

Annual Report Summary Format

Period Covered by the Report: Spring 2001-Summer 2003

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Title: Food web interactions, spatial subsidies and the flow of energy between the Mobile Bay delta and offshore waters: A SGER proposal to the Alabama Center for Estuarine Studies

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Institution: University of South Alabama

Research Category: SGER

Project Period: 24 months

Objective(s) of the Research Project: Ultimately, our goal was to develop a new proposal designed to assess the importance of cross-habitat linkages and spatial subsidies in determining the productivity of coastal food webs in the northern Gulf of Mexico. In the review of our initial proposal, the SAC identified two key issues that must be addressed before a larger proposal could be funded. The issues were a need to 1) identify a control site(s) that could be used to assess the impacts of the causeway on food web linkages between Alabama's offshore waters and higher order consumers found in the Mobile Bay delta (MBD) and 2) provide evidence that stable isotope analyses could identify the sources of energy at the base of the MBD food web. Through this SGER we sought to address the SAC concerns, and collect the preliminary data required to more fully develop our initial proposal.

Progress Summary/Accomplishments:

Objective 1): The original research goal was to determine if estuarine-dependent prey were subsidizing the diets of higher order freshwater consumers, and to show the SAC that isotopes would be useful tools to assess the strength of this linkage. We concluded that an ideal control site would have a hydrological barricade that would prevent higher order freshwater consumers from encountering estuarine-dependent prey. As such, we hypothesized that the City of Mobile's water reservoir (Big Creek Lake) might serve as an appropriate control site for a future study. Big Creek Lake is located within Mobile County. This freshwater impoundment supports the same consumer species found within the MBD. To document this, we collected multiple consumers and prey species.

Objective 2): To demonstrate that isotopic signatures within the tissues of freshwater consumers would vary accordingly with estuarine-dependent prey density, some 44 higher order consumers (including largemouth bass, hybrid striped bass, gars, pike and bluegill) were collected at our control site in April 2001. An additional, 154 fishes were collected throughout the lower MBD. Of these, some 24 individuals from Big Creek Lake and 77 from MBD were processed for carbon and nitrogen isotopes. These data have been received and are in the process of analysis (see below for two examples of our findings to date). Published reports of fish diets, plus our previous field observations, indicated the there might be important seasonal shifts in the importance of marine prey subsidies. As a result, a second sampling was conducted in September 2001. In this effort over 200 fishes were collected and processed for analyses. The carbon data have been received from the September collections and we anticipate that the nitrogen analyses will completed by the end of May 2002. Now we have all of the nitrogen

analyses on hand and are completing the stomach content analyses from these fishes. We are now comparing and contrasting the isotopic signatures of these fishes with those of likely sources of energy at the base of each food web. We have identified a number of new basal sources that we will need to collect this coming summer.

Expected Results and Our Findings To Date:

We hypothesized that there would be important differences in the isotopic signatures of the same species of consumers collected from MBD, and Big Creek Lake. Also, we hypothesized that there would be important seasonal shifts in the importance of estuarine-dependent prey in freshwater consumer diets. Based on our initial analyses, we find support for both hypotheses. We have found, using two-way ANOVA, that there were highly significant differences ($p < 0.003$) in the carbon signatures, between seasons and between locations, of large mouth bass (*Micropterus salmoides*). Post-hoc, pairwise, comparisons of sites found the carbon signatures of fishes collected from our control site (Big Creek Lake) varied significantly from all other sites. There were no differences among signatures at collection sites throughout the delta. This indicates that the carbon signatures of this higher order consumer shift with season and that these differences are probably related to increasing abundances of estuarine-dependent in the diets of these fishes in the MBD in September.

Omnivores seem to be similarly affected by the degree of openness in their surrounding environment. Similar analyses of bluegills (*Lepomis macrochirus*) found no significant effect of season on the carbon signature. Location, however, did have a highly significant effect on their carbon signatures. As with the findings from the largemouth bass comparison, bluegills signatures varied greatly between the control site and the MBD, further indicating an important role for cross habitat exchange of production in open ecosystems in the MBD.

Publications/Presentations: No publications are yet in progress.

Future Activities: We plan to complete the analyses of these data by the end of August. Based on the information we currently have on hand, we believed that our new and improved experimental design will allow us to produce a scientifically justifiable, expanded ACES proposal for the 2003 funding cycle.

Supplemental Keywords: Ecosystem, food web, cross-habitat energy exchange.

Relevant Web Sites: No web site will be created until the data analyses are complete.

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