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Northwest Atlantic Fisheries Organization

Report of the Joint Scientific Council and Fisheries Commission Working Group on Precautionary Approach

29 February-2 March 2000
Brussels, Belgium

NAFO
Dartmouth, N.S., Canada

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1. Opening

The Joint Scientific Council and Fisheries Commission Working Group on Precautionary Approach was called to order by Co-Chairmen W. B. Brodie and J. Baird (Canada) at 1015 hr, 29 February 2000, at Albert Borschette Conference Centre, Brussels, Belgium. Representatives from Canada, Denmark (in respect of the Faroe Islands and Greenland), European Union, Iceland, Japan, Norway, Russian Federation and the United States of America and observers from NEAFC were present (Annex 1). The Chairman welcomed participants and expressed gratitude to the host Contracting Party (EU) for the invitation to host the meeting and for the excellent facilities.

The Co-Chairmen first outlined the history of the development of the Precautionary Approach (PA) at NAFO. In particular, the Scientific Council began discussions on the PA during its June 1997 Meeting. This was followed by the Scientific Council Workshop in March 1998 and the first Joint Fisheries Commission and Scientific Council Working Group Meeting in May 1998. Subsequent to the Scientific Council Meeting of 27 April – 1 May 1999, and the Joint Scientific Council and Fisheries Commission Working Group Meeting of 3-5 May 1999, the Terms of Reference and Agenda for this meeting of the Working Group were developed by the Fisheries Commission during its Annual Meeting in 13-17 September 1999. The Co-Chairmen highlighted the NAFO FC Doc. 99/13 on the Resolution to Guide Implementation of the Precautionary Approach within NAFO.

2. Appointment of Rapporteur

The Co-Chairmen proposed that T. Amaratunga, Assistant Executive Secretary, should act as the rapporteur for the general preparation of the report of this meeting, while individual rapporteurs will be appointed when necessary to address certain specific agenda items (e.g. Agenda items 4, 5, 6, 7, 8, 9 and 10).

3. Adoption of Agenda

In considering the agenda, the Chairman noted the Provisional Agenda circulated by the Executive Secretary on 31 December 1999 in accordance with Rule 4.2 of the Rules of Procedure.

The Working Group (WG on PA) noted that the CWP Intersessional Meeting held during 14-16 February in Copenhagen, Denmark, had considered inter-agency (NAFO, ICES, ICCAT and FAO) concepts and terminology of PA. The WG on PA agreed to review the Draft report of that meeting. The agenda was accordingly modified to include Item 4a for consideration of the CWP Working Group report, and adopted (see Annex 2). List of papers considered is at Annex 3.

4. Harmonization of Concepts and Terminology

a. Report of CWP Intersessional meeting – February 2000

The Draft report of the CWP Intersessional Meeting of 14-16 February 2000 was presented by Co-Chairman, W. B. Brodie (it was noted W. B. Brodie was also the Chairman of the CWP Intersessional meeting). The Chairman's summary of that report is given at Annex 4. The WG on PA noted that this was work produced by scientists from FAO, ICCAT, NAFO and ICES.

b. Discussion of an EU Paper

The EU representative presented a paper entitled "The Precautionary Approach in Fisheries – The issue of harmonization of concepts and terminology" (Annex 5). Following his presentation, the EU

representative emphasized that the Scientific Council has been developing a framework for the implementation of the PA but that this framework has not yet been endorsed by the Fisheries Commission.

During discussions, some delegations disagreed with the paper's interpretations of existing international agreements and its corresponding conclusions relating to the activities in several international fisheries organizations and by Contracting Parties to implement the precautionary approach to fisheries management. It was also pointed out that the paper addresses matters other than the harmonization of concepts and terminology. There was considerable debate on the paper presented by the EU delegation. It was proposed by the EU to include the paper as an annex during the review of the WG on PA report. There was no agreement by the WG on PA on this paper, including whether or not to include it in the WG on PA Report as an Annex. Some delegations expressed the need for guidance from the Fisheries Commission on the inclusion of working documents in working group reports.

Some Contracting Parties also expressed diverging views with respect to the absence of consideration of F_{msy} as a limit in the approach suggested by the EU paper. The EU representative invited those delegations which disagreed to give their reasons. Further he stressed that existing international instruments offered no support for using F_{lim} as F_{msy} as a rule. In response, it was pointed out that, in the NAFO area target reference points of 2/3 F_{msy} and $F_{0.1}$ have been used and that, despite this, nearly 2 dozen groundfish have gone under moratorium or by-catch only fisheries. A view was expressed that promoting fishing mortality levels greater than or equal to F_{msy} in the context of the Northwest Atlantic was not consistent with conservation.

It was also pointed out that there are no compelling reasons to establish targets in a PA framework that are less conservative than the targets already agreed in recent management practices. The importance of setting targets was also pointed out by some Contracting Parties.

c. Contracting Parties' Experience with the Application of the Precautionary Approach

Canada

The Canadian delegation summarized Canada's activities in relation to the Precautionary Approach. Canada has been active for many years in implementation of precautionary fisheries management. The domestic Conservation Harvest Plan development process includes a number of precautionary measures. Canadian scientists and managers have been actively involved in the NAFO process, and scientists have been significantly involved in ICES through its development of the Precautionary Approach. The Precautionary Approach is embodied as an integral part of Oceans Act that came into force in January 1997. In addition, Canada ratified UNFA in August 1999. A Science Workshop was held in November 1999 during which Canadian scientists and managers explored application of the Precautionary Approach for 7 representative stocks that included finfish species, shellfish and marine mammals. The Fisheries Resource Conservation Council (FRCC), mandated to provide advice on Atlantic groundfish stocks, has prepared a discussion paper for domestic review and held a redfish workshop in January 2000 to explore, with industry, managers, and scientists, concepts of their discussion paper as they pertain to redfish. Canada has also been active for many years in conservation of Pacific Coho Salmon, culminating, in February 2000, with the adoption of a Wild Salmon Policy to conserve the resource that includes adherence to the Precautionary Approach. Canada has also been active in NASCO initiatives to adopt the Precautionary Approach for application to Atlantic salmon.

In summary, Canada strongly supports implementation of the Precautionary Approach as evidenced through: ongoing involvement in international fora dealing with Precautionary Approach, incorporation of Precautionary Approach into Oceans Act of 1997, ratification of UNFA in the summer of 1999 and ongoing activity on many domestic fronts.

USA

The U.S. delegation explained that the principal U.S. fisheries legislation mandated co-management with regional fisheries management councils and that, with its most recent amendments (1996), required the setting of limit and threshold reference points, pre-agreed management actions according to timelines, and the possibility of setting target reference points in addition to management for optimum yield, which can be no greater than MSY. The impact of fisheries conservation and management measures on habitat and affected coastal communities must also be considered. The U.S. delegation provided a paper on the U.S. fisheries management experience.

European Union

The EU explained that long-term management arrangements based on a Precautionary Approach were being agreed upon and implemented for an increasing number of fish stocks in the Northeast Atlantic. These arrangements consist of predetermined biomass levels to define the critical level of stocks, pre-agreed fishing mortality rates which offer high probability of the stock not falling below the critical level and provision for specified safety margins which, if approached, will trigger remedial action. Such arrangements started with North Sea herring in 1997 and they now cover the following stocks:

- Norwegian spring spawning/Atlanto Scandian herring (involving the EU, Faroe Islands, Iceland, Norway and Russia)
- North East Atlantic mackerel (involving the EU, Faroe Islands and Norway)
- EU-Norway joint stocks in the North Sea:
- cod
- saithe
- haddock
- plaice
- stocks under the purview of the International Baltic Sea Fisheries Commission (IBSFC): Eastern cod stock and Western cod stock

Norway

Norway referred to the process of establishing a management plan for Norwegian spring spawning herring and underscored the following elements as important:

- simulation exercises to analyse the consequences of various exploitation rates on indicators as average yield, stability in yield and the risk of bringing the spawning stock below limit reference points.
- existence of a working group with both biologists and economists to evaluate the results of the simulation exercise
- decision made by the parties concerned.

