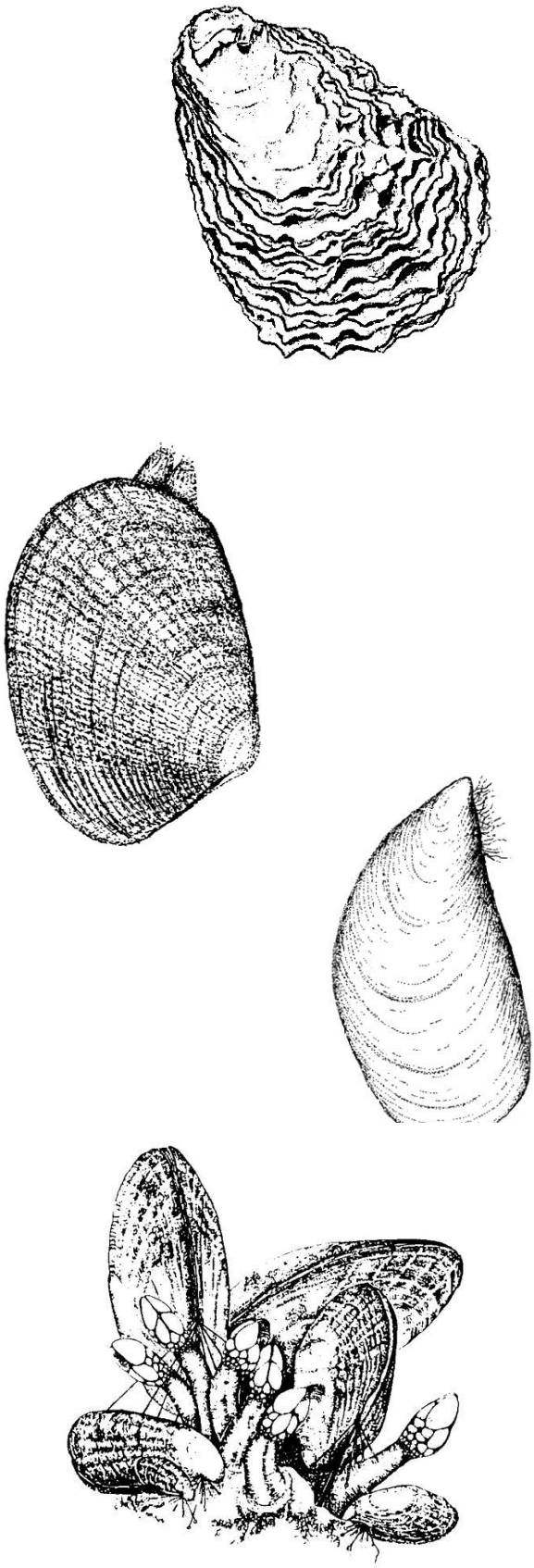

ASSESSMENT OF NATURAL RESOURCE DAMAGES

LOST-USE DAMAGES TO RECREATIONAL SHELLFISH HARVEST IN PENN COVE CAUSED BY THE F/V DEEP SEA OIL SPILL OF 2012

State of Washington
Department of Fish and Wildlife
Habitat Program
Resource Protection Division
Oil Spill Team

Penn Cove Lost Use Claim

This is a claim in accordance with 33 CFR part 136 for damages suffered by the citizens of Washington State as the result of lost access to the shellfish resources located in Penn Cove on Whidbey Island. These loses occurred when public shellfish beaches were closed by the Washington State Department of Health until the shellfish could be verified as being safe for human consumption following contamination from an oil spill. This oil spill resulted following a fire on, and eventual sinking of, the former fishing vessel F/V DEEP SEA in May of 2012. The Washington Department of Health closed these public beaches for either 22 or 38 days (depending on location) to recreational shellfish harvesting which resulted in an estimated loss of 1,996 shellfish harvest user days. These lost shellfish harvest user days will cost an estimated $126,267 to compensate the shellfish harvesters in Washington State. While it is likely that other natural resources were also damaged by this incident, no cost effective method of determining those damages has been identified, and therefore no cost assessment has been included for these resources. The data and method for determining the damage assessment for lost shellfish harvest user days is provided below.

Claimant

The Washington State Department of Fish and Wildlife is acting as the lead trustee in this case. Shellfish were the primary natural resource impacted by the 2012 F/V DEEP SEA oil spill in Penn Cove, Washington. Shellfish are a trust resource of the Washington Department of Fish and Wildlife (RCW 77.04.012 - Mandate of department and commission. “Wildlife, fish, and shellfish are the property of the state. The commission, director, and the department shall preserve, protect, perpetuate, and manage the wildlife and food fish, game fish, and shellfish in state waters and offshore waters.”).

Referring to RCW 90.48.368(4) “When a resource damage assessment is required for an oil spill in the waters of the state, as defined in RCW 90.56.010, the state trustee agency responsible for the resource and habitat damaged shall conduct the damage assessment and pursue all appropriate remedies with the responsible party.” The Washington Department of Fish and Wildlife is the trustee agency that should represent the state of Washington for the 2012 F/V DEEP SEA oil spill.

The trustee certifies the accuracy and integrity of this claim being submitted to the Fund and certifies that any actions taken or proposed, were or will be, conducted in accordance with the Act and consistent with all applicable laws and regulations.

This assessment was conducted in accordance with applicable provisions of the natural resources damage assessment regulations promulgated under section 1006(e)(1) of the Act (33 U.S.C. 2706(e)(1) and Washington Administrative Code 173.183 Oil Spill Natural Resource Damage Assessment.

The claimant has not commenced an action in court to recover costs which are the subject of this claim.

To the best the trustee's knowledge and belief, no other trustee has the right to present a claim for the same natural resource damages (i.e. lost non-treaty recreational shellfish harvest opportunity) and that payment of any subpart of the claim presented would not constitute a double recovery of the same natural resource damages.

Signing Officials:

Jeff Davis Dated
Assistant Director, Habitat Program
Washington State Department of Fish and Wildlife
600 Capitol Way N.
Olympia WA 98501

For technical questions regarding this claim Mr. Donald Noviello is the designated point of contact. He can be reached by phone at (360) 902-8124 or by e-mail at Donald.Noviello@dfw.wa.gov.

Responsible Party

The Washington Department of Ecology and the United States Coast Guard investigated the spill and determined the responsible party to be the owner of the F/V DEEP SEA, Mr. Rory A. Westmoreland d.b.a. Northwest Steel & Recycling or Cuttin Steel & Recycling located at [redacted]

A letter demanding payment for damages to natural resources in Penn Cove between May 13 and June 22, 2012 was sent to the responsible party, Mr. Rory A. Westmorland, by Washington State Assistant Attorney General, Martha Wehling via U.S. Mail and Certified Mail on July 11, 2016 specifying a demand for payment of $126,267 no later than October 13, 2016 (Attachment 2). On October 21, 2016 Ms. Wehling issued a memorandum via E-mail to Mr. Donald Noviello (WDFW) documenting that the responsible party, Mr. Westmorland, had been contacted with the demand for damages and that he did not provide a written response to the demand nor remit payment by the October 13th, 2016 deadline pursuant to 33 U.S.C. § 2713(c) (Attachment 3).

The responsible party has no known insurance that could cover the cost of natural resource damages.

Lost Recreational Shellfish Harvest

The spill caused oiling of recreational shellfish beaches around the perimeter of Penn Cove temporarily rendering the shellfish unfit for human consumption. Specifically, the beaches of San de Fuca, West Penn Cove, and Long Point were each closed for 22 days due to potential oil contamination while Madrona beach was closed for 38 days. These four beaches would have been open for recreational shellfish harvest during this time if not for the oil spill. Oil spill related closures are indicated in red in Table 1 below.

Table 1. Oil Spill Caused Penn Cove Beach Closure Dates in 2012

Beach Segment counterclockwise from north	5/15/2012	5/16/2012	5/17/2012	5/18/2012	5/19/2012	5/20/2012	5/21/2012	5/22/2012	5/23/2012	5/24/2012	5/25/2012	5/26/2012	5/27/2012	5/28/2012	5/29/2012	5/30/2012	5/31/2012	6/1/2012	6/2/2012	6/3/2012	6/4/2012	6/5/2012	6/6/2012	6/7/2012	6/8/2012	6/9/2012	6/10/2012	6/11/2012	6/12/2012	6/13/2012	6/14/2012	6/15/2012	6/16/2012	6/17/2012	6/18/2012	6/19/2012	6/20/2012	6/21/2012	6/22/2012
Monroe Landing	Closed due to potential for other contaminenants																																				
E. San de Fuca	Closed due to potential for other contaminenants																																				
San de Fuca																																					
W. Penn Cove (Mueller Park north)																																					
W. Penn Cove (South of Mueller Park)																																					
Penn Cove/Madrona																																					
Coupeville	Closed due to potential for other contaminenants																																				
Long Point West	Closed due to potential for other contaminenants																																				
Long Point																																					
				Water Festival							Memorial Day Weekend														Free Fishing Weekend													

The graphic below illustrates the location of the beaches noted above.

Due to visible oil sheens in the area, the Washington State Department of Health - in coordination with the Island County Public Health Shellfish Program - closed all public beaches in Penn Cove to recreational and commercial shellfish harvest on May 15, 2012. Note: Some of the beaches in this area (specifically Coupeville, Long Point West, East. San de Fuca and Monroe Landing) were already closed for shellfish harvesting due to pollution sources not related to the oil spill. Since these four beaches would not have been open to recreational shellfish harvest during the time of the oil spill, they are not included as part of this claim.

The remaining beaches in the area (San de Fuca, West Penn Cove and Long Point) were reopened on June 6th after shellfish on these beaches had been evaluated and determined to be safe for human consumption. Madrona Beach remained closed until June 22, 2012. Note: The southern part of West Penn Cove beach (south of Mueller Park) also remained closed until June 22, 2012 but it is presumed that any shellfish harvesters, intending to harvest at this location, are likely to have simply moved to the open portion of the beach north of Mueller Park. For purposes of calculating lost shellfish harvest use days, therefore, West Penn Cove was assumed to be open after June 5, 2012.

The methods used to evaluate the reopening of beaches are described in the attached "After Action Report" from the Washington Department of Health (Attachment 4). A map of the location of the posting of closure notices provided by the Island County Public Health Shellfish Program is also provided (Attachment 5).

Estimation of lost use value

The determination of the value associated with the lost use of recreational shellfish beaches is based on an estimation of lost use (user days) and on the value associated with that lost use.

Estimating Lost User Days

There is no direct data available that represents the number of shellfish harvesters that were not able to access the closed shellfish beaches during this incident. Modeled harvester data for the beaches closed as a result of the spill is available, however, for each of the two years (2010 and 2011) preceding the incident. Given that there is no known reason to expect harvester use patterns to have changed prior to the incident, an average of the data from the preceding years was used to estimate the expected use of the individual beaches for 2012 during the closure period.

Model discussion:

Data on shellfish harvester use in terms of harvester days was obtained from the WDFW shellfish harvest management group (Attachment 6). The estimate of harvester days per beach is calculated for individual public beaches in Puget Sound based on aerial counts made from a fixed-wing aircraft at the approximate time of local low tide. These "head counts" at low tide are expanded using a model to account for "all-day effort" – the total number of harvesters using the beach during the course of the entire day. Aerial surveys are performed on about 50 randomly-selected days between March and September each year, on days with a "daylight clamming tide". Daylight clamming tides are tides lower than 2.0 feet occurring during daylight hours.

All shellfish harvesting effort data are divided into three strata, based on the tide height and the day of the week. Tides -2.0 feet and lower are considered "extreme low (ELOW)," while "low tides (LOW)" are those between -0.1 and -1.9 feet. "High tides (HIGH)" are those from 0.0 to 1.9 feet. The ELOW stratum (extreme low tides occurring on weekends or holidays) typically attract the most shellfish harvesters. The LOW stratum (weekday extreme low tides and weekend low tides) draw fewer harvesters than ELOW tides. The HIGH stratum (weekday low tides, weekend and weekday high tides) draws yet fewer harvesters. PLUS tides, those greater than 2.0 feet draw the least potential shellfish harvesters. PLUS tides are calculated at 16 percent of the observed daily average for all annual tidal days combined.

The 2012 oil spill closure days were categorized into the four stratums previously defined (ELOW, LOW, HIGH and PLUS) based on the tidal elevation for those dates in 2012. The number of days in each stratum was then multiplied by the average for that stratum derived from the harvest-day estimates for the same time period in the two prior years (2010 and 2011) (see Table 2).

Value of a Lost Recreational User Day

The monetary value of the lost user-days is based upon the December 2008 study titled "Economic Analysis of the Non-Treaty Commercial and Recreational Fisheries in Washington State – Final Report" (Attachment 7). This study estimated the net economic value of a shellfish harvesting trip at $43 per day (2006 value). The net economic value is the monetary value that anglers place on sport fishing over and above what they actually spend to participate in the fisheries. This value from 2006 was adjusted to a 2012 inflation corrected value of $48.97 using the United States Department of Labor, Bureau of Labor Statistics, CPI Inflation Calculator (Attachment 8).

The total monetary value of the loss was calculated by multiplying the total lost user-days by the adjusted net economic value as adjusted for inflation.

Lost User Days * Net Economic Value of Trip * CPI Inflation Adjustment = Value of Lost Use

Finally, this value was adjusted up by the WDFW standard indirect rate of 29.21 percent. The indirect rate covers costs from tasks not directly linked to work products, but necessary to perform the work. Some costs are in Business Services, like payroll, information technology and Human Resources support. Indirect also includes some overhead costs, such as lease costs for offices and computers. Lastly, it includes administrative support within the resource program, including senior managers, budget, contracts and other administrative staff.

Proposal to Enhance Recreation Shellfish Harvest Opportunity in the Penn Cove Area

The damage claim compensation would be used to fund the planting of additional shellfish seed (oysters) on the public access beaches in the Penn Cove area that were closed due to the oil spill. This work would be coordinated by the WDFW Fish Management Program, Marine Shellfish Division. The final number of shellfish seed bags that can be purchased for planting will depend on market prices at the time of purchase but it is anticipated that over 2000 bags can be obtained and distributed to three public shellfish beaches in the Penn Cove area. The initial proposal is for shellfish seed bags to be distributed at up to the following levels in the first year: 800 West Penn, 600 Madrona, and 400 Long Point. The reminder of the funds will be spent on more bags for the second season. The actual amount of seed acquired and delivered could be adjusted to expend the full amount of funds available. The intent is to expend all funds in the first two seasons following receipt and in no case later than three years from receipt of the claim funds.

Table 2. Estimate of Lost Shellfish Recreation Harvester Use Days at Penn Cove Public Tidelands During Incident Related Closure Period

WEST PENN COVE	***Estimated Effort (harvester-days)***								
YEAR	**ELOW**	**HIGH**	**LOW**	**PLUS**					
2010&2011 Average	252.83	37.65	140.18	16.13					
Total days in stratum (May 15-June 5)	2	12	5	3					
						Total Lost Harvester Use Days			**Value**
Estimated effort lost in stratum	505.66	451.80	700.90	48.38		**1,706.74**			$83,579
MADRONA	***Estimated Effort (harvester-days)***								
YEAR	**ELOW**	**HIGH**	**LOW**	**PLUS**					
2010&2011 Average	11.14	1.72	6.39	0.73					
Total days in stratum (May 15-June 21)	2	21	10	5					
						Total Lost Harvester Use Days			**Value**
Estimated effort lost in stratum	22.28	36.12	63.90	3.63		**125.93**			$6,167
SAN DE FUCA	***Estimated Effort (harvester-days)***								
YEAR	**ELOW**	**HIGH**	**LOW**	**PLUS**					
2010&2011 Average	1.22	0.13	0.50	0.06					
Total days in stratum (May 15-June 5)	2	12	5	3					
						Total Lost Harvester Use Days			**Value**
Estimated effort lost in stratum	2.44	1.56	2.50	0.19		**6.69**			$328
LONG POINT	***Estimated Effort (harvester-days)***								
YEAR	**ELOW**	**HIGH**	**LOW**	**PLUS**					
2010&2011 Average	19.93	3.02	15.13	1.48					
Total days in stratum (May 15-June 5)	2	12	5	3					
						Total Lost Harvester Use Days			**Value**
Estimated effort lost in stratum	39.86	36.24	75.65	4.44		**156.19**			$7,649
						Total Lost Harvester Use Days			**Value**
					Total	1,996			$97,722
WDFW Indirect Cost									$28,545
Grand Total									$126,267

List of Attachments

(1) Department of Ecology, Spills Program Investigation Summary Form DEE0512.
(2) Attorney General Certified letter to the responsible Party, Mr. Rory Westmoreland, dated July 11, 2016.
(3) Attorney General letter via email to Mr. Don Noviello Dated October 21, 2016.
(4) Department of Health, Office of Shellfish and Water Protection After Action Report: F/V Deep Sea oil spill – Penn Cove Shellfish Growing Area Closure, June 2012.
(5) Island County Public Health Shellfish Program, Oil Spill from the FV Deep Sea, Penn Cove, May 13, 2012 Recreational Shellfish Harvest Closure Sign Posting.
(6) Excel Spreadsheet of Washington State Department of Fish and Wildlife shellfish harvest effort data.
(7) Final Report, Economic Analysis of the Non-Treaty Commercial and Recreational Fisheries in Washington State, December 2008.
(8) Screen Shot of Bureau of Labor Statistics, Inflation calculator 2008 to 2012 adjustment.

SPILLS PROGRAM Investigation Summary Form	**Spill/Violation/Incident Name:** FV *Deep Sea*, fire, sinking & oil spill **Spill/Violation/Incident Date/Time:** May 13, 2012 / 18:00 **Investigation Type:** 2 **ERTS #:** 633857 **Filename Reference:** DEE0512

1. Incident Type: Oil spill
2. Source Type Category: Vessel
3. Source Type *(see States/BC list)*: Other vessel (former fishing vessel in other use)
4. Date/time reported to Washington State: May 13, 2012 / 02:55 **[1]**
5. Reported to Washington State by: PO Bruce Reed, USCG
6. Reporter Phone/Fax/Email: (206) 217-6002
7. Activity at time of Spill/Violation/Incident *(see States/BC list)*: Stationary / in port
8. Medium: Marine *(USCG AOR)*
9. Location name: Penn Cove, Whidbey Island
10. Latitude/Longitude *(degrees to 5 decimals)* : 48.220700° N / 122.711460° W
11. County *(nearest)*: Island
12. City/Town *(nearest)*: Coupeville
13. Name of Parent Company/Responsible Party (RP): Rory A. Westmoreland dba Northwest Steel & Recycling **[2][3]** (or Cuttin Steel & Recycling[1] **[4]**)
14. Company/RP Contact Person: Rory A. Westmoreland dba Northwest Steel & Recycling (or Cuttin Steel & Recycling)
15. Contact Phone/Fax/Email: [redacted]
16. Contact Address: [redacted][2] or [redacted] **[5]**[3]
17. Type of oil spilled *(see States/BC list)*: Diesel oil, waste oil, lube oil, hydraulic oil
18. Total spilled *(US Gallons)*: 5,555
19. Spilled to water *(US Gallons)*: 5,555
20. Spilled to impermeable surface *(US Gallons)*: 0
21. Total recovered *(US Gallons)*: 7,266 [4,166 from on-water recovery; 3,100 from vessel tanks/spaces]
22. Total spill potential *(US Gallons)*: 8,655
23. NRDA spill determination *(US Gallons)*: 5,555
24. Environmental Conditions *(please specify units)* **[6]** **Weather:** Clear **Visibility:** 5+ miles **Temperature:** ~60 F **Wind** *(dir. & spd.)*: WNW 5-10 mph **Tidal stage & height:** various **Current** *(dir. & spd.)*: various **Wave height:** various **Swell:** NA
25. Investigator(s): Dick Walker, Carl Andersen, Norm Davis, Mike Lynch
26. Lead Investigator: Mike Lynch
27. Lead Investigator Phone/Fax/Email: 360.407.7482 / 360.407.7288 / mily461@ecy.wa.gov

[1] The bill of sale of the *Deep Sea* from the Port of Seattle to Randy Westmoreland indicated Westmoreland was also doing business as Northwest Steel & Recycling. However, that business was not registered to Westmoreland, but to another individual. Cuttin Steel & Recycling was licensed as a business license on December 13, 2011, to Westmoreland -- after the bill of sale was signed. Northwest Steel & Recycling and Cuttin Steel & Recycling had business licenses issued in early December 2011.

[2] Address used by Westmoreland when signing the bill of sale for the *Deep Sea*.

[3] A physical address used by Westmoreland with the Washington Department of Licensing in association with the Renton, WA address listed as a mailing address.

By 17:00 the *Deep Sea* had settled by the stern, and at about 18:00 it rolled to port and sank (Figure 3). **[8][32]** The vessel contained a substantial amount of oil in its tanks, which began to leak out, shutting down the large shellfish growing operation immediately adjacent to the site (Penn Cove Shellfish) as well as recreational shellfish harvesting areas in Penn Cove.

A significant spill response and salvage operation was undertaken by the US Coast Guard and state of Washington.[4] The state of Washington (Washington State Department of Fish and Wildlife and Ecology) determined the best course of action was to raise the vessel to remove the ongoing threat of the oil spill to state and private resources. The *Deep Sea* was raised to the surface of Penn Cove by divers and crane barges on June 3, 2012 (Figure 4). Approximately 5,555 gallons of diesel, hydraulic and lube oils spilled to the waters of Penn Cove as a result of the incident.

Figure 3 – *Deep Sea* rolling to port and sinking at about 18:00 on May 13, 2012, with boom deployed and a fireboat (left in smoke) and US Coast Guard vessel (right) standing by [Note the Penn Cove Shellfish floats at right of photo.]
[Photo courtesy of John Callahan]

[4] http://www.ecy.wa.gov/programs/spills/incidents/FVdeepsea/index.html

In March 1997, Factotum Fisheries, Inc. of Marysville, Washington obtained a business license in Washington. **[11]** The company undertook a refurbishment of the *Deep Sea*, including, among other things, the main engine and associated systems in the engine room. In the process, Factotum used PVC (polyvinyl-chloride plastic) throughout the engine room, including for cooling water, sanitation, and ammonia refrigeration systems. The cooling water piping led from the sea chests - below the waterline - to engine room machinery. **[10]**

The venture proved unprofitable, and after a September 2006 voyage to fish off of the coast of Oregon, the *Deep Sea* returned to Fishermen's Terminal in Seattle, Washington, where it was laid up (Figure 6). **[10][12]** Factotum Fisheries fell behind on payments for moorage to the Port of Seattle, which operates Fishermen's Terminal. The Port seized the vessel and offered it for sale. It was purchased for $2,500 on November 22, 2011, by Rory Westmoreland of Washington, "dba [*doing business as*] Northwest Steel & Recycling." **[2]** Westmoreland purchased the vessel for the purpose of scrapping it. An associate of Westmoreland estimated the vessel could yield 140 tons of scrap at about $280 per ton.**[10][35]**

Figure 6 – *Deep Sea* moored at Fishermen's Terminal in October 2006
[Photo courtesy of Maureen Reilly via Flickr]

In December 2011, Westmoreland had the *Deep Sea* towed to Penn Cove by Western Towing and anchored there (Figures 6 & 7). **[10][13][14]**

would have to be removed from state-owned aquatic lands in Penn Cove. **[10][13][14] [33]**

Westmoreland told WDNR that he sold the vessel in February. **[13]** A handwritten bill of sale was provided to WDNR by Westmoreland with no original date, buyer name, or full signatures. **[15]** The sale price is indicated as $100, with the requirement that the new owner move the vessel from Penn Cove. The bill of sale appeared contingent on the provision of an asbestos survey by "Rory." A note in a different handwriting bearing the initials "RW" is dated March 13, 2012—the same day that WDNR began billing Westmoreland about $83/day for the vessel's presence on state-owned aquatic lands—and indicates "as is, new owner to assume all responsibility from this date." **[13]**

However, the sale of the vessel did not occur because the potential buyer backed out due to asbestos concerns and the WDNR fines being accrued. **[35]**

After "nearly two dozen contacts" with Mr. Westmoreland by WDNR, the *Deep Sea* remained at anchor in Penn Cove. **[13]**

Compliance History

In August 2008, Ecology received an anonymous complaint of a neighbor (Westmoreland) crushing cars on his property in Renton, Washington. According to King County Code Enforcement, "Case number E0200539 has been an ongoing matter from 2002, which resulted in a legal Notice & Order to the owner to encourage compliance in relation to the code violations. Compliance hasn't been met, and the case is currently at PENALTY status, which means it is being prepared to go before our Prosecuting Attorney." However, a King County Hazardous Waste (KCHW) program visit to the property showed no evidence of such activity, though the property was only observed from the street. **[16]**

In October 2011, Ecology received a complaint via KCHW and the Washington State Patrol (WSP) about another Renton property associated with Westmoreland. The complaint indicated that cars were being cut up on the property for scrap. An email from WSP stated, "Are at this location today, lots of gas and oil on ground…" The complaint was referred by Ecology to KCHW for follow-up. **[17]** On November 9, 2011, a joint investigation of the property by Ecology Water Quality, USEPA, WSP, Seattle & King County Public Health, King County Natural Resources & Parks, and KCHW confirmed the car crushing activity at this residential address. **[18]** The concerns, issues and violations uncovered during the investigation were transmitted to Westmoreland in a letter dated December 27, 2011. **[20][21]**

On November 9, 2011, the joint investigation team also visited the Northwest Steel & Recycling site at which Westmoreland was doing business. Issues identified included "mismanaged hazardous waste, mismanaged solid waste, illegal auto wrecking, water quality and zoning." **[22][23]** It was Northwest Steel & Recycling's name that Westmoreland used in addition to his own when he purchased the *Deep Sea* from the Port

•Bales of absorbent material

May 14
On Monday, May 14, some commercial shellfish operations in Penn Cove voluntarily stopped harvesting before fuel reached nearby mussel rafts. The volume of diesel spilled from the boat grew through Monday leaving a very thin coating of oil over the commercial operation and leading the Washington Department of Health to close the area. Recreational shellfish harvesting in Penn Cove was also temporarily closed.

