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Report of the NAFO Precautionary Approach Working Group (PA-WG)

28 February, by Webex

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NAFO Precautionary Approach Working Group (PA-WG)

February 28, 2023. 09:00 Halifax time

WebEx

Co-chairs; Fernando González-Costas and Steve Cadrin

1. Opening.

The meeting was opened by the co-Chairs Fernando González-Costas (European Union) and Steve Cadrin (invited expert) at 09:00 hours (UTC/GMT -4 hours in Halifax, Nova Scotia) on Tuesday, 28 February 2023.

The co-Chairs welcomed participants attending in person and virtually. This included representatives from Canada, Denmark (in respect of Faroes and Greenland) the European Union, and the United States of America, as well invited experts on Precautionary Approach Framework on Fisheries Management. A full participants list is presented in Annex 2.

a) Appointment of Rapporteurs.

Scientific Council Coordinator Tom Blasdale was nominated as rapporteur of the meeting.

b) Adoption of Agenda

The agenda was adopted as circulated (Annex 1)

2. Progress in the development of the three alternative PA Frameworks.

Fernando González presented the progress made on the development of the three alternative frameworks that were approved at the December 2022 NAFO Precautionary Approach Working Group (PA-WG) meeting (SCS Doc. 22/26). The presentation covered the two frameworks with one operational biomass reference point between B_{lim} and B_{msy} approved in December, Option 1 and 2 of the PA-WG December 2022 report (NAFO SCS Doc. 22/26) and the proposal of a third framework (Option 3) with two operational biomass reference points between B_{lim} and B_{msy}.

In the discussion, the need to rationalize the name of the different zones and reference points of the frameworks was commented. The actual names are those used in the current NAFO PA framework (NAFO/FC Doc. 04/18). It was decided to review these names at future PA-WG meetings.

A proposal to try to join the columns of the Management Strategies and Courses of Action tables in a single column was discussed. It was agreed to keep the format of two columns, one to describe the qualitative management actions and another to describe the management measures based on a mathematical Harvest Control Rule (HCR). It was highlighted that management measures based on a mathematical HCR will be much easier to test than qualitative management actions in future PA revision steps.

Possible mathematical HCR shapes were discussed, especially the segmental and logistic shapes. And it was agreed to implement in the alternative frameworks simple HCR with straight lines between the different Reference Points.

The following changes were agreed in the Options 1 and 2 that were discussed in December:

- It was agreed to change the Safe Zone management actions proposed in December 2022 for the following simpler one: "F equal/below F_{target}".
- Implement as mathematical HCR in the Danger Zone of Option 1 a straight line with a maximum value F= F_{target} in B_{buffer} and a minimum value F=0 in B_{lim} and maximum value F= F_{target} in $B_{trigger}$ and a minimum value F=0 in B_{lim} for Option 2.

It was discussed and approved the Option 3 framework with two intermediate biomass reference points between B_{lim} and B_{msy}: B_{buffer} with a low probability that biomass will be less than B_{lim} and with a $B_{trigger}$ similar to Option 2. It was agreed that $B_{trigger}$=0.8*Bmsy and for B_{buffer} two different ways of estimating it were approved; one based on the risk that the biomass is less than B_{lim} and the other much more practical and simpler as the mean value between B_{lim} and $B_{trigger}$. For the risk that the biomass is less than B_{lim}, a value of 10% or less is proposed. As possible management measures in the Danger and Recovery zones, the following are proposed:

- Recovery Zone (B_{buffer}<B<$B_{trigger}$) qualitative action: F that allows a low risk (40%) of stock decline in the projections period.
- Danger Zone (B_{lim}<B<B_{buffer}) qualitative action: F that allows a very low risk (10%) of stock decline in the projections period.
- Recovery Zone (B_{buffer}<B<$B_{trigger}$) HCR: a straight line with a maximum value F= F_{target} in $B_{trigger}$ and a minimum value F=2/3*F_{target} in B_{buffer}.
- Danger Zone (B_{lim}<B<B_{buffer}) HCR: a straight line with a maximum value F= 2/3*F_{target} in B_{buffer} and a minimum value F=0 in B_{lim}.

The approved alternative Frameworks options are the following:

Option 1: With one intermediate biomass reference point: B_{buffer}.

