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Objective record of *Epinephelus marginatus* (Serranidae: Epinephelinae) from the Sultanate of Oman (Arabian Sea)

by

Philippe BÉAREZ* (1), Marion I. MENNESSON (2) & Eric PELLÉ (3)

Résumé. – Signalement objectif d'*Epinephelus marginatus* (Serranidae : Epinephelinae) sur la côte du Sultanat d'Oman (mer d'Arabie).

Deux spécimens (268-665 mm de longueur standard) du mérou *Epinephelus marginatus* (Lowe, 1834) ont été prélevés au marché aux poissons de Salalah, dans le Sultanat d'Oman. Ces spécimens confirment la présence de l'espèce en Oman et représentent son signalement le plus au nord dans l'océan Indien.

Key words. – Epinephelinae – *Epinephelus marginatus* – Dusky grouper – New record – Oman – Indian Ocean.

Groupers (subfamily Epinephelinae) include 185 valid species (Fricke *et al.*, 2020). Most of them are among the most prized fishes and are subject to considerable fishing pressure throughout their range (Craig *et al.*, 2011; Sadovy de Mitcheson *et al.*, 2012). The dusky grouper, *Epinephelus marginatus* (Lowe, 1834) is no exception to this rule; it is classified by the IUCN as Endangered in the Mediterranean (Cornish and Harmelin-Vivien, 2011) and Vulnerable at global scale (Pollard *et al.*, 2018), and its capture is subject to protective measures in several countries.

The dusky grouper is not only an iconic demersal species of the Mediterranean Sea, but also has one of the strangest disjunct geographical distribution among groupers. Originally described from off Madeira, the dusky grouper is distributed in the eastern Atlantic, from the Bay of Biscay, with stray specimens reported as far north as the British Isles and the English Channel (Mahé et al., 2012), south to Angola, including oceanic islands and throughout the Mediterranean Sea (Heemstra and Anderson, 2016); in the southwestern Atlantic, from central Brazil to Argentina (Irigoven et al., 2005); in the southwestern Indian Ocean, from South Africa to southern Mozambique (Heemstra and Heemstra, 2004) and Madagascar (Fourmanoir and Crosnier, 1964), with vagrant specimens reported from Réunion Island (Reid et al., 2016). Randall (1995) also recorded the species from Oman. However, despite pictures made by J. Hoover and J. Randall (Randall, 1995, 1997) in several places of the country (see also Froese and Pauly, 2019), Pollard et al. (2018) considered the records from southern Oman as probable waifs or misidentifications.

The present report confirms the presence and documents the range of *Epinephelus marginatus* into the northwestern part of the Indian Ocean (Fig. 1), and provides the first COI sequence for the species in this area.

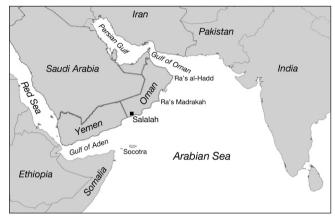


Figure 1. – Map of the Arabian Sea with the location of Salalah, Dhofar, in the Sultanate of Oman.

MATERIALS AND METHODS

Two specimens were purchased at the fish market of Salalah, Dhofar, Sultanate of Oman (Fig. 1): the largest one (665 mm standard length (SL)) on 7 Jan. 2018 (Fig. 2A) and the small one (278 mm SL) on 21 Jan. 2019 (Fig. 2B). Fishermen caught these specimens around Mirbat, ca. 65 km west of Salalah, while targeting demersal fish, mostly emperors (*Lethrinus nebulosus*), sea breams and groupers, with hook and line at a depth of 25-30 m.

