

# Projeto Meros Do Brasil Photo-ID: First Insights of Goliath Grouper (*Epinephelus itajara*, Epinephelidae) Population and Movements at Fernando de Noronha National Marine Park

## Projeto Meros Do Brasil Foto-ID: Primeras Ideas de Población y Movimientos del Mero Guasa (*Epinephelus itajara*, Epinephelidae) en el Parque Nacional Marino Fernando de Noronha

## Projeto Meros Do Brasil Photo-ID: Les Premiers Aperçus de Population et des Mouvements du Mérrou (*Epinephelus itajara*, Epinephelidae) au Parc National Marine Fernando de Noronha

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### ABSTRACT

Photo-identification (photo-ID) is a widely utilized approach on a variety of marine species including marine mammals, sea turtles and cartilaginous fish, providing a single non-invasive mark-recapture technique, which is critical for threatened species such as the goliath grouper, *Epinephelus itajara*. Photographic records came from the Participative Survey Program of **Projeto Meros do Brasil** and from photo/video companies. Recognition of individual animals, used natural marks, mainly spots over the head of the GG. The free computer-aided photo-identification I3S was used, although some manual inspection of the photo database was needed. The offshore archipelago of Fernando de Noronha (National Marine Park), located 186nm off northeastern Brazil (03°50' S, 32°25' W), provided the most important data that allowed long time analyses, between April 2004 and May 2013, where six different GG were registered in 84 different days. Results showed that goliath groupers were observed at 11 different dive sites. From April 2004 to November 2006, four different goliath groupers were in the area, disappearing in the following years, where the fifth specimen was observed from December 2007 to January 2012, being then replaced by the sixth specimen in October 2012, registered for the last time in May 2013. Caverna da Sapata and Ilha do Meio where the most visited places by the fifth specimen along 50 months, which also migrated distances of 11km within a maximum of four days, between these sites. The Project intends to start a telemetry tagging study to refine the information on a well-known spawning area in south Brazil.

KEY WORDS: Fish behavior, endangered species, mark-recapture, grouper, South Atlantic

### INTRODUCTION

Photo-identification (photo-ID) is a widely utilized approach on a variety of marine species including marine mammals, sea turtles and cartilaginous fish, providing a single non-invasive mark-recapture technique, which is critical for threatened species such as the goliath grouper, *Epinephelus itajara*.

The goliath grouper is the largest grouper in the Atlantic Ocean (> 2 m total length - TL, > 400 Kg) (Bullock et al. 1992). GG are sedentary and have a high degree of site fidelity, performing yearly spawning migrations (Eklund and Schull 2001, Pina-Amargós and Gonzáles-Sansón 2009). Adults inhabit both natural and artificial reefs, generally in depths less than 50 m (Bullock et al. 1992), while juveniles are often observed in mangrove (nursery) areas.

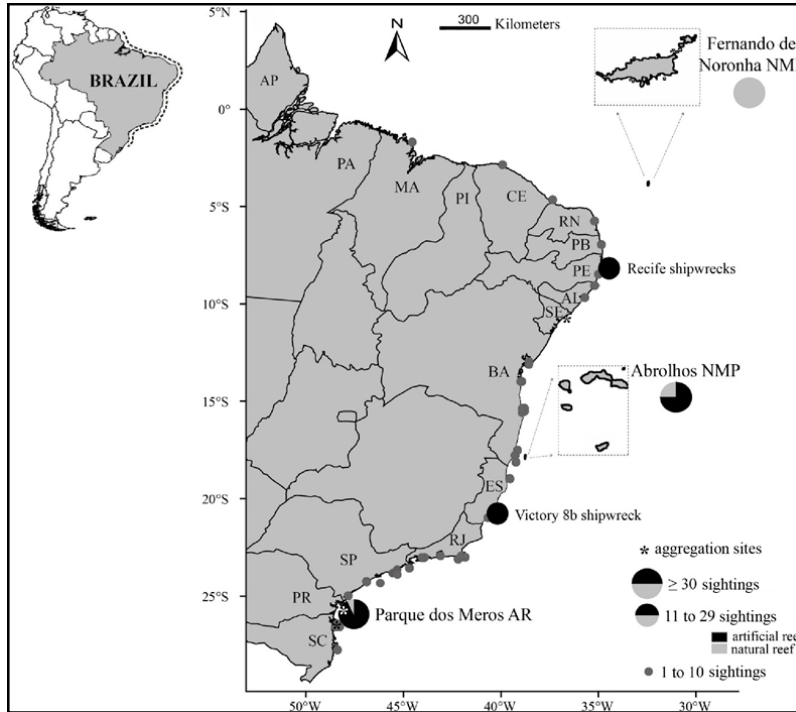
Since 2002, goliath groupers are being studied in Brazil by *Meros do Brasil Project* ([www.merosdobrasil.org](http://www.merosdobrasil.org)), representing the first Brazilian initiative toward the study of spawning aggregations of reef fish along the Brazilian coast, as well as other broader aspects of its biology associated to the conservation of coastal marine habitats.

