EVOSTC ANNUAL PROJECT REPORT

Project Number: 12120111A

Project Title: PWS Herring Research and Monitoring: Validation of Acoustic Surveys for Pacific Herring Using Direct Capture

Principal Investigator: Dr. Mary Anne Bishop

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Time Period Covered by the Report –February 1, 2012 – January 31, 2013.

Date of Report: February 10, 2013

Summary of Work Performed

Acoustic surveys provide a low-cost, remote sensing tool to estimate species specific fish biomass and abundance as well as distribution of pelagic fish and zooplankton. To ground truth acoustic data, pelagic trawls provide the primary *in situ* method to validate species composition, help facilitate the estimation of acoustic biomass and collect additional biological data such as length-frequency distribution and age. Pelagic trawl data also can aid in the interpretation of previously collected acoustic data from other surveys conducted within the Prince William Sound (PWS).

The primary objectives for the *Direct Capture* study include:

1) Improve capture methods used to validate acoustic surveys.

2) Increase the sample size for identification, quantification, and measurement of juvenile (0+, 1+, 2+) and adult (3+ and older) herring schools as well as other fish schools in survey areas.

3) Provide data on species composition and length frequency to aid in the interpretation of current and historical acoustic surveys.

4) Provide adult herring samples to Alaska Department of Fish and Game for the adult herring age-structure-analyses model.

5) Provide juvenile herring samples to researchers investigating juvenile herring fitness and disease.

The first direct capture study, *HRM: A High Temporal and Spatial Resolution Study to Validate the Separate Herring Condition Monitoring Program* (PI's Kline and Heintz) began in August 2011 (pre-award) and was completed in June 2012. Personnel from this study assisted with the monthly direct capture on several occasions, under the direction of HRM project leader Scott Pegau.

Our first multi-project direct capture effort was scheduled for November 2012 in conjunction with the *HRM study: Juvenile Herring Abundance Index*. Prior to that juvenile herring survey and to ensure that our validation methods would be appropriate for our study area and goals, Megan McKinzie, the project's fisheries biologist, participated in the EVOS Gulfwatch study:

Monitoring long-term changes in forage fish distribution, abundance, and body condition in Prince William Sound (USGS Alaska Science Center, PI's Piatt and Armitsu). From July 20-26, 2012 McKinzie was onboard the *R/V* Alaskan Gyre with other scientists assisting with data collection. This cruise conducted diurnal, concurrent acoustic and mid-water trawl surveys in northern Prince William Sound. The cruise also collected oceanographic measurements, zooplankton samples, and conducted beach seines. In addition to acquiring experience fishing the mid-water trawl, the forage fish cruise has provided critical information to determine the appropriate net and mesh size required for our herring validation surveys.

Methods. When we originally wrote the proposal for this project we planned to use Dr. Rob Campbell's trawl (12.8 m (L) x 7.6 m (W) x 9.1 m (H)). Unfortunately, Campbell lost this trawl during field work, forcing us to purchase a new trawl. Based on our sampling objectives, desired species and age classes it was determined that a sweeper mid-water trawl would be the most effective net design. The net has an approximately 154 m^2 mouth (14 m x 11m) and is 22 m long. Mesh size diminishes from 38 mm at the mouth to 12 mm at the cod end (Innovative Net Systems, Inc.). The net is held open by two 0.4 m^2, series 2000 steel mid-water trawl doors (Nor 'Eastern, Inc.); each weighing approximately 76 lbs. The net and doors are deployed via dual winches with enough 3/8" dynema line to fish to a maximum depth of about 70 m. Target depth for juvenile herring capture is 15-25 m. The unexpected cost of purchasing the trawl, doors, as well as higher than expected costs for the reel and winches prevented us from purchasing a trawlmaster. Therefore, in lieu of a trawlmaster, we elected to use a SBE37 Microcat (MCat) attached to the floatline to record trawl depth as well as time, salinity, temperature and sound velocity.

However, due to hydraulic compatibility issues between our reel/winches and the charter vessel during the initial November 2012 survey we were unable to obtain sufficient power to successfully deploy and haul our mid-water sweeper trawl, despite several attempts at system modifications and replumbing. Therefore, within each survey bay (Fig. 1) large gillnets (160' X 16'; 1/4, 3/8, 1/2, and 3/4 sq. in mesh) were deployed and allowed to soak overnight in areas of high acoustic signature as an alternative validation method (Table 1). All fish captured were identified to species, separated and measured for total length and weight.

