

EPA-Alabama Center for Estuarine Studies Annual Report

Period Covered by Report: July 1, 2002 - December 31, 2002

Date of Report: January 25, 2003

Title: Natural Biogeochemical Tags of Striped Mullet, *Mugil cephalus*, Estuarine Nursery Areas in the North Central Gulf of Mexico

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Institution: ¹University of South Alabama, ²Louisiana State University

Research Category: EPA Science to Achieve Results: Small Grant for Exploratory Research

Project Period: July 1 2001 - December 31, 2002; no-cost extension through June 30, 2003

Objectives of the Research Project:

The objective of this project is to develop natural tags of juvenile striped mullet, *Mugil cephalus*, (mullet) in the north central Gulf of Mexico (GOM) based on otolith elemental (e.g., Ba, Ca, K, Mg, Mn, Na, and Sr) and stable isotope (C, N, and O) signatures unique to their natal estuaries. We have collected juvenile mullet from estuaries located in four areas of the north central GOM (Fig. 1) and are developing natural tags of each area based on analysis of otolith chemical composition performed by high resolution-inductively coupled plasma-mass spectrometry (HR-ICP-MS) and isotope ratio-mass spectrometry (IR-MS). Previous studies have demonstrated drainage basins, hydrographic linkages, and water chemical composition are different among these four areas and similar within them. Therefore, we expect to find significant differences in the chemical signatures of juvenile mullet otoliths from different natal habitats in the north central GOM. In future studies, we will employ developed natural tags to estimate estuarine site fidelity of adult mullet, connectivity among north central GOM mullet populations, and estuarine-specific contribution to the offshore spawning stock in winter.

Progress Summary/Accomplishments:

Juvenile mullet were collected from estuaries around the north central GOM from late May through early July in 2001 and 2002 (Table 1, Figure 1). Sagittal otoliths were extracted from each fish and prepared for elemental analysis with HR-ICP-MS and IR-MS. Preliminary analyses of otolith chemistry by HR-ICP-MS indicated concentrations of several elements are estimable at levels significantly higher than detection limits (e.g. Ba, Ca, K, Mg, Mn, Na, and Sr). Otolith concentrations of stable isotopes of Sr (⁸⁶Sr, ⁸⁷Sr, and ⁸⁸Sr) also appear to be estimable with HR-ICP-MS.

Publications/Presentations: none

Future Activities:

Analyses to determine otolith elemental and stable isotope signatures will proceed during winter 2003. Quality control of elemental and stable isotope analyses will be assured by running multiple replicates of each sample (n = 7 for HR-ICP-MS and n = 2 for IR-MS). For HR-ICP-MS analyses, blanks will be prepared to estimate detection limits (mean blank ± s.e.) for each element, and percent recovery will be estimated for a subset of samples with the method of standard addition. Additionally, matrix effects and instrument drift will be estimated and corrected for using a standard reference material currently being developed for otolith chemical analysis by the National Institute of Standards. For IR-MS analyses, isotopic composition of

otoliths will be reported as delta values relative to reference standards run concurrently with samples.

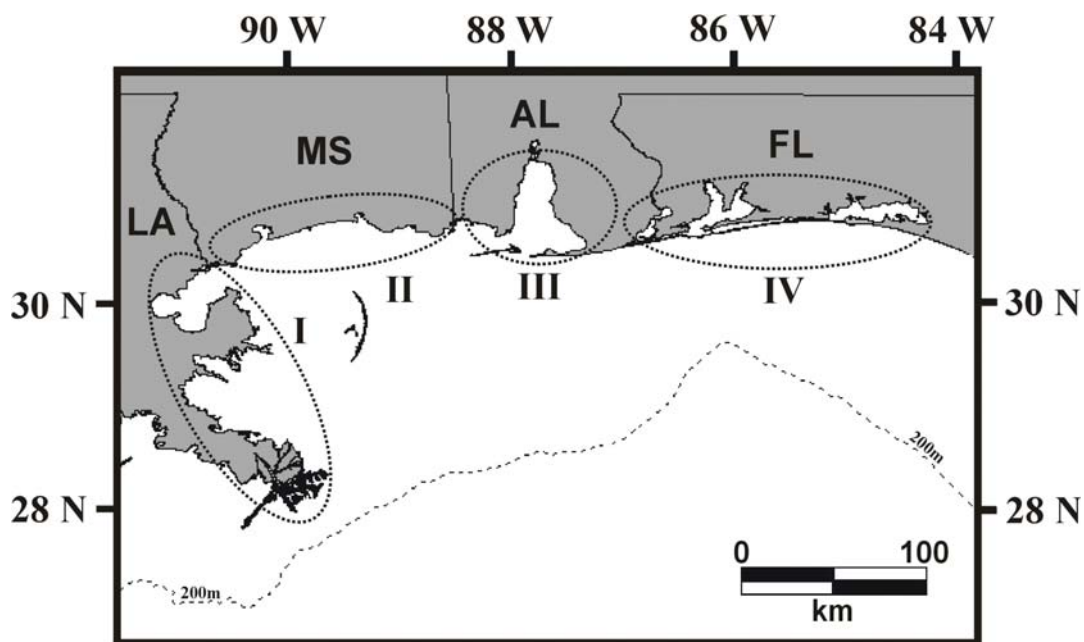
Keywords: otolith, Mugil, HR-ICP-MS, IR-MS, estuarine, life-cycle analysis, ecology, north central Gulf of Mexico, SIC: 0912

Relevant Web Sites: none

Table 1. Sample sites and sample sizes of juvenile mullet collected in spring 2001.

| Area | 2001 Stations | 2001 Sample Sites | 2002 Stations | 2002 Sample Sites |
|------|---------------|-------------------|---------------|-------------------|
| I | 10 | 138 | 7 | 76 |
| II | 6 | 82 | 6 | 84 |
| III | 6 | 88 | 6 | 81 |
| IV | 8 | 115 | 7 | 78 |

Figure 1. Estuarine systems sampled for juvenile mullet in spring 2001 and 2002.



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length frequency distributions of juvenile striped mullet sampled in 2001 and 2002.

