etc., in the fishery context. It is argued that, if narrowly interpreted, the precautionary principle could lead to socio-economic havoc. If reasonably interpreted, however, the Principle offers a golden opportunity to progress towards sustainable fisheries development. Suggestions are made for the implementation of precautionary approaches in fisheries management.

1. Introduction

Fisheries management practice has evolved slowly during the last half century, constantly lagging behind theory. Progress achieved since the first FAO Technical Committee on Fisheries in 1945 has been insufficient largely due to competition and expansion in an open access context as well as inadequate research and institutions. While traditional management practice has still to improve, new aspects related to environmental conservation are emerging which many require an acceleration of the process of evolution of fisheries management and a broadening of its scope to take non-fishery user concerns into account.

Part XII of UNCLOS, "Protection and preservation of the marine environment", does not contain detailed instruments for implementation of the conservation of the marine ecosystem, but it stresses that States have the duty to protect and preserve the environment from pollution, Burke stresses however that if

* Based on a paper published in "Ocean and Coastal Management" No. 22 (1994).

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ecosystem conservation requires measures for the fisheries sector under Article 192. States will have to apply such measures as provided by the fisheries provisions of UNCLOS and to strike a balance between the environmental and fisheries provisions to ensure sustainable exploitation.

Environmental concern has increased drastically in fisheries with the World Conference on Human Environment, Stockholm, 1972, the work of the 'Brundtland' Commission from 1984 to 1987³ and the preparation for the UN Conference on Environment and Development, Rio de Janeiro, 1992. This concern which was already apparent in the FAO Technical Conference of Fishery Development and Management, Vancouver, 1973, and the FAO World Conference of Fisheries Management and Development Rome, 1984, was exacerbated by the international conflict on large-scale pelagic driftnet fishing in the high seas at the end of the 1980s and the related Resolution 44/225 of the UN General Assembly in December 1989.

There is a worldwide trend towards preventive approaches to management of renewable resources (of IUCN⁴) and such approaches have been advocated in the past for fishery management, but rarely implemented. As the global concern for the environment is gaining momentum in fisheries, one can expect that the principles adopted at the international level for environmental protection, such as the Precautionary Principle, may be progressively forced on fisheries systems. The wide adoption of the Principle could change drastically the state of affairs in marine living resources conservation and could offer an opportunity to improve fisheries management and ensure sustainable fisheries development. Its careless generalization to fisheries could, however, lead to economic and social chaos in the fishing industry.

The purpose of this paper is, therefore, to review the available information on the Precautionary Principle, to clarify the implication of its potential application to fisheries and its relationships with conventional management approaches. The paper addresses this issue mainly in the context of international fora but many of the implications are also relevant at national level. The following section will : (1) describe the Precautionary Principle : (2) analyse its scientific, technical and legal implications for fisheries : and (3) propose elements for precautionary fisheries management strategies.

2. The Precautionary Principle

The Precautionary Principle seems to have existed for a long time in national laws related to human health and for instance, in the regulations of pharmaceutical industries. It seems to have been then progressively invoked in relation to pollution and its impact on human health and later its impact on the environment. As environmental concern and conscience grew, preoccupation for human safety has been progressively extended to the human environment and to other animal species and from a national to an international context. This has led to a growing reference to the Principle, often without much analysis of the practical implications.

In the international environmental softlaw, the Precautionary Principle emerged as a recognition of the uncertainty involved in impact assessments and management and in particular, in the determination of the future consequences (and associated costs) of present decisions. It is related to the central issues of inter-generational equity—our responsibility towards future generations and long-term discount rates and is particularly relevant when uncertainty is high and potential consequences of decisions could affect the survival of humanity.⁶ By comparison, traditional fisheries management deals with intragenerational equity — and allocation of resources between the present users. The Principle was

apparently referred to in relation to pollution prevention in the early 1980s in Germany, ("Vorsorgeprinzip", and applied to issues related to the ozone layer, the greenhouse effect and the conservation of nature. It has touched indirectly on fisheries through the International Conventions on Dumping at Sea (Paris and Oslo Convention, Marpotl) in relation to pollution by fishing vessels.

It has been recently addressed for fisheries in relation to the actual or suspected impacts of the activity, on coastal habitats and ecosystems. endangered species, genetics and biodiversity. In most cases this was done only implicitly. Of particular relevance is the implicit emergence of this Principle in the discussions of the Preparatory Commissions of the UN Conference on Environment and Development on Oceans and particularly in the three Action Programmes on costal areas high seas and marine living resources. The International Conference for the Protection of the North Sea (London, November 1987: The Hague, March 1990) used it explicitly in decisions regarding coastal States, jurisdiction, habitats, species and fisheries including pollution from ships.

In order to understand better its potential implications for fisheries, the terms of its declaration could be adapted to fisheries -for illustration, replacing the word 'substances' by 'fishing practices' and deleting specific reference to the North Sea. (Such 'transposition' from environmental to fisheries softlaw which may be considered abusive to some readers is unfortunately what is presently happening). This Precautionary Principle would read as follows :

Accepting that in order to protect a marine area from possibly damaging effects of the most dangerous fishing practices and gears a precautionary approach is necessary which may require

Fisheries Today : Positive aspects

- 100 million tons of food produced
- 200 million tons of people's livelihood
- EEZs established
- Threats to sustainability identified
- International instruments agreed
- National policies improving
- Species diversity still largely maintained
- People being more aware and involved
- Concern for small-scale fisheries expressed

action to control fishing activities even before a causal link has been established by absolutely clear scientific evidence

States accept the principle of safeguarding the marine ecosystem by reducing dangerous fishing practices, by the use of the best technology available and other appropriate measures. This applies especially when there is reason to assume that certain damage or harmful effects on the living resources are likely to be caused by the such fishing practices and technologies, even where there is no scientific evidence to prove a causal link between practices and effects (the principle of precautionary action).

The UN Resolution 44/225 on large-scale pelagic driftnet fishing in the high seas (December 1989) gives an example of expression of the Precautionary Principle for international fisheries. Although not as stringent as the original proposals put forward by the countries promoting it, the Resolution is a good example of the type of approach which might be internationally agreed to in the future. It is also likely that the strategy and principles behind this resolution will be used again in the future, both in the high seas and inside EEZs. After having expressed concern about the importance of the fleets, the length of the nets, their mode of operation, their potential impact on anadromous and highly migratory species, their by-catch, and the concern of coastal countries on the state of resources close to their EEZs, the Resolution recommends that :

- (a) A moratorium should be imposed on all . . fishing... by 30 June 1992; (b) immediate action should be taken to reduce progressively... fishing activities in the South Pacific region with a view to the cessation of such activities by July 1991 and (c) further expansion..in the North Pacific and all other high seas areas...should cease immediately.

