INTERNATIONAL PACIFIC HALIBUT COMMISSION

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ECONOMIC STATISTICS

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FISHERIES-RELATED ECONOMIC STATISTICS

The purpose of this paper is to provide an overview of data sources contributing to the development of the Pacific halibut multiregional economic impact assessment (PHMEIA) model.

Commercial fishing

Canada and the United States account for the majority (70-80% for the 2014-2019 period, **Table 1**) of Pacific halibut global output, as reported by the Food and Agriculture Organization (FAO). Aquaculture output of Pacific halibut is currently marginal (FAO not specifying), but on the rise (see reports by L. Welch).

Data on commercial fisheries landings in the United States are available through NOAA. Statistics for each state represent a census of the volume and value of finfish and shellfish landed and sold at the dock. Collecting these data is a joint state and federal responsibility. Alaska's landings data are collected from mandatory trip tickets by the Alaska Department of Fish and Game (ADFG), then consolidated and disseminated (as aggregates) by the Alaska Fisheries Information Network (AKFIN). Commercial Fisheries Entry Commission (CFEC) reports on the number of permits, as well as earnings by residents and non-residents. Data on Pacific halibut fishing in Washington, Oregon, and California (reported collectively as WOC) are collected by the Washington Department of Fish and Wildlife (WDFW), Oregon Department of Fish and Wildlife (ODFW), and California Department of Fish and Wildlife (CDFW), respectively. Each of these state agencies requires submission of fish tickets reporting on Pacific halibut sales. These data are processed and disseminated by the Pacific Fisheries Information Network (PacFIN).

Data on British Columbia's commercial fisheries landed volume and value are published in the *British Columbia Seafood Year In Review* (BCSYIR) by Canada's Ministry of Agriculture (AgriService BC) and are based on data received from Fisheries and Oceans Canada (DFO). The landed value is based on DFO fish slips processed by the Regional Data Unit.[1] DFO's commissioned series of reports *Analysis of commercial fishing licence, quota, and vessel values* also reports on the lease price of Pacific halibut quotas. These are depicted together with the ex-vessel price in **Figure 2**.

Data on commercial landing value (available for all regions for 1951-2019, **Figure 1** below) suggest a considerable increase in Pacific halibut output driven by Alaska fisheries since the 1980s. However,

[1] In previous years, the landed value data were based on data received from the DFO fish slips with some alterations made after analysis conducted by a contracted consultant. Any alterations to the landed values were based on investigating the landed values recorded on the DFO fish slips and making adjustments where the final value was not found to be an accurate representation, including any bonus payments. The Province has not included any alterations to the original DFO fish slip data since 2019.

revenue has been dropping throughout the last decade. The statistics for recent years are available in **Table 2**. Detailed comparison by region between 2019 and 2020 is available in **Table 3**.

Data on employment in major fisheries in Alaska, including Pacific halibut fisheries, is compiled on a monthly basis by the Alaska Department of Labor and Workforce Development (AK DLWD). Share of nonresident wages in fisheries is reported annually in the report Nonresidents Working in Alaska. Statistics Canada reports annually on employment in *Fish, hunting and trapping* sector, but no estimates are available for the Pacific halibut fishery. No specific estimates on jobs in the fisheries sector are available for the US West Coast states. Available employment statistics for Pacific halibut commercial fishing are summarized in **Table 2**.

Table 1: Global Pacific halibut production (t, 2014-2020).

	2014	2015	2016	2017	2018	2019	2020
Canada	3,619	3,710	3,747	3,812	3,330	3,163	2,959(1)
USA	10,479	11,008	11,286	11,895	9,877	11,203	10,106(1)
Russia	4,754	4,220	4,346	3,895	5,932	4,172	NA
% IPHC	74.8%	77.7%	77.6%	80.1%	69.0%	77.5%	NA

(1) Based on IPHC data. Note that FAO data in principle should include harvest volume for all commercial, industrial, recreational and subsistence purposes, and aquaculture. However, the values for Canada and USA align with commercial landings reported by DFO and NOAA.

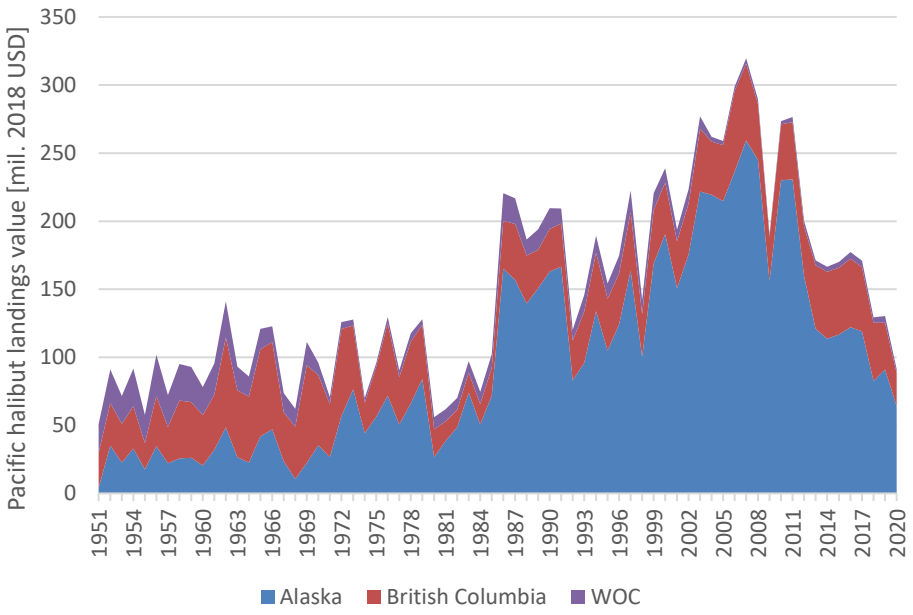

Figure 1: Pacific halibut landings value (1951-2020) in 2018 USD.

