Spatial Isotopic Variability of *Lutjanus griseus* in the Dry Tortugas and Mexico

C. Quigley[1], T. Gerard[2], E. Malca[1], B. Muhling[1], J. Lamkin[2]
[1]University of Miami, Cooperative Institute for Marine and Atmospheric Studies, RSMAS, Miami, FL 33149
[2]NOAA, Southeast Fisheries Science Center, Early Life History Unit, Miami, FL 33149

Introduction

Gray snapper (*Lutjanus griseus)* (FIG 1) are an ecologically and commercially important reef fish found in the coastal areas of the Western Atlantic. Before settling into mangrove or sea grass habitats as juveniles, and reef habitats as adults, snapper undergo a pelagic larval stage (Gerard, 2009). Due to difficulty in tagging fish during this early life stage, much still remains unknown about natal origins and ontogenetic pathways as the snapper settle into their adult populations.

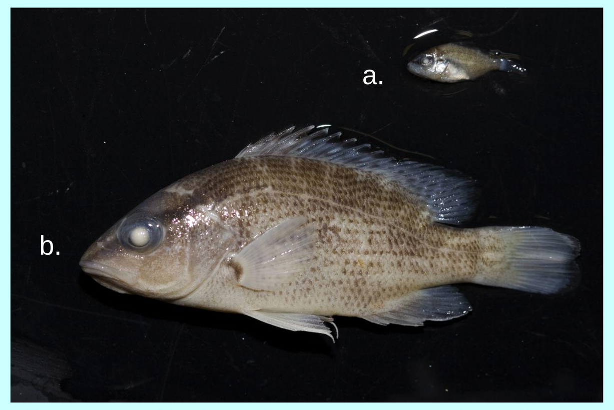

Figure 1. a. Newly settled recruit and b. Juvenile *Lutjanus griseus*

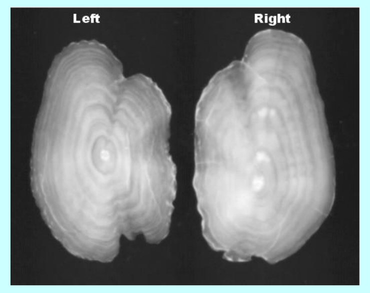

Figure 2. saggital otoliths

The calcium carbonate ear bones (FIG 2), or otoliths, of snapper grow in ring-like patterns, depositing new as the fish matures. They serve as a natural tag recording chemical events throughout the life of the fish (Gauldie, 1996). Comparing core samples, which reflect natal conditions, and edge samples, which correspond to conditions at the time and location of capture, may aid in identifying the sources of these populations as well as possible relationships or similarities between them.

The Loop Current (FIG 3), which originates in the Yucatan Strait, travels from the Yucatan Peninsula into the Gulf of Mexico, exits through the Florida Straits and continues into the Gulf Stream. This physical connection may contribute in the transport of larvae in the Gulf of Mexico (Roberts, 1997). Gray snapper from two sites along this pathway, the Dry Tortugas and Quintana Roo, Mexico, will be compared to determine sources of origin or connectivity between the populations.