May 15
A temporary shellfish harvesting closure was issued by the Washington State Department of Health until further notice.

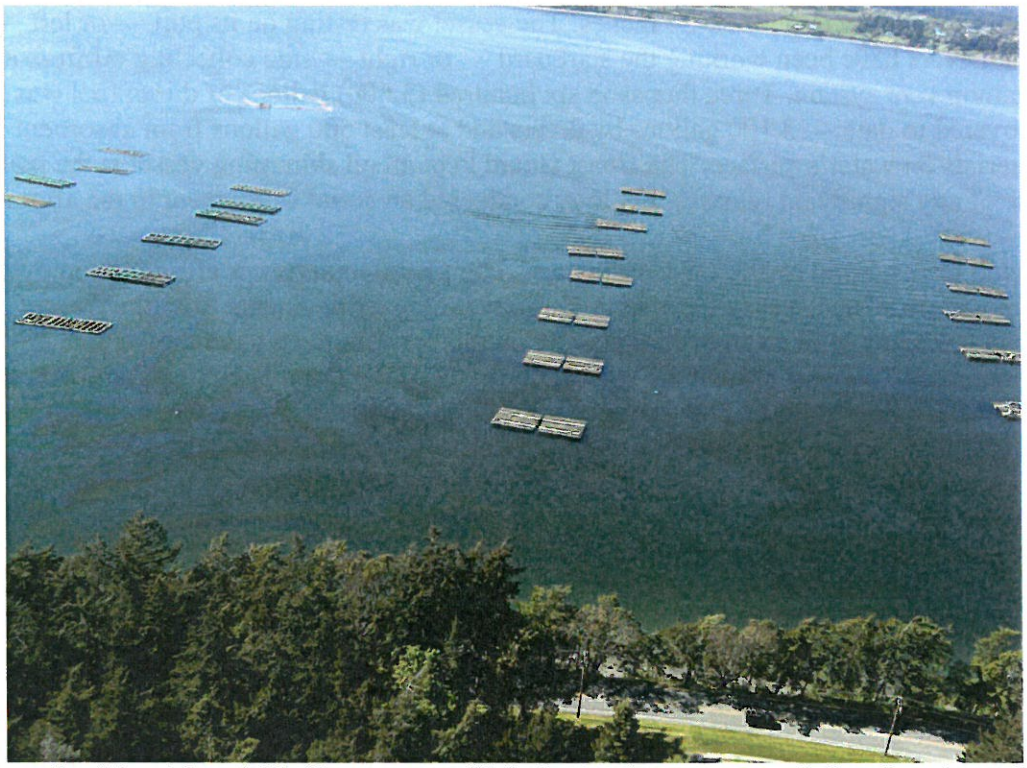

Figure 8 – May 15 aerial helicopter overflight by Ecology personnel showing sheen from the *Deep Sea* impacting the shellfish floats of Penn Cove Shellfish

May 16
About 6,400 feet of boom was deployed and a total of 3,500 gallons of diesel fuel were recovered to date. Dive teams continued efforts to remove oil from the *Deep Sea*. A contractor maintained three rings of oil spill containment boom – 6,400 feet in total – around the site and used skimming equipment and other oil spill cleanup materials to remove oil contained in that area. The Washington State Department of Natural Resources developed options for salvaging the vessel once the Coast Guard and Ecology's environment assessment team had completed their work. The Coast Guard opened the federal Oil Spill Liability Fund to pay for response efforts. The Coast Guard

May 24
Ecology's contractor, Global, began to assemble a flotilla of specialized vessels to raise the *Deep Sea*. Ecology coordinated vessel removal operations with the Washington Department of Natural Resources (WDNR), which owned the aquatic land where the *Deep Sea* was moored and sank. Ecology, WDNR and Global worked on plans for the vessel recovery. The *Deep Sea* still contained an unknown quantity of oil, small amounts of which continued to surface over the sunken ship. Oil spill containment boom ringed the area to contain such leaks.

May 27
The multi-agency effort to lift the *Deep Sea* continued through the Memorial Day weekend. Global dive crews continued their work to prepare the fishing vessel to be lifted from the bottom of Penn Cove. Divers discovered that when the vessel sank on May 13, it rolled and a tangle of debris fell off the main deck and landed in several feet of silt at the bottom of the cove. The dive teams worked safely and carefully to ensure nothing went wrong with the salvage operations. Operations to raise the vessel were estimated to begin no sooner than Wednesday, May 30.

Aerial flyovers have confirmed what on-water observers saw: The *Deep Sea* was still leaking a small but continuous amount of oil – including diesel fuel and other petroleum products. The oil was mostly contained within the ring of containment boom on the water surface directly above the vessel. About 1,400 gallons of oil had been recovered from the water surface since the vessel sank. The oil was removed from the water using absorbent materials inside the boom.

May 28
The crane barge *DB Oakland* arrived on-site in the late afternoon. The *DB Oakland* was intended to help place lifting chains under the *Deep Sea*'s hull.

May 29
The date on which contractors planned to begin raising the sunken fishing vessel *Deep Sea* was pushed back to Sunday, June 3. Divers continued to prepare the vessel for the lift operation. A multi-agency unified command continued to coordinate the recovery effort. The command was comprised of the U.S. Coast Guard, Washington departments of Ecology and Natural Resources, Island County Department of Emergency Management, Global and NRC-Environmental Services (NRCES).

Divers for Global, working under a contract with Ecology, cleared a path under the *Deep Sea*'s stern through which to pull a heavy lifting chain. Divers began digging a deeper hole for a second lifting chain under the vessel's center. The dive team encountered machinery, hatch covers and other material that had fallen off the *Deep Sea*. Divers had to remove some of these objects, which had settled deeply into the muddy bottom, to allow digging of lifting chain passages. Planners expected the 300-foot crane barge, *DB General*, to depart Seattle for Penn Cove late Saturday, June 2. The vessel was expected to provide the bulk of the lifting power in tandem with a 140-foot crane barge, the *DB Oakland*. Both cranes belonged to General Construction Co.

Oil trapped in the hull when the vessel rested on its side floated to the surface when floating cranes set the *Deep Sea* upright before raising it on the previous day, June 3. Coast Guard and Ecology officials determined that the *Deep Sea* presented no substantial threat of an oil spill. The *DB General*, the larger of the two floating cranes that lifted the *Deep Sea*, left Penn Cove late in the day.

June 5
The *Deep Sea* was ready to depart, depending on weather conditions. The tug *Taurus* was brought in to move the vessel. The Coast Guard approved a tow plan for the vessel's trip to Seattle.

Environmental cleanup crews started wrapping up efforts to remove oil from the water immediately surrounding the *Deep Sea*. They also began to remove some of the five thousand seven hundred (5,700) feet of oil spill containment boom and cleanup materials deployed for the lifting.

The state Department of Health reopened the shellfish harvest areas north of Mueller Park after test results showed samples taken from those areas were safe to eat.

June 6
The *Deep Sea* departed Penn Cove shortly after 05:00, towed by the tug *Taurus*. The crane barge *DB Oakland* followed directly behind. The *Deep Sea* arrived at 15:00 at the Stabbert Maritime dry dock in Seattle for dismantling.

June 7
WDNR issued the following statement:

> *The vessel* Deep Sea, *which was towed into Stabbert Maritime Yacht and Ship in Seattle on Wednesday, June 6, will be broken up and disposed of once the investigation of the cause of the fire is complete, the Washington State Department of Natural Resources (DNR) announced today.*
>
> *The vessel caught fire on May 12 while illegally anchored on state-owned aquatic lands in Penn Cove on Whidbey Island; it sank the following evening. DNR has asked the King County Sheriff's fire investigation unit to assist with determining the cause of the fire.*
>
> *DNR does not yet have a cost estimate to dismantle the vessel. The crews that raised the vessel from Penn Cove estimated the* Deep Sea *was filled with 30,000 to 40,000 pounds of mud and silt when it was hauled out. The mud will need to be removed from the vessel before a full assessment can be made of the extent of toxic substances on board, such as asbestos. The more toxic materials found, the more it will cost to dispose of the vessel and its contents.*
>
> *Disposal of the vessel will be paid for out of DNR's Derelict Vessel Removal Program, along with a portion of the $3 million one-time Jobs Now Act funding*

to the overhead in a "V" shaped pattern. The metal coolant piping attached to the overhead in that area was deformed and drooping down into the compartment.

The area of origin was the port side of the freezer/hold, outboard of the large deck hatch in the area at or below the deformed coolant piping.

In the course of the scene examination of the vessel it was determined that a number of the doorways/bulkhead and hatches had been open at the time of the fire/sinking.

Due to the fact that the vessel had sunk and its fuel tanks vented to the environment contaminating the interior of the vessel, samples of the unburned/partially burned combustible materials within the vessel were not collected.

Note: Due to the heavy fire damage and oxidation to the walls and overhead in the superstructure because of the vessel sinking, it could not be determined if there were additional/multiple areas of origin in the superstructure associated with this event.

To summarize, the King County investigators concluded the fire was set on the port side of the forward hold/freezer compartment of the *Deep Sea*.

Based on the information gathered, the immediate cause of the oil spill was:
Suspected illegal activity – The King County Sheriff's Office, Fire/Arson Investigation Unit, determined person or persons unknown started a fire on the port side of the *Deep Sea*'s forward hold/freezer compartment.

30. Analysis/Findings of Contributing Factors: *(See States/BC Oil Spill Task Force Spill & Incident Reporting Data Collection Dictionary.)*

Mechanism for flooding/sinking
The *Deep Sea* sank roughly 19 hours after the fire was noted. It was observed to roll to port and sink by the stern (Figure 3). During firefighting efforts a small fireboat had sprayed water aboard the *Deep Sea*.

The USCG provided Ecology with photographs taken during the boarding of the *Deep Sea* by their Pollution Threat Assessment Team. Two of the photographs show the presence and use of PVC pipe within the *Deep Sea*'s engine room space (Figures 9 & 10). Ecology inquired with the one of those involved with the *Deep Sea*'s rehabilitation that began in the late 1990s as to the presence and use of PVC pipe in the engine room space. He indicated that PVC pipe had been used throughout the engine room for cooling water from sea chests (which are below the waterline, Figure 13), and for marine sanitation and ammonia compressor purposes. **[10]** Some of the overboard discharge fitting were located above, but close to, the vessel's waterline (Figures 14 & 15).

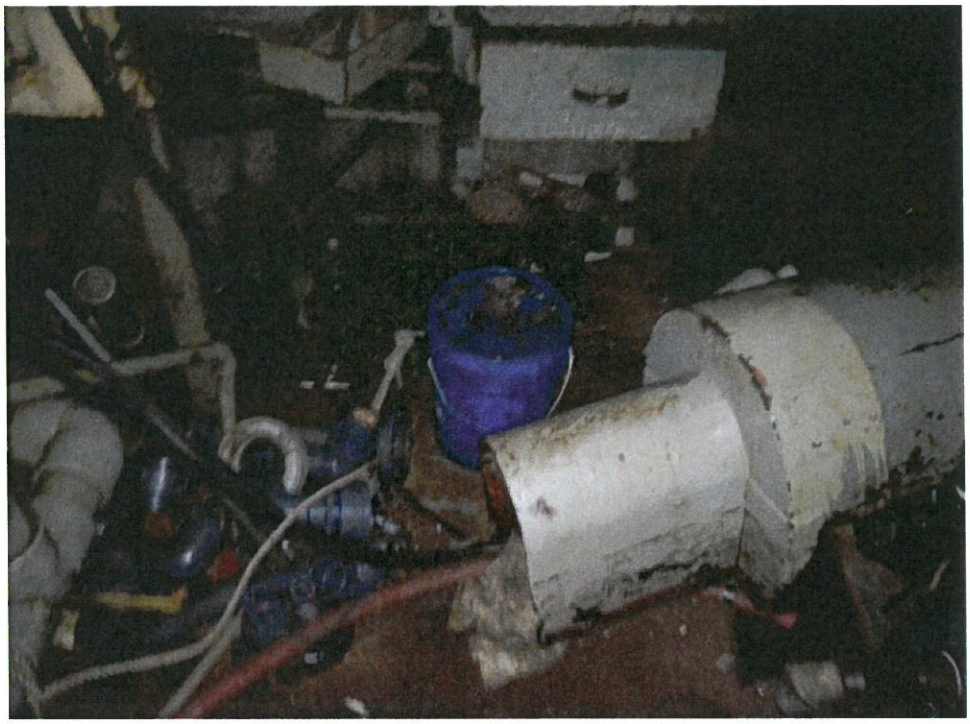

Figure 10 - *USCG photograph from January 6, 2012, of the* Deep Sea*'s engine room showing PVC piping pieces in no short supply.*

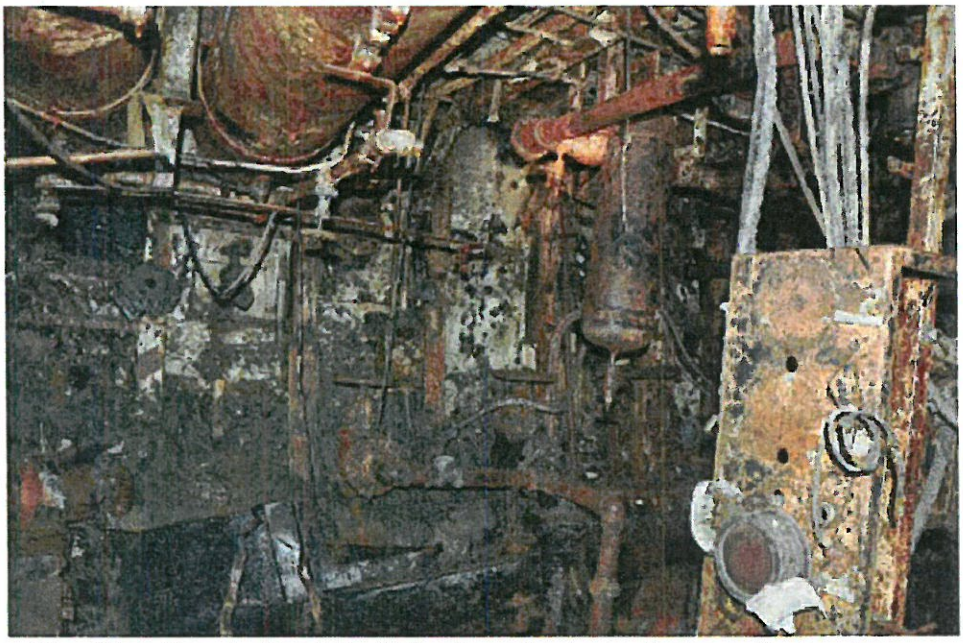

Figure 11 – *King County Sheriff's Office investigator's photograph showing some of the damage to the engine room.*

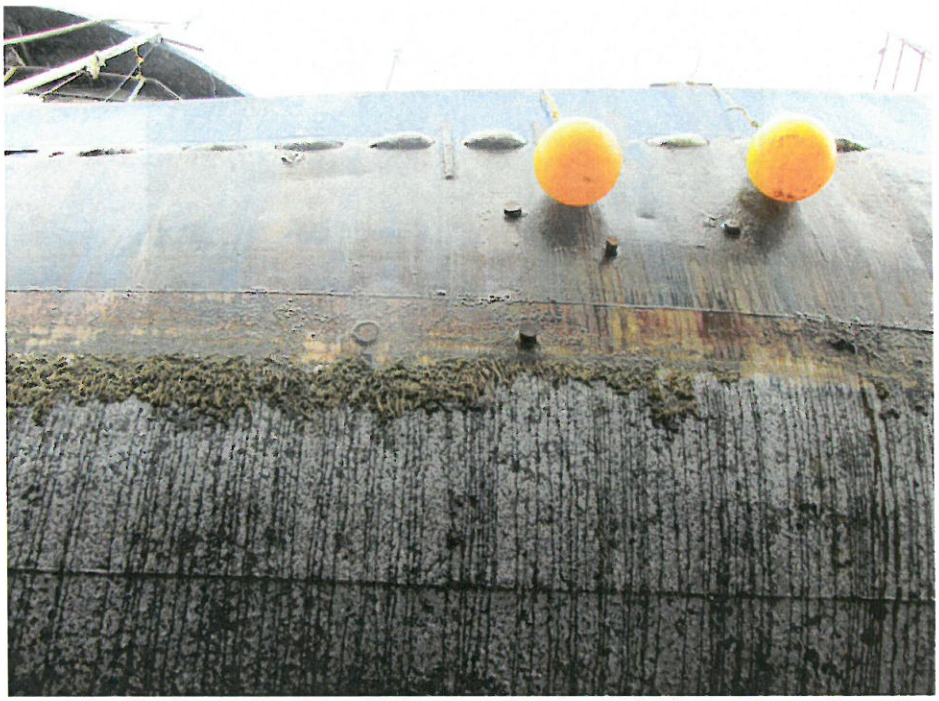

Figure 14 – *Ecology photograph showing the port side diver-plugged overboard discharges of the Deep Sea in drydock at Stabbert. Note the overboards are close to the waterline.*

Figure 15 – *Ecology photograph showing the starboard-side diver-plugged overboard discharge of the* Deep Sea *in drydock at Stabbert. Note the overboard is close to the waterline.*

piping connected to sea chests and overboard fittings near the waterline.[6] PVC piping in the engine room was likely either consumed by the fire or compromised. Open sea chest valves connected to compromised piping (metal or PVC) would have allowed water to enter the engine room from well below the waterline, while compromised piping connected to overboard fittings normally above the waterline may have sunk below the water surface as the result of the firefighting water introduced. Either of these would have allowed the ingress of water to the engine room that caused the *Deep Sea* to sink about 19 hours after the fire was noted.

Vessel Security

According to the King County Sheriff's Office, Fire/Arson Investigation Unit report **[31]**:

> *...At the time of my investigation the large hatch for the hold located in front of the superstructure was missing the port side piece and the small hatch in its center...*
>
> *...The heaviest fire damage observed to the component was to the front of the component in the area closest to the two hatches between the engine room, a small space between the engine room and the forward hold/freezer compartment. At the time of my examination both of the hatches were open. A visual examination of both hatches disclosed that they appeared to have both been open at the time of the fire...*
>
> *...In the course of the scene examination of the vessel it was determined that a number of the doorways/bulkhead and hatches had been open at the time of the fire/sinking...*

In addition, photographs of the *Deep Sea* during the fire and before the sinking indicated a large opening or openings on the foredeck from which flame and smoke emanated (Figures 1, 2 & 18).

Figure 18 – *Photograph by Norm Paulsen, Seattle Times.*

[6] The owner of Penn Cove Shellfish reported to Ecology that his facility engineer noted smoke coming from the *Deep Sea*'s "bilge holes" during firefighting efforts. **[10]**

RCW 90.56.340, "Duty to remove oil," states:

> *It shall be the obligation of any person owning or having control over oil entering waters of the state in violation of RCW 90.56.320 to immediately collect and remove the same. If it is not feasible to collect and remove, said person shall take all practicable actions to contain, treat and disperse the same. The director shall prohibit or restrict the use of any chemicals or other dispersant or treatment materials proposed for use under this section whenever it appears to the director that use thereof would be detrimental to the public interest.*

The *Deep Sea*'s owner, Mr. Westmoreland, did not undertake the spill response and salvage activities to mitigate the threat of additional oil spillage. As a result, these activities were undertaken by the USCG and Washington State.

32. Prevention actions taken by Parent Company/RP: *(What has the company/RP said it will do or is doing to prevent recurrence of this incident?)*
None.

33. Additional observations: *(Observations that may not relate directly to cause or contributing factors, but that may generate prevention recommendations.)*
The *Deep Sea*'s internal hatches between the forward freezer hold, a cofferdam space, and the engine room were not closed. Based on the fire investigator's report, it appears this allowed the fire to propagate freely into the engine room space where it likely damaged ship's piping systems, leading to the sinking. This investigation did not determine whether the owner typically left these hatches open or whether someone else (potentially the arsonist) opened them.

In January 2012, a USCG Pollution Threat Assessment Team inspected the *Deep Sea* and determined the vessel did not pose a spill threat. A similar dissonance between a USCG evaluation of threat and the actual threat occurred on the Columbia River involving the barge *Davy Crockett*. The USCG needs to emphasize training of their pollution personnel to ensure appropriate skills are available to properly evaluate the risk of derelict and potentially derelict vessels. Skills necessary include locating, accessing, accurately gauging, and documenting tanks, as well as main engines and ancillary vessel equipment, which may contain oil. Skills are also needed to properly evaluate the risk of a vessel spill, sinking or fire given the level of care exhibited, including the length of time the vessel has been laid up and the potential for illegal activities. Broadly worded determinations of "no pollution threat" based on partial assessments should be avoided.

WDNR did not notify Ecology of the *Deep Sea* in Penn Cove, Whidbey Island, Washington when it became a concern of local interests in late 2011.

Ecology Spills Program has maritime professionals on staff that can be called upon to help assess the volume of oil aboard potentially derelict vessels and the threat of spill posed by them. Joint oil spill threat assessments using both Ecology and USCG personnel

[6] Coupeville, WA weather observations for May 12-13, 2012
[7] USCG Port State Information Exchange and NMFS Fishing Vessel database information for the *Deep Sea*
[8] Web Log of Julie Mattson, "A (Mothers) Day to Remember," May 13, 2012 containing an eyewitness account of the fire and sinking
[9] From www.foodcompanycookbooks.blogspot.com "Wakefields King Crab Meat," December 28, 2007
[10] Investigation notes of Michael Lynch, Ecology
[11] Washington Department of Licensing record for Factotum Fisheries, Inc.
[12] Email from Mike Lynch dated May 24, 2012
[13] WDNR Press Release dated May 14, 2012
[14] Whidbey Island Examiner, "Aging fishing boat draws curiosity, concern," dated January 18, 2012
[15] Handwritten Bill of Sale dated March 13, 2012
[16] ERTS # 607836
[17] ERTS # 629770
[18] ERTS # 630353
[19] DNR Supplemental Report
[20] Letter to Rory Westmoreland from Sue Hamilton dated December 27, 2011
[21] November 9, 2011, ICT Site Investigation Summary - 23019 192nd Ave SE, Renton WA
[22] November 9, 2011, ICT Site Investigation Summary - 18407 Renton-Maple Valley Rd SE, Renton WA 98038
[23] Letter to Rory Westmoreland from Sue Hamilton dated March 1, 2011
[24] Email from Trudy Harding, Ecology, to Sue Hamilton, et al "RE: Recent Westmoreland developments" dated January 6, 2012
[25] Email from Sue Hamilton to Trudy Harding, et al "RE: Westmoreland III" dated March 16, 2012
[26] Announcement of April 10, 2012 Joint Visit to Westmoreland site
[27] King County letter to Prestegaard dated April 26, 2012
[28] Notice of Termination of Storage Tenancy, from Prestegaard to Westmoreland, June 2012
[29] Letter from Prestegaard to King County Health, June 5, 2012
[30] King County ICT case closure summary, July 18, 2012
[31] King County Sheriff's Office, Fire/Arson Investigation Unit, Incident Report # 12-130860
[32] Island County Sheriff's Call Log for the *Deep Sea* fire/sinking, ID#: C672128
[33] WDNR Supplemental Investigation Report, Citation #: C0300133, DNR Incident #: 21-088478
[34] WDNR email, Richardson to Ferris, dated May 14, 2012
[35] Notes of Jeff Fishel, Ecology dated February 12, 2013

37. This investigation will be referred for enforcement review.

Bob Ferguson
ATTORNEY GENERAL OF WASHINGTON
Fish, Wildlife & Parks Division
PO Box 40100 • Olympia, WA 98504-0100 • (360) 664-8520

July 11, 2016

VIA U.S. MAIL and CERTIFIED MAIL – 7014 0510 0001 9956 7043

Mr. Rory A. Westmoreland
32288 U.S. Hwy 97
Oroville, WA 98844

RE: Demand for Payment for WDFW's Shellfish Damages Resulting From the Deep Sea Oil Spill in Penn Cove

Dear Mr. Westmoreland:

I represent the Washington Department of Fish and Wildlife (WDFW), and this letter constitutes a demand for payment for the damage done to natural resources in Penn Cove between May 13 and June 22, 2012, pursuant to 33 U.S.C. § 2702(a), (b)(2)(A), 33 C.F.R. §§ 136.105(e)(10) and 136.207, RCW 90.56.370, and WAC 173-183-880.

On May 12, 2012, your vessel, the F/V Deep Sea, caught fire. The vessel sank on May 13, 2012. The resulting 5,555 gallon oil spill resulted in the Washington State Department of Health closure of public shellfish harvesting in Penn Cove on May 15 for the beaches located at San de Fuca, West Penn Cove, Long Point, and Madrona Beach. The Department of Health was unable to reopen the shellfish beds until June 5 (San de Fuca, West Penn Cove north of Mueller Park, and Long Point) and June 22 (West Penn Cove south of Mueller Park and Madrona). A study by NOAA's Office of Response and Restoration (2014, A. Mearns, et al.) found that mariculture mussels submerged one to two meters below the surface were contaminated by the spill, and that depuration of polycyclic aromatic hydrocarbons took four to five months.

Multiple federal and state agencies sought reimbursement for their costs and damages as a result of the spill. It is our understanding from a January 22, 2016, summary prepared by Fidelity National Title that you currently have over $4.8 million in outstanding judgments against you. Those related to the Deep Sea spill include:

- United States Environmental Protection Agency: $127,301.98
- Department of Justice: $2,919,249.25
- Washington State Department of Natural Resources: $1,547,014.89
- Washington State Department of Ecology (settlement): $301,000

Bob Ferguson
ATTORNEY GENERAL OF WASHINGTON
Fish, Wildlife & Parks Division
PO Box 40100 • Olympia, WA 98504-0100 • (360) 664-8520

July 11, 2016

VIA U.S. MAIL and CERTIFIED MAIL – 7014 0510 0001 9956 7043

Mr. Rory A. Westmoreland
[redacted]

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- Washington State Department of Ecology (settlement): $301,000

Further, the Department of Ecology sought reimbursement from the Coast Guard's National Pollution Funds Center (NPFC) for its reimbursement of costs. The NPFC also awarded, on reconsideration, $122,192.41 to Penn Cove Shellfish LLC, a commercial business, on April 22, 2015, related to the damage to commercial shellfish from the spill.

