

NOAA 2011 Protected Species Studies of Eulachon Smelt in Oregon and Washington

PROGRESS REPORT

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Project accomplishments by objective are:

A). Stock Assessment Objective

1. *Complete larval sampling at mainstem Columbia River stations January 1- May 31, during 2011, and 2012*

Season One: January 1 –May 31, 2011

(See previous progress report for time period 1 January through 30 June, 2011.)

Season Two: January 1 –May 31, 2012

Due to indications of earlier spawning, we began sampling Columbia River transect stations the first week of December, on 12/6/11, and have continued sampling once per week. The Grays River was also sampled on 12/20/11. Sampling efforts are ongoing.

2. *Complete calculations of river discharge by July 31, during 2011, and 2012*

Season One: January 1 –May 31, 2011

Calculations of river discharge for the mainstem Columbia River were completed for the sampling period (Jan. 12 – May 26, 2011) using data from the USGS gauging station: *14246900 Columbia River at Beaver Army Terminal*, near river mile 55 (Figure 1), when available. When data from this station were missing, mainstem Columbia River discharge was estimated using estimates from a combination of USGS, Department of Ecology, and Columbia R. DART stations

in the Cowlitz, Sandy, Lewis, Willamette, and Washougal Rivers, and the Columbia River below Bonneville Dam gauge stations.



Figure 1: Orange circles indicate general locations of mainstem Columbia River transect sample sites. Blue triangle indicates the approximate location of the USGS Columbia River gauge station 14246900 at Beaver Army Terminal.

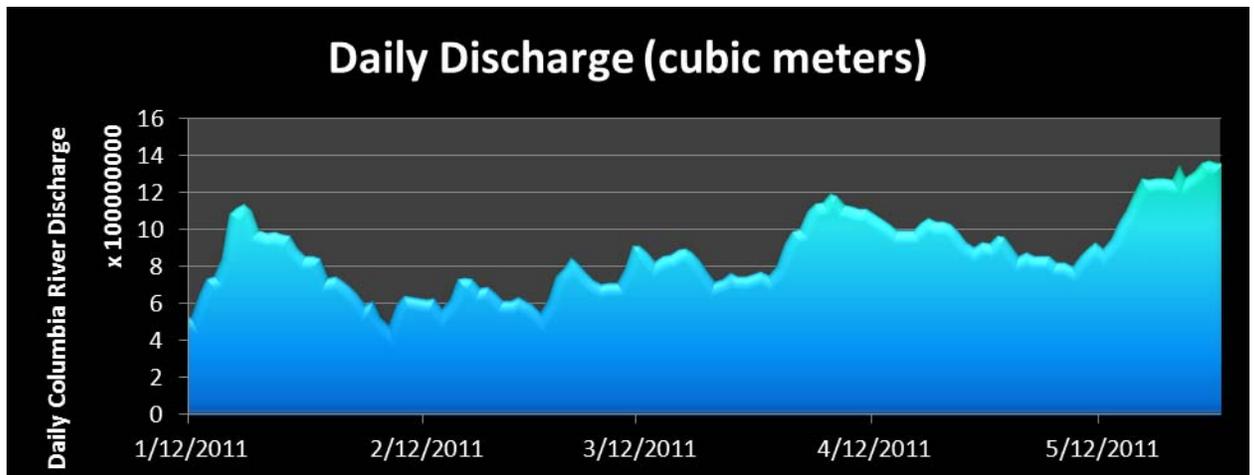


Figure 2: Calculated daily Columbia River Discharge at Beaver Army Terminal during the 2011 eulachon smelt plankton (egg and larvae) sampling period.

Calculation of river discharge for the Grays River were completed for the sampling period (Jan. 12 – May 12, 2011) using data from the Department of Ecology gage station 25B060, near the mouth of the Grays River.

Season Two: January 1 –May 31, 2012

(Task is not scheduled for completion during this reporting period.)

