Oregon Department of Fish and Wildlife

Economics of Oregon's Recreational and Commercial Pacific Halibut Fisheries

Oregon Department of Fish and Wildlife
Marine Resources Program
&
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Corvallis, Oregon

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Economic impacts to the Oregon recreational and commercial fisheries for the 2015 IPHC catch limit alternatives

Summary

This report provides the economic impacts to the Oregon halibut fisheries for the 2015 IPHC catch limit alternatives (hereafter IPHC Alternatives). The economic implications for each alternative were paired alongside the biological implications that were provided by IPHC staff (Ian Stewart) at the IPHC Interim Meeting (Table 1). This pairing provides a more comprehensive understanding of the economic and biological trade-offs.

The biological benefits from a reduction in the catch limit from the Status Quo Catch Alternative to the Blue Line Alternative are relatively minor, while the costs to Oregon recreational and commercial fisheries would be great. Specifically, this reduction in the catch limit would 1): only have a seven percent effect on the probability of the long-term (2018) spawning biomass decreasing; 2) have less than one percent effect on the long-term spawning biomass falling below 30 percent of historic levels; 3) decrease the value of the Oregon halibut fisheries by 20 percent ($0.77-million).

A short summary of the economic impacts to the recreational and commercial fisheries is provided in the next section, and full descriptions of the economic impacts and methodologies used in their computation are included in Appendix 1 for the recreational fishery and Appendix 2 for the commercial fishery.

Table 1. Biological and economic trade-offs (to Oregon) for select 2015 Catch Level Alternatives. Modification of decision table presented by IPHC staff (Ian Stewart) at the IPHC Interim Meeting to show economic and biological implications aside each other.

			Biological Implications				Fishery/Economic Implications					
			Stock Trend		Stock Status		Fishery Trend		Impacts to Oregon ($millions)			
			Spawn. Bio. in 2018		Spawn. Bio. in 2018		FCEY from har. policy		Value by fishery			
2015 Alternative	Coastwide removals (millions)	Area 2A TAC (FCEY) (thousands)	is less than 2015	is 5% less than 2015	is less than 30%	is 5% less than 20%	is less than 2015	is 10% less than 2015	Com-mercial	Rec-reational	Total	Total Loss if less than SQ Catch
No Removals	0.0	0	<1/100	<1/100	1/100	<1/100	<1/100	<1/100	0.00	0.00	0.00	-3.53
30 mlbs	30.0	540	17/100	4/100	5/100	<1/100	3/100	2/100	0.60	1.38	1.98	-1.55
Blue Line	38.7	750	40/100	23/100	8/100	<1/100	36/100	23/100	0.84	1.92	2.76	-0.77
SQ Catch	41.4	960	47/100	30/100	9/100	1/100	51/100	38/100	1.07	2.46	3.53	0.00
50 mlbs	50.0	1010	75/100	51/100	13/100	1/100	95/100	84/100	1.13	2.60	3.73	(+0.25)

Notes:

1) Modification of decision table presented by Ian Stewart at the IPHC Interm Meeting; ***Modification 1: Economic impacts to Oregon added***

2) Used long-term (by 2018) biological implications instead of both short-term (by 2016) to make table more consise and readable

3) Used a selection of Alts. from originial table to be more concise and readable ; still maintains wide range and alts of interest (Blue)

4) Commercial values are in ex-vessel revenue and recreational values are in expenditures (angler spending on halibut fishing trips)

5) Ex-vessel and expenditures values used since are comparible values for sport and commercial (but are conservative values-see Appendices for detail)

6) Alterantives without name from original table were given a name based on their respective mlbs of total coastwide removals (e.g., 30 mlbs Alt)

7) Area 2A is US West Coast (Oregon, California, Washington); TAC and thousands of lbs used since most familiar measure of 'quota' in 2A

Economic impacts for the Oregon recreational halibut fishery

A reduction in the Area 2A Total Allowable Catch (TAC; or FCEY) from the Status Quo Catch Alternative (960,000 lbs.) to the Blue Line Alternative (750,000 lbs.) is projected to reduce the economic contribution of the Oregon recreational halibut fishery (in terms of angler spending) by approximately a half-million dollars per year (Table 1); nearly a quarter of the overall value of the fishery.

Further, over half of this loss (60 percent; $325,000) would be expected to occur in Newport alone, the primary port utilized by the recreational fishery (Table 2). However, Garibaldi, the second most utilized halibut port (15 percent of total effort), may be the most affected economically because the population is small (800 people) and the per capita impacts ($60 per person) would be three times greater than any of the other ports. Methods and assumptions used to project economic impacts for the recreational halibut fishery are discussed in Appendix A.

The halibut fishery is one of the most important recreational fisheries in Oregon despite only having a small fraction of the coast-wide halibut 'quota' (i.e., 0.5 percent of coastwide FCEY). The fishery brings an influx of tourist dollars to coastal economies, as most halibut anglers travel far distances to fish, stay overnight, and consequently spend money locally on hotels, restaurants, fuel, etc. Further, the halibut seasons are designed so that the bulk of this spending occurs during spring months (i.e., May and June) when overall tourism is relatively low (compared to summer) and when there are fewer other fisheries to draw anglers to the coast (e.g., salmon and tuna occur in summer). And perhaps most importantly, the halibut fishery has been much more stable than the salmon and tuna fisheries, thereby providing a more dependable revenue source, and a hedge against bust salmon or tuna years.

Table 2. Total and regional economic impacts to the Oregon recreational halibut fishery if the 2015 catch limit is changed from status quo (Δ$ SQ Catch).

		Total Economic Impacts			Regional Economic Impacts (Δ$ SQ Catch)					Per Capita Econ. Impacts (Δ$ SQ Catch)			
2015 Alt.	2A TAC	Trips	$ Total	Δ$ SQ Catch	Newport	Garibaldi	Depoe B.	Brookings	Other	Newport	Garibaldi	Depoe B.	Brookings
No Rmlvs	0	0	$0	-$2,460,288	-$1,483,554	-$366,583	-$189,442	-$169,760	-$250,949	-$89	-$276	-$82	-$16
30 mlbs	540	8,046	$ 1,383,912	-$1,076,376	-$649,055	-$160,380	-$82,881	-$74,270	-$109,790	-$39	-$121	-$36	- $7
Blue Line	750	11,174	$ 1,921,977	-$538,311	-$324,602	-$80,208	-$41,450	-$37,143	-$54,908	-$19	- $60	-$18	- $3
SQ Catch	960	14,304	$ 2,460,288	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
50 mlbs	1010	15,049	$ 2,588,428	+$128,140	+$77,268	+$19,093	+$9,867	+$8,842	$13,070	+$5	+$14	+$4	+$1

Notes:
1) Values are in angler expenditures (direct spending per trip on fuel, bait, lodging, etc.)
2) Regional impacts = total impacts x proportion of total angler trips based from the community
3) Per capita regional impacts = total regional impacts / population of community
4) 2A catch limit in thousands of TAC (FCEY) because most familiar measure to participants

Economic impacts for the Oregon commercial halibut fishery

A reduction in the coast-wide catch level (FCEY) from the Status Quo Alternative to the Blue Line Alternative is projected to reduce the economic contribution of the Oregon commercial halibut fishery (in terms of value of catch) to Oregon coastal economies by $234,000 per year (Table 1); a fifth of the overall value of the fishery.

Since halibut landings also generate additional revenue for non-harvesters (e.g., processors and distributors), actual economic impacts are greater than landed catch values alone. Therefore, regional economic impacts (REI; personal income) resulting from catch were used to provide a better measure of actual economic impacts resulting from a decreased catch limit (Table 3). A reduction in the catch limit to the Blue Line Alternative would reduce regional economic impacts by $422,000.

A reduction in the catch limit would be hardest felt by a small portion of individual vessel owners. Although the value of halibut landings relative to overall commercial landings is minor (<1 percent), 32 percent of the value of the Oregon halibut fishery is harvested by only 10 percent of the vessels (The Research Group 2014). If the vessels are unable to recoup displaced halibut revenue (may not be possible since the other major fisheries are limited-entry and are at full capacity), then operations be may jeopardized.

As previously stated, a small portion of individual vessel owners would be hardest hit, and the same would hold true for the fishing communities in Oregon. Specifically, economic impacts from a reduction in the catch limit would have the greatest effect on Newport (70 percent of landings), followed by Coos Bay/Charleston (10 percent of landings).

Table 3. Projected economic impacts for the commercial halibut fishery to Oregon for the 2015 IPHC Alternatives (values in thousands).

	2A TAC		Oregon Harvest		Oregon Econ. Impacts (compared to SQ Catch)		
2015 Alt.	net lbs	rnd lbs	Volume	Value	Harvest Value	Personal Income	Change
No Removals	0	0	0	0	-1108	-1735	-100%
30 mlbs	540	718	106	604	-505	-790	-46%
Blue Line	750	998	147	839	-270	-422	-24%
SQ Catch	960	1277	189	1,073	-35	-55	-3%
50 mlbs	1010	1343	199	1,129	+21	+33	+2%

Notes:

1. Value is sale price of landings (ex-vessel revenue); economic impacts are in personal income and account for total value of halibut landings to fishers, processors, and communities
2. 2015 landings assume that Oregon lands the same portion of the entire non-tribal commercial fishery (of 2A) as in 2013
3. 2015 harvest value assumes year 2014 prices
4. Source: Study, Gilroy (2014), Stewart (December 15, 2014), TRG (March 2014), and PacFIN annual vessel summary data (March and November 2014 extractions).

Appendix A: Methods and assumptions used to project economic impacts for the Oregon recreational halibut fishery

Methods summary

Total economic impacts were projected by: 1) determining the corresponding 2A TACs (FCEYs) for an encompassing range of select IPHC coast-wide total removal alternatives (hereafter IPHC Alternatives); (2) determining the relationship between 2A TAC and Oregon recreational halibut angler trips using historical data; (3) using the relationship to project the number of trips for the IPHC Alternatives; (4) determining the value per trip, based on angler expenditures (trip costs); and (4) determining total economic impacts by multiplying trips by value per trip.

Regional impacts (i.e., to port cities) were determined by partitioning total economic value to ports based on respective proportional contribution to total effort (e.g., Newport was assigned 60 percent of total value since 60 percent of total effort occurs there). Impacts per capita for port cities were also determined to provide scale of the value of the halibut fishery relative to the population size.

1. Corresponding 2A TACs for IPHC Alternatives

To determine economic impacts to the Oregon recreational halibut fishery for the IPHC (coast-wide removal) Alternatives, corresponding 2A TACs had to be first determined. To reduce the complexity of graphs and tables used in the analysis, a selection of five of the nine IPHC Alternatives were used in the analysis (Table A.1). The five selected encompass a comprehensive range of 2A TACs, and include those of greatest potential interest to IPHC Commissioners (i.e., Blue Line and Status Quo Catch). Corresponding 2A TACs for the IPHC Alternatives were provided by Ian Stewart and were determined using survey-based apportionment results from this year (except for the Status Quo Catch Alternative, which was established by the IPHC Commissioners last year).

Table A.1. Corresponding 2A TACs (FCEYs) for select IPHC (coast-wide total removal) Alternatives from the 2015 IPHC decision table (Stewart 2015).

	Coast-wide (millions of lbs.)		Area 2A (thousands of lbs.)	
2015 IPHC Alt.	Total Mortality	TAC	Total Mortality	TAC
No Removals (0 mobs)	0.0	0.0	0	0
30 mobs	30.0	16.5	620	540
Blue Line (38.7 mobs)	38.7	25.0	840	750
SQ Catch (41.4 mobs)	41.4	27.5	1,050	960
50 mobs	50.0	36.0	1,100	1,010

2. Relationship between 2A TAC and Oregon recreational halibut trips

As would be expected, the number of trips Oregon recreational halibut trips is related (linearly) to the size of the 2A TAC. The relationship was accordingly modeled using linear regression (through the origin; forces zero trips for closed fisheries), and was found to be 1,490 angler trips per 100,000 pounds of 2A TAC (black diagonal line; Figure A.1). Although the relationship is relatively strong (i.e., black line fits the data well), there are other factors besides the 2A TAC that influence the number of angler trips (e.g., variation in halibut catch per day for anglers or weights of catch).

The relationship reflects the 2015 allocation scheme of Area 2A, and accounts for deductions made in both 2014 and 2015 to the 2A allocation of the Oregon recreational halibut fishery (i.e., 1 percent of the recreational fishery allocation was transferred from Oregon to California both years by the Pacific Fishery Management Council and the National Marine Fisheries Service). Since Oregon now receives a lesser share of the 2A TAC, historic trips counts had to be calibrated downward to fit the reduced 2015 allocation scheme.

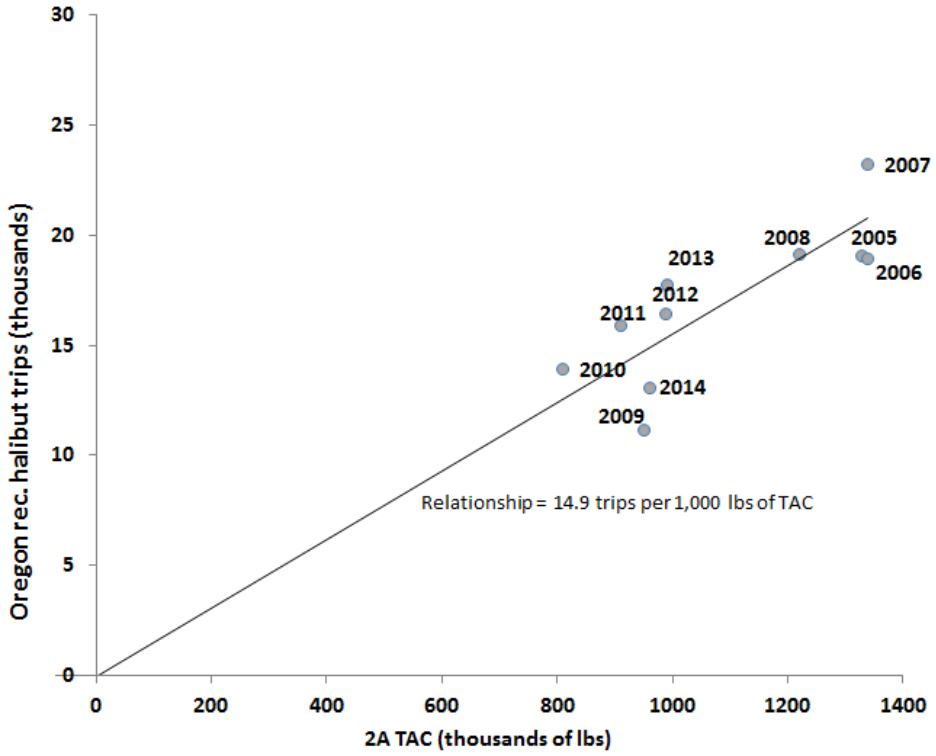


Figure A.1: Relationship between Oregon recreational halibut trips and 2A TAC, 2005-current.

3. Projected Oregon recreational halibut trips for the IPHC alternatives

Projected Oregon recreational trips were made by inserting the corresponding 2A TACs for the IPHC Alternatives into the regression model (from section 2). For example, projected trips for the Blue Line Alternative were modeled by multiplying 1,490 (trips per 100,000 lbs. of 2A TAC) by 7.5 (the Blue Line 2A TAC in 100,000s of lbs.), thereby equaling 11,175 trips.

Projections of Oregon recreational halibut trips for the IPHC Alternatives are expected to be accurate because the relationship between trips and the 2A TAC, used to develop the projection model, is strong (discussed in section 2).

Projected trips for the IPHC Alternatives (black, blue, and green dots) as well as actual trips (grey dots) from past years are shown in Figure A.2. As can be seen, the projected trips for the Blue Line Alternative (11,174; blue dot) are considerably less than projected trips for the Status Quo Catch Alternative (14,304; green dot), and substantially less (~50%) than the number of trips that occurred per year from 2005-2008.

