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## RECORD OF DICEPHALOUS EMBRYO IN LONGNOSE SPURDOG *SQUALUS BLAINVILLEI* (CHONDRICHTHYES: SQUALIDAE) FROM THE SYRIAN COAST (EASTERN MEDITERRANEAN)

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### ABSTRACT

*This paper reports the first record of a dicephalous specimen of *Squalus blainvillei* (Risso, 1810) from the Syrian coast and the second known to date for this species – a female embryo of longnose spurdog, reaching 200 mm in total length, probably a near-term embryo despite the presence of an external yolk sac. The causes of this abnormality are discussed and commented.*

**Key words:** Chondrichthyes, Squalidae, *Squalus blainvillei*, viviparous aplacental species, conjoined twins, Eastern Mediterranean

## RITROVAMENTO DI UN EMBRIONE DICEFALO DI SPINAROLO BRUNO *SQUALUS* *BLAINVILLEI* (CHONDRICHTHYES: SQUALIDAE) LUNGO LA COSTA SIRIANA (MEDITERRANEO ORIENTALE)

### SINTESI

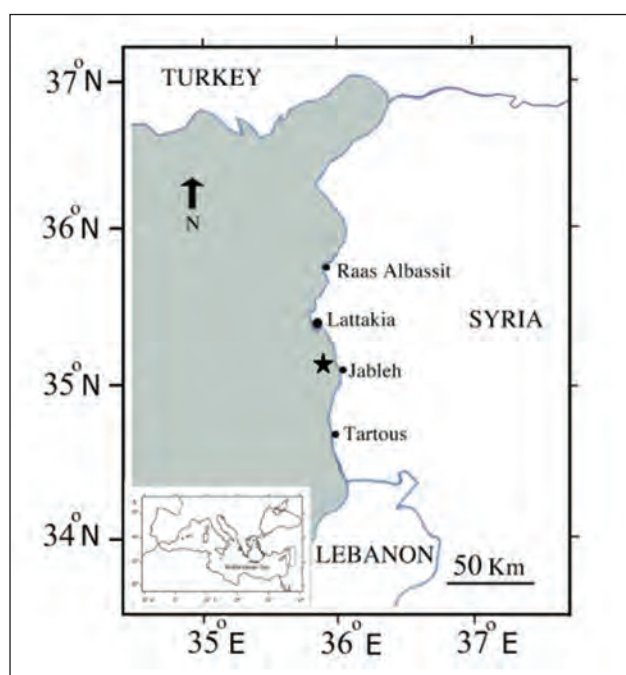
*L'articolo riporta il primo ritrovamento di un esemplare dicefalo di *Squalus blainvillei* (Risso, 1810) lungo la costa siriana, ossia il secondo a oggi segnalato per questa specie. Si tratta di un embrione femminile di spinarolo bruno, della lunghezza totale di 200 mm, probabilmente in fase embrionale terminale nonostante la presenza di un sacco vitellino esterno. Le cause di quest'anomalia vengono discusse e commentate.*

**Parole chiave:** Chondrichthyes, Squalidae, *Squalus blainvillei*, specie aplacentali vivipare, gemelli siamesi, Mediterraneo orientale

## INTRODUCTION

Following Dawson (1964, 1966, 1971) and Dawson & Heal (1971), Ribeiro-Prado *et al.* (2008) noted that three categories of abnormalities could be distinguished in fish species: colour (full or partial albinism), genital apparatus (total, semi or pseudo hermaphroditism) and morphological deformities (teratological cases, also called 'monstrosities' by the authors), with the latter being the most frequently reported category in elasmobranch species. To date, two lists summarizing the abnormalities recorded in elasmobranch species have been compiled, one including all elasmobranch species (Saïdi *et al.*, 2006) and the other only skates and rays (Ribeiro-Prado *et al.*, 2008).