. . .Such a measure will not be imposed in a region or, if implemented, can be lifted, should effective conservation and management measures be taken, based upon statistically sound analysis to be made jointly by the parties concerned...

The Resolution recommended immediate action on the basis of 'concern', in the absence of convincing evidence or scientific consensus and assuming therefore that driftnets have undesirable impacts unless shown otherwise.

A major property of the Principle is that it inverts the course of action, requiring that measures are taken first and, subsequently, relaxed if research demonstrates convincingly that they are not necessary. It affects the relationship between science and policy and between management and development by :

- (a) focusing the spotlight on scientific uncertainty and related risk in decision-making;
- (b) reverting the burden of proof on industry; and
- (c) giving priority to preventive management on crisis solving.

The Principle is a reaction to a situation that environmentalists regard as unbalanced and loaded in favour of short-term gain. If narrowly interpreted, without reference to social and economic considerations, it could reverse the situation in favour of the environment and of non-consumptive users, giving them the benefit of the doubt and safeguarding all their interests even in the worst case assumption. The latter would imply that all risks are to be taken by economic activities.

The problem is not new to fisheries. James* wrote that the managers' dilemma was that 'by always leaning backwards in regulation, *giving to the resources the benefit of the doubt* (emphasis added), he

might come up with reasonable assurance of protecting the resource, except that the economic survival of thousands of individuals, hundreds of communities and dozens of countries may be affected by the administrative action taken'.

In the following sections, distinction should be made between the Precautionary Principle and precautionary approaches or measures. The 'Principle' will refer to the 'hard line' rule proposed for management of highly polluting activities. The 'approaches' will refer to practical ways and sets of measures which are precautionary in nature but may lead to more realistic application in fisheries.

3. Implications of the Precautionary Principle

3.1 Implications for Research

3.1.1. Best scientific evidence

The Kristiana Conference in 1901, just before the creation of the International Council for the Exploration of the Sea, endorsed the principle of scientific enquiry as basis for rational exploitation of the sea. The same principle was also agreed on at the International Conference on the Conservation of the Living Resources of the Sea, hosted by FAO in Rome in 1955. It was finally integrated with the United Nations Convention for the Law of the Sea, adopted in 1982. Prior scientific consensus (on cause-effect relationships and potential consequences of action) has been the basis for action in international fisheries management and will remain one of the most neutral and peaceful ways to reduce costs of interaction between nations and user-groups.

Fisheries Today : Negative aspects

- 60-70% of stocks require urgent intervention
- 30-40% overcapacity & \$50 billion of losses
- Collapses of stocks & 20 million tons of discards
- Risk of technology dumping and more overfishing
- Potential threat to biodiversity
- Coastal environments degrading land based industries
- Social unrest & civil disobedience increasing
- Industrial threat to traditional fisheries

In modern fishery management systems, scientists are asked to :

- (1) determine the theoretical potential production of a stock (usually equated to MSY);
- (2) calculate the corresponding level of fishing effort, as a benchmark level not to be surpassed;
- (3) determine the appropriate size at first capture before which fish should not be caught in significant numbers;
- (4) recommend ways in which the above can be achieved (mesh sizes, closed areas, closed seasons) and the bio-economic and technical trade-offs involved;
- (5) assess the effects of fishing and forecast impacts of management options.

Despite its level of development, particularly in the northern hemisphere, fishery science has played only a limited and advisory role in the complex decision-making process of fisheries development.' The limitations of the data, models and paradigm are being progressively recognized¹⁰ together with the uncertainty unavoidably attached to any scientific assessment. Raising the research standard further to model ecosystem behaviour under combined environmental and fishing stress and considering socio-economic effects implies data, understanding and financial and human resources which, in many instances, would be unrealistic. However, research can contribute substantially to the reduction of management uncertainty by :

- Improving the statistical power of the methods used for assessing biological and economic parameters, testing their sensitivity to data errors and systematically producing estimates of bias and precision in the derived parameters."
- Expanding the range of available models towards multispecies and ecosystem models, taking environmental variability into account.
- Testing the sensitivity of models used for fisheries and ecosystem management to uncertainties in their parameters and in their functional structure. In particular, testing routinely the impact of such uncertainties on the performance of management.
- Analysing a range of possible options with a range of models showing the likely direction and, if possible, the magnitude of the biological and socio-economic consequences of these options as well as the level and direction of the uncertainty (risk assessment).
- Experimenting with management systems as advocated by Walters and Hilborn⁵ many years ago."
- Improving fishing gear and practices. Work must be done not only on better ways to use gears but on the development of better gear (square mesh trawls, turtle and by-catch excluder devices, biodegradable nets and pots, etc...) with better selectivity and less environmental impact.

UNCLOS requires 'the best scientific evidence' when designing and adopting management and conservation measures. It provides that in EEZs it shall be taken into *account* (emphasis added) by the coastal State (article 62) and in the high seas, *measures are designed on it* (emphasis added) (Article 119). Although the obligation seems to be less stringent for the coastal States in its area of exclusive jurisdiction than for States co-operating in the high seas, the requirement for scientific evidence is clear. The discussion by Burke² of the UNGA 441225 in this respect highlights some of the problems. UNCLOS is satisfied with the 'best available evidence'. It does not define the quality of the evidence required in any quantitative manner and 'does not necessarily place a great or imposing burden that must be discharged

before the necessary conservation measures can be taken... The 'best available' standard even permits the use of poor evidence to justify conservation measures, if that evidence is the best available?² UNCLOS, however, also does not indicate what should be done if there is no scientific information available. One would assume that the spirit of the text is that such scientific information should be urgently collected but this does not preclude measures being taken in the meantime. UNCLOS does not provide criteria on how to decide what is the best scientific information if conflicting scientific results are available, nor does it give guidance on how to operate in the absence of the scientific consensus which UNCLOS implicitly assumes. In such case, the Precautionary Principle would ensure that action is not deferred sine die. (In the driftnet issue such a procedure was set up through international scientific monitoring but the consensus on the implication of the results of the programme was never reached.)

The UNGA Resolution 44/225 on large scale pelagic driftnet fishing recognizes in its preamble 'that any regulatory measures...should *take account* of(emphasis added) the best scientific evidence available and analysis', using for a high seas problem, the weaker wording that UNCLOS provided for EEZ resource management. The purpose of this might have been to avoid the constraint that measures would have to be based on(emphasis added) the evidence available.