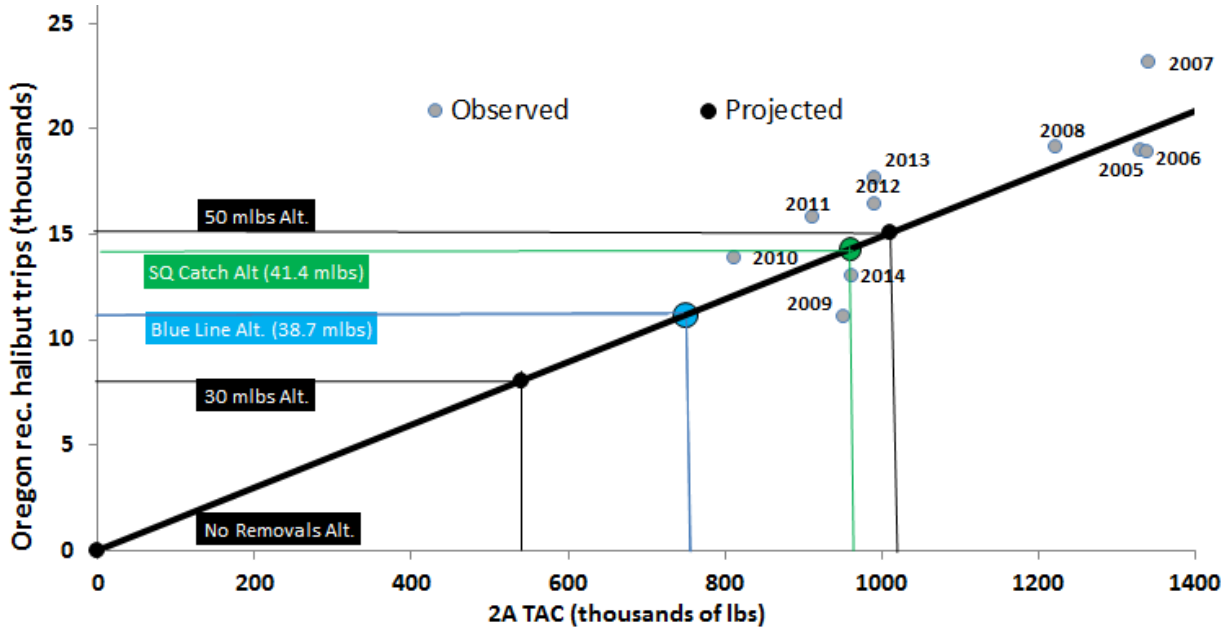


Figure A.2: Projected Oregon recreational halibut trips for the 2015 IPHC Alternatives (black dots, large blue dot for the Blue Line Alt., large green dot for Status Quo Catch Alt.) and corresponding 2A TACs. Also shown are observed trips and 2A TACs from 2005-2014 (grey dots) and the relationship between trips and the 2A TAC (diagonal black line).

4. Economic value per Oregon recreational halibut trip

To determine the economic impacts for each of the IPHC alternatives, a monetary value had to applied to the corresponding projected number of Oregon recreational halibut trips (from step 3). Since recreational anglers do not sell their catch, economists commonly use angler expenditures, the money spent on trip related expenses (e.g., fuel, lodging, tackle), to assess the economic contribution of recreational angler trips.

Note that angler expenditures are a conservative measure of value, as there are additional sources of value related to these trips such as indirect trip costs (e.g., boat purchases), secondary spending (e.g., "money multipliers"), and personal satisfaction (e.g., enjoyment). Quantification of these additional sources of value will require extremely intensive analysis, and is a goal for the 2015 economic analysis.

For this analysis, the most recent expenditure data for Oregon anglers from the National Marine Fisheries Service (NMFS) nationwide marine angler expenditure survey by Lovell et al. (2013) were used. To account for differences in expenditures among charter ($381) and private anglers ($120), a weighted average ($172) was used based on proportional contribution of each to total halibut effort (i.e., 80 percent private trips; 20 percent charter trips).

$172 (weighted avg. per trip) = $381 per charter trip x 0.2 proportion charter trips
+ $120 per private trip * 0.8 proportion private trips

5. Projected total economic impacts

Total economic impacts for the IPHC Alternatives were determined by multiplying projected trips by value (expenditures) per trip (Table A.2; Figure A.3). A reduction in the 2A TAC from the Status Quo Catch Alternative (960,000 lbs.) to the Blue Line Alterative (710,000 lbs.) is projected to decrease the value of the fishery by over $500-thousand, from $2.46-million to $1.92-million (Table B.2). Any reductions for 2015 would be in addition to the $1-million loss that has already occurred since the mid-2000's, when the 2A TAC was over a million lbs.

Table A.2. Value of the Oregon recreational halibut fishery, in angler expenditures, for select IPHC Alternatives (and corresponding 2A TACs) and change in value from Status Quo (Δ$ SQ).

		Total Economic Impacts		
IPHC Alternative	2A TAC	Trips	$ Total	Δ$ SQ
No Removals	0	0	$ 0	$ -2,460,288
30 mlbs	540	8,046	$ 1,383,912	$ -1,076,376
Blue Line	750	11,174	$ 1,921,977	$ -538,311
Status Quo Catch	960	14,304	$ 2,460,288	$ 0
50 mlbs	1,010	15,049	$ 2,588,428	$ +128,140

6. *Regional economic impacts to coastal communities*

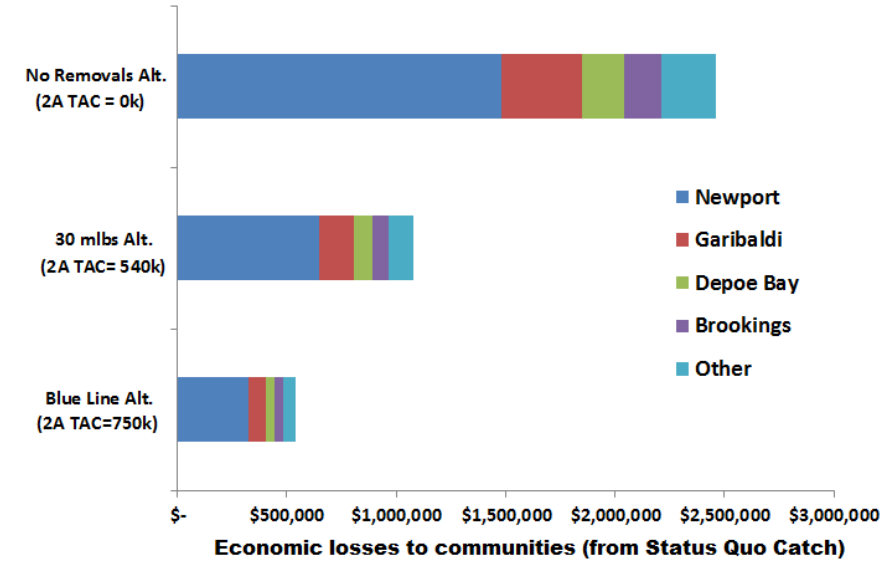
Because the recreational halibut fishery is based out of a limited number of small port communities, it is important to gauge regional economic impacts because most of the expenditures, and thus most of the total economic impacts, are going to occur in these port communities (e.g., lodging, charter fees, restaurants). However, since not all trip related expenditures occur in port communities (e.g., fuel), economic impacts are best described in total instead of by region.

Regional economic impacts were determined by distributing the total economic impacts to the port communities based on their respective contribution to total halibut trips. For example, 8 percent of total economic impacts were assigned to Depoe Bay because 8 percent of total effort is based there. Additionally, regional impacts were scaled to the populations of the port communities (expenditures per capita) to better provide a perspective of the economic consequences to the communities for the IPHC Alternatives, as smaller such as (e.g., Garibaldi; population=800) are more greatly impacted by a set reduction of trips (e.g., 1,000) than larger, more economically diversified communities (e.g., Newport; population=10,100).

If the 2A TAC is reduced from Status Quo (Alternative), more than half the total loss will occur to Newport alone (Figure A.3; Table A.3); however, the greatest economic impacts are going to occur in Garibaldi, with per capita losses over three times greater than elsewhere (Table A.3).

Table A.3 and Figure A.3. Projected regional economic impacts by port and per capita (per port) from status quo harvest level (Δ$ SQ) for each harvest level option.

		Total Economic Impacts			Regional Economic Impacts (Δ$ SQ Catch)					Per Capita Econ. Impacts (Δ$ SQ Catch)			
2015 Alt.	2A TAC	Trips	$ Total	Δ$ SQ Catch	Newport	Garibaldi	Depoe B.	Brookings	Other	Newport	Garibaldi	Depoe B.	Brookings
No Rmlvs	0	0	$0	-$2,460,288	-$1,483,554	-$366,583	-$189,442	-$169,760	-$250,949	-$89	-$276	-$82	-$16
30 mlbs	540	8,046	$ 1,383,912	-$1,076,376	-$649,055	-$160,380	-$82,881	-$74,270	-$109,790	-$39	-$121	-$36	- $7
Blue Line	750	11,174	$ 1,921,977	-$538,311	-$324,602	-$80,208	-$41,450	-$37,143	-$54,908	-$19	- $60	-$18	- $3
SQ Catch	960	14,304	$ 2,460,288	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
50 mlbs	1010	15,049	$ 2,588,428	+$128,140	+$77,268	+$19,093	+$9,867	+$8,842	$13,070	+$5	+$14	+$4	+$1



Appendix B: Methods and assumptions used to project economic impacts for the Oregon recreational halibut fishery

Introduction

The report provides a brief economic review of Oregon's commercial Pacific halibut fishery in recent years. The report also shows the estimated regional economic impacts (REI) to Oregon from the International Pacific Halibut Commission (IPHC) proposed catch limits in regulation Area 2A. (Area 2A includes Puget Sound and the ocean adjacent to the three continental West Coast states.) The REI's are for the IPHC proposed apportionment alternatives for managing the fishery in Year 2015 as compared to Year 2014. (The IPHC is the international body that determines acceptable exploitable biomass and harvest rate conservation standards for the Pacific Ocean coastwide halibut range. There are eight regulation areas within the range.) The IPHC adopted the apportionment alternatives during an interim meeting in December 2014. The alternatives included a "blue line" catch limit that assumes IPHC target harvest rates are applied to the current estimate for exploitable biomass. Other alternatives include a Year 2014 "status quo" catch limit for Year 2015. The IPHC will meet in January to select a preferred alternative for all eight regulation areas.

Even for the status quo alternative there would be a decrease in the Oregon REI because the Pacific Fishery Management Council (PFMC) decided in November 2014 to increase the California sport allocation from one percent to four percent. (The PFMC is the management agency for the continental West Coast states that adopts a catch sharing plan (CSP) for user groups and determines pre-season and in-season management specifications to keep harvests within the catch limits.) The PFMC adopted CSP splits the catch limit in Area 2A to be 35 percent tribal and 65 percent non-tribal. The CSP change decreased the Area 2A non-tribal fisheries commercial allocation from 31.7 to 30.7 percent, the Washington sport allocation from 36.5 to 35.6 percent, and the Oregon sport allocation from 30.7 to 29.7 percent. Oregon commercial halibut fishery landings from a directed fishery (with a CSP 85 percent) and salmon troll incidental fishery (with a CSP 15 percent) are about 74 percent of the Area 2A commercial non-tribal allocation.

The Oregon commercial halibut fishery provides a small amount of harvest revenue to a relatively large number of participants. The explanation for the large number of participants includes the low gear-up costs for participation and open access licensing. Many of the directed fishery participants already have groundfish fishery longline gear deployed and it is a minor cost to switch out to halibut gear. In addition to directed fishery participation, there are many participants in the incidental halibut salmon troll fishery. While the average per vessel harvest revenue is minor in recent years for the directed halibut fishery, there could be some participation motivated by wanting to continue a landing history if this open-access, derby fishery is switched to a property rights management approach in the future.

Harvesting

There were 192 thousand round weight pounds landed at an ex-vessel value of $0.9 million in 2013 and 185 thousand round weight pounds worth $1.0 million in 2014. (Year 2014 landing information is preliminary based on delivery information through October.) Halibut ex-vessel

prices averaged $4.82 per round weight pound in 2013 and $5.69 per round weight pound in 2014. The price in 2014 is a 30 year record inflation adjusted high. There were a total of 93 vessels that had shoreside halibut landings in 2013 and 173 in 2014. The average halibut revenue of the 52 vessels that harvested more than $500 in 2013 was $17,648, which was seven percent of their total fisheries revenue. Of the 93 vessels that landed halibut in Oregon in 2013, there were 46 vessels that landed halibut with troll gear, 46 that landed halibut with longline gear, one that used other hook and line gear. There were also 25 vessels that landed halibut in the shoreside Pacific whiting fishery in 2013. (The Pacific whiting fishery is a maximized retention fishery. Harvesters are not paid for the landings and processors typically distribute the fish to food banks or destroy them.) There were 89 deliveries in the directed fishery, 83 deliveries in the incidental fishery, and 82 deliveries in the shoreside whiting fishery in 2013. Of the 173 vessels that landed halibut in Oregon in 2014, 45 used hook and line gear, 127 used troll gear, and one used another gear type. There were 21 vessels that landed halibut in the shoreside whiting fishery in 2014. There were 73 deliveries in the directed fishery, 319 deliveries in the incidental fishery, and 58 deliveries in the shoreside whiting fishery in 2014.

The halibut fishery is an opportunistic fishery given its low cost for entry and open access nature. Most of the vessels (56 percent of the vessels landing more than $500 in 2013) made landings in Newport. Newport is close to productive halibut fishing grounds and there are many home-port vessels already participating in the groundfish fixed gear (longline and pot gear) fishery and salmon troll fishery.

The wide fluctuations in the halibut fishery participation have subsided in recent years. There were years in the late 2000's decade when the salmon fishery was essentially closed on Oregon's central coast that reduced participation in the incidental fishery. The improved salmon abundances in 2014 attracted many more vessels into this fishery, and consequently, participation in the incidental halibut fishery almost tripled in 2014.

Processing

Thirteen processors or buyers purchased over $10 thousand of Oregon landed halibut each in 2013 and this comprised over 96 percent of all landings. The top three processors or buyers purchased about 62 percent of all Oregon halibut landings.

Nearly the entire production of the northern Pacific halibut fishery is consumed in the U.S. market. The introduction of a property rights system in the Alaska and B.C. fisheries elongated the "fresh" halibut domestic whole fish market to more than one-third of the production by 2004. The fresh fish domestic market fetches a premium price as compared to frozen product forms. Halibut product forms are usually fresh or frozen fletches or steaks. Smaller "chicken" halibut (10 to 20 pounds) is sometimes sold whole (headed and gutted). A delicacy is halibut cheeks with size ranging from three ounces to more than a pound each.

The general ex-processor price trend increased through 2011, but dropped after that year reflecting consumer resistance to table fare prices. There was price recovery in 2014 due to better consumer buying position from general economy improvement and due to a drop in harvest supplies reaching market. The processor margin (including contribution to profit) is approximately $1.00 per finished pound across a typical mix of product forms. The Pacific

halibut fishery is MSC certified starting in 2006 at the request of the Fishing Vessels Owners Association.

Oregon and Washington are in a price taking position from Alaska's lead in market position. Only about 2.4 percent of the halibut population that can be fished is found off Oregon and Washington, about 15.6 percent off British Columbia, and the remaining 82 percent off of Alaska. The dockside price for Alaska halibut decreased from record highs in 2011 at $6.29 (nominal statewide average price per landed pound) to $4.91 in 2013. Mid-year prices were $1.30 higher (south central Alaska spot price) in 2014 than in 2013.

