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Update on the lobster species from Rocas Atoll Marine Reserve, Brazil

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Abstract: This study is an update of list of lobster species from Rocas Atoll Marine Reserve, Brazil. The data were obtained trough visual censuses and photographic registers during expeditions since 1997 until 2014. It represents the first record of *Enoplometopus antillensis* Lütken, 1865, *Palinurellus gundlachi* Von Martens, 1878, and *Panulirus laevicauda* (Latreille, 1817) and reinforces the occurrence of *Panulirus argus* (Latreille, 1804), *Panulirus echinatus* Smith, 1869, and *Parribacus antarticus* (Lund, 1793) from Rocas Atoll. The presence of different lobster species shows us the importance of Rocas Atoll Reserve in relation to number of species and abundance of lobsters.

Key words: Rocas Atoll, Decapoda, *Panulirus*, *Parribacus*, *Palinurellus*

Lobsters play an important trophic role as a top predator in benthic marine ecosystems and also have an economic importance due to your intensive and valuable fishery (Cruz et al. 2015). Rocas Atoll (03°51′ S, 033°48′ W) is the only atoll in the South Atlantic and one of the smallest in the world (Silva et al. 2001). This marine reserve was the first one to be established in the Brazilian coast and this area has importance to the territorial policy of the Federation due to its remote location off the continental coast, resulting in an increase of the Brazilian Exclusive Economic Zone. The Marine Reserve includes an area of 360 km² distant and is located 266 km off the mainland coast (Pereira et al. 2013). Rocas has a diverse crustacean fauna from crabs (*Callapa* sp., *Carpilius corallinus*, *Grapsus grapsus*, *Ocypode quadrata* and *Johngarthia lagostoma*), lobsters (*Panulirus argus* and *P. echinatus*), shrimps (*Stenopus hispidus*) and others (Grossman et al. 2012). The aims of this study are to provide an updated list of lobsters from Rocas Atoll and also to confirm the presence of the three species belonging to the genus *Panulirus* White, 1847, from Rocas Atoll Reserve, Brazil.

The data (observations and photographs of lobsters) were obtained during expeditions from 1997 to 2014 in the pools formed during low tide at Rocas Atoll and in the sandy islands (Figure 1). Lobsters were recorded at depths of 0–6 m during non-destructive visual censuses with minimum ecosystem interference. Conservation measures in the reserve suggest that researchers do not collect animals if it is not extremely necessary. Data collection was done by snorkeling around each pool and visually searching for lobsters inside crevices, holes and all places inside the pools during day time. The search effort was measured but this is not the aim of this study. Some data are collected around the two islands when individuals were found dead in the sand. Specimens were identified *in situ* and if necessary photographed to further identification, but it was not necessary to collect any specimen. Identifications were based on the lobster key of Holthuis (1991) and used the main characteristics of color, spine patterns, antenna size, other characters, and those characters were used to describe the morphology of the each species. The classification follows Chan (2010).

Six lobster species were recorded on the Rocas Atoll reef during the study. All of them were photographed, except for *Panulirus laevicauda* (Latreille, 1817). The species are: *Enoplometopus antillensis* Lütken, 1865; *P. gundlachi* Von Martens, 1878; *P. argus* (Latreille, 1804); *P. echinatus* Smith, 1869; *P. laevicauda*, and *Parribacus antarticus* (Lund, 1793). The species newly recorded from the atoll are *Enoplometopus antillensis*, *Palinurellus gundlachi*, *Parribacus antarticus* and *Panulirus laevicauda*.

Infraorder Astacidea Latreille, 1802
Superfamily Enoplometopoidea Saint Laurent, 1988
Family Enoplometopidae Saint Laurent, 1988