The introduction of the Precautionary Principle in fisheries could appear, therefore, an attempt to 'fill the gaps' in UNCLOS, preventing the absence of scientific data or consensus opening a loophole leading to 'laissez-faire' management and development strategies. UNCLOS does not foresee, however, that an existing fishery could be closed if data are not available. The Precautionary Principle has been criticized by the GESAMP Steering Group on Scientifically Based Strategies for Marine Environmental Protection and Management⁴ as 'the acceptance of suspicion rather than scientific evidence as sufficient to introduce controls'. Contrary to the usual rule for crime regulations, potential culprits are considered guilty pending proof to the contra?. It should be hardly debatable that, in fisheries, when scientific data are available together with a monitoring and management system, the basic requirement of UNCLOS should prevail, e.g. that decisions be taken on the basis of the best scientific evidence available.

3.1.2 *Burden of proof*

The burden of proof is traditionally on research and management, with the rare exceptions where scientific work has been used to limit the development programmes on new fisheries. They have to demonstrate that harm is being done to the stock before measures can be imposed on industry. History has shown that, because of the continuous bargaining between management and industry (and related socio-economic pressures) the 'proofs' may be arguable and their impact on decisions often far from satisfactory. The adoption of the Precautionary Principle would imply a fundamental reversal of the burden of proof, placing on those actors (group of fishermen countries) who claim that no action is required the onus of proving that what they intend to do will not lead to 'unacceptable' effects on the resources.

As an example, in relation to the conditional reopening of the large scale pelagic driftnet fishery, it was proposed to the UN General Assembly in 1990" that :

Unless joint assessments by all concerned..of sound scientific data from a specific large-scale driftnet fishery conclude that there are no unacceptable impacts by that fishery, the conditions for relief of the moratoria... are not met (the subjective words have been underlined by the present author).

This proposal puts on the fishing nations the burden to prove that, if allowed, driftnets would not have an unacceptable impact, leaving implicitly to the other nations the right to accept or not accept the

proof. This is in line with the Precautionary Principle which requires States to take preventive or corrective action even in the absence of sufficient scientific evidence of a causal link between a suspected factor and the adverse effects observed (or even before any effect is observed at all).

This was confirmed by UNGA Resolution 46/15 of December 1991 on large-scale pelagic driftnet fishing which called for action against this type of fishery on the basis that: 'the international community (which) have reviewed the best available data...have failed to conclude that this practice had no adverse impact...and that...evidence has not demonstrated that the impact can be fully prevented'.

Another example can be found in the EEC Council Regulation 3451/92 of 27/11/1992 which regulates the use and the length of driftnets (limited to 2.5 km) in EEC waters. Article 9a grants a derogation until 31/12/1993 to some vessels allowing them. It states, however, that: 'the derogation shall expire on the above date, unless the Council, acting by a qualified majority on a proposal by the Commission, decides to extend it in light of the scientific evidence showing the absence of ecological risk linked thereto. This indicates clearly that, unless provided otherwise, driftnets of more than 2.5 km are considered harmful.

Finally, the form in which the ICES Advisory Committee on Fisheries Management (ACFM) delivers its advice gives another example of precautionary approaches: 'for 'stocks where, at present, it is not possible to carry out any analytical assessment with an acceptable reliability, ACFM shall indicate precautionary TACs to reduce the danger of excessive efforts being exerted on these stocks'.

3.1.3. *The role of statistics*

The UNGA resolution 44/225 requires 'sound statistical analysis' and this new terminology could be considered as an attempt to clarify the concept of best, equating it with 'statistically sound'. Relations between statistics and the Precautionary Principle have been discussed by Gray¹² who welcomed the adoption of the Precautionary Principle for environmental law but worried about the fact that it implies that it is no longer necessary to have scientific facts to back up environmental legislation as one can simply "have reasons to assume" that an effect can take place to justify a management decision. He warns about the risk for scientific objectivity if proper statistical procedures are not the basis for assessments. He concluded that the Precautionary Principle should not be part of science since, by definition, it does not rely on scientific evidence.

The advantage of referring to statistics is that it offers a way of using well-established mathematical techniques and tests to decide what information is 'best' on statistical grounds. Bringing statistics into the picture would force scientists and decision-making systems to recognize and measure explicitly the levels of uncertainty and the risks attached to the decisions.

There are, however, also problems with statistics. They are of many types (parametric, non-parametric, geostatistics). Statistics for spatial analysis are still to be improved. Biological distributions tend to be continuous (rarely random) and stratification is usually not fully satisfactory. Under these conditions, the use of many statistical tests is questionable. Separating the 'signal' from the 'blank noise' in a data set and distinguishing fishing effects from environmental ones is, in many instances, a nightmare. Obtaining a consensus on statistical analysis might therefore not always be easier than on scientific evidence. If such agreement on sound statistical analysis has to be obtained by consensus, a single country could easily block the process. The lack of international agreement on the results of the joint driftnet fishery research programme illustrates this difficulty.

The Challenge of Responsible Fisheries
Changes in Objectives

FROM:

- Sustain stocks
- Max. annual catches
- Max. employment
- Full resources use
- Short-term interests
- Local concerns

TO:

- sustain ecosystems
- Max. long-term welfare
- Sustainable employment
- Efficient use (no waste)
- Short/long-term interests
- Local & global concerns

Achieved by Changes in Policy

FROM:

- Open access
- Free access
- Sectoral policy
- Command and Control
- Top-down approach
- Risk-prone approach

TO:

- Right-based systems
- User fees
- ICAM, ICFM
- + Macro-instruments
- Participative approach
- Precautionary approach

3.2. Implications of management

Human beings are not 'prudent predators' because their intervention is disjointed, and the feedback controls that they respond to are in good part independent of the natural resource ecosystem.⁹ Their activities, not sufficiently controlled by natural signals of resources stress, can continue despite environmental degradation with potentially irreversible effects. One should recognize, however, that fishermen whose livelihood depends on living resources are more sensitive to natural feedback control than most land-based activities. Notwithstanding, the hard facts demonstrate without any doubt that such feedback has been in many instances insufficient to avoid excessive stress on fisheries stocks, with severe ecological and economic consequences. Improvements are therefore necessary and the following sections will look at ways in which the Precautionary Principle could help.

Hey¹⁷ states that a precautionary approach to environmental protection should be based on clean production methods and best available technology, comprehensive methods of environmental and economic assessment, scientific and economic research towards better understanding and analysis of options, appropriate legal, administrative and technical procedures. If taken out of their precautionary context, as described above, the elements of the approach look very traditional, at least to fisheries management specialists.

