



Goals, Objectives, and Performance Metrics for the IPHC Management Strategy Evaluation (MSE)

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PURPOSE

To review the Management Strategy Advisory Board (MSAB) goals and objectives used in the Management Strategy Evaluation (MSE). This includes the consideration of coastwide objectives related to overall scale and objectives related to distributing the TCEY. Link goals and objectives with performance metrics, and define a set of performance metrics to use for evaluating and ranking management procedures.

1 INTRODUCTION

Defining goals and objectives is a necessary part of a management strategy evaluation (MSE) which should be revisited often to make sure that they are inclusive and relevant. The MSAB currently has four goals with multiple objectives for each. The four goals, and primary general objectives for each are

- biological sustainability,
 - keep biomass above a limit to avoid critical stock sizes
- optimize directed fishing opportunities,
 - limit catch variability
 - maximize directed fishing yield
- minimize discard mortality, and
- minimize bycatch and bycatch mortality.

The goal previously called “fishery sustainability, access, and stability” was refined to be “optimize directed fishing opportunities” to better reflect the desires of the directed fishery. It is felt that the goal is to optimize fishery yield with respect to stability and sustainability and optimizing the fishing opportunities ensures access. The discard and bycatch goals have not been specifically considered in the MSE but are identified as important goals to consider in the future.

Performance metrics have also been developed from these objectives by defining a measurable outcome, a tolerance (i.e., level of risk), and time-frame over which it is desired to achieve that outcome. Objectives that do not have all of these elements specified and are not framed as a probability are labeled as “statistics of interest.”

Primary objectives were identified by the MSAB and Commission for evaluation of MSE results related to coastwide fishing intensity and presented at AM095. Associated performance metrics were also presented (Table 1). The biological sustainability objective (SB_{Lim}) must be met before evaluating the fishery stability objective (Average, Annual Variability; AAV), which must be met before evaluating the fishery yield objective (maximize the TCEY).

Table 1: Primary measurable objectives used for evaluation of MSE results for coastwide fishing intensity presented at AM095.

GENERAL OBJECTIVE	MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE	PERFORMANCE METRIC
1.1. KEEP BIOMASS ABOVE A LIMIT TO AVOID CRITICAL STOCK SIZES Biomass Limit	Maintain a minimum female spawning stock biomass above a biomass limit reference point at least 90% of the time	$SB < \text{Spawning Biomass Limit } (SB_{Lim})$ $SB_{Lim}=20\%$ spawning biomass	Long-term	0.10	$P(SB < SB_{Lim})$
2.1. LIMIT CATCH VARIABILITY	Limit annual changes in the coastwide TCEY	Average Annual Variability (AAV) > 15%	Short-term	0.25	$P(AAV > 15\%)$
2.2. MAXIMIZE DIRECTED FISHING YIELD	Maximize average TCEY coastwide	Median coastwide TCEY	Short-term	STATISTIC OF INTEREST	Median \overline{TCEY}

SB = dynamic relative (unfished equilibrium) spawning biomass, also noted as dRSB.

Short-term: immediate future 3 years (metrics reported for each year)

Long-term: time period needed to represent equilibrium conditions, i.e., 100+ time-steps (metrics reported for the last 10 time-steps of the long term time period)

P(): Probability (times out of 100) that the event occurs

Statistic of Interest: A metric that will be reported, but is not to be evaluated as meeting a specific criteria.

Additional performance metrics, linked to objectives, were also reported and evaluated at MSAB012 (Appendix I). These metrics were secondary and helped to interpret the results and understand trade-offs. The online [MSE Explorer Tool](#) assisted in compare performance metrics across various management procedures.

The following paragraphs from the AM095 report are pertinent to objectives.

AM095-R, para 59a. The Commission **ENDORSED** the primary objectives and associated performance metrics used to evaluate management procedures in the MSE process (as detailed in paper IPHC-2019-AM095-12)

AM095-R, para 59c. The Commission **RECOMMENDED** the MSAB develop the following additional objective, as well as prioritize this objective in the evaluation of management procedures, for the Commission's consideration.

- i. A conservation objective that meets a spawning biomass target.

The recommendation in paragraph 59c will be discussed in Sections 2.1 and 5.

