



PHMEIA APP MANUAL

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PURPOSE

This document provides a description and tutorial of the IPHC's web-based economic impact visualization tool (http://iphcecon.westus2.cloudapp.azure.com:3838/ModelApp_azure/) presenting the results of the Pacific halibut multiregional economic impact assessment (PHMEIA).

BACKGROUND

The complexity of Pacific halibut supply-side restriction in the form of region-based allocations suggests the need for a tool enabling regulators to assess various combinations of catch allocations. To address this, the Pacific halibut multiregional economic impact assessment (PHMEIA) results are complemented by an interactive web-based application allowing users to estimate and visualize joint effects based on custom changes simultaneously applied to all IPHC-managed Pacific halibut producing areas. The tool is available at:

http://iphcecon.westus2.cloudapp.azure.com:3838/ModelApp_azure/.

The tool comprises three components:

- (1) Estimates of the economic impact (EI) of the Pacific halibut commercial fishing sector at the regional level (map and table) – ***EI of the commercial sector – map*** tab (tab 1) and ***EI of the commercial sector – table*** tab (tab 2)
- (2) Visualization of community impacts in Alaska (county-level results) – ***Community impacts in AK*** tab (tab 3)
- (3) Estimates of the economic impact if the Pacific halibut charter sector in Alaska contrasted with the estimates for the commercial sector – ***EI of charter fishing in AK*** tab (tab 4)

Components can be selected by choosing the appropriate tab on the left-hand side panel. The panel on the left also includes control widgets allowing the user to customize estimates. The box below input controls summarizes the selected inputs.

Model details can be found on the IPHC website, in the [Economic Research](#) section. The latest updates on the model development are also available in [IPHC-2021-SRB018-09](#).

Economic impact of the Pacific halibut commercial fishing

The map (tab 1) and the table (tab 2) display the EI estimates as deviations from the status quo in the selected year (select box 1 in the sidebar) in the selected currency (select box 2 in the sidebar).

The EI is calculated based on the input supplied in terms of Pacific halibut output value (in mil. USD/CAD) by region (see **Box 1** for definitions of regions) using sidebar sliders (**Figure 1**).

The default values are set to status quo outputs in each region in the selected year;¹ thus, by definition, the initially displayed EI is NULL. The displayed results should be interpreted as “*what would be the economic impact if the output in AK/BC/WC increased/decreased by XX mil. USD/CAD in the given year.*” Decreasing the output to ZERO in each region gives the total contribution of the Pacific halibut commercial fishing to the economy of each region.

Box 1: PHMEIA model regions

The PHMEIA model accounts for interregional spillovers. These represent economic stimulus in regions other than the one in which the exogenous change is considered. This allows accommodation of increasing economic interdependence of regions and nations. The model considers three primary Pacific halibut producing regions, as well as residual regions, to account for cross-boundary effects of fishing in the Pacific Northwest:

- Alaska (AK)
- US West Coast (WC – including WA, OR and CA)
- British Columbia (BC)
- Rest of the United States (RUS)
- Rest of Canada (ROC)
- Rest of the world (ROW) – exogenous in the model

By accounting for the economic linkages among these six regions, the study shows the importance of the multiregional approach to measuring economic impacts more accurately. This is particularly important in the context of shared resources and joint management, such as the case of collective management of Pacific halibut by the IPHC.

¹ For Alaska, the analysis focuses on harvest landed under IFQ and CDQ management program and reported sold.

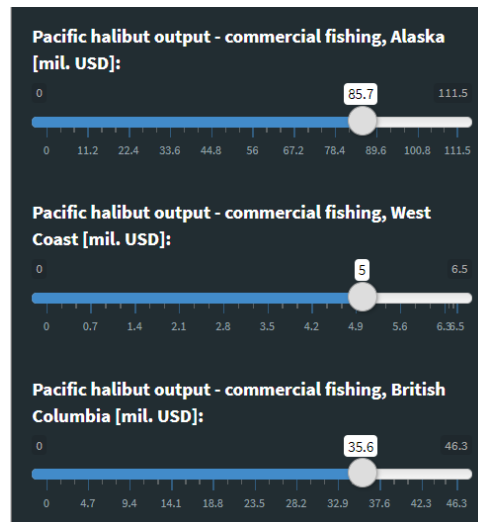


Figure 1: PHMEIA model input sliders.