3.2.1. Management under uncertainty

It is obvious that fisheries management could certainly be improved. Many important stocks are too close or even below their MSY level, leading to instability. Many have ecologically or economically collapsed. The situation raises particular concern in the high seas⁸ but is far from satisfactory, in all EEZs¹⁰. Management failure results essentially from the common property nature of fisheries and the lack of effective will to control fishing effort levels directly in the absence of an explicit allocation of resources. In a fishery system with an efficient resources allocation scheme, both research and management would have performed better. Allocation can, however, be achieved only through lengthy and politically difficult processes of evolution of property and user rights, and the resulting deficiencies and uncertainty must be faced.

Perings⁶ notes that 'there is no consensus on what the principle means for decision-making under uncertainty'. In general, the Precautionary Principle is invoked when a negative impact on man -and, by extension, on the ecosystem — is suspected and when the options or even the survival of future human generations are at stake. It should be obvious that fisheries do not threaten the future of humanity even though their mismanagement may severely affect the livelihood of coastal communities. There can be no doubt, however, that fisheries have an impact on the ecosystem and its species, if only by reducing target species abundance, age structure and reproductive potential. Some involuntary impacts on associated species will also occur. Impacts on habitats, although limited, cannot be excluded for some mobile gears (beach seines, trawls, etc.). A major difference, however, between fisheries and pollution (for which the Principle was created) is that the survival of capture fisheries and aquaculture is directly dependent on the state of the environment (including the biodiversity) they exploit. This is not the case for, say, chemical industries dumping sewage into the coastal areas.

The aquatic resources properties, their 'fluid' nature, the quality of the fishery data and limits of scientific understanding lead to the existence of a certain level of uncertainty on the understanding of the ecosystem and on the scientific advice. This, in turn, implies some level of risk of error in management decisions

aiming at maintaining the resources and the environment. The risk cannot be totally eliminated. One can easily assume that in a complex multi-resources and multi-user system the overall level of uncertainty in the parameters and the system itself is so high that a zero-risk strategy would imply no development at all. A strategy hardly viable.

If sustainable use is the objective, in order to produce a continuous flow of goods and services from the living aquatic resources the Precautionary Principle can only aim at reducing detrimental impacts below some acceptable threshold and not at eliminating them altogether. It follows that the judgement will have to be based on scientific evidence and advice on what levels of impacts are acceptable, taking into consideration the short-and long-term impacts and their socio-economic as well as ecological implications.

3.22. *Assimilative capacity and acceptable levels of impact*

The concept of assimilative capacity of the environment has generated heated debate. This concept implies that nature can absorb a certain quantity of pollution without significant effect. For some industries it is important to estimate the assimilative capacity of the ocean and use it as a resource (i.e. for dumping wastes). According to Hey," the concept also implies that science can determine the assimilative capacity and that management will be efficient enough to prevent negative effects and abuse. She says that this concept depends too much on short-term economic considerations and is not precautionary. One can easily see the concern when the assimilative capacity is defined in terms of radioactive wastes, heavy metals and other non-reversible impacts.

Originality of PA2FM

- Fishing is harmful unless proven otherwise
- It considers risk for resources and people
- Increased people's participation is needed
- It is not limited to exceptional conditions
- It becomes an integral part of good practice
- Science has a central role, but
- A different science is called for
- It is compatible with UNCLOS and fills some gaps.

The problem is significantly different with fisheries. Their purpose is to impact the resource and capture part of the natural productivity in order to extract food and revenues. The resources do have an assimilative capacity in terms of the fishing mortality they can stand. In a way the Maximum Sustainable Yield could be considered a measure of the maximum assimilative capacity of a stock. The same concept can apply to a multispecies resource and to an ecosystem even though defining and measuring such capacity is not a trivial issue.

As the cause-effect relationship between fishing and the resources is obviously not questioned, the problem lies in (a) the degree of impact that could be allowed (e.g. the assimilative capacity) and (b) the discrimination of fishing impacts from environmental impacts -whether natural (normal year-to-year climate fluctuations) or resulting from human activities (degradation and global climate change).

3.2.3. *Standards and criteria*

The Precautionary Principle is not formulated in absolute terms and it offers little guidance on how to apply it in practice. Better quantification and qualification are required and words such as detrimental, substantial, significant, harmful, unacceptable, which are generally used in various expressions of the Principle, need a more accurate definition. There is a whole range of degrees in each of these and other terms currently used. One of the major tasks for research and management will be to develop the agreement on standards, criteria and critical thresholds on which to base decisions. Criteria will be needed to face the management requirements of the diversity of existing ecosystems and resources. Clarification is required, for example, on the concepts of sustainability (in a naturally variable context) and reversibility (for multi-equilibrium systems). Measures of ecological stress will also have to be agreed. The following examples illustrate the difficulty of establishing a set of coherent and credible criteria.

With reference to the issue of by-catch, for example, Miles⁷ stressed the danger of setting criteria at excessively high levels, with the risk of crippling national industries beyond what is required to ensure long-term resources conservation, recalling that criteria established for high seas will tend to be proposed also for EEZs. This author cites a paper on driftnets presented to the United Nations in 1991, and in which an 'efficient harvest' is defined as the one which :

- (a) will ensure as far as practicable that human activities do not result in the decrease of any population of marine species below a level close to what ensures the greatest net annual increment or
- (b) will not catch numbers of either target or non-target species that will result in significant changes in the relationship among any of the key components of the marine ecosystem of which they are part.

The first criterion implies that populations are not decreased beyond their MSY abundance level where their natural turnover is the highest. This is in line with the original UNCLOS requirements and it has been shown since then, that it is not biologically and economically advisable in most cases to extract the Maximum Sustainable Yield. For multispecies fisheries, however, it would require that all species be exploited below their MSY abundance and therefore that the overall level of exploitation be fixed at the lowest level required by the species with the lowest resilience. In a typical Mediterranean multispecies trawl fishery where long-living bottom species (e.g. seabreams and red mullets) are targeted together with short-living pelagics (e.g. sardines), this would imply fishing sardines well below the possible level of harvest in order to meet the criterion for seabreams and mullets. The problem has been recognized in the report of the FAO Expert Consultation on Large Scale Pelagic Driftnet Fishing (FAO⁸ para 74).

The second criterion implies that fishing does not disturb the food chain significantly. There are two problems there. First, the word 'significantly' is subjective and the criterion gives no guidance on the basis of which a food chain disturbance is to be considered 'significant' or not. Second, applying fully the first criterion leads, in practice, to differential fishing, to a change in relative abundance of species and may very well affect the food chain. As a consequence, the second criterion is difficult to use in practice for many fisheries and may not even be coherent with the first one.

