Project Goals

My research is addressing the following questions:

1. Can I identify elements of the system that could result in the prodigious jack returns seen from the 2008 & 2010 out-migrating cohorts?
2. What kinds of impacts could the large numbers of hatchery-raised salmon have on the wild-reared salmon population, if any (especially in years of poor ocean conditions)?
3. What can these models tell us about the size of differences between apparent and actual growth? Can model-fitting techniques be used to reliably improve estimates of actual growth, given a measure of apparent growth and a system including size-selective mortality?
4. Using the general theory of size-mediated survival, how well can a simple model involving the initial size of a cohort of fish and a simple broad environmental covariate (e.g. PDO) model the Smolt-to-Adult survival in the system?

Update Narrative

A significant chunk of the past year was devoted to dealing with some health concerns of mine. I struggled to continue working during these months, but my productivity was poor.

Since returning I have put significant effort into the generation of a detailed plan for the three research papers I will work on with the tools I've developed. Each paper is a bit more ambitious and expansive than the previous one.

The first will investigate the difference in survival of out-migrating wild versus hatchery smolts from the mouth of the Columbia River (CR) until they exit the CR plume near Willapa Bay. On average, this takes about 7 days. The short time span will mean that there will be little growth, and more attention can be paid to initially measured sizes, food intake, metabolism, and predation rate. I am currently gathering supplemental data and adding code to support this analysis (Welch et al. 2011, Weitkamp et al. 2012, Miller et al. 2013, Brosnan et al. 2014, Burke et al. 2014, Claiborne et al. 2014). This data will be used to calibrate the model and establish bounds for the parameter space.

The second will emphasize the growth component of the model, by examining survival from the CR to approximately the US-Canada border. This transit time averages around 22 days. This greater span of days will allow me to examine the impact of ocean conditions affecting growth on survival. Specifically, this study seeks to address the observed pattern of sampled/returning fish size. In years with poor ocean conditions, fewer fish are observed, but they are larger than in years with favorable ocean conditions. This will use a more sophisticated growth model, incorporating the idea that greater numbers of fish in poor years are out-competed for food by their larger peers. Larger fish will gain an advantage. The supplemental data from the first part will be useful for this part as well, to calibrate the model and restrict the parameter space to one reflective of the data.

The third will bring it all home. The model will run over the full life-cycle, from out-migration, over the course of a typical stay in the ocean, and finally returning to the CR. It will also host two simultaneous populations. These populations will differ in their parameter values, but will jointly compete for food. This may be useful for understanding possible interactions between fish from different ESUs or even between wild and hatchery fish.

I am currently making exploratory runs with my software to get the bugs out and improve automation. Once the parameter space is established it will be straightforward to fit parameters to appropriate values or simply to explore that parameter space.

My plan is to finish my degree during winter quarter 2017. I'll be using one final quarter of Sea Grant funding, followed by a combination of self-funding and going on-leave as appropriate.

Brosnan, I., D. Welch, E. Rechisky, and A. Porter. 2014. Evaluating the influence of environmental factors on yearling Chinook salmon survival in the Columbia River plume (USA). Marine Ecology Progress Series **496**:181-196.

Burke, B. J., J. J. Anderson, and A. M. Baptista. 2014. Evidence for multiple navigational sensory capabilities of Chinook salmon. Aquatic Biology **20**:77-90.

Claiborne, A., J. Miller, L. Weitkamp, D. Teel, and R. Emmett. 2014. Evidence for selective mortality in marine environments: the role of fish migration size, timing, and production type. Marine Ecology Progress Series **515**:187-202.

Miller, J. A., D. J. Teel, A. Baptista, and C. A. Morgan. 2013. Disentangling bottom-up and top-down effects on survival during early ocean residence in a population of Chinook salmon (Oncorhynchus tshawytscha). Canadian Journal of Fisheries and Aquatic Sciences **70**:617-629.

Weitkamp, L. A., P. J. Bentley, and M. N. Litz. 2012. Seasonal and interannual variation in juvenile salmonids and associated fish assemblage in open waters of the lower Columbia River estuary. Fishery Bulletin **110**:426-450.

Welch, D. W., M. C. Melnychuk, J. C. Payne, E. L. Rechisky, A. D. Porter, G. D. Jackson, B. R. Ward, S. P. Vincent, C. C. Wood, and J. Semmens. 2011. In situ measurement of coastal ocean movements and survival of juvenile Pacific salmon. Proceedings of the National Academy of Sciences of the United States of America **108**:8708-8713.

REPORT
E/I-19
03/01/2015 - 02/29/2016
Submitted On: 03/25/2016 12:38:23 AM

METRICS & MEASURES

Acres of coastal habitat

Metric/Measure	Value	Note
Acres of coastal habitat	0	

Fishermen and seafood industry personnel

Metric/Measure	Value	Note
Fishermen and seafood industry personnel	0	

Communities - economic and environmental development

Metric/Measure	Value	Note
Communities - economic and environmental development	0	

Stakeholders - sustainable approaches

Metric/Measure	Value	Note
Stakeholders - sustainable approaches	0	

Informal education programs

Metric/Measure	Value	Note
Informal education programs	0	

Stakeholders who receive information

Metric/Measure	Value	Note
Stakeholders who receive information	0	

Volunteer hours

Metric/Measure	Value	Note
Volunteer hours	0	

P-12 students reached

Metric/Measure	Value	Note
P-12 students reached	0	

P-12 educators

Metric/Measure	Value	Note
P-12 educators	0	

REQUESTED INFORMATION

Publications

No **Publications** information reported

Students Supported

No **Students Supported** information reported

Narratives

Progress Report
Uploaded File: 2016_Report_(NA12OAR4170069).pdf

Partners This Period

No **Partners This Period** information reported

STANDARD QUESTIONS

Economic Impacts

No **Economic Impacts** information reported

Tools, Technologies, Information Services / Sea Grant Products

(1)

Description	Chinook outgoing & return PIT-tag database from 1998-2015. Data originated in PTAGIS and has been crafted into details of outmigration time (as juveniles) & return time (as adults). Length and weight

	measures are integrated when they exist.
Developed (in the reporting period)?	Yes
Used (in the reporting period)?	Yes
Used for EBM?	No
ELWD product?	No
Number of managers	0
Description/Names of managers	

(2)

Description	Tool for broadly testing feasible regions of the parameter space for the PDE model used. Also estimates parameters using best match to returning size distribution. Aspects of this may prove useful to managers in the future.
Developed (in the reporting period)?	Yes
Used (in the reporting period)?	Yes
Used for EBM?	No
ELWD product?	No
Number of managers	0
Description/Names of managers	

Community Hazard Resilience

No **Community Hazard Resilience** information reported

Meetings, Workshops, Presentations

No **Meetings, Workshops, Presentations** information reported

Leveraged Funds

(1)

Purpose	Expand and publish research from Passolt 2012. Further develop and test model using new software.
Source	Bonneville Power Adminstration
Amount	20500
Start Date	09-20-2015
End Date	12-18-2015

Impacts and Accomlishments

No **Impacts and Accomlishments** information reported