Denmark (in respect of Faroe Islands and Greenland)

Denmark (in respect of Faroe Islands and Greenland) referred to the management practice with respect to the capelin stock off East Greenland, Iceland and Jan Mayen. Through many years the 3 Parties have used a limit of 400 000 tons as the minimum stock size required at the end of the fishing season for reproductive purposes.

Iceland

The history of the precautionary management strategy goes back to the early 1970s when the Icelandic summer spawning herring stock collapsed. At that time $F_{0.1}$ was introduced in the ICES/NAFO area. After a two year moratorium the Icelandic summer spawning herring has since then been managed according to $F_{0.1}$ concept. The SSB recovered in the 1970s from almost nothing to about 400-500 000 tons in the 1980s. At present the stock is at historical maximum of approximately 500 000 tons. The present TAC is 100 000 tons.

For capelin in the Iceland-Greenland-area a minimum target SSB of 400 000 tons was set in 1979. This management strategy of leaving 400 000 tons of mature capelin to spawn each season seems to work quite successfully and there has never been a reason to reconsider this target level of SSB.

Mainly due to overfishing the cod stock at Iceland declined from year to year until the mid-nineties. A risk analysis, originally three species model incorporating capelin, shrimp and economical aspects, was carried out in order to study different management strategies on the rebuilding of the stock. The model has been extended also to include marine mammals (whales). As a result from this modelling a harvest control rule was introduced in 1995 which restricts catches to 25% of the fishable stock (age groups 4+). The HCR has been enforced since then with excellent results, i.e. the fishable stock has almost doubled, the SSB has increased from 200 000 to about 500 000 tons and at the same time F has reduced by more than 50%.

In the early 1990s precautionary TACs were set for some groundfish species as dab, long rough dab, ling, blue ling and tusk according to the precautionary principle even though biological information in order to define the precautionary reference points was not available.

The saithe stock at Iceland, (also dealt with within ICES) is managed at present by using the PA reference point (F_{pa} and B_{pa}) for the first time in 1999. For plaice at Iceland (which is not dealt with within ICES) precautionary reference points were also implemented in 1999. This stock had shown a sharp decline in recent years and measurements to halt that decline failed. A TAC based on the PA reference points led to a decrease in the quota from 7 000 tons to 3 000 tons in one step. As plaice is also a by-catch in the other demersal fisheries such a reduction in catches was technically hardly possible. The TAC was therefore revised to 4 000 tons.

The main aim of the fisheries management is to monitor the stocks and to keep a viable and sustainable fishery based on the precautionary principle. The goal can be achieved in different ways using different harvest control rules depending on the stock and fishery in view as can be seen in the examples given above.

Japan

Japan explained that the main method to manage its fisheries is fleet control system including reductions of fishing vessels for resource management. In addition to this, recently Japan has introduced the TAC system in its EEZ and manages its fisheries more cautiously.

Russia

Russian fishery management system is mainly based on Total Allowable Catches (TAC). Work on implementation of the Precautionary Approach (PA) into TAC assessments were started more than 3 years ago. Since then different options for the PA procedure of TAC estimation have been tested. As a result, a precautionary evaluation framework was designed which now is successfully used on a routine basis for 5 pollock stock units within Russian EEZ in the North Pacific. Besides, attempts are being conducted to apply the approach to some Pacific crab species and to several objects of Russian far-seas fishery in Atlantic.

Conclusion on Section 4

To this date, no formulations of the PA framework have been accepted by international fisheries organizations. However, several elements of the PA have been implemented by various management authorities (see item 4.c).

The WG on PA agreed that there are several broad similarities between the ICES and NAFO versions of the PA. The biomass limits (defined as B_{lim} in both frameworks), are virtually the same, although B_{lim} is also used in ICES as an indication of biomass below which recruitment is unknown. The biomass buffers (B_{pa} in ICES, B_{buf} in NAFO) generally correspond to a level of biomass at which there is a high probability of being above

B_{lim}. However, the harvest control rules in the current formulations are different - the NAFO Scientific Council framework suggests no fishing below B_{buf}, whereas the ICES framework indicates a reduced fishing mortality below B_{pa}. The WG on PA concluded that determination of harvest control rules is the role of managers. In the NAFO context, it is the Fisheries Commission's responsibility to determine appropriate harvest strategies corresponding to reference biomass levels. The WG on PA preferred the B_{buf} term as opposed to B_{pa}.

The NAFO Scientific Council framework proposes that F_{lim} should be set no higher than F_{msy}, based on its interpretation of UNFSA. The ICES framework does not make specific reference to F_{msy}. The WG on PA did not reach agreement on which formulation was more appropriate. Differences of opinion may be related to experiences with fish stocks in the Northwest Atlantic as regards to their response to exploitation *vs* the Northeast Atlantic. Consequently seeking harmonization at this time may be premature.

5. Operationalizing the Precautionary Approach into the Management Plans for Three Model Stocks (Cod in Div. 3NO, Yellowtail flounder in Div. 3LNO, Shrimp in Div. 3M)

A paper entitled "Considerations for the implementation of the Precautionary Approach into the Management Plans of Stocks Managed by the Northwest Atlantic Fisheries Organization (NAFO) - a discussion paper prepared by Canada" was presented by the Canadian delegation (PA WG WP 00/01). This paper was prepared to focus the discussions on the implementation of the precautionary approach, taking into account the elements of the resolution adopted by the Fisheries Commission. It outlined the progress made on the two model stocks used to first explore ways of implementing the precautionary approach, namely cod in Div. 3NO, and yellowtail flounder in Div. 3LNO. The document proposed additional steps for implementation of the precautionary approach for these stocks. For these stocks, the document provided a history of the precautionary approach and proposed practical steps to consider in its implementation under the headings of "harvest strategies and reference points", "conservation and management measures", and "research and monitoring". The following is a summary of information presented in the Canadian paper:

Cod in Divisions 3NO

The Div. 3NO cod stock has remained at a low level since the initial cessation of directed fishing in the early 1990s. Because current stock size is so low, the discussion necessarily focused on the strategy to reach the first benchmark to rebuilding, i.e. B_{lim}.

The NAFO Scientific Council framework for implementation of the precautionary approach identifies the need to "initiate precautionary monitoring" when the biomass is below B_{buf}. The paper proposed that any directed fishing below B_{lim} may only be allowed for the purpose of collecting information that would permit further evaluation of resource abundance. To safeguard against possible abuse, it was suggested that a protocol/guidelines be established respecting this activity.

It was noted that to this point in time, neither the Scientific Council nor the Fisheries Commission has focused much attention on eventual targets for stock rebuilding (SSB) or exploitation rates. It was also suggested that at current levels of SSB, the main objective of fisheries managers should be to minimize the by-catch of cod when fishermen are directing for other species. Some measures that could be considered to achieve this objective were outlined.

The Southeast Shoal area has been clearly identified as a nursery area for not only Div. 3NO cod, but also for yellowtail flounder. Information from research surveys also indicates that juveniles are found in other areas of the stock distribution. In order to afford pre-recruits of these stocks the best possible chance to survive and enter the fisheries and mature portion of the populations, the paper suggested that consideration be given to closures or other management measures in areas where juveniles are concentrated.

The paper identified the importance of having reliable information on catches taken as by-catch in other fisheries, as well as information on spawning times and locations, on juvenile nursery areas, on weight-

at-length and maturity-at-length. Information on current spatial distribution of the stock compared to historical patterns may also be useful in indicating resource health and should be presented in the assessments.

Yellowtail Flounder in Divisions 3LNO

The Div. 3LNO yellowtail flounder stock appears to have rebuilt and its biomass seems to be within its expected productivity range. The re-opening of the Div. 3LNO yellowtail fishery in 1998 was based on a target relative exploitation rate of 6% which was believed to be conservative while allowing a commercial operation. The fishery has been conducted so as not to jeopardize the recovery of other stocks still under moratoria.

Based on general production analysis, the Scientific Council has tentatively identified F_{buf} and this level of fishing corresponds closely to the exploitation rate of 2/3 F_{msy}, a reference point used in the past for fisheries management. At this point in time, the Fisheries Commission has not focused much attention on eventual targets for stock rebuilding (SSB) or discussed whether the F_{buf} proposed by Scientific Council is an appropriate fishing mortality limit or target. This stock is considered to be in a data moderate situation and the paper suggested that scientists continue their work aimed at development of an age-structured model to estimate population size and, on that basis, recommend biological reference points as appropriate. In absence of progress in this area, the information from the production model should be further examined and the use of appropriate indices should be examined to determine the possible derivation of provisional biological reference points.