3. Complete laboratory work (larval densities in samples) by June 30, during 2011, and 2012

Season One: January 1 –May 31, 2011

Laboratory analysis consisting of visually identifying and counting 61,146 smelt eggs and larvae from 202 samples collected in the mainstem Columbia River and the Grays River during the 2011 field season was completed.

Expansion of the samples to weekly and annual outflow estimates were done in accordance with the procedures described for the Fraser River (McCarter and Hay 2003). The mean estimate for 2011, was 590 billion eggs and larvae produced from the mainstem and tributaries above the Columbia River estuary. The estimate for the Grays River (which flows into the estuary below the Price Island/Clifton index site) was 4 billion eggs and larvae.

The temporal pattern of smelt plankton outflow at the Price Island/Clifton Channel index site is depicted in Figures 3 and 4 below.

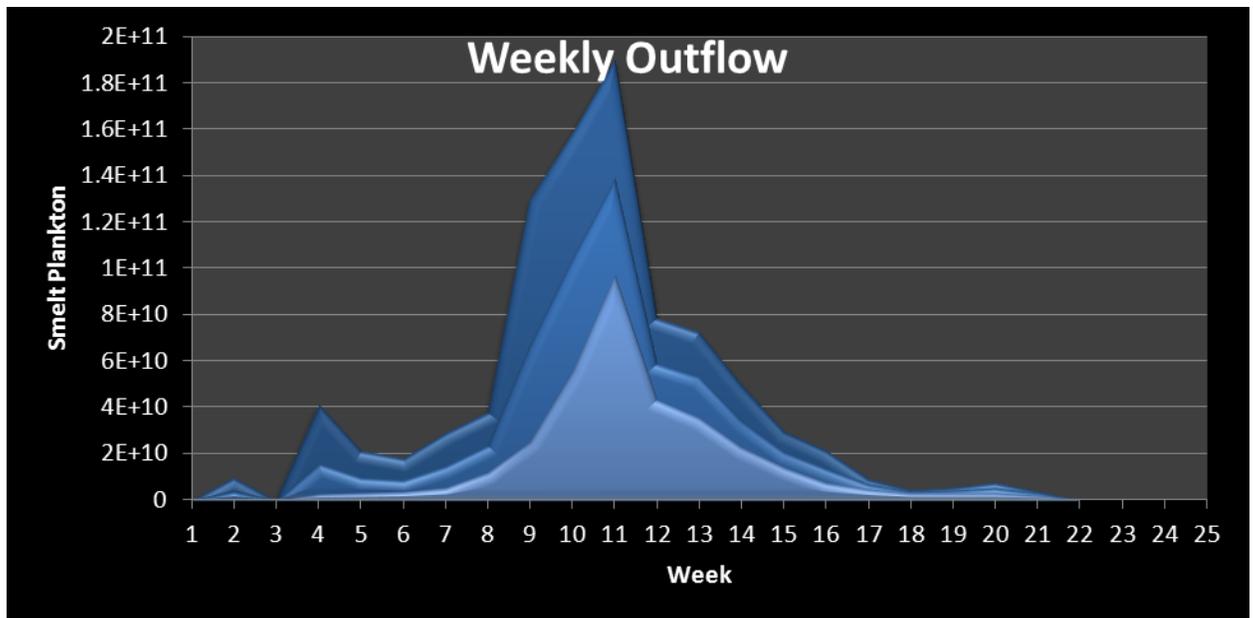


Figure 3: Weekly outflow (passive outmigration) of eulachon smelt plankton (eggs and larvae) into the Columbia River estuary, as measured at the Price Island/Clifton Channel index site, during 2011. Dark Blue represents upper (95%) confidence level, the medium blue represents the mean, and the light blue represents the lower (95%) confidence level estimate of smelt plankton.

