EVOSTC ANNUAL PROJECT REPORT

Recipients of funds from the *Exxon Valdez* Oil Spill Trustee Council must submit an annual project report in the following format by **Sept. 1 of each fiscal year** for which project funding is received (with the exception of the final funding year in which a final report must be submitted). **Please help ensure that continued support for your project will not be delayed by submitting your report by Sept. 1. Timely receipt of your report allows more time for court notice and transfer, report review and timely release of the following year's funds.**

Satisfactory review of the annual report is necessary for continuation of multi-year projects. Failure to submit an annual report by **Sept. 1** of each year, or unsatisfactory review of an annual report, will result in withholding of additional project funds and may result in cancellation of the project or denial of funding for future projects. **PLEASE NOTE:** Significant changes in a project's objectives, methods, schedule, or budget require submittal of a new proposal that will be subject to the standard process of proposal submittal, technical review, and Trustee Council approval.

Project Number: 090811

Project Title: Prince William Sound Herring Forage Contingency

PI Name: Thomas Kline

Time period covered: FY09

Date of Report: August 28 2009

Report prepared by: Dr. Tom Kline

Project website (if applicable):

Work Performed: Summarize work performed during the reporting period, including any results available to date and their relationship to the original project objectives. Explain deviations from the original project objectives, procedural or statistical methods, study area or schedule. Also describe any known problems or unusual developments, and whether and how they have been or can be overcome. Include any other significant information pertinent to the project.

• Funding of year 3 commenced in March, retroactive to include attendance at 2009 Alaska Marine Science Symposium.
• The P.I. and post-doc (Dr. Campbell) attended the 2009 Alaska Marine Science Symposium.
• Three cruises were conducted, two to collect herring (November 2008 and March 2009) and one to collect zooplankton (September - October 2008). The scope of these cruises was described in the Interim Progress Report July 2007 and in the Powerpoint presentation

shown during the October 2007 workshop. Preliminary results were shown in the latter, in the FY2008 Annual Report as well as December 2008 workshop. An edited down version of latter presentation was repeated at the 2009 Alaska Marine Science Symposium. These previously shown results are not presented here so that new information can be instead.
• Further preliminary results are presented below (these are draft figures, some may be included in the presentation the P.I. will make at the 2009 Annual Herring Workshop, which is expected to take place in October 2009).
• Further lab processing of samples is in progress.

Pacifc herring (*Clupea pallasi*) populations in Prince William Sound, Alaska (PWS) have remained low since crashing in the early 1990's. The 1999-year class performed well, by having a strong recruitment at age three. However, this recruitment event was insufficient to restore herring populations to the levels of the 1980's. Overall, recruitment of herring in PWS remains low. The *Exxon Valdez* Oil Spill Trustee Council funded Sound Ecosystem Project (SEA), which made observations during the 1994 to 1998 period, postulated that herring recruitment in PWS is driven by early life history processes. This project addresses how these processes may have changed since SEA ended. The current project is describing manifestations of change that are important for PWS herring recruitment: the energy content of herring and zooplankton, the role of oceanic zooplankton subsidies for herring and herring competitors, and the species of zooplankton available as forage.

The SEA project provides a foundation for this investigation. The Principal Investigator (P.I.) participated as a SEA project P.I. working closely with other SEA herring investigators. In particular, the P.I. collaborated closely with P.I. Dr. A.J. Paul, now retired. We paired our analyses using the same herring samples, exchanged results as well as specimens, and co-published results. An important issue is to determine if conditions in herring nursery habits in PWS have changed since SEA ended in 1998. To make this assessment without systematic error requires close duplication of the sampling design and methods used then so that the results will be comparable. The P.I.'s direct familiarity with the methods used and results obtained during SEA is thus facilitating this project. Results of the SEA project, subsequent projects, and other proposed project results are integrated into this study as appropriate.

The Prince William Sound herring forage contingency project is assessing plankton energy content, sources, and taxonomic composition, relationships between herring energy content and plankton sources, and potential food source interactions with sympatric fishes. We report here detailed analyses from 2008. Sections 1 to 3 deal with analysis of plankton. Sections 4 and 5 deal with analysis of herring. Section 6 reflects upon recent climatic trends that may be an important consideration when applying these data at a later date.

Relative foraging success on zooplankton can determine herring year class strength because herring need to acquire sufficient energy from their food to survive the long high latitude winter. Herring may feed opportunistically on a wide range of zooplankton species although they prefer large copepods. Good herring recruitment may be contingent on the presence of zooplankton populations enabling herring to achieve high fall energy values. Zooplankton energy is being measured to understand this source variability. Zooplankton may vary in quality (origin and composition – species and stages of species) and quantity (zooplankton population density) and these aspects may be related to each other.

1. Plankton Energy

Bulk plankton content energy was assessed in terms of density with respect to water volume as a measure of habitat quality and in terms of energy density per unit mass as a measure of food quality. Figure 1.1 summarizes 2008 zooplankton energy content data. PWS herring nursery bays were each quite different with respect to both parameters. There was approximately one order of magnitude less energy available per unit volume of water in October-November compared to May. Highest habitat quality was found in more open waters such as the Sound or Gulf. Food quality was somewhat better in May.

2. Plankton community structure (this section prepared by Dr. Rob Campbell)

Patterns in the structure of the plankton community were analyzed by hierarchical clustering and indicator species analysis (ISA). Rare species (occurring in <10 % of stations) were not included in the analysis, and data was log10(n+1) transformed prior to analysis. Clustering was done on the Euclidean distance matrix from the species × station matrix, using Ward's linkage method. The resulting clusters broke down fairly well into geographic areas (Figure 2.1), with well-defined clusters for two of the bays (Eaglek and Whale), and an open water clusters that could be further subdivided into central PWS and shelf and slope clusters. A number of stations in Bays in eastern PWS clustered together, including all of Simpson Bay, and stations in St. Matthews Bay and Port Gravina, though two stations in Zaikof Bay and one station in Whale Bay also fell into that cluster.