During 1998 and 1999, the fishery has been prosecuted with a suite of management measures aimed at protecting juvenile fish, minimizing the by-catch of American plaice, cod and witch flounder, and at allowing mature yellowtail flounder to spawn one more time. The paper suggested that such measures be continued to complement the PA. In particular, it suggested that it is important to conduct any fishery for yellowtail in a manner that will keep American plaice and cod by-catches at the lowest possible level. It noted that by-catches of Div. 3LNO yellowtail flounder have been increasing and suggested that a revision of conservation measures be undertaken so as to ensure that by-catch are truly incidental in nature.

The Southeast Shoal area has been clearly identified as a nursery area for Div. 3LNO yellowtail flounder as well as Div. 3NO cod. Information from research surveys also indicates that juveniles are found is other areas of the stock distribution. It was suggested that the Fisheries Commission should consider a resolution to close the Southeast Shoal area and other areas identified as having high concentrations of juveniles.

Prior to re-opening the yellowtail flounder fishery in Div. 3LNO, the scientific data collection programs were improved so as to obtain a better description of stock trends. In particular, joint Canadian industry-science surveys were introduced and undertaken seasonally. While the regular survey program was continued and was instrumental in the assessment of the stock, the additional information obtained from the industry surveys provided information on the expected performance of a commercial operation, on seasonal variations in the catch rates, and on probable levels of by-catch of other species. The information obtained during these surveys allowed the scientists to estimate stock abundance with some confidence, given the stability of the results from the various sources. The paper suggested that these research initiatives be continued and noted the June 1999 recommendation of the Scientific Council on the need "to restore the Council's ability to do age-structure analyses on this stock."

Discussion

It was noted that the proposed steps in the implementation of a PA did not include specific reference to harvest control rules. The need to address harvest control rules in an implementation plan was noted. The WG on PA agreed on the next steps in the implementation of the Precautionary Approach for these two model stocks. These steps are outlined in Annexes 6 and 7 for Div. 3NO cod and Div. 3LNO yellowtail flounder, respectively.

The WG on PA did not consider the next steps for the implementation of the PA for shrimp in Div. 3M. It was noted that work by the Scientific Council related to a precautionary approach is ongoing and will be reviewed again in November 2000, prior to the 2001 fishing season.

6. Implementation Plan for the Precautionary Approach to Other NAFO Stocks

The template for an implementation plan developed for the model stocks was applied to one other stock managed by NAFO, namely American plaice in Div. 3LNO. The situation for this stock is similar to that of cod in Div. 3NO in the sense that the stock is at a very low level, much below the biomass limit reference point. The WG on PA agreed to the next steps in the implementation of the PA for Div. 3LNO American plaice as presented in Annex 8.

The implementation of the PA will, no doubt, take time but a detailed implementation plan including steps such as the ones agreed in Annexes 6, 7 and 8 for two of the model stocks, and for American plaice in Div. 3LNO, could help in channeling future efforts directed at the precautionary approach. It is suggested that similar detailed plans be developed for other stocks under the management of the NAFO Fisheries Commission.

For other stocks, the management objectives should be identified by the Fisheries Commission and should include, but not be limited to, the rebuilding and maintenance of stock biomass at a level that can support sustainable fisheries and produce stable yields.

As a general rule for all NAFO stocks, the Fisheries Commission should specify management strategies and ensure that data collection and analysis is carried out in support of the PA. If necessary, additional supportive management measures should be specified.

Management Strategy

The Fisheries Commission shall specify management objectives and strategies. Management actions include the selection of biomass and fishing mortality target reference points and setting corresponding limit and buffer reference points as calculated by the Scientific Council. Management strategies include specification of courses of action consistent with a Precautionary Approach Framework, specifically time horizons for stock rebuilding and fishing mortality adjustments to ensure stock recovery and/or avoid stock collapse. An evaluation of possible consequences of management actions shall include the specification of acceptable levels of risk.

Data Collection/Analysis

The Fisheries Commission, in consultation with the Scientific Council shall promote the collection and analysis of data to enhance the ability of the Scientific Council to evaluate the state of the resources. These shall include, but not be limited to the following:

1) conduct statistically sound, comprehensive research surveys,
2) obtain information on spawning times and locations as well as location of juvenile nursery areas,
3) collection of data on weight-at-length and maturity-at-length to be used to monitor SSB and for prediction of future trends,
4) develop information on the recent spatial distribution of the stocks with respect to historical distribution patterns,
5) stock assessment, modelling and forecasting using all appropriate data and up-to-date methods.

Supportive Management Measures/Good Practices

When the biomass of a stock is below B_{lim}, the main focus of the Fisheries Commission should be to minimize by-catch of adults and juveniles in fisheries directed at other species. As such, additional technical management measures may be specified, including but not limited to, the following:

1) Specification of technical conservation measures that permit only by-catch that is truly incidental in nature.
2) Closure of specific areas for specified time periods where by-catch has persisted, and where high concentrations of juveniles have been observed.

7. Consideration of Changes or Additions to the Fisheries Commission's Request to the Scientific Council to Reflect the Precautionary Approach

Proposals for modifications to the Fisheries Commission's Request for Advice to Scientific Council for 2001 were tabled by Canada and Norway. The WG on PA discussed the inclusion (or not) of references to various paragraphs, articles and annexes of the UN Fish Stock Agreement in the proposed modified request but there was no consensus reached. As such, the WG on PA decided not to draft revisions to the current Fisheries Commission's Request to Scientific Council for advice, i.e. the request agreed by Fisheries Commission in September 1999. Instead, it was agreed that the following items pertaining to advice under the PA would be submitted to Scientific Council for consideration.

It was agreed that the term 'Precautionary Approach Framework' would not be used as the Fisheries Commission has not yet formally adopted the PA Framework as proposed by the Scientific Council.

Additional Items for Consideration by the Scientific Council at its June 2000 Meeting include:

1. Many of the stocks in the NAFO Regulatory Area are well below any appreciable level of B_{lim} or B_{buf}. For these stocks, the most important task for the Scientific Council is to inform on how to rebuild the stocks. In this context and building on previous work of the Scientific Council in this area, the Scientific Council is requested to evaluate various scenarios corresponding to recovery plans with timeframes of 5 to 10 years, or longer as appropriate. This evaluation should provide the information necessary for the Fisheries Commission to consider the balance between risks and yield levels, including information on the consequences and risks of no action at all. Whenever possible, this evaluation should be cast in terms of risks analyses relating removals from various sources to B_{lim} (B_{buf}) and F_{lim} (F_{buf}).

   References to "risk" and to "risk analyses" should refer to estimated probabilities of stock population parameters falling outside biological reference points.

2. Where reference points are proposed by the Scientific Council as indicators of biological risk, they should be accompanied by a description of the nature of the risk incurred if the reference point is crossed (e.g. short-term risk of recruitment overfishing, loss of long-term yield, etc.)

3. When a buffer reference point is proposed in order to maintain a low probability that a stock, measured to be at the buffer reference point may actually be at or beyond the limit reference point, the Scientific Council should explain the assumptions made about the uncertainty with which the stock is measured, and also the level of 'low probability' that is used in the calculation.

4. Wherever possible, short and medium term consequences should be identified for various exploitation rates (including no fishing) in terms of yield, stability in yield from year to year, and the risk or probability of moving the stock beyond B_{lim} or B_{buf}. Whenever possible, this information should be cast in terms of risk assessments relating fishing mortality rates to the risks of falling below B_{lim}, the risks of stock collapse and recruitment overfishing, as well as the risks of growth overfishing and the consequences in terms of both short and long term yields.

5. When providing risk estimates, it is very important that the **time horizon** be clearly spelled out. By way of consequence, risks should be expressed in timeframes of 5, 10 and 15 years (or more), or in terms of other appropriate year ranges depending on stock specific dynamics. Furthermore, in order to provide the Fisheries Commission with the information necessary to consider the balance between risks and yield levels, each harvesting strategy or risk scenario should include, for the selected year ranges, the risks and yields associated with various harvesting options in relation to B_{lim} (B_{buf}) and B_{target}, and F_{lim} (F_{buf}) and $F_{target,}$.

