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## Understanding the IPHC's harvest decision table (2018)

PREPARED BY: IPHC SECRETARIAT (I. STEWART; 1 DECEMBER 2017)

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### PURPOSE

To provide an updated guide to the IPHC's harvest decision table reflecting changes made in response to Commission decisions at the 2017 Annual Meeting (AM093).

### CONTEXT

The decision table represents one part of the IPHC's process for setting annual catch limits for Pacific halibut (*Hippoglossus stenolepis*). This process begins with the stock assessment, conducted each fall using the most recent data from the current year's fishery-independent setline survey and fisheries in addition to the historical data included in previous analyses. The stock assessment uses an ensemble of models to estimate the probability distributions describing the current stock size, trend, and demographics. These probability distributions are used to evaluate alternative harvest levels for the upcoming year (and up to three years in the future) such that the Commission and stakeholders can directly compare the trade-offs between potential yield (catch) and the short term risks to the stock and fishery. Additional information for Commission decision making comes in the form of recommendations from the Subsidiary Bodies (Conference Board, Processor Advisory Board, Scientific Review Board) as well as public comment. Regulatory Area-specific catch limits, distributing the coastwide yield found in the harvest decision table, are further informed by the catch tables produced before and during the meetings partitioning all projected mortality by fishery and Regulatory Area.

### THE DECISION TABLE

The decision table summarizes the stock assessment results in the form of probability distributions. For the 2018 decision making process, the IPHC Secretariat will provide a modified format of the decision table produced in recent years. The primary change is to exchange the rows and columns, such that management alternatives will now occur as columns across the top of the table, and risk metrics as rows. This will allow for additional metrics to be included (such as 2-year projections), and also to highlight the reference line and other management options of similar magnitude down the center of the table. In this new format, each column of the table represents a different alternative harvest level for the upcoming year. Each column begins with the description of the harvest alternative including the sum of all sources of mortality (total removals), the coastwide Total Constant Exploitation Yield (TCEY; inclusive of all mortality of Pacific halibut except bycatch and commercial Pacific halibut fishery discards less than 26" (66 cm) in length), and the level of fishing intensity (measured as  $F_{SPR}^1$ ). The  $F_{SPR}$  is the only value that represents an estimate, and therefore an approximate 95% credible interval is reported such that the uncertainty in this estimate is explicit. The columns included in the table are divided into three sections:

- 1) Low levels of mortality on a coarse grid (~10 million pounds (~4,500 t) of total mortality) intended to illustrate the underlying stock dynamics and effects of low levels of fishing intensity. The first column consists of no anthropogenic removals of any kind from the stock.

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<sup>1</sup> SPR denotes the Spawning Potential Ratio, the equilibrium reduction in the female spawning output per fish estimated to occur under a given level of fishing. This value ranges from 100% in the absence of all fishing mortality to 0% at a level of fishing under which each female fish would be estimated to have no reproductive output. It reflects current size-at-age, maturity, fecundity and fishery selectivity information.

- 2) A finer grid of catch limits (in ~ 1-2 million pound (450-900 t) increments) centered on the reference level of fishing intensity (SPR=46%). The reference level represents the average fishing intensity over the period 2014-2016, and was selected during the 2017 AM as an interim point of comparison pending results from the IPHC's ongoing Management Strategy Evaluation (MSE) process.
- 3) High levels of mortality (again on a coarse grid) for evaluating the effects of very high fishing intensity.

Additional columns are added as needed during the decision making process in order to place specific alternatives in context, e.g. historically, these have included the previous year's catch limits, alternative harvest rates, incremental changes between specific alternatives, and others. It is anticipated that one or more alternative fishing intensity levels will be included this year for comparison with MSE results.

The body of the table represents the probability (in times out of 100; this can be thought of as a percent or a ratio) estimated from the assessment ensemble of a specific outcome for set of management risk metrics. These metrics are divided into four categories:

- 1) **Stock trend** (rows a-f). Stock trend is defined as the probability of a decrease in female spawning biomass. This probability is estimated after the first year of the projection (row a), two years (row c), and three years into the future (row e). In order to gauge the severity of any projected decrease, the probability of at least a 5% decrease is also reported for one year (row b), two year (row d), and three year (row f) projections. Projections are limited to three years in order to avoid substantial influence of incoming year-classes (cohorts) that are not yet well informed by observed data. These risk metrics are independent of any harvest strategy policy considerations.
- 2) **Stock status** (rows g-l). Stock status is calculated relative to the threshold and limit female spawning biomass reference points used in the IPHC's historical harvest policy. The risk metrics are the probability of dropping (or remaining) below the  $SB_{30\%}$ <sup>2</sup> threshold (at which the historical harvest policy suggested a reduction in fishing intensity) in one year (row g), two years (row i), or three years (row k) or the  $SB_{20\%}$  limit reference point (at which the historical harvest policy suggested suspending directed fishing) in one through three years (rows h,j, and l).
- 3) **Fishery trend** (rows m-r). Fishery trend reflects the probability that the TCEY would have to be reduced in order to achieve the reference level of fishing intensity after one year (row m), two years (row o), and three years (row q). In order to gauge the severity of any projected decrease, the probability of at least a 10% decrease is also reported for one year (row n), two year (row p), and three year (row r) projections.
- 4) **Fishery status** (row s). Fishery status reflects the probability that the catch level for that row would result in a fishing intensity that exceeds the reference level (SPR=46%). By definition, the column corresponding to the reference level of fishing intensity will have a probability of 50/100 (or 50%). The IPHC does not currently have a limit reference point (i.e., an overfishing level) for evaluation in this section of the table.

An example harvest decision table is provided on the next page.

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<sup>2</sup> SB30% and SB20% are currently calculated using historical definitions of average recruitment and average spawning biomass per recruit. These calculations are under review during 2017 and may be replaced with dynamic reference points that better reflect current stock biology in the future.



Example decision table illustrating the new format for the 2018 decision making process.

2018 Alternative		No removals	Reference: SPR=46%											
Total removals (M lb)		0.0												
TCEY (M lb)		0.0												
Fishing intensity		F <sub>100%</sub>							FXX%					
Fishing intensity interval		--							xx-xx%					
Stock Trend (spawning biomass)	in 2019	is less than 2018												a
		is 5% less than 2018												b
	in 2020	is less than 2018												c
		is 5% less than 2018												d
	in 2021	is less than 2018												e
		is 5% less than 2018												f
Stock Status (Spawning biomass)	in 2019	is less than 30%												g
		is less than 20%												h
	in 2020	is less than 30%												i
		is less than 20%												j
	in 2021	is less than 30%												k
		is less than 20%												l
Fishery Trend (TCEY)	in 2019	is less than 2018												m
		is 10% less than 2018												n
	in 2020	is less than 2018												o
		is 10% less than 2018												p
	in 2021	is less than 2018												q
		is 10% less than 2018												r
Fishery Status (Fishing intensity)	in 2018	is above F <sub>46%</sub>	0						50					s