It has been proposed respectively to the United Nations General Assembly (cited by Miles²¹) and in the Report on Ecologically Sustainable Development of Fisheries (Australia²²) that :

The mortality inflicted on any target or non-target species...is unacceptable if it exceeds the level that would when combined with other sources of mortality, result in a total level that is not sustainable by the population in the long term.

As data permits, fish management authorities set target species catch levels in accordance with the requirement that fishing does not exceed ecologically sustainable levels for both target and non-target species..

Taking into account mortalities from all sources when assessing fisheries impacts is a prerequisite (including natural mortality, indirect fishing mortality as by-catch, direct fishing mortality as target, etc.). Estimating drop-out mortality is a very demanding task but assuming it is feasible. A problem remains with the term 'sustainable' in both proposals.

The production model theory says that resources are sustainable (in the sense of being able to regenerate themselves) at various levels of abundance depending on the level of harvest. In other words a stock can reproduce itself for a long period of time, and therefore be considered sustainable at high (virgin state), medium (MSY level) and even low level of abundance. As stocks are fished down, their variability and the risk of collapse increases. But in theory, and in practice, stocks can be said to be sustainable even at fairly low levels. It has been agreed in UNCLOS that stocks should not be exploited beyond their MSY level of abundance and this could be considered a bottom line criterion for stock 'sustainability', remembering, however, that stocks' MSY vary with environment and that, even when abundance is above the MSY level, the risk of collapse is not nil (Laurec²¹).

From an ecosystem point of view, if balance between ecosystem components must be maintained, minimizing by-catch or using extremely selective gears might not be necessarily the best solution (with the proviso that discards be limited to a strict minimum). Garrod²² suggested that in multispecies management, a reasonable strategy would be to exploit all species proportionally to their abundance in order to maintain the overall structure. More work is certainly required on this matter before objective guidance can be given.

New criteria, not foreseen in UNCLOS, are required if species sustainability is to be ensured at low risk of collapse. They would have to refer to, for example, minimum reproductive biomass, safe biological limits, optimum recruitment levels, maximum statistical probability of ecological or economic collapse, especially in areas of high environmental variability (upwellings) or for particularly low resilience species.

New criteria are also needed for precautionary ecosystem management, related to global stress indicators, resilience factors, habitat conditions, etc. Some of the required principles can be found in the management charter of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and

in the IUCN Strategy for Sustainability²⁴:

- minimize conversion of critical ecosystems to ‘lower’ conditions,
- balance habitat conversion with restoration (not net loss),”
- maintain ecological relationships,
- maintain populations at the greatest net annual increment
- restore depleted populations
- minimize risk of irreversible change in the marine ecosystem, etc.

Genetic conservation criteria, when introduced, will make things even more complicated as management will have to face conservation requirements at both ecosystem/biodiversity, species and genetic level.

3.2.4. Improving decision-making process

In international management the best principles are useless if the decision-making process leading to their practical implementation is flawed and inefficient. The quality of the decision-making process is also important when criteria and standards have to be agreed on. The following section therefore briefly analyses the issue, looking at potential solutions for improvement.

In general, fisheries management agreements implicitly accept that fishing activities which are not explicitly prohibited or subject to regulations may be undertaken freely. Their regulation (including prohibition) requires a particular action to be taken. The necessary decisions are usually taken by consensus between all parties. Voting procedures are rarely used, even when they are foreseen by the basic texts. In international fora the consensus procedure allows agreement only on the lowest common denominator between all parties, gives a *de jure* right of veto to the minority and has led to the too little, too late fisheries management. The problem has been stressed by various scholars as a weakness in international fora and the introduction of majority voting procedures would correct this situation.^{10,17,24,25}

When the agreement reached is legally binding, parties are given time to object, and if they do so, to opt out of the procedure because ‘no State can be expected to accept limitations on its sovereignty without its consent’ even though the opting-out party puts at risk the interests that the others have in virtue of their own sovereignty.” The country which does not accept the resulting legal obligation may find it convenient to leave the agreement while continuing to fish in the Convention area. (Alternatively, vessels from a party to the Convention may move under a flag of convenience of a State not party to the Convention in order to avoid the obligation contained in the Convention.) Attempts to make the right to fish in the high seas subject to complying with UNCLOS provisions or to the increase the flag State’s liability have, for the moment, met with little success. The idea is progressing slowly, however.

The concept of ‘people’s participation’ in national resources management is being voiced and increasingly recognized in international fora. We can safely assume that the public will be more and more associated with and involved in the decision-making process on environment and development issues. In parallel it is being proposed that management agencies, research and industry should be explicitly and directly accountable to the public for the state of the resources on which they have been given user-rights.^{20,26} In addition public opinion has been used by environmental protection lobbies for decision-forcing and as a test-board for ‘acceptability’ of measures, norms or criteria. Actively altered public opinion has been

instrumental for instance to force an international moratorium on whaling, an international ban on large-scale pelagic driftnets and a ban on coastal gillnets in California.

3.2.5 *The concept of best available technology*

One requirement of precautionary management or development is to use the 'best available technology' (a parallel to the concept of 'best scientific evidence available'). This requirement has been made in a number of international instruments related to environmental policy.⁷² This simply means that all that is technologically feasible must be done to prevent the harmful effect, and little more can be done to make this requirement more precautionary.' The application of the concept usually implies the establishment of 'black' and 'grey' or 'red', 'orange' and 'green' lists of fishing practices.* Poison and dynamite (and probably large-scale pelagic driftnets) would be in such a black or red list. As an example, the Convention on the Conservation of European Wildlife and Natural Habitats, Berne, 1979, gives in its annex IV, the list of non-selective gears to be banned, which includes nets in general. (Although relevant in principle for migratory birds, the Berne Convention has been used in Italy in reference to the large-scale pelagic driftnet fishery).

The potential problem in classifying fishing technologies in such lists is illustrated in Thome-Miller and Catenaz⁸ who mention that examples of methods that are contributing to depleting marine living resources include fishing the deep ocean with huge driftnets, operating large vessels able to process huge catches at sea, using aerial spotters and acoustic fish finders to process huge catches at sea, using aerial spotters and acoustic fish finders to locate schools of target fish, and using more and more efficient fishing equipment without restrictions on size or location of catch. This shows a total confusion and unjustified amalgamate between the lack of selectivity of some gears and the large catches which are possible on abundant small pelagic species, as well as between fishing efficiency and fishing mortality, forgetting that total effort is what is to be controlled.

The 'best management methodology' would be, following the same rationale, a concept of value. It is unlikely that any management method would be the best in absolute terms but techniques particularly robust and well-adapted to fragile species or communities in a particular socio-economic and cultural context could be given a status as standard.

