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Short Communication

First record of black corals (Antipatharia) in shallow coastal waters of northern Chile by means of underwater video

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ABSTRACT. This record is the first report of black corals (Antipatharia) in shallow waters of the continental coast of Chile, and extends their geographical range in shallow waters of the upper continental shelf of South America by ~3000 km from Ecuador (~1°S) to Coquimbo, Chile (~29°S). Specimens were observed between 70 and 107 m on three underwater video transects executed in July 2016 on the rocky reef El Toro, which is located about 65 km northwest of Coquimbo. The images were taken with the cameras of a remotely operated vehicle (ROV) at a distance of about two meters from the rocks. Although the image resolution does not allow an exact identification of the species, the multi-branched corals were distinguished from other cnidarians as Antipatharia by the dark color of the stem.

Keywords: Antipatharia, black corals, mesophotic, northern Chile, Pacific Ocean.

The order Antipatharia, black corals, is distributed from polar to tropical seas and from shallow coastal waters to the deep sea and contains over 280 species in seven families: Antipathidae, Aphanipathidea, Cladopathidae, Leiopathidae, Myriopathidae, Stylopathidae, and Schizopathide (Opresko, 1972, 2001, 2006). According to the literature, the southernmost record of black corals on shallow waters on the continental shelf of South America is located in the Machalilla National Park of Ecuador (~1°S) (Bo *et al.*, 2012).

According to Alarcón (2009), 20 antipatharian species in four families (Antipathidae, Cladopathidae, Leiopathidae, and Myriopathidae) are registered in Chile, with 11 species distributed between the Peruvian and Magellan Province (18°-56°S). Except for *Antipathella minor*, *A. assimilis*, and *A. contorta*, all reports are from South Chilean fjord system at ~320 m at ~50°S (Häussermann & Försterra, 2007). All other records are from the continental slope or seamounts, where the specimens were collected when they became entangled in fishing gear such as longlines. Recently, Araya *et al.* (2016) reported the first Chilean record of *Lillipathes ritamariae* Opresko & Breedy, 2010, which was also found as bycatch in a demersal longline at about 1300-1800 m depth in the north of Chile off Calama (27°S). For Chile, the only records of black corals in shallow waters (<100 m) are from the oceanic islands of the Juan Fernández Archipelago and Desventuradas Islands (Lee *et al.*, 2008; Alarcon, 2009; Friedlander *et al.*, 2016).

Here, we report the first shallow-water record for continental Chile of a black coral. Specimens were observed on the rocky reef El Toro (~29°S), which is located in Coquimbo Bay, ~60 km northwest of Coquimbo and ~10 km south of the Choros and Damas islands (Fig.1a). El Toro is an unexplored aggregation of rocks that emerge a few meters above sea level and is surrounded by sandy bottoms (Melo *et al.*, 2007). This part of the bay is an important fishing ground for squat lobsters (*Pleuroncodes monodon* and *Cervimunida johni*) and shrimps (*Heterocarpus reedi*) in the region (Acuña *et al.*, 2005). The benthic communities of the nearby islands of Choros, Damas, and Chañaral islands were studied intensively during the past decade; however, sampling was done by scuba diving and to shallow depths, ~20 m. El Toro and its surroundings are affected by the Humboldt Current System and by sporadic upwelling and spatio-temporal heterogeneity

