

**NORTHEAST CONSORTIUM
ANNUAL REPORT**

For period July 1, 2008 – June 30, 2009

1. Project title and contract number

Exploring the potential inadvertent effects of Gulf of Maine and Georges Bank area closures on cod life-history variation

Prime Award No. NA06NMF4720095

Subaward No. 08-008

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4. Major accomplishments and milestones

The primary objectives of this project are as follows:

- 1) Demonstrate the existence of life-history variants (i.e. ecotypes or morphotypes) in Atlantic cod from the Gulf of Maine and Georges Bank
- 2) Examine whether Gulf of Maine and Georges Bank closed areas favor sedentary cod types over migrant cod types
- 3) Examine whether closed areas alter cod feeding and growth

Since beginning sampling in summer of 2007, we have made great progress towards achieving these objectives. The following is a list of milestones and accomplishments for this project:

- 1) Sampling for cod has been conducted on a total of 32 days-at-sea aboard 5 industry vessels (see list of participants above) throughout the Gulf of Maine and Georges Bank and in and around 5 of the major closed areas (see Figure 1, Appendix).
- 2) A total of 1,323 cod have been captured and mostly processed for the parameters outlined in the proposal. Specifically we have collected the following data for nearly all of these cod:
 - a. Length, weight, liver weight, gonad weight, gutted weight
 - b. Sex
 - c. Age (from otoliths)
 - d. 13 body shape variables for morphometric analyses
 - e. Color; we have developed a red/green ratio (RGR) measurement from digital images as a robust way of quantifying color in cod
 - f. Stable carbon and nitrogen isotope signatures (subset of 307 cod)
 - g. Diet (from stomach contents)
 - h. Parasite loads

While multivariate analyses of all these variables for all cod is pending completion of sampling (as is submission of data to NEC), preliminary analysis of life-history variables for red cod at Cashes Ledge points to the existence of a distinct life history variant for cod (see previous report). In addition, preliminary results point to a possible effect of closed areas on cod life history variation, particularly body shape (Figure 2, Appendix) which is hypothesized to be related to swimming behavior (i.e., residency vs. migrant).

5. Unexpected difficulties and project alterations

No major difficulties have been encountered and no alterations have been made to our work plan (other than continued directed sampling for red cod) since submission of the previous annual report.

6. Next steps, tasks for next 12 months

- 1) Complete field sampling (funds remain for roughly 8 charter days to be completed); we will continue to target red cod populations (Cashes Ledge and various inshore sites) and we will make one more 2 day trip to Closed Area II which, given its distance and difficulty getting to, has only been sampled once so far.
- 2) Complete laboratory processing of new samples.

- 3) Analyze all data to test for the existence of life-history variants (with a focus on red cod)
- 4) Analyze all data to test for effect of closure status on cod life-history (see Figure 2 for preliminary results on body shape).

7. Impacts of the project to fishermen/fishing community, and scientist/science community

Results from this project have been presented at numerous venues over the last year. A poster and an oral presentation were given at the annual NEC Participants meeting. An oral presentation that drew on results from this project was given at a workshop on “*Exploring fine-scale ecology for groundfish in the Gulf of Maine and Georges Bank*” (York Harbor, ME, April 1-2, 2009); a poster highlighting the effects of closure status on cod life history was also presented at this workshop.

