

SECTION VI

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Report of the Fisheries Commission Working Group of Fishery Managers and Scientists on Conservation Plans and Rebuilding Strategies (WGFMS-CPRS)**9-11 July 2013
Saint-Pierre et Miquelon****Contents**

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Report of the Fisheries Commission Working Group of Fishery Managers and Scientists on Conservation Plans and Management Strategies (WGFMS-CPRS)

**9-11 July 2013
Saint-Pierre et Miquelon**

1. Opening of the Meeting

The Chair, Jean-Claude Mahé (EU), opened the meeting at 1015 hrs on Tuesday, 9 July 2013. M. Latron Patrice, Préfet de Saint-Pierre et Miquelon welcomed the participants (Annex 1). Representatives from Canada, European Union, France (in respect of St.-Pierre et Miquelon), USA, as well as from the Scientific Council were in attendance (Annex 2).

2. Appointment of Rapporteur

Ricardo Federizon (NAFO Secretariat) was appointed rapporteur.

3. Adoption of Agenda

The sequence of item numbers from the previously circulated provisional agenda was slightly modified. Two sub items under Other Matters, Greenland halibut and Shrimp in Div. 3L, were inserted (Annex 3).

4. Presentation of Scientific Council Advice

In 2012, the Fisheries Commission (FC) requested the Scientific Council (SC) for specific advice on stocks currently under the Conservation Plans and Rebuilding Strategies (CPRS) programme and on stocks for consideration under CPRS. The advice concerns fish stocks 3M cod, 3NO cod and 3NO witch flounder and other subject relevant for the agenda of this meeting.

The SC representative presented the scientific advice which was formulated by SC at its June 2013 Meeting (Annex 4). The comprehensive scientific advice is documented in NAFO SCS Doc 13/17. Feedback of the SC was also provided on the draft Terms of Reference of two proposed Joint Fisheries Commission-Scientific Council Working Groups (slide 17 of Annex 4). In addition to the advice on the 3 stocks noted above, SC's review of initial work on management strategy evaluation for 3LNO American plaice was also presented.

5. Elaboration of a general framework including management objectives and performance statistics

A general framework on risk-based management strategies was developed (Annex 5). The purpose of this document is to provide guidance on the development and implementation of strategies based on the application of the Precautionary Approach framework.

The document will be forwarded to the Fisheries Commission with a recommendation for adoption.

6. Development of alternative strategies for stocks that may not be suited to formulaic rules and/or for stocks where reference points do not exist or cannot be developed

Review of the latest scientific advice suggests there is limited progress on which the development of alternative strategies can be based. Reference points should be developed wherever possible, and the WG noted the SC priority on this matter. The advice is that it will be stock dependent. It was however noted that certain elements that are required in the development of alternative strategies have been reflected in the general framework (see Annex 5).

This WG recommends that this item be retained in the agenda of the proposed joint FC-SC WG on Risk-based Management Strategies (FC-SC WG-RBMS).

7. Review and update of management objectives, framework and performance statistics of 3NO cod and 3LNO American plaice CPRS

The WG considered the SC advice on target reference points for 3NO cod. The WG further noted that the SC analysis suggests that the current square bracketed value for Bmsy is likely to be too high, compared to the target reference point. The WG did not recommend adoption of the Btarget value as proxy for Bmsy at this time and recommends that

FC seek clarification from SC in September 2013 on the derivation of the target reference points, including on the possible use of Btarget as a proxy for Bmsy.

Concerning 3LNO American plaice CPRS, it was noted that there was no significant change of advice from the SC regarding this stock. Therefore, this WG did not make specific recommendations of CPRS update.

Recognizing the need for target reference points for biomass and fishing mortality in managing fisheries, the need to clarify the purpose of an interim milestone such as B_{isr} in the current plan and the development of a framework for risk-based management strategies, the WG suggests that consideration be given to updating relevant sections of the NAFO PA Framework.

Considerations should be given to future review of the existing CPRS/Management Strategies taking into account the ongoing work to develop Management Strategies for other stocks.