There was considerable debate on a paper presented by the EU delegation, entitled EU Summary - " A Way Forward" (Annex 9). This was proposed by EU as an explanatory memorandum, for Fisheries Commission consideration in future Fisheries Commission requests for advice. There was no agreement by the WG on PA on this paper, including whether or not to include it in the WG on PA report as an Annex. As was the case in Agenda item 4b), some delegations expressed the need for guidance from the Fisheries Commission on the inclusion of working documents in Working Group reports.

8. Consideration of Criteria for Reopening a Fishery in Light of the Precautionary Approach

Stocks under moratoria have been characterized by a very low spawning stock biomass and a reduced age-range. There is often a concern that the level of spawner biomass reached corresponds to a level where the chance of producing good year-classes is greatly reduced.

Once recovery has begun and spawner biomass has reached a level sufficient to allow consideration of reopening of the fishery, under a PA this reopening must be consistent with a strategy of continued stock rebuilding.

The discussion related to stocks under moratorium has necessarily focused on the strategy to reach the first benchmark to rebuilding, i.e. B_{lim}. In order to monitor the progress of stock rebuilding, milestones should be established so as to permit a review of the stock trajectory in relation to reference points within reasonable timeframes.

For the stock currently under moratorium, the other elements of a PA (i.e. other than B_{lim}), have not received detailed attention. Key considerations in the decision of re-opening include the determination of B_{lim}, the determination of the fishing mortality (F) at re-opening, the probability of continued growth in the stock, the trade-offs between yield/probability of growth in the stock and the risks that the stock could actually fall (again) below a pre-determined limit.

The other elements of a PA will need to be defined. Also, any reopening of commercial activity should only be contemplated under specific conditions. In particular, increased focus on additional conservation measures such as limitations on by-catch is required in order to afford the resource the best chance of recovery.

As such, additional technical management measures may be specified, including but not limited to, the following:

1. *Protection of Spawners:*
   Management should incorporate controls to limit the catch during the main spawning periods in order to ensure the best possible spawning success. Information can be made available from scientists to guide managers in this regard. Scientists can also provide information regarding spawning areas for possible protection as well (see above).

   An important conservation objective should be to allow development of a full age-range in the spawner population in order to promote the best possible stability in annual recruitment.

2. *Protection of Pre-recruits (Area Closures):*
   Specific areas that have been clearly identified as significant nursery areas should be closed, as appropriate, for a specified time so as to minimize the mortality on small fish. In addition, other management measures to protect small fish should be considered.

3. *Concerns with By-catch:*
   Fisheries for other species that might result in by-catch of the species under consideration must be conducted in such a manner so as to keep by-catch at the lowest possible level. This would necessitate careful review of possible management strategies including adequate monitoring.

4. *Concerns with By-catch of Other Species:*
   Fisheries for the directed species that might result in bycatch of other species, especially those under moratorium, must be conducted in such a manner so as to keep bycatch at the lowest possible level. This would necessitate careful review of possible management strategies including adequate monitoring.

9. Consideration of Additional Supportive Management Measures to Complement the Application of the Precautionary Approach

The WG on PA noted a number of supportive management measures/good practices during discussion on the two model stocks (Div. 3NO cod, Div. 3LNO yellowtail flounder), as well as one additional stock (Div. 3LNO American plaice). The information on these three stocks is included in Annexes 6, 7 and 8.

10. Other Matters

The WG on PA considered some examples of supportive management measures as follows:

- The WG on PA noted that management of the NAFO stocks are based on single-species models. In the years to come, it will important to enhance our understanding of the ecosystem in order to base our management decision on models also taking into account of how fish stocks react to changes in the environment as well as the significance of stock interactions.
- The WG on PA noted that a primary cause of depleted fish stocks around the world is the existence of a too large fishing capacity relative to the fish resources. In order to achieve not only sustainable fish stocks, but sustainable fisheries, the Fisheries Commission should stimulate initiatives to curb overcapacity in the fishing fleet.

Some Contracting Parties considered the following measures as examples:

- TAC/Moratorium
- Limited Entry
- Vessel Replacement Restrictions
- Effort Control
- Conservation Harvesting Plans
- By-catch Protection Provisions
- Minimum Fish Size
- In-season Management
  - By-catch Protocols (In-season)
  - Small fish Protocols (In-season)
- Spawning Closures
- Juvenile Closures
- By-catch Closures
- Fishing Gear Restrictions – Minimum Mesh
- Fishing Gear Restrictions – Separator Grates
- Observers – Canadian Zone
- Observers – NRA - % Coverage
- Dockside Monitoring - % Coverage
- Vessel Monitoring Systems
- Air Patrols
- Ship Patrols
- On-board Inspections
- Basic Scientific Surveys
- Comprehensive Scientific Surveys

Some Contracting Parties considered these measures as example of already good management practices.

11. Adoption of Report

During the concluding session of the WG on PA on 2 March 2000, the draft report was reviewed and the report was adopted.

12. Adjournment

Noting the WG on PA work was brought to a successful completion, the Co-Chairmen, W. B. Brodie/J. Baird, thanked the participants, expressing hopes that the work done so far on the PA will continue to meet the Resolution on implementation of the PA outlined by the Fisheries Commission. Special thanks were extended to the NAFO Secretariat and the EU hosts for the arrangements and meeting facilities.

There being no further business, the Co-Chairmen adjourned the meeting at 1930 hrs.

Annex 1. List of Participants

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Annex 2. Agenda

1. Opening (Co-Chairmen Bill Brodie and Jim Baird, Canada)

2. Appointment of rapporteur

3. Adoption of Agenda

4. Harmonization of concepts and terminology
   a) Report of CWP Intersessional Meeting – February 2000
   b) Discussion of an EU paper
   c) Contracting Parties' experience with the application of the Precautionary Approach

5. Operationalizing the Precautionary Approach into the Management Plans for Three Model Stocks

6. Implementation Plan for the Precautionary Approach to other NAFO Stocks

7. Consideration of changes or additions to the Fisheries Commission's Request to the Scientific Council to reflect the precautionary approach

8. Consideration of Criteria for reopening a fishery in light of the Precautionary Approach

9. Consideration of additional supportive management measures to complement the application of the Precautionary Approach

10. Other Matters

11. Adoption of report

12. Adjournment

Annex 3. List of Papers Considered

1. Resolution to Guide Implementation of the Precautionary Approach within NAFO. NAFO FC Doc. 99/13, Serial No. N4198, 1p.

2. Considerations for the Implementation of the Precautionary Approach into the Management Plans of Stocks Managed by the Northwest Atlantic Fisheries Commission (NAFO) – a discussion paper prepared by Canada. PA W.G. Working Paper 00/1, 18 p.

3. The Precautionary Approach in Fisheries – The issue of harmonization of concepts and terminology. EU Working Paper. PA W.G. Working Paper 00/2, 6 p.

4. Draft Report of the Working Group on Precautionary Approach Terminology. CWP Intersessional Meeting – February 2000, 19 p. (CWP-19 in July 2001 will review this report before finalization).

5. Chairman's Summary. CWP Intersessional Meeting of the Working Group on Precautionary Approach Terminology, 12 p. (Co-Chairman W. B. Brodie's summary presented at this meeting – see Annex 4.)

6. The Precautionary Approach: A New Paradigm, or Business as Usual? V. R. Restrepo, P. M. Mace, and F. M. Serchuk. 1999. Feature Article 1, p.61-70. *In*: Our Living Oceans, Report on the Status of U.S. Living Marine Resources, 1999, NOAA Technical Memorandum NMFS-F/SPO-41, 301 p. (Submitted by the US Delegation, 6 p.)

Annex 4. Chairman's Summary, CWP Intersessional Meeting 2000
Meeting of the Working Group on Precautionary Approach Terminology
[The complete report is submitted to CWP for finalization]

The CWP Intersessional was held during February 14-16, ICES HQ in Copenhagen. FAO, ICCAT, ICES and NAFO representatives attended the meeting.