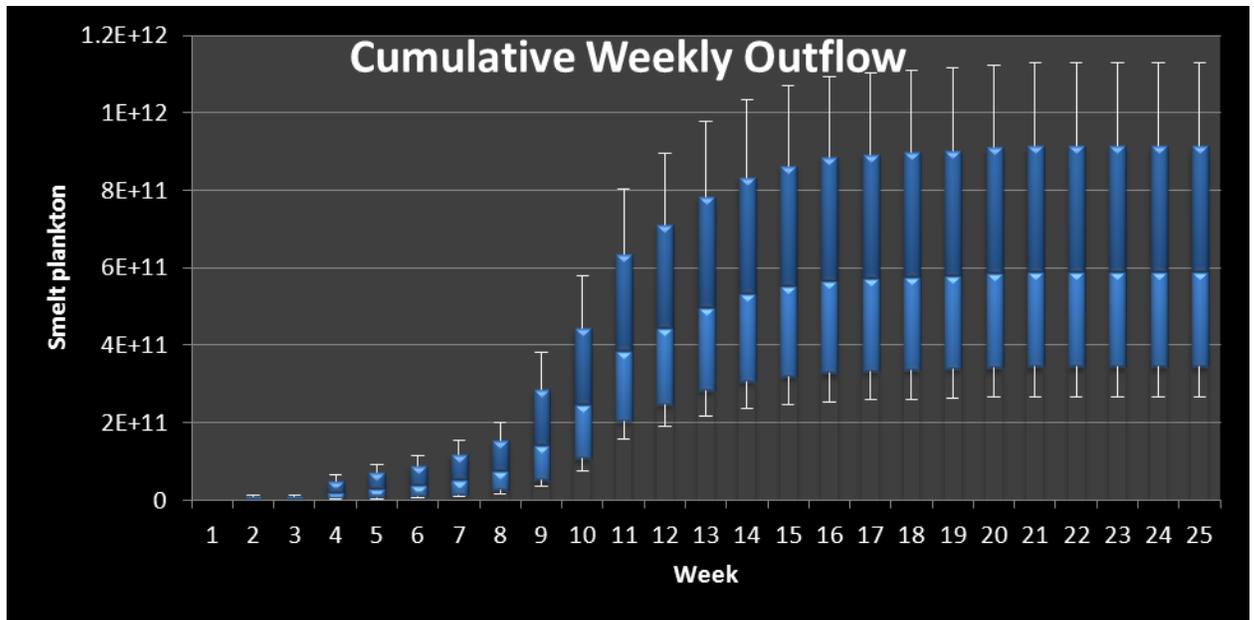


Figure 4: Cumulative weekly outflow (passive outmigration) of eulachon smelt plankton (eggs and larvae) into the Columbia River estuary, as measured at the Price Island/Clifton Channel index site, during 2011. Outer edges of the box represent the confidence interval, and the division within the box represents the mean estimate of cumulative smelt plankton outflow.

Season Two: January 1 –May 31, 2012

(Task is not scheduled for completion during this reporting period.)

4. *Complete sampling of adult smelt December 1, 2010- March 31, 2011, and December 1, 2011- March 31, 2011*

Season One: December 1, 2010 –March 31, 2011

The closure of eulachon fisheries prevented the sampling of adults from commercial and/or recreational landings.

On several occasion WDFW staff assisted the Cowlitz Tribe in efforts to collect returning adults in the Cowlitz River using dip nets. Only about 600 individuals were encountered. The majority were evaluated for sex and then released. Of these, 17 were identified as females. About 9 males and 9 females were retained by the Cowlitz Tribe and transported to the Abernathy Laboratory to be spawned for an egg and larval development study. WDFW took the opportunity to retain 135 individuals for further analysis, including 8 females. Of the 600 smelt encountered, only about 3% were females.

Though we were successful in collecting adult eulachon using dip nets, we deemed it impractical to continue dip net sampling due to the limited spatial and

temporal scope accessible to staff using this method, and the low numbers of females encountered. Pursuit of this task will remain suspended unless alternative means to acquire adult eulachon and funding to do so are identified.