Table 2: Summary of available data on Pacific halibut commercial fishery.

Region	2014	2015	2016	2017	2018	2019	2020	Unit	Source
Pacific halibut commercial landings value									
AK	105.3	112.0	118.9	117.1	88.0	94.1	66.6	mil. USD	AKFIN
BC	46.9	53.8	58.3	58.9	44.1	46.4	33.3	mil. CAD	Province of BC
WOC	3.7	3.9	4.6	4.6	4.2	5.0	3.3	mil. USD	PacFIN
Employment in the Pacific halibut commercial fishing sector									
AK	1130	1122	1131	1106	1068	1071	858	n empl.	AK DLWD
BC	NA	NA	NA	NA	NA	NA	NA	-	-
WOC	NA	NA	NA	NA	NA	NA	NA	-	-

Notes: NA indicates that the value is not available. All monetary values in current USD/CAD, as reported in the cited source.

Table 3 Pacific halibut commercial landings by IPHC Regulatory Area – 2019 vs. 2020.

IPHC Regulatory Area	Value [1000 USD] 2019	Price [USD] 2019	Value [1000 USD] 2020	Price [USD] 2020
2A	5,015	4.86	3,254	4.53
2B	34,990	6.69	24,800	5.07
2C	17,306	5.67	12,685	4.33
3A	43,378	5.65	28,131	4.38
3B	8,436	5.46	6,168	4.19
4A	5,947	4.46	4,439	3.80
4B	4,080	4.41	3,286	3.67
4C	1,991	4.23	243	3.76
4D	4,453	4.49	5,387	3.94
4E	348	5.42	280	3.94
SUM AK (2C-4E)	85,938	5.35	60,618	4.21

Notes: NA – not available. Data for 2A based on PacFIN, and data for 2B based on BCSYIR. Estimates for Alaska based on data from eLandings system, limited to harvest landed under IFQ and CDQ management program and reported sold. Value calculated based on average price per ticket and landings allocated based on ADFG grid converted to IPHC regulatory areas. For border areas, the first reported area was assigned.

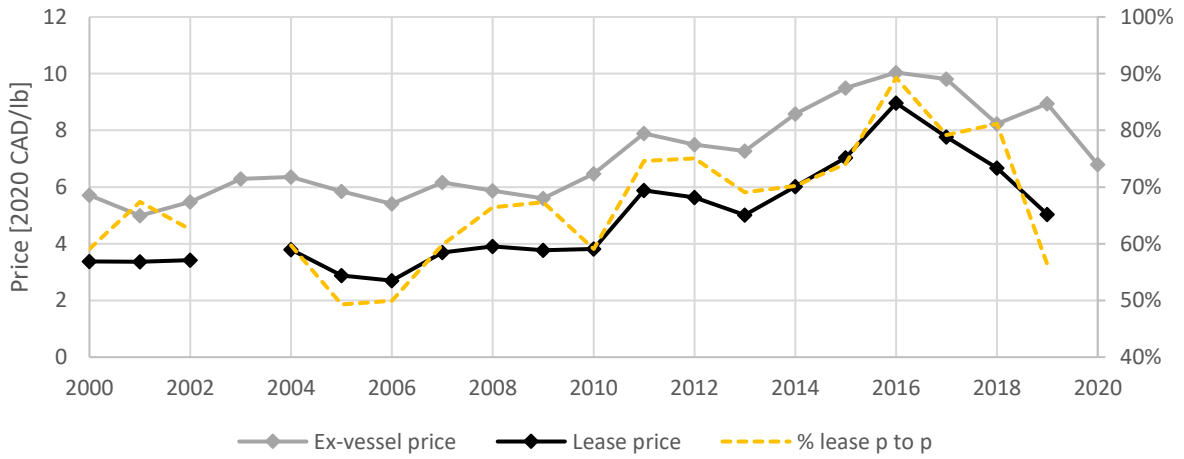

Figure 2: Ex-vessel vs. lease price in the Canadian commercial Pacific halibut fishing sector.

Size limits and U32 fish

Pacific halibut commercial fishery is subject to 32-inch minimum size limit (IPHC Fishery Regulations, section 19). However, since 2020 the IPHC sells Pacific halibut less than 32-inch (U32) that has been

caught as a part of the Fishery-Independent Setline Survey (FISS) design. These fish, although limited in number, provide the first direct information on the price for U32 Pacific halibut for comparison with the price of fish larger than 32 inch (O32), as well as the critical price ratios found in the IPHC's analysis of size limits (**Table 4**, IPHC-2020-IM096-09).[2]

Table 4: Pacific halibut U32 vs. U32 price ratio (2020-2021).

