# *EVOSTC Annual Project Report*

***Project Number:*** *10100132-F*

***Project Title:*** *PWS Herring Survey: Sound Wide Juvenile Herring, Predator, and Competitor Density via Aerial Surveys*

***PI Name:*** *Evelyn D. Brown*

***Time Period Covered:*** *April 2010 thru August 2010*

***Date of Report:*** *July 15, 2011 retroactive to August 2010*

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***Project Website:*** *Shared at PWSSC web site http://pwssc.org/herringsurvey/*

**Work Performed:** 2010 was the start up year for this project. Measurable tasks to the August deadline for annual reports included equipment purchase, project planning, attending the marine symposium and a research planning meeting, performing June, July and August aerial surveys, and distributing edited data.

The project proceeded as planned except that the contract was not initiated until January of 2010 by permission of the PI. Therefore, the purchase and set up of field equipment was delayed until March of 2010. Two rugged touch screen HP computers were purchased for the project along with ArcPad software which was installed on both computers. An aerial survey-specific script designed for Alaska Department of Fish and Game herring surveys was provided by a department contractor. Although there was a small amount budgeted for alteration of this software specific to this project, the contractor did not have time to provide that service and the software was used without change. However, software support was required for the preparation and set up of the field computers and the contract funds were absorbed by that service. Because the software did not adequately capture the data collected, requiring extensive handwritten notes, editing took longer than initially anticipated. The PI did attend the Marine Symposium although no presentations were provided since the project had not started. By April, a dedicated aircraft was secured and the PI attended a field planning meeting in Cordova in May of 2010. Historic data sets were distributed to other herring researchers during this meeting and the transfer of equipment needed for the herring survey project was arranged trawl used to sample age 0 and other juvenile fish in the nursery bays.

The field season in 2010 was plagued with particularly bad weather, even for Cordova standards, and for every survey day, there were two or three weather days. However, despite the dismal survey conditions, we were able to conduct two full circuits of PWS in June, During June; one full circuit of PWS was flown with repeat surveys in selected regions that appeared to

have juvenile herring in abundance compared to other regions. Also in June, a camera boom was designed and fabricated to fit the Prince William Sound Science Center (PWSSC) Research Vessel "New Wave" and mounted on the vessel for use during July cruises. During July, two full circuits were flown including two days of coordination with the New Wave for guided sampling (using the camera) of aerial mapped schools. Using the camera pole extended over the front of the vessel, we were able to guide the vessel into approximately 10 schools and captured images of the fish to be used for validation. During August, a single circuit of PWS was completed included coordination with the PWSSC juvenile herring acoustic cruise aboard the R/V Auklet. The acoustic tracks were surveyed by air four times over two days of the acoustic cruise to allow comparison of acoustic and aerial survey results. During the aerial surveys, fish schools were counted, the surface areas were noted, and the species of fish were recorded included age specific notations for herring. In addition, avian and marine mammal predators were mapped and behaviors associated with foraging were noted. Jellyfish aggregations were also measured and mapped. Figures 1 through 8 show examples of the types of school and predator configurations observed as well as the pole camera mounted on the New Wave. Figure 9 shows the coverage of PWS by aerial surveys. The attached table lists the flights performed over the course of the season.

Several observations are worth noting for the 2010 season. The analysis for the 2011 report will enumerate these observations. First of all, there appeared to be an abundance of age 1 herring as well as other forage species in PWS compared to the SEA/APEX years (94-99). The marine mammal population, especially Stellar sea lions, harbor seals, humpback whales, and minke whales, has appeared to increase dramatically as well. In addition, there were sightings of never before observed whale species such as grays and fin whales inside PWS, marine mammal aggression behavior (e.g. minkes attacking humpbacks) was observed, and it was common to see sea lions and seals foraging on juvenile herring (a rare observation in the past). The predation pressure from these species appears to have increased dramatically but comparing the actual counts will allow a true comparison. Finally, Auke Bay researchers observed large amounts of juvenile saffron cod a couple years ago during a nearshore beach seine survey. These fish seem to have matured and we observed them in several herring nursery bays in large layers under and associated with herring schools. Figures 7 and 8 show the size of the cod associated with the sampled herring shown.

