Marine Biodiversity Records, page 1 of 4.
doi:10.1017/S1755267215001074; Vol. 8; e136; 2015 Published online

First record of colour abnormalities in the bocon toadfish *Amphichthys cryptocentrus* (Valenciennes 1837) (Teleostei: Batrachoididae)

CLÁUDIO L.S. SAMPAIO[1], JOSÉ DE ANCHIETA C.C. NUNES[2], RAPHAEL M. MACIEIRA[3] AND JOSÉ AMORIM REIS-FILHO[2]

[1]Universidade Federal de Alagoas, Unidade de Ensino Penedo, Av. Beira Rio, s/no, Centro Histórico, Penedo, AL, 57.200-000, Brazil, [2]Programa de Pós-Graduação em Ecologia e Biomonitoramento and Laboratório de Ecologia Bentônica, Instituto de Biologia; Universidade Federal da Bahia, R. Barão de Geremoabo, s/no, Ondina, Salvador, BA, 40.170-000, Brazil, [3]Laboratório de Ictiologia Aplicada – Labpeixe; Complexo Biopráticas, Universidade Vila Velha – UVV, R. Comissário José Dantas de Melo, 21, Boa Vista, Vila Velha, ES, 29.102-770, Brazil

The batrachoidid Amphichthys cryptocentrus *is an estuarine reef-associated species, characterized by a body of a uniformly dark background colour and head greatly depressed. We report colour abnormalities for this species, based on two specimens collected in the south-western Atlantic. Additionally, morphometric data and information about the species' feeding habits and reproduction are provided. One specimen (most of the body was non-pigmented) exhibited small dark spots over a uniformly white body, but eyes were normally pigmented. Another specimen (totally non-pigmented) was oculocutaneous albino, lacked body pigmentation and eyes were pink-reddish translucent. Potential effects of these colour abnormalities on their ecology and behaviours are discussed.*

Keywords: batrachoidids, Brazil, albinism, hypomelanosis, estuarine-reef fish

Submitted 16 February 2015; accepted 6 August 2015

INTRODUCTION

Many anomalies in fish have been described, including colour abnormalities (Dawson, 1964, 1966, 1971; Dahlberg, 1970; Brown & Núñez, 1998; Macieira *et al.*, 2006; Simon *et al.*, 2009; Piorski & Nunes, 2010). Hypermelanosis (e.g. Simon *et al.*, 2009), hypomelanosis (e.g. Venizelos & Benetti, 1999; Burton, 2010), ambicoloration (only flatfishes, see Macieira *et al.*, 2006) and albinism (e.g. Gudger, 1937; Venizelos & Benetti, 1999; Piorski & Nunes, 2010) are some examples of colour abnormalities in marine fish. Albinism in fish refers to the absence of skin pigmentation, rather than it being associated solely with a hereditary characteristic. The diagnostic feature of oculocutaneous albinism is the lack of pigmentation on the skin and retina (Witkop, 1989). In fish, colour abnormality has important economic significance because it can deter the consumer from buying. When associated to skeletal malformations (which affect body development) (Burton, 2010; see Shikano, 2005), alterations from typical behaviour may have important ecological implications (Sazima & Pombal, 1986). Abnormalities are also linked to lower market values and higher production costs in aquaculture.

Although hypomelanosis has been reported to many marine fish species in the Atlantic Ocean (Lopes & Muratori, 1991; Feitoza *et al.*, 2003; Sampaio *et al.*, 2006), examples of chromatic anomalies, such as true albinism and intermediary stages, have seldom been described in marine fishes (Deynat, 2003). In Brazil, reported cases of albinisms are limited to a few freshwater teleosteans (Sazima & Pombal, 1986; Brito & Caramaschi, 2005) and to one species of Chondrichthyes (Teixeira & Araújo, 2002). Among Western Atlantic Batrachoidiformes, oculocutaneous albinism has recently been reported to the pacuma toadfish *Batrachoides surinamensis* (Bloch & Schneider, 1801) in north-east Brazil (Piorski & Nunes, 2010). The family Batrachoididae is represented in Brazil by six genera and 13 species, including *Amphichthys cryptocentrus* (Valenciennes, 1837). The bocon toadfish, *A. cryptocentrus*, is typically found in shallow waters of reef and estuarine environments and it has been recorded from Central America (Panama) to Bahia State (Brazil) (Collette, 2002; Menezes, 2003). Here, we report the first record of oculocutaneous albinism and hypomelanosis for *A. cryptocentrus* and present information on the biology of the species.

