GULF of ALASKA

gulfofalaska.nprb.org

GULF OF ALASKA INTEGRATED ECOSYSTEM PROGRAM:

Observations on the Larval Fish Communities in the Eastern and Western Gulf of Alaska from 2011 Field Collections

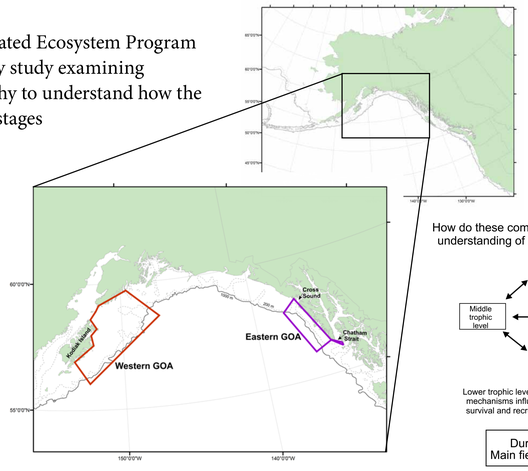
NOAA FISHERIES Lisa De Forest, Debbie Blood, Ann Matarese, and Jeff Napp

Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Seattle, WA, USA 98115

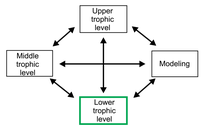
Introduction:

The Gulf of Alaska Integrated Ecosystem Program (GOA-IERP) is a four year (2011–2014) multi-disciplinary study examining interactions between physical and biological oceanography to understand how the environment influences the survival of early life history stages (egg to young-of-the-year) and recruitment of five commercially and ecologically important groundfishes:

Theragra chalcogramma (walleye pollock), *Gadus macrocephalus* (Pacific cod), *Atheresthes stomias* (arrowtooth flounder), *Anoplopoma fimbria* (sablefish) and *Sebastes alutus* (Pacific Ocean perch - POP). The program has two primary field seasons (2011 and 2013) to conduct biological and oceanographic surveys in the eastern and western GOA. More than 40 scientists (fishery biologists, oceanographers, and modelers) from 11 institutions are taking part in this 17.6 million dollar study funded by the North Pacific Research Board.



How do these components interact to improve our understanding of the Gulf of Alaska ecosystem?



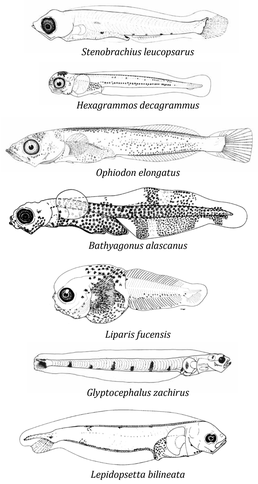
Lower trophic level - Determine how physical transport mechanisms influence nutrients, plankton, and larval survival and recruitment of five species of groundfish

Duration: 2010 - 2014
Main field years: 2011 & 2013

WESTERN GOA

Spring Taxa	Percent FO	Summer Taxa	Percent FO
Hexagrammos decagrammus	80.85	***Sebastes* spp.**	**69.81**
Stenobrachius leucopsarus	71.74	*Bathymaster* spp.	20.75
Theragra chalcogramma	**60.87**	*Artedius harringtoni*	16.98
***Sebastes* spp.**	**56.52**	*Mallotus villosus*	16.98
Ammodytes hexapterus	43.48	*Lepidopsetta bilineata*	15.09
Atheresthes stomias	**36.96**	*Stenobrachius leucopsarus*	15.09
Icelinus spp.	32.61	*Hexagrammos octogrammus*	14.55
Bathyagonus alascanus	30.43	*Sebastolobus* spp.	9.43
Lepidopsetta polyxystra	28.26	*Protomyctophum thompsoni*	5.66
Lumpenus maculatus	26.09	*Ronquilus jordani*	5.66
Cryptacanthodes aleutensis	25.53	*Ruscarius meanyi*	5.66
Bathylagus pacificus	23.91	*Liparis fucensis*	3.77
Gadus macrocephalus	**23.91**	*Liparis mucosus*	3.77
Hippoglossoides elassodon	21.74	*Mallotus villosus*	3.64
Hippoglossus stenolepis	21.74	*Coryphaenoides acrolepis*	1.89
Hemilepidotus hemilepidotus	21.28	*Glyptocephalus zachirus*	1.89
Hexagrammos lagocephalus	19.15	*Isopsetta isolepis*	1.89
Ophiodon elongatus	19.15	*Limanda proboscidea*	1.89
Anoplopoma fimbria	**17.02**	*Liparis* spp.	1.89
Anoplarchus insignis	15.22	*Osmeridae*	1.89

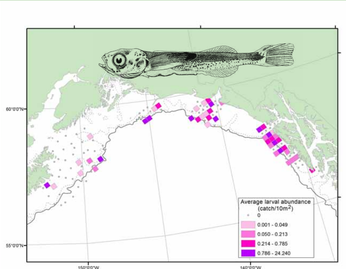
Names of target taxa bolded.



