NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

Species Recovery Grants to States (Section 6 Program)

Pursuant to NOAA Award No. **NA14NMF4720011**

Studies of Eulachon in Oregon and Washington

Report Period: **January 1 – June 30, 2017**

Submitted by: **Christine Mallette, Editor**
Ocean Salmon and Columbia River Program
4034 Fairview Industrial Dr. SE
Salem, Oregon 97302
(503) 947-6213
christine.mallette@state.or.us

July 2017

Studies of Eulachon in Oregon and Washington

Semi-Annual Performance Progress Report
January 1 to June 30, 2017

ODFW COST CODE: 55000 420009-02

Personnel

Both permanent and seasonal personnel worked on these tasks.

Charles M. Barr, Project Leader**,** Ocean Salmon and Columbia River Program, 17330 SE Evelyn Street, Clackamas, OR 97015, (971) 673-6081, C.Mac.Barr@state.or.us;

Eric S. Anderson, Project Assistant**,** Ocean Salmon and Columbia River Program, 17330 SE Evelyn Street, Clackamas, OR 97015, Eric.S.Anderson@state.or.us;

Project Accomplishments by Objective

A) Stock Assessment Objective

1. *Complete larval sampling in the Columbia River and Oregon and Washington coastal rivers December 1- May 31.*

   Season One: December 1, 2014 – May 31, 2015

   (See previous progress report for time period 1 January through 30 June, 2015)

   Season Two: December 1, 2015 – May 31, 2016

   (See previous progress report for time period 1 January through 30 June, 2016)

   Season Three: December 1, 2016 – May 31, 2017

   Staff from ODFW visited three Oregon coastal streams – Cummins, Tenmile and Big creeks – during the January through June reporting period to: (1) collect ichthyoplankton samples to quantify outflow of larval eulachon smelt (Big, Cummins, and Tenmile creeks) and (2) collect water quantity data to develop models relating discharge and water level (Big and Cummins creeks; see sub-objective 2). During this reporting period, staff from ODFW visited Big, Cummins and Tenmile creeks on 28 different occasions, collecting 45 ichthyoplankton samples from Big Creek, 44 ichthyoplankton samples from Cummings Creek, and 58 ichthyoplankton samples from Tenmile Creek (Table 1). In addition, 21 discharge samples were collected from both Big and Cummins creeks (Table 1). Water quantity information and ichthyoplankton samples were not collected during every sampling trip due to constraints related to site conditions (i.e., excessive flows). Throughout the first six reporting periods, field personnel collected a total of 484 ichthyoplankton samples from Big, Cummins, and Tenmile creeks and 143 water

quantity samples from Big and Cummins creeks (Table 1). As described previously (Mallette 2014b), typical conditions in Tenmile Creek (i.e., high water levels and velocity) preclude effective collection of information necessary to estimate instantaneous discharge and thus only larval outflow will be quantified in that stream.

Table 1. Distribution of sampling episodes and ichthyoplankton and stream discharge samples collected in Big, Cummins and Tenmile creeks, Jul. 2014–Jun. 2017.

Reporting Period	Water Body	Sampling Period	Sampling Trips	Ichthyoplankton Samples	Discharge Samples
Jul.–Dec., 2014	Big Cr.[a]	n/a	n/a	n/a	n/a
	Cummins Cr.	12/09/2014–12/30/2014	4	7	3
	Tenmile Cr.	12/09/2014–12/30/2014	3	7	n/a[b]
Jan.–Jun., 2015	Big Cr.	03/04/2015–05/05/2015	13	26	10
	Cummins Cr.	01/08/2015–05/05/2015	28	56	25
	Tenmile Cr.	01/08/2015–04/28/2015	27	53	n/a[b]
Jul.–Dec., 2015	Big Cr.	12/16/2015–12/31/2015	4	8	1
	Cummins Cr.	12/16/2015–12/31/2015	4	8	2
	Tenmile Cr.	12/17/2015–12/31/2015	4	8	n/a[b]
Jan.–Jun., 2016	Big Cr.	01/04/2016–04/29/2016	25	50	20
	Cummins Cr.	01/04/2016–04/29/2016	25	50	38
	Tenmile Cr.	01/04/2016–04/29/2016	25	48	n/a[b]
Jul.–Dec., 2016	Big Cr.	12/13/2016–12/31/2016	3	6	3
	Cummins Cr.	12/22/2016–12/31/2016	2	4	2
	Tenmile Cr.	12/13/2016–12/31/2016	3	6	n/a[b]
Jan.–Jun., 2017	Big Cr.	01/05/2017–04/28/2017	23	45	21
	Cummins Cr.	01/05/2017–04/28/2017	22	44	21
	Tenmile Cr.	01/05/2017–04/28/2017	28	58	n/a[b]
		Total	243	484	143