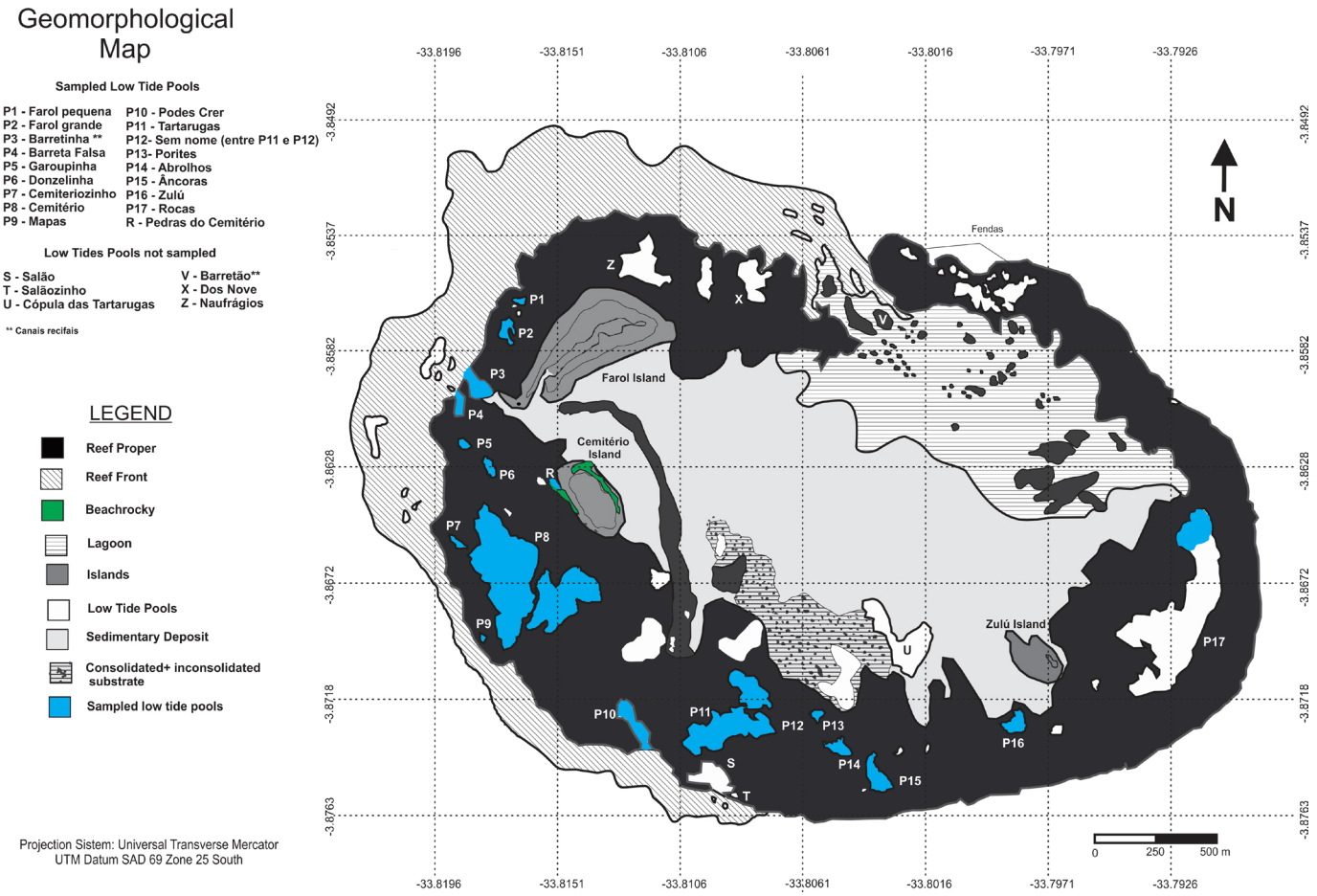

Figure 1. Geomorphological map from Rocas Atoll with areas sampled.

Enoplometopus antillensis Lütken, 1865 (Figure 2)

Diagnosis: Ground color of body orange/red; lateral face of carapace with a large white circle (and wavy white lines posteriorly); ambulatory legs orange/red with narrow white bands; abdomen with several ocellated spots (white spots circled with orange or black) (Poupin 2003). Depth distribution: mainly recorded around 15–30 m unusually at 200 m (Poupin 2003).

Habitat: It is a species of reef lobster endemic to the Atlantic Ocean that is found in rocky and coral reefs, where it hides in small crevices (Chan and Wahle 2011).

