Ichthyoplankton Diversity in the Eastern and Western Gulf of Alaska During Spring and Summer of 2011 and 2013

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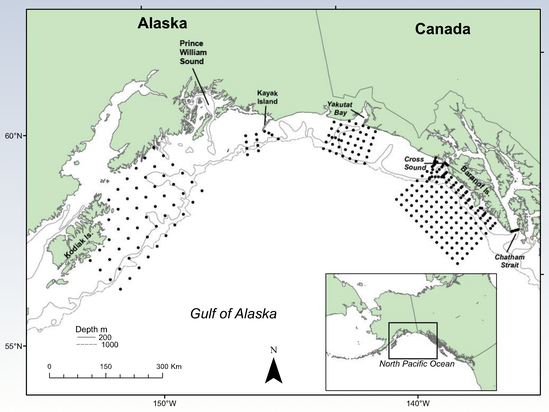
Introduction

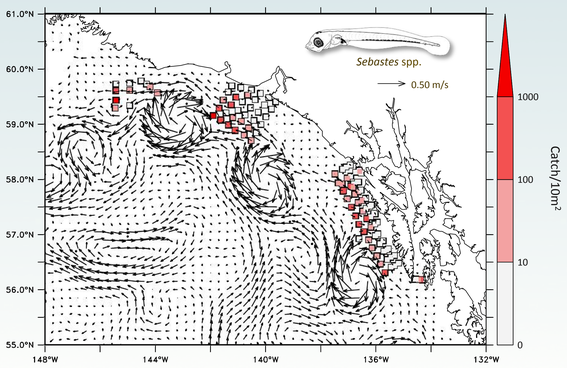
The Gulf of Alaska Integrated Ecosystem Research Program (GOA-IERP) is a multi-disciplinary study examining interactions between physical and biological oceanography to understand how the environment influences the survival of early life history stages and recruitment of selected commercially and ecologically important groundfishes. Surveys in the eastern (east of Prince William Sound) and western (near Kodiak Island) Gulf of Alaska (GOA) were conducted during spring and summer of 2011 and 2013. Although well-described for the western GOA, species diversity and early life history patterns are poorly understood in the eastern GOA.



The GOA-IERP dataset provides an opportunity to investigate species diversity and compare the western GOA, characterized by a wide shelf, with the GOA gulf, which has a very narrow shelf, over two non-consecutive years. Preliminary results presented here describe seasonal, regional and interannual variation in occurrence and distribution of the most frequently occurring and abundant species.

Oceanography

Oceanographic factors, such as the propagation of eddies in the eastern GOA, directly affect the distribution of larvae. The narrow shelf coupled with eddies in the Alaska Coastal Current lead to high levels of on-shelf flow of slope water and off-shelf flow of coastal water which greatly impacts larval transport over the shelf. High *Sebastes* spp. catches along the shelf margin reflect the influence of multiple eddies in the spring of 2011.



Methods

Ichthyoplankton surveys were conducted in spring and summer of 2011 and 2013 in April-May and July-August. The sampling grid in the east was extended in summer of 2013 to include offshore stations. Sampling was conducted using a 60-cm bongo sampler with 500-µm mesh.

References

Allen, M.J. and G.B. Smith, 1988. Atlas and zoogeography of common fishes in the Bering Sea and northeastern Pacific. NOAA Tech. Rep. NMFS 66, 151 p.

Briggs, J.C., and B.W. Bowen. 1988. A realignment of marine biogeographic provinces with particular reference to fish distributions. J.Biogeogr. 39:12:30.