	2020			2021		
	p U32	p O32	price ratio	p U32	p O32	price ratio
Coastwide	$4.16	$4.77	87.2%	$5.66	$6.91	81.9%
2A	NA	NA	NA	$3.45	$5.72	60.4%
2B	$5.70	$5.91	96.5%	$7.00	$8.12	86.1%
2C	$4.16	$4.57	91.0%	$6.23	$6.70	93.0%
3A	$3.72	$4.39	84.6%	$6.29	$6.97	90.3%
3B	$3.82	$4.43	86.3%	$5.84	$6.04	96.6%
4A-E	NA	NA	NA	$4.92	$5.46	90.1%

Notes: NA indicates that the survey design did not cover the specified IPHC Regulatory Area.

Production structure

An essential input to the PHMEIA model is data on production structure (i.e., data on the distribution of revenue between profit and expenditure items). The model uses estimates from the species-based NOAA model for Alaska for 2014 (Seung, Waters, and Taylor 2019), as well as Pacific halibut sector estimates for the West Coast provided directly by the authors of the NOAA input-output model for the Pacific Coast fisheries (Leonard and Watson, 2011; Pacific halibut estimates not published). No equivalent detail model is available for British Columbia, although some partial statistics are derived from Edwards and Pinkerton (2020).[3]

Seafood processing

Alaska's direct marketers, catcher processors, catcher exporters, buyer exporters, shore-based processors, or floating processor permit holders are required to complete and submit to the ADFG a Commercial Operator's Annual Report (COAR). COAR reports on the by species statewide raw input purchase cost and wholesale value of the processed seafood. COAR data on Pacific halibut are also available by COAR Areas (ADFG, personal communication), supplementing the county-level analysis for Alaska.

In British Columbia, there are three types of seafood industry licenses issued by the Ministry of Agriculture, Food Safety and Inspection Branch. These include fish vendor license, fish receiver license and fish processing license. Interprovincial sales and sales abroad also require a license from the Canadian Food Inspection Agency (CFIA) under Safe Seafood for Canadians Regulations (SFCR). The wholesale value for halibut published in the *British Columbia Seafood Year in Review* is based on the provincial Annual Fish Production Schedule (AFPS) survey which is sent to all British Columbia processers, receivers (buyers), and custom clients (all seafood sellers). Worth noting is that while the

[2] The 2020 analysis found that if the relative price for U32 Pacific halibut is at least 63% of the price of current catch of O32 fish, then the fishery as a whole is projected to achieve equal or increased value if the minimum size limit was removed.

[3] Edwards and Pinkerton (2020) provide estimates of average operational and fixed costs. These, together with information on the quota lease price published in Castlemain (2019), are used to derive value added related to Pacific halibut fishing used in the model.

wholesale of Pacific halibut increased from 2018 to 2019, the *Seafood product preparation and packaging* sector in British Columbia is shrinking, noting 21% drop in contribution to GDP over the same period, as reported by Statistics Canada.

No data on the wholesale value of Pacific halibut are routinely collected for the US West Coast. The model uses the latest (2017) NOAA estimates on species-specific processor markups suggesting that for every dollar spent on Pacific halibut, the processors deliver USD 1.15 worth of product.

Alaska Department of Labor and Workforce Development reports on the number of resident and non-resident workers in the Alaska seafood industry, as well as the associated wages. No details on employment by processed species are available. Employment in seafood processing for the lower 48 is available from the *Quarterly Census of Employment and Wages*, but no statistics specific to Pacific halibut processing on the US West Coast are published. Detailed data on employment and wages in British Columbia seafood processing are available via AgriService BC series of publications *British Columbia Fish Processing Employment*. The statistics are reported by species, with estimates based on the additional information each company provides on the species groups that are processed in the facility and the estimated percent of jobs attributed to each group. The latest report from 2018 includes data up to 2016.

Table 5 summarizes statistics available for the Pacific halibut processing sector.

Table 5: Summary of available data on the Pacific halibut processing sector.

Region	2014	2015	2016	2017	2018	2019	2020	Unit	Source
Pacific halibut wholesale value									
AK	109.9	129.4	138.9	136.6	110.5	108.6	78.3	mil. USD	COAR
BC	106.9	98.5	94.9	70.4	65.9	71.4	64.6	mil. CAD	AgriService BC
WOC	1.17(1)	1.12(1)	NA	1.15(1)	NA	NA	NA	-	NOAA
Employment in the Pacific halibut processing sector									
AK	NA	NA	NA	NA	NA	NA	NA	-	-
BC	293	NA	319	NA	NA	NA	NA	n.empl.	AgriService BC
WOC	NA	NA	NA	NA	NA	NA	NA	-	
Wages paid by the Pacific halibut processing sector									
AK	NA	NA	NA	NA	NA	NA	NA	-	-
BC	9.2	NA	14.0	NA	NA	NA	NA	mil. CAD	AgriService BC
WOC	NA	NA	NA	NA	NA	NA	NA	-	-

Notes: NA indicates that the value is not available. All monetary values in current USD/CAD, as reported in the cited source.
(1)No wholesale value data available. Instead, the table reports on markup values for Pacific halibut.