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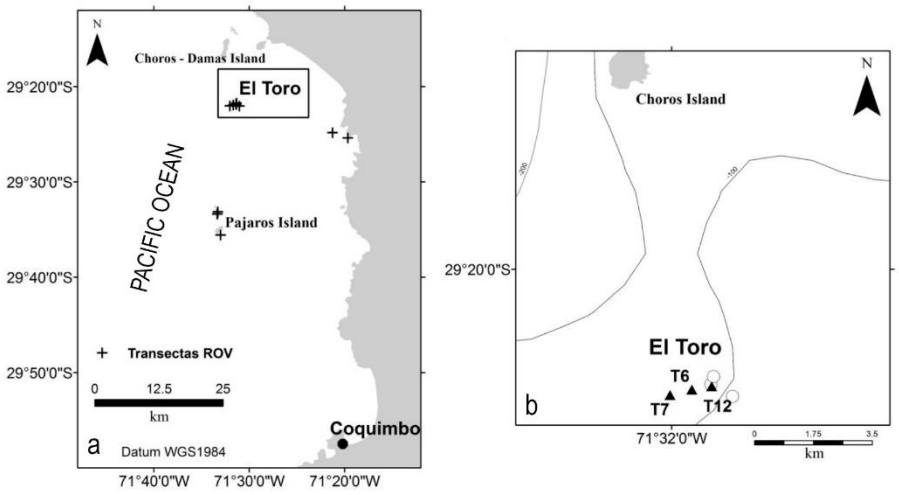

Figure 1. a) General map showing the location of the shallow El Toro in northern Chile and ROV transects during the Oceana La Higuera 2016 expedition, and b) detailed map of El Toro and the transects (T6, T7, and T12) where the black corals were observed. Distance between each transect was ~500 m.

caused by the ENSO (El Niño Southern Oscillation) large-scale climatic phenomena, which result in superimposing regional patterns of ecological processes (Thiel *et al.*, 2007). Typical near-bottom water temperature and salinity at 100-200 m in Coquimbo Bay are respectively ~12.1°C and ~34.8 (Melo *et al*., 2007). The annual mean surface temperature, measured over a period of seven years until 2008, on the continental coast off El Toro, was ~12-16°C (Tapia *et al*., 2014).

On 4-8 July 2016, the NGO Oceana used a remotely operated vehicle (ROV) to document the seafloor of Coquimbo Bay during the Oceana La Higuera 2016 expedition on board the motor vessel Stella Maris II. The ROV Commander MK2 (Mariscope Meerestechnik, Kiel, Germany) was equipped with a main front camera, recording in 2.7 k (2704×1524 pixels), and an additional camcorder (Panasonic SD 909), recording 30 frames per second in 1920×1080 pixels, that was positioned in front of the ROV with a fixed angle of 15 degrees towards the bottom. The ROV also was equipped with four head lights of 200W each, distributed in each corner of the ROV frame above and below the cameras. The distance between the camera and the seafloor or rocks varied between one and two meters to avoid crashing the ROV against the rocks as currents on top of the rock aggregations of the reef are very strong. Black corals were documented at three of 11 transects (Fig. 1b) and were identified by using Antipatharian images and descriptions in Opresko (2001, 2006).

All specimens of black corals were distinguished from other anthozoan cnidarians found on the videos due to the dark color of the skeleton, where visible, and the branch morphology. Image resolution was insufficient for seeing details of the polyps or the presence of spines, but amplifications of some images allowed a rough surface of the skeleton of the stem to become noticeable (Fig. 2b). Although the available material allowed only a limited analysis of morphological characteristics and prevented us from assigning them to species or genus, patterns of ramification and branching indicate the presence of two different species. *Antipatharia* sp. 1 species had ramification up to the third order and was fan-shaped (Fig. 2a), whereas the *Antipatharia* sp. 2 (Fig. 2b) showed ramification up to the fifth order, and the animals look much bushier and arborescent (Fig. 2b). Specimens of *Antipatharia* sp. 2 are similar to individuals of the genus *Lillipathes* and *Antipathes*, which have been registered at greater depths in northern and southern Chile (Araya *et al*., 2016; Häussermann & Försterra, 2007). Therefore, *Antipatharia* sp. 2 may belong to the family of Anthipathidae.

Aggregations of the black corals were recorded at three different transects at El Toro; several specimens of the fan-shaped species at 91 m (T6: 29.366°S, 71.528°W) and 107 m (T7: 29.367°S, 71.534°W), and the more arborescent species was found at 70 m (T12: 29.365°S, 71.523°W). All specimens were attached near the edges of the rocks a few meters above the surrounding plain seabed and were always observed in the deepest parts of each transect. The sizes of the colonies are estimated to be 30-50 cm in height, assuming that the distance of the ROV to the rocks was 1-2 m.