Bycatch

If the number of harvesting participants was defined as those that discard halibut, the number would be much higher than what this report shows for participants in the directed and incidental halibut fisheries. There are significant discards in the trawl and fixed gear groundfish fisheries where halibut is a prohibited species. Groundfish fishery (includes all tribal and non-tribal trawl and fixed gear fisheries) discard mortality as a share of all removals in Area 2A was 11 percent or 129 thousand net weight pounds in 2013. The halibut discard encounters (the catch discarded which are modeled to live as well as die) about equaled the commercial tribal fishery catch in 2013.

Discard mortality in the groundfish trawl fishery decreased dramatically from 2010 to 2011 following the issuance of individual bycatch quota (IBQ) for the first year implementation of the groundfish trawl fishery individual fishing quota (IFQ) program. The penalty disincentive for exceeding the assigned IBQ resulted in a remarkable decrease from 399 thousand round weight pounds in the 2010 bottom trawl limited entry fishery before the program to 68 thousand round weight pounds the first year of the IFQ program.

The obvious directed fisheries participants' concern for bycatch is the opportunity cost they incur for lowered catch limits to account for these discard mortalities from an exploitable biomass. Accounting for the growth and natural mortality of the sub-legals, the IPHC estimates one pound of discard mortality in Area 2A for the current year means about a one pound lost harvest production in future directed fisheries in Area 2A.

Apportionment Alternatives Economic Impact

The economic contributions from the Oregon commercial non-tribal halibut fishery in both 2013 and 2014 was about $1.4 million personal income. The decreased REI for the "blue line" alternative would be $422 thousand personal income in 2015 if prices, fisherman behavior as a result of catch limit changes, and other economic modeling assumptions were unchanged from 2014. The decreased harvest earnings are $270 thousand or 24 percent decrease. The status quo alternative would have a decreased REI of $55 thousand personal income due to the Area 2A commercial non-tribal allocation change in 2015.

Industry Challenges and Opportunities

The Pacific halibut directed and incidental fisheries provide minor revenues in comparison to Oregon's other fisheries, but can be important and timely during an individual's vessel annual operations. The lowering of earnings in any one of a portfolio of fisheries without opportunity

for increasing revenue in another fishery may affect the overall viability of the fishing business. Moreover, further restrictions in the halibut fishery could redirect participants to other fisheries that are already in an over capacity status. Processors have invested capital and secured markets for halibut seafood products. The continued reductions in deliveries undermines their ability to recoup investment costs and can harm distributor and retailer market relationships who expect diversified and time predictable product offerings.

The Oregon commercial halibut fishery takes place in a backdrop of: (a) an allocation scheme whose basis was crafted when catch limits were much higher; (b) inflexible regulatory programs that are international and national; and (c) new science findings about species habitat, migration, and biology. If the property rights management system for the commercial non-tribal halibut fisheries in Alaska and British Columbia has economic lessons, then the West Coast fishery is not optimally managed for net economic benefits. However, state agencies singularly on the West Coast have limited influence on changing management approaches.

The offered economic contribution information in the report, albeit brief and limited, is an important addition to the halibut fishery management decision making process. The IPHC does not accompany their apportionment alternatives with descriptions for economic efficiencies nor REI. Further, the PFMC does not provide economic analysis descriptions for annual CSP decision making processes.

Economic Review of Oregon's Commercial Pacific Halibut Fishery

I. Introduction

This report provides a brief economic review of Oregon's commercial Pacific halibut fishery in recent years. The report has explanations for the regional economic impacts (REI) from the International Pacific Halibut Commission (IPHC) proposed catch limits in regulation Area 2A. (Area 2A includes Puget Sound and the ocean adjacent to the three continental West Coast states.) The REI's are for the IPHC proposed apportionment alternatives for managing the fishery in Year 2015 as compared to Year 2014.[1] (The IPHC is the international body that determines acceptable exploitable biomass and harvest rate conservation standards for the Pacific Ocean coastwide halibut range. There are eight regulation areas within the range.) Regulation area apportionment alternatives were released at the IPHC December 2014 Interim Meeting.[2] Adoption of a preferred alternative for the 2015 season will take place at the IPHC January 2015 Annual Meeting. The Pacific Fishery Management Council (PFMC) is the agency responsible for adopting the allocations and management specifications of the catch limits among user groups in Washington, Oregon, and California. The allocations for the upcoming 2015 season were decided at the PFMC November 2014 meeting. Further specification of season management measures will occur at the PFMC March and April 2015 meetings.[3]

The Pacific halibut fishery is internationally managed. The IPHC promulgates regulations governing the fishery under the Convention between the United States and Canada for the Preservation of the Halibut Fishery of the North Pacific Ocean and Bering Sea. Regulations proposed by the IPHC are subject to approval by the Secretary of State with concurrence from the Secretary of Commerce according to provisions of the Northern Pacific Halibut Act of 1982 (NPHA). (The NPHA is the Convention's implementing legislation in the U.S.) The NPHA authorizes the U.S. regional fishery management councils (e.g. the North Pacific Fishery Management Council (NPFMC) for Alaska and the PFMC for the West Coast) to develop regulations that are in addition to, and not in conflict with, approved IPHC regulations. The councils' regulation rule making is handled by the National Marine Fisheries Service (NMFS). Due to fishery data acquisition programs and the overlap of halibut and non-halibut fishing, councils and NMFS collaborate with the affected states in the management of halibut fisheries.

The PFMC formally adopted a catch sharing plan (CSP) for Area 2A in 1988. A new CSP was adopted in 1994 that incorporated the settlement of a court case that defined a tribal allocation to be 35 percent of the Area 2A catch limit. The CSP has been revised many times and has become very detailed in sharing percentages assigned to user groups, sub-areas, and seasons (Gilroy et al.

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1. This report often refers to the fishery for Pacific halibut as just the halibut fishery for brevity. There is also a fishery for California halibut and this report's use of the term "halibut" is not inclusive of both.
2. The Alaska, British Columbia, and West Coast halibut fishery history, species biological traits, current management regime, and abundance issues are aptly described in information at the IPHC website (www.iphc.int). A historical accounting of the halibut fishery through middle 1970's is colorfully described in Bell (1981).
3. Usually the only management measures needing specification at the March and April PFMC meetings are for incidental harvest of halibut in the salmon troll fishery and primary sablefish fishery north of Point Chehalis, Washington. The PFMC hears proposals for changing user group allocations and fishery management measures at the September meeting.

2011).[4] The PFMC revised the CSP in November 2014 to increase the California sport allocation from one percent to four percent starting in the 2015 season. The allocation for the commercial non-tribal fishery, the Washington sport fishery, and the Oregon sport fishery were each decreased by one percent to account for the California sport fishery increase from one percent to four percent.

The economic contribution analysis described in this report is for the Oregon portion of the 20.6 percent Area 2A catch limit assigned to the commercial non-tribal allocation in 2013 and 2014.[5] The Area 2A non-tribal catch limit was allocated 44.4 percent to sport fisheries in 2013 and 2014. Sport fisheries take place in Puget Sound and ocean catch areas. The tribal portion is 35 percent in 2013 and 2014. Thirteen tribes, including four coastal Washington tribes, utilize the allocation by harvesting commercially in Puget Sound and ocean catch areas. Tribes utilize a small portion of the allocation in a year-around ceremonial and subsistence fishery.

The IPHC has determined acceptable exploitable biomass and harvest rate conservation standards since signing of the first Convention by Canada and the U.S. in 1923. The Pacific halibut species' biomass has been historically estimated to be quite variable, and the recent trend over the last decade has been steep declines (IPHC 2014e). However, the abundance declines appear to have stabilized in the last couple of years. Biomass declines have been accompanied by dramatic decreases in size-at-age averages. During the last couple of years showing abundance stabilization, there has not been evidence of strong recent recruitments (IPHC 2014d).

Historical catch and effort, and stock assessment estimates are used to portray trends in the fishery and fish resource conditions. Figure B.1a shows halibut removals from all of the IPHC regulated areas since 1888.[6] Figure B.1b shows halibut removals for Area 2A since 1981. The itemization of Area 2A removals in 2013 is shown in Figure B.2. Figure B.3 shows commercial tribal and commercial non-tribal fisheries itemized by states' landings since 1981. Figure B.4 shows Oregon commercial fishery landings volume and harvest value since 1981. Figures B.5 and B.6 show fleet participation trends. The estimated spawning biomass time-series for all IPHC regulatory areas in 1888 to 2013 is shown in Figure B.7.

Because of the recent declines in exploitable biomass, commercial and recreational user groups have heightened interest in management to make sure decisions allow for conservation justified fishing opportunities. The purpose of this economic analysis is to provide information to the user groups and management decision makers about the commercial halibut fishery. Staff at Oregon Department of Fish and Wildlife (ODFW) are developing additional economic analysis information about the alternative catch limits for the halibut sport fishery.

The offered economic contribution information in this report, albeit brief and limited, is an important addition to the halibut fishery management decision making process. The IPHC does not accompany their apportionment alternatives with descriptions for economic efficiencies nor

4. Appendix A graphically shows the Area 2A CSP for 2014.
5. Year 2013 has complete halibut fishery landings for West Coast states. Year 2014 landing data is preliminary and includes Oregon fish ticket records through October 2014.
6. Removals are retained catch, discard mortalities in non-halibut fisheries, and wastage mortality in halibut fisheries. Wastage are the discards that principally come from minimum harvest size restrictions.

REI. Further, the PFMC and NMFS do not provide economic analysis descriptions for annual CSP decision making processes.[7,8,9]

II. Methods

Study results are expressed in different measurements. Landings are either measured by weight in net or round pounds, or value in ex-vessel prices paid to harvesters. Round pounds are a calculated weight of fish when purchased by the buyer or processor. Halibut is delivered eviscerated when sold to the buyer or processor. An adjustment factor of 1.33 is used to convert landed weight (when the fish is gutted, headed, slimed, and de-iced) to round weight. Payments to harvesters (sometimes called harvester revenue or ex-vessel value) is simply the amount of the transaction between the harvester and the purchaser, which is usually a seafood processor. The harvester can also sell directly to the public through provisions of a special license. The value of seafood products with primary manufacturing in Oregon is called first wholesale value (sometimes also called ex-processor value). Values, prices, and economic contribution estimates have been adjusted to real dollars using the GDP implicit price deflator developed by the U.S. Bureau of Economic Analysis, except where noted.

Landing data is mostly from ODFW's annual volume and value reports. Other landing data is from the Pacific Fisheries Information Network (PacFIN) extractions dated March 2014 for data year 2013 and November 2014 for data year 2014, or data supplied by IPHC staff through personal communication. The PacFIN information source is based on fish tickets issued when a harvester delivers a catch to a processor or sells catch to the public. The ODFW compiles this information and then uploads it to the PacFIN system.

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7. An early CSP adopted for the 1990 season did have economic descriptions for regional economic impacts and net economic benefits (Radtke 1989). A National Environmental Policy Act (NEPA) environmental assessment (EA) and Regulatory Flexibility Act (RFA) regulatory impact review (RIR) document for the current CSP adopted in 1994 also was presented with economic analysis descriptions. Recent successive changes to the Area 2A CSP have made references to other NEPA documentation for the West Coast groundfish fishery management that have included economic analysis of other fisheries including the halibut fishery.
8. The exclusion is despite quantitative economic analysis descriptions being required according to federal Executive Order 12866, the RFA, consistency with the National Standard 5 and 8 in the Magnuson Stevens Act (MSA), and provisions of the NPHA. National Standard 5 is for considering efficiency in utilization, but not have economic allocation as sole purpose. National Standard 8 is for considering fishing communities to provide for their sustained participation and to minimize adverse economic impacts.
9. The IPHC and PFMC have provided direct value measurements in describing management alternatives. However, direct value measurements such as commercial harvest pounds and available recreational days can be misleading when decision makers are trying to understand economic effects. The direct values do not provide information about how these fishing activities drive the economy. Commercial fisheries economic effects are driven by the ex-vessel value and processing margin per unit of fish landed. Recreational fisheries economic effects are driven by the amount and distribution of expenditures made by recreational anglers fishing in different modes (private boat or charter vessels). It is the indirect and induced economic effect information that is needed to show regional economic impacts. For example, the commercial fisheries indirect effects are from the businesses who supply fuel, gear, ice, bait, food, electricity, water, equipment, etc. to vessels and processors. Induced effects include the economic activity driven by the spending of income by fishing and processing crews, owners of the vessels and plants, and employees of the suppliers. Adding up all the rounds of re-spending in the economy produces the estimate of total economic contribution. The amount of the total output paid for labor determines total personal income measurement for economic contribution.

Some measurements used in this report stratify vessels for landing more than $500 harvest value in a year. This is to help account for fish ticket database errors as well as to assist in segregating vessels into a class where a serious economic event is occurring. The threshold may have some justification for showing the vessel is active in the fishery, but it is not necessarily an indicator it is a vessel's targeted fishery.

Bringing in halibut in Area 2C
Source: NOAA Fisheries Service (2012).

The harbors where landings are made and their assigned port groups are as follows. The Astoria port group includes Gearhart/Seaside and Cannon Beach; Tillamook port group includes Garibaldi, Netarts, Nehalem, and Pacific City; Newport port group includes Depoe Bay and Waldport; Coos Bay port group includes Florence, Winchester Bay, and Bandon; and Brookings port group includes Gold Beach.

Measuring the economic contributions from activities such as harvesting, processing, and distributing seafood products requires development of economic models to show how the dollar flows within and between industries and reaches households in Oregon. Seafood landed and processed in coastal communities and shipped out of state to major markets, such as Los Angeles, is an export that brings in new money to coastal communities as well as the State of Oregon in general. Revenue generated by delivery to at-sea processors, fishing in Alaska, or other fisheries and returned to Oregon in terms of crew shares, profits, and payments for repair and maintenance can also be considered a source of export earnings. The spending and re-spending of these revenues from local harvesters, local processors, and distant water harvesters creates additional wages and profits for workers and proprietors in the general economy. The sum of all of these dollar flows (in economic jargon, the direct, indirect, and induced effects) that end up in households is called in this report the economic contributions measured by personal income.

The Fishery Economic Assessment Model (FEAM) was used to calculate fishing industry economic contributions. The FEAM is a derivation of the IMPLAN input-output model.[10] FEAM results are estimates of the total personal income derived from the commercial fishing industry for local economies and for the State of Oregon economy. The FEAM generates results for both marginal and average catch and effort per unit measurements. The FEAM is more fully described in William Jensen Consulting (1996), and more recently by Seung and Waters (2006).

10. IMPLAN (IMpact Analysis for PLANning) models are available for various U.S. geographic levels, states, national economy, and international economies. The models are distributed by IMPLAN Group LLC, 16740 Birkdale Commons Parkway, Suite 212, Huntersville, NC 28078.

There are other economic terms used in this report for which no measurements are made. One of the economic terms is "net economic benefits" and another one is "resource rent." Net economic benefits is an economic concept that could include all positive and negative net economic values of the fish resource, including the non-use valuation that society holds for a healthy fish resource. An obvious positive net economic value is any profits generated by the commercial fishery after the expenses (variable costs like fuel, bait, gear loss, and pro-rated fixed costs like moorage) to prosecute the fishery are subtracted. The net economic value for recreational fisheries is anglers' willingness-to-pay for the fishing experience less the actual costs for the experience. A less obvious value that would be claimed as a society cost is any decreases in the stock's health due to fishery management decisions. These are example net economic values and the tabulating of all economic surpluses is much more involved.

