

Northeast Consortium Cooperative Research Annual Progress Report, January 2010

Project Title: Genetic Identification of Atlantic Cod Spawning Stocks in U.S. Waters using Microsatellite and SNP DNA Markers

Award Number: 111B03

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Project Objectives: Our research objectives are to identify the spatial and temporal stock structure of Atlantic Cod (*Gadus morhua*) in US waters, using genetic analyses. Specifically, our aim is to identify and sample major spawning aggregations throughout the Gulf of Maine, Georges Bank, and areas south of Georges Bank, and to determine if these aggregates are genetically unique stocks.

Major Accomplishments & Milestones: During this reporting period, our primary focus has been on dissemination of the results of our work. To this end, we prepared a manuscript, which is now in final review for publication in the Marine Ecology Progress Series:

Kovach, A.I., T.S. Breton, D.L. Berlinsky, L. Maceda, and I. Wirgin. *In Review*. Fine-scale spatial and temporal genetic structure of Atlantic Cod in US Waters. Submitted to the *Marine Ecology Progress Series*.

A major finding of our work on cod stock structure is summarized in Figure 1.

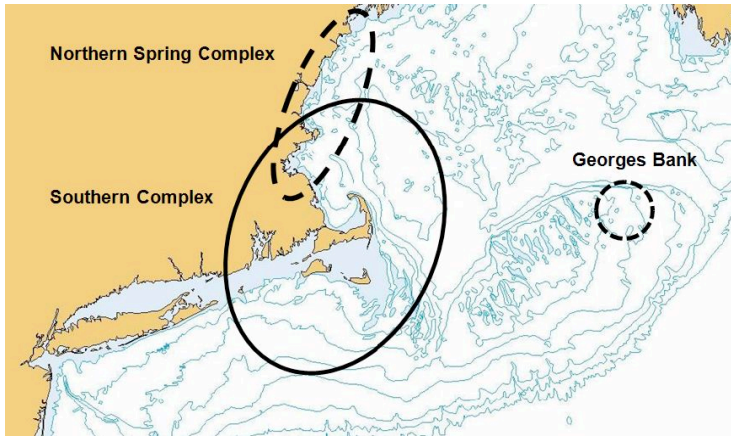


Figure 1. Proposed Atlantic cod spawning complexes in U.S. waters based on genetic differentiation. The Northern Spring Complex includes spring-spawning cod in the spring in Massachusetts and Ipswich Bays and southern coastal Maine; the Southern Complex includes primarily winter-spawning cod in the inshore and offshore Gulf of Maine, Nantucket Shoals and Cox Ledge (and also some offshore spring-spawning populations); and the Georges Bank population spawns in the winter on the Northeast Peak of the bank.

We have also been actively collaborating with scientists involved in other regional cod activities, including colleagues at the University of New Hampshire, University of Massachusetts at Dartmouth, and Gulf of Maine Research Institute. We are working on generating a synthetic model of cod population structure in the Gulf of Maine, which incorporates information from cod at all life stages and life history processes, including larval dispersal, juvenile habitat selection, and adult migration and site fidelity. Our efforts to date have led to proposal submissions, meeting presentations, and a manuscript submission to the American Fisheries Society Gulf of Maine Science Symposium Proceedings:

Runge, J.A., A. Kovach, J. Churchill, L. Kerr, and 17 others. *In Review*. Understanding Climate Impacts on Recruitment and Spatial Dynamics of Atlantic Cod in the Gulf of Maine: Integration of Observations and Modeling. Gulf of Maine Symposium: Advancing Ecosystem Research for the Future of The Gulf. American Fisheries Society.

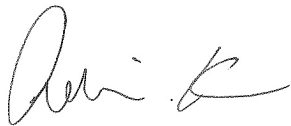
During the reporting period, we have also continued with our sample collection efforts from adult spawning cod on western Georges Bank and Cox Ledge through our collaboration with Steve Cadrin at SMAST, University of Massachusetts-Dartmouth and NOAA/NMFS. Laboratory work is continuing with DNA isolation and genotyping of these new samples. We will compare the genetic variation of these samples with those from our earlier work to evaluate temporal stability and refine our current understanding of cod stock structure.

Unexpected Difficulties/Project Alterations: We have not experienced any major difficulties nor had to alter our project objectives.

Next Steps: Our future plans include continuing our work to refine our understanding of the spatial structure of adult spawning cod populations in the Gulf of Maine, and determining whether the genetic structure remains temporally stable. To this end, we are actively engaged in seeking additional spawning populations via discussions with fisherman, contacts at Massachusetts Division of Marine Fisheries, steering committee members, and other interested partners. Through collaborative efforts with our cooperative partner, Steve Cadrin (University of Massachusetts-Dartmouth/SMAST) and a group of industry partners (fisherman) we are obtaining samples from targeted trips to the Chatham, western Georges Bank area. We have chosen to focus further on this area, as we currently have a limited number of samples from the region and we consider it be an area of potential interest, due to the likely role of the Great South Channel in influencing population structure. We will also continue our efforts to obtain samples of cod from coastal Maine. Given the depleted nature of these populations, we have to date not been able to obtain samples from this area, but are seeking to do so from the Maine Department of Marine Resources Maine-New Hampshire Inshore Trawl Survey. Tasks for the next six months will include additional sample collection and continued genetic analyses.

Impacts: Our research involves collaboration between scientific researchers, managers and commercial fisherman. We have been working closely with our steering committee members in sample collection and have made efforts to communication our preliminary findings through reports, scientific publications, seminars and meetings. Our project is generating much interest and we anticipate that our findings will be incorporated into the scientific information used to develop fisheries management plans. In particular, our findings have contributed to a recent awareness about the need to rethink and reassess stock boundaries for groundfish, especially Atlantic cod, and to move potentially towards fine-scale management. Marine scientists, fisheries managers, fisherman and conservation agencies, such as the Penobscot River Restoration Trust, would benefit from knowing our findings.

Report prepared by Adrienne Kovach, January 14, 2010.

A handwritten signature in cursive script, appearing to read 'Adrienne Kovach', written in black ink.