Methods of measuring specimens follow Heemstra and Randall (1993). The last two dorsal and anal soft rays are counted as one if they are adjacent at the base and share the same pterygiophore. Gill-raker counts are made on the first gill arch and include rudiments

To corroborate identification, the sequence for the partial (barcode region) Cytochrome c oxidase subunit 1 (COI) was obtained, and compared to reference sequences in the Barcode of Life Database (BOLD). We followed Dettaï *et al.* (2012) for DNA extraction, PCR, sequencing and quality control. Data processing and sequence assembly were done in Geneious 9.0.5 (http://www.geneious.com, Kearse *et al.*, 2012). All the COI sequences were aligned with Muscle Alignment. Percentage of identity between sequences was obtained in Geneious. Sequences were used to blast search the full BOLD, as well as GenBank.

⁽¹⁾ Archéozoologie, archéobotanique: sociétés, pratiques et environnements (AASPE 7209), Muséum national d'Histoire naturelle, CNRS. CP56, 57 rue Cuvier, 75005 Paris, France. [bearez@mnhn.fr]

⁽²⁾ Biologie des organismes et écosystèmes aquatiques (BOREA 7208), Muséum national d'Histoire naturelle, Sorbonne Université, Université de Caen Normandie, Université des Antilles, CNRS, IRD, CP26, 57 rue Cuvier, 75005 Paris, France. [marion.mennesson@mnhn.fr]

⁽³⁾ Direction des Collections, Muséum national d'Histoire naturelle, CP11, 57 rue Cuvier, 75005 Paris, France. [pelle@mnhn.fr]

^{*} Corresponding author

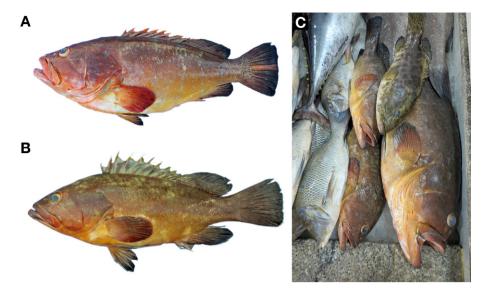


Figure 2. – Specimens of dusky grouper from Salalah, Oman. A: *Epinephelus marginatus*, 793 mm TL (MNHN-ICOS-01381). B: *E. marginatus*, 331 mm TL (MNHN-IC-2019-0025). C: Three individuals of *E. marginatus* observed at the Salalah fish market on 19/01/2019.

Due to the large size of one of the specimens, only its skeleton was kept and deposited in the fish osteological collection at the Muséum national d'Histoire naturelle (MNHN) under the number MNHN-ICOS-01381. The small specimen is preserved in the MNHN fish collection under the number MNHN-IC-2019-0025. The two COI sequences were deposited in GenBank under accession numbers MT762946 and MT762945, respectively.

RESULTS

Both morphometric and molecular data confirm that the two grouper individuals collected from the Salalah fish market belong to the species *Epinephelus marginatus* (Lowe, 1834) (Fig. 2A, B).

Morphologic data

331-793 mm total length (TL), 268-665 mm SL, 115-280 mm head length (HL), 571-9371 g total fresh weight. Head length contained 2.3 to 2.4 times in SL. Dorsal fin with 11 spines and 14 soft rays. Anal fin with 3 spines and 8 soft rays. Caudal fin rounded. Measurements of the small specimen are presented in table I as percentages of standard length.

Molecular data

There are many COI sequence in BOLD for *E. marginatus*. The two sequences are 100% similar; percentage of identity between these sequences and those from France, Tunisia, Turkey, Israel and South Africa (BOLD sequences) are between 99.3% and 100%. This level of similarity is generally characteristic of intraspecific divergence (Ward *et al.*, 2009), and strongly corroborates the identification as *E. marginatus*.

Distribution

In the northwestern Indian Ocean, the dusky grouper has a distribution range restricted to the Arabian Sea coast of Oman. According to previous observations (Randall, 1997; J. Hoover pers. comm.), it has been objectively reported from Ra's Madrakah to Salalah. The present records confirm the presence of this grouper in the Arabian Sea coast off Oman.