Notes: [a] sampling did not commence until March 4, 2015 due to delays in permitting (i.e., the permit was not received until 3/3/2015).

[b] Conditions (i.e., water level and velocity) precluded the installation of a water-level logger and the collection of data necessary to estimate instantaneous discharge. Thus, only larval outflow was/will be quantified.

2. Complete calculations of river discharge by July 31.

Season One: December 1, 2014 – May 31, 2015

(See previous progress report for time period 1 January through 30 June, 2015)

Season Two: December 1, 2015 – May 31, 2016

(See previous progress report for time period 1 January through 30 June, 2016)

Season Three: December 1, 2016 – May 31, 2017

In both Big and Cummins creeks, when environmental conditions allowed, water data characterizing velocity ($m \cdot sec^{-1}$) and depth measurements (m) were collected at regular intervals along a transect. These data, and measurements of stream width (i.e., transect width), were used to calculate instantaneous discharge ($m^3 \cdot s^{-1}$). Instantaneous discharge values estimated throughout the sampling period were then used in conjunction with water level measurements (m), recorded by water-level data loggers, to develop predictive models relating discharge and water level (Figures 1 and 2). Water-level data loggers were installed in Big and Cummins creeks on December 13, 2016 and December 22, 2016, respectively. A storm event that occurred on February 5, 2017 displaced a large log in Cummins Creek and knocked the water-level sensor and the attached post sideways (parallel to the stream bed) so that it was not functioning properly. Due to dangerously high flows, a replacement sensor was not installed until February 28, 2017. Because the water-level sensor at Cummins Creek has been continually hit by displaced logs during storm events, the sensor was moved approximately 200 meters upstream where it would be better protected from displaced logs. Data was successfully downloaded from water-level sensors at both sites on April 28, 2017.

Predictive models were then applied to water-level data recorded by water-level sensors to predict discharge during intervals when it was not quantified directly. To evaluate these relationships, an ordinary least-squares (OLS) model was fit to untransformed data collected from Cummins and Big creeks, separately. Assessment of the model assumptions indicated heteroscedastic and non-normal errors. In light of this, a second OLS model was fit after log transforming both response (discharge) and independent (water level) variables. Reassessment of the model assumptions indicated that the transformation effectively stabilized the variance and helped normalize residuals; thus, log-log formulations of the models were used for predictive purposes. Unfortunately, we were unable to fit a predictive model for Cummins Creek after the replacement water-level sensor was installed (2/28/2017—4/28/2017). Therefore, an OLS model was only fit for data from the original sensor (12/22/2016—2/2/2017; Figure 1). This may have been due to the location of the replacement water-level sensor. It may have been installed in a spot where the water level is not representative of the rest of the creek. Next year, we will attempt to find a new location where we can get accurate water level data and also have the sensor protected from displaced logs that could knock the sensor over during storm events.

As stated previously, the water body-specific discharge-water level relationships were applied to water-level data to predict discharge during intervals when it was not quantified directly. Because the models were developed based on log-transformed data, output was back-transformed by taking the anti-log of the predictions. To account for bias associated with back-transformation, a correction factor (MSE/2) was applied, as proposed by Baskerville (1972). Lastly, mean daily discharge predictions ($m^3 \cdot s^{-1}$) were converted to daily discharge values ($m^3 \cdot d^{-1}$; Figures 3 and 4).

