

TECHNICAL MEMORANDUM (FINAL)

April 28, 2009

Memo to: Andy Appleby, Washington Department of Fish and Wildlife
From: Tom Wegge, TCW Economics

RE: Economic Analysis of WDFW's Hatchery 2020 Plans



The Hatchery Scientific Review group (HSRG) retained TCW Economics to conduct an economic assessment of the State's Draft Hatchery Action Implementation Plans (Hatchery 2020 Plans). This memorandum summarizes the final results of the economic assessment, and describes the methods, including data sources, used to conduct the assessment.

Accompanying this memorandum is an excel workbook that includes the data used to analyze WDFW's 120 salmon and steelhead hatchery programs, and the economic impact estimates for each program.

Results

As described in more detail below, the analysis of economic impacts focuses on measuring the expected effects of each program on generating local personal income from affected commercial and sport fisheries in different economic regions of the state. The estimates are considered minimum contributions due to the methods used to estimate freshwater sport catch, including lower than optimum levels of sampling in some marine commercial fisheries.

State-operated hatcheries for salmon and steelhead evaluated in this analysis are located in watersheds in the Puget Sound region, Coastal region, and Lower Columbia River region. The commercial and sport fisheries where hatchery-produced salmon and steelhead are harvested also occur in these three regions, as well as in more distant fisheries located outside of state waters (e.g., southeast Alaska, British Columbia, and Oregon coast). For this analysis, however, only effects associated with the harvest in Washington State waters were evaluated.

Puget Sound Hatchery Programs

The contribution to local personal income of salmon and steelhead hatchery programs located in the Puget Sound region is shown by watershed in Table 1. Local personal income generated from Puget Sound hatchery production is estimated at \$11.4 million annually in commercial fisheries and \$18.4 million in sport fisheries.

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For hatchery produced fish that are harvested in commercial fisheries, the Puget Sound marine and freshwater net fisheries account for \$10.9 million, or about 96 percent of the total personal income generated. Hatchery production of chum accounts for about 53 percent of the total personal income generated and hatchery production of Chinook accounts for about 38 percent.

For hatchery produced fish caught in sport fisheries, \$11.4 million of the total \$18.4 million in local personal income is associated with sport fishing activity in freshwater areas of the Puget Sound region. Puget Sound marine sport fisheries account for about \$6.5 million and ocean sport fisheries account for about \$627,000 in local personal income. Hatchery produced coho caught in both marine and freshwater sport fisheries generate about \$7.8 million annually, steelhead sport fisheries generate about \$6.7 million, and Chinook sport fisheries generate about \$3.9 million in local personal income. Hatchery programs in the Snohomish watershed contribute about \$5.1 million annually in local personal income in the Puget Sound region and hatchery programs in the Payullup/White watershed contribute about \$3.4 million annually.

It is estimated that commercial and sport fisheries in the Puget Sound region that depend on hatchery production support an estimated 532 full- and part-time jobs throughout the region. This number of jobs does not include hatchery jobs or other jobs indirectly supported by operations at hatchery facilities.

Coastal Hatchery Programs

The contribution to local personal income of salmon and steelhead hatchery programs located in the Coastal region is shown by watershed in Table 2. Local personal income from coastal hatchery production is estimated at \$1.5 million annually in commercial fisheries and \$7.6 million in sport fisheries. Almost all of the local personal income generated by the harvest from coastal hatchery programs occurs in the State's coastal economic region.

For hatchery produced fish harvested in commercial fisheries, coastal net fisheries account for 97 percent of the total personal income generated. Hatchery coho production accounts for \$1.0 million of the \$1.5 million in annual personal income. Although not reported in Table 2, it is estimated that more than 80 percent of the local personal income is captured in the Westport area, which is the primary port associated with catch area 2.

