SEDAR 23-RW-02

SEDAR 23
Gulf of Mexico and South Atlantic Goliath Grouper

Review Workshop
Key West, Florida, 15-17 November 2010

Working paper for the review panel

prepared by
Sarah Frias-Torres, PhD
Ocean Research & Conservation Association,
1420 Seaway Drive, Fort Pierce, FL 34949 USA.
E-mail: sfrias-torres@teamorca.org
Tel: 772-467-1600

Contents:

During the SEDAR 23 Data Evaluation Workshop (St, Petersburg FL, 26-30 April 2010) and the Assessment Workshop (St. Petersburg, FL, 2-6 August 2010), a series of critical information gaps were identified in our knowledge of goliath grouper. This report focuses on some of those information gaps, based on recent and ongoing fieldwork conducted since April 2010, and not included in any of the workshops mentioned. The contents is listed as it answers each information gap. The information provided here is going through the process of scientific journal peer review, and it is offered to the Expert Panel for their convenience during the SEDAR 23 Review Workshop (Key West, FL, 15-17 November 2010)

Question: Is there any scientific evidence supporting fishers perception that goliath grouper recovery is impacting target commercial and recreational fisheries in Florida?

Answer: Poster presentation at “Linking science to Management: A conference & workshop on the Florida Keys marine ecosystem”, Hawks Cay, FL 19-22 October 2010. Abstract and Poster (adapted from a 48 by 72” format) included.
Poster title: “Social Perceptions Confronting Science in an Endangered Reef Fish”

Question: What is the socioeconomic value of a goliath grouper spawning aggregation?

Answer: preliminary data summary provided from ongoing field research.

Linking Science to Management:
A Conference and workshop on the Florida Keys Marine Ecosystem
October 19-22, 2010, Duck Key, Florida.

Poster # 26: Human Dimensions Section. Thursday October 21, 2010; 5:30 pm-8:00 pm
ABSTRACT

Social Perceptions Confronting Science in an Endangered Reef Fish

Sarah Frias-Torres
Ocean Research & Conservation Association,
1420 Seaway Drive, Fort Pierce, FL 34949 USA.
E-mail: sfrias-torres@teamorca.org

Worldwide, culling of ocean predators has been proposed as a means to overcome depleted fisheries.

The goliath grouper, *Epinephelus itajara*, the largest grouper fish in the Atlantic Ocean is critically endangered throughout most of its distribution range. The species has been protected in the United States since 1990. In Florida, some commercial and recreational fishers consider *E. itajara* a top voracious predator of fish and lobster. Fishers advocate the culling of the protected *E. itajara* population as a solution to recover declining stocks.

Here I examine the scientific evidence against culling *E. itajara* and outline the potential ecosystem services of a recovering *E. itajara* population. Analyses of the *E. itajara*'s commercial extinction event in the late 1980s, coupled with dietary and morphological studies reveal that its recovering population is not the cause of declining fishery stocks in Florida. Instead, *E. itajara* could provide valuable ecosystem services for local ecotourism and become a biological agent to control the invasive Indo-Pacific red lionfish (*Pterois volitans*) in Atlantic reefs.

The persistence of the myth—goliath groupers eating all the fish and lobsters of the reef—distracts attention from the real problem of overfishing, and emphasizes the need of science outreach among stakeholders

Contact Information: Dr. Sarah Frias-Torres, Ocean Research & Conservation Association, 1420 Seaway Drive, Fort Pierce, FL 34949, USA. Phone: 772-467-1600, Fax: 772-467-1602 E-mail: sfrias-torres@teamorca.org

For more on our goliath grouper research:
http://www.teamorca.org/cfiles/goliath.cfm

Social perceptions confronting science in an endangered reef fish [1/2]

Sarah Frias-Torres
Ocean Research & Conservation Association, Fort Pierce, FL 34949, USA

Introduction

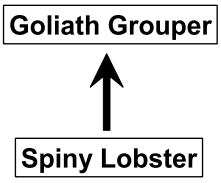
Worldwide, culling of ocean predators has been proposed as a means to overcome depleted fisheries [*1*]. The goliath grouper (*Epinephelus itajara*), the largest grouper in the Atlantic ocean and critically endangered throughout most of its distribution range, has been protected in the United States since 1990.[*2,3*]

Figure 1. Previously extinct goliath grouper spawning aggregation re-forming off Jupiter, Florida, after 20 years of banned fishing. *Photo credit: Walt Stearns*.