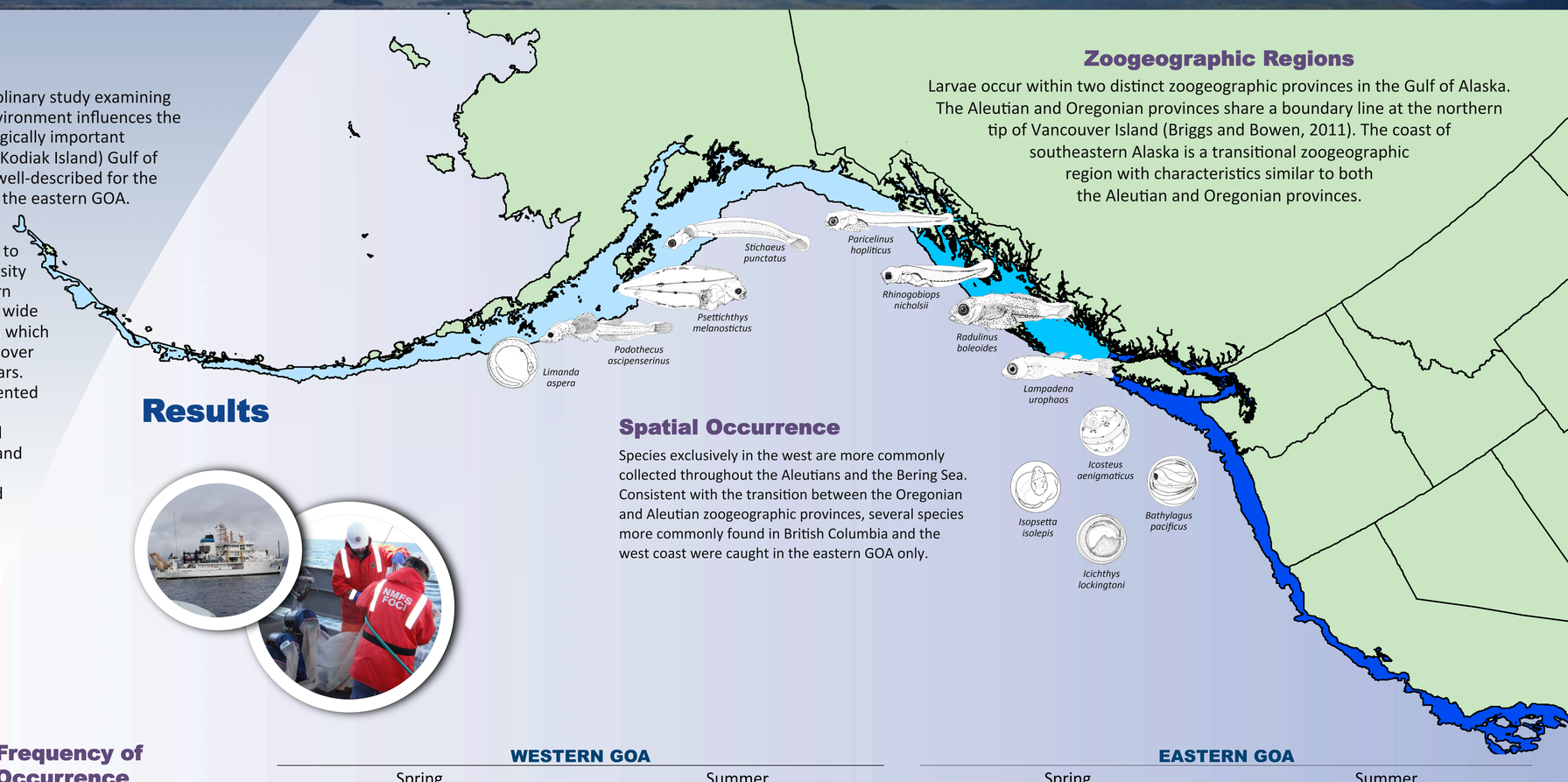
Doyle, M.J., and K.L. Mier. 2012. A new conceptual framework for evaluating the early ontogeny phase of recruitment processes among marine fish species. Can. J. Fish. Aquat. Sci. 69: 2112–2129.

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

Results

Zoogeographic Regions

Larvae occur within two distinct zoogeographic provinces in the Gulf of Alaska. The Aleutian and Oregonian provinces share a boundary line at the northern tip of Vancouver Island (Briggs and Bowen, 2011). The coast of southeastern Alaska is a transitional zoogeographic region with characteristics similar to both the Aleutian and Oregonian provinces.



Spatial Occurrence

Species exclusively in the west are more commonly collected throughout the Aleutians and the Bering Sea. Consistent with the transition between the Oregonian and Aleutian zoogeographic provinces, several species more commonly found in British Columbia and the west coast were caught in the eastern GOA only.

Frequency of Occurrence

Top ten most frequently occurring species are listed for spring and summer of 2011 and 2013.

- Spring values generally higher than summer in both regions
- West has greatest values in spring, east has greatest values in summer
- *Stenobrachius leucopsarus*, a myctophid, only non-focal species abundant in all cruises