Season Two: December 1, 2011 –March 31, 2012

(Pursuit of this task has remained suspended. See Task A4.)

5. *Complete fecundity, sex, and age determinations on adult samples by July 31, during 2011 and 2012*

Season One: December 1, 2010 –March 31, 2011

Of roughly 600 adult eulachon collected in cooperation with the Cowlitz Tribe, 135 individuals were retained by WDFW staff to measure length weight and estimate fecundity. Of these, only 8 were females. Determination of the fecundity, age, and sex was made.

Season Two: December 1, 2011 –March 31, 2012

Assessments during 2012 are contingent with the availability of adult eulachon samples (see task A4).

6. *Compile environmental correlates by August 15, during 2011 and 2012*

Season One: December 1, 2010 –May 31, 2011

Measures of the Southern Oscillation Index (SOI), and Pacific Decadal Oscillation (PDO) were compiled as indices of general climate patterns that have been identified as potentially impacting forage fish abundance.

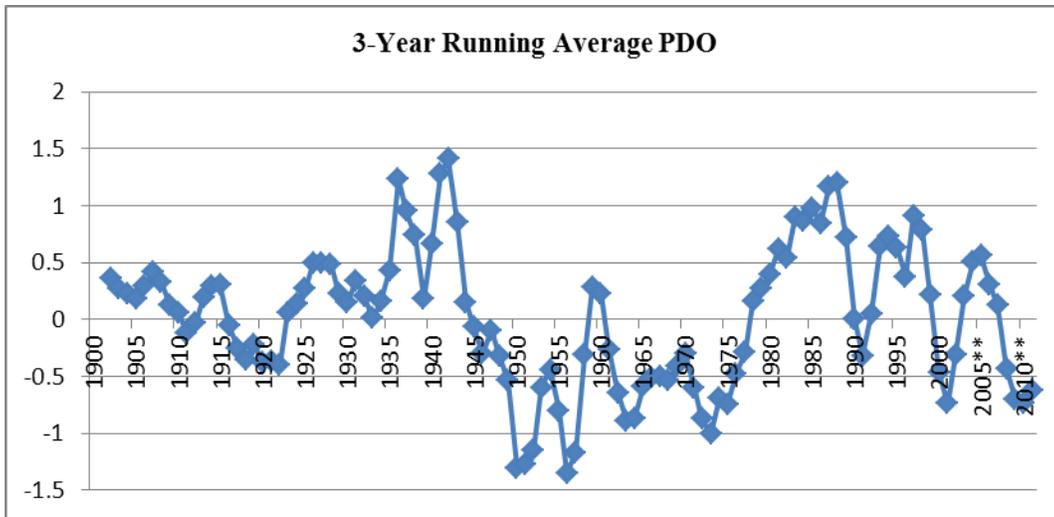


Figure 5: Three-year running average of the Pacific Decadal Oscillation (PDO) index of ocean conditions.

