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## Mortality projections - Using the IPHC mortality projection tool

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### UPDATES

This tool was updated for use during the 95<sup>th</sup> Session of the IPHC Annual Meeting (AM095). Due to the ongoing US government shutdown, there were no updated bycatch estimates so the general results remain unchanged. Several editorial formatting changes were made, and a minor error in the summation of commercial discard mortality was corrected. Results should be nearly identical for most configurations.

### PURPOSE

To provide an introduction and usage guide for the IPHC's web-based mortality projection tool (<https://iphc.int/data/projection-tool>).

### BACKGROUND

Each year, for the IPHC Interim and Annual Meetings, a large number of catch tables are produced which illustrate the projected mortality associated with various mortality limits proposed by the Commission and individual stakeholders.

In an attempt to provide greater transparency to all user groups, the IPHC Secretariat have developed a web-based, interactive tool to provide all participants in the process the ability to create alternative projection tables as is necessary for discussion and decision making, without having to rely directly on the IPHC Secretariat during peak information sharing periods.

In addition, alternative levels of projected bycatch are available as two options: 1) previous year's bycatch levels, and 2) full regulatory bycatch (i.e. maximum bycatch given Prohibited Species Catch limits and other restrictions combined with the previous year's bycatch for fisheries that do not have limits).

### THE MORTALITY PROJECTION TOOL

The Tool is divided into five components:

- 1) Inputs
- 2) Summary results
- 3) Biological distribution
- 4) Detailed sector mortality information
- 5) Graphics

A brief description of each of these is provided below, noting all key features and any changes from previously available projection tables.

#### ***Inputs***

The first section of the table provides the user with four places to input information (Fig. 1):

- 1) The unit of measurement<sup>1</sup>.

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<sup>1</sup> Net weight represents the weight with the head and entrails removed; this is approximately 75% of the round (wet) weight.

- 2) The ‘Coastwide distributed mortality limit’ (TCEY). This value represents the total of all mortality on the stock except bycatch of Pacific halibut less than 26 inches<sup>2</sup> (“U26”; 66cm).
- 3) The percent of the *Coastwide distributed mortality limit* (TCEY) assigned to each IPHC Regulatory Area. Although the percentages describing the distribution of the ‘Coastwide distributed mortality limit’ among IPHC Regulatory Areas, are intended to sum to 100%, if they do not they are automatically rescaled so that the sum of the distributed mortality limits by IPHC Regulatory Area will exactly match the total input. This is indicated to the user through red highlighting (instead of grey) appearing for the total.
- 4) The level of projected bycatch.

**Inputs**

Select weight units: **Millions of net pounds**

Enter coastwide distributed mortality limit (TCEY): **40.00**

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
Enter <u>distributed</u> mortality limit %	<b>1.9%</b>	<b>12.3%</b>	<b>15.7%</b>	<b>40.9%</b>	<b>7.4%</b>	<b>5.5%</b>	<b>4.9%</b>	<b>11.5%</b>	<b>100.0%</b>
<b>Total by Region</b>					<b>Region 2</b>	<b>Region 3</b>	<b>Region 4</b>	<b>Region 4B</b>	
					<b>29.9%</b>	<b>48.3%</b>	<b>17.0%</b>	<b>4.9%</b>	

Select bycatch option: **Previous year's bycatch**

**Fig. 1.** Example of the “Inputs” section of the mortality projection tool. Only the cells in yellow can be modified by the user.

### Summary Results

From the user-defined inputs, the projected ‘Coastwide total mortality limit’ (all projected mortality<sup>3</sup>), and the Spawning Potential Ratio (SPR) are updated automatically based on results created for this tool using the 2018 stock assessment (IPHC-2019-AM095-09; Fig. 2; projected SPR is only available when using the previous year’s bycatch). These values can then be compared directly with the Decision Table (IPHC-2019-AM095-09) for an evaluation of the relative risk associated with the input limits. The total mortality limit and the distributed mortality limit (TCEY) are then provided for each IPHC Regulatory Area.

