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CASE REPORT **OLGU SUNUMU**

Abnormal hermaphroditic shark *Squalus blainville* (Risso, 1826) (Chondrichthyes: Squalidae) from the Aegean Sea

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Abstract: Eighty-six specimens of longnose spurdog *Squalus blainville* were examined for determination of some bio-ecogical features. During the study, one of the specimens was determined as a hermaphrodite with a clasper and yolk sac formation. This very rare case in elasmobranch is a report of hermaphroditism recorded from the Aegean Sea.

Keywords: Abnormality, reproduction biology, longnose spurdog, demersal shark

INTRODUCTION

Chondrichthyes have wide of reproductive type, including oviparity, aplacental and placental viviparity, with several variations while all species are considered gonochoristic. Hermaphroditism is defined by Atz (1964) as the existence of both sexes in a single specimen and is very rare in elasmobranchs. At the same time, examples of hermaphroditism have been observed in different elasmobranch species [longhead catshark *Apristurus longicephalus* (Iglesias et al., 2005), bigeye houndshark *Iago omanensis* (Barnes et al., 2018), portjackson shark *Heterodontus portusjacksoni* (Jones et al., 2005), brown lantern shark *Etmopterus unicolor* (Yano and Tanaka, 1989), southern lantern shark *Etmopterus granulosus* (Irvine et al., 2002), velvet belly *Etmopterus spinax* (Costa et al., 2013), lesser spotted dogfish *Scyliorhinus canicula* (Murray and Baker, 1924), blue shark *Prionace glauca* (Pratt, 1979), blacktip shark *Carcharhinus limbatus* (Hendon et al., 2013), pelagic stingray *Pteroplatytrygon violacea* (Ribeiro-Prado et al., 2009), brazilian guitarfish *Rhinobatos horkelii* (Gianeti and Vooren, 2007), multispine skate *Bathyraja multispinis* (Scenna et al., 2007), Black Dogfish, *Centroscyllium fabricii* (Yano, 1995), Blackmouth Catshark, *Galeus melastomus* (D'Iglio et al., 2022), longnose spiny dogfish *Squalus blainvillei* (Kousteni and Megalofonou, 2010)].

The longnose spurdog *Squalus blainvillei* (Risso, 1826) is a benthic shark with aplacental viviparous positioned at the top of the trophic web that is widely distributed in the Eastern and Western Atlantic, Mediterranean (Anastasopoulou et al., 2017; Serena, 2005; Dunn et al., 2013). Squalids are not the target species in Mediterranean fisheries and are often considered by-catch (Serena et al., 2009).

The present paper details a very rare occurrence of abnormal hermaphroditism in *Squalus blainville* specimen from the Aegean Sea.

MATERIAL AND METHODS

The eighty-six specimens of *S. blainville* were collected from the fish market in İzmir on July 2019 for bio-ecological studies. These specimens, which were transferred to Izmir Fish Market, were caught by bottom trawl. One of these specimens showed abnormalities in the reproductive system with having both clasper and female specific yolk sac (Figure 1). The total length, total body weight and lengths of clasper (from the anterior end of the cloaca to the distal tip of the clasper) of the abnormal hermaphrodite specimen were recorded. This sample was stored in 4% formalin solution after photographing. The collected specimen was deposited in the Fish Collection Centre of İzmir Kâtip Çelebi University (IKC.PIS.1259).

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Figure 1. Abnormal Hermaphroditic *S. blainville* of 47 cm TL, Ys, Yolk sac; C, claspers

RESULT AND DISCUSSION

The specimen with 47 cm total length was detected as a male with claspers due to external morphologic examination. However, when it was dissected, a female gonad formation with yolk sac had been found which signs of hermaphroditism (Figure 1). There are two yolk sacs with a diameter of 2.3-2.7 cm.

In cartilaginous fish, the claspers, which are unique to males, are structures derived from the pelvic fin that allow the transfer of sperm to the female. Unmatured males, the clasper length is shorter than the pelvic fin, but exceeds the pelvic fin length in mature males (D'Iglio et al., 2022). It was found that the claspers of the hermaphrodite specimen were less developed than other same size mature males (Table 1).

Table 1. Comparisons of measurements between recorded abnormal hermaphrodite specimens and twelve mature males of *Squalus blainville*

	Hermaphrodite	Mature males	
		Mean	Range
Total length (mm)	470	470.4	420-530
Total weight (g)	486	475.91	348-684
Clasper length (mm)	15.76	43.31	30.98-55.72

Similarly, Iglesias et al. (2005) and Pratt (1979) reported that the clasper length of the hermaphrodite female specimens is smaller than gonochoristic males *Apristurus longicephalus* and *Prionace glauca,* respectively and Iglesias et al. (2005) used the definition of "functional female" for these hermaphrodite specimens. In addition, Barnes et al. (2018) has pointed out the simultaneous clasper formation in the presence of developed female sexual organs for the hermaphrodite *Iago omanensis* species, which is in concordance with our findings. Differently from this, Kouesteni and Megalofonou (2010) reported a *S. blainville* specimen with an internal male reproductive organ without claspers. Yano (1995) detected abnormal hermaphroditism in only 4 of the 2600 *E. fabricii* samples examined. Until now, the case of hermaphroditism has been reported in seven species of Squalidae (Irvine et al., 2002; Kouesteni and Megalofonou, 2010) and mostly seen in Squaliformes among Chondrichthyes (Gianeti and Vooren, 2007). Hermaphroditism is described as by abnormal and normal hermaphrodite by Atz (1964) and Iglesias et al (2005), while 'pseudo-hermaphrodite' and 'true hermaphrodite' terms are described by Irvine et al. (2002). Considering these, our findings are consistent with the definition of abnormal or pseudo-hermaphrodite.

The reasons for hermaphroditism in chondrichthyans are complex and difficult to explain (Atz, 1964). Hermaphroditism in sharks may be a sign of developmental anomaly, but it is known that anthropogenic contamination (man-made chemicals, including organochlorine pesticides, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, surfactants and plasticisers) affects the reproductive behaviour of marine organisms (Colborn and Clement, 1992; Sumpter et al., 1996; Devlin and Nagahama, 2002; De Metrio et al., 2003). In addition, compounds containing even in low concentrations synthetic chemicals such as birth control pills are known to cause sex change in wild fish populations (Rana et al., 2015).

The Mediterranean elasmobranch community is thought to suffer from strong depletion because of overfishing. Besides, considering the possibility of the increasing number of effects, such as anthropogenic contamination that are aforementioned, would make elasmobranch populations more fragile.

Spurdogs are benthic species mostly living on the soft bottom in inshore and offshore waters and are likely to accumulate pollution. In conclusion, these abnormalities in the reproductive biology of demersal sharks, such as *S. blainville* should be subject to further investigations.

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AUTHORSHIP CONTRIBUTIONS

Uğur Özden: Sampling, writing – original draft preparation. Erhan Irmak: Sampling, methodology, conceptualisation, reviewing, editing.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest or competing interests.

ETHICS APPROVAL

No specific ethical approval was necessary for this study.

DATA AVAILABILITY

The data supporting the conclusions of this paper are available in the main paper.

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