There are two major components of the harvest strategy: coastwide scale and TCEY distribution (Figure 1). The MSE has recently focused on coastwide scale with an input fishing mortality rate (F_{SPR}) determining the total coastwide mortality, thus objectives have focused on coastwide scale. The MSE program of work is now focusing on both components and will define coastwide objectives as well as distributional objectives (area specific objectives).

In this document, we first present the MSAB defined objectives related to coastwide scale, and performance metrics linked to those objectives. This is followed by a discussion of potential additional scale objectives. We then present

the distribution objectives defined by the MSAB ad-hoc working group (para 20, IPHC-2018-MSAB011-R) and proposed by the U.S.A. Commissioners at IM093, and continue with a general discussion of distribution objectives.

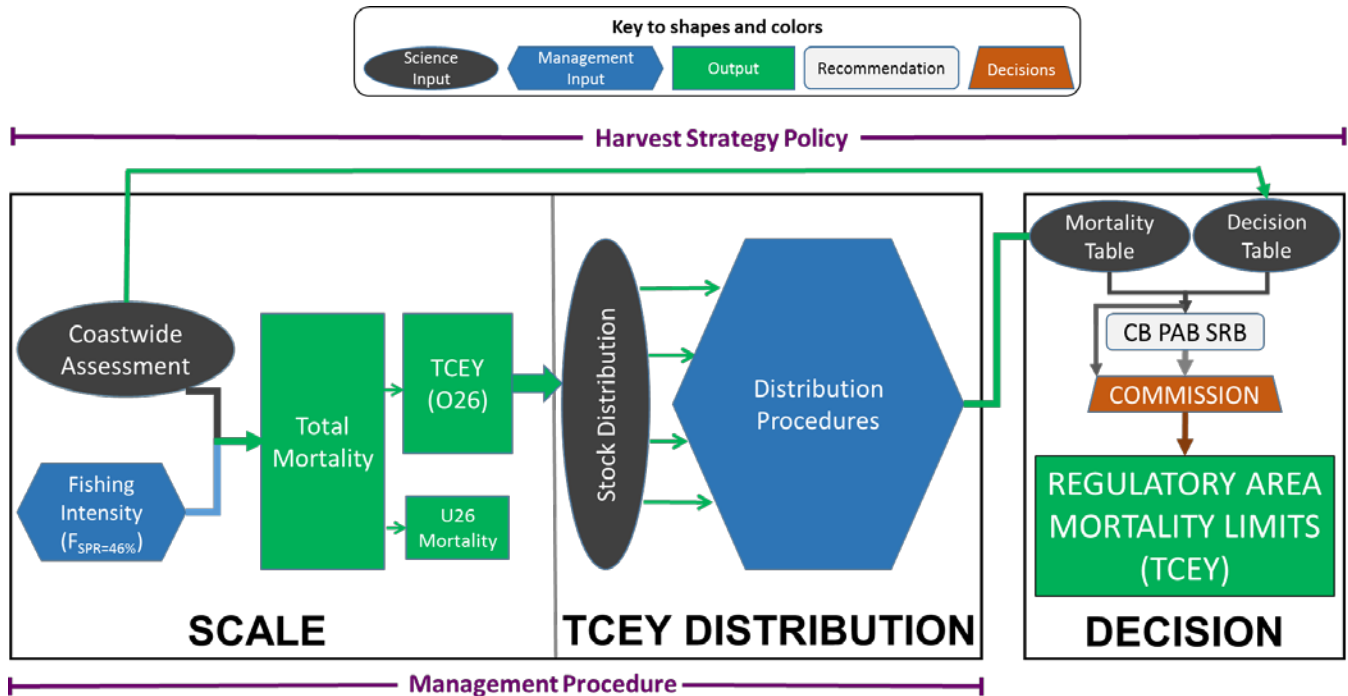


Figure 1: An illustration of the IPHC harvest strategy policy showing the coastwide scale and TCEY distribution components which make up the management procedure. The decision step is the Commission decision-making procedure, which considers inputs from many sources.

2 MSAB GOALS AND OBJECTIVES RELATED TO COASTWIDE SCALE

As shown in Table 1, three primary coastwide objectives have been defined and used to evaluate MSE results. Many more objectives and performance metrics have also been identified (Appendix I) which are used to further evaluate the MSE results when necessary.