Since the species is considered Critically Endangered by the IUCN, as well as, the first fish species that had a moratorium in Brazil, *Meros do Brasil Project's* research themes involve: articulation with local knowledge from fisheries communities (Gerhardinger et al. 2006), institutional governance, public policy, environmental education, monitoring of catches and gathering of biological samples, genetics (Benevides et al. 2014), aquaculture, interaction with fisheries, conservation of associated environments, spawning aggregations (Leite et al. 2010, Carvalho 2012, Bueno et al., In press), mark-recapture inside estuaries and reefs, and photo identification, which is the focus of this article.

### CHOOSING THE STUDY AREA

Previous investigations on habitat use and abundance of goliath groupers in Brazil from a participative survey - which engaged volunteer divers in data-collection (see Giglio et al., In press) - provided the first clue to focus efforts on photo ID research.

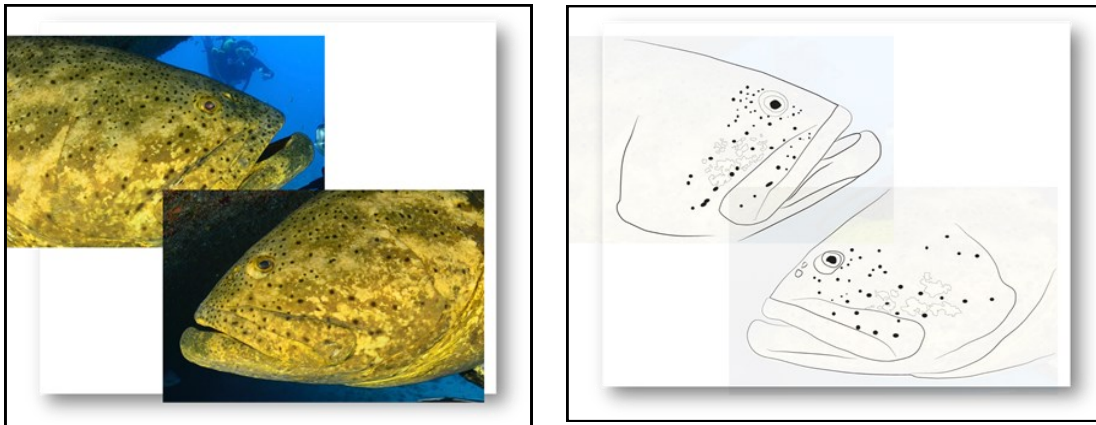
According to Giglio et al. (In press), 17% of sightings came from Fernando de Noronha Archipelago, a National Marine Park (Fernando de Noronha NMP – Figure 1), which was then chosen to be studied. The offshore archipelago is



**Figure 1.** Sightings of *E. itajara* along Brazilian coast. States: South: SC = Santa Catarina; PR = Paraná; Southeast: SP = São Paulo; RJ = Rio de Janeiro; ES = Espírito Santo; Northeast: BA = Bahia; SE = Sergipe; AL = Alagoas; PE = Pernambuco; PB = Paraíba; RN = Rio Grande do Norte; CE = Ceará; PI = Piauí; MA = Maranhão; North: PA = Pará and AP = Amapá. NMP = national marine park; and AR = artificial reef. (Source: Giglio et al., In press).

located 186nm off northeastern Brazil (03°50' S, 32°25' W) (Figure 1), and is under the influence of the northern branch of the South Equatorial Current. The leeward seascape is mainly composed of descending slopes with large scattered boulders and patch reefs, whereas the windward side of the archipelago is characterized by extensive algal-vermetid ridges along rocky shorelines (Maida and Ferreira 1997).

