1. PROJECT INFORMATION

GOA IERP Project Number:	4181-00
Title:	UTL – Surviving the Gauntlet
Overall project duration	1 October 2010 – 30 Sept 2014
Overall project funding	$3,765,811
Report period	1 April 2011 to 1 December 2011
Report submission date	10 November 2011
Lead Author of Report*	Jamal Moss

**Although there may be only one lead author of the report, all PIs and co-PIs of the project, as identified in the approved statement of work and listed below, are responsible for the content of the Semiannual Progress report in terms of completeness and accuracy.*

Principal Investigator(s), Co-Principal Investigators and Recipient Organization(s):

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2. PROJECT OVERVIEW

a. Briefly (4-5 sentences) describe the core purpose of your project, and the underlying need for this research.

The overall goal of our research is identifying and quantifying the major ecosystem processes that regulate recruitment strength of key groundfish species in the Gulf of Alaska (GOA). We concentrate on a functional group of five predatory fish species that are commercially important and account for most of the predatory fish biomass in the GOA. We focus on recruitment success because large swings in the abundance of these species have occurred despite precautionary fishing levels. Their early life begins with an offshore pelagic phase followed by a nearshore settlement phase. Spatial distribution, food preference, and habitat suitability of these two life history phases are poorly known. Fieldwork will define a critical environmental window for these five focal species by examining the gauntlet they endure while crossing from offshore spawning to nearshore settlement areas. We will contrast two regions: the central GOA with a broad shelf dominated by high oceanographic variability and large demersal fish biomass and the

eastern GOA (SEAK) with a narrower shelf, lower demersal biomass, and higher species diversity. Retrospective analysis of biological and environmental variability combined with multispecies stock assessment models will determine the relative influence of environmental parameters and identify processes influencing recruitment. Regional differences will be linked to dietary preference of top level predators to infer causal mechanisms for population trends and influence of climate change on ecosystem structure and diversity.

b. State the specific GOAIERP hypothesis or hypotheses that your project is addressing.

The Gauntlet: The primary determinant of year-class strength for marine groundfishes in the GOA is early life survival. This is regulated in space and time by climate-driven variability in a biophysical gauntlet comprising offshore and nearshore habitat quality, larval and juvenile transport, and settlement into suitable demersal habitat.

GOAIERP hypotheses are posted in SharePoint at: https://agora.afsc.noaa.gov/sites/gisr

c. List the specific objective(s) of your research project.

1.) Quantify, by region, the temporal variability in potential climatic, oceanographic, or biological drivers influencing the early life survival of key groundfish species. Differences between the eastern and central GOA will be examined through retrospective analyses of available spatial datasets. Please refer to the retrospective component progress report for more details.

2.) Determine by region the abundance, distribution, and condition of key groundfish species during their offshore to nearshore pelagic phase through at-sea sampling with concurrent observations of the biophysical environment (i.e. oceanography, prey, competitor, and predator fields). Please refer to the lower trophic level (LTL) and the middle trophic level (MTL) component progress reports for more details on nearshore sampling and the offshore concurrent observations of oceanography, prey, competitor, and diet fields.

3.) Create benthic habitat suitability maps by region through analysis of available bathymetry and substrate data (e.g. slope, grain-size) to characterize the nearshore demersal habitat.

4.) Develop growth curves and consumption rates through laboratory work, which will parameterize simple bioenergetics models that will estimate potential fish growth for rockfish.

5.) Analyze dietary preference and foraging behavior of seabirds and relate diet to prey availability. Please refer to the MTL component progress report for more details on the estimation of total biomass removals by seabirds.

3. PROGRESS SUMMARY

a. Provide a table showing the timeline and milestones for the current reporting period only.