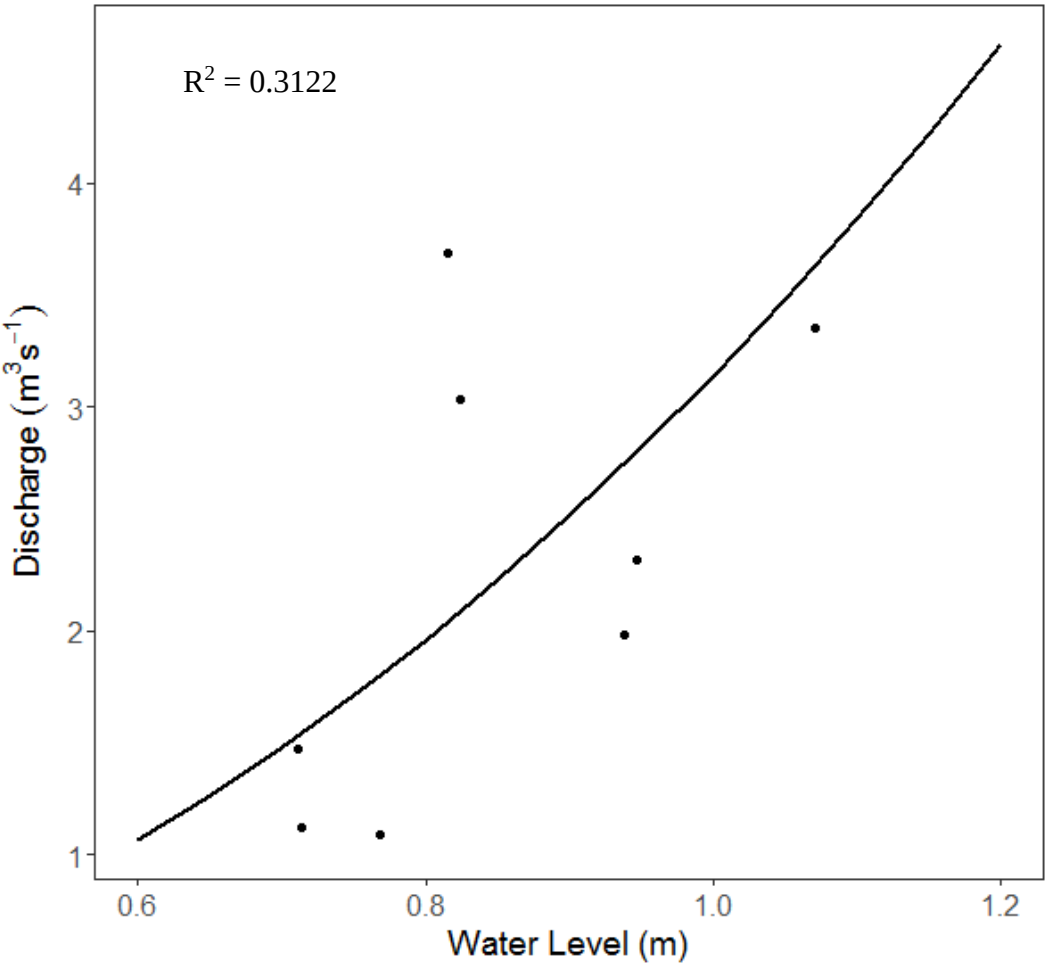

Figure 1. Relationship between water level and discharge in Cummins Creek. Data used in model development were collected from 12/22/2016 to 2/2/2017.

