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

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PURPOSE

To review the MSAB goals and objectives; add new, remove outdated, or update goals and objectives as necessary. Link goals and objectives with performance metrics to report in October 2017.

BACKGROUND

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 has developed five goals with multiple objectives for each (Tables 1–5). Performance metrics can be developed from the goals and objectives by defining a measurable outcome, a probability (i.e., level of risk), and time-frame over which it is desired to achieve that outcome (Table 1).

PERFORMANCE METRICS

Performance metrics are the quantities used to evaluate alternative management strategies. A number of performance metrics are obvious from the objectives in Tables 1–5, but some objectives do not have obvious performance metrics. The following performance metrics were developed from Tables 1–5, with numbering indicating the Goal and Measurable Outcome. Orange colored bold words indicate decision points. Green colored text indicates that the metric is a calculated value. Blue colored text indicates that the metric is a probability, which is always phrased as a risk (the probability of something undesirable).

1. The median of the average **Relative Spawning Biomass (RSB)** or **Equilibrium Relative Spawning Biomass (ERSB**, see IPHC-2017-MSAB09-07) over a **10-year period far in the future.**

1.a. The probability that the **spawning biomass** in a **10-year period far in the future** is below a **specific value**, or below an equilibrium value such as **Relative Spawning Biomass (RSB)** or **Equilibrium Relative Spawning Biomass (ERSB**, see IPHC-2017-MSAB09-07).

1.b. The probability that the **spawning biomass** in a **10-year period far in the future** is below **20% of B_0**.

1.d. The probability that the **spawning biomass** in a **10-year period far in the future** is below **30% of B_0**.

1.e. The probability that the **spawning biomass** declines **by any amount** in a **10-year period far in the future** when the **estimated spawning biomass** is **between the limit** (i.e., 20% B0) **and the threshold** (i.e., 30% B_0).

2.1. The median average **FCEY** over a **10-year period far in the future.**

2.a. The probability that the **FCEY** in a **10-year period far in the future** is equal to **zero.**

2.c. The probability that the **FCEY** in a **10-year period far in the future** is **<10% of the average 1993–2012 FCEY or >10% of the average 1993–2012 FCEY**. Note that the averages of the commercial catch, wastage, sport, and personal catch for 1993–2012 are 60.4, 2.1, 8.7, and 1.0 million pounds, respectively. The average of all catches, excluding bycatch, for 1993–2012 is 72.3 million pounds. The annual catch has been greater than 72.3 million lbs in 16 of the last 40 years and has ranged from 22,461 thousand pounds in 1977 to 87,669 thousand pounds in 2004. The catch in the last 40 years has been outside of ±10% of 72.3 million pounds in 28 different years. Note, that **a short-term statistic** may also be of interest.

2.d. The probability that the **FCEY** in a **10-year period far in the future** is **<70% of the average 1993–2012 FCEY**. Seventy percent of the average 1993–2012 FCEY is 50.6 million pounds. The catch was last above this value in 2010, and has been below this value in 14 of the last 40 years (was greater from 1985 through 2010).

2.e. The probability that the **FCEY** changes by more than **15%** from **one year to the next** over a **10-year period far in the future**. The catch has changed by 15% or more in 9 of the last 40 years, with 3 of those being reductions in catch. In the last 20 years, there were 2 reductions (2011) and 1 increase (1997) greater than 15%.

2.2. The average annual variability (AAV) in a **10-year period far in the future**. AAV is the average absolute change in catch divided by the average total catch, expressed as a percentage.

$$AAV = \sum_{t=2}^{10} |C_t - C_{t-1}| \Big/ \sum_{t=2}^{10} C_t$$

The AAV's over 10 year periods for the last 40 years, starting in 1977, were 21%, 6%, 5%, and 10%.

3.a. The probability that the wastage in a **10-year period far in the future** is **>10% of the annual catch limit**.

3.1. The median average wastage over a **10-year period far in the future.**

Table 1: Objectives for the biological sustainability goal along with intent and performance metric quantities (measurable outcome, probability, and time-frame). Acknowledgements to Michele Culver (WDFW) for originally putting this table together.