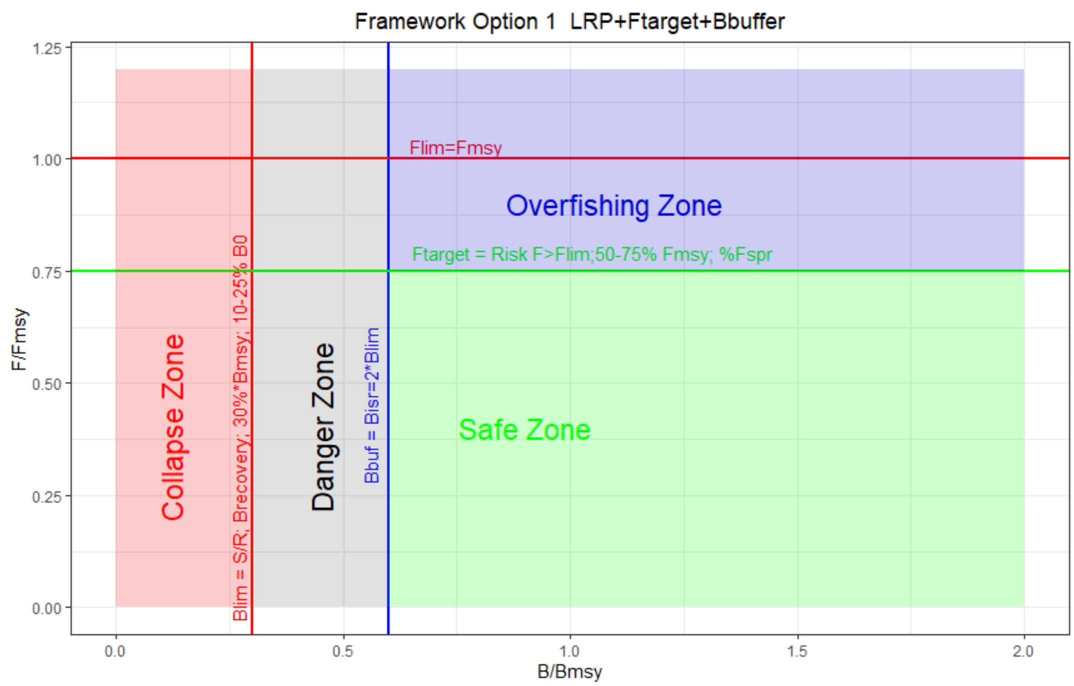

Figure 1. NAFO PA Framework Option 1 with one intermediate biomass reference points (B_{buffer}). B_{lim} red vertical line, B_{buffer} blue vertical lines, F_{lim} red horizontal line, F_{target} green horizontal line. The possible proxies of the different reference points are ordered according to the agreements of point 3 of the agenda. Safe Zone (green) = B>B_{buffer} and F<F_{target}; Overfishing Zone (blue) = B>B_{buffer} and F>F_{target}; Danger Zone (grey) = B_{lim} <B< B_{buffer}; Collapse Zone (red) = B< B_{lim}.

Management Strategies and Courses of Action Option 1		
PA Zone	Qualitative management actions	harvest control rule (HCR)
Safe ($B>B_{buffer}$ and $F<F_{target}$)	F equal or below F_{target}.	F equal or below F_{target}.
Overfishing ($B>B_{buffer}$ and $F>F_{target}$)	Reduce F to equal/below F_{target}.	Reduce F to equal/below F_{target}.
Danger Zone ($B_{lim}<B<B_{buffer}$)	consider F expected to promote rebuilding	HCR F=f(biomass); straight line with a maximum value F= F_{target} in B_{buffer} and a minimum value F=0 in B_{lim}
Collapse Zone ($B<B_{lim}$)	F should be set as close to zero as possible.	F should be set as close to zero as possible.

Option 2: With one intermediate biomass reference point: $B_{trigger}$.

