Biology and cultural significance of the freshwater sawfish (*Pristis microdon*) in the Fitzroy River Kimberley, Western Australia

Report to Threatened Species Network **2004**

Cover Artwork:

Competition winner, freshwater sawfish painting
by Joy Nuggett
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Kimberley Land Council

Numerous language experts and people of the west Kimberley in conjunction with the Kimberley Language Resource Centre

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Project Summary

During a collaborative study involving researchers and members from Murdoch University, the Kimberley Land Council, the Kimberley Language Resource Centre and numerous communities of the west Kimberley, a total of 79 endangered freshwater sawfish *Pristis microdon* were captured (and released) from King Sound and the Fitzroy, May and Robinson rivers between 2002 and 2004. Forty of these individuals were tagged. This culturally significant species, is not only an important food source, but is included in a number of stories and beliefs of the peoples of the Fitzroy River, where it is referred to as 'galwanyi' in Bunuba and Gooniyandi, 'wirridanyniny' or 'pial pial' in Nyikina, and 'wirrdani' in Walmajarri (see Chapter 2). In relation to the biology and ecology of the species (Chapter 1), of the 73 individuals sexed, 43 were female, ranging in length from 832 to 2770 mm TL, and 30 were male, ranging in length from 815 to 2350 mm TL. Length-frequency, aging and maturity data indicate that the Fitzroy River is an important nursery for juveniles of the species, which appear to live in the river for up to 4 or 5 years before leaving the river to mature. The stomachs of nine individuals showed that the diet of this species is dominated by the ariid catfish, *Arius graeffei*, however fine detrital matter and cherabin were also commonly encountered. Additionally, both the relationship between rostrum length and total length, and the number of rostral teeth in female and male *P microdon* was significantly different. The number of teeth on the left side of the rostrum ranged from 17 to 21 in females and 19 to 23 in males, and although there is some overlap, 97.06% of individuals with 19 or less left rostral teeth were female, and 94.12% of individuals with 21 and more left rostral teeth were male. The high abundance of *P. microdon* encountered immediately below Camballin Barrage, and the fact that six of the eight recaptures of a total of 40 tagged individuals were also at this locality illustrated the fact the Barrage hinders the upstream migration of the species.

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CHAPTER 1

The freshwater sawfish *Pristis microdon* Latham 1794 in the western Kimberley, Western Australia, including notes on its morphology, ecology, diet and biology in the Fitzroy River

Introduction

Like many of the elasmobranchs occurring in northern Australia, distribution data for the freshwater sawfish (*Pristis microdon*) is lacking. The remoteness, restricted access, and seasonal flooding have resulted in few ichthyological surveys being conducted in the west Kimberley. Although anecdotal records allude to the fact that freshwater sawfish was known from the west Kimberley, it was not until a comprehensive ichthyological survey of the Fitzroy River by Morgan *et al*. (2002), and that by Thorburn *et al.* (2003), with the specific aim of capturing elasmobranch species throughout rivers in northern Australia, that this river appeared to support the largest population of this species in all the rivers sampled. For example, of the 28 freshwater sawfish captured from the 137 sites sampled by Thorburn *et* al. (2003), 13 were from four of the five sites sampled in the Fitzroy River, with an additional two individuals collected from the Robinson River, which also enters King Sound approximately 50 kilometres to the north of the mouth of the Fitzroy River. Furthermore, this figure does not include 14 dead specimens that Thorburn *et al.* (2003) found dead on the banks of the Fitzroy River at Telegraph Pool (see Figure 1).

Of the four species of *Pristis* known to inhabit Australian waters, *P. microdon* is the species most commonly associated with freshwaters (Last and Stevens 1994). Known from tropical waters of the Indo-West Pacific (including northern Australia, New Guinea, South-east Asia, India and eastern Africa), *P. microdon* is distinguished from other sawfishes by the combination of the following characteristics, first dorsal fin anterior to the pelvic fins; caudal fin bearing a conspicuous ventral lobe (Compagno and Last 1998); 18-23 teeth on the rostrum, and is reputed to reach 7 metres in length (Last and Stevens 1994, Compagno and Last 1998). There is however some argument as to whether *P. microdon* should be synonymised with *Pristis perotteti* and *Pristis zephyreus* from the Atlantic and east Pacific, respectively; two species that are also often associated with inland waters (see for example Thorson 1982, Last and Stevens 1994, Compagno and Cook 1995, Compagno and Last 1998). Although these two species both possess a first dorsal fin anterior to the pelvic fins, and a distinct lobe on the lower caudal fin, Ishihara *et al.* (1991) found that their rostral teeth counts varied significantly, i.e. 17-21 and 19-23 cf. 14-17 and 16-20 in female and male *P. microdon* and *P. perotteti*, respectively, and thus, while they tentatively considered that these species were valid, expressed the need for further investigation.

Throughout the world, sawfish populations have been decimated from gill net and trawl fisheries, due to their ease of entanglement in nets by their toothed rostrum (Simpfendorfer 2000). While there is currently insufficient data to determine the status of Australian populations, the susceptibility of *Pristis* species to fishing and habitat loss has been observed overseas, where numerous populations are threatened and their distributional ranges contracting (Pogonoski *et al*. 2002). For example, both Pogonoski *et al*. (2002) and Peter Last (CSIRO Marine Research, pers. comm.) consider that *P. microdon* has been eliminated from parts of South-east Asia, that current rates of decline for this species are unsustainable, and that northern Australia may soon represent the only geographical region where viable populations persist. This decline has subsequently led to *P. microdon* being listed as endangered (IUCN Red List 2003) throughout the world, and as vulnerable (Environment Protection and Biodiversity Conservation (EPBC) Act 1999) in Commonwealth waters of Australia. Although the listing of *P. microdon* affords it some protection, Commonwealth waters begin three nautical miles from the low water mark (under the Offshore Constitutional Settlement 1987, 1988 and 1995). The Western Australian (State) Government is therefore responsible for the waters between this three nautical mile limit and the coast, and freshwaters (see Boulter 2002). Despite being protected in Federally managed waters, *P. microdon* is not listed under Schedule 2 (Protected Fish) of the Western Australian State Fish Resources Management Regulations 1995, which precludes it from protection in waters managed by the

Western Australian Government. Although Part 1 of Schedule 2, detailing 'commercially protected fish', states that "all freshwater aquatic organisms other than sooty grunter and catfish of the family Ariidae" are protected from commercial practices, it is unclear if *P. microdon* is included in this freshwater classification (David Harvey, Department of Fisheries, Western Australia, pers. comm). Furthermore, the species remains unprotected from recreational fishers in state waters.

With the exception of differences in rostral teeth counts between sexes, and some age versus length data (much of which was collected from Papua New Guinean specimens), virtually nothing is known with regard to the biology of this species in Australia. *Pristis microdon* is also an important cultural and spiritual icon for a number of indigenous peoples throughout northern Australia, including many of the traditional owners that live on, and utilise the resources of, the Fitzroy River, such as the Bunuba, Gooniyandi, Ngarinyin, Nyikina and Walmajarri peoples (Morgan *et al.* 2002, 2004). In the area around Fitzroy Crossing, and downstream to the confluence of the estuary with the sea near Derby, *P. microdon* is referred to as 'galwanyi' in Bunuba and Gooniyandi, 'wirridanyniny' in Nyikina, and 'wirrdani' in Walmajarri, is actively fished for, and continues to form an important part of the diet of a number of these peoples. The cultural significance of *P. microdon* and its importance as a food source provide additional incentive to focus on this species in the Fitzroy River, and ensure the sustainability of this iconic species as a food resource.

In light of the current decline of many *Pristis* populations, and the discovery that the Fitzroy River apparently contained relatively high numbers of *P. microdon* the current study focused on that system to meet the following aims:

1. Determine the distribution and any broad-scale habitat associations of freshwater sawfish within the Fitzroy River and nearby marine waters.

2. Describe the aspects of the biology, such as size range, sex-ratio, age/size at maturity , numbers of teeth on the rostrum, relationship of rostrum length to total length, and diet of freshwater sawfish in the Fitzroy River.

3. Determine if a relationship exists between size and sex of individuals, and the size and the number of teeth on their rostrum for use as a diagnostic tool in determining historical sex and size data from rostra that were collected as trophies from sawfish in freshwaters, and whether these 'saws' belong to *P. microdon*.

4. Document the spiritual and cultural importance of this species, and thus in conjunction with Kimberley Land Council and Kimberley Language Resource Centre, establish an education and awareness program.

5. Implement a tagging program that in future will provide valuable data on the movements of *P. microdon* within the river and nearby marine habitats.

6. Based on rostram teeth counts determine whether Fitzroy River *P. microdon* and Atlantic *P. perotteti* are morphologically indistinguishable.

Materials and Methods

Study site

Located in the western Kimberley of Western Australia, the Fitzroy River drains almost 90 000km^2, and is significantly larger than any other river in the region (Figure 1) (Anon 1993, Storey 1998). The Fitzroy River enters King Sound south of Derby, and continues upstream ~300 km (past the town of Fitzroy Crossing) before splitting into the Margaret and Fitzroy rivers that continue several hundred kilometres further inland. Sampling during this study was mainly focused on the river near to and downstream of this junction. This region experiences an arid to semi-arid monsoonal climate, and receives the majority of its rain during the 'wet season' between November and March. During this time the river experiences peak flows, and receives almost 90 % of its mean annual streamflow of 6150 GL/year (measured at Fitzroy Crossing, and the highest of any river in Western Australia) (Ruprecht and Rodgers, 1998).

Environmental variables and habitat

Salinity (ppt), temperature (^{o}C), and an indication of water clarity using a secchi disc (cm), depth, estimated flow rate and tidal influence were recorded at each site. In addition, immediate habitat was described, including predominant sediment type, density of aquatic vegetation types and detritus, riparian vegetation and snag density.

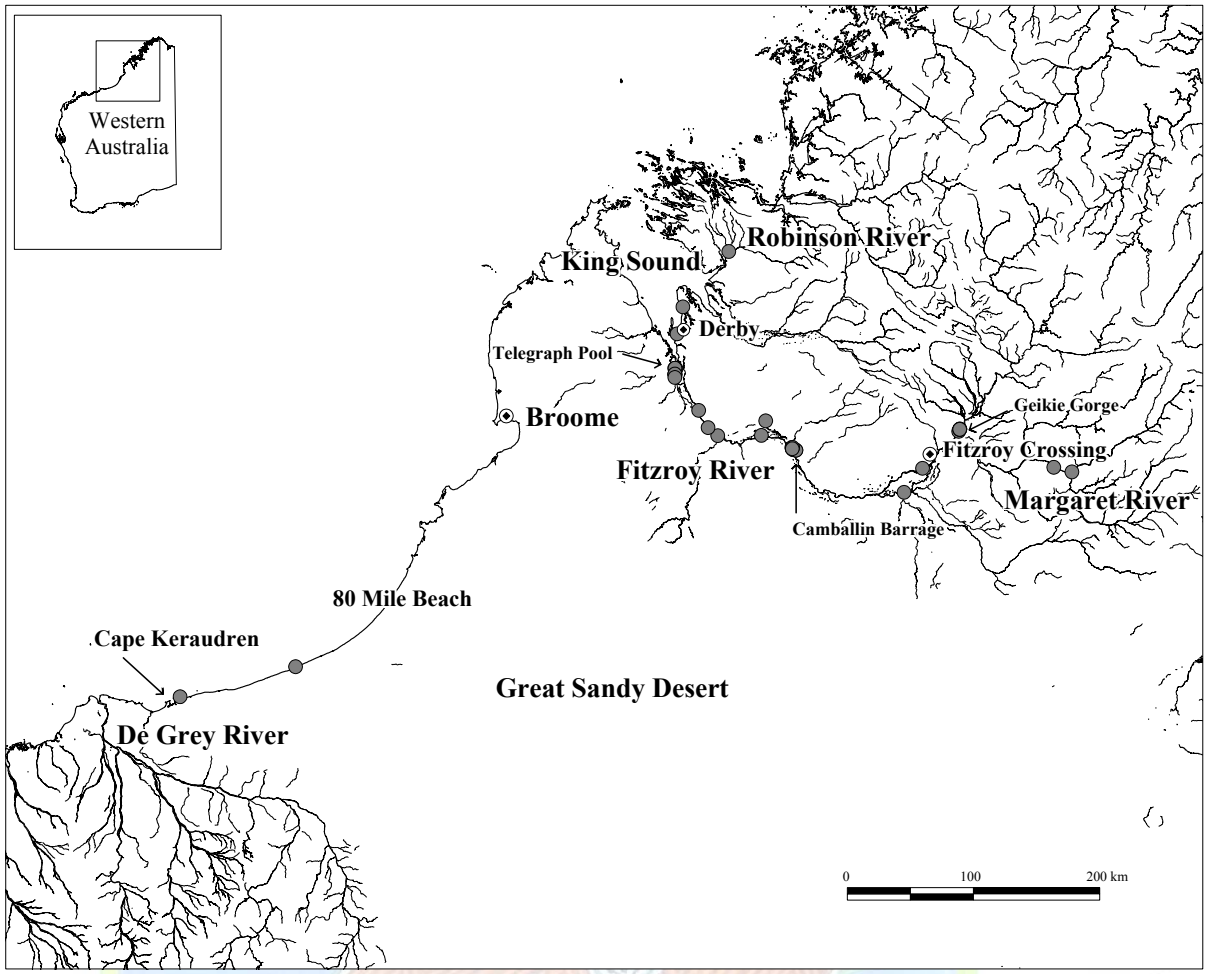

Figure 1 Sites at which the freshwater sawfish (*Pristis microdon*) was captured in the western Kimberley region during sampling in 2002 (see Morgan *et al.* 2002, Thorburn *et al.* 2003), 2003 and 2004, and from 80 Mile Beach.