8. Development of CPRS for 3NO witch flounder and initial development of CPRS for 3LN redfish and 3M cod

Concerning 3NO witch flounder, in order to continue the development of the CPRS, and noting the SC priority to establish reference points for this stock, the WG recommends FC to request SC to develop reference points including Blim, Bmsy and Fmsy (e.g. through modelling or proxy). The WG further recommends FC, jointly with SC to request the joint FC-SC WG-RBMS to continue the consideration of CPRS development during scheduled meetings.

Concerning 3LN redfish, the WG recommends FC, jointly with SC to request the joint FC-SC WG-RBMS to continue to develop the CPRS, possibly in the form of a *Management Strategy Evaluation (MSE)*, including defining management objectives and performance statistics.

Noting the possible future availability of scientific resources, the WG recommends FC to consider requesting SC to be prepared to undertake a MSE for 3LN redfish prior to 2014 Annual Meeting. The WG notes that this would require an iterative process requiring dialogue between the two bodies through the FC-SC WG-RBMS including possible intersessional meetings to define management objectives and performance statistics. The joint FC-SC WG-RBMS would have the authority to provide SC, if agreed by the FC-SC WG-RBMS, with appropriate input (management objectives, performance statistics, options for Harvest Control Rules (HCR)) for an MSE for 3LN redfish and that this would launch the SC process.

Concerning 3M cod, the WG recommends FC to request SC in continuing the work on reference points and provide Bmsy and Fmsy proxies. The WG further recommends FC, jointly with SC to request the joint FC-SC WG-RBMS to continue to develop the CPRS, including defining management objectives and performance statistics. An initial meeting would occur prior to the June 2014 SC meeting and could accommodate a range of related issues (e.g. 3LN redfish, 3NO witch flounder, etc).

In order to carry out the above recommendations and in consideration of the proposed joint FC-SC WG-RBMS, the WG recommends that FC, jointly with SC requests FC-SC WG-RBMS to meet intersessionally (in person or electronically) as needed. Such meetings will be called by the co-chairs and in consultation with CPs and the Secretariat. An initial meeting would occur prior to the June 2014 SC meeting and could accommodate a range of related issues (e.g. 3NO witch flounder, 3LN redfish, 3M cod).

9. Discussion on the draft Terms of Reference and work plan of the proposed Joint Fisheries Commission-Scientific Council Working Group on Conservation Plans and Rebuilding Strategies

Following the 2012 recommendation that this WG considers the broader use of the Precautionary Approach framework, extension of management strategy evaluation and/or other risk-based management approaches including conservation plans and rebuilding strategies, FC tasked the FC Chair in collaboration with the Chairs of SC and other relevant WGs to draft the ToR of the proposed Joint Fisheries Commission-Scientific Council Working Group on Risk-based Management Strategies (WG-RBMS).

The Chair on behalf of the FC Chair introduced the draft ToR contained in FCWG-CPRS WP 13/1. Discussions on the draft led to the conclusion of this WG that the proposed WG-RBMS should adopt a flexible approach to conducting its meetings. To expedite its work, the proposed joint WG should have the ability to have open forum/dialogue as well as more formal agenda elements (sessions) with official delegations, at the discretion of the co-chairs. It was also recognized that flexibility would be required in this approach to accommodate the blended nature of the joint WG and the issues being addressed. Recommendations to FC would be developed through formal sessions with official delegations.

10. Recommendations to be forwarded to the Fisheries Commission

Recommendations formulated by the WG as found in various sections of this Report are compiled. The following agreed recommendations are to be forwarded to the FC at the 2013 Annual Meeting:

1. On General Framework

The WG recommends that General Framework on Risk-based Management Strategies (Annex 5) be adopted.

2. On Development of alternative strategies for stocks that may not be suited to formulaic rules and/or for stocks where reference points do not exist or cannot be developed

The WG recommends that this item be retained in the agenda of the proposed joint FC-SC WG-RBMS.