Photographic records came from the Participative Survey Program of **Projeto Meros do Brasil** and from photo/video companies. Recognition of individual animals used natural marks, mainly spots over the head of the goliath grouper (Figure 2). The free computer-aided photo-identification I3S (<http://www.reijns.com/i3s/>) was used, although manual inspection of the photo database was performed, considering different angles.



**Figure 2.** Sketch of the black dots that cover the head of goliath groupers (*Epinephelus itajara*). Each image was mapped and analyzed in order to identify the individuals at the study site. Photo: Guilherme Cavalcante Vasconcelos.

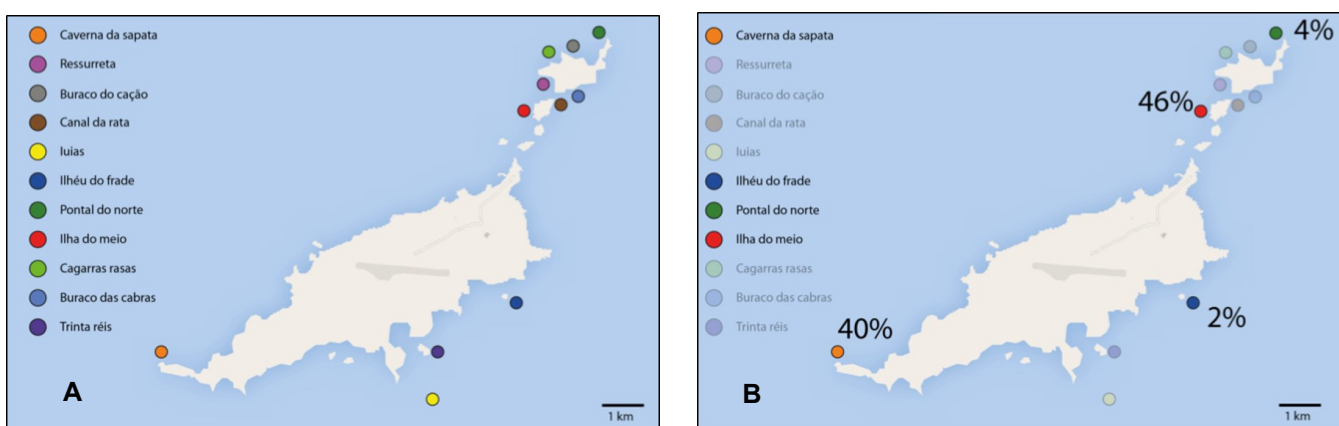
## RESULTS AND DISCUSSION

Between April 2004 and May 2013, six different GG (Figure 3) were registered in 84 different days. From April 2004 to November 2006, only four different GG were in the area, disappearing in the following years, where the fifth specimen was observed from December 2007 to January 2012, being then replaced by the sixth specimen in October 2012, registered for the last time in May 2013.

Fernando de Noronha National Marine Park provided so far, the relevant data that allowed long time analyses. Such factor that can be related to its strong touristic potential (specially for SCUBA diving), allied to consolidated companies that provide photographic services to tourists, where goliath grouper sightings figure as a major attraction.

Results showed that the six goliath groupers were observed at 11 different dive sites (Figure 4a). Ilha do Meio and Caverna da Sapata sheltered most of the sightings, accounting to frequencies of occurrence of 46% and 40%, followed by Pontal Norte (4%) and Ilhéu do Frade (2%), while the remaining sites had smaller contributions (Figure 4b).

The first goliath grouper (pink circle – Figure 1) showed up in April 2004, and was last observed in April 2006, performing 25 months, being registered other three times between dates. The second (light green circle – Figure 1) was first observed in May 2004, and never seen again after August 2005, 16 months, also with three registers between dates. The third goliath grouper (blue circle – Figure 1)



**Figure 4.** Fernando de Noronha Archipelago, and the 11 sites where goliath groupers (*Epinephelus itajara*) were spotted (a); percentage contribution of most relevant sites (b).