Net economic benefit calculations include the positive (termed benefits) and negative (termed costs) net economic values across all user groups (including tribal, commercial, and recreational) and non-users (groups that place a value on the stock's existence). The benefits and costs are projected over future periods at a declared economy level (such as the nation). The declaration for this accounting stance is to differentiate the user groups to be included in the benefit-cost analysis. For example, an accounting stance for the net economic benefits just for commercial fishing industry participants can be applied. When society benefits and costs are included, a national level is generally applied. One summary statistic for the analysis is net present value which is the sum of discounted net between benefits and costs over the period being analyzed. The result is inherently sensitive to the choice of discount rate. When properly calculated, the result is a relatively objective method of determining the improvement in wealth resulting from an action. However, it is not the only summary statistic that should be considered in a net economic benefit analysis application. One advantage of using the net economic benefit analysis method is that fishery management measures applied in an initial year will cause changed biological and economic conditions that are staged over future years. The economic contribution analysis method used in this report simply assesses the changed economic activity that occurs in an initial year.

Net economic value is a comparable measurement no matter the source from where it is generated, therefore it is often used to show changed economic effects from different fish resource allocations between commercial and recreational sectors (Carter et al. 2008 and Arnason 2009). If the sum of net economic values is greater under one allocation scheme than another, then the higher summed scheme is more efficient. The concept is that the economic value of a fishery is maximized when the net economic value per pound by one sector to increase its allocation matches the net economic value per pound forgone by the other sector as its allocation is reduced.[11] At this point, the economically efficient allocation is achieved because the highest net economic value is obtained from the available fish resource at the least cost. If the sector specific net economic value information was available, management policy makers

11. The equal marginal net economic value principal is criticized by Holzer and McConnell (2014). They say that determining marginal values for sectors is complicated, and when it can be accomplished, can be quite variable. The heterogeneities within the commercial and recreational sectors may mean that those precluded fish in one sector will have higher value than those that actually get the fish in the other sector.

could then use efficiency evaluation results along with other information to judge fish resource allocation changes.[12]

The term resource rent (or just the one word rent) introduces opportunity and expectation costs to a commercial fisheries profit equation. There would be subtractions from the fishery earnings from not only the prosecution costs, but also from using the capital investment and labor investment in a next best substitute manner. There is another cost in the rent equation for the perceived amount of profit to be made. The perceived profit parameter means rent reflects on a participant's rational economic behavior. The numbers used in the equation for opportunity costs and perceived profits might be for the participation in another ongoing fishery. Determining the numbers from the substitute ongoing fishery can be problematic and economists will take short cuts by assuming the capital investment opportunity cost is what would have been the earned interest in an investment market; assuming the labor opportunity cost is the minimum hourly wage applied to an eight hour day during fishing preparation and trips; and, assuming perceived profits are a declared normal profit from a successful investment venture. Lindner et al. (1992) provides detailed information about calculating resource rent in their analysis of the transition from an over exploited to an efficiently managed fishery in New Zealand.

Economic contribution is the term used in this report to describe the calculated halibut fishery's proportion of the overall commercial fishing industry's economic effects in the statewide economy. The term "economic impacts" is used to describe how different conditions (such as more or less landings) would be a change in the economic effects. The impacts term is a reference to a short-term consequence, because in the long-term there will be compensating adjustments.

The marginal economic impact factor was from a Year 2011 simulation model calibrated to the Year 2014 halibut fishery prices. Harvesting and processing behavior as a result of different regulations, fish resource abundance, landing prices, seafood markets, weather, opportunities in other fisheries, etc. may be different in other years. The uncertainty in calculating economic impacts due to changed responsive behavior was not included in the source simulation model's development. While the uncertainty would be important if the analysis was offering a single prediction, the analysis is to show comparative economic effects among alternatives. Each of the alternatives comparative differences will have the same uncertainty envelope.

III. Commercial Halibut Fishery Profile

A. Harvesting Sector

The Oregon commercial halibut fishery provides a small amount of harvest revenue to a relatively large number of participants. The explanation for the large number of participants includes the low gear-up costs for participation and open access licensing. Many of directed

12. Calculating the net economic benefits for reallocation between the sectors is complicated by the 32 inch size limit restrictions for the commercial fishery and no size limits imposed on the recreational fishery. Total fish mortality between the sectors is a necessary inclusion in the analysis. A share of the commercial sector wastage will become harvestable fish for the recreational sector after consideration of the recreational sector wastage. There could also be over time stock feedback mechanisms due to the changed recruitment from size-at-age mortality changes.

fishery participants already have groundfish fishery longline gear deployed and it is a minor cost to switch out to halibut gear.[13] In addition to directed fishery participation, there are many participants in the incidental halibut salmon troll fishery. While the average per vessel harvest revenue is minor in recent years for the directed halibut fishery, there could be some participation motivated by wanting to continue a landing history if this open-access, derby fishery is switched to a property rights management approach in the future.

The profile explanation for vessels participating in the halibut fishery uses 2013 and 2014 for comparison years. The explanations rely on statistics showing in Table B.1.

There were 192 thousand round pounds landed at an ex-vessel value of $0.9 million in 2013 and 185 thousand round pounds worth $1.0 million in 2014 (Table B.1).[14] Halibut ex-vessel prices averaged $4.82 per round weight pound in 2013 and $5.69 per round weight pound in 2014. The price in 2014 is a 30 year record inflation adjusted high. There were a total of 93 vessels that landed halibut in 2013 and 173 in 2014. There were 52 vessels (56 percent of all vessels) with landings more than $500 of halibut in 2013 and 92 in 2014. The average halibut revenue of all 52 vessels was $17,648 in 2013, which was seven percent of their total fisheries revenue. The average halibut revenue in 2013 for the top 10 vessels was $49,681 and their dependency on halibut revenue was 11 percent.[15] The top nine (10 percent) vessels harvested 50 percent of this fishery's total value. The bottom 43 (i.e. 52 minus nine vessels or 46 percent of all vessels delivering more than $500) harvested 10 percent of the total value. The 52 vessels landing more than $500 of halibut in Oregon in 2013 have home-ports in Astoria (three); Tillamook (three); Newport (25); Coos Bay (seven); Port Orford (seven); Brookings (two); Eureka, California (one); Fort Bragg, California (one); and coastal Washington south and central (three). While in past years there have been landings at Oregon ports for halibut caught in the Alaska EEZ, there were no Oregon landings with area of catch outside the U.S. West Coast EEZ in 2013 or 2014.

Of all 93 vessels that landed halibut in Oregon in 2013, there were 46 vessels that landed halibut with troll gear, 46 that landed halibut with longline gear, one that used other hook and line gear. There were also 25 vessels that landed halibut with zero value, 19 that used midwater trawl, six that used roller trawl, and one that used selective flatfish trawl.[16] No vessels caught halibut with both longline and other hook and line in 2013, and they typically use only one gear for halibut during the year. There were 89 deliveries in the directed fishery, 83 deliveries in the incidental fishery, and 82 deliveries in the shoreside whiting fishery in 2013. There were other deliveries for research harvests and some illegal gear deliveries.

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13. Many vessels use the same groundlines and it is only necessary to use different snap-on gangions and hooks for the halibut fishery.
14. Fishery statistics exclude research vessel counts and a small amount of catch that was harvested for research purposes. Fishery statistics also include vessel participation and catch when halibut is landed with groundfish gear categories. This gear is related to the shoreside whiting fishery being a 100 percent retention fishery. The halibut is delivered to processors, but the harvesters do not receive payment for the landings. There was one research vessel that landed 11 thousand round pounds of halibut in 2013 and 19 thousand round pounds in 2014, and 25 vessels landed 2,365 round pounds of halibut with zero harvest value in the shoreside groundfish fishery in 2013, and 23 vessels landed 2,074 round pounds in 2014.
15. Dependency is defined to be the share of a vessel's total harvest revenue.
16. The shoreside whiting fishery is a trawl gear fishery that is maximized retention. The halibut catch using the trawl gear is landed, but the vessels do not receive revenue. The halibut is processed and distributed usually to food banks or destroyed.

Of the 46 vessels that landed halibut with troll gear in 2013, all of them also landed Chinook salmon with troll gear since the incidental halibut fishery is a salmon to halibut ratio fishery. More than half of them (27 vessels) also landed albacore tuna with troll gear. Total troll halibut ex-vessel value is $15 thousand, troll Chinook ex-vessel value by these vessels is $1.2 million, and albacore tuna ex-vessel value by these vessels is $0.7 million. The 41 halibut vessels with less than $500 of halibut include 40 vessels that also had more than $1 thousand of salmon, and 18 of those had $1 thousand or more of tuna as well. None of those vessels had any pink shrimp, Pacific whiting, or Pacific sardine, and seven had over $500 of groundfish, all of which also had salmon and some of which also had Dungeness crab or tuna.

Of the 173 vessels that landed halibut in Oregon in 2014 (preliminary data), 45 used hook and line gear, 127 used troll gear, and one vessel landed halibut with another gear type. There were 21 vessels that delivered halibut in the shoreside whiting fishery in 2014. There were 73 deliveries in the directed fishery, 319 deliveries in the incidental fishery, and 58 deliveries in the shoreside whiting fishery in 2014. There were other deliveries for research harvests and some illegal gear deliveries.

The vessels making halibut landings generally have diversified portfolios. Table B.4 shows the other fisheries in which vessels making halibut landings also participate. Not unexpected because longline gear is used in both the halibut and groundfish fisheries, the directed fishery participants have proportionately higher participation in the groundfish fisheries than the incidental fishery participants.

A Shortlived Bonanza

The Lightship Ground is a shoal region off the mouth of the mighty Columbia River. In 1916, through an inebriated crew member in a Seattle saloon, it came to be known that the Puget Sound dory vessel *Tom and Al* had in late April encountered extremely heavy halibut fishing near the Columbia River Lightship. By May, practically the entire Puget Sound halibut fleet and some Canadian vessels from Vancouver were fishing the hitherto secret ground. That month alone, three million pounds of halibut were taken from the relatively small area that came to be known as the Lightship Ground (map below). One of the vessels was the *S.S. Chicago*, a large 149-net-ton steamer owned by Chlopeck Fish Co. of Seattle, which with 12 dories caught 320,000 pounds - the second largest single fare of halibut ever taken in the Pacific halibut fishery! This record catch which was landed in Seattle, was caught in less than two days fishing time on the Lightship Ground.

Notwithstanding the phenomenal initial productivity, the "Ground" was literally cleaned out in a few months. Despite a practically complete cessation of fishing in the region during the subsequent 50 year, there has been no recuperation. On September 16, 1966, a halibut vessel under charter to the Halibut Commission fishing 28 skates (3,360 hooks) over the identical ground, caught but four halibut with a total weight of 82 pounds.

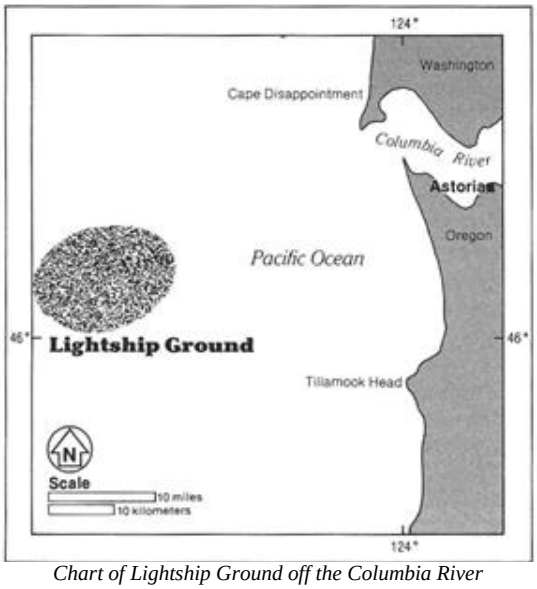

Chart of Lightship Ground off the Columbia River

Source: Bell (1981).

The halibut fishery is an opportunistic fishery given its low cost for entry and open access nature. Most of the vessels (56 percent of the vessels landing more than $500 in 2013) made landings in Newport. Newport is close to productive halibut fishing grounds and there are many home-port vessels already participating in the groundfish fixed gear (longline and pot gear) fishery and salmon troll fishery.

There have been wide fluctuations in fishery participation, however the annual exit/entry has somewhat subsided in recent years (Figure B.5). There were years in the late 2000's decade when the salmon fishery was essentially closed on Oregon's central coast that reduced participation in the incidental fishery. The improved salmon abundances in 2014 attracted many more vessels into this fishery, and consequently, participation in the incidental halibut fishery almost tripled between 2013 and 2014. Despite low gear-up costs for participation, there does not appear to be the potential revenue incentive to attract harvesters into the directed fishery as in earlier years when stock status allowed higher catch limits. The participant tenure (Figure B.6) shows only 10 percent of all vessels that participated in the fishery in the five years ending in 2013 made landings in all five years. This can be compared to the Dungeness crab fishery's 44 percent participation in all five years.

The commercial non-tribal fishery is 20.6 percent (31.7 percent of the non-tribal share) of the Area 2A catch limit in 2014. There are sub-allocation shares for directed (85 percent) and incidental (15 percent) fisheries. The incidental fishery is for the salmon troll fishery. (In some years of higher abundance, the sablefish longline fishery north of Point Chehalis, Washington is also an incidental fishery. However, its allocation is subtracted from the halibut recreational allocation for the subarea.) The directed fishery is managed for season open days, trip limits, area closures (subject to groundfish Rockfish Conservation Area (RCA) boundaries to protect overfished groundfish species, and northern boundary at the U&A tribal fishery area), and 32 inches and over size. The incidental salmon troll fishery is managed as a ratio fishery with trip limits and the same size limit as for the directed fishery. Both fisheries can have inseason adjustments to pre-season announced specifications in order that allocated catch limits are not exceeded. A vessel may not participate in both the directed fishery and the incidental fishery. Vessels annually request licenses from the IPHC and may harvest anywhere in Area 2A waters. The number of licenses in Area 2A total and the licenses associated with Oregon registered vessels are shown in Table B.2. Both directed and incidental fishery participating vessels mostly use ice storage and typically deliver at ports near successful fishing grounds within a few days of harvest.

About 74 percent of the Area 2A commercial non-tribal fishery catch limit was landed at Oregon ports in 2013. Oregon halibut vessels in 2013 included 47 directed halibut fishery and 46 incidental troll salmon fishery. Washington commercial non-tribal halibut vessels included about 16 directed halibut fishery, 14 incidental sablefish fishery, and 54 incidental salmon fishery. The combined Area 2A estimated non-tribal commercial total is 63 directed fishery vessels, 100 incidental salmon fishery vessels, and 14 incidental sablefish fishery vessels. Their estimated catch was 163 thousand net pounds in the directed fishery, 30 thousand net pounds in the incidental salmon fishery, and 14 thousand net pounds in the incidental sablefish fishery.

The number of 10-hour days when the directed halibut fishery is open has been reduced in recent years. In 2013 and 2014, there were two days assigned to the fishery, but the second day had drastically reduced trip limits. For example in 2013, the first day for a 45 foot vessel was 4,480 net weight pounds and the second day was 1,495 net weight pounds. The first day in 2014 was 4,480 net weight pounds and the second day was 995 net weight pounds. Of the 47 directed fishery vessels in Oregon in 2013, 42 vessels participated in the first day fishery, but only 32

vessels participated in the second day fishery. There were 27 vessels participating both days, and only five of the second day participants were not a first day participant.

The allowable landing ratio for the incidental fishery when the 2014 season began April 1 was one halibut per four Chinook salmon, plus an extra halibut per landing, with the total number of halibut per vessel per trip not allowed to exceed 12. There were in-season adjustments to the ratio. The fishery closed on September 11, 2014. The beginning season 1:4 ratio has changed from 1:2 in 2008 and 2009, and 1:3 in 2013. Salmon stock abundance has generally increased during these years causing relaxation of the ratios to preserve same halibut catch over the open salmon season.

B. Processing Sector

Thirteen processors or buyers purchased over $10 thousand of Oregon landed halibut each in 2013 and this comprised over 96 percent of all landings.[17] The top three processors or buyers purchased about 62 percent of all Oregon halibut landings.