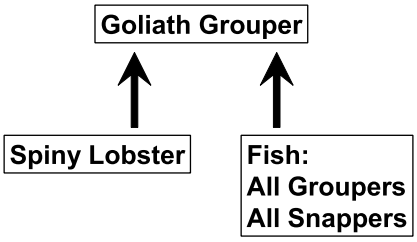
In Florida, some commercial and recreational fishers demand the culling or "thinning out" of the goliath grouper population, because it is considered a top predator of fish and lobster.

Two common food web perceptions are:

Food web 1: Perception from lobster fishers



Food web 2: Perception from recreational and commercial fishers.



What is the scientific evidence in support of such social perceptions?

If food web 1 is correct:

•The extinction event of goliath grouper (super- predator) should have increased the population and commercial catches of spiny lobster (its only prey)

•Stomach contents of goliath grouper should contain only spiny lobster

If food web 2 is correct:

•Same as above, including groupers and snappers

•Dentition in goliath grouper should include canine teeth typical of a piscivorous fish

What are canine teeth?

Lion

Piscivorous grouper

Methods

Data were obtained from:

1. National Marine Fisheries Service (NMFS-NOAA) data of commercial landings for goliath grouper (*Epinephelus itajara*, Serranidae), spiny lobster (*Panulirus argus*, Palinuridae)and gray snapper (*Lutjanus griseus*, Lutjanidae) http://www.st.nmfs.gov/st1/commercial/

2. Florida Fish and Wildlife Conservation Commission data on fishing effort http://www.floridamarine.org

3. Published literature on goliath grouper anatomy, stomach contents and isotope analyses.[*2, 4, 5, 6*]

Results

The goliath grouper commercial extinction event (1970-1990) did not result in an increase of lobster or gray snapper catches

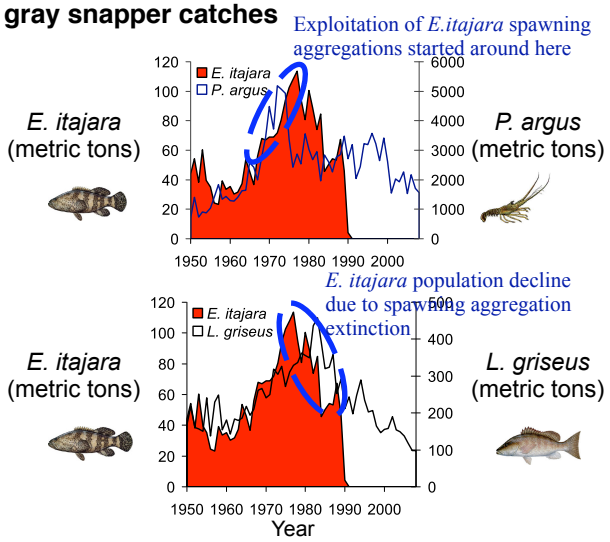


Figure 2. Time series of commercial landings in Florida compared To the extinction curve of *E. itajara*. Correlations during the goliath grouper extinction event (1970-1990) are not statistically significant for *P. argus* (r = -0.006, p = 0.98) for *L. griseus* (r=0.477, p = 0.08)

Social perceptions confronting science in an endangered reef fish [2/2]

Sarah Frias-Torres
Ocean Research & Conservation Association, Fort Pierce, FL 34949, USA

If food webs 1 or 2 were correct, Fig 2 correlations would be significant and negative

Commercial fishing effort in Florida (total catch, number of trips) declined during and after the goliath grouper extinction event