As you may be aware, WDFW is the state agency which manages shellfish and their habitat. See RCW 77.60; WAC 220-52. As a result of the shellfish closures, WDFW calculated the damages to natural resources as $126,267. This is based on the number of days of closure, the number of historic recreational shellfish harvesters, and an estimated $48.97 cost for a shellfish harvester user day. WDFW valued the lost use by multiplying lost user days with the net economic value of a shellfish harvesting trip and the CPI inflation adjustment. West Penn Cove had 1,706.74 lost harvester user days, with a value of $83,579. Madrona had 125.93 lost harvester use days, with a value of $6,167. San de Fuca had 6.69 lost harvester use days, with a value of $328. Long Point had 156.19 lost harvester use days, with a value of $7,649. Combined, these total 1,996 lost harvester use days with a value of $97,722. WDFW also included its indirect costs of $28,545 to result in a total cost of the damages to recreational shellfish harvesters from the Deep Sea oil spill at $126,267.

We request that you pay the demand for $126,267 no later than October 13, 2016. 33 U.S.C. § 2713(c). Please remit payment in the form of a cashier's check or money order made out to "WDFW" and mailed to my attention at PO Box 40100, Olympia, Washington 98504-0100.

If you have any questions about this demand, please do not hesitate to contact me at (360) 753-6287 or marthaw@atg.wa.gov.

Sincerely,

Martha Wehling
Assistant Attorney General
WSBA No. 36295

cc: Donald T. Noviello, Oil Spill Team, WDFW

Bob Ferguson
ATTORNEY GENERAL OF WASHINGTON
Fish, Wildlife & Parks Division
PO Box 40100 • Olympia, WA 98504-0100 • (360) 664-8520

VIA EMAIL – Donald.Noviello@wdfw.wa.gov

October 21, 2016

Mr. Don Noviello
Oil Spill Planning and Response Specialist
Washington State Department of Fish and Wildlife
Habitat Program – Oil Spill Team
M/S 43143
600 Capitol Way N
Olympia, WA 98501

RE: Demand for Payment to Rory Westmoreland for Deep Sea Oil Spill in Penn Cove

Dear Mr. Noviello:

On July 11, 2016, the Washington State Attorney General's Office sent a letter to Mr. Rory Westmoreland demanding payment on behalf of the Washington Department of Fish and Wildlife (WDFW) for the shellfish damages resulting from the Deep Sea oil spill in Penn Cove between May 13 and June 22, 2012.

The demand was sent via U.S. mail and certified mail, and at Mr. Westmoreland's telephonic request, sent again on August 29, 2016. Mr. Westmoreland did not accept the certified mail. Mr. Westmoreland did not provide a written response to the demand, and he did not remit payment by the October 13, 2016, deadline pursuant to 33 U.S.C. § 2713(c).

Sincerely,

Martha F. Wehling
Assistant Attorney General
(360) 753-6287

Office of Shellfish and Water Protection

After Action Report:

F/V Deep Sea oil spill – Penn Cove Shellfish Growing Area Closure

June 2012

For more information or
Additional copies of this report contact:

Division of Environmental Health
Office of Shellfish and Water Protection
P.O. Box 47824
Olympia, WA 98504-7824

(360) 236-3330
FAX (360) 236-2257

Contents

OIL SHEEN OVER PENN COVE MUSSEL RAFTS, MAY 14, 2012, 5 PM

Introduction – Summary of F/V Deep Sea incident

On Sunday, May 13, 2012, the F/V "Deep Sea" sank at its moorings at about 6 pm after a fire started aboard the vessel 19 hours earlier. The cause of the blaze is unknown. The only commercial harvester, Penn Cove Shellfish, voluntarily ceased harvest of shellfish Sunday morning as a precautionary measure before the vessel sank. Penn Cove Shellfish's wet stored product was moved from Penn Cove to other facilities in Quilcene on Sunday as well. The vessel was boomed prior to the sinking. An assessment of the scene that evening from one of the Ecology response personnel (Carl Anderson) showed limited contamination in the growing area: "I did a quick assessment around the boomed area and only noted minor sheen. There is some motor oil recovered within the boom and diesel sheen to the SE. I spoke we Ian with Penn Cove Mussels and we agreed that it looks pretty good so far. My assessment of the mussel floats showed little to no sheen."

The volume of diesel spilled from the boat grew through Monday, leaving a very thin coating of oil over the commercial operation, leading the Washington Department of Health to close the area on Tuesday. Recreational shellfish harvesting in Penn Cove was also temporarily closed. Hydrocarbon ID samples taken by Ecology on May 14 identified this sheen as #2 fuel oil (red diesel). The leaks that caused this spill were plugged by May 16 and only minor leakage noted afterward. Although initial reports from the owner of the vessel indicated only a small amount of diesel fuel (50-150 gallon on board), the latest estimate (6/8/12) is over 7200 gallons recovered. NOAA and DOH jointly collected shellfish samples on Friday, May 18, two days after the oil sheen from a significant leak passed over the growing area. All PAH values in mussels were below the NOAA Criteria for reopening areas closed from oil spills.

The Deep Sea was refloated on Sunday, June 3 and removed from Penn Cove on Wednesday, June 6. The northern portion of Penn Cove was opened to commercial and recreational harvest on June 5 based on joint NOAA/FDA sensory panel testing of mussels from Penn Cove collected on June 4. Harvest from commercial mussel rafts was reopened on June 8 based on a second sensory panel testing mussels collected that day. The remaining closed beach (Madrona Beach) in the growing area is scheduled to reopen on June 22.

Criteria for reopening areas closed from oil spills

For reopening the growing areas, Washington State Department of Health followed general criteria from the NOAA document 'Managing Seafood Safety after an Oil Spill' This document has been used in oil spills in Oregon, Washington, and Alaska, and outlines the following reopening criteria:

- Abatement of the risk of oil further contaminating the growing area.
- Lack of visible oil sheen on the water throughout the commercial growing areas.
- Shellfish tissue samples must meet the risk-based criteria for all analytes of concern in the source oil relative to the potential health risk posed by certain cancer-causing polycyclic aromatic hydrocarbons (PAHs).
- Tissue samples must pass an independent sensory testing conducted by a panel of experts from the NOAA Seafood Inspection Program.

More specific guidance and protocols were developed jointly by NOAA and FDA following the Deepwater Horizon oil spill and are included in the Reference section. For this response we had these slight deviations from NOAA guidance:

Chemical testing was done before sensory panel testing. Chemical testing is normally confirmatory only; the sensory panel is used as the main method to confirm shellfish safety as (1) taint is present at levels lower than would normally be considered a health concern, and (2) sensory panel work is cheaper with a quicker turnaround. A quote from a private lab for similar chemical analysis was $202.40/sample with a 15 business day turnaround (a 5 business day turnaround would have added a 75% surcharge). A set of 12 samples with an expedited turnaround for chemical analysis would have therefore cost at least $4250 and taken a week for results, compared to a sensory panel which would cost NOAA/FDA $2500 to administer with results within 24 hours.

For this response we took advantage of concurrent NOAA sampling on a separate study that allowed for chemical testing at no cost to DOH with expedited (48 hour) turnaround. Samples were collected shortly after the worst of the oil spill travelled over the mussel rafts, and provided valuable baseline data for sensory panel timing.

Timing for sensory panel was shorter than originally recommended by NOAA. DOH advocated for shorter depuration periods prior to convening a sensory panel than was originally recommended by NOAA for several reasons:

- Contamination was mostly contained during the spill. Booms were in place prior to any significant spillage, limiting contamination in the growing area.
- NOAA guidance was developed in response to the Deepwater Horizon spill in the Gulf of Mexico. Tidal flushing is greater in Puget Sound, and the majority of commercial shellstock in Penn Cove is grown on mussel rafts that are submerged and less exposed to an oil sheen.
- The predominant shellfish species (mussels) generally depurates contaminants more quickly than other shellfish species.
- The economic losses incurred by the commercial shellfish operation in Penn Cove relative to sensory panel costs advocated for more frequent testing to minimize closure time. Also, a lack of data from Puget Sound encouraged more frequent testing to get a better sense of cleansing rates in this growing region.

No follow-up sensory panel was scheduled for Madrona Beach after the second set of sensory analysis. Based on depuration trends from results of consecutive sensory panels and the relative harvest from Madrona Beach (harvester days at this beach are estimated by WDFW to be

about 10% of West Penn Cove beach use) DOH decided to extend the closure of Madrona Beach to reopen on June 22 to avoid added agency costs for convening another sensory panel.

Shellfish Testing

1. Chemical Testing

NOAA and DOH jointly collected shellfish samples on Friday, May 18, two days after the oil sheen from a significant leak passed over the growing area. Fortunately for DOH, NOAA had already scheduled testing for a different study on shellfish chemical uptake from oil spills, allowing additional sample collection and expedited analysis. Six samples were taken at representative points at the mussel rafts (at the four corners and at the north and south end of the middle section) and at the two most popular public beaches, Madrona and West Penn Cove. Samples were then shipped with ice packs to Louisiana State University's Response and Chemical Assessment Team (LSU-RCAT) for analysis. Results were made available on Monday, May 21.

DOH's toxicologist conducted an evaluation of test results using NOAA Criteria for reopening areas closed from oil spills based on concentrations of chemical contaminants in seafood and a consumption rate of 30 g/day of seafood. Maximum PAH values in mussels from Penn Cove were compared to NOAA Criteria. All values in mussels are below the NOAA Criteria for reopening areas closed from oil spills.

Table 1. Polycyclic aromatic hydrocarbons (PAHs) in mussels from Penn Cove, Washington

Chemical	Maximum Permissible Level (MPL) (ppm) [1]	Penn Cove Mussels Maximum (PCMM) (ppm)	Carcinogenic Ratio (PCMM/MPL)	Meet criteria (Pass/Fail)
Naphthalene	90	0.539	NA	Pass
Fluorene	90	0.214	NA	Pass
Anthracene/phenanthrene	700	0.328	NA	Pass
Fluoranthene	0.8	0.000053U	0.00006625	Pass
Pyrene	0.1	0.000159*U	0.00159	Pass
Benz(a)anthracene	1	0.000092U	0.000092	Pass
Chrysene	1	0.000092U	0.000092	Pass
Benzo(a)pyrene	0.02	0.000067U	0.00335	Pass
Sum of carcinogenic ratio <1			0.00519025	Pass

NA – not applicable
ppm – parts per million

U- data qualifier indicating non-detect at method detection level
* - sum of method detection level at non-detect for Pyrene, C-1, and C-2 Pyrenes

LSU-RCAT made similar conclusions: "There is no evidence of significant or high level diesel contamination in any of the tissue samples as would be expected from exposure during a spill … There were no detectable carcinogenic parent PAHs (i.e. benzo(a)pyrene) in these samples."

Based on these results, additional samples for chemical analysis are not deemed necessary unless a significant spill occurred during vessel removal.

2. Sensory Panel testing

For Sensory Panel sampling, DOH generally followed guidance in Chapter 2 (Collection and Preservation of Seafood Samples for Sensory Evaluation) of the NOAA Technical Memorandum 'Guidance on Sensory Testing and Monitoring of Seafood for Presence of Petroleum Taint Following an Oil Spill'. DOH's involvement with the sensory panel was to collect samples as described below and deliver them to NOAA's Sand Point Laboratory for sensory panel evaluation for taint. A schematic showing the general process is shown in Figure 1.

Mussels were the primary species collected for evaluation as they are the most prevalent species in the growing area and the species observed to have the largest exposures to oil sheen.

Shellfish Sample Handling

DOH routinely follows specific recommendations regarding the collection, handling, documentation, and analysis of shellfish tissue samples in various guidance documents prepared for the U.S. Environmental Protection Agency, Region 10, and the Washington State Department of Ecology (http://www.ecy.wa.gov/programs/eap/qa/docs/GranteeQAPP/index.html). These protocols were developed in an effort to standardize data gathering and hence increase the comparability of Puget Sound data. NOAA guidance is consistent with these documents.

Shellfish Sampling Design

Samples were taken from representative locations in the growing area. Sampling replicated locations sampled on May 18, but with additional samples from public beaches. A total of 12 samples were taken: six from the mussel rafts (rafts A-1, A-7, C-1, C-8, F-4 and F-8), two samples each at the two most popular public beaches (Madrona Beach and West Penn Cove) and one sample at each of the other public beaches (San de Fuca and East San de Fuca). Sample locations are shown in Figure 2.

Mussels were collected as follows:

- Groups of mussels were pulled off substrate
- Dead mussels or mussels with broken/empty shells were discarded
- Barnacles/beards/algae were manually removed where practical
- +/- 40 mussels were collected per sample (half for sensory panel, half for storage if needed later)
- Mussels were put into individually labeled mesh bags and rinsed in marine water before placing in a lined cooler with ice packs
- GPS coordinates were taken at each sample location

Once sampling was completed, coolers were brought back to Penn Cove Shellfish's warehouse. Each sample bag was emptied on a stainless counter and separated into two subsets and each subset was placed in separate bags. Half of the subsets were repackaged in two lined Penn Cove Shellfish 10# boxes with ice packs (6 samples from rafts in one box, 6 samples from recreational beaches in another). Duplicate samples were placed back in the coolers for transport to Tumwater for storage (frozen at -20°C) for later analysis if needed. Boxed samples were delivered to the NOAA Sand Point laboratory. Chain of custody forms were filled out prior to transferring samples to NOAA staff.

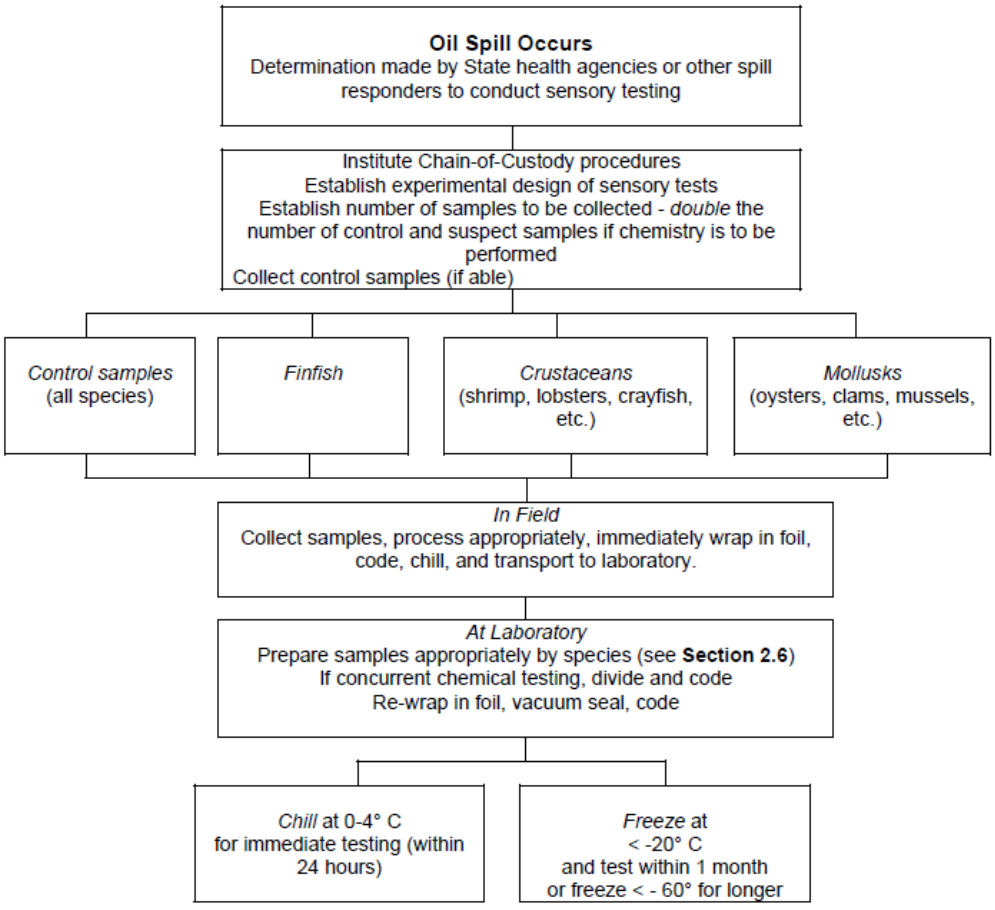

Figure 1. Summary of sample collection, handling, and shipping for sensory evaluation.

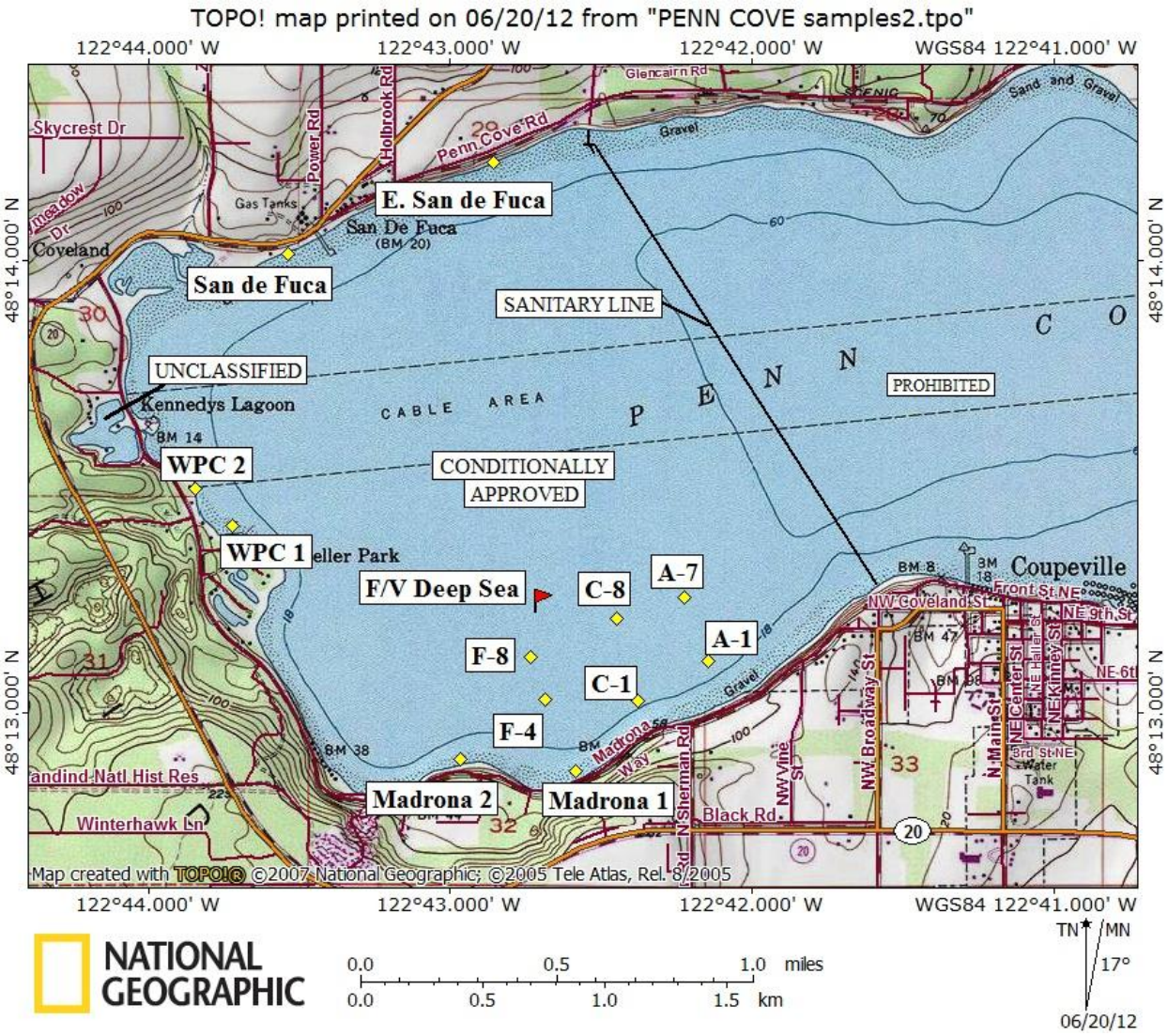

Figure 2. Sample locations (yellow diamonds), F/V Deep Sea sinking location noted by red flag.

At the time of the sampling for the sensory analyses on the morning of June 4, the Deep Sea had been refloated but was still present in Penn Cove. Booms were in place, but traces of oil sheen had been observed escaping the primary boom area and drifting near the east portion of the mussel rafts. Sampling scheduled for the morning of June 4 was delayed from 8 a.m. until 10 a.m. due to time needed to verify adequacy of decontamination and towing procedures with Unified Command. Samples arrived at NOAA too late to conduct a sensory panel that afternoon, so samples were stored and analyzed the following morning. Slight contamination was detected from two samples from the mussel rafts (A-1 and F-8) and higher contamination was detected at the two Madrona Beach sample locations. No contamination was detected from the samples

from the northern portion of Penn Cove, so it was opened to commercial and recreational harvest on June 5.

A second sensory panel was scheduled for Friday, June 8. Northern beach sampling was omitted in this round. Duplicate samples were not collected, and the mesh bags were placed directly into coolers for transport to the NOAA Sand Point lab rather than 10# product boxes used earlier (although separate plastic liners were used for raft and beach samples). Raft samples passed on this round so the commercial rafts were opened on June 8, but slight contamination was still detected in the Madrona Beach samples. Based on the trend of consecutive tests, it was decided to allow two weeks of depuration to avoid scheduling another sensory panel and to reopen Madrona Beach on June 22.

After Action Activities

- DOH continues to participate with the state Natural Resource Damage Assessment (RDA) committee to quantify environmental damages and restoring public resources to pre-spill levels.

- Guidance documents collected and contact lists developed during this response will be incorporated into desk reference manuals for future use.

Lessons Learned/Recommendations

This is the first oil spill in Washington State significantly impacting shellfish growing areas since the Dalco oil spill in October 2004 and the Foss Maritime spill at Point Wells in December 2003. More detailed guidance and protocols developed jointly by NOAA and FDA in response to oil spills have been developed since that time in response to the Deepwater Horizon oil spill in the Gulf of Mexico. The initial stages of response included making initial contacts with NOAA, FDA, and SSCA personnel and reviewing several guidance documents and case studies. The case study for the effects of Cosco Busan spill in San Francisco Bay in 2008 to oyster beds in Drakes Estero was most helpful for this response.

Tracking down avenues for reimbursement for expenses related to the spill also took some time during the initial stages of response. We learned that reimbursements would come from the Oil Spill Liability Trust Fund, through the Washington Department of Ecology, and that we needed to assign a project code and track staff time, and all external/internal expenses related to the spill. Avenues of reimbursement also had to be clarified with NOAA for their time related to chemical and sensory panel testing.

In addition to NOAA/FDA guidance, for future response DOH personnel should also review Ecology's Spill Response Program (http://www.ecy.wa.gov/programs/spills/spills.html) webpage to gain familiarity with the state spill response framework. Establishing regular contact with response personnel, local health, NOAA, and FDA and involvement with Unified Command teleconferences helped coordinate response and testing. Coordination between agencies during a large and high profile event and fielding numerous media requests were difficult with available staffing; involving staff from other Environmental Health programs to assist in response should be considered if large events happen in the future. Events were very fluid on the ground, with many unanticipated delays and logistical complications, so flexibility and contingency planning are also important.

Only three trained sensory panel members were available locally (two from NOAA, one from FDA). If additional members were needed, additional costs and logistical considerations would be in play to fly them in for sensory panels. Internal NOAA protocol requires that preliminary sensory panel results also need to be vetted by a program manager in Washington DC prior to communication to our office, so timely response needs to be coordinated when the panels are scheduled. DOH and NOAA are tentatively scheduled to debrief this response to improve procedures for future events.