Different abnormalities were listed for sharks – most commonly, snout deformities, skeletal deformities and abnormal and/or missing fins –, however, of the 33 cases reported only two concerned dicephalic embryos (Saïdi *et al.*, 2006), also known in literature as two-headed or dicephalous sharks (see Sans-Coma *et al.*, 2017). According to Bondeson (2001), the term dicephalous applies to conjoined specimens with totally separated heads on a single body, while the term diprosopus refers to a single body and head, with only parts of the latter duplicated (Sans-Coma *et al.*, 2017).



**Fig. 1:** Map of the Mediterranean showing Syria, and map of the Syrian coast indicating the capture site of the dicephalous *Squalus blainvillei* (black star).

**Sl. 1:** Zemljevid Sredozemskega morja in Sirije z označeno lokaliteto vzdolž sirske obale, kjer je bil ujet dvoglavi primerek vrste *Squalus blainvillei* (črna zvezdica).

Generally, such deformities are only observed in embryos, as these do not survive after laying or hatching in the wild (Galván-Magaña *et al.*, 2011). The aim of this paper is to report a new record – a two-headed embryo removed from a normal adult female of a longnose spurdog *Squalus blainvillei* (Risso, 1826) caught off the Syrian coast – and to complete the Sans-Coma *et al.*'s review (2017) concerning the dicephalous sharks known to date.

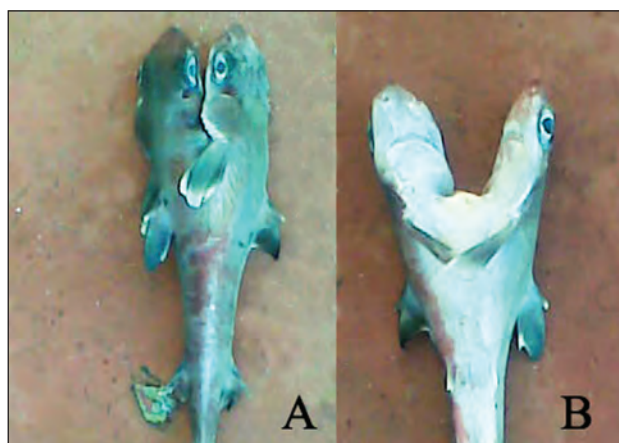
## MATERIAL AND METHODS

On 13 February 2013, a shark carrying a dicephalous embryo was captured off the Syrian coast, by trawl net, on sandy bottom, at a depth of about 50 m. The capture site was located 5 km off the beach of Jablah, a Syrian coastal town, at 35° 44' E, 35° 24' N (Fig. 1). Due to the rarity of the abnormal specimen, it was impossible for us to recover it from the fishermen, so unfortunately, it is not preserved in an ichthyological collection. Our study is thus mainly based on photographs (see Figs. 2 and 3).

## RESULTS AND DISCUSSION

The adult shark was identified following McEachran & Branstetter (1984) and Louisy (2002), based on a combination of morphological characters, such as: origin of first dorsal spine on a vertical with inner pectoral corner, dorsal surface without white spots, anterior nasal flap with a small, but distinct lobe. McEachran & Branstetter (1984) and Louisy (2002) noted that *Squalus blainvillei* could be distinguished from its close relative species, spurdog *S. acanthias* Linnaeus, 1758, by the presence of white spots and the lack of lobe in the nasal flap in the latter.

The respective dicephalous specimen was a female embryo measuring 200 mm in total length (TL), with



**Fig. 2:** Dicephalous *Squalus blainvillei* captured off the Syrian coast. A. dorsal surface, B. ventral surface.

**Sl. 2:** Dvoglavi primerek vrste *Squalus blainvillei*, ujet ob sirske obali. A. hrbtna stran, B. trebušna stran.

a single body, normal fins and two heads originating anteriorly to the gills. Each head exhibited a mouth, two eyes, two spiracles and two gill openings. The body of the embryo was supported by two well-developed vertebral columns and ended with a single caudal fin (Figs. 2A and 2B). The size of the specimen corresponded to that of near-term embryos; for instance, Quignard (1971) reported that size at birth for the *S. blainvillei* from the Tunisian coast occurred between 210 and 240 mm TL, Capapé *et al.* (2000) reported it between 224 and 255 mm TL for the Languedocian coast, southern France, and Kousteni & Megalofonou (2011) between 180 and 229 mm TL for the eastern Mediterranean. A large external yolk sac appears in Fig. 3, characteristic of viviparous aplacental shark species generally resorbed in an internal vitelline vesical in near-term embryos (see Capapé & Reynaud, 2011). This yolk sac is unique to the dicephalous embryo and could explain its large size.