3. On Update of 3NO cod CPRS

The WG recommends FC to request SC clarify in September 2013 the derivation of target reference points, including on the possible use of Btarget as a proxy for Bmsy.

4. On Development of CPRS for 3NO witch flounder, 3LN redfish and 3M cod

4.1 Concerning 3NO witch flounder, the WG recommends FC to request SC in providing reference points including Blim, Bmsy and Fmsy (e.g. through modelling or proxy). The WG further recommends that FC, jointly with SC, request the FC-SC WG-RBMS continue the consideration of CPRS development during scheduled meetings.

4.2 Concerning 3LN redfish, the WG recommends that FC, jointly with SC, request the WG-RBMS to meet intersessionally (in person or electronically) as needed to continue the development of the CPRS possibly in the form of MSE. An initial meeting would occur prior to the June 2014 SC meeting.

4.3 Concerning 3M cod, the WG recommends FC to request SC continue the work on reference points and provide Bmsy and Fmsy proxies. The WG further recommends that FC, jointly with SC request the FC-SC WG-RBMS to meet intersessionally (in person or electronically) and continue to develop the CPRS, including defining management objectives and performance statistics.

5. On Management Strategy Evaluation (MSE) Greenland halibut and shrimp

5.1 Concerning 2+3KLMNO Greenland halibut, the WG recommends a review focusing on the performance of the current Management Strategy and HCR in order to assess if the initial objectives of the rebuilding programme are being met. The WG further recommends FC to consider developing a work plan for the Greenland halibut MSE review with a view to take a decision in September 2014.

5.2 Concerning 3L Shrimp, the WG recommends FC to consider requesting the WG-RBMS to start developing a management strategy, including HCR.

11. Other Matters

a) Greenland halibut Management Strategy Evaluation (MSE).

The WG noted that the 2+3KMLNO Greenland halibut Management Strategy (MS) was adopted in 2010 and shall be in force initially until 2014. The draft terms of reference of the WG-RBMS provides a mandate to undertake an evaluation of, and possible update of the MS for this stock.

Noting timelines for the review, FC would need to consider requests to SC, which would provide the necessary scientific analysis for the review. The FC will need to consider the approach to the review and as an initial step, the WG

recommends a review focusing on the performance of the current Management Strategy and HCR in order to assess if the initial objectives of the rebuilding programme are being met.

FC would also need to consider developing a work plan for Greenland halibut MSE review with a view to take a decision in September 2014.

b) Shrimp in Division 3L.

The WG recommends FC to consider requesting the WG-RBMS to start developing a management strategy including HCR.

12. Adoption of the Report

This report was adopted through correspondence after the meeting.

13. Adjournment

The meeting adjourned at 1300 hours on Thursday, 9 July. The Chair thanked the host France (in respect of Saint-Pierre et Miquelon) for the hospitality and excellent meeting facilities, the participants for their input and the Secretariat for their support. Canada and EU on behalf of other delegations expressed its thanks and appreciation to the Chair for its leadership.

Annex 1. Welcome speech by M. Latron Patrice, Préfet de Saint-Pierre et Miquelon

France on behalf of St-Pierre et Miquelon is honored to welcome this OPANO work group and the honorable delegations taking part in this reunion.

It is St-Pierre et Miquelon's second time holding an OPANO reunion. The last one was in 2009. This underlines the importance St-Pierre et Miquelon gives the OPANO, an organization internationally known for its seriousness and its definite competence in this matter of fishery management.

France on behalf of St-Pierre et Miquelon, values a long term stock management. The history of the islands has been closely linked to the fishery for the past centuries and will be able to go on only because of a well-planned resource management. For this reason, France on behalf of St-Pierre et Miquelon totally complies with the fundamental principles that govern OPANO.

Therefore, it seems essential that cooperation between scientists and resource managers be as close as possible within the regional fishery organisations. To that effect, France on behalf of St-Pierre et Miquelon is pleased to see that this dialogue is precisely one of the reasons for this work groups existence.