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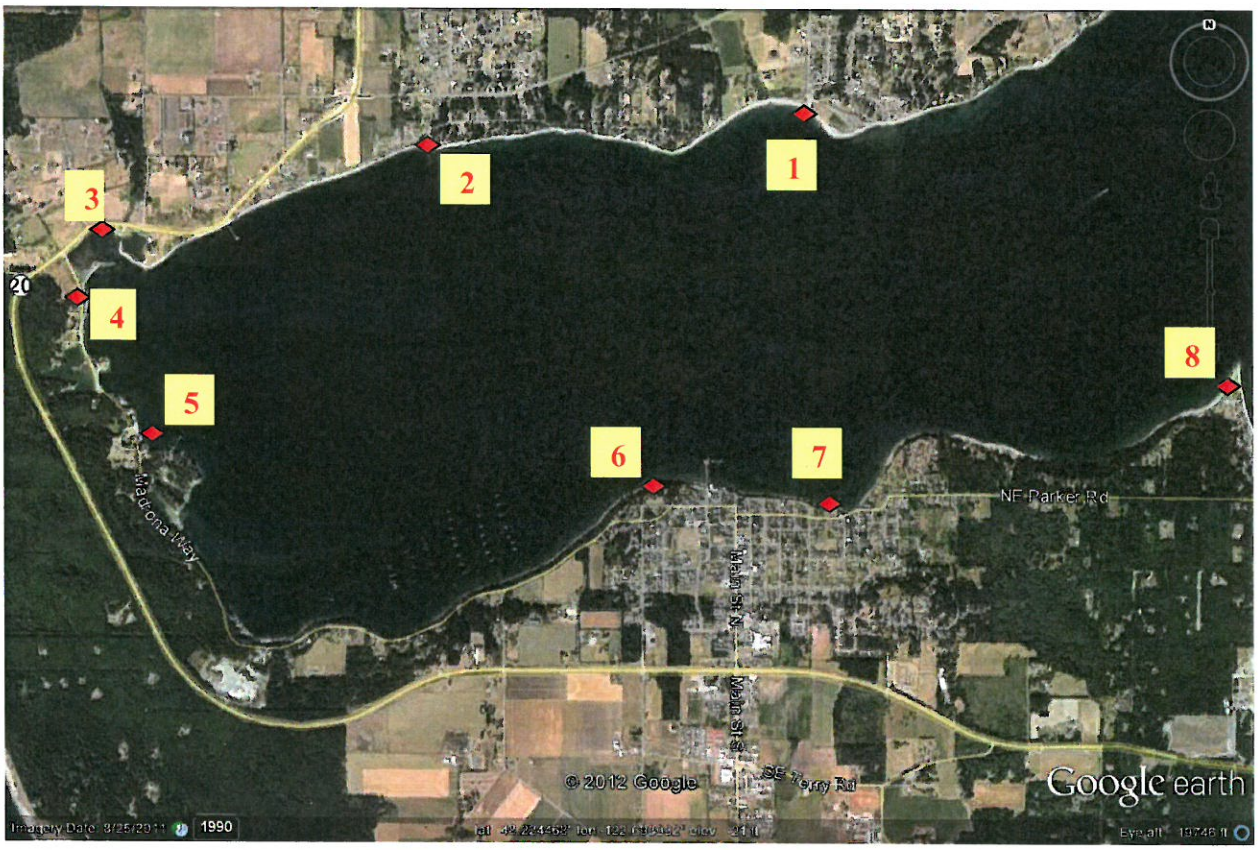
Island County Public Health
Shellfish Program

Oil Spill from the FV Deep Sea, Penn Cove, May 13, 2012
Recreational Shellfish Harvest Closure Sign Posting

Signs Posted on: May 15, 2012 between 1500 and 1800
Signs Posted by: Kathleen Parvin & Helena Hennighausen, ICPH
Sign Type: Red, Closed, Pollution

1. **Monroe Landing Parking Area** (Monroe Landing Rd & Penn Cove Rd)
2. **Rolling Hills Dock Parking Area** (AKA East Penn Cove) (Riepma Ave & Penn Cove Rd.)
3. **San de Fuca Parking Area** (AKA West Penn Cove) (SR 20 at Zylstra)
4. **Grasser Property** (road side pull out on Madrona Way 0.1 mile east of SR 20)
5. **Penn Cove Public Tidelands Parking Area** (Madrona Way 0.25 mile east of SR 20)
6. **Coupeville Town Park** (Entrance to Bluff Trail)
7. **Coupeville Boat Ramp Parking Area** (Coupeville Treatment Plant)
8. **Long Point Parking Area** (North end of Marine Drive)



West Penn Cove (240150)

DATE	STRATUM	ESTIMATED HARVESTERS
3/27/2012	HIGH	24.99
4/6/2012	HIGH	26.43
4/7/2012	LOW	349.41
4/8/2012	ELOW	210.87
4/9/2012	LOW	178.24
4/12/2012	HIGH	37.14
4/23/2012	HIGH	89.81
4/25/2012	HIGH	32.20
4/26/2012	HIGH	40.68
4/27/2012	HIGH	9.12
5/4/2012	HIGH	44.98
5/5/2012	ELOW	580.61
5/6/2012	ELOW	347.52
5/7/2012	LOW	369.36
5/11/2012	HIGH	59.41
5/19/2012	LOW	0.00
5/20/2012	LOW	0.00
5/23/2012	HIGH	0.00
5/24/2012	HIGH	0.00
5/25/2012	HIGH	9.28
5/26/2012	LOW	9.20
6/2/2012	ELOW	6.49
6/3/2012	ELOW	0.00
6/9/2012	LOW	105.73
6/16/2012	LOW	27.85
6/20/2012	HIGH	94.07
6/22/2012	HIGH	43.69
6/25/2012	HIGH	0.00
7/1/2012	ELOW	138.41
7/2/2012	LOW	111.41
7/3/2012	LOW	176.06
7/5/2012	LOW	262.17
7/7/2012	LOW	253.38
7/17/2012	HIGH	74.97
7/19/2012	HIGH	126.56
7/20/2012	HIGH	43.38
7/21/2012	LOW	139.80
7/22/2012	LOW	70.48
7/31/2012	LOW	143.39
8/1/2012	LOW	197.10
8/14/2012	HIGH	50.00
8/15/2012	HIGH	30.58
8/16/2012	HIGH	68.68
8/17/2012	HIGH	34.11

8/19/2012	HIGH	36.15
8/29/2012	HIGH	48.93
8/30/2012	HIGH	27.60
9/13/2012	HIGH	9.72
9/14/2012	HIGH	23.42
9/15/2012	HIGH	154.07
3/20/2011	HIGH	88.20
3/22/2011	HIGH	67.41
3/23/2011	HIGH	145.37
3/24/2011	HIGH	139.63
4/7/2011	HIGH	50.81
4/8/2011	HIGH	59.81
4/9/2011	LOW	95.85
4/12/2011	HIGH	9.20
4/17/2011	LOW	64.47
4/18/2011	LOW	110.41
4/29/2011	HIGH	0.00
5/3/2011	HIGH	69.32
5/7/2011	LOW	185.68
5/8/2011	LOW	83.96
5/9/2011	HIGH	0.00
5/10/2011	HIGH	25.79
5/16/2011	LOW	65.53
5/19/2011	LOW	159.53
5/23/2011	HIGH	31.37
6/1/2011	HIGH	18.74
6/3/2011	LOW	135.84
6/4/2011	ELOW	344.19
6/5/2011	ELOW	181.37
6/7/2011	HIGH	19.99
6/12/2011	LOW	89.12
6/15/2011	LOW	194.98
6/16/2011	LOW	302.46
6/20/2011	HIGH	9.04
6/28/2011	HIGH	9.37
6/30/2011	LOW	103.06
7/1/2011	LOW	180.80
7/2/2011	ELOW	399.99
7/3/2011	ELOW	264.75
7/6/2011	HIGH	40.22
7/18/2011	HIGH	0.00
7/19/2011	HIGH	22.80
7/30/2011	ELOW	163.50
7/31/2011	ELOW	148.94
8/1/2011	HIGH	96.61
8/3/2011	HIGH	72.32
8/13/2011	LOW	220.83

8/30/2011	HIGH	0.00
8/31/2011	HIGH	51.62
9/9/2011	HIGH	0.00
9/10/2011	HIGH	43.33
3/4/2010	HIGH	4.20
3/6/2010	HIGH	37.47
3/17/2010	HIGH	0.00
3/19/2010	HIGH	0.00
3/20/2010	LOW	130.00
4/13/2010	HIGH	0.00
4/14/2010	HIGH	15.88
4/17/2010	LOW	194.38
4/18/2010	LOW	237.66
4/19/2010	HIGH	46.01
4/21/2010	HIGH	14.44
5/2/2010	LOW	103.24
5/11/2010	HIGH	0.00
5/12/2010	HIGH	39.32
5/14/2010	LOW	162.72
5/15/2010	ELOW	433.82
5/16/2010	ELOW	221.92
5/17/2010	LOW	77.52
5/24/2010	HIGH	0.00
5/30/2010	ELOW	239.56
6/12/2010	ELOW	582.95
6/13/2010	ELOW	376.09
6/14/2010	LOW	131.12
6/17/2010	HIGH	27.60
6/18/2010	HIGH	40.68
6/24/2010	LOW	92.51
6/26/2010	ELOW	214.11
6/27/2010	ELOW	127.07
6/30/2010	HIGH	51.06
7/1/2010	HIGH	24.30
7/9/2010	LOW	71.08
7/10/2010	ELOW	74.50
7/13/2010	LOW	91.66
7/14/2010	LOW	139.60
7/26/2010	HIGH	0.00
7/27/2010	HIGH	20.75
8/9/2010	LOW	157.17
8/11/2010	HIGH	124.94
8/12/2010	HIGH	42.98
8/13/2010	HIGH	14.31
8/21/2010	LOW	53.01
8/23/2010	HIGH	0.00
9/9/2010	HIGH	9.04

Madrona (240140)

DATE	STRATUM	ESTIMATED HARVESTERS
3/27/2012	HIGH	0.00
4/6/2012	HIGH	0.00
4/7/2012	LOW	0.00
4/8/2012	ELOW	25.65
4/9/2012	LOW	4.86
4/12/2012	HIGH	0.00
4/23/2012	HIGH	0.00
4/25/2012	HIGH	0.00
4/26/2012	HIGH	0.00
4/27/2012	HIGH	0.00
5/4/2012	HIGH	0.00
5/5/2012	ELOW	0.00
5/6/2012	ELOW	48.95
5/7/2012	LOW	0.00
5/11/2012	HIGH	0.00
5/19/2012	LOW	0.00
5/20/2012	LOW	0.00
5/23/2012	HIGH	0.00
5/24/2012	HIGH	0.00
5/25/2012	HIGH	0.00
5/26/2012	LOW	0.00
6/2/2012	ELOW	0.00
6/3/2012	ELOW	0.00
6/9/2012	LOW	0.00
6/16/2012	LOW	0.00
6/20/2012	HIGH	0.00
6/22/2012	HIGH	0.00
6/25/2012	HIGH	0.00
7/1/2012	ELOW	6.29
7/2/2012	LOW	13.80
7/3/2012	LOW	0.00
7/5/2012	LOW	12.79
7/7/2012	LOW	0.00
7/17/2012	HIGH	0.00
7/19/2012	HIGH	0.00
7/21/2012	LOW	0.00
7/22/2012	LOW	0.00
7/31/2012	LOW	0.00
8/1/2012	LOW	0.00
8/14/2012	HIGH	0.00
8/15/2012	HIGH	0.00
8/16/2012	HIGH	0.00
8/17/2012	HIGH	0.00
8/29/2012	HIGH	0.00

8/30/2012	HIGH	0.00
9/13/2012	HIGH	0.00
9/14/2012	HIGH	0.00
9/15/2012	HIGH	0.00
3/20/2011	HIGH	0.00
3/22/2011	HIGH	38.16
3/23/2011	HIGH	8.74
3/24/2011	HIGH	17.47
4/7/2011	HIGH	0.00
4/8/2011	HIGH	0.00
4/9/2011	LOW	0.00
4/12/2011	HIGH	0.00
4/17/2011	LOW	0.00
4/18/2011	LOW	0.00
4/29/2011	HIGH	0.00
5/3/2011	HIGH	0.00
5/7/2011	LOW	54.24
5/8/2011	LOW	49.63
5/9/2011	HIGH	4.64
5/10/2011	HIGH	0.00
5/16/2011	LOW	0.00
5/19/2011	LOW	4.17
5/23/2011	HIGH	0.00
6/1/2011	HIGH	4.64
6/3/2011	LOW	37.82
6/4/2011	ELOW	22.17
6/5/2011	ELOW	33.75
6/7/2011	HIGH	0.00
6/12/2011	LOW	0.00
6/15/2011	LOW	4.30
6/16/2011	LOW	0.00
6/20/2011	HIGH	0.00
6/28/2011	HIGH	0.00
6/30/2011	LOW	26.43
7/1/2011	LOW	0.00
7/2/2011	ELOW	9.56
7/3/2011	ELOW	0.00
7/6/2011	HIGH	0.00
7/18/2011	HIGH	0.00
7/19/2011	HIGH	0.00
7/30/2011	ELOW	0.00
7/31/2011	ELOW	12.41
8/1/2011	HIGH	0.00
8/3/2011	HIGH	0.00
8/13/2011	LOW	0.00
8/30/2011	HIGH	0.00
8/31/2011	HIGH	0.00

9/9/2011	HIGH	0.00
9/10/2011	HIGH	0.00
3/4/2010	HIGH	0.00
3/6/2010	HIGH	0.00
3/17/2010	HIGH	0.00
3/19/2010	HIGH	0.00
3/20/2010	LOW	0.00
4/13/2010	HIGH	0.00
4/14/2010	HIGH	0.00
4/17/2010	LOW	9.81
4/18/2010	LOW	19.62
4/19/2010	HIGH	0.00
4/21/2010	HIGH	0.00
5/2/2010	LOW	23.68
5/11/2010	HIGH	0.00
5/12/2010	HIGH	0.00
5/14/2010	LOW	0.00
5/15/2010	ELOW	0.00
5/16/2010	ELOW	23.07
5/17/2010	LOW	13.68
5/24/2010	HIGH	0.00
6/12/2010	ELOW	0.00
6/13/2010	ELOW	19.78
6/14/2010	LOW	0.00
6/17/2010	HIGH	0.00
6/18/2010	HIGH	0.00
6/24/2010	LOW	0.00
6/26/2010	ELOW	0.00
6/27/2010	ELOW	9.98
6/30/2010	HIGH	0.00
7/1/2010	HIGH	0.00
7/9/2010	LOW	0.00
7/10/2010	ELOW	0.00
7/13/2010	LOW	0.00
7/14/2010	LOW	0.00
7/26/2010	HIGH	0.00
7/27/2010	HIGH	0.00
8/9/2010	LOW	0.00
8/11/2010	HIGH	43.33
8/12/2010	HIGH	8.53
8/13/2010	HIGH	0.00
8/21/2010	LOW	0.00
8/23/2010	HIGH	0.00
9/9/2010	HIGH	0.00

San de Fuca (240120)

DATE	STRATUM	ESTIMATED HARVESTERS
3/27/2012	HIGH	0.00
4/6/2012	HIGH	0.00
4/7/2012	LOW	0.00
4/8/2012	ELOW	0.00
4/9/2012	LOW	0.00
4/12/2012	HIGH	0.00
4/23/2012	HIGH	0.00
4/25/2012	HIGH	0.00
4/26/2012	HIGH	0.00
4/27/2012	HIGH	0.00
5/4/2012	HIGH	0.00
5/5/2012	ELOW	0.00
5/6/2012	ELOW	0.00
5/7/2012	LOW	4.60
5/11/2012	HIGH	0.00
5/19/2012	LOW	0.00
5/20/2012	LOW	0.00
5/23/2012	HIGH	0.00
5/24/2012	HIGH	0.00
5/25/2012	HIGH	0.00
5/26/2012	LOW	0.00
6/2/2012	ELOW	0.00
6/3/2012	ELOW	0.00
6/9/2012	LOW	0.00
6/16/2012	LOW	0.00
6/20/2012	HIGH	0.00
6/22/2012	HIGH	0.00
6/25/2012	HIGH	0.00
7/1/2012	ELOW	0.00
7/2/2012	LOW	0.00
7/3/2012	LOW	0.00
7/5/2012	LOW	0.00
7/7/2012	LOW	0.00
7/17/2012	HIGH	0.00
7/19/2012	HIGH	0.00
7/21/2012	LOW	0.00
7/22/2012	LOW	0.00
7/31/2012	LOW	0.00
8/1/2012	LOW	0.00
8/14/2012	HIGH	0.00
8/15/2012	HIGH	0.00
8/16/2012	HIGH	0.00
8/17/2012	HIGH	0.00
8/29/2012	HIGH	0.00

8/30/2012	HIGH	0.00
9/13/2012	HIGH	0.00
9/14/2012	HIGH	0.00
9/15/2012	HIGH	0.00
3/20/2011	HIGH	0.00
3/22/2011	HIGH	0.00
3/23/2011	HIGH	0.00
3/24/2011	HIGH	0.00
4/7/2011	HIGH	0.00
4/8/2011	HIGH	0.00
4/9/2011	LOW	0.00
4/12/2011	HIGH	0.00
4/17/2011	LOW	0.00
4/18/2011	LOW	0.00
4/29/2011	HIGH	0.00
5/3/2011	HIGH	0.00
5/7/2011	LOW	0.00
5/8/2011	LOW	0.00
5/9/2011	HIGH	0.00
5/10/2011	HIGH	0.00
5/16/2011	LOW	0.00
5/19/2011	LOW	0.00
5/23/2011	HIGH	0.00
6/1/2011	HIGH	9.45
6/3/2011	LOW	0.00
6/4/2011	ELOW	0.00
6/5/2011	ELOW	0.00
6/7/2011	HIGH	0.00
6/12/2011	LOW	0.00
6/15/2011	LOW	0.00
6/16/2011	LOW	0.00
6/20/2011	HIGH	0.00
6/28/2011	HIGH	0.00
6/30/2011	LOW	0.00
7/1/2011	LOW	0.00
7/2/2011	ELOW	9.79
7/3/2011	ELOW	0.00
7/6/2011	HIGH	0.00
7/18/2011	HIGH	0.00
7/19/2011	HIGH	0.00
7/30/2011	ELOW	0.00
7/31/2011	ELOW	0.00
8/1/2011	HIGH	0.00
8/3/2011	HIGH	0.00
8/13/2011	LOW	4.64
8/30/2011	HIGH	0.00
8/31/2011	HIGH	0.00

9/9/2011	HIGH	0.00
9/10/2011	HIGH	0.00
3/4/2010	HIGH	0.00
3/6/2010	HIGH	0.00
3/17/2010	HIGH	0.00
3/19/2010	HIGH	0.00
3/20/2010	LOW	0.00
4/13/2010	HIGH	0.00
4/14/2010	HIGH	0.00
4/17/2010	LOW	0.00
4/18/2010	LOW	0.00
4/19/2010	HIGH	0.00
4/21/2010	HIGH	0.00
5/2/2010	LOW	0.00
5/11/2010	HIGH	0.00
5/12/2010	HIGH	0.00
5/14/2010	LOW	4.56
5/15/2010	ELOW	0.00
5/16/2010	ELOW	0.00
5/17/2010	LOW	0.00
5/24/2010	HIGH	0.00
6/12/2010	ELOW	0.00
6/13/2010	ELOW	13.44
6/14/2010	LOW	7.71
6/17/2010	HIGH	0.00
6/18/2010	HIGH	0.00
6/24/2010	LOW	0.00
6/26/2010	ELOW	0.00
6/27/2010	ELOW	0.00
6/30/2010	HIGH	0.00
7/1/2010	HIGH	0.00
7/9/2010	LOW	0.00
7/10/2010	ELOW	0.00
7/13/2010	LOW	0.00
7/14/2010	LOW	0.00
7/26/2010	HIGH	0.00
7/27/2010	HIGH	0.00
8/9/2010	LOW	0.00
8/11/2010	HIGH	0.00
8/12/2010	HIGH	0.00
8/13/2010	HIGH	0.00
8/21/2010	LOW	0.00
8/23/2010	HIGH	0.00
9/9/2010	HIGH	0.00

Long Point (240160)

DATE	STRATUM	ESTIMATED HARVESTERS
3/27/2012	HIGH	0.00
4/6/2012	HIGH	0.00
4/7/2012	LOW	19.73
4/8/2012	ELOW	9.50
4/9/2012	LOW	19.44
4/12/2012	HIGH	0.00
4/23/2012	HIGH	0.00
4/25/2012	HIGH	0.00
4/26/2012	HIGH	0.00
4/27/2012	HIGH	0.00
5/4/2012	HIGH	0.00
5/5/2012	ELOW	32.07
5/6/2012	ELOW	36.45
5/7/2012	LOW	17.92
5/11/2012	HIGH	9.72
5/19/2012	LOW	0.00
5/20/2012	LOW	0.00
5/23/2012	HIGH	0.00
5/24/2012	HIGH	0.00
5/25/2012	HIGH	4.60
5/26/2012	LOW	0.00
6/2/2012	ELOW	0.00
6/3/2012	ELOW	0.00
6/9/2012	LOW	0.00
6/16/2012	LOW	0.00
6/20/2012	HIGH	34.34
6/22/2012	HIGH	0.00
6/25/2012	HIGH	0.00
7/1/2012	ELOW	18.62
7/2/2012	LOW	54.24
7/3/2012	LOW	47.14
7/5/2012	LOW	33.59
7/7/2012	LOW	0.00
7/17/2012	HIGH	0.00
7/19/2012	HIGH	0.00
7/21/2012	LOW	0.00
7/22/2012	LOW	17.33
7/31/2012	LOW	13.22
8/1/2012	LOW	20.11
8/14/2012	HIGH	0.00
8/15/2012	HIGH	4.30
8/16/2012	HIGH	0.00
8/17/2012	HIGH	0.00
8/29/2012	HIGH	3.97

8/30/2012	HIGH	17.92
9/13/2012	HIGH	0.00
9/14/2012	HIGH	0.00
9/15/2012	HIGH	9.45
3/20/2011	HIGH	9.12
3/22/2011	HIGH	0.00
3/23/2011	HIGH	8.67
3/24/2011	HIGH	9.45
4/7/2011	HIGH	0.00
4/8/2011	HIGH	9.20
4/9/2011	LOW	0.00
4/12/2011	HIGH	0.00
4/17/2011	LOW	0.00
4/18/2011	LOW	8.96
4/29/2011	HIGH	0.00
5/3/2011	HIGH	0.00
5/7/2011	LOW	8.89
5/8/2011	LOW	0.00
5/9/2011	HIGH	0.00
5/10/2011	HIGH	0.00
5/16/2011	LOW	8.60
5/19/2011	LOW	86.86
5/23/2011	HIGH	0.00
6/1/2011	HIGH	0.00
6/3/2011	LOW	27.36
6/4/2011	ELOW	31.46
6/5/2011	ELOW	0.00
6/7/2011	HIGH	0.00
6/12/2011	LOW	19.44
6/15/2011	LOW	25.58
6/16/2011	LOW	18.90
6/20/2011	HIGH	0.00
6/28/2011	HIGH	4.60
6/30/2011	LOW	8.67
7/1/2011	LOW	26.89
7/2/2011	ELOW	12.58
7/3/2011	ELOW	50.86
7/6/2011	HIGH	0.00
7/18/2011	HIGH	0.00
7/19/2011	HIGH	0.00
7/30/2011	ELOW	63.54
7/31/2011	ELOW	0.00
8/1/2011	HIGH	4.52
8/3/2011	HIGH	0.00
8/13/2011	LOW	0.00
8/30/2011	HIGH	0.00
8/31/2011	HIGH	15.60

9/9/2011	HIGH	8.81
9/10/2011	HIGH	0.00
3/4/2010	HIGH	12.23
3/6/2010	HIGH	4.60
3/17/2010	HIGH	0.00
3/19/2010	HIGH	8.40
3/20/2010	LOW	0.00
4/13/2010	HIGH	0.00
4/14/2010	HIGH	0.00
4/17/2010	LOW	9.72
4/18/2010	LOW	24.30
4/19/2010	HIGH	18.08
4/21/2010	HIGH	0.00
5/2/2010	LOW	0.00
5/11/2010	HIGH	0.00
5/12/2010	HIGH	0.00
5/14/2010	LOW	8.89
5/15/2010	ELOW	6.29
5/16/2010	ELOW	0.00
5/17/2010	LOW	17.92
5/24/2010	HIGH	0.00
6/12/2010	ELOW	22.83
6/13/2010	ELOW	39.14
6/14/2010	LOW	30.54
6/17/2010	HIGH	0.00
6/18/2010	HIGH	0.00
6/24/2010	LOW	17.33
6/26/2010	ELOW	45.16
6/27/2010	ELOW	3.31
6/30/2010	HIGH	22.60
7/1/2010	HIGH	0.00
7/9/2010	LOW	0.00
7/10/2010	ELOW	6.81
7/13/2010	LOW	34.98
7/14/2010	LOW	7.71
7/26/2010	HIGH	0.00
7/27/2010	HIGH	0.00
8/9/2010	LOW	16.31
8/11/2010	HIGH	0.00
8/12/2010	HIGH	0.00
8/13/2010	HIGH	0.00
8/21/2010	LOW	0.00
8/23/2010	HIGH	0.00
9/9/2010	HIGH	0.00

East San de Fuca (240180)

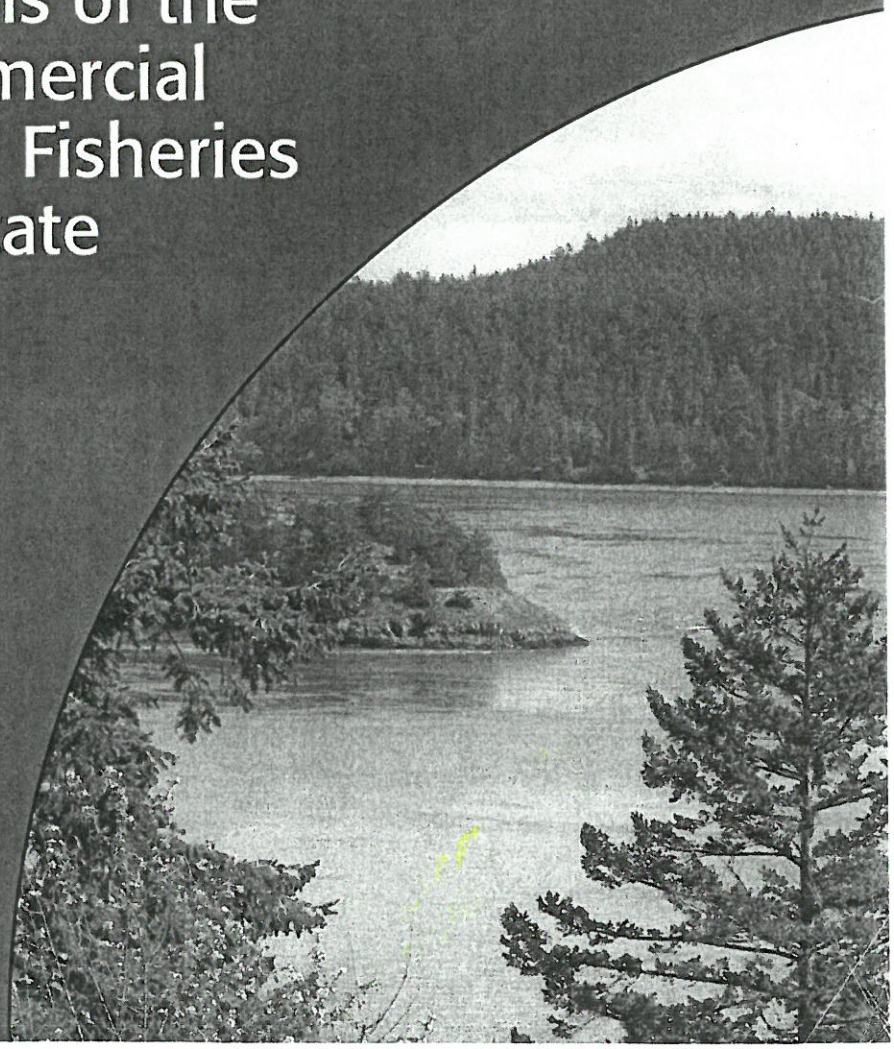
DATE	STRATUM	ESTIMATED HARVESTERS
3/27/2012	HIGH	0.00
4/6/2012	HIGH	0.00
4/7/2012	LOW	0.00
4/8/2012	ELOW	0.00
4/9/2012	LOW	5.00
4/12/2012	HIGH	0.00
4/23/2012	HIGH	0.00
4/25/2012	HIGH	0.00
4/26/2012	HIGH	0.00
4/27/2012	HIGH	0.00
5/4/2012	HIGH	0.00
5/5/2012	ELOW	0.00
5/6/2012	ELOW	0.00
5/7/2012	LOW	0.00
5/11/2012	HIGH	0.00
5/19/2012	LOW	0.00
5/20/2012	LOW	0.00
5/23/2012	HIGH	0.00
5/24/2012	HIGH	0.00
5/25/2012	HIGH	0.00
5/26/2012	LOW	0.00
6/2/2012	ELOW	0.00
6/3/2012	ELOW	0.00
6/9/2012	LOW	0.00
6/16/2012	LOW	0.00
6/20/2012	HIGH	10.09
6/22/2012	HIGH	0.00
6/25/2012	HIGH	0.00
7/1/2012	ELOW	0.00
7/2/2012	LOW	13.93
7/3/2012	LOW	0.00
7/5/2012	LOW	0.00
7/7/2012	LOW	0.00
7/17/2012	HIGH	0.00
7/19/2012	HIGH	0.00
7/21/2012	LOW	0.00
7/22/2012	LOW	0.00
7/31/2012	LOW	0.00
8/1/2012	LOW	4.17
8/14/2012	HIGH	0.00
8/15/2012	HIGH	0.00
8/16/2012	HIGH	0.00
8/17/2012	HIGH	0.00
8/29/2012	HIGH	0.00

