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TEN NEW RECORDS OF MARINE FISHES FOR SÃO TOMÉ, WEST AFRICA

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Abstract. Three chondrichthyes: *Rhincodon typus* Smith, 1828; *Mobula tarapacana* (Philippi, 1892); and *Mobula thurstoni* (Lloyd, 1908), and seven teleosts: *Beryx decadactylus* Cuvier, 1829; *Peristedion* cf. *cataphractum* (Linnaeus, 1758); *Coryphaena hippurus* Linnaeus, 1758; *Liopropoma emanueli* Wirtz et Schliewen, 2012; *Chromis cadenati* Whitley, 1951; *Chromis limbata* (Valenciennes, 1833); and *Makaira nigricans* Lacepède, 1802 were recorded for the first time for São Tomé. These records were based on fishes landed in local markets, captured, or observed while SCUBA diving and from BRUV surveys.

Keywords: first record, São Tomé, Tropical Eastern Atlantic, elasmobranchs, teleosts

The Democratic Republic of São Tomé and Príncipe is a group of two islands in the Gulf of Guinea (western Africa), lying between the Equator line and 1º42N (Fig. 1). São Tomé, the largest island, is located about 250 km west off mainland Africa. Despite being considered a marine biodiversity hotspot (Roberts et al. 2002), the marine fauna of the Gulf of Guinea is understudied when compared to other regions at similar latitudes.

Since the work of the Portuguese scientist Osório, late in the 19th century, very few studies have addressed the costal biodiversity from São Tomé e Príncipe (STP). Currently there are 234 reported marine fish species for the region (Afonso et al. 1999, Wirtz et al. 2007).

During an expedition to São Tomé Island, in November 2015, aiming to document costal ichthyofaunal diversity, the authors of the presently reported study recorded unreported marine fish species for the region. These new records result from approximately ten hours of sampling in local markets and fisheries landing sites in São Tomé island, 52 hours of SCUBA diving (46 hours in Rolas Islet (an islet south of São Tomé), five hours in Lagoa Azul, in São Tomé island, and one hour in Santana islet) and 7 hours surveys with a Baited Remote Underwater Video (BRUV) system. Recent reports by local collaborators were also included whenever they could be verified and supported by photographic evidence. Families are listed according to Nelson et al. (2016) and mobulas identification was based on Notarbartolo-di-Sciara (1987).

Family RHINCODONTIDAE
Genus *Rhincodon* Smith, 1829
***Rhincodon typus* Smith, 1828**

A single individual of circa eight meters TL was observed late November 2015 (Fig. 2A), while scuba diving at Santana islet (0°14′30.01″N, 6°45′26.67″E). According to the dive guide, J. Câmara, the whale shark swum unwary four times from the bay to the islet, at 5–8 m depth.

The world's largest fish, feeds on plankton and can grow up to at least 12 m, perhaps up to 18 m (Colman 1997, Eckert and Stuart 2001). Whale sharks are circumglobal in all tropical and warm temperate seas, oceanic and coastal except the Mediterranean (Compagno 2001), but to date, this species had not been reported for STP. Seasonal feeding aggregations of larger numbers (tens, to low hundreds) are recorded from many areas in the African

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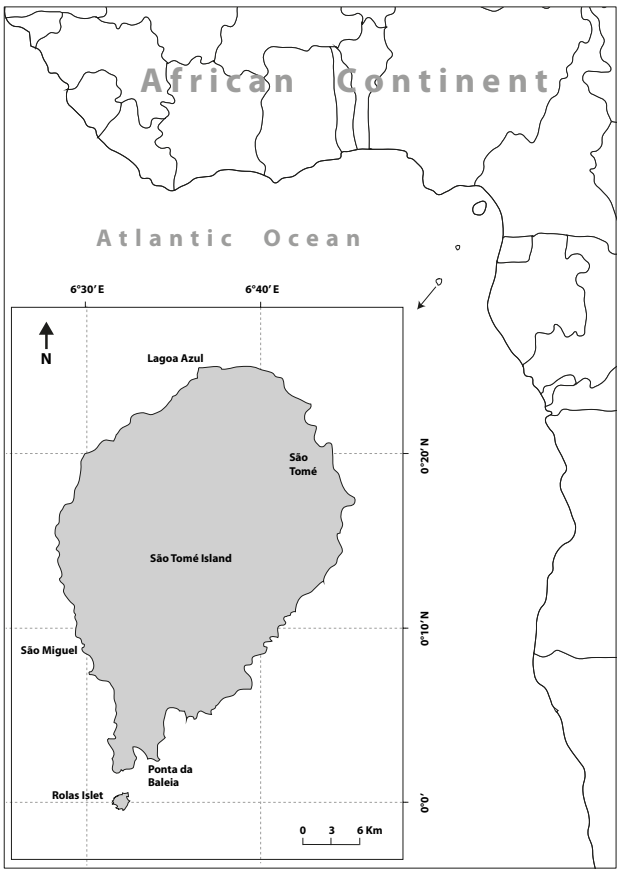