While the table tab (tab 2) includes the full set of results for the given combinations of fishery outputs, the map in tab 1 displays the selected type of EI and its components (see **Figure 2** for control widgets). First, the user selects the type of impact to display. These are defined as follows:

- **Output:** Output is a measure of the total value of goods produced.
- **Wages:** Compensation of employees, includes employer social contributions (e.g., contributions for employee pension)
- **Value added/GDP:** Value added is a measure of the wealth created by industry activity. It is the sum of compensation of employees, taxes on production and imports less subsidies, and gross operating surplus, which includes proprietor income. Value added and the value of the intermediate inputs gives the output. Note that the PHMEIA model endogenizes only households. The impact on taxes and returns to the capital (value added components other than employee compensation and proprietor income) is fixed. Thus the estimate can be equivalently considered a measure of impact on earnings by households by place of work.
- **Employment:** Employment measure represents the number of jobs supported by economic activity. Estimates of employment are given in the number of employees. The EI in terms of the number of employees is proportional to the estimate of output.
- **Households income:** Households income is a measure of the impact on earnings by households by place of residence. This estimate accounts for the flow of earnings between regions related to out-of-state employment, flows related to beneficial ownership of Pacific halibut fishing rights in Alaska (i.e., quota holdings), and corporate interests of the processing sector. Impact on household income is derived directly from the SAM matrix and cannot be decomposed into direct, indirect and induced EIs (see next paragraph).

Second, the user may select EI components that will be displayed:

- **Direct EIs** reflect the changes realized by the direct Pacific halibut resource stock users, i.e., Pacific halibut fishers.
- **Indirect EIs** are the result of business-to-business transactions indirectly caused by the direct EIs. The indirect EIs provide an estimate of the changes related to expenditures on goods and services used in the production process of the directly impacted industries. In the context of the PHMEIA, this includes an impact on upstream economic activities associated with supplying intermediate inputs to the direct users of the Pacific halibut resource stock.
- **Induced EIs** result from increased personal income caused by the direct and indirect effects. In the context of the PHMEIA, this includes economic activity generated by households spending earnings that rely on the Pacific halibut resource.

Unless fully substituted by imports, changes in the fisheries output are also associated with production adjustments by **forward-linked industries** relying on the supply of fish. Selecting *Include forward-linked (FL) Pacific halibut processing* includes in the assessment of the EI also the Pacific halibut processing sector. It is important to note that because the output of an industry requires output from other industries, EI in terms of output (option 1 in the *Type of impact to display* select box) double-counts if one attempts to use it to measure the EI including forward-linked processing. In this case, the estimates should be interpreted as the amount of dollars in circulation.

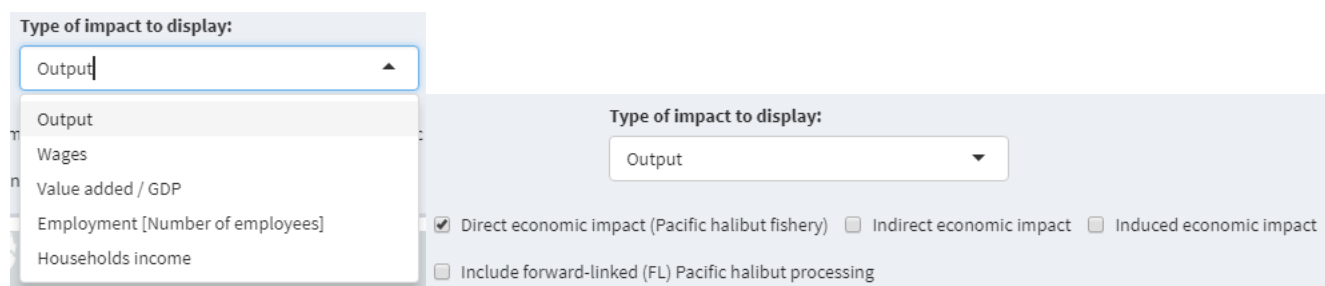


Figure 2: Control widgets allowing the user to select the type of EI and its components.