Jean-Claude Mahé, Chairman of this work group, has a great knowledge of the islands, for he is a native of St-Pierre and I would like to wish him to successfully lead the debates so that this reunion turns out to be most productive. I would also like to mention the presence of the President of the Conseil Territorial de St-Pierre et Miquelon, Stéphane Artano, leader of the French delegation and also vice-president of the OPANO. I wish you all a great stay on our islands and hope that your debates will be productive.

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Annex 3. Agenda

1. Opening of the Meeting
2. Appointment of Rapporteur
3. Adoption of Agenda
4. Presentation of Scientific Council Advice
5. Elaboration of a general framework including management objectives and performance statistics
6. Development of alternative strategies for stocks that may not be suited to formulaic rules and/or for stocks where reference points do not exist or cannot be developed
7. Review and update of management objectives, framework and performance statistics of 3NO cod and 3LNO American plaice CPRS
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Annex 4. Scientific Advice

Advice from SC relevant to CPRS

SC met from Jun 7–20, 2013 in Dartmouth

Stock assessments and responses to FC requests were the main topics

This presentation summarizes SC responses to FC requests on CPRS-related issues

1

B_{msy} and F_{msy} for cod in Div. 3M.

- SC concluded that is not possible at this time to provide candidate values of B_{msy} and F_{msy}
 - Estimates not plausible due to the high uncertainty in the stock recruit relationship
 - Proxies depend on assumptions about recruitment
 - More research needed on the possibility of changes in productivity and the level of recruitment that should be used to estimate MSY

2

Productivity of 3NO Cod and define MSY reference points

- SC concluded that there have been major changes in productivity for Div. 3NO cod.
- During 1990s sustainable yield was near zero.
- As interim F target SC recommends either F_{0.1} (0.19) or **F35%SPR** (0.20) based on long term data.
F corresponding to level of SSB/R which is 35% of the SSB/R obtained when F=0
- SC further recommends a level of 180 000 – 185 000 t of SSB as an interim B_{target}.

3

Productivity of 3NO Cod and define MSY reference points

- Changes in productivity for Div. 3NO cod have had a major impact on the level of fishing mortality that the population can sustain without decline.
- Low productivity period for extended period of time in 1990's. During this period sustainable yield was near zero.
- Current levels of productivity are much higher, although not as high as in the 1960s.
- There is a need to develop fishing mortality reference points that can be updated using only recent data, but that incorporate all components of productivity.

4

Productivity of 3NO Cod and define MSY reference points

- It is recommended that until more information is available: a value of F_{0.1} (0.19) or F_{35%}¹ (0.20) be considered as a possible F_{target}. These levels of F have a very low probability of being higher than F_{lim} = F_{max} (less than 5%).
- A possible candidate for B_{target} could be the equilibrium SSB of the proposed F_{target} (F_{0.1} or F_{35%}), which gives a value around 180 000 – 185 000 t.
- Taking a similar definition for B_{isr} as the ICES MSY B_{trigger}, a B_{isr} candidate for Div. 3NO cod could be a value around 120 000 t if we take a very low probability (less than 5%) or 135 000 t if we take a low probability (less 10%) of being below these levels when fishing at the proposed F targets.

¹ F corresponding to level of SSB/R which is 35% of the SSB/R obtained when F=0

5

With regards to witch flounder in Div. 3NO, FC requests SC to provide reference points or proxies, including Blim.

- SC analysed available data for 3NO witch but was not able to recommend reference points at this time.
- Biomass indices in the mid 1980's were higher, but it was considered unlikely that they represent the highest level experienced by this stock.
- Thus in this case it was not appropriate to apply the 85% decline criterion for establishing a limit reference point.

6

With regards to witch flounder in Div. 3NO, FC requests SC to provide reference points or proxies, including Blim.

