ATTACHMENT C ***EVOSTC Annual Project Report Form***

Form Rev. 10.3.14

*Please refer to the Reporting Policy for all reporting due dates and requirements.

1. Program Number: *See*, Reporting Policy at III (C) (1).

15120111-L

2. Project Title: *See*, Reporting Policy at III (C) (2).

PWS Herring Research and Monitoring Program – Juvenile Herring Condition Monitoring

3. Principal Investigator(s) Names: *See*, Reporting Policy at III (C) (3).

Kristen Gorman (PWSSC); Ron Heintz, Fletcher Sewall (NOAA/Auke Bay Labs)

4. Time Period Covered by the Report: *See*, Reporting Policy at III (C) (4).

1 February 2015 to 31 January 2016

5. Date of Report: *See*, Reporting Policy at III (C) (5).

February 2016

6. Project Website (if applicable): *See*, Reporting Policy at III (C) (6).

Http://pwssc.org/research/fish/pacific-herring/

7. Summary of Work Performed: *See*, Reporting Policy at III (C) (7).

Project Summary - Overview

The juvenile herring condition monitoring (HCM) project is a collaborative effort between the Prince William Sound Science Center (PWSSC) and the Auke Bay Laboratory (ABL). This is the fourth year of sampling within EVOSTC's Herring Research and Monitoring (HRM) program although the work is an extension of similar efforts of the Prince William Sound (PWS) Herring Survey program. The core of this project involves the collection of age-0 Pacific herring (*Clupea pallasii*, hereafter juvenile herring) at two time periods during winter, November and March, to assess energetic strategies that might influence over-winter survival throughout PWS. Specific objectives of the HCM project follow:

Objective 1. Monitor juvenile herring condition by sampling in November.

Objective 2. Monitor juvenile herring condition by sampling in March.

Objective 3. Apply resultant observations from Objectives 1 and 2 to continue refining an overwintering mortality model with the addition of physiological indicators.

Objective 4. Monitor seasonal changes in juvenile herring diets (November vs. March) and examine relationship between diet and herring condition (objective not specifically defined in earlier proposals).

Project Summary – Samples Collected 2015 for both PWSSC and ABL

During 2015, juvenile herring were successfully collected during the core sampling events in March and November 2015 (Fig. 1). In addition, juvenile herring were collected monthly between February and July for disease and condition monitoring in Cordova Harbor (Fig. 1) in collaboration with Dr. Paul Hershberger's work as part of the HRM.

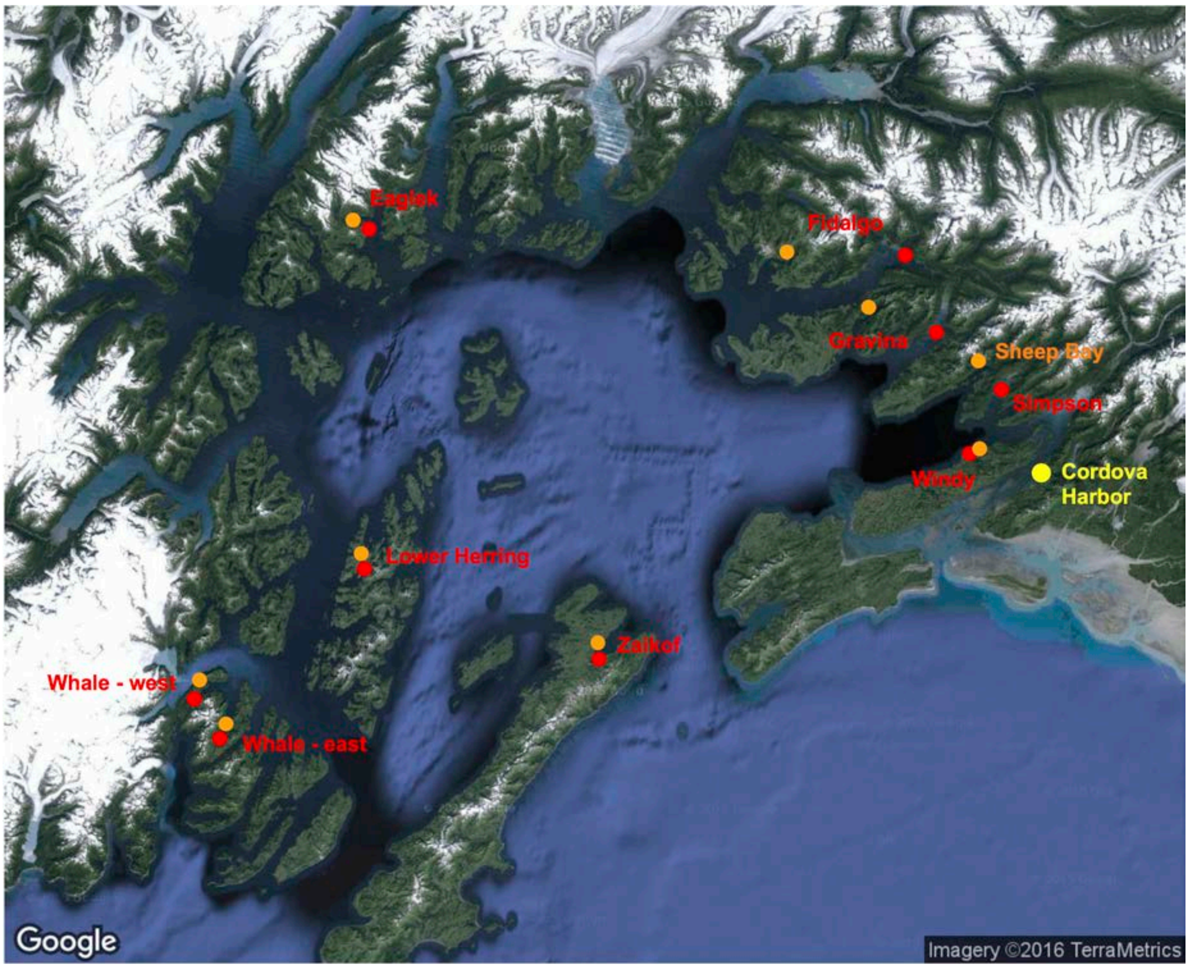

Figure 1. Sampling locations for juvenile herring condition monitoring throughout Prince William Sound during 2015. Locations sampled by Cordova fisherman in March 2015 are noted in orange, areas sampled by PWSSC staff in November 2015 are noted in red. Monthly disease sampling occurred February – July in Cordova Harbor, noted in yellow.

March sampling was conducted in collaboration with members of Cordova Fisherman United (CDFU) who used cast and gill nets to collect juvenile herring from several study sites located throughout PWS (Fig. 1, orange points). These data compare with similar data collected in November 2014 (not shown in Fig. 1) to assess over-winter changes in energy content of fish. The following samples were collected in the field during March 2015 for energetics analysis at PWSSC and ABL:

Date	*Location*	*Sample Size (n)*	*Collector*
3/21-22/2015	Whale Bay-West	129	Victor Jones, F/V Chelsea Dawn
3/22-23/2015	Whale Bay-East	162	Victor Jones, F/V Chelsea Dawn
3/23-24/2015	Zaikof Bay	140	Victor Jones, F/V Chelsea Dawn
3/19-20/2015	Lower Herring Bay	155	Kory Blake, F/V Crystal Falls
3/20-21/2015	Eaglek	9	Kory Blake, F/V Crystal Falls
3/21/2015	Windy Bay	65	Kory Blake, F/V Crystal Falls
3/20/2015	Fidalgo	150	Carl Burton, F/V Mandy La Nae
3/21/2015	Gravina	0	Carl Burton, F/V Mandy La Nae
3/22/2015	Sheep Bay	0	Carl Burton, F/V Mandy La Nae

In November, PWSSC staff completed a successful cruise of PWS collecting juvenile herring from eight bays. Sampling was conducted aboard a charter vessel primarily using trawl equipment, although other types of gear were sometimes used such as cast and gill nets in order to compare the size selectivity of gear types. Fish collected during this cruise were shared between PWSSC energetics projects, ABL projects, and Dr. Paul Hershberger's projects with HRM. The following sample sizes were collected in the field during November 2015 for energetics analysis at PWSSC and ABL:

Date	*Location*	*Sample Size (n)*	*Collector*
11/6-7/2015	Simpson Bay	342	PWSSC
11/7-8/2015	Gravina	13	PWSSC
11/8-9/2015	Fidalgo	145	PWSSC
11/9-10/2015	Eaglek	68	PWSSC
11/10-11/2015	Lower Herring Bay	227	PWSSC
11/12/2015	Whale Bay-East	225	PWSSC
11/12-13/2015	Whale Bay-West	33	PWSSC
11/13-14/2015	Zaikof Bay	82	PWSSC
11/14/2015	Windy Bay	12	PWSSC

Monthly winter sampling to obtain disease and energetic data was conducted during 2015 in Cordova Harbor. Cast nets were used to catch juvenile herring that were processed for disease in collaboration with Dr. Paul Hershberger's lab (n = 60). An additional set of samples (n = 20) was collected and processed for coupled disease and energetics data where the energy analysis is performed at PWSSC using bomb calorimetry. The following samples were collected for this project in the 2015 fiscal year:

Date	*Location*	*Sample Size (n)*	*Collector*
2/3/2015	Cordova Harbor	60	Megan Roberts, Darren Roberts, Kristen Gorman
3/4/2015	Cordova Harbor	80	Megan Roberts, Darren Roberts, Kristen Gorman, Julia McMahon
4/3, 4/9, 4/10/2015	Cordova Harbor	81	Kristen Gorman, Julia McMahon
5/5, 5/6, 5/11/2015	Cordova Harbor	80	Kristen Gorman, Julia McMahon
6/1, 6/2, 6/4/2015	Cordova Harbor	80	Kristen Gorman, Julia McMahon, Vivian Gonzalez, Austin Potter
7/8/2015	Cordova Harbor	6	Kristen Gorman, Julia McMahon, Austin Potter

Project Summary – Previously Collected Samples Processed in 2015, Data Management, Analysis Updates for PWSSC

The laboratory work by both PWSSC and ABL for this project is fairly extensive and results in previously collected samples being processed in the lab during the current fiscal year, which are described in more detail below. The general approach for the PWSSC component has been to conduct proximate analysis to estimate juvenile herring energy density using C/N atomic ratios and dry/wet mass ratios. C/N ratios are based on stable isotope analyses conducted at the University of Alaska Fairbanks – Alaska Stable Isotope Facility (http://ine.uaf.edu/werc/asif/). The relationship is formalized as:

Whole Body Energy Density (kJ/g wet mass) = -2.90242 + 32.585 x (dry/wet mass ratio) + 0.103514 x C/N after Paul et al. (2001).

Bomb calorimetric (BC) analysis, conducted at PWSSC, is then subsequently performed on ~10% of these same samples to ground-truth the energy density estimates from proximate analysis. In 2015, PWSSC made great progress in processing the backlog of BC samples collected since the start of HRM in 2012. This backlog of samples was a result from the change in PIs during this program from Kline to Gorman. In 2015, PWSSC processed samples for BC analysis from juvenile herring collected in the field during 2012, 2013, 2014, spring 2015. The following are numbers of samples analyzed for carbon and nitrogen stable isotopes and BC over the course of the current HRM program with the majority of the BC data produced in the last fiscal year.

Year	*Isotope Sample Size (n)*	*BC Sample Size (n)*	*Percent of Isotope Samples Analyzed by BC*
2012	852	91	10.7%
2013	449	53	11.8%
2014	682	69	10.1%
2015 spring only	263	28	10.6%
Totals	**2,246**	**241**	

The BC work is critical to understanding the accuracy of proximate analysis for inferring energy density of juvenile herring. The backlog of BC samples was a major delay in completing further ecological analyses of herring energy density, as we had no understanding of the accuracy of the proximate data until the BC work was completed. Our BC work over the last fiscal year suggests that energy density estimates of juvenile herring based on proximate and BC analyses accord well, with an error of 0.17 kJ/g wet mass (Fig. 2). Kline (2013) observed a similar level of error in energy estimation between the two methods (i.e, <0.10 kJ/g wet mass). An error of 0.17 kJ/g is very close to the margin of error for multiple BC instruments (0.15 kJ/g wet mass, F. Sewall, pers. comm). Further, because the difference in energy estimates between BC and proximate analysis is small (0.17 kJ/g) in comparison with the differences in energy estimates of interest in an ecological context, i.e., Fig. 3 below (~1.5 kJ/g wet mass), we do not intend to apply a correction factor to proximate analysis values in future analyses.

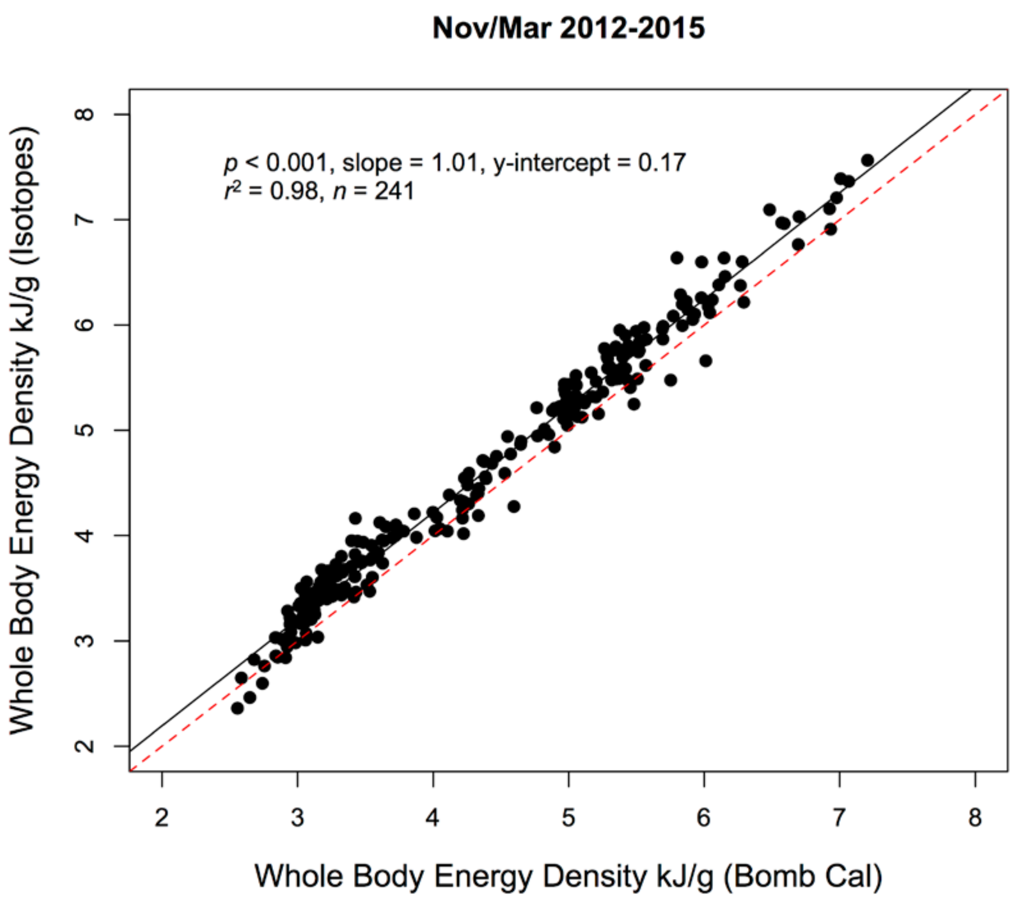

Figure 2. A comparison of energy density estimates of juvenile herring from the November and March time series between 2012 - 2015 using coupled proximate and bomb calorimetric techniques. Bomb calorimetry data were produced in 2015. The red dashed line indicates a 1:1 relationship.

New proximate analysis data for fall 2014 and spring 2015 continue to confirm our understanding that juvenile herring in March have a reduced energetic state in comparison with fish collected in November. March 2015 data are interesting because these fish were collected following a record breaking warm winter in the Gulf of Alaska and Prince William Sound, yet the energy density of these fish was similar to that of previous years. One possible explanation is that these fish are essentially at an energy threshold, below which would result in death, and therefore, little variation exists in energy density even among drastically different years in terms of ocean conditions (Fig. 3).