It is important to note that the results represent a static snapshot of EIs based on the observed prices and other economic conditions. A dynamic approach to estimating the economic impact of Pacific halibut resource is an extension suggested in the IPHC 5-year Program of Integrated Science and Research (2021-2026) ([IPHC-2021-SRB018-10](#)).

The full set of results for the selected combination of fishery outputs can be downloaded by clicking the **Download** button at the bottom of the table tab (tab 2).

Example 1

The example section suggests a series of steps that modifies the app output. Text in blue represent selections in the control widgets. What follows is the interpretation of the displayed results. Example 1 focuses on displaying the desired set of EI measured by region.

1. Select tab → [EI of the commercial sector – map](#)

2. Select year → 2019
3. Select currency → USD
4. Change the position of the slider Pacific halibut output – commercial fishing, Alaska [mil. USD] → 90 (this represents a hypothetical change in the output by the commercial fishing sector in Alaska from USD 85.7 mil. to USD 90 mil., i.e., an increase of the production by USD 4.3 mil. or 5% (you can use keyboard arrows for precise selection of the output).

The box below the sliders summarizes the user-defined adjustments and compares them with the selected year's status quo. The default display following the adjustment of the Pacific halibut output is the direct EI in terms of output, i.e., change in the landing value by region (here adopted only for Alaska). Note that the changes on the map displaying in light-to-dark green indicate increases with respect to the status quo, while decreases will display in the orange-to-red palette.

5. Select → Indirect economic impact and → Induced economic impact (Direct economic impact (Pacific halibut fishery) remains selected)

The map will now display the sum of the full set of the EI components (direct, indirect, and induced EI). Note that selecting indirect and/or induced components of the EI, the economic impact is realized not only in Alaska but also in other regions because of the spillover effects.

6. Change the type of impact to display to → Value added/GDP

Now, the map will display the contribution of the Pacific halibut commercial fishing in Alaska to each region. Other types of EI that can be displayed include wages, employment, and households income).

7. Select → Include forward-linked (FL) Pacific halibut processing

Selecting this option extends the scope of the displayed EIs to the forward-linked Pacific halibut processing sector. The measure including forward-linked processing assumes that the change in the fishing sector has a proportional impact on the processing sector that relies on the supply of fish.

The model suggests that an increase of Pacific halibut output in Alaska by 5% in 2019 would contribute to the GDP of Alaska about USD 2.6 mil., but there would also be a substantial contribution to the economy of the US West Coast (USD 0.6 mil.) and the rest of the United States (USD 1.5 mil.). See the final output from the described example in **Figure 3**.