MATERIALS AND METHODS

Two specimens of *Amphichthys cryptocentrus* with chromatic abnormalities were collected in June and July 2003 by professional collectors of marine ornamental fish in coral reefs and rocky shores inside Todos os Santos Bay, Salvador City, Bahia

Corresponding author:
J.A. Reis-Filho
Email: amorim_agua@yahoo.com.br

State, Brazil (see for details: Nunes *et al.*, 2013; Reis-Filho & Santos, 2014). One specimen had oculocutaneous albinism and the second specimen exhibited hypomelanosis. In order to assess morphological differences, another specimen with normal coloration was also captured for comparison (Figure 1A–C). Specimen identification followed (Menezes & Figueiredo, 1998) and measurements were made with callipers. Morphometric data are expressed as a percentage of the standard length (SL).

Three specimens of both abnormal and normal chromatic fish were captured and placed in aquaria (40 cm width × 100 cm length × 60 cm height; 240 SL). Once the acclimatization period was completed (2 h), we recorded their behaviours over a 4 h period. The three specimens were photographed, examined and deposited at the fish collection of the Universidade Estadual de Feira de Santana (LIUEFS).

RESULTS

The oculocutaneous albine specimen (LIUEFS 5739, 140.5 mm SL), which exhibited a total lack of body pigmentation, had the characteristic pink-red translucid eyes and exposed the blood vessels. The hypomelanistic (LIUEFS 5842, 139.8 mm SL) specimen exhibited small dark spots over a uniformly white body and had normally pigmented eyes. Both specimens that exhibited chromatic abnormalities were juveniles, but their sex could not be determined. Analysis of the stomach contents of the hypomelanistic revealed the presence of the Xanthid crab *Cronius ruber* (Lamarck, 1818) and two unidentified Nematoda. The stomachs of the other two specimens were empty. The normally pigmented specimen (LIUEFS 6225, 297.6 mm SL) exhibited a uniformly dark body that is characteristic of the species as described in Figueiredo & Menezes (1978) and Collette (2002). Table 1 provides a comparison of morphometric data in *Amphichthys cryptocentrus*, based on specimens captured in Todos os Santos Bay. In addition to the unmistakable distinction in pigmentation, there were few morphometric and meristic measures that were different between the examined fish. The individual with normal pigmentation showed lower values in the length of dorsal fin and diameter of the eye when compared to the other individuals that were clearly non-pigmented.

The behavioural notes taken whilst the fish were kept in aquaria showed that oculocutaneous albino and hypomelanistic individuals presented clear signs of stress (biting of a hand-net left in the tank, searching for darker areas of the tank and producing sound). The *A. cryptocentrus* with normal pigmentation, however, had a behaviour similar to that observed in the natural environment, sheltering near the rocks and sediment contained inside of the aquaria.

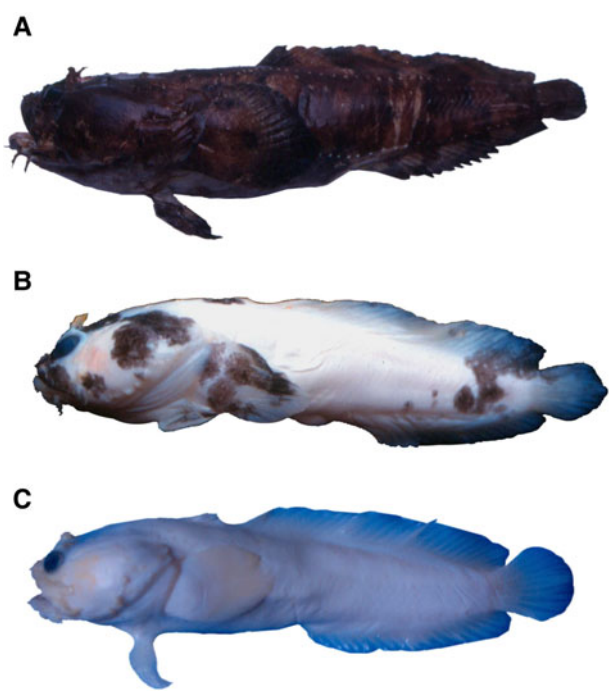

Fig. 1. *Amphichthys cryptocentrus*: (A) normal pigmentation, (B) hypomelanistic and (C) oculocutaneous albino.