The ad-hoc working group, consisting of Peggy Parker, Chris Sporer, Dan Falvey, and Michelle Culver from the MSAB (Glenn Merrill was not available), and Allan Hicks and Steve Keith from IPHC Secretariat met via webinar on June 26 to discuss and refine the MSAB goals and objectives. Subsequent email exchanges occurred before presenting those goals and objectives at MSAB012, where further refinements were implemented. The four goals were retained (Section 1) and the focus of the refinements was on identifying the main objectives, phrasing them in a useful manner, classifying them as primary or secondary, and defining a performance metric. For each goal there are general objectives, which are broad and aspirational. Measurable objective(s) are related to these general objectives, and where possibly a measurable outcome, time-frame, and tolerance are defined. A performance metric is then linked to each measurable objective. Some objectives are measurable, but a tolerance is not defined. These objectives are informational in that they are useful to consider, but do not have a probability or risk associated with them. They can help to identify some of the properties of a management procedure and may be used to discriminate between a smaller set of management procedures. For example, the median catch and which management procedures result in greater median catch is often useful.

The Commission identified 3 primary objectives as well. A single biological sustainability objective and a catch stability objective matched with MSAB objectives. The Commission also identified the objective of maintaining

catch above an undefined level with an undefined tolerance. Without definitions of the measurable objective and the tolerance, it was not possible to use this objective in the evaluation of the MSE results.

2.1 ADDITIONAL OBJECTIVES TO EVALUATE COASTWIDE SCALE

In addition to defining a measurable objective, time-frame, and tolerance for a threshold catch level, additional objectives related to coastwide scale may be useful to identify. The recommendation from MSAB012 was a range of SPR values between 40% and 46% identifying 42% or 43% as a target value. Unfortunately, none of the management procedures presented at MSAB012 satisfied the catch variability objective (maintain the AAV less than 15% with a 75% probability), thus no specific management procedure could be chosen as satisfying all primary objectives. However, the range of SPR's evaluated showed increasing catch variability at lower SPR values, and a faster rate of increase when SPR was less than 40%. Additionally, there was a sentiment that the relative spawning biomass (stock status) should generally not be less than 40%, and SPR values around 46% generally kept the relative spawning biomass near or above 40%.

This evaluation based on the target biomass was an objective that has not been specifically stated and identified as a primary objective. It would be worth exploring this unstated objective to determine what the actual measurable objective is. It may be an objective to maintain a current stock status above 40%. Or, it may be an objective related to fishery performance in that a higher stock status results in higher catch rates (although this has not been explicitly linked). This objective should be discussed and stated as a primary objective to aid in choosing a management procedure that is consistent with the MSAB012 recommendation. Section 5 on consistency within the harvest policy and how specification of a target stock status will determine the SPR may be useful to consider in this discussion.

3 MSAB GOALS AND OBJECTIVES RELATED TO DISTRIBUTION OF THE TCEY

3.1 BIOLOGICAL SUSTAINABILITY

Paragraph 30 of IPHC-2018-SRB012-R stated that “[t]he SRB ... recognized that biocomplexity is not an appropriate concept because it is poorly defined and not understood for Pacific halibut, especially over large spatial scales. Further, the terms “preserve” and “preservation” should be “conserve” and “conservation” as most fisheries management is about conservation.” However, in paragraph 31 of IPHC-2018-SRB012-R, “the SRB AGREED that the defined Bioregions (i.e. 2,3,4, and 4b described in paper IPHC-2018-SRB012-08) are presently the best option for implementing a precautionary approach given uncertainty about spatial population structure and dynamics of Pacific halibut.” Therefore, objectives should be defined that relate to conserving some level of spatial population structure, and these can be included under the Biological Sustainability goal. Given the uncertainty about spatial population structure and dynamics of Pacific halibut, these objectives may be more difficult to define. The ad-hoc working group that met in 2018 to discuss objectives did not address spatial biomass objectives beyond identifying a general objective to conserve spatial population structure.

Conserving spatial population structure may mean several different things. It may mean maintaining the current distribution across regions, or maintaining the proportion of spawning biomass in each Region within a specified range, or maintaining a minimum spawning biomass or proportion of spawning biomass in a Region. Multiple measurable objectives may be defined for the general objective. However, based on current knowledge, conserving spatial population structure should relate to the broad Biological Regions currently defined and not necessarily to the finer spatial definition of IPHC Regulatory Areas.