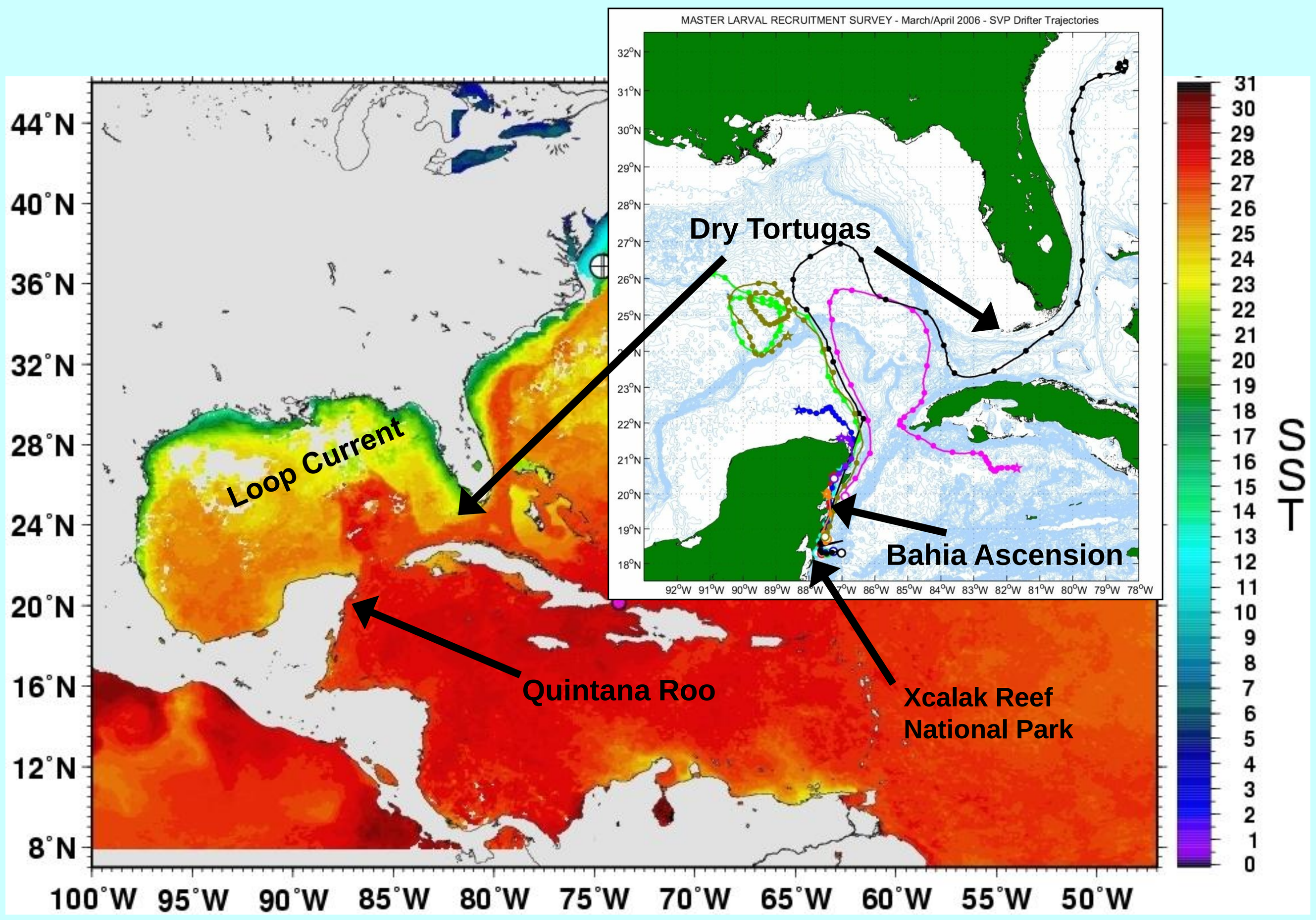

Figure 3 . MODIS Sea Surface Temperature composite for Dec. 3-10, 2002 and drifter trajectories for the Gulf of Mexico and Western Atlantic

Objectives

This study aims to analyze $\delta^{13}C$ and $\delta^{18}O$ in otoliths to assess the connectivity of age-0 juvenile gray snapper in the Quintana Roo, Mexico and the Dry Tortugas.

1. Compare $\delta^{13}C$ and $\delta^{18}O$ core signatures and $\delta^{13}C$ and $\delta^{18}O$ edge signatures within and between both sites.
2. Compare $\delta^{13}C$ and $\delta^{18}O$ core and edge signatures from both sites to previously analyzed whole otolith and newly settled recruit signatures from each site.

Methods

Juvenile gray snapper (*Lutjanus griseus*) were collected from Long Key in the Dry Tortugas during the summer of 2002, and Quintana Roo, Mexico from June through August, 2004. A total of 60 otoliths were extracted. All samples were embedded in epoxy resin and transverse sections were cut across the core on either side using a double bladed Buehler Isomet low speed saw. Sections were glued onto individual glass slides and polished using 800 and 600 grit Microcut Discs and a round polishing cloth. Using a New Wave Research micromill drill with a Leica GZ6 microscope and CCD camera (FIGS 4 and 5), 1 core and 1 edge sample from each otolith were drilled, and powder was collected in glass kiel vials. Drilled samples were then dissolved in phosphoric acid and $\delta^{13}C$ and $\delta^{18}O$ signatures were analyzed in a Thermo Quest Finnigan Delta Plus mass spectrometer at the SIL, RSMAS using standard procedures. Differences between sample sites were tested using Primer software in nonparametric multivariate ANOVA (Permanova).