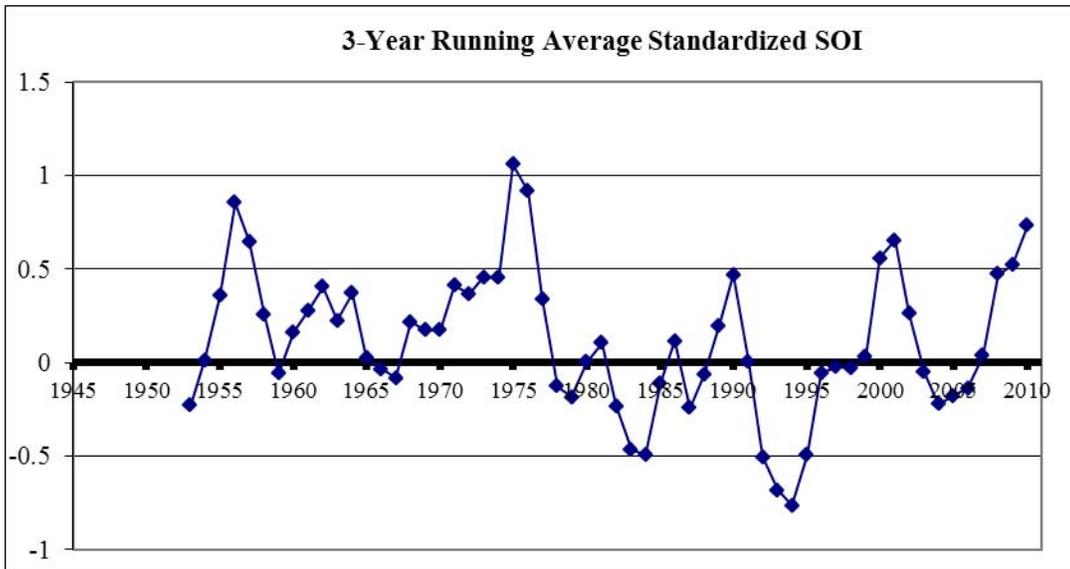


Figure 6: Three-year running average of the Southern Oscillation Index (SOI) of ocean conditions.

Season Two: December 1, 2011 –May 31, 2012

(Task is not scheduled for completion during this reporting period.)

7. *Complete calculation of Spawning Stock Biomass calculations by August 31, during 2011 and 2012*

Season One: January 1 –May 31, 2011

Calculations of the spawning stock biomass for the Columbia River have been completed. However, limited data on fecundity and sex ratio may limit the value of the estimate.

Season Two: January 1 –May 31, 2012

(Task is not scheduled for completion during this reporting period.)

8. *Complete retrospective analysis and report on performance of indicators relative to SSB by September 30, 2012*

(Task is not scheduled for completion during this reporting period.)

B) Freshwater Distribution Objective.

1. *Complete plankton tows and spawning substrate sampling at Columbia River and tributary stations January 1- May 31, 2011-2013*

Season One: January 1 –May 31, 2011

(See previous progress report for time period 1 January through 30 June 2011.)

Season Two: January 1 –May 31, 2012

Although this task is not scheduled for completion during this reporting period, reports of adult eulachon activities in the lower Columbia River compelled us to begin sampling in November. We began collection activities in the mainstem Columbia River November 21, 2011, and completed 54 vertical plankton tows and 31 spawning substrate sets through the end of this reporting period (December 31, 2011). Collection activity began near the town of Cathlamet Washington and proceeded upstream to the area below Bonneville Dam (Figure 2). We plan to continue mainstem sampling weekly through June 2012.