Fig. 1. Geographic location of São Tomé, Africa

continent such as Tanzania, Mozambique, South Africa, Somalia (Norman 2005), but so far, none for the West African coast. The whale shark is listed as Endangered (EN) by IUCN (Pierce and Norman 2016).

Family MOBULIDAE
Genus *Mobula* Rafinesque, 1810
***Mobula tarapacana* (Philippi, 1892)**

One specimen with approximately 180 cm wingspan was seen and photographed in a restaurant (Fig. 2B), in São Tomé city. Two other individuals were recorded NW off Rolas Islet, free swimming in the water column at 30 m deep, in May 2015. The animals were observed over the top of an underwater cliff, which raises from more than 300 to 80 m of depth. According to the dive instructor Relmison Ferreira (RF), the animals, with approximately 2 m wingspan, approached the diver from the bottom and circled him for more than 15 minutes. One month later, RF recorded another individual flapping its fins at the surface during a fishing trip to the same area. It remained at the surface for a few minutes before diving. The distribution of this species is circumglobal in temperate and tropical oceans with reports of its presence scattered across the Indian, Pacific and Atlantic Oceans (Compagno and Last 1999). In the North Atlantic, *M. tarapacana* is known to perform large scale seasonal migrations from their northern distribution limit, the Azores archipelago (Sobral and Afonso 2014), to the region of Cape Verde islands in West Africa (Thorrold et al. 2014), suggesting high degree of population connectivity, at least in the northeast Atlantic, possibly including the Gulf of Guinea. *Mobula tarapacana* is listed as Vulnerable (VU) by IUCN (Pardo et al. 2016).

***Mobula thurstoni* (Lloyd, 1908)**

One individual with approximately 140 cm wingspan was photographed in a restaurant (Fig. 2C), in São Tomé city, in February 2016. It was an immature male and was caught by a local fishermen off São Tomé city. This species is pelagic but more common near the coast (McEachran and Notarbartolo di Sciara 1995). Its geographic distribution is probably circumglobal in all temperate and tropical seas,

Fig. 2. Presently reported fish from São Tomé, Africa: *Rhyncodon typus* (**A**), *Mobula tarapacana* (B), *M. thurstoni* (**C**); Photo credits: Paulo Pichel (A), Hugo Lagos (B), and João Câmara (C)

but not completely defined. In the eastern Atlantic it has been reported for Côte d'Ivoire and Senegal (Clark et al. 2006) but not for STP. It is listed as Near Threatened (NT) by IUCN (Clark et al. 2006).

Family BERYCIDAE
Genus *Beryx* Cuvier, 1829
***Beryx decadactylus* Cuvier, 1829**

A single specimen of approximately 40 cm TL was documented in São Tomé market (Fig. 3A). According to local fishermen and fishmongers all fish sold in the market are fished locally and no fish imports are known. Despite its worldwide distribution (Maul 1990), this species had not been recorded in São Tomé before. Being a benthopelagic fish from the bottom of the upper slope, between 200 and 900 m depths (Maul 1990), it is not surprising that it has not been reported before since most fisheries in São Tomé are costal or pelagic and previous publications focused only on coastal fish (Afonso et al.1999, Wirtz et al. 2007) and possibly did not consider *Beryx* spp. even though it may had been previously observed.

Family PERISTEDIIDAE
Genus *Peristedion* Lacepède, 1801
***Peristedion* cf. *cataphractum* (Linnaeus, 1758)**

While analysing the stomach content of the aforementioned *B. decadactylus*, one individual with approximately 8 cm TL was found (Fig. 3B). This species is known to occur in the eastern Atlantic, from the British Isles to Angola, including the Mediterranean, in depths between 50 and 600 m (Miller and Richards 1990). Given the likely fishing gear (hand lines) negative selectivity of this small fish, the depth limits of local artisanal fishing and the fact that this is not a commercial species in São Tomé, it is not surprising that it had never been reported for São Tomé before.