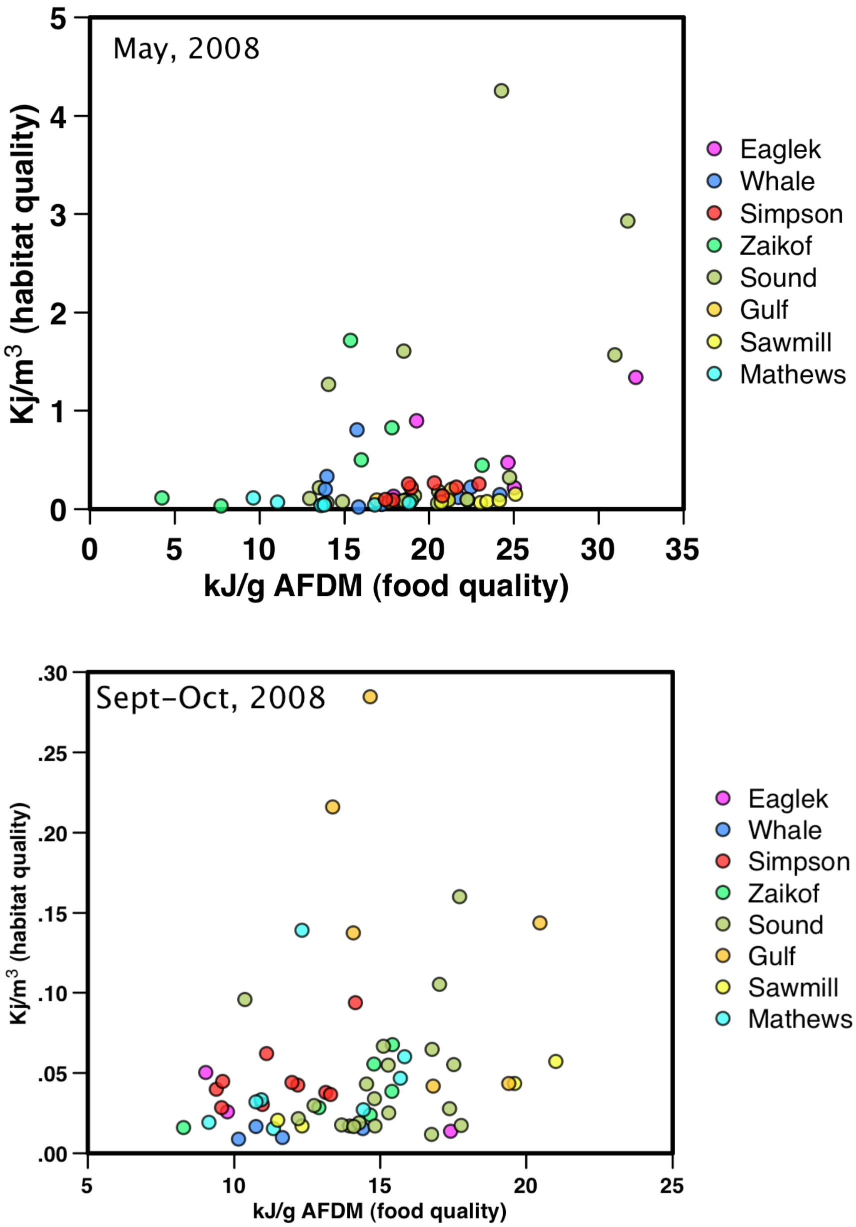


Figure 1.1. Plankton energy; May (upper panel) and September-October (lower panel) 2008. Energy is expressed in terms of density with respect to water volume by habitat name as a measure of habitat quality and in terms of energy density per unit ash-free dry mass (AFDM) of zooplankton as a measure of food quality. The Prince William Sound (PWS) herring nursery bays (Whale, Eaglek, Zaikof, Simpson, Mathews, and Sawmill) were each quite different with respect to both parameters. Each point in the figure above reflects one net sample from 50 to 100 m^3 of water (sample volume based on flow meter reading). These results confirm that plankton energy availability is highly variable in space and time and that not all herring nursery habitats are equal. This information will need to be considered for herring population supplementation projects, especially those involving juvenile life stages.