Nearly the entire production of the northern Pacific halibut fishery is consumed in the U.S. market (Herrmann and Criddle 2006). The introduction of property rights system in the Alaska and B.C. fisheries elongated the "fresh" halibut domestic whole fish market to more than one-third of the production by 2004.[18] The fresh fish domestic market fetches a premium price as compared to frozen product forms.

Halibut product forms are usually fresh or frozen fletches or steaks. Steaks can be bone-in or boneless. There are about four fletches per fish, with fletches from larger fish usually cut into smaller pieces. Smaller "chicken" halibut (10 to 20 pounds) is sometimes sold whole (headed and gutted). Fletches normally run eight to 12 pounds. Steaks typically are offered in four to 10 ounces. A delicacy is halibut cheeks with size ranging from three ounces to more than a pound each (Seafood Choices Alliance 2007). The finished pound yield for steaks is 62 percent and the yield for fletches is 41 percent from round weight pounds (Crapo et al. 2004).

The general ex-processor price trend increased through 2011, but dropped after that year reflecting consumer resistance to table fare prices (Seafood Source 2013). There was price recovery in 2014 due to better consumer buying position from general economy improvement and due to a drop in harvest supplies reaching market. The processor margin (including contribution to profit) is approximately $1.00 per finished pound across a typical mix of product forms (Radtke 2014). The Pacific halibut fishery is MSC certified starting in 2006 at the request of the Fishing Vessels Owners Association.

Oregon and Washington are in a price taking status from Alaska's lead in market position. Only about 2.4 percent of the halibut population that can be fished is found off Oregon and Washington, about 15.6 percent off British Columbia, and the remainder 82 percent off of Alaska (IPHC 2014c). The dockside price for Alaska halibut decreased from record highs in

17. The processor purchases of halibut include research landings.
18. Harvesters are paid by fish grade which corresponds to size. Grades are in 20 pound increments starting with 20 pounds. It is typical in recent years that each successive grade has a 25 cent price differential. The higher ex-vessel price is due to higher yields from larger fish.

2011 at $6.29 (nominal statewide average price per landed pound) to $4.91 in 2013. Mid-year prices were $1.30 higher (south central Alaska spot price) in 2014 than in 2013 (SeafoodNews.com 2014).

C. Bycatch Sector

If the number of harvesting participants was defined as those that discard halibut, the number would be much higher than what this report shows for participants in the incidental and directed halibut fisheries. There are significant discards in the trawl and fixed gear groundfish fisheries where halibut is a prohibited species.[19] Groundfish fishery (includes tribal and non-tribal trawl and fixed gear) discard mortality as a share of all removals in Area 2A was 11 percent or 129 thousand pounds in 2013 (IPHC 2014b). The trawl groundfish fishery share was about 58 percent which has 40 to 60 percent discard mortality for bottom trawl gear and 100 percent for mid-water trawl gear; the non-nearshore fixed gear groundfish fishery share was 36 percent which has 16 to 18 percent discard mortality for longline gear and 15 to 30 percent for pot gear; and, the share in other fisheries was about six percent. Fish excluders were implemented in the shrimp trawl fishery in Area 2A in 2003 which has reduced bycatch in that fishery to zero in recent years. The halibut discard encounters (the catch discarded which are modeled to live as well as die) about equaled the commercial tribal fishery catch in 2013.

Discard mortality in the groundfish trawl fishery decreased dramatically from 2010 to 2011 following the issuance of halibut individual bycatch quota (IBQ) for the first year implementation of the groundfish trawl fishery individual fishing quota (IFQ) program.[20] The penalty disincentive for exceeding the assigned IBQ resulted in a remarkable decrease from 399 thousand round weight pounds in the 2010 bottom trawl limited entry fishery before the program to 68 thousand round weight pounds the first year of the IFQ program (Jannot et al. 2014). The estimated halibut discard mortality from the non-tribal 2013 trawl and fixed gear fishery was a 24 percent decrease from 2012.

The obvious directed fisheries participants' concern for bycatch is the opportunity cost they incur for lowered catch limits to account for these discard mortalities from an exploitable biomass. Bycatch and wastage mortality is mostly sublegal size (under 32 inches) fish. Accounting for the growth and natural mortality of the sub-legals, one pound of discard mortality in Area 2A for the current year means about a one pound lost harvest production in future directed fisheries in Area 2A (Hare and Williams 2013). The ratio varies widely depending on net migration, reproductive capacity, survivorship, etc. The estimated ratio for Bering Sea bycatch is approximately three pounds lost in directed fishery yields.

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19. Discard mortalities are from Stewart (2014) and Jannot et al. (2014). Jannot et al. (2014) used information from the West Coast Groundfish Observer Program (WCGOP). Expansion factors are used to account for fisheries that do not have observers. The WCGOP data takes into account potential survival after being discarded. An observer notes size and physical condition (excellent, poor, dead) of the discard. A modeled mortality rate that depends on gear and other variables is applied. For example, the bottom trawl fishery assumed discard rates are 20 percent for excellent, 55 percent for poor, and 90 percent for dead. The pot gear fishery discard rates are zero percent, 100 percent, and 100 percent for the three conditions.
20. The shoreside trawl fishery north of 40°10' N latitude is managed using a system of IBQ's. For 2012 through 2014, 15 percent of the Area 2A TCEY for legal sized halibut and not to exceed 130,000 net weight pounds is subtracted from the TCEY to account for expected trawl bycatch mortality. Beginning in 2015, the amount to be subtracted will be capped at 100,000 net weight pounds. A set-aside for 10 mt is to cover bycatch mortality in the at-sea whiting fishery and trawl fishery south of 40°10' N latitude. The remainder is issued as IBQ.

IV. Predicted Economic Impacts from Year 2014 Commercial Fishery and Year 2015 Proposed Commercial Fishery

The statewide total economic contribution of the commercial fishery in 2013 was $1.4 million personal income (TRG March 2014). This represented 0.4 percent of all economic contribution from Oregon's shoreside landings fishing industry (Appendix B). Most of the economic contribution from the commercial halibut fishery accrues to communities included in the Newport Port Group at 56 percent (Table B.5). The next highest was Coos Bay Port Group at 14 percent, followed by Astoria at seven percent.

Vessel participation, landing information, processor activity, and other economic model driver information is not yet complete for the commercial fishery in 2014, but sufficient data and application of reasonable assumptions can be used to make a preliminary estimate of economic contribution for the season (Table B.6). Halibut prices increased in 2014 ($5.69 per round weight pound) as compared to 2013 ($4.82 per round weight pound). Catch was 184.5 thousand round weight pounds with a $1.0 million harvest value. The decrease in pounds over 2013 landings coupled with the increase in price in 2014 resulted in about the same harvest value between the two years. Since economic contribution is the result of expenditures afforded by harvester and processor earnings, it is not surprising the economic contribution from the fishery is also about the same for the two years. Newport had a comparatively higher proportion of the statewide economic contribution in 2014 than in 2013.

REI per harvest unit is applied to apportionment alternative catch limits recently released by the IPHC (IPHC 2014d).[21] The alternatives were developed for probabilities the unfished biomass will fall below conservation standards due to the catch limits (Table B.7).[22,23] Table B.8 shows the alternatives' Area 2A catch limits in 2015 and the economic impact difference as compared to Year 2014. The decreased personal income for the "blue line" alternative would be $422 thousand in 2015 if prices, fisherman behavior as a result of catch limit changes, and other economic modeling assumptions were unchanged from 2014. The decreased harvest earnings are $270 thousand or 24 percent decrease for the blue line alternative. The explanation for the status quo alternative decreasing is because of the Area 2A commercial non-tribal allocation change in 2015.

V. Discussion

21. The economic impact calculation methods for this table use the Area 2A apportioned and commercial non-tribal allocation catch limits in 2014 rather than actual catch. Marginal REI per pound and not average REI per pound was applied to calculate the impacts.
22. Readers of this report are encouraged to review the supporting documentation from the IPHC that describes methods used in developing the blue line alternative. Stewart and Martell (2013) and Stewart (2014) provide historical stock assessment information and methods used to develop the management alternatives. The stock assessment information methods relied on an ensemble analysis.
23. The existing conservation standard is to maintain the spawning stock biomass above 30 percent of the unfished state 80 percent of the time each year. The management alternatives are presented in the form of a risk-benefit decision table, wherein risks of negative impacts on stock and fishery performance are associated with the benefits of particular choices of harvest level. This format for decision making more fully reflects uncertainty and allows the Commission to weigh the risks and benefits of management choices, as well as overall harvest policy, when deciding on catch limits.

A. Summary of Economic Impacts of Proposed Year 2014 Season Catch Limits

The Pacific halibut directed and incidental fisheries provide minor revenues in comparison to Oregon's other fisheries, but can be important and timely during an individual's vessel annual operations. The lowering of earnings in any one of a portfolio of fisheries without opportunity for increasing revenue in another fishery may affect the overall viability of the fishing business. Moreover, further restrictions in the halibut fishery could redirect participants to other fisheries that are already in an over capacity status. Processors have invested capital and secured markets for halibut seafood products. The continued reductions in deliveries undermines their ability to recoup investment costs and can harm distributor and retailer market relationships who expect diversified and time predictable product offerings.[24]

B. Industry Challenges and Opportunities

The Oregon commercial halibut fishery takes place in a backdrop of: (a) an allocation scheme whose basis was crafted when catch limits were much higher; (b) inflexible regulatory programs that are international and national; and (c) new science findings about species habitat, migration, and biology. Also, if the management of commercial non-tribal halibut fisheries in Alaska and British Columbia has economic lessons, then the West Coast fishery is not optimally managed for net economic benefits.[25] However, state agencies singularly on the West Coast have limited influence on changing management approaches.

The following observations characterize the current conditions and issues facing fishery participants. They are offered without prescriptive solutions or judging the merit for changing the current management approaches.

1. Current science findings are ambivalent whether the biomass trend trajectory is heading toward historical population averages witnessed in 1920 up to 1980, or whether the trajectory has stabilized at recent year higher than average levels (Figure B.7). For sure, the stock assessment indicates that biomass has been declining continuously over much of the last decade. There is decreasing size at age, and reproduction age recruitment strengths are much smaller than those observed through the 1980's and 1990's. Lower spawning recruitment (assuming other mortality factors are constant) means harvest rates must decrease if biomass conservation standards are to be met. Any good news is that the estimated female spawning biomass appears in recent years stock assessments to have stabilized near 200 million pounds since 2009 (IPHC 2014c).

2. Halibut has significant bycatch mortality in other than directed fisheries, including the trawl and fixed gear groundfish fisheries. The bycatch mortality in these fisheries has exceeded the allocations for the directed fisheries in past years. An amount of exploitable biomass commensurate with harvest efforts and techniques in these valuable

24. Large chain restaurants, cruise ship companies, and multi-state retailers comprise the bulk of the seafood market. They want a steady supply so they can streamline their menus or advertise specials well in advance. Processors have risks when negotiating deals, having to fulfill orders by purchasing fish on the global marketplace when their own processed fish is not available.
25. Casey et al. (1995) and Herrmann and Criddle (2006) discuss improved profitability from moving first the British Columbia and soon after the Alaska commercial halibut fisheries to property rights systems.

fisheries are needed to be set aside to preserve full groundfish species access. This means the proportion set aside for the bycatch fisheries increases, and proportions allowed for directed and incidental fisheries decrease, as the exploitable biomass decreases. It could be there are clever management approaches that would allow retention of the halibut bycatch with acceptable consequences to all halibut fishery participants.[26] The Port Orford Ocean Resource Team (POORT) in Oregon has already requested the ODFW consider making a sub-area longline fishery an incidental fishery in Oregon. The ODFW passed the request onto NMFS, who in turn has stated an intent to review the request subject to priorities for other fishery management issues (PFMC 2010). Mirick (2011) analyzed options for making the central coast sablefish fishery an incidental fishery by transferring all or a portion of the non-tribal directed 2A commercial halibut fishery (hereafter the directed fishery) quota to the fixed gear sablefish fishery (limited entry with or without sablefish endorsement and open access). It is a complicated review to determine how much of the current discard mortality could be diverted to retained harvests. Any new fish for the incidental fishery would be re-directed from existing allocations.

3. The Magnuson Stevens Act (MSA) gives wide discretion to fishery management councils for modifying allocation schemes. During exploitable biomass downturns, there can be increased scrutiny of past allocation agreements if it can be shown net economic benefits are increased with different allocations. Many economic analyses have shown a shift in allocations away from commercial and towards increased recreational access will increase net economic benefits up to demand saturation (Criddle 2004 and Plummer et al. 2012). Fisheries with high recreational participation elsewhere in the nation are managed on a sliding scale favoring commercial fisheries shares when exploitable biomass is high and the reverse when biomass is low. If it can be established that there are quasi-commercial rights in present systems, then inter-sector transfer mechanisms can be devised to compensate for the movement of allocated catch.

4. Economic research shows there is resource rent dissipation in open access, highly regulated fisheries. Deacon et al. (2011) discusses example fisheries similar to the Oregon commercial halibut fishery and makes recommendations on alternative management approaches such as property rights systems that could be used to increase rents. Such research is not obscure to fishery participants who have been exposed to the crafting of the groundfish trawl fishery IFQ program. Advantages of property rights

26. Halibut is a prohibited species in the groundfish trawl and fixed gear fisheries. Many of the same participants in the fixed gear fisheries are also participants in the directed commercial halibut fishery, so offsetting catch in one fishery for retaining the catch in another fishery would have merit. The management problem in programs without individual quota assignments is there can be unintended consequences from incidental fisheries for making the secondary species a marketable harvest. For example, bycatch is a multispecies problem because actions to decrease the bycatch of one species might cause the increase bycatch of other species. There is now a disincentive in the groundfish trawl fishery for halibut bycatch through regulatory individual caps that will shutdown a vessel's groundfish fishing operations if the cap is exceeded. The only disincentive in the fixed gear fisheries for avoidance of halibut bycatch are the slightly higher costs for operationally making the discards. A bycatch reduction goal for the fixed gear fleet would be to somehow address the opportunity cost of bycatch now experienced by the directed commercial and sport fisheries and still allow net economic benefits to accrue to the nation from fuller use of the halibut fish resource.

systems are supported by other research addressing harvest price increases and operational efficiencies, such as in the Alaska and British Columbia halibut fisheries due to their change from an open access management to an IFQ program in the early 1990's. Even though the West Coast fishery is in a price taking seafood market, there might be niche higher price fresh market opportunities if there was more even flow and date predictable landings. The ability to acquire sufficient quota for profitable fishery participation is the material gain in property rights system.

5. A Pacific halibut stock assessment is completed annually by IPHC staff and is for the entire population. For fishery management purposes, the exploitable biomass is apportioned to regulation areas based on indicators of biomass conditions and presence. The apportionment strategy works to reduce possibility of depletion on a large scale. However, local depletion could occur within sub-areas where there is high exploitation rate not compensated by recruitment and net migration. This is of particular concern to the non-mobile fleet such as the commercial fleet smaller boats, charter service operators, and treaty fisherman. These participants can be harmed because they are unable to effectively move between regions. The commercial fleet comprised of larger vessels has less concern, because they will redistribute to higher density regions. A narrative inset in this report describes an area off the Oregon coast where local depletion has occurred.

   Management solutions to avoid local depletions are difficult. Commercial vessels using gear comprised of miles of skates have very high fishing power. Management techniques to restrict gear or use other operational input controls (i.e. open fishing days) introduce additional economic burdens to the fleet already clamped by tight output controls (i.e. daily vessel and area total catch limits). However, reliance on individual economic behavior that considers higher costs per unit of effort to avoid areas of scarcity is not assured to protect resource sustainability. This is because behavior decisions will avoid fish resource and ecosystem externalities (Seijo et al. 1998). Management approaches fall back on instituting detailed spatial exclusions. Indeed, halibut fishing area management for depths and spot closures to avoid bycatch impacts to non-halibut species is already being used in Area 2A.