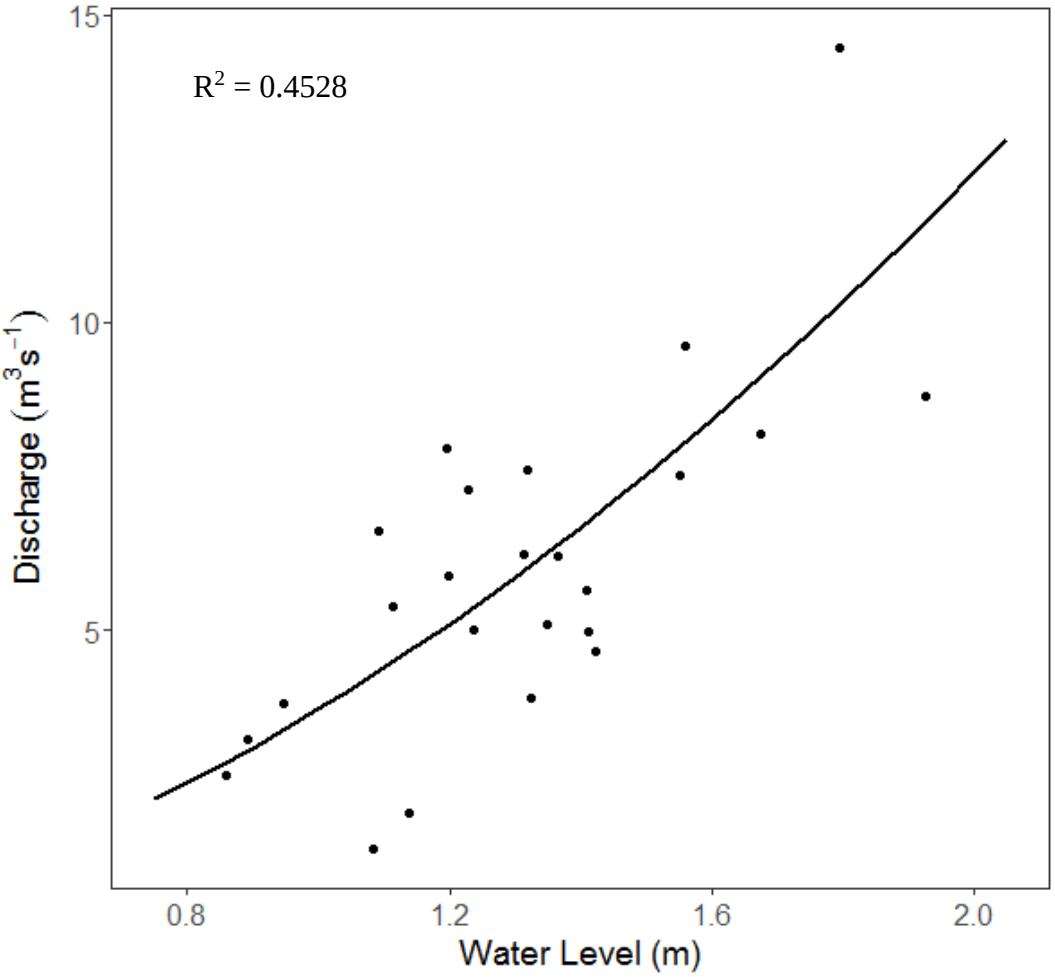

Figure 2. Relationship between water level and discharge in Big Creek. Data used in model development were collected from 12/13/2016 to 4/28/2017.

