1. PROJECT INFORMATION

GOA IERP Project Number:	G83
Title:	The role of cross-shelf and along-shelf transports as controlling mechanisms for nutrients, plankton and larval fish in the coastal Gulf of Alaska
Overall project duration	Oct 1, 2010-Jan 31, 2015
Overall project funding	
Report period	May 2010 – Apr 30, 2011
Report submission date	May 1, 2011
Lead Author of Report*	Russ Hopcroft

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

Dr. Russell Hopcroft, University of Alaska Fairbanks, hopcroft@ims.uaf.edu
Dr. Jeffrey M. Napp, NOAA NMFS AFSC, jeff.napp@noaa.gov
Dr. Calvin W Mordy, University of Washington, Calvin.W.Mordy@noaa.gov
Dr. Phyllis Stabeno, NOAA PMEL, phyllis.stabeno@noaa.gov
Dr. Suzanne L. Strom, Western Washington University, Suzanne.Strom@wwu.edu

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 this proposal is to determine how physical transport mechanisms influence lower trophic levels, and subsequently the survival and recruitment of five species of groundfish (*walleye pollock, Pacific cod, arrowtooth flounder, sablefish, Pacific ocean perch)* targeted by the GOA-IERP UTL program. We will examine primary production, the distribution of zooplankton and larval fish, and the physical mechanisms that determine their spatial and temporal patterns in two distinct regions of coastal Alaska: eastern (EGOA) and western (WGOA). While many mechanisms controlling along-shelf and cross-shelf fluxes in the two regions are likely similar, we hypothesize that there are also distinct differences between the narrow shelf of EGOA and the broader downwelling dominated shelf of WGOA. Our three primary objectives for each region are to quantify, compare and contrast: (1) the timing and magnitude of the different cross-shelf exchange mechanisms, using an extensive suite of oceanographic (i.e., moorings, drifters, cruises) and atmospheric measurements, (2) how these physical mechanisms influence the distribution, timing and magnitude of phytoplankton productivity, and (3) how both transport and primary productivity control the distribution, productivity, and fate of both zooplankton and ichthyoplankton. New observations will be supported by retrospective studies using previously collected data from these regions, in some

cases extending our horizon back as much as 30 years. These products (and infra-structure) are identified as essential to the success of the other three modules of the GOA-IERP program.

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

- Quantify the importance, timing and magnitude of the climactic and oceanographic mechanisms that control ocean conditions in the EGOA and CGOA.
- Determine how physical and biological mechanisms influence the distribution, timing and magnitude of primary and secondary productivity in nearshore, inshore, and offshore areas of the EGAO and CGOA.
- Provide a synoptic view, from the shoreline out to beyond the shelf-break, of the distribution and abundance of forage fishes and the early life stages of five focal groundfish species.
- Use a comparative approach to assess spatial and temporal variability in the ecosystem, primarily between the EGOA and CGOA and among spring, summer, and fall.
- Use historical datasets to analyze temporal variability in potential climatic, oceanographic, or biological drivers influencing the early life survival of key groundfish species.

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

- Compare and quantify the importance, timing and magnitude of the different cross-shelf and along-shelf transport mechanisms in the two regions.
- Compare and contrast how physical mechanisms influence the distribution, timing and magnitude of phytoplankton productivity in the two regions.
- Compare and contrast the mechanisms that control the distribution of the zooplankton prey for larval and juvenile fishes, and the structure of the food web between primary producers and these early life history stages of the target fish taxa in the two regions.

3. PROGRESS SUMMARY

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

Proposed	***Status***
Planning and preparation	Ongoing & on track
Retrospective Analysis	Ongoing & on track
Field Work: Mooring deployment	Currently 15 of 16 in water
Field Work: LTL spring cruise	One ongoing, one delayed
Co-ordination with MTL, UTL, Retrospective and Modeling	Ongoing
Attendance of AMSS and PI meeting	Done

b. Describe report period progress.

The reporting period has been occupied largely with planning and logistical activities directed toward the 2011 field season. Supplies were ordered and packaged for various cruises. Radio-isotope permitting and logistics needed to be resolved for use onboard the RVs *Thompson* and

Tiglax. Several major pieces of equipment ultimately needed to be built or purchased to address programmatic needs. Documentation of common protocols needed to be prepared, with students trained in their implementation.