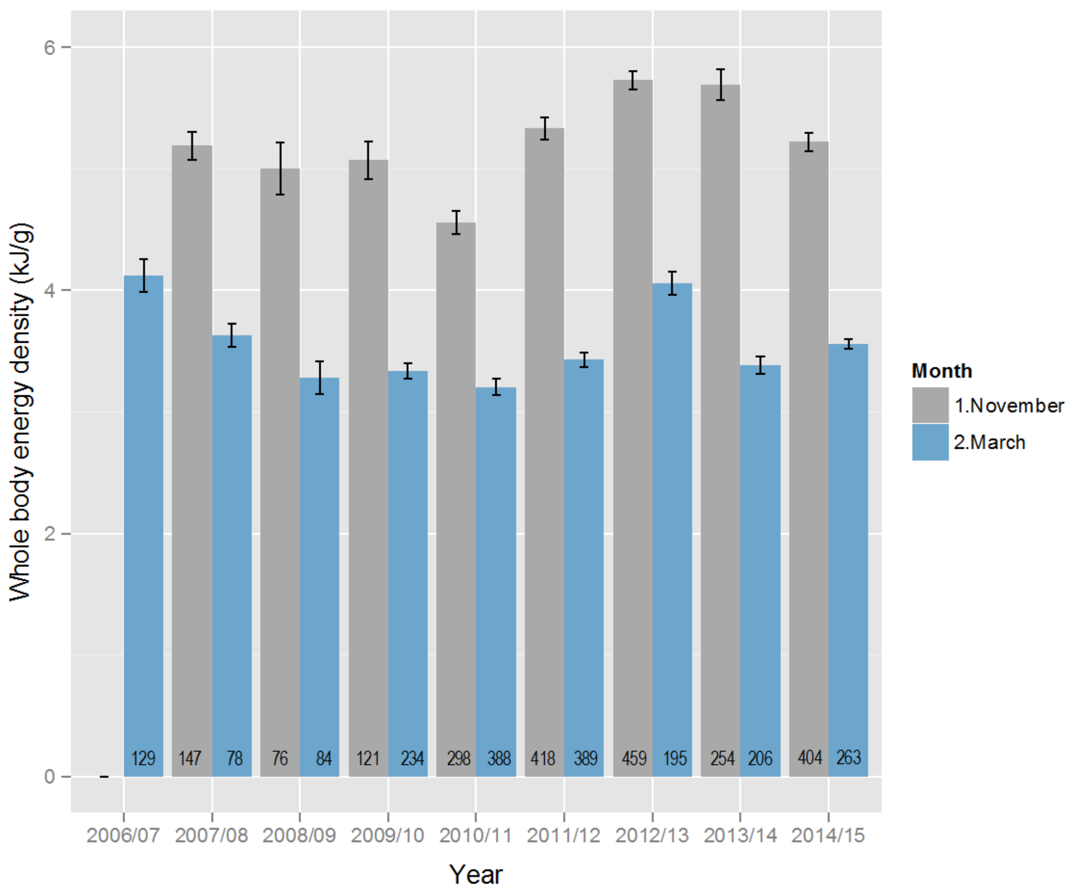

Figure 3. November and March time series of energy variation among juvenile herring collected from Prince William Sound. Sample sizes are noted at the bottom of each bar. Error bars are 95% confidence intervals.

Samples collected for disease (ichthyophonus, ICH) and BC analysis from Cordova Harbor were also all processed in 2015 – disease prevalence was determined by Dr. Paul Hershberger's lab, while BC analysis was performed at PWSSC. Our work suggests that ICH prevalence increases in Cordova Harbor later in the season, where more than 50% of fish are infected by June (Fig. 4).

Data for July are not shown in Fig. 4 due to small sample sizes (n = 6), however, the results were similar for June as 4/6 fish were ICH+, a 66.7% infection rate. During July 2015, Gulf Watch Alaska crews working on forage fish also caught juvenile herring outside Cordova Harbor. Interestingly, these fish had a comparatively low infection rate, 7.7% (n = 39, 3/39 fish ICH+). These results suggest that the higher ICH prevalence by early summer appears to be specific to Cordova Harbor, suggesting a possible local source associated with disease exposure. Within months, we found no difference in the energy density of infected and non-infected fish (Fig. 4), suggesting that body condition is not a factor associated with ICH infection. We do note that fish sampled later in the season in Cordova Harbor were less energy dense than fish caught earlier in the season, which may indicate some role for susceptibility to infection mediated by a general decline in body condition. We are hoping to continue these studies in 2016, however, currently there are no juvenile herring available to sample in Cordova Harbor.

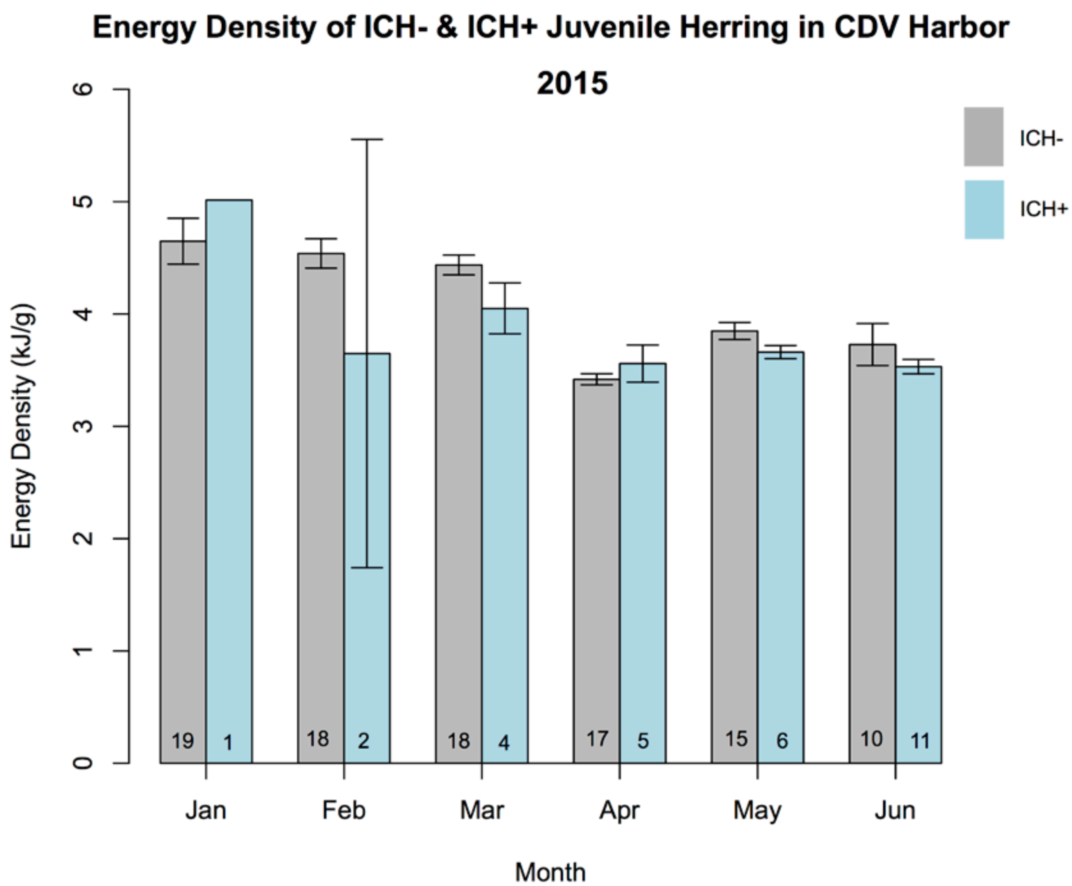

Figure 4. Monthly time series of energy density and ICH prevalence in juvenile herring samples collected from Cordova Harbor in 2015. Grey bars note ICH negative fish, blue bars note ICH positive fish. Error bars are 1 standard error of the mean. Sample sizes noted at the bottom of each bar.

One ecological aspect of the work that we are currently examining is relationships between carbon gradients from either the Gulf of Alaska or PWS and energy density of juvenile herring. These ideas were presented recently as part of a larger talk at the Alaska Marine Science Symposium, January 2016 by Heinz. We are learning that fish collected from different regions of Prince William Sound appear to have different carbon sources that also correlate with energy density - fish collected from the west side of PWS are more depleted in their lipid-corrected $\delta^{13}C$ values reflecting a Gulf of Alaska carbon source (Kline 1999) and these fish tend to be more energy dense, which compares with fish collected from eastern PWS (Fig. 5).