TERMS OF REFERENCE FOR THE MEETING

1) Review the terminology and definitions of concepts in use by the different agencies.
2) Identify where concepts are identical and where these differ. Explore consequences of such differences in concepts to the reference points used for providing scientific advice within the Precautionary Approach.

PRESENTATION AND COMPARISON OF AGENCY PA FRAMEWORKS.

The CWP Intersessional noted NAFO and ICCAT both include science and management bodies, while ICES is strictly a scientific body.

Examination of PA work from other perspectives (EC, Canada, USA).

FAO

FAO presented a summary of main issues noted in the 5 years of PA implementation (1995-2000) eg. Marine Protected Areas Harvest Control Rules, role of science, operational management procedures, several others. The relevant papers were appended to the CWP Intersessional Draft Report.

ICCAT

The ICCAT presentation addressed the following:

- has not yet formalized an operational framework for implementing the PA.
- formed an ad hoc WG of the Standing Committee on Research and Statistics (SCRS) to examine the PA.
- proceeded along a slightly different track than either NAFO or ICES, noting that *"Annex II of the Straddling Stocks Agreement states that F_{MSY} should be a minimum standard for a limit reference point. This is potentially in conflict with the objectives of the ICCAT Convention, which imply that F_{MSY} is the target.*"
- SCRS decided that it needs to conduct stock-specific evaluations using simulation methods.
- ICCAT has not yet made a decision on what reference points would be treated as limits in providing PA advice.
- SCRS routinely provides estimates of stock status relative to MSY benchmarks for all stocks with quantitative assessments.
- SCRS provided working definitions of targets, limits, thresholds, and harvest control rules.

ICES

The ICES presentation addressed the following:

- In order for stocks and fisheries exploiting them to be within safe biological limits, there should be a high probability that :

  1) the spawning stock biomass is above the threshold where recruitment is impaired, and
  2) the fishing mortality is below that which will drive the spawning stock to the biomass threshold which must be avoided.

- To have a high probability to avoid the thresholds, ICES calculates a buffer that when applied to the limit reference points provide estimates of the precautionary reference points F_{pa} and B_{pa} ($_{pa}$ stands for precautionary approach).

- ICES proposed in 1998 and 1999 a number of "lim" and "pa" reference points as a provisional step to the implementation of a precautionary approach.

- F_{pa} and B_{pa} are thus the main devices in the ICES framework for providing advice. They are thresholds which constrain advice or trigger advice for implementation of management/recovery plans.

- If fishery management decisions lead to F_{pa} being exceeded, this would be regarded as overfishing and management would not be regarded as consistent with a precautionary approach.

NAFO

The NAFO presentation addressed the following:

- The PA framework was first defined within NAFO SC in 1997 - characterized by limit, buffer, and target reference points for spawning stock biomass and fishing mortality.

- F_{lim} can be no higher than the fishing mortality rate which generates MSY. The target recovery level for biomass (B_{tr}) for overfished stocks is the total stock biomass which would produce MSY.

- B_{lim} is defined as the level of spawning biomass that the stock should not be allowed to fall below.

- Buffers (B_{buf} and F_{buf}) are defined for B_{lim} and F_{lim} to ensure that there is a high probability that the limit reference points are not reached.

- Within each of the biomass/fishing mortality zones defined by the reference points (collapsed, danger zone, recovery zone, recovered zone), specific courses of action are indicated.

- A full suite of reference points has not yet been developed for any NAFO stocks, but substantial progress has been made on some stocks, particularly those with age-based analytical assessments.

INTER AGENCY COMPARISONS

The CWP Intersessinal review of comparisons contained the following:

COMPARISON OF TERMINOLOGY

- Terminology for limit reference points is consistent. ICES, NAFO and ICCAT use B_{lim} and F_{lim} terms to refer to biomass and fishing mortality limit reference points.

- Terminology for threshold reference points differs between agencies. ICES names these points F_{pa} and B_{pa}, NAFO names them F_{buf} and B_{buf}, ICCAT proposes to name them F_{thresh} and B_{thresh}.

- Target reference points:
  Not presently proposed by ICES nor acknowledged in its precautionary framework.
  NAFO has a conceptual definition of targets for fishing mortality and biomass (F_{target} and B_{target}) but at present only proposes B_{target} reference points for rebuilding purposes.
  ICCAT notes that its Convention defines F_{msy} and B_{msy} as targets.

COMPARISON OF DEFINITIONS (LIMITS)

- For the biomass limit reference point, the operational definition is that it is a marker of the biomass below which low recruitment can be expected. However, in many cases ICES has also used this as a marker of the biomass below which recruitment is unknown. This alternative usage is not reflected in the nomenclature.

- For fishing mortality limit reference points, the operational definition varies:
  - ICES mostly uses F_{lim} to indicate a fishing mortality above which there is an unacceptable risk of the stock size declining below B_{lim} in some medium or long-term period. Hence it is a marker of the longer term risk of incurring recruitment overfishing.
  - In the NAFO framework F_{lim} is taken as corresponding to F_{msy}, which means that it is used as a marker of decreasing stock stability and the loss of long-term yield.
  - ICCAT has yet to develop a position on this, but notes that UNFSA guidelines for a fishing mortality limit are in potential conflict with the ICCAT Convention which implies using F_{msy} as a target.

COMPARISON OF DEFINITIONS (THRESHOLDS)

- Definition of biomass threshold levels tends to be more consistent across agencies.
  - Both ICES and NAFO use thresholds as markers of levels of probability, considered unacceptable, that a stock is measured (or forecast) to be at the threshold level, may actually be at or below the limit biomass, given some particular uncertainty assumptions.
  - ICES also in some cases defines a threshold level as a marker of a region of unknown dependence of recruitment on stock size. This definition has been applied for some stocks with a history of only moderate exploitation.
  - ICCAT's intended use of thresholds is as reference points that fall between limits and targets.

- Definition of F mortality threshold is less consistent.
  - ICES has defined F_{pa} in four different ways, as marker of:
    (a) an unacceptable probability that stock is fished at F_{lim} when it is measured to be F_{pa}, (ie for ICES, unacceptable long-term risk of recruitment overfishing)
    (b) a high probability of growth overfishing in short term
    (c) an unacceptable probability that SSB may fall below B_{pa} in medium term
    (d) an unacceptable probability that SSB may fall below B_{lim} in medium term

- The NAFO definition is similar to (b) above. The ICCAT definition is still not developed.

CONCEPTS AND USAGE

Significant differences in operational definitions of reference points in the ICES, NAFO, and ICCAT areas were identified:

- Such differences have quite normally been driven by differences in the institutional framework in which these scientific bodies operate, and by the different dynamics of the stocks for which they provide advice (eg. many stocks in NAFO area at very low level).

- One key difference is that the three organisations have made different interpretations of UNFSA.

NAFO: F_{msy} or a proxy should be adopted as the value for the limit reference point F_{lim}.
ICES: does not incorporate F_{msy} in its PA framework. ICES considered that F_{msy} is an extremely difficult parameter to estimate reliably and was therefore reluctant to use this value in the provision of management advice.
ICCAT: UNFSA guidelines for a fishing mortality limit are in potential conflict with the ICCAT Convention which implies using F_{msy} as a target.

- Other technical differences in calculation of reference points exist between the NAFO and ICES frameworks.

HARVEST CONTROL RULES

NAFO, ICES and ICCAT all consider that it is the responsibility of the management agencies concerned to pre-agree conservation and management action in the event that they consider such pre-agreements to be necessary.

If a stock falls outside the "safe" or "target" area of its precautionary framework, action should be taken to :
- decrease fishing mortality below the threshold value
- take action to allow biomass to increase towards a rebuilding target.

NAFO has in many instances illustrated a linear reduction in fishing mortality in its precautionary framework. However, as presently most NAFO stocks are below B_{lim}, and such a linear reduction is not particularly germane to present conditions.

In the ICES area, many stocks are presently between limit and threshold reference points, and a diversity of approaches has been taken to proposing recovery plans. These are usually stock-specific and to a greater or lesser extent are evolved in dialogue with management agencies.

DATA MODERATE/POOR ENVIRONMENTS

About half the stocks assessed by ICES, more than 80% of the stocks assessed by the NAFO Scientific Council, and all stocks assessed by ICCAT are considered to be data moderate or data poor - age based assessments are unable to be successfully applied or indirect aging methods are used.

