

First Observation of a Pregnant Tiger Shark (*Galeocerdo cuvier*) at Reunion Island, Western Indian Ocean

Sébastien Jaquemets¹, Malcolm J. Smale^{2,3}, Antonin Blaison⁴,
David Guyomard⁵ and Marc Soria⁴

¹Université de La Réunion, laboratoire ECOMAR, FRE3560 INEE-CNRS, 15 Avenue René Cassin CS92003. 97744 Saint-Denis Cedex 09. Ile de La Réunion, France; ²Port Elizabeth Museum at Bayworld, PO Box 13147, Humewood, 6013 Port Elizabeth. South Africa; ³Department of Zoology, Nelson Mandela Metropolitan University, PO Box 77000, Port Elizabeth, South Africa; ⁴UMR 212 EME, IRD de La Réunion, 2 rue Joseph Wetzell, CS 41095, 97495 Sainte-Clotilde, Ile de La Réunion, France; ⁵Comité Régional des Pêches Maritimes et des Elevages Marins de La Réunion, 47 rue Evariste de Parny, BP295, 97827 Le Port Cedex, Ile de La Réunion, France

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Abstract—The tiger shark *Galeocerdo cuvier* is a common predator in tropical oceans although its biology is still not well documented, especially in the western Indian Ocean. We report the first observation of a pregnant tiger shark captured at Reunion Island in November 2012. A total of 42 embryos without external yolk sacs, measuring 750-846 mm in total length, were found in the two uteri. The sex ratio was nearly 1:1 and males and females did not differ in size or weight. Although the embryos were fully formed, the teeth had not yet erupted through the gums, suggesting that birth would take place a few weeks later. This information is in agreement with observations made in other locations, including the limited data available for this region, suggesting that mating occurs in late winter and parturition in summer.

The tiger shark *Galeocerdo cuvier* is an apex predator commonly found in tropical regions of the world's oceans (Randall 1992). Although the species has been studied in a variety of locations, including the Gulf of Mexico (Branstetter et al. 1987), the Hawaiian Islands (Whitney & Crow 2007), the east coast of South Africa (Wintner & Dudley 2000, Aitken 2003) and Australia (Simpfendorfer 1992, Heithaus 2001), its biology is still not well documented, especially in the western

Indian Ocean. Males reach sexual maturity at 285-310 cm total length (TL), while females mature at 287-345 cm TL (Clark & van Schmidt 1965, Simpfendorfer 1992, Whitney & Crow 2007). Litter sizes can be large (10-80 embryos) and seem to be highly variable between individuals and location, although mean values typically are 30-60 embryos per litter (Bigelow & Schroeder 1948, Bass et al. 1975, Simpfendorfer 1992, Whitney & Crow 2007).

Here we report the first observation of a pregnant tiger shark captured at Reunion Island in the western Indian Ocean. The female of 384 cm TL was caught by a fisherman on the narrow shelf of the west coast of the island at a depth of ~45 m on 22 November 2012 at 10:30 am. A total of 42 embryos without external yolk sacs were found in the two uteri; one was aborted during capture. Embryos measured 750-846 mm TL and weighed 1339-1646 g. The sex ratio was 1:1.1, and males ($n = 20$; TL = 811.3 ± 16.7 mm; M = 1439.2 ± 79.9 g) and females ($n = 22$; TL = 805.3 ± 18.6 mm; M = 1444.3 ± 75.3 g) did not differ significantly both in mean TL ($U=193$, $p=0.503$) and body mass ($U=244.5$, $p=0.545$). Although fully-formed and displaying the typical body coloration, the embryos were not full-term as their teeth had not yet erupted, i.e. they were not visible, suggesting that they would have been born a few weeks later.

Records of pregnant females are uncommon in tiger sharks despite their size and prevalence in shark catches in tropical oceans (Randall 1992). One recent study conducted in Hawaii provided the first comprehensive investigation of tiger shark reproduction (Whitney & Crow 2007). In the western Indian Ocean, Fourmanoir (1961) and Bass *et al.* (1975) recorded information on the breeding biology of the species based on five specimens. Aitken (2003) recorded a female of 359 cm TL (269 cm pre-caudal length) caught in KwaZulu-Natal with 17 embryos averaging 86 cm TL. More recently, a pregnant female of ~380 cm TL, caught at Mayotte (northern Mozambique Channel) on 30 October 2009, had at least 30 embryos of ~70 cm TL (A. Jamon pers. com.; <http://www.images-photos-plongee.com/article-requin-tigre-commun-tiger-shark-galeocerdo-cuvieri-a-mayotte-ocean-indien-39440870.html>).

Data from the pregnant female caught in Reunion Island is in accordance with the size at maturity, litter size and size of late-term embryos recorded from other locations (Fourmanoir 1961, Clark & von Schmidt 1965, Bass *et al.* 1975, Branstetter *et al.* 1987,

Simpfendorfer 1992, Whitney & Crow 2007, Aitken 2003). In addition, considering the dates of capture of pregnant females and the range in size of embryos recorded at Reunion, Mayotte, Kwazulu-Natal (Bass *et al.* 1975, Aitken 2003) and Madagascar (Fourmanoir 1961), pupping seems to occur during the austral summer in the western Indian Ocean, as has been reported for northeast Australia (Simpfendorfer 1992). On 30 November 2012, a female with well-healed bite marks on the side of the body close to the dorsal fin, characteristic of mating, was observed at Reunion (authors' pers. obs.). With a gestation period of 15-16 months (Clark & von Schmidt 1965, Whitney & Crow 2007) and sperm storage that can extend up to 4-5 months between mating and ovulation (Whitney & Crow 2007), this observation suggests that the mating period in Reunion is in late winter or early summer, as indicated by Fourmanoir (1961) for Madagascar. This is in agreement with evidence of mating during spring and pupping during spring and summer in the northern hemisphere (Randall 1992), and with pups born in late summer in Hawaii (Whitney & Crow 2007).

Sharks play an important role in structuring marine communities, although this remains poorly understood in many regions (Stevens *et al.* 2000, Ferreti *et al.* 2010). Although shark species diversity in the southwestern Indian Ocean is lower than in other regions of the Indo-Pacific (Last & Stevens 2009), the number of exploited species is high, making this area a high conservation priority for sharks (Lucifora *et al.* 2011). At Reunion Island, sharks are not highly exploited and, consequently, little is known about their biology, ecology, population size and dynamics. Sharks can be highly migratory animals, and it would be beneficial to conduct regional studies to fill gaps in our knowledge and implement efficient conservation plans that would include sustainability in the exploitation of some species. Finally, as apex predators, their conservation would improve the overall conservation of the ecosystems in which they live.

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