For hatchery produced fish caught in sport fisheries, \$6.8 million of the total \$7.6 million in local personal income is associated with sport fishing activity in coastal freshwaters. Ocean sport fisheries account for about \$821,000 and Puget Sound marine sport fisheries account for about \$25,000 in local personal income. Hatchery fish caught in steelhead sport fisheries generate about \$4.2 million annually, Chinook sport fisheries generate about \$876,000, and coho sport fisheries generate about \$2.6 million in local personal income. Hatchery programs in the Wynoochee watershed contribute the most personal income (\$1.9 million), followed by hatchery programs in the Solduc/Quillayute and Humptulips watersheds (\$1.3 million each).

It is estimated that commercial and sport fisheries in the Coastal region that depend on hatchery production support an estimated 277 full- and part-time jobs throughout the region. This number of jobs does not include hatchery jobs or other jobs indirectly supported by operations at hatchery facilities.

Lower Columbia River Hatchery Programs

The contribution to local personal income of salmon and steelhead hatchery programs located in the Lower Columbia River region is shown by watershed in Table 3. Local personal income

from Lower Columbia River hatchery production is estimated at \$1.5 million annually in commercial fisheries and \$27.9 million in sport fisheries.

For hatchery produced fish harvested in commercial fisheries, the Lower Columbia River net fisheries account for about \$974,000, or about 67%, of the total personal income generated. Hatchery production of coho accounts for about 53 percent of the annual \$1.4 million in personal income generated and Chinook accounts for about 47 percent.

For hatchery produced fish caught in sport fisheries, \$14.5 million of the total \$27.9 million in local personal income is associated with sport fishing activity on the Columbia River mainstem and about \$10.5 million is associated with sport fishing in terminal areas (tributary fisheries) of the Lower Columbia River. Ocean sport fisheries account for about \$2.8 million and Puget Sound marine sport fisheries account for about \$74,000 in local personal income. Hatchery fish caught in steelhead sport fisheries generate about \$13.7 million annually, Chinook sport fisheries generate about \$3.7 million, and coho sport fisheries generate about \$10.5 million in local personal income. Hatchery programs in the Cowlitz River watershed contribute the most personal income at \$14.8 million annually, distantly followed by hatchery programs in the Lewis River watershed (\$5.7 million) and Kalama River hatchery programs (\$2.8 million).

It is estimated that commercial and sport fisheries in the Lower Columbia River region that depend on hatchery production support an estimated 1,108 full- and part-time jobs throughout the region. This number of jobs does not include hatchery jobs or other jobs indirectly supported by operations at hatchery facilities.