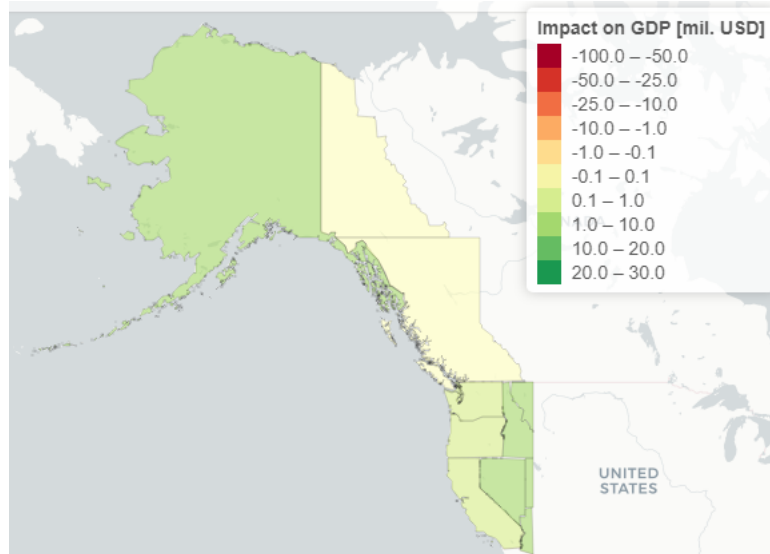


Figure 3: Impact on GDP of 5% increase on Pacific halibut output in Alaska based on 2019 economic conditions.

Example 2

1. Select tab → [EI of the commercial sector – map](#)
2. Select year → 2019
3. Select currency → USD
4. Select → [Indirect economic impact](#) and → [Induced economic impact \(Direct economic impact \(Pacific halibut fishery\) remains selected\)](#)
5. Change the position of the slider Pacific halibut output - commercial fishing, West Coast [mil. USD] → 4 (20% decrease)
6. Change the position of the slider Pacific halibut output – commercial fishing, Alaska [mil. USD] → 96 (12% increase)

Notice that a decrease in Pacific halibut output on the US West Coast (step 5) has a negative impact on the region and causes ca. USD 2.4 mil. loss. However, an additional increase in output in Alaska (step 6) results in positive net EI on the US West Coast (ca. USD 1.2 mil). See the comparison in **Figure 4**.

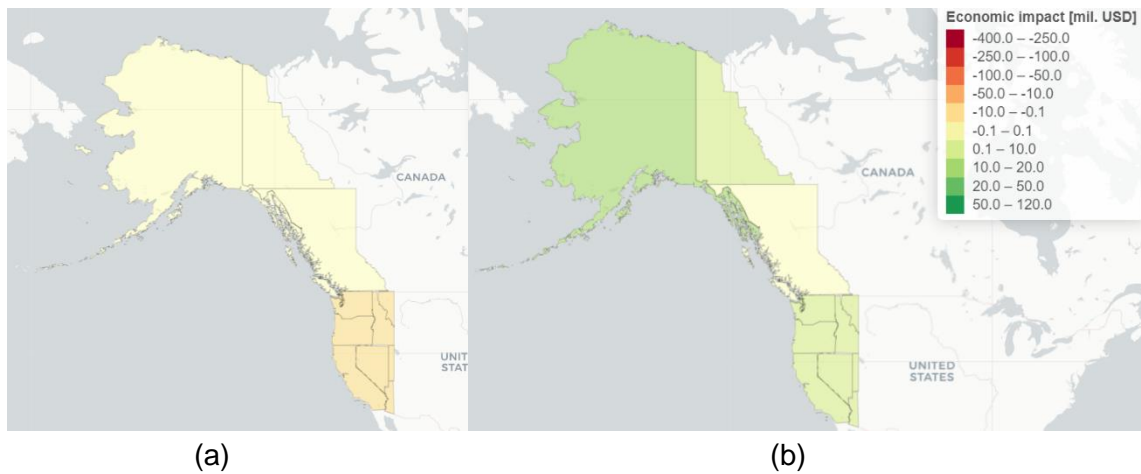


Figure 4: EI of (a) 20 % decrease of Pacific halibut output in WC and (b) 20 % decrease of Pacific halibut output in WC and 12% increase in Alaska. Both figures based on 2019 economic conditions.

Community impacts in Alaska

Besides providing economic impact estimates for broadly-defined regions (as defined in **Box 1**), the PHMEIA model results inform the community impacts of the Pacific halibut commercial fishing in Alaska, and highlight communities (counties) particularly dependent on fishing-related economic activities.