We supplemented our validation efforts with a small mesh gillnet (60' X 16'; 1/4, 5/16, and 3/8 sq. in) and cast nets to provide samples to the juvenile herring and disease projects conducted concurrently with the acoustic surveys. All fishing was done opportunistically while at anchor (Table 2) .All captured fish were identified to species and herring samples were separated by project (Table 3).

Preliminary Data. During the November 2012 cruise, large gillnet efforts used for acoustic validation collected a total of 34 fish representing nine species (Table 4). Pacific herring were captured in highest abundance and within five of the seven bays (Fig. 2). Small mesh gillnets and cast net efforts collected a total of 1,837 individuals from 14 different species. Due to sampling objectives and fishing methods utilized, age-0 and age-1 juvenile herring; our target species, was captured in highest abundance across all bays (Fig. 3). Overall, Eaglek Bay had the highest species richness (n = 8) followed by Port Gravina and Whale Bays (n =7, respectively).

Eaglek Bay also had the highest species diversity (H' = 1.7) followed by Lower Herring and Simpson Bays (H' = 0.9, respectively) (Figure 4).

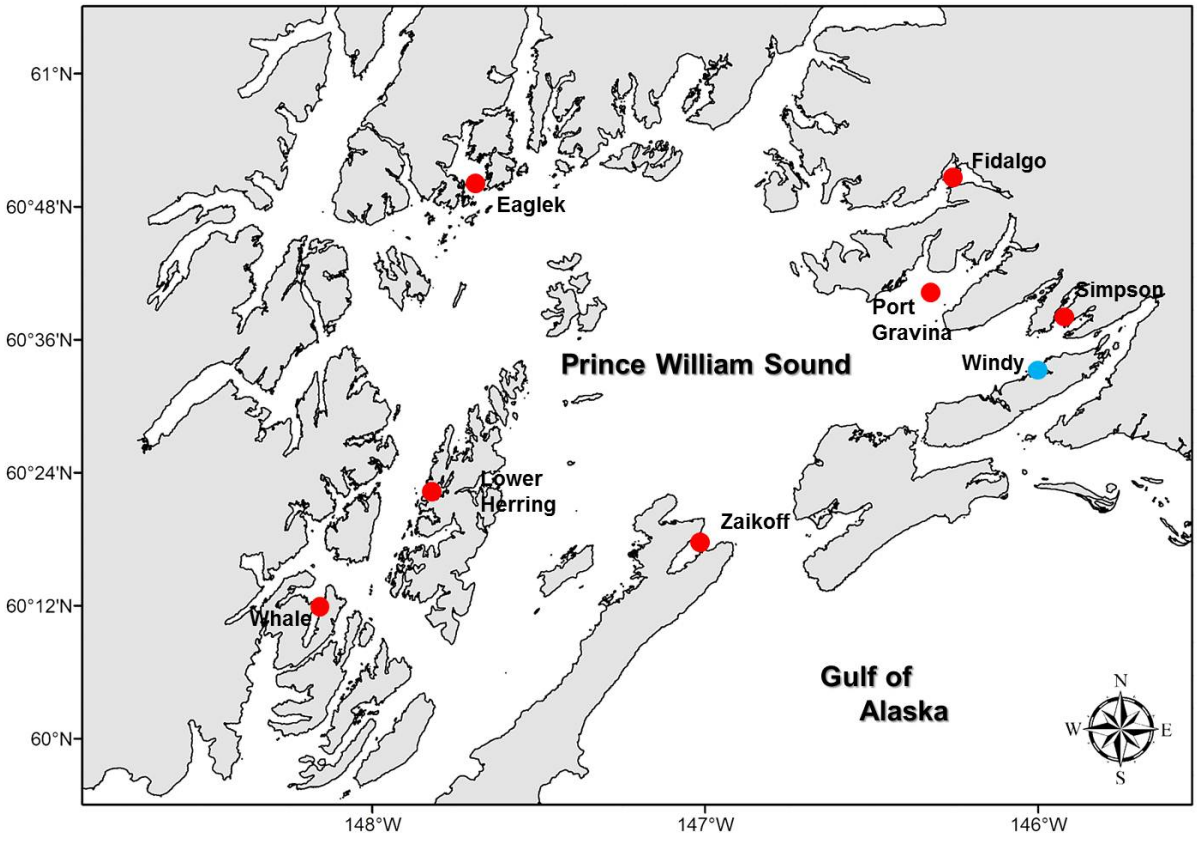

Figure 1. Location of acoustic surveys for juvenile herring and corresponding validation sampling. Red circles represented bays sampled during the November 2012 survey and blue circles represents bays that will be added in subsequent years.