6. There have been advances in aquaculture research that may make farmed halibut production feasible (Fletcher and Rise 2012). Based on parallels for the rapid ramp-up in aquaculture salmon production, an immediate effect would be to undermine prices for wild capture fish (Knapp et al. 2007).

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Table B.1. Oregon Commercial Halibut Fishery Characteristics in 2013

Volume (thousands, round pounds)		192
Price		$4.82
Ex-vessel value (thousands)		$926
Change from 2012		1%
3 year average		6%
10 year average		10%
Economic contribution (millions)		$1.39
Share onshore total		0.4%
	Count	Share
Vessels	93	100%
Vessels >$500	52	56%
Average halibut revenue	$17,648	
Halibut share		7%
Vessels 50% value	9	10%
Vessels 90% value	30	32%
Top 10 vessels	10	11%
Average halibut revenue	$49,681	
Halibut share		11%

Notes:
1. Fishery statistics include landings by vessels delivering to Oregon ports in the commercial non-tribal directed and salmon incidental fisheries. Halibut landings for research (11 thousand pounds and $56 thousand in 2013) and landings in the shoreside whiting fishery (two thousand pounds in 2013) are excluded.
2. Economic contributions are measured in personal income (millions in 2013 dollars) at the statewide economic level.
3. Some Oregon home-ported vessels make halibut deliveries to ports in other states, but only their Oregon landings are included in the table tabulations. Similarly, vessels home-ported in Washington and California will make landings in Oregon from both the directed and salmon incidental fisheries. The landings by these vessels are included in the table statistics.

Source: PacFIN annual vessel summary, March 2014 extraction; and TRG (March 2014).

Table B.2. Numbers of Vessels That Applied for (and Received) an IPHC License for Commercial Halibut Fisheries for the Last Five Years.

Oregon Registered Vessels	2014	2013	2012	2011	2010
Directed Commercial	99	88	115	102	136
Incidental Sablefish (N of Pt. Chehalis)	2	0	1	Not open	
Directed and Incidental Sablefish	5	8	4		
Incidental Troll Salmon	239	192	173	180	125

Total Vessels	2014	2013	2012	2011	2010
Directed Commercial	137	123	156	146	190
Incidental Sablefish (N of Pt. Chehalis)	5	6	2	Not open	
Directed and Incidental Sablefish	24	20	19		
Incidental Troll Salmon	425	328	308	312	232

Source: Lynn Mattes, ODFW, personal communication December 17, 2014.

Table B.3. Oregon Commercial Halibut Fishery Vessel Revenue Frequency Distribution in 2012-2014

	Vessel Counts		
Revenue category	2012	2013	2014
>$10,000	28	29	28
<$10,000 and >$1,000	41	15	34
<$1,000 and >$500	20	9	31
<$500 and >$200	16	15	46
<$200 and >$100	15	17	23
<$100 and >$0	5	9	12
$0	19	25	21
Total	144	119	195

Notes: 1. Includes one research vessel in the highest revenue category in each year.
Source: PacFIN annual vessel summary, April 2013, March and November 2014 extractions.

Table B.4. Oregon Commercial Halibut Fishery Vessel Participation in Other Active Fisheries in 2013 and 2014

	2013 Vessels				
		Incidental		Directed	
Fishery	Total	Amount	Share	Amount	Share
Salmon					
Net	0	0	na	0	na
Troll	70	46	66%	24	34%
D. crab	46	11	24%	35	76%
P. shrimp	c	0	na	c	na
A. tuna	55	22	40%	33	60%
Groundfish					
LE	17	c	na	c	na
OA	23	5	22%	18	78%
P. whiting	0	0	na	0	na
P. sardine	0	0	na	0	na
P. halibut	93	46	49%	47	51%
Other	c	0	na	c	na

	2014 Vessels				
		Incidental		Directed	
Fishery	Total	Amount	Share	Amount	Share
Salmon					
Net	0	0	na	0	na
Troll	151	125	83%	26	17%
D. crab	53	19	36%	33	62%
P. shrimp	c	0	na	c	na
A. tuna	93	61	66%	31	33%
Groundfish					
LE	19	c	na	c	na
OA	21	5	24%	16	76%
P. whiting	0	0	na	0	na
P. sardine	0	0	na	0	na
P. halibut	173	127	73%	45	26%
Other	c	0	na	c	na

Notes:
1. Active fisheries are defined as $500 minimum shoreside harvest value for a vessel in each fishery, except Pacific halibut minimum is $1. The filters should not be interpreted as an indicator for a vessel's targeted fisheries participation.
2. Vessel counts are not additive because a vessel may participate in more than two of the defined fisheries. The table only shows counts for one single fishery active vessels participation in addition to halibut. It is not possible to discern in this table how many vessels participated in three or more of these fisheries.
3. Halibut vessels are defined to be incidental halibut catch in the salmon fishery if they landed over $0 of halibut with troll gear, and directed vessels if they landed over $0 of halibut with hook and line gear.
4. One directed halibut vessel with groundfish OA cross participation was a research vessel, and is not included.
5. Counts with a "c" are not shown to avoid revealing confidential information.

Source: PacFIN annual vessel summary, March and November 2014 extractions.

Table B.5. Oregon Commercial Halibut Fishery Vessel Participation and Economic Contribution by Port Group in 2013

	Vessels				Harvest		Economic Contribution
Port Group	Total	>$500	50% Value	90% Value	Volume	Value	(thousands)
Astoria	9	5	c	5	15,705	71,305	91
Tillamook	9	3	c	c	9,139	45,179	50
Newport	53	27	6	15	138,816	657,938	772
Coos Bay	18	12	4	10	34,691	174,626	198
Port Orford	8	7	c	5			
Brookings	c	c	c	c	6,922	33,400	35
Statewide	93	52	9	30	205,273	982,448	1,389

Notes:
1. Volume is measured in round pounds. Economic contributions are preliminary and measured in personal income (thousands in 2013 dollars) at the coastwide economic level for port groups. The Brookings port group includes Port Orford.
2. Counts with a "c" are not shown to avoid revealing confidential information.
3. The column titled ">$500" is an arbitrary threshold to filter for vessels that are actively participating in the shown fishery. The fisheries in each port group are counted separately, so the $500 filter is applied to each. Statewide, the $500 threshold may be landed at any combination of port groups.
4. Most of the vessels landing less than $500 are harvesting halibut incidentally in the salmon fishery. Vessels with halibut landings but no value are excluded from vessel counts because it is shoreside whiting fishery bycatch. One vessel made only research landings in Astoria, Coos Bay, and Brookings, and is excluded from vessel counts. Harvest and economic contribution include research and shoreside whiting fishery bycatch.
5. The vessel counts under the columns titled for percent value are the number of vessels it took to land that percent of the ex-vessel value of the fishery.
6. Some vessels participate in distant water fisheries, such as the West Coast offshore whiting fishery where deliveries are made to motherships. Only Oregon shoreside landings are included in the table compilations.
7. Vessels with identification of "NONE" or "ZZ..." are excluded from vessel counts. These vessels are typically delivering in treaty fisheries.

Source: PacFIN annual vessel summary, March 2014 extraction; and TRG (March 2014).

Table B.6. Oregon Commercial Halibut Fishery Harvest and Economic Contribution by Port Group in 2014

	Harvest		Economic Contribution
Port Group	Pounds	Value	(thousands)
Astoria	9,512	55,893	70
Tillamook	15,559	89,040	98
Newport	128,160	729,359	845
Coos Bay	27,833	155,640	175
Brookings	3,438	19,669	20
Statewide	184,502	1,049,601	1,462

Notes:
1. Landings and regional economic impacts (REI) economic contribution estimates for 2014 are preliminary.
2. Economic contributions are measured in personal income (thousands in nominal dollars) at the coastwide economic level for port groups. The Brookings port group includes Port Orford.
3. Halibut landings for research and landings in the shoreside whiting fishery are excluded.

Source: PacFIN annual vessel summary, November 2014 extraction and TRG (March 2014).

Table B.7. IPHC Decision Table of Proposed Alternatives for the 2015 Season

				Stock Trend				Stock Status				Fishery Trend				Fishery Status
				Spawning biomass				Spawning biomass				Fishery CEY from the harvest policy				Harvest rate
				in 2016		in 2018		in 2016		in 2018		in 2016		in 2018		in 2015
2015 Alternative	Total removals (M lb)	Fishery CEY (M lb)	Fishing intensity	is less than 2015	is 5% less than 2015	is less than 2015	is 5% less than 2015	is less than 30%	is less than 20%	is less than 30%	is less than 20%	is less than 2015	is 10% less than 2015	is less than 2015	is 10% less than 2015	is above target
No removals	0.0	0.0	$F_{100\%}$	<1/100	<1/100	<1/100	<1/100	5/100	<1/100	1/100	<1/100	<1/100	<1/100	<1/100	<1/100	0/100
FCEY = 0	13.1	0.0	$F_{73\%}$	<1/100	<1/100	<1/100	<1/100	5/100	<1/100	2/100	<1/100	<1/100	<1/100	<1/100	<1/100	<1/100
	20.0	7.7	$F_{64\%}$	<1/100	<1/100	1/100	<1/100	6/100	<1/100	3/100	<1/100	<1/100	<1/100	<1/100	<1/100	<1/100
	30.0	16.5	$F_{54\%}$	3/100	<1/100	17/100	4/100	7/100	<1/100	5/100	<1/100	3/100	2/100	3/100	2/100	4/100
Blue Line	38.7	25.0	$F_{46\%}$	19/100	<1/100	40/100	23/100	8/100	<1/100	8/100	<1/100	37/100	22/100	36/100	23/100	50/100
status quo	41.4	27.5	$F_{45\%}$	26/100	1/100	47/100	30/100	8/100	<1/100	9/100	1/100	57/100	37/100	51/100	38/100	50/100
Maintain 2014 SPR	43.3	29.5	$F_{43\%}$	31/100	1/100	56/100	36/100	8/100	<1/100	10/100	1/100	73/100	51/100	63/100	49/100	88/100
	50.0	36.0	$F_{39\%}$	44/100	5/100	75/100	51/100	9/100	1/100	13/100	1/100	99/100	91/100	95/100	84/100	>99/100
	60.0	45.8	$F_{34\%}$	65/100	22/100	96/100	82/100	11/100	1/100	23/100	2/100	>99/100	>99/100	>99/100	>99/100	>99/100
				a	b	c	d	e	f	g	h	i	j	k	l	m

Notes:
1. Removals and FCEY are expressed in net pounds.
2. The rows are alternatives including the "blue line" alternative. The assumption for this alternative is IPHC target harvest rates are applied to the current estimate of exploitable biomass.
3. The columns are risk metrics expressed as probability in "times out of 100."
4. SPR is spawning potential ratio.

Source: IPHC (2014d).

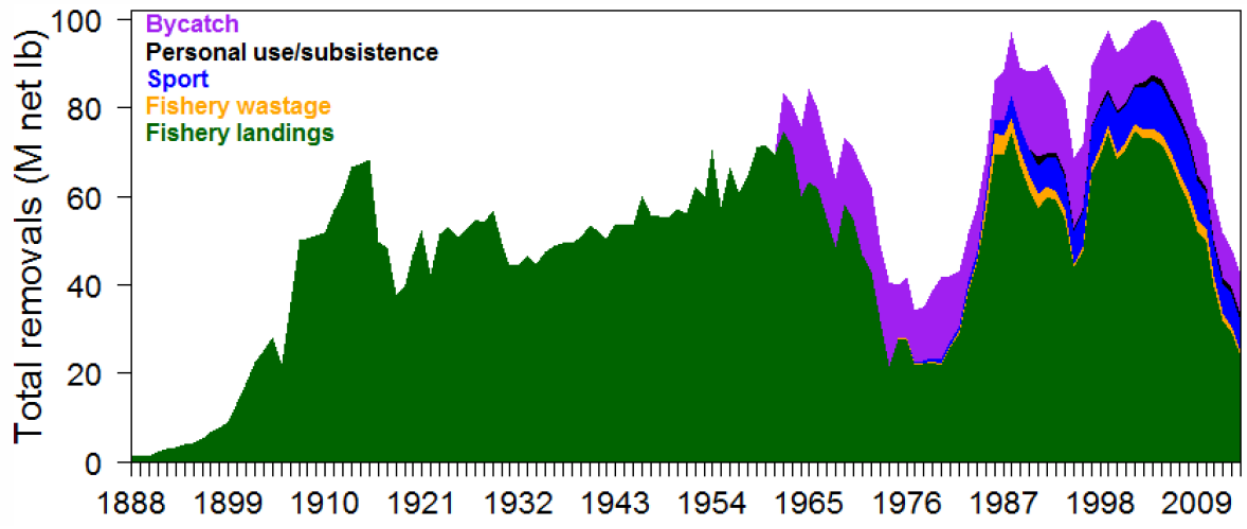
Table B.8. Oregon Commercial Halibut Fishery Harvest and Economic Impacts From Proposed Management Alternatives in 2015.

IPHC		Area 2A			Oregon Economic Impacts		
Management	IPHC	FCEY	Oregon Harvest		Harvest	Personal	
Alternative	FCEY	Apportioned	Volume	Value	Value	Income	Change
FCEY = 0	0.0	0	0	0	-1,108	-1,735	-100%
4	16.5	718	106	604	-505	-790	-46%
Blue Line	25.0	998	147	839	-270	-422	-24%
Maintain 2014 SPR	29.5	1,136	168	955	-153	-239	-14%
8	36.0	1,343	199	1,129	21	33	2%
Status Quo	27.5	1,277	189	1,073	-35	-55	-3%

Notes:
1. Economic impact (harvest value and personal income are in thousands of nominal dollars) is the difference in the proposed alternatives in 2015 less 2014. Economic impact from research and bycatch is not included. The difference is based on comparison to 2014 allocation and not actual catch. The calculated economic impact differs from Table B.6 which relies on actual catch.
2. The share of U.S. West Coast commercial non-tribal harvests from inside the EEZ delivered to Oregon ports in 2013 was used to estimate proposed 2015 landings. The Oregon share of landings in 2013 for the Area 2A commercial non-tribal harvests was 74.1%. The share is computed after excluding research, bycatch, and sablefish incidental catch. The catch includes the directed fishery and salmon ratio fishery harvests.
3. IPHC FCEY is in millions of net pounds. The Area 2A FCEY and estimated Oregon harvest volume are in thousands of round pounds. Harvest value assumes Year 2014 prices.

