

# Analyzing Pollock Hydroacoustics Collected from Fishing Vessels in the Bering Sea

Final Report to  
Pollock Conservation Cooperative Research Program

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# Collaborators

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# Overview

- 2001: Developed a prototype data logger
- 2002—2006: Deployed on 3—7 fishing vessels in the Bering Sea
- Collected terabytes of information
- 2005 --: Worked on data analysis, posters, presentations, articles
- Wespestad, Dorn: Participated in ICES Hydroacoustics Working Group
- 2008: Attended international ICES SEAFACETS meeting; presented poster, submitted paper (Shen , Quinn, Wespestad, Dorn), Bergen, Norway, June 2008

# Overall Goal

- To investigate if data collected from commercial vessel acoustic sounders could be utilized to investigate temporal-spatial changes in the abundance and distribution of walleye pollock in the Bering Sea.
- Simple answer: YES!

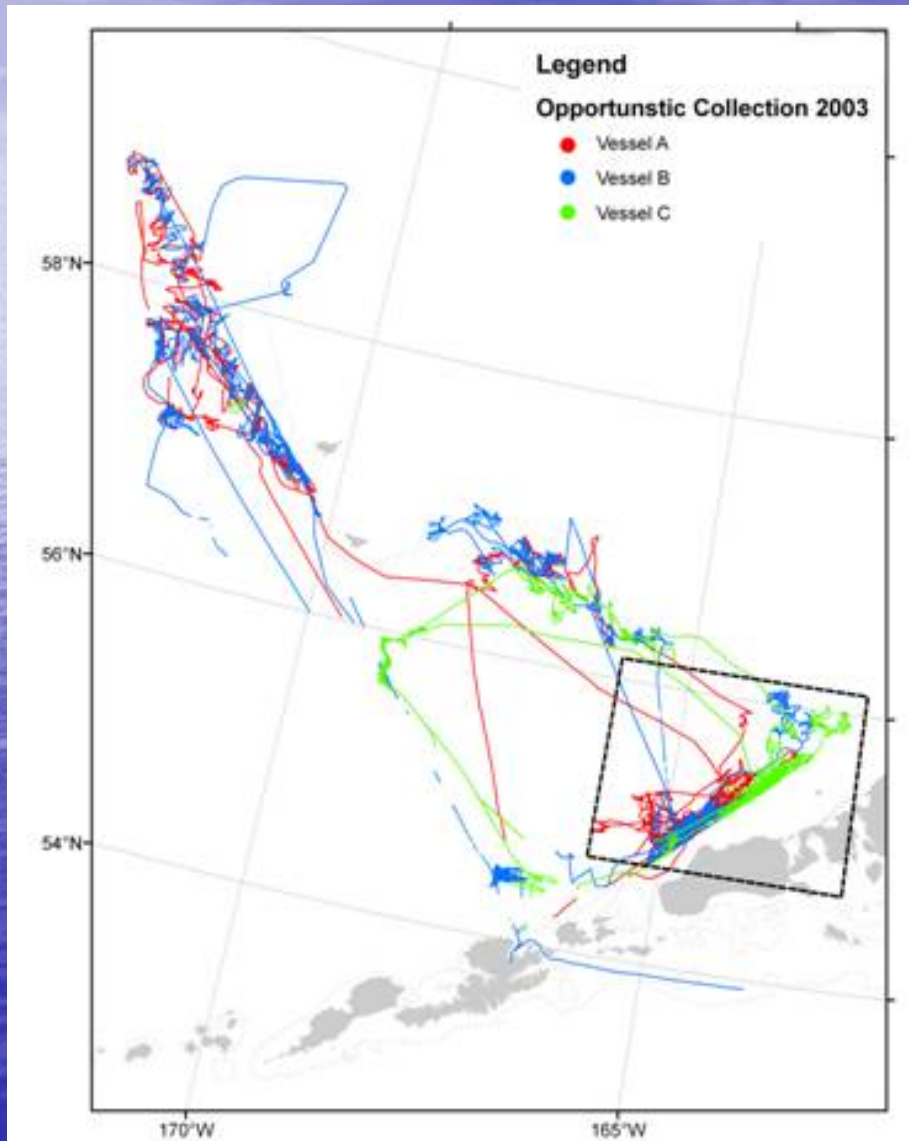
# Summary of Data Obtained

Vessel	Year	Raw File Size GB	Vessel	Year	Raw File Size GB
Alaska Ocean	2002	156.9	Star Bound	2004	0.8
Island Enterprise	2002	132.1	American Dynasty	2005	98.5
Kodiak Enterprise	2002	30.3	Island Enterprise	2005	49.4
American Dynasty	2003	14.2	Kodiak Enterprise	2005	42.6
American Triumph	2003	29.6	Ocean Rover	2005	40.1
Island Enterprise	2003	95.6	Star Bound	2005	45.8
Kodiak Enterprise	2003	63.8	American Triumph	2006	81.9
Ocean Rover	2003	32.6	Island Enterprise	2006	100
Star Bound	2003	90.2	Pacific Glacier	2006	114
American Dynasty	2004	96.2	Starbound	2007	86
American Triumph	2004	248	Kodiak Enterprise	2008	85
Island Enterprise	2004	44.7	Island Enterprise	2008	85
<b>All Years Total</b>					<b>1863.3</b>

# Related objectives

- To see if local depletion occurs during course of fishing season
- To quantify aspects of pollock schooling and spatial structure
- To investigate changes in pollock variables during the fishing season
- To examine harvesting behavior

# Example



# Funding

- 2001 – 2007: PCCRC, \$252K
- 2002: AFSC, \$72K, (2 yr Grad student)
- Throughout: AFSC scientific involvement
- 2008: \$37K (9 mo. Grad student)
- 2009: UAF: Thesis Completion Fellowship
- Total: \$289K by PCC

# Research Products

- *Oral Presentations*
- Steven J. Barbeaux, Martin Dorn, James Ianelli, and John Horne. 2005. Visualizing Alaska pollock (*Theragra chalcogramma*) Aggregation Dynamics. Presentation to the ICES Annual Science Meeting, Aberdeen, Scotland.
- Shen, H., T.J. Quinn II, V. Wespestad, M.W. Dorn, and M. Kookesh . 2006. Schooling changes of EBS walleye pollock during fishing. Lowell Wakefield Symposium on Resiliency of Gadid Stocks to Fishing and Climate Change, Anchorage AK, October/November 2006.