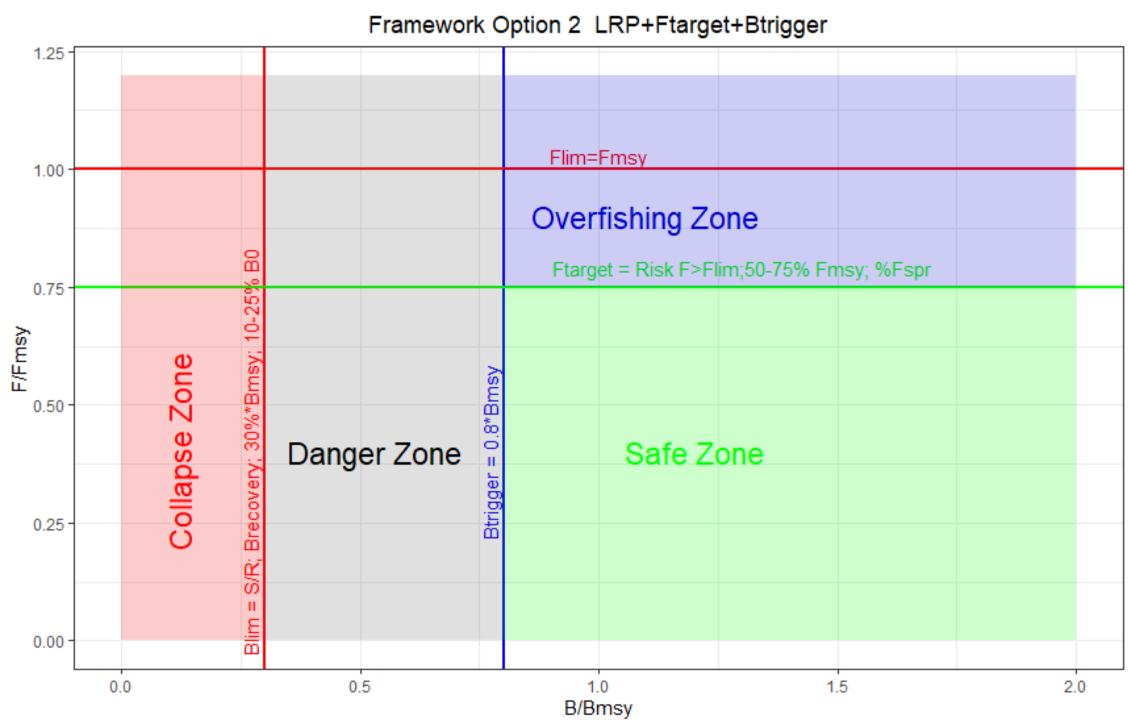

Figure 2. NAFO PA Framework Option 2 with one intermediate biomass reference points ($B_{trigger}$). B_{lim} red vertical line, $B_{trigger}$ blue vertical lines, F_{lim} red horizontal line, F_{target} green horizontal line. The possible proxies of the different reference points are ordered according to the agreements of point 3 of the agenda. Safe Zone (green) = $B>B_{trigger}$ and $F<F_{target}$; Overfishing Zone (blue) = $B>B_{trigger}$ and $F>F_{target}$; Danger Zone (grey) = $B_{lim} <B< B_{trigger}$; Collapse Zone (red) = $B< B_{lim}$.

Management Strategies and Courses of Action Option 2		
PA Zone	Qualitative management actions	harvest control rule (HCR)
Safe ($B>B_{trigger}$ and $F<F_{target}$)	F equal or below F_{target}.	F equal or below F_{target}.
Overfishing ($B>B_{trigger}$ and $F>F_{target}$)	Reduce F to equal/below F_{target}.	Reduce F to equal/below F_{target}.
Danger Zone ($B_{lim}<B<B_{trigger}$)	consider F expected to promote rebuilding	HCR F=f(biomass); straight line with a maximum value F= F_{target} in Btrigger and a minimum value F=0 in B_{lim}
Collapse Zone ($B<B_{lim}$)	F should be set as close to zero as possible.	F should be set as close to zero as possible.

Option 3: With two intermediate biomass reference points: B_{buffer} and $B_{trigger}$.

