



## Captive nurse shark *Ginglymostoma cirratum* (Bonnaterre, 1788) breeding at Projeto Tamar, northeastern Brazil

MARIA ISABEL G. PAIVA, GONZALO G. ROSTAN, & THAIS T. PIRES

Fundação Projeto Tamar.- Av. Farol Garcia D'Ávila, s/n, Praia do Forte, Mata de São João-BA, Caixa postal 2219.

\*Corresponding author: [bebel@tamar.org.br](mailto:bebel@tamar.org.br)

**Abstract.** Nurse sharks *Ginglymostoma cirratum* are the shark species most commonly exhibited in aquariums. However, studies of their reproduction in captivity are very rare. Here we report on the first documented captive breeding of *G. cirratum* in Brazil, and one of the very few recorded worldwide.

**Key words:** reproduction, captivity, nurse shark.

**Resumo: Reprodução de tubarão-lixia *Ginglymostoma cirratum* em cativeiro, no Centro de Visitantes do Projeto Tamar, Bahia, Brasil.** O tubarão-lixia *Ginglymostoma cirratum* é a espécie de tubarão mais exposta em aquários. Entretanto, estudos da sua reprodução em cativeiro são bastante raros. Este trabalho reporta a primeira reprodução em cativeiro de *G. cirratum* no Brasil e uma das poucas registradas no mundo.

**Palavras-chave:** reprodução, cativeiro, tubarão-lixia.

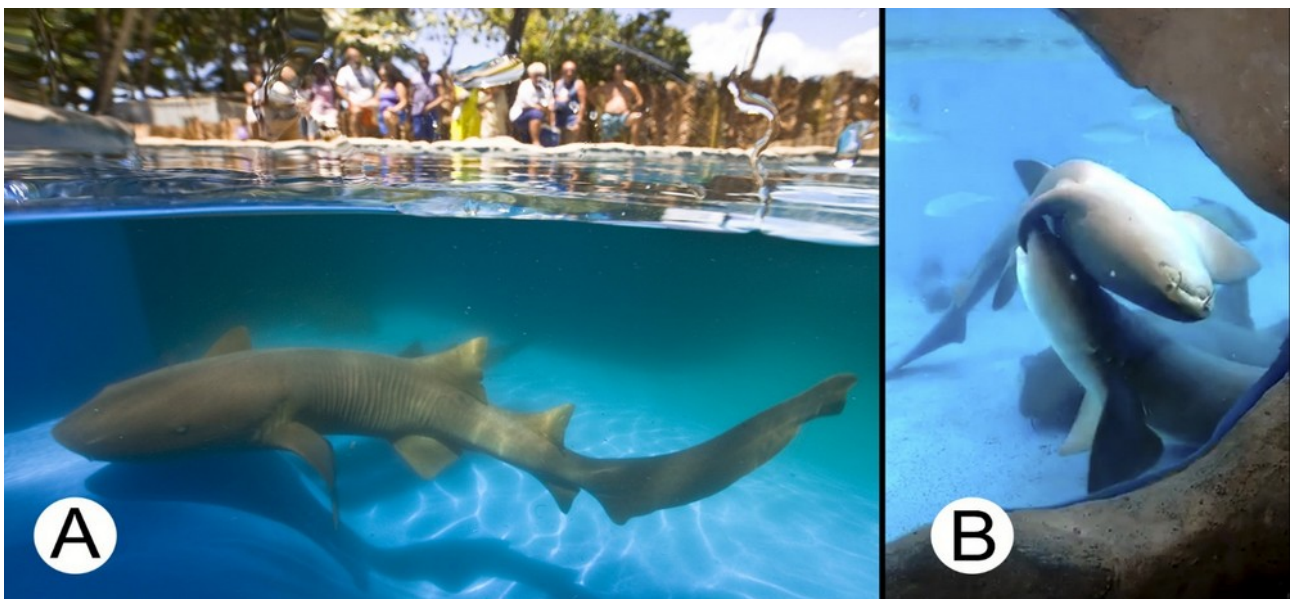
The nurse shark *Ginglymostoma cirratum* occurs in temperate and tropical waters of the Atlantic. It is a predominantly demersal species, found at depths of 1 to 75 m on sandy or rocky bottoms, and eventually observed in deeper ranges (Compagno 2001, Del Moral-Flores *et al.* 2015). Female *G. cirratum* reaches sexual maturity at a total length of 230-240 cm, while males at around 210 cm (Compagno 2001). Their reproductive cycle is biennial and consists of a five to six-month gestation period and a two-year ovarian cycle (Castro 2000). The embryos are lecithotrophic and can be found in different development stages during the first four months of gestation, measuring 28–30.5 cm at birth (Castro 2000). *G. cirratum* is included in the official List of Brazilian Endangered Species as Vulnerable and worldwide as Data Deficient by the International Union for Conservation of Nature (IUCN) (Rosa *et al.* 2006, Rosa & Gadig 2009). Over the past three decades, captive husbandry techniques have improved, allowing the study of their reproductive biology (Gonzalez 2006), growth (Govender *et al.*