Table 1. Summary of acoustic validation fishing effort and number of fish collected via large gillnets by bay for the November 2012 cruise.

	Large gillnet		
Site	Reps	Total time (h:mm)	# Fish
Eaglek	2	10:26	6
Fidalgo	2	17:52	1
Lower Herring	2	27:18	5
Port Gravina	1	8:20	2
Simpson Bay	1	9:11	1
Whale	2	18:03	7
Zaikoff	2	16:36	12

Table 2. Summary of effort for energetics and disease projects sampling by bay and method.

	Small gillnet			Cast net		
Site	Reps	Total time (h:mm)	# Fish	Reps	Total time (h:mm)	# Fish
Eaglek	2	7:29	59	3	3:40	40
Fidalgo	1	2:00	164	1	0:30	0
Lower Herring	2	4:30	18	2	6:00	108
Port Gravina	3	4:05	5	3	4:30	193*
Simpson Bay	0	0:00	0	2	5:30	65
Whale	1	7:15	835	1	1:00	9
Zaikoff	1	1:28	23	1	1:30	318

*an additional 1000 post-larval capelin were also collected but not included in analyses

Table 3. Breakdown of the number of juvenile herring samples retained by bay and project.

	PWSSC	USGS	NOAA
Site	Energetics	Disease	Energetics
Eaglek	42	0	0
Fidalgo	70	0	61
Lower Herring	41	30	37
Port Gravina	71	60	64
Simpson Bay	35	0	30
Whale	529	0	100
Zaikoff	117	60	50

Table 4. Number and lengths (mm, $\bar{x} \pm se$) of fish caught by large gillnets used for acoustic validation during the November 2012 cruise.

		Nov 2012 Acoustic Validation	
		Total length (mm)	
Species	**N**	**$\bar{x}$ ± SE**	**Range**
capelin	5	121 ± 2	116-128
Pacific cod	3	183 ± 76	101-335
Pacific halibut	1	239	
Pacific herring	19**	158 ± 15	86-237
saffron cod	1	209	
sculpin*	1	111	
slender eelblenny	2	113 ± 4	109-117
sturgeon poacher	1	74	
walleye pollock	1	131	