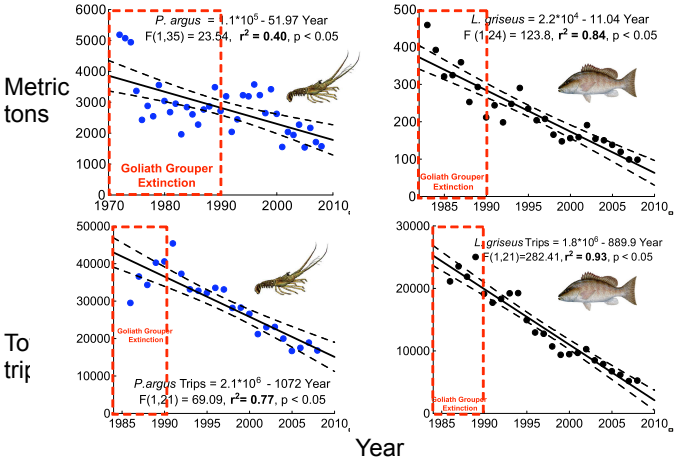


Figure 3. Trends of commercial fishing effort in Florida. All linear regressions are negative and statistically significant. Dotted lines are 95% confidence interval limits.

If food webs 1 or 2 were correct, Fig. 3 regressions would bepositive

Commercial catch per unit effort (CPUE, kg/trip) has increased since the onset of the goliath grouper fishing moratorium in 1990

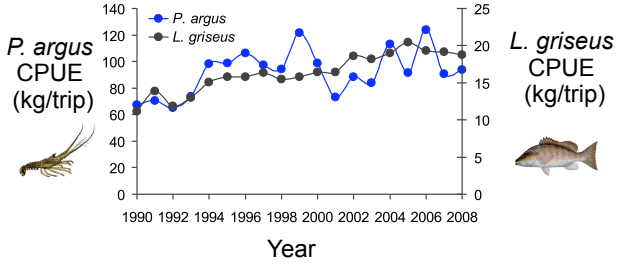


Figure 4. Time series of commercial catch per unit effort in Florida. slight, but statistically significant increases for *P. argus* [F(1,17) = 5.1, p = 0.03] and *L. griseus* [F (1.17) = 114.03, p = 0.00]

In reference to 1990, CPUE has increased annually

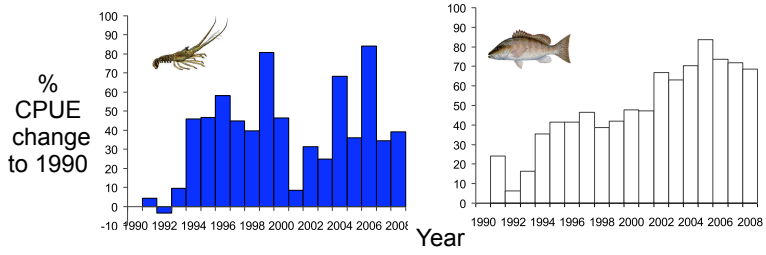


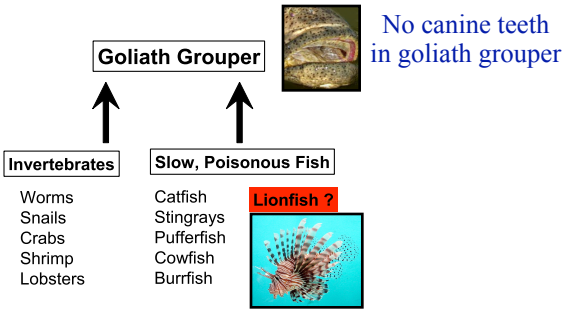
Figure 5. Time series of percentage change in catch per unit effort (CPUE) in reference to 1990. CPUE increased annually and average of 38.8 % (SE 5.8) for *P. argus* and 49.2 % (SE 5.0) for *L. griseus*.

Figures 3 to 5 suggest hyperstability, a condition found in overfished stocks.