**Figure 3.** The six diferente goliath groupers observed in Fernando de Noronha National Marine Park, from April 2004 to May 2013. Photos by: Rafael Antunes, Zaira Matheus, Andreza dos Santos.

showed up in July 2005, leaving in September of the same year, 2 months. The fourth (orange circle – Figure 1) appeared a single time, on November 2006.

On the other hand, the fifth GG (purple circle – Figure 1), showed up on December 2007, and was registered on 63 different dates, up to the last observation on January 2012, being then replaced by the sixth specimen (dark green – Figure 1) in October 2012, registered for the last time in May 2013, eight months.

Caverna da Sapata and Ilha do Meio where the most visited places by the fifth specimen along 50 months in Fernando de Noronha, performing small migrations detected by the indexing system of Photoshop Adobe Lightroom®, used by collaborator photographers.

Regarding migrations, the fifth goliath grouper migrated distances of ~14 km in 2008, from Caverna da Sapata (MAY, 8<sup>th</sup>) – 56 days – to Pontal do norte (JUL, 3<sup>rd</sup>) and again – 36 days - to Caverna da Sapata (AUG, 8<sup>th</sup>) (see Figure 3a). Then after in 2011, ~11 km within at least six days, between Ilha do Meio (DEC 5<sup>th</sup>), to Caverna da Sapata (DEC, 11<sup>th</sup>), again at Ilha do Meio (DEC 17<sup>th</sup>), in 2011. The shortest movement time was detected in 2012, from Ilha do Meio (DEC, 20<sup>th</sup>) to Caverna da Sapata (DEC 24<sup>th</sup>), comprising no more than four days to perform the ~11 km that separate both areas.

Future efforts will focus on gathering as much as possible of photographic material from diving operators and photo companies, as well as, pre-digital pictures from photographers in order to better refine data on goliath grouper movements at this offshore Brazilian Archipelago.

*Project Meros do Brasil* is also making the use of Photo-iD in a well-known spawning area in South Brazil, where it also intends to start a telemetry tagging study to refine the information on goliath grouper movements.

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#### LITERATURE CITED

- Benevides, E.A., M.N.S. Vallinoto, A.F.H. Fetter-Filho, J.R.B. de Souza, G. Silva-Oliveira, M.O. Freitas, B.P. Ferreira, M. Hostim-Silva, A.A. Bertoncini, F. Blanchard, and R.A. Torres, 2014. When physical oceanography meets population genetics: The case study of the genetic/evolutionary discontinuity in the endangered goliath grouper (*Epinephelus itajara*; Perciformes: Epinephelidae) with comments on the conservation of the Species. *Biochemical Systematics and Ecology* 56:255e266.
- Bueno, L.S., A. Bertoncini, C. Koenig, F. Coleman, M.O. Freitas, J. Leite, and A.A. Hostim-Silva. [In press]. The reproductive period for goliath grouper (*Epinephelus itajara*) in southern Brazil. *Journal of the Marine Biological Association of the United Kingdom*.
- Carvalho, F.G. 2012. Etnoecologia e Agregações de Peixes das Famílias Serranidae e Lutjanidae na Costa de Santa Catarina. Master Dissertation in Ecology and Conservation, Universidade Federal do Paraná. 93 pp.
- Gerhardinger, L.C., R.C. Marenzi, A.A. Bertoncini, R.P. Medeiros, and M. Hostim-Silva. 2006. Local ecological knowledge on the goliath grouper *Epinephelus itajara* (Teleostei: Serranidae) in southern Brazil. *Neotropical Ichthyology* 4:441-450.
- Giglio, V.J., J.A. Alves, L.C. Gerhardinger, F.C. Grecco, F. Daros, and A.A. Bertoncini. [In press]. Habitat use and abundance of goliath grouper *Epinephelus itajara* in Brazil: a participative survey.
- Leite, J.R., L.S. Bueno, J.A. Alves, F.F. Daros, A.A. Bertoncini, F.G. Carvalho, and M. Hostim-Silva. 2012. Description of different color displays of Goliath Grouper on aggregations in Santa Catarina, Brazil. *Book of abstracts 12th ICRS*. 12th International Coral Reef Symposium, 2012, Cairns, Australia.
- Maida, M. and B.P. Ferreira. 1997. Coral reefs of Brazil: an overview. *Proceedings of the 8th International Coral Reef Symposium* 1:263–274.