The map in tab 3 offers two options for displaying values (radio buttons options):

- **Direct earnings only [mil. USD]:** This includes earnings in the Pacific halibut commercial sector (Pacific halibut commercial fishing and Pacific halibut processing) retained in each county after adjusting for the cross-country flows related to employment and profits. Earnings from wages in the Pacific halibut fishing sector were assigned to counties based on the registered homeport of the vessel, while in the Pacific halibut processing sector, based on the processing location. Proprietor income in the Pacific halibut fishing was assigned to counties based on the residence of the permit owner and residence of the vessel owner (assuming 50-50 split, if different), and in the Pacific halibut processing, based on the location of the processor final point of contact.
- **Total economic impact [mil. USD]:** This is the sum of direct earnings as well as indirect and induced EIs evaluated based on the *local exposure* to the region's Pacific halibut economic impact, using calculated multiplier effects.² Local exposure was assessed as a county's share in the total value of Pacific halibut landed in Alaska. This approach implies the use of imported commodities in the same proportions by each county and no cross-county trade in commodities, which in turn implies that intra-Alaska indirect and induced economic effects retention within the county.

² Extending the community analysis beyond a simplified approach described in [IPHC-2021-SRB018-09](#) to a full community level (or any other spatial scale) SAM-based model requires significant investment in identifying the economic relationships between different sectors or industries (including both seafood and non-seafood industries) within each broader-defined region, this including deriving estimates on intra-regional trade in commodities and flow of earnings. It is an appealing extension of the current model, but not a feasible avenue for the project with its current time frame.

The displayed earnings/EI are in absolute values for the selected Pacific halibut output in Alaska³ (in mil USD, slider in the left-hand side panel) given economic conditions in the selected year (select box on the left-hand side panel). Greyed areas indicate counties that did not have a sufficient number of observations to preserve the confidentiality of the Pacific halibut direct users.

When selecting *Adjust outputs by IPHC regulatory area*, instead of selecting output in terms of value, the user can select harvest volume by IPHC regulatory area based on which the results are calculated.

Community effects assessment is currently limited to Alaska. The feasibility of a similar assessment for other regions (British Columbia, US West Coast) is currently under investigation.

Example 3

Example 3 focuses on the displaying impact of commercial fishing in Alaska on Alaskan households by county. Note that the impact outside Alaska is omitted here.

1. Select tab → [Community impacts in AK](#)
2. Select year → [2019](#)
3. Change the position of the slider Pacific halibut output – commercial fishing, Alaska [mil. USD] → [90](#) (same as in Example 1)

The default display following the adjustment of the Pacific halibut output is the impact on direct earnings. This includes impact on wages and profits in both Pacific halibut commercial fishing and Pacific halibut processing sector. Note that the community impacts are displayed in absolute terms, as opposed to deviation from the status quo (Example 1).

4. Select → [Total economic impact \[mil. USD\]](#)

The displayed values are now adjusted for indirect and induced EIs evaluated based on each county's *local exposure* to the region's Pacific halibut economic impact.

5. Select → [Adjust outputs by IPHC regulatory areas](#)

Selecting this option allows the user to display direct earnings/total economic impact calculated based on output in terms of volume (in 1000 lbs, net weight) by IPHC regulatory area. Under each numeric box, the comment section will indicate how the selected value compares with the status quo for the area.

Note that selecting the same number in different numeric boxes will have a different outcome (**Figure 5**). For example, [2000](#) under 2C (representing 2 mil. lbs) results in USD 2.6 mil in direct earnings, majority of which in Petersburg county, while [2000](#) under 4B results in USD 2.0 mil. in earnings, predominately affecting Aleutians West county.

³ This includes Pacific halibut harvested in IPHC regulatory areas 2C, 3A, 3B and 4A-E even if landed outside Alaska.

Information for some countries cannot be displayed because of the confidentiality restrictions (countries in grey). However, the direct earnings/total economic impact for these countries is included in the total for all regions displaying in the text below numeric input boxes.