Seafood trade

Data on trade in seafood products by the United States is available from NOAA Fisheries. The database provides no evidence for the export of fresh Pacific halibut, although some must be included in generic category HS 0302290100 : *Flatfish NSPF Fresh*. Frozen Pacific halibut exports are lumped with Atlantic halibut (HS 0303310015: *Flatfish halibut Atlantic, Pacific frozen*). Within this category, exports from Alaska and WOC were USD 4.6 mil. in 2019. Comparing this with Canadian statistics suggests that the majority of frozen Pacific halibut is sent to the Canadian market (USD 4.3 mil., HS 0303310020: *Halibut, Pacific, frozen*). Overall, this suggests that the majority of the US-caught Pacific halibut is contributing to the US economy throughout its value chain. Exports of processed Pacific halibut

products (e.g., fillets) are difficult to trace because they are generally merged with other halibut species and could include imported products.

Imports of fresh Pacific halibut, primarily coming from Canada (USD 29.5 mil., 89% from Canada in 2019), adds to the US domestic supply. There is, however, strong evidence that the domestic Pacific halibut is facing increasing pressure from imports. While the imports of fresh products (HS 302210020: *Flatfish Halibut Pacific Fresh*) increased between 2018 and 2019 only modestly (6%), import of frozen Pacific halibut (HS 0303310020: *Flatfish Halibut Pacific Frozen*) increased by 165%. The majority of the increase is attributed to imports from Russia. Although the import of frozen Pacific halibut is still modest (USD 7.4 mil.), there are growing concerns regarding the Alaskan Pacific halibut sector's vitality given the competition flooding the market with cheaper products (see reports by L. Welch).

Detailed data on Pacific halibut products trade by Canada are sourced directly from the Province of British Columbia. Fresh Pacific halibut accounts for about 5% of fresh fish exports from British Columbia, amounting to USD 26.1 mil. in 2019. Canadian statistics on exports of frozen Pacific halibut (HS 03033120*: Pacific Halibut frozen*) end in 2016, but replacing it generic frozen halibut category (HS 03033100: *Halibut frozen*) suggest that British Columbia exported in 2019 also up to USD 0.6 mil. worth of frozen Pacific halibut products. There are no fresh Pacific halibut-specific import statistics for Canada. Fresh Pacific halibut is lumped in HS 0302210090: *Halibu NES fresh/chilled*, but data on import from Alaska and WOC suggest import by British Columbia of USD 6.2 mil. and by Canada as a whole of USD 19.2 mil. Imports of frozen Pacific halibut fillets (HS 0304830020: *Fillets, of Pacific halibut, frozen*) by Canada amounted to USD 11.0 mil. in 2019, of which USD 9.0 mil. was from China.

Cross-regional flow of earnings

In 2020, about 37% of Alaska quota share units were reported as owned by residents of other states, mainly Washington, about 23%, but this includes also landlocked states. Moreover, about 16% of vessels fishing halibut (under IFQ or CDQ license) were registered as owned by resident of a state other than Alaska. Most of Alaska harvest is landed in state (97% in 2019 and 2020), although some is delivered to ports in Washington or Oregon. Detailed statistics on the structure of beneficial ownership of Pacific halibut fishing in Alaska in 2020 have been compiled using eLandings data and information available CFEC Public Search Application, and are available in **Table 6**.

In case of Canada, the cross-provincial transfer of benefits related to harvest profit is less pronounced. While the distribution issue is present, it is more of a question whether quota owner is an active participant or investor (Edwards and Pinkerton 2019). Most of the non-participants live in British Columbia, although many in the lower mainland, far from fishing grounds (Danielle Edwards, UBC, personal communication). According to DFO's Fishing License Statistics, no vessel holding a Pacific halibut quota is registered as foreign, but it is important to note that there is no rule against it (House of Commons Canada 2019).

Table 6: Beneficial ownership of AK Pacific halibut fishery in 2020.

Vessel owner's state of residence	Permit (quota) owner's state of residence	Landed value [mil. USD]	Unique vessels	Unique permits	Revenue share	Landed in AK
AK	AK	40.7	572	903	67.7%	100%
AK	WOC	2.9	36	40	4.8%	98.5%
AK	US-r	1.3	21	21	2.2%	100%
WOC	AK	1.2	14	19	2.0%	100%
WOC	WOC	11.3	68	90	18.8%	87.3%
WOC	US-r	1.7	7	8	2.8%	94.6%
US-r	AK	0.2	4	6	0.4%	100%
US-r	WOC	*	*	*	*	*
US-r	US-r	0.6	10	11	1.0%	100%

Note: US-r indicates states other than AK, WA, OR, or CA. Compiled using eLandings data on the value of landings and information from the CFEC Public Search Application. Includes only landings under IFQ and CDQ management program. *Indicates values removed to preserve confidentiality (less than three vessels or permits).

Flow of earnings is also associated with labor compensation. When wages are paid to non-residents, the majority of that money will flow to the place of their primary residence. While no statistics on the composition of employment in the Pacific halibut fisheries sector are available for the regions considered in the model, some notable general statistics are worth mentioning. According to the Alaska Department of Labor and Workforce Development, nonresidents made up 20.8% of Alaska's workforce in 2019 and earned 15.3% of wages (Kreiger and Whitney 2021). This share is considerably higher, reaching 61.2%, for the fishing sector[4] and 68.3% for *Seafood processing* sector.[5] No equivalent estimates were identified for British Columbia or the US West Coast.