What	*Who*	*Start and end dates*	*Status*
UTL field surveys	**Moss, Fournier**	June 30 – October 2011	Complete

Hire UTL field survey lead	**Moss**	April 1– June 1 2011	Complete
Georegistering and digitizing of central GOA bathymetry and sediment data and begin process for southeast Alaska region	**Zimmermann, Shotwell**	April 1– Dec. 1 2011	In progress
Create SOW for habitat post doc position	**Zimmermann, Shotwell**	Begin 2011	In progress
Contract post-doc	**Heintz**	May 2011	Complete
Design preliminary studies to determine ingestion rate in POP	**Heintz**	May – June 2011	Complete
Acquire POP for lab studies	**Heintz/ Sreenivasan**	August 2011	Incomplete
Begin lab studies on POP	**Sreenivasan**	September – December 2011	Incomplete
Acquire field samples for diet and energetics	**Heintz**	August – October 2011	Complete
Identify & hire at-sea observers for remaining UTL cruises	**Slater**	April – October 2011	Complete
Oversee initiation & help with rhinoceros auklet study at St. Lazaria	**Slater**	June 2011	Complete
Direct rhinoceros auklet study at St. Lazaria	**Will**	Present – November 2011	Complete
Supervise seabird monitoring work at St. Lazaria Island	**Slater**	May – September 2011	Complete

b. Describe report period progress.

Retrospective Analysis (1):
Please refer to retrospective component progress report.

Fisheries Oceanographic Surveys (2):
The Auke Bay Laboratories conducted the first Upper Trophic Level (UTL) fisheries oceanographic survey which was conducted aboard the 162 ft. stern ramp trawler F/V *Northwest Explorer* from June 30th – July 24th, July 31st – August 22nd , September 3rd – September 25th, and September 26th – October 9th. The research cruise was staffed by scientific personnel from the UTL, MTL, and LTL components. Sampling occurred in the SEAK and central GOA regions in addition to a limited area within the vicinity of Yakutat Bay and Kayak Island. Fish samples were collected using a midwater rope trawl, a Cantrawl model 400 made by Cantrawl Nets LTD of Richmond, BC, Canada. The 400 model is a 198-m midwater rope trawl that has a mouth opening 55 m wide x 15 m deep, is comprised of hexagonal mesh wings in the body, and has a 1.2-cm mesh codend liner at the foot. The trawl was either fished at depth to verify acoustic targets or modified to fish at the water surface by stringing buoys along the headrope. Surface tows were 30 minutes in duration and made at predetermined grid stations. Midwater trawls targeting specific layers varied in duration and occurred whenever acoustic verification was deemed necessary. Immediately after a trawl was brought onboard catches were sorted by species and standard biological measurements (length, weight, and maturity) were recorded.

Whole age-0 marine fish, juvenile salmon, and forage fish were collected and frozen whole for transport to the laboratory for food habits, energetic, and genetic analyses. A livebox was attached to the codend of the survey trawl at predetermined grid stations to collect live age-0 rockfish in the SEAK region. Once the livebox was retrieved, live *Sebastes* specimens were immediately transferred to an aerated livewell on deck. All other species caught in the livebox were returned to the sea.

An observer stationed in the wheelhouse quantified marine mammal and seabird abundance while the ship was underway.

Physical oceanographic data was collected at gridded survey stations by deploying conductivity, temperature, and depth meter (CTD) with ancillary sensors (SBE-911, Sea-Bird Electronics, Inc, Bellevue, WA). This provided vertical profiles of salinity, temperature, fluorescence, photosynthetic available radiation (PAR), and dissolved oxygen. Water samples for nutrients (N, P, Si), chlorophyll a, phytoplankton, and microzooplankton were collected (surface 10m, 20m, 30m, 40m, and 50m depth) using 5-L Niskin bottles. Water samples were filtered for Chlorophyll a with GFF filters, which were stored in the dark at -40°C. Nutrient samples were taken from Niskin bottles and stored at -40°C. Microzooplankton was preserved in acid Lugol's and phytoplankton in formalin.

Zooplankton and ichthyoplankton samples were collected at gridded station using double oblique bongo tows with 505 micron mesh nets mounted to 60-cm diameter frame simultaneously with 150 micron mesh nets mounted to a 20-cm diameter frame. Oblique tows were made from the surface to near bottom (5 meters) to a maximum of 200 m with a 45° wire angle. Neuston tows were made at the surface with an approximate speed of 2 knots with a Sameoto sampler. The net was adjusted to keep the frame half in and half out of water for 10 minutes.

Numerous attempts were made to collect live age-0 rockfish specimens for wetlab experiments in summer and fall; however, none of these attempts were successful. Very few were captured in the livebox and those that were captured expired in the livewell before being transported to the laboratory. Once it became clear that live rockfish collection onboard our survey vessel were not going to work in fall either, arrangements were made to capture fish within Sitka Sound using a beach seine. This attempt was also unsuccessful because age-0 rockfish had moved out of the nearshore environment and into deeper water.