Hyperstability occurs when fish or fishers behavior results in stable or increasing CPUE even as fish abundance declines, until the stock starts to collapse [7]

Dentition studies reflect a generalize diet, due to lack of canine teeth typical of piscivorous fish. This is consistent with stomach content studies and isotope analysis. [*2, 4, 5, 6*]

All the scientific evidence indicates a more diverse food web than what is proposed by social perceptions



Conclusions

1. **Goliath groupers are <u>not</u> top predator of lobsters, groupers and snappers.**
2. **Scientific evidence does <u>not</u> support culling of goliath grouper as a means to increase lobster, grouper and snapper catches**
3. **The ability to feed on poisonous fish potentially makes goliath grouper one of the main native predators available to fight the Atlantic invasion of the Indo-Pacific red lionfish (*Pterois volitans*)**

Acknowledgments: I thank J. Serafy, E. Widder , D. DeMaria, and K. Lindeman for comments on earlier drafts; W. Stearns for providing his copyrighted photography. This work was partially funded by the Schmidt Research Vessel Institute. Views expressed herein are those of the author and do not necessarily reflect the views of any supporting agency.

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Socio-economic value of a goliath grouper spawning aggregation Preliminary analysis

Sarah Frias-Torres
Ocean Research & Conservation Association,
1420 Seaway Drive, Fort Pierce, FL 34949 USA.
E-mail: sfrias-torres@teamorca.org

Introduction

The goliath grouper (*Epinephelus itajara*), the largest grouper fish in the Atlantic ocean and critically endangered throughout most of its distribution range, has been protected in the United States since 1990.[*1,2*]. Non-extractive uses of goliath grouper could be a management strategy to ensure the long-term survival of the species, particularly for a charismatic megafauna species such as goliath groupers, presenting valuable ecotourism traits such as being curious, unafraid of divers, and forming spawning aggregations [*3*]. Studies of dive tourism in reef fish spawning aggregations are scarce [*4*]. Here I provide preliminary data on the socio-economic value of one goliath grouper spawning aggregation located off Jupiter, east Florida.

Methods

Monitoring of diver use in the goliath grouper spawning aggregation off Jupiter, Florida, was conducted July 1-October 30, 2010 at one dive shop in the area, which provides daily trips to visit the aggregation during the spawning season.

Results and discussion

The goliath grouper spawning aggregation generated at least **US $ 600,000 in direct revenues** for one dive shop off Jupiter, Florida, for the duration of the spawning season. Such revenues contributed a minimum of **US $ 39,000 in sales taxes** to the state of Florida. The calculation was conservative and based on the following:

Cost per diver
boat trip for 2-tank dive = $70
rental of 2 Nitrox tanks = $30
Minimum cost per diver = $100.
Divers might need to rent additional gear, such as weights and weight belt, regulators, BCs, mask, fins, etc, but the minimum estimate of $100 per diver, assuming each diver brings his/her full gear (except tanks) is used for the calculation.

Diver loads per day
Boat capacity = 20 divers; Number of boats available = 2; Number of 2-tank trips/boat = 2 (morning, afternoon)
Total diver load = 20 divers x 2 boats x 2 trips/boat/day = 80 divers/day

Socio-economic value of a goliath grouper spawning aggregation
Preliminary analysis [Continued]

Spawning aggregation diving days
The goliath grouper spawning aggregation lasts for 4 months (July through October), however, the best diving occurs during the middle and end of the aggregation period. Therefore, only 2.5 months were used to calculate the total number of dive-days available, to account for days with rough weather, low visibility, or days when the dive boats are not operating at full capacity.

Total dive-days = 2.5 months x 30 days/month = 75 dive-days

Revenues generated by the goliath grouper spawning aggregation off Jupiter, Florida, for one dive shop in the area:

80 divers/day x 75 dive days x $100/diver = $600,000 direct revenues

$600,000 x 6.5 % sales tax = $39,000 tax revenues for the State of Florida.

Conclusions

Although the results are preliminary and further analysis is needed, they show the positive impact of the goliath grouper spawning aggregation diving ecotourism for local Florida businesses. The goliath grouper spawning aggregation occurs towards the end of the low tourist season, a critical time for businesses dependent on tourist dollars. In addition to the direct revenues and sales taxes generated in the dive shop, divers also require other services, such as food, accommodations, and transportation, which have not been quantified yet. The study must be extended to other dive shops operating along the east Florida coast which also organize dive trips to visit the goliath grouper spawning aggregation.

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