Spatial Distribution of Walleye Pollock (*Gadus chalcogrammus*) Life Stages in the Gulf of Alaska 2013

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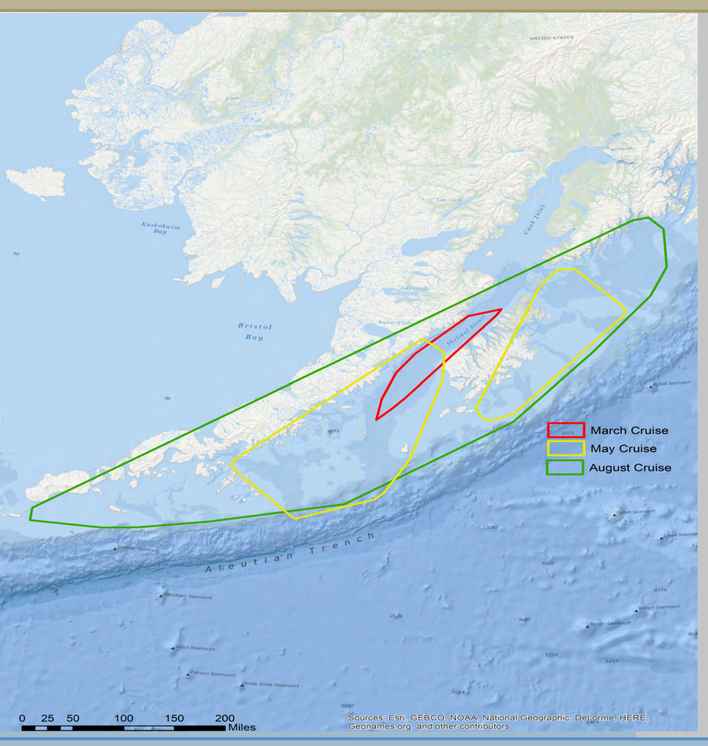
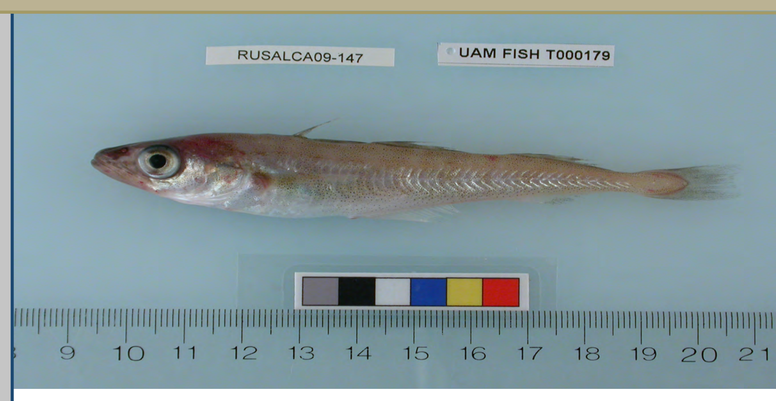


Abstract

Three extensive research surveys conducted during 2013 gave the Alaska Fisheries Science Center the opportunity to collect significant amounts of data concerning Walleye Pollock (*Gadus chalcogrammus*) distributions in the Gulf of Alaska. This project was guided by two questions: how much of the distance between larval and age-0 distributions could be explained by ocean currents, and is it possible to determine what percentage of larvae released from the Kenai Peninsula end up in the Shelikof Strait, to the east of Kodiak Island, or are retained in the Kenai area? The goal of the project was to gather survey data, conduct spatial analyses, and run models of larval drift. Using ESRI's ArcGIS software, it was possible to map the data chronologically beginning with the spawning adult populations, the larvae, and finally the larger age-0 fish. Using these maps as a base, along with data for currents and ocean temperature, we explored whether the larvae could have traveled the observed distance and what percentage of larvae ended up in the Shelikof Strait. Making larval drift distance calculations using the LarvaMap program, it was discovered that the age-0 distribution was a result of offspring from Shelikof but that a significant number of those hatched elsewhere probably mixed with this group. The percentage of larvae transported down the Strait from Kenai as opposed to around Kodiak Island was roughly a 30/70 percentage split.



