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Deep cleaning: a wrasse and a goby clean reef fish below 60 m depth in the tropical south-western Atlantic

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Most studies and records of cleaning symbiosis between reef fish originate from shallow waters, ranging about 1–30 m depth. We record herein the wrasse Bodianus pulchellus *and the goby* Elacatinus phthirophagus *cleaning below 60 m depth in the tropical south-western Atlantic. The wrasse was recorded cleaning two large piscivorous clients (a jack and a grouper) and the goby was recorded cleaning a grouper. Cleaning interactions between deep-reef fish and both of these cleaners may be expected at depths even greater than those reported here.*

Keywords: cleaning symbiosis, deep-reef fish, Labridae, *Bodianus pulchellus*, Gobiidae, *Elacatinus phthirophagus*

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Most studies and records of cleaning symbiosis between reef fish originate from shallow waters ranging 1–28 m depth (e.g. Youngbluth, 1968; Johnson & Ruben, 1988; Grutter, 1997; Sazima *et al.*, 2000; Gasparini *et al.*, 2007). However, in the western Atlantic some cleaner species are recorded in depths up to about 60–70 m in north-eastern Brazil (Rocha *et al.*, 2000; Feitoza *et al.*, 2005) and up to about 100 m in the Caribbean (Humann & DeLoach, 2002), which opens the possibility that cleaning interactions would occur at depths greater than previously reported. We present here records of a wrasse (Labridae) and a goby (Gobiidae) cleaning below 60 m depth in the tropical south-western Atlantic, and validate the above suggestion.

The field work was made at Fernando de Noronha Archipelago (03°50′S 32°15′W), off north-eastern Brazil in the tropical south-western Atlantic. The records were made at the shipwreck 'Corveta Ipiranga' at 62 m depth with SCUBA gear on 26 June and 27 September 2008, and 25 July 2009, all records between 1200 and 1400 h. Since diving time with conventional SCUBA gear is greatly limited at depths greater than 30 m, cleaning interactions were photographed and briefly recorded with the use of *ad libitum* and 'behaviour' samplings (Martin & Bateson, 1986), both of which are adequate for transitory behaviours and opportunistic observations. The photographs were used for further analyses of the cleaning behaviour. Copies of the digital photographs are on file at the Museu de Zoologia da Universidade Estadual de Campinas (ZUEC).

Two to three spotfin hogfish (*Bodianus pulchellus*) individuals about 10–15 cm total length (TL) were recorded cleaning two piscivorous clients, the yellow jack (*Caranx bartholomaei*) and the black grouper (*Mycteroperca bonaci*). The wrasses inspected and cleaned several body parts of the jack (Figure 1) including mouth and gill cover areas. The black grouper was thoroughly cleaned on the body, one wrasse partially entering the gill chamber to clean the gill filaments (Figure 2). The jack hovered in the water column and displayed a bronze sheen, darker than its habitually silvery with yellowish cast colour (Humann & DeLoach, 2002; our personal observations). The black grouper was pale except for the fins when first detected, but darkened upon the observers' approach. Even if piscivores are not among the preferred clients of wrasses (e.g. Johnson & Ruben, 1988; Francini-Filho & Sazima, 2008) perhaps due to predation risk (Francini-Filho *et al.*, 2000), this was not the case for the spotfin hogfish recorded here. The 'willingness' of the two clients to be cleaned by the hogfish and the 'boldness' of the latter likely are due to the apparent general absence and/or low numbers of cleaners at depths greater than 30 m in the western Atlantic (Johnson & Ruben, 1988; Rocha *et al.*, 2000; our personal observations).

Fig. 1. Spotfin hogfish (*Bodianus pulchellus*) inspects the base of pectoral fin of a yellow jack (*Caranx bartholomaei*) near a shipwreck at 62 m depth, Fernando de Noronha Archipelago, off north-eastern Brazil. Photograph: Zaira Matheus.