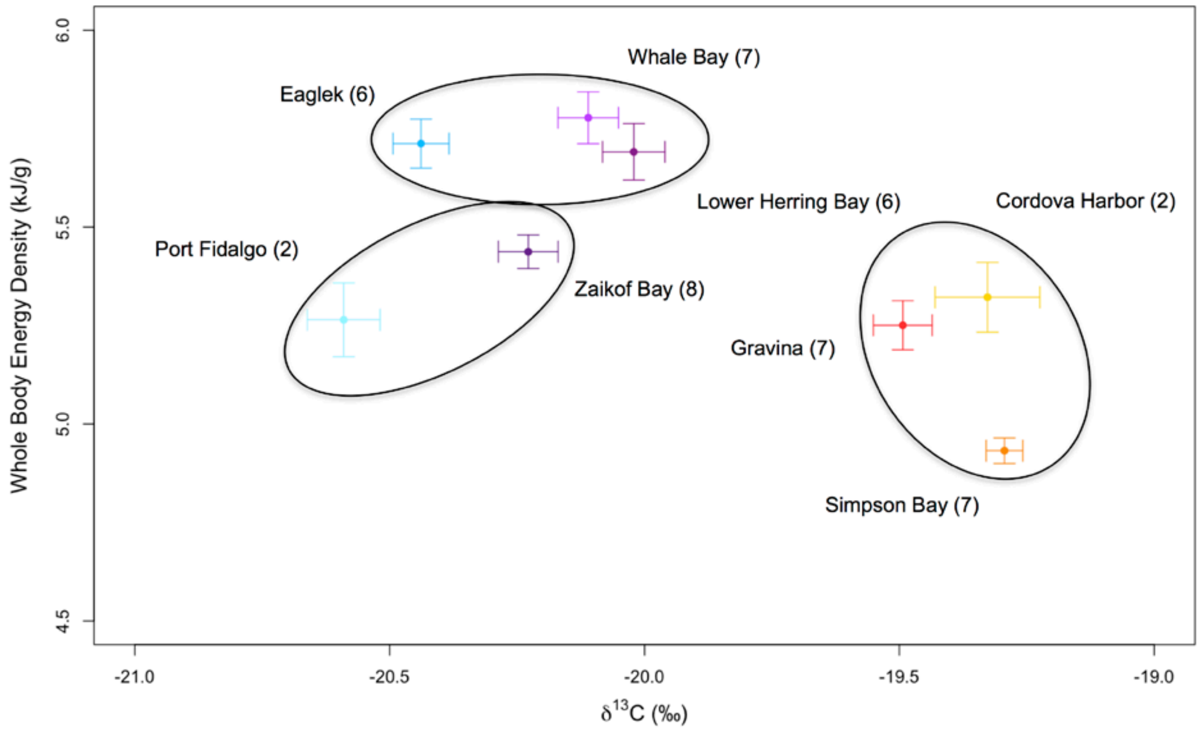

Figure 5. Spatial variability in PWS juvenile herring carbon stable carbon isotope signatures (lipid-corrected) and energy density based on proximate analysis. Numbers in parentheses are years of data for each site. Data include years prior to the current EVOSTC HRM program. Colors simply reflect the different sampling locations.

Our ability to start ecological analyses of our data has been greatly facilitated by an extensive effort during 2015 to develop an Access database for the juvenile herring energetics work at PWSSC. The database was designed in collaboration with a contractor skilled in database development and data were completely proofed this fall by a PWSSC technician. The efficiency for managing data with the new Access database, which now holds 12,444 sample entries, is excellent and will greatly facilitate the writing of several manuscripts.

Project Summary – Previously Collected Samples Processed in 2015, Analysis Updates for ABL

Lipid and RNA/DNA analyses as indicators of fish condition and growth were conducted at ABL on the following samples in 2015:

Date of sampling	*Location*	*Sample Size (n)*
Nov-2014	Eaglek	20
	Lower Herring	20
	Simpson	20
	Whale	20
	Zaikof	19
Mar-2015	Eaglek	6
	Lower Herring	18
	Whale	20
	Zaikof	20
	Total Nov + Mar	163

Processing of stomach content samples for identification and enumeration of prey taxa was also completed for these fish in 2015. Compilation and proofing of the diet data is in progress.

Preliminary results from ABL work indicate that November juvenile herring fat content (% lipid on wet tissue mass basis) increases with body size (fork length). A generalized additive model (GAM) fit to the data pooled across six years for November 2009 - 2014 suggests % lipid increases at a faster rate for larger fish (Fig. 6). A piecewise regression model fit to the data indicates that a shift in lipid allocation rate occurs at approximately 78 mm fork length (95% CI: 64 – 91 mm, Fig. 7).

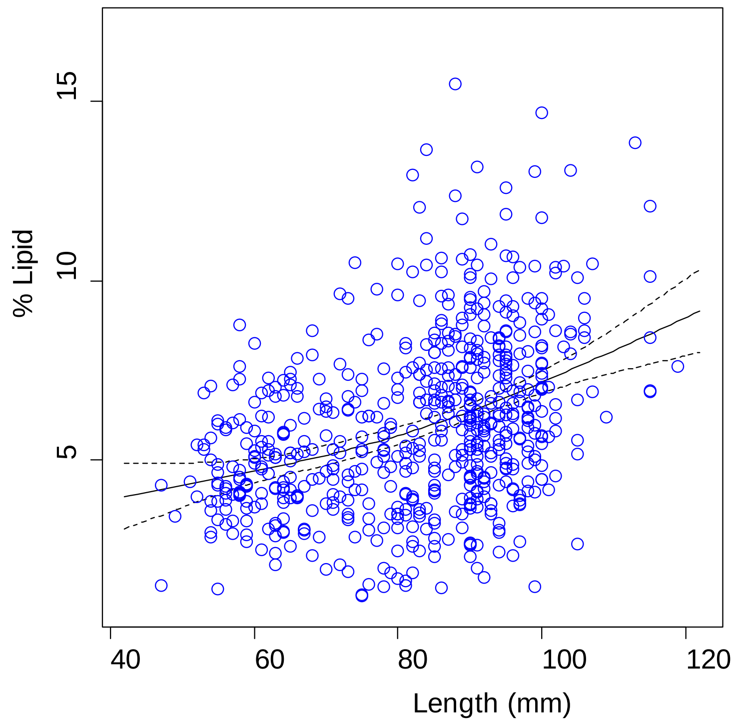

Figure 6. Lipid content (% wet tissue mass) as a function of fork length (mm) with GAM fit (dashed lines show 95% CI) for juvenile herring collected in PWS in November 2009 – 2014 (n = 629).

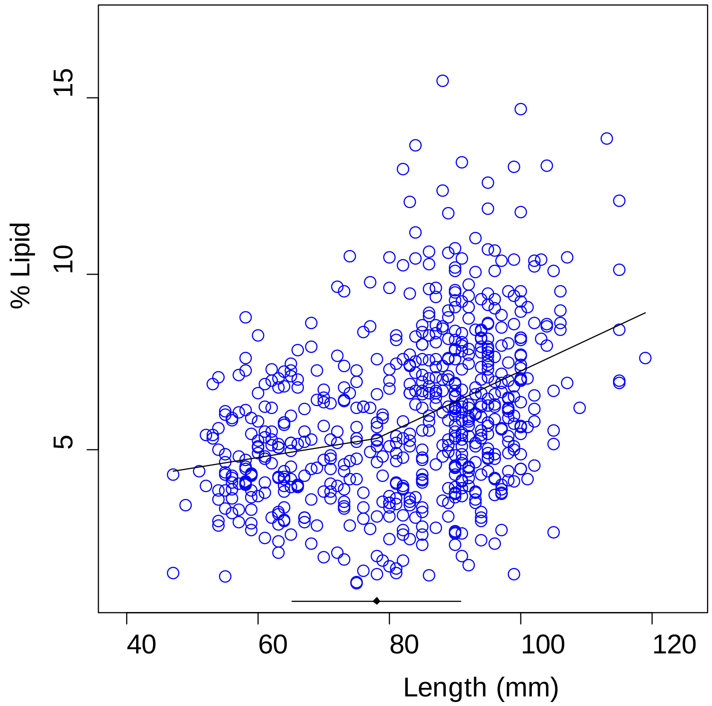

Figure 7. Lipid content (% wet tissue mass) as a function of fork length with piecewise regression line (bar at bottom shows breakpoint and 95% CI) for juvenile herring collected in PWS in November 2009 – 2014 (*n* = 629).

In contrast, juvenile herring growth effort (RNA/DNA ratio) decreases with body size. The GAM fit suggests a high RNA/DNA ratio for small herring, followed by a decline to minimum levels associated with no growth (Fig. 8). A piecewise regression model fit to the data indicates that a shift in growth effort occurs at approximately 73 mm fork length (95% CI: 69 – 78 mm), with minimum RNA/DNA shown for herring at 85 mm (95% CI: 82 – 88 mm) and larger (Fig. 9).