Sample sites and methods

Pristis microdon were captured throughout the Fitzroy River, King Sound, and in the Robinson River during sampling in October and November 2002 as part of a study of freshwater and estuarine elasmobranchs in northern Australia (Thorburn *et al.* 2003), during two three week sampling trips in June and November 2003, and three trips to the Fitzroy River in March, April and July 2004. Sampling within the river was primarily conducted at sites accessible to the general public, including the tidally affected (on large tides) Snag, Telegraph and Langi's Pools, the freshwaters below Camballin Weir, and Geikie Gorge upstream of Fitzroy Crossing (Figure 1).

Sampling equipment included sinking monofilament gill nets (20m panels of 5, 7.5, 10, 15 and 20 cm stretched mesh) that were set perpendicular to the river bank. Nets were checked every hour to ensure that handling and release times were minimised. All possible data that could be collected

from dead individuals found on the river banks was recorded. In addition, several individuals captured by traditional owners using baited lines and two records of *P. microdon* collected by colleagues undertaking studies on the Pilbara coast have been collated with data collected during the current study.

Measurements and tagging

The total length (TL) (mm) (Figure 2), sex, clasper length and stage of calcification in males, rostrum length (RL) (mm), measured from the tip to where the head begins to broaden (Figure 3), and number of teeth on each side of the rostrum were recorded for all individuals captured. For those captured on the Pilbara coast, only approximate lengths were given (see above).

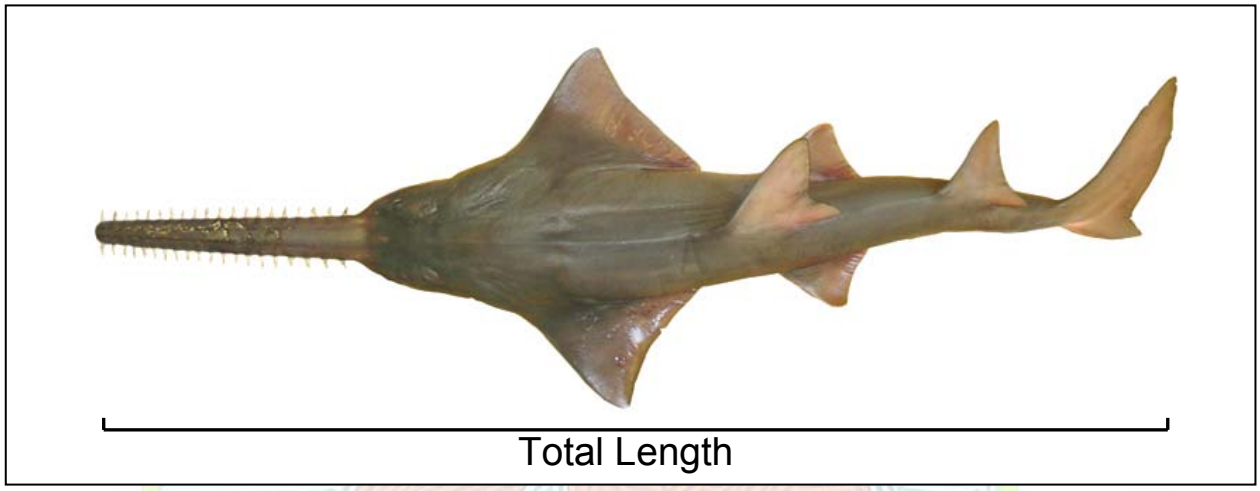

Figure 2 Measurement of the total length (TL).

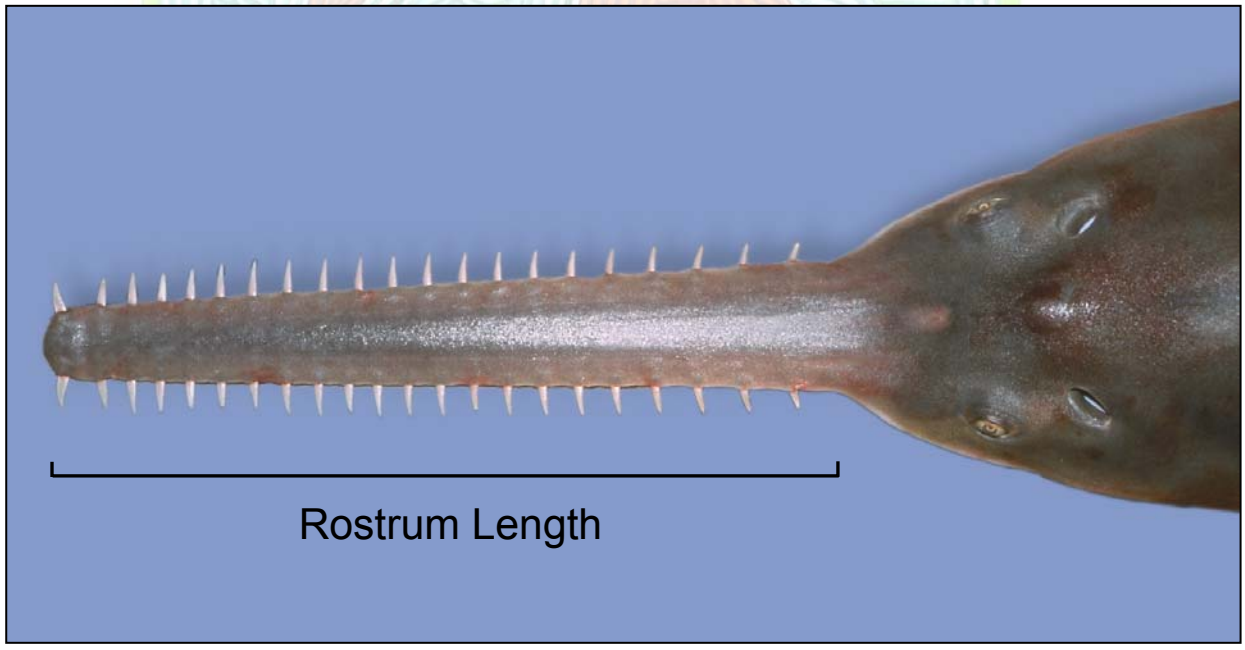

Figure 3 Measurement of the rostrum length (RL).

Sawfish captured during sampling in 2003 and 2004 were tagged with a cattle style tag, placed in the second dorsal (Figure 4) or pectoral fin of the individual before being released. A fin clip was also taken, immediately placed on ice until it could be frozen, and held at Murdoch University, to provide tissue samples for any future molecular studies. While a priority of this study was to attain as much information as possible on this species without employing fatal techniques, some biological samples (such as vertebrae for aging and stomachs for dietary analysis) were obtained from individuals found dead, such as those from Telegraph Pool, and from traditional owners who allowed the removal of samples before consumption.

Figure 4 Location of tag in second dorsal fin of a freshwater sawfish (*Pristis microdon*).

Length and age structure of freshwater sawfish in the Fitzroy River

Whilst such a small sample size precluded any validation that annuli are laid down annually on the vertebrae of freshwater sawfish, these data in conjunction with length-frequency data permitted inferences to be made regarding the age structure of this population. At least six vertebrae were removed from beneath the first dorsal fin of 10 of the dead specimens encountered prior to the commencement of the WWF project. Vertebrae were cleaned and kept on ice in the field until they could be frozen. Once defrosted, excess tissue was removed and the centra separated before being placed in 5% sodium hypochlorite solution until the centra were clean of any remaining tissue. The centra were then removed, rinsed thoroughly in water, and allowed to dry for several hours. A minimum of two centra from each specimen was then embedded in resin and a 0.3 mm longitudinal section cut with an Isomet low speed rotary saw. These sections were then mounted on a slide with DePex, and observed under a dissecting microscope with reflected light. Counts of the number of growth rings or annuli (i.e. the narrow translucent bands representing reduced growth periods, as opposed to the adjacent wider opaque bands that represent faster growth) commencing after the

birth mark (identified by a change of angle on the outer edge of the corpus calcerium) were then made for each individual (see Figure 7).

Stages of maturity

The stage of maturity in male *P. microdon* was determined on the basis of clasper calcification, i.e. individuals were considered immature when claspers were small and uncalcified, maturing if claspers were extending and becoming semi-calcified or mature when claspers were fully calcified (see Figure 8). Recently dead female freshwater sawfish that were found on the banks of the Fitzroy River were dissected and their ovaries and uteri examined. An individual possessing undeveloped ovaries and thin, flaccid uteri was considered immature; maturing when the uterus begins to enlarge and ovary contains differentiated ova; and mature when the ovary contains yolked ova and the uterus is enlarged.

Stomach contents

Of the dead individuals encountered, the stomachs from nine were retrieved, whilst the others and their stomachs were in an advanced stage of decomposition. Samples were frozen or preserved in 100% ethanol, and the contents viewed and identified under a dissecting microscope. Estimation of the stomach fullness on a scale of zero to 10 (zero representing an empty gut and 10 being fully distended) and the percentage contribution of each food category was made, from which the percentage occurrence and mean percentage volumetric contribution of each food category was calculated (methodology adapted from Hynes 1950).

Relationship of rostrum length and total length

A likelihood ratio test (Cerrato 1990) was used to determine if the ratio of rostrum length (RL) to total length (TL) was significantly different between the sexes. As a significant difference was detected, the relationship of RL to TL was determined, using the SPSS statistical package, for each sex independently.

Sexual dimorphism of rostral tooth number

To investigate if differences exist in the number of rostral teeth between sexes, the number of teeth on the left and right side was recorded for 43 females and 25 male *P. microdon*. No difference was detected between the tooth number on either side of the rostrum in both males and females, and as such the percentage occurrence of the number of rostral teeth on the left side only and the total number, occurring in female and males *P. microdon* was generated. The SPSS statistical package

was subsequently used to investigate the differences in the number of left rostral teeth, and of the total number of rostral teeth of males and females, using an analysis of variance (ANOVA).

Results

Sex ratio, length ranges and capture locations of freshwater sawfish in the Fitzroy River

A total of 79 *P. microdon* were recorded from the Fitzroy River and other sites sampled throughout King Sound between 2002 and 2004 (Figure 1). Of these, 57 were captured in the Fitzroy River, whilst two individuals were captured in each the Robinson River and in the marine waters of King Sound, with the use of gill nets (from 26 of the 79 sites sampled). A further 15 individuals were found dead on the banks of the river, one was observed free swimming at Camballin Barrage, and two were obtained from fishers in Geikie Gorge. Of the 73 individuals sexed, 43 were female and 30 were male (sex ratio was 1.43 females : 1 male). The females ranged in length from 832 to 2770 mm TL, while the males ranged from 815 to 2350 mm TL, respectively.

Two freshwater sawfish were captured in 2 of the 26 sites sampled in marine, macrotidal waters of King Sound, while 18 were captured in nine of the 20 estuarine sites sampled (i.e. Telgraph Pool and Snag Pool), 34 were captured in 10 of the 16 sites sampled in the middle reaches of the Fitzroy River (i.e. below the Camballin Barrage) and seven were captured in four of the 17 sites sampled in the upper riverine reaches (i.e. Giekie Gorge). *Pristis microdon* was captured from salinities of 21 and 31ppt in King Sound, and salinities ranging from 0 to 40ppt in the estuarine reaches. Salinities in the middle and upper reaches were always 0 ppt.