Goal	Objective	Measurable Outcome	Probability	Time-frame	Intent
Biological Sustainability	1.1. Keep biomass above a **limit** below which no fishing can occur	a) Maintain a minimum number ***[spawning potential ratio?]*** of mature female halibut coast-wide	0.99	Each year	• Ensure that conservation needs of the stock are met for long-term sustainability with a high degree of certainty • Regularly monitor stock biomass (i.e., continuation and improvement of survey and stock assessment efforts) to detect changes in status and abundance • **Define reference points and harvest targets (e.g., MSY)** • Take a risk-averse approach when the stock is below the threshold
		b) 2) Maintain a minimum spawning stock biomass of 20% of the unfished biomass	0.95	Each year	
	1.2. Account for all sizes in the population?	*c)*			
	1.3. Reduce harvest rate when abundance is below a threshold	d) Maintain a minimum spawning stock biomass of 30% of the unfished biomass	0.75	Each year	
	1.4. Risk tolerance and assessment uncertainty	e) When Limit < estimate biomass < Threshold, limit the probability of declines	0.05 – 0.5, depending on est. stock status	10 years	

Table 2: Objectives for the fishery sustainability goal along with intent and performance metric quantities (measurable outcome, probability, and time-frame). Acknowledgements to Michele Culver (WDFW) for originally putting this table together.

Goal	Objective	Measurable Outcome	Probability	Time-frame	Intent
Fishery Sustainability and Stability and Assurance of Access – Minimize Probability of Fishery Closures	2.1. Maintain an economically sufficient level of catch (i.e., target) across regulatory areas	a) Maintain directed fishing opportunity	0.95	Each year	• Ensure that the directed fishery has viable fishing opportunities every year • Provide directed fisheries that are economically beneficial to individual participants, local businesses, and broader communities • Support efforts to allow continued access to the halibut resource within acceptable conservation limits
		b) Maximize [Optimize?] yield in each regulatory area	0.5	Each year	
		c) Maintain median catch within ±10% of 1993-2012 average	?	Within 5 yrs	
		d) Maintain average catch at > 70% of historical 1993-2012 average	0.9	Each year	
	2.2. Limit catch variability	e) Limit annual changes in TAC, coast-wide and/or by Regulatory Area, to < 15%		Each year	

Table 3: Objectives for the minimize wastage goal along with intent and performance metric quantities (measurable outcome, probability, and time-frame). Acknowledgements to Michele Culver (WDFW) for originally putting this table together.

Goal	Objective	Measurable Outcome	Probability	Time-frame	Intent
Minimize Wastage	3.1. Harvest efficiency	a) Wastage in the longline fishery < 10% of annual catch limit	0.75	Over 5 years	• Support fishing practices that reduce wastage • Regulatory revisions that promote efficiency

Table 4: Objectives for the minimize bycatch goal along with intent and performance metric quantities (measurable outcome, probability, and time-frame). Acknowledgements to Michele Culver (WDFW) for originally putting this table together.

Goal	Objective	Measurable Outcome	Probability	Time-frame	Intent
Minimize Bycatch and Bycatch Mortality	4.1.	a)		**Over 5 years**	• **Support fishing practices that reduce bycatch and bycatch mortality**

Table 5: Objectives to serve consumer needs goal along with intent and performance metric quantities (measurable outcome, probability, and time-frame). Acknowledgements to Michele Culver (WDFW) for originally putting this table together.

Goal	Objective	Measurable Outcome	Probability	Time-frame	Intent
Serve Consumer Needs	5.1.	a)			• Strive to avoid or minimize regulatory changes that result in large fluctuations in product availability

REPORTING RESULTS

The thirteen performance metrics described above would be reported in a table as rows with the columns representing different management strategies (Table 6). Additionally, figures will be created as necessary to show specific performance metrics against the management procedures, as well as interesting trade-offs between performance metrics.

Table 6: An example of how the performance metrics calculated from the simulations may be reported.