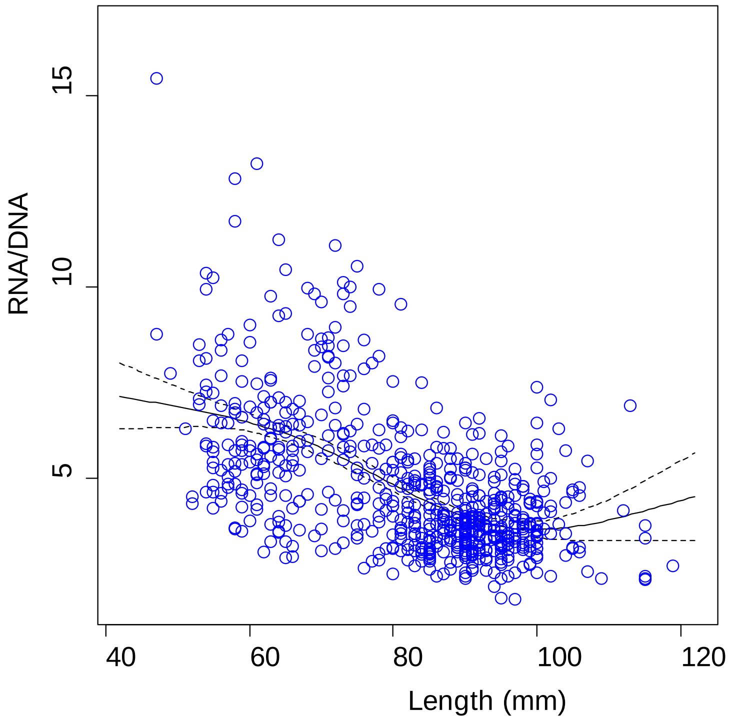

Figure 8. RNA/DNA as a function of fork length with GAM fit (dashed lines show 95% CI) for juvenile herring collected in PWS in November 2009 – 2014 (*n* = 668).

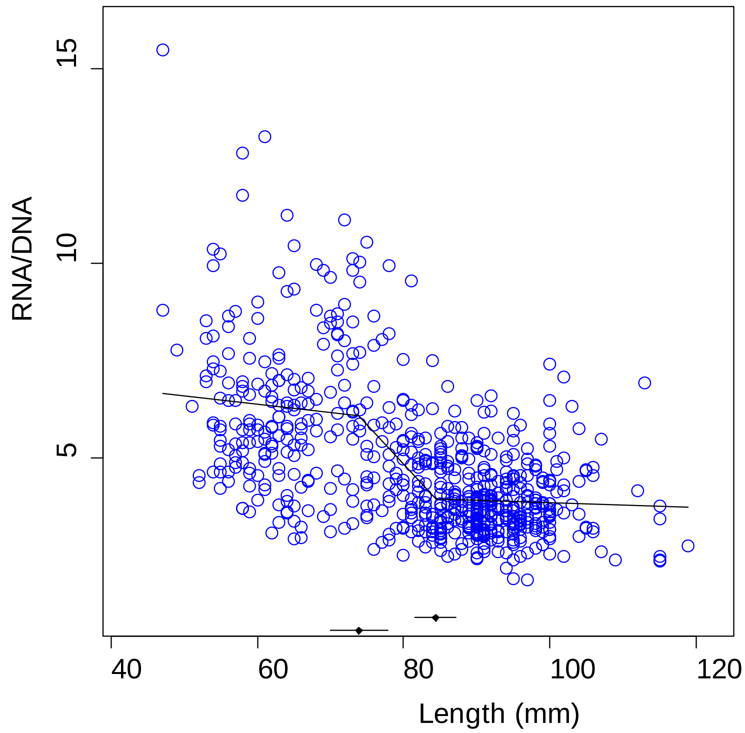

Figure 9. RNA/DNA as a function of fork length with piecewise regression line (bars at bottom show breakpoints and 95% CIs) for juvenile herring collected in PWS in November 2009 – 2014 (*n* = 668).

These size-based patterns in energy storage and growth are similar to those described for November juvenile herring from PWS as part of the Herring Survey program in 2009 – 2012.

To compare relative condition and growth of YOY herring across years and bays in PWS from November of 2009 to 2014, it is necessary to compare residuals from these regression models to account for the effects of different sizes of fish captured among sampling events. Comparison of lipid and RNA/DNA residuals indicates juvenile herring in 2012 were clearly above average in % lipid and RNA/DNA over the 6-year period studied (Fig. 10). 2012 was also the year in the study period with the lowest annual average water temperatures (Fig. 11), suggesting that temperature influences juvenile herring condition and growth.

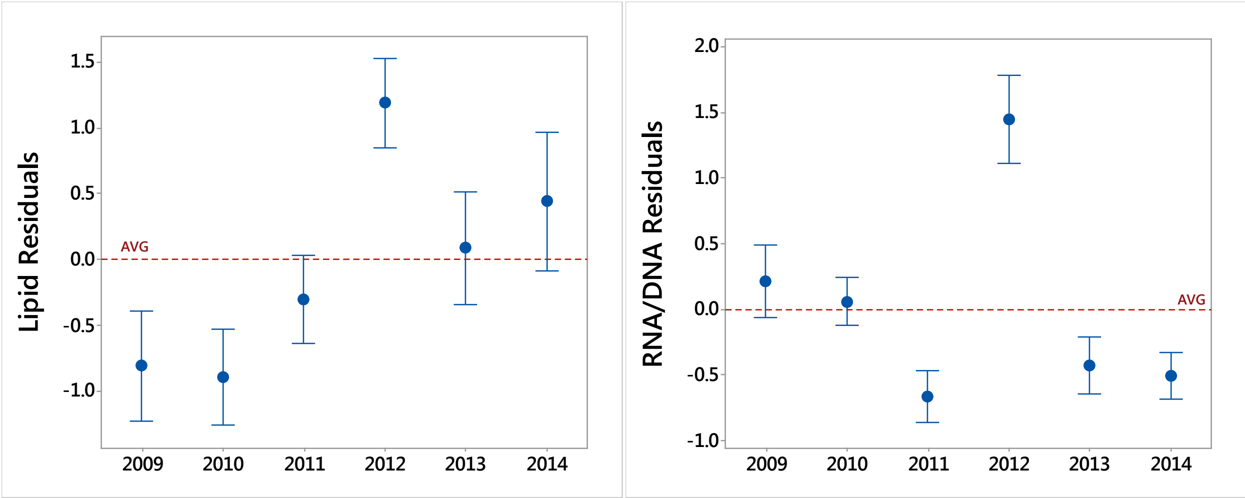

Figure 10. Residuals from the piecewise regression of lipid (left panel) and RNA/DNA (right panel) versus length of juvenile herring collected in PWS in November 2009 – 2014. Means and 95 % confidence intervals shown.

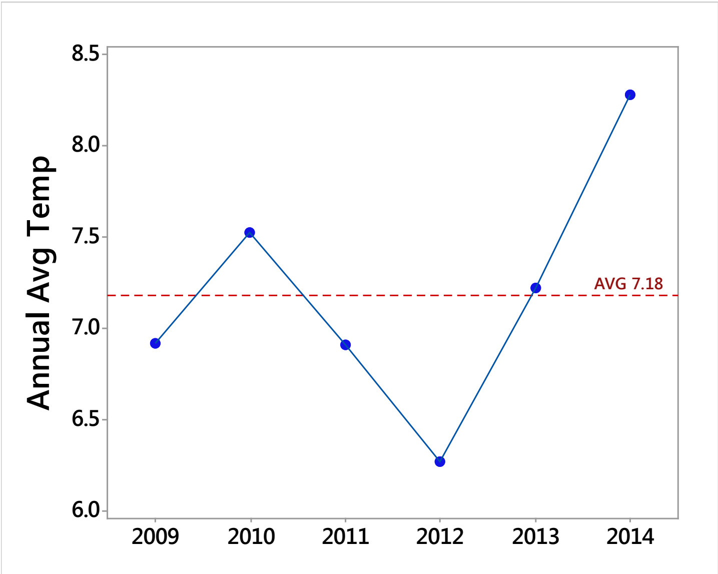

Figure 11. Average annual water temperature in PWS in 2009 – 2014, as measured at NOAA Cordova tide station, ~6 ft. below mean lower low water. (Data downloaded 10/9/15 from: https://tidesandcurrents.noaa.gov/stationhome.html?id=9454050.)