*spp unknown; **only 13 measured

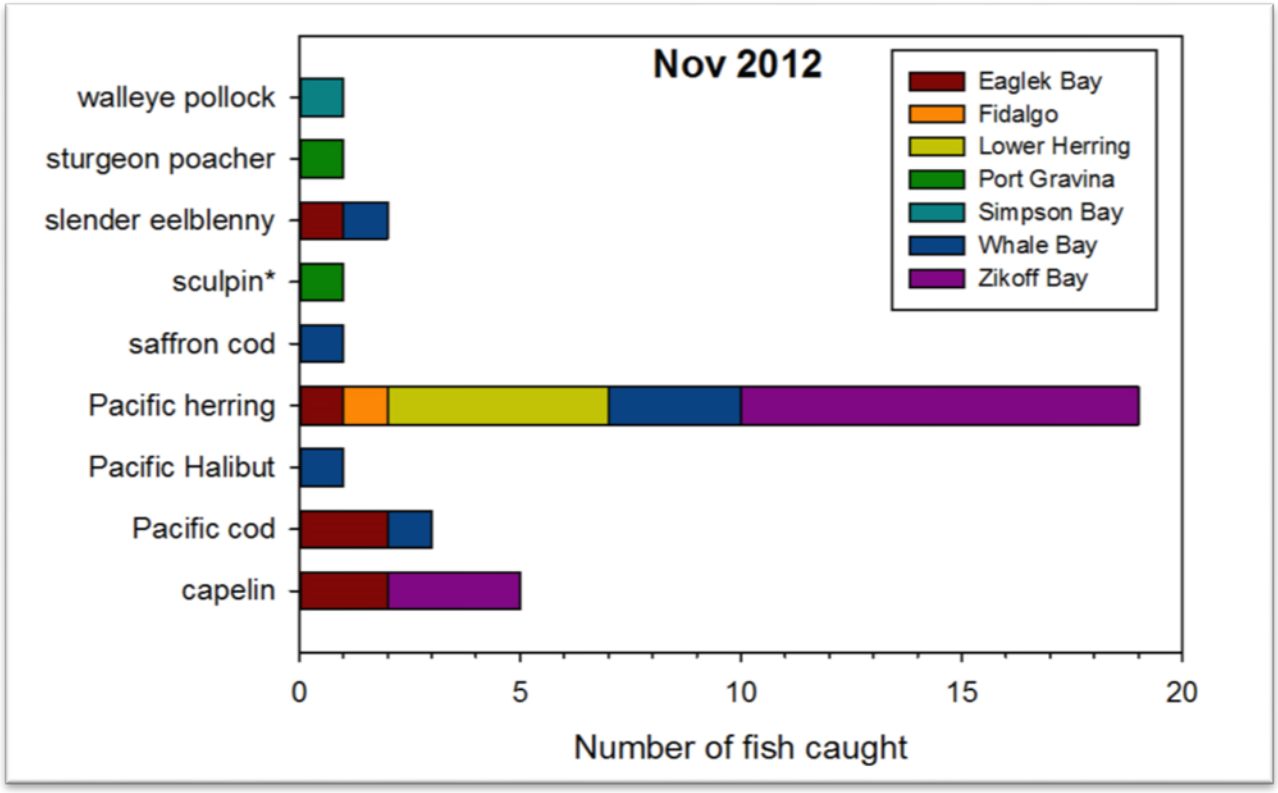

Figure 2. Number and species of fish caught by bay via the large gillnets used for acoustic validation, November 2012.

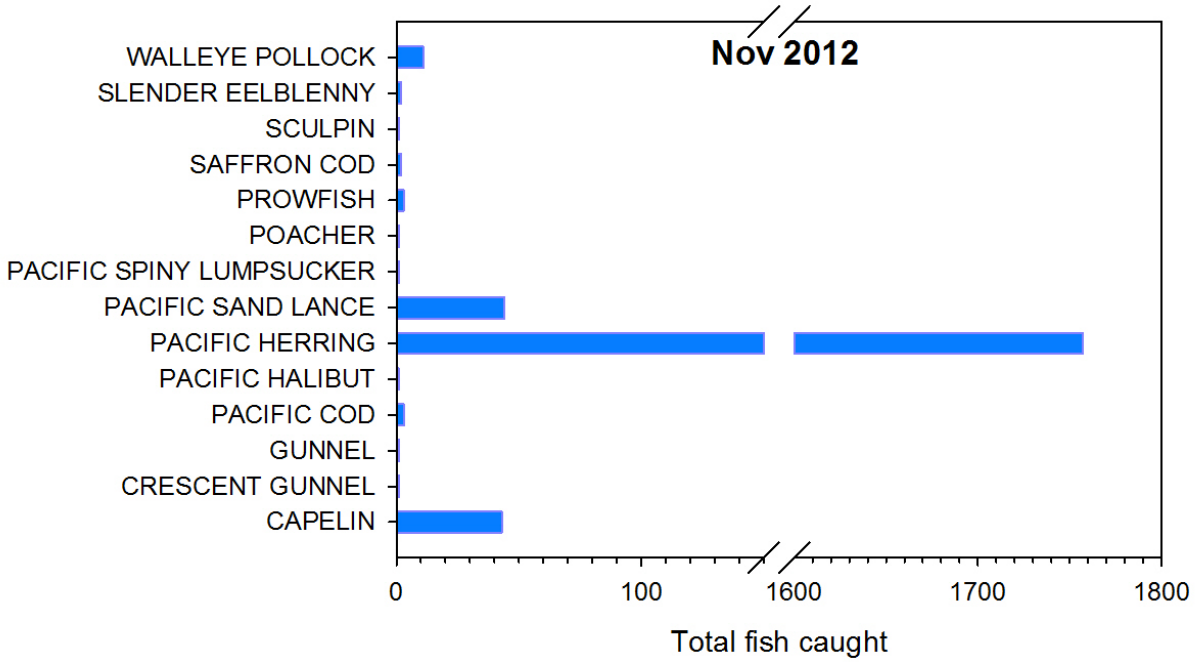

Figure 3. Total number of fish collected by species across all bays and sampling methods used for validation, disease and energetics projects during the November 2012 cruise.