The one task that was not completed was the distribution of data. Because the ArcPad software did not allow inclusion of all the data types collected for this survey, editing required a lot more time than initially anticipated. The goal of distributing edited data by August was not realistic and was delayed. It would be more realistic to set the data distribution milestone at May the following year given the amount of time needed to edit, correct, organize, and query the data for distribution. In addition, the use of this data by outside or coordinating researchers requires some of the PIs time for interpretation and if that request falls outside of the bounds in time and resources of this project, additional funding may be required to meet that need. However, for this and next year, the query and interpretation efforts will be included in the existing project funding.

**Future Work:** Future work will include the editing and delivery of the data, the density-dependent correlations of predators and competitor species, and collaboration with the acoustic investigators in the comparison of the two data types. We do not anticipate changes to the current proposal and plan to follow the objectives as described in the original proposal.

**Coordination/Collaboration:** We coordinated and collaborated with two other PWS Herring Survey projects. Rob Campbell operated the camera boom for two days during on of his zooplankton cruises as an economic alternative to chartering a vessel specifically for aerial validation. As part of the project plan, we coordinated with the acoustic cruise for two days to allow comparison of surface versus sub-surface distribution of fish schools. Combined with the historic SEA data, our goal with the paired acoustic-aerial data is to explore the possibility of using a sub-surface correction factor for surface school indices.

**Community Involvement/TEK & Resource Management Applications**: An important part of this project is to create a tool useful to ADFG by allowing a prediction of recruitment to the adult herring population while employing local knowledge to collect this data. The contracted pilot is a local professional fish spotter who is active in the commercial herring and salmon fisheries around the state. The skills and ability of this and other local fish spotter pilots add to data collection capability by effectively doubling the swath width of the survey and due to their familiarity with fisheries management data needs. During the course of the surveys, the pilot is trained to observe and record the data of concern for this project and is able to relay observations from one side of the plane while the surveyor/passenger collects data from the other side. Three different spotter pilots were trained in the identification of juvenile herring schools as well as other forage schools such as sand lance and capelin and the collection of sea bird and marine mammal predator counts and behavior. We anticipate that the surveys can be transferred and performed by these pilots with a local trained surveyor who could be another pilot, a fisherman, or a person identified by the local fisherman's union. Over the course of this field season, three locals accompanied and trained with the PI. We anticipate developing a standard protocol that will be easy to transfer and that will keep the cost of aerial surveys at a minimum as they will be performed by local talent and existing resources.

**Information Transfer:** Because this was the first field year, there were no publications or presentations prepared.

**Budget:** The project was performed within the total budget allowed but there were some changes. Field travel costs were under estimated and project travel went over budget by $768. The field computers were $992 more than projected and the camera boom shipped from the University was not usable and a new camera boom was fabricated for approximately $2000 which caused the contract line to be over by $2052. However, these costs were absorbed by reducing the personnel costs by approximately $4000 to keep the project within budget. This reduction in man hours was part of the reason that the data delivery was delayed. We do not anticipate going over on contracts this year and we have found ways to reduce travel costs and as a result, we do not anticipate needed additional funding.

