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From the cradle to the grave: green turtle hatchlings (*Chelonia mydas*) preyed upon by two-spots red snappers (*Lutjanus bohar*)

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Competing interests

The authors declare no competing interests.

Abstract

The observation of trophic interactions such as predation provide valuable information to model food webs and better understand ecosystem functioning. Such information is crucial for rare and endangered species in order to adapt management measures and ensure their conservation. However, trophic interactions are rarely observed in the marine realm, even for well-known or widespread species. During a scientific cruise in the Scattered Islands (Southwestern Indian Ocean), we observed endangered green turtle hatchlings (*Chelonia mydas*) in the gut content of two subadults two-spots red snappers (*Lutjanus bohar*). This trophic link involving emblematic species has not been previously described. The two-spots red snapper is a widespread coral reef fish in the tropical Indo-Pacific. Although it is unclear how fish predation affects marine turtle population dynamics, the occurrence of hatchlings in all the snapper samples suggests that fish could be significant sources of predation. Yet this predation pressure remains to be further studied and quantified to be considered in marine turtle population monitoring.

Keywords: trophic interaction, marine turtle, red bass, snapper, lutjanids

Main text

Marine turtles are flagship species for marine conservation with many conservation and monitoring programs around the world (Mazaris et al 2017). Marine turtle hatching success is affected by several biotic and abiotic factors such as temperature, salinity, humidity, water inundation and predation (Lei & Booth 2017). With their nesting sites located on sandy beaches, the nests are often subject to human and non-human predation that cause hatch failure and the destruction of more than 50% of the nests in some regions (e.g., McLachlan et al 2015). A large variety of marine turtle nest predators around the world have been reported including fire ants (*Solenopsis invicta*), crabs (*Ocypode cursor*), raccoons (*Procyon lotor*), red foxes (*Vulpes vulpes*) and rats (*Rattus rattus*) (Lei & Booth 2017, Caut et al 2008, Barton & Roth 2007). Additionally, marine turtle hatchlings are known to be heavily predated on land by

seabirds (Caut et al 2008, Lagarde et al 2001). Once into the ocean, they remain vulnerable to predation by large fishes (Gyuris 1994). However, the fish species involved in this trophic interactions remain poorly known. Some scarce examples have been reported such as predation by an adult blue tuskfish (*Choerodon cyanodus*) on a juvenile green turtle (*Chelonia mydas*) on the outer reef flat around Heron Island, Great Barrier Reef (Harborne & Tholan 2016) and predation by mangrove jacks (*Lutjanus argentimaculatus*) on juvenile flatback turtles (*Natator depressus*) on Thevenard Island, Western Australia (Wilson et al 2019).

Here, we document a predation occurrence of green turtle hatchlings, an endangered species following the IUCN Redlist (iucnredlist.org), by two-spot red snappers (*Lutjanus bohar*, Fig. 1a) around a remote island. Europa island (22° 20' S, 40° 22' E) is the largest of the Scattered Islands, a French overseas territory located in the Mozambique channel, Southwestern Indian Ocean (SWIO). Europa is a low-lying (7m elevation) 28 km² coral island surrounded by sand dunes. A shallow lagoon, almost empty at low tide, is located on the northwestern part of the island and a dense mangrove forest covers the northeastern part. The fauna and flora of these islands are protected by the *Terres Australes et Antartiques Françaises* (TAAF) administration and enforcement is maintained by a permanent military detachment. Europa hosts one of the most important nesting sites for green turtles in the SWIO with 0.7 to 2.4 million juveniles hatching annually (Ciccione & Grizel 2007, Lagarde et al 2001).

On April 9th 2019, a hatch of green turtles was observed on a beach located northeast of the island (Fig. 1b, c). The day after, on April 10th, two individuals of *L. bohar* were selectively sampled by scientific divers on a 10 m deep fringing reef of Europa close to the hatching site (Fig. 2). The stomach content of both individuals contained green turtle hatchlings (Fig. 1d, e). The first *L. bohar* individual measured 38.4 cm total length (TL) with a preserved green turtle hatchling, measuring 5.1 cm (shell length), in its stomach. Two green turtle hatchlings in different digestive states were found in the second individual,

which was 58.9 cm long (TL). The intact turtle and the digested one were 5.1 cm and 5.3 cm long respectively. Size and state of the three green turtle hatchlings would suggest a recent hatch, probably the one observed the day before the fish sampling according to green turtle experts from the scientific cruise (Pierre Gogendeau and Hugues Evano, personal communication).