TABLE 1

Contribution to Local Personal Income from 2020 Hatchery Plan

Hatchery Production Region: **PUGET SOUND**

Watershed	COMMERCIAL FISHERIES				SPORT FISHERIES			
	Ocean Troll	Puget Sound Marine and FW Net	Coastal Net	Total Commercial	Ocean	Puget Sound Marine	Freshwater	Total Sport
Nooksack								
steelhead	\$0	\$1,007	\$0	\$1,007	\$0	\$0	\$137,593	\$137,593
chinook	\$53,504	\$852,738	\$1,182	\$907,424	\$5,075	\$306,485	\$241,519	\$553,079
coho	\$3,826	\$105,622	\$101	\$109,549	\$18,785	\$94,096	\$119,540	\$232,421
subtotal	\$57,330	\$959,367	\$1,283	\$1,017,980	\$23,860	\$400,581	\$498,651	\$923,092
Skagit								
steelhead	\$0	\$16,187	\$0	\$16,187	\$0	\$0	\$630,388	\$630,388
chinook	\$1,665	\$6,246	\$0	\$7,911	\$203	\$38,511	\$488	\$39,202
coho	\$5,992	\$47,985	\$121	\$54,098	\$71,783	\$397,481	\$355,447	\$824,711
subtotal	\$7,657	\$70,418	\$121	\$78,196	\$71,986	\$435,992	\$986,323	\$1,494,301
Stillaguamish								
steelhead	\$0	\$0	\$0	\$0	\$0	\$0	\$507,433	\$507,433
chinook	\$455	\$1,091	\$0	\$1,546	\$72	\$9,351	\$0	\$9,423
coho	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
subtotal	\$455	\$1,091	\$0	\$1,546	\$72	\$9,351	\$507,433	\$516,856
Snohomish								
steelhead	\$0	\$504	\$0	\$504	\$0	\$0	\$4,664,972	\$4,664,972
chinook	\$5,891	\$1,785	\$0	\$7,676	\$1,008	\$103,796	\$42,205	\$147,009
coho	\$4,238	\$5,392	\$101	\$9,731	\$32,314	\$147,514	\$135,641	\$315,469
subtotal	\$10,129	\$7,681	\$101	\$17,911	\$33,322	\$251,310	\$4,842,818	\$5,127,450
Lake Washington								
steelhead	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
chinook	\$33,326	\$297,928	\$455	\$331,709	\$3,597	\$241,265	\$20,005	\$264,867
coho	\$5,039	\$71,895	\$0	\$76,934	\$69,653	\$292,514	\$90,996	\$453,163
subtotal	\$38,365	\$369,823	\$455	\$408,643	\$73,250	\$533,779	\$111,001	\$718,030
Green/Duwamish								
steelhead	\$0	\$30,864	\$0	\$30,864	\$0	\$0	\$408,874	\$408,874
chinook	\$54,806	\$519,614	\$727	\$575,147	\$6,260	\$505,320	\$1,708	\$513,288
coho	\$14,818	\$303,364	\$324	\$318,506	\$152,978	\$828,348	\$493,528	\$1,474,854
subtotal	\$69,624	\$853,842	\$1,051	\$924,517	\$159,238	\$1,333,668	\$904,109	\$2,397,015
Payullup/White								
steelhead	\$0	\$6,187	\$0	\$6,187	\$0	\$0	\$76,603	\$76,603
chinook	\$34,250	\$257,774	\$0	\$292,024	\$2,703	\$416,003	\$250,545	\$669,251
coho	\$7,709	\$204,946	\$0	\$212,655	\$96,654	\$1,145,784	\$1,454,480	\$2,696,918
subtotal	\$41,959	\$468,908	\$0	\$510,867	\$99,357	\$1,561,787	\$1,781,628	\$3,442,772
Deschutes								
steelhead	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
chinook	\$91	\$99	\$0	\$0	\$0	\$0	\$46,108	\$46,108
coho	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
subtotal	\$91	\$99	\$0	\$0	\$0	\$0	\$46,108	\$46,108
Kitsap								
steelhead	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
chinook	\$101,030	\$280,974	\$0	\$382,004	\$10,790	\$432,681	\$3,415	\$446,886
coho	\$8,782	\$85,609	\$0	\$94,391	\$102,015	\$595,615	\$488	\$698,118
subtotal	\$109,812	\$366,584	\$0	\$476,396	\$112,805	\$1,028,296	\$3,903	\$1,145,004
Skokomish/Dosewallips								
steelhead	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
chinook	\$101,935	\$1,744,240	\$0	\$1,846,175	\$6,561	\$581,803	\$585,256	\$1,173,620
coho	\$2,199	\$16,962	\$49	\$19,210	\$37,493	\$247,368	\$253,717	\$538,578
chum	\$0	\$6,036,512	\$0	\$6,036,512	\$0	\$0	\$0	\$0
subtotal	\$104,134	\$7,797,714	\$49	\$7,901,897	\$44,054	\$829,171	\$838,973	\$1,712,198
Elwha/Dungeness								
steelhead	\$0	\$5,827	\$0	\$5,827	\$0	\$0	\$299,581	\$299,581
chinook	\$1,511	\$1,190	\$0	\$2,701	\$0	\$58,272	\$1,952	\$60,224
coho	\$1,590	\$11,706	\$0	\$13,296	\$9,060	\$73,062	\$445,224	\$527,346
subtotal	\$3,101	\$18,722	\$0	\$21,823	\$9,060	\$131,334	\$746,757	\$887,151
ALL WATERSHEDS								
steelhead	\$0	\$60,576	\$0	\$60,576	\$0	\$0	\$6,725,444	\$6,725,444
chinook	\$388,464	\$3,963,678	\$2,364	\$4,354,316	\$36,269	\$2,693,487	\$1,193,200	\$3,922,956
coho	\$54,193	\$853,482	\$696	\$908,371	\$590,735	\$3,821,782	\$3,349,060	\$7,761,577
chum	\$0	\$6,036,512	\$0	\$6,036,512	\$0	\$0	\$0	\$0
TOTAL	\$442,657	\$10,914,248	\$3,060	\$11,359,775	\$627,004	\$6,515,269	\$11,267,705	\$18,409,978