Cross-county flows in Alaska

According to 2020 data from eLandings combined with information on vessels and permits available via CFEC (details in **Table 7**), the county of landing matched the county of vessel owner residence for about 48.5% worth of Alaskan harvest. When it comes to the residence of the permit owner, it matched the county of landing for 46.1% harvest value. Vessel homeport matched about 50.0% worth of landings. The direction of the flow of benefits from the landing area to vessel owner residence, quota holder residence and vessel homeport location is depicted in **Figure 3**. Here, the inner circle represents the county where the fish was landed, and the outer circle represents the county where (1) the vessel owner resides, (2) where the quota owner resides, and (3) the vessel homeport is located. The width of the ring section represents the estimated value of landings.

[4] However, the preliminary results from the IPHC economic survey focused on the Pacific halibut fleet suggest more local employment in this part of the fishing sector. Consequently, PHMEIA assumes the following composition of the labor force (in terms of wages) in the Pacific halibut fishing sector: 78% Alaska residents, 20% residents of the US West Coast and 2% residents of other US states. Due to the currently low sample size, the adopted estimates on the cross-state flow of wages in the Pacific halibut fishing sector are subject to change.

[5] The model adopts the same share to Pacific halibut processing, assuming there is no significant difference in the operations of processing plants depending on the species. The nonresident origin is assumed to follow the general trends reported by the Internal Revenue Service (IRS 2020).

Table 7 Cross-regional and cross-county flow of benefits related to residence of the vessel owner, the permit owner, and vessel homeport (2020).

	Landing value	Value by the residence of the vessel owner	Change vs. landing value	Value by the residence of the quota holder	Change vs. landing value	Value by vessel homeport location[(1)]	Change vs. landing value
Aleutians East	5.69	0.62	-89.2%	0.67	-88.3%	1.23	-78.4%
Aleutians West	7.04	1.44	-79.6%	1.81	-74.3%	4.52	-35.9%
Anchorage	0	0.77	+	1.42	+	0.37	+
Bristol Bay	c	0	NA	0	NA	0	NA
Dillingham	0.05	0.06	25.7%	0.06	25.7%	0.06	25.7%
Fairbanks North Star	0	c	+	c	+	0	+
Haines	c	1.02	NA	0.72	NA	0.38	NA
Hoonah-Angoon	1.64	0.76	-53.7%	0.65	-60.6%	0.97	-40.9%
Juneau	5.81	2.96	-49.1%	2.87	-50.5%	6.04	4.0%
Kenai Peninsula	16.81	12.50	-25.6%	10.44	-37.9%	11.69	-30.5%
Ketchikan Gateway	0.82	0.81	-0.9%	0.89	9.3%	1.05	27.8%
Kodiak Island	6.29	6.97	10.7%	5.74	-8.8%	8.30	31.9%
Lake and Peninsula	0	c	+	c	+	c	+
Matanuska-Susitna	0	2.01	+	1.30	+	c	+
Nome	0.57	0.57	0.0%	0.57	0.0%	0.49	-13.8%
Petersburg	3.79	6.32	66.6%	6.58	73.5%	7.15	88.5%
Prince of Wales-Hyder	0.51	0.52	1.9%	0.55	7.8%	0.61	18.4%
Sitka	1.07	1.92	79.1%	1.79	67.7%	2.04	91.2%
Southeast Fairbanks	0	1.14	+	1.04	+	c	+
Skagway	c	0	NA	c	NA	0	NA
Valdez-Cordova	3.53	1.26	-64.2%	1.95	-44.9%	1.78	-49.6%
Wrangell	1.16	1.25	7.7%	1.15	-1.1%	1.10	-5.3%
Yakutat	3.68	1.95	-47.0%	1.83	-50.1%	1.61	-56.3%
WOC	1.57	14.22	803.4%	14.33	810.7%	10.34	556.7%
US-r	0	0.96	+	3.60	+	0	+

Notes: US-r indicates states other than AK, WA, OR, or CA. c – confidential, represents less than three vessels; + represents a positive flow when the landing base was zero. [(1)]Vessel homeport was not identified for about USD 228,600 worth of landings.

(1) Landing area vs. vessel owner residence

(2) Landing area vs. permit owner residence

(3) Landing area vs. vessel homeport location

Figure 3 Direction of the flow of benefits from the landing area to (1) vessel owner residence, (2) quota holder residence, and (3) vessel homeport location.

The majority of the Pacific halibut buyers in 2020 were located in Alaska (97.8% in terms of value); 2.2% worth of harvest went to out-of-state buyers and could not be traced further. Within Alaska, 99.7% of buyers were shorebased processors. Processing typically occurs in the buyer's location. Only about 10.9% of the harvest in terms of landing value went through custom processing, of which 23.9% in the place different to the location of the buyer, typically right where it was landed (100%). The remaining harvest (i.e., not going through custom processing) matched the landing county for about 91.4% of landings in terms of value, with the remainder going through buying stations located at the landing location.

Following the flow of revenues further, about 58.9% worth of harvest purchased by shorebased processors was purchased by shorebased processors that listed as a point of contact a county other than the location of the processing facility. What is more, 96.3% of the above value can be traced to processors with point of contact on the US West Coast. Note that the share here was calculated based on the original landing value and does not account for variation in wholesale value dependent on the type of produced outputs.