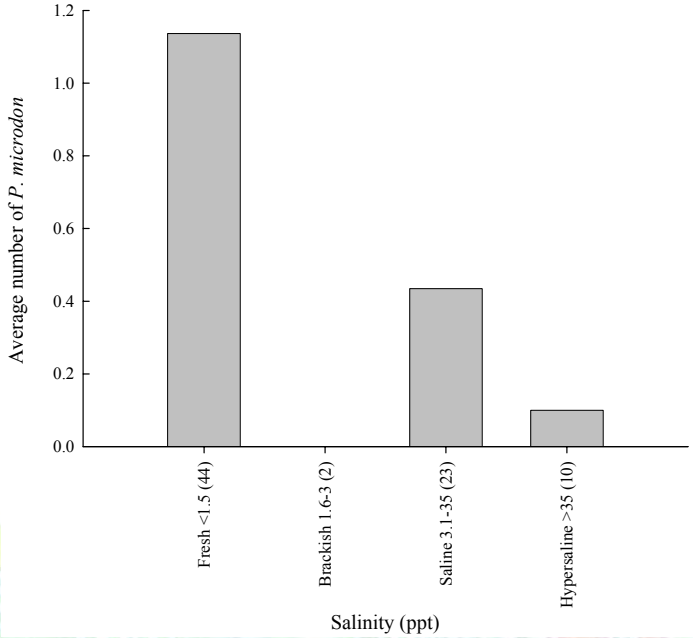

Figure 5 The average number of freshwater sawfish (*Pristis microdon*) caught in fresh, brackish, saline and hypersaline sample sites. The number of sample sites at each salinity are shown in parethesis.

At the sites of capture, water was generally shallow with an average depth of 2.32 m (but as deep as 4 m), and between 29 to 32.5 ^{o}C. Nets however were often set in shallow waters (<4 m) but were adjacent to deeper sections up to 10 m. The capture of this species in both upper freshwater and macrotidal marine environments, is thus reflected in the range of water clarity, with a secchi disc reading ranging from greater than 170 cm in the fresh, to as little as 5 cm in King Sound. In terms of immediate habitat from which individuals were captured, sites were generally dominated by sand, and to a lesser extent silt, and were rarely captured over gravel/rock bottoms. Sites also generally had low algal or macrophyte cover, low detrital levels and little large woody debris.

Tagging

A total of 40 *P. microdon* (29 female and 11 male) were tagged during sampling in 2003 and 2004. Only one sawfish was recaptured in 2003, this being a female (2150 mm TL) which was originally tagged in June approximately three kilometres below Camballin Barrage, and where it was recaptured in November. During this time she had attained a length of 2180 mm TL. Captures of two tagged sawfish in Geikie Gorge were reported to the Kimberley Land Council in April 2004, however the tag numbers were not recorded. Later in Octoberr 2004, two sawfish were recaptured by recreational fishers below Camballin Barrage. These sawfish were originally tagged at this location in July 2004, however accurate lengths were not obtained before release. These same two sawfish, in addition to a third which was also originally tagged in July 2004, were recaptured again by the authors at Camballin Barrage in November 2004. Thus, in 4 months, two of these sawfish

grew 82 and 170 mm, while the third was the same size. All three of these sawfish had between one and two fishing hooks and line in their mouths.

Age and length of freshwater sawfish in the Fitzroy River

Despite relatively low numbers of female and male *P. microdon* being collected, and the fact that sampling was not equal throughout all seasons, the length-frequency histograms (Figure 6) presented, in conjunction with the growth data collected from vertebral aging provides some insight into the growth of this species. It is possible that length-frequency data for both female and male *P. microdon* captured, reflect that these individuals belong to four modal classes, these being 0+, 1+, 2+ and 3+ animals. Modal (year) classes are potentially observed around 900 mm TL for both sexes of the 0+ year class. Although only one female of ~1600 mm TL was collected this possibly reflects another modal class for 1+ years, with other modal classes observed at 1900-2000 mm TL for 2+, and at 2400 mm TL for 3+ years. The large 3500 mm TL female shown is that caught in marine waters off 80 Mile Beach. In males, three or four modal classes are potentially observed at approximately 1500 mm TL and 2100mm TL, but it it is possible another exists between these.

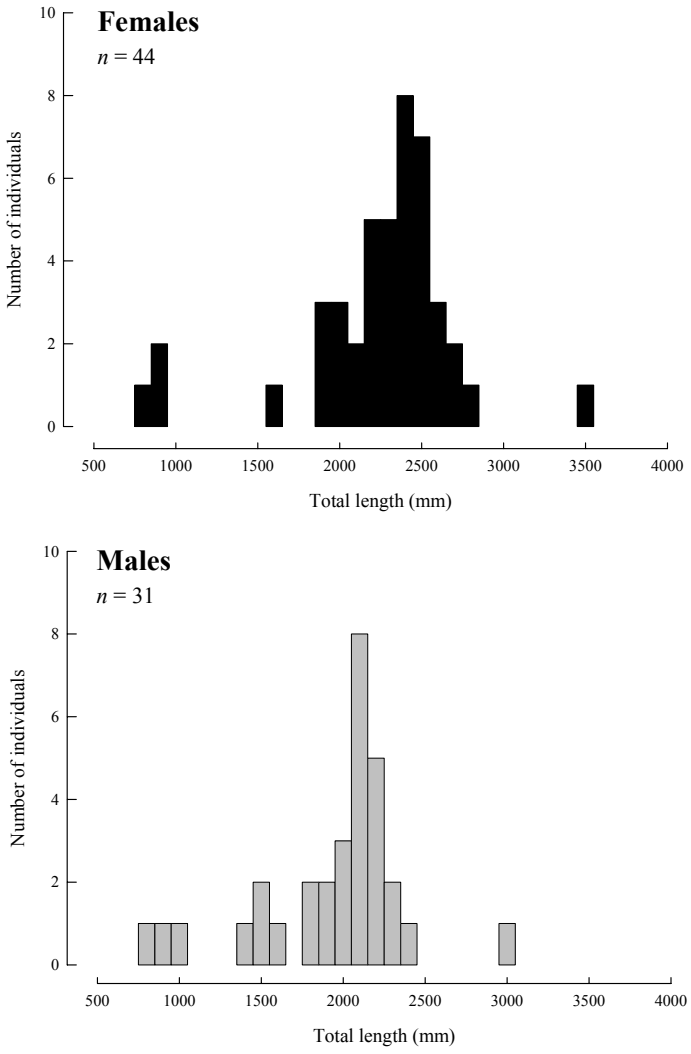

Figure 6 Length-frequency histograms for female and male *Pristis microdon* collected during the study.

Aging of two small female individuals captured in mid October and July of 832 mm TL and a 912 mm TL, respectively, revealed they had no growth rings beyond the birth zone, supporting the notion that they are in their first year of life (Table 1, Figures 6, 7). Furthermore, vertebral sectioning of a 1600 mm TL and 2271 mm TL female further revealed two and three (possibly four in the largest specimen) growth rings, respectively. It appears that no 1+ (i.e. in their second year of life) females were captured. Although no growth rings were observed in one of the smallest males (933 mm TL) captured (0+), one zone was observed in a 1040 mm TL specimen (1+). Additional year classes may be reflected by the male length-frequency data (Figure 6), including those individuals near to 1500 mm TL and 2100 mm TL, respectively. Similarly, two growth rings were observed in the vertebrae of 1587 mm TL male (2+), and three growth rings observed in three large individuals of 2080, 2105 and 2142 mmTL (3+) (a fourth translucent zone may be seen forming in the 2080 mm TL individual in Figure 7). From the length-frequency data, it is possible that an additional year class (4+) exists for female *P. microdon* being generally larger than males, up to 2770 mm TL.

Table 1 The total length (mm) and number of growth rings on sectioning vertebrae of *Pristis microdon*. N.B. 0 zones correspond to sawfish in their first year of life, 1 zone corresponds to sawfish in their second year of life, 2 zones correspond to sawfish in their third year of life, and so on.

Sex	Total Length (mm)	Number of Zones
Females	832	0
	912	0
	1600	2
	2271	3-4
Males	933	0
	1040	1
	1587	2
	2080	3-4
	2105	3
	2142	3

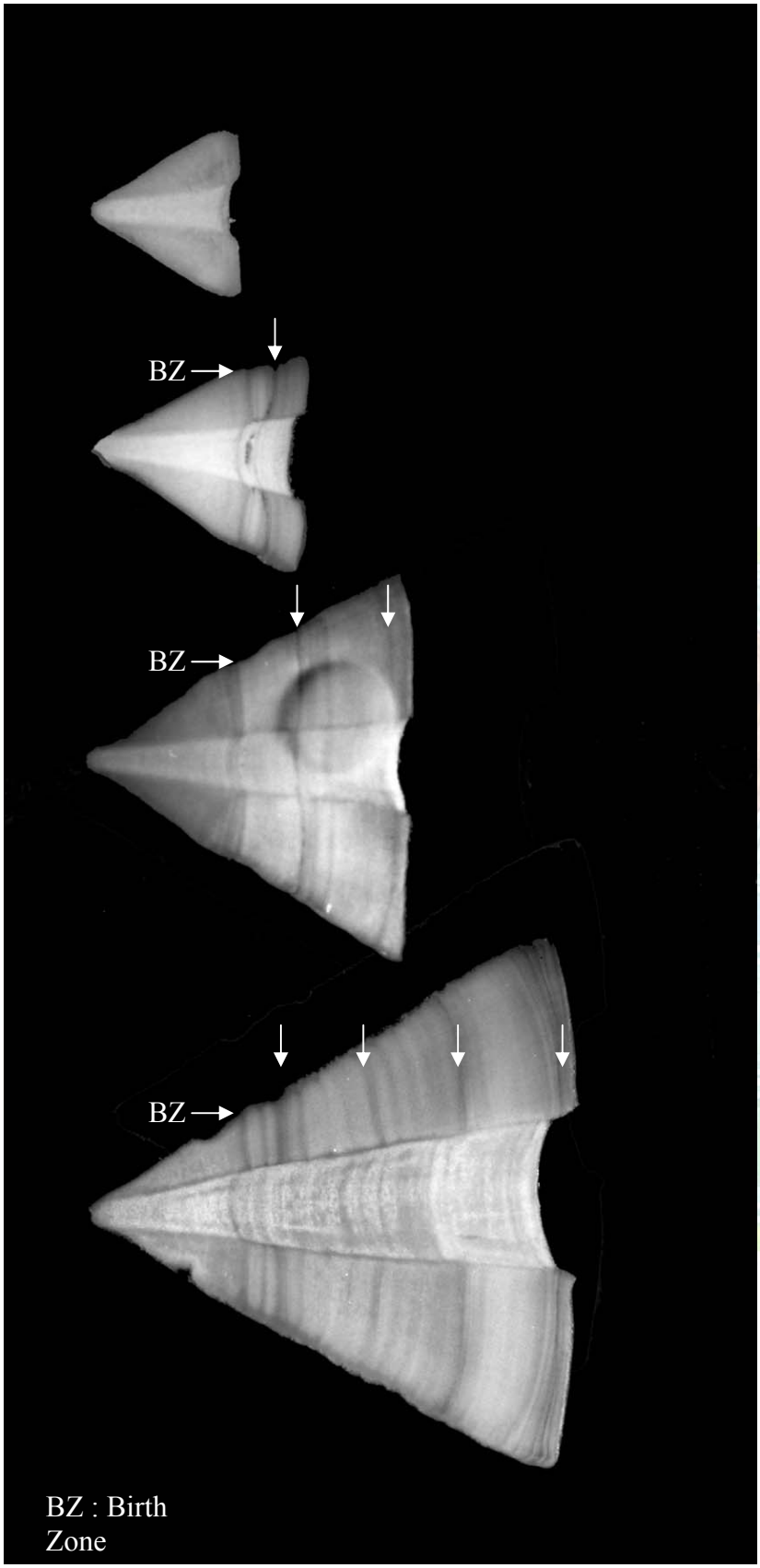

Figure 7 Vertebral sections of *Pristis microdon*, depicting main translucent zones, which may correspond to annuli.

Maturity status of freshwater sawfish in the Fitzroy River

All 30 male *P. microdon* captured in the Fitzroy River and King Sound were immature with small non-calcified claspers (Figure 8a). Their claspers ranged in size from 25 and 10 mm inner and outer lengths to 92 and 43 mm TL inner and outer lengths in the smallest (815 mm TL) and largest male (2350 mm TL), respectively. A mature male (~ 3000 mm TL) with large calcified claspers (Figure 8b) was captured, by Murdoch University colleagues Glen Young and Matt Pember, in the ocean near Cape Keraudren and Wallal (80 Mile Beach) in 2003 (Figure 1). Dissection of two large females (~ 2500 mm TL and another 2271 mm TL) found dead on the banks of the Fitzroy River had undeveloped ovaries and thin, flaccid uteri, indicating immaturity and suggesting that all smaller females would have been similarly immature.