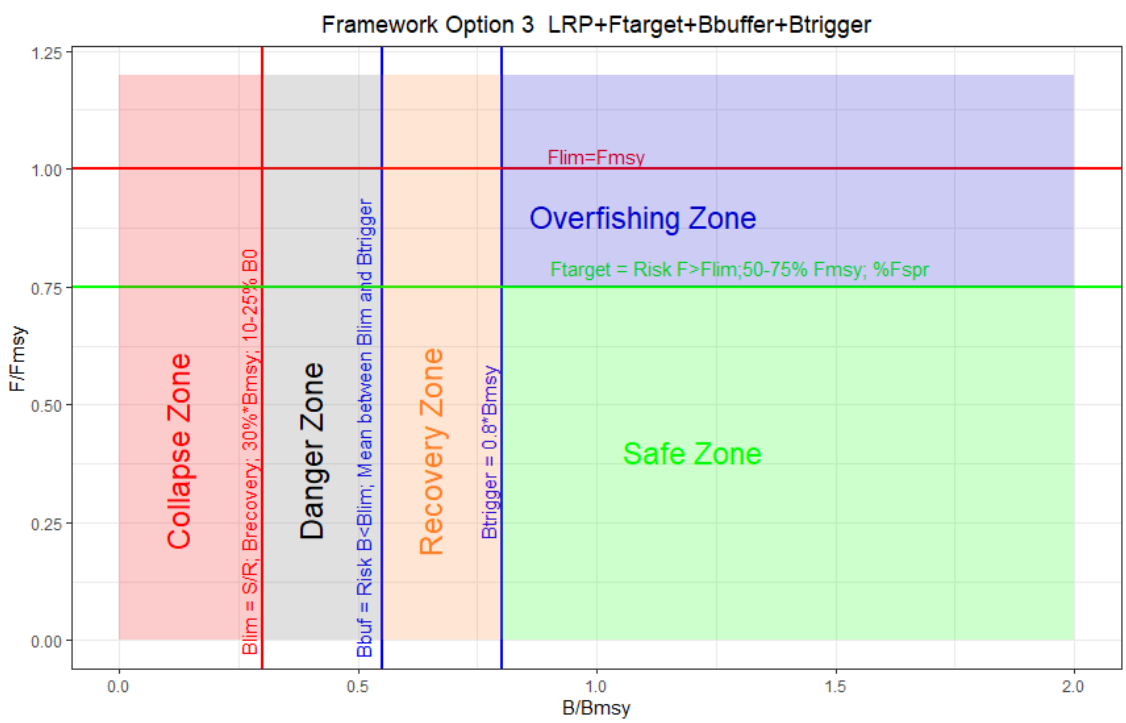

Figure 3. NAFO PA Framework Option 2 with two intermediate biomass reference points (B_{buffer} and $B_{trigger}$). B_{lim} red vertical line, B_{buffer} and $B_{trigger}$ blue vertical lines, F_{lim} red horizontal line, F_{target} green horizontal line. The possible proxies of the different reference points are ordered according to the agreements of point 3 of the agenda. Safe Zone (green) = $B>B_{trigger}$ and $F<F_{target}$; Overfishing Zone (blue) = $B>B_{trigger}$ and $F>F_{target}$; Recovery Zone (chocolate) = $B_{buffer} <B< B_{trigger}$; Danger Zone (grey) = $B_{lim} <B< B_{buffer}$; Collapse Zone (red) = $B< B_{lim}$.

Management Strategies and Courses of Action Option 3		
PA Zone	**Qualitative management actions**	**harvest control rule (HCR)**
Safe ($B>B_{trigger}$ and $F<F_{target}$)	F equal or below F_{target}.	F equal or below F_{target}.
Overfishing ($B>B_{trigger}$ and $F>F_{target}$)	Reduce F to equal/below F_{target}.	Reduce F to equal/below F_{target}.
Recovery Zone ($B_{buffer}<B<B_{trigger}$)	F that allows a low risk (40%) of stock decline in the projections period.*	HCR F=f(biomass); straight line with a maximum value F= F_{target} in $B_{trigger}$ and a minimum value F=2/3*F_{target} in B_{buffer}
Danger Zone ($B_{lim}<B<B_{buffer}$)	F that allows a very low risk (10%) of stock decline in the projections period.*	HCR F=f(biomass); straight line with a maximum value F= F2/3*F_{target} in B_{buffer} and a minimum value F=0 in B_{lim}
Collapse Zone ($B<B_{lim}$)	F should be set as close to zero as possible.	F should be set as close to zero as possible.

*In red the proposed risk values.

3. Ranking the possible proxies for the different Limit Reference Points.

It was agreed at the December 2022 meeting that this ranking would be finalized and discussed at the end of February 2023. The possible proxies for the different LRPs have been included in a Working Paper available in the share point, which would have to be ordered according to their convenience.