TABLE 2

Contribution to Local Personal Income from 2020 Hatchery Plan

Hatchery Production Region: **COASTAL**

Watershed	COMMERCIAL FISHERIES				SPORT FISHERIES			
	Ocean Troll	Coastal Net	Puget Sound Marine and FW Net	Total Commercial	Ocean	Puget Sound Marine	Freshwater	Total Sport
Solduc/Quillayute								
steelhead	\$0	\$243,243	\$0	\$243,243	\$0	\$0	\$839,217	\$839,217
chinook	\$1,270	\$7,293	\$99	\$8,662	\$0	\$5,484	\$65,137	\$70,621
coho	\$7,454	\$196,097	\$45	\$203,596	\$85,956	\$3,468	\$335,931	\$425,355
subtotal	\$8,724	\$446,633	\$144	\$455,501	\$85,956	\$8,952	\$1,240,285	\$1,335,193
Humptulips								
steelhead	\$0	\$10,864	\$0	\$10,864	\$0	\$0	\$393,749	\$393,749
chinook	\$0	\$0	\$0	\$0	\$0	\$0	\$321,293	\$321,293
coho	\$4,983	\$127,472	\$91	\$132,546	\$39,115	\$3,975	\$570,131	\$613,221
subtotal	\$4,983	\$138,336	\$91	\$143,410	\$39,115	\$3,975	\$1,285,173	\$1,328,263
Wynoochee								
steelhead	\$0	\$5,540	\$0	\$5,540	\$0	\$0	\$1,828,224	\$1,828,224
chinook	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
coho	\$0	\$87,240	\$0	\$87,240	\$5,134	\$274	\$80,994	\$86,402
subtotal	\$0	\$92,780	\$0	\$92,780	\$5,134	\$274	\$1,909,218	\$1,914,626
Satsop								
steelhead	\$0	\$0	\$0	\$0	\$0	\$0	\$171,259	\$171,259
chinook	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
coho	\$3,616	\$25,795	\$166	\$29,577	\$107,623	\$0	\$33,176	\$140,799
subtotal	\$3,616	\$25,795	\$166	\$29,577	\$107,623	\$0	\$204,435	\$312,058
Skookumchuck								
steelhead	\$0	\$0	\$0	\$0	\$0	\$0	\$532,805	\$532,805
chinook	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
coho	\$308	\$3,646	\$0	\$3,954	\$6,105	\$0	\$51,475	\$57,580
subtotal	\$308	\$3,646	\$0	\$3,954	\$6,105	\$0	\$584,280	\$590,385
Willapa								
steelhead	\$0	\$0	\$0	\$0	\$0	\$0	\$231,760	\$231,760
chinook	\$2,295	\$66,758	\$0	\$69,053	\$27,525	\$0	\$156,133	\$183,658
coho	\$4,929	\$204,019	\$45	\$208,993	\$169,084	\$4,380	\$301,045	\$474,509
subtotal	\$7,224	\$270,777	\$45	\$278,046	\$196,609	\$4,380	\$688,938	\$889,927
Nemah								
steelhead	\$0	\$0	\$0	\$0	\$0	\$0	\$31,715	\$31,715
chinook	\$2,295	\$66,758	\$0	\$69,053	\$27,525	\$0	\$45,376	\$72,901
coho	\$4,929	\$204,019	\$45	\$208,993	\$169,084	\$4,380	\$213,708	\$387,172
subtotal	\$7,224	\$270,777	\$45	\$278,046	\$196,609	\$4,380	\$290,799	\$491,788
Naselle								
steelhead	\$0	\$0	\$0	\$0	\$0	\$0	\$170,283	\$170,283
chinook	\$3,414	\$100,136	\$0	\$103,550	\$41,131	\$0	\$185,896	\$227,027
coho	\$4,713	\$143,166	\$0	\$147,879	\$142,300	\$3,103	\$227,125	\$372,528
subtotal	\$8,127	\$243,302	\$0	\$251,429	\$183,431	\$3,103	\$583,304	\$769,838
ALL WATERSHEDS								
steelhead	\$0	\$259,647	\$0	\$259,647	\$0	\$0	\$4,199,012	\$4,199,012
chinook	\$9,274	\$240,945	\$99	\$250,318	\$96,181	\$5,484	\$773,835	\$875,500
coho	\$30,932	\$991,454	\$392	\$1,022,778	\$724,401	\$19,580	\$1,813,585	\$2,557,566
TOTAL	\$40,206	\$1,492,046	\$491	\$1,532,743	\$820,582	\$25,064	\$6,786,432	\$7,632,078