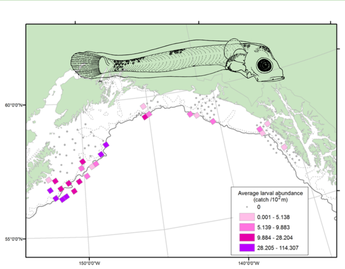
EASTERN GOA

Spring Taxa	Percent FO	Summer Taxa	Percent FO
Stenobrachius leucopsarus	68.42	***Sebastes* spp.**	**89.80**
***Sebastes* spp.**	**52.63**	*Stenobrachius leucopsarus*	53.06
Anoplopoma fimbria	**37.07**	*Liparis fucensis*	16.33
Hexagrammos decagrammus	30.17	*Artedius harringtoni*	8.16
Liparis fucensis	19.30	*Radulinus asprellus*	8.16
Bathylagus pacificus	16.67	*Glyptocephalus zachirus*	6.12
Leuroglossus schmidti	15.79	*Leuroglossus schmidti*	6.12
Cryptacanthodes aleutensis	15.52	*Bathylagus pacificus*	4.08
Hemilepidotus spinosus	13.79	*Liparis mucosus*	4.08
Ophiodon elongatus	12.93	*Mallotus villosus*	4.08
Hexagrammos lagocephalus	12.07	*Ruscarius meanyi*	4.08
Poroclinus rothrocki	11.40	***Anoplopoma fimbria***	**3.85**
Ammodytes hexapterus	10.53	*Icelinus* spp.	2.04
Bathyagonus alascanus	9.65	*Lepidopsetta bilineata*	2.04
Atheresthes stomias	**8.77**	*Malacocottus zonurus*	2.04
Protomyctophum thompsoni	8.77	*Myctophidae*	2.04
Clupea pallasi	6.14	*Paricelinus hopliticus*	2.04
Cryptacanthodes aleutensis	6.14	*Protomyctophum thompsoni*	2.04
Theragra chalcogramma	**6.14**	*Radulinus boleoides*	2.04
Zaprora silenus	6.14	*Scorpaenichthys marmoratus*	2.04

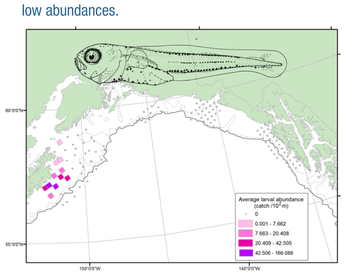
Names of target taxa bolded.



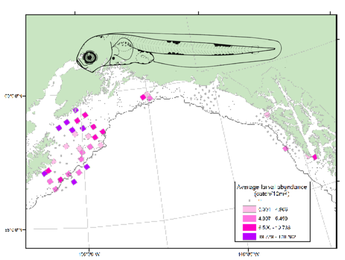
- Larvae were found in spring throughout the GOA. Highest abundance was observed in the neuston layer at the shelf break. Greater abundances were collected in spring on the eastern side of the GOA. Larvae were collected in summer only in the eastern GOA and at very low abundances.



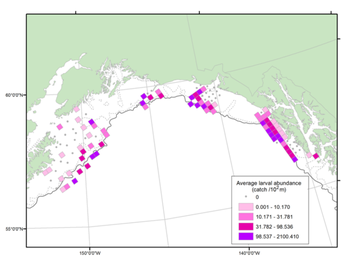
- Atheresthes stomias larvae were collected only in spring, mostly along the shelf break and in deep water. Greater abundances were found in the western GOA.

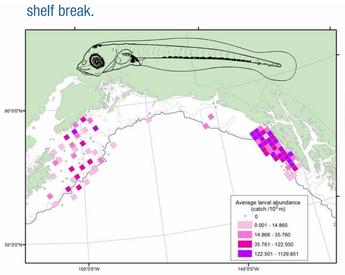


- *Gadus macrocephalus* were found only at the westernmost stations in the western GOA in spring. No larvae were collected in the eastern GOA.



- Collected only in spring, few *Theragra chalcogramma* were found in the eastern GOA. Larvae collected in the western GOA were distributed over the shelf and shelf break.





- Presently, *Sebastes alutus* (Pacific Ocean perch) are indistinguishable from other species of rockfish larvae. As a result, larval rockfishes are identified only to genus level (*Sebastes* spp.). *Sebastes* spp. were ubiquitous and frequently encountered throughout the study area in both spring and summer. In spring, *Sebastes* spp. were the most abundant of the target larvae with the majority collected in deep water; in summer, larvae were the most frequently collected taxon and were found mainly on the shelf.