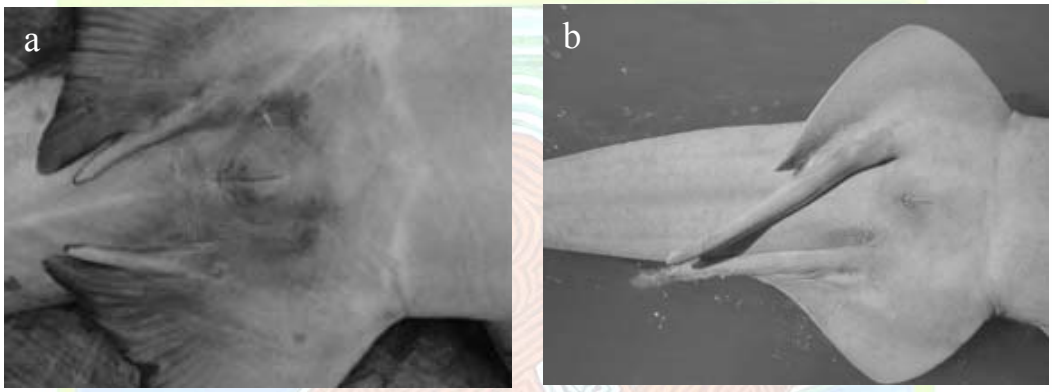

Figure 8 The claspers of *P. microdon* from (a) a riverine immature 2160 mm TL male, and (b) an oceanic mature male ~ 3000 mm TL, possessing large calcified claspers. The latter was captured in the ocean near Cape Keraudren on the Pilbara coast.

Diet of freshwater sawfish in the Fitzroy River

All nine of the stomachs of *P. microdon* dissected contained the lesser salmon catfish *Arius graeffei*, and constituted almost 60% of their overall diet. The other major components of the diets were fine detrital matter (13.47% of the total volume, occurring in 55.56% of stomachs examined), cherabin (*Macrobrachium rosenbergii*) (9.06% by volume, 66.67% of stomachs) and insect parts (6.47% by volume, 77.78% of stomachs). Filamentous algae (4.26% by volume, 33.33% of stomachs), sand (3.24% by volume, 44.44% of stomachs), coarse detrital matter (2.06% by volume, 44.44% of stomachs), other teleost parts (1.32% by volume, 22.22% of stomachs), nematodes (0.53% by volume, 11.11% of stomachs) and molluscs (0.26% by volume, 11.11% of stomach) were also consumed by freshwater sawfish.

Rostrum length versus total length, and sexual dimorphism of rostrum tooth number

A likelihood ratio test (Cerrato 1990) revealed that the relationship between total length (TL) and rostrum length (RL) for female and male *P. microdon* were significantly different ($P < 0.001$, df = 2) therefore the sexes were not pooled. Subsequently, the SPSS statistical package found that a POWER relationship provided the line of best fit for both female and male data sets ($r^2 = 0.969$ and 0.957, respectively). Thus, the relationship between TL and RL (mm) in female and male *P. microdon* is $RL = 0.4517.TL^{0.9113}$ and $RL = 0.8580.TL^{0.8260}$, respectively (Figures 9 and 10).

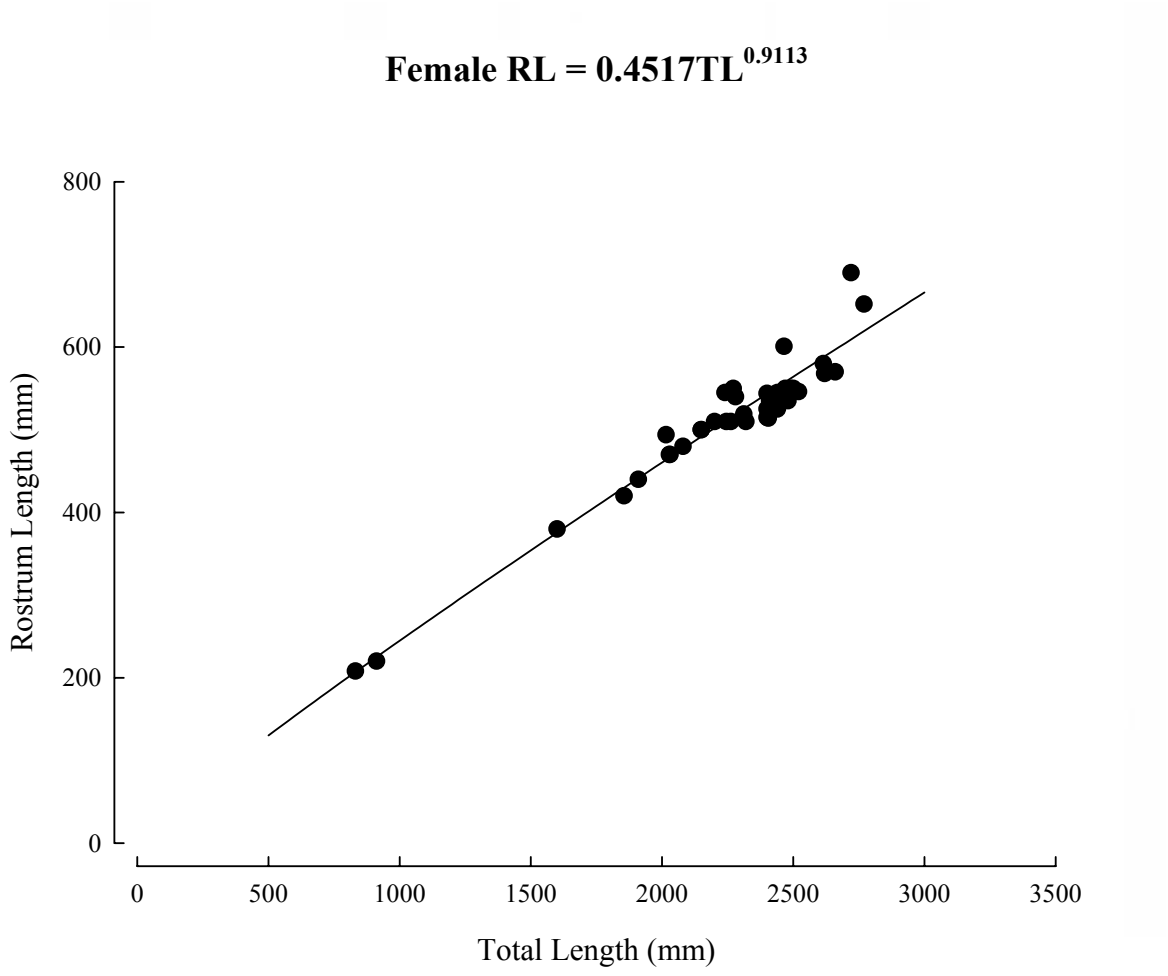

Figure 9 The relationship between total length (TL) and rostrum length (RL) in female *Pristis microdon*.

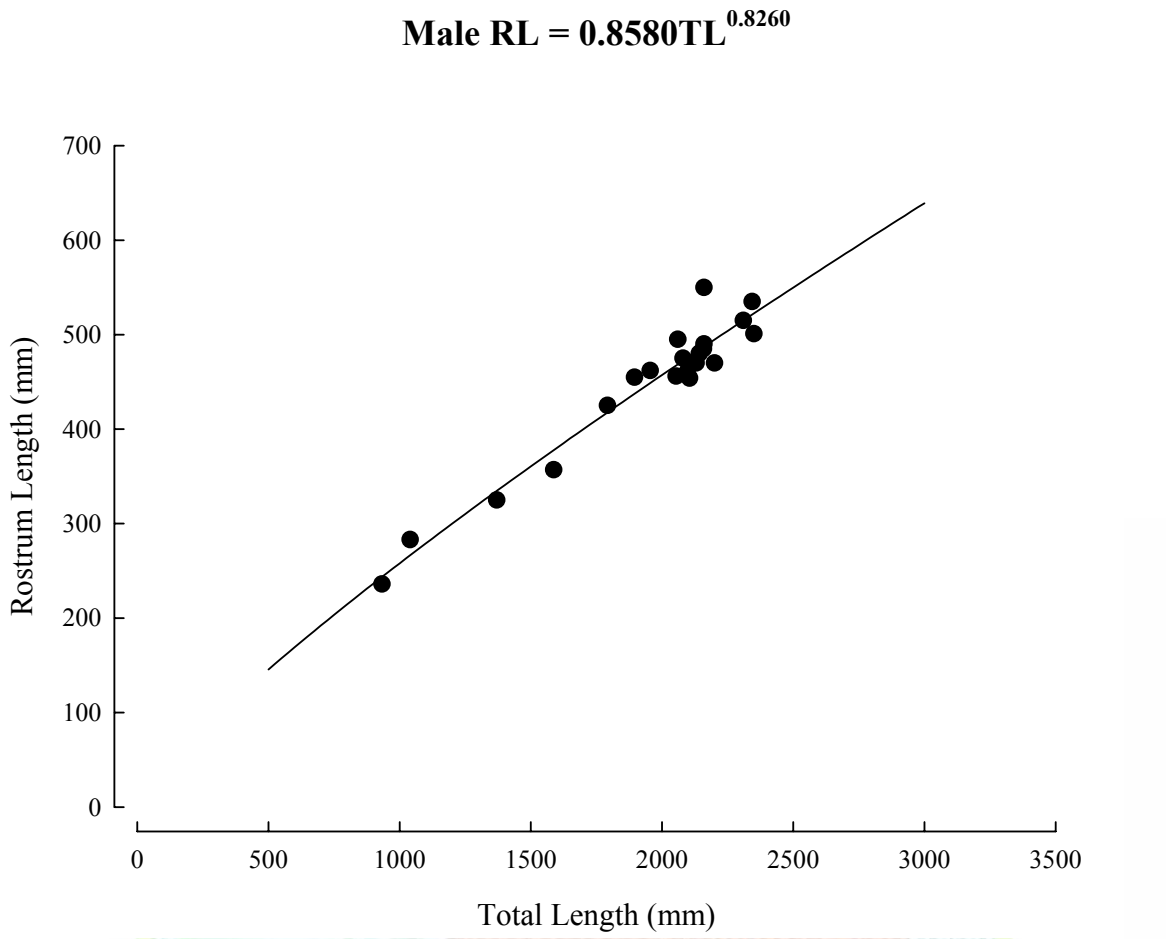

Figure 10 The relationship between total length (TL) and rostrum length (RL) in male *Pristis microdon*.

The number of rostral teeth ranged from 17 to 21 in females, and 19 to 23 in males (Figure 11). Males generally had higher numbers of teeth on the rostrum, averaging 20.96 and 20.88 (from 25 individuals counted) on the left and right hand side of the rostrum, respectively, compared to females that had an average of 18.86 and18.88 (from 43 individuals counted) on the left and right, respectively.

Of these, 62.79% of females, and 44% of males had the same number of teeth on both sides of their rostrum (Figure 12). Although 16 (37.21%) females had a difference of tooth number between the left and right side of the rostrum, there appeared to be no evidence that one side generally had more teeth. This was also the case with males, however a greater percentage (56%) had unequal numbers of teeth on each side of their rostrum.

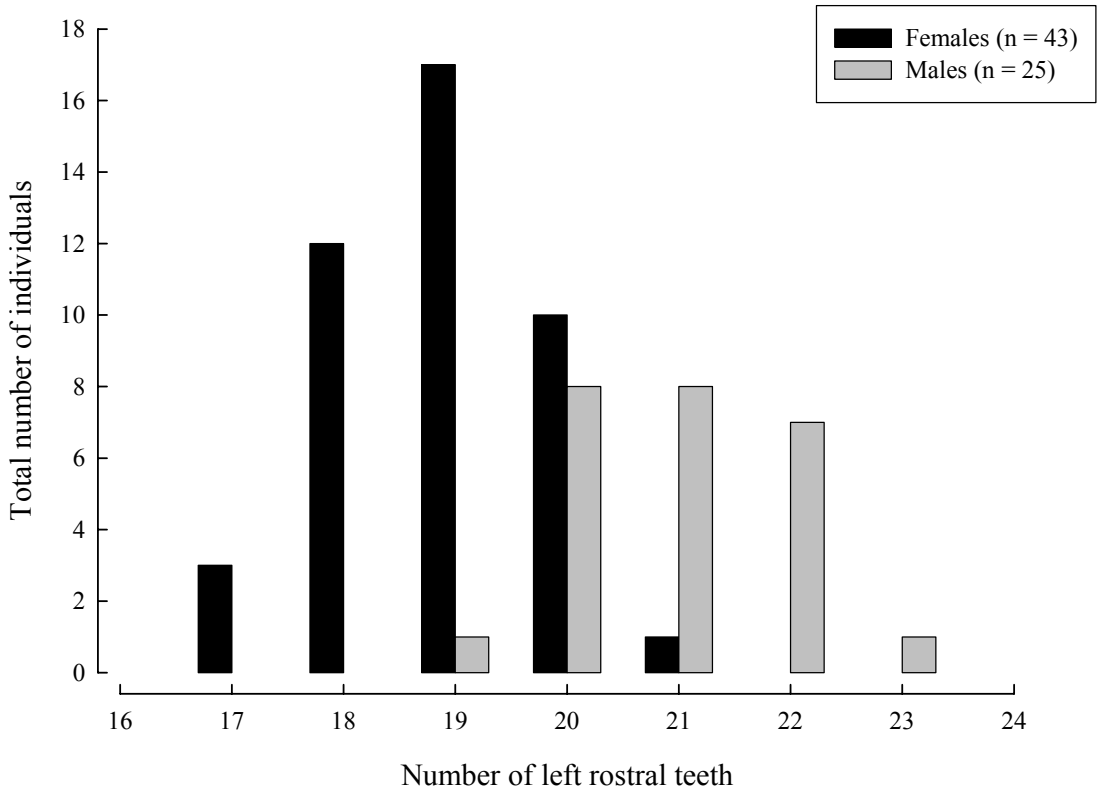

Figure 11 Frequency distribution of the number of left rostral teeth in female and male *Pristis microdon*.