A criticism of the 'best available fishing technology' concept is that (a) 'best' is defined neither in qualitative nor quantitative terms and (b) the accumulation of 'best technologies' could be the worst thing happening to fish if the total effort is not controlled. The wording assumes a universal value judgement on what is 'best' without providing guidance on the basis for such judgement. The best gear from an extreme ecological point of view may be one that catches nothing. The General Assembly Resolution 441228 on UNCED refers to 'environmentally sound' technology in a document which, however, stresses abundantly the necessity to take into account also socio-economic value as required by the FAO definition on sustainable development.

3.3. *Legal implications*

Although General Assembly resolutions are not legally binding, they can have enormous political significance. The consequences of the General Assembly resolution on large-scale pelagic driftnets gave an example of the potential impact. Although its legal status is that of a recommendation, a UNGA resolution may have an effect wider than that in revealing indirectly what State practice is, or pointing

to what States might be willing to accept. The UN Convention on the Law of the Sea is in a similar category pending its entry into force (although it is considered that parts of the Convention (including the fisheries provisions) already constitute customary law even before the entry into force of the Convention), though an obligation to act in accordance with its provisions can be linked to the need for those States which have signed it not to act in a manner contrary to its objects and purposes (Vienna Convention of the Law of Treaties, Art. 15)

These points do not, however, elevate the Precautionary Principle to a legal requirement in its own right and Nollkaemper⁷ indicates that, for the time being, the Precautionary Principle is no more than a non-binding norm, operating within the framework of particular agreements. Hey,¹⁷ however, argues that the Principle 'may be on its way to becoming part of customary international law'.

The Precautionary Principle might, however be invoked in fisheries conservation issues as a factor, indeed very important factor, in negotiations between States to establish conservation measures in circumstances where there is an obligation to negotiate in good faith to reach agreement, e.g. with respect to straddling stocks under UNCLOS or with respect to high seas fishing under article I 19. Given the wide support to the Principle in the world community a State or a party which refers objectively to it directly or indirectly most probably hopes that it cannot be accused of bad faith. The above discussions on the Principle show however that it may easily lead to abuse.

4. Implementation of precautionary approaches

4.1. Existing precautionary approaches

Precautionary approaches for fisheries management have long been advocated even though they have rarely been applied in practice. Preventive (proactive) management has been recommended in order to avoid crisis and higher costs in the future.

This included :

- (1) step-wise development with impact monitoring as opposed to massive development with no accompanying research;
- (2) early effort limitation instead of laissez-faire investment strategies which lead to overfishing;
- (3) design of institutional or financial 'brakes' to avoid 'explosive' development;
- (4) prior authorization for ordering new vessels or borrowing money for them;
- (5) precautionary quotas for species for which proper assessments are not available;
- (6) using 'pessimistic models' (e.g. the Schaefer production model instead of the Fox model or yield-per-recruit models) for stocks where low resilience is suspected;
- (7) recommendation for multispecies management;
- (8) recommendations for 'experimental management' to test systems response.'
- (9) recommendations of development targets below the Maximum Sustainable Yield (MSY) e.g. F_{01} , $F_{2/3}$, F_{MSY} ;
- (10) adoption of the concept of 'safe biological limits'

- (11) modelling systems response across the whole uncertainty range,²⁹
- (12) agreement on cautious management thresholds (e.g. minimum spawning biomass) and course of action before crisis occurs.³⁰

The poor state of fisheries resources in many areas indicate that despite their potential availability, such measures have not been adopted widely or successfully implemented. Ways must therefore be found to strengthen existing precautionary approaches.

In case of doubt as to the effect on the marine environment and resources, preventive or remedial action would have to be taken, decision erring on the safe side. For example, the General Assembly Resolution 44/225 on large-scale pelagic driftnet fishing recommended immediate action in the absence of scientific consensus. The generalization of the approach would imply that the prohibition of a disputed fishing technique is in order even in the absence of scientific information demonstrating its harmfulness until its harmlessness has been demonstrated (freely translated from the original in French)³¹. Although the usefulness of this approach can be easily seen in case of very high risk its ordinary application for everyday fisheries management could very quickly discredit the Principle itself.

Paying lip service to the principle will not satisfy the growing international pressure for more environmentally friendly technologies and development. As Hey²⁵ rightly stresses, what is new in the Precautionary Principle is not so much the implied measures themselves but the way in which such measures are to be implemented (i.e. stringently) and when they are implemented ('as soon as a detrimental effect...becomes plausible'). A precautionary fisheries management policy may combine a variety of approaches and regulatory tools as follows :

- *Adopting the sustainable development principle* as defined by the FAO Conference. Specific and shorter-term objectives would have to be broadly compatible with it. Hey²⁷ argues that not linking explicitly environment and development would be contrary to the precautionary approach.
- *Adopting the principle of precautionary management*, This would entail adopting a preventive management approach and the measures listed below. The degree of 'precaution' (e.g. the amount of constraint and the degree of stringency) would be negotiated on a case-by-case basis, for each agreement or convention.
- *Using the 'best scientific evidence available'*. In most cases fisheries impacts are progressive and reversible leading to small risk. There should therefore be time available to collect data and build up scientific consensus at least on the level of uncertainty. All fisheries should be covered by an information system, the complexity and cost of which should be commensurate with the level of risk e.g. higher for long-living species (mammals, sharks, etc.) and in highly unstable resources systems, e.g. small pelagic stocks in upwelling areas.
- *Adopting a broader range of management benchmarks* and reference points more directly related to reproduction capacity (safe biological limits, minimum spawning biomass, etc.). In particular using such reproductive capacity as the system status indicator and explicit management target.
- *Developing a set of criteria* to be used when assessing present or potential impacts of developments. These criteria would take into account, *inter alia*, the potential degree of impact on the reproduction capacity of target and non-target species, the level of risk to the stock and associated species caused by the combination of fishing and environment variability, the degree of reversibility of the observed or forecasted impacts. In particular, criteria will be needed for

ecosystem management and acceptable degrees of ecosystem disturbance for the various types of ecosystems presently exploited.

Taking a *risk-averse* stand : assessing the degree of risk created by ongoing fishing activities; establishing maximum rates of exploitation based on acceptable levels of impacts: requiring an environmental impact assessment before authorizing any increase of fishing intensity beyond such rates; requiring prior environmental assessment before opening a new fishery (as required by some pressure groups) implies that all resources are put under a management scheme of various degrees of stringency and sophistication, without exception. Such risk can, in theory, be assessed by simulation of management systems as already done for the management of Whales²⁹ but the degree of complexity will increase drastically for multispecies and ecosystem management and with the inclusion of socio-economic considerations.