## Aerial Survey Flight Log - Prince William Sound 2010

| Date | Start Time | End Time | Survey Type | Survey Region | Cloud Cover (%) | Ceiling (ft) | Survey Conditions | Water Visibility |
|---|---|---|---|---|---|---|---|---|
| 6/13/2010 | 12:42 | 18:29 | Broadscale | SE and part of NE PWS | 100 | 2000 | Good | Fair-Excellent |
| 6/14/2010 | 10:20 | 10:45 | NA | aborted flight due to weather | 100 | 900 | poor | poor |
| 6/19/2010 | 15:17 | 18:23 | Broadscale | Central Sound Survey - Hinchinbrook and Montague | 100 | 1200 | poor | poor-fair |
| 6/20/2010 | 13:45 | 18:28 | Broadscale | Redo part of Central Sound and SW PWS | 80 | 5000 | excellent | good |
| 6/21/2010 | 14:57 | 19:10 | Broadscale | Western PWS, Knight Island - avoiding large fog bank coming in to sound | variable | variable - fog | excellent | good |
| 6/22/2010 | 13:27 | 18:55 | Broadscale | Northwestern PWS bays and fjords | 50 | 2500 | excellent | good |
| 6/23/2010 | 14:27 | 20:30 | Broadscale & Catches | North central, northern fjords & bays, NE (Pt Valdez) - vessel drop off | 100 | 2000 | good | fair |
| 6/24/2010 | 14:57 | 16:45 | Broadscale | Copper R flats, Wingham and Kayak Island - Entrance | 100 | 2500 | good | poor to fair |
| 7/9/2010 | 15:04 | 16:37 | Broadscale | CR Delta, Wingham, Kayak,. Hinchinbrook-Entrance | 100 | variable - fog | good | poor to fair |
| 7/12/2010 | 11:51 | 14:45 | Broadscale | Northern Hinchinbrook, SE PWS | 80 | 1500 | excellent | good |
| 7/14/2010 | 10:04 | 19:46 | Broadscale & Camera Boat | NE & Eastern Sound - Camera Vessel Work | 50 | 5000 | excellent | good |
| 7/15/2010 | 10:16 | 13:30 | Broadscale | Central Sound and SW Bays | 100 | variable - fog | poor to fair | fair |
| 7/16/2010 | 10:31 | 16:45 | Broadscale & Catches | NW and Northern PWS | 100 | variable - low | poor to fair | fair |
| 7/17/2010 | 11:19 | 15:30 | Broadscale | Central and SW Bays and Passes | 100 | variable - low | poor to fair | fair |
| 7/20/2010 | 13:51 | 14:09 | NA | Attempted NW survey - mechanical and weather problems - aborted | 100 | fog | poor - fog | poor |
| 7/21/2010 | 15:03 | 20:00 | Broadscale | NW PWS; fjords, bays and passes | 100 | variable - fog | poor to fair | poor to fair |
| 7/23/2010 | 11:00 | 15:50 | Broadscale | Western PWS, Knight Island Passage and Perry Island | 100 | 1100 | fair | fair |
| 7/28/2010 | 11:45 | 15:45 | Broadscale & Catches | North Shore and Perry Island - catch validations | 100 | variable - fog/drizzle | poor to fair | poor to fair |
| 7/29/2010 | 11:00 | 12:45 | Broadscale | Central and SW Sound; abbreviated survey | 100 | varible | fair | fair |
| 8/3/2010 | 12:30 | 17:15 | Broadscale | SE and Eastern PWS - Wash. Post photojournalist aboard | 50 | 5000 | excellent | good |
| 8/6/2010 | 11:25 | 16:45 | Broadscale & Acoustics | Eastern, NE and Northern PWS - catch validations - repeat surveys over acoustic tracks | 100 | 800 - variable | fair | fair |
| 8/7/2010 | 11:43 | 18:55 | Broadscale & Acoustics | SE, Central and SW PWS - repeat surveys over acoustic tracks | 90 | 1500 | good | fair - good |
| 8/8/2010 | 9:37 | 15:30 | Broadscale | Central, Western, and NW PWS - last survey | 50 | 2500 | excellent | good |

Figure 1. Age 0 herring school at Perry Island:

Figure 2. Age 1 herring at Zaikof Bay, Montague Island.

Figure 3. Adult herring schools in Knight Island Passage.

Figure 4. Juvenile herring exhibiting heavy predation pressure at Glacier Island.

Figure 5. Sea lions hauled out at Wooded Island.

Figure 6. The New Wave with camera pole extended headed toward an age 0 herring school in Simpson Bay.

Figures 7 & 8. Age 1 herring schools were observed and measured from the plane, sampled using a jigging pole after landing the plane, and as a bonus, saffron cod were captured under the herring school each with a whole herring inside. The saffron schools were extensive and appeared to be heavily predating on herring.

Figure 9. Cumulative aerial flight path for 2010.