Family CORYPHAENIDAE
Genus *Coryphaena* Linnaeus, 1758
***Coryphaena hippurus* Linnaeus, 1758**

Three specimens were recorded and one was photographed (Fig. 3C) and sampled during an artisanal fishing landing in Rolas Islet. Wirtz et al. (2007) recorded *Coryphaena equiselis* Linnaeus, 1758 for São Tomé but not *C. hippurus*. Considering dolphinfish is a circum-tropical ocean pelagic species and widely important as a commercial fish (Oxenford 1999) it is somehow surprising that it had not been recorded for São Tomé in previous studies. The low sampling effort for this region, associated with possible seasonal fluctuations in abundance of this species might explain the inexistence of previous reports.

Family SERRANIDAE
Genus *Liopropoma* Gill, 1861
***Liopropoma emanueli* Wirtz et Schliewen, 2012**

At least six individuals were observed and one was photographed (Fig. 3D) while scuba diving (five of them in São Miguel (0°07′49.76″N, 6°28′41.57″E) and one in Ponta Baleia, (0°01′59.79″N, 6°33′17.58″E) São Tomé island, at depths between 32 and 47 m. The animals were observed swimming close to the sea bottom in rocky boulders habitat (diameters between 30 and 150 cm) with high density of gorgonians. In the same habitat, *Coris atlantica* Günter, 1862, *Paranthias furcifer* (Valenciennes, 1828), *Heteropriacanthus cruentatus* (Lacepède, 1801), and *Gorogobius stevcici* Kavačić et Schliewen 2008, were often observed. This species was recently described from Cape Verde Islands (Wirtz and Schliewen 2012) and is also known from Senegal (Wirtz 2014). Its presence in São Tomé, so far, appears to confirm Wirtz et al. (2007) observations of "an undescribed species of the genus *Liopropoma*".

Family POMACENTRIDAE
Genus *Chromis* Cuvier, 1814
***Chromis cadenati* Whitley, 1951**

While exploring deep water rocky reefs between 90 and 100 m NW Rolas Island using a BRUV we documented a school with more than 15 *Chromis cadenati*, with approximately 15 cm TL (Fig. 3E). This damselfish was previously reported for Senegal, Guinea, Liberia and Ghana from depths between 20 and 60 m (Wirtz 2012, Rocha and Myers 2015). This new record expands not only its geographic distribution, but it is also the deepest observation of any damselfish, which are typically common on coral and rocky reefs, but also in other shallow-water habitats including sand and rubble patches, silty embayments, harbours, and seagrass beds (Allen 1991).

***Chromis limbata* (Valenciennes, 1833)**

Various individuals were recorded in two dives in São Miguel (0°07′49.76″N, 6°28′41.57″E) at depths between 32 and 40 m. Observed individuals ranged in size from 3 to 12 cm TL (Fig. 3F) and all were swimming close to the bottom in the same type of habitat as described for *Liopropoma emanueli*. Known as the Azores Chromis, *C. limbata* was once believed to be restricted to the Macaronesian Islands (Azores, Madeira, and Canaries) and the western coast of Africa (between Senegal and Congo) (Wood 1977, Edwards 1986, Rocha et al. 2008). It has, however, been reported for areas far from its originally known occurrence, such as South Brazil (Leite et al. 2009) and as far as Luanda (Angola) (Patrícia De Brito, personal communication) (Fig. 3G), which is its new southernmost record for the eastern Atlantic.

Despite the currently known wide (and possible spreading) distribution, this represents the first record of this species for an African island. In either case, the mechanisms that have allowed these wide range expansions remain obscure. Given the scarcity of studies in this region, we have to consider both the possibility that this population derived from a recent colonization, potentially originating from the Macaronesia, or an ancient relict population.