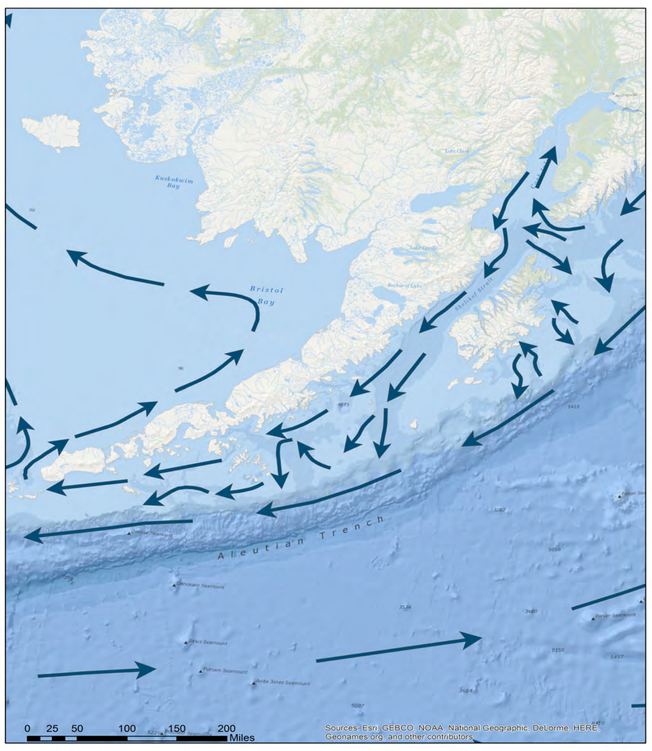
Prediction

The distribution of larvae can be explained by their transport from the spawning location, and that the bifurcation of currents around Kodiak Island can introduce larvae from Kenai to those from Shelikof.

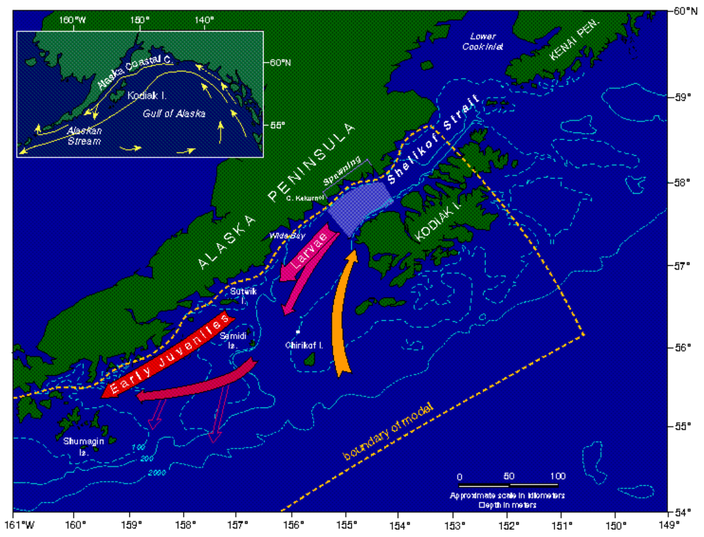
Procedure

Data was acquired through the AFSC database with the help of my mentors. Using the ArcMap program the data was transformed into layers using interpolation tools based on location and value, and then displayed under the Alaska Albers Equal Area Conic projection. Distance calculations were also performed with ArcMap and by hand. LarvaMap was used to generate particle models which were transferred to ArcMap.