PA-WG recommendations for a Precautionary Approach Framework are expected to meet the objectives of the NAFO Convention (PA-WG 2021). General Principle (b) of the Convention is to "adopt measures based on the best scientific advice available to ensure that fishery resources are maintained at or restored to levels capable of producing maximum sustainable yield". PA-WG concluded that this principle requires conserving stocks at approximately B_{MSY} and rebuilding depleted stocks to B_{MSY}. Considering ecosystem and stock variability, the framework should be intended to maintain stocks above B_{MSY} more often than not, which implies that fishing mortality should be limited to less than F_{MSY} more often than not. The Framework should include limit reference points for fishing mortality and stock biomass as well as either buffer reference points or other risk-based management procedures to achieve sustainability and optimum yield in the context of uncertainty. There are valid options for defining F_{lim} (e.g., F_{MSY}, %Maximum spawning potential proxies, F associated with B_{lim}). In the context of uncertainty and natural variability, MSY can be approximately achieved by a variety of alternative management procedures that define limit and target reference points differently.

MSY Reference Points and Proxies

The primary challenge with the estimation of MSY reference points is they require information that is not supported by many stock assessments:

1) an age-based or size-based stock assessment with a well-estimated stock-recruit relationship, because steepness of the relationship largely determines F_{MSY}; or
2) a production model with an informative series of catch and stock indices over a wide dynamic range of stock size and fishing mortality.

Therefore, MSY proxies are commonly adopted from yield per recruit, spawning potential per recruit or historical proxies.

Yield-per-recruit (YPR) can be derived using numerical life tables (Thompson & Bell 1934) or an analytical solution (Beverton & Holt 1957). F_{max} is derived as the F expected to produce maximum YPR, but F_{max} is usually much greater than F_{MSY} because YPR calculations assume no stock-recruit relationship or any decrease in recruitment at high F (e.g., Horbowy & Hommik 2022). F_{max} is also often poorly defined for fisheries that select relatively large fish. Therefore, $F_{0.1}$ (F with 10% of the initial increase in YPR from F=0), was developed as precautionary proxy for F_{max} because it is expected produce nearly maximum YPR as a lower F (Gulland & Boerma 1973). Although YPR reference points can be used to avoid growth overfishing (e.g., not allowing fish to achieve their optimal growth potential), they cannot be used to avoid recruitment overfishing.

Spawner-per-Recruit (SPR) proxies were developed to avoid recruitment overfishing by maintaining spawning potential (Gabriel et al. 1989, Goodyear 1993). A range of SPR reference points have been proposed. Based on simulations of a wide range of life histories, Clark (1991) proposed that $F_{35\%SPR}$ is expected to maintain at least 75% of MSY, and $F_{35\%}$ was similar to $F_{0.1}$ when selectivity at age was similar to maturity at age. Clark (1993) proposed $F_{40\%SPR}$ as a target to reduce interannual variability, and Clark (2002) showed that greater %SPR maintains higher stocks with some foregone yield. Based on a meta-analysis of *Sebastes* species, Dorn et al. (2002) proposed $F_{50\%SPR}$ as a F_{MSY} proxy for Pacific rockfish. Biomass reference points can be derived as the product of SSB per recruit and an assumption of average recruitment.

The appropriate choice of MSY proxy depends on life history. Horbowy & Hommik (2022) simulated equilibrium yields for a wide range of life-histories and found that steepness of the stock-recruit relationship (h) had the largest effect on F_{MSY}, with smaller effects from natural mortality (M) and growth rate. Their analyses confirmed that F_{max} was greater than F_{MSY} for all scenarios, and $F_{0.1}$ and F40% were greater than F_{MSY} when steepness was relatively low (h<=0.6). If steepness can be estimated, then F_{MSY} can also be directly estimated. If not, other life history attributes associated with productivity (e.g., fecundity, longevity, age at maturity, etc.) should be considered in the selection of F_{MSY} proxies.

If reference points cannot be estimated, proxies can be based on historical periods with relatively high, stable or increasing stock size (e.g., Cadrin et al. 2004). A proxy for F_{MSY} can be a relative F, derived as a catch/stock-index exploitation ratio during a historical period of high and stable stock size. F_{tar} can be a relative F during a historical period of increasing stock size.

