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First occurrence of dusky grouper *Epinephelus marginatus* (Lowe, 1834) in a Marine Protected Area on the Uruguayan coast

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Abstract: The present study reports the first records of endangered species, dusky grouper Epinephelus marginatus, on the Uruguayan coast. The occurrence of dead or disoriented individuals along the surf zone within the Marine Protected Area (MPA) of Cerro Verde (Uruguay) was recorded. . Continuous monitoring and future studies are needed to reveal the relevance of this MPA in the conservation of this endangered grouper species in the southernmost limit of its distribution in the Southwestern Atlantic.

Résumé : *Premier signalement du mérou brun* Epinephelus marginatus *(Lowe, 1834) dans une Aire Marine Protégée de la côte urugayenne.* Cette étude rapporte les premiers signalements de l'espèce en voie de disparition, le mérou brun *Epinepleus marginatus*, sur la côte uruguayenne. La présence d'individus morts ou en nage désorientée le long d'une zone de déferlement à l'intérieur de l'Aire Marine Protégée (AMP) de Cerro Verde (Uruguay) a été comptabilisée. Une surveillance continue et de futures études sont nécessaires pour révéler la pertinence de cette AMP pour la conservation de cette espèce de mérou menacée dans la limite sud de son aire de distribution du sud-ouest Atlantique.

Keywords: disease outbreak ● Epinephelidae ● endangered species ● MPAs

Coastal marine ecosystems are highly productive areas harboring a diverse fauna that have been overexploited and devastated by human activity in many regions of the world (Halpern et al., 2008; Jackson, 2008). Marine Protected Areas (MPAs) have been implemented in several countries to preserve these crucial marine ecosystems and their biodiversity (Kelleher & Kenchington, 1991), in order to ensure fishing productivity inside and outside its boundaries through spillover and larval export (Roberts et al., 2001; Goñi et al., 2008). According to the International Union for Conservation of Nature (IUCN), MPAs are classified in two categories: areas of the integral protection, characterized by the absence of exotic species, human activities and any kind of facilities and restricted protected areas, were fishing and exploitation of other natural

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resources are limited and controlled (Kelleher & Kenchington, 1991).

The Uruguayan coast features four MPAs along its extension, all classified as restricted protected areas, three in the Department of Rocha (Cerro Verde e Islas La Coronilla, Cabo Polonio and Laguna de Rocha) and one in the Department of Maldonado (Laguna Garzón). The region of Cerro Verde (33°56´12"S-53°29´16"W) are located on the northeast coast of Uruguay and covers an area of approximately 510 Km^2 (Fig. 1). This area is part of the "Bañados del Este e Franja Costera" Biosphere Reserve established in 1976 and is a RAMSAR site since 1982 and is on the National System of Protected Areas as a category of "Management Habitat and/or Species". The MPA of Cerro Verde is characterized by dissipative beaches with fine sand, low slope and a wide surf zone, harboring greater diversity and abundance of macrofauna (Lercari & Defeo, 2006). It is also common the occurrence of many species of megafauna such as marine mammals, marine turtles and seabirds, as well as sharks, rays and large teleosts (Castro, 2004; Velez-Rubio et al., 2013).

In 2014, we observed the occurrence of the dusky grouper *Epinephelus marginatus* (Lowe, 1834) during the monitoring of sea turtle stranding of the local NGO Karumbe in the MPA of Cerro Verde. Berg (1895) reported the occurrence of *Epinephelus gigas* (= *marginatus*) between Montevideo (Uruguay) and Mar del Plata (Argentina). Since then, there have been only two other records of epinephelids species to Patagonia (Argentine) (Rico & Acha, 2003; Irigoyen et al., 2005), but no records along the Uruguayan coast until the current report. Like other species of the Epinephelidae family, the dusky grouper *Epinephelus marginatus* is a large-body fish and an ambush predator that inhabits rocky bottoms at depths up to 250 m, although it occurs at higher densities below 50 m (Heemstra & Randall, 1993; Harmelin & Harmelin-Vivien, 1999). In the littoral zone, juveniles are usually found in tide pools (Azevedo et al., 1995), artificial rock bottoms (Condini et al., 2011 & 2014) and even within estuarine zones (MVC, unpublished data). Dusky grouper is a monoandric protogynous hermaphroditic species, with late maturation and slow growth rate (Manooch & Mason, 1987), which due to increasing fishing pressure was included in the IUCN Red List as "Endangered" (EN A2d) (Cornish & Harmelin-Vivien, 2004).

