**Excerpt from June 2017 Discussion paper on performance metrics**

# Performance metrics review

Choosing between different ABM management alternatives can be done by comparing how each alternative meets defined objectives. Therefore, it is important to define detailed objectives with measurable outcomes. This can be difficult, and should involve input from stakeholders and decision-makers. Typically, overarching goals are defined first and translated into measurable objectives, and there may be multiple measurable objectives for each goal. Sometimes it is helpful for analysts to ask stakeholders and decision-makers questions which can then lead to measurable objectives. For example, a question related to an overarching goal of “maintaining a healthy fish stock” may be “Is there a minimum spawning stock abundance that is desired?” which may lead to a measurable objective of “keeping the spawning stock above a certain abundance for a specified number of years with a specified probability.” This measurable objective has an outcome (“a certain abundance”), a time-frame (“a specified number of years”) and a probability or acceptable risk level. A performance metric can then be defined to evaluate whether a measurable objective has been achieved (e.g., the probability that the spawning stock abundance is above a certain level over a specific number of years).

## Council Purpose and Need (adopted April 2016)

“The current fixed yield based halibut PSC caps are inconsistent with management of the directed halibut fisheries and Council management of groundfish fisheries, which are managed based on abundance. When halibut abundance declines, PSC becomes a larger proportion of total halibut removals and thereby further reduces the proportion and amount of halibut available for harvest in directed halibut fisheries. Conversely, if halibut abundance increases, halibut PSC limits could be unnecessarily constraining. The Council is considering linking PSC limits to halibut abundance to provide a responsive management approach at varying levels of halibut abundance. The Council is considering abundance-based PSC limits to control total halibut mortality,provide an opportunity for the directed halibut fishery, and protect the halibut spawning stock biomass, particularly at low levels of abundance. The Council recognizes that abundance-based halibut PSC limits may increase and decrease with changes in halibut abundance.”

Council objectives inferred from the Purpose and Need for this action to form overarching goals:

1. Halibut PSC limits should be indexed to halibut abundance
2. Halibut spawning stock biomass should be protected especially at lower levels of abundance
3. There should be flexibility provided to avoid unnecessarily constraining the groundfish fishery particularly when halibut abundance is high
4. Provide for directed halibut fishing operations [in the Bering Sea].
5. Provide for some stability in PSC limits on an inter-annual basis.

These overarching goals in the attached tables were then used to formulate draft measurable objectives from which to derive performance metrics incorporating feedback from stakeholders at the February 2017 workshop. These overarching goals may be in competition with each other. To best design and evaluate alternatives which can be compared in a future risk assessment to assist policy-level decision-making, specific measurable objectives for this action must be defined. As noted above, measurable objectives are best defined in conjunction with stakeholder input.

## Summary of performance metrics

Table 3 lists performance metrics and features relative to Council objectives (and how they might be measured). Relative to consideration of individual indices the WG noted the following in considering elements of Table 3:

Index is proportional to halibut abundance that it is meant to measure

Index is not subject to an unreasonable amount of uncertainty

Index is available in a timely manner

Information to derive index is easily obtained.

Which Council objectives does index relate to?

For combinations of indices (integrated index) the objectives in Table 3 should be evaluated using simulations and consider old and young population components (with correlations between indices considered) and also the coastwide stock status and geographic range.

## Glossary of terms

**Council Objectives** A list of overarching goals for abundance-based halibut PSC management that were inferred from the Council’s Purpose and Need Statement.

**Measurable Objective** An objective that can be specified explicitly (e.g., ensure the spawning biomass stays above a minimum threshold) and evaluated with a performance metric (e.g., ensure the spawning biomass stays above 20% of the unfished spawning biomass with 90% probability) which reflects and is linked to the Council objectives. Performance metrics are used to judge policy alternatives relative to these objectives. An additional quantity as part of the measurable objective may be a probability (level of tolerance) which to evaluate against. Probabilities are framed as a risk (something undesirable happening).

