

Scientists unravel secrets of marine life at the only atoll in South Atlantic: Rocas Atoll, Brazil

The place

The Southern Atlantic Ocean harbors unique and relatively understudied reef systems compared to the Caribbean and Pacific Ocean reefs. Among these ecosystems, laying around 130 nautical miles from the Northeastern coast of Brazil is **Rocas Atoll, the only atoll in the entire Southern Atlantic**. Atolls are typically formed by



reefs that grow around volcanic islands. Throughout millions of years, these islands start sinking while the reef continues to grow and transforming into a ring-shaped barrier reef enclosing a shallow interior. Most of the atolls around the world are formed by **corals**, but in **Rocas Atoll calcareous algae instead are the main reef builders** responsible for its growth. The atoll's interior is protected from wave surge, **enclosing a shallow lagoon** that allows for the slow accumulation of sand and the formation of **natural tide pools of different sizes and shapes during low tide**. At Rocas Atoll, some of these pools are completely isolated from the open ocean, constituting **calm environments (closed pools)**. Animals that remain in these pools when tide goes down remain confined until the tide goes up again. Different pools keep a direct connection with the open ocean, even during low tides. This way, they are directly influenced by wave surge and allow for the constant **flux of animals** between the atoll's interior and the open ocean. Due to constant wave exposure, these environments have a **more rough condition (open pools)** than closed pools. These **differences among pools** determine which fish, algae and corals, among other organisms, inhabit each environment and how these organisms interact.



A protected paradise

In addition to the beauty and uniqueness of its reef formation, **Rocas Atoll is one of the only marine reserves in Brazil** created in **1978** and **one of the first in the world**. Extractive activities, such as fishing and poaching are prohibited in these fully protected areas. **Enforcement was intensified after 1991** due to the establishment of a **permanent research and monitoring station**. Since then, the **Marine Biological Reserve of Rocas Atoll** have consolidated as **one of the most effective marine protected areas in Brazil**, hosting an abundant marine fauna and acting as a nursery area for seabirds, marine turtles and sharks.



The research

Researchers of the Brazilian Marine Biodiversity Network SISBIOTA-Mar (more information at www.sisbiota.ufsc.br) teamed up to reveal some of the secrets of marine life at Rocas Atoll. In a multidisciplinary work, they addressed ecological aspects ranging from the chemical composition of algae to the fish abundance at the Atoll.

This study, authored by Longo and collaborators, was published this June at the internationally renowned scientific journal *PLoS One*. The study explores and describes



particularities of marine life in different habitats of **Rocas Atoll** and show that **the tide regime** is one of the main factors that dictate the pace of marine life at this atoll.

“Have you ever imagined feeling the tide going up and along with it feeling the presence of your main predators? Have you ever thought about a place where in a few moments tide currents will be so strong and the risk of being eaten so high that the only thing you will do until the tide goes down again is to swim and hide?”

You probably have never had these thoughts before, but they are part of the daily lives of fishes at near-pristine places such as Rocas Atoll.

This study shows that **sharks hardly get trapped in closed pools during low tides**, being more commonly observed in open pools. Conversely, **surgeonfish (*Acanthurus chirurgus*) can feed up to 10 times more while trapped in closed pools** during low tide. The authors believe these environments provide shelter against direct wave action and predators. **As tides begin to raise again, sharks swim towards the interior of the Atoll**, some of them passing through the reef while the water level is only enough to partially cover their bodies.

Rocas Atoll is one of the few tropical reefs all over the Southern Atlantic in which large predators, such as sharks, are still part of the daily lives of other fishes. In many coastal reef environments or where fishing is allowed, sharks are often rare or even disappeared.

This study also indicates that **feeding by the surgeonfishes** in closed pools during low tide **might affect the distribution of the algae** that cover the bottom of the reef. These fish prefer to consume a specific type of a sugar-rich red algae (*Digenea simplex*) that is uncommon in closed pools but abundant in other areas of the reef where fish feed less, such as open pools.



Conclusions

Tide changes that happen every day and are actually occurring in this very moment, **dictate the pace of marine life at Rocas Atoll**: from algae to small crustaceans, fishes, sharks and even the researchers doing their fieldwork! **Understanding the mechanisms and functioning of marine ecosystems in protected and isolated environments such as Rocas Atoll** is fundamental, as it gives us the **invaluable chance of observing natural processes under limited human influence**.

Rocas Atoll is a very important natural laboratory that allows us to reflect on the influence we may exert on marine ecosystems. Comparative studies can prompt the development of informed conservation strategies so that in the future other places would bring into our minds the same image Rocas does: that of a protected paradise.

Reference: Longo G.O., Morais R.A., Martins C.D.L., Mendes T.C., Aued A.W., Cândido D.V., de Oliveira J.C., Nunes L.T., Fontoura L., Sissini M.N., Teschima M.M., Silva M.B., Ramlov F., Gouvea L.P., Ferreira C.E.L., Segal B., Hora P.A., Floeter, S. R. (2015). **Between-Habitat Variation of Benthic Cover, Reef Fish Assemblage and Feeding Pressure on the Benthos at the Only Atoll in South Atlantic: Rocas Atoll, NE Brazil.** *PLoS one*, 10(6), e0127176.

<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0127176>