3.2 OPTIMIZE DIRECTED FISHING OPPORTUNITIES

Three general objectives are currently defined for this goal: 1) limit catch variability, 2) maximize directed fishery yield, and 3) minimize potential for no catch limit for the directed commercial fishery. Under each general objective, there are coastwide TCEY measurable objectives and the ad hoc working group identified potential measurable objectives specific to IPHC Regulatory Area, which are mostly based off the coastwide measurable objectives. Biological region was the appropriate spatial scale for the biological sustainability goal, but fishery objectives are related to IPHC Regulatory Areas because quotas are distributed to these areas and those areas are of interest to a quota holder. A finer spatial scale may be important to individual fishers and may be considered in future evaluations.

It is easy to translate coastwide objectives into area-specific objectives, but additional objectives will be important to IPHC Regulatory Areas and not all areas will have the same objectives. For example, the coastwide objective to avoid a change in the TCEY greater than 15% with a 25% tolerance can easily be applied to IPHC Regulatory Areas. However, specific areas may want to identify objectives that are important to that stakeholder group. For example, AM095 identified two potential measurable objectives for IPHC Regulatory Areas 2A and 2B. IPHC Regulatory Area 2A appears to desire a TCEY of 1.65 Milbs and IPHC Regulatory Area 2B appears to desire a specific percentage of the coastwide TCEY (17.7% was calculated for 2019 catch limits based on a 70% weight given to the recent historical share of 20% and a 30% weight given to the proportion calculated in the current interim harvest strategy). These objectives could be translated into performance metrics for evaluation or may be formulated directly in a management procedure. For now, a few objectives specific to IPHC Regulatory Area are identified (Appendix II) and others should be defined at MSAB meetings in 2019.

3.3 COMMISSION INPUT ON OBJECTIVES RELATED TO DISTRIBUTING THE TCEY

The Commission did not provide any specific input on area-specific objectives at AM095, but some guidance was provided at AM094 including a list proposed by U.S. Commissioners of possible objectives related to distributing the TCEY. The following paragraphs from AM094 are pertinent to distribution objectives.

AM094-R, para 32. The Commission **NOTED** the current fishery goals, objectives, and performance metrics identified by the MSAB for the MSE process, as detailed in Appendix IV of the MSAB10 report (IPHC-2017-MSAB10-R).

AM094-R, para 33. The Commission **NOTED** the summary presentation which was in response to Circular IPHC-2017-CR022 requesting stakeholder feedback on objectives proposed by a USA Commissioner related to distributing the TCEY presented at IM093. These objectives were categorized under the overarching goals defined by the MSAB for AM094.

AM094-R, para 34. The Commission **NOTED** the other concepts proposed by a USA Commissioner related to distributing the TCEY were not stated as measurable objectives but may be useful when developing management procedures to evaluate.

AM094-R, para 35. The Commission **NOTED** that:

- a) the Commission objectives related to distributing the TCEY may be presented at MSAB11 for further stakeholder feedback.
- b) the intent of the “other Commission concepts” could be further clarified and incorporated into the MSAB process, and can be converted to measurable objectives.
- c) the MSAB may develop measurable outcomes and performance metrics associated with these Commission objectives.

AM094-R, para 37. The Commission **REQUESTED** that the objectives related to distributing the TCEY, as detailed in Circular IPHC-2017-CR022, be presented at MSAB11 for further stakeholder feedback.

The guidance from Commissioners had one request: that the objectives outlined in IPHC-2017-CR022 be presented at MSAB11 for discussion (IPHC-2018-AM094-R, para 37). These are the objectives related to distribution that were proposed by U.S. Commissioners and are shown in Table 2. This table also shows response of the MSAB at MSAB011 to each objective. The MSAB felt that two of the objectives are already covered in the current objectives, one should be dropped because it is not pertinent to the current MSE work, and more discussion is needed for the others. These proposed objectives may be a useful starting point for defining measurable objectives related to distributing the TCEY.