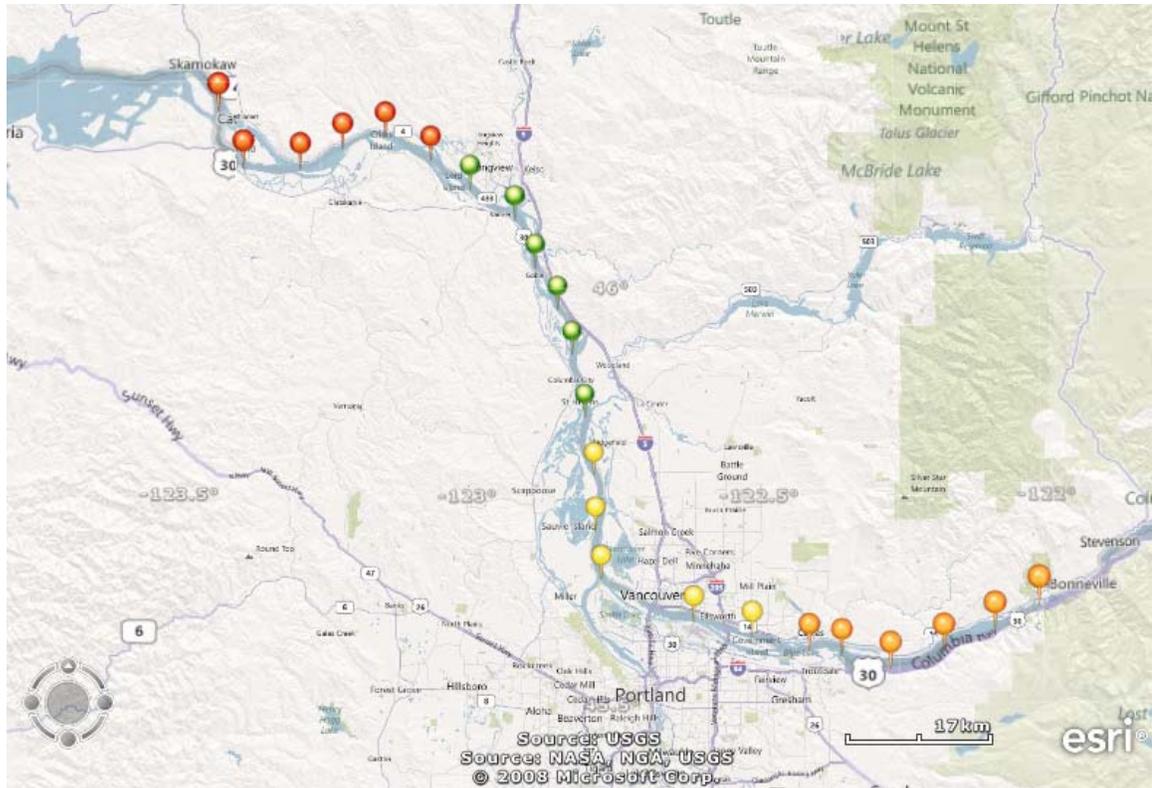


Figure 2: Overview of sampling locations used to set artificial substrate mats and vertical plankton tows in the mainstem Columbia River. November sampling occurred in areas with red pin marks. Subsequent weeks sampling proceeded in an upstream direction. Upcoming sampling activities (January 1–June 30, 2012) will be conducted primarily in the areas demarked with green, yellow and orange pins.

2. *Complete plankton tows and spawning substrate sampling from coastal streams outside the Columbia Basin January 1- June 30, 2011-2013*

Season One: January 1 –May 31, 2011

(See previous progress report for time period 1 January through 30 June 2011.)

No additional effort was scheduled or expended during this reporting period (July 1–December 31, 2011). Reductions in the funding profile will reduce the scope of our effort in coastal streams to opportunistic events that may occur January–June 2012.

Season Two: January 1 –May 31, 2012

(This task is not scheduled for completion during this reporting period.)

3. *Complete surveys of Sandy and Cowlitz River for extent of spawning activity January 1-May 31, 2011-2013*

Season One: January 1 –May 31, 2011

(See previous progress report for time period 1 January through 30 June 2011.)

No additional effort was scheduled or expended during this reporting period (July 1–December 31, 2011). Reductions in the funding profile will reduce the scope of our effort in tributary streams to opportunistic events that may occur January–June 2012.

Season Two: January 1 –May 31, 2012

(Task is not scheduled for completion during this reporting period.)

C) Marine Life-stage Objective.

1. *Complete experiments on gear-related bycatch reduction*

a. *Pilot phase: August 1-October 31, 2010*

(See previous progress report for time period 1 July through 31 December 2010.)

b. *Season 1: April 1-October 31, 2011*

(See previous progress report for time period 1 January through 30 June 2011.)