**Summary results**

Projected coastwide SPR: **46%**

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
<b>Total mortality limits</b>	<b>0.78</b>	<b>4.93</b>	<b>6.26</b>	<b>16.72</b>	<b>3.07</b>	<b>2.31</b>	<b>1.96</b>	<b>5.71</b>	<b>41.73</b>
<b>Distributed mortality limits (TCEYs)</b>	<b>0.78</b>	<b>4.91</b>	<b>6.26</b>	<b>16.35</b>	<b>2.97</b>	<b>2.21</b>	<b>1.95</b>	<b>4.59</b>	<b>40.00</b>

**Fig. 2.** Example of the “Summary” section of the mortality projection tool.

<sup>2</sup> There is currently to survey with which to determine the stock distribution of Pacific halibut less than 26 inches, and these fish are capable of movement to other IPHC Regulatory Areas prior to entering the directed fisheries.

<sup>3</sup> Mortality that is not subject to Catch Sharing Plans (CSPs) is projected to be equal to the most recent year of actual data; this includes subsistence, non-CSP recreational mortality, and bycatch mortality.

### ***Biological Distribution***

This section references the most recent stock distribution information by Biological Region (**IPHC-2019-AM095-08**). The distributed mortality limits for each Biological Region are provided for comparison with the biological stock distribution. These two values are then used to project a harvest rate by Biological Region, standardized such that Region 3 (Regulatory Areas 3A and 3B) is always equal to a value of 1.0<sup>4</sup> and the other Regions (2, 4 and 4B) are relative to that value.

### ***Detailed sector mortality information***

This section provides the level of detail that has been historically reported in the annual mortality tables. It reflects the specific Catch Sharing Plans (CSPs) in place in IPHC Regulatory Areas 2A, 2B, 2C, 3A, and 4CDE allocating the mortality among fishery sectors and (for IPHC Regulatory Area 4CDE) among sub-Areas.

There are two changes to this table relative to the tables produced for and during the 2018 Annual Meeting (AM094):

- 1) Projected U26 directed commercial Pacific halibut discard mortality has been combined with O26 discard mortality. This change was agreed to during the AM094 and represents only a 0.1% addition to the TCEY.
- 2) Projected recreational discard mortality in IPHC Regulatory Area 2B has been moved from the FCEY to the non-FCEY section (with no change to the TCEY or calculation of the 85%:15% allocation in that agreement) in order to better reflect the details of that allocation agreement.

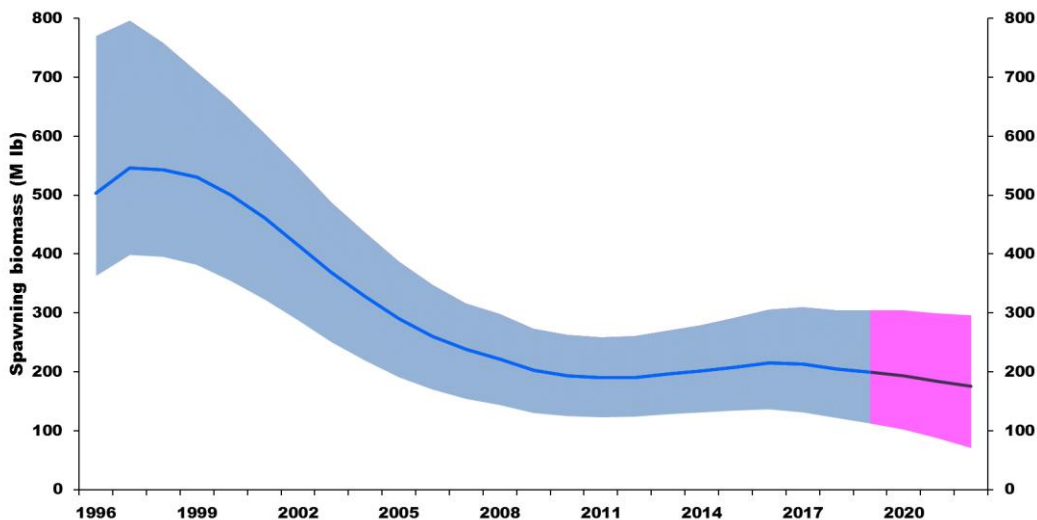
### ***Graphics***

This section provides a series of graphical results updated to reflect the inputs made by the user. These, or very similar, graphics have been previously available in as part of meeting documents and/or associated presentation material.