TABLE 3

Contribution to Local Personal Income from 2020 Hatchery Plan

Hatchery Production Region: **LOWER COLUMBIA RIVER**

Watershed	COMMERCIAL FISHERIES					SPORT FISHERIES				
	Ocean Troll	Columbia River Net Catch	Coastal Net	Puget Sound Marine and FW Net	Total Commercial	Columbia River Mainstem	Ocean	Puget Sound Marine	Freshwater	Total Sport
Grays River										
steelhead	\$0	\$0	\$0	\$0	\$0	\$117,518	\$0	\$0	\$0	\$117,518
chinook	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
coho	\$899	\$12,726	\$345	\$30	\$14,000	\$0	\$40,542	\$0	\$59,282	\$99,824
subtotal	\$899	\$12,726	\$345	\$30	\$14,000	\$117,518	\$40,542	\$0	\$59,282	\$217,342
Elochoman River										
steelhead	\$0	\$0	\$0	\$0	\$0	\$546,188	\$0	\$0	\$0	\$546,188
chinook	\$60,719	\$16,023	\$0	\$694	\$77,436	\$9,313	\$29,517	\$3,468	\$36,106	\$78,404
coho	\$3,626	\$88,534	\$0	\$0	\$92,160	\$4,147	\$193,957	\$6,023	\$272,258	\$476,365
subtotal	\$64,345	\$104,557	\$0	\$694	\$169,596	\$59,648	\$223,474	\$9,491	\$308,364	\$1,100,977
Cowlitz River										
steelhead	\$0	\$0	\$0	\$0	\$0	\$8,586,776	\$0	\$0	\$0	\$8,586,776
chinook	\$115,105	\$43,433	\$0	\$198	\$158,736	\$67,532	\$113,457	\$2,920	\$1,097,081	\$1,280,990
coho	\$10,480	\$289,190	\$2,365	\$181	\$302,216	\$0	\$885,535	\$24,931	\$4,045,561	\$4,956,027
subtotal	\$125,585	\$332,623	\$2,365	\$379	\$460,952	\$8,654,308	\$998,992	\$27,851	\$5,142,642	\$14,823,793
North Fork Toutle River										
steelhead	\$0	\$0	\$0	\$0	\$0	\$205,761	\$0	\$0	\$0	\$205,761
chinook	\$22,382	\$17,739	\$0	\$4,561	\$44,682	\$9,980	\$27,243	\$0	\$349,836	\$387,059
coho	\$322	\$34,920	\$0	\$0	\$35,242	\$64,893	\$169,317	\$548	\$712,602	\$947,360
subtotal	\$22,704	\$52,659	\$0	\$4,561	\$79,924	\$280,634	\$196,560	\$548	\$1,062,438	\$1,540,180
South Fork Toutle River										
steelhead	\$0	\$0	\$0	\$0	\$0	\$185,269	\$0	\$0	\$0	\$185,269
chinook	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
coho	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
subtotal	\$0	\$0	\$0	\$0	\$0	\$185,269	\$0	\$0	\$0	\$185,269
Coweeman River										
steelhead	\$0	\$0	\$0	\$0	\$0	\$32,621	\$0	\$0	\$0	\$32,621
chinook	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
coho	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
subtotal	\$0	\$0	\$0	\$0	\$0	\$32,621	\$0	\$0	\$0	\$32,621
Kalama River										
steelhead	\$0	\$0	\$0	\$0	\$0	\$1,161,799	\$0	\$0	\$0	\$1,161,799
chinook	\$157,226	\$62,946	\$0	\$991	\$221,163	\$249,170	\$97,995	\$5,384	\$503,530	\$866,079