Figure 4 depicts the flow of revenue from the harvest location to the processor point of contact. Here, nods represent spatial aggregation:

- Blue – harvest by IPHC Regulatory Areas;
- Red – county of the landing site;
- Yellow – if ordered, county of the custom processing;
- Green – county of the reported buyer (location of the buying station not included in the figure);
- Purple – location of the Fisheries Business License holder (based on the contact address).

Ribbons represent flows in terms of the estimated value of landings (mil. USD) (i.e., landing value, not adjusted for value added through processing):

- Blue ribbons represent the flows from harvest grounds to landing sites in Alaska;
- Grey ribbons represent the flows between nodes that are located in the same Alaskan county;
- Orange ribbons represent the flows between nodes that are located in different counties;
- Red ribbons represent the flows out of Alaska.

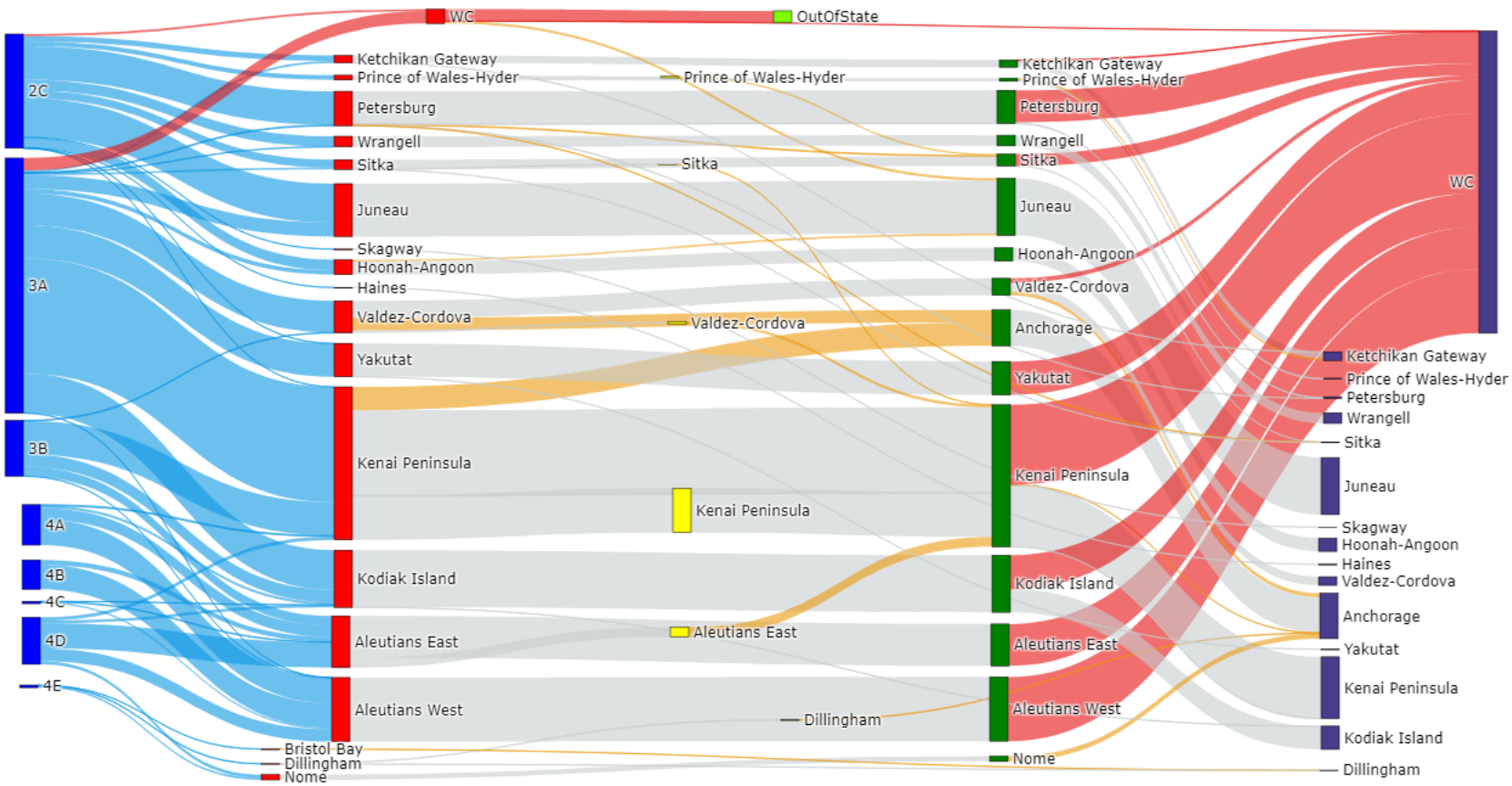

Figure 4 Flow of Pacific halibut harvest from harvest location to buyer's headquarters (2020).

Recreational fishing

The Sport Fish Division of the ADFG conducts annually a mail survey to estimate sport fishing total harvest, total catch and participation in the number of anglers, and the number of days fished (generally referred to as Statewide Harvest Survey). Additionally, NOAA reports on the number of anglers by resident type (coastal vs. out-of-state) as a part of the *Marine Recreational Information Program*. The charter sector is also required to report on daily trips through the Saltwater Logbook Program. NOAA also reports on ownership of Charter Halibut Permits (CHPs). The ownership structure of Alaskan CHP's in terms of the number of endorsed angler is depicted in **Figure 5**.