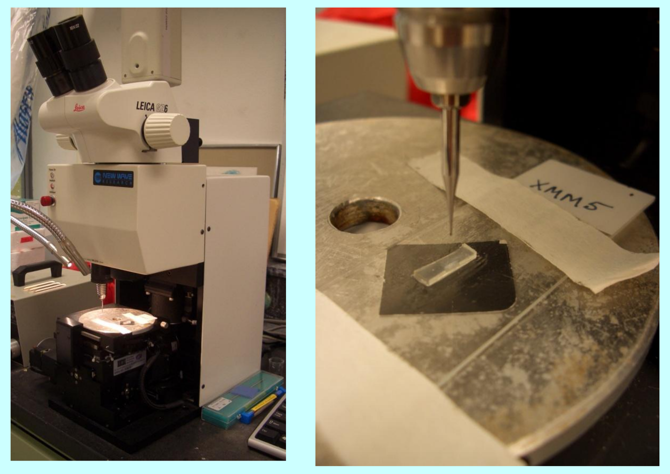
Figures 4 and 5. New Wave Research micromill


Figure 6. Xcalak Reef National Park.

Preliminary Results

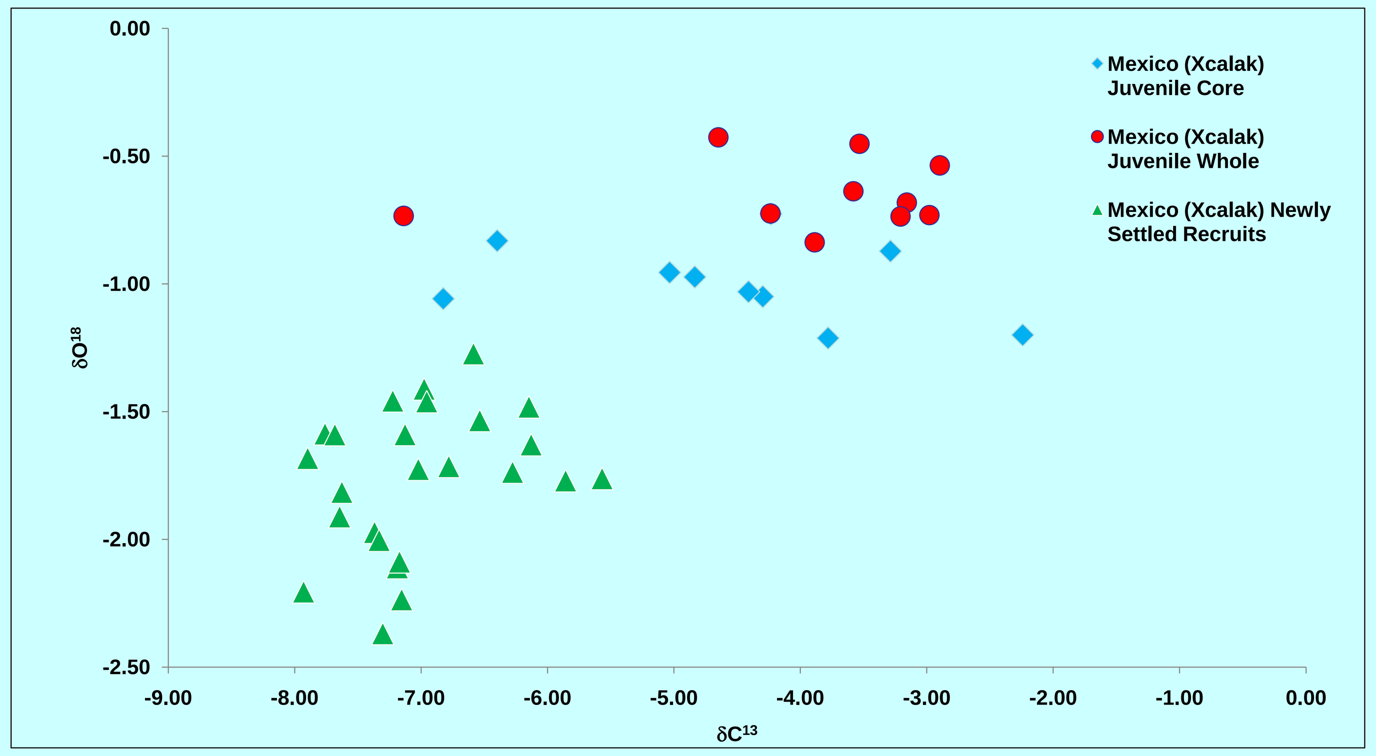

Figure 7. Isotopic signatures for whole otoliths and core samples of Mexico (Xcalak) juvenile snapper, and signatures for whole otoliths of Mexico newly settled recruits