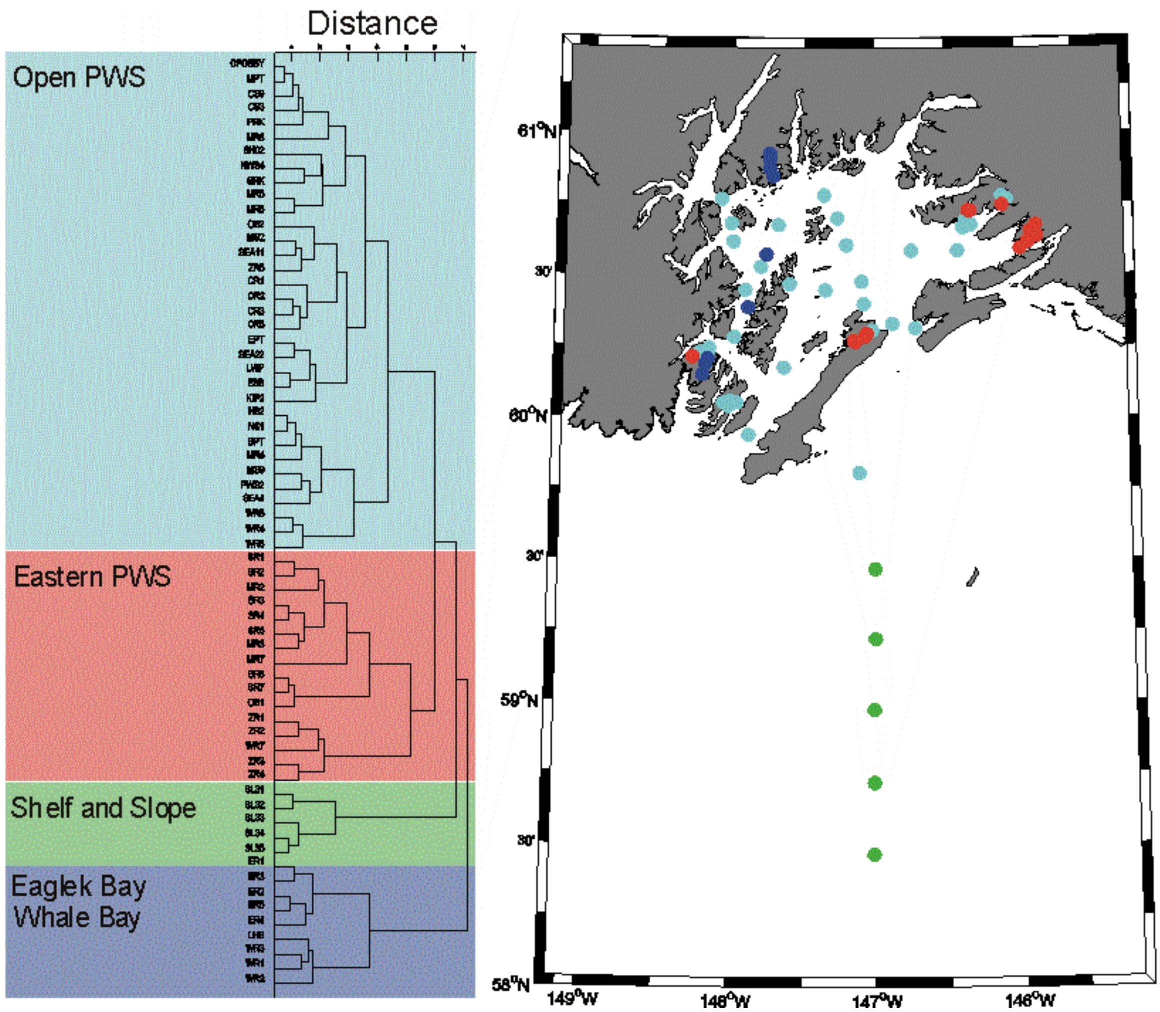


Figure 2.1 Hierarchical clustering analysis of plankton taxa in PWS, autumn 2008. Left panel: Dendrogram showing the resulting station groupings. The clustering had a cophenetic correlation of 0.64. Right panel: Map of the stations indicating the cluster identity of each station. Symbol colors correspond to the identified clusters.

Indicator species analysis (Dufrene and Legendre, 1997) was used to identify the important plankton taxa in the station groups identified by the cluster analysis. The ISA statistic for each group is the product of the relative abundance of the taxa in the group (scaled to all groups) and the frequency of occurrence of species in the group. An associated probability was calculated for each ISA statistic by Monte Carlo simulation (10000 iterations), and a critical value of 0.05 used to diagnose significant groups. The results of the ISA were sorted within each group to produce a list of taxa ranked by their relative importance in each cluster (Table 2.1). There were several taxa common to the different clusters, particularly small copepods (<2 mm), pteropods, and cnidarian medusae. The differences between the clusters were thus primarily caused by differences in the abundances of the different taxa. Abundances of the common taxa identified by ISA (Figure 2.2) varied considerably between areas, with large copepods and pteropods (which are more oceanic species) occurring in the open water stations. Euphausiid calyptopis were also abundant in central PWS.

Table 2.1 Indicator species analysis (ISA) for the station groups identified by hierarchical cluster analysis. The taxa are vertically sorted by relative importance within each cluster, with more important taxa above less important taxa.

Open PWS	Eastern PWS	Shelf and Slope	Eaglek/Whale Bay
Copepods <2 mm	Copepods <2 mm	Copepods <2 mm	Copepods <2 mm
Larvacea	Pteropods	Larvacea	Larvacea
Pteropods	Amphipods	Pteropods	Pteropods
Medusae	Copepods >2 mm	Medusae	Medusae
Euphausiid alyptopis	Larvacea	Siphonophore	Decapod Zoea

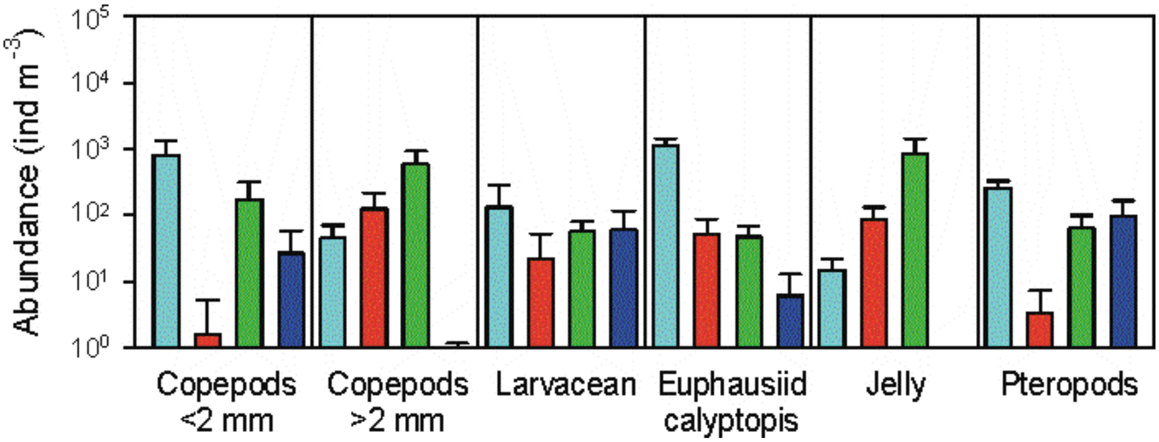


Figure 2.2 Abundance (mean ± standard deviation) of the more common plankton taxa identified by ISA, arranged by the station groups identified by hierarchical cluster analysis. Color indicates the cluster group, and corresponds to the colors used in Figure 2.1.