8/30/2012	HIGH	0.00
9/13/2012	HIGH	0.00
9/14/2012	HIGH	0.00
9/15/2012	HIGH	0.00
3/20/2011	HIGH	0.00
3/22/2011	HIGH	0.00
3/23/2011	HIGH	4.44
3/24/2011	HIGH	0.00
4/7/2011	HIGH	0.00
4/8/2011	HIGH	0.00
4/9/2011	LOW	0.00
4/12/2011	HIGH	0.00
4/17/2011	LOW	0.00
4/18/2011	LOW	0.00
4/29/2011	HIGH	0.00
5/3/2011	HIGH	0.00
5/7/2011	LOW	0.00
5/8/2011	LOW	0.00
5/9/2011	HIGH	0.00
5/10/2011	HIGH	0.00
5/16/2011	LOW	0.00
5/19/2011	LOW	0.00
5/23/2011	HIGH	0.00
6/1/2011	HIGH	0.00
6/3/2011	LOW	0.00
6/4/2011	ELOW	0.00
6/5/2011	ELOW	0.00
6/7/2011	HIGH	0.00
6/12/2011	LOW	19.99
6/15/2011	LOW	4.41
6/16/2011	LOW	3.90
6/20/2011	HIGH	0.00
6/28/2011	HIGH	0.00
6/30/2011	LOW	0.00
7/1/2011	LOW	0.00
7/2/2011	ELOW	0.00
7/3/2011	ELOW	0.00
7/6/2011	HIGH	0.00
7/18/2011	HIGH	0.00
7/19/2011	HIGH	0.00
7/30/2011	ELOW	0.00
7/31/2011	ELOW	6.33
8/1/2011	HIGH	0.00
8/3/2011	HIGH	0.00
8/13/2011	LOW	0.00
8/30/2011	HIGH	0.00
8/31/2011	HIGH	0.00

9/9/2011	HIGH	0.00
9/10/2011	HIGH	0.00
3/4/2010	HIGH	0.00
3/6/2010	HIGH	0.00
3/17/2010	HIGH	0.00
3/19/2010	HIGH	0.00
3/20/2010	LOW	0.00
4/13/2010	HIGH	4.73
4/14/2010	HIGH	0.00
4/17/2010	LOW	10.00
4/18/2010	LOW	14.99
4/19/2010	HIGH	0.00
4/21/2010	HIGH	0.00
5/2/2010	LOW	0.00
5/11/2010	HIGH	0.00
5/12/2010	HIGH	0.00
5/14/2010	LOW	0.00
5/15/2010	ELOW	0.00
5/16/2010	ELOW	6.66
5/17/2010	LOW	0.00
5/24/2010	HIGH	0.00
6/12/2010	ELOW	0.00
6/13/2010	ELOW	0.00
6/14/2010	LOW	3.90
6/17/2010	HIGH	0.00
6/18/2010	HIGH	0.00
6/24/2010	LOW	0.00
6/26/2010	ELOW	0.00
6/27/2010	ELOW	0.00
6/30/2010	HIGH	0.00
7/1/2010	HIGH	0.00
7/9/2010	LOW	0.00
7/10/2010	ELOW	0.00
7/13/2010	LOW	15.57
7/14/2010	LOW	0.00
7/26/2010	HIGH	0.00
7/27/2010	HIGH	0.00
8/9/2010	LOW	0.00
8/11/2010	HIGH	0.00
8/12/2010	HIGH	0.00
8/13/2010	HIGH	0.00
8/21/2010	LOW	0.00
8/23/2010	HIGH	0.00
9/9/2010	HIGH	0.00

FINAL REPORT

Economic Analysis of the Non-Treaty Commercial and Recreational Fisheries in Washington State



December 2008

Economic Analysis of the Non-Treaty Commercial and Recreational Fisheries in Washington State

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Corvallis, OR

December 2008

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Final Report:
Economic Analysis of the Non-Treaty Commercial and Recreational Fisheries in Washington State

Governor Christine Gregoire's Request

"To allow us to fully educate the public on the importance of fishing, I would like the Commission to summarize the economic benefit that our commercial and recreational fisheries provide the state. While sustainable fishing practices must be consistent with conservation needs of the fish, both fisheries have an important economic role, particularly in our rural communities."

Executive Summary

This study was conducted with the express purpose of addressing the request from Governor Gregoire to explore the economic importance of the non-treaty commercial and recreational fisheries in the State of Washington. The study is designed to summarize the overall economic benefits of Washington's non-treaty commercial and recreational fisheries for 2006. Although the study estimates net economic values and economic impacts of both commercial and recreational fisheries, it is not sufficiently comprehensive and the values are not estimated with adequate precision to warrant a comparative analysis of the two fisheries. Some components of net economic values were not quantified and, in the case of economic impacts, the effects associated with the spending by state resident anglers are fundamentally different from the effects generated by non-resident recreational anglers and by commercial fishers.

Study Conclusions

Ultimately, our findings indicate that commercial and recreational fisheries not only contribute employment and personal income, but also contribute in several other significant ways to Washington's economy, as well as to its residents' quality of life.

In terms of economic impacts, commercial and recreational fishing conducted in Washington fisheries directly and indirectly supported an estimated 16,374 jobs and $540 million in personal income in 2006. When viewed in the context of the Washington state economy, these levels of employment and earnings account for about 0.4 percent of total statewide employment and about 0.2 percent of total statewide personal income in 2006.

Recreational fishing generates the larger share of economic impacts, supporting 12,850 jobs or more than three-quarters of the fishing-related jobs in 2006. Of the jobs supported by recreational anglers, state residents accounted for more than 90 percent of the spending that supports these jobs.

While the spending by non-resident anglers contributes to the tourism economy in Washington State, spending by resident anglers serves to direct discretionary consumer spending toward fishing-related goods and services. As a consequence, spending by non-resident anglers plays a more pivotal role in supporting the state economy than does the spending by resident anglers.

The non-treaty commercial fishery in Washington waters also contributes an estimated $38 million in net economic values (net income or profits), allowing commercial fishers to participate in a livelihood that has been passed down from generation to generation. And, recreational fisheries generate an estimated $424 million in net economic values (over and above expenditures) to the estimated 725,000 residents who live and fish in Washington, suggesting that sport fishing substantially contributes to anglers' quality of life.

Detailed Summary of Finding

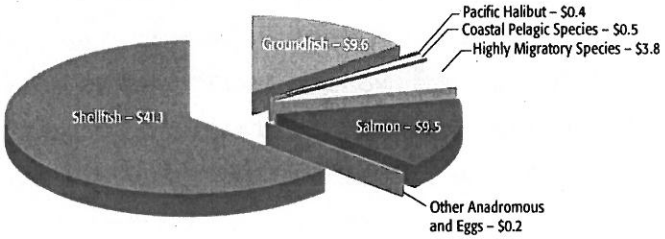
Our study focuses specifically on fishing activity in state waters in 2006, and considers two widely used but distinctly different economic measures:

- Net economic values and
- Economic impacts

Net economic values measure the net (or surplus) value to commercial and sport anglers who participate in the fisheries. For sport anglers, net economic values measure an angler's willingness to pay over and above actual out-of-pocket costs to fish. For commercial fishers, net economic values represent the profit (or net income) from fishing. Economic impacts, on the other hand, measure the jobs and personal income that are directly and indirectly supported statewide by sport and commercial fishing activity.

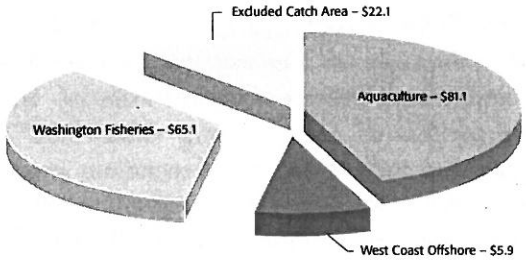
Commercial Fishery

Washington State's commercial fishing industry is structured around a multi-species fishery. Groundfish, halibut, albacore, salmon, and shellfish are all major species groups important to the industry. In 2006, non-tribal commercial fish landings from Washington fisheries totaled nearly 109.4 million pounds, generating $65.1 million in ex-vessel value (i.e. the price received by commercial fishers for fish landed at the dock) for fish harvesters. Although groundfish produced the greatest share of landings (about 54%), shellfish generated the greatest share of ex-vessel value (63%).



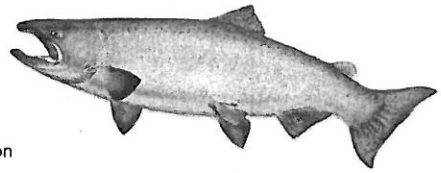
Harvest value from Washington fisheries in 2006 by species group (in millions of dollars)

As indicated above, this study focuses on the fisheries in Washington waters only, which represent only one part of a much larger commercial fishing industry in Washington State. But the commercial fishing industry in Washington has other vital components, including harvesting by western Washington tribes; harvesting in distant waters including Alaska, Oregon and Canada; and aquaculture operations.



Harvest value from Washington fisheries and other commercial landings in 2006 (in millions of dollars)

In terms of regional catch, the Coastal area is by far the largest contributor to commercial fish harvesting in Washington, accounting for 85 percent of total pounds landed and 63 percent of total ex-vessel value. Grays Harbor County—producing



King Salmon

$19.3 million in landings from Washington fisheries—is the state's largest commercial port area, and accounted for nearly 30 percent of the total value of landings from Washington fisheries in 2006. Other port counties with significant shares of commercial harvest values include Whatcom County (21%), King County (9%), Skagit County (7%), and Clallam County (5%).

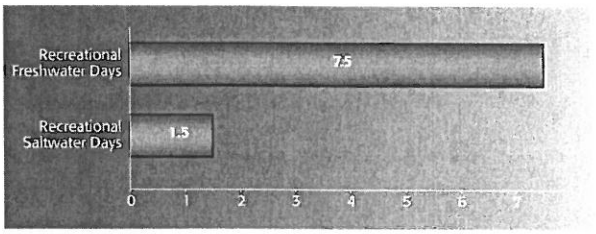
Seafood processing also contributes significantly to the value of Washington's commercial fisheries. Including in-state processing, the wholesale value of fishery products caught in Washington waters was an estimated $101 million in 2006. Groundfish accounted for about 61 percent of this value, and shellfish accounted for about 21 percent.

Recreational Fishery

An estimated 824,000 anglers fished (finfishing and shellfishing) in Washington State in 2006. About 88 percent of these anglers were state residents, and 12 percent were nonresidents. State residents fished about 8.5 million days (about 93% of all fishing days in Washington) and nonresidents fished 615,000 days (about 7% of all fishing days).

In addition to finfishing, shellfishing is a popular activity in Washington State, primarily along the Pacific Coast and the shoreline of Puget Sound. Both Dungeness crab harvesting in North Puget Sound waters and clamming for razor clams along the Pacific Coast shoreline are very popular with state residents.

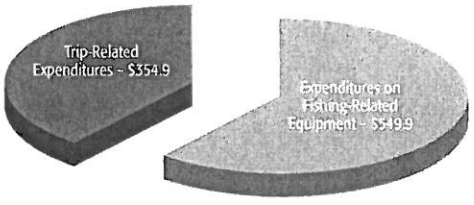
In 2006, an estimated 286,000 anglers sport fished in marine waters in Washington, accounting for 1.5 million saltwater angler days. Salmon was the most popular target species, comprising 52 percent of the saltwater angler days. On about 35 percent of angler days shellfish was the target, and on the remaining 12 percent of days other saltwater species were the major focus.



Recreational fishing days in Washington State in 2006 (millions of days)

Fishing for trout was the most popular freshwater fishing activity (48% of all angler days in Washington State), followed by fishing for salmon (23%), steelhead (12%), and black bass (12%). An estimated 538,000 anglers participated in freshwater fishing in Washington State in 2006, accounting for 7.5 million angler days.

Recreational anglers in Washington State spent an estimated $904.8 million in 2006 on fishing-related equipment and trip-related items. Trip-related expenditures, including food, lodging, transportation, and other trip expenses, totaled $354.9 million, and expenditures on fishing-related equipment totaled about $549.9 million.



Recreational fishing expenditures in Washington State in 2006 (millions of dollars)

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Final Report: Economic Analysis of the Non-Treaty Commercial and Recreational Fisheries in Washington State

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Appendices

Final Report: Economic Analysis of the Non-Treaty Commercial and Recreational Fisheries in Washington State

List of Tables

List of Figures

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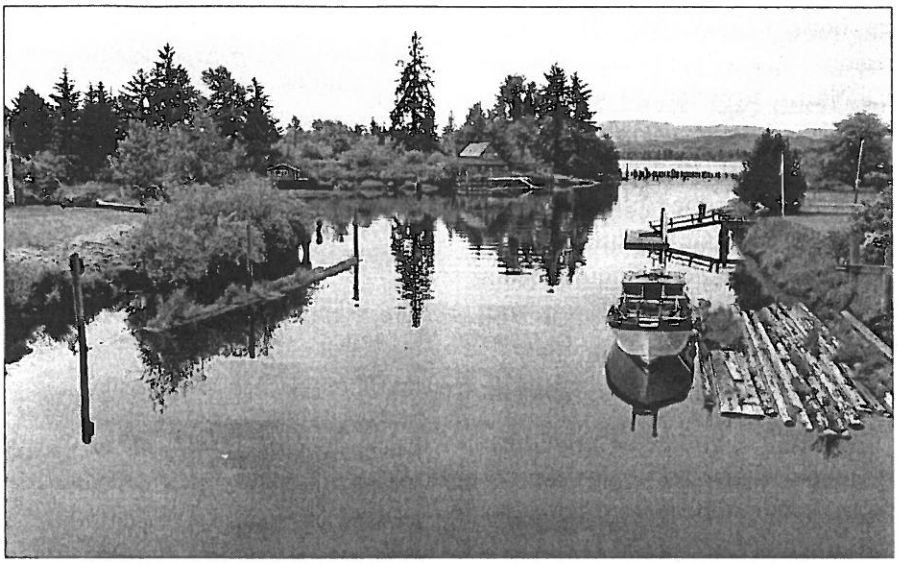
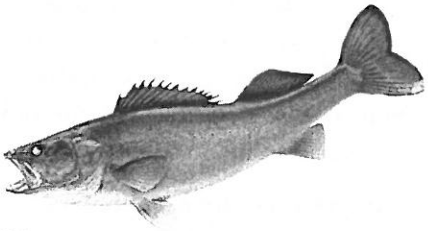


Section 1



Walleye

INTRODUCTION

This economic study of the non-treaty commercial and recreational fisheries in the state of Washington was commissioned by the Washington State Department of Fish and Wildlife (WDFW). The impetus for the study was provided by Governor Chris Gregoire in a request to the Washington Fish and Wildlife Commission, as stated in the following:

"Economic Benefits: To allow us to fully educate the public on the importance of fishing, I would like the Commission to summarize the economic benefit that our commercial and recreational fisheries provide the state. While sustainable fishing practices must be consistent with conservation needs of the fish, both fisheries have an important economic role, particularly in our rural communities."

As stated in the study objectives, both net economic values and economic impacts are addressed in the report. Net economic values and economic impacts are two widely used but distinctly different economic measures. Net economic values measure the net (or surplus) value to commercial and sport anglers associated with participating in the fisheries. For sport anglers, net economic values measure an angler's additional willingness to pay to fish over and above actual out-of-pocket costs. For commercial fishers, net economic

This report addresses the Govenor's study guidance. More specifically, the report addresses the following objectives:

- identify affected fisheries and their beneficiaries
- establish the conceptual foundation (net economic values and economic impacts) for assigning value to the beneficiaries
- characterize sport fishing activity in terms of catch and effort by species groups for the 2006 base year
- establish statewide economic values (net economic values) and impacts (jobs, earnings) associated with sport fisheries for the 2006 base year
- characterize commercial fishing activity in terms of harvest by species groups and by port
- establish statewide economic values (net economic values) and impacts (jobs, earnings) associated with commercial fisheries for 2006 base year

values mostly represent the profit (or net income) from fishing. Economic impacts, on the other hand, measure the jobs and personal income that are supported by sport and commercial fishing activity. Both commercial and sport fishing are widely recognized as important industries to the state of Washington, making significant contributions that support local, regional, and the state economy.

Although this study focuses on the values that fisheries provide to users (commercial fishers and sport anglers) of the resources, it should be acknowledged that protecting fishery resources, particularly those resources that may be threatened or endangered, has value to persons who don't directly use (or even consume) fishery resources. These values are often referred to as non-use or passive use values. Although non-use values are not included for evaluation in this study, it is important to acknowledge them and to understand that a more comprehensive accounting of all of the social and economic values of Washington fisheries would attempt to address them more thoroughly. Because there is considerable debate within the economics profession concerning the theory and legitimacy of measuring these values, further examination of them here is considered beyond the study scope.

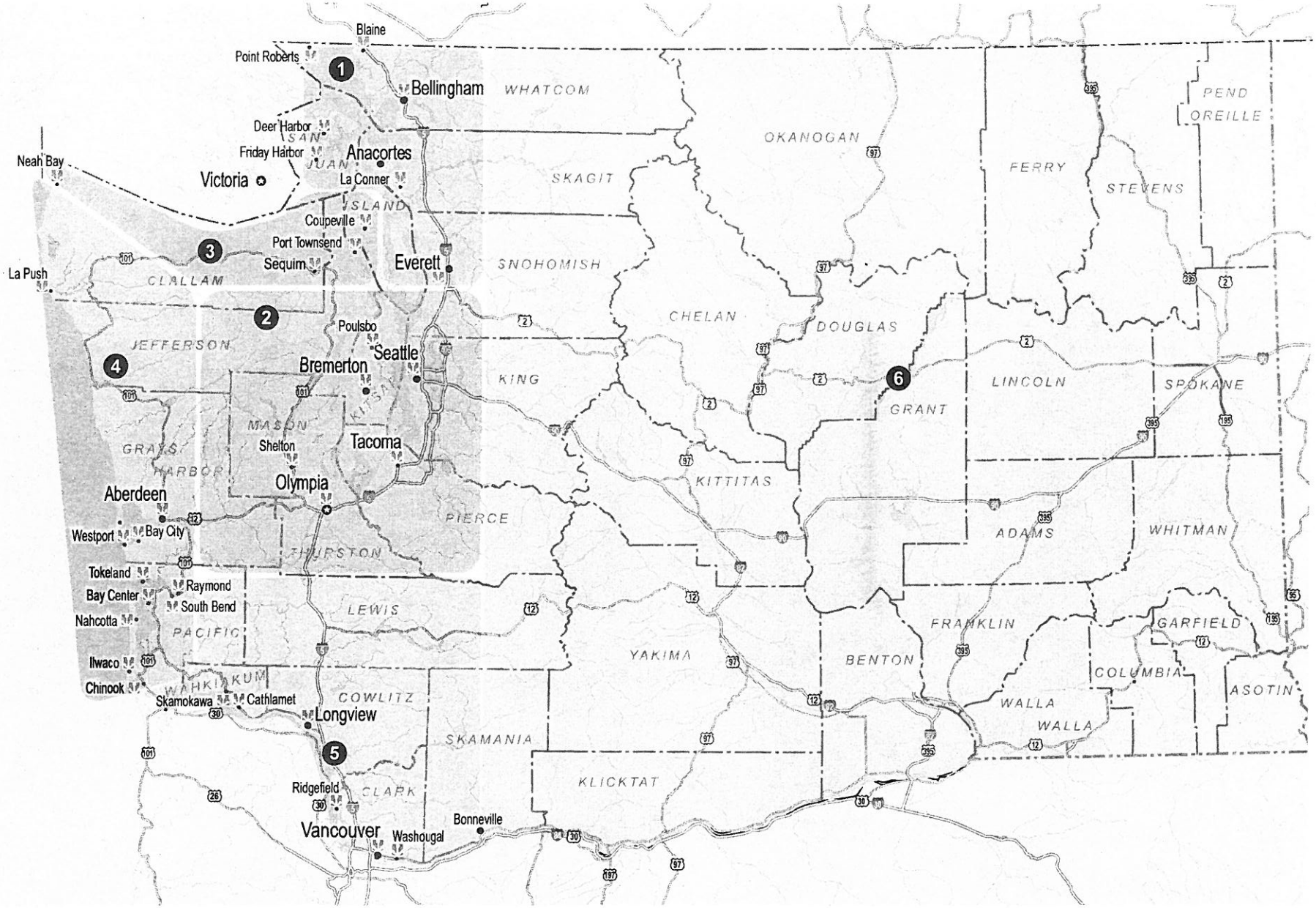
The focus of this study is on statewide economic values and impacts. Although the study focus is statewide, the approach used to develop these values and impacts is based on regional building blocks of information that also shed light on the regional importance of fisheries throughout the state. The study regions include Puget Sound (including North Puget Sound, South Puget Sound, and the Strait of Juan de Fuca), the coast (from Cape Flattery to the mouth of the Columbia River), and the Columbia River (including the river and its tributaries below Bonneville Dam and the vast inland watershed above the dam). These regions are highlighted in ***Figure 1.***

This study is limited to estimating economic values and impacts associated with non-tribal fisheries in Washington waters only. Fisheries that are excluded from assessment include the fisheries of the western Washington treaty tribes; distant water fisheries, including the Alaskan and Canadian fisheries; catch landed in Washington from harvest areas south of the seaward extension of the Washington-Oregon land border; fisheries where Washington home-port vessels deliver to other states; and fish products from aquaculture operations in Washington State. As described in more detail in Section 4, these additional commerical fishery components contribute substantially to the overall value of the commercial fishing industry in Washington as well as to the state economy. Therefore, it is important to recognize that the economic values and impacts of the commercial fisheries described in Section 2 of this report represent only a piece of a much larger industry in the state of Washington.

Lastly, a note about those who were instrumental in assembling the information that serves as the report foundation. We wish to thank Lee Hoines and Eric Kraig of the WDFW whose tireless efforts to assemble data from the commercial fishing license and catch database, and from WDFW's Sport Catch Report made pulling this report together in short order possible. Also, a special thanks to Craig Burley for keeping all the parts moving at all times that allowed us to meet a tight schedule.

Net economic values (NEVs) and economic impacts provide information that helps decisionmakers answer different questions. Because NEVs are monetary measures of economic welfare, they are used to evaluate the economic efficiency of policy or program changes. Benefit-cost analysis is a widely used analytical tool for evaluating the economic efficiency of policy actions, such as changing hatchery production or reallocating fish harvest among user groups. Decisions are reached on whether the benefits of proposed changes in existing policy would exceed the costs of the proposed action. Economic impacts, on the other hand, provide decision makers with information on how policy changes affect economic activity, as measured in terms of jobs and personal income, in communities, regions, or even at the state or national level. Because economic impacts are measures of economic activity, the information is important in the context of local and regional economic development goals. For example, a major increase in hatchery capacity and operations could result in increasing the number of jobs and personal income in areas targeted for economic development, thereby contributing to achieving local economic development objectives.

Figure 1. Study area and generalized catch regions



LEGEND

- U.S. Canadian and Washington State Border
- Counties
- Major Cities/Towns
- Ports

Catch Regions

1. North Puget Sound
2. South Puget Sound
3. Strait
4. Coast
5. Lower Columbia River
6. Upper Columbia River (and eastern Washington)

N

20 10 0 10 20

Scale in Miles

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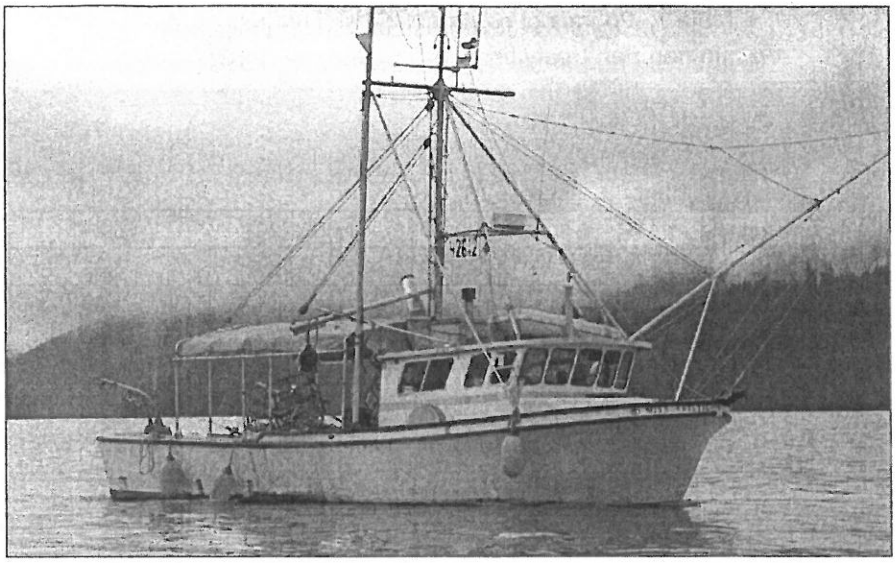

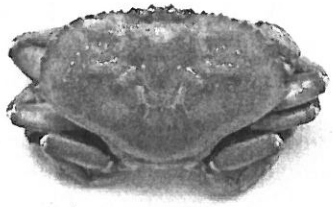

Dungeness crab

COMMERCIAL FISHERIES

This section presents an overview of the commercial fishing industry and fishing activity, followed by descriptions of pounds landed and ex-vessel value of fish commercially harvested in 2006, which are characterized by species group, by catch region, and by port county of origin. The economic impacts generated by the commercial fishery also are described at the state level.

