Inter- and intra-specific movement and resource use patterns across ocean-estuarine seascapes

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Fish Life Cycles



Estuaries are widely used as nursery habitats for **transient fish species**, including spot (Leiostomus xanthurus) and sand seatrout (Cynoscion arenarius). In contrast, other fish species complete their life cycle entirely within estuaries, including the marsh resident, Gulf killifish (Fundulus grandis).

Examining ontogenetic migrations and resource use across a salinity gradient can provide an estimate of nursery function by linking trophic to movement dynamics. Our overall goal is to use otolith elemental chronologies of Sr/Ca and Ba/Ca to classify migratory behaviors, and tissue-specific bulk stable isotope ratios of carbon, nitrogen and sulfur ($\delta^{13}C$, $\delta^{15}N$, and $\delta^{34}S$) to estimate the timing of a diet shift of transient and resident fish in Barataria Bay, Louisiana toward the following:

(1) Do estuarine habitat use patterns differ across ontogeny? (2) Does estuarine habitat use and residency differ among regions of the estuary? (3) Can isotopic values of the Gulf Killifish be used to create seascapes that represent the spatial heterogeneity in available resources across the estuary?

We are leveraging existing fish samples collected by the Coastal Water Consortium (GoMRI) and NOAA RESTORE Science Program to develop methodologies to visualize and integrate the biomarker data.



Samples with existing bulk stable isotope data include juvenile fish from two transient species (sand seatrout and spot) and one marsh resident (Gulf killifish). Isotopic values indicate that sand seatrout juveniles may be more recent migrants to the estuary





Gulf killifish collection sites in southern Louisiana span area of approx. 40 km².





Gulf killifish collections in southern Louisiana marsh span small area of approx. 1,000 m².

Latitude	29.25480 -	
	29.25475 -	
	29.25470 -	
	29.25465 -	
	29.25460 -	
	29.25455 -	
	29.25450 -	
	90.664	4
	_	

Trace metal signatures (strontium, barium, and magnesium concentrations to calcium in mmol/mol Ca) from adult Gulf killifish otoliths. The small area depicted includes areas different marsh habitats (creek, edge, pond).

Summary and Next Steps

Interpolation plots of bulk stable isotope and trace metal values in Gulf killifish reflect local conditions and indicate habitat heterogeneity at different spatial scales, from site-level (km) to sub-habitat level (m).

Bulk stable isotope values suggest ontogenetic shift in production resource use in spot but not in Gulf killifish based on δ^{13} C and δ^{34} S.

Next steps are to derive otolith microchemistry data for Gulf killifish, spot and sand seatrout with paired bulks stable isotope data.



Stable Isotope Seascapes



Stable isotope values ($\delta^{13}C$, $\delta^{15}N$, $\delta^{34}S$) from adult Gulf killifish muscle tissues were visualized using contour map functions using base R code and the *dplyr* package and geocoded to fit the terrain of the marsh.



Stable isotope relationships (panels a and b) and SI relationships to total length in Gulf killifish (adult tissue samples) and spot (juvenile tissue samples) (panels c and d).

Trace Metal Seascapes







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