3. Characterization of herring food sources using stable isotope analysis (SIA)

An emergent pattern arising from one and a half decades of observations is that pelagic food resources in the PWS region can be dichotomized into coastal and oceanic sources based on carbon stable isotope analysis (SIA; Kline 2009). Coastal production is defined as organic carbon generated in PWS and in the low salinity patches of ocean associated mesoscale eddies, which is characterized by high stable isotope values ($\delta^{13}C' > -20$ in zooplankton), whereas oceanic production, organic carbon generated in oceanic areas but not in low salinity patches, is characterized by low values ($\delta^{13}C' < -20$ in zooplankton). Trophic fractionation effects increase isotope values by 1 $\delta^{13}C'$ unit per trophic level thus herring $\delta^{13}C'$ values < -19 reflect oceanic carbon (Kline 1999). The more negative the $\delta^{13}C'$ value the greater the proportion of oceanic carbon. This isotopic dichotomy was verified during 2008 (Figure 3.1). The working hypothesis is that coastal food webs are primarily diatom based, which leads to high $\delta^{13}C'$ values whereas the low oceanic values reflect high nutrient low chlorophyll (HNLC) based food webs (Kline 2009). HNLC enables greater primary producer isotopic fractionation (preferential uptake of ^{12}C over ^{13}C, which is the opposite of trophic fractionation) and hence more negative values Any given zooplankton or fish species that is broadly distributed in the study area can potentially manifest a range in dependency on these alternate production sources as evidenced by their observed $\delta^{13}C'$ range. This has been shown in the values observed for the three species of *Neocalanus* copepods (Kline 2009) as well as herring and other fishes (e.g., Kline 2007). In other words, SIA reveals differences in feeding habit that are independent of the species composition of diet. SIA thus complements rather than replaces taxonomic analysis of diet.

These data are critical for interpreting the isotope shifts measured in herring (section 5 below). Planktivorous fish such as herring consuming carbon exclusively of PWS origin are expected to have $\delta^{13}C'$ values of -19 to -17 based on these observations and trophic fractionation effects (e.g., Kline et al. 2008). Values more negative than ~ -20 range can thus be inferred to reflect incorporation of GOA or oceanic carbon.

Neocalanus is an oceanic copepod taxon requiring water deeper than 300m for part of its life history. The mere occurrence of *Neocalanus* in the relatively shallow PWS herring nursery bays (Figure 3.1) quite distant from this deep water speaks volumes for the connectivity of these habitats with the greater oceanic system.

