Annex 1. Elements of Discussion for Projection Scenarios

The following elements will be considered to draft recovery target scenarios in order that enough details are provided so that it removes uncertainty on what has to be done.

1. To model population trajectory, we need to specify population conditions (recruitment, growth, maturation, natural mortality). We need to define only one set of conditions that would have reasonable chances to represent current and future realities. It is proposed to use conditions prevailing since the early 1990s up to now because it starts with the middle point of the best datasets (last 30 years) and covers a period that is long enough to capture a variety of environmental and species conditions that have prevailed over the recent past, without counting on series of exceptional years that have occurred between the 60's and mid-80's. This period would also be long enough so the absence of data for some years for some stocks should not have a strong impact on the range and average of parameter values. As much as possible, the time period should be the same across stocks within a given DU.

   If a different time period is to be used for a given stock, a strong rationale should be provided.

2. Projection horizon
   - Given that the COSEWIC/IUCN decline "A" criterion make reference to 10 years or 3 generations whichever is longer, projections should expand over at least 3 American Plaice generations.1 Generation time is defined as the average age of parents in a population, the maximum length of this time period for all stocks is 16 years. American Plaice generation time is meant to be estimated in such as way that it reflects pre-fished states by adding the 'typical' age at first maturity (age at 50% maturity) observed as long ago as we have data for (for each stock of American Plaice) and then adding to that age the value of (1/M), where M is the instantaneous rate of natural mortality (M=0.2).

   - Projections could all go to 2058 (48 years from now) so that there is enough of a time span to evaluate progress against wide range of possible targets for all stocks/DUs (see below), but see first bullet under #3 below. The projection could be adapted and the information presented in a way that shows the end of 48 year timeline horizon as well as the timeline horizon for their particular stock generation time series (3 generations)

3. Possible population targets to measure progress against it and likelihood of success using projections according to the scenarios regarding fishing mortality (see #4 below)

   <u>SARA Targets:</u>

   To satisfy COSEWIC's assessment criteria to declare that a species is not threatened (or of it becomes special concern), i.e. that it does not require a SARA recovery strategy.

1 The A1 and A2 subcriteria apply to decline within last 3 generations. It may be that for a given stock/DU, the population has been stable for 2 generations already, and stability for another generation would be sufficient for the stock/DU to surpass the threatened category threshold as it pertains to decline in number of mature individuals. Nevertheless, it is suggested that projections for all stocks and DU cover at least the next 3 generations.

This can be done using Criterion “A” rate of decline in total number of mature individuals thresholds (see Table 1 below). By default, this is normally what should be done at a minimum.

Management Targets:

Use the limit reference point from the PA framework as a target for rebuilding, where available. This corresponds to $B_{lim.}$

4. Possible Scenarios for Fishing Mortality (natural and human induced):

The fishing mortality scenarios will be different depending on the DUs. It should also be noted that Economics will need to provide input as they will need to determine specific activities on specific fleets for each DU. Economics would determine the most cost-effective way to find reductions in mortality. Therefore, there needs to be a back and forth between biologists and economics. It was determined that Science could start modelling scenarios for option a, b, and c below, but will also model “d”, a pre-specified reduction from current level of fishing mortality from all sources, that will be determined at the DU level by managers in each region:

a. Natural mortality only (100% reduction in human induced mortality)
b. Natural mortality and recent level of human induced mortality (0% reduction in human induced mortality) through fishing operations (bycatch from other directed fishing, discards, directed). Need to define “recent”: e.g. last 3 years (depends on stock and availability of data)
c. Natural mortality and only fishing mortality from by-catch and discards. This implies no directed fishing and would be useful to model for stocks under moratorium or for stocks where there is a possibility of a closure on directed fishing (depends on stock and data availability)
d. Pre-specified reduction from current level of fishing mortality from all sources (e.g. 50% reduction in human induced mortality). Science will, by default, model projection scenarios based on 100% reduction rate in human induced mortality (no fishing). This will be covered under “a.” above, but for each DU, Management will also need to determine other reduction rate(s) that are in line what they think is achievable from a management perspective. This(ese) reduction rate(s) will need to be identified in each of the Regions in advance of the RPA meeting so that Science is able to run the this through the projection trajectory model for each DU.

5. Displaying results

a. Projections, if possible, should be made based on number of mature individuals as well as biomass of spawners, over appropriate time periods as specified above.

and

b. Results should be displayed in terms of probability of achieving the set targets and describing uncertainties.

Table 1: COSEWIC Quantitative Criterion A

Indicator	Endangered	Threatened
A. Decline in Total Number of Mature Individuals		
A1. An observed, estimated, inferred or suspected reduction in total number of mature individuals over the last 10 years or 3 generations, whichever is the longer, where the causes of the reduction are: clearly reversible **and** understood **and** ceased, based on (and specifying) any of the following: (a) direct observation (b) an index of abundance appropriate to the taxon (c) a decline in index of area of occupancy, extent of occurrence and/or quality of habitat (d) actual or potential levels of exploitation (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.	Reduction of ≥ 70%	Reduction of ≥ 50%
A2. An observed, estimated, inferred or suspected reduction in total number of mature individuals over the last 10 years or 3 generations, whichever is the longer, where the reduction or its causes may not have ceased **or** may not be understood **or** may not be reversible, based on (and specifying) any of (a) to (e) under A1.	Reduction of ≥ 50%	Reduction of ≥ 30%
A3. A reduction in total number of mature individuals, projected or suspected to be met within the next 10 years or 3 generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.	Reduction of ≥ 50%	Reduction of ≥ 30%
A4. An observed, estimated, inferred, projected or suspected reduction in total number of mature individuals over any 10 year or 3 generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased **or** may not be understood **or** may not be reversible, based on (and specifying) any of (a) to (e) under A1.	Reduction of ≥ 50%	Reduction of ≥ 30%