Sixteen moorings were designed and built for deployment as part of GOAIERP. Instruments will measure temperature, salinity, nitrate, fluorescence, currents, bottom pressure, and oxygen, Eight moorings were deployed from F/V *Harmony*. The cruise departed Seattle on March 15 and successfully deployed all moorings along the SE Alaska (Fig. 1). Seven of the remaining eight moorings were shipped to Homer, AK and deployed from the R/V *Tiglax* during April 26-27, 2011. The final mooring is to be deployed from the R/V *Thompson*, mid May 2011.

As this report is being prepared the *Tiglax* is executing the western Gulf of Alaska segment of the LTL spring survey, while the *Thompson* is sailing April 30th to undertake the eastern and northern portions.

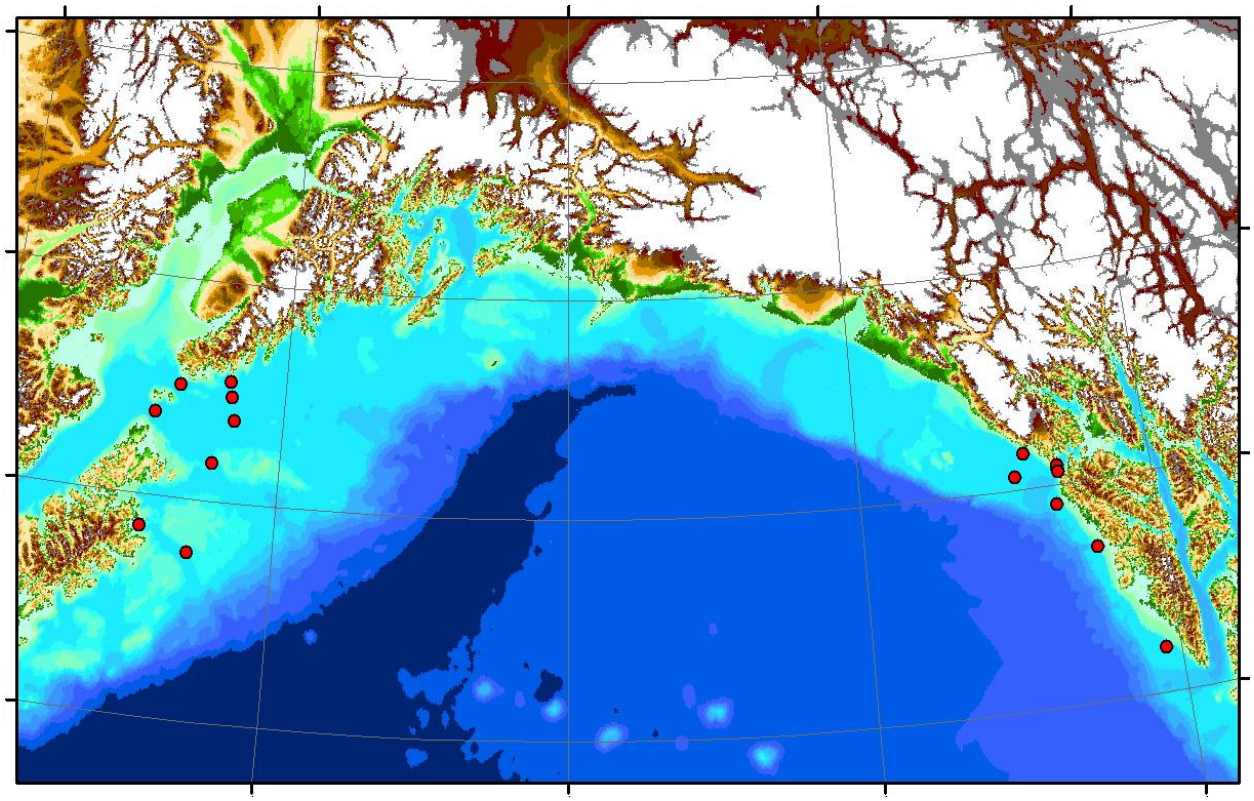

Figure 1: The locations of the 8 moorings, which were deployed in southeast Alaska. Measurements vary among moorings.

Ichthyoplankton samples from the spring and summer pilot study (1NW10 and 2NW10) were sent to Poland for sorting and identification. The spring samples were completed, verified in Seattle and preliminary results were presented at the spring Principal Investigator meeting. Poland should be finished with the summer samples by the end of May. Retrospective analyses of ichthyoplankton data were conducted by the project using data collected by NOAA's Recruitment Processes Program and are reported separately

c. Describe preliminary results.