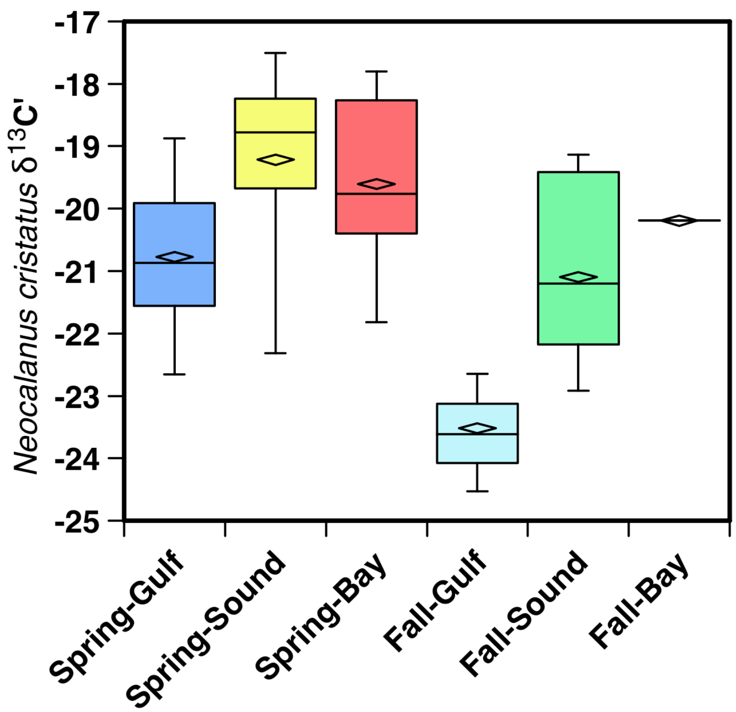


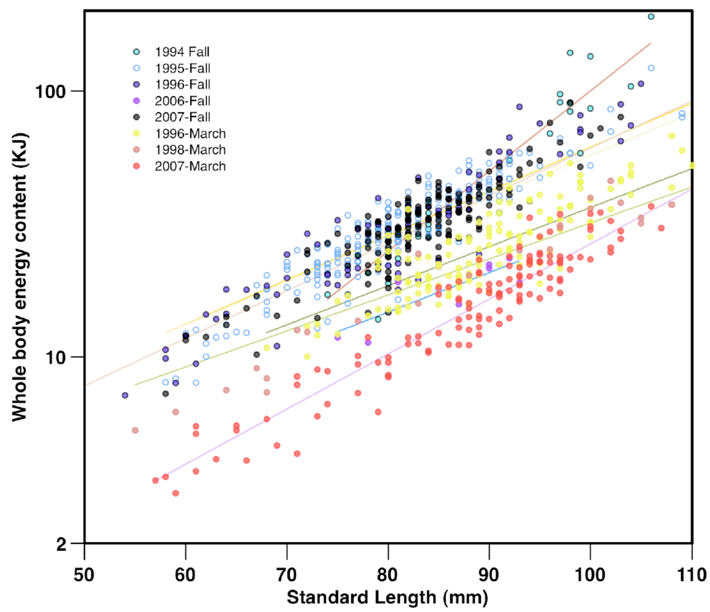
Figure 3.1 Stable isotope diagnostics for 2008. 2008 $\delta^{13}C'$ data of *Neocalanus cristatus* by habitat type (herring nursery bays = Bay, other parts of PWS = Sound, offshore in the Gulf of Alaska = Gulf) as box and whisker plots. These data validate SIA as a tracer of Gulf of Alaska (GOA) carbon in PWS by confirming previous observations (e.g., Kline 2009). Rationale for the SIA single species approach was given in Kline (1999) and Kline (2009).

4. Loss of herring energy during overwintering

An important ecological component is ecosystem energy flow. Energy flow is particularly important in high latitude ecosystems such as PWS, which is at 60° N latitude, because of strong seasonality. A long-standing hypothesis for high latitude herring populations is that they need to acquire sufficient energy during the feeding season to survive the long winter (Blaxter and Holliday, 1963). This led to the Sound Ecosystem Assessment (SEA) program's herring overwintering hypothesis that 'overwinter survival of juvenile herring affects subsequent year-class strength' (Norcross et al., 2001). Data collected during SEA and now during this project verify that herring lose much of their accumulated energy between November and March of the following year (Figure 4.1). The relative loss of energy was greater more recently (Figure 4.1).

The whole-body energy density (WBED) units used in the lower panel of Figure 4.1 are like those reported by A.J. Paul during the SEA program (e.g., Paul and Paul 1998). Whereas whole-body energy content (WBEC; Figure 4.1 upper panel) is a conservative measurement (first law of thermodynamics applies), WBED is not. WBEC content, however, does not incorporate effects of changing water content, which is an important physiological parameter, whereas WBED does. Because the methods used in this project to derive energy levels generate values of both WBEC and WBED for each analysis, we have the use of both options. WBED is also an important consideration for herring predators (A.J. Paul, pers. comm.). WBED appears to be far less dependent on herring length compared to WBEC (Figure 4.1) and is thus a better parameter to use when aggregating data to a single mean or median value or when one needs to compare energy with metrics other than length on a two-dimensional plot such as for food source subsidy analysis using stable isotopes (section 5 below). WBED is thus a better parameter to synoptically characterize PWS herring populations. Furthermore, from WBED one can calculate the number of days the population is expected to live based on their stored energy reserves.

The life expectancy of fasting herring can be estimated from WBED, the morbidity threshold, and the daily energy loss rate observed for Alaskan winter conditions in a laboratory study (Paul and Paul 1998). The average age-0 PWS herring in March 2007 had 40 days of energy reserves whereas the average age-0 PWS herring observed in April 2007 had 35 days to live. The upper quartile of the population had ≥ 64 days to live in March and ≥ 46 days to live in April. The upper quartile of the population observed at the start of spring were thus likely to survive until the spring bloom on their energy reserves. By this time many of those alive in November had already succumbed. The average age-0 herring in November 2007 had only 88 days to live, which is considerably shorter than winter. The upper quartile had ≥ 108 days to live, not much better. In November, the upper 4%, 2%, and 1% of the population had energy reserves of, respectively, ≥ 148, 159, and 171 days. Thus only a small percentage of the population in November 2007 was likely to survive winter without supplementing energy reserves, such as by eating.



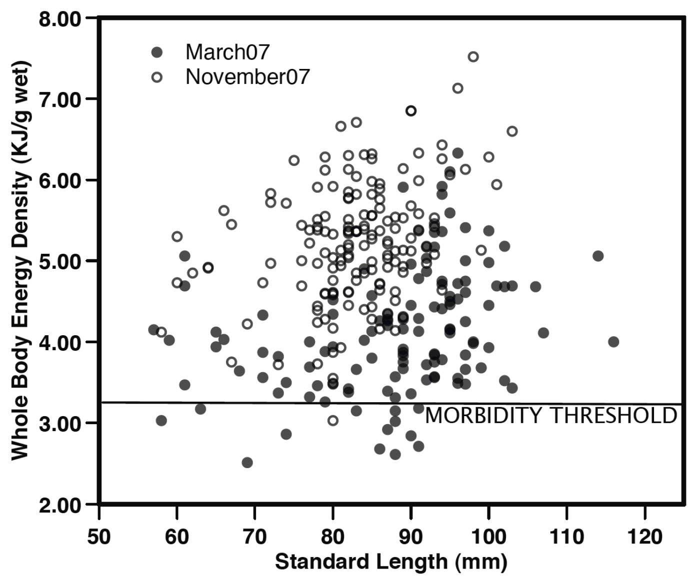


Figure 4.1. Ontogenetic (increase with size) and temporal (year to year and fall to late winter) variation in WBEC (upper panel) and WBED (lower panel) of age-0 PWS herring. The upper panel compares fall (cooler colors) vs. late winter (warmer colors) energy as a function of length (length does not change during fasting; Paul and Paul 1998) for recent and previous PWS herring studies in terms of energy content. The systematic decrease in energy that takes place over winter is evident across all size classes; $R^2 = 0.9$ and $P < 0.001$ for both March and November 2007. Energy levels in 2007 (red circles) were lower than that previously observed. Fall 2007 herring (black circles) were more similar to past data. WBEC is on a log scale. The correlations between length and WBED were significant ($P < 0.001$ for both regressions, which are not shown), however, the coefficients were much less than WBEC, $R^2 =$ 0.5 for November and 0.1 for March. Nevertheless, the correlation suggests that herring size explains half of the variation in energy reserves in November with larger herring having more energy per unit mass. The mean morbidity threshold determined by Paul and Paul (1998) is shown in the lower panel.