Table 2. Pacific halibut TCEY distribution goals and objectives presented by U.S.A. Commissioners at IM093. Table reproduced from IPHC-2017-IM093-R. The column labeled MSAB011 shows the response of the MSAB at MSAB011 to each objective.

Goal	Objective	MSAB011
Biological sustainability: Preserving bio-complexity	1. Maintaining diversity in the population across IPHC Regulatory Areas.	More discussion
	2. Prevent local depletion at IPHC Regulatory Area scale.	More discussion
Fisheries Sustainability: Maintain access and serve consumer needs.	1. Maintain commercial, recreational and subsistence fishing opportunities in each IPHC Regulatory Area.	Covered
	2. Maintain processing opportunities in each IPHC Regulatory Area.	Dropped
Fisheries Sustainability: Maximize yield by regulatory area	1. Distribution is responsive to IPHC Regulatory Area abundance trends and stock characteristics (ex. Fishery WPUE, age structure, size at age etc.).	More discussion
	2. Distribution is responsive to management precision in each IPHC Regulatory Area.	More discussion
	3. Minimize impact on downstream migration areas.	More discussion
	4. Minimize discard mortality and bycatch.	Parking lot
Fisheries Sustainability: Minimize variability,	1. Limit annual TCEY variability due to stock distribution in both time and scale.	Covered
	2. Avoid zero sum distribution policy.	More discussion



4 POTENTIAL OBJECTIVES RELATED TO DISTRIBUTING THE TCEY

Given past discussions at MSAB meetings, the objectives proposed by U.S. Commissioners (Table 2), and some brainstorming, the following potential distribution objectives were identified and may be a useful start to defining a set of distribution objectives agreed upon by the MSAB.

GOAL: Biological Sustainability

GENERAL OBJECTIVE	MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE	PERFORMANCE METRIC
<i>CONSERVE SPATIAL POPULATION STRUCTURE</i>	Maintain a proportion of O26 Pacific halibut in each Biological Region within the range observed by the IPHC fishery-independent setline survey		Long-term		
	Maintain a defined minimum proportion of spawning biomass in each Biological Region		Long-term		
	Proportion of O26 Pacific halibut biomass in each Biological Region		Long-term	<i>STATISTIC OF INTEREST</i>	
	Proportion of Pacific halibut spawning biomass in each Biological Region		Long-term	<i>STATISTIC OF INTEREST</i>	

GOAL: Optimize directed fishing opportunities.

GENERAL OBJECTIVE	MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE	PERFORMANCE METRIC
2.1. LIMIT CATCH VARIABILITY	Limit annual changes in the TCEY for each Regulatory Area	Average Annual Variability by Regulatory Area (AAV _A) > 15%	Long-term	0.25	$P(AAV > 15\%)$
		AAV _A	Long-term	<i>STATISTIC OF INTEREST</i>	<i>AAV and variability</i>
		Change in TCEY by Regulatory Area > 15% in any year	Short-term	<i>STATISTIC OF INTEREST</i>	$\frac{TCEY_{i+1} - TCEY_i}{TCEY_i}$
2.2. MAXIMIZE DIRECTED FISHING YIELD	Maximize average TCEY by Regulatory Area	Median coastwide TCEY	Long-term Short-term	<i>STATISTIC OF INTEREST</i>	<i>Median \overline{TCEY}</i>
	Maintain TCEY above a minimum level by Regulatory Area	$TCEY_A < TCEY_{A,min}$	Long-term Short-term	?? ??	$P(TCEY < TCEY_{A,min})$
	Maximize high yield (TCEY) opportunities by Regulatory Area	$TCEY_A > XX \text{ Mlbs}$	Long-term Short-term	<i>STATISTIC OF INTEREST</i>	$P(TCEY < 50.6 \text{ Mlbs})$
	Present the range of TCEY by Regulatory Area that would be expected	Range of TCEY by Regulatory Area	Long-term Short-term	<i>STATISTIC OF INTEREST</i>	<i>5th and 75th percentiles of TCEY</i>

Average Annual Variability (AAV): The average percentage change in TCEY from year to year. Note, that the TCEY may change by a higher percentage or a lower percentage, but would be this value on average.

Fishery trigger (SB_{Trig}): The value that triggers a reduction in fishing intensity when the stock is estimated to be below this spawning biomass

“On the ramp”: The state of reduced fishing intensity because the biomass is estimated to be below the fishery trigger. The “ramp” refers to the reduction of fishing intensity in the harvest control rule.