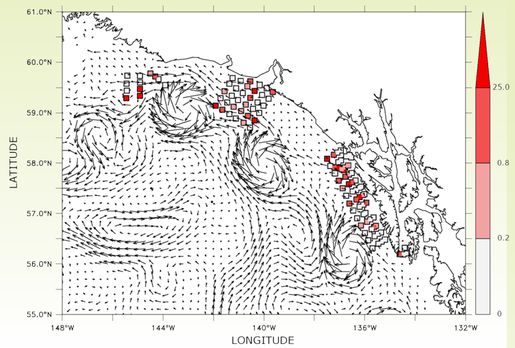
Emerging Questions General

How do taxonomic composition, levels of abundance among species, larval sizes and distribution patterns from the eastern GOA compare with the western GOA?

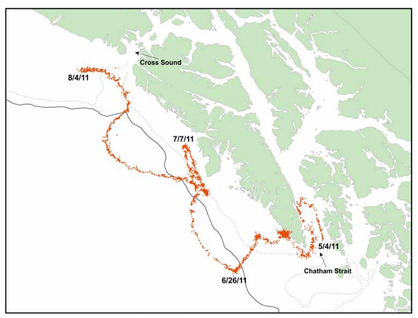
➡ *Why do the larvae of deep spawning taxa appear to have more contiguous distribution than shallow spawning taxa?*

Was 2011 unusual in terms of timing of spawning and subsequent development rates of larvae?

➡ *Where are the gadid larvae in the eastern GOA?*



Regional Ocean Modeling System (ROMS NEP6) velocity model for surface waters of the eastern Gulf of Alaska during spring 2011. Distribution and abundance of Anoplopoma fimbria collected from the neuston layer is superimposed on top of the model output.



Drifter was released early May in the mouth of Chatham Strait, moved north, then exited the strait in mid-May (5/12). It moved off and back onto the shelf twice while traveling northward, crossing back onto the shelf south of Cross Sound and continuing north parallel to the coast.

Emerging Questions Physics

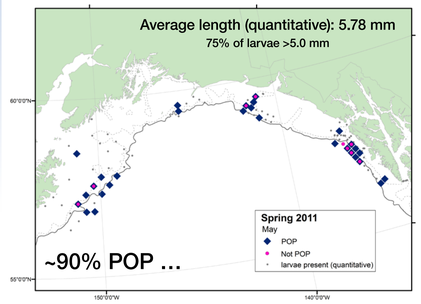
Are the areas of high concentrations of target taxa larvae found in areas of unique physics?

➡ *How do the physics in these areas explain patterns of distribution and abundance?*

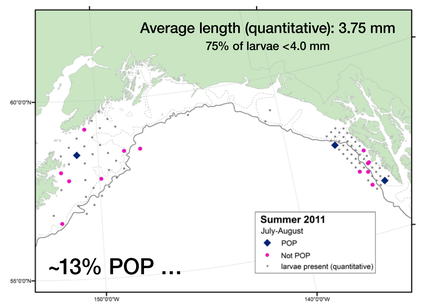
Do eddies play a role in the transport of eggs and larvae?

➡ *Are most larvae entrained in currents along the coastline or might they be swept out over deeper water?*

Using genetics to identify larval *Sebastes alutus* (POP)



Majority of genetic specimens collected in May were identified as POP.



Average size of rockfish larvae collected was smaller than in spring. Only a few large specimens (>15 mm) were collected.

Additional Samples for Analysis

- 2103 field season is underway. During the spring cruise more species diversity was observed than in 2011 and 125 bongo and neuston samples were collected.

Emerging Questions Genetics

Sebastes spp.

How do the genetic identification results for the spring and summer relate to larval *Sebastes* spp. distribution patterns?

➡ *Do we have enough genetic information to call the rockfish larvae collected in spring POP?*

Do differences in size of *Sebastes* spp. larvae in spring vs summer indicate timing of spawning for different species?

➡ *Could timing of spawning explain differences in percentage of POP in the genetic results between spring and summer?*

Acknowledgements: This project was funded by the North Pacific Research Board under the Gulf of Alaska Integrated Ecosystem Research Program. We would like to acknowledge and thank AFSC colleagues Morgan Busby and Ashlee Overdick for their time and help identifying eggs and larvae. Miriam Doyle (JISAO) shared her vast knowledge of the Gulf of Alaska ecosystem through her retrospective studies and assisted in the overall logistics of the field program. The following PI's shared unpublished data with us: Phyllis Stabeno (drifters), Carol Ladd (eddies), Al Hermann (model output), Jamal Moss and Wyatt Fourier (age-0 and genetic data) and Olav Ormseth (age-0). Finally, we would like to thank everyone that has helped to collect and preserve specimens out at sea.

The recommendations and general contents presented in this poster do not necessarily represent the views or official position of the Department of Commerce, the National Oceanic and Atmospheric Administration or the National Marine Fisheries Service.

Photos: Morgan Busby, Morgan Ostendorf