EPA – ACES Annual Web Summary Report

Period Covered by the Report: 06/01/02 – 12/31/02
Date of Report: 01/21/03
EPA Agreement Number: R-82707201-03
Title: *"A Preliminary Survey of Macroalgal and Aquatic Plant Distribution in the Mobile-Tensaw Delta"*
Investigator(s): Kelly M. Major & Clinton S. Major
Institution: University of South Alabama
Research Category: Small Grant for Exploratory Research
Project Period: 06/01/02 – 12/31/03

Objective(s) of the Research Project:

The three main objectives of the proposed research are:

1) to obtain data regarding macroalgal and aquatic plant species richness, abundance and distribution in the Mobile-Tensaw Delta.
2) to examine temporal and spatial variations in physicochemical parameters and land use characteristics of the Mobile-Tensaw Delta as they relate to macroalgal and aquatic plant distribution.
3) to identify potentially useful bioindicators.

These objectives will be pursued with the assistance of an undergraduate who will receive practical research training in the area of algal/plant ecology. Emphasis will be placed on algal/plant taxonomy and collection of chemical and environmental data. Effects of salinity, nutrient concentration, temperature and irradiance are of primary interest regarding algal and aquatic plant distribution patterns as they are the dominant abiotic factors in the Mobile Delta ecosystem.

Progress Summary/Accomplishments:

As monies were awarded after the algal/plant growing season, in October of 2002, our efforts have focused on the acquisition of pre-existing aerial photographs of the Delta and field equipment needed for the upcoming spring sampling season. Student interviews are also underway to fill the undergraduate research assistant position available through this grant.

Thus far, two reconnaissance trips have been made along the river system in an effort to identify suitable sites for the establishment of permanent sampling transects for the 2003 algal/plant growing season.

Publications/Presentations:

Mobile Bay National Estuary Program (MBNEP) – article for the "State of the Bay" report. This article is due to be published in the local newspaper (The Mobile Register) during March of 2003.
SEE ATTACHED

Future Activities:

Collection and Identification of Algae and Aquatic Plants

Using topographic maps and a Global Positioning System, a reconnaissance survey will be conducted to identify and categorize land use adjacent to and downstream of the Mobile-Tensaw Delta. Land use categories, and information regarding plant distribution and prevailing physical/chemical trends around Gravine Island from Drs. Anne Boettcher and Tim Sherman, will then be used to stratify sampling sites along the river system. A monthly sampling regime will be implemented to collect data from a total of 15 sites (5 sites will be centrally located within the Delta), representing the complexity of this aquatic ecosystem, along a gradient from the confluence of the Mobile and Tensaw Rivers to Mobile Bay. Sampling transects (10 x 20 m), running parallel to the shore, will be set up within each site. Macroalgal/plant abundance and distribution will be assessed at 5 m intervals, both along the shore and perpendicularly outward to a depth of 2 m, using a 0.5 x 0.5 m quadrat subdivided into 100 cells. The number of cells covered by each species will be counted and converted to percent cover. Collections will be made for identification and creation of vouchers. Specimens will be maintained in water-filled Ziploc bags (algae and higher plants) or scintillation vials (bryophytes) and placed on ice for later identification and mounting.

Measurement of Physicochemical Parameters

In situ measurements of ambient water temperature, dissolved oxygen, pH, salinity, surface irradiance and light attenuation levels will be made per site visitation. Separate water samples will be collected in triplicate at each site, and sampling period, for later determination of water column total suspended solids (TSS), Chlorophyll and nutrient (NO_3^-, NO_2^-, NH_4^+ and PO_4^{3-}) concentrations. To minimize degradation effects, Chl and ammonium samples will be analyzed immediately upon returning to the laboratory on each sampling date. Nitrate/nitrite samples will be frozen and analyzed as time allows. Water samples collected for pigment analysis will be filtered, solvent extracted (90% acetone) in dim light and quantified spectrophotometrically using the equations of Jeffrey and Humphrey (1975). Nitrate, nitrite and ammonium concentrations will be determined using the standard colorimetric techniques, designed for the chemical analysis of seawater, as outlined in Parsons *et al.*(1984). Orthophosphate levels will be estimated using the colorimetric ascorbic acid method (Greenberg *et al*. 1992).