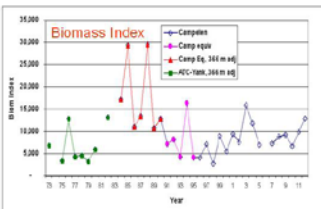
- The lowest points in the biomass index occurred 1993-1998, and measuring increase of the stock against this level is a useful metric, until a limit reference point can be calculated.
- Establishing reference points for this stock remains a priority in SC, and further analysis should continue, to be presented in the full assessment of this stock scheduled in 2014.

7

3NO Witch

- The Canadian spring survey index has data from 1973 to 2012, and was therefore considered the most useful index to examine for developing a possible LRP.
- Survey indices in the early period were adjusted for lack of coverage in strata between 366 and 731 m in depth, which began in 1991.

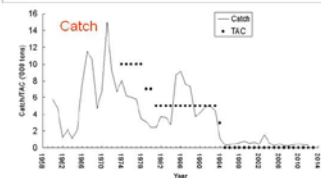
8



3NO Witch

SC concluded that the biomass in the 1980's, while higher, likely did not represent the highest stock size ($B_{0.1}$), given the high catches which occurred over several years in the 1960's and early 1970's.

Thus in this case it was not appropriate to apply the 85% decline criterion for establishing a limit reference point.



9

3NO Witch

- Another candidate for a proxy for an LRP is the lowest biomass from which there has previously been a rapid and sustained recovery (B_{recovery}).
- Scientific Council considered it unlikely that this criterion has been met for this stock.

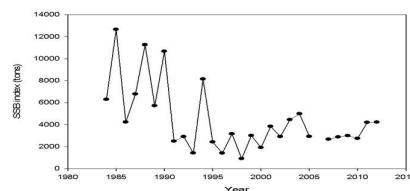
10

Witch flounder in Div. 3NO

Fisheries Commission requests the Scientific Council to provide estimates for exploitable biomass and for spawning stock biomass, or appropriate proxies, as well as smoothing, as appropriate.

11

3NO Witch – SSB Index



An index of spawning stock biomass (SSB) was accepted by SC. The index shows an increase from the lowest values in the mid 1990's, but remains well below the peak values in 1985 to 1990. Indices of exploitable biomass, although not developed here, would likely be very similar to the total biomass indices.

12

Stocks without Reference Points

- With regards to stocks without reference points and that cannot be developed, the Fisheries Commission requests the Scientific Council to provide advice on:
 - a) considerations for reopening stocks under moratorium.
 - b) what would constitute a sustainable harvest rate for healthy stocks.

13

Stocks without Reference Points

- A full answer implies the existence of reference points for the stocks in question.
- SC recommends high priority is given to the development of limit reference points within Scientific Council.
- SC also recommends that the current NAFO PA framework be revised and that this should be conducted in close cooperation between SC Council and the proposed joint SC-FC Working Group on Risk-Based Management Strategies.

14

Stocks without Reference Points

- Ref. pts are needed to delineate sustainable exploitation levels. Reopening of fisheries would occur when stock has increased to a level where there is low risk of impeded recruitment.
- In theory ref pts can be defined for all stocks either derived quantitatively or as proxies. However, this has to be done on a stock by stock basis as each stock is a special case. For a few stocks particular circumstances – for example indices that do not adequately cover the stock distribution – might in the interim prohibit this.

15

Stocks without Reference Points

- SC is in the process of developing ref pts for all stocks. This is time consuming, and has to be done in addition to all other commitments of SC and FC and is therefore not yet finalized.
- SC recognizes the need to speed up the definition and assignment of PA (and/or other) ref pts to all NAFO stocks.

16

Terms of reference for joint SC/FC WGs

- In general the objectives and proposed specific duties for the group were welcomed.
- SC believes that its role at these meeting is to clarify technical aspects of the scientific advice and this function is best served by an open form of dialogue between members of SC and FC.
- During other phases of the meeting it may be desirable to revert to a delegation-based style. A “Scientific Council Delegation” could be formed at this point.