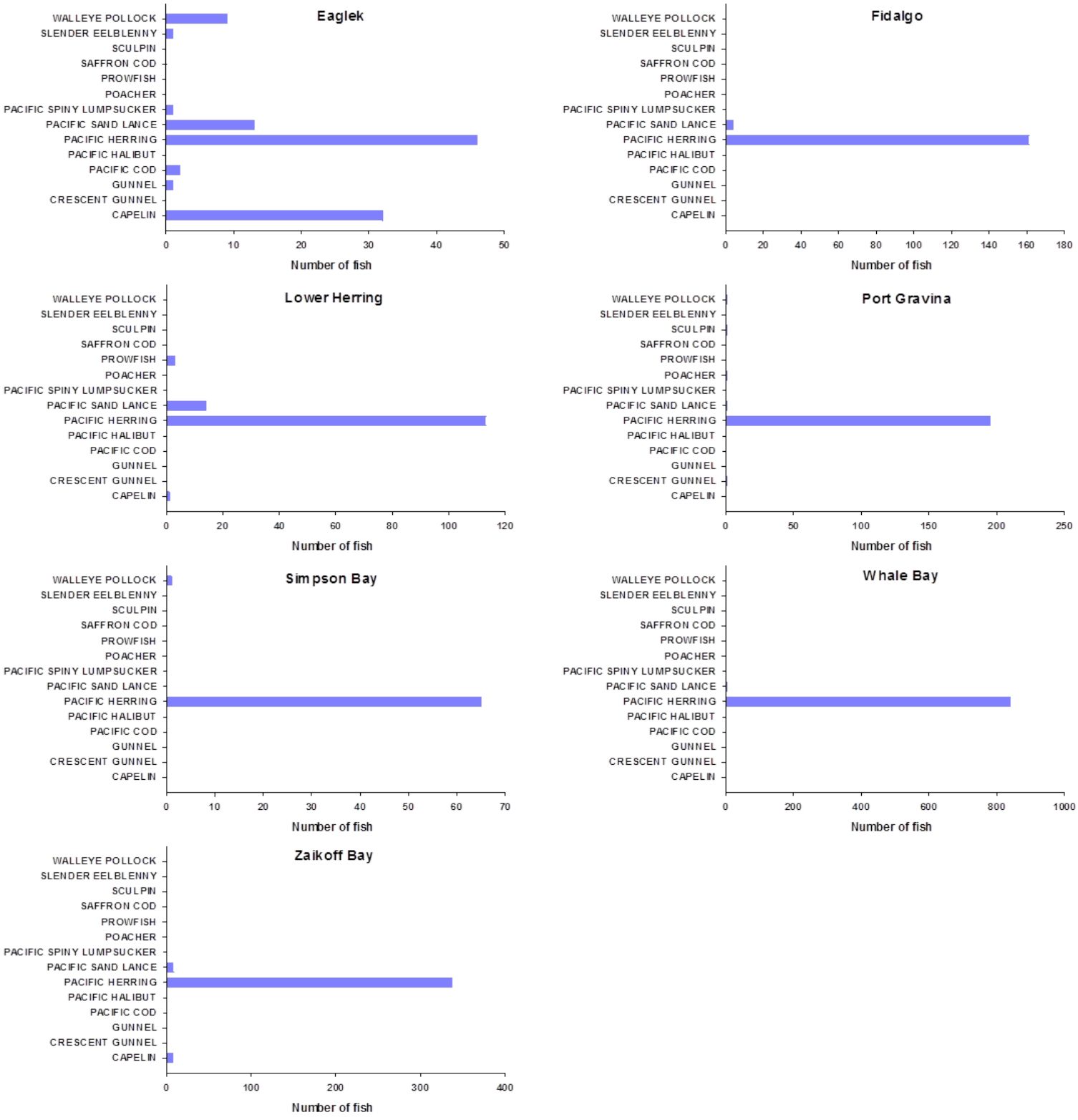

Figure 4. Number and species of fish caught by bay using all gear types (large and small gillnets and cast net) during the November 2012 cruise. Species list represents all species caught at all locations through the study period.