The lipid stores and growth of juvenile herring in autumn varied among bays across years, such that no specific bay consistently produced herring in the best condition. Eaglek and Simpson bays tended to be below average in lipid and growth across years, while Whale and Zaikof herring tended to be above average across years (Figs. 12 and 13).

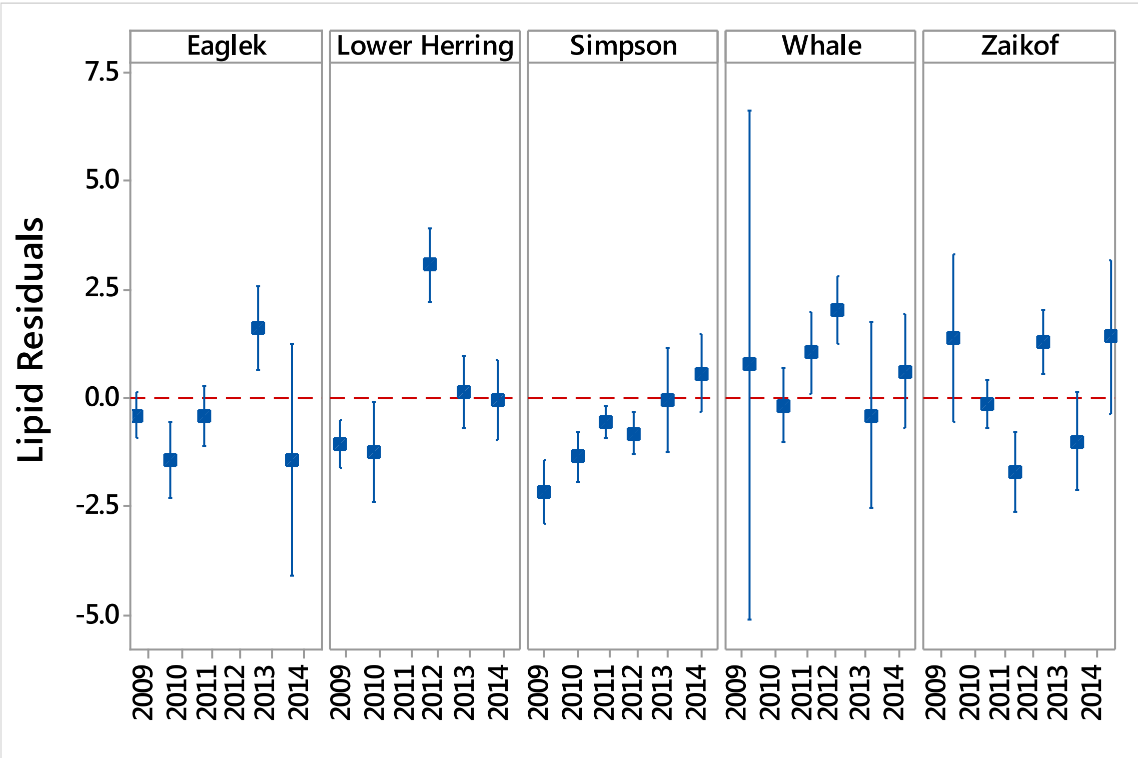

Figure 12. Residuals from the piecewise regression of lipid versus fork length of juvenile herring collected in PWS in November 2009 – 2014. Means and 95 % confidence intervals shown.

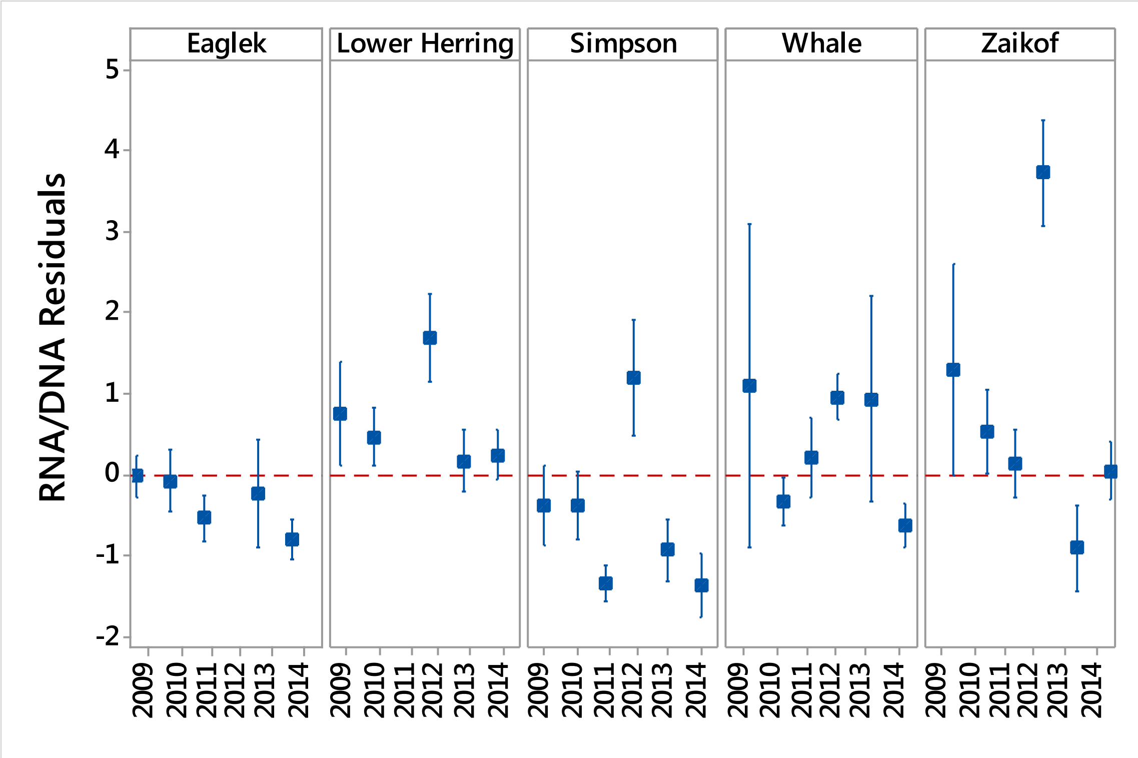

Figure 13. Residuals from the piecewise regression of RNA/DNA versus fork length of juvenile herring collected in PWS in November 2009 – 2014. Means and 95 % confidence intervals shown.

Juvenile herring that had above-average growth rates tended to also have greater fat stores in November (Fig. 14).

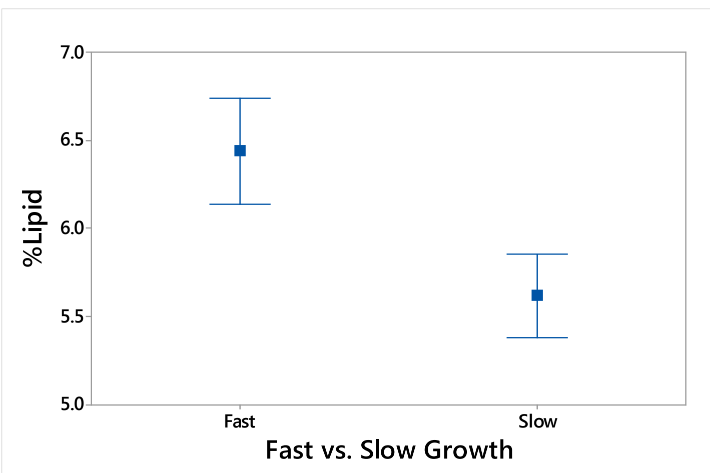

Figure 14. Comparison of lipid content (% wet tissue mass) for juvenile herring collected in PWS in November 2009 – 2014 with above average growth rate versus below average growth rate. "Fast" growth group (*n* = 262) is defined as individuals with positive residuals from the piecewise regression of RNA/DNA vs. length. "Slow" growth individuals (*n* = 349) had negative residuals. Means and 95 % confidence intervals shown.

By late winter (March), juvenile herring that were close to exhausting their fat stores were compelled to forage, as indicated by the higher stomach content masses (as % body weight) for herring with low % lipid (Fig. 15).