A multi-day shrimp charter cruise was completed in early August 2011 to gather underwater video observations of eulachon interacting with deflecting grids designed to guide them up and out of shrimp trawls (also called bycatch reduction devices or BRDs). Video data was obtained from 16 hauls and has been fully analyzed to evaluate the behavior and condition of eulachon and other species. A draft manuscript has been prepared summarizing this work entitled “Evaluating the behavioral impairment of escaping fish can help measure the effectiveness of bycatch reduction devices”. The abstract of the manuscript is as follows:

The behavior of roundfish excluded from an ocean shrimp (*Pandalus jordani*) trawl with a deflecting grid was studied using underwater video. The main study objective was to evaluate the condition of escaping eulachon (*Thaleichthys pacificus*); a species considered “threatened” under the United States Endangered Species Act. Observed behaviors were quantified in relation to a proposed model of an ideal trawl

escapement based on an actively swimming fish avoiding contact with the grid. This model of avoidance-based escapement assumed that a roundfish in excellent condition would, 1) maintain distance from the grid, 2) avoid physical contact with the grid, 3) maintain a forward swimming orientation, and 4) maintain an upright vertical orientation. Of the species and size classes of fish encountered, large eulachon (approximately 170-240 mm total length) came closest to the proposed model of avoidance-based escapement, indicating less behavioral impairment than other species. Small eulachon (<150 mm) were not frequently encountered. Almost 80% of the large eulachon maintained an upright vertical orientation throughout their escape and exited the trawl in a forward-swimming orientation. Large eulachon maintained distance from the deflecting grid better than the other species encountered ($P < 0.001$) and typically showed no contact or only minimal contact with it (63%). Only about 20-30% of the large eulachon showed behaviors indicating fatigue, such as laying on or sliding along the grid. In contrast, both adult and juvenile Pacific hake (*Merluccius productus*) frequently showed signs of fatigue, including sliding along or laying on the grid, exiting the trawl in physical contact with the grid or failing to maintain an upright vertical orientation throughout their escape. Lingcod (*Ophiodon elongatus*) and juvenile rockfish (*Sebastes*) were intermediate in their escape behavior between Pacific hake and large eulachon. They more frequently maintained an upright vertical orientation throughout their escape than Pacific hake, but also showed signs of fatigue, such as sliding along the grid or exiting the trawl in physical contact with it.

Peer-reviews of this manuscript are expected to be received within the next 1-2 months. With the collection and analysis of video data now completed, and considering reductions in scope of work in response to budget reductions, no further activity is anticipated under the bycatch reduction segment of this study.

c. *Season 2: April 1- October 31, 2012*

Due to budget reductions this task has been removed from the scope of work, and is no longer planned.

2. *Complete observation of Washington ocean shrimp trawl fisheries*

a. *Pilot phase: August 1-October 31, 2010*

(See previous progress reports for time periods 1 July through 31 December 2010 and 1 January through 30 June 2011, respectively.)

b. Season 1: April 1-October 31, 2011

Four observers were hired and trained during March 2011 in advance of the commercial shrimp trawl fishery which opened April 1, 2011. Coverage of the fishery was approximately 24% at the tow level, or about 827 observed tows out of an estimated 3457 for the season. A trip is typically four or five days in duration including run time to and from the fishing grounds. Shorter trips have occurred when fishing is especially productive. Fleet activity has been regulated somewhat by processors limiting the number of landings a vessel can make. This is intended to limit the amount of product flow through the processing facility.

The trawl fleet is comprised of vessels operating from the ports of Westport and Ilwaco. On occasion, an observer will board a vessel departing from Warrenton, Oregon if the vessel intends to land in Washington. Vessels selected for observer coverage include those intending to land in Washington. Regulations require skippers to report anticipated departures to the project lead. Vessels licensed by both Oregon and Washington have been observed. Observed trips have ranged from Cape Blanco, Oregon to La Push, Washington but have been primarily off of the coast of Washington.

Data collected include skipper logbooks, observer logbooks, trip information, catch composition, and biological information. Skipper logbooks are mandatory for all trips. Observers sample bycatch for each tow. Tow, date, location, duration, and depth are recorded. For most tows, bycatch is separated completely to category or species level and weighed. Sub-sampling procedures are followed when the quantity of bycatch makes complete sampling impractical, e.g. large numbers of juvenile hake. Eulachon are given priority for sampling. A maximum of 50 individual eulachon are sampled per trip for lengths. Approximately 750 eulachon genetic samples have been collected and preserved for later analysis. At sea, rockfish (most are juveniles due to exclusion of adults by excluders or BRDs) are sorted and weighed as a category when species identification is not certain. However, efforts to identify to the species level have been undertaken.

c. Season 2: April 1- October 31, 2012

(Task is not scheduled for completion during this reporting period.)