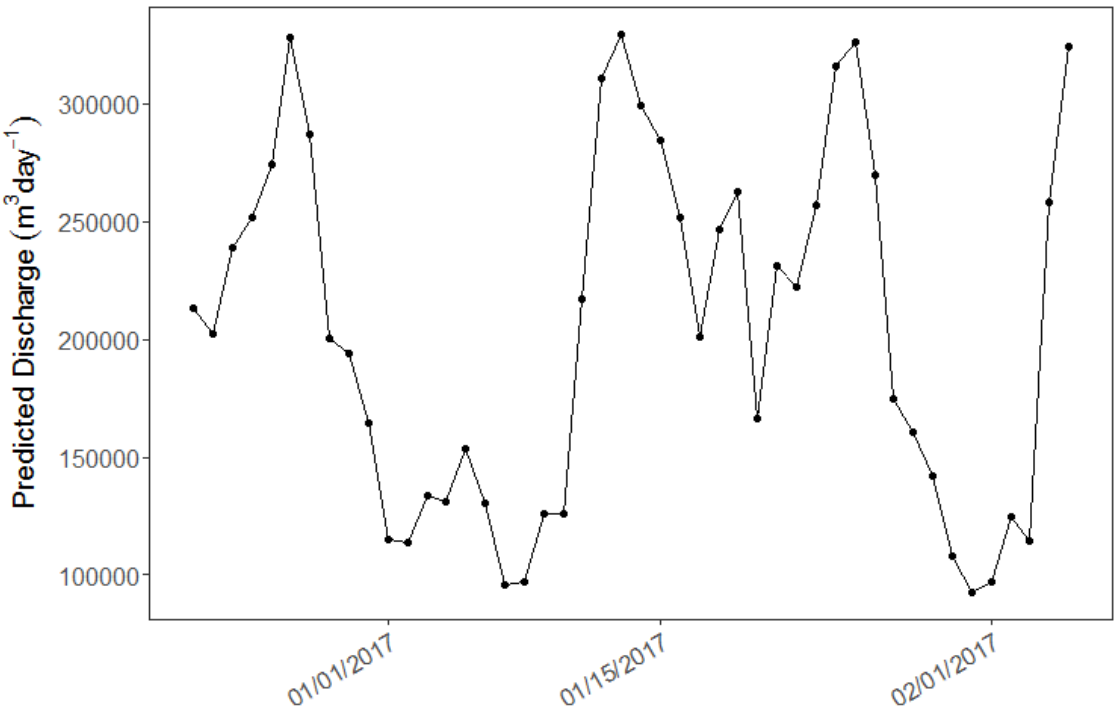

Figure 3. Predicted discharge in Cummins Creek

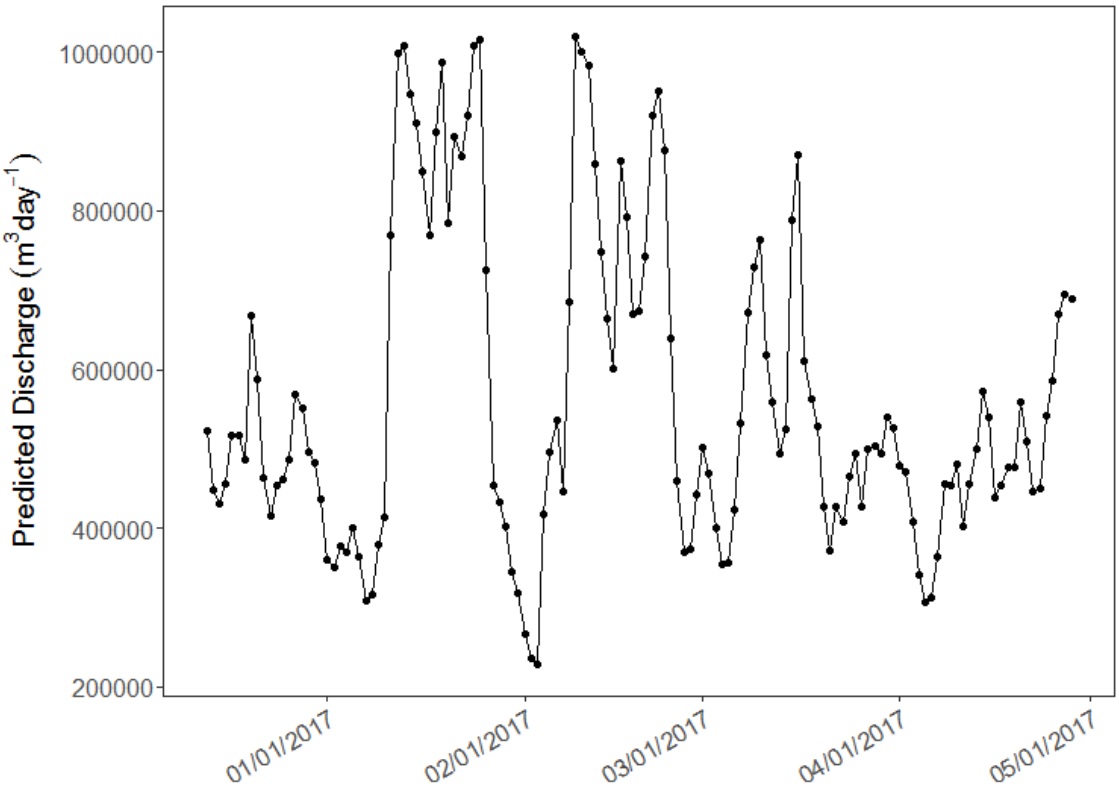

Figure 4. Predicted discharge in Big Creek.