Summary of Future Work to be Performed –

In January 2013 we submitted and received the Alaska Department of Fish and Game permit for all 2013 herring collections. We have also submitted a collecting protocol to the Prince William Sound Institutional Animal Care and Use Committee (IACUC). Protocols are often a requirement in the methods section for publication.

In mid-March 2013 we will conduct a trial run to test the modified reel and winches to ensure all hydraulic issues have been resolved. In November 2013, we will again validate juvenile herring acoustic surveys in conjunction with the *PWS Herring Research and Monitoring Juvenile Herring Abundance Index*. For acoustic validation fishing efforts we will use the sweeper mid-water trawls as previously planned for this project. Large gillnets and a box trawl will be used as the primary back-up methods for validation if necessary. We will also continue to collect herring samples for the disease and energetics projects.

Two projects will begin within the next 12 months. One of the new projects in Year 2 is the *Expanded Adult Herring Surveys*, which will be comprised of a cruise or cruises in late March/early April 2013. For acoustic validation and for the genetics study that is part of the Herring HRM, we will be collecting fish primarily using jigs and gillnets, and to a lesser extent cast nets. We will not be using the mid-water trawl for validation because of ADFG concerns that too many adult herring would be captured. During the spring surveys, we have also been asked to collect Pacific cod to see if stomach contents contain herring for the HRM disease study (PI Hershberger). The second new project, *Juvenile Herring Intensive Acoustic & Validation Surveys,* begins in October 2013. For this project, we will sample Simpson Bay and an adjacent eastern PWS Bay approximately every two weeks. We will use the midwater trawl as our principal means to collect fish, and supplement it with gillnets and cast nets.

Coordination/Collaboration –

Our project is part of the Prince William Sound Herring Research and Monitoring Group. Field work is conducted concurrent with acoustic herring surveys, and EVOS Gulfwatch seabird winter observations. As part of our effort, we make collections for the two HRM herring fitness studies (PI Kline and PI Heintz) and the HRM herring disease study (PI Hirschberger) and we assisted with direct capture for the High Temporal and Spatial Resolution Study to Validate the Separate Herring Condition Monitoring Program (completed June 2012). Principal investigator Bishop attended the April 2012 EVOS Herring meeting in Cordova. In addition, Principal investigator Bishop presented research findings at a November 2012 EVOS Herring Research and Monitoring meeting in Anchorage. We also collaborated with Gulfwatch PI's Piatt and Armitsu in July 2012. From July 20-26, 2012 McKinzie, biologist for this project was onboard the *R/V* Alaskan Gyre with other scientists assisting with diurnal, concurrent acoustic and mid-water trawl surveys in northern Prince William Sound.

Community Involvement/TEK and Resource Management Applications –
While this project does not have a community involvement component, we consulted with local fisher experts about reel and winch design and modifications.

Information Transfer –

Popular Press:

A picture of the new reel with a caption was published in the Fall 2012 Breakwater, the newsletter of the Prince William Sound Science Center.

Budget –

***EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL**
ANNUAL PROGRAM REPORT YEAR 1

Budget Category:	Proposed Year 1	Actual Year 1	TOTAL Difference
Personnel	$32,469	$224	$32,245
Travel	$1,000	$12	$988
Contractual	$900	$340	$560
Commodities	$5,400	$676	$4,724
Equipment	$10,700	$17,071	($6,371)
Indirect Costs (*will vary by proposer*)	$11,931	$375	$11,556
SUBTOTAL	$62,400	$18,698	$43,702
General Administration (9% of subtotal)	$5,616	$1,683	$3,933
PROJECT TOTAL	$68,016	$20,381	$47,635
Other Resources (Cost Share Funds)	$0	$0	$0

COMMENTS:

FY12	**Program Title: HRM Validation of Acoustic Surveys** **Team Leader: Bishop**	**SUMMARY**

Equipment in year 1 was overspent because the trawl net we intended to use was lost at sea and we needed to replace it.