Fig. 3 uses previously calculated projections for a range of mortality levels to illustrate the coastwide stock trend associated with the inputs to the sheet. Importantly, not all possible SPR values are available, so the closest value available is reported. The value reported above the figure is updated and should be checked to ensure it is consistent with the value reported in the "Inputs" section; all values associated with columns in the Decision table, as well as some additional values are available.

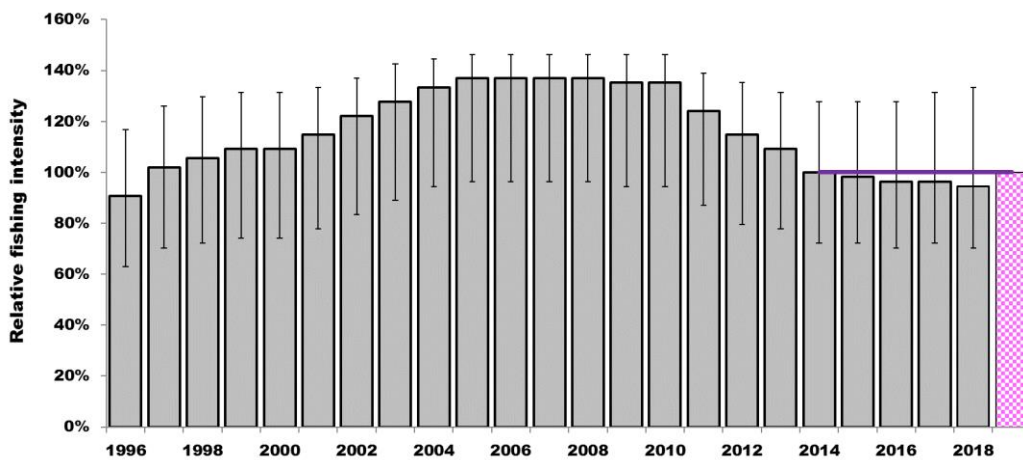
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<sup>4</sup> The harvest rates by Biological Region are relative, therefore the rates could be standardized to any Region and the choice to standardize to Biological Region 3 is arbitrary.



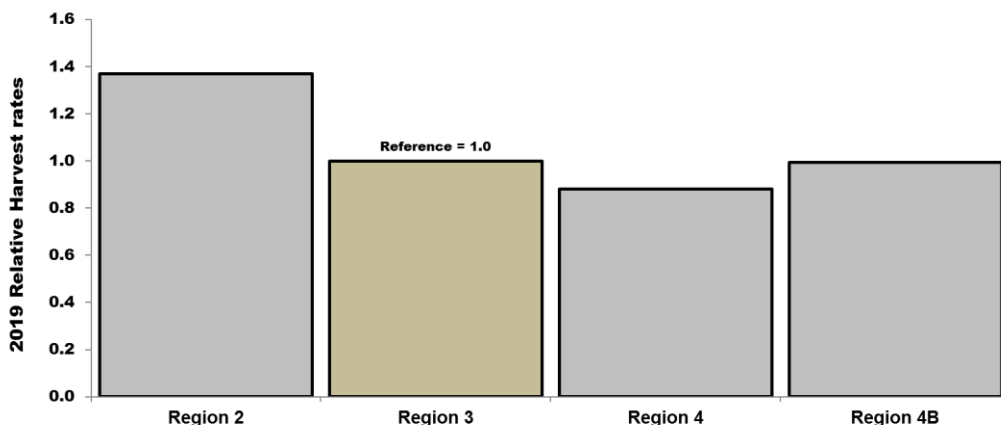
**Fig. 3.** Estimated (blue) and projected (pink) female spawning biomass, with an approximate 95% credible interval (shaded region) from the stock assessment ensemble.

