Clarification of field characters for three freshwater sharks and a photographic atlas of Glyphis glyphis and G. garricki from the Adelaide River, Northern Territory, Australia

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ABSTRACT

Eighty-two Glyphis glyphis, one G. garricki and two Carcharhinus leucas were caught at six localities in the Adelaide River on 66 gill-netting trips from mid-May to mid-December during 2001, 2003–05 and 2009. Photographs are presented that differentiate these euryhaline sharks. The small second dorsal fin of C. leucas clearly separates it from Glyphis species. The waterline (i.e. junction of dark dorsal and pale ventral colouration) on G. glyphis extends just under the eye whereas it extends well below the lower margin of the eye in G. garricki. Photographs showing shark bite marks on other species are presented. Because of the presence of G. glyphis under 610 mm TL with umbilical scars, it is postulated that Marrakai Creek is a nursery area and an important juvenile habitat of this species especially from September–December.

KEYWORDS: Adelaide River, Bull Shark, Northern River Shark, Speartooth Shark, Carcharhinus leucas, Glyphis garricki, Glyphis glyphis.

INTRODUCTION

Thirty-one of the 54 known species of whaler sharks (family Carcharhinidae) are found in Australia and three of these can occur far up rivers well into fresh water (Last & Stevens 2009). Prior to the commencement of Nurseryfish (Kurtus gulliveri) life history studies in 2001 (Berra 2003; Berra et al. 2007 and papers cited therein), the Speartooth Shark (Glyphis sp. A) and the Northern River Shark (Glyphis sp. C) (Last & Stevens 1994) were undocumented from the Adelaide River. Glyphis sp. A was subsequently determined to be conspecific with Glyphis glyphis (Müller & Henle, 1839) and Glyphis sp. C was described as a new species, G. garricki (Compagno, White & Last, 2008). DNA barcoding, based on mitochondrial cytochrome oxidase I gene (cox 1) sequences supported the taxonomic placement and separation of the two species of Glyphis (Wynen et al. 2009).

The cosmopolitan Bull Shark, Carcharhinus leucas (Müller & Henle, 1839) (Fig. 1A), is known from many of Australia’s northern rivers including the Ord, Daly, Adelaide, and East Alligator (Berra 2007; Last & Stevens 2009). Carcharhinus amboinesis (Müller & Henle, 1839) is morphologically very similar to the Bull Shark, but much less likely to be found upstream in fresh water (Last & Stevens 2009). The extent of Speartooth Shark, G. glyphis (Fig. 1B), distribution is unknown, but it has been taken from the Alligator Rivers of the Northern Territory in addition to the Adelaide River, as well as from the Bizant and Wenlock Rivers of Queensland and the Fly River in southern New Guinea (Peverell et al. 2006; Compagno et al. 2008; Pillans et al. 2009). The Northern River Shark, Glyphis garricki (Fig. 1C), has an uncertain distribution in parts of southern New Guinea and northern Australia including the entrance to Cambridge Gulf, King Sound, Ord River and Doctors Creek in Western Australia, and the Adelaide, East, and South Alligator Rivers in the Northern Territory (Thorburn & Morgan 2004; Compagno et al. 2008; Pillans et al. 2009).

Compagno et al. (2008) recognised five species of Glyphis: G. gangeticus, G. glyphis, G. siamensis, G. garricki, and an undescribed species from Borneo (Glyphis sp. B). The latter has recently been described as G. fowlerae (Compagno et al. 2010). Compagno et al. (2008) provided a comprehensive review of G. glyphis, described G. garricki and listed many internal and external taxonomic characteristics that distinguish the species. However, a few published characters used to distinguish G. glyphis from G. garricki are problematical to apply in the field in some cases (Compagno et al. 2005, 2008; Last & Stevens 2009; Wynen et al. 2009). The purposes of this paper are to clearly state and illustrate how to distinguish the shark species likely to be found in fresh water in the Adelaide River using only field characters on living specimens and to present a record of photographs of Glyphis.
METHODS