The expected WBED at the end of a fasting period can be estimated from the WBED at the start of the period, the morbidity threshold, and the mean daily energy loss rate observed for Alaskan winter conditions in a laboratory study (Paul and Paul 1998). Based on the observed WBED of age-0 herring in November 2007 (Figure 4.1), the expected mean WBED of surviving herring in March 2008 is 3.6 kJ/g wet mass. This compares favorably with the mean WBED of herring observed in March 2007 of 4.1kJ/g (Figure 4.1). A somewhat higher WBED is expected since herring are not strictly fasting during winter (Foy and Norcross 2001). A similar approach can be used for a one-month prognostication.

Good samples of age-0 herring were obtained from Simpson Bay 31 days apart in March and April 2007. The expected mean WBED of April survivors based on March WBED observations was 3.6 kJ/g wet mass. The actual observed April WBED was 3.9 kJ/g wet mass. The 0.3 kJ/g wet mass difference was statistically significant (Mann-Whitney U test). The slightly higher observed value is consistent with some feeding. Given that the morbidity threshold varied by 0.8 kJ/g wet mass among individual herring (Paul and Paul 1998), the fasting energy predictions based on laboratory experiments were consistent with field observations with some, although not much, winter feeding. Furthermore, Paul and Paul (1998) observed that wild herring sampled in March from the same location as their laboratory subjects had statistically significant higher WBED levels of 0.3 kJ/g wet mass greater than the laboratory survivors.

The above analyses validate the laboratory observations of energy loss and herring morbidity made by Paul and Paul (1998). We can thus estimate the WBED level needed to survive a specified fasting period from the morbidity threshold and the mean daily energy loss rate observed for Alaskan winter conditions in the laboratory study (Paul and Paul 1998). Assuming a winter fasting period of 120 days (mid-November to mid-March), herring would thus need a WBED of at least 6.0 kJ/g wet mass in order to have at least 3.2 kJ/g wet mass at the end of the fasting period. Only a minority of the herring observed in November 2007 had WBED values greater than 6.0 kJ/g wet mass, thus most PWS herring in November were not prepared to survive four months of fasting.

Does over-wintering energy loss factor into herring recruitment? This cannot presently be answered since all nursery cohorts observed thus far have led to poor recruitment. If, for example, much higher energy reserves were observed in March and these herring recruited in large numbers (~ 1 billion) at age 3, then this question would be answered affirmatively. Furthermore, if there had been a correspondingly higher energy level the previous November, e.g., >> 6.0 kJ/g wet mass, then there would be evidence that energy accumulated during the previous summer led to good recruitment. If instead the fall levels were similar to those already observed and the March reserves were high, it would suggest less net energy loss during winter. It is thus important to observing herring energy reserves both before and after winter.

5. Prince William Sound's energy subsidies.

Complex dynamic processes drive material in and out of PWS (Vaughan et al. 2001). In particular is that pelagic fishes in PWS receive significant oceanic carbon energy subsidies from the adjacent Gulf of Alaska (Kline 1999, Kline 2007). Year-to-year differences in the relative contribution of energy subsidies from the Gulf is important because it explained 50% of PWS pink salmon recruitment variation and thus may potentially explain this for other species as well

(Kline et al. 2008). Among PWS resident pelagic fishes, juvenile herring have the greatest dependency oceanic subsides (Kline 2008). Typically more than half of herring energy is of oceanic origin. The 1994 and 1995 herring cohorts had the highest energy levels observed thus far and these cohorts were associated with high oceanic subsidies (Norcross et al. 2001). A spin-off of the elemental analysis approach used in the current project has been simultaneous SIA and energy analysis enabling data plots such as Figure 5.1 that reveal associations of energy content with energy sources. The herring data available to date are compared to similar data collected during the SEA project (Figure 5.1). The energy values are not hugely different, however there was greater dependency on GOA carbon during summer to early fall feeding during SEA compared to the present since the October-November $\delta^{13}C'$ values were then overall more negative. During the winter, there was slightly greater dependency on PWS carbon during SEA then now since there were more herring with higher $\delta^{13}C'$ values.

Overwintering mortality results in significant losses of age-0 herring in PWS (Norcross et al. 2001). Herring sampled in March were winter survivors and these tended have dependency on oceanic subsidies ($^{13}C'$ values mostly < -19). Lowest WBED values near ~ 3.2 kJ/g wet mass were at the morbidity threshold (Paul and Paul 1998) and thus moribund (discussed above). We have yet to observe a cohort of age-0 PWS herring where WBED was sufficiently high in the fall that overwintering mortality could be projected to be low.

6. *Recent Pacific Decadal Oscillation (PDO) trends: 2008 was a cold year*

There has been a significant climatic shift in the last two years. The PDO index, which is based on sea surface temperature anomalies, slipped into a negative or cool phase in late 2007 that has persisted through 2008 until the present (Figure 6.1). Cooler temperatures may slow development rates (Q10 law) that may provide an explanation for the occurrence of *Neocalanus* late in 2008. Herring recruited well in the 1980's when the PDO was positive (Figure 6.2); thus quite different from present ocean conditions. There were no strong herring recruitments during the protracted period of negative PDO that lasted from the late 1940's to the early 1970's (Figure 6.2).