DISCUSSION

Sedentary fish species have a wide range of structural and colour adaptions that render them cryptic in their habitat (Brito & Caramaschi, 2005). Several species that live close to the substrate, like the *Amphichthys cryptocentrus*, are partly camouflaged by their similarity to their background. The chromatic abnormalities observed in *A. cryptocentrus* may be regarded as disruptive in its habitat. It has been hypothesized that albinism has little influence on nocturnal or cryptic fish species, which would not be noticed by their predators (Sazima & Pombal, 1986). Albinism, therefore, would have little influence on the longevity of fishes such as batrachoidids (Piorski & Nunes, 2010), which are solitary,

Table 1. Meristics and morphometric of *Amphichthys cryptocentrus* from the Todos os Santos Bay, Bahia, north-east Brazil.

Counts and measurements	Normal LIUEFS 6225	Albino LIUEFS 5739	Hypomelanistic LIUEFS 5842
Number of dorsal fin rays	29	28	28
Number of anal fin rays	24	23	23
Number of pectoral fin rays	21	22	22
Number of pores on the upper lateral line	35	34	32
Pores on the lower lateral line	32	33	31
Standard length (mm)	297.6	140.5	139.8
Height[a]	23.3	23.6	25.8
Predorsal distance[a]	41.8	43.2	45.2
Pre-anal distance[a]	58.3	52.8	56.0
Pre-pelvic distance[a]	26.1	25.0	24.3
Caudal peduncle width[a]	7.4	9.0	7.6
Length of pectoral fin[a]	22.2	18.8	19.0
Length of pelvic fin[a]	14.6	16.1	15.8
Length of caudal fin[a]	12.9	17.3	16.6
Length of dorsal fin base[a]	8.7	12.9	10.7
Length of anal fin base[a]	55.8	56.6	53.5
Head length[a]	40.3	42.5	39.2
Snout length[a]	4.7	5.2	5.0
Diameter of the orbit[a]	5.4	6.4	6.5
Postorbital distance[a]	24.7	24.3	23.8
Interorbital distance[a]	7.5	7.4	6.6

[a]Morphometric data expressed as percentage of standard length.

have cryptic habits, may live partially buried or in crevices and exhibit nocturnal activity. However, chromatic abnormalities followed by unusual behaviour exhibited by *A. cryptocentrus* (as seen in this report inside the aquaria), could aid visually oriented predators, particularly when it occurs in the natural environment. Brito & Caramaschi (2005) observed this increase in predation risk in non-pigmented loricarrids (albino specimens) found in a tropical South American river.

The international marine fish ornamental trade pays high amounts for rare species or specimens that exhibit chromatic abnormalities (Michael, 2001; Wood, 2001; Sampaio *et al.*, 2006). This may explain the capture of the two specimens of *A. cryptocentrus* by professional collectors of ornamental fishes, where normally the pigmented individuals have market value in Bahia State and those with abnormal colours are only rarely traded for ornamental purposes (C.L.S. Sampaio, personal observation).

Records of albinism in *Mustelus schmitti* (Springer, 1939) from Rio Grande do Sul (southern Brazil) (Teixeira & Araújo, 2002); hypomelanosis in *Genidens genidens* (Cuvier, 1829) associated with underwater observations of other non-pigmented fish specimens at the Baía de Guanabara, Rio de Janeiro State (south-eastern Brazil) (Lopes & Muratori, 1991); a recent record of *Batrachoides surinamensis* (Batrachoididae) at Ilha do Maranhão, Maranhão State (north-eastern Brazil) (Piorski & Nunes, 2010); abnormal pigmentation patterns in Achiridae from the Piraquê-Açú Estuary, Espírito Santo (Venizelos & Benetti, 1999; Macieira *et al.*, 2006) and partial melanism in the coney *Cephalopholis fulva* (Epinephelidae) near Escalvada islands (Espírito Santo state) (Simon *et al.*, 2009) suggest the hypothesis that colour abnormalities in fish are more common in nocturnal and/or cryptobenthic species than in diurnal or non-cryptic ones. The additional records of *A. cryptocentrus*, therefore, lend further support to this hypothesis.

ACKNOWLEDGEMENTS

Special thanks to Samuele Clerici and Bernardo Linhares for kindly donating the specimens of *Amphichthys cryptocentrus*; Ierece Rosa (Universidade Federal da Paraíba) and Lili Colman (University of Exeter) for paper review; Paulo Roberto Lopes for depositing specimens at LIUEFS fish collection and to CNPq and CAPES for providing research fellowships to the authors. Thanks also to Dive Bahia for their constant support during fieldwork.

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Correspondence should be addressed to:
J.A. Reis-Filho
Programa de Pós-Graduação em Ecologia e Biomonitoramento and Laboratório de Ecologia Bentônica, Instituto de Biologia Universidade Federal da Bahia, R. Barão de Geremoabo s/no, Ondina, Salvador, BA, 40.170-000, Brazil
email: amorim_agua@yahoo.com.br