3. *Complete laboratory work (larval densities in samples) by August 31.*

   Season One: December 1, 2014 – May 31, 2015

   (See previous progress report for time period 1 January through 30 June, 2015)

   Season Two: December 1, 2015 – May 31, 2016

   (See previous progress report for time period 1 January through 30 June, 2016)

   Season Three: December 1, 2016 – May 31, 2017

   From December 13, 2016 – April 28, 2017 (season three), staff from ODFW collected a total of 163 individual ichthyoplankton samples from Cummins, Tenmile and Big creeks (Table 1). Although ichthyoplankton were encountered in several samples collected during season three, none of the specimens were identified as eulachon.

   To support data management and analyses (e.g., linear model development, density estimation, etc.), staff from ODFW maintained and refined a database relating field and laboratory parameters.

4. *Complete calculation of Spawning Stock Biomass calculations by September 30.*

   Season One: December 1, 2014 – May 31, 2015

   (See previous progress report for time period 1 January through 30 June, 2015)

   Season Two: December 1, 2015 – May 31, 2016

   (See previous progress report for time period 1 January through 30 June, 2016)

   Season Three: December 1, 2016 – May 31, 2017

   We developed and implemented a sampling design that would allow collection of information necessary to estimate Spawning Stock Biomass (SSB) for Big and Cummins creeks (see above and Mallette 2014a). However, lack of encounters with eulachon larvae will preclude the estimation of SSB for the third season.

B) Genetic Analysis Objective.

1. *Complete collection of genetic samples in conjunction with activities under objective A by June 30.*

   Season One: December 1, 2014 – May 31, 2015

   (See previous progress report for time period 1 January through 30 June, 2015)

Season Two: December 1, 2015 – May 31, 2016

(See previous progress report for time period 1 January through 30 June, 2016)

Season Three: December 1, 2016 – May 31, 2017

Because no eulachon larvae were encountered during examination of samples from Cummins and Big creeks, samples will not be available for genetic analysis from season three.

2. *Complete all laboratory work (genetic sample processing) by August 31, 2017.*

   Eulachon larvae collected from Oregon coastal streams for genetic analysis will be transferred to the Washington Department of Fish and Wildlife's Molecular Genetics Laboratory to allow for subsequent genetic analysis. To date, ODFW has submitted nine individual Eulachon larvae for genetic analysis (Mallette 2015).

3. *Complete all genetic analyses by September 30, 2017.*

   Eulachon larvae collected from Oregon coastal streams for genetic analysis (see above) during season one of sampling were transferred to the Washington Department of Fish and Wildlife's Molecular Genetics Laboratory to allow for subsequent genetic analysis.

C) Outreach and Education Objective.

1. *Complete webpage development and populate webpages with information from previous studies by December 31, 2014.*

   (See previous progress report for time period 1 January through 30 June, 2015)

2. *Complete annual webpage update by October 31.*

   Year One: July 1, 2014 – June 30, 2015

   (See previous progress report for time period 1 January through 30 June, 2015)

   Year Two: July 1, 2015 – June 30, 2016

   (See previous progress report for time period 1 January through 30 June, 2016)

   Year Three: July 1, 2016 – June 30, 2017

   Progress reports for the July–December, 2015 (Storch and Mallette 2015b) reporting periods have been uploaded to the interim project webpage

(http://www.dfw.state.or.us/fish/OSCRP/CRI/publications.asp#Eulachon). Project staff and web developers at ODFW continue to work toward development of a stand-alone, eulachon-specific, webpage.

3. *Incorporate more eulachon information into the displays and activities at the City of Vancouver, WA/WDFW Annual Sturgeon Festival.*

   Year One: July 1, 2014 – June 30, 2015

   (See previous progress report for time period 1 July through 31 December, 2014)

   Year Two: July 1, 2015 – June 30, 2016

   (See previous progress report for time period 1 January through 30 June, 2016

   Year Three: July 1, 2016 – June 30, 2017

   ODFW staff participated in, and developed material for, the Vancouver, WA/WDFW Annual Sturgeon Festival held on September 17th 2016.