- In such cases alternative methods for assigning reference points are gradually being explored.

- For some stocks, ICES has introduced proxies to represent reference points using indices of stock size and other data sources. In ICES there is continued development of reference points.

  In the NAFO SC, surplus production models (ASPIC) have been explored in some data moderate situations, whereas under data poor conditions, the "traffic light" approach has been evaluated. It is anticipated that these and other available methods will be examined in the context of all NAFO stocks in the near future.

- ICCAT has a long tradition of using a wide variety of simple assessment methods and a suite of proxies to reference points that are tailored to fit specific situations.

POSSIBILITIES FOR COMMON USAGE OF CONCEPTS AND TERMINOLOGY

Although specific interpretations of the UNFSA guidelines differed, the objectives of the three scientific agencies of ICES, ICCAT(SCRS) and NAFO (SC) share these common elements:

- Reference points should be chosen in such a way as to allow managers to operate a fishery to take sustainable yields close to the estimated long-term maximum. Reference points should generally lead to stock dynamics which satisfy these conditions, in order of priority:

a) Low probability of recruitment overfishing.

b) The choice of thresholds should be made so as to avoid a recruitment collapse or to minimize risk when approaching an area where the stock dynamics are poorly known.

- The $_{pa}$ reference points of ICES, the $_{buf}$ reference points of NAFO, and the $_{threshold}$ concept of ICCAT all refer to the same idea, ie. to provide a buffer or safety margin to ensure that here is a high probability that the $_{limit}$ reference points on biomass or fishing mortality will not be reached.

- There are a number of other initiatives on the PA underway in various organizations and national departments. Thus, even if it were possible, it may be premature to recommend a common approach to the PA. In many cases, work on the PA is very much in the exploratory stage.

Annex 5. EU Working Paper

THE PRECAUTIONARY APPROACH IN FISHERIES

The issue of harmonisation of concepts and terminology

1. Prologue

At the 1999 Annual Meeting of NAFO, the EU Delegation was requested to present a working paper on harmonisation of concepts and terminology of the Precautionary Approach. At that time, it was not clear that a CWP Inter-sessional Meeting 2000 would be held in Copenhagen from 14 to 16 February 2000 and bring together representatives from ICES, ICCAT, NAFO and FAO in order to review terminology and definitions of concepts of the Precautionary Approach. As the report of this meeting has not yet become available, the present paper can only be of a provisional nature.

2. The Precautionary Principle

Several international treaties relating to different subject matters such as marine pollution, climate change or biological diversity contain references to the Precautionary Principle. Definitions vary from instrument to instrument and writer to writer. A representative definition drawn from these treaties (e.g. the 1992 Convention on the Protection of the Marine Environment of the Baltic Sea Area) could summarised as follows:

> "*States shall take preventive measures in respect of action, which may have deleterious effects, even when there is no conclusive evidence of a causal relationship between inputs and their alleged effects.*"

This constitutes a departure from a former position which held that, *if it cannot be convincingly demonstrated that some action will have deleterious effects, that action may be undertaken*. The new principle brings with it a reversal of the burden of proof in that it stipulates that, *if it cannot be convincingly demonstrated that some action will <u>not</u> have deleterious effects, that action should <u>not</u> be undertaken*.

The formulation of the Precautionary Principle clearly gathered momentum at the UN Conference on the Environment and Development (UNCED). This lead to the 1992 Rio Declaration, Principle 15 of which provides that

> "*In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.*"

The preamble of the 1992 Convention on Biological Diversity draws upon this language as follows:

> "*Noting that it is vital to anticipate, prevent and attack the causes of significant reduction or loss of biological diversity at source,*
>
> *Noting that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimise such a threat,*"

3. The Precautionary Approach in the field of fisheries

3.1 The 1982 UN Convention on the Law of the Sea requires to rely on "the best scientific evidence available" when taking conservation and management measures (see Article 119 (1) (a) for high seas areas and Article 61 (2) for sea areas under national fisheries jurisdiction). This requirement is

sometimes being misinterpreted in too strict if not perfectionist a sense as meaning that, in situations where scientific information offers no full certainty, no conservation measures could be taken. This misinterpretation ignores the inevitable imperfection of science and, therefore, can be seen as one of the motives for the emergence of the Precautionary Approach in the field of fisheries.

The shaping of the Precautionary Approach in the field of fisheries was very much influenced by UNCED and its follow-up processes. It has now been enshrined in both Article 6 of the 1995 UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks as well as Article 7.5 of the 1995 FAO Code of Conduct for Responsible Fisheries. Under these instruments, the Precautionary Approach is to be applied widely to conservation, management and exploitation of fisheries resources. It requires States to err on the side of caution "when information is uncertain, unreliable or inadequate. The absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation measures." Furthermore, States are required to determine both stock-specific precautionary reference points as well as the action to be taken when theses reference points are approached or exceeded.

This brings together two sets of rules which, at first sight, seem to be irreconcilable. On the one hand, there is acknowledgement that States will continue to work in a world of imperfect information. On the other hand, the technique of reference points requires risk management in a sophisticated decision-making process based on very detailed scientific risk analysis and other objective information. The latter shows that the Precautionary Approach is not only confined to cases where adequate scientific information is lacking.

3.2 The significance of Article 6 of the UN Agreement is that, for the first time in a multilateral fisheries treaty, it spells out the way in which the Precautionary Approach adopted at UNCED is to be applied. However, the UN Agreement *ratione materiae* only covers straddling fish stocks and highly migratory fish stocks. As treaty law, it will not be applicable to so-called 'discrete stocks', i.e. stocks which exclusively occur in high seas areas.

Another special feature of the UN Agreement is that it exemplifies in some detail the technique of precautionary reference points in the form of "Guidelines" set out in Annex II. Guidelines are indicative by their very nature. At the time of their drafting, they were intended to offer States Parties an example of how a system of precautionary reference points could work. They were, however, neither meant to be exhaustive nor were they intended to pre-empt future developments.

3.3 In actual fact, subsequent experience with the Precautionary Approach shows that recent developments have already started overtaking the system of reference points set out in Annex II. This system presupposes perfect knowledge of a given stock. On such a basis, the system would be limited to simply setting both a biomass related conservation (or limit) reference point which defines the critical level of the stock, below which the stock should never fall, and a pre-agreed (target) fishing mortality rate which offers a high probability of the stock not approaching or not falling below the defined critical level.

In view of uncertainties inherent to both the relevant scientific advice as well as the risk assessments needed when deciding upon management strategies, it was seen as a problem that one could never be sure about an entirely accurate selection of reference points. This has led to the concept "trigger points" to mark a security margin or a "buffer", whereby the distance between a conservation (limit) reference point and a "trigger point" is indicative of the risk which is considered to be acceptable in a given case. The more mechanistic system of Annex II does not provide for such security margins and, therefore, falls short of genuine risk management which, in order to judge and determine what is an "acceptable level of risk", presupposes meticulous assessment of potential consequences in terms of gains of lower risks set against losses in yield.

4. ICES/NAFO Frameworks for the implementation of the Precautionary Approach

4.1 Both ICES and the Scientific Council of NAFO have developed and, as this is a dynamic process, are in the course of refining Frameworks for the implementation of the Precautionary Approach. None of these Frameworks has yet been formally endorsed en block by competent management agencies.

4.2 Differences in nomenclature

ICES advises on conservation limits (limit reference points) which define the critical stock level, below which stock size should never fall, and precautionary reference points ("trigger points" or "buffers") which, if adhered to, offer a high probability of keeping the stock above the critical level and which, if approached or exceeded, should trigger remedial action to bring the stock within safe biological limits.

The former consist of **Blim** = absolute bottom line Spawning Stock Biomass (SSB) and **Flim** = abolute upper level of fishing mortality rate (F). The latter consist of **Bpa** = level of SSB higher than Blim and **Fpa** = level of F lower than Flim.

ICES regards Blim and Flim as incontrovertible values. However, the basis for some of the suggested values is debatable. The concept implies that if current F is estimated as greater than Flim or current SSB is estimated as less than Blim, the associated fisheries should be stopped.