Alaska charter owners are also regularly surveyed on their cost and earnings (Alaska Saltwater Sport Fishing Charter Business Cost and Earnings Survey). The survey was previously administered in 2012, 2013, 2014, and 2016 to collect data on the 2011-2013 and 2015 seasons. The latest survey, administered in 2018, describes the 2017 fishing season (Lew and Lee 2019).

On the West Coast, marine recreational fishing is monitored by the Pacific Coast Recreational Fisheries Information Network (RecFIN). RecFIN surveys include the Ocean Sampling Program and Puget Sound Sampling Program, administered in Washington, the Ocean Recreational Boat Survey and Shore and Estuary Boat Survey, administered in Oregon, and the California Recreational Fishing Surveys. Participation in the recreational fishery is reported in terms of the number of angler trips and the number of boat trips per region, mode, and trip type. Trip type is defined in terms of target species.

Periodically, all anglers in the United States are surveyed about their annual expenditures on saltwater recreational fishing. The latest survey covering both trip-based expenditures (e.g., ice, bait, and fuel) and cost of fishing equipment and other durable goods (e.g., fishing rods, fishing tackle, and boats) was conducted in 2011 (Lovell, Steinback, and Hilger 2013). A reduced scope survey, inquiring only about durable goods' expenditures, was conducted last in 2014 (Lovell et al. 2016).

DFO conducts a nation-wide *Survey of Recreational Fishing in Canada* every five years. The latest took place in 2015. The survey targets all individuals identified in the provincial and territorial recreational fishing license databases and inquires about direct expenditures associated with their fishing trips. No statistics specific to Pacific halibut recreational fishing are reported. BC Stats reports on key indicators for sport fishing, including GDP, revenue, employment, and wages associated with sport fishing activities in *British Columbia's Fisheries and Aquaculture Sector* report, but the latest data are available for 2016.

Catch and effort data for recreational fishing in British Columbia is collected using the Internet Recreational Effort and Catch (iREC) reporting program. The program collects information every month from randomly selected participants on fishing activity including kept and released catch of over 80 species of finfish and shellfish, as well as effort information by date, area and fishing method. The program is being conducted for DFO by an independent consulting company that

specializes in survey delivery. Canadian catch and effort data is also collected via logbooks, lodge manifests and recreational creel surveys.

Table 8 summarizes available recreational fishing statistics, including data on participation, revenue, and expenditures in all Pacific halibut producing regions.

Table 8: Recreational fishing statistics – available data on participation, revenue and expenditures.

Region	2014	2015	2016	2017	2018	2019	2020	Unit	Source
Effort - saltwater recreational fishing									
AK	876.5	890.1	782.4	811.9	773.7	829.7	565.6	1000 angler-trips	NOAA
BC	NA	2,014.3	NA	NA	NA	NA	NA	1000 angler-days	DFO
WOC[(1)]	2,844.8	2,939.3	2,664.3	2,733.0	1,796.8	1,832.6	1,389.8	1000 angler-trips	RecFIN
Effort - saltwater party/charter/guided fishing									
AK	248.9	253.8	255.1	260.3	262.4	262.6	NA	1000 angler-days	ADFG
BC	NA	NA	NA	NA	NA	NA	NA	-	-
WOC[(1)]	653.2	713.1	657.0	667.2	654.4	670.8	452.1	1000 angler-trips	RecFIN
Participation in Pacific halibut recreational fishing									
AK-guided[(2)]	199.4	199.4	205.0	205.7	210.5	210.3	191.6[(3)]	1000 angler-days	(Webster and Powers 2020)
AK-unguided	NA	NA	NA	NA	NA	NA	NA	-	-
BC	NA	NA	NA	NA	NA	NA	NA	-	-
WOC-charter[(4)]	5.4	5.8	5.7	6.9	5.6	5.9	4.6	1000 angler-trips	RecFIN
WOC-private[(4)]	18.9	20.7	26.2	28.2	27.3	26.2	23.6	1000 angler-trips	RecFIN
Business revenue from saltwater recreational fishing									
AK	NA	116.1[(5)]	NA	111.5[(5)]	NA	NA	NA	mil. USD	(Lew and Lee 2018, 2019)
BC	598.2	626.9[(6)]	655.7	NA	NA	NA	NA	mil. CAD	BC Stats
WOC[(7)]	NA	NA	NA	NA	NA	NA	NA	-	-
Expenditures on saltwater recreational fishing									
AK	115[(8)]	122.4[(5)]	NA	89.2[(5)]	NA	NA	NA	mil. USD	(Lew and Lee 2018, 2019; Lovell et al. 2016)
BC[(8)]	NA	578.1	NA	NA	NA	NA	NA	mil. CAD	DFO
WOC	2219[(9)]	NA	NA	NA	NA	NA	NA	mil. USD	(Lovell et al. 2016)