Spatial Analyses

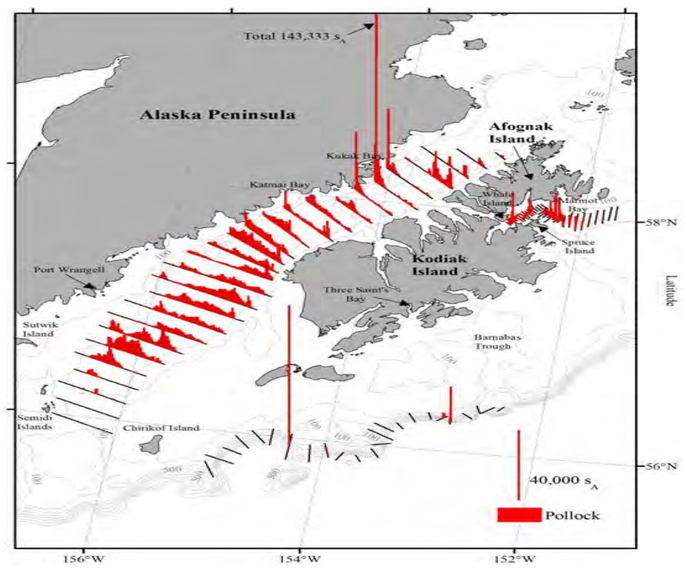


Currents in the Gulf of Alaska



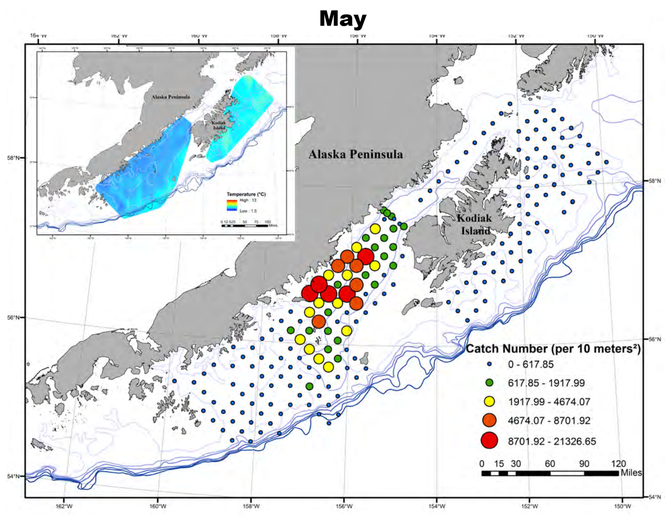
Early Life History of Walleye Pollock
(*Gadus chalcogrammus*) near Shelikof Strait

March



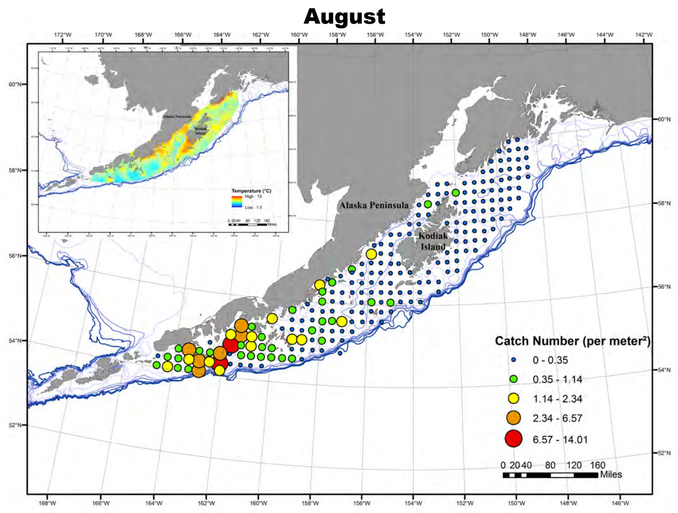
Spawning adult estimations using acoustic survey data