Statistical Analyses

Descriptive Statistics: A series of descriptive statistics will be applied to preliminary field data (e.g., species distribution and abundance) and ecological characterizations (e.g., species richness and abundance indices). Identification and placement of algal and aquatic plant assemblages into a hierarchical classification will be performed using a two-way indicator species analysis (TWINSPAN) and canonical correspondence analysis (CCA), using the statistical package PcOrd (ter Braak 1986, Jongman *et al*. 1987). TWINSPAN is a divisive numerical classification technique developed specifically for hierarchical classification of community data (Gauch 1982). An analysis of variance (ANOVA) will be used to determine if species assemblages differ, along a gradient, from the Delta to Mobile Bay.

Community Comparisons: Multivariate analyses will be used to explore plant assemblage structure and the relationship between assemblage structure and environmental characteristics. Principal components analysis (PCA) will be used to define subsets of water-quality and habitat variables to determine if variables measured at all sites accurately reflect environmental gradients from north to south. Spatial and temporal variations in plant communities will be evaluated using detrended correspondence analysis (DCA). Detrended correspondence analysis employs an improved eigenvector ordination technique and is based on reciprocal averaging; DCA corrects two main flaws of the reciprocal averaging technique:

1) arch distortion and 2) violation of orthogonality criteria (Gauch 1982). Reciprocal averaging, or correspondence analysis, is a multivariate technique that maximizes the correlation between species scores and sample scores along an assumed gradient (Hill & Gauch 1980).

Predictive models: Using Arcview®, a data layer will be developed to include all biological and environmental data. This information will be used, in combination with additional spatial data layers, to develop a GIS predictive model that will identify additional locations for algal and aquatic plant assemblages based on geology, soils and river conditions.

Except where indicated above, data will be analyzed using a PC (Dell Dimension 8100; Pentium 4) and SYSTAT (version 9.0) statistical software. The p-value will be set at the level of ≤ 0.05 for all analyses.

Schedule of Work and Milestones:

****Because awards were made later than anticipated, the following schedule has been adjusted accordingly.**

Year 1

Spring 2003	Site selection and assessment of sampling method(s) Initiation of assessment of algal/plant distribution, collection and identification Initiation of physicochemical characterization of sites
Summer 2003	Algal/plant distribution, collection and identification continued Physicochemical characterization continued
Fall 2003	Algal/plant distribution, collection and identification continued Physicochemical characterization continued
Winter 2003	Algal/plant distribution, collection and identification continued Physicochemical characterization continued

Year 2 (no additional funds requested)

Spring 2004	Finish sampling for Year 1
Summer 2004	Complete all chemical analyses and specimen identifications Compilation and analysis of data for Year 1 of survey
Fall 2004	Submit final synthesis to ACES Presentation of results at professional meetings

Supplemental Keywords: land-use, estuarine, ecological effects, stressors, population, indicators, aquatic habitat, ecology, plant biology, modeling, surveys and south central

Relevant Web Sites: N/A

References:

Gauch, H.G., Jr. (1982) *Multivariate Analysis and Community Structure*. Cambridge University Press, Cambridge.

Greenberg, A.E., Clesceri, L.S. & Eaton, A.D. (1992) **In***: Standard Methods for the Examination of Water and Wastewater***.** Washington, D.C.: American Public Health Association.

Hill, M.O. & Gauch, H.G. (1980) *Vegetagio*. 42: 47-58.

Jeffrey, S.W. & Humphrey, G.F. (1975) *Biochim. Physiol. Pflanzen.* 167: 191-194.

Jongman, R.H.G., ter Braak, C.J.F. & Tongeren. (1987) *Data Analysis in Community and Landscape Ecology*. Cambridge University Press, Cambridge.

Parsons, T.R., Maita, Y. & Lalli, C.M. (1984) **In**: *A Manual of Chemical and Biological Methods for Seawater Analysis*. Pergamon Press, New York.

ter Braak, C.J.F. (1986) *Ecology*. 67: 1167-1179.

Acknowledgements and Disclaimers:

This research has been supported by a grant from the U.S. Environmental Protection Agency's Science to Achieve Results (STAR) Program, through the Alabama Center for Estuarine Studies. Although the research described in this article has been funded wholly or in part by the U.S. Environmental Protection Agency's STAR program (grant # R-82707201-03), it has not been subjected to any EPA review and, therefore, does not necessarily reflect the views of the Agency. No official endorsement should be inferred.