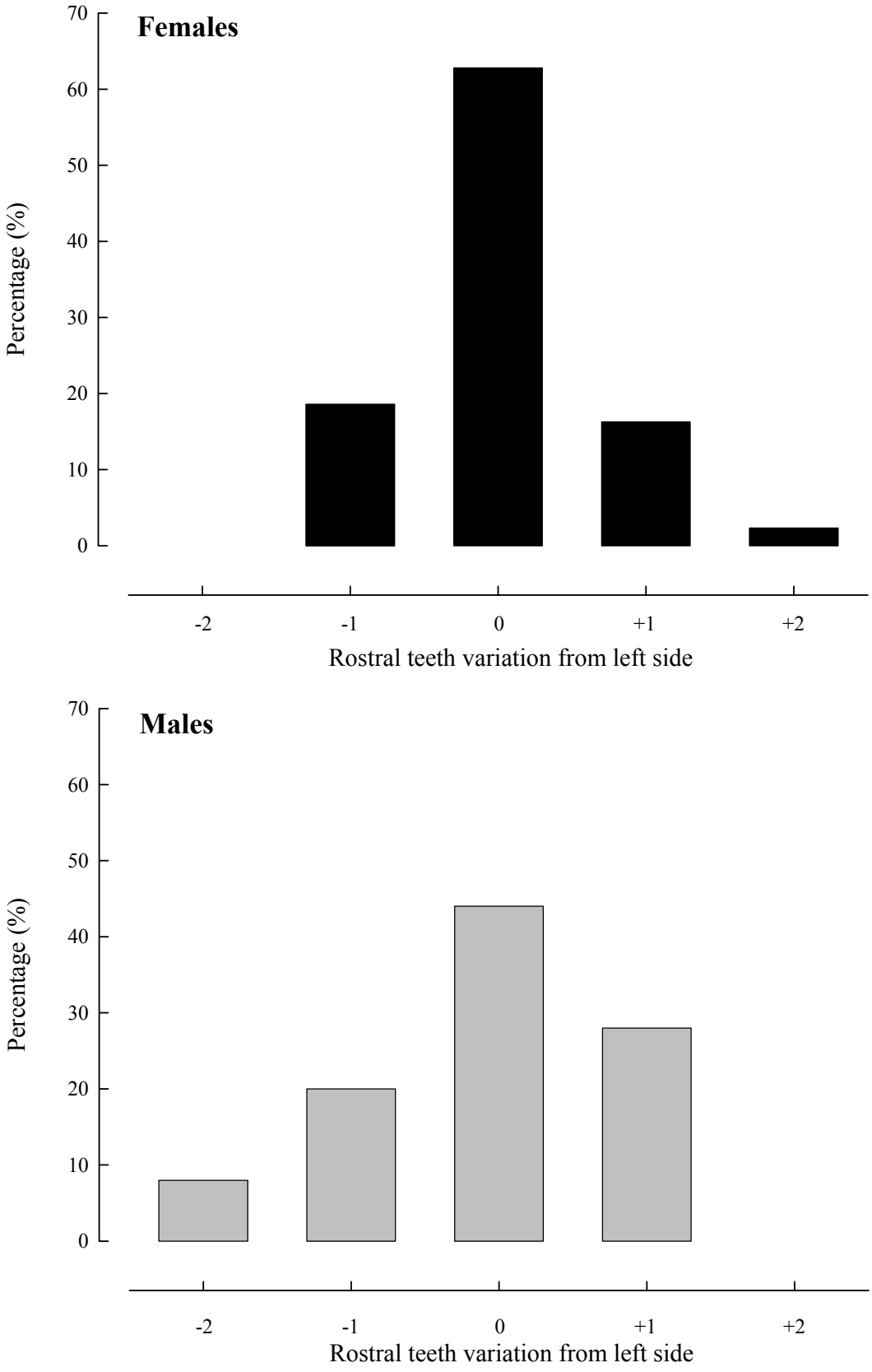

Figure 12 Rostral tooth number variation in relation to the number on the left side for female and male *Pristis microdon*.

While investigating the patterns in differences in the number of rostral teeth in females and males, for the purpose of identification from the rostrum alone, Figures 13 illustrates the proportion of female and male freshwater sawfish with between 17 and 23 left rostral teeth. Although there is some overlap between females and males, 97.06% of individuals with 19 or less left rostral teeth were female, and 94.12% of individuals with 21 and more left rostral teeth were male. Furthermore, the percentage occurrence of males possessing 20 left rostral teeth was slightly higher than females (32% cf. 23.26%). A difference also appears to exist between males and females when comparing total tooth number of teeth (Figure 14). With the exception of one female which possessed 42 rostral teeth, the majority possessed less than 40. Males possessed between 38 and 46 rostral teeth. Although overlap exists between the sexes from 38 to 42 rostral teeth, 94.59% of individuals with 39 or less rostral teeth were female, and 95.45% of individuals with 41 rostral teeth or more were male.

A Levenes test of homogeneity of variances found that variances for both the number of left rostral tooth and total number of teeth, respectively, in females and males, was not significant and thus data was not transformed. Subsequently, an ANOVA revealed that both the difference of the number of left rostral teeth ($P < 0.001$), and the total number of rostral teeth ($P < 0.001$) of males and females were significantly different. This has the advantage of allowing the collation of sex ratio data from 'saws' that are in peoples collections within the west Kimberley and it also, together with the rostum length / total length relationship to analyse size distributions within the Fitzroy River.

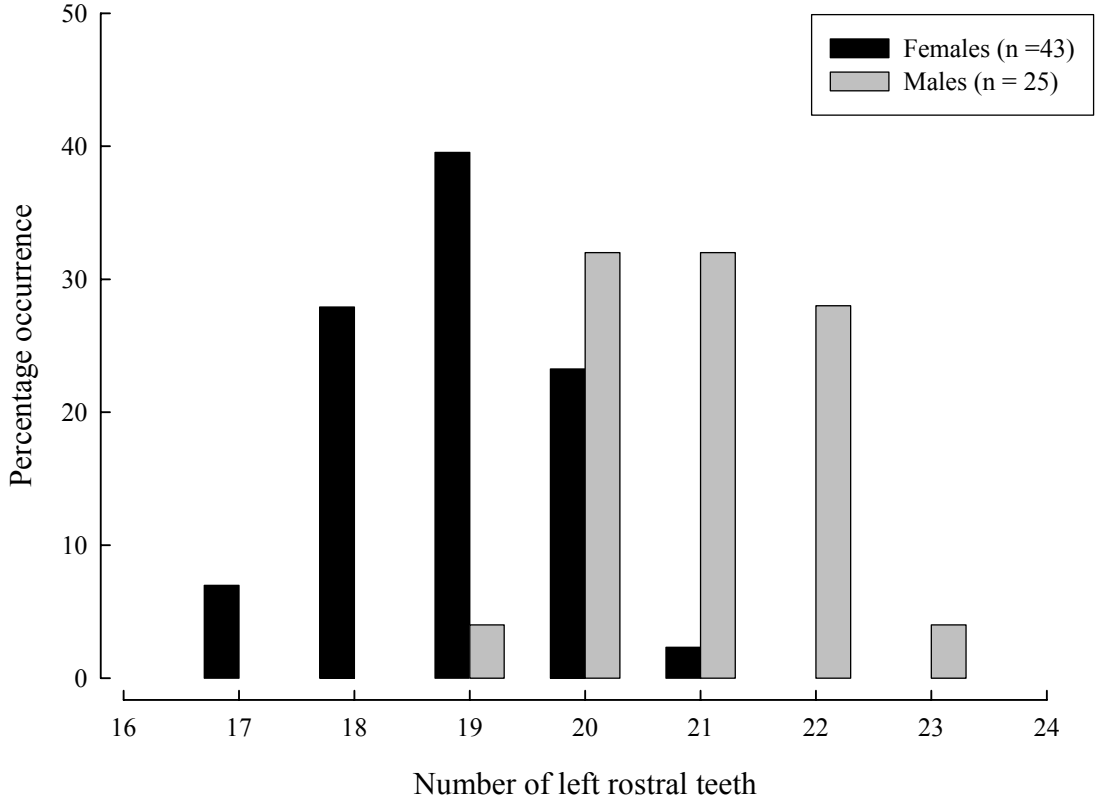

Figure 13 The percentage occurrence of the number of left rostral teeth in female and male *Pristis microdon*.

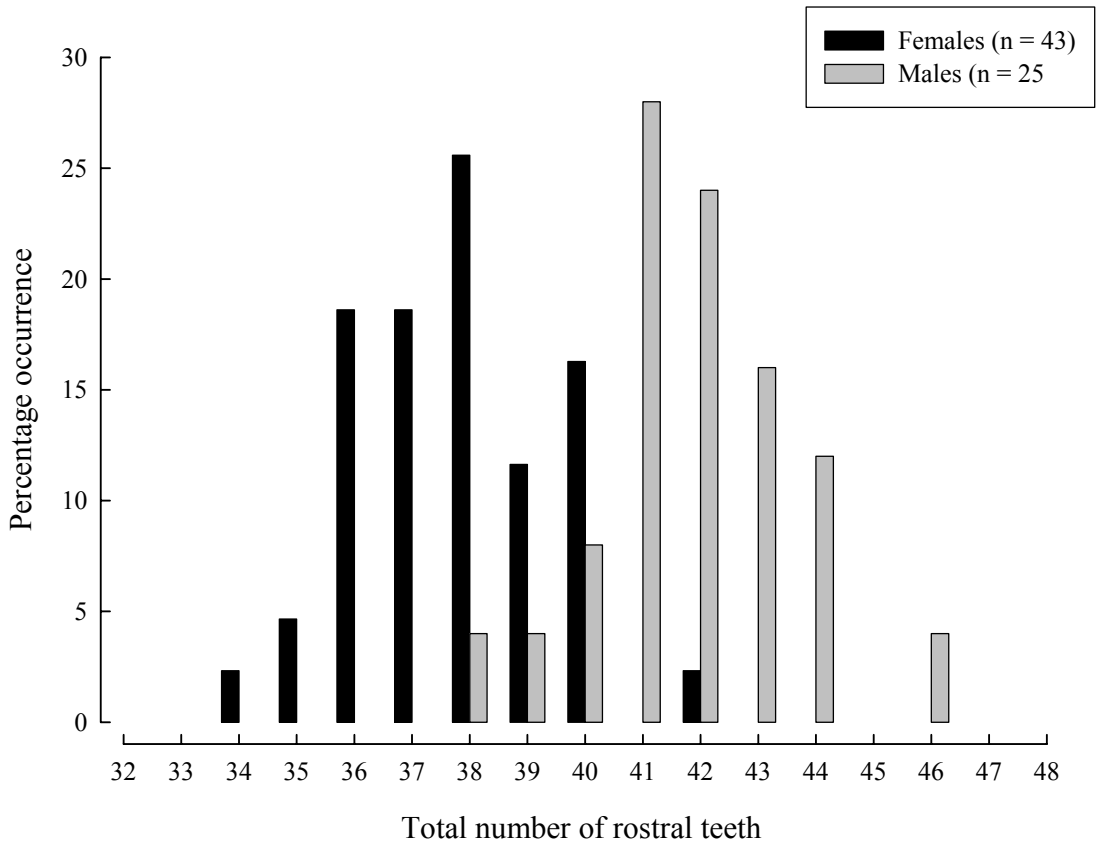

Figure 14 The percentage occurrence of the total number of rostral teeth in female and male *Pristis microdon*.

Discussion

With the exception of two individuals captured in the marine waters of King Sound, all *P. microdon* encountered during this study were caught within rivers (essentially in the Fitzroy River), and were a maximum of ~ 2.8 m in length, despite this species being reputed to reach 7 m (Last and Stevens 1994). The immaturity of all the male specimens captured (indicated by non-calcified claspers), and the possession of undeveloped ovaries and uteri of two large females, possibly reflect that this species utilises tropical rivers, such as the Fitzroy River, as a nursery for juveniles, a strategy used by other 'freshwater' elasmobranchs, including the bull shark (*Carcharhinus leucas*), where large mature individuals remain offshore, and juveniles penetrate freshwater riverine reaches far inland (Merrick and Schmida 1984, Thorburn *et al*. 2003). While there are currently no published records of *P. microdon* occurring offshore off the west Kimberley coast, at the time of this study positive identification of two large individuals were made of a 3500 mm TL female and 3000 mm TL mature male, a significant distance south of King Sound, in nearshore marine waters at 80 Mile Beach (Wallal) and near Cape Keraudren, respectively (Figure 1). These captures provide some support for the notion that upon maturation individuals move out of the river, or alternatively attain maturity outside the river.