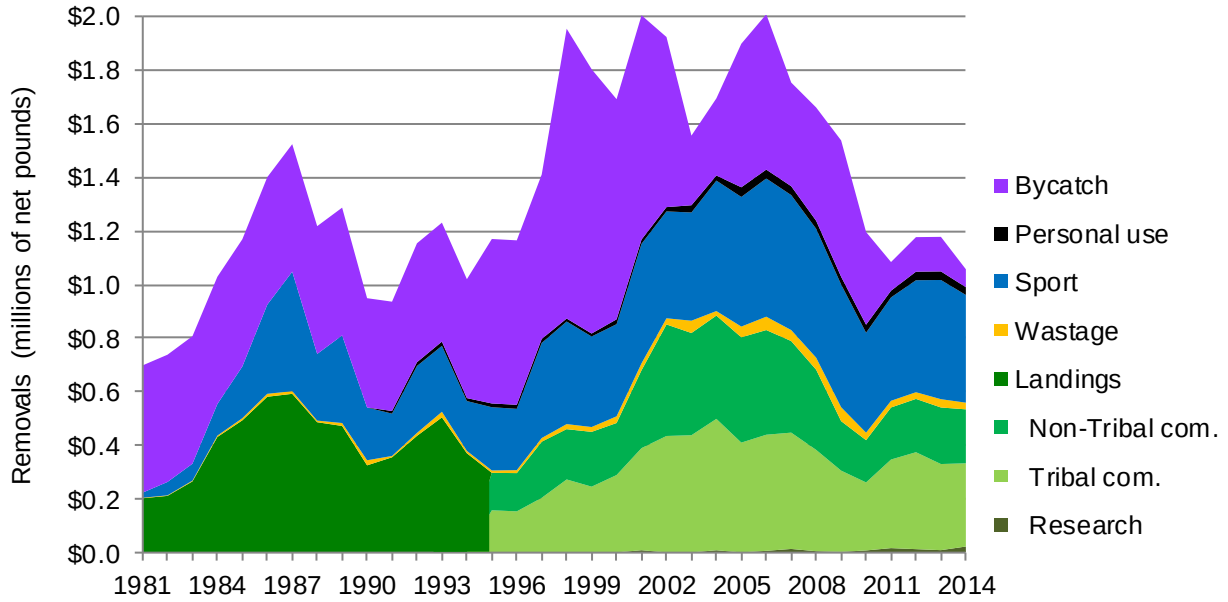
Source: Study, Gilroy (2014), Stewart (December 15, 2014), TRG (March 2014), and PacFIN annual vessel summary data (March and November 2014 extractions).

Figure B.1a. Halibut Removals From All IPHC Regulation Areas in 1888 Through 2013



Source: Stewart (2014).

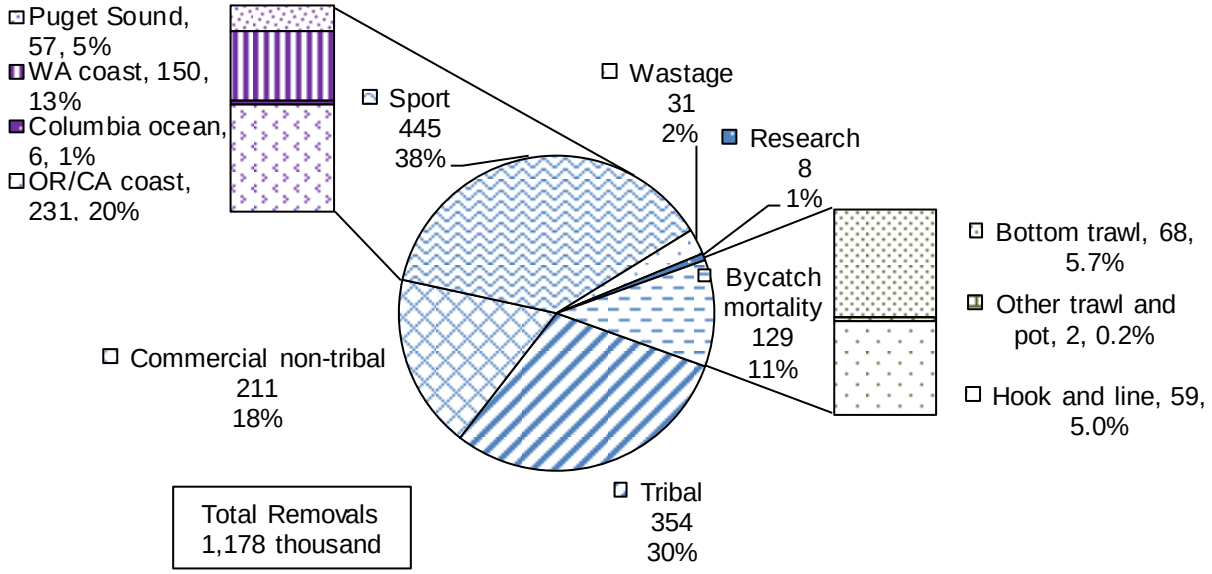
Figure B.1b. Halibut Removals From IPHC Regulation Area 2A in 1981 to 2014.



Notes: 1. Itemization of landings starting in 1995 shows court ordered settlement for 35 percent tribal allocation starting in that year. Personal use in this graphic is all tribal ceremonial and subsistence (C&S) catch which is a component of the 35 percent tribal allocation.

Sources: The removals for bycatch, personal use, sport, wastage, and summed landings are from Stewart (2014) up to 2013, and from Gilroy (2014) for 2014. Landings itemization uses proportions from PacFIN data for 1995 to partial 2014.

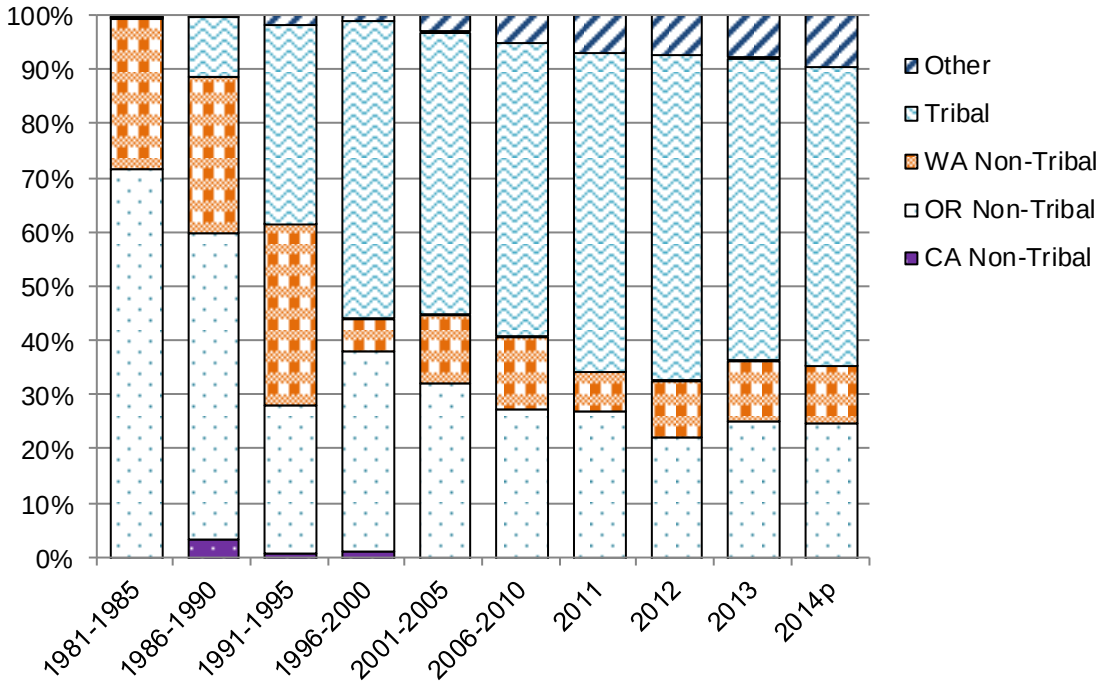
Figure B.2. Halibut Area 2A Removals in 2013.



Notes:
1. Removals in thousands of net pounds. Bycatch and wastage are estimated discard mortalities from non-halibut and commercial halibut (directed and incidental) fisheries respectively.
2. Tribal contains commercial (322 thousand net pounds) and C&S (32 thousand net pounds).
3. Sport includes removals when anglers are guided (24 percent) and unguided (76 percent). Shares are based on Oregon and Washington angler trips for halibut trip type.

Sources:
1. IPHC (personal communication, December 2013).
2. Bycatch mortality proportions based on 2013 data from IPHC (2014b).
3. Sport proportions for 2013 by area from IPHC (2014a), and by fishing mode from RecFIN.

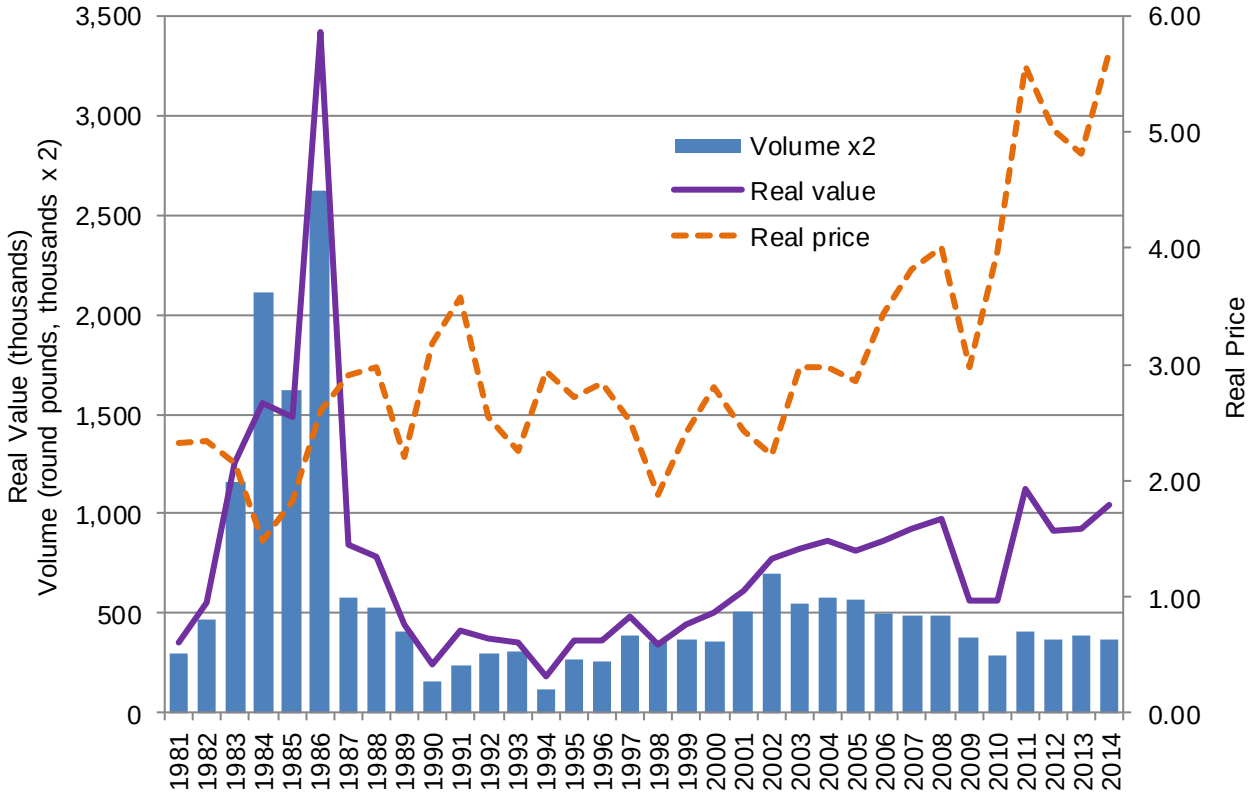
Figure B.3. Halibut Removal Shares for Landings in Area 2A by Tribal and States Commercial Fisheries in 1981 to Partial 2014.



Notes:
1. Excludes catch areas outside the EEZ. Includes Puget Sound catch area.
2. "Other" includes disposition codes other than human food, such as research, seizures, etc.
3. The identified states for removals in the commercial non-tribal fishery are based on where catch was delivered and not on catch area other than being harvested somewhere within the Area 2A waters. There are large amounts of halibut delivered to Washington ports for harvests made in Alaska catch areas. These harvests are not included in the graph.
4. Period averages are based on round pounds.
5. Year 2014 is estimated complete through October for Oregon, September for Washington, and June for California.

Source: PacFIN annual vessel summary data, March 2008, April 2009, March 2010, July 2011, April 2013, March 2014, and November 2014 extractions.

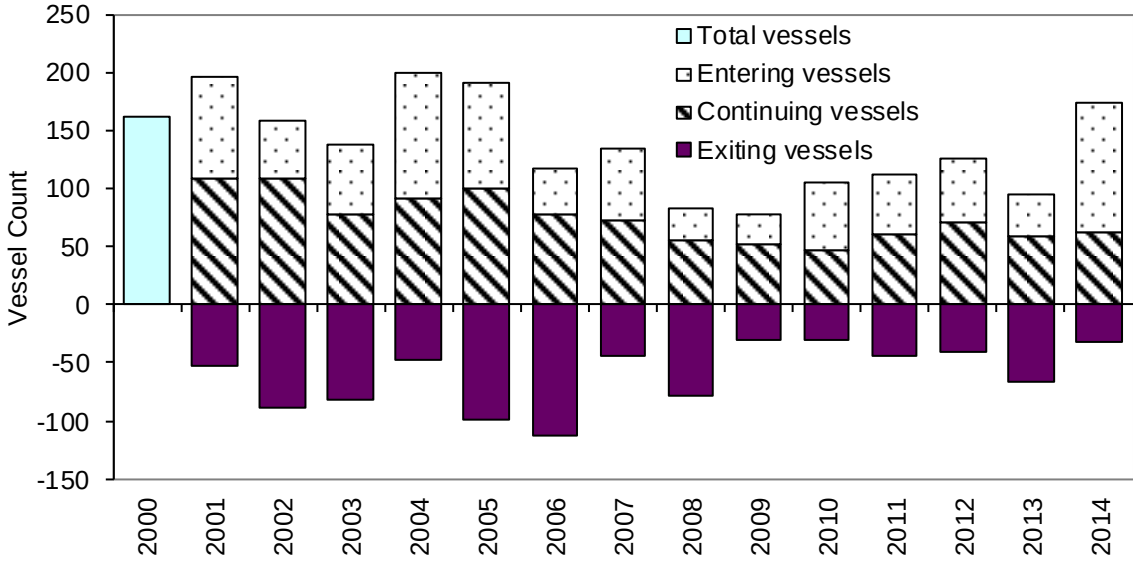
Figure B.4. Oregon Commercial Halibut Fishery Harvest Volume, Value, and Price in 1981 to October 2014



Notes:
1. Real value is in thousands of 2013 dollars and real price is in 2013 dollars, adjusted using the GDP implicit price deflator developed by U.S. Bureau of Economic Analysis.
2. Volume is in thousands of round pounds.
3. Excludes landings with research disposition (19 thousand pounds in 2014), and landings with no value reported (two thousand pounds in 2014). Excludes landings from catch areas outside the EEZ (none in 2014).
4. Year 2014 is estimated complete through October.

Source: PacFIN annual vessel summary data, March 2008, April 2009, March 2010, July 2011, April 2013, March 2014, and November 2014 extractions.

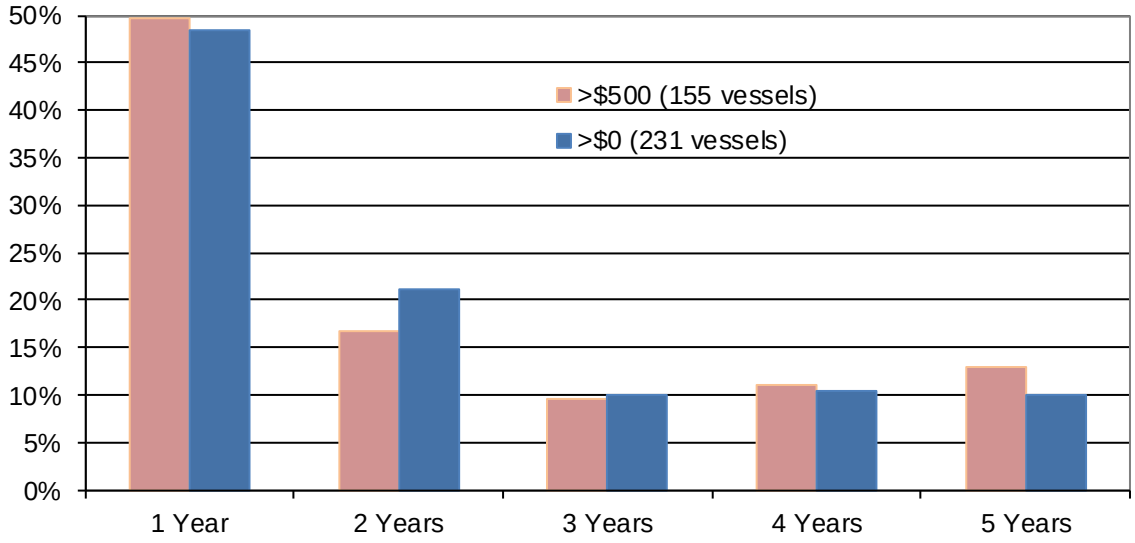
Figure B.5. Oregon Commercial Halibut Fishery Vessel Participation Trends in 2000 to 2014.