Performance Metrics	Management Procedures				
	SPR=35%	SPR=40%	SPR=45%	SPR=50%	SPR=55%
Biological Sustainability					
Median average RSB	XXXX	XXXX	XXXX	XXXX	XXXX
P(SB<X%)	XX%	XX%	XX%	XX%	XX%
P(RSB<20%)	XX%	XX%	XX%	XX%	XX%
P(RSB<30%)	XX%	XX%	XX%	XX%	XX%
P(↓SB|20–30%B_0)	XX%	XX%	XX%	XX%	XX%
Fishery Sustainability					
Median average FCEY	XXXX	XXXX	XXXX	XXXX	XXXX
P(FCEY=0)	XX%	XX%	XX%	XX%	XX%
P(FCEY<>10% average)	XX%	XX%	XX%	XX%	XX%
P(FCEY < 70% average)	XX%	XX%	XX%	XX%	XX%
P(ΔFCEY > 15%)	XX%	XX%	XX%	XX%	XX%
AAV	XXXX	XXXX	XXXX	XXXX	XXXX
Minimize Wastage					
Med average wastage	XXXX	XXXX	XXXX	XXXX	XXXX
P(wastage > 10%)	XX%	XX%	XX%	XX%	XX%

RECOMMENDATION/S

That the Management Strategy Advisory Board:

1) **NOTE** paper IPHC-2017-MSAB09-08 which provides a review of the goals and objectives previously defined by the MSAB, a number of possible performance metrics to present in October, and a list of recommendations needed.
2) **CONSIDER** the goals and objectives and suggest additions or deletions. Add objectives for goals that currently do not have objectives (4 & 5).
3) **RECOMMEND** performance metrics to report at MSAB10 to evaluate the simulations considered in paper IPHC-2017-MSAB09-07.
4) **SUGGEST** ways to report the performance metrics and results from the simulations considered in paper IPHC-2017-MSAB09-07.

ADDITIONAL DOCUMENTATION / REFERENCES

APPENDIX A: COASTWIDE CATCHES EXCLUDING BYCATCH

Table A.1: Directed fishery catches (M lbs) from Stewart (2017) starting in 1977, and excluding bycatch.

Year	Commercial	Wastage	Sport	Personal	Total
1977	21.88	0.29	0.29	0	22.46
1978	22	0.28	0.38	0	22.66
1979	22.54	0.3	0.56	0	23.4
1980	21.87	0.3	0.85	0	23.02
1981	25.74	0.35	1.11	0	27.2
1982	29.01	0.4	1.3	0	30.71
1983	38.39	0.53	1.62	0	40.54
1984	44.97	0.72	1.84	0	47.53
1985	56.1	2.7	2.36	0	61.16
1986	69.63	4.65	3.18	0	77.46
1987	69.47	4.2	3.51	0	77.18
1988	74.39	3.49	4.88	0	82.76
1989	66.95	3.46	5.23	0	75.64
1990	61.6	3.38	5.59	0	70.57
1991	57.08	3.46	6.51	2.01	69.06
1992	59.89	2.5	6.18	1.11	69.68
1993	59.27	2.05	7.73	0.93	69.98
1994	54.73	2.51	7.07	0.93	65.24
1995	43.88	0.93	7.46	0.54	52.81
1996	47.34	1.15	8.08	0.54	57.11
1997	65.2	1.45	9.03	0.54	76.22
1998	69.76	1.72	8.59	0.74	80.81
1999	74.31	1.65	7.38	0.75	84.09
2000	68.29	1.45	9.01	0.76	79.51
2001	70.7	1.69	8.1	0.77	81.26
2002	74.66	1.72	8.01	0.77	85.16
2003	73.14	2.08	9.35	1.38	85.95
2004	73.11	2.3	10.71	1.55	87.67
2005	71.82	2.22	10.86	1.54	86.44
2006	67.98	2.46	10.2	1.48	82.12
2007	62.87	2.59	11.47	1.49	78.42
2008	58.57	2.76	10.68	1.34	73.35
2009	52.05	2.94	8.79	1.31	65.09
2010	49.72	3.21	7.85	1.24	62.02
2011	39.51	2.46	7.1	1.14	50.21
2012	31.99	1.67	6.78	1.15	41.59
2013	29.04	1.43	7.63	1.13	39.23
2014	23.7	1.3	7.19	1.2	33.39
2015	24.67	1.28	7.46	1.2	34.61
2016	25.03	1.18	7.38	1.2	34.79