

Short Communication

First *in situ* record of the deep-sea shark *Hexanchus griseus* (Chondrichthyes: Hexanchidae) off Rapa Nui (Easter Island, Chile), and management implications

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ABSTRACT. The conservation of threatened sharks requires defining the occurrence and distribution range of the species and key habitats for their survival. During surveys of mesophotic and deeper benthic habitats (50 to 340 m depth) off Rapa Nui (Easter Island, Chile, southeastern Pacific), using a remotely operated vehicle, a male bluntnose sixgill shark, *Hexanchus griseus* (Hexanchidae), was sighted. The estimated total length of this immature specimen was ~146 cm. This is the first documented record of the species off Rapa Nui. The *in situ* evidence of this threatened deep-water shark highlights the urgency to build management strategies to protect vulnerable apex predators of coastal and deep-waters ecosystems of the recently created Rapa Nui Marine Protected Area for Multiple Uses, above all from the effects of fisheries and other human activities (e.g. bycatch, marine litter).

Keywords: Bluntnose sixgill shark; presence; near-threatened species; ROV; Easter Island; southeastern Pacific

The bluntnose sixgill shark *Hexanchus griseus* (Bonnaterre, 1788) is a large deep-water shark with global, yet patchy, distribution (Ebert et al. 2013). This demersal species is found in tropical, temperate, and boreal waters on the continental slope, shelf, and occasionally inshore at depths of 0-2490 m (Griffing et al. 2014, Weigmann 2016). It also occurs on seamounts and mid-ocean ridges and is often associated with high biological productivity and upwelling areas (Ebert et al. 2013). Juveniles can make incursions over the continental shelf, as was reported recently by Becerril-García et al. (2017), who described the incidental catch of a juvenile female by coastal fishermen of Punta Lobos, Baja California Sur, Mexico (northeastern Pacific). *Hexanchus griseus* is infrequently reported as either targeted or incidental catch from industrial and artisanal demersal trawl, longline, handline, traps, and gillnet fisheries (Finucci et al. 2020 and references therein). The bycatch, a latent threat for this species, is frequently unreported. In central Chile, the species represented ~5% of bycatch from squat lobster fisheries on the benthic ecosystem (Montero et al. 2020). This

predatory shark is listed as Near Threatened (NT) by the International Union of Conservation of Nature (IUCN) (Griffing et al. 2019), close to meeting Vulnerable A2bd (Finucci et al. 2020). Records of the presence of *H. griseus* in remote deep-water ecosystems of the southeastern Pacific are highly fragmentary.

Rapa Nui, known as Easter Island (27°13'S, 109°37'W) (Fig. 1), constitutes an emerged peak of the large chain of seamounts comprising the Salas y Gómez Ridge and is located relatively close to the East Pacific Rise (Rodrigo et al. 2014). It is considered the easternmost apex of the Polynesian triangle and the most isolated inhabited island on Earth (<http://islands.unep.ch>). To protect this unique marine biodiversity, in June 2018 the Chilean government created the Rapa Nui Marine Protected Area for Multiple Uses (MPA) including the Motu Motiro Hiva Marine Park (a 150,000 km² no-take marine area surrounding Salas y Gómez Islet). It currently represents the largest marine