Biomass Limit Reference Point

The precautionary principle is to avoid irreversible harm (UN 1992), which is often expressed as recruitment failure in fisheries. Therefore, B_{lim} is usually based on recruitment impairment. For example, ICES (2021) defines B_{lim} from the stock-recruit relationship for stocks with a dynamic range and evidence of impairment, as the break point of a segmented regression. For stocks with occasional large recruitment, ICES defines B_{lim} as the lowest stock that produced large recruitment. B_{lim} for stocks with no evidence of impairment had been derived from the lowest observed stock (B_{loss}).

As an alternative for stocks with no evidence of impairment, ICES is considering B_{lim} as a portion of B_0, the equilibrium stock size at F=0 (ICES 2022). For example, B_{lim}=10%B_0 for moderately productive stocks or B_{lim}=25%B_0 for less productive stocks. B_{lim} has also been defined as a portion of B_{MSY}. For example, B_{lim}=30%B_{MSY} for 3LNO yellowtail flounder. Under the assumption of logistic growth, B_{MSY}=50%B_0, so the Blim for 3LNO yellowtail flounder is 15%B_0. The biomass that the stock has

Risk-Based Targets

Target reference points can be explicitly risk-based. For example, a low percentile (P*) of the probability distribution (e.g., lower confidence interval) of the F_{MSY} estimate (or its proxy) can be used as F_{tar} (Prager & Shertzer 2010). The percentile is based on managers' risk tolerance (US risk tolerance for F>F_{MSY} is 10-45% based on region, fishery, and B/B_{MSY}).

When the statistical distribution is not reliable, uncertainty buffers are often based on qualitative evaluation of uncertainty (Restrepo et al. 1998). For example, F_{tar} could be 75%F_{lim} for assessments with moderate uncertainty. F_{tar} could be 50%F_{lim} for more uncertain assessments.

Proposed Reference Points for the Precautionary Approach Framework

PA-WG proposes that the most appropriate reference points are conditional on the information available from each stock's assessment, the stock's general life history, and the amount of uncertainty in the assessment. The are presented as ranks based on tiers of information available, with more informative assessment and reference points ranked higher. Conditional options are indicated as bullets and ranked options as numbers and letters.

Options for Limit Reference Point (F_{lim})

1. Direct estimate of F_{MSY}
    a. from an age-based or size-based analysis with a well-defined stock-recruit relationship
    b. from a production model with an informative series of catch and indices, if age- or length-based analysis is not possible
    c. from production analysis of stock biomass estimates (Jacobson et al. 2002)
2. %Maximum Spawning Potential, depending on life history
    - $F_{35-40\%}$ for stocks with moderate productivity (e.g., high fecundity, ~20 year longevity; cod, plaice)
    - $F_{50\%}$ for stock with relatively low productivity (e.g., low fecundity, ~50 year longevity; redfish)
    - ~$F_{30\%}$ for stocks with relatively high productivity (e.g., high fecundity, ~10 year longevity)
3. Yield per Recruit for data–limited stocks
    - $F_{0.1}$ for stocks with moderate productivity and uncertain spawning potential
    - F_{max} is not a reliable proxy for F_{MSY}.
4. Historical proxies (if information is insufficient for #1-3):
    a. F during periods of relatively high and stable stock size
    b. exploitation ratio (catch/survey biomass) during periods of relatively high stable stock size

Options for B_{MSY} (to derive $B_{trigger}$=80%B_{MSY})

1. Direct estimate of B_{MSY}
    a. SSB_{MSY} from an age-based or size-based analysis with awell-defined stock-recruit relationship
    b. B_{MSY} from a production model with an informative series of catch and indices, if age or length-based analysis is not possible
    c. B_{MSY} from production analysis of stock biomass estimates (Jacobson et al. 2002)
2. %Maximum Spawning Potential, depending on life history
    - $SSB_{F35-40\%}$ for stocks with moderate productivity (e.g., high fecundity, ~20 year longevity; cod, plaice)
    - $SSB_{F50\%}$ for stock with relatively low productivity (e.g., low fecundity, ~50 year longevity; redfish)
    - $SSB_{\sim F30\%}$ for stocks with relatively high productivity (e.g., high fecundity, ~10 year longevity)
3. Yield per Recruit for data–limited stocks
    - $SSB_{F0.1}$ for stocks with moderate productivity and uncertain spawning potential
    - SSB_{Fmax} is not a reliable proxy for SSB_{MSY}.
4. Historical proxies (if information is insufficient for #1-3):
    a. stock size during periods of relatively high and stable stock size
    b. stock index during periods of relatively high stable stock size