Four and five inch mesh (101–127 mm) monofilament gill nets were set, usually on rising neap tides, on 66 occasions at localities in the Adelaide River (Fig. 2) and its tributaries in various months of the dry season during 2001 (27 trips May–November), 2003 (17 trips October–November), 2004 (9 trips July–August), 2005 (9 trips November–December), and 2009 (4 trips September–October). Since Nurseryfish were the object of the study, sharks were generally counted, sometimes photographed, and immediately released alive without sexing or precise measurement. Marrakai Creek (12°40.86’S, 131°20.1’E) was the most commonly sampled locality since it consistently yielded Nurseryfish. Sharks were netted as by-catch. Three male and two female G. glyphis were deposited in the Museum and Art Gallery of the Northern Territory, Darwin (NTM). Their registration numbers are S.15304-001, S.15305-001, S.15351-001, S.16262-001 and S.16255-001. Four additional specimens of G. glyphis (S.15095-001, S.15299-001, S.15301-001, S.15303-001) and four specimens of G. garricki (S.15098-001, S.15302-001, S.16158-001, -002) at the NTM were also examined and photographed.

RESULTS

Eighty-two Glyphis glyphis, one G. garricki (930 mm TL) and two Carcharhinus leucas were netted at six localities (Fig. 2). The total length (TL) of G. glyphis specimens that were measured ranged from 540 to 1010 mm. Three live specimens of G. glyphis were taken to the aquarium at the Territory Wildlife Park. They survived the month-long quarantine period in approx. 7 ppt brackish water, but died when transferred to completely fresh water. The vast majority of the netted G. glyphis were smaller than 1 m TL. The largest specimen was estimated at less than 2 m TL. Other estimated specimens include one approx. 1300 mm TL, and five were approx. 1 m TL. Umbilical scars were present on the smallest specimens 540–610 mm TL (Fig. 1D). During the 2009 Nurseryfish collections, six G. glyphis (4F: 2M) 760–1010 mm TL were tagged as part of the “Estimating fishing-related mortality and designing sustainable management protocols for shark fisheries in Northern Australia” by Northern Territory Fisheries (Department of Resources). To date, 12 Glyphis have been tagged, and no recaptures have been recorded as of July 2010 (Grant Johnson pers. comm.).

Interestingly, the two G. glyphis taken from the lower reaches of the Adelaide River at E and F Creeks (Fig. 2) were caught on 18 May 2001. In spite of 15 subsequent netting trips from 29 May through 30 August, no Glyphis were taken upstream in Marrakai Creek until 11 September 2001. A total of four G. glyphis were taken in September, 22 in October, 35 in November and 19 in December of all years. The single G. garricki was caught on 26 October.
2009 and the two Bull Sharks were caught at Beatrice Creek (Fig. 2) on 27 July 2001.

*Glyphis* can be distinguished from the Bull Shark by the large size of the second dorsal fin of *Glyphis* relative to the first dorsal fin (Last & Stevens 2009) (Fig. 1A–C). The height of the second dorsal fin of *Glyphis* is at least half the height of the first dorsal fin, whereas in the Bull Shark, the second dorsal fin is only one-third as high as the first dorsal fin. *Glyphis* caught in the Adelaide River are relatively sleek and silvery-grey with a bright white ventral surface, whereas Bull Sharks tend to be more robust-bodied and brownish grey (Figs 1A–C). The *Glyphis* snout is slightly pointed (Fig. 1E), as opposed to the bluntly rounded snout of Bull Sharks, and the eye of *Glyphis* is smaller than the eye of a similar sized Bull Shark (Peverell et al. 2006). The lower jaw teeth of *Glyphis* are smooth and narrow, hence the vernacular name “speartooth” (Fig. 1E), whereas Bull Sharks have serrated, triangular, stout lower jaw teeth (Last & Stevens 2009).