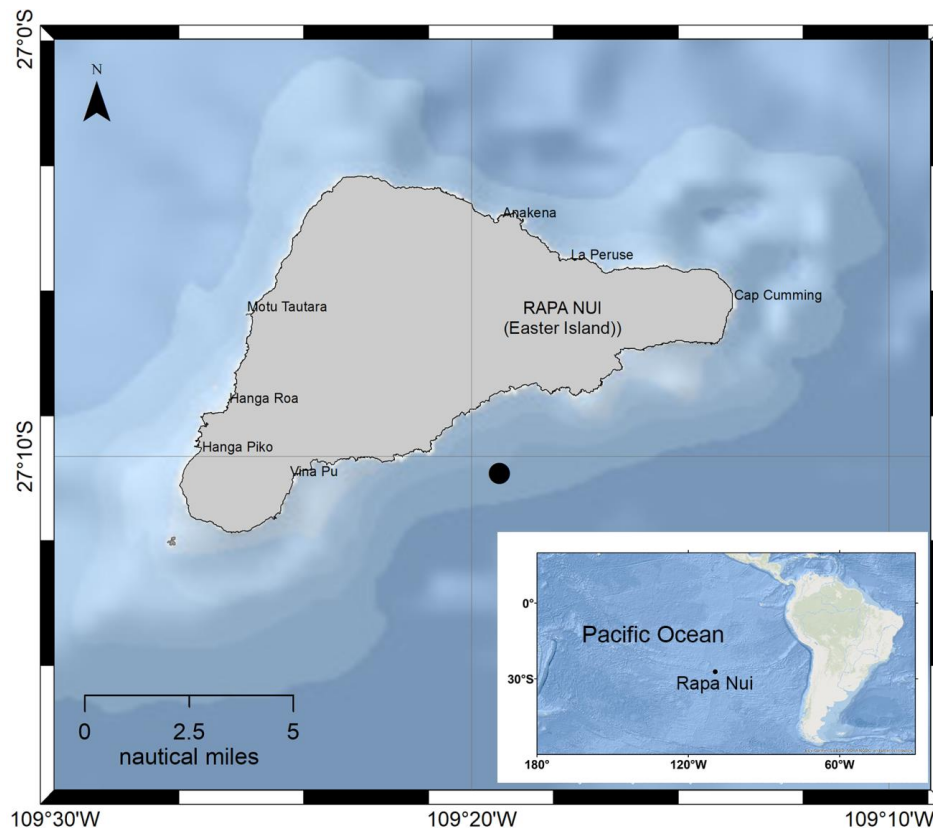


Figure 1. The geographic location of Rapa Nui (Easter Island, Chile) in the southeastern Pacific. The *in situ* sighting of *Hexanchus griseus* is indicated (black circle, southeastern side of the island).

protected area of Latin America (~579,000 km²). Although not particularly species-rich, compared to other Polynesian islands, Rapa Nui is recognized for the high overall endemism levels of its coastal marine fishes, ~22% after Randal & Cea (2010), or up to 40.3% if including regionally endemics (Friedlander et al. 2013), and invertebrate taxa (4 to 34%, Fernández et al. 2014). Although in progress, no management plan has been formulated to regulate fisheries activities in the MPA.

During surveys of benthic habitats (50 to 340 m depth) off Rapa Nui using a remotely operated vehicle (ROV; Commander MKII, fitted with two HD cameras and laser pointers), carried out by the Millennium Nucleus Center of Ecology and Sustainable Management of Oceanic Islands (ESMOI) and Oceana-Chile, a male *H. griseus* was recorded. The observation was performed in January 2018, off the southeastern side of the island (27°10'25"S, 109°19'20"W), at 320 m depth over a predominantly sandy substrate (Fig. 2). The length of the head was estimated when the shark swam perpendicular to the ROV camera using the ROV-mounted laser pointers as a size reference. The head length of the specimen was ~30 cm, and given that in this species the head length is about 21% of the body

length (Becerrill-García et al. 2017); thus, the estimated total length (TL) of the specimen would be ~142 cm. In addition, the TL and fork length (FL) were also calculated directly from images taken with the ROV, mounting together views of different body parts. These images were taken when distances between the shark and the ROV and between the ROV and the seafloor were nearly the same, allowing the reconstruction of a entire lateral view of the animal. Through this method, the estimated TL was 146 cm with an FL of 119 cm (Fig. 3), confirming the TL obtained by applying the conversion factor suggested by Becerrill-García et al. (2017). Since it has been proposed that males of this species mature at 309 cm (Crow et al. 1996), the specimen was an immature individual.

This is the first *in situ* documented sighting of this deep-sea species off Rapa Nui and the second for the marine ecoregion of Rapa Nui, suggesting that *H. griseus* could be a resident species of the area. A previous expedition conducted in February-March 2011 registered the species near Salas y Gómez Islet (Motu Motiro Hiva), ~500 km east of Rapa Nui (Friedlander et al. 2013). Randal & Cea (2010) reported 165 epipelagic and offshore fish species, and only nine