Following Sans-Coma *et al.* (2017), it is the second record of a dicephalous specimen of *Squalus blainvillei* known to date, the first being the specimen found by Lozano Cabo (1945) off the Spanish Mediterranean coast. Therefore, three cases of dicephaly were found in viviparous aplacental shark species and only one in an oviparous shark species, Atlantic saw tail cat shark *Galeus atlanticus* (Vaillant, 1888), which, following Sans-Coma *et al.* (2017), suggests that dicephaly is more common in viviparous placental shark species. To this regard, Galván-Magaña *et al.* (2011) stated that *Prionace glauca* could register the highest number of two-headed embryos due to the fact it is one of the most fecund sharks in the world, its litter reaching up to 50 specimens. The abnormality is assumed to begin during the embryonic development. In viviparous aplacental sharks, the embryos are free in the mother's uteri conversely, while in viviparous placental sharks, each embryo is confined to a restricted chamber and attached to the uterine wall by an umbilical stalk, with such conditions presumably facilitating an abnormal development during gestation.

Ehemann *et al.* (2016) noted that two-headed shark embryos were more common in the wild than in captivity, and stated that such abnormalities might be caused by overfishing. Additionally, Galván-Magaña *et al.* (2011) noted that scientists frequently reported these anomalies, and that two-headed sharks had become more prevalent. However, unfavourable environmental conditions such as large exposure to pollutants, play an important role in the occurrence of abnormalities in elasmobranchs and Ribeiro-Prado *et al.* (2008) explain why they are more frequently observed in oviparous than viviparous species: the former develop their eggs in



**Fig. 3: Dicephalous *Squalus blainvillei* captured off the Syrian coast, with the arrow indicating the yolk sac.**

**Sl. 3: Dvoglavi primerek vrste *Squalus blainvillei*, ujet ob sirski obali. Zvezdica označuje rumenjarkovo vrečo.**

the wild, whereas in the latter, the embryos are protected by the mother during their embryonic development. Similar patterns have been reported in our study area, abnormalities were described in two skates species, thornback ray *Raja clavata* Linnaeus, 1758, and long-nosed skate *Dipturus oxyrinchus* (Linnaeus, 1758), by Capapé *et al.* (2015a, b).

Abnormalities in elasmobranch species in the wild are the consequence of different and various parameters, including viruses, pollutants, and especially genetic factors. In complete agreement with Ehemann *et al.* (2016) and Sans-Coma *et al.* (2017), we can say it remains difficult to conduct a research about the birth defects affecting sharks, dicephaly in particular, as two-headed specimens are still rare and probably unable to survive in the wild.

## DVOGLAVI RJAVI TRNEŽ *SQUALUS BLAINVILLEI* (CHONDRICHTHYES: SQUALIDAE) IZ SIRSKO OBALE (VZHODNO SREDOZEMSKO MORJE)

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### POVZETEK

Avtorja poročata o prvem primeru pojavljanja dvoglavega primerka vrste *Squalus blainvillei* (Risso, 1810) iz sirske obale in o drugem znanem dozdaj za to vrsto. Zarodek samice rjavega trneža, ki je meril 200 mm v dolžino, je bil v sklepni fazi, čeprav je še vedno imel zunanjo rumenjarkovo vrečo. Avtorja nadalje razpravljata o tej anomaliji.

**Ključne besede:** Chondrichthyes, Squalidae, *Squalus blainvillei*, živorodna aplacentalna vrsta, siamska dvojčka, vzhodno Sredozemsko morje

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