A total of 35 taxa of eggs and larvae were identified from bongo samples during the spring pilot study. Larvae from all 5 target species were collected. Highest occurrences occurred for rockfishes (*Sebastes* spp.) and arrowtooth flounder (*Atheresthes stomias* - Figure 1). Sablefish (*Anoplopoma fimbria*) were collected mostly in water >1000m.

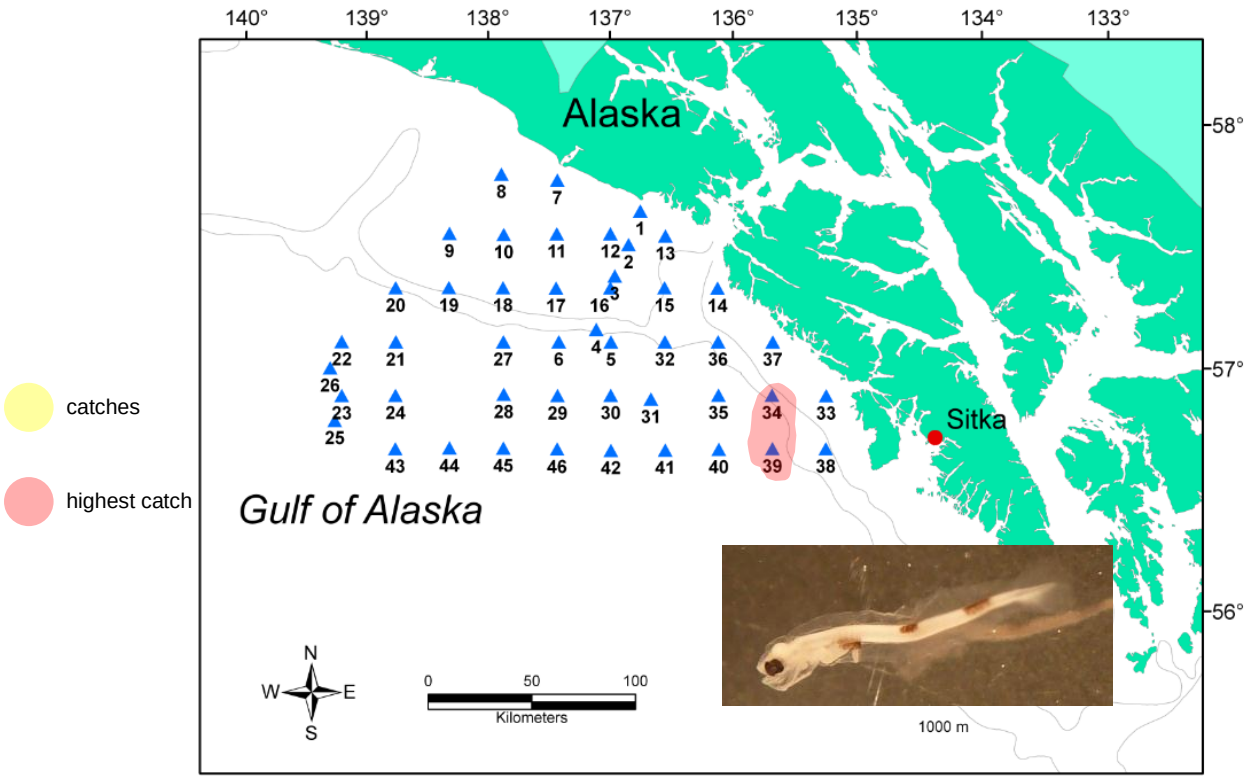

Figure 1. Distribution of larval arrowtooth flounder (*Atheresthes stomias*) collected during the spring 2010 pilot study. One hundred thirty three larvae were collected during the survey ranging in size from 6 – 12 mm total length. Note that length at hatch is 3.9 – 4.8 mm.

Results from the retrospective analyses are reported separately.

d. Describe integration activity.

Much of the first half year was spent in coordination of future sampling. Two PI meetings were held, with multiple conference calls and on site meetings held between the LTL, UTL, MTL and Modeling components to discuss and coordinate our sampling efforts. We coordinated sampling efforts with both UTL and MTL for collection of physical and chemical data, and worked to ensure consistent methods and equipment would be used between project components.

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

At the time of this writing, the major concern is execution of the spring LTL cruise on the R/V Thompson. The cruise has been delayed due to equipment failures on the ship (main

propulsion systems). Presently the cruise will begin on April 30, 2011 from Seattle. The cruise will return to Port Angles, WA on May 21, 2011, and unload in Seattle on May 24.