Equipment and samples collected during summer and fall UTL surveys were shipped to colleagues located at PMEL, ECO-FOCI, UAF, and WWU.

Habitat Suitability (3):
A preliminary bathymetric surface of the CGOA area was constructed from historical smooth sheet data sets, which are single-beam or lead-line soundings available from the National Geophysical Data Center (NGDC). While most of these smooth sheets data sets are available as digital files from NGDC, there is a lot of proofing and editing required ensuring that each smooth sheet data set is complete and correct.
In general, the following steps describe how this initial CGOA bathymetric map was constructed. First, each smooth sheet (color digital image of the original paper map) was georegistered in ArcMap. Second, a custom datum shift brought the image from the original datum, such as Valdez or Port Hobron, into proper alignment with NAD83. Third, the digital soundings file was compared to the NAD83-aligned smooth sheet and shifted, if necessary, to also align the digital soundings with NAD83. There is no other method of determining the datum of the digital soundings and, in this region unacceptably large datum differences of 300m in Latitude and Longitude are common. Fourth, the digital soundings were compared to the smooth sheet image for correctness and completeness - in some instances entire smooth sheets were digitized, while others required a little or no digitization. Fifth, overlaps of contradictory data sets were resolved and the depth soundings from about 80 smooth sheets in the CGOA area were combined into a large file (~900,000 data points). Sixth, in ArcMap the bathymetric points were converted into a

Triangulated Irregular Network (TIN), which is a continuous surface of triangles constructed by using the bathymetric points as vertices for the triangles. This preliminary surface helped identify additional errors and data gaps which we are working towards fixing.

There are additional useful data sets which can be extracted from the smooth sheets. Features such as rocky reefs, kelp, rocks and islets are represented as symbols on the smooth sheets and we are working on digitizing these. Sediments such as gravel, sand and mud are also available on the smooth sheets as verbal notations and we are about one third or one half of the way done digitizing these for the CGOA. Eventually we should be able to create sediment surfaces such as percent sand or mean grain size which can be draped over the bathymetric surface.

The same process of working on the smooth sheets, creating a preliminary bathymetric surface, feature and sediment data sets is also in progress for the EGOA project area.

Seabirds and Marine Mammals (4):
Summaries of seabird and marine mammal numbers are presented in Tables 1 and 2. A total of 26 seabird and 3 marine mammal species were seen during the 4 survey legs. In general, there was a higher diversity and greater numbers of seabird species seen in the northern grids than in the southern grids.

Seabird Colony (5):
Monitoring work based at St. Lazaria and East Amatuli islands was carried out in 2011 as in previous years by Alaska Maritime National Wildlife Refuge staff. Telemetry work was carried out on rhinoceros auklet adults to determine foraging range and patterns.

Physiology (6):
Experimental arenas and holding tanks were brought online at the Auke Bay Laboratories wetlab facilities and are currently ready to receive fish. Feeding and growth rate experiments are on hold until next summer because live rockfish were not collected. However, experimental trials will be conducted on juvenile herring and capelin this winter to test equipment and provide information on these important forage species.

c. Describe preliminary results.

Fisheries Oceanographic Surveys (2):
A total of 192 surface trawl hauls were completed in 2011, with 108 of those trawls occurring in summer (June 30th – August 22nd) and 84 in fall (September 3rd – October 9th). Few age-0 target marine species were encountered in the SEAK or central regions during summer or fall. Herring (*Clepea pallasii*), smelt (*Osmerus morax*), and capelin (*Mallotus villosus*) were rarely encountered in either region or season, but were found in large aggregations during fall. Juvenile salmon (*Oncorhynchus* spp.) were highly abundant in summer and fall. Adult salmon were abundant in during summer months but were rarely encountered during fall.

Age-0 rockfish (*Sebastes* spp.) were primarily distributed 30-60 miles offshore in the SEAK region and along the shelf break due west of Yakutat Bay during summer months. Few were located on the shelf in either region. Arrowtooth flounder (*Atheresthes stomias*) were encountered during summer but not during fall, with the largest catches on the shelf in the central region. Age-0 Pacific cod (*Gadus macrocephalus*), pollock (*Theragra chalcogramma*), and sablefish (*Anoplopoma fimbria*) were rarely encountered in either region or season.