TCEY: For the coastwide operating model this is the sum of commercial landings, commercial discard mortality, recreational mortality, and subsistence mortality.



5 CONSIDERATIONS FOR THE DEVELOPMENT OF OBJECTIVES AND MANAGEMENT PROCEDURES

A harvest policy should be internally consistent, meaning that the reference points defined should have mathematically defined relationships with each other. For example, if an objective was to fish at a level that resulted in Maximum Sustainable Yield (MSY), the harvest policy should define either a fishing mortality that would result in MSY, or an MSY that would determine a fishing mortality rate (F_{MSY}), because one leads to the other. Independently defining both reference points will likely result in inconsistencies and difficulty in meeting objectives. The harvest policies of many fisheries management agencies define a proxy target fishing mortality rate, a proxy biomass target, and a harvest control rule that reduces fishing intensity at low biomass levels (a biomass trigger). However, defining two of these quantities determines the third. For example, defining the proxy fishing mortality rate and a harvest control rule will determine the target biomass (the median biomass expected to be achieved).

A similar point can be made with respect to conservation objectives. A very important conservation objective for fisheries management is to avoid low stock sizes that may result in a lack of sustainability for the stock. Therefore, the main objective related to biological sustainability should be to avoid a minimum stock size with a high probability (many harvest policies use a biomass limit of 20% of B_0 and a probability of 90% to be above that biomass limit). A second conservation objective for a biomass threshold (an upper reference point) can be defined but is not necessary because reporting the biomass target that would be achieved (along with fishery objectives related to stability and yield) would be sufficient to determine an appropriate harvest control rule while minimizing the risk of very low stock sizes. Defining a limit and a threshold to achieve will likely result in one being met before the other, thus making one moot. A single measurable conservation objective related to avoiding a biomass limit is all that needs to be defined as an objective.

For simplicity and the reasons noted above, the ad-hoc working group suggested moving to a single conservation objective related to avoiding a biomass limit: to maintain a minimum female spawning stock biomass above a biomass limit reference point ($SB_{Lim}=20\%$ spawning biomass) at least 90% of the time. The management procedure is a harvest control rule defined by a fishing mortality related to SPR (F_{SPR}), an upper control point (i.e., fishery trigger), and a lower control point (i.e., fishery limit). The biomass limit reference point is also serving as the lower control point of the harvest control rule, although the biomass limit and fishery limit can be defined independently.

Recommendation 59c from the AM095 report (develop a conservation objective that meets a spawning biomass target) is the third and dependent reference point since an F_{SPR} and a control rule are being developed. For example, Table 3 shows the resulting median relative spawning biomass that results from different F_{SPR} values and three control rules when using the coastwide MSE simulations. If a spawning biomass target is defined as the dynamic relative spawning biomass that results in 50% of the simulations being above and 50% being below (i.e., the median) then Table 3 can be used to determine the management procedure (subject to achieving all other primary objectives).

Table 3: Median dynamic relative spawning biomass for different values of SPR and three different control rules.

CR	SPR													
	0.56	0.54	0.52	0.50	0.48	0.46	0.44	0.42	0.40	0.38	0.36	0.34	0.32	0.30
40:20	50.7	48.8	47.0	45.4	43.9	42.6	41.5	40.4	39.5	38.6	37.8	37.1	36.4	35.8
30:20	50.2	48.0	45.9	43.7	41.6	39.7	37.9	36.4	35.1	33.9	32.9	31.8	31.0	30.4
25:10	50.3				41.5	39.4	37.3	35.3	33.4	31.6	29.9	28.6	27.5	26.5

6 RECOMMENDATION/S

That the MSAB:

- 1) **NOTE** paper IPHC-2019-MSAB013-07 which provides a review of the goals and objectives previously defined by the MSAB and refined by the MSAB ad-hoc working group, associated performance metrics, and outcomes of AM095 as they relate to objectives.
- 2) **CONSIDER** the current MSAB goals, measurable objectives and associated performance metrics, and the identification of primary objectives (Table 1).
- 3) **CONSIDER** the additional objectives and statistics of interest to supplement the evaluation of management procedures (Appendix I).
- 4) **RECOMMEND** an objective related to maintaining catch above a specific level with definitions of a measurable objective (the catch level) and a tolerance (an acceptable probability of dropping below this catch).
- 5) **RECOMMEND** a measurable conservation objective to meet a spawning biomass target or an objective that captures the intent.
- 6) **RECOMMEND** distribution objectives for evaluation of the Scale and Distribution components of the harvest strategy policy.
- 7) **RECOMMEND** a practical set of performance metrics, including statistic of interest, to report for the evaluation of future simulations.
- 8) **SUGGEST** methods (e.g. tables and figures) to report the performance metrics listed here for the evaluation of future results from the simulations.

7 ADDITIONAL DOCUMENTATION / REFERENCES

- IPHC. 2017. Management Strategy Evaluation Goals and Objectives. 18 December 2017. IPHC Circular 2017-022. <https://iphc.int/library/documents/circulars/management-strategy-evaluationmse-goals-and-objectives> 2pp
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- IPHC. 2018. Report of the 12th Session of the IPHC Scientific Review Board (SRB012). Seattle, Washington, United States of America, 19-21 June 2018. IPHC-2018-SRB012-R. <https://iphc.int/uploads/pdf/srb/srb012/iphc-2018-srb012-r.pdf> 17 pp.

8 APPENDICES

- I. Additional objectives and associated performance metrics



APPENDIX I: ADDITIONAL OBJECTIVES AND ASSOCIATED PERFORMANCE METRICS

GOAL: Biological Sustainability

GENERAL OBJECTIVE	MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE	PERFORMANCE METRIC
<i>REPORT A METRIC THAT IS BASED ON NUMBERS OF PACIFIC HALIBUT</i>	<i>An absolute measure</i>	<i>Number of mature female halibut</i>	<i>Long-term</i>	<i>STATISTIC OF INTEREST</i>	<i>Median Number of Mature Females</i>
<i>REPORT A METRIC INDICATING THE SPAWNING BIOMASS EXPECTED TO BE ABOVE 50% OF THE TIME (I.E., AN IMPLIED TARGET)</i>	<i>An absolute measure</i>	<i>Spawning Biomass</i>	<i>Long-term</i>	<i>STATISTIC OF INTEREST</i>	<i>Median \overline{SB}</i>
<i>REPORT A METRIC THAT GIVES AN INDICATION HOW OFTEN THE BIOMASS IS BELOW THE FISHERY TRIGGER</i>	<i>Maintain a biomass that is above the biomass limit and not on the ramp a high percentage of the time</i>	<i>B < Spawning Biomass Limit (Fishery Trigger)</i> <i>Fishery Trigger=30% spawning biomass</i>	<i>Long-term</i>	<i>STATISTIC OF INTEREST</i>	<i>P(SB < Fish_{Trig})</i>
<i>CONSERVE SPATIAL POPULATION STRUCTURE</i>					

SB = dynamic relative (unfished equilibrium) spawning biomass, also noted as dRSB.

Short-term: immediate future 3 years (metrics reported for each year)

Long-term: time period needed to represent equilibrium conditions, i.e., 100+ time-steps (metrics reported for the last 10 time-steps of the long term time period)

P(): Probability (times out of 100) that the event occurs

Statistic of Interest: A metric that will be reported, but is not to be evaluated as meeting a specific criteria.

GOAL: Optimize directed fishing opportunities.

GENERAL OBJECTIVE	MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE	PERFORMANCE METRIC
2.1. LIMIT CATCH VARIABILITY	Limit annual changes in the coastwide TCEY	AAV	Long-term	STATISTIC OF INTEREST	AAV and variability
		Change in TCEY > 15% in any year	Short-term	STATISTIC OF INTEREST	$\frac{TCEY_{i+1} - TCEY_i}{TCEY_i}$
	Limit annual changes in the TCEY for each Regulatory Area	Average Annual Variability by Regulatory Area (AAV _A) > 15%	Long-term	0.25	$P(AAV > 15\%)$
		AAV _A	Long-term	STATISTIC OF INTEREST	AAV and variability
		Change in TCEY by Regulatory Area > 15% in any year	Short-term	STATISTIC OF INTEREST	$\frac{TCEY_{i+1} - TCEY_i}{TCEY_i}$
		AAV while on the ramp	Long-term	STATISTIC OF INTEREST	AAV given estimated SB < SB _{Trig}
	Gain insight into the additional variability in the TCEY when on the ramp	Percent of time “on the ramp” (estimated stock status is below the fishery trigger; SB _{trig})	Long-term	STATISTIC OF INTEREST	$P(\widehat{SB} < SB_{Trig})$
		SB _{Trig} to be evaluated (e.g., 30% or 40%)			