Notes: 1. Vessel counts itemized for whether they landed in the fishery the previous year.
2. Excludes vessels with halibut landings with zero value (mostly trawl).

Source: PacFIN annual vessel summary, March 2008, April 2009, March 2010, July 2011, April 2013, March 2014, and November 2014 extractions.

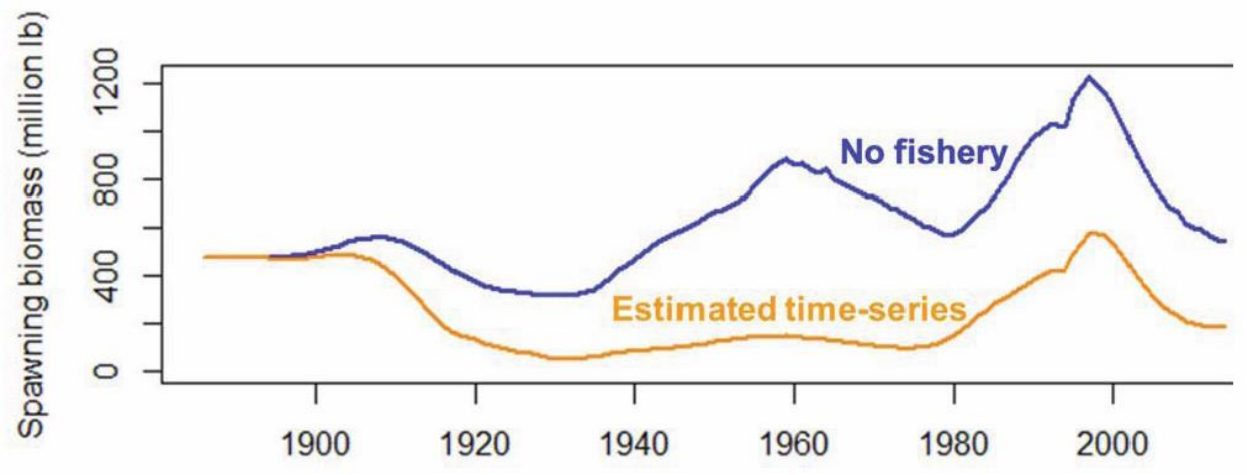
Figure B.6. Oregon Commercial Halibut Fishery Vessel Participation Tenure During Period 2009 to 2013.



Notes: 1. Includes Oregon home-port vessels (home-port is defined as the port group where a vessel made the most landings by value), excludes vessels with identifier "NONE" or "ZZ...", includes only vessels with U.S. West Coast halibut value >$500 or >$0.
2. Vessels are tracked over years by their plate numbers. If a vessel is re-documented and continues participation in the same fishery, then its previous experience is omitted. Only vessels that make deliveries in each year are included in the analysis.

Source: PacFIN annual vessel summary March 2010, July 2011, April 2013, and March 2014 extractions.

Figure B.7. Estimated Spawning Biomass Time-Series for All IPHC Regulatory Areas in 1888 to 2013.



Notes: 1. Spawning biomass are estimates from the IPHC long time-series model. The lower line (orange) is the calculated spawning biomass and the upper line *(blue) is the recreated time-series in the absence of fishery removals.

Source: Stewart (2014).

Appendix C

Oregon Commercial and Recreational Fishing Industry Economic Contributions in 2012

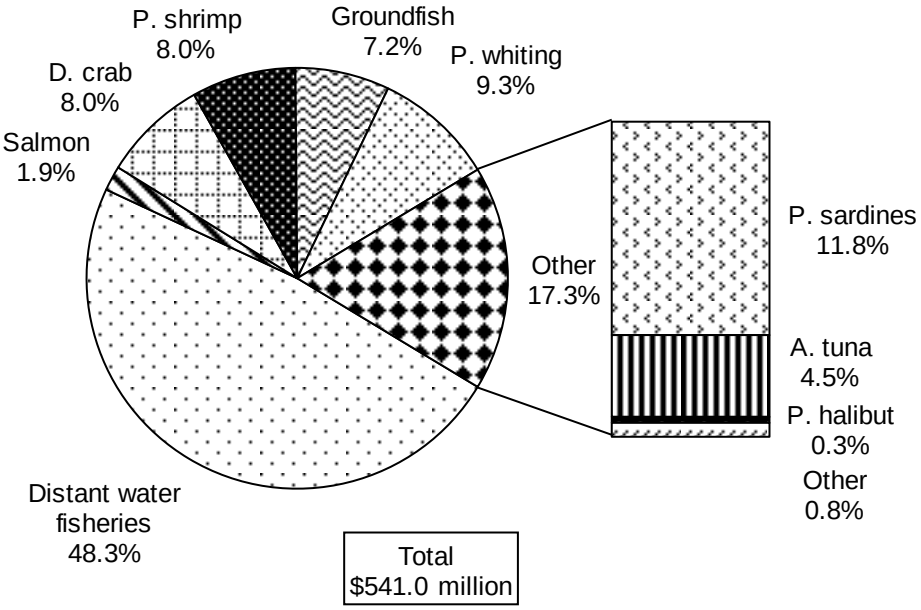
Table C.1. Oregon Commercial Economic Contributions by Major Fishery in 1981 to 2013.

	Onshore Landings								
Years	Salmon	D. Crab	Pink Shrimp	Groundfish	Pacific Whiting	Other Finfish and Shellfish	Total Landed Fish	Distant Water Fisheries	Total
1981	41.3	15.8	29.4	74.6	-	54.8	215.9	-	215.9
1982	49.9	16.1	15.9	85.4	-	29.8	197.0	-	197.0
1983	12.1	15.7	9.0	75.7	-	21.4	133.8	-	133.8
1984	19.6	15.0	4.6	60.7	-	22.3	122.1	-	122.1
1985	34.4	20.5	13.0	63.9	-	26.2	158.0	-	158.0
1986	58.2	13.1	34.7	58.7	-	37.3	202.1	124.2	326.3
1987	78.8	16.3	49.5	78.3	-	44.0	266.9	115.4	382.4
1988	124.2	21.1	36.4	80.2	-	48.0	309.9	108.8	418.7
1989	45.3	23.8	42.5	84.5	-	57.7	253.7	103.5	357.3
1990	30.5	24.0	30.4	75.7	1.2	50.2	212.1	134.3	346.4
1991	20.4	12.4	21.1	86.6	10.2	30.1	180.8	91.1	271.9
1992	8.8	29.7	47.2	73.3	26.3	23.6	208.8	88.5	297.3
1993	5.8	25.7	24.7	74.4	14.3	21.3	166.3	86.6	252.8
1994	3.3	29.8	21.3	69.1	30.1	17.1	170.7	91.7	262.5
1995	8.7	41.9	19.3	75.1	45.5	18.2	208.8	95.7	304.6
1996	8.3	58.5	21.7	73.3	41.8	24.6	228.2	100.6	328.8
1997	6.8	31.1	20.2	66.3	51.1	29.0	204.4	118.7	323.2
1998	5.6	29.1	8.0	48.9	36.1	24.5	152.2	132.8	285.1
1999	4.8	52.7	22.5	54.6	44.4	16.8	195.7	161.0	356.7
2000	10.8	54.0	28.0	60.9	38.7	40.6	232.9	135.1	368.1
2001	15.3	43.8	24.0	49.7	28.4	46.3	207.4	143.3	350.7
2002	17.7	48.2	35.0	33.6	18.4	51.8	204.7	151.9	356.6
2003	20.1	84.7	16.0	41.5	25.1	64.9	252.4	160.6	412.9
2004	25.3	95.0	11.9	38.4	37.3	87.4	295.3	154.2	449.5
2005	19.4	57.9	16.0	41.1	40.9	98.4	273.6	168.0	441.6
2006	8.5	110.4	10.8	42.6	41.9	76.9	291.2	156.2	447.3
2007	7.7	70.5	20.0	42.9	29.2	88.5	258.8	179.4	438.2
2008	7.2	51.5	25.4	49.8	21.2	63.2	218.3	271.3	489.6
2009	6.4	75.8	15.9	52.4	21.8	59.4	231.7	213.8	445.5
2010	12.4	56.9	23.8	46.9	25.1	62.2	227.4	227.8	455.2
2011	10.5	72.3	44.3	46.8	65.3	53.4	292.6	285.5	578.2
2012	10.5	44.1	43.9	39.7	50.9	94.7	283.7	265.0	548.7
2013	18.4	110.4	42.2	37.5	70.9	73.8	353.1	265.0	618.0
Avg08-12	9.4	60.1	30.6	47.1	36.9	66.6	250.7	252.7	503.4

Notes:
1. Economic contributions are expressed as personal income in millions of 2013 dollars. Adjustments to 2013 dollars use the GDP implicit price deflator developed by the U.S. Bureau of Economic Analysis.
2. Year 2013 is preliminary. Distant water for 2013 is not a model result and just repeats 2012.
3. The economic contributions from salmon fisheries include ocean troll and Columbia River gillnet fisheries, so the estimates will be greater than ocean salmon fisheries as reported by the PFMC.
4. Groundfish in 2013 includes (personal income in thousands) flatfish ($16,891), sablefish ($12,080), cod/rockfish (other than sablefish) ($7,042), and sharks/skates ($1,456).
5. "Other" in 2013 includes (personal income in thousands) Pacific sardines ($40,050), albacore tuna ($25,533), Pacific halibut ($1,389), sturgeon ($201), sea urchins ($488), and other species ($6,126).

6. Economic contributions from fish meal production are included in Pacific whiting. The largest source of fish carcasses in past years has been mostly from surimi production. Pacific whiting demand has shifted to H&G and fillet product forms which have higher resource yields and lesser material available for fish meal production.
7. The economic contribution from distant water fisheries includes the effects of vessel revenue returned to Oregon's economy from U.S. West Coast at-sea fisheries, Oregon home-port vessels landing in other U.S. West Coast states and Alaska, southern Pacific Ocean, and other fisheries. New fishing vessel construction, fishery management, and fishery research and training are not included.

Figure C.1. Oregon Commercial Economic Contributions by Major Fishery in 2012.



Notes: 1. Economic contributions are expressed as total personal income in millions of 2012 dollars.
2. Year 2012 is preliminary estimates.

Source: TRG (September 2013).

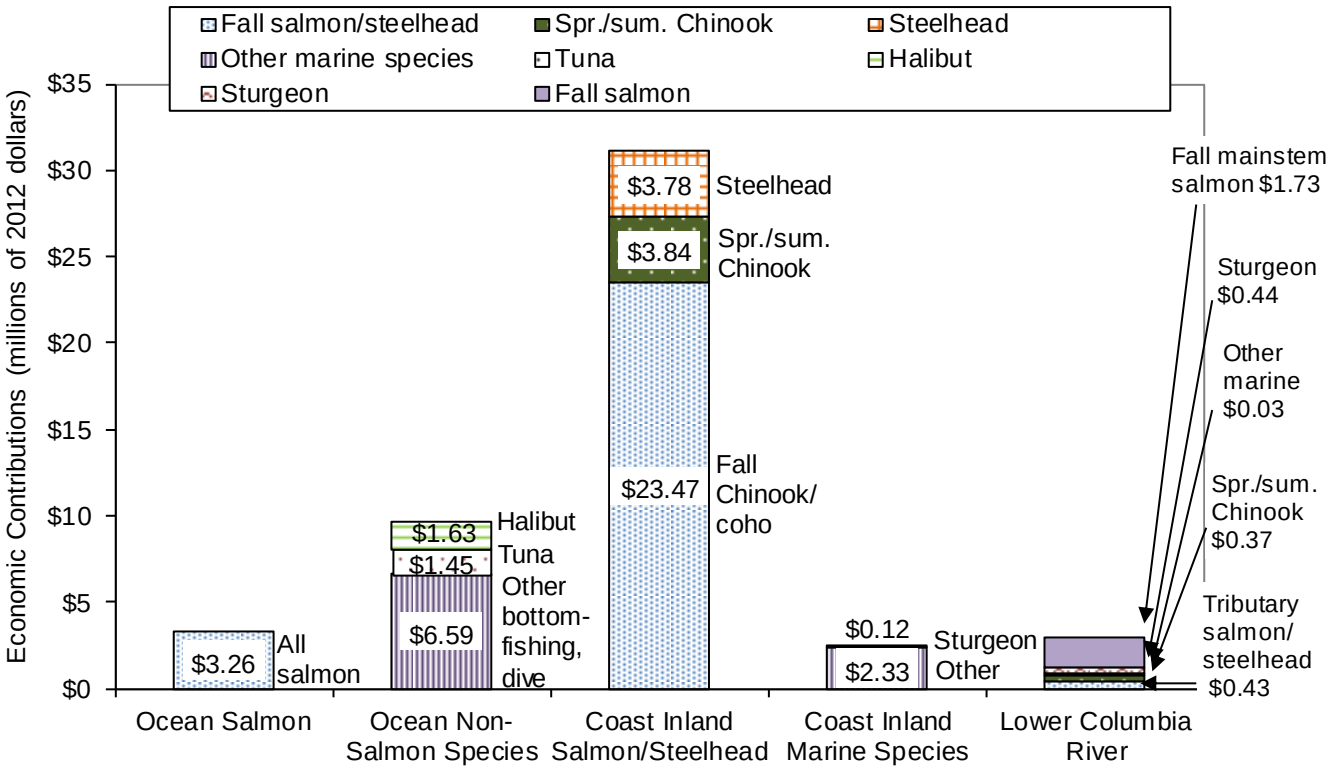
Table C.2. Oregon Ocean and Inland Recreational Fisheries Economic Contributions in 2012

		Recreational					
		Fishery Location					
	Commercial		Coast Inland		Lower		
Target Fishery	Ocean Salmon	Ocean	Salmon/ Steelhead	Marine Species	Columbia River	Total	Fishery Share
Ocean salmon	$5.62	$3.26				$3.26	6.6%
Inland fall salmon			$23.47		$0.33	$23.79	48.1%
Inland steelhead			$3.78		$0.10	$3.88	7.8%
Inland spr./sum. Chinook			$3.84		$0.37	$4.21	8.5%
Mainstem fall salmon					$1.73	$1.73	3.5%
Ocean halibut		$1.63				$1.63	3.3%
Ocean tuna		$1.45				$1.45	2.9%
Ocean bottomfish		$6.59				$6.59	13.3%
Other marine species				$2.33	$0.03	$2.37	4.8%
Sturgeon				$0.12	$0.44	$0.56	1.1%
Total	$5.62	$12.92	$31.09	$2.46	$3.00	$49.46	100.0%
Shares		26.1%	62.9%	5.0%	6.1%	100.0%	

Notes: 1. Economic contributions are expressed as personal income in millions of 2012 dollars and are at the coastwide economic level.
2. Fall Columbia River mainstem salmon is sometimes referred to as the Buoy 10 salmon fishery.
3. Other marine species is sometimes referred to as bottomfishing when it takes place in the ocean.

Source: TRG (July 2013).

Figure 2. Oregon Recreational Ocean and Inland Fisheries Economic Contributions in 2012.



Notes: ODFW SSHSTRP data is 2011, June 2013 extraction.
Source: TRG (July 2013).