Distribution: This species is found in Bermuda, Florida, Bahamas, Bonaire, Panama, Venezuela, Brazil (off northeast coast and off Rio Grande do Norte State), Ascension and St Helena Islands, Madeira, Canary Islands, Gulf of Guinea, Cape Verde Islands (Poupin 2003).

Remarks: A total of 5 specimens were observed in the low tide in Rocas Atoll. This species was found in Âncoras pool, Barreta Falsa pool, Mapas pool, Salãozinho pool and Cemitério rocky slabs. In all previous references it is not clear whether this species was actually collected at Rocas Atoll.

Infraorder Achelata Scholtz & Richter, 1995
Family Palinuridae Latreille, 1802

Palinurellus gundlachi Von Martens, 1878 (Figure 3)

Diagnosis: Rostrum triangular, longer than wide; lateral margin of carapace without teeth behind anterolateral tooth; posterior margin of abdominal pleura evenly sinuously rounded.

Habitat: This species is rather scarce and it is found in depth range from 1.5–35 m in rather inaccessible places among rock and coral.

Distribution: This species is known from Bermuda, Bahamas, southern Florida, Yucatán, Caribbean Arc, Curacao and Brazil (Pernambuco and Bahia states) (Carpenter 2002).

Remarks: This is a new record for this species from Rocas Atoll. In April 2014, we found a dead specimen at Farol Island and two molts in the Abrolhos and Âncoras pools. We also found a specimen in the Cemiteriozinho pool and another one in Âncoras pool in October 2014.

Panulirus argus (Latreille, 1804) (Figure 4)

Diagnosis: Body cylindrical and spiny with very long and thin antennae; presents an antenular with two pairs of strong thorns; presents transverse grooves in the abdomen rings; reddish/brownish; features four white spots located on the second abdominal somite. This species is undergoing discussion among geneticists and ecologists because of the new genetic knowledge that

Figure 2. *Enoplometopus antillensis* Lütken, 1865 in rocky slabs at Cemitério beach rocks, Rocas Atoll, 2000. Photo by Maurizélia de Brito Silva.

Figure 3. Molt of *Palinurellus gundlachi* Von Martens, 1878 in Âncoras pool, Rocas Atoll, 2013. Photo by Juliana de Carvalho Gaeta.

Figure 4. *Panulirus argus* (Latreille, 1804) in Barretinha pool, Rocas Atoll, 2014. Photo by Juliana de Carvalho Gaeta.

distinguishes populations of North and Central America of Brazil's population (Tourinho et al. 2012)

Habitat: It is found among rocks, on reefs, in eelgrass beds or in any habitat that provides protection. It inhabits shallow waters, occasionally down to 90 m depth or even deeper (Holthuis 1991). Cruz et al. (2011) reported catches between 100 and 150 m from Brazilian waters.

Distribution: This species occurs in Western Atlantic from Florida to southern Brazil. Along the Brazilian coast, it occurs from Pará (01°27′ S, 048°30′ W) to São Paulo (23°32′ S, 046°38′ W) and two oceanic islands: Fernando de Noronha Archipelago (03°50′ S, 032°24′ W) and Rocas Atoll (03°45′ S, 032°19′ W) (Holthuis 1991; Coelho and Ramos-Porto 1998; Melo 1999). The ecology and biology is best understood lobster of the Brazilian lobsters because it is the most important crustacean fishery resource.

Remarks: A total of 98 specimens were recorded during October 2014 expedition and they were commonly found in the northwest side of the atoll.

Panulirus echinatus Smith, 1869 (Figure 5)

Diagnosis: Body cylindrical and spiny with very long and thin antennae. It presents an antenular with a pair of strong thorns. The body and especially the tail are covered by distinct rounded whitish spots. Antennulae and legs streaked with yellowish or whitish longitudinal lines, not banded or spotted.

Habitat: It habits depth range from 0–35 m but usually not deeper than 25 m (Holthuis 1991).

Distribution: This species had been recorded mainly in Central Atlantic Islands (Canary Islands, Cape Verde Islands, St. Pauls Rocks, Fernando de Noronha Archipelago, Rocas Atoll, Trindade Island, Ascension and St. Helena) and along the Northeastern Brazil coast (Ceará to Rio de Janeiro, including Arquipélago de São Pedro e São Paulo, Fernando de Noronha, Atol das Rocas, and Ilha da Trindade) (Manning et al. 1990; Coelho and Ramos-Porto 1998; Melo 1999).