Options for Target Fishing Mortality (F_{tar})

1. Lower percentile of the probability distribution of the F_{lim} estimate, in which the percentile reflects the Commission's risk tolerance, for stocks with reliable estimates of uncertainty
2. If statistical distribution is unreliable, fixed % of F_{lim}
    - 75%F_{lim} for assessments with moderate uncertainty
    - 50%F_{lim} for more uncertain assessments
    - Higher %SPR than F_{lim}
3. For more data-limited stocks (if information is insufficient for #1-2):
    a. F during historical period of stock increase
    b. exploitation ratio during period of stock increase

<u>Options for Limit Biomass</u> (B_{lim})

1. Based on stock-recruitment information:
    - point of recruitment impairment (break point of segmented regression) if there is contrast in stock-recruit and a break point is clearly defined)
    - lowest observed stock that produced strong recruitment for stocks with occasional good year-classes
2. $B_{recovery}$ for stocks that have evidence of recovery and there is no reliable stock-recruit information.
3. 30% B_{MSY} if B_{MSY} is well estimated by a logistic production model
4. %B_0 based on life history of the stock
    - 10%B_0 for moderately productive stocks
    - 25%B_0 for less productive stocks

<u>Options for Precautionary Biomass Reference Point</u> (B_{buf})

1. Upper percentile of the probability distribution of the B_{lim} estimate, in which the percentile reflects the Commission's risk tolerance, for stocks with reliable estimates of uncertainty and upper percentiles that are sufficiently less than $B_{trigger}$.
2. If statistical distribution is unreliable or upper percentiles is not sufficiently less than $B_{trigger}$, B_{buf} can be the average of B_{lim} and $B_{trigger}$ or 2xB_{lim}.

4. Possible proxies of the LRPs of the three stocks chosen as case studies.

The designated experts (DEs) for the stocks chosen to apply the alternative PA frameworks (yellowtail flounder Div. 3LNO, cod Div. 3M and redfish Div. 3M) presented the estimates of the possible values of the proxies of the reference points of the different alternative frameworks.

Yellowtail flounder Div. 3LNO. This stock is currently assessed using a Schaefer surplus production model in a Bayesian framework and aging data is not available for the stock. B_{lim} = 30% B_{msy} and F_{lim}=F_{msy} have been adopted by SC as limit reference points for this stock (STACFIS 2004). The last full assessment was in 2021 (SCR 21/018). The three alternative frameworks were presented by DE showed the stock trajectory (1969-2020) with the following additional reference points:

- Alternative framework 1. B_{buffer}=2*B_{lim} and several options for F_{target} (Ftarget =F near MSY, 85% F_{msy} and 80% F_{msy})
- Alternative framework 2. $B_{trigger}$=0.8*B_{msy} and the same options for F_{target} as in option 1.
- Alternative framework 3. B_{buffer}=2*B_{lim}, $B_{trigger}$=0.8*B_{msy} and several options for F_{target} as in 1 and 2.

The PA-WG agreed, based on the discussions and agreements under the point 2 and 3 of the agenda, that for this stock, reference points shown in the alternative frameworks will be the following:

- B_{lim} = 30% B_{msy}
- F_{lim}= F_{msy}
- $B_{trigger}$ =0.8 B_{msy}
- F_{target} both based on the risk (40%) to be above Fmsy and 75% F_{msy} will be shown
- B_{buffer} for alternative framework Option 1 will be B_{bisr}=2*B_{lim}
- B_{buffer} for alternative framework Option 3; two values for will be shown, the average of $B_{trigger}$ and B_{lim} as well as the risk (10%) of be bellow B_{lim}

Cod Div. 3M. This stock is currently assessed using a Statistical Catch at Age model (SCAA). B_{lim} = $B_{recovery}$ = SSB_{2007} and F_{lim}=$F_{30\%SPR}$ have been adopted by SC as reference points for this stock. The last full assessment was in 2022 (SCR 22/25). The three alternative frameworks showed the stock trajectory (1988-2021) with the following additional reference points estimated with different models were presented by the DE:

- Alternative framework 1. B_{buffer}=2*B_{lim} and F_{target}=$F_{40\%SPR}$
- Alternative framework 2. $B_{trigger}$=0.8*B_{msy} and F_{target}=$F_{40\%SPR}$.
- Alternative framework 3. B_{buffer}=2*B_{lim}, $B_{trigger}$=0.8*B_{msy} and F_{target}=$F_{40\%SPR}$.