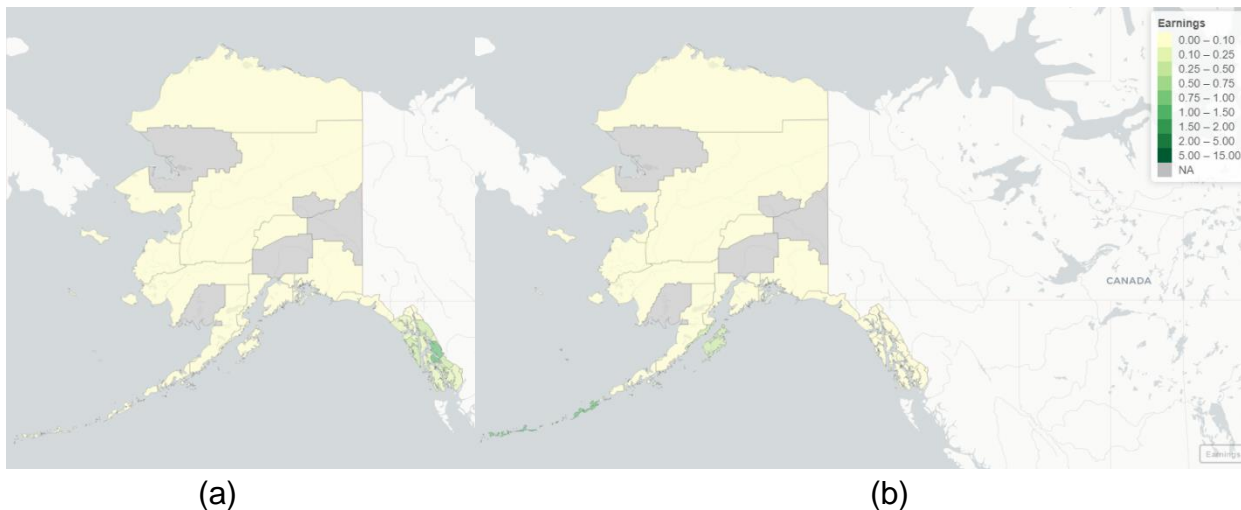


Figure 5: Community impacts in terms of direct earnings based on (a) 2 mil. lbs output in 2C and (b) 2 mil. lbs output in 4B.

Economic impact if the Pacific halibut charter sector in Alaska

An extended PHMEIA-r model accounts for the charter sector in Alaska. The preliminary estimates are presented in tab 4. The estimates focus on the economic impact of the charter sector on households, also providing a comparison with the economic impact on households of commercial fishing in Alaska. Six measures are specified:

- Economic impact on households in Alaska - total in mil. USD: total economic impact (the sum of the direct, indirect, and induced EIs from changes to the Pacific halibut sector (commercial/charter); includes EI associated with the forward-linked Pacific halibut processing sector for the commercial sector) retained in Alaska
- Economic impact on households - total in mil. USD: total economic impact in all regions, includes spillover effects to other regions
- Economic impact on households in Alaska - USD per 1 USD of output: total economic impact retained in Alaska divided by the total output; for the charter sector, the total output is the estimated gross revenue
- Economic impact on households - USD per 1 USD of output: total economic impact in all regions divided by the total output
- Economic impact on households in Alaska - USD per 1 lb of removals: total economic impact retained in Alaska divided by the by the volume of removals by the sector (retained harvest plus discards); this measure intends to provide an estimate of an impact per lb of Pacific halibut removal counted against the harvest limits in the stock assessment.
- Economic impact on households - USD per 1 lb of removals: total economic impact in all regions divided by the volume of removals by the sector.

The estimates assume that the economic impact of Pacific halibut charter fishing in Alaska is equivalent to estimating the total economic loss resulting from the saltwater charter sector therein shrinking by share of Pacific halibut effort in total effort. Estimates are based on constant prices. Adoption of demand-adjusted prices is proposed in the IPhC 5-year Program of Integrated Science and Research (2021-2026) ([IPHC-2021-SRB018-10](#)).

Inclusion of the recreational component for other regions (British Columbia, US West Coast) is underway.