Remarks: This is the most abundant species in the atoll with 2,426 specimens observed in October 2014. They are easily seen in their shelters during the day and walking during the night searching for food or partners. This species' ecology was studied at two oceanic islands, Rocas Atoll (Silva *et al*. 2001) and Arquipélago de São Pedro e São Paulo (00°55′ S, 029°20′ W) (Pinheiro et al. 2003; Góes and Lins-Oliveira 2009).

Panulirus laevicauda (Latreille, 1817)

Diagnosis: Body greenish, cylindrical and spiny body with very long and thin antennae. A line of very small spots along the posterior margin of the abdominal somites, the rest of the upper surface of the abdomen

Figure 5. *Panulirus echinatus* Smith, 1869 at Farol pool, Rocas Atoll, 2013. Photo by Juliana de Carvalho Gaeta.

Figure 6. *Parribacus antarticus* (Lund, 1793) in Podes Crer pool, Rocas Atoll, 2014. Photo by Juliana de Carvalho Gaeta.

not spotted and it is smooth. Pleura and hard part of tail fin with numerous very distinct spots in addition to a larger eye spot near the base of the pleura and has spotted frontal horns.

Habitat: It is usually found in coastal waters, down to 50 m depth in rock or coral substrate (Holthuis 1991).

Distribution: This species occurs from Bermuda and Florida to Brazil, previously the occurrence was in Fernando de Noronha Archipelago (03°50′ S, 032°24′ W) and from Maranhão to Rio de Janeiro (03°50′ S, 038°20′ W, 023°17′ S, 044°10′ W) (Holthuis 1991; Coelho and Ramos-Porto 1998; Melo 1999).

Remarks: This species was observed once in the reef while walking to samples in the low tides pools. This is the first record of this species from Rocas Atoll. Ecological and biological studies on this species are scarce and commonly connected to studies of *P. argus* because most of the time they are captured together in Northeast Brazil.

Family Scyllaridae Latreille, 1825
Subfamily Ibacinae Holthuis, 1985

Parribacus antarticus (Lund, 1793) (Figure 6)

Diagnosis: Body broad and flat with very short antennae and shaped blades. The lateral margin of the four segments of the antenna is serrated, with between 6 and 8 teeth (Cruz et al. 2011).

Habitat: Found at depths from 0–20 m in coral or stone reefs with a sandy bottom (Holthuis 1991) and perhaps also found at other depths (Silva et al. 2013).

Distribution: This is a worldwide species and is known from seamounts. The distribution goes from Florida to Brazil, and along the Brazilian coast from Amapá to São Paulo (00°02′ N, 051°03′ W – 23°32′ S, 046°38′ W), including Rocas Atoll and Fernando de Noronha (Holthuis 1991; Coelho and Ramos-Porto 1998; Melo 1999).

Remarks: Two molts of this species were found in October of 2013 in the Podes Crer pool and two specimens in the same pool in April 2014 and five specimens were observed in October 2014.

The genus *Panulirus* is one of the most economically important in Brazilian fishery (Abrunhosa et al. 2008) and two species are included at the IUCN Red List because of the intensive and uncontrolled fishery. The family Scyllaridae is bycatch of the *Panulirus* fishery (Cruz et al. 2011). Species belonging to all other families are also caught in the fishery but unintentionally and they have no value in the market. The presence of all lobster species in the Rocas Atoll demonstrates its importance for biodiversity. The finding of juveniles and adults including ovigerous female of *Panulirus echinatus* indicates the maintenance of a local population in this marine protected area (MPA) (Gaeta, unpublished). MPAs that exclude the practice of fishing, such as Rocas Atoll, have been shown to increase the abundance and size of marine species (Hoskin et al. 2011). Not only can MPAs protect juveniles until they reach maturity and enter the fishery, but they also protect and enhance existing spawning stock (Goñi et al. 2010) and maintain biodiversity. The study provides additional information on lobster species in Rocas Atoll. It reinforces the biological importance of this MPA and the necessity to continue protection of this rich ecosystem to help lobster populations.

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