NAFO uses three reference points for each SSB and F, namely **Blim** and **Flim**, **Bbuf** and **Fbuf** (buf = buffer) and **Btr** and **Ftr** (tr = target).

Blim and Flim seem to be consistent in both models. However, NAFO classifies Flim as equal to Fmsy (i.e. Flim can be no higher than the fishing mortality rate which generates maximum sustainable yield [msy]).

Bpa and Fpa should in principle correspond to NAFO's Bbuf and Fbuf. It has been suggested, however, that, if Bbuf and/or Fbuf were approached or transgressed, the associated fisheries should be stopped. If this were correct, the difference would not only be semantic. It would amount to using the same uncertainties twice and, thus, lead to defining absolute bottom line SSB at a higher level than really required. The establishment of Blim and Flim would then become a futile exercise.

In the ICES model, no attempt is made to define targets. If the aforementioned perception of Bbuf and Fbuf were the right one, NAFO's Btr and Ftr would in reality be "trigger points". Furthermore, NAFO's Btr is being used as the target recovery level for biomass for overfished stocks and defined as the total stock biomass which would produce maximum sustainable yield. This seems to conflict with the use of Flim as Fmsy as an absolute upper level of fishing mortality rate.

4.3 Differences in interpretation – Flim as Fmsy

Paragraph 7 of Annex II of the UN Agreement states that "The fishing mortality rate which generates maximum sustainable yield should be regarded as a minimum standard for limit reference points".

In the NAFO model, it is contended that this clause would make it a requirement to use Fmsy as the absolute upper level of fishing mortality rate. This would imply an automatism which would force to choose a much lower (target) fishing mortality rate in order to stay away from critical stock levels. This might unnecessarily restrict yields.

There is nothing in the UN Agreement which could support such a strict interpretation. By using the term "should", the clause itself is not constructed as a compulsory one. Furthermore, the clause is embedded in guidelines, the indicative nature of which has already been mentioned above (see point 3.2).

Such a strict interpretation would also conflict with the 1982 UN Convention on the Law of the Sea. Articles 119 (1) [for high seas areas] and 61 (3) [for sea areas under national fisheries jurisdiction] provide that conservation measures shall be designed "to maintain or restore populations of harvested species at levels which can produce the maximum sustainable yield". This implies a stock-oriented finality such that the fishing mortality rate which generates maximum sustainable yield is constructed as a management objective (i.e. a target) which should be achieved with a high probability on average. This excludes the use of Fmsy as a conservation (limit) reference point in the sense of the UN Agreement. Pursuant to the provisions of Article 4 of the UN Agreement, the relevant provisions of the 1982 UN Convention on the Law of the Sea prevail in cases of doubt or conflict.

It should also be noted that the use of Fmsy is extremely difficult to implement for most stocks because of great problems in computing reliable values of Fmsy. For this very reason, ICES' interpretation has been largely to ignore the clause in question.

4.4 Differences in interpretation – pre-agreed remedial action

Paragraph 4 of Annex II of the UN Agreement states inter alia that previously agreed reference points "shall be used to trigger pre-agreed conservation and management action". The NAFO model uses this clause to suggest that remedial action should consist of a linear decrease in fishing mortality in all cases where stock size falls below the predetermined level.

However, the clause cannot be invoked in support of this suggestion. As shown above (see point 3.3), the Annex II system of reference points only contemplates situations where stock size approaches or falls below the critical level. In such a case, "pre-agreed conservation and management action" in the sense of the said clause will consist of a closure of the associated fisheries.

In contrast to that, experience with "trigger points" or "buffers" has shown that any attempt of pre-determining remedial action in the event that stock size should approach or fall below the so defined safety margin would be too speculative in nature and, thus, fall short of the specific conditions prevailing at the time when remedial action becomes necessary. Indeed, if remedial action were to be pre-determined by a pre-agreed set of measures, the specificities encountered at the time when recourse to such action becomes necessary will almost certainly lead to divergence from the pre-agreed set of measures. In this sense, the pre-agreed set of measures might prejudice proper remedial action. It is clear, however, that the establishment of a precautionary "trigger point" or "buffer" carries with it an agreement of principle to take remedial action whever the relevant pre-determined value is approached or transgressed.

4.5 The need for harmonisation

Differences in terminology are normally indicative of differing concepts. As a general rule, terminology should be used in a harmonised fashion in all cases where there are no conceptual differences. Difference in terminology should be reserved to cases where different concepts so warrant.

Annex 6. Next steps in the implementation of the Precautionary Approach - Cod in Divisions 3NO

Objectives

The action plan for implementation of a Precautionary Approach should include the nine objectives discussed at the Joint Scientific Council/Fisheries Commission Working Group meeting in May 1999:

1. Restore and maintain stock at level that can support sustainable fisheries.
2. Rebuild SSB to a level that will increase the probability of good recruitment.
3. Keep directed fisheries closed in the short term.
4. Determine the spawning stock biomass at which the fishery will be re-opened.
5. Develop additional criteria to guide potential fishery re-openings.
6. Minimize the by-catch for cod in directed fisheries for other fisheries.
7. Identify and evaluate options for B_{lim} (60000 t SSB at high productivity level and 35000 t SSB at low productivity level). In doing so, use the following performance measures in the risk analysis:
   - The time (year) at which B_{lim} is reached at various probability levels
   - The yield potential at re-opening.
8. Evaluate risks of stocks being below B_{lim}.
9. Full review and analysis of 1) the stock recruitment data to determine the high and low productivity levels 2) options for B_{lim} and 3) the appropriate risk analysis.

Management Strategies

1. As an initial management objective, Fisheries Commission should rebuild SSB to a level that will increase the probability of good recruitment and restore and maintain the stock at a level that can support sustainable fisheries.
2. Fisheries Commission should set a provisional limit SSB reference point of 60,000 t, and should determine harvest strategies and management measures in the context of this reference.
3. No directed commercial fishing should occur while SSB is below B_{lim}.
4. As there are indications of a possible shift to a lower productivity regime wherein B_{lim} may about 35,000 t, Fisheries Commission should request that Scientific Council should continue to monitor this resource and conduct further reviews of the biomass limit reference.
5. Fisheries Commission shall, as appropriate, review and revise these management measures and strategies based on any new advice provided by Scientific Council.

Data Collection/Analyses

1. A Contracting Party may submit a proposal to the Fisheries Commission for monitoring activity on 3NO cod to permit further evaluation of resource abundance. The Fisheries Commission, with the prior concurrence of the Coastal State on the proposed monitoring activity, shall seek the advice of Scientific Council with respect to ensuring appropriate data collection related to the proposed monitoring activity.
2. It is important to continue to obtain information on spawning times and locations as well as on juvenile nursery areas.
3. Ongoing collections of weight-at-length and maturity-at-length data should continue and the data used in the context of the monitoring of SSB and prediction of future trends.
4. Information on current spatial distribution of the stock compared to historical should be presented in the assessments.

Supportive Management Measures/Good Practises

1. Below Blim, the main focus of Fisheries Commission should be to minimize the by-catch of cod, when fishers are directing for other species, and to minimize the catch of juveniles. Some measures that could be considered to achieve this objective are:
   - Review of current directed fisheries for the determination of specific cod by-catch problems so that remedies can be applied.
   - A revision of conservation and technical measures that only permit by-catch that is truly incidental in nature.
   - Closure of specific areas for specific periods of time identified as: a) areas where high levels of cod by-catch are persistent, b) nursery areas, and c) areas where high concentrations of juveniles are found.

Annex 7. Next steps in the implementation of the Precautionary Approach - Yellowtail flounder in Divisons 3LNO

Objectives

The action plan for implementation of a Precautionary Approach should include the eight objectives discussed at the Joint Scientific Council/Fisheries Commission Working Group meeting in May 1999:

1. Maintain harvest levels that will continue to rebuild and maintain the stock biomass above the rebuilt biomass level.
2. Continue with a comprehensive suite of management measures.
3. Ensure a conduct of the fishery in a manner that will not jeopardize recovery of other stocks in the area which are currently under moratorium, specifically 3NO cod and 3LNO American plaice.
4. Performance measures of interest to the managers could be expressed in terms of biomass and its trajectory and where it is with respect to the reference level and catch levels. With respect to catch, the performance measure was: cumulated yield, yield trajectories and trends (in particular, to identify declining trends).
5. It was noted that production models do not permit determination of all reference points. It should be ensured that data are available for scientists to move toward using age-structured modelling.
6. Despite these limitations, production modelling is a tool that could be used to start to evaluate real F limits and could be used to provide insight in what will happen if there are lower or higher fishing mortality levels.
7. There is a need to develop "target" biomass levels that could be higher than the biological limits so as to take into account management objectives including economic considerations.
8. Endorse the work of the Scientific Council in its attempts to develop a better understanding of the stock-recruit relationship.

