Foraging Ecology of Juvenile Spot, Leiostomus xanthurus, in Apalachicola Bay, Florida

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Abstract
Estuaries provide important nursery habitats that support the production of ecologically and economically important fishes. Apalachicola Bay experiences considerable variation in hydrography due largely to variation in river flow that may impose constraints on the functioning of juvenile nursery habitats. Using juvenile spot, a common estuarine-dependent species, as a model species I am testing the hypothesis that variability in diet of juvenile spot within primary nursery habitats is related to seasonal variation in river flow and associated environmental conditions. The frequency of occurrence and index of relative importance were compared between regions of Apalachicola Bay during spring recruitment. The diets of 84 juvenile spot (9 – 27 mm standard length) from 12 locations throughout Apalachicola National Estuarine Research Reserve (ANERR) were sampled monthly from February to April 2009. Stations were grouped into East Bay (the primary nursery habitat) that is most affected by riverine fluctuations and Mid/Outer Bay. Prey items within the stomach and intestine were identified to the lowest taxonomic level possible, counted, and a volumetric measurement was estimated for each prey category. Dominant prey items of juvenile spot included harpacticoid and calanoid copepods, ostracods, chironomid larvae, and nematodes. Copepods dominated the diets in both East Bay and Mid/Outer Bay. Harpacticoid appear to be more important in East Bay, whereas calanoids appear to be more important in Mid/Outer Bay. Continued diet and future stable isotopic analyses over two years will contribute to a better understanding of the effects of variable freshwater input on the foraging ecology of juvenile spot during their residency in estuarine nursery habitats.

Introduction
• The functioning of estuaries as productive nursery habitats is strongly linked to freshwater and nutrient inputs from the associated watershed (Nixon 2002)
• Environmental conditions in the Bay (e.g. salinity) are strongly related to the magnitude and timing of river flow
• Apalachicola River flow has undergone considerable reductions in recent years due to a combination of drought, river modifications, and upstream water diversions to support municipal and agricultural needs (Ruhl 2005)
• Changes in river flow over sustained periods may lead to a shift in the trophic organization of the bay (Livingston 1997)
• Spot are a common estuarine-dependent species (3rd most abundant in the Bay) that utilize Apalachicola Bay as a nursery before moving offshore
• Trophic, distribution, and abundance analyses are being conducted on juvenile spot in the Bay to help elucidate the effects of variable river flow on population dynamics of this common species
• We hypothesize that spot abundance and foraging ecology will vary spatially and temporally in relation to river flow

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Field Methods
• 12 stations were sampled monthly during 2008-2009 in Apalachicola Bay (Figure 1)
• Stations were grouped as: East Bay (Stations 8-10), the primary nursery, and Mid/Outer Bay Stations (St. 1-7, 11-12; Figure 1)
• Spot diets were analyzed from February to April, the primary recruitment period

Laboratory Methods
• Alimentary tract was removed and the contents weighed
• Prey items were identified to the lowest possible taxonomic level
• Individual prey items were counted and the volumetric contribution of each prey category was estimated (Figure 2)
• Index of relative importance (Equation 1), frequency of occurrence, percent number, and percent volume were calculated for the dominant prey items of spot diets in East Bay and Mid/Outer Bay
• A percent of full stomachs was calculated (n=64; Figure 3) and a normalized stomach fullness was calculated for fish with prey items (Figure 4)

Discussion
• Similar to prior studies, spot are benthic foragers and their diet throughout the Bay during spring is dominated by copepods
• The relative importance of harpacticoid and calanoid copepods differs between East Bay and Mid/Outer Bay perhaps due to spatial differences in prey availability
• East Bay diets contained a significant percentage of freshwater chironomid larvae, indicative of a riverine influence on spot foraging

Future Work
• Analyze diet composition of juvenile spot throughout the Bay and across seasons and years
• Identify contributing sources of organic matter and trophic level using C and N stable isotopes
• The broader goal of this work is to determine the primary food sources of juvenile spot and how variable river flow (both anthropogenic and naturally derived) may affect the use of Apalachicola Bay as a nursery habitat for these juvenile fishes

Preliminary Results
• In both regions, the dominant prey items were calanoid and harpacticoid copepods, making up at least 60% of the juvenile spot diets (Figure 2)
• Harpacticoid copepods dominated diets in East Bay while calanoid copepods dominated spot diets in Mid/Outer Bay (Figure 2)
• Surprisingly, polychaetes are not seen in high abundance in either East Bay or Mid/Outer Bay diets (Figure 2)
• Bivalve veligers and cumaceans were present in Mid/Outer Bay while absent in East Bay (Figure 2)
• Chironomids (Dipteran larvae), Nematodes, and Ostracod were seen in greater abundance in East Bay specimens (Figure 2)
• Juvenile spot in East Bay had a higher percentage of feeding than those resident in Mid/Outer Bay (Figure 3)
• Juvenile spot resident in East Bay have a lower normalized stomach fullness than the Mid/Outer Bay spot (Figure 4)

References