Industry and Activity Overview

The Washington commercial fishing industry is structured around a multi-species fishery. Major species groups important to the state's fishing industry are groundfish, halibut, salmon, albacore, and shellfish. Important species within the groundfish category include whiting, flatfish, rockfish, lingcod, and sablefish. Washington fishers must rely on a number of different fisheries that are seasonal and fluctuate from year to year for their livelihoods. Additionally, many Washington-based commercial fishing enterprises, including harvesters, processors and support businesses, rely to a great extent on the catch of Alaskan and other distant water fish that is delivered to Washington ports for processing and distribution to world markets. All of these fisheries contribute to a wide range of commercial activities that have economic and social significance to those engaged in commercial fishing, including fish buyers and processors, suppliers of commercial fishing equipment and services, and fishing communities that depend on these fisheries. Seafood harvesters use a variety of fishing gear that falls under the broad categories of net gear, dredge gear, pot gear, gear that uses hooks and lines, and other gear.

In the Puget Sound area ***(see Figure 1)***, major commercial fishing ports are located in Seattle, Bellingham Bay, and Blaine. Ports are also located in Friday Harbor, Anacortes, La Conner, Everett, Tacoma, Olympia, and Shelton. Seattle has traditionally served as an important entry port for Alaska, and many of the large seafood catcher-processors participating in Alaskan fisheries are based there. Blaine and Bellingham, both north of Seattle, are important ports for groundfish vessels, with about one-third of the Puget Sound

port group's fishing vessels home ported in Bellingham in 2001. In terms of the distribution of different sized vessels, Puget Sound is consistent with the West Coast as a whole, with about two-thirds of the vessels under 40 feet; however, one of the two vessels over 150 feet participating in West Coast fisheries is based in Seattle. (NMFS 2005)

Along the Strait of Juan de Fuca, ports are located in Port Townsend, Sequim, Port Angeles, and Neah Bay. Port Angeles is the delivery port for the bulk of limited entry fixed gear and open access groundfish vessels in the Strait of Juan de Fuca region. Ports along Washington's coast include La Push, Copalis Beach, Grays Harbor, Westport, Willapa Bay, and Ilwaco.

The seafood distribution chain begins with deliveries by the harvesters (ex-vessel landings) to the shoreside networks of buyers and processors, and includes the linkage between buyers and processors and seafood markets. Most Washington commercial landings are delivered to shore-based processors and are processed within the state, although a portion of the catch is handled by at-sea processors on factory ships. On-shore processing capacity has been consolidating in recent years.

Several companies have left the market or have chosen to quit the business entirely. This has led to trucking fish from certain landing ports communities for processing. Therefore, landings do not necessarily indicate processing activity in those communities. Some proces-

Table 1. Pounds of commercial fish landings from Washington non-treaty fisheries in 2006, by species group

SPECIES GROUP AND MAJOR SPECIES	POUNDS LANDED	PERCENT OF TOTAL
Groundfish (excluding Pacific Halibut)		
Pacific whiting	51,066,719	86.2
Sablefish	2,119,563	3.6
Sole (Dover and petrale)	1,646,374	2.8
Spiny dogfish	1,079,207	1.8
Other groundfish	3,306,061	5.6
Total Groundfish	***59,217,924***	***100.0***
Pacific Halibut		
Total Pacific Halibut	***135,868***	***100.0***
Coastal Pelagic Species		
Sardines	7,354,425	89.3
Herring (bait)	445,437	5.4
Other pelagic species	433,216	5.3
Total Coastal Pelagic Species	***8,233,078***	***100.0***
Highly Migratory Species		
Albacore tuna	4,799,705	99.9
Other highly migratory species	2,961	<0.1
Total Highly Migratory Species	***4,802,666***	***100.0***
Salmon		
Chum	8,273,081	75.1
Sockeye	1,251,656	11.4
Chinook	972,851	8.8
Coho	522,640	4.7
Pink*	–	–
Total Salmon	***11,020,228***	***100.0***
Other Anadromous and Eggs		
Sturgeon	92,226	58.1
Mixed shad	60,366	38.1
Columbia River smelt	5,866	3.7
Eggs – chum	163	0.1
Total Other Anadromous and Eggs	***158,621***	***100.0***
Shellfish		
Dungeness crab	17,106,237	66.3
Pink shrimp	4,986,709	19.3
Geoduck clams	2,472,598	9.6
Other shellfish	1,224,598	4.7
Total Shellfish	***25,789,641***	***99.9***
GRAND TOTAL	*109,358,026*	

* The pink salmon fishery occurs during odd-numbered years only. The average annual catch (pounds landed) of pink salmon caught in Washington waters in 2001, 2003, and 2005 was 5,238,586 pounds.

Source: WDFW license and fish ticket database (Hoines pers. comm.)

sors in Washington receive landings from both Washington and Alaska fisheries. (NMFS 2005)

Fish Harvesting and Ex-Vessel Value

Non-tribal commercial fish landings from Washington fisheries totaled nearly 109.4 million pounds in 2006, generating $65.1 million in ex-vessel value (i.e., the price received by commercial fishers for fish landed at the dock) for fish harvesters. As ***Table 1*** shows, landings are grouped into seven major species groups, including groundfish, Pacific halibut, coastal pelagic species, highly migratory species, salmon, other anadromous species and eggs, and shellfish.

In term of pounds landed, the groundfish group, with 59.2 million pounds in landings, is Washington's largest fishery, accounting for 54 percent of the commercial catch from Washington waters. Within this species group, Pacific whiting accounts for more than 85 percent of total groundfish landings. Landings of groundfish generated $9.6 million in ex-vessel value for harvesters in 2006, with landings of sablefish and Pacific whiting contributing substantially to this total ***(Table 2)***.

Although the groundfish species group produces the greatest share of landings, the shellfish species group, with 25.8 million pounds in landings, generates the greatest share of ex-vessel value. The $41.1 million in shellfish landings accounted for 63 percent of total ex-vessel value, compared to 15 percent for the groundfish group,

Table 2. Value (ex-vessel) of commercial fish landings from Washington fisheries in 2006, by species group

SPECIES GROUP AND MAJOR SPECIES	EX-VESSEL VALUE	PERCENT OF TOTAL
Groundfish (excluding Pacific Halibut)		
Sablefish	$4,307,235	44.8
Pacific whiting	$3,025,858	31.5
Sole (Dover and petrale)	$990,652	10.3
Other groundfish	$1,295,122	13.5
Total Groundfish	***$9,618,867***	***100.0***
Pacific Halibut		
Total Pacific Halibut	***$407,382***	***100.0***
Coastal Pelagic Species		
Sardines	$311,575	61.7
Herring (bait)	$148,007	29.3
Other pelagic species	$45,082	8.9
Total Coastal Pelagic Species	***$504,664***	***99.9***
Highly Migratory Species		
Albacore tuna	$3,777,024	100.0
Other highly migratory species	–	–
Total Highly Migratory Species	***$3,777,024***	***100.0***
Salmon		
Chum	$4,739,201	49.9
Chinook	$2,552,615	26.9
Sockeye	$1,492,285	15.7
Coho	$711,455	7.5
Pink*	–	–
Total Salmon	***$9,495,556***	***100.0***
Other Anadromous and Eggs		
Sturgeon	$182,957	94.8
Columbia River smelt	$9,557	4.9
Eggs – chum	$652	0.3
Mixed shad	$2	–
Total Other Anadromous and Eggs	***$193,168***	***100.0***
Shellfish		
Dungeness crab	$29,567,235	71.9
Geoduck clams	$7,957,798	19.4
Pink shrimp	$1,589,534	3.9
Other shellfish	$1,987,995	4.8
Total Shellfish	***$41,102,562***	***100.0***
GRAND TOTAL	***$65,099,232***	

* The pink salmon fishery occurs during odd-numbered years only. The average annual value of pink salmon caught in Washington waters in 2001, 2003, and 2005 was $547,525.

Source: WDFW license and fish ticket database (Hoines pers. comm.)

attributable to total landings from Washington waters in 2006. Within the shellfish group, Dungeness crab accounts for more than two-thirds of landings and ex-vessel value, as shown in ***Tables 1 and 2.***

Albacore is the most important highly migratory species. In 2006, albacore landings from Washington waters totaled 4.8 million pounds and about $3.8 million in ex-vessel values. Of the coastal pelagic species, sardines are the most important.

Salmon is a major contributor to the Washington commercial fishing industry. In 2006, salmon landings from Washington waters totaled 11.0 million pounds and $9.5 million in ex-vessel value, accounting for 10.1 percent of the total landings and 14.6 percent of the total ex-vessel value generated by landings across all species groups. Within the salmon species group, chum salmon accounted for three-quarters of salmon landings and about half the ex-vessel value. Despite accounting for only 8.8 percent of pounds landed within this group, Chinook contributed more than a quarter of the total value of salmon landings from Washington waters.

Smaller contributions to Washington's overall commercial fishery are made by the "other anadromous species and eggs group" and Pacific halibut. As ***Tables 1 and 2*** show, the "other anadromous species and eggs group" produced about 159,000 pounds of landings, valued at $193,200, in 2006. Within this group, sturgeon and shad landings accounted for the vast majority of landings and value. Pacific halibut landings from Washington waters totaled 135,900 pounds, generating $407,400 in ex-vessel value in 2006.

Landings and the associated value of those landings from Washington fisheries in 2006 are shown by catch region in ***Table 3***. The Coastal catch area is by far the largest contributor to the overall Washington fishery, accounting for 85 percent of pounds landed and 63 percent of ex-vessel value. Within the Coastal catch region, landings of groundfish (including Pacific halibut, highly migratory species, and coastal pelagic species) and shellfish species are the biggest contributors. Combined, these two species groups accounted for nearly 99 percent of the pounds landed in the catch region and 95 percent of the ex-vessel value. Most of the remaining value of the catch in the coastal catch area is generated by landings of salmon.

Outside of the coastal catch region, the North and South Puget Sound catch regions were the largest contributors to the overall Washington commercial fishery in 2006. The North Puget Sound catch area contributed nearly 7 percent of the pounds landed within the overall fishery and 14 percent of its ex-vessel value ***(Table 3)***. The South Puget Sound catch contributed a larger share to the overall Washington fishery, producing 9 percent of landed pounds and 19 percent of ex-vessel value. Within both catch regions, the salmon species group is a much bigger contributor to landings and ex-vessel values than it is in the other catch regions. The value of salmon landings totaled $3.8 million in the South Puget Sound area and $2.9 million in the North Puget Sound area, accounting for 40 percent and 27 percent, respectively, of the value of all salmon landings within the overall Washington commercial fishery. Within both the North and South Puget Sound catch regions, salmon landings accounted for nearly one-third of the value of all landings. Shellfish, however, was the larger contributor to ex-vessel value in both areas, accounting for about two-thirds of total ex-vessel value within both the North and South Puget Sound catch regions.

Within the Strait of Juan de Fuca catch region, which accounted for 0.8 percent of pounds landed and 1.7 percent of ex-vessel value within the overall Washington fishery, shellfish and groundfish are the major contributors. Shellfish produced 83 percent of the catch area's total pounds landed and 94 percent of its ex-vessel value. Groundfish accounted for most of the remaining landings and value within the catch area ***(Table 3)***.

The Lower Columbia River catch region, which accounted for 0.6 percent of the landings and 1.8 percent of the ex-vessel value within the overall Washington fishery, is dominated by the catch of salmon species ***(Table 3)***. Harvests of salmon produced 84 percent of both the pounds landed and ex-vessel value of the total catch in the Lower Colombia River catch region. The Upper Columbia River, which is primarily a recreational and tribal fishery, produced 8,400 pounds of non-

Table 3. Pounds landed and value (ex-vessel) of commercial fish landings from Washington non-treaty fisheries in 2006, by catch region (in thousands of pounds and dollars)

SPECIES GROUP	CATCH REGION												STATE TOTAL	
	NORTH PUGET SOUND		SOUTH PUGET SOUND		STRAIT OF JUAN DE FUCA		COAST		LOWER COLUMBIA RIVER[1]		UPPER COLUMBIA RIVER			
	Pounds Landed	Value	Pounds Landed	Value	Pounds Landed	Value	Pounds Landed	Value	Pounds Landed	Value	Pounds Landed	Value	Pounds Landed	Value
Groundfish[2]	647.3	$203.3	643.4	$198.9	135.8	$60.3	70,642.0	$13,400.6	3.7	–[3]	8.4[4]	–[3]	72,080.6	$13,863.1
Pacific Halibut	–	–	–	–	–	–	135.9	$407.4	–	–	–	–	135.9	$407.4
Salmon	3,255.9	$2,909.4	6,468.8	$3,777.2	4.5	$4.9	773.9	$1,789.6	517.0	$1,014.5	–	–	11,020.2	$9,495.6
Other Anadramous and Eggs	–	–	0.2	$0.7	–	–	64.6	$8.3	93.9	$184.2	–	–	158.5	$193.2
Shellfish	3,374.2	$6,207.4	2,666.3	$8274.1	704.8	$1,068.5	19,044.0	$25,552.1	0.2	$0.3	–	–	25,789.6	$41,102.6
TOTAL	*7277.4*	*$9,320.1*	*9778.7*	*$12,250.9*	*845.1*	*$1,133.7*	*90,660.4*	*$41,158.0*	*614.8*	*$1,199.0*	*8.4*	–	***109,184.8***	***$65,061.7***

Notes:
[1] The Lower Columbia River includes the river and tributaries below Bonneville Dam.
[2] Includes highly migratory and coastal pelagic species in the Coastal region.
[3] Notes: No value is estimated because the catch is a by-catch for which the harvester is not paid for the product.
[4] This catch is mostly carp caught by commercial fisheries from Oregon who do not sell their catch.

Source: WDFW license and fish ticket database (Hoines pers. comm.)

Table 4. Value (ex-vessel) of commercial fish landings from Washington fisheries in 2006, by port county of origin (in thousands of dollars)

SPECIES GROUP	PORT COUNTY OF ORIGIN									
	CLALLAM	CLARK	COWLITZ	GRAYS HARBOR	ISLAND	JEFFERSON	KING	KITSAP	MASON	PACIFIC
Groundfish[1]	$1,456.7	–	–	$5,270.0	$0.5	$54.0	$104.4	–	$35.0	$2,480.5
Salmon	$603.5	$43.4	$325.5	$513.5	$16.9	$117.3	$1,391.9	–	$1.3	$1,068.5
Other Anadramous and Eggs	$0.002	–	$50.7	$8.0	–	–	$1.0	–	–	$56.9
Shellfish	$1,036.1	–	$3.8	$13,470.6	$64.9	$1,197.0	$4,481.7	$190.7	$54.6	$7,384.1
TOTAL	*$3,096.3*	*$43.4*	*$380.0*	*$19,262.1*	*$82.3*	*$1368.3*	*$5,979.0*	*$190.7*	*$90.0*	*$1,099.0*

SPECIES GROUP	PORT COUNTY OF ORIGIN								STATE TOTAL
	PIERCE	SAN JUAN	SKAGIT	SNOHOMISH	THURSTON	WAHKIAKUM	WHATCOM	OTHER	
Groundfish[1]	$122.7	–	$27.7	$77.9	$4.4	–	$4,674.1	–	$14,307.9
Salmon	$106.8	$28.4	$593.0	$679.1	$158.5	$380.4	$3,404.5	$63.1	$9,495.6
Other Anadramous and Eggs	$0.5	–	–	–	–	$75.6	–	$0.4	$193.1
Shellfish	$1,920.4	$107.2	$3,730.4	$619.2	$1,309.0	$104.9	$5,427.9	$0.01	$41,102.5
TOTAL	*$2,150.4*	*$135.6*	*$4,353.1*	*$1,376.2*	*$1,471.9*	*$560.9*	*$13,506.5*	*$63.5*	*$65,099.1*

Notes:
[1] Includes Pacific halibut, highly migratory species, and coastal pelagic species.

Counties include the following ports:

CLALLAM	La Push, Neah Bay, Port Angeles, Sequim
CLARK	Ridgefield, Vancouver, Washougal
COWLITZ	Longview
GRAYS HARBOR	Aberdeen, Bay City, Westport
ISLAND	Coupeville, Deer Harbor, Whidbey Island
JEFFERSON	Port Townsend
KING	Seattle
KITSAP	Poulsbo, Bremerton
MASON	Shelton
PACIFIC	Bay Center, Chinook, Ilwaco, Nahcotta, Raymond, South Bend, Tokeland
PIERCE	Tacoma
SAN JUAN	Friday Harbor
SKAGIT	La Conner
SNOHOMISH	Everett
THURSTON	Olympia
WAHKIAKUM	Cathlamet, Skamokawa
WHATCOM	Bellingham Bay, Blaine, Point Roberts

tribal commercial landings in 2006, primarily carp caught by commercial fishers who do not sell their catch.

The value of commercial fish landings from Washington fisheries for counties with commercial ports is shown in ***Table 4***. Grays Harbor County, with $19.3 million in landings from Washington fisheries, is the state's largest commercial port area, accounting for nearly 30 percent of the total value of landings from Washington fisheries in 2006. Other port counties with significant shares of statewide commercial harvest values include Whatcom County (21%), King County (9%), Skagit County (7%), and Clallam County (5%). From a species perspective, groundfish harvest values are largest in Grays Harbor County, Whatcom County, and Pacific County. Shellfish is also a large contributor to the commercial catch landed in Grays Harbor County, as it also is in Whatcom County and Pacific County. Salmon landings from Washington's fishery are largest in Whatcom, King, and Pacific counties.

Economic Values and Impacts

The economic benefits of Washington's commercial fishery are measured in terms of the net economic values and economic impacts of commercial fishing and seafood processing.

Net economic value (NEV) is a gauge of the amount of wealth generated for participants in the commercial fisheries. For this study, NEV for the commerical fishery is characterized by the gross revenue generated by commercial fishing and processing minus the costs to harvest and process seafood. In other words, NEV represents the profits to commercial harvesters and processors.

The economic impacts of Washington's commercial fishery are characterized by the economic output (revenues) of the commercial fishing harvesting and processing sectors and by the employment and personal income directly and indirectly generated by those activities. The methods used to assess net economic values and economic impacts are described in ***Appendix B***.

Net Economic Values

As discussed previously, the commercial harvest of fish and shellfish from Washington waters generated about $65.1 million in ex-vessel value for harvesters in 2006. Processing the seafood produced by this harvest generated an estimated $101.0 million in wholesale value for companies located in Washington ***(Table 5)***. About 61 percent of this value was attributable to the harvest of groundfish species; 21 percent was generated by processing of shellfish species.

The NEV (or profit) for harvesters and processors generated by the 2006 harvest from Washington waters was estimated to total $38.0 million ***(Table 5)***. Shellfish harvesting and processing was the greatest contributor to these benefits, accounting for 46 percent of total NEV. NEV generated by the harvesting and processing of groundfish and salmon species contributed 32 percent and 19 percent, respectively, to total NEV. While NEV is positive in the aggregate, it may mask what is happening at an individual fishery level or business level. For example, some local harvesters or processors likely were operating at a loss in 2006, but, in the aggregate, these

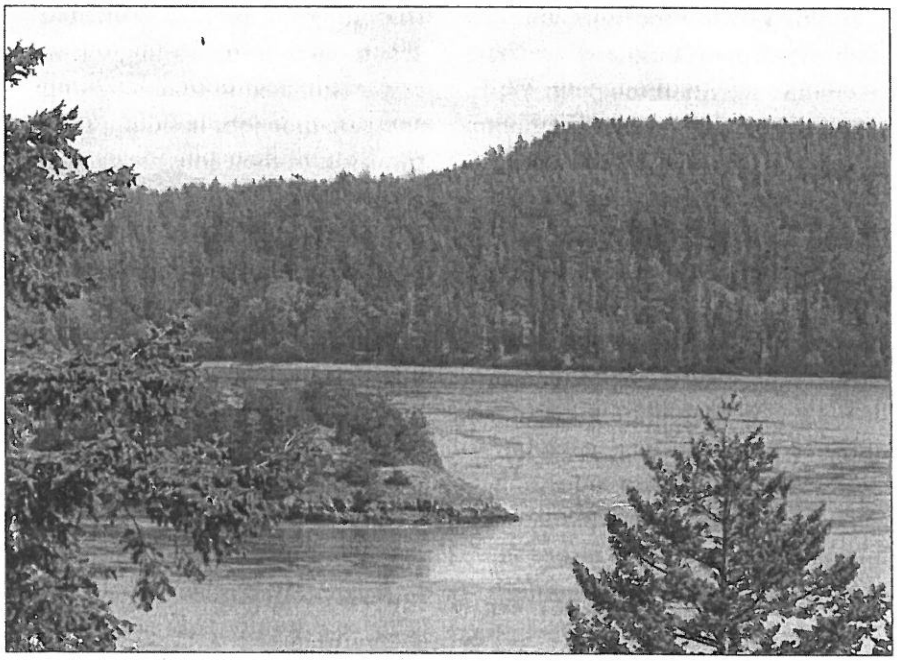

Table 5. Net economic values and economic effects generated by the Washington commercial fishery in 2006

FISHERY[1]	REVENUE[2]		PERSONAL INCOME[3]			EMPLOYMENT[4]		NET ECONOMIC VALUE[5]
	HARVESTER	PROCESSOR	HARVESTER	PROCESSOR	TOTAL	JOBS	PERCENT OF TOTAL	
Groundfish	$13,901	$31,437	$18,775	$22,970	$41,745	993	28%	$12,116
Pacific halibut	$407	$486	$587	$76	$663	16	0.4%	$196
Salmon	$9,496	$16,624	$12,370	$8,935	$21,305	507	14%	$7,091
Other anadromous and eggs	$193	$2,838	$2,901	$1,492	$4,393	105	3%	$1,138
Shellfish	$41,103	$49,636	$53,935	$25,981	$79,916	1,903	54%	$17,484
Total	***$65,100***	***$101,021***	***$88,567***	***$59,456***	***$148,022***	***3,524***	***100%***	***$38,024***

Notes: All dollars are in thousands.

[1] Fisheries are for Pacific Ocean harvests within the EEZ, excluding Dungeness crab harvested off the Oregon coast and all other commercial inland fisheries that are landed onshore. Aquaculture and tribal harvests also are excluded.

[2] Harvester revenue (ex-vessel revenue) are what harvesters receive when selling their retained catch. Processor revenue is the wholesale value of seafood products.

[3] Personal income consists of total personal income generated by harvester and processor activities, including the indirect and induced multiplier effects.

[4] Jobs are the number of full- and part-time jobs using Bureau of Economic Analysis estimates for wage and salary earnings and proprietorship earnings in Washington in 2006.

[5] Net economic value is the prorated profitability of vessels and processors active in the Washington fishery.

Source: TRG 2008.

losses were being offset by the profits of other harvesters or processors.

Economic Impacts

Fishing vessels, processors, and industry-support businesses generate economic activity throughout Washington State. The estimated economic impacts, including the personal income and jobs, generated by the harvesting and processing of seafood from Washington waters in 2006 are shown in ***Table 5.*** The personal income generated by this activity is estimated to total $148.0 million, including $88.6 million in personal income from harvesting activities and $59.4 million from processing activities. These income estimates include personal income earned in other sectors of the Washington economy generated by purchases of inputs by seafood harvesters and processors and by the spending of their employees on goods and services.

Employment generated by seafood harvesting and processing attributable to catch from Washington waters is estimated to total 3,524 full- and part-time jobs in 2006 ***(Table 5).*** Most of these jobs are generated by the catch and harvest of shellfish, groundfish, and salmon. It should be noted that many seafood harvesting and processing jobs are seasonal and part time, and that the total number of jobs in the commercial fishing and processing industries likely exceeds the estimated jobs shown in ***Table 5.*** The economic effects generated by harvests from Washington waters represent a small part of Washington's economy, but are important at the community level along the Washington Coast, the Strait of Juan de Fuca, and the Puget Sound areas.

Of the species groups shown in ***Table 5***, the shellfish fishery accounted for the highest share (54%) and the halibut fishery the smallest share (0.4%) of the total personal income and jobs directly and indirectly generated by harvests from Washington waters. Salmon species accounted for about 14 percent of total income and jobs.

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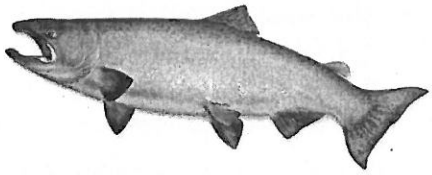


King Salmon

RECREATIONAL FISHERIES

This section presents an overview of recreational fishing in Washington State, followed by a description of recreational catch and effort by species group and catch area. Angler expenditures, net economic values and economic impacts of recreational fishing at the state level also are described.