May



Larval counts sampled using bongo net, inset shows temperature data

August



Age-0 fish sampled using trawl nets

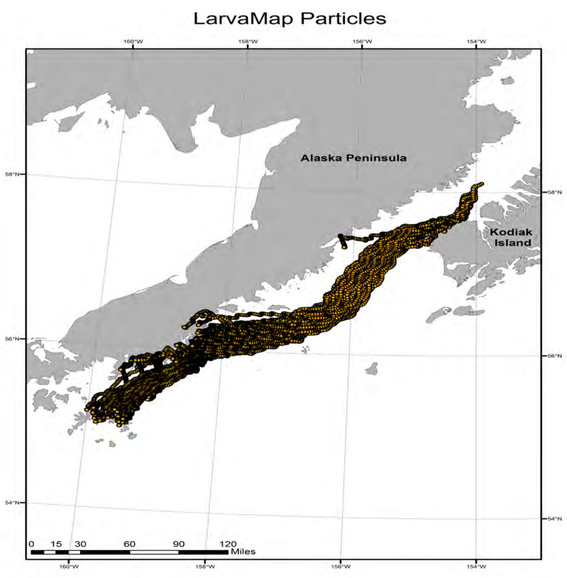
Results

Using the map materials and the distance calculations I was able to answer my two primary research questions in addition to an idea of the general trends of population recruitment. Displayed below are the results from my distance calculations in a table format, and the LarvaMap particle model:

Path	Observed path in kilometers	Predicted path based upon current speed		Modeled path
		10cm/sec	30cm/sec	
Spawning to larvae	195	536	1607	207
Larvae to young of the year	469	752	2255	697

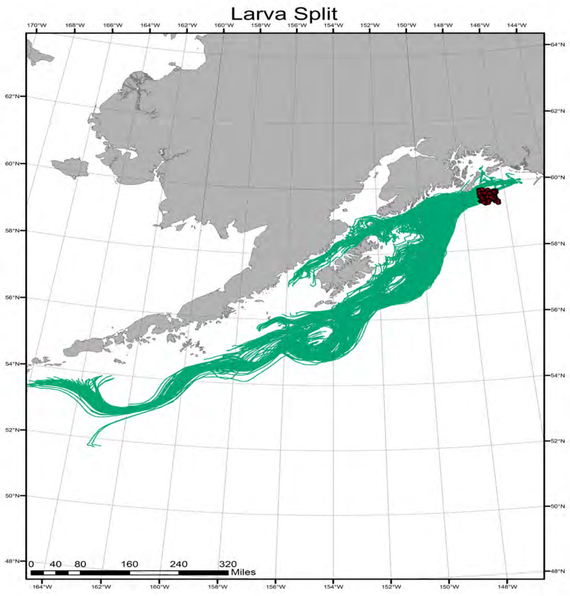
In March, the spawning aggregations of Walleye Pollock were observed in high numbers in one location and very few elsewhere. This is perhaps the result of other historical spawning locations (Cape Kekurnoi) being fished out. In May, larvae were observed in high concentrations , and conditions in this area were cold. In August, the unusual aggregation of age-0 fish further down the chain probably means that there was a high amount of food in the form of Euphausiids. Together with the relevant temperature data it is possible to form a hypothesis of which conditions favor survival at different life stages.

LarvaMap Particles



As shown below, it is likely that some of the distance between larval and age-0 distributions is caused by ocean currents. In addition, it was found that about 16 percent of Kenai larvae ended up traveling down the Shelikof Strait while 72 percent were transported down the eastern side of Kodiak Island. The remaining 12 percent were retained near the Kenai Peninsula.

Larva Split



Conclusions

The 2013 field season proved that there is still much to be learned about Walleye Pollock. While the 2013 year class yielded useful results, comparing data year to year would likely illustrate much more clearly the trends of the stock as a whole. Further research could also include an egg survey, new sampling areas, as well as updated current and circulations models to more accurately predict where Pollock will end up.

Acknowledgments

This project would not have been possible without significant amounts of time and patience contributed by Tiffany Vance, Annette Dougherty, and everyone else at the AFSC and NOAA Western Regional Center who assisted me every step of the way. Further research citations include:

Jones, D. T., S. C. Steinessen, and A. L. McCarthy. 2014. Results of the acoustic-trawl surveys of Walleye Pollock (Gadus chalcogrammus) in the Gulf of Alaska, February-March 2013 (DY2013-02 and DY2013-03). AFSC Processed Rep. 2014-03, 81 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Vance, T.C., S. Sontag and K. Wilcox. 2015 Cloudy with a Chance of Fish in D. Wright, Ocean Solutions, Earth Solutions, Redlands, CA: ESRI Press.

Wei Chan of NOAA (Pacific Marine Environmental Laboratory Seattle) provided the larval tracks for the Larva Split map.