coho	\$1,463	\$28,783	\$0	\$0	\$30,246	\$14,394	\$100,879	\$1,643	\$627,949	\$744,865
subtotal	\$158,689	\$91,729	\$0	\$991	\$251,409	\$1,425,363	\$198,874	\$7,027	\$1,131,479	\$2,762,743
Lewis River										
steelhead	\$0	\$0	\$0	\$0	\$0	\$2,267,976	\$0	\$0	\$0	\$2,267,976
chinook	\$5,770	\$15,222	\$0	\$0	\$20,992	\$41,584	\$3,265	\$0	\$522,559	\$567,408
coho	\$10,470	\$199,338	\$764	\$60	\$210,632	\$41,717	\$904,498	\$22,256	\$1,915,805	\$2,884,276
subtotal	\$16,240	\$214,560	\$764	\$60	\$231,624	\$2,351,277	\$907,763	\$22,256	\$2,438,364	\$5,719,660
Salmon Creek										
steelhead	\$0	\$0	\$0	\$0	\$0	\$102,044	\$0	\$0	\$0	\$102,044
chinook	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
coho	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
subtotal	\$0	\$0	\$0	\$0	\$0	\$102,044	\$0	\$0	\$0	\$102,044
Washougal River										
steelhead	\$0	\$0	\$0	\$0	\$0	\$496,002	\$0	\$0	\$0	\$496,002
chinook	\$80,634	\$80,858	\$0	\$1,586	\$163,078	\$104,459	\$71,826	\$5,293	\$281,528	\$463,106
coho	\$3,602	\$84,204	\$641	\$76	\$88,523	\$159,793	\$179,600	\$1,278	\$79,286	\$419,957
subtotal	\$84,236	\$165,062	\$641	\$1,662	\$251,601	\$760,254	\$251,426	\$6,571	\$360,814	\$1,379,065
ALL WATERSHEDS										
steelhead	\$0	\$0	\$0	\$0	\$0	\$13,701,954	\$0	\$0	\$0	\$13,701,954
chinook	\$441,836	\$236,221	\$0	\$8,030	\$686,087	\$482,038	\$343,303	\$17,065	\$2,790,640	\$3,633,046
coho	\$30,862	\$737,695	\$4,115	\$347	\$773,019	\$284,944	\$2,474,328	\$56,679	\$7,712,743	\$10,528,694
TOTAL	\$472,698	\$973,916	\$4,115	\$8,377	\$1,459,106	\$14,468,936	\$2,817,631	\$73,744	\$10,503,383	\$27,863,694

Methods

The estimates of regional economic impacts derived from assessing the expected harvest of hatchery-produced salmon and steelhead caught in commercial and sport fisheries are expressed primarily in terms of personal income accruing to households within defined local areas (multi-county regions). Local personal income is considered a key indicator of economic activity, and is used in economic analysis to evaluate distributional effects on local and regional economies associated with hatchery production. Estimates of local personal income, which the Pacific Fishery Management Council also derive to annually assess the economic effects of its salmon allocation decisions, reflect the wages, profits, and property income associated with expenditures made by commercial fishers and sport anglers in their fishing pursuits.

