

EVOS Annual Progress Report

Project Number: # 070817

Project Title: Physical Oceanographic Factors Affecting Productivity in Juvenile Pacific Herring
Nursery Habitats

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Time Period Covered by Report: June - August 2008

Date of Report: Sept. 4, 2008

Work Performed: The results of the previous year of this study were summarized in a synthesis report sent to the Exxon Valdez Oil Spill Trustee Council (EVOSTC) in May, 2008, titled Physical Oceanographic Processes in Relation to Productivity of Pacific Herring (Gay 2008). The present report, therefore, addresses work accomplished mainly during final quarter of the project over the summer of 2008 and various problems encountered during that time. A table of all activities (including collaborative work) performed during the entire 2008 field season is given in Appendix A. Please note that this report is a summary of work accomplished and a more thorough report of the results from 2008 will be presented during the October 2008 meeting to be held in Anchorage.

Over the summer of 2008 the following field work was performed: 1) installation and downloading of meteorological data from a buoy and a shore based weather station in Whale Bay and one shore based station in Simpson Bay; 2) three intensive hydrography/ADCP cruises to Whale Bay and two cruises to Simpson Bay to supplement last year's data; 3) one thermosalinograph (TSG) cruise measuring hydrography, i.e. temperature/salinity/fluorescence/turbidity (T/S/F/Tb), over PWS and within Eaglek Bay and Whale Bay; and 4) deployment and retrieval of two oceanographic moorings within Whale. Some of Simpson's station maintenance and downloading of weather data was done during trips to Simpson using the PI's skiff. These sessions represent additional work not scheduled in the original DPD. On two occasions, intensive hydrography/ADCP cruises in Simpson also supported collaborators from Texas A&M University at Galveston (TAMUG) collecting ancillary measurements of deep currents, turbidity (sediment size distribution) and temperature, salinity and dissolved oxygen. Each of the other major project segments is addressed below.

Intensive Hydrography Cruises. Three intensive hydrography cruises around PWS were undertaken from June 4th to the 7th, July 31st to August 3rd and August 23rd to the 27th. These included continuous recording of current profiles collected with an acoustic Doppler current profiler (ADCP) and water column hydrography (T/S) collected continuously with an undulating sled and repeatedly at CTD stations (T/S/F/Tb) located throughout both Whale and Simpson. Most of the initial results of the 2007 intensive hydrography cruises and mooring data from Simpson were described in the synthesis report. The cruises to Simpson Bay performed n

2008 showed patterns in flow and T/S properties similar to observations made during the previous year (Gay 2008). However, some variation in surface currents and hydrography were seen reflecting a marked change in weather conditions between years. These measurements along with the ancillary weather data will be quite valuable in explaining the combined forcing mechanisms that affect water exchange into the main basin and into the northern (inner) basin.

Both currents and hydrography at Whale were highly influenced by inflow of glacial water emanating from Icy Bay, a neighboring tidewater glacial fjord. These observations confirmed those made during the surveys of Whale made during the Sound Ecosystem Assessment (SEA) project. However, just as Simpson exhibited variation in physical oceanographic characteristics between 2007 and 2008, so also did Whale. In the latter case, this appears to have been an attribute of high snow accumulation over the winter and its gradual release over the summer due to below average air temperatures, which caused an estuarine outflow from the fjord. This is a marked contrast to conditions observed in the 1990s in which the inner basins were warmer and saltier than the outer basin. Hopefully, the high resolution CTD data collected during the second and third cruises will show how this outflow interacted with glacial water from Icy Bay entering Whale during ebb tides. Analysis of the currents and hydrography may also reveal how flows in the upper 100 m affect transport into the Southern Arm of the fjord. Note that the latter region of the fjord is primarily where age 0 juvenile herring were observed during the SEA program. One caveat here is that the highly detailed structure of the currents provided by the 600 kHz ADCP within Simpson was not available at Whale. This was due to the considerably deeper basin depths (100-300m) at Whale which required using a lower frequency 150 kHz ADCP in order to achieve bottom tracking.

TSG Cruise. This cruise was sponsored in part by OSRI and in part by my project. It was accomplished on two separate legs; one between July 18th and 21st and one on July 26th. The surveys included measurements of the temperature (T), salinity (S), fluorescence (F), and turbidity (Tb) of the nearsurface water throughout Prince William Sound (PWS) and within the two of the fjords studied during the SEA project. Also, within Whale a 600 kHz ADCP was towed to determine the feasibility of using GPS as a reference for absolute currents. This attempt had mixed success and from these trials it was concluded that only the use of the 150 kHz ADCP would suffice to survey Whale.

In addition to the TSG data, full water column T/S/F/Tb profiles were collected at various oceanographic stations distributed over the cruise area (*see the revised detailed project description (DPD), July 2007*). Lines of stations were also occupied, spanning across the inlets near the Alaska Ocean Observing System (AOOS) mooring sites in Hinchinbrook Entrance and Montague Strait. The hydrography data collected during the TSG cruise should provide a comparison of physical conditions within PWS and the four nursery habitats in mid summer of 2008. Unfortunately, budget constraints limited other TSG cruises in 2008 to surveys made in mid to late winter (Feb. and March).

Moorings at Whale Bay. The two moorings at Whale were successfully deployed and retrieved, and with the exception of the loss of the anti-foulant cells on one of the nearsurface CTs all the instruments collected data throughout the deployment. It is hoped that these data will show if exchange of deep water below 100 m (and hence nutrients from PWS) that enters into the

Whale's outer basin also enters into the Southern (inner) basin. The mooring retrieval represents the last portion of the 2008 field season directly undertaken by this project. Any additional data collected next fall and late winter will be done by collaborative projects.