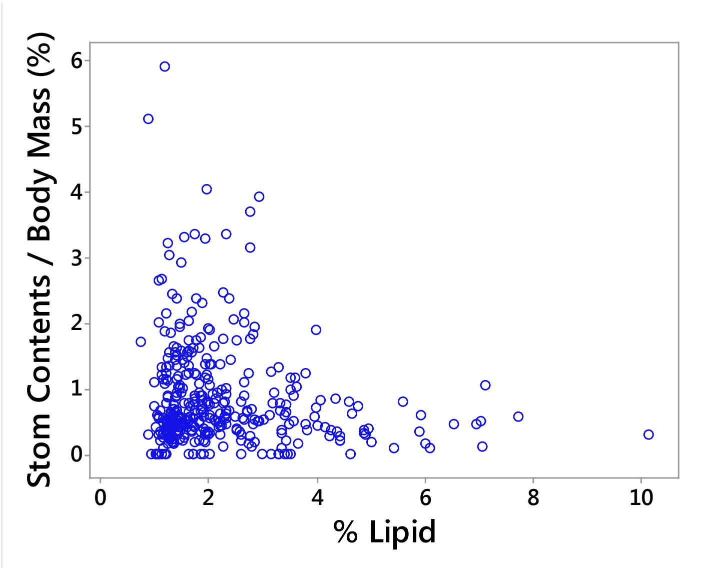

Figure 15. Stomach contents mass as a percentage of body mass, relative to lipid content (% wet tissue mass) for juvenile herring collected from PWS in March of 2010 – 2015 (n = 382).

Diet analysis across the 6 years of available data showed that juvenile herring in fall of 2011 had consumed the most food, as indicated by higher stomach contents masses relative to body mass (Fig. 16). Detailed prey identification and enumeration conducted since November 2011 showed that the energy density of prey in fall herring diets was highest in 2011 (Fig. 17), driven by the high proportion of euphausiids in diets that year (Fig. 18). However, the high quantity and quality of diets in fall 2011 did not appear to result in high lipid levels or growth rates for herring in fall 2011, suggesting that water temperature may moderate the effects of diet.

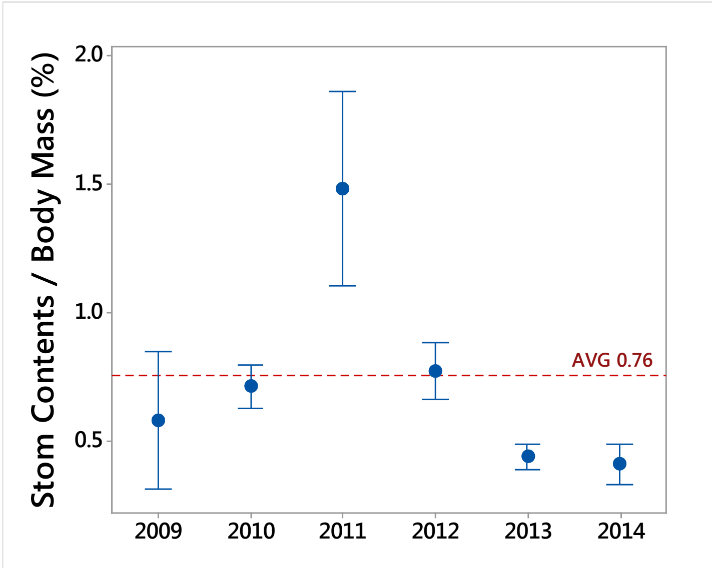

Figure 16. Stomach contents mass as a percentage of body mass for juvenile herring collected from PWS in November of 2009 – 2014.

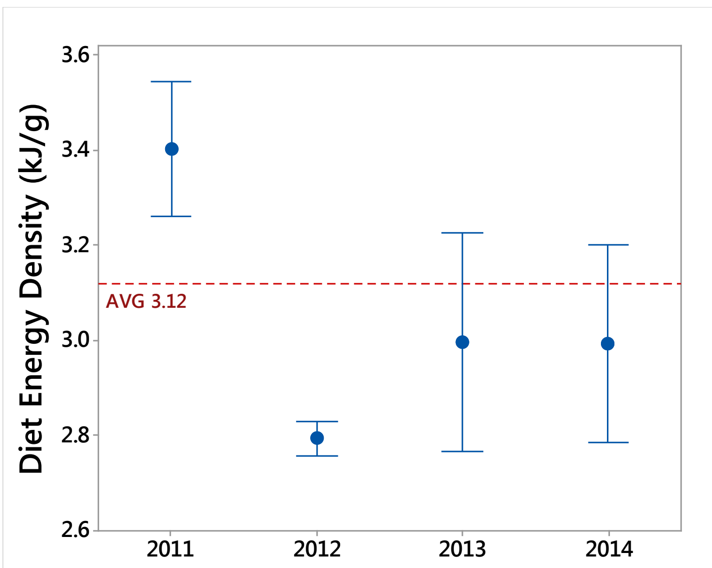

Figure 17. Diet energy density for juvenile herring collected from PWS in November of 2011 – 2014.

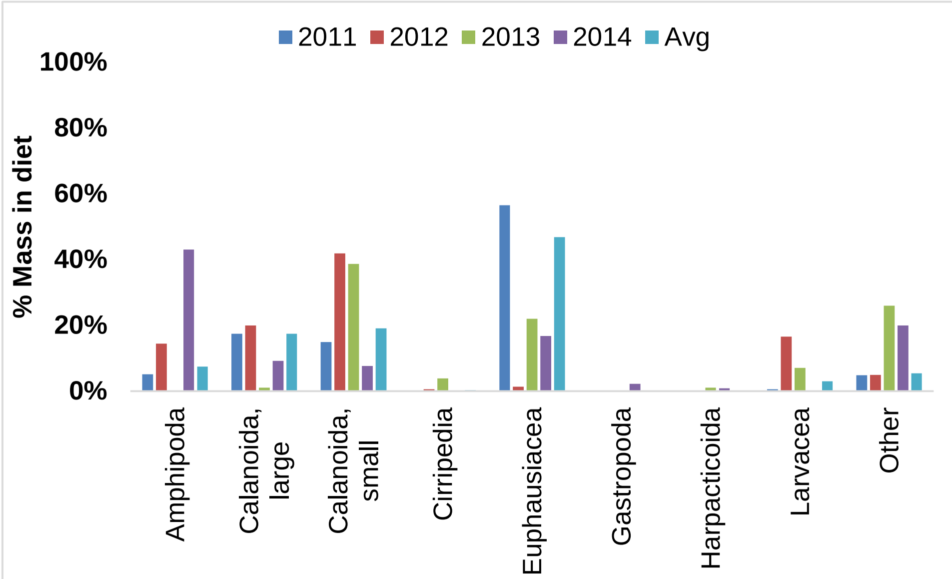

Figure 18. Diet proportion (% of total mass consumed) of prey identified in stomach contents of juvenile herring collected from PWS in November of 2011 – 2014.

Project deliverables for this reporting period

Annual PI Meeting: A PI meeting was held in Anchorage (February 2015) along with the EVOSTC Science Panel Meeting. Both Heintz and Gorman attended this meeting and Heintz presented a synthesis of the HRM juvenile energetics herring work completed to date. A second PI meeting was held in Anchorage in November 2015 and was attended by Gorman. Heintz attended a joint meeting between Gulf Watch Alaska and HRM at this time. Sewall was unable to attend the November 2015 meetings.

Outreach contributions: News articles were submitted to Delta Sound Connections by Gorman and Heintz/Sewall (Feb 2015).

March Juvenile Herring Collections: Completed March 2015. Samples sent to Auke Bay Labs in April 2015.

Student Interns: Two summer interns were supported to assist laboratory work by the PWSSC energetics project. Vivian Gonzalez's internship helped fulfill an undergraduate requirement for her degree in Biology at Bryan College. Austin Potter, a Chugiak High School student, also completed a summer internship.

American Fisheries Society annual meeting: Fletcher Sewall presented a poster on this project at the 2015 AFS annual meeting held in Portland, Oregon.

November Juvenile Herring Collections: Completed November 2015. Samples sent to Auke Bay Labs in mid-December 2015.

Reporting: A mid-year report was submitted to EVOSTC in August 2015. A semi-annual project report was submitted to NOAA in August 2015.

Submit FY2016 Work Plan for Review: Work Plan was submitted in August 2015 to match the current EVOSTC reporting dates.

Alaska Marine Science Symposium: Gorman, Heintz and Sewall attended AMSS in January 2016. Heintz delivered an oral presentation and Sewall presented a poster on this project at AMSS in 2016.