DISCUSSION

Up to now it seems that E. marginatus has only been reported from the Arabian Sea coast off Oman and that it is absent from surrounding areas: i.e. Gulf of Aden (Al Sakaff and Esseen, 1999); Socotra (Zajonz et al., 2019); Red Sea (Golani and Bogorodsky, 2010); Persian Gulf (Eagderi et al., 2019); Pakistan (Psomadakis et al., 2015). Reddy (1984) recorded the species from a rockpool on the Visakhapatnam coast, Bay of Bengal. Despite a rather good correspondence of the morphomeristic data (considering that body depth = 75% of HL, not SL) of his 200 mm SL individual with our data, the author mentioned that the edges of all fins are black but did not mention the typical white distal margin of the median fins of E. marginatus, well visible on young individuals. Hence, in this study, this specimen is regarded either as a stray or a misidentification. Randall (1995) suggested that the restricted occurrence of such a temperate species off southern Oman could be related to the presence of the seasonal coastal upwelling (Vic et al., 2017). The coastal upwelling is more intense between Salalah and Ra's Madrakah (Vic et al., 2017), an area that corresponds well with the known range of the dusky grouper in Oman. This area also corresponds, biogeographically, to most part of the Western Arabian Sea Ecoregion (Spalding et al., 2007).

The dusky grouper is not rare in southern Oman and can be observed regularly at the fish market of Salalah, at least in January (Fig. 2C). The question of its origin in Oman is puzzling and would deserve more investigation, as the closest records in the Indian Ocean are from the southwest part, at least 4,000 km south of Salalah. Such a disjunct distribution is however also found among other bony fish families present in Oman coastal waters (Randall, 1995). Sparids are probably the best example, with the occurrence of several close relatives of northeastern Atlantic and/or southern African species: *Boops lineatus* (Boulenger, 1892), *Diplodus capensis* (Smith, 1844), *D. kotschyi* (Steindachner, 1876), *D. omanensis* Bauchot & Bianchi, 1984, *Lithognathus mormyrus* (Linnaeus, 1758), *Pagellus affinis* Boulenger, 1888.

A modern origin of the Omani population of the dusky grouper from the Mediterranean Sea through the Suez Canal is unlikely, as the species has never been reported from the red Sea (Golani and Bogorodsky, 2010). Long distance colonization from South Africa is also unlikely even if vagrant have been detected far from their source population, as for example in Réunion Island (Reid *et al.*,

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Table I. – Meristics and measurements (in mm or expressed as percent of SL) for the small specimen of *Epinephelus marginatus* from Oman (MNHN-IC-2019-0025).

| | Epinephelus marginatus MNHN-IC-2019-0025 |
|-------------------------|---|
| Standard length | 268 |
| Total length | 331 |
| Dorsal-fin ray count | X-I, 14 |
| Anal-fin ray count | III, 8 |
| Pectoral-fin ray count | 17 |
| Pelvic-fin ray count | I, 5 |
| Lateral line scales | 66 |
| Lateral scale series | 105 |
| Gill raker count | 8 + 14 |
| % of SL | |
| Body depth | 32.55 |
| Body width | 17.13 |
| Head length | 42.78 |
| Snout length | 9.66 |
| Orbit diameter | 7.65 |
| Preorbital depth | 3.84 |
| Interorbital width | 6.47 |
| Maxilla width | 5.30 |
| Upper jaw length | 18.31 |
| Caudal peduncle depth | 11.94 |
| Caudal peduncle length | 17.57 |
| Predorsal length | 38.79 |
| Preanal length | 72.76 |
| Prepelvic length | 41.60 |
| Dorsal-fin base | 51.99 |
| Longest dorsal spine | 14.22 |
| Longest soft dorsal ray | 17.35 |
| Anal-fin base | 15.43 |
| Third anal spine length | 11.66 |
| Longest anal soft ray | 18.10 |
| Caudal-fin length | 22.88 |
| Pectoral-fin length | 21.46 |
| Pelvic-fin length | 20.43 |
| Pelvic spine length | 10.72 |

2016). Clearly, further genetic research on populations of the dusky grouper is needed to determine their origin, the timing of colonization and their connectivity at global scale.

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