Juvenile chinook (*O. tshawytscha),* the least encountered juvenile salmon species was primarily located in SEAK waters. Juvenile pink (*O. gorbuscha*) and chum (*O. keta*) salmon were most abundant outside of

Cross Sound and in coastal waters of between the Kenai Peninsula and Kodiak Island. Sockeye (*O. nerka*) and coho (*O. kisutch*) salmon were broadly distributed, but less abundant relative to juvenile pink and chum. Juvenile salmon catches during fall months were lower in SEAK and greater in the central GOA. Pink salmon composed the majority of adult salmon catch during fall and were primarily distributed off of the central GOA shelf. Catches of all species of adult salmon decreased during fall.

Mid-water catches consisted of rockfish, groundfish, forage fish, and salmon in the SEAK during summer. Adult light dusky and Pacific ocean perch (POP) were the most prevalent rockfish species encountered while adult walleye pollock were targeted and captured at four locations. An abundance of longfin smelt and adult capelin were encountered once, while a mix of larval capelin co-occurring with adult pollock was more common. A myctophid layer was targeted and successfully sampled once. Although salmon were never actively targeted for mid-water target verification, chinook and pink salmon were caught in multiple tows. Mid-water tows made in the western GOA during summer months captured the same assemblage of species: light dusky, POP, pollock, longfin smelt, capelin, and myctophids. However, pollock and POP catches were much larger in the central GOA and salmon absent in the catch during summer. During fall months light dusky, POP, capelin and pollock were captured in the SEAK region, but myctophids and smelt were absent. Adult herring were captured in multiple tows. Capelin were captured in multiple tows (n=4) in the central GOA during fall, but pollock and POP were the comprised the majority of the catches.

A livebox was attached to the codend of the trawl and deployed in the SEAK region in both the summer and fall. During summer sampling operations the livebox was fished at pre-designated grid stations located 60 miles offshore. Sixteen hauls were completed with the livebox attached, which yielded 112 *Sebastes* specimens. Mortality rates were observed at ~50% and it was determined that we did not have enough live individuals to warrant live transportation back to the laboratory for feeding rate experiments. During fall survey operations the livebox was fished in the inside waters of SEAK prior to arrival at the designated grid. The livebox remained on the survey trawl during the sampling of the southernmost transect and for additional stations that were 60-40 miles offshore as extensions of existing transects. A total of 4 *Sebastes* species were captured.

Habitat Suitability (3):
The preliminary bathymetric map reveals numerous seafloor features in greater detail than previously seen. The bathymetry clearly defines the boundaries of Portlock Bank and the three sections of Albatross Bank, which dominate the western half of the CGOA. The shape and the continuity of the canyons which divide the banks are greatly clarified. The canyons are sometimes obstructed by curvilinear deposits, some of which are small and diffuse, while others are large and pronounced. We hope to identify these deposits as possible moraines, which are piles of glacially accumulated rock, or as ebb tidal deltas, which are gradual accumulations of finer grain sediments. A notable curvilinear deposit divides Marmot Bay from the Gulf of Alaska and has a curved length of about 55 km, a width of about 3 km, and a height of about 50 m. The Albatross Canyons and Banks are crossed by nearly linear, NE-SW trending features which are probably earthquake faults. In the eastern half of the CGOA are some broad, diffuse curvilinear deposits which extend in a fairly continuous arc of about 150 km and are as far as 75 km offshore. The best (most accurate and detailed) bathymetry is typically from the nearshore area, which is fortunate for our project's focus on successful larval settlement in shallow waters.

We have just begun experimenting with developing metrics from the smooth sheet bathymetry, features and sediment data so that we can quantify the nearshore larval settlement areas. This will be important not only for producing maps of preferred larval settlement, but also for making comparisons between MTL bay study sites. For example, the shoreline can be digitized within a bay and converted into bathymetry data points (on the smooth sheets the shore is defined in terms of location and tidal depth). This process is

time-consuming but produces a very valuable product: shoreline length might prove to be a valuable measure of a bay's productivity. Once the shore bathymetry is added to the bay bathymetry, horizontal slices of the bay can be made such that the surface area and volume of the bay's water can be made at any depth. Vertical slices of the bay can also be made such that constrictions within the bay, or the openness of the bay to the Gulf of Alaska, can be made. The area of islands, islets, rocks, kelp patches, rocky reefs, and sediment types can be estimated. The bathymetric representation of the bay can also be linked to the land (USGS topographic maps) so that freshwater inflow points of rivers and streams can be located along with an estimated amount of annual precipitation, which might be an important factor for larval fish.