Literature Cited

Kline, T.C., Jr. 1999. Temporal and spatial variability of $^{13}C/^{12}C$ and $^{15}N/^{14}N$ in pelagic biota of Prince William Sound, Alaska. Canadian Journal of Fisheries and Aquatic Sciences 56(Suppl. 1):94–117.

Kline, T.C., Jr. 2013. PWS Herring Survey: Pacific Herring Energetic Recruitment Factors, *Exxon Valdez* Oil Spill Restoration Project Final Report. (Project 10100132-C). Prince William Sound Science Center, P.O. Box 705, Cordova, AK 99574.

Paul, A.J., J.M. Paul, and T.C. Kline Jr. 2001. Estimating whole body energy content for juvenile Pacific herring from condition factor, dry weight, and carbon/nitrogen ratio. *In:* F. Funk, J. Blackburn, D. Hay, A.J. Paul, R. Stephenson, R. Toresen, and D. Witherell (eds.), Herring: Expectations for a New Millenium. University of Alaska Sea Grant, AK-SG-01-04, Fairbanks. Pp. 121-133.

Summary of Future Work to be Performed

Work efforts for FY2016 are expected to be the same as proposed. We plan to continue with March sampling and subsequent laboratory analysis. Since the program ends in January 2017, we anticipate not conducted the fall 2016 sampling as we have in the past since we would not be collecting coupled data in March 2017. The activities for fall 2016 have yet to be determined, but will be decided upon in consultation with the program lead, Scott Pegau, and other PIs.

We would like to continue the coupled disease and energy density sampling in Cordova Harbor in FY2016, however, currently there are no juvenile herring in the harbor to sample. This likely reflects the poor forage fish conditions evident by mass seabird die-offs in the region this winter.

Gorman, Heintz and Sewall plan to submit several manuscripts to the Gulf Watch/HRM special edition of Deep-Sea Research that is planned in 2016. Thus, we foresee considerable synthesis and writing occurring over the next year.

8. Coordination/Collaboration: *See,* Reporting Policy at III (C) (8).

a) Within a Trustee Council-Funded Program.
The HCM project primarily requires coordination of PIs at PWSSC and ABL. Gorman, Heintz and Sewall were in good communication in 2015 to complete project goals.

In 2015 we continued a winter monthly study of disease and energetics in collaboration with Dr. Hershberger's lab at Marrowstone Marine Field Station/USGS whose work is a separate project within the HRM Program.

Manuscripts planned for 2016 will likely include working with Gulf Watch Alaska PIs (R. Campbell) to couple data with HCM.

b) With other Trustee Council-Funded Projects.
None in 2015.

c) With Trustee or Management Agencies.
None in 2015.

9. Information and Data Transfer: *See,* Reporting Policy at III (C) (9).

a) Publications produced during the reporting period.
None

b) Conference and workshop presentations and attendance during the reporting period.

PI meetings: Gorman and Heintz attended the EVOSTC science panel meeting in early 2015, and PI meetings in fall 2015.

AMSS: Heintz, Gorman and Sewall attended in Jan 2016. Heintz delivered an oral presentation and Sewall presented a poster on this project at AMSS in 2016.

c) Data and/or information products developed during the reporting period, if applicable.
New data were produced this year for all components of the project.

d) Data sets and associated metadata that have been uploaded to the program's data portal.
Data/metadata through summer 2015 will be uploaded to the AOOS workspace by the end of February 2016. This will be an important effort for the PWSSC component that will be facilitated by the new Access database as data are now much more efficiently managed.

10. Response to EVOSTC Review, Recommendations and Comments: *See*, Reporting Policy at III (C) (10).

Comment by EVOSTC fall 2016

None, no response required.

Comment by EVOSTC September 2015

Parts of this expensive proposal/project are vague. In particular the 'new' work looking at juvenile scales is not clear. (1) Is the plan to take scales from juvenile fish? If so, this could be difficult because, depending on the time of year and fish size, scales may be incompletely developed and very fragile. (2) Have the investigators done any 'preliminary work' to examine the feasibility of their approach? (3) The project refers to 'predictive models' but is there a hypothesis? (4) Will this project build on previous 2012 EVOSTC-supported projects on scales by Moffitt?

PWSSC Response
The plan for this new project was to measure scales from age-0 fish. This project was completed in 2014 (see 2014 EVOS Annual Report, Figure 14). In terms of hypotheses, we are testing the hypotheses that 1) increased growth in age-0 fish is associated with increased energy density based on juvenile data and that 2) larger scale growth at age-0 is associated with successful spawning based on scale data from older recruited fish where age-0 scale growth has been measured. The work builds off of previously supported EVOSTC projects.

11. Budget: *See*, Reporting Policy at III (C) (11).

PWSSC component budget:

Budget Category:	Proposed FY 12	Proposed FY 13	Proposed FY 14	Proposed FY 15	Proposed FY 16	TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$0.0	$64,700.0	$67,300.0	$70,000.0	$72,800.0	$274,800.0	$ 111,587
Travel	$0.0	$3,000.0	$5,900.0	$5,900.0	$6,100.0	$20,900.0	$ 5,259
Contractual	$0.0	$24,800.0	$25,600.0	$26,300.0	$28,900.0	$105,600.0	$ 46,753
Commodities	$0.0	$7,500.0	$5,000.0	$8,300.0	$6,700.0	$27,500.0	$ 4,029
Equipment	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Indirect Costs (*will vary by proposer*)	$0	$30,000	$31,200	$33,200	$34,400	$128,800.0	$ 50,289
SUBTOTAL	$0.0	$130,000.0	$135,000.0	$143,700.0	$148,900.0	$557,600.0	$217,917.0
General Administration (9% of	$0.0	$11,700.0	$12,150.0	$12,933.0	$13,401.0	$50,184.0	N/A
PROJECT TOTAL	$0.0	$141,700.0	$147,150.0	$156,633.0	$162,301.0	$607,784.0	
Other Resources (Cost Share Funds)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	

$190,733 will be carried forward into FY2016. Of this, $90,413 is allocated for salary. One main reason there is such a large carry-over for salary is due to the change in PIs during the course of this program (2012-2016) from Kline to Gorman. Kline was a senior PI and Gorman a new PI, therefore, they had significantly different salary rates that resulted in a considerable portion of salary not used by the current PI. However, the project in FY2015 did spend $111,588 in salaries, which was mainly driven by technician time to complete the backlog of BC analysis. FY2016 will be final year of the project during which manuscript writing will take place. PI Gorman may use more than 6 months of salary funding in FY2016, likely closer to 8-9 months, in order to complete several manuscripts on the project. $9,541 will be carried forward for travel. Meetings in the last year have all been in Alaska and therefore did not require as much funding. In FY2016, PI Gorman plans to attend 2-week professional development course at Colorado State University on Bayesian modeling, which will help facilitate analysis during this final year of the program. Some of the carry-over for travel funds will be used to attend the Bayesian short course. A total of $46,718 will be carried over for supplies and contractual in FY2016. It is expected that half of this money will be used for stable isotope analysis of sampling collected in November 2015 and March 2016.

ABL component budget:

Budget Category:	Proposed FY 12	Proposed FY 13	Proposed FY 14	Proposed FY 15	Proposed FY 16	TOTAL PROPOSED	ACTUAL CUMULATIVE
Personnel	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
Travel	$0.0	$0.0	$3,900.0	$7,100.0	$4,000.0	$15,000.0	$5,474.0
Contractual	$0.0	$75,000.0	$75,000.0	$75,000.0	$75,000.0	$300,000.0	$220,494.0
Commodities	$0.0	$6,000.0	$5,000.0	$5,000.0	$5,000.0	$21,000.0	$13,538.0
Equipment	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	
SUBTOTAL	$0.0	$81,000.0	$83,900.0	$87,100.0	$84,000.0	$336,000.0	$239,506.0
General Administration (9% of	$0.0	$7,290.0	$7,551.0	$7,839.0	$7,560.0	$30,240.0	N/A
PROJECT TOTAL	$0.0	$88,290.0	$91,451.0	$94,939.0	$91,560.0	$366,240.0	
Other Resources (Cost Share Funds)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	

Commodities and travel spending is slightly low, but overall the spending is on target. Travel expenses in FY15 were lower than expected due to no travel for PI meeting, AMSS 2016 travel on the FY16 budget, and only Heintz traveling to the synthesis meeting. ~$12k will be carryover into FY16.

We appreciate your prompt submission
and thank you for your participation.