Family ISTIOPHORIDAE
Genus *Makaira* Lacepède, 1802
***Makaira nigricans* Lacepède, 1802**

One specimen of blue marlin was recorded in this study, while an artisanal fisherman was landing his catch in Rolas Islet (Fig. 3H). This species occurs in tropical and

Fig. 3. Presently reported fish from São Tomé, Africa: *Beryx decadactylus* (**A**), *Peristedion* cf. *cataphractum* (**B**), *Coryphaena hippurus* (**C**), *Liopropoma emanueli* (**D**), *Chromis cadenati* (**E**), *Chromis limbata* from São Tomé (**F**), *C. limbata* from Angola (**G**), *Makaira nigricans* (**H**)*;* Photo credits: Áthila Andrade Bertoncini (A, B, C, D, F, H), JF (E); Carlos Araújo (G)

temperate Atlantic waters (Nakamura 1985). Previously unreported, the presence of this species in São Tomé may be explained by the same reasons as for *Coryphaena hippurus*, i.e., a low sampling effort, although it is occasionally seen in local fish markets around the island.

These new records for São Tomé are not surprising given the tropical/sub-tropical affinities of most species. Despite wider latitudinal distributions of *Beryx decadactylus* and *Peristedion* cf. *cataphractum*—both also occur in temperate and cold high latitude waters (Maul 1990, Wheeler 1992)—these two species are not considered coastal, and have not been addressed in previous studies.

Our report of *Rhincodon typus*, *Mobula tarapacana*, and *Mobula thurstoni*, all pelagic and migratory species, further stresses the absence/rarity of elasmobranchs in São Tomé, possibly due overexploitation and consequent population decline. Photographic records from 2015 and 2016 and comments from local fishermen and restaurant owners are evidence that devil rays are marketed in STP. In some Asian markets (e.g., Indonesia), its gill rakers can reach a high value and the flesh is used for human consumption (Clark et al. 2006). As far as we were informed, in São Tomé there is not a market for gill rakers, either local or export but, according to local restaurant owners and fishermen, devil rays are locally caught occasionally and sold commercially for food.

In approximately 52 hours of underwater observations, between 1 and 47 m depth, and besides the Whale shark, we only recorded one elasmobranch, *Myliobatis* sp., in a deep reef, which swam away when approached. Even in our visits to local markets and fisheries landing sites no elasmobranchs were observed. One of the authors (NV-R) reported that *Ginglymostoma cirratum* (Bonnaterre, 1788) was a common shark in shallow areas in 2005.

During our study, we also reported the presence of *Uropterygius wheeleri* Blache, 1967. One individual was observed on a rocky vertical wall, at approximately 6 m depth, during a night dive, in Baía Chinha (0º00′17.54″S, 6º31′42.47″E), Rolas Islet. Since the animal was inside a crevice, except for the head (Fig. 4), total length estimation was not possible. This species had been reported by Osório (1891, 1898) but the most recent papers dedicated to updates on fish species for São Tomé, namely Afonso et al. (1999) and Wirtz et al. (2007) did not give *U. wheeleri* as a valid species. This report confirms its presence in São Tomé.

Although STP has a rich ichthyofauna (yet understudied), symptoms of overfishing are clear, such as:

- The lack of top predators, mainly sharks and large groupers, with only a few large Lutjanids occasionally observed—*Lutjanus dentatus* (Duméril, 1861) and *Lutjanus agennes* Bleeker, 1863;
- The presence of fishing net debris in the reefs;
- Signs of gear impact on the sea floor (e.g. large broken gorgonians were frequently seen);
- (Prevalence of small size fishes, namely herbivores, such as parrotfishes (*Scarus* and *Sparisoma*), in the local fish markets.

Fig. 4. *Uropterygius wheeleri*; Photo credit: Nuno Vasco-Rodrigues

This scenario results from local small scale artisanal fisheries alone, since large scale fisheries (namely trawling) or use of explosives was not reported for the area. In light of these facts, conservation efforts in STP are deemed urgent. It is relevant to note that the local population is evenly dependent on fish protein. Out of 30 meals present to the authors at the Rolas village (only one native food serving establishment exists) only three where non fish protein. Conservation efforts such the establishment of marine protected areas would probably benefit from the introduction of alternative affordable protein source in order to preserve the richness and uniqueness of the local marine fauna and the sustainability of artisanal fishing.

With these new records, the number of known valid species for São Tomé and Príncipe increases to a total of 245. A more intense sampling effort including (1) regular surveys to local markets and fisheries landing sites in São Tomé, but also in Príncipe island, (2) sampling of deeper water habitats, usually inaccessible by recreational scuba diving, and using techniques that allow effective sampling, will potentially increase the number of species for this rich and important area of the tropical east Atlantic.

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