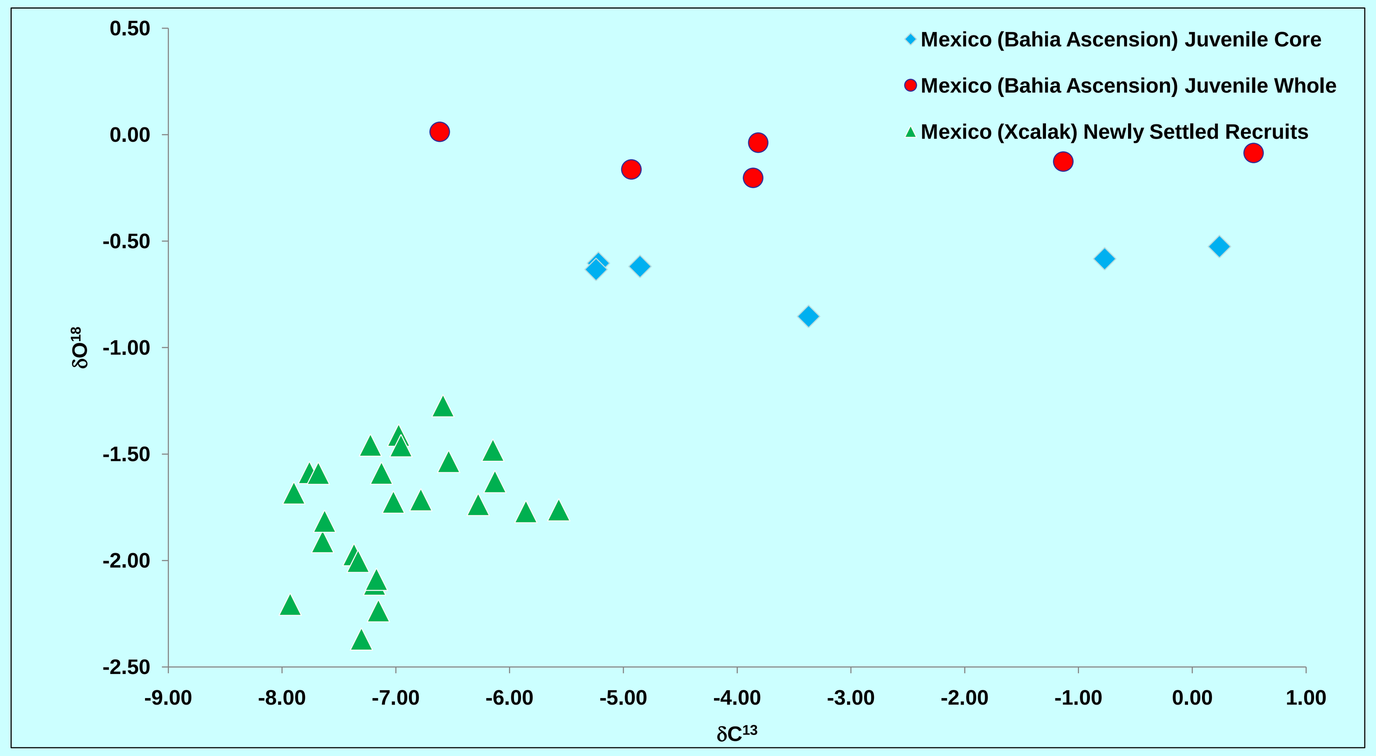

Figure 8. Isotopic signatures for whole otoliths and core samples of Mexico (Bahia Ascension) juvenile snapper, and signatures for whole otoliths of Mexico newly settled recruits