Lutjanus bohar is a large reef fish widely distributed across the tropical Indo-Pacific. It is not targeted by fisheries in many regions, such as the Western Pacific Region, where it is known to cause ciguatera poisoning (Lewis 2001). Conversely, it is commercially harvested in regions where it can be safely consumed, such as the Seychelles (Government of Seychelles 2015). Often described as solitary, *L. bohar* can form large shoals, notably during spawning events (Sadovy de Mitcheson et al 2008). This species is known to feed on organisms widely distributed along the trophic spectrum, including fish, shrimps, crabs, amphipods, stomatopods, gastropods and urochordates (Farmer & Wilson 2011). However, marine turtle hatchlings have never been listed among their preys. This observation extends both the *L. bohar* diet and the list of marine turtle predators. *Lutjanus bohar* reaches a maximum TL of about 90 cm and is commonly seen to lengths of 75 cm (Allen et al 2003). Its maturity is reached at about 30 cm for males and between 42 and 50 cm for females corresponding to a mean age of 1.46 years and 9.39 years respectively (Longnecker et al 2014, Mariott & Mapstone 2007). Along with its large abundance in many regions, widespread distribution in the tropical Indo-Pacific, and ability to eat several sea turtles per individual, *L. bohar* can be involved in the regulation of marine turtle populations, applying an unexpected predation pressure. This ecological role has never been assigned to a fish yet and highlights the ecological importance of this common reef fish species.

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Figures

Figure 1. Seascape picture of the Europa fringing reef, with an aggregation of two-spot red snappers (*Lutjanus bohar*) in background (a). Pictures of green turtle (*Chelonia mydas*) nesting tracks (b) and hatchlings (c) observed on Europa island, and the two *L. bohar* with their stomach contents (d, e). Photo credit: J.-B. Juhel, M. –C. Cheutin, C. Albouy.

Figure 2. Map of the protected island Europa. The red points correspond to the sampling sites where the two-spot red snappers were collected.



Figure 1

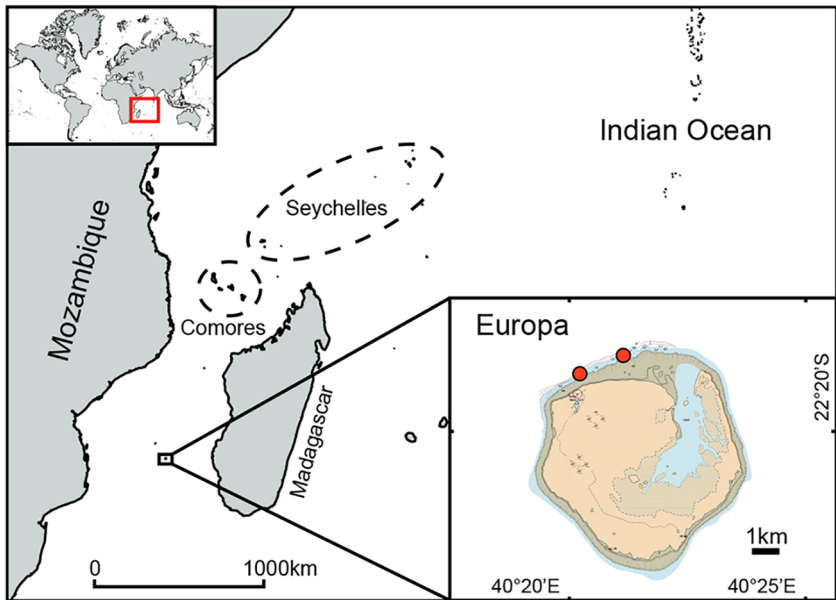


Figure 2