Seabirds and Marine Mammals (4):
A total of 26 bird species were seen over 4 survey legs; only 3 species of marine mammals were identified. In general, there was a higher diversity of species seen near the southeast Alaska panhandle, while greater numbers and a larger estimated biomass of seabirds were noted in the northern grids.

Seabird Colony (5):
Monitoring work based at St. Lazaria and East Amatuli islands was carried out in 2011 as in previous years by Alaska Maritime National Wildlife Refuge staff. Preliminary results of data collected on the focal species showed that rhinoceros auklet productivity was slightly lower than in recent years, but within the range of values recorded since 1994. Pacific herring comprised 42% of biomass within bill-loads collected from rhinoceros auklets at St. Lazaria Island. Capelin (27%), sand lance (21%) and kelp greenling, salmon spp., and unidentified fish filled in the remainder (10%, combined). Diet samples (not yet analyzed) were also collected from fork-tailed storm-petrels at St. Lazaria and East Amatuli islands. Tufted puffin diet samples were also collected at East Amatuli.

Telemetry work focused on foraging (areas, patterns, depths, and effort) was conducted on rhinoceros auklet adults by a graduate student attending UAF. These birds can be sensitive to human intrusions so there were mixed results in recapturing them. Preliminarily, it seemed that relatively few useful data were collected in 2011. These data will be analyzed to yield as much information as possible.

d. Describe integration activity.

Fisheries Oceanographic Surveys (2):
We put forth considerable effort to ensure that LTL and MTL objectives were accomplished on summer and fall fisheries oceanographic surveys; which included coordination of shipping oceanographic and hydroacoustic equipment, trouble shooting oceanographic equipment, sample collection, and the shipping of samples. Agreements were made between the UTL and the Alaska Fisheries Science Center Resource Assessment and Conservation Engineering (RACE) division's bottom trawl survey and the Alaska Department of Fish and Game's small and large mesh bottom trawl surveys to collect age-0 and age-1 target species and explore future collaborations. We anticipate that the alliances made in 2011 will be maintained throughout the GOA Project timeline.

Meetings with EVOS long term monitoring project PIs were held to discuss potential collaborations between the two programs with particular attention toward forage fish, herring, and marine mammal work. The UTL will continue to work with these groups over the winter as they finalize 2012 field sampling and research plans.

Chlorophyll data collected in the SEAK region during the 2010 pilot study and analyzed last winter were provided to the LTL group and the retrospective analysis group to ground truth SeaWiFS data which will link the field survey data with historical data.

Habitat Suitability (3):

We have worked closely with Kim Rand in the MTL so that we can provide any possible bathymetry, feature and/or sediment information for MTL site selection and field work activities. We have provided geo-referenced and datum shifted smooth sheets, corrected bathymetry and digitized sediment data for MTL research sites, along with instruction in GIS so that the information can be used properly.

Seabirds and Marine Mammals (4):
At-sea data collection of seabird and marine mammal distributions and numbers was limited to the UTL program. However, we also provided an observer for the spring and fall GLOBEC cruises so those data could be integrated with UTL and MTL work.

Seabird Colony (5):
Data collection efforts at seabird colonies were limited to the UTL program.

e. Describe any concerns you may have about your project's progress.

We have three primary concerns. The first concern is the lack of age-0 target species captured in 2011 summer and fall surveys. Catches were so low that we may not have enough samples to generate statistically significant results if 2013 proves to be an anomalously low abundance year as well. Our second concern is the delay in feeding and growth rate experiments resulting from unsuccessful attempts to capture live specimens in the field and transport them to the laboratory. Assuming that live specimens are collected early next summer, resulting experimental data and model parameterization would be delayed by 10 or more months. A third project concern was the difficulty of retrieving rhinoceros auklets to which a telemetry device was attached. Little information was obtained in 2011 to pinpoint foraging locations and depths. If the Alaska SeaLife Center will allow, we hope to use captive birds as proxies to improve data collection efforts planned for 2013.

f. Poster and oral presentations at scientific conferences or seminars

1. Oral presentation: To GOA Plan Team to provide an overview of the program and report on preliminary summer survey findings.