The most useful field character for separating *G. glyphis* from *G. garricki* is the relationship between the waterline (i.e. the junction of dark and light or dorsal and ventral colour delineation) and the eye (Compagno et al. 2008). In *G. glyphis* the waterline is at the lower margin of the eye (Fig. 1B,E) and is not visible in a ventral view of the head (Fig. 1F). In *G. garricki* the waterline extends well below the lower margin of the eye by at least an eye diameter (Fig. 1G), and is visible in a ventral view of the head (Fig. 1F). This character is visible in life and persists in preserved specimens (Fig. 1H). However, the colour paintings in Compagno et al.’s (2005) field guide show the waterline of *G. garricki* (G. sp. C) and *G. glyphis* (G. sp. A) as identical. Drawings in more recent publications have corrected this inaccuracy (Compagno et al. 2008).

Compagno et al. (2008) and Last & Stevens (2009), stated that *G. glyphis* has a black blotch at the ventral tip of the pectoral fin and that *G. garricki* lacks this blotch. Wynen et al. (2009: Table 2) erroneously reversed this characteristic. The living and preserved specimens of *G. glyphis* I have observed from the Adelaide River definitely have a black blotch at the distal end of the ventral aspect of the pectoral fin (Fig. 1D). However, the one living and four preserved specimens of *G. garricki* examined also have dusky pigment on the apex of the ventral pectoral fin (Fig. 1F, bottom). It is not quite as dark as on *G. glyphis* (Fig. 1, top), but this distinction may be too subtle to be applied in the field.

Shark predation is a fact of life faced by fishes in the freshwater reaches of the Adelaide River. Figure 3 shows damage probably inflicted by *Glyphis* on several species. It is not possible to determine if the bites occurred while the specimens were trapped in the gill net, or if the fish became trapped after being bitten. However, the former seems most likely.

SIMPLIFIED KEY TO THE SHARK SPECIES IN FRESH WATER IN THE ADELAIDE RIVER

1a. Second dorsal fin approx. one-third height of first dorsal fin; lower jaw teeth triangular and serrated .................................................*Carcharhinus leucas* (Bull Shark)

1b. Second dorsal fin approx. one-half height of first dorsal fin; lower jaw teeth elongate and smooth ................. 2

2a. Waterline extends just below ventral edge of eye; waterline pigment not visible in ventral view ................. ......................*Glyphis glyphis* (Speartooth Shark)

2b. Waterline extends at least one eye diameter below ventral edge of eye; waterline pigment visible in ventral view.................................................................

..................................................*Glyphis garricki* (Northern River Shark)

DISCUSSION

Although little is known of the biology of *Glyphis glyphis*, it is relatively common in the Adelaide River and easily distinguished from the Bull Shark. It occurs sympatrically with its less common congener *G. garricki*, from which it can be distinguished by the location of the waterline relative to the eye. On 26 October 2009, 3.25 hours of netting produced 11 *G. glyphis* and one *G. garricki*. Although the author cannot rule out the possibility that a specimen might have been captured more than once, this seems to approximate the perception of their relative occurrence. The numerical tagging program begun by Northern Territory Fisheries (Department of Resources) will hopefully lead to a greater understanding of the movements and life history of both species of *Glyphis*, subjects addressed by Pillans et al. (2009).

Since many of the small *G. glyphis* bore umbilical scars and were under 610 mm TL, it is likely that Marrakai Creek is a nursery ground as well as an important juvenile habitat for this species. The months of September to December appear to be the time of their greatest abundance in Marrakai Creek, however, field work in the wet season (January–April) is nearly impossible there. Thorburn & Rowland (2008) demonstrated that the rivers of northern Australia act as nurseries for juvenile Bull Sharks, *C. leucas*. Although the specimens caught in the Adelaide River were only small due to the gill net mesh size, on 8 December 2005 nine *Glyphis* were netted in 2.5 hours and one was estimated at 2 m. When the net was lifted, only the head was visible and it quickly tore through the net and submerged.
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REFERENCES


Fig. 3. Shark bites: A, Kurtus gulliveri (Nurseryfish), Marrakai Creek, Adelaide River, 24 November 2005; B, Pristis microdon (Freshwater Sawfish) Marrakai Creek, 15 June 2001, released. Note crescent-shaped bite above left pectoral fin; C, Lates calcarifer (Barramundi), Marrakai Creek, 29 September, 2009. All photographs: author.


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