Previous research

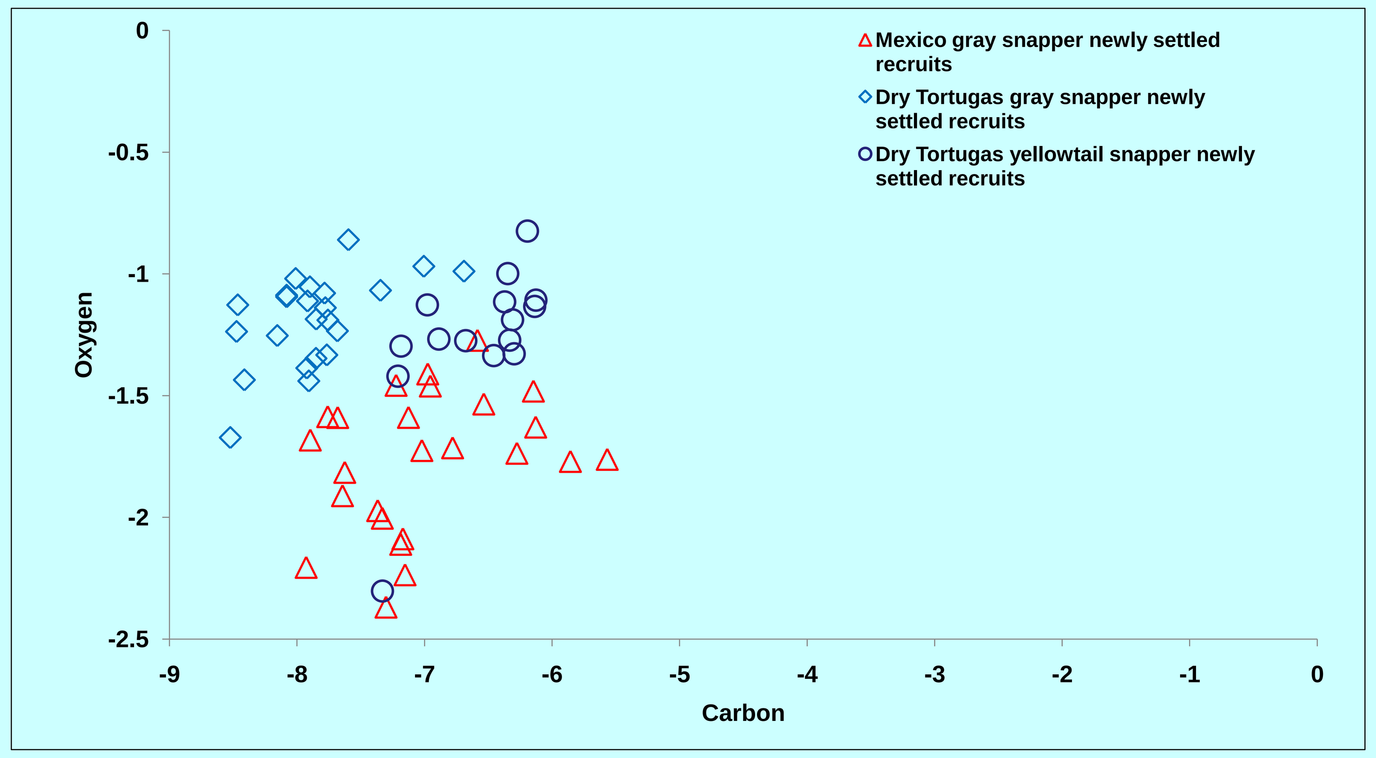

Figure 9. $\delta^{13}C$ and $\delta^{18}O$ signatures for yellowtail snapper newly settled recruits from the Dry Tortugas and gray snapper recruits from the Dry Tortugas and Mexico

Conclusions

A significant difference ($p<0.05$) in $\delta^{13}C$ signatures between the Mexico newly settled recruits and juveniles from both Xcalak and Bahia Ascension sites may indicate a change diet or metabolic rate as the fish mature.

No significant difference in $\delta^{13}C$ signatures between core and whole otolith samples in juveniles from both Xcalak and Bahia Ascension sites may correspond to prompt chemical display of their new diet shortly after recruitment.

A wider dispersion of $\delta^{13}C$ signatures for both Mexico sites among core and whole otolith samples could reflect a wider range of available food sources

A significant difference ($p<0.05$) in $\delta^{18}O$ signatures between Mexico larvae and juveniles from both sites could be a result of dissimilar environmental conditions experienced in different habitats. However, it is possible that the larvae, which were caught in the summer, are showing decreased signatures because they have only experienced low oxygen conditions during the warmer season, whereas juveniles, that have experienced both winter and summer seasons, show a more averaged signature.

Further Research

Analysis of $\delta^{13}C$ and $\delta^{18}O$ signatures in edge samples from Mexico and $\delta^{13}C$ and $\delta^{18}O$ signatures in core and edge samples from the Dry Tortugas will be assessed.

Acknowledgements

The research associates from the NOAA Early Life History Unit at the Southeast Fisheries Science Center in Miami, FL.

P. Swart and A. Saied from the Stable Isotope Laboratory at the University of Miami RSMAS Miami, FL

El Colegio de la Frontera Sur (ECOSUR) for aid in Mexico sample collection

Coral Reef Conservation Program for funding sample collection

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