The Use of Otolith Chemistry to Compare Sources of Snapper Recruits from Southern Florida

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Introduction

Early life history stages of fish are critical in determining the status of adult populations. Measuring isotopic ratios of carbon and oxygen (^{13}C and ^{18}O) through otolith chemistry provide information on these early stages. Otoliths are calcified structures found in all teleost fish[1]. They are metabolically inert thus perfect recorders of ambient water conditions. Multiple species of juvenile (11-30mm, standard length SL)snapper (*L. Griseus, L. Synagris*) from various sites in Biscayne Bay and the Florida Keys were analyzed for this study. Snapper of Southern Florida form transient spawning aggregations and migrate to traditional spawning grounds[2]. Otolith chemistry of newly settled juvenile snapper will be used to interpret aspects of spawning locations. This study intends to suggest whether these recruits originate from a single or multiple spawning aggregations? This study predicts that a single spawning aggregation will supply new recruits to nursery habitats in southern Florida.

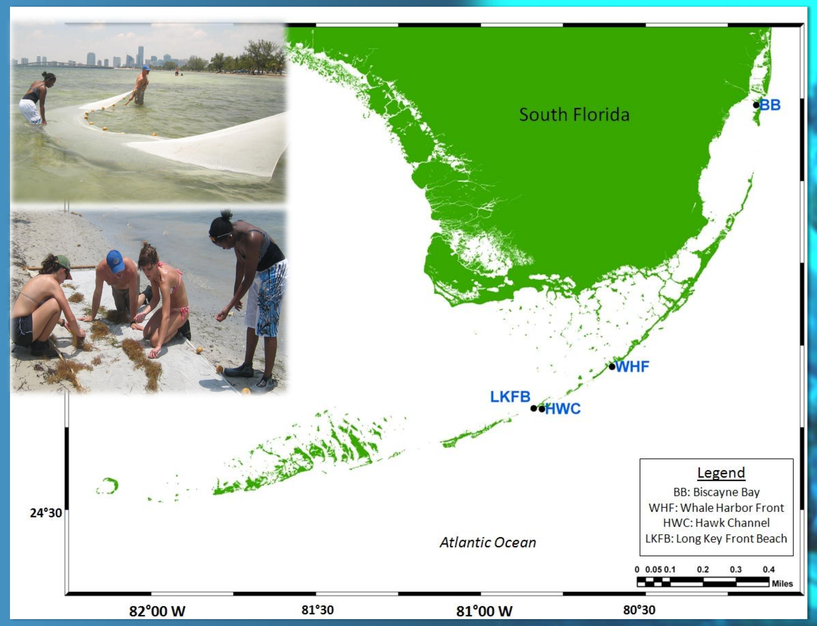
Objectives

- To identify new recruits of *Lutjanidae* to taxonomic species level
- To analyze the ^{13}C and ^{18}O signatures of otoliths for spatial variation in newly settled *L. Griseus* and *L. Synagris* collected from multiple sites
- To measure ^{13}C and ^{18}O signatures in otoliths of newly settled species of *Lutjanidae* over time
- To compare ^{13}C and ^{18}O signatures of multiple species of *Lutjanidae*

Methodology

SAMPLE COLLECTION

- 20ft seine is used to collect snapper (SL <30mm) from sea grass beds between June and August 2003-2007 from Biscayne Bay (BB), Hawk Channel (HWC), Whale Harbor Front (WHF) and Long Key Front Beach(LKFB)



Methodology *(cont'd)*

Table 1 Species Characteristics

Snapper Species	Dorsal Fin spine-ray Count	Anal Fin spine-ray Count	Melanophore Patterns	Lateral spot
L. Griseus (Gray)	X,14	III,7-9	Dark stripe through eye, strips on body, pigment on dorsal fin close to body	N/A
L. Synagris (Lane)	X,12	III,8	A row of pigment on the body near base of dorsal fin	Lateral line through lower 1/3
L. Analis (Mutton) NO IMAGE AVAILABLE	X, 14(13-15)	III,(7)8	Bars slanted down and to the rear	Within a dark bar, lateral line through lower 1/3
L. Apodus (School Master)	X,14	III,8 (7-9)	Bars	N/A

IDENTIFICATION

Sub set of fish are identified to taxonomic species level according to physical characteristics[5] (table 1).

EXTRACTION

Metal and glass probes used to penetrate skull(fig.6), otoliths are placed in series of cleaning solutions (Milli-Q water, 6%Sodium Hypochlorite) and dried.