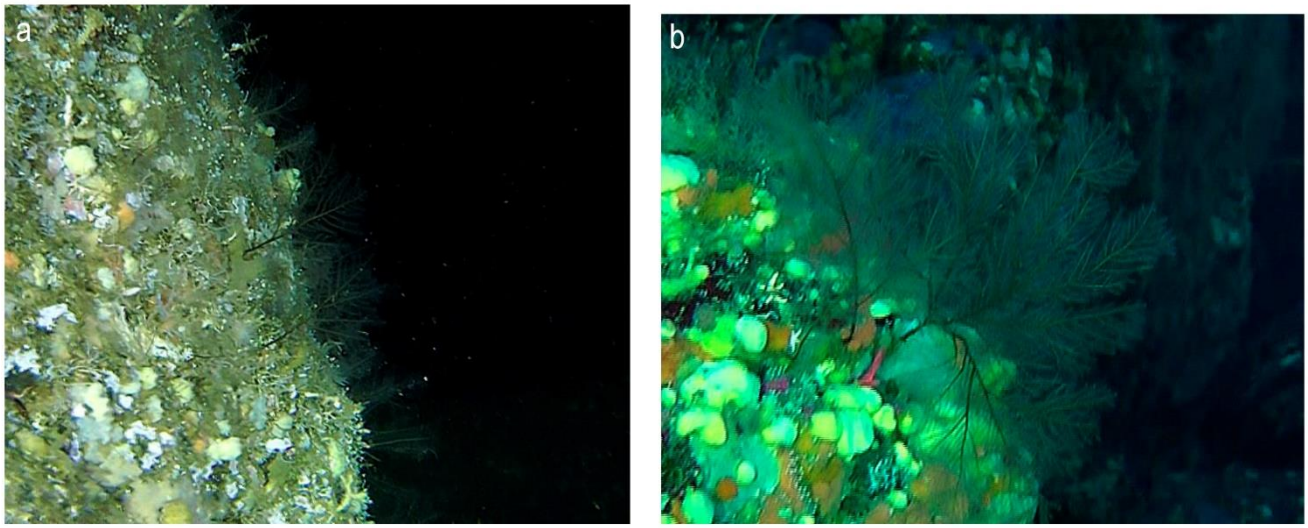

Figure 2. Images of black corals observed with underwater video during the Oceana La Higuera 2016 expedition at the rocky reef El Toro: a) *Antipatharia* sp. 1 at T7 (107 m), and b) *Antipatharia* sp. 2 at T12 (70 m).

This record in shallow continental waters suggests that black corals along the Chilean coast occur at locations that are inaccessible to non-technical divers and characterized by extremely irregular bottoms with pinnacle-like steep raising rocks that inhibit traditional bottom sampling with trawls or dredges. As shown in the present study, visual documentation by means of ROV is an excellent alternative to investigate benthic communities at such locations. We could only assign individuals to order and tentatively to the family because difficult weather conditions prevented us from getting closer to the corals to obtain enough details to assign specimens to genus or species. Despite the limits of using such video data for species assignments, identifying specimens as black corals from such data is possible with minimal error. For example, validation of underwater images of black corals in mesophotic coral ecosystems taken with ROVs in the Gulf of Mexico revealed that misidentification of corals is only high when it comes to species level (Nutalli *et al*., 2016). Nevertheless, more specific visual documentation and biological sampling should be carried out in the future to validate the present records and to identify the species. Given the key ecological importance of corals as habitat providers that enhance local biodiversity (Bo *et al.*, 2012; Wagner *et al*., 2012) and the common concern about protecting and monitoring them, we consider any report about the distribution of these corals of particular importance for the implementation of management and conservation strategies.

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