In addition to personal income generated by commercial and recreational fisheries that depend on hatchery production, it should be recognized that salmon and steelhead hatcheries operating in Washington also directly affect local and regional economies by providing employment opportunities for those working at the many hatcheries throughout the state, and indirectly through the procurement of materials and services needed for operation of hatchery facilities. These economic effects were not evaluated in this assessment.

An excel spreadsheet model (entitled the Hatchery Impact Model) was developed to estimate the regional and state-level economic impacts of fisheries that depend on the salmon and steelhead hatchery program. The spreadsheet model comprises 15 worksheets, including four worksheets for each hatchery region (Puget Sound, Coastal, and Columbia River) and three worksheets with factors to translate catch estimates to regional economic impacts. The following first four steps were used to develop the Hatchery Impact Model for each of the three hatchery regions. (For purposes of describing the methodology, model worksheets developed for the Puget Sound hatchery region are used for reference purposes, but the methods apply to all three hatchery regions.) The fifth step describes the procedures used to convert estimates of personal income to number of jobs.

Step 1: Compile Data for Average Annual Contributions of WDFW Hatchery Programs

Estimated commercial and sport catch data (in number of fish) provided by the WDFW for its hatchery programs in Puget Sound, Coastal, and Columbia River watershed areas were entered into the Hatchery Impact Model according to species type and catch area. WDFW catch estimates (except freshwater sport catch) were based on coded wire tag (CWT) recoveries as provided by: Regional Mark Information System Database [online database]. Portland (OR): Regional Mark Processing Center, Pacific States Marine Fisheries Commission. URL:< <http://www.rmpc.org>>. Average brood year (1996-2001, [catch years 2000-2005]) CWT estimates of smolt survival and contribution to fisheries were then applied to current hatchery programs (WDFW, Science Division data base). Freshwater sport catch estimates were derived from the WDFW Catch Record Card System (CRC). As shown in the "Puget Sound Harvest" worksheet, commercial and sport catch data associated with each individual hatchery program were entered into the model.

Step 2: Convert Catch Data to Commercial Pounds and Sport Angler Trips

The catch data compiled in Step 1 required conversion so that the catch data units would match the regional economic impact (REI) factors used to estimate personal income. For commercial fisheries, catch needed to be converted to pounds to be consistent with REI factors; for sport fisheries, catch needed to be converted to angler trips.

The “Conversion” worksheet of the Hatchery Impact Model shows the average weight and angler-trip conversion factors used to convert catch to pounds and angler trips for each species and catch area. The sources for conversion factors include the following:

Commercial Fisheries

- Commercial ocean troll and coastal net Chinook and coho salmon weights (dressed weight per fish): PFMC 2008 SAFE Report, Appendix D, Table D-3 (average weights over the 2004-2008 period)
- Puget Sound commercial marine and freshwater net Chinook and coho weights (round weight per fish): The Research Group, draft Mitchell Act DEIS socioeconomic section, Appendix A, Table A.3 (pounds per fish for Washington Puget Sound)
- Commercial freshwater net catch for steelhead, Chinook, and coho (round weight per fish): The Research Group, draft Mitchell Act DEIS socioeconomic section, Appendix A, Table A.3 (pounds per fish for Columbia Basin inland commercial gillnet)
- Commercial Puget Sound chum weight: Washington Department of Fish and Wildlife Web site (<http://wdfw.wa.gov/fish/chum/chum-3d.htm>)

Sport Fisheries

- Sport ocean and Puget Sound marine catch per angler trip: catch-per-unit-of-effort factors for each catch area from Washington Department of Fish and Wildlife “Average Annual Contributions of ... Hatchery Programs to Washington State Fisheries” reports for each of the three hatchery regions
- Sport Columbia River catch per trip: The Research Group, draft Mitchell Act DEIS socioeconomic section, Appendix A, Table A.3 (inverted days per fish for Columbia Basin inland recreational mainstem for Chinook, coho, and steelhead), and data from ODFW’s creel survey of the Lower Columbia River (Table 2 of the annual report)
- Sport freshwater catch per trip for steelhead, Chinook, and coho: U.S. Department of the Interior, Fish and Wildlife, U.S. Department of Census Bureau. 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (personal communication from William Beattie to TCW Economics, March 23, 2009), and information compiled by WDFW staff (personal communication from James Dixon) from Coastal creel surveys

The conversion factors were applied to the commercial and sport catch data in the model’s “Puget Sound Harvest” worksheet to arrive at the pounds of commercial landings and number of sport angler trips shown in the “PS Converted” worksheet.