Since MSY RP have been estimated using Surplus Production Models, it has been observed that these RP should not be directly compared to those obtained using the age structured model, so the procedure to make them comparable will be explored and applied.

- The PA-WG set, based on the discussions and agreements under the point 2 and 3 of the agenda, that for this stock, reference points shown in the alternative frameworks will be the following:
- B_{lim} = $B_{recover}$=SSB_{2007},
- F_{lim} = $F_{30\%SPR}$
- $B_{trigger}$ = 0.8*B_{msy}
- F_{target} = both $F_{40\%SPR}$ and based on the risk (40%) to be above F_{msy} will be show;
- B_{buffer} for alternative framework Option1 = B_{bisr} = 2*B_{lim}
- B_{buffer} for alternative framework Option 3 two values will be shown, the average of $B_{trigger}$ and B_{lim} as well as the risk (10%) of be bellow B_{lim}.

Redfish Div. 3M. This stock is currently assessed using an Extended Survival Analysis model (XSA), the last full assessment was in 2021 (SCR Doc 21/034).

In order to estimate the MSY biological reference points for this stock the results from the conducted exploratory analysis have been presented. Two different approaches have been used from the following R-packages: (i) EQSIM and (ii) FLBRP.

On the two approaches [(i) and (ii)] different types of stock-recruitment models have been tested, i.e. Ricker, segmented regression, smooth Hockey stick and Beverton and Holt. During the simulations, also different conditions have been tested, by changing the following variables: the plus group; by removing the recruitment "outliers" points from the data; by reducing the length of data considered to fit the model; the assessment error in the advisory year; and the autocorrelation in assessment error in the advisory year.

The comparison of the estimates obtained by the two approaches with the F reference points estimated from the XSA and used on the stock projections, shows that the estimations obtained by the approach (ii) are more in line with those numbers.

Notwithstanding, the biological reference points estimated with the two approaches are not considered adequate, due to the weak stock-recruitment model fitting.

The proposal is to estimate the MSY biological reference points by applying the production models adjusted to the biomass estimated in the last assessment, by following the same approach as in cod case.

No agreement was reached on the reference points that should be used in the alternative frameworks. The group decision was that until May, more work would be done between the DEs and the external experts to see a possible reference points proposal to use in the alternative frameworks.

5. Next steps

It was agreed that the DEs and co-chairs will continue to work to finalize the case studies. The last approved assessment will be used in all cases. A further meeting will be scheduled after the end of March to finalize the decisions.

The alternative frameworks and management action tables will be presented to WG-RBMS in April.

6. Other matters

No other matters were discussed.

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APPENDIX I. MEETING AGENDA

NAFO Precautionary Approach Working Group (PA-WG)

February 28, 2023, by WebEx

Co-chairs; Fernando González-Costas and Steve Cadrin

Draft Agenda

1. Opening.
   1.1. Appointment of Rapporteurs.
   1.2. Adoption of Agenda
2. Progress in the development of the three alternative PA Frameworks.

   At the meeting on December 1, it was agreed to develop three alternative frameworks and their main features. These Frameworks have already been agreed upon and the table of management measures associated with each framework has yet to be finalized. These frameworks are collected in a working paper that is available in the share point and has been distributed among the participants.

3. Ranking the possible proxies for the different Limit Reference Points.

   It was agreed at the December 2022 meeting that this ranking would be finalized and discussed at the end of February 2023. The possible proxies for the different LRPs have been included in a Working Paper available in the share point, which would have to be ordered according to their convenience.

4. Possible proxies of the LRPs of the three stocks chosen as case studies.

   These proxies are collected in a working paper available in the share point and it would be necessary to decide for each case which of them is used to implement the alternative frameworks.

5. Next steps

   It would be necessary to decide the steps to follow before the RBMS meeting on April 18-20,2023. At this meeting we should, at least, present the complete alternative PA frameworks to discuss them with the managers in case they want to change something about them. (structure, table of management measures, possible levels of acceptable risk, etc.)

6. Other matters

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