Average Annual Variability (AAV): The average percentage change in TCEY from year to year. Note, that the TCEY may change by a higher percentage or a lower percentage, but would be this value on average.

Fishery trigger (SB_{Trig}): The value that triggers a reduction in fishing intensity when the stock is estimated to be below this spawning biomass

“On the ramp”: The state of reduced fishing intensity because the biomass is estimated to be below the fishery trigger. The “ramp” refers to the reduction of fishing intensity in the harvest control rule.

TCEY: For the coastwide operating model this is the sum of commercial landings, commercial discard mortality, recreational mortality, and subsistence mortality.

GENERAL OBJECTIVE	MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE	PERFORMANCE METRIC
2.2. MAXIMIZE DIRECTED FISHING YIELD	Maintain TCEY above a minimum level coastwide	Coastwide TCEY < $TCEY_{min}$	Long-term Short-term	?? ??	$P(TCEY < TCEY_{min})$
	<i>Maximize high yield (TCEY) opportunities coastwide</i>	<i>Coastwide TCEY > 50.6 Mlbs (70% of 1993-2012 average)</i>	<i>Long-term Short-term</i>	<i>STATISTIC OF INTEREST</i>	$P(TCEY < 50.6 \text{ Mlbs})$
	<i>Present the range of coastwide TCEY that would be expected</i>	<i>Range of coastwide TCEY</i>	<i>Long-term Short-term</i>	<i>STATISTIC OF INTEREST</i>	<i>5th and 75th percentiles of TCEY</i>
	<i>Maximize average TCEY by Regulatory Area</i>	<i>Median coastwide TCEY</i>	<i>Long-term Short-term</i>	<i>STATISTIC OF INTEREST</i>	<i>Median \overline{TCEY}</i>
	Maintain TCEY above a minimum level by Regulatory Area	$TCEY_A < TCEY_{A,min}$	Long-term Short-term	?? ??	$P(TCEY < TCEY_{min})$
	<i>Maximize high yield (TCEY) opportunities by Regulatory Area</i>	<i>$TCEY_A > 50.6 \text{ Mlbs}$ (70% of 1993-2012 average)</i>	<i>Long-term Short-term</i>	<i>STATISTIC OF INTEREST</i>	$P(TCEY < 50.6 \text{ Mlbs})$
	<i>Present the range of TCEY by Regulatory Area that would be expected</i>	<i>Range of TCEY by Regulatory Area</i>	<i>Long-term Short-term</i>	<i>STATISTIC OF INTEREST</i>	<i>5th and 75th percentiles of TCEY</i>
MINIMIZE POTENTIAL FOR NO CATCH LIMIT FOR THE DIRECTED COMMERCIAL FISHERY	<i>Minimize fishery closures</i>	<i>Directed commercial allocation = 0</i>	<i>Long-term Short-term</i>	<i>STATISTIC OF INTEREST</i>	$P(\text{Directed Mort} = 0)$

GOAL: Minimize Discard Mortality

GENERAL OBJECTIVE	MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE	PERFORMANCE METRICS
3.1. HARVEST EFFICIENCY	Discard mortality is a small percentage of the longline fishery annual catch limit	>10% of annual catch limit	Long-term Short-term	0.25	$P(DM > 10\%FCEY)$
<i>ABSOLUTE MEASURE</i>	<i>Absolute</i>	<i>Discard Mortality (DM)</i>	<i>Long-term Short-term</i>	<i>STATISTIC OF INTEREST</i>	<i>Median \overline{DM}</i>

GOAL: Minimize Bycatch Mortality

GENERAL OBJECTIVE	MEASURABLE OBJECTIVE	MEASURABLE OUTCOME	TIME-FRAME	TOLERANCE	PERFORMANCE METRICS