The initial delay (14 April to 30 April) is not expected to negatively affect our ability to map the distributions of larvae from the 5 target taxa and conduct the planktonic and hydrographic surveys. The delay has, however, prevented us from doing primary productivity work on the *Tiglax*, since both ships will now be at sea at the same time, and we do not have enough trained personnel (2 per ship) and gear to mount two simultaneous efforts of this measurement.

Ballooning responsibility for additional project components is a significant concern of all LTL PIs. For various reasons, PMEL has been forced to pay for much more ship-time than expected. UAF has needed to purchase oceanographic equipment for UTL cruises and staffing of UTL has created logistical and financial challenges. A much larger magnitude of sample analysis is being requested of the LTL team than initially conceived. While the PIs remain committed to doing what it takes to create a successful program, these added demands are proving awkward to absorb within budgets that were already restrictive.

f. Poster and oral presentations at scientific conferences or seminars

Hopcroft, R.R., K.O. Coyle, T.J. Weingartner, T.E. Whitledge. Measuring the pulse of the Gulf of Alaska: oceanographic observations along Seward Line, 1997-2010. Kodiak Marine Science Symposium. April 10, 2011 – *the Gulf of Alaska program was introduced during the presentation*

Stabeno, P. , N. Kachel, P. Sullivan. Gulf of Alaska – starting point for the physics. FOCI lunch seminar, Feb. 9, 2011, Seattle WA.

Ann Matarese provided a description of the spring distributions of target taxa larvae at the PI meeting in February (3rd & 4th) based on the preliminary data from the GOA IERP spring pilot cruise. The presentation is available on the Sharepoint site.

g. Education and outreach

Suzanne Strom described and answered questions about this project to a San Juan County WA Beach Watchers training group (this is a Washington State University extension program). She was also interviewed by the Bellingham Herald (newspaper) about this grant: no article has yet appeared.

4. PROGRESS STATUS

Analysis of 2010 samples is on track for successful completion. Assuming that the R/V *Thompson* leaves Seattle by the end of April, we expect to continue to make satisfactory progress on the ichthyoplankton component of the LTL project. Even with the later sailing date, we should still be able to capture larvae of the five target species using a combination of bongo and neuston nets.

5. FUTURE WORKPLAN and DATA DELIVERY

Workplan

What	*Who*	*Start and end dates*	*Other key dates*
Spring LTL Thompson cruise	**LTL PIs**	30 April – 21 May, 2011	

Spring LTL Tiglax cruise	**LTL PIs**	26 April – 11 May	Mooring deployments
Temp., salinity, nutrients, oxygen collections on 3 UTL cruises	**LTL PIs**	15 April– October 15	Lead oceanographer will be from LTL.
Ichthyoplankton collections on (2) UTL cruises	**LTL PIs**	30 June – 24 July & 30 July – 25 August	
Analyze chl, microzoo, phyto samples	**Fredrickson, Strom**	summer and fall 2011	
Begin data analysis	**Strom, Fredrickson**	summer and fall 2011	
Processing of metazooplankton	**Hopcroft**	Fall2011/Winter2012	
2010 Ichthyoplankton Data available	**Napp**	1 October 2011	
Spring 2011 ichthyoplankton samples to Poland	**Napp**	1 September 2011	
Mooring recovery cruises	**Stabeno, Mordy**	2011 September/ October	Exact dates TBD

Data delivery.

GOAIERP Data Delivery Table		
Data type for delivery	Delivery Month & Year	Person sending data, with email address
LTL Cruise reports with stations completed	Within 60 days of each cruise	hopcroft@ims.uaf.edu
Satellite-tracked drifter data - location	Real-time. Final data will be delivered one month after drifter stops transmitting	Dave.Kachel@NOAA.gov
Spring hydrogaphic data (T, S, PAR, fluorescence, oxygen, nutrients)	September 2011	Dave.Kachel@NOAA.gov Peggy.sullivan@noaa.gov
Photosynthesis data – spring 2011 Thompson cruise	Nov 2011	Suzanne.Strom@wwu.edu
Chlorophyll data – spring 2011 Thompson and Tiglax cruises	Nov 2011	Suzanne.Strom@wwu.edu
2010 Ichthyoplankton	September 2011	Kimberly.Bahl@NOAA.gov