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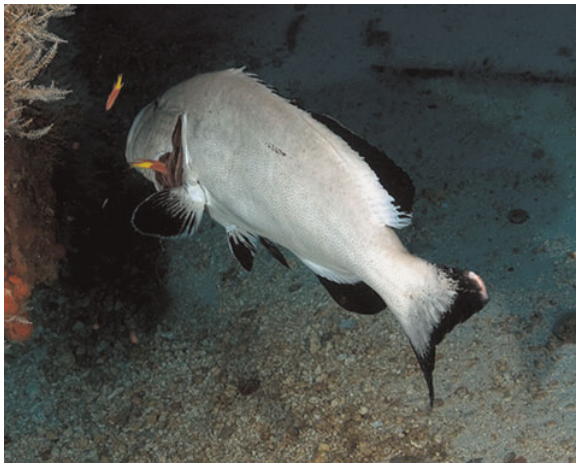

Fig. 2. Spotfin hogfish (*Bodianur pulchellus*) cleans the gills of a black grouper (*Mycteroperca bonaci*) at a shipwreck at 62 m depth, Fernando de Noronha Archipelago, off north-eastern Brazil. An individual of this wrasse species nears the grouper's open mouth. Photograph: Zaira Matheus.

One Noronha goby (*Elacatinus phthirophagus*) individual with a total length of about 4 cm was recorded cleaning a black grouper (*Mycteroperca bonaci*) on the head near the mouth (Figure 3), and entering the oral cavity and gill chamber. The grouper remained stationary, hovering close to the bottom, and displayed its dark phase (Humann & DeLoach, 2002). Changes in colour and/or pattern (as already noted above) are regarded as signals by the client fish to the cleaner, besides making ectoparasites more visible on the body of the client (Grutter, 2005). Cleaners of the genus *Elacatinus* are known for tending cleaning stations on, or close to, the substratum (Colin, 1975; Sazima *et al.*, 2008), whereas wrasses tend cleaning stations higher in the water column (Sazima *et al.*, 2005; Francini-Filho & Sazima, 2008), which is the case of our records at the shipwreck. The 62 m depth record of the Noronha goby is the deepest one to date (up to 18 m in the original description, Sazima *et al.*, 2008). However, the barber goby (*Elacatinus figaro*), also a cleaner (Sazima *et al.*, 2000), is recorded up to 57 m off north-eastern Brazil albeit no cleaning was observed in this situation (Rocha *et al.*, 2000).

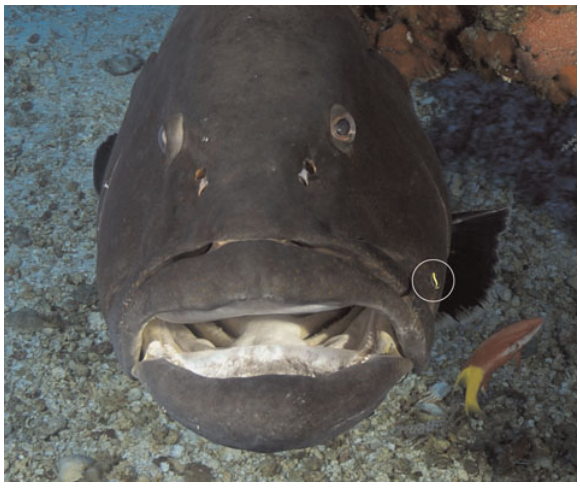

Fig. 3. Noronha goby (*Elacatinus phthirophagus*) cleans the head near the upper jaw (circle) of a black grouper (*Mycteroperca bonaci*) at a shipwreck at 62 m depth, Fernando de Noronha Archipelago, off north-eastern Brazil. The spotfin hogfish visible in the picture was cleaning the grouper as well. Photograph: Zaira Matheus.

Since the spotfin hogfish is recorded at depths up to 70 m in north-eastern Brazil (Feitoza *et al.*, 2005) and up to about 100 m in the Caribbean (Humann & DeLoach, 2002), cleaning interactions between deep-reef fish and this wrasse may be expected at depths even greater than that reported here. The same may be surmised for the Noronha goby, and perhaps some other cleaner gobies within the genus *Elacatinus*.

The cleaning interactions recorded here for *Bodianus pulchellus* and *Elacatinus phthirophagus* at deep-reef habitat followed the same general patterns of interactions reported for shallower areas, i.e. cleaning stations tended in accordance to the general habits of the cleaner species, fish clients remaining stationary while cleaned, changes in clients' coloration, and clients' body parts explored by the cleaners (e.g. Johnson & Ruben, 1988; Sazima & Moura, 2000; Francini-Filho & Sazima, 2008). However, due mostly to impoverishment of the number of species and individuals of potential client fish at deeper areas (Thresher & Colin, 1986; Feitoza *et al.*, 2005; Luiz Jr *et al.*, 2008) a few differences, such as number of interactions and/or clients, as well as clients' species composition, may be expected for cleaning interactions at deep and shallow reefs.

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