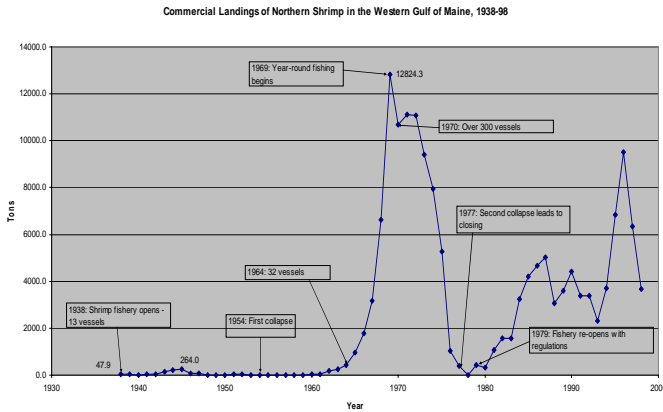


Understanding Variability in the Gulf of Maine Northern Shrimp (*Pandalus borealis*) Population

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Background, Question and Importance



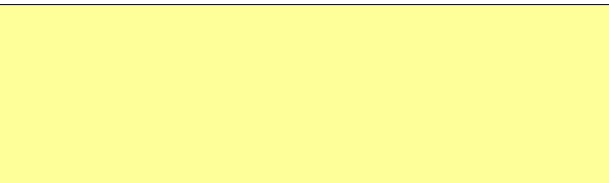
Data from the Atlantic States Marine Fisheries Commission as cited in Clark, Stephen H., Cadrin, Steven X. et al. 2000. *The Gulf of Maine Northern Shrimp (*Pandalus borealis*) Fishery: a Review of the Record*. J. Northw. Atl. Fish. Sci. 27, 193-226

Milestones

- 1954: First collapse due to natural variability and lack of technology to exploit offshore resources
- 1969: Technology and fleet have increased to year-round fishing in all areas
- 1977: Second collapse due to over fishing
- 1979: Shrimp fishery reopens with season and net size restrictions

Issues Addressed by Regulation

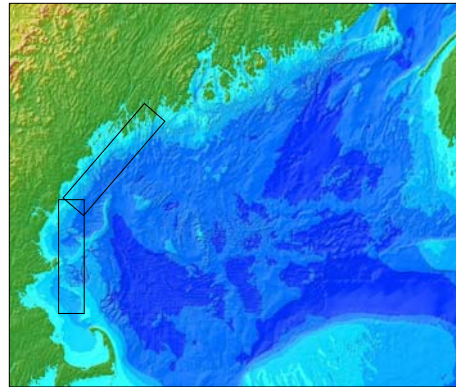
- Longest continuously open Gulf of Maine shrimp fishery in history – over 25 years
- Balance between technology and regulation allows us to see the natural annual variability signal of the population as a whole in the fishery catch data



The Importance of the Project

- Improve the ability to accurately predict the shrimp population which . . .
 - Enhances the marketability of Gulf of Maine shrimp
 - Encourages sustainable fishing practices
- Promote interaction among biologists, physicists and fishermen which . . .
 - Supports ecosystem based resource management in the Gulf of Maine

Data and Goals



Northern shrimp in the Western Gulf of Maine move inshore to the indicated area to release eggs each winter/spring. What happens to the planktonic larvae after hatching and before becoming benthic is an important factor in determining the recruitment and thus the variability of that year's population

Biological Data

- Timeline of planktonic shrimp larvae in water column
- Distribution of larvae within spawning grounds
- Larval growth and mortality rates

Physical Data

- Gulf of Maine wind data over larvae plankton time
- Gulf of Maine density data over larvae plankton time

Goals

- Determine how physical/biological conditions impact:
 - Inshore transport (retention and recruitment)
 - Upstream transport (retention and recruitment)
 - Downstream or offshore transport (loss)
- Develop hypotheses on which to base future research



Gulf of Maine Shrimp © 2012 www.gomshrimp.com

Methods



The "Pulse of the Gulf" program currently runs semi-weekly biological data collection cruises along this 6 station transect using the UNH research vessel "Gulf Challenger."

Collect Data

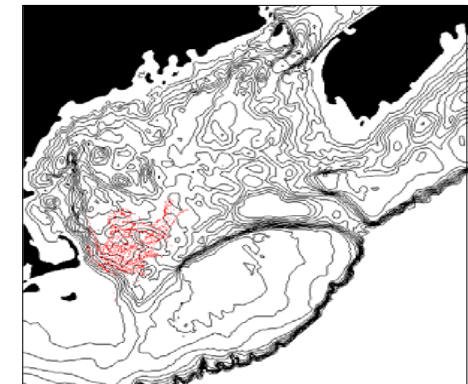
- Planktonic time and distribution data are currently being collected
- Growth and mortality rate data will be culled from previous studies
- Wind data is based on continuous monthly mean average data maintained by the National Center for Environmental Predictions
- Density data is based on 1970 – 2003 monthly mean average data maintained by the Bedford Institute of Oceanography

Couple Physical and Biological Data

- Physical data have been incorporated into a particle tracking model
- Incorporate spatial/temporal constraints of biological data into model

Run and Analyze Model

- Run the particle tracking code (see diagram below) using various physical forcing and biological scenarios
- Generate and test hypotheses based on comparison between results, known data and observations



Snapshot of Gulf of Maine model incorporating physical and biological data analogous to those required by this project. This particle tracking code will be modified to the physical and biological conditions of this study.

Map data courtesy of James Pringle