Step 3: Estimate Local Regional Economic Impacts

Once catch was converted to commercial pounds and sport angler trips, local REI factors for each species and catch area were applied to the converted catch to estimate the regional economic impacts (local personal income) of each hatchery program for each catch area.

The model’s “Local Impact Factors” worksheet shows the REI factors used to convert catch (in pounds) and angler trips for each species and catch area to regional economic impacts. The sources for the local impact factors include the following:

Commercial Fisheries

- Commercial ocean troll, coastal net, and Puget Sound marine and freshwater net Chinook and coho salmon REI factors (per pound of dressed weight): FEAM impact factors for 2008 provided by the PFMC in file “Tables CH IV Econ Sup”
- Commercial freshwater net catch for steelhead, Chinook, and coho REI factors (per pound of round weight): The Research Group, draft Mitchell Act DEIS socioeconomic section, Appendix A, Table A.3 (per fish REI factor for Columbia Basin inland commercial gillnet, converted to a per pound REI factor based on average pounds per fish)
- Commercial Puget Sound chum REI factor: personal communication from Ed Waters to TCW Economics on 4/17/09, providing REI factor for chum, based on FEAM/PFMC factors

Sport Fisheries

- Sport ocean and Puget Sound marine REI factors (per angler trip): FEAM charter and private boat trip impact factors for 2008 provided by the PFMC in file “Tables CH IV Econ Sup” (factors for charter and private boats were weighted based on boat-type trip distributions over the 2004-08 period: 35% charter, 64% private, as reported in the PFMC 2008 SAFE Report)
- Sport Columbia River and freshwater REI factors: The Research Group, draft Mitchell Act DEIS socioeconomic section, Appendix A, Table A.3 (for Columbia Basin inland recreational mainstem for Chinook, coho, and steelhead)

The commercial pounds and angler trips in the model’s “PS Converted” worksheet were multiplied by the REI factors in the “Local Impact Factors” worksheet to calculate the regional impact estimates for each catch area, species, and hatchery program shown in the “PS Local REI” worksheet. This worksheet provides the estimated regional economic impact that occurs in each regional catch area resulting from the commercial and sport catch of salmon produced by each hatchery program.

Step 4: Estimate State-Level Economic Impacts

The same methods used to arrive at regional economic impacts, described in Step 3, were employed to develop estimates of the economic impacts at the state level resulting from the catch in each catch area. The REI factors used for this assessment are shown in the model’s “State Impact Factors” worksheet. The sources for the state-level REIs are the same as those described in Step 3 for local-level REIs. Application of the state-level factors in the “State Impact Factors” worksheet to the commercial pounds and sport angler trips in the “PS Converted” worksheet results in the state-level economic impacts shown in the “PS State REI” worksheet.

Step 5: Convert Aggregate, Region-Wide Estimates of Personal Income to Number of Jobs Supported

The number of jobs directly and indirectly supported by hatchery-dependent fishing activity is, for many, a more intuitive indicator of economic impacts than personal income. This final step involved converting estimates of personal income associated with the commercial and sport harvest from hatcheries to estimates of total jobs supported in the three regions. To accomplish this, the following earnings-per-job factors were used to convert total personal income in each

region to number of jobs: Puget Sound, \$55,923; Washington Coast, \$33,100; and Lower Columbia River, \$38,200. (All values are reported in 2007 dollars.) The source for deriving these factors is the Bureau of Economic Analysis, April 2009, Table CA05N: Personal Income by Major Source and Earnings by NAICS Industry, and Table CA25N: Total Full-Time and Part-Time Employment by NAICS Industry. Washington, DC.