Future Work: Future research objectives were addressed in detail in the revised DPD submitted in July 2007. Various logistical and budget constraints encountered during the early stages of the study were also outlined in the 2007 progress report. Here I will describe how these were specifically addressed during the 2008 field season.

The original objectives in 2008 called for focusing the intensive hydrographic cruises on Whale Bay, a fjord located in a region influenced by freshwater discharge from tidewater glaciers. Fieldwork in this fjord was still a major objective. However, because of vessel availability in 2008 intensive surveys of Simpson were again accomplished in mid to late summer. Unfortunately, there were further problems with the undulating CTD system involving cabling and sensor failures, and this limited data collection with the SB9 CTD to Whale only.

The objectives and methodology used in 2008 remained the same, but the scheduling changed slightly. For example, intensively surveying two fjords during each cruise reduced the overall time spent within each location to about 15 hr. This permitted collecting quasi-synoptical data in both fjords under the same interannual climate, which was preferable in comparing the response of these fjords to local climatic forcing. As aforementioned in the 2007 progress report, it is becoming more apparent that interannual climatic variation is increasing. For example, in just four years the summer climate of PWS and elsewhere in Alaska went from a warm anomaly in 2004 to a cool anomaly in 2008. How this may be related to either a shift in the Pacific Decadal Oscillation (PDO) or to background global warming is uncertain. The affects of the former will only be revealed by a time series with a sufficiently long fundamental frequency (i.e. inter-decadal).

Coordination/Collaboration: The coordination and collaboration with other projects was successful for the most part in 2008 (see Appendix A). These data included hydrographic (T/S) profiles collected during both the afore-mentioned TSG cruise and the EVOS sponsored cruises conducted by R. Thorne (Trends in adult and juvenile herring distribution and abundance in PWS). One final data set should be available following a cruise scheduled for Thorne's project in November 2008. In addition to the above work, coordination with research being conducted in Simpson Bay by personnel from TAMUG was accomplished. A key researcher at TAMUG is Dr. Antonietta Quigg who is studying primary productivity (i.e. phytoplankton dynamics). Dr. Quigg is analyzing chlorophyll and nutrient samples collected in 2008.

Due to budget constraints only one synoptic TSG cruise was conducted in the summer of 2008. At present, it is uncertain whether the money for these cruises will be included in the AOOS budget for next year (2009). However, if such funds were to become available it would behoove the herring restoration program to include money through my project to include hydrography measurements in the four SEA fjords next year.

Community Involvement/TEK & Resource Management Applications:

During the 2008 field season, community involvement was limited to contracting or renting vessels for use in the intensive physical surveys of the four SEA fjords. Resource management applications are not applicable at this time.

Information Transfer: No publications or presentations were scheduled during the 2008 summer field season. However, presentation of the second year's results are planned for the Ocean Sciences meeting in January 2009 in Anchorage sponsored by the EVOSTC. In addition, I will be analyzing the data for inclusion in my PhD dissertation, which will be written in part over the 2009 budget year. The dissertation will serve as a final report for this project in 2010.

Budget: A detailed explanation of the budget changes requested for next year will be submitted along with a revised DPD later once I have reached Texas A&M. For now I will state that I am requesting an additional \$4K to cover the equipment problems and the TSG cruise incurred in 2008 and (possibly) an additional \$6K to cover fjord hydrography during TSG cruises in 2009 (if these occur). Finally, I have revised the original amount requested for salary in 2009 from 3 months to 5. I feel this is justified in that I may not return to TAMU in the fall that year, but may instead remain in Cordova to complete writing my dissertation. As such, I will require more financial support to accomplish this.

Signature of PI: _____

APPENDIX A Table of research tasks and collaborative activities performed during the 2008 field season for project # 070817:
Physical Oceanographic Factors Affecting Productivity in Juvenile Pacific Herring Nursery Habitats.

<u>Month</u>	<u>Dates</u>	<u>Cruise Type & Locations</u>	<u>Types Data Collected or Service Performed</u>
Feb	?	TSG cruise (AOOS/OSRI) - A. Craig	Collect tsg data over PWS & and ctd data at select stations
March	16-23	Juvenile Herring Cruise - D. Thorne	Broad scale hydrography; CTDs at 6 stations in each fjord
March	?	TSG cruise (AOOS/OSRI) - A. Craig	Full tsg/ctd cruise & ctd data over PWS & at MS/HE
May	12-28?	Zooplankton Cruise - T. Kline	Hydrography (Hydrobios CTDF) at discrete depths in above fjords CTD Moorings deployed at WB; Intensive ADCP/ Hydrography transects at WB; CTDs elsewhere
June	3-7	Cruise to all SEA fjords - Auklet	Upload met data at Simpson
June	21	Trip to Simpson - Scott Pegau	Collect tsg data over PWS & and ctd data at select stations; Upload met data at Simpson and Whale
Jul	18-21,26	TSG cruise (OSRI) - A. Craig	CTD Moorings retrieved at WB; Intensive ADCP/ Hydrography transects; CTDs elsewhere
July/Aug	31-3	Cruise to all SEA fjords - Auklet	Hydrography (Hydrobios CTDF) at discrete depths in above fjords
Sept	?	Zooplankton Cruise - T. Kline	Broad scale hydrography; CTDs at 6 stations in each fjord
Nov	?	Juvenile Herring Cruise - D. Thorne	