Agreeing on acceptable levels of impacts (andrisk). They will never be nil and their 'acceptability' will be influenced by cultural, historical and socio-economic conditions. Different pressure groups, with different interests, will disagree on the degree of risk which is 'acceptable'. Negotiations between interest groups, and within an appropriate institutional and legislative framework will be necessary. Without them, the degree of compliance will be low, raising the related costs of enforcement beyond acceptable levels. The bargaining that characterized past management practices will therefore still be necessary. The difference and strength of the new approach is that the process would be more formalized and trade-offs more explicit and transparent to public opinion.

Basing management decisions on combined stresses on resources and environment. This implies that effort reductions or special measures affecting fisheries will be taken when the stock will face unusually unfavourable environmental conditions. One implication that would prevent fishermen from being penalized by environmental degradation caused by other human activities is to see fisheries in the context of coastal integrated management.

Improving management response time by adopting 'action triggering levels' for status variables (e.g. reproductive capacity, risk level) at which action will immediately be taken by management in pre-defined directions agreed beforehand. This would particularly be required for highly variable resources such as small pelagic species in upwelling systems and for depleted resources in a process of rebuilding and confronted with environmental variability.

Improving participation of 'non-fishery users' in fisheries management bodies as a way to open a more constructive dialogue and take all interests into account when developing and managing fisheries. This requires more 'transparency' in fisheries management and better reporting procedures on the status of stocks to the public.

Improving decision-making procedures by introducing voting procedures or using them when they already exist.

Introducing prior consultation procedures for fishing activities listed in the 'grey' or 'orange' list. This would require that States proposing to introduce such activity present a report, comparable to an EIQ report for comments. Hey²⁴ warns, however, of the paperwork that might be involved if such procedures are used too often and suggests limiting the procedure to activities for which phasing out has been decided and to request an annual report during the phasing out period.

Strengthening monitoring control and surveillance and raising penalties to deterrent levels.

The type of action and the degree of urgency required must be a function of the probability of occurrence of a certain type of impact of a certain magnitude. Decisions are comparatively easy when risks are extremely high. Proposing to prohibit, even without any scientific background, the use of explosives to fish in the high seas would probably not meet with much international opposition as harmful fisheries techniques (dynamite, poison) are normally banned in all national fisheries legislation. However, deciding whether a 5% by-catch of sharks in a longline tuna fishery is acceptable or not will require more careful consideration.

More stringent measures could and would probably be advocated by extremists as necessary for implementing a precautionary approach but that would probably be considered unrealistic from the technical, socio-economic and political points of view. Nollkaemper states that a strict interpretation of the Principle would render it meaningless in practice. In fisheries, extreme measures would include for instance :

- banning of all activities which negatively affect the environment (implying the closing down of all fisheries),
- requiring proof of harmlessness before starting any fishery, a requirement obviously impossible to meet,
- * requesting that the most advanced techniques be systematically applied by all member States

5. Conclusion and Discussion

Many environmentalists are beginning to understand and stress the need for managing the combination of natural and socio-economic systems, but it is not clear that they have reached the point of cost-benefit analysis or widely adopted a problem-solving approach in a social milieu." On the other hand, industry must also start to understand that the spiral of short-term economic and social problems created by a lack of control, the rates of harvest and the pursuit of short-term economic goals cannot continue to justify the erosion of the resources and the environment at the expense of present and future generations.

The Precautionary Principle looks like both a golden opportunity for better management and a threat to fisheries industries; at once a safeguard of the opportunities of future generations and a potential source of inequity for those of today. It is therefore important that misunderstanding and extremism are avoided. The problem should not be expressed in terms of a drastic choice between a standpoint of extreme ecological conservatism and one of total liberalism (terminology taken and freely translated from Savin³¹). Between these two unrealistic extremes lies an area of possibilities and opportunities for mankind, requiring balance, dialogue and mutual understanding, as well as significant changes in decision-making and legal frameworks.

UNCLOS already imposed the concepts of MSY and optimum utilization and referred to the need to take into account the reproductive needs of species associated with or dependent upon harvested species. It did not impose on coastal States the heavy burden of proof before action could be taken even if it did not give much guidance on how to build consensus (apart from broadly referring to co-operation) and how to act if consensus could not be reached. This and the fact that precautionary techniques have always been available in the fisheries management tool-box lead us to conclude, with Nollkaemper⁷ and Hey,²⁵ that the direction of the methods required under the Precautionary Principle is not a new one.

Instead of introducing a fundamental change, the Precautionary Principle follows and stresses the trend towards more environmental concern already expressed for instance in the FAO Technical Conference on Fisheries in Vancouver (Canada) in 1973¹² and in the FAO World Conference on Fisheries Development and Management, Rome 1984. It puts the focus more clearly on uncertainty and the related hidden costs of present decisions for future generations. It is promoted as a means to ensure inter-generational equity but, if incorrectly applied, is an attempt to re-allocate resources to non-consumptive users often without much reference or concern towards intra-generational equity or scientific objectivity.

The Principle underlines a growing consensus on the approaches to be taken. Its implicit extension to fisheries emphasizes the growing awareness that fisheries management cannot be seen in isolation and must fit an integrated context which satisfies the requirement for long-term resources sustainability and environmental conservation. The trend is particularly striking in coastal areas where the concept of Integrated Coastal Areas Management and Development (ICAM) is developing extremely rapidly. The psychological importance of coining a new term should not be underestimated and as Nollkaemper points out, if this term is perceived by policy-makers as carrying with it the feeling of urgency and of the need to take drastic preventive measures, it may be effective where traditional jargon failed.

No matter how irritating environmental constraints may be, a responsible approach is required for at least two good reasons. First, it is required for the long-term survival of the economic activity. Second, taking the USA as an example, commercial fishermen represent 1% of the voters while recreational fishermen represent 20% of the voters." The 'public' pressure, triggered by environmental (or pseudo environmental) considerations could therefore lead to actual shifts in resources allocation to user-groups considered, rightly or wrongly, as environmentally safer. It is important to stress here, with Miles⁴ and Sum⁶⁵ that the principles and criteria adopted to solve the high seas problems will, most probably, end up also in national law inside EEZs.

Following the recommendation of its member countries, FAO will develop guidelines for Responsible Fishing. The International Conference on Responsible Fishing (Cancun, Mexico, May 1992), organized by Mexico in close consultation with FAO, recognized the need for such a comprehensive and balanced concept of sustainable utilization of fisheries resources in harmony with the environment. The concept intends to promote fishery practices compatible with the requirements of ecosystems, ocean resources and consumers (food quality) and the guidelines needed for its implementation will have to give due consideration to the need for precautionary approaches.