17

Management plans for Div. 3LNO Am. plaice

- The current CPRS contains rules that are too vague and/or incomplete in their current formulation to be tested by simulation.
- In 2012 SC advised that the CPRS decision rules were complicated, and that the performance statistics (which embody the management objectives) were vague and recommended simpler harvest control rules be considered for adoption.
- Preliminary work on management strategy evaluation (MSE) for Div. 3LNO American plaice was reviewed by SC.

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Management plans for Div. 3LNO Am. plaice

- This study tested the performance of simple, explicit, survey based harvest control rules and is capable of quantifying risks with respect to PA reference points, a requirement under the NAFO PA framework.
- The work shows promise and should be continued.
- Discussions on management objectives and performance statistics are needed and this could take place in the new Joint FC-SC WG on Risk-Based Management Strategies.
- Further scientific work on the MSE for American plaice should be conducted and reviewed by Scientific Council.

19

Relevant SC response from 2012 FC Request:

The Fisheries Commission adopted in September 2011, conservation plans and rebuilding strategies for 3NO cod and 3 LNO American plaice and “recognizing that further updates and development of the plans may be required to ensure that the long term objectives are met”. FC requests SC to:

- a) Provide advice on the addition of a new intermediate reference point (i.e. *Bisr*) in the NAFO precautionary approach framework to delineate an additional zone between *Blim* and *Bmsy* as proposed by the working group**
- b) Taking into consideration the new reference point *Bisr*, provide advice on an updating NAFO PA framework and provide a description for each zone.**

20

SC response from 2012

- In 2011 SC advised that *Bbuf* was not required because both Div. 3LNO American plaice and Div. 3NO cod have analyses of the probability that biomass is below *Blim*. However an additional zone between *Blim* and *Bmsy* in the NAFO PA Framework could be considered.
- Providing advice on a new intermediate ref pt and selecting an appropriate level depends on the purpose and on the properties that such a reference point would have. The purpose of the proposed *Bisr* is not clear to SC.
- If the purpose is to serve as a ‘milestone’ for the FC to track rebuilding, then the reference point can have any value that the FC wishes.
- If the purpose of the *Bisr* is to mark the beginning of the safe zone, or to mark an SSB above which there is a high probability of being above *Blim*, or if the purpose is to mark any zone for which there would be some change in an HCR, then analyses as to the appropriate level would need to be conducted.

21

SC response from 2012

- SC can’t advise on particular levels until it is clear as to the purpose of *Bisr*.
- SC also can not advise on updating the NAFO PA framework as it also depends on the purpose of *Bisr*.
- SC recommends that this exercise be conducted jointly with the FC.
- Therefore, the SC chair will contact the FC chair about the possibility of forming a joint working group to re-evaluate the NAFO PA framework. SC members of this group would bring work peer reviewed by SC to the discussions.

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Annex 5. General Framework on Risk-based Management Strategies (FCWG-CPRS WP 13/3 Rev. 2)

1. Introduction:

The purpose of this document is to provide guidance on the development and implementation of risk management strategies based on the application of the Precautionary Approach framework.

While not intended to be a template, the following are recommended elements for the development and implementation of risk based management strategies

2. Biological Synopsis / Fishery Overview:

A brief overview outlining the main biological characteristics of the stock with emphasis on the aspects which impact rebuilding of the stock, as appropriate, including:

- A species' **life history characteristics** (e.g. growth rates, fecundity, longevity, age-at-maturity, size-at-maturity) - critical elements to consider in determining a stock's response to both fishing pressures and rebuilding measures
- **Multispecies interactions** – these can have a strong influence on stock recovery potential and ability of all stocks to reach MSY
- **Environmental conditions** (e.g. temperature, salinity) - will impact the rebuilding dynamics of a stock by affecting life history characteristics, such as fecundity, growth and general productivity. Environmental conditions will also influence predator and prey abundance, which in turn impacts a stocks' overall health and recruitment.

A brief overview of the fisheries in which the stock is captured, including both targeted catch and by-catch, including:

- Impacts of rebuilding on other fisheries - rebuilding efforts for a depleted stock harvested in a mixed-stock or multispecies fishery may have impact on / be impacted by fishing opportunities on targeted stocks/species whose populations are healthy

3. Objective(s):

Objectives (fishery and conservation related) should be clearly stated and direct the development of specific measures. Milestones may also be established as interim steps to achieving objectives.