The capture of *P. microdon* at Cape Keraudren is additionally interesting as this species has not been recorded in the nearby De Grey River, or in any other river throughout the Pilbara region (Morgan and Gill 2004). There are no large rivers between King Sound and Cape Keraudren, and between these points the Great Sandy Dessert extends to the coast. To the north of King Sound much of the land is topographically high, such as the Mitchell Plateau, and thus numerous rivers present barriers, upstream of which this species would not be able to penetrate. Previous ichthyological surveys of rivers to the north of King Sound, including the Isdell, Lawley, Mitchell, Prince Regent, King Edward and Drysdale rivers, have not recorded freshwater sawfish (Rosen, Nelson and Butler cited in Vari 1978, Allen 1975, Hutchins 1977, 1981, Allen and Leggett 1990, Thorburn *et al*. 2004). Thus, the waters of King Sound, and permanence of the Fitzroy River, may provide the most significant habitat for this species in this region, with mature animals radiating out from this point.

Despite authors such as Last and Stevens (1994) reporting that the freshwater sawfish in Australia appeared to be confined to freshwater drainages and the upper reaches of estuaries, and the belief that this species probably breeds in freshwater (Compagno and Last 1998, Pogonoski *et al*. 2002), results from this study suggest that this species is better described as a 'marine opportunist', and not

as a 'freshwater' species. Considering the maximum sizes and the immaturity of the animals encountered in the river, and the fact this animal attains a large size (up to 7 metres) and maturity is not reached until ~ 3 metres or greater, we can question the likelihood of a predatory species of this size sustaining itself (and manoeuvring) in rivers of northern Australia, many of which fluctuate greatly with season. Furthermore, Taniuchi *et al*. (1991) reports that the only mature *P. microdon* captured during that study from the Oriomo River estuary, New Guinea, was in the estuary, despite the capture of an additional 35 immature individuals from within the rivers. Several specimens collected from the Sepik River, New Guinea, during that study possessed yolk scars, and thus, Tanaka (1991) considered these were born in fresh water as they were caught 80 km from the sea (Taniuchi *et al*. 1991). This however is not an unfeasible distance for a juvenile elasmobranch to travel upstream after being born in or near the estuary, as two small *P. microdon* (and numerous *Carcharhinus leucas* possessing umbilical scars) were captured over 100 kilometres from King Sound (at Camballin Barrage) in the Fitzroy River during this study.

The significance of the Fitzroy River is further strengthened by the fact that it has the highest run-off of any river in Western Australia, is the largest catchment (~90 000 km^2) of any river in the Kimberley, and the topography of the land surrounding King Sound and the Fitzroy River is comparatively flat (especially below Fitzroy Crossing where the floodplain extends some 300 km to the coast). Thus, the entrance to this river is accessible to *P. microdon* throughout the year, even during the dry season when large tides connect the upper estuary with freshwater pools, allowing individuals to move upstream into relatively 'safe' waters. Additionally, water remains throughout the dry season, with the channel comprised of a series of large often interconnected pools and billabongs. The Fitzroy River is also a highly 'productive' river, illustrated by the high diversity of fishes in the large deep pools (the richest fluvifaunulae in Western Australia (Morgan *et al*. 2002, 2004)). These species (such as *A. graeffei*) often occur in extremely high abundances and thus potentially provide an important food source for a larger predatory species, such as *P. microdon*. Furthermore, large potential predators of *P. microdon*, such as adult sharks and estuarine crocodiles, rarely penetrate farther upstream than the estuary.

Considering the length-frequency data, and growth ring patterns observed in several specimens during this study, *P. microdon* may inhabit the river for between 3 and 5 years (possibly marginally longer for females) before heading out to marine waters. The fact that more females than males were caught in the Fitzroy River, together with the greater number of larger females being encountered, may additionally indicate that the males leave the river earlier (possibly after attaining maturity) or, modal (year) classes may indicate the faster growth of females beyond the first two

years. Assuming a birth size ranging from 50 (Wilson 1999) to 76 cm (Compagno and Last 1998), the first growth ring may be deposited around 1000 mm TL, the second at approximately 1500 mm TL, and a third beyond 2000 mm TL in both sexes. This is much faster than the growth rate expressed by Tanaka (1991), who interpreted vertebrae data from *P. microdon* collected from rivers in northern Australia and Papua New Guinea, despite growth rates appearing consistent in the first two years between the studies. In that study, first year growth was estimated to be 18 cm, with specimens up to 897 mm TL being considered in their first year (0+), while those between 992 and 1181 mm TL are in their second year (1+). Tanaka further explains however that growth in the tenth year is only 10 cm, and that deduced that an immature (sex unspecified) specimen of 2473 mm TL was 16 years old. This is thus inconsistent with the findings of this study, where vertebral rings and length-frequency data appear to indicate that animals of a similar size encountered in the Fitzroy River were closer to being in their 3rd (perhaps 4th) year. In support of this, Wilson (1999) reports the growth of a captive animal growing from 60 to 260 cm in 3 years. In addition, Tanaka (1991) expresses that the only mature *P. microdon* encountered in that study was a 3610 mm TL male reported to be 44 years old. As mentioned, a mature male ~ 3000 mm TL was encountered near Cape Keraudren, and thus, from this study it is believed that maturity would be reached at an age closer to that of the individuals encountered in the Fitzroy River and King Sound. Although the first individual recaptured grew only 30 mm in four months, two other recaptured sawfish grew 82 and 170 mm in the same period of time. In light of the fact that a majority of these periods coincide with the cooler waters of the dry season, and presumably a slow growth period, it supports the notion that growth rates are greater than those expressed by Tanaka (1991).

Length-frequency data indicates that a majority of the *P. microdon* collected were approximately 2000 mm TL and greater, and that small specimens were poorly represented. Although a number of techniques were employed to capture specimens, most were collected by gill net, including fine meshes capable of entangling small specimens. This may indicate a greater foraging effort being made by larger individuals, who thus cover greater areas to search for prey. . Alternatively, it is possible that habitat utilisation differs, with small individuals remaining in the shallows during the day, and large ones remaining less active in deeper holes and predominantly active at night.

Diet

The diets of *P. microdon* investigated during this study indicate this species forages close to the benthos. While it has been noted that this species uses its rostrum to stun slow moving fishes (Merrick and Schmida 1984, Pogonoski *et al*. 2002, Allen 2002), the abundance of the Ariid catfish, *A. graeffei*, in the diet of *P. microdon*, and the presence of cherabin, detrital matter, sand and

molluscs indicate this species feeds low in the water column, as opposed to targeting upper water column species such as *Nematalosa erebi* which appears an equally abundant potential prey source in the Fitzroy River.

Migration of Pristis microdon in the Fitzroy River

Sampling during this project emphasised the effect of barriers on the upstream migration of *P. microdon* in the Fitzroy River. During most tides, shallow sand banks prevent sawfish moving upstream from Telegraph Pool, and thus individuals appeared to accumulate at this locality, presumably while trying to migrate upstream. Large tides (up to 12 metres in King Sound) however allow fishes to move into upstream pools. This accumulation of individuals was also observed below Camballin Weir, where catches were vastly higher from a series of interconnected pools immediately downstream (despite being unable to access and sample these sites during the wet season). The weir itself is a remnant of failed irrigated agriculture trials during the 1960's, and diverts water into Snake Creek, and the surrounding flood plain. Although inundated during the peak floods of the wet season, for much of the year (up to 10 months) it is exposed, and thus impedes the movement of all migratory species (both up and downstream). The presence of high numbers of predatory species, such as the bull shark *C. leucas*, below the weir (Thorburn *et al.* 2002, 2004) indicate that predation pressure is thus high, and its accessibility to fishers means additional pressure is placed upon target species, including *P. microdon*. Furthermore, pieces (vertebrae and flesh) of a freshwater sawfish were found within the stomach of a bull shark captured below the barrage.

Sexual dimorphism of rostral teeth and diagnostic applications

Considering the reported contraction in the range of *P. microdon* throughout the world, and in Australia, rostrums held in private collections may be useful in obtaining past distribution data for comparison. While the range in rostral teeth counts in females (17 to 21) and males (19 to 23) found in this study were the same as that found by Ishihara *et* al. (1991), the average number of left and right rostral teeth from those specimens collected from the Fitzroy River varied slightly from that study, with females during this study having an average of 18.86 and 18.88 cf. 19.2 and 18.7, and males having an average of 20.96 and 20.88 cf. 21.0 and 21.8 on the left and right sides, respectively. Although some overlap exists, counts of the number of left rostral teeth, and total tooth count, were shown to be significantly different between the sexes, and that in general, males have more teeth than females. Thus, rostrums with 19 or less left rostral teeth are likely to be from a female (or fewer than 38 teeth in total), and 21 or more is likely to be from a male (or more than 40 teeth in total). If the sex can be determined from the rostral tooth number, the total length may

then be generated more accurately by the respective POWER functions generated. In general, males have longer rostrums than females of the same total length.

Pristis microdon* vs *P. perotteti

Replacement of rostral teeth in sawfish does not occur (Slaughter and Springer 1968, Thorson 1973). Although overlap in the number of rostral teeth occurs between sawfish species, it is still an important diagnostic feature. As aforementioned, the current study agreed with the range in rostral teeth number recorded by Ishihara *et al*. (1991), and the average number observed in *P. microdon* also varied from that of *P. perotteti*. Although Tanaka (1991) found the growth rate of *P. microdon* to differ from that of *P. perotteti* (Thorson 1982) growing 18 cm in the first year and 10 cm in the tenth cf. 30-40 cm in the first three years and 12 cm in the tenth, Tanaka (1991) does not appear to clarify if these species are different, rather suggests that the differences may be due to the aging methodology used, rather than to their habitat. The length-frequency and vertebral aging data in this study however, although being less comprehensive than that of Thorson (1982) and Ishihara (1991), indicate that *P. microdon* from King Sound may grow at a much faster rate than that of *P. perotteti*. Indeed, further data and validation of the growth rates of *P. microdon* need to be collected.

Conservation recommendations

Of greatest immediate need for the conservation of *P. microdon* is the recognition by the Commonwealth and State Governments of the significance of Australian populations. Although this species has been shown to be locally abundant, as is the case in the Fitzroy River, the longevity of this species would be supported by the upgrading of the current EPBC 1999 listing to endangered, and in Western Australia, its listing under Schedule 2 (Protected Fish) of the Fish Resources Management Regulations 1995. Penalties would subsequently exist for the unlawful killing of this species and deter wasteful acts such as trophy collecting, and that witnessed while sampling in the Fitzroy River (see Thorburn *et al.* 2003), in which numerous *P. microdon* were killed by fishers in Telegraph Pool (Figure 15). Indigenous communities however should retain their traditional rights to fish for this species for consumption.

The continuation of sawfish tagging in the Fitzroy River may provide the opportunity to verify the notion that mature animals leave the river and disperse throughout King Sound and along the Kimberley (and Pilbara) coast. Although numerous meetings with traditional owners, explaining the purpose of the tags, and the reinforcement that indigenous persons retained traditional fishing rights and thus could capture and consume *P. microdon*, cultural misunderstandings led to the tags

of two recaptured animals being destroyed, and unreported. Thus, the production of educational material, including posters displayed throughout the various communities, presenting information in the various indigenous languages will continue. Satellite tagging is another option for monitoring the movements of *P. microdon* in the Fitzroy River. This may provide insight into the major times of activity and foraging ranges.

At this point in time, the potential for intensive irrigated agriculture continues to be investigated in the Fitzroy River region. The effects of impassable barriers on migratory species, including *P. microdon* is readily observed at Camballin Barrage, where 34 freshwater sawfish were captured. A similar number of the aggressive bull sharks were captured below this impediment, where they were found to prey on freshwater sawfish. While the diversion of water into Snake Creek is dependent upon the barrage remaining, the construction of a fish ladder or fish diversion channel would allow migratory species to continue upstream throughout the year. Large dams such as that proposed at Dimond Gorge or Margaret Gorge however, which aimed to reduce the natural flooding regime during the wet season, and increase the flow during the dry season (Anon 1993), would invariably affect the seasonal distribution of fishes, and again deny migratory species access to the habitat upstream and productive floodwaters (*P. microdon* was recorded from Margaret Gorge by Morgan *et al.* 2002, 2004). The exclusion of species above dams has been observed on the Ord River above the diversion dam in Lake Kununarra (Doupé *et al*. 2003).

Indeed, further studies of *P. microdon* throughout the Kimberley region (and northern Australia) are required to understand the true robustness of Australian populations. As is often the case, education of local communities and others who utilise the Fitzroy River, as to the importance of this population will assist in the persistence of this iconic species.