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References

1. **Garcia, S.M.** Fisheries research and management : virtues and constraints of a symbiosis. Paper presented at the *1st World Fisheries Congress, Athens (Greece), May 1992.*
2. **Burke, W.T.,** The law of the sea concerning coastal state authority over driftnets in the high seas. *FAO Legislative Study, 46 (1991) 13-32.*

3. WCED, *Our common future*. World Conference on Environment and Development. Oxford University Press. Oxford, 1987. 400 pp.
4. IUCN, *Caring for the world. A strategy for sustainability*, Second Draft. IUCN, UNEP, WWF: 1990, 135 pp.
5. **Walters, C.J. & Hilborn, R.**, Ecological optimization and adaptive management, *Am. Rev. Ecol. Syst.*, 9 (1978) 157-88.
6. **Perrings, C.**, Reserved rationality and the Precautionary Principle : technological change, time and uncertainty in environmental decision making. In *Ecological Economics. The Science and Management of Sustainability*, ed. R. Costanza, Columbia University Press, New York, 1991 pp. 153-67
7. **Nollkaemper, A.**, The Precautionary Principle in international law, *Mar. Pollut. Bull.*, 22(3) (1991) 107-10.
8. **James, M.C.**, Fishery administrators' problems *Proc. Gulf Caribb. Fish. Inst.*, Third Annual Session (Nov. 1950), pp. 65-8
9. **Edwards, R.L.**, History and contributions of the Woods Hole Fisheries Laboratory, *Ms. Fish. Rev.* 50(4) (1988) 13-17.
10. **Garcia, S.M.**, Ocean Fisheries Management. The FAO Programme. Paper presented at the *International Conference on Ocean Management in Global Change*, Genoa, Italy, June 22-26, 1992.
11. The UNGA Resolution 441225 on driftnet fishing refers to sound statistical analysis as a requirement. Gray² also makes a plea for environment related decision-making to be based on sound traditional statistical techniques.
12. **Gray, J.S.** Statistics and the Precautionary Principle, *Mar. Pollut. Bull.*, 2 1(4) (1990) 174-6.
13. The approach has not yet been widely used because the potential socio-economic and political consequences of the experiment are implicitly felt to be less than those of the present management strategies. The concept may gain wider acceptance when, under the pressure of 'public opinion' fishermen and managers will have to face the alternative of accepting the risk of the experiment or having to face the risk of a ban.
14. FAO, Report of the meeting of the GESAMP steering group on scientifically-based strategies for marine environmental protection and management. Challes-les-Eaux, France 28-3 1/8/89. *GESAMP XX3*. 1989, 18 pp.
15. **Miles, E.I.**, The need to identify and clarify national goals and management objectives concerning by-catch. Paper presented to the *National Industry By-catch Workshop*, Newport, Oregon, USA, 4-6/2/92 : 14 pp. (MS)
16. **Serchuk, F. & Grainger, R.** Revised procedures for providing fishery management advice by the International Council for the Exploration of the Sea. The new form of ACFM advice. NMFS Second Annual National Stock Assessment Workshop. 3 1/3-2/4/1992. Southwest Fisheries Science Center, La Jolla, CA, 14 pp.

17. **Hey, H.**, The precautionary concept in environmental policy and law : Institutionalizing caution. *Georgetown Inst. Env. Law Review* (in press) : 19 pp. (MS).
18. **Garcia, S.M. & Majkowski, J.**, State of high seas resources. Paper presented at the 24th Annual Conference of the Law of the Sea Institute. Tokyo, July 24-27/1990 : 44 pp. (MS)
19. **FAO**, Report of the Expert Consultation on Large-Scale Pelagic Driftnet Fishing. *FAO Fish. Rep.*, 434 (1990), 84 pp
20. Australia, Ecologically Sustainable Development Working Groups. *Final Report, Fisheries, Australian Government Publishing Service (November, 1991).* 202 pp.
21. **Laurec, A.**, Fonteneau, A. & Champagnat, C., A study of the stability of some stocks described by self-generating stochastic models. *Rapp. P. V. Reun. CIEM*, 177 (1980) 423-38.
22. **Garrod, D.J.**, Management of multiple resources. *J. Fish. Res Bd Can.*, 30 (1973) 1977-85.
23. This concept of 'compensation' is also retained in the Australian Report on Ecologically Sustainable Fisheries²⁰ which proposes that human activities should lead to 'no net loss of habitat' implying that, if some part of a habitat must be damaged somewhere, compensation is provided somewhere else.
24. **Andresen, S.**, Science and politics in international management of whales. *Marine Policy* (April 1989), 99-1 17.
25. **Hey, H.**, The precautionary approach. Implication of the revision of the Oslo and Paris conventions. *Mar: Pol.* (July 1991), 244-54.
26. **Constable, A.J.**, The role of science in environmental protection. *Aust.J. Mar. Freshw. Res*, 42 (1991) 527-38.
27. The colour refers to the degree of acceptance of the technology. By cultural association or reference to traffic light conventions, 'black' and 'red' would refer to banned methods, 'grey' and 'orange' would refer to methods which would require special procedures before being introduced. and 'green' would refer to ecologically friendly methodologies.
28. **Thorne-Miller, B. & Catena, J.**, The living ocean. Understanding and protecting marine biodiversity. *The Oceanic Society of Friends of Earth 1991*, 180 pp.
29. **Delamare, W.K.**, Simulation studies on management procedures. *Int Whaling Comm., Rep.*, 36 (1986) 429-50.
30. **McCall, A.D.**, Population models for the Northern Anchovy (*Engraulis Mordax*) *Rapp. Proc. V. CIEM*. 177 (1980) 299-306.
31. **Savini, M.**, La reglementation de la peche en haute met par l Assemblée Generale des Nations Unies. *Annuaire Francais de Droit international* 36 (1990) 607-47.
32. Sustainable development is the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such development conserves land, water and plant genetic resources, is environmentally non-degrading, technologically appropriate, economically viable and socially acceptable.¹⁴

33. Royce, W.R., The historical development of fishery science and management *Mar. Fisher. Rev.*, 50 (4) (1988) 30-9.
34. Stevenson, J.C., FAO Technical Conference on Fishery Development and Management. *J. Fish. Res. B. Can.*, 30 (12), Part 2 (1974) 1257.
35. Sumi, K., IV. International legal issues concerning the use of driftnets with special emphasis on Japanese practices and responses. *FAO Legislative Study*, 47 (1991) 45-70.