2. Oral presentation: To the Alaska Chapter of the American Fisheries Society to report on preliminary 2011 field survey results.

3. Oral presentation: Framework for Describing Groundfish Habitat Information for the Gulf of Alaska and Aleutian Islands by Mark Zimmermann, Jane A. Reid, and Nadine Golden presented at the American Fisheries Society meeting in Seattle, WA, September 5-8, 2011.

g. Education and outreach

Bonita Nelson (UTL education and outreach coordinator) participated in The Gulf of Alaska Ecosystem Workshop – Extending a Model for Transforming Ecosystem Science into Educational Resources.

UTL field survey blog: http://gulfofalaska.nprb.org/program/field.html (UTL cruises are not able to accommodate teachers at sea).

4. PROGRESS STATUS

We have made satisfactory progress in completing all tasks scheduled for the current reporting period with the exception of collecting and transporting live age-0 rockfish from the field to the laboratory for

feeding and growth rate experiments and the obtaining of limited rhinoceros auklet foraging pattern data. Summer and fall field surveys are complete and survey data is in the process of being proofed and checked. Samples are being organized and prepared for diet and genetic analyses.

5. FUTURE WORKPLAN and DATA DELIVERY

Workplan

What	*Who*	*Start and end dates*	*Other key dates*
UTL field survey data release to SharePoint	**Moss**	December 1 – 31 2011	
Age-0 focal species diet processing	**Fournier**	December 1 – June 31 2012	
Adult diet salmon processing	**Fournier**	December 1 – March 31 2012	
Complete georegistering and digitizing of central GOA bathymetry and sediment data and begin process for southeast Alaska region	**Zimmermann, Shotwell**	December 1 – completion of product	
Create SOW for habitat post doc position	**Zimmermann, Shotwell, Moss, Heifetz**	December 1 – March 31	
Test experimental design with surrogate species	**Heintz**	December 1 – March 31	
Award contract and initiate rockfish genetics processing	**Heifetz**	December 1 – March 31 2012	
Acquire field samples	**Heintz**	August – Oct 2011	
Begin lab studies on POP	**Sreenivasan**	September – December 2011	
Rhinoceros auklet diet sample processing	**Slater**	September – November 2011	
Fork-tailed storm-petrel diet sample processing	**Slater**	September 2011 – March 2012	
Seabird/Marine mammal observational data processing	**Slater**	17 October 2011 – 30 April 2012	

Data delivery.

GOAIERP Data Delivery Table		
Data type for delivery	Delivery Month & Year	Person sending data, with email address
2011 field survey data and cruise report	December 2011	Jamal Moss jamal.moss@noaa.gov
Adult salmon diet data	March 2012	Wyatt Fournier wyatt.fournier@noaa.gov
Age-0 focal species diet data	June 2012	Wyatt Fournier wyatt.fournier@noaa.gov
Rhinoceros auklet diet data	December 2011	Leslie Slater

		leslie_slater@fws.gov
Tufted puffin diet data	April 2012	Arthur Kettle arthur_kettle@fws.gov
Fork-tailed storm-petrel diet data	April 2012	Leslie Slater leslie_slater@fws.gov
Seabird/marine mammal observational data	May 2012	Leslie Slater leslie_slater@fws.gov
Species Specific Habitat Suitability (SSHA) maps	None	

1) 2011 field survey data will be posted to the SharePoint by December 31st 2011. Haul data (surface and subsurface hauls). UTL surveys serve as the platform for collecting data in the GOA for the MTL (bioacoustics) and LTL (physical and biological oceanography, zooplankton, icthyoplankton) components. Data delivery schedules for these modules can be found in the MTL and LTL bi-annual report. Specific survey data to be delivered are:

    - Haul location, timing, weather, and net mensuration
    - Fish species abundance by haul (counts and total weight)
    - Individual lengths and weights for all fish sampled
    - Event log with time and location (GPS) of all sample activities

2) Wyatt Fournier will disseminate fish diet data.
    - Prey composition by prey group weight for adult salmon
    - Prey composition by prey group weight for age-0 marine fish

3) Leslie Slater will disseminate shipboard seabird and marine mammal observational data and seabird colony diet and tag data.
    - Transect line counts (with locations) of seabirds and marine mammals
    - Diet and tag data from colonies