Management Strategies

1. As a management objective, Fisheries Commission should maintain SSB at a level that will continue the probability of good recruitment and maintain the stock at a level that will support a sustainable fishery.
2. Given that the present estimate of F_{buf} is in the same range as the 2/3 F_{MSY} value used in past requests from Fisheries Commission, the value of 11% for exploitation rate could continue to be used by Fisheries Commission as a basis for establishing catch levels until such time as Scientific Council may recommend an alternative.
3. Fisheries Commission requests Scientific Council to give priority to work aimed at calculation of possible biological reference points as appropriate including age-based models and any other applicable stock evaluation methodologies.
4. Fisheries Commission shall, as appropriate, review and revise these management measures and strategies based on any new advice provided by Scientific Council.

Data Collection/Analyses

1. Scientific Council and Fisheries Commission should encourage continuation of multiple annual surveys in support of stock assessment.
2. Contracting Parties should ensure that appropriate data are collected and that scientists utilize stock evaluation techniques that allow for estimation of stock size and exploitation rates, risk assessment procedures, and a fuller evaluation of reference points.
3. Scientific Council continue efforts to develop a better understanding of the stock-recruit relationship.
4. Scientific Council and Contracting Parties continue to monitor expansion of the range into Div. 3L.
5. Scientific Council and Contracting Parties continue to monitor recruitment as well as trends in weight-at-age.
6. Scientific Council to review and update, as necessary, information on spawning locations and timing.
7. Scientific Council to provide updated information to the Fisheries Commission regarding the distribution of juvenile yellowtail flounder in relation to adult distribution.

Supportive Management Measures/Good Practises

1. Fisheries Commission should take steps to minimize the catch of juveniles, and ensure that the total catches of yellowtail flounder are in accordance with the target exploitation rate. Some measures that could be considered to achieve this objective are:
   - Review of current directed fisheries for the determination of specific yellowtail flounder by-catch problems so that remedies can be applied.
   - A revision of conservation and technical measures that only permit by-catch that is truly incidental in nature.
   - Closure of specific areas for specific periods of time identified as: a) nursery areas, and b) areas where high concentrations of juveniles are found.

2. Fisheries Commission to explore the utility of closure periods to protect spawners as well as the utility of closures of areas identified as spawning locations.

Annex 8. Next steps in the implementation of the Precautionary Approach - American plaice in Divisions 3LNO

Objectives

The action plan for implementation of a Precautionary Approach should include the following eight objectives that are similar to those developed during the 1999 meeting of the Working Group for the other 3 model stocks as follows:

1. Rebuild SSB to a level that will increase the probability of good recruitment.
2. Keep directed fisheries closed in the short term.
3. Determine the spawning stock biomass at which the fishery will be re-opened.
4. Develop additional criteria to guide potential fishery re-openings.
5. Minimize the by-catch for American plaice in directed fisheries for other fisheries.
6. Identify and evaluate options for B_{lim}. In doing so, use the following performance measures in the risk analysis:
   - The impacts of possible changes in natural mortality on estimates of B_{lim}
   - The time (year) at which B_{lim} is reached at various probability levels
   - The yield potential at re-opening.
7. Evaluate risks of stock being below B_{lim}.
8. Full review and analysis of 1) the stock recruitment data to determine the high and low productivity levels 2) the data as they pertain to possible changes in natural mortality 3) options for B_{lim} and 4) the appropriate risk analyses.

Management Strategies

1. As an initial management objective, Fisheries Commission should rebuild SSB to a level that will increase the probability of good recruitment and restore and maintain the stock at a level that can support sustainable fisheries.
2. Fisheries Commission should adopt a conservation objective for 3LNO American plaice that ensures an ongoing full age range in the spawner population in order to promote the best possible stability in annual recruitment.
3. No directed commercial fishing should occur while SSB is below B_{lim}.
4. Fisheries Commission should request Scientific Council to continue monitoring of resource and conduct a full review of reference points.
5. Fisheries Commission shall, as appropriate, review and revise these management measures and strategies based on any new advice provided by Scientific Council.

Data Collection/Analyses

1. A Contracting Party may submit a proposal to the Fisheries Commission for monitoring activity on 3NO cod to permit further evaluation of resource abundance. The Fisheries Commission, with the prior concurrence of the Coastal State on the proposed monitoring activity, shall seek the advice of Scientific Council with respect to ensuring appropriate data collection related to the proposed monitoring activity.
2. It is important to continue to obtain information on spawning times and locations as well as on juvenile nursery areas.
3. Ongoing collections of weight-at-length and maturity-at-length data should continue and the data used in the context of the monitoring of SSB and prediction of future trends.
4. Information on current spatial distribution of the stock compared to historical should be presented in the assessments.
5. Scientific Council should continue its investigations on the impact of possible changes in natural mortality, in particular with respect to the determination of reference points for American plaice in 3LNO. The assessment framework (analytical or otherwise) should be investigated and defined in that context.

Supportive Management Measures/Good Practises

1. Below B_{lim}, the main focus of Fisheries Commission should be to minimize the by-catch of American plaice, when fishers are directing for other species, and to minimize the catch of juveniles. Some measures that could be considered to achieve this objective are:
   - Review of current directed fisheries for the determination of specific American plaice by-catch problems so that remedies can be applied.
   - A revision of conservation and technical measures that only permit by-catch that is truly incidental in nature.
   - Closure of specific areas for specific periods of time identified as: a) areas where high levels of American plaice by-catch are persistent, b) nursery areas, and c) areas where high concentrations of juveniles are found.

Annex 9. EU Summary

"The way forward"

Suggested wording for an "Explanatory Memorandum" which could be attached to the Fisheries Commission's future request for scientific advice

Stocks differ greatly in their inherent dynamics, in the amount of available information, and in the information content of the available data. The establishment of biological reference points, and the use of these points for management purposes, needs to be **highly stock specific**. Experience gained so far clearly shows that this is the most important prerequisite to obtain an acceptable result. With this in mind, the Precautionary Approach offers a suitable instrument to achieve the following goals (in order of implementation):

1. Ensure sustainability by maintaining a low risk of recruitment decline and stock collapse.

2. Where stocks are not overfished, threshold reference points (B_{pa} and B_{buf}, F_{pa} and F_{buf}) should be used in order to avoid entering an area of stock dynamics where either knowledge is poor or risk increases without any increase in yield.

3. Allow for sustainable fisheries with appropriate and stabilised yields in the long term.

In order to provide fisheries managers with the information needed to agree on management plans that fulfil these criteria, the Scientific Council should be requested to provide the following:

Risk assessment: whenever possible, estimates of the

- Risks of irreversible damage to the stock
- Risks of stock collapse and recruitment overfishing
- Risks in relation to long-term yield or growth overfishing

as associated with different fishing mortality rates.

When providing risk estimates, it is very important that the **time horizon** is clearly spelt out. By way of consequence, risks should be expressed in time frames of 5, 10 >15 years or other appropriate year ranges depending on stock specific dynamics. Furthermore, fisheries managers also need to consider the balance between risks and yields. For each alternative harvesting strategy or risk scenario, the corresponding yield should be presented over the same time period as related to the risk.

Many of the stocks in the NAFO Regulatory Area are well below an appreciable level of B_{lim} or B_{buf}. For these stocks, the most important task for Scientific Council is to inform on how to rebuild the stocks. The Scientific Council has made clear progress on some of the stocks. It must be emphasised, however, that it is of utmost importance for fisheries managers to obtain the aforementioned type of information. In this context, the importance of alternative recovery plans with time frames of 2-5 years or longer, as appropriate, and the corresponding risk/yield balances must also be stressed. One alternative scenario should always pertain to the consequences and risks of no action at all.