In March 2014, seven individuals of dusky grouper were found dead or swimming disoriented along the surf zone within the MPA of Cerro Verde. Their total length and weight ranged from 388 to 736 mm and 879.6 to 6650.0 g, respectively. The digestive system of all specimens were dissected and analyzed according to Condini et al. (2011), but both stomachs and guts were empty, suggesting absence of feeding activity during the pre-mortem period. Gonads

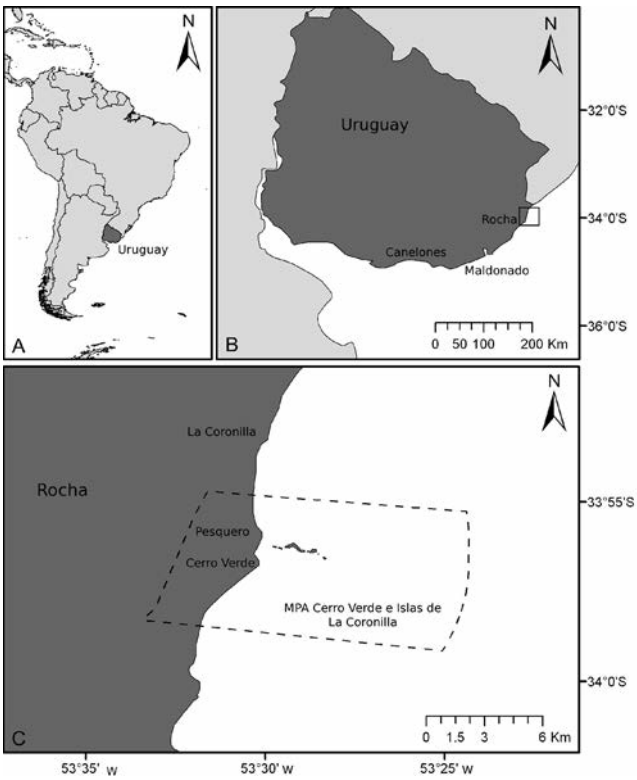

Figure 1. The Uruguayan coast showing the location of M.P.A. Cerro Verde e Islas de La Coronilla.

of six specimens were microscopically examined following Condini et al. (2014), identifying four females (two immature, phase F1, and two mature, phase F2) and two maturing males (M1). The occurrence of immature and mature females and males may be an indication that MPA of Cerro Verde presents habitat prerequisites to harbor dusky grouper populations. Further studies on age structure and reproduction are needed to evaluate if the area contains self-sustaining populations of this endangered species.

It was not possible to identify the death cause of the dusky groupers found at the MPA of Cerro Verde. Nevertheless, it is worth noting that stranded individuals at surf zone or individuals swimming in circles with agonistic behavior of *E. marginatus* and *E. costae*, similar with the ones reported in this study, were found in the Mediterranean Sea off the coast of Algeria and Tunisia (Haddad-Boubaker et al., 2014; Kara et al., 2014). In both cases, researchers diagnosed the presence of the Betanodaviruses, which acts on the central nervous system causing a viral nervous necrosis (VNN). This serious disease led to high fish mortality worldwide, particularly for marine species and, occasionally, for freshwater species (Munday et al., 2002). This disease usually affects young-of-the-year and juveniles, but adult fish can also be affected (Munday et al., 2002; Kara et al., 2014). It was not possible to collect samples to determine the presence of

Betanodaviruses when the groupers were found at the Uruguayan coast, but their symptoms were similar to those observed in individuals found dead or agonizing along the Southern coast of the Mediterranean Sea. Future studies and focus monitoring of stranded groupers at the Uruguayan coast should evaluate the presence of Betanodaviruses.

Several studies showed the importance of marine protected areas for species conservation, including groupers (Russ & Alcala, 1996a & b; Bouchereau et al., 1999; Russ & Alcala, 2004; Pastor et al., 2009). Therefore, it is essential to carry out ecological studies on this species in order to reveal the importance of this MPA for its conservation at its southernmost distribution in the Southwestern Atlantic.

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