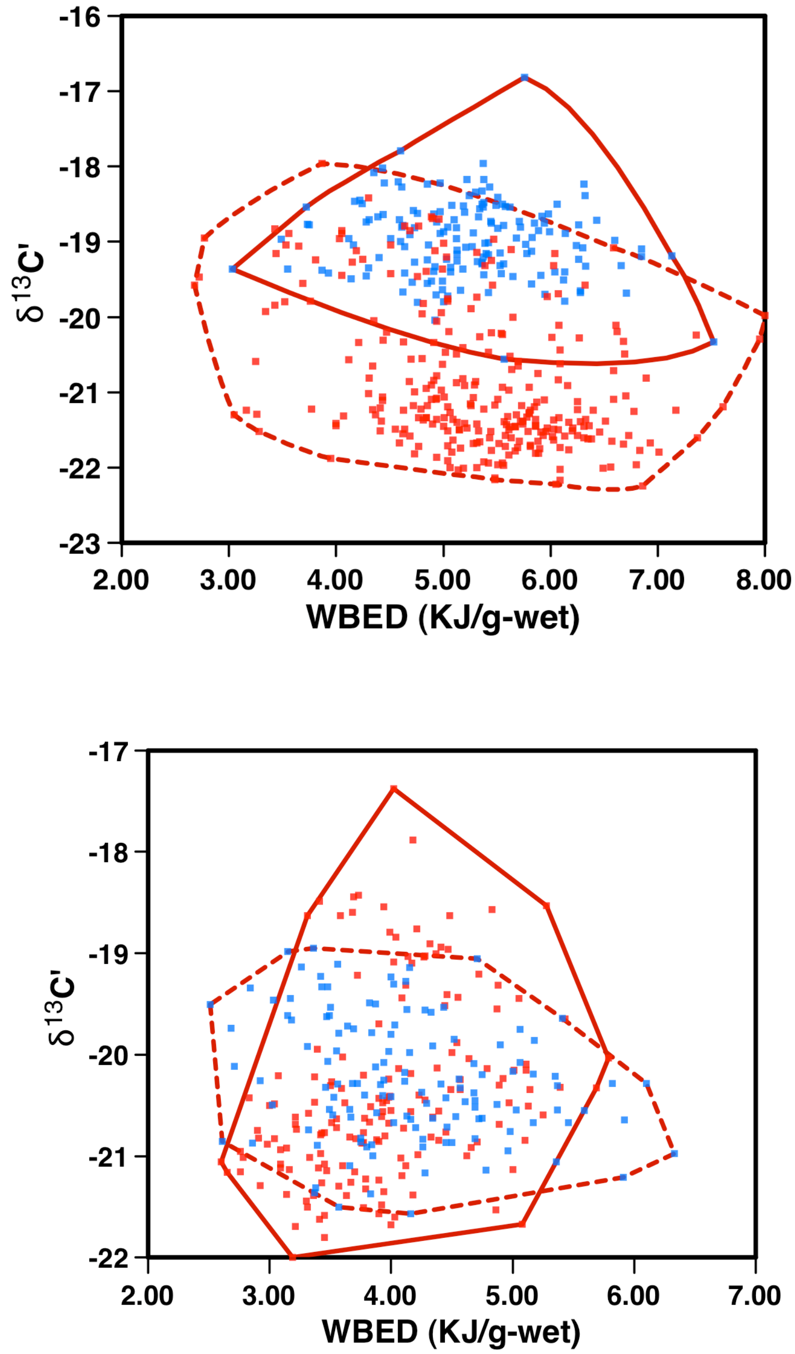


Figure 5.1 Scatter-plot of paired WBED and SIA observations comparing SEA (red symbols) and present data (blue symbols) in October-November (upper panel) and March (lower panel). Note that most of the points either in the recent as well as the SEA in the upper panel are < 6.0, thus most herring observed during all studies since the oil spill were doomed to die during winter. Most of the herring surviving the winter had δ^{13}C' values that were less than -20 suggesting the importance of GOA subsidies during whatever winter feeding that might exist.

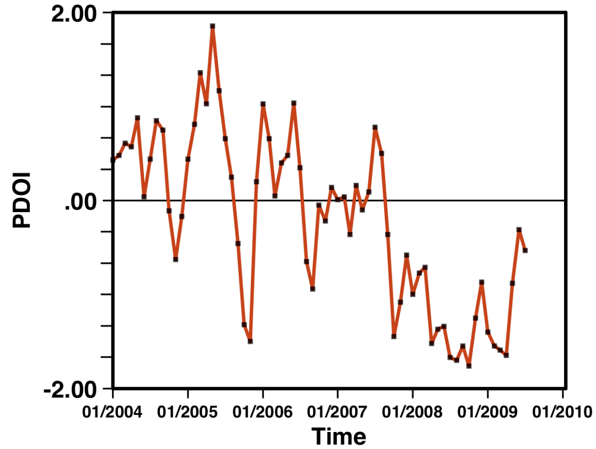


Figure 6.1. PDO index from January 2004 through July 2009 showing continuous negative anomaly during 2008 that commenced in late 2007 and continued into 2009. Monthly PDOI data taken from PDO webpage: http://jisao.washington.edu/pdo/.