4. *Attend and present work at a regional meeting and a conference or workshop annually.*

   Year One: July 1, 2014 – June 30, 2015

   (See previous progress reports for time periods 1 July through 31 December, 2014 and 1 January through 30 June, 2015)

   Year Two: July 1, 2015 – June 30, 2016

   (See previous progress report for time period 1 July through 31 December, 2015 and 1 January through 30 June, 2016)

   Year Three: July 1, 2016 – June 30, 2017

   Staff from ODFW attended the annual meeting of the Oregon Chapter of the American Fisheries Society on February 28, 2017 and discussed informally with other researchers the details/preliminary findings from the current study.

5. *Present findings of previous work and preliminary year one work at the national meeting of the American Fisheries Society at Portland, OR in August 2015.*

   (See previous progress report for time period 1 July through 31 December, 2015)

D) Reporting.

1. *Complete semi-annual progress reports for each objective by June 30 and December 31.*

   Year One: July 1, 2014 – June 30, 2015

   (See previous progress reports for time periods 1 July through 31 December, 2014 and 1 January through 30 June, 2015)

   Year Two: July 1, 2015 – June 30, 2016

   (See previous progress reports for time periods 1 July through 31 December, 2015 and 1 January through 30 June, 2016)

   Year Three: July 1, 2016 – June 30, 2017

   This is the sixth progress report for the current grant prepared and submitted by the Oregon Department of Fish and Wildlife. The co-awardee (WDFW) will be filing separate progress reports as separate awards were granted to both agencies listed in the joint-state proposal.

2. *Complete comprehensive report of study by December 31, 2017.*

   (Work not scheduled to occur during this reporting period)

3. *Document and distribute datasets from the study by December 31, 2017.*

   (Work not scheduled to occur during this reporting period)

4. *Complete submission of articles to peer reviewed journals by December 31, 2017.*

   No articles were submitted during this reporting period.

Expenditures (Estimated; ODFW only, excludes expenditures by co-awardee):

Total expenditures January 1 – June 30, 2017**:** **$ 25,800**

References

Baskerville, G. L. 1972. Use of logarithmic regression in the estimation of plant biomass. Can. J. For. Res. 2:49-53.

Mallette, C. 2014a. Studies of eulachon smelt in Oregon and Washington. Project completion report by the Oregon Department of Fish and Wildlife and the Washington Department of Fish and Wildlife. Submitted to the National Oceanic and Atmospheric Administration.

Mallette, C. 2014b. Studies of eulachon smelt in Oregon and Washington. Report of progress for 1 July 2014 through 31 December 2014 by the Oregon Department of Fish and Wildlife and the Washington Department of Fish and Wildlife submitted to the National Oceanic and Atmospheric Administration (http://www.dfw.state.or.us/fish/OSCRP/CRI/docs/section_6_eulachon_interim_report_jul_dec_2014.pdf).

Mallette, C. 2015. Studies of eulachon smelt in Oregon and Washington. Report of progress for 1 January 2015 through 30 June 2015 by the Oregon Department of Fish and Wildlife and the Washington Department of Fish and Wildlife submitted to the National Oceanic and Atmospheric Administration (http://www.dfw.state.or.us/fish/OSCRP/CRI/docs/section_6_eulachon_interim_report_jan_jun_2015.pdf).

Storch, A.J. and C. Mallette 2015b. Studies of eulachon smelt in Oregon and Washington. Report of progress for 1 July 2015 through 31 December 2015 by the Oregon Department of Fish and Wildlife and the Washington Department of Fish and Wildlife submitted to the National Oceanic and Atmospheric Administration (http://www.dfw.state.or.us/fish/OSCRP/CRI/docs/section_6_eulachon_interim_report_jul_dec_2015.pdf).

This report has been prepared by: **Charles M. Barr**
Predation Studies Project Leader
Phone: 971-673-6081
E-mail: C.Mac.Barr @state.or.us