Fig. 4. provides a comparison of the projected fishing intensity relative to recent estimates.



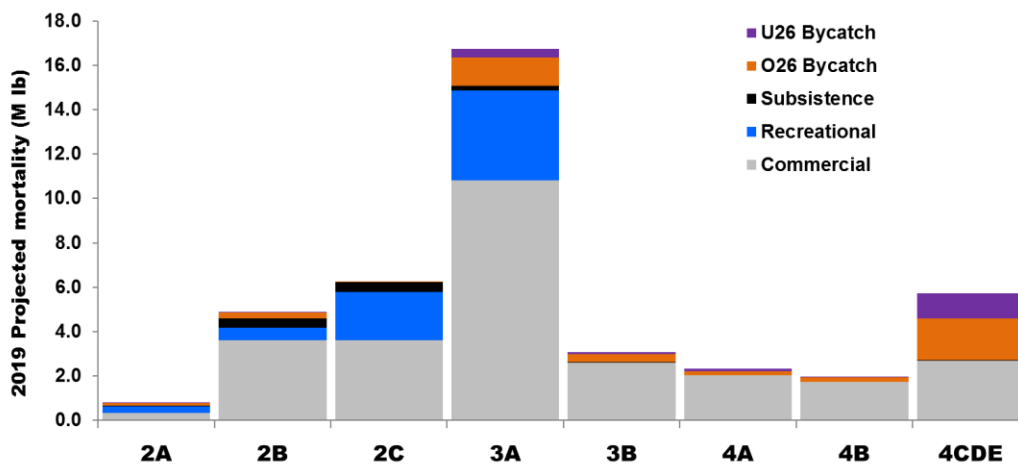
**Fig. 4.** Estimated (grey) and projected (hatched) fishing intensity relative to the SPR=46% 'handrail' (Horizontal line). Error bars (whiskers) represent an approximate 95% credible interval from the stock assessment ensemble.

Fig. 5 provides a graphical display of the relative harvest rates by Biological Region.

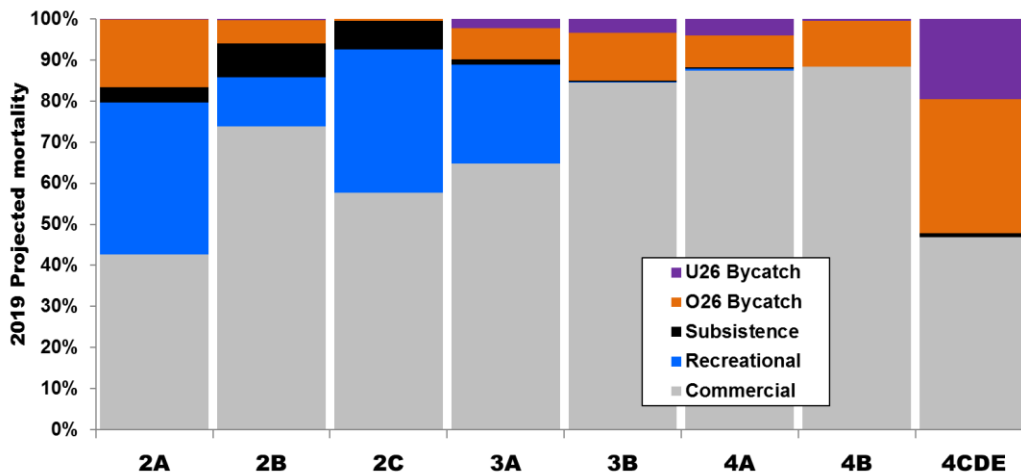


**Fig. 5.** Relative harvest rates, based on the IPHC fishery-independent setline survey and distributed mortality by Biological Region.

Fig. 6 and Fig. 7 provide the detailed CSP information (allocation) in both absolute values (millions of net pounds; Fig. 6) and relative values (percent of the projected mortality within each IPHC Regulatory Area; Fig. 7).



**Fig. 6.** Projected mortality by fishery sector and IPHC Regulatory Area.



**Fig. 7.** Relative projected mortality by fishery sector within IPHC Regulatory Areas.