Objectives and milestones may take into account the following components:

- A target, which is preferably quantifiable (e.g. specified biomass goal)
- A desired time to reach the target (e.g. specified # of years/ generations)
- An acceptable probability level for reaching the target within the specified timeframe

The long-term objective of a Risk-based Management Strategy is to achieve and to maintain the Stock Biomass and the Fishing Mortality in the 'safe zone', as defined by the NAFO Precautionary Approach framework and to ensure that fisheries resources are maintained at or restored to levels capable of producing maximum sustainable yields, according to the Convention objectives (resolution NAFO/GC Doc. 08/3).

4. Reference Points:

The level of information available to perform a quantitative assessment and to define biological reference points may vary considerably between stocks. There are currently stocks with an adopted quantitative assessment and with limit and/or potential target reference points defined but there are stocks with inadequate information to perform a quantitative assessment and for which the definition of reference points is difficult or not possible.

Where limit reference points can be defined, they should be calculated by the Scientific Council (SC).

SC should also provide advice and analysis in support of the development of other reference points (e.g. targets).

5. Guidance on Management Strategies and Harvest Control Rules¹

a. Stocks below limit reference point

¹ Noting the merits of quantifiable and testable harvest control rules, these aspects should be considered, on a stock by stock basis, in the development of risk-based management strategies.

- no directed fishing, and
- by-catch should be restricted to unavoidable by-catch in fisheries directing for other species

b. Re-opening to direct Fishing:

A decision to reopen the fishery should only be considered when Biomass is above Blim.

When a stock has recovered beyond B_{lim} , initial TAC levels should be set at conservative levels to allow for continued recovery and growth.

Decisions to reopen a fishery should take into account any available risk analysis. Where quantitative risk analysis is available, reopening the fishery should only be considered when there is a very low² probability of Biomass actually being below B_{lim} .

In the absence of a quantitative risk analysis, a decision to reopen a fishery would only occur when FC has a high degree of confidence, taking into account any available advice/analysis from SC, that biomass is above Blim or its proxy. Any subsequent increases in TAC should be gradual in order to allow for monitoring of the stock response to the fishery.

c. Open fisheries:

The NAFO Precautionary Approach framework should be applied and Harvest Control Rules (HCR) should be developed in order to specify actions to be taken.

Fisheries specific harvest control rules should be designed with the objective of keeping the fishery in the safe zone.

There should be a low probability that fishing mortality will exceed F_{lim} .

Scenarios may be considered which mitigate decline in biomass and/or limit increases in TACs as a means to balance fishery socio-economics and long-term conservation objectives.

d. Closing of Directed Fishing:

When the estimated biomass is at B_{lim} (that is when there is a 50 % probability to be at or below Blim), the fishery should be closed, subject to consideration of short term projections and stock fluctuations.

e. Additional management measures

When practical, considerations may be given to specific management measures to reduce fishing mortality associated with bycatch including discards, and/or improve selectivity.

6. Ecosystem Considerations:

Risk-based management strategies should be consistent with the ecosystem approach and take into consideration the associated species.

7. By-catch provisions:

For closed fishery, by-catch provisions in the CEMs should be reviewed periodically, to coincide with scheduled assessments of the stock by Scientific Council, and adjusted to reflect the overall trend in spawning stock biomass.

8. Monitoring and Review:

Reviews should be completed on a regular basis at intervals such that failures of the plan (e.g. prolonged declining or stagnant stock growth) can be detected, and changes made as required.

On-going changes in stock status, resulting in implementation of associated harvest decision rules should be continuously examined; trends observed in long-term monitoring are an essential element for consideration in reviewing rebuilding plan performance.

Additional management action may be considered if the stock does not show signs that rebuilding is occurring.

² The actual level of risk should be specified by managers.