# Research Products

## *Poster Presentations*

- Shen, H., M. Kookesh and T.J. Quinn II. Interaction between commercial fishing and walleye pollock in eastern Bering Sea. Marine Science in Alaska: 2006 Symposium, Anchorage, Alaska, January 2006.
- Shen, H., T.J. Quinn II, V. Wespestad, M.W. Dorn, and M. Kookesh. 2007. Using EDSU to investigate the spatial structure of walleye pollock (*Theragra chalcogramma*) schools in the eastern Bering Sea. Marine Science in Alaska: 2007 Symposium, Anchorage, Alaska, January 2007.
- Shen, H., M.W. Dorn, V. Wespestad, and T.J. Quinn II. 2008. Using acoustic data to study the searching behavior of harvesters in eastern Bering Sea pollock fishery. Poster presentation at the Alaska Marine Science Symposium, Anchorage, Alaska, January 2008.
- Shen, H., M.W. Dorn, V. Wespestad, and T.J. Quinn II. 2008. Schooling pattern of eastern Bering Sea walleye pollock in relation to fishing pattern. Poster presentation at the ICES International SEAFACETS Symposium, Bergen, Norway, June, 2008.

# Research Products

## *Published Reports*

- Dorn, M.W., W.A. Karp, V.G. Wespestad, J. Ianelli, and T.J. Quinn, II. 2002. Using fishing vessels to collect acoustic data for scientific purposes: preliminary results from midwater trawlers in the eastern Bering Sea walleye pollock fishery. Contribution 67 of the ICES Symposium on Acoustics in Fisheries and Aquatic Ecology, Montpellier, France, 10-14 June 2002. 11 pp.
- Steven J. Barbeaux, Matthew Kookesh, Martin Dorn, Chris Wilson, and Alex De Robertis. 2004. Calibration of Simrad ES60 echosounders on a commercial fishing vessel. Alaska Fisheries Science Center, National Marine Fisheries Service, Seattle WA. 12 p.
- Shen, H., Quinn, T.J., II, Wespestad, V., Dorn, M.W., and Kookesh, M. 2008. Using acoustics to evaluate the effect of fishing on school characteristics of walleye pollock. Pages 125 – 140 In Resiliency of Gadid Stocks to Fishing and Climate Change, Alaska Sea Grant College Program, AK-SG-08-01, Fairbanks AK.
- Shen, H., Dorn, M.W., Quinn, T.J., and Wespestad, V. *in press*. Schooling pattern of eastern Bering Sea walleye pollock and its impact on fishing behavior. Proceedings of the SEAFACETS Symposium, Bergen, Norway, June 2008. ICES Journal of Marine Science.
- More to come! (UAF PhD Dissertation from Shen, UW PhD Dissertation from Barbeaux producing peer-reveiwed publications)

# Spin-offs

- Additional data collections aboard chartered vessels employed for trawl surveys
  - a large scale project initiated in 2006
  - two BT survey charter vessels and NOAA Ship Miller Freeman
  - acoustics-based index of midwater pollock abundance from charters
  - Agreement between platforms during the summer 2007
  - further justification for the use of acoustic data from commercial fishing vessels
- Fruitful collaborations between the PIs and MACE Program at AFSC
  - document detailing a standard set of protocols for collecting opportunistic acoustic data
  - developing software to automate data processing of opportunistic acoustic data.

# Further work by Shen

- Study 1. Analysis of the changes of schools in one dimension, two dimensions and three dimensions. Examine the relationship between harvester search pattern and fish distribution.
- Study 2. Catch depletion analysis using observer data. Examine if observer data and hydroacoustic data show consistent patterns.

# Collaborations With International Researchers

- ICES Fisheries Acoustics Science and Technology Working Group (FAST) Annual meetings: Wespestad, Dorn
- Contributed to **ICES. 2007. Collection of acoustic data from fishing vessels. ICES Cooperative Research Report No. 287. 83 pp.**
- Attending the international ICES SEAFACETS symposium in Bergen, 2008
- ICES 2009 Annual Science Conference: Dorn, co-convenor: theme session on monitoring requirements, observation technologies and methods (e.g. acoustics) for pelagic organisms

# Further work by Barbeaux

- a focused study developing a means of using the data from multiple vessels in a quantitative framework
- a broader application of the technique to assess the migration and abundance of pollock among partitions of the Eastern Bering Sea Shelf.

# Summary and Recommendations

- Useful tool for monitoring interannual variation in the midwater scattering
  - effective eye on the fishing process and its effect on the environment;
  - provides researchers with a fisherman's view of the resource
  - broader temporal frame of reference (winter, spring pollock distributions)
  - understanding movements and behavior in relation to fishing and environment
- Time series of summary statistics from fishery acoustics ????
  - Bottleneck: logistic and financial support for data collection, storage and retrieval.
  - an archiving and retrieval system needs to be developed (PCCRC involvement?)
  - maintenance and servicing of on-board data storage devices (industry?)

# The END!