**Threshold** A value or range of values that must be achieved to meet a measurable objective.

**Time Frame** There are two concepts here. The first is how far into the future is considered (e.g., short-term or long-term). The second is a range of years over which the measurable objective is to be evaluated.This can be short-term, long-term, annual, a period of 10 years, etc.

**Performance Metric** Metric or statistic that is used to evaluate whether a measurable objective is achieved. Performance metrics are used in scientific analysis to gauge success in meeting measurable objectives. The Performance Metric is determined from the Threshold and Time Frame.

**Other Terms:**

**AAV** Average Annual Variability

**ABM** Abundance based management specifically for Pacific halibut

**Control Rule** A function relating a metric of stock status to a resulting management limit, such as a catch, fishing mortality, or effort limit

**BCR** Bycatch control rule; a control rule for setting the limit of a bycatch (PSC) species based on a specified metric of stock status

**PSC** Prohibited species catch (for halibut, synonymous with bycatch)

**SPR** Spawning potential ratio; the ratio of spawning biomass per recruit at a particular level of fishing mortality to the spawning biomass per recruit under an assumption of no fishing. Spawning biomass per recruit is the amount of future spawning biomass that can be expected as the result of a fish spawning over the course of its lifetime, assuming a particular level of constant fishing mortality.

**SSB** Spawning stock biomass

Table 3. Council objectives and overarching goals (first column) and measures and characteristics of performance metrics that might apply for contrasting future alternative PSC management measures.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Council Objectives** | **Measurable objective** | **Threshold** | **Time Frame** | **Performance metric** |
| There should be flexibility provided to avoid unnecessarily constraining the groundfish fishery particularly when halibut abundance is high | Average PSC limit | NA | short and long term | Average (PSC limit) |
| The PSC limit is below the 2016 PSC limit a certain percentage of time. | 3,515 t | short and long term | P(PSC limit < 3,515t) |
| The PSC limit is below the 2016 PSC catch a certain percentage of time. | 2,337 t | short and long term | P(PSC limit < 2,337t) |
| Maintain CPUE above a minimum value to reach the TAC (and below PSC) |  | short and long term | P(CPUE < ???) |
| Provide for some stability in PSC limits on an inter-annual basis. | Achieve a level of inter-annual variability in PSC levels that is below an acceptable level | NA | short and long term | Average annual variation (AAV) in halibut PSC limit P(AAV < ???%) |
| Halibut spawning stock biomass should be protected especially at lower levels of abundance | Measure the impact on spawning biomass | NA | short and long term | Fishery-specific SPR |
| Not allow the impact on the spawning biomass to exceed a specific level. |  | short and long term | P(SPR < ???) |
| Maintain the spawning biomass above a value |  | short and long term | P(SB < ???) |
| Maintain a diversity of sizes in the population. |  | long-term |  |
| Maintain the spawning biomass above critical levels | 20% of equilibrium | short and long term | P(SB < 20%) |
| Provide for directed halibut fishing operations [in the Bering Sea]. | A minimum FCEY in 4CDE |  |  | P(FCEY < ???) |
| A target FCEY in 4CDE |  | short and long term | P(FCEY < ???) |
| The proportion of the directed fishery catch limit is greater than X% of the total catch limit (floor and ceiling?) |  | short and long term | P(FCEY/TCEY < ???) |
| Halibut PSC limits should be indexed to halibut abundance | The change in PSC limit has a minimum level of variation relative to the indices |  | General | Slope (b) of combined control rule > ??? |
| The range of the index for which a minimum level of variation is achieved. |  | short and long term | P(floor used) P(ceiling used) |
| PSC is proportional to halibut abundance |  | short and long term | PSC limit change relative to halibut biomass |
| Incorporate appropriate size ranges to index the important components |  | short and long term | Indices apply to segments of population (e.g., U12, O26) |