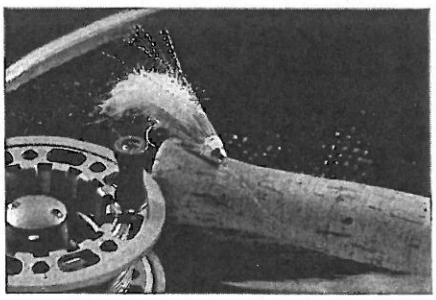
Activity Overview

According to the U.S. Fish and Wildlife Service, 824,000 state resident and non-residents (16 years old and older) fished in Washington State in 2006. Of this total, 725,000 anglers (88 percent) were state residents, and 98,000 anglers (12 percent) were non-residents. Anglers fished a total of 9.1 million days in Washington, an average of 12 days per angler. State residents fished about 8.5 million days, or about 93 percent of all fishing days in Washington. Non-residents fished 615,000 days in Washington, or about 7 percent of all fishing days in the state. (USFWS 2008)

Marine fishing and shellfishing in Washington State occurs along more than 500 miles of Pacific coast shoreline and more than 2,000 combined miles of Puget Sound, San Juan Islands, Strait of Juan de Fuca and Hood Canal shoreline (see ***Figure 1***). Sport fishing opportunities also are available in more than 4,000 rivers and streams (stretching over 50,000 miles), 7,000 lakes (over 2,500 at alpine elevations) and 200 reservoirs. (WDFW 2008)

Many lakes in the state are open year around, but the spring lake fishing "opener" on the last Saturday in April signals the traditional start of freshwater fishing activity. WDFW estimates that as many as 500,000 anglers fish on that weekend alone. Other waters are managed with different seasons, often to protect nesting waterfowl or for other biological reasons. To meet fishing demand, WDFW hatcheries stock about 22 million trout and kokanee fry annually. Trout (and kokanee) fishing highlights include:

- Trout fishing, especially for rainbows in lowland lakes, is usually best in spring and fall when the water is cool (but not frigid). Larger, deeper lakes can be good for trout all year.

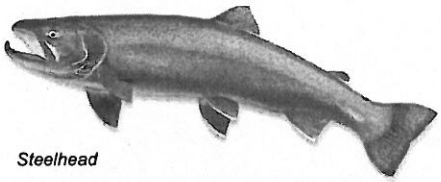


- June and July are usually best for kokanee (a landlocked or non-anadromous sockeye salmon)
- Many alpine or high elevation lakes are stocked with cutthroat, rainbow and golden trout between June and October. Eastern brook trout, lake trout and brown trout have been introduced to add diversity to the stocking program.

Rivers and streams generally open June 1, after trout have had a chance to spawn and most anadromous salmonid smolts (juvenile salmon, steelhead, sea-run cutthroat, and char) migrate to saltwater. Most rivers and streams are managed to produce wild trout, salmon and steelhead. Consequently, few rivers and streams are stocked with hatchery reared trout.

Mountain whitefish are popular stream catches in winter when they gather in schools to spawn. Some streams have special "whitefish-only" winter seasons. Walleye fishing in Columbia River reservoirs is a year around opportunity, with most trophy class fish caught in late winter and early spring months. As temperatures rise, warmwater species such as bass, crappie, sunfish, and catfish provide other angling prospects.

Angling opportunities for anadromous fish such as steelhead and salmon vary widely according to area, time of year, and status of the particular run or species. Open seasons for marine fish, anadromous fish and shellfish sometimes are set or adjusted during the year. Highlights of fishing for anadromous species and shellfishing include:



Steelhead

- Fishing opportunities for smelt (eulachon) on the Columbia River and its tributaries depend on annual smelt abundance. North Coast and Puget Sound fisheries for other smelts, such as surf and longfin, also vary with the run size.
- Shad runs in the lower Columbia River peak in late May through early July, with several million shad passing Bonneville Dam annually.
- Sturgeon fishing on the Columbia River has been growing in popularity, thereby requiring more restrictive measures. Harvest quotas are often reached and published regulations are changed during the season.
- Open seasons for lingcod, halibut and rockfish vary among the 13 marine areas to protect the populations of these species. Other marine bottomfish are generally available year around.
- Oysters, clams, shrimp and crab are in their prime in the spring during daytime low tides on Puget Sound and Hood Canal beaches.

In addition to its more publicized fish planting programs, WDFW also manages stocking programs designed to enhance shellfishing opportunities for species such as clams and oysters.

Catch and Effort

Anglers in Washington State catch finfish in marine and fresh waters and harvest shellfish along marine shorelines. About two-thirds of the catch of bottomfish are caught in coastal waters and the remaining third caught in the marine waters of Puget Sound (***Table 6***). Salmon are caught in both fresh waters and marine waters, with about 60 percent of the salmon catch occurring in marine waters. Puget Sound salmon account for about 60 percent of all salmon caught in marine waters. In fresh waters, 57 percent of the salmon was caught in Puget Sound streams and 38 percent was caught in the Columbia River and its tributaries. Most of the steelhead (74%) and almost all of the sturgeon (95%) caught in Washington waters in 2006 were caught in the Columbia River and its tributaries. Although catch numbers are not available for trout and other inland species, about 22 million trout and kokanee (land-locked salmon) are stocked annually in inland streams and lakes.

Shellfishing is a popular activity along the Pacific Coast and the shoreline of Puget Sound. As shown in ***Table 7***, harvesting Dungeness crab is very popular in North Puget Sound waters, accounting for more than 85 percent of the statewide catch. Most (78%) of the spot shrimp harvested by recreational shellfishers is caught in South Puget Sound waters. Razor clams are only harvested on coastal beaches but is a highly popular activity, with tens of thousands of clammers heading to the coast on

weekends when razor clamming is open (Kraig pers. comm). Other clamming and oyster harvesting occurs mostly on shoreline beaches in the South Puget Sound area.

According to the U.S. Fish and Wildlife Service (2008), 286,000 anglers participated in sport fishing in marine waters in Washington State in 2006, and accounted for 1.5 million saltwater angler days (***Table 8***). Trout was the most popular freshwater target species, followed by salmon, steelhead, and black bass. Of the saltwater species, salmon accounted for 52 percent of all saltwater angler days, followed by shellfish (35% of saltwater angler days) and other saltwater species (13%).

Economic Values and Impacts

This section describes the economic values and impacts associated with sport fishing activity in Washington State. First, the expenditures that anglers make to participate in recreational fishing in Washington State are described. Second, the net economic values associated with sport fishing, which represent the value that anglers place on sport fishing over and above their expenditures, are identified. Lastly, economic impacts, as measured by statewide jobs and earnings, associated with sport fishing activity and angler spending are presented.

Expenditures and net economic values are two widely used but distinctly different economic measures of sport fishing. Whereas angler expenditures represent out-of-pocket costs that

Table 6. Recreational finfish catch (numbers of fish) in Washington in 2006, by species group and catch region

SPECIES GROUP	CATCH REGION				
	PUGET SOUND	COAST	COLUMBIA RIVER	UNKNOWN AREA	TOTAL
Bottomfish	112,457	295,151	—	—	407,608
Pacific Halibut	2,727	6,977	692	—	10,400
Albacore	—	18,941	—	—	18,941
Salmon					
Marine	65,423	43,027	—	—	108,450
Freshwater	98,576	7,186	65,817	1,227	172,806
Steelhead	12,709	15,415	80,294	477	108,895
Sturgeon	203	456	15,695	182	16,536
Total	***292,095***	***387,153***	***162,498***	***1,886***	***843,636***

Notes:
Columbia River region includes the Columbia River and all tributaries, including the Snake River.

Bottomfish catch in area 4b is included in the coastal region.

Albacore landings in Washington include fish caught in marine waters off the southern coast of Washington and northern coast of Oregon. All trips originated from ports in Ilwaco and Westport. Includes albacore caught by charter fleet only.

Source: Preliminary data for the Sport Catch Report and other catch data provided by WDFW (Kraig pers. comm).

Table 7. Recreational shellfish catch (pounds) in Washington in 2006, by species group and catch region

SPECIES GROUP	NORTH PUGET SOUND	SOUTH PUGET SOUND	STRAIT	COAST	COLUMBIA RIVER	TOTAL
Dungeness crab	3,330,004	271,167	261,540	—	—	3,862,711
Shrimp	23,520	87,996	1,950	—	—	113,466
Razer clams	—	—	—	3,601,000	—	3,601,000
Other clams	93,038	252,628	—	—	—	345,666
Oysters	19,129	632,966	—	—	—	652,095

Notes:
All values are in pounds except for oysters, which are in number of oysters.

Columbia River region includes the Columbia River and all tributaries, including the Snake River.

Source: Preliminary data for the Sport Catch Report provided by WDFW (Kraig pers. comm)

Table 8. Anglers, fishing days, and net economic values in Washington State in 2006, by type of fish

SPECIES GROUP	Freshwater			Saltwater			Total			
	NUMBER OF ANGLERS[1]	ANGLER DAYS[1]	NET ECONOMIC VALUES	NUMBER OF ANGLERS[1]	ANGLER DAYS	NET ECONOMIC VALUES	NUMBER OF ANGLERS[1]	ANGLER DAYS[1]	NET ECONOMIC VALUES	PERCENT OF TOTAL NET ECONOMIC VALUES
Crappie	15,000	114,000	$4,133,000	–	–	–	15,000	114,000	$4,133,000	0.9%
Panfish	46,000	574,000	$20,810,000	–	–	–	46,000	574,000	$20,810,000	4.5%
White bass/ striped bass hybrids[2]	30,000	292,000	$10,586,300	–	–	–	30,000	292,000	$10,586,300	2.3%
Black bass	75,000	1,087,000	$39,408,600	–	–	–	75,000	1,087,000	$39,408,600	8.5%
Catfish, bullheads	23,000	244,000	$5,897,400	–	–	–	23,000	244,000	$5,897,400	1.3%
Walleye, sauger	23,000	78,000	$2,827,800	–	–	–	23,000	78,000	$2,827,800	0.6%
Steelhead	113,000	1,097,000	$51,260,500	–	–	–	113,000	1,097,000	$51,260,500	11.1%
Trout	337,000	3,622,000	$145,903,900	–	–	–	337,000	3,622,000	$145,903,900	31.6%
Salmon	142,000	1,763,000	$82,381,300	152,000	811,000	$47,038,000	294,000	2,574,000	$129,419,300	28.0%
No target	29,000	203,000	$7,359,600	–	–	–	29,000	203,000	$7,359,600	1.6%
Other freshwater fish	47,000	265,000	$9,607,400	–	–	–	47,000	265,000	$9,607,400	2.1%
Other saltwater fish	–	–	–	44,000	187,000	$11,220,000	44,000	187,000	$11,220,000	2.4%
Shellfish	–	–	–	129,000	547,000	$23,521,000	129,000	547,000	$23,521,000	5.1%
TOTAL	*538,000*	*7,524,000*	*$380,175,800*	*286,000*	*1,545,000*	*$81,779,000*	*824,000*	*9,069,000*	*$461,954,800*	*100.0%*

Notes:
[1] Values do not add to the total because some anglers targeted multiple species.
[2] Although these values were reported by the USFWS (2008), WDFW has indicated that these species do not occur in Washington State and is likely a misidentification.

Sources:
Number of anglers and angler days are as reported by USFWS (2008).
Net economic values were derived from angler days and per day values identified in Appendix A and summarized in this section.

anglers incur to participate in sport fishing, net economic values (often referred to as "consumer surplus") represent the net or surplus amount that anglers would (theoretically) be willing to spend to participate in sport fishing. Economic impacts measure the importance of the "sport fishing economy."

Table 9. Trip and equipment expenditures for sport fishing in Washington in 2006 by resident and nonresident anglers (in thousands of dollars)

TYPE OF EXPENDITURE	RESIDENT ANGLERS	NON-RESIDENT ANGLERS	ALL ANGLERS IN WASHINTON[2]
Trip-related expenditures			
Food and lodging	$104,600	$13,278	$117,878
Transportation	$97,508	$22,623	$120,130
Boating costs[1]	$71,482	$2,136	$73,619
Other trip costs	$36,686	$6,567	$43,253
Total trip-related expenditures	***$310,276***	***$44,604***	***$354,880***
Equipment expenditures	$467,469	$18,477	$549,915
Total expenditures	*$777,745*	*$63,081*	*$904,795*

Notes:
[1] Boating costs for non-residents were estimated based on available data.
[2] Expenditures for equipment and total expenditures by all anglers in Washington do not equal the sum of values from resident and non-resident anglers because these values were derived from different samples.
Source: USFWS 2008

Angler Expenditures

According to the U.S. Fish and Wildlife Service (2008), all fishing-related expenditures in Washington State totaled about $905 million in 2006 (***Table 9***). Trip-related expenditures, which include food, lodging, transportation, and other trip expenses, totaled $355 million, or about 39 percent of all fishing expenditures. Expenditures for food and lodging were $118 million and transportation expenditures were $120 million. Other trip expenses, such as equipment rental, bait, and cooking fuel, totaled $117 million. Each angler spent an average of $482 on trip-related costs during 2006.

Anglers spent about $550 million on equipment in Washington in 2006, 60 percent of all fishing expenditures. Fishing equipment (rods, reels, line, etc.) spending totaled $139 million, 29 percent of the equipment total. Auxiliary equipment expenditures (tents, special fishing clothes, etc.) and special equipment expenditures (boats, vans, etc.) amounted to $347 million, or about 71 percent of the equipment total. Special and auxiliary equipment are items that were purchased for fishing but could be used in activities other than fishing. The purchase of other items, such as magazines, membership dues, licenses, permits, stamps, and land leasing and ownership, amounted to $64 million—7 percent of all fishing expenditures.

Net Economic Values

Net economic values measure the monetary value that anglers place on sport fishing over and above what they actually spend to participate in the fisheries. These values are the appropriate measure of economic value for a wide range of analyses (including benefit-cost analysis) that quantify and compare benefits and costs. Total user benefits from sport fisheries are calculated as the summation of anglers' willingness to pay across all individuals who participate in sport fishing.

Net economic values associated with sport fishing typically are determined based on the value of an angler day (or trip). Angler surveys often are used to estimate these values. Values differ by type of activity, including species sought, mode of fishing (e.g., shore fishing or fishing from a boat), and angler success. As described in ***Appendix A***, net economic values for recreational fisheries focus on sport anglers only, and are estimated based on a review of previous studies of anglers' net willingness to pay for fishing opportunities. For this study, the following per day values are used to estimate the net economic value of sport fishing:

- Salmon fishing in marine waters, $58/day
- Other fishing in marine waters, $60/day
- Shellfish harvesting, $43/day
- Trout fishing, $50/day

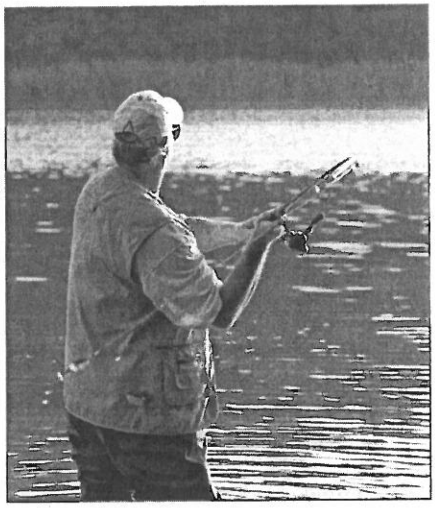
- Salmon/steelhead fishing in freshwaters, $58/day
- Other coldwater fishing in freshwaters, $45/day
- Warmwater fishing, $30/day

Based on these per day values and on the number of angler days reported in ***Table 8***, net economic values for sport fishing in Washington State are estimated at $462.0 million in 2006, including $380.2 million for freshwater fishing and $81.8 million for saltwater fishing. At $145.9 million, fishing for trout generates the greatest amount of net economic values, followed by salmon (both saltwater and freshwater) at $129.4 million, steelhead at $51.3 million, and black bass at $39.4 million.

Economic Impacts

The economic impacts generated by sport fishing activity can be traced from anglers who purchase goods and services, to the creation of statewide jobs and earnings that are supported by these purchases. Anglers purchase gasoline and food, stay at motels and campgrounds, and purchase other goods and services in communities throughout the state. This spending directly supports jobs and generates earnings in fishing-related sectors, and indirectly generates jobs and earnings in many other sectors of the economy as the directly-affected businesses and their employees spend in the local economy. In effect, angler purchases result in three types of economic impacts on regional and the state economy:

- Direct impacts: the first round effect of angler-related spending



(e.g., increase in food sales, income to food store owners, wages paid to store employees).

- Indirect impacts: the ripple effect of additional rounds of re-spending of the initial angler-related expenditures (i.e., the effects of purchases of additional goods and services by other firms in sectors supplying goods and services to food stores, such as food wholesalers and transporters).
- Induced impacts: further ripple effects generated by employees in directly and indirectly affected businesses spending some of their wages in other businesses (i.e., food store employees spend part of their wages in local businesses whose owners and employees also spend in the local area).

Together, these three effects constitute the total impact on sales, employment and income resulting from angler spending. The magnitude and location of the impacts are affected by the number of anglers, amount of spending, and where anglers make their purchases.

In 2006, anglers accounted for more than 9 million angler days in the state and generated an estimated $355 million in trip-related spending and $549 million in equipment expenditures. Direct impacts of this spending on the state economy include supporting an estimated 7,950 jobs and $165.7 million in personal income (***Table 10***). Accounting for the multiplier effect (indirect and induced impacts) increases the total statewide number of jobs to 12,850 and $392.9 million in personal income. Business sectors substantially affected by angler spending include food and lodging (1,383 direct jobs supported), transportation (304 direct jobs supported), sporting goods (4,961 direct jobs supported), recreation equipment rental (92 direct jobs supported), and recreation services (1,149 direct jobs supported).

Because spending by non-resident anglers is part of the tourism industry in Washington State, it is important to highlight the impact that angler spending by non-resident visitors have on the state economy. As shown in ***Table 10***, spending by non-resident anglers directly support 509 jobs statewide and indirectly support an additional 374 jobs through the multiplier effect. Spending by non-resident anglers also directly generates $13.1 million and indirectly generates an additional $17.4 million in personal income for persons working in recreation-related sectors.

Table 10. Estimated economic impacts of sport fishing in Washington waters in 2006

ANGLER CATEGORY/ SECTOR	JOBS[1]			PERSONAL INCOME[2]		
	DIRECT JOBS[3]	TOTAL JOBS[3]	PERCENT OF TOTAL	DIRECT INCOME[3]	TOTAL INCOME[3]	PERCENT OF TOTAL
Resident Anglers						
Food & Lodging[4]	1,227	1,600	14%	$28,838	$37,183	11%
Transportation[5]	247	284	2%	$9,707	$11,335	3%
Sporting goods[6]	4,217	4,241	38%	$75,641	$76,079	22%
Recreation equipment rental[7]	79	84	1%	$2,464	$2,620	1%
Recreation services[8]	1,152	1,178	10%	$28,224	$28,846	8%
Other sectors[9]	38	3,896	35%	$830	$190,019	55%
Total	*6,960*	*11,283*	*100%*	*$145,704*	*$346,082*	*100%*
Non-Resident Anglers:						
Food & Lodging[4]	159	193	22%	$3,960	$4,713	15%
Transportation[5]	75	79	9%	$3,473	$3,621	12%
Sporting goods[6]	178	180	20%	$3,189	$3,227	11%
Recreation equipment rental[7]	18	18	2%	$551	$365	1%
Recreation services[8]	77	80	9%	$1,894	$1,948	6%
Other sectors[9]	2	333	38%	$49	$16,670	55%
Total	*509*	*883*	*100%*	*$13,116*	*$30,544*	*100%*
All Anglers:						
Food & Lodging[4]	1,383	1,807	14%	$32,499	$41,968	11%
Transportation[5]	304	346	3%	$11,959	$13,806	4%
Sporting goods[6]	4,961	4,989	39%	$88,989	$89,486	23%
Recreation equipment rental[7]	92	98	1%	$2,861	$3,036	1%
Recreation services[8]	1,149	1,178	9%	$28,156	$28,862	7%
Other sectors[9]	61	4,432	34%	$1,237	$215,738	54%
Total	*7,950*	*12,850*	*100%*	*$165,701*	*$392,896*	*100%*

Notes:

[1] Represents the number of full- and part-time jobs.

[2] Represents employee compensation and proprietors income in thousands of 2006 dollars.

[3] Values for All Anglers do not equal the sum of values from Resident Anglers and Non-Resident Anglers because these values were derived from different samples.

[4] Represents employment and income generated by visitor trip spending in food stores, eating and drinking places, and hotels, motels, and other businesses providing accommodations.

[5] Represents employment and income generated by visitor trip spending on airfare, public transportation, and private transportation.

[6] Represents employment and income generated by visitor spending during and apart from fishing trips on fishing equipment (e.g., bait, tackle, rods and reels) in sporting goods stores.

[7] Represents employment and income generated by visitor trip spending on rental of recreation equipment.

[8] Represents employment and income generated by visitor trip spending on recreation services (e.g., boat launching and mooring, guides).

[9] Represents employment and income directly and indirectly generated in all other sectors of the Washington state economy.

Source: IMPLAN model runs using trip and equipment expenditures estimates for fishing in Washington in 2006 by resident and non-resident anglers as inputs.

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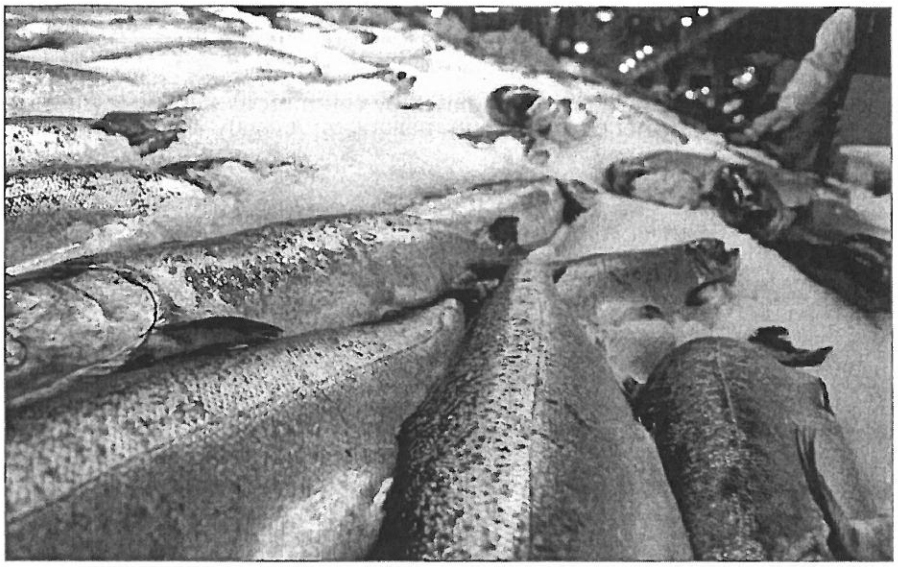

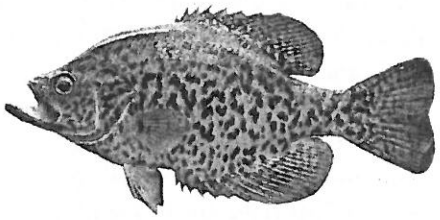

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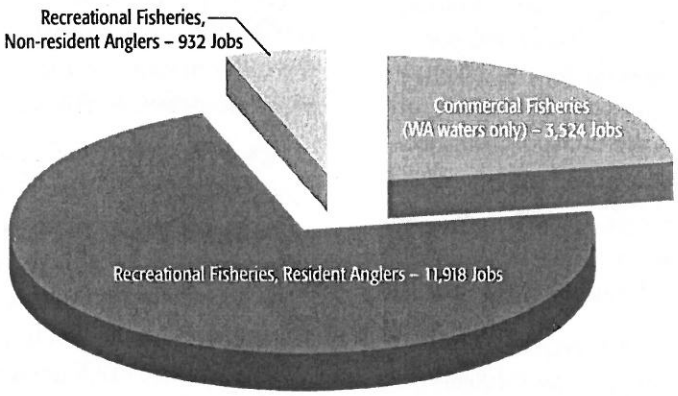
ECONOMIC IMPORTANCE OF COMMERCIAL AND RECREATIONAL FISHERIES IN WASHINGTON

This study evaluated the economic values and impacts of commercial and recreational fisheries in Washington State. Although the estimates of these measures are conceptually consistent for the two fisheries, comparing the results between the fisheries is not appropriate for several reasons. In the case of net economic values, some components were not quantified, such as surplus values to consumers associated with the commercial harvest or non-use values. In the case of economic impacts, the impacts associated with the spending by state resident anglers, which comprise more than 90 percent of the total recreational effects, are fundamentally different in terms of contribution to the state economy from the effects generated by non-resident recreational anglers and by commercial fishers. Overall, the study is not sufficiently comprehensive and the values are not estimated with adequate precision to warrant a comparative analysis of the two fisheries.

As described in Sections 2 and 3, commercial and recreational fishing activity in Washington waters directly and secondarily supported an estimated 16,374 jobs and $540.0 million in personal income in 2006. As shown in ***Figure 2***, recreational fishing generated an estimated 12,850 jobs of which spending by resident anglers supported 11,918 jobs and non-resident spending supported 932 jobs. Commercial fishing and processing

Figure 2. Statewide jobs supported by commercial and recreational fisheries in 2006



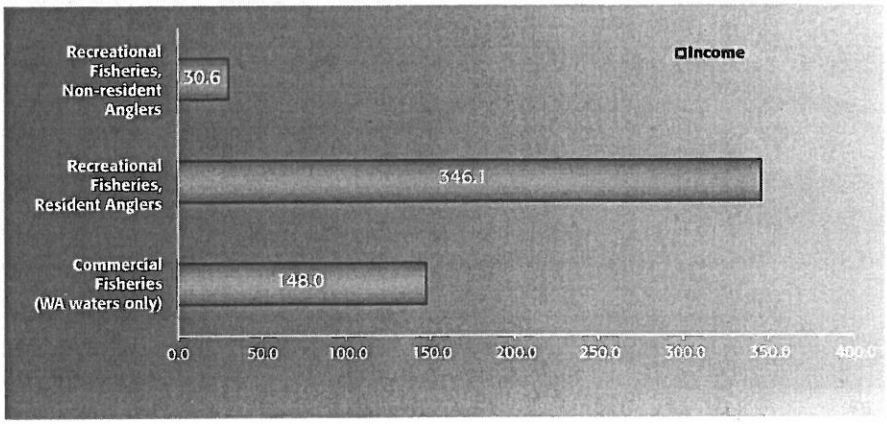
in Washington waters generated an estimated 3,524 jobs in 2006.

When viewed in the context of the Washington State economy, the total levels of employment and earnings accounted for about 0.4 percent of total statewide employment and about 0.2 percent of total statewide personal income in 2006. Unlike spending by non-resident anglers that contributes to the tourism economy, spending by resident anglers serves to direct discretionary consumer spending towards fishing-related goods and services. When the spending and associated economic effects generated by resident angler spending are excluded, commercial and non-resident recreational fishing accounts for about 0.1 percent of statewide employment and less than 0.1 percent of statewide personal income.