Fig.6 Process of Otolith removal from skull viewed under a Lecia transmitted-light microscope

Fig. 8 Delta Plus (Stable isotopes lab equipment)

RATIO ANALYSIS

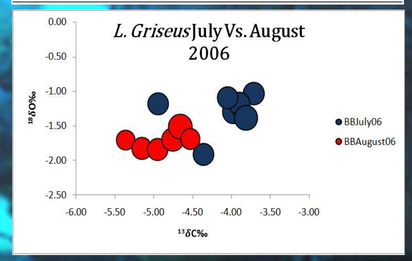
- Otoliths combined with phosphoric acid are analyzed using a Finnigan-MAT 251, sample is later analyzed by a Finnigan Delta plus with a Kiel III device attached(fig. 8), data produced is corrected for isobaric interferences using mass spectrometer procedures[3].

Results

TABLE 2 *Species Data Table*

Site/Date	*L. Griseus*	Percent of total (%)	Mean SL (mm)	*L. Synagris*	Percent of total (%)	Mean SL (mm)
Biscayne Bay						
2006						
July	7	10.6	28.1	N/A		
August	6	9.09	27.3	N/A		
2007						
August	8	12	27.5	N/A		
September	4	6.06	27	N/A		
Hawk Channel						
2004						
August	N/A			3	4.55	14.67
2005						
June	6	9.09	14	N/A		
Whale Front Harbor						
2003	N/A			9	13.64	15.78
August	8	12	11.38	8	12	15.63
September						
Long Key Front Beach						
2005						
August	7	10.6	27	N/A		
TOTAL	**46**			**20**		

- Snapper identified to the taxonomic species level ranged in size from ~11 to 27mm SL (table 2).
- ^{13}C and ^{18}O values for *L. Griseus* otoliths of Jul and Aug 2006 were (fig. 10)significantly different ($p = 0.002$,
- 2007 Signatures of *L. Griseus*, in Biscayne Bay were significantly different ($p = .005$), SL was not a a covariate ($p = 0.18$, fig. 10a)



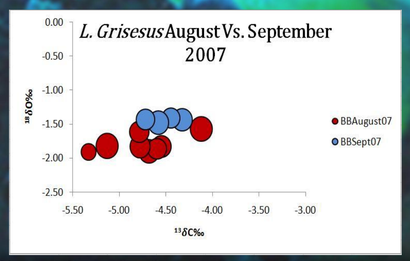
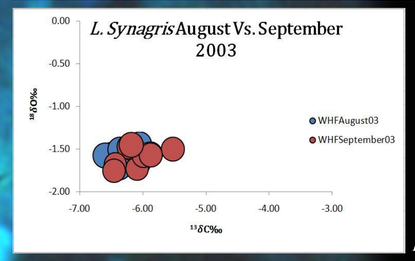


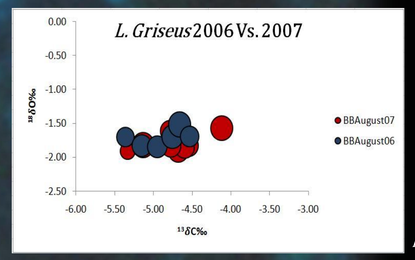
Figure 10,10a various bubble sizes indicate various SL

Results *(cont'd)*



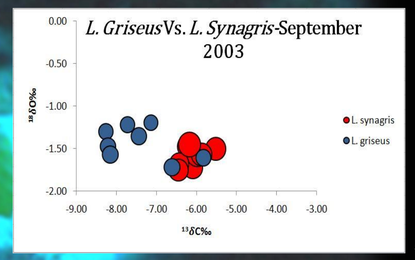
- Overlapping otolith signatures of *L. Synagris* from WFH suggest little monthly variation ($p = 0.45$). SL does not seem to be a covariate since the mean SL of both samples are approximately 16mm (fig. 11).

Fig .11



- ^{13}C and ^{18}O values of *L. Griseus* otoliths are compared yearly, otolith signatures show no significant difference (p= .3, fig. 12).

Fig .12



- ^{13}C ratios between WFH's *L. Synagris* and *L. Griseus* recruits are significantly different (fig. 13)

Fig .13

Conclusion

- Isotopic signatures of otoliths from year to year were similar enough to be considered as the natural mark of a traditional spawning aggregation.
- Overlapping signatures for newly settled *L. Griseus* between August and September 2007 suggest potential for a single spawning source.
- Species variability made *L. Synagris* unable to become a proxy for *L Griseus.*
- Predictions made stating isotopic signatures will show no significant difference spatially were unable to be statistically accredited.
- Temperature measurements were not incorporated into this study, if measurements were taken further inferences could be made from the results
- Isotopic values that would address the spatial objectives were not received in time for analysis and presentation
- A greater number of snapper samples and isotopic results are needed to completely fulfill the objectives of this study

References:

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