3. *Complete processing of the observation data from the Washington ocean shrimp trawl fisheries by December 31, 2010-2012*

Processing of the data from the 2011 season is still underway as of December 31, 2011. Observer data has been entered in MS Access and is currently undergoing QA/QC procedures. Skipper data (logbooks) is nearly entered and will be checked and transferred into ArcGIS

4. *Complete processing of the data from the gear experiments by December 31, 2010-2012*

See C) 1.b. and 1.c. above

5. *Complete outreach education for the ocean shrimp trawl fishers*

a. *Project Launch: July 31, 2010*

(See previous progress report for time period 1 January through 30 June 2011.)

b. *Pilot Phase Review: February 28, 2011*

(See previous progress report for time period 1 January through 30 June 2011).

c. *Season Review: February 29, 2012*

(Task is not scheduled for completion during this reporting period.)

d. *Project Completion: December 31, 2013*

(Task is not scheduled for completion during this reporting period.)

D) Genetic Analysis Objective.

1. *Complete collection of genetic samples in conjunction with activities under objectives 1-3*

(See previous progress report for time period 1 January through 30 June 2011.)

2. *Complete laboratory work (genetic sample processing) by June 30, 2011-2013*

Beyond preservation of genetic samples, genetic analysis has been curtailed due to cuts to the project budget. The WDFW Molecular Lab acquired funding from a Section 6 grant from NOAA and Washington State General Funds to standardize their laboratory to the Canadian Department of Fish and Oceans' Lab. WDFW Molecular lab obtained 96 Eulachon DNA samples from DFO and genotyped the samples at 14 microsatellite loci. Allele bins were named according to DFO nomenclature such that genotypes developed by WDFW could be compared with original genotypes from DFO for the same individuals. We used this comparison to confirm that allele calls matched between WDFW and DFO. There were 13 differences between genotypes (out of 1392 total) where one agency scored a heterozygote (two different sized alleles) and the other agency scored a homozygote (two same sized alleles). In these cases, one allele was missed in a heterozygote such that it appeared to be a homozygote. This scoring issue is known as "large-allele drop-out" where the larger-sized allele amplifies poorly or not at all, and is missed during scoring. However, these differences constituted less than 1% of the data set. Five Eulachon loci were hyper-variable and had between 50 and 100 alleles per locus. Because the standardization data set included 23% to 73% of the alleles at any single locus, mostly from the center of the allele size distribution, a second round of standardization may be necessary to include alleles that were absent from this data set. This will ensure that allele nomenclature remains standardized throughout allele size ranges.

3. *Complete all genetic analyses by September 30, 2013.*

Genetic analyses will only be pursued if sufficient funds are made available during FFY 2013. The priority will be on getting genetic analysis completed for the shrimp trawl eulachon bycatch, with other sub-objectives taking on a lower priority.

E) Reporting.

1. *Complete annual progress reports for each objective by June 30, 2011-2013*
2. *Complete comprehensive report of three year study by December 31, 2013*
3. *Document and distribute datasets from the study by December 31, 2013*
4. *Complete submission of articles to peer reviewed journals by December 31, 2013*

There were no articles or presentations made to peer groups during 2011.

Expenditures:

ODFW, July 1 – December 31, 2011:	\$ 18,599
ODFW Subcontract to WDFW:	
July 1, 2010 – June 30, 2011 (revised total)	\$ 262,333
July 1, 2011 – December 31, 2011	\$ 73,739
Subtotal July 1 – December 31, 2011:	\$ 92,338