Although the contribution of Washington's commercial and recreational fisheries to the overall state economy is relatively small, the contributions to individual sectors of the state's economy are more important. Spending by recreational anglers generates important economic contributions to several key sectors of the state's economy, including an estimated 0.6 percent of statewide jobs in the food and lodging sector, 0.9 percent of the jobs in the transportation sector, 21.7 percent of the jobs in the sporting goods retailing sector, and 4.7 percent of the jobs in the amusement and recreation services sector.

In terms of the contribution that Washington commercial fisheries made to the state economy, it should be emphasized that this study focuses on the commercial fisheries in Washington waters. Other components of the commercial fishing industry in Washington include harvesting by western Washington tribes; fish harvesting in distant waters including Alaska, Oregon and Canada; and aquaculture operations.

Figure 3. Statewide income generated by commercial and recreational fisheries in 2006 (in millions of dollars)



The value of commercial landings from Washington waters only totaled $65.1 million, which accounts for about 22 percent of the total jobs and 15 percent of the total personal income in the state's overall commercial fishing and seafood processing sector. As reported by TRG (2008), the 2006 harvest value for three prominent commercial fisheries not included in this study are:

- ***West Coast offshore Pacific whiting fishery.*** This fishery is prosecuted by motherships, catcher vessels, and catcher-processor vessels that homeport in Puget Sound localities. The offshore catch areas for this fishery extends from the U.S.–Canada border to north of San Francisco. The estimated harvest value by the 11 catcher vessels that hail from Washington ports was $2.9 million in 2006. The estimated harvest value by the nine catcher-processors that hail from Washington ports was $8.9 million.
- ***Oregon Coast catch area.*** Species harvested south of the Washington-Oregon land boundary but delivered to Washington ports include albacore tuna ($11.4 million), Dungeness crab ($2.5 million), sablefish ($1.2 million) Pacific whiting ($1.0 million), and pink shrimp ($0.5 million).
- ***Alaska and other non-West Coast mainland waters.*** These fisheries include a predominant Pacific halibut fishery, in which the landing value of harvests in 2006 was $6.2 million, representing 74 percent of

all Pacific halibut delivered in Washington in 2006.

Additionally, aquaculture accounted for $81.1 million of commercial harvest value.

Spending by resident and non-resident anglers in Washington is part of a billion dollar sport fishing industry in Washington State that supports a network of retail and wholesale businesses. In 2006, anglers spent an estimated $550 million on fishing equipment and made about $355 million in trip-related costs. Spending by non-resident anglers (estimated at $63.1 million in 2006) is part of an important tourism industry in Washington that has been valued at nearly $14 billion in 2006 (Dean Runyan Associates).

In addition to commercial and recreational angler spending, fishing-related expenditures also are made annually by governmental and non-governmental agencies for education, research, management, and enforcement of the fishing industries.

Lastly, it must be recognized that, in addition to the employment and personal income contributions to the regional and state economy, these fisheries contribute in other important ways to Washington's economy and the quality of life of its residents. The commercial fishery in Washington waters contributes an estimated $38 million in net economic values (net income) to commercial fishers, allowing them to participate in a livelihood that has been passed down from generation to generation. Additionally, sport fishing opportunities generate an estimated $424 million in net economic values (surplus value over and above expenditures) to the estimated 725,000 resident anglers in Washington. And finally, the working waterfronts that serve both Washington and distant water fisheries are an integral part of many communities. These waterfronts attract visitors wanting to experience and see lively commerce activities in a backdrop of expansive harbor views. Although this economic study is more narrowly focused on the economic values to commercial fishers and sport anglers, the broader social and economic values supported by the commercial and recreational fisheries must be acknowledged.

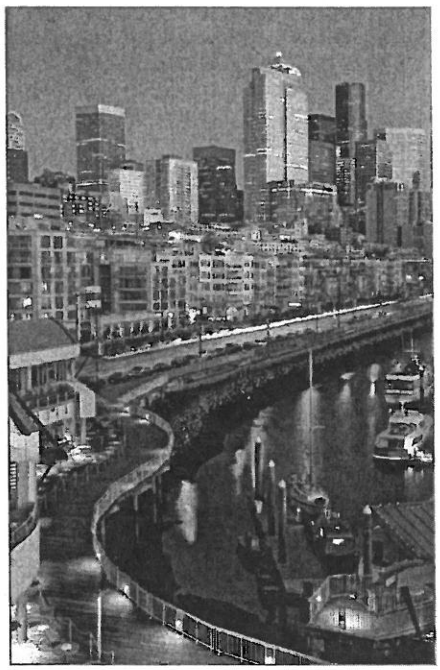
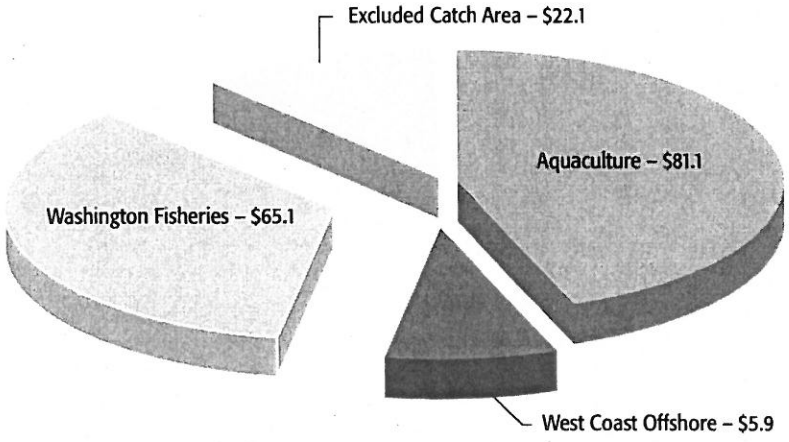


Figure 4. Harvest value from Washington fisheries and other commercial landings in 2006 (in millions of dollars)



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Appendix A

NET ECONOMIC VALUES FOR RECREATIONAL FISHING

[Note: Much of the material in this appendix is drawn from a report prepared by the U.S. FWS (2003) that describes results from a special contingent valuation study as part of the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.]

In 2006, an estimated 824,000 anglers fished in Washington State. These anglers spent $349.9 million on trips to participate in sport fishing. Expenditures are a useful indicator of the importance of sport fishing activities to local, regional, and national economies. However, they do not measure the economic benefit to either the individual participant or, when aggregated, to society.

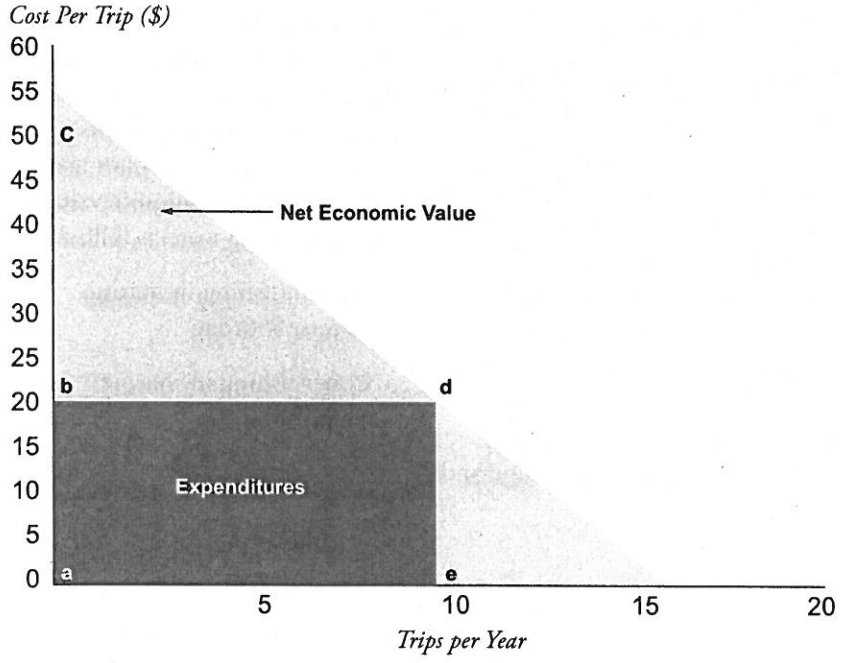
Net economic values associated with sport fishing include values that recreational fisheries generate for both consumers (anglers) and producers of goods and services that sell to anglers. Net economic value to consumers is measured by the dollar amount that anglers would be willing to pay over and above what they actually pay to participate in sport fishing. Net economic value to producers (e.g., charter boat operators, guides, and other sport fishing-related businesses) is measured by the net income (or profit) generated by sales to recreational anglers.

For this study, only net economic values to consumers (sport anglers) are evaluated. It is assumed that the net income to producers would occur elsewhere in the economy if anglers changed their spending behavior. For example, if sport anglers no longer have opportunities to sport fish for salmon in Puget Sound, the net income to sport fishery-related producers associated with the reduction in angler spending would shift to producers of other goods and services as anglers shift their spending patterns. Consequently, there would be no net change in net income from a state perspective.

Expenditures and net economic values are two widely used but distinctly different measures of the economic value of recreational fisheries. Net willingness to pay, or "consumer surplus," is the accepted measure of economic value for a wide range of analyses that seek to quantify benefits and costs. The total benefit to anglers is the summation of willingness to pay across all fishing participants.

There is a direct relationship between expenditures and net economic value, as shown in ***Figure A-1***. A demand curve for a representative angler is shown in the figure. An individual angler's demand curve provides the number of trips that the angler would take per year at different trip costs. The downward sloping demand curve represents the angler's marginal willingness to pay per trip and indicates that each additional trip is valued less by the angler than the preceding trip. All other factors

Figure A-1. Individual angler's demand curve for fishing Trips



being equal, the lower the cost per trip (vertical axis) the more trips the angler will take (horizontal axis). The cost of an angling trip serves as an implicit price for fishing because a market price generally does not exist for this activity. At $60 per trip, the angler would choose not to fish, but if fishing trips were free, the angler would take 16 fishing trips. At a cost per trip of $20, the angler takes 10 trips, with a total willingness to pay $375 ***(area acde in Figure A-1)***.

Total willingness to pay is the total value that the angler places on participation. The angler will not take more than 10 trips because the cost per trip ($20) exceeds what he would pay for an additional trip. For each trip between zero and 10, however, the angler would actually have been willing to pay more than $20 (the demand curve, showing marginal willingness to pay, lies above $20). The difference between what the angler is willing to pay and what is actually paid is the net economic value.

In this simple example, therefore, net economic value is $175 [($55 – $20) × 10 ÷ 2)] (triangle *bcd* in ***Figure A-1***) and angler expenditures are $200 ($20 × 10) (rectangle *abde* in ***Figure A-1***). Thus, the angler's total willingness to pay is composed of net economic value and total expenditures. Net economic value is simply total willingness to pay minus expenditures. The relationship between net economic value and expenditures is the basis for asserting that net economic value is an appropriate measure of the benefit an individual derives from participation in an activity and that expenditures are not the appropriate benefit measure. Expenditures are out-of-pocket expenses on items an angler purchases in order to fish. The remaining value, net willingness to pay (net economic value), is the economic measure of an individual's satisfaction after all costs of participation have been paid.

For this study, net economic values to sport anglers is estimated based on the findings of previous studies focused on estimating net economic values for different sport fishing activities. These values are summarized in ***Table A-1***, with specific values used to estimate the value of freshwater and saltwater fishing for different species highlighted. All values in ***Table A-1*** are presented in 2006 values. In addition to the values reported in ***Table A-1***, net economic values for trout fishing ($50/angler day) were derived from the U.S. FWS's special report (2003) cited at the beginning of this appendix. The per-day values used to estimate the net economic values for sport fishing were as follows:

- Salmon fishing in marine waters, $58/day
- Other fishing in marine waters, $60/day
- Shellfish harvesting, $43/day
- Trout fishing, $50/day
- Salmon/steelhead fishing in freshwaters, $58/day
- Other coldwater fishing in freshwaters, $45/day
- Warmwater fishing, $30/day

These per day values were applied to the number of angler days to derive estimates of total net economic values for all anglers in Washington State.

Table A-1. Net economic values for sport fishing, by type of fishing and region

Species Category	N	NORTHEAST	N	SOUTHEAST	N	INTERMOUNTAIN	N	PACIFIC	N	ALASKA	N	NATIONAL
Cold Water	58		20		116		13		4		3	
Min		$3.75		$19.48		$6.62		$2.56		$2.56		$30.28
Max		$149.57		$117.05		$420.57		$194.41		$96.28		$53.85
Average		$39.54		$51.25		$62.54		$54.10		$53.90		$38.53
Median		$27.04		$51.19		$47.22		$45.31		$58.37		$31.47
Warm Water	119		63		38		3				7	
Min		$0.48		$3.84		$13.05		$14.91				$19.34
Max		$176.10		$254.30		$129.56		$41.01				$115.59
Average		$42.87		$54.37		$45.55		$28.59				$55.59
Median		$27.18		$47.13		$32.84		$29.83				$55.93
Coastal	11		34				24				9	
Min		$2.41		$3.36				$5.80				$9.14
Max		$215.16		$990.22				$533.72				$272.19
Average		$68.47		$144.74				$140.09				$73.70
Median		$7.34		$73.32				$102.10				$59.66
Anadromous	33		1		16		27		18		3	
Min		$0.35		$138.22		$15.11		$19.31		$20.73		$41.62
Max		$149.61		$138.22		$85.00		$287.33		$84.40		$190.16
Average		$39.41		$138.22		$51.20		$65.61		$40.76		$103.36
Median		$4.69		$138.22		$49.21		$57.92		$38.90		$78.30
Mixed	30		1		16				16			
Min		$0.71		$134.24		$26.77				$55.96		
Max		$61.91		$134.24		$217.71				$328.96		
Average		$20.08		$134.24		$59.28				$213.13		
Median		$18.32		$134.24		$36.18				$206.87		
Not Specified	112		16		48		14		2		1	
Min		$4.51		$3.46		$11.28		$1.74		$85.18		$67.12
Max		$390.45		$474.77		$312.71		$119.87		$105.94		$67.12
Average		$49.66		$93.47		$77.31		$39.10		$95.56		$67.12
Median		$36.01		$34.20		$62.70		$43.12		$95.56		$67.12

Note:
All values presented in the table have been converted to a 2006 base year.

Source: Derived from Boyle et. al 1997

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Appendix B

ANALYZING THE ECONOMIC IMPACTS OF COMMERCIAL AND RECREATIONAL FISHERIES

Input-output analysis was used to analyze the economic impacts of the commercial and recreational fisheries. This appendix describes the models, data, and underlying assumptions used in these analyses. The description of the analytical methods for commercial fisheries, including estimating net income values, is mostly based on information provided by The Research Group (2008) for this study.

Input-output analysis is a means of examining relationships within an economy, both between businesses and between businesses and final consumers. It captures all monetary market transactions for consumption in a given period. The primary input variable for input-output analysis is the dollar value of purchases of products or services for final use (i.e., final demand), which drive input-output models. Industries respond to meet demands directly by supplying goods or indirectly by supplying goods and services to industries responding directly to final demand changes. The primary output variables are predicted estimates in direct, indirect, and induced employment and income for the affected industries within a study area. (Minnesota IMPLAN Group 2000).

Commercial Fisheries Analysis

For analyzing the economic impacts of the commercial fisheries, the Fishery Economic Assessment Model (FEAM) was used. FEAM generates measures of regional economic impacts (REI) measured by personal income and measures of commercial harvesting and primary processing business profitability[1]. The REIs are the result of the fishing industry business spending within the defined region. The spending is payments to labor and for other costs associated with prosecuting fisheries, processing a product and readying it for distribution, and the capital costs for vessels and processing plants. The defined region for this study is the state of Washington. The FEAM uses economic input-output relationships to multiply the fishing industry spending through all businesses and households that are touched by the direct (first round spending by the fishing industry), indirect (spending by suppliers to the fishing industry), and induced (re-spending by households that have received money through wages or proprietor income) effects from the fishing industry[2]. Because the FEAM results are payments to labor for all sectors of the economy, a calculation of jobs (both full-time and part-time) can be developed using the region's average wage and proprietorship income.

For this study, FEAM is useful because it provides factors for the REI and net income value (NEV) producer measures per harvest pound. NEV is a social welfare quantity that is a gauge of the amount of wealth generated to the nation from the fishing industry activity. These factors are specific to vessel and processor stratifications. For example, a vessel stratification includes the many species caught using certain gear types by a vessel that is predominantly engaged as a crabber vessel, and a processor stratification includes seafood product types (such as fresh and picked crab) produced from those harvests.

The FEAM is a matrix that marries the many vessel and processor stratifications that are found in the Washington fishing industry. The matrix is static. Changes that might occur from different market conditions, such as the price paid to harvesters or

1. The FEAM was developed by William Jensen and Hans D. Radtke for Alaska and U.S. West Coast. The model has been updated many times and is currently used by the Pacific Fishery Management Council (PFMC) for preparation of fishery management plans. An economic theory description of the FEAM can be found in Seung and Waters (2005).

2. The I/O model used in the FEAM is the IMpact Analysis for PLANning (IMPLAN) model offered by the Minnesota IMPLAN Group Inc., St. Paul, Minnesota.

prices received by processors for certain products, are not reflected in the matrix. In this study, the incremental factors are being applied to only a small portion of the commercial fishing industry in the state (i.e., harvest from Washington waters only).

The measures of business profitability (business net income) are itemized for a suite of vessel and processor types. The profitability and other variable and fixed costs from the business types can be used to estimate NEV. The total dimension of NEV includes consumer seafood value and the revenue created from the fishing and processing activity minus costs to undertake the activity and minus opportunity cost of the resources employed (i.e., what if something else were done with those resources instead of the activity?). The consumer seafood value is the difference in what a consumer would pay for seafood less what is actually paid for the seafood provided from the activity. It is a measure of net willingness-to-pay (WTP) and is sometimes called consumer surplus; as such, it is a conceptual value that can only be found through consumer surveys.

The difference between the fishing industry revenues raised and actual and opportunity costs is sometimes called producer surplus. The estimation of opportunity costs in the producer surplus equation is difficult because it also requires surveying industry participants. It is another measure that is acknowledged, but usually either is borrowed and adapted from other studies or omitted from the calculation.

In FEAM, the fishery sectors exist at a level of stratification that is appropriate for predicting the economic impacts coming from a change in landings of a particular species, changes in landings by a specific vessel type, or landings at a particular port area. FEAM is a production-oriented model which is able to estimate the impacts of changes in harvesting sectors. The FEAM consists of two submodels. The first submodel calculates revenues and expenditures of harvesting and processing industries. The second submodel is the IMPLAN model. The regional economic impacts are calculated by multiplying revenues and expenditures by the multipliers in the IMPLAN model. In FEAM, the harvesting sector is disaggregated by type of vessels, and the processing sector by type of processors. For each of the harvesting and processing subsectors, FEAM provides data on output by species, value added components, and use of intermediate inputs. Value added components include labor income (crew share, processing workers' income, and administrative salaries), capital income (operating income), and indirect business taxes (fish taxes and business/property taxes).

In FEAM, harvesters and processors purchase primary inputs (labor and capital) and intermediate inputs. The intermediate inputs include vessel/engine repair, fuel and supplies, insurance, and other goods and services. Processors also purchase fish from the harvesting sector. Revenues from both the harvesting and processing sectors are then allocated to (i) expenditures on intermediate inputs, (ii) labor income (crew shares, income to processing workers, and administrative workers), and (iii) capital income (operating income, income to owners of vessels and processing facilities). The expenditure on intermediate inputs can be divided into different variable and fixed expenditure categories such as vessel/engine repair, fuel and lubricants, supplies, insurance, and other goods and services.

The multiplier for each expenditure category is calculated as the weighted average of the IMPLAN multipliers for the corresponding sector(s). The weight is calculated as the ratio of the amount of the expenditure allocated to a given IMPLAN sector to the total expenditure in the category. The multipliers for these expenditure categories thus calculated are used to estimate changes in regional income from a change in fishery sectors' output level. Similarly, household income (expenditure), consisting of labor income and capital income, can be allocated to IMPLAN sectors. The multiplier for household income (expenditure) is calculated as the weighted average of the IMPLAN multipliers for the corresponding sector(s).

It is important to note that the REI measure for the small portion of the fishing industry activity being assessed should be considered an economic contribution within the overall effects from the fishing industry. It is an annualized estimate

alternative uses of capital and/or there were alternative employment opportunities, NEV might be significantly lower than the estimates shown.

- Only commercial REI and NEV "use" benefits are calculated. There may be other non-use and non-market benefits associated with commercial fisheries that would be additive to the use benefits. For example, there may be tourists who are drawn to working waterfronts, and their spending may generate economic contributions and add to economic wealth. There may be (positive or negative) passive use values associated with commercial harvests that should be taken into account in the NEV calculation. Passive use values are associated with people wanting the fish resource to exist but who may not actually use the resource.

Recreational Fisheries Analysis

The analysis of economic impacts of the recreational fisheries was conducted using the IMPLAN economic input-output model and the 2006 data set for Washington State. IMPLAN (Impact Analysis for PLANning) is a computer-driven input-output model originally developed by the USDA Forest Service in cooperation with the Federal Emergency Management Agency and the USDI Bureau of Land Management to assist the Forest Service in land and resource management planning. The IMPLAN system has been in use since 1979, evolving from a mainframe, non-interactive application to a menu-driven microcomputer program that is completely interactive. (Minnesota IMPLAN Group 2000)

The IMPLAN system comprises two components: the software and the database. The software performs the necessary calculations, using study area data, to create regional and state input-output models. The databases, which are available at the county and zip code area level, and which are periodically revised using updated socioeconomic data, provide all the information needed to create the IMPLAN models. The primary input variables needed to conduct an impact analysis using IMPLAN are estimates of final demand for products or services.

For evaluating the economic impacts of recreational fisheries in Washington State, angler spending identified in ***Table 10*** was first disaggregated to appropriate expenditure categories based on spending profiles identified in Southwick Associates 2007. These results were then inputted to corresponding sectors in the IMPLAN model. The following IMPLAN sectors, with types of expenditures imputted to them, were used for the IMPLAN model runs:

- Food and beverage stores (used for food expenditures)
- Food services and drinking places (used for food expenditures)
- Hotels and motels—including casino hotels (used for lodging expenditures)
- Air transportation (used for airfare transportation expenditures)
- State and local government passenger transit (used for public transportation expenditures)
- Gasoline stations (used for private transportation expenditures)
- Sporting goods, hobby, books, and music stores (used for fishing and recreation equipment expenditures)
- General and consumer goods rental (used for equipment rental expenditures)
- Other amusement, gambling, and recreational industries (used for boat launching, mooring, guides, and land use fee expenditures)
- Other sectors: all other sectors of the Washington State economy

Recreational spending estimates were inputted into the IMPLAN model separately for expenditures made by all anglers, by resident anglers, and by non-resident anglers. The output of the modeling runs included estimates of direct, indirect, and induced levels of employment and personal income at the state level.

for conditions as they occurred in the year 2006. If the activity were for some reason taken away, it may be there would be adjustments that would ameliorate the loss one way or another and show a different impact. For these reasons, the REI estimates shown here have fairly qualified use as a comparison to the fishing industry in other points in time.

The FEAM version being used to develop the REI and NEV is described in greater detail in Davis (2003). This FEAM version was populated using the particular year 2006 harvests that are included in this study. The harvest data are from PacFIN downloads[3]. Those particular harvests represent about one-quarter of the ex-vessel revenues generated by the vessels in Washington's fishing fleet that make West Coast offshore and onshore deliveries. The spending that occurs in the Washington economy from these particular harvests is about five to six percent of the total fishing industry spending when Alaska and other distant water fisheries and private aquaculture are included. Washington's total fishing industry economic contributions from West Coast fisheries in 2004 is described in TRG (2006). The distant water fisheries effects are discussed in NRC (1986 and 1999) and more recently TRG (2007).

A summary list of assumptions used to generate the commercial REI and NEV estimates are as follows:

- Only harvesting and primary processing effects are assessed. Processed products can enter seafood distribution channels that can generate additional economic effects in Washington's economy. Management, enforcement, and research activity is not included in the economic effects measurements.
- The economic effects are a contribution measure that may have substitutes if the included fisheries are taken away. Harvesters might be able to pursue other West Coast or distant water fisheries and processors may have access to other catches. The substitutes may have different industry input-output and export-import relationships, and therefore, the effect on the economy of the substituted activities may be different.
- The economic effects are static and not necessarily linear. That is, if the included fisheries are more or less than shown, the proportional difference in REI and NEV may be different. The model does not include industry behavior dimensions, such as would undoubtedly occur if there was a shift in prices received for seafood products or prices paid to harvesters.
- The total value of seafood products associated with the included fisheries is based solely on what the seafood actually sells for. In other words, the difference in what a consumer would be willing to pay and actually pays is assumed to be zero.
- Those that work in commercial harvesting and processing businesses are motivated by the enjoyment of their careers and do not compare their participation with other employment prospects. Moreover, the harvesting and processing businesses do not necessarily have other profit making opportunities. Therefore, the opportunity costs from participating in the harvesting and processing of the included fisheries are assumed to be zero
- The economic effects from the movement of fish resources between commercial and recreational user groups cannot be assessed with the modeled estimates. Showing economic benefits from changes in allocations would require close examination of spending on a per unit basis and in aggregate before any conclusions could be reached.
- The calculation of NEV included a portion of fixed costs and labor costs that were not discounted. If other assumptions were made about

3. The Pacific Coast Fisheries Information Network (PacFIN) is a database program sponsored by the PSMFC. West Coast states, British Columbia, and Alaska fish ticket information is regularly uploaded to a central database. The database assists fish management and enforcement for federally managed fisheries. It also assists in fish resource research and investigations. Additional information is available at: http://www.psmfc.org.

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The CPI inflation calculator uses the average Consumer Price Index for a given calendar year. This data represents changes in prices of all goods and services purchased for consumption by urban households. This index value has been calculated every year since 1913. For the current year, the latest monthly index value is used.

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