Figure 15 The removal of the 'trophy' rostrum (top), and (bottom) effects of discarded fishing line (there is no hook attached).

Camballin Barrage

References

Allen, G.R. (1975). A preliminary checklist of the freshwater fishes of the Prince Regent River reserve north-west Kimberley, Western Australia. In, miles, J.M. ans Burbidge, A.A. (eds), A biological survey of the Prince Reagent reserve north-west Kimberley, Western Australia in August, 1974. *Wildlife Research Bulletin of Western Australia* 3:1-116.

Allen, G.R. and Legget, R. (1990). A collection of freshwater fishes from the Kimberley Region of Western Australia. *Records of the Western Australian Museum* 14: 527-545.

Allen, G.R., Midgley, S.H. and Allen, M. (2002). *Field Guide to Freshwater Fishes of Australia*. CSIRO/Western Australian Museum, Perth.

Anon. (1993). *Fitzroy Valley Irrigation A Conceptual Study*. For the Kimberley Resources Development Office. Prepared by ACIL Economics and Policy Pty Ltd, Kinhill Engineers Pty Ltd, Bryn Roberts and Associates and Water Authority of Western Australia.

Boulter, S.L. (2002). *Coast Law in Western Australia*. Environmental Defenders Office WA, Perth, Australia.

Cerrato, R. M. (1990). Interpretable statistical tests for growth comparisons using parameters in the von Bertalanffy equation. *Canadian Journal of Fisheries and Aquatic Sciences* 47: 1416-1426.

Compagno, L.J.V. and Cook, S.F. (1995). Order Pristiformes, sawfishes. In: Fowler, S.L., Camhi, M., Burgess, G.H., Cailliet, G.M., Fordham, S.V., Cavanagh, R.D., Simpfendorfer, C.A. and Musick, J.A. (eds) *Sharks, Rays and Chimaeras: The status of the chondrichthyan fishes*. IUCN/SSC Shark Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.

Compagno, L.J.V. and Last, P.R. (1998). Order Pristiformes Pristidae sawfishes. *In*: K.E. Carpenter & V.H. Niem (ed.) *FAO Species Identification Guide for Fisheries Purposes. The Living Marine Resources of the Western Central Pacific*. Volume 3. Batoid fishes, chimaeras and bony fishes part 1 (Elopidae to Linophrynidae). FAO, Rome, pp 1410-1417.

Department of Primary Industries and Energy. (1998). *Australian Water Resources Council, Water Management Series No. 13*. Australian Government Publishing Sevice, Canberra.

Doupé, R., Morgan, D.L., Gill, H.S., Rowland, A.J. and Annadale, D. (2003). *Ecological and Social Issues Concerning the Establishment of a Recreational Barramundi Fishery in Lake Kununarra*. Report to the Lake Kununarra Fish Stock Enhancement Committee and Ord Land and Water Inc.

Hutchins, J.B. (1977). The freshwater fish fauna of the Drysdale River national Park North Kimberley, Western Australia. In, Kabay, E.D. and Burbidge, A.A. (eds), A biological survey of the Drysdale River National Park North Kimberley, Western Australia in August, 1975. *Wildlife Research Bulletin of Western Australia* 6:1-133.

Hutchins, J.B. (1981). Freshwater fish fauna of the Mitchell Plateau Area, Kimberley, Western Australia. In, *Biological Survey of the Mitchell Plateau and Admiralty Gulf, Kimberley, Western Australia*. Western Australian Museum Publication, Perth.

Hynes, H. B. N. (1950). The food of sticklebacks with a review of the methods used in studies of food in fishes. *Journal of Animal Ecology* 19: 36-58.

Ishihara, H., Taniuchi, T. and Shimizu, M.. (1991). Sexual dimorphism in number of rostral teeth in the sawfish, *Pristis microdon* collected from Australia and Papua New Guinea. *University Museum, University of Tokyo, Nature and Culture* 3:83-89.

Last, P.R and Stevens, J.D.. (1994). Sharks and Rays of Australia. CSIRO Division of Fisheries, CSIRO, Australia. 513 pp.

Merrick, J.R. and Schmida, G.E. (1984). *Australian Freshwater Fishes. Biology and Management*. Griffin Press, Netley, South Australia.

Morgan, D., Allen, M., Bedford, P. and Horstman, M. (2002). *Inland Fish Fauna of the Fitzroy River Western Australia, including the Bunuba, Gooniyandi, Ngarinyin, Nyikina and Walmajarri Aboriginal names*. Report to the Natural Heritage Trust: 56 pp.

Morgan, D.L., Allen, M.G., Bedford, P. and Horstman, M.. (2004). Fish fauna of the Fitzroy River in the Kimberley region of Western Australia – including the Bunuba, Gooniyandi, Ngarinyin, Nyikina and Walmajarri Aboriginal names. *Records of the Western Australian Museum* 22:147-161.

Morgan, D.L. and Gill, H.S. (2004). Fish fauna in inland waters of the Pilbara (Indian Ocean) Drainage Division of Western Australia – evidence for two provinces. *Zootaxa* In press.

Pogonoski, J.J., Pollard, D.A. and Paxton, J.R.. (2002). *Conservation overview and action plan for Australian threatened and potentially threatened marine and estuarine fishes*. Environment Australia, Canberra. 375 pp.

Ruprecht, J. and Rogers, S. (1998). Hydrology of the Fitzroy River. In, Storey, A. and Beesley, L. (eds), *Limnology of the Fitzroy River, Western Australia: a technical workshop*. Proceedings of a workshop held on 18th of February 1998, Edith Cowan University, Claremont Campus, Claremont, Western Australia.

Simpfendorfer, C.A. 2000. Predicting population recovery rates for endangered western Atlantic sawfishes using demographic analysis. *Environmental Biology of Fishes* 58:371-377.

Slaughter, B. H. and Springer, S. (1968). Replacement of rostral teeth in sawfishes and sawsharks. *Copeia* 3: 499-506.

Storey, A. (1998). Irrigated agriculture on the Fitzroy River: background and aims of the workshop. In, Storey, A. and Beesley, L. (eds), *Limnology of the Fitzroy River, Western Australia: a technical workshop*. Proceedings of a workshop held on 18th of February 1998, Edith Cowan University, Claremont Campus, Claremont, Western Australia.

Tanaka, S. (1991). Age estimation of freshwater sawfish and sharks in northern Australia and Papua New Guinea. *University Museum, University of Tokyo, Nature and Culture* 3:71-82.

Thorburn, D.C., Peverell, S., Stevens, J.D., Last, P.R. and Rowland, A.J. (2003). *Status of Freshwater and Estuarine Elasmobranchs in Northern Australia.* Report to the Natural Heritage Trust: 79 pp.

Thorburn, D.C., D.L. Morgan, A.J. Rowland & H.S. Gill. (2004). *Elasmobranchs in the Fitzroy River, Western Australia*. Report to the Natural Heritage Trust. 29 pp.

Thorson, T. B. (1973). Sexual dimorphism in number of rostral teeth of the sawfish, *Pristis perotteti* Muller and Henle, 1841. *Transactions of the American Fisheries Society* 102: 612-614.

Thorson, T. B. (1982). Life history implications of a tagging study of the largetooth sawfish, *Pristis perotteti*, in Lake Nicaragua-Rio San Juan System. *Environmental Biology of Fishes* 7: 207-228.

Vari, R.P. (1978). The Terapon perches (Percoidei, Teraponodae). A cladistic analysis and taxonomic revision. *Bulletin of the American Museum of Natural History* 159: 175-340.

Wilson, D. (1999). Freshwater sawfish *Pristis microdon*. Australia New Guinea Fishes Associations' A-Z notebook of native freshwater fish. *ANGFA Bulletin* 41.

CHAPTER 2

Cultural significance in the Fitzroy River catchment of the freshwater sawfish *Pristis microdon* for the Nyikina, Bunuba, Gooniyandi and Walmajarri language groups

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(CULTURAL HERITAGE CONNECTIONS PTY LTD)

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Introduction

During the first part of 2004, a joint project was initiated by the Centre for Fish and Fisheries Research at Murdoch University situated in Perth, Australia and the Land and Sea Unit of the Kimberley Land Council (KLC) located in northern Western Australia (through its Fitzroy River Care Project) to undertake a biological and cultural study of the Freshwater Sawfish (*Pristis microdon*) in the Fitzroy River that runs through the Kimberley region. Earlier studies had shown that the Freshwater Sawfish was present in larger numbers within this river than possibly any other in the world and funding was obtained through the Threatened Species Network to undertake the

project. The Kimberley Language Resource Centre (KLRC) provided additional support and expertise to the project in relation to the languages of the Indigenous groups within whose boundaries the Freshwater Sawfish is found (Nyikina, Bunuba, Gooniyandi and Walmajarri).

Cultural Heritage Connections Pty Ltd was commissioned in July 2004 to provide field expertise to collect and collate the information obtained from the four identified language groups relating to the cultural significance of the Freshwater Sawfish to the people of each of the individual language groups. The following report documents this information that was obtained during a three-week period in July 2004.

Background

The Kimberley region in Western Australia covers an area greater than the state of Victoria. The Fitzroy River travels from King Sound near Derby for more than 500km through this landscape that consists of a variety of landforms including rugged hills and plains. The section of interest within this project was from the mouth of the river in King's Sound to the exposed Devonian reefs of the Geikie Range, upstream from Geikie Gorge National Park near Fitzroy Crossing.

Within the Kimberley region there are five broad language families that have a number of smaller language groups within those familles. The study area runs through the accepted boundaries of four of these language groups. From King Sound to Noonkanbah is the country of the people of the Nyikina language group. Within and around the township of Fitzroy Crossing, the country of the Bunuba and Gooniyandi language groups meet. Bunuba country extends from here to the northwest of the township to stations known as 'Fairfield' and 'Leopold Downs'. Alternatively the Gooniyandi country can be found to the southeast of the township and includes the station known as 'Christmas Creek'. Just south of the town of Fitzroy Crossing itself, you can find the country of the Walmajarri language group that extends south into the Great Sandy Desert.

During previous studies undertaken on the Fitzroy River, Morgan *et al.* (2002) identified an area of habitat of the Freshwater Sawfish within the boundaries of the Indigenous language groups listed above. It was recognised that the fish had both biological and cultural significance and whilst conducting field visits, members of the Nyikina, Bunuba, Gooniyandi and Walmajarri language groups were invited to share with the researchers their knowledge of the Freshwater Sawfish and its cultural significance to each of them.

Methods

During 2003 and 2004, researchers from Murdoch University conducted a number of field visits to areas on the Fitzroy River. The primary objectives were firstly to catch specimens of the Freshwater Sawfish, and to tag, obtain tissue samples and document their characteristics before releasing them back into the river. Secondly, the objective was to document the cultural significance of the Freshwater Sawfish to the Nyikina, Bunuba, Gooniyandi and Walmajarri speakers.

During a trip in July 2004, visits were made into King Sound on the 9th of July 2004 before going to Snag Pool from the 10th and 12th of July. Following this, a third trip was organised from the 14th until the 16th of July to Camballin and the Barrage. These trips were undertaken with representatives of the Nyikina language group.

The final trip was to Fitzroy Crossing from the 18th until the 22nd of July. During this time meetings were held by the river with members of the Bunuba language group whilst another was conducted within the town with Gooniyandi representatives. Due to unforseen circumstances, people from the Walmajarri language group were unable to participate however, a meeting was held with them on the 20th of August 2004.

The author, throughout the field visits, recorded the stories and beliefs about the Freshwater Sawfish and the information regarding its cultural significance. The method used to do so was one where conversations about the Freshwater Sawfish were prompted, the detail written down and later checked with the participants in question. These conversations invariably led to discussions about the river as whole and other fish species that are of importance to the people and this information is also documented in the sections.

Cultural significance within the language groups

During the field visits, members of each of the four language groups were consulted. The primary objective of this was to document the cultural significance of the Freshwater Sawfish for the Nyikina, Bunuba, Gooniyandi and Walmajarri people. The information provided within this section details the results of these discussions.

Nyikina

There are a number of different dialects of the Nyikina language group and three of these are from the Upper Fitzroy River, Lower Fitzroy River and Noonkanbah regions. The landforms within the regions vary and the country covers both saltwater and freshwater. 'Wirridanyniny' is reportedly the name given to the Freshwater Sawfish by these people (Morgan *et al*, 2004; pg. 156), however the name 'pial pial' is also used locally. A number of representatives from the group participated in the field visits and spoke with me about the fish and its significance to them.

Whilst speaking with Lucy Marshall, during one of the field trips to Camballin and the Barrage, she told us about when she was younger and living on Mount Anderson Station. With her family and friends, they would 'poison' the waterholes with bark from a freshwater mangrove (probably *Barringtonia acutangula*; 'mudjula' in Nyikina) to stun the fish so that they were able to catch many of them. She said that they would pull out the larger fish first like shark, crocodiles, sawfish and stingrays, as they would urinate in the water and counteract the 'poison'.