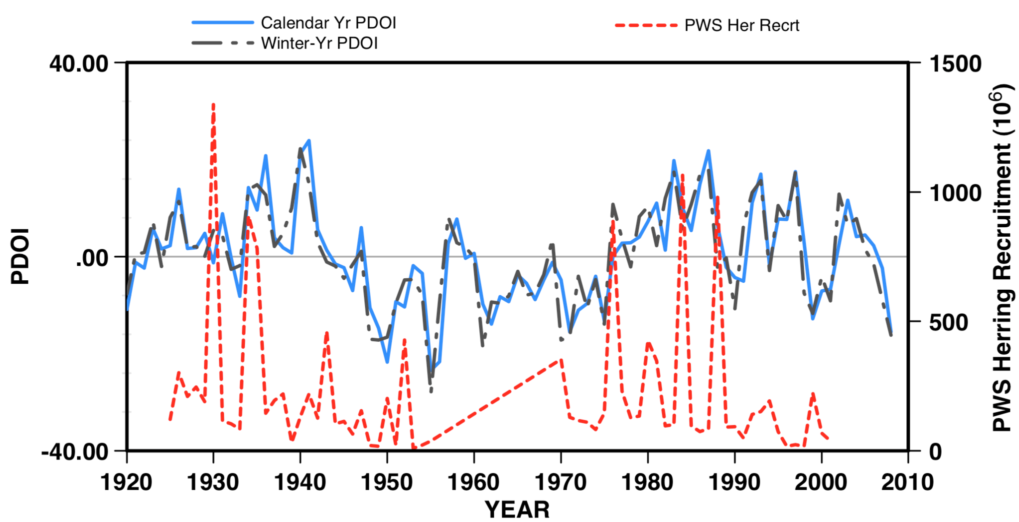


Figure 6.2. PWS herring recruitment and PDOI history. Calendar year (January-December) PDOI and Winter years (July-June) PDOI data (summation of monthly PDOI values taken from PDO web page as above). Herring recruitment data taken from Funk (2007)

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Completed and Future Measurable Project Tasks

FY08 4th Quarter (July 1, 08 to September 30, 08)
September Complete zooplankton survey #4, September-October 2008 (COMPLETED)

FY09 1st Quarter (October 1, 08 to December 31, 08)
November Complete juvenile herring survey #4, November 2008 (COMPLETED)

FY09 2nd Quarter (January 1, 09 to March 31, 09)
January Annual Marine Science Symposium (COMPLETED)
March Complete juvenile herring survey #5, March 2009 (COMPLETED)

FY09 3rd Quarter (April 1, 09 to June 30, 09)
June Complete analysis of zooplankton survey #3, (COMPLETED)
June Complete analysis of juvenile herring survey #3, (Analysis at lab)

FY09 4th Quarter (July 1, 09 to September 30, 09
September* Complete analysis of zooplankton survey #4, (COMPLETED)
September* Complete analysis of juvenile herring surveys #4, November 2008 and #5, March 2009 (Analysis at lab)
April, 2010 Submit Final Report, to the Trustee Council Office (To be done)

* the NOAA contract is expected to extend beyond the end of FY09; accordingly the work will be completed one year after the anticipated start of the FY09 contract (March 2009) and not the calendar date given here.

Future Work: Summarize work to be performed during the upcoming year, if different from the original proposal. Describe any proposed changes in objectives, procedural or statistical methods, study area or schedule. ***NOTE**: Significant changes in a project's objectives, methods, schedule or budget require submittal of a new proposal subject to the standard process of proposal submittal, technical review and Trustee Council approval.*

Coordination/Collaboration: Describe efforts undertaken during the reporting period to achieve the coordination and collaboration provisions of the proposal, if applicable.

• Field work sampling for herring involved collaboration with the project being led by Dr. Thorne
• Collected live materials for Dr. Hershberger's project

• Herring length frequency data requested by Dr. Bishop transmitted to Herring P.I.'s via email
• Preliminary graphs transmitted to Herring P.I.'s via email
• Samples were provided to this project by other projects; from Steve Moffitt (ADFG) and J.J. Vollenweider (NOAA)

Community Involvement/TEK & Resource Management Applications: Describe efforts undertaken during the reporting period to achieve the community involvement/TEK and resource management application provisions of the proposal, if applicable.

• Contributed to community herring planning effort
• Conducted special plankton outreach laboratory sessions for Cordova High School students
• Gave lectures on plankton to the community
• Preliminary results sent to collaborators for use in resource management

Information Transfer: List (a) publications produced during the reporting period, (b) conference and workshop presentations and attendance during the reporting period, and (c) data and/or information products developed during the reporting period. ***NOTE:*** *Lack of compliance with the Trustee Council's data policy and/or the project's data management plan will result in withholding of additional project funds, cancellation of the project, or denial of funding for future projects.*

a)

Kline, T.C., Jr. 2009. Characterization of carbon and nitrogen stable isotope gradients in the sub-Arctic Pacific Ocean using terminal feed stage copepodite V *Neocalanus cristatus.* Deep-Sea Research II. In Press.

b)

Provided article for the PWSSC Breakwater newsletter.
Oral presentation at the 2009 Alaska Marine Science Symposium
Oral presentation given at 2009 Alaska Marine Science Symposium repeated in Cordova
Poster presentation at Third GLOBEC Open Science meeting and participated in pelagic fish ecology workshop

c)

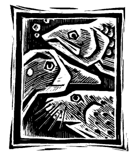
Preliminary graphs transmitted to Herring P.I.'s via email, workshops, symposia, and this report

Budget: Explain any differences and/or problems between actual and budgeted expenditures, including any substantial changes in the allocation of funds among line items on the budget form. Also provide any new information regarding matching funds or funds from non-EVOS sources for the project.
NOTE: *Any request for an increased or supplemental budget must be submitted as a new proposal that will be subject to the standard process of proposal submittal, technical review, and Trustee Council approval.*

none

We can accept your annual report as a digital file (Microsoft Word or WordPerfect), with all figures and tables embedded. Acrobat Portable Document Format (PDF) files (version 4.x or later) are also acceptable; please do not lock PDF files or include digital signatures.

Please submit reports electronically to science_director@evostc.state.ak.us. Also, please be sure to post your annual report on your own website, if you have one.



We appreciate your prompt submission of your annual report and thank you for your participation.