8. Signature and date



Graham Sherwood

June 30, 2009

8. Appendix

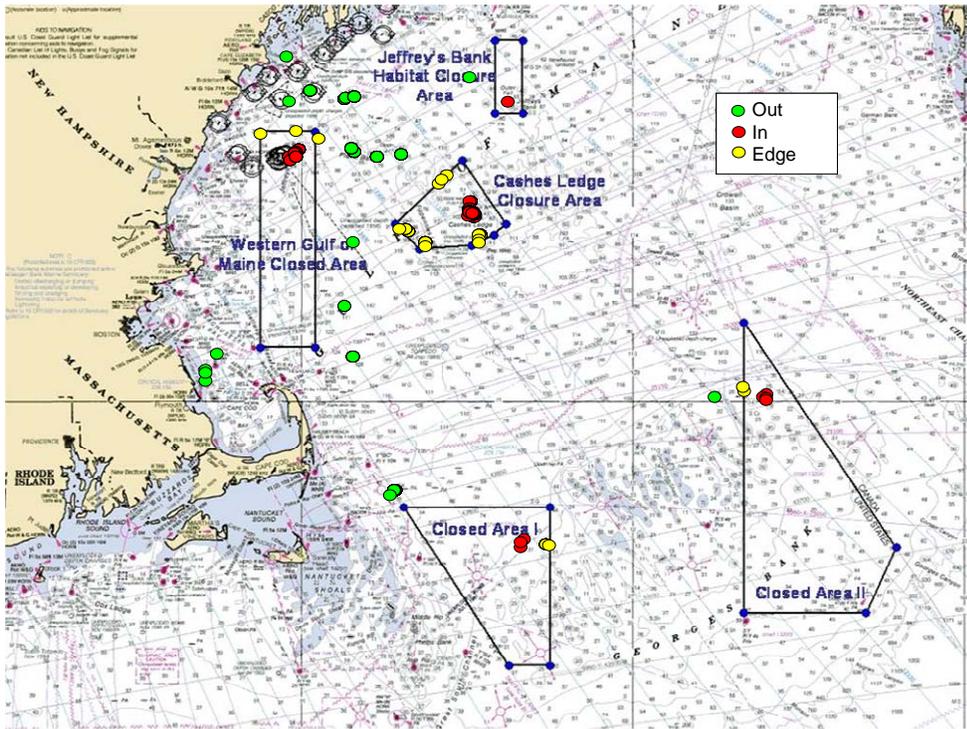


Figure 1. Chart of Gulf of Maine and Georges Bank showing location of closed areas and sampling effort over last two and half seasons.

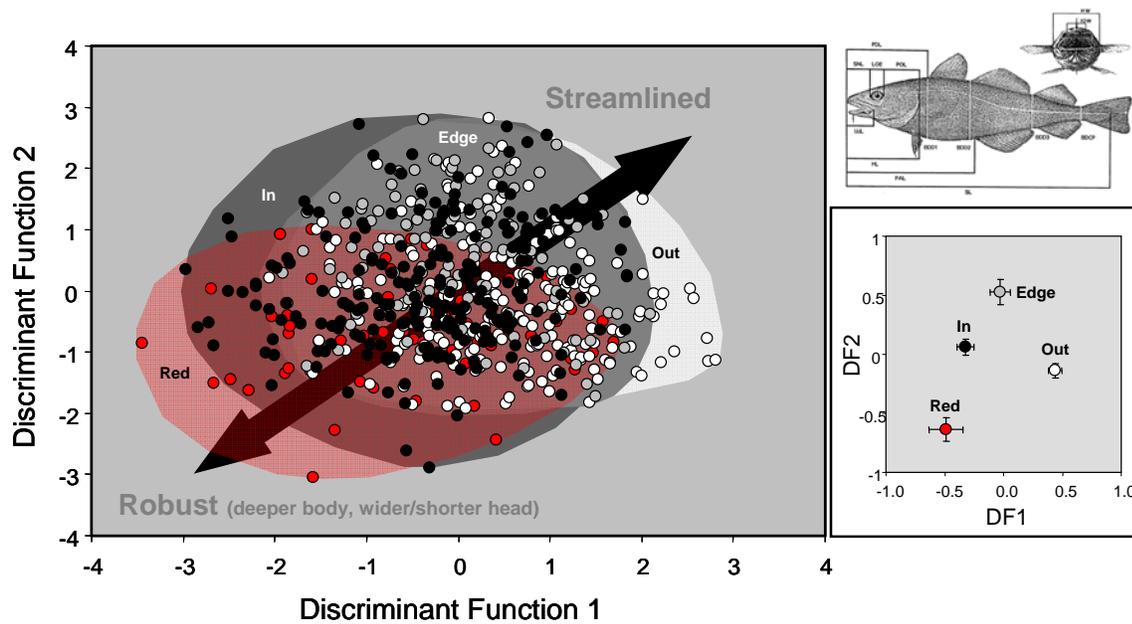


Figure 2. Discriminant function analysis of 13 body shape variables for red cod and cod captured inside, outside and near the edge of 5 major closed areas. Body shape of normal colored cod is significantly more robust (less streamlined) inside closed areas than outside.