1991), size at sexual maturity and other lifecycle parameters (Gruber & Keyes 1981, Uchida *et al.* 1990, Smith 1992, Gonzalez 2004). *Ginglymostoma cirratum* present easy adaptation and long-term survival in captivity (Castro 2000), therefore being one of the shark species most commonly displayed in aquariums and public exhibits around the world. At Projeto Tamar's largest Visitor Centre, in Praia do Forte, northeastern Brazil, three *G. cirratum* individuals, one 2.47 m male and two females (2.34 m and 2.55 m respectively), accidentally captured by local fishermen, have been kept on public display since the early 2000's for educational and conservation purposes. The shark tank holds 190,000 litres of water, has two chambers of different depths (2 and 3.40 m), and ultraviolet and ozone systems are used to maintain water quality, 10% of which is replaced daily (Fig.1).

Reproductive behaviour, involving the male and the larger of the two females, was first observed at the end of 2012 (during November and December). Subsequently, during April and May,



**Figure 1.** Shark tank, *Ginglymostoma cirratum*, at Projeto Tamar.



**Figure 2.** **A-** The larger *Ginglymostoma cirratum* breeding female. **B-** Active breeding behaviour display.

empty egg cases were found on the bottom of the tank, while the female continued to display active breeding behaviour (Fig. 2). On 1<sup>st</sup> June 2013, the first live pup was born (Fig. 3), followed by several others, totalling 13 pups, 8 females and 5 males (Table I). Two years later, the same female gave birth to two other pups (Fig. 4), both males, during April 2015.

Shortly after birth, the pups were moved to a smaller 10,000-litre open-system tank with constant-flow circulation, to allow closer observation of their

development and avoid predation from the adult sharks. New-born weights and lengths are described in Table I. Four pups survived and their development continues to be consistently monitored to this date.

Comprehensive field studies of nurse shark reproductive behaviour and biology are rare (Pratt & Carrier 2001). In addition, little has been published on the reproductive biology of captive elasmobranchs, when compared to studies in the wild (Henningsson *et al.* 2004). Carrier *et al.* (1994) suggested the behaviour of captive animals often



**Figure 3.** Nurse shark pup, *Ginglymostoma cirratum*, from the first breeding episode.

**Table I.** Sex, birth date and new-born length and weight of nurse sharks *Ginglymostoma cirratum* born at Projeto Tamar (M – male, F – female).

Sex	Birth	Length (cm)	Weight (g)
M	01/06/2013	27	100
F	29/06/2013	23.5	90
F	29/06/2013	24	90
F	05/07/2013	25.5	80
F	07/07/2013	25.5	110
F	10/07/2013	24.5	90
F	11/07/2013	24.5	90
M	11/07/2013	24	90
F	19/07/2013	26	110
F	20/07/2013	24	70
M	01/08/2013	24	80
M	04/08/2013	26	80
M	05/08/2013	23	50
M	19/04/2015	21.5	60
M	20/04/2015	20.5	60

differs significantly from what is observed in wild populations. The reproductive behaviour of *G. cirratum* in captivity at Projeto Tamar, on the other hand, followed the same pattern described by Castro (2000) in the wild, with a two-year ovarian cycle (June 2013 and April 2015). Several captive

breeding studies reported low reproductive success rates (Henningsen *et al.* 2004, Koop 2005), with frequent release of wind eggs (Carrier *et al.* 2003, Henningsen *et al.* 2004). Here we described the successful birth of live pups, though in smaller numbers than those described in the wild, with 13 and two pups born on the first and second breeding episodes respectively, as opposed to 30 and over described by Castro (2000). This may be explained by the presence of a single male in the tank, as multiple paternity has been suggested by Saville *et al.* (2002) as an important element in *G. cirratum* reproduction. Previous descriptions of reproductive success in controlled environments are restricted to a semi-captive situation (Kuenen 2000), which highlights the high relevance of the results described here, particularly because *G. cirratum* is a threatened species in Brazil. The results presented herein contribute to our understanding of the nurse shark breeding process in captivity for conservation purposes.

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**Figure 4.** Nurse shark pups, *Ginglymostoma cirratum*, from the second breeding episode.

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