WESTERN GOA

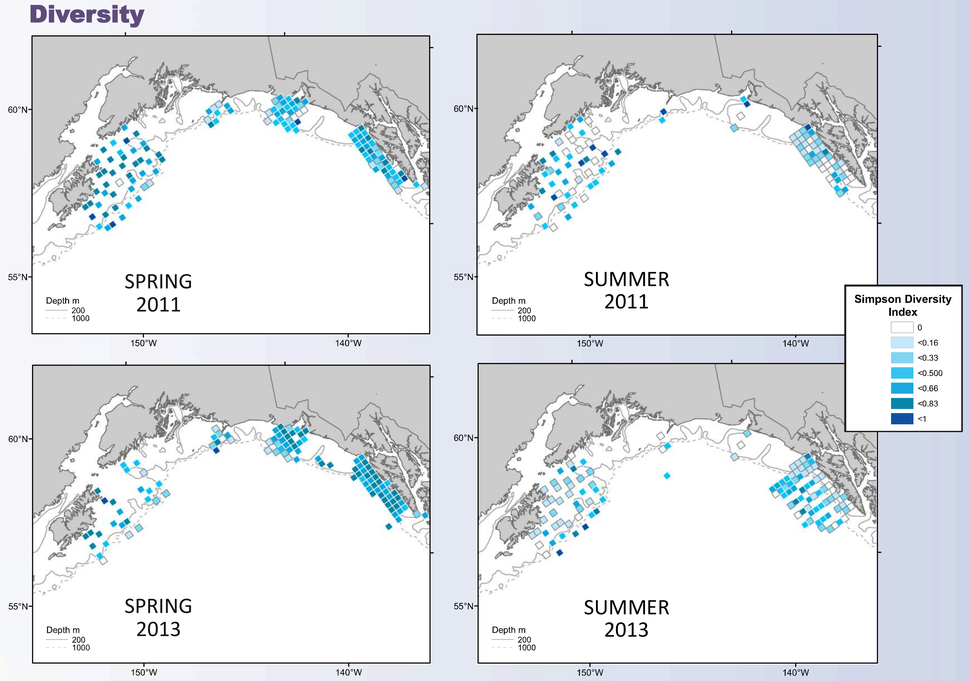
Spring Taxa	% FO 2011	% FO 2013	Summer Taxa	% FO 2011	% FO 2013
Stenobrachius leucopsarus	71.7	53.9	*Sebastes* spp.	69.8	71.2
Gadus chalcogrammus	60.9	80.8	*Bathymaster* spp.	20.8	19.2
Sebastes spp.	56.5	42.3	*Artedius harringtoni*	17	7.7
Ammodytes personatus	43.5	30.8	*Mallotus villosus*	17	59.6
Atheresthes stomias	37	34.6	*Stenobrachius leucopsarus*	15.1	15.4
Icelinus spp.	32.6	50	*Lepidopsetta bilineata*	15.1	11.5
Bathyagonus alascanus	30.4	15.4	*Sebastolobus* spp.	9.4	3.9
Lepidopsetta polyxystra	28.3	30.8	*Protomyctophum thompsoni*	5.7	5.8
Lumpenus maculatus	26.1	23.1	*Ronquilus jordani*	5.7	13.5
Gadus macrocephalus	23.9	73.1	*Ruscarius meanyi*	5.7	-

EASTERN GOA

Spring Taxa	% FO 2011	% FO 2013	Summer Taxa	% FO 2011	% FO 2013
Stenobrachius leucopsarus	68.4	66.7	*Sebastes* spp.	89.8	84.1
Sebastes spp.	52.6	59.7	*Stenobrachius leucopsarus*	53.1	79.7
Anoplopoma fimbria	21.1	28.1	*Liparis fucensis*	16.3	15.9
Liparis fucensis	19.3	27.2	*Artedius harringtoni*	8.2	2.9
Bathylagus pacificus	16.7	31.6	*Radulinus asprellus*	8.2	1.5
Leuroglossus schmidti	15.8	36.8	*Leuroglossus schmidti*	6.1	20.3
Poroclinus rothrocki	11.4	9.7	*Glyptocephalus zachirus*	6.1	1.5
Ammodytes personatus	10.5	27.2	*Bathylagus pacificus*	4.1	5.8
Bathyagonus alascanus	9.7	5.3	*Mallotus villosus*	4.1	1.5
Protomyctophum thompsoni	8.8	11.4	*Ruscarius meanyi*	4.1	4.4

*indicates focal species

Diversity



Simpson's Diversity Index is a measure of diversity that takes into account the number of species present, as well as their abundance. The index is based on the complete list of taxa collected in the bongo net and ranges from zero (only one species present) to one (all species present).

Species diversity in spring varied between regions and years: Simpson's Diversity Index shows greater diversity in the western GOA in 2011, whereas diversity in the eastern GOA was greater in 2013. Spatial patterns of diversity were more consistent in the western GOA, with greater spatial variability in diversity in the eastern GOA.

Conclusions

- Many of the non-focal species collected during the spring and summer surveys were from the Aleutian zoogeographic fauna and were found in both the eastern and western GOA
- Diversity was greater in the spring than in the summer, reflecting species early life history phenologies and the association of peak larval abundances with the timing of the spring plankton bloom (Doyle and Mier, 2012)
- Many species have transitioned to juvenile habitats by summer and may not be sampled by the bongo, which would affect diversity values
- Deep-water features, such as troughs bisecting the shelf and upwelling areas, appear to be 'hot spots' for larvae originating from spawning habitat over the slope or basin
- Further results will be reported in future collaborative research on larval assemblages and transport during the GOA Synthesis Phase