Notes: NA indicates that the value is not available. All monetary values in current USD/CAD, as reported in the cited source. [(1)]Includes estuary fishing. [(2)]Effort is defined as angler-days with recorded bottomfish hours or harvest of at least one halibut. However, because mix trips are commonplace in Alaska, the PHMEIA model adopts the share of reported bottomfish trips (excluding mix trips) vs. all saltwater trips, to calculate the share of Pacific halibut dependent effort. [(3)]Forecast. [(4)]In general this could include California halibut (species not specified), although no halibut trips are reported for California. [(5)]Includes only the charter sector. [(6)]Revenue for the guided sector in the PHMEIA model is assessed based on the results of DFO's Survey of Recreational Fishing in Canada, and follows from the estimates on the anglers expenditures on the Package Deals and Fishing Services. [(7)]Revenue for the guided sector in the PHMEIA model is assessed based on the values reported in the report *The Economic Contribution of Marine Angler Expenditures in the United States* (Lovell et al. 2013), using the following expenditure categories: charter fees and crew tips. [(8)]Pacific halibut sharein the PHMEIA model was estimated using BC annual recreational limit and general estimates for the IPHC Regulatory Area 2A. [(9)]Includes only expenditures on durable goods. These accounted for 33% in Alaska and 66% in WOC of the total expenditures in 2011 (Lovell et al. 2013).

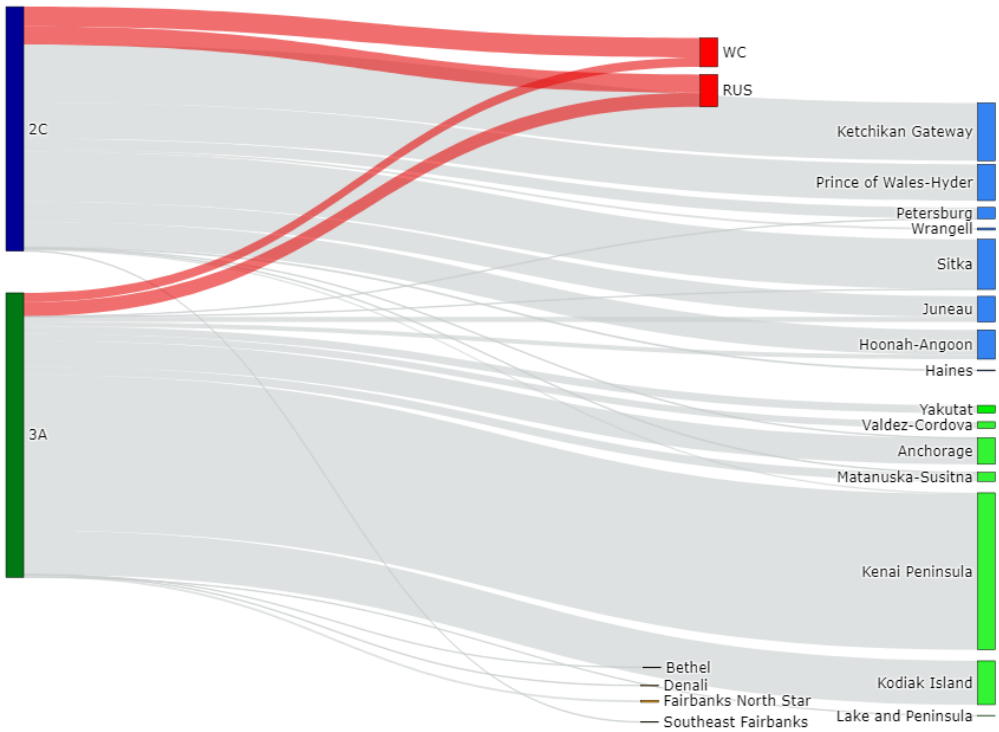

Figure 5 Ownership structure in Alaska charter sector (2020).

Subsistence fishing

Previous research suggested that noncommercial or nonmarket oriented fisheries contribution to national GDP is often grossly underestimated, particularly in developing countries (e.g., Zeller, Booth, and Pauly 2006). Subsistence fishing is also important in traditional economies, often built around indigenous communities. Wolfe and Walker (1987) found that there is a significant relationship between the percentage of native population in the community and reliance on wildlife as for a food source in Alaska. However, no comprehensive assessment of the economic contribution of the subsistence fisheries to the Pacific northwest is available. The only identified study, published in 2000 by Wolfe (2000), suggest that the replacement value of the wild food harvests in rural Alaska may be between 131.1 and 218.6 million dollars, but it does not distinguish between different resources and assumes equal replacement expense per lbs. Aslaksen et al. (2008) proposed an updated estimate for 2008 based on the same volume, noting that transportation and food prices have risen significantly between 2000 and 2008 and USD 7 a pound is a more realistic replacement value. This gives the total value of USD 306 million, but the approach rely upon the existence of a like-for-like replacement food (in terms of taste and nutritional value), which is arguably difficult to identify in many cases (Haener et al. 2001) and ignores the deep cultural and traditional context of halibut in particular (Wolfe 2002). A more recent study by Krieg, Holen, and Koster (2009) suggests that some communities may be particularly dependent on wildlife, consuming annually up to 899 lbs per person, but no monetary

estimates are derived. Moreover, although previous research points to the presence of sharing and bartering behavior that occurs in many communities (Szymkowiak and Kasperski 2020; Wolfe 2002), the economic and cultural values of these networks have yet to be thoroughly explored.

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