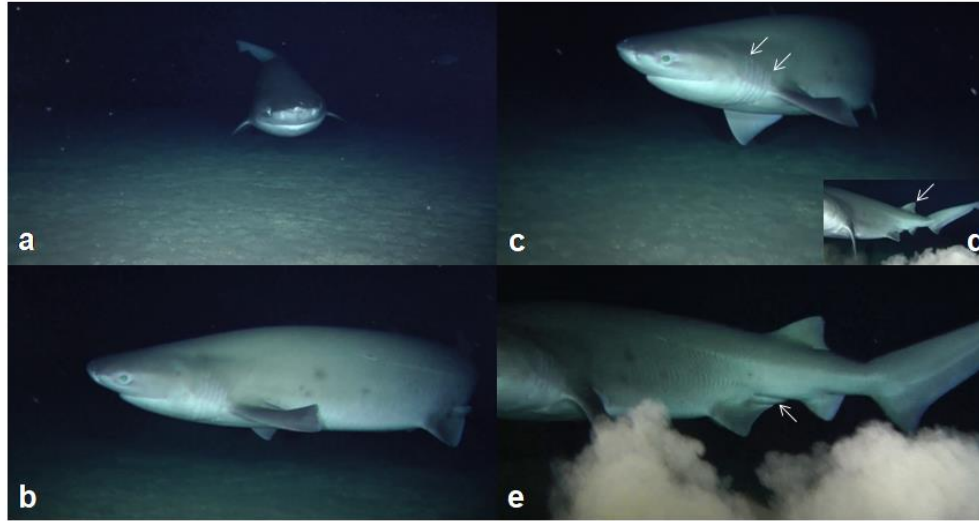


Figure 2. Images of sighted *Hexanchus griseus* off Rapa Nui (Easter Island, Chile), at 320 m depth over a sandy substrate. General view, species-specific and sexual characteristics (white arrows) are shown: a) front view, b) anterior part of the body, c) detail of the six gills, d) positions of the dorsal fin close to the caudal fin, and e) claspers of this male specimen.

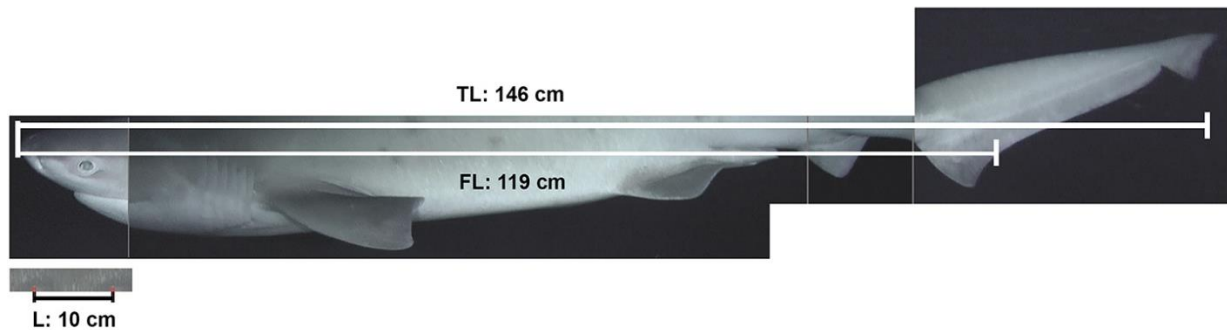


Figure 3. Reconstructed lateral view of the *Hexanchus griseus* immature male from superposing images taken with the ROV. The estimated total length (TL) and estimated fork length (FL) are shown. The distance between the ROV-mounted laser pointers, used as a size reference, is shown in the bottom left corner.

were elasmobranchs. Of these, solely the Galapagos shark *Carcharhinus galapagensis* (Snodgrass & Heller, 1905) was listed as year-round resident species (Morales et al. 2019a).

In the case of vulnerable sharks, documenting and defining the occurrence and ranges of distribution is critical to formulating informed conservation strategies and identifying key habitats for their survival (García et al. 2008). Sighting an *H. griseus* male in the MPA reinforces the importance of creating management measurements to regulate fisheries activities (live specimens release, bycatch banning in recreational, artisanal, or industrial fisheries) and mitigate indirect effects of other human activities (such as plastics contamination, domestic waste, wastewater runoff). Furthermore, this record adds to the first report of the white tip-shark *Triaenodon obesus* (Rüppell, 1837), a transient species sighted in coastal waters, at 18 m

depth off Hanga Roa Bay (Morales et al. 2019b). As indicated earlier, endemic or regionally endemic fishes account for up to 40.3% of the total species at Rapa Nui. At the same time, apex predators, primarily sharks and jacks, represent only 2% of the fish biomass at this site (Friedlander et al. 2013). Thus, these *in situ* observations constitute essential evidence to support management strategies that guarantee the protection of marine apex predators of the deep-waters and of the coastal ecosystem and contribute relevant information for the ongoing construction of a management plan for the recently created Rapa Nui MPA. Additionally, the connectivity between Rapa Nui and nearby marine ecosystems or even with the benthic ecosystem of central Chile must be taken into account because large sharks have migrations that are often beyond the reach of the MPA.

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