"We would take heaps of it home with us" Lucy tells. "Barramundi was the good fish to eat. We would only eat them stingrays and sawfish when there was nothing else. Although sometimes when there weren't many fish, then we would cook them up [sawfish] for a feast".

"There was also another time when we poisoned that waterhole and there was a big salty [saltwater crocodile] in there. Was hard to get him out that time, and a little scary" she said. "That happened sometimes. Sometimes we would have to pull in big ones [saltwater crocodiles] when we poisoned the waterholes."

Fishing with hand lines is the method that is currently used by most Indigenous people in the region in conjunction with throw-nets that are used to catch bait.

Information was also provided by both Lucy and Lena Buckle regarding seasonal indicators that were observed over the years not only to find food but also to ensure that you remained healthy.

"During the floods you weren't to swim or fish the first time the water came. The second and third waves you could as much as you liked."

"We would also look for the bark coming off trees of the Eucalyptus" ('kulbigji' in Nyikina). This would indicate when crocodile eggs were hatching and stingrays were laying down their fat. This

also signals the time when the eggs are ready for eating and the rays for catching. “If you are pregnant though, you can’t eat the sawfish or the stingrays. If you do, you get a heat rash.”

Barramundi and catfish are also important species to the Nyikina people. There is a story and dance about catfish swimming in circles and other stories about the barramundi that are very important. Although there were no stories or totems as such for the Freshwater Sawfish, the women spoke about the fact that they are part of the river and therefore part of the river totem.

In addition to this, the people who participated who belong to the Nyikina language group were able to provide the names of some of the different freshwater and saltwater fish species in the Fitzroy River region that were previously collected from members of the Kimberley Language Resource Centre (KLRC) and were reported earlier this year (Morgan, *et al.* 2004; pg.156). Table 1 provides the results and includes the phonetic pronunciation, as confirmation of the spelling is still required.

Table 1 Names in Nyikina of some of the fish species found in the Fitzroy River.

Freshwater species	Common Name	Nyikina (verification required of spelling)	Phonetic pronunciation
Anguilla bicolour	Indian short-finned eel	Budgarburra	budge-a-bura
Anodontiglanis dahli	toothless catfish	Mowalun	mow-a-lun
Scatophagus argus	spotted scat	Kirrang kirrang	girrang girrang
Selenotoca multifasciata	striped butterfish	Kirrang kirrang	girrang girrang
Marilyna meraukensis	Merauke toadfish	Koongonoong	Goongonoong

Bunuba

Geikie Gorge or ‘Darngku’ is a special place on the Fitzroy River for the Bunuba people. It is a place of beauty that attracts thousands of visitors every year. It is also around this section of the river that the Freshwater Sawfish or as the Bunuba say, ‘galwanyi’ can be found (Morgan, *et al*, 2004; pg. 156). One of the people who best know this section of the river is Mary Aitken, a local Bunuba woman who operates Darngku Heritage Cruises during the dry season.

Mary spoke about catching sawfish within and around the gorge on a number of occasions. One recollection she has is when she was out fishing with her sister with hand lines off the sandbar

within Geikie Gorge National Park. Mary hooked a sawfish and then her sister hooked one as well. Both of their lines were being pulled and Mary said "Those fish, they kept going, going, going." They held on to the lines for a while but in the end they had to snap them off, as the fish were so big. She caught another one a couple of years ago that had a long bill. She chopped the rostrum off and gave it to the CALM ranger at Geikie Gorge to put up in the rotunda for everyone to appreciate.

She also knows where to look in certain places in the gorge to find sawfish (stingrays too). "You don't go looking for them though," she said. "Too much [meat]. Just if you happen to catch them [do you eat them]. One of these spots is on the right, round the bend from the White Rock [Darngku]. From the sandbar too. There are a number of spots."

Sometimes you can also tell where they are from groups of bubbles that rise to the surface of the water. "Sometimes the bubbles are from turtles though. Sometimes crocs. When the turtles or crocs are hanging around nearby you won't be able to get a bite from the bream."

She went on to talk more about the sawfish and about the times of year that they catch different sizes of the fish. You can catch the little ones during the flood. These little ones they usually throw back. Sometimes they do take those little ones to eat (but none that are smaller than a metre in length).

You can catch the big ones when the water starts to go down after the floods, or later in the year just before the wet season starts. In the 1960's, 70's, 80's people used to get huge ones. The biggest one Mary ever caught was the length of her Toyota tray-back. It had a big, thick saw with the entire rostrum attached to it.

"We take him home for eating if we don't catch any other fish. Only when we need to do we take it home and share with our family and friends. When we have lots of barra and bream we put him [the sawfish] back – its too much [meat]. Sometimes he's too heavy to carry it back to the car. We put him back then too. Some old people like eating their sawfish though. Old people love their sawfish."

When meeting with the other Bunuba speakers, most of the participants spoke about eating the sawfish. Patsy Shaw and Nancy Rogers were two of these people who also mentioned that you could catch them all year around. Nancy also spoke about cooking the sawfish before continuing on to talk about the many ways you cook all of the different fish that you eat.

“To cook the sawfish you take out the rubbish [guts] and cook the fat in a pot. You have to make a bed of coals in a hole and put the sawfish meat on top of them. You wrap it in paperbark and then put him on the coals. Cover him up with some more coals and leave him to cook a while. When he’s ready, you dip the meat in the fat and eat him like that”. Suggestions were later made that it should be eaten with damper, a little salt and pepper mixed in and some onion or curry as well.

“To cook the crocodile you cut him on this side under here [left side under the armpit] and take out the rubbish [guts]. Put him on the coals and cover him with more coals. Cook up that meat and eat him.”

“You cook that goanna the same and barramundi too. But that barramundi, you fill his belly with hot rocks first, then cook him.”

Mary then provided more detail regarding cooking the goanna, catfish and barramundi. “With the goanna, first you have to take the guts out and you get them from either the throat or the bottom. Then you sew him back up and turn him over and over again over the flames of the fire. You do this to get that scaly thing out. Then you place coal and rocks in a hole before placing the goanna on top of these. Next you cover this with sand and put coals on top of that. Leave it for maybe two-three hours if he’s a big one so that the meat gets really cooked.”

“Barramundi however, is cooked in a similar fashion, but you don’t gut him. Instead you build a big fire first and let him die. This way he won’t flop around in it when you are trying to cook him. You cook him the same as the sawfish – you put him in paperbark before putting him on the fire. You do this by wetting the paperbark first and put it around the fish. This wet paperbark then goes on to the coals. You then wrap it in a dry one as well and put lots of hot sand and coals on top. This one you cook for one-two hours. You eat everything then, guts too. These fish aren’t dirty inside so you can eat it all. Sometimes the old people though, they cut him up and steam him in a big pot with curry too. Leave him for a while in this before they eat him.”

“Catfish are a little different though. You have to squeeze their guts out and then pretty much turn him inside out before you cook him. Bream is more like the barramundi – you gut him first the same way you would a barramundi that you were taking home before you cooked it. You cook these whole on the coal but only eat the meat and the fat. The cherabin you chuck straight on the coals as they have more taste when cooked this way rather than steamed.”

Dillon Andrews also articulated the special care and importance of fish for the Bunuba people. “When someone passes away you can’t eat red meat and fish becomes the staple for 6-12 months or more. Sawfish is an important part of this type of diet as it provides a lot of meat.”

Gooniyandi

Previous researchers have spoken with Gooniyandi people to find out their name for the Freshwater Sawfish. They call it ‘galwanyi’ (Morgan *et al.* 2004). Whilst I was in Fitzroy Crossing I spoke with Topsy Chestnut, a Gooniyandi person, about the stories that the Gooniyandi people might have had about the Freshwater Sawfish. She said that there are no stories about the Freshwater Sawfish in particular but there are a couple of stories that include them. They are as follows:

“We have a story about a rock in Christmas Creek. When the river floods the big fish are allowed to go past him and swim where they like. When the water is dropping though, the rock, he calls to the big fish to come back to the other side of him, back to the river. He calls to fish like the shark, the sawfish and the barramundi. He calls to them to come back otherwise they will get caught in the shallow pools. The rock can move to go and get them. A couple of times he hasn’t called them back though and those big fish have been caught where they shouldn’t be (when nothing bigger than the catfish should be there).”

“There is also a story about two birds. One of them was a heron. The other was a spoonbill. The heron got some bark from one of the freshwater mangrove trees. She was going to use it to ‘poison’ some waterholes to get some fish. As she was walking along she passed a spoonbill.

‘Where are you going?’ the spoonbill asked.
‘I’m going to poison some waterholes down there and get some fish’ the heron replied.
‘I’ve just come from there and there are no fish there anymore’ said the spoonbill.
The heron, she was surprised by this. But she said, ‘OK’. So she dropped that poison bark where she was and got no fish. The freshwater mangrove then grew along that section of Christmas Creek to the river. “

Sometimes Topsy has caught sawfish on a hand line out the back of Gogo Station. Sometimes she has caught sharks too. But doesn't catch stingrays anymore. She's seen the sawfish on Margaret River as well as on Christmas Creek.

"After the floods when the waters are dropping, sometimes you catch the little sawfish then. You throw them back usually, unless you are really hungry and then you eat him." She also commented about the rostrum, "You might keep him sometimes and hang him up. Other times you just throw it away."

Walmajarri

The Walmajarri word for the Freshwater Sawfish is 'Wirrdani' (Morgan *et al.* 2004; pg. 156). Although their country is predominantly in the Great Sandy Desert, a small part of their country is near the Fitzroy River. I spoke with Josephine Forest, Amy Nuggett and Annette Kogolo about their experiences with the Freshwater Sawfish.

Josephine caught a sawfish out at the Barrage last year with a tag in its fin and she threw it back. She also caught another one on the river near Nurtuwarta (Forest River). This place has shallow water and after the flood levels dropped they found the fish stranded in a waterhole. When she catches Freshwater Sawfish, she sometimes throws them back and at other times she eats them. When she eats one, she will wrap it in paperbark and cook it a special way in the ground. "It tastes really good."

Like people from the Nyikina language group, the people belonging to the Walmajarri language group also used the bark of a freshwater mangrove to 'poison' the waterholes so that once stunned, the fish would float and be easily caught. The people would target the waterholes that were left behind as the creeks dried up – places that still had large numbers of fish and they would put the bark in those. Hand lines and throw-nets have almost replaced this traditional method however at special times such as sorry business, the bark is still used to catch catfish in particular.

Modifications have also been made over time not only to the equipment used but how it is made. Hand lines are usually made from nylon, however Josephine and her family used to string their own lines normally from cotton. They would also take needles, heat them in the fire and using their mouth, bend it into a hook. They would use the smaller needles to catch cherabin and the larger ones for bream.

In order to catch the different types of fish, the Walmajarri people would use a variety of bait. They would use frogs, grasshoppers, cherabin, mussels and half-changed tadpoles. Crab was used to catch barramundi and salted meat was good to catch catfish. At times when bait was scarce, boiled damper would also be used. By throwing sand in the water, all of the fish would be attracted by the noise and everyone would see what types of fish were there.

Whilst talking with the ladies, they also spoke about the different types of fish that they liked to eat and times when it may not be appropriate. Josephine and Amy reminisced over being told these stories by their older sisters. In fact, it was Topsy Chestnut's (Gooniyandi) grandmother who used to teach them not to eat certain things.

If a woman is pregnant, the Walmajarri women believe that she shouldn't eat the eel, as it will cause the baby to stay in one place and cease moving quickly. Pregnant women shouldn't eat catfish either, as the spike would poke the woman in the stomach during digestion and cause her to have a miscarriage. Additionally, by eating turtle whilst the mother is pregnant will cause the skin of the baby to peel off. (When a person is seen with peeling skin in these times, they believe that their mother must have been eating turtle in the early days of her pregnancy). However, they do believe it is alright for the mother and baby to eat the sawfish when you are pregnant and crocodile as well. They become important parts of a pregnant woman's diet.

Should unusual fish be caught during an outing, the women believe it means there is a pregnant woman amongst them who is either in her early stages and may be unsure of the pregnancy or has not yet passed the information on as it is too early in the pregnancy. Amy recalled a time that she thought she had caught a sawfish, the pull on her line was so great. In fact she pulled in six mussels and it was later discovered there had been a pregnant woman with them.

Barramundi is another fish that is important in everyone's diets. They believe that once you catch a big barramundi, you should put all of the fish's scales around the body of a young child. Mother and child are both able to eat the fish and old people still eat this fish in the traditional, cultural way. Cod and black bream were also good to eat. Although cods were known for their big mouths, black bream were seen as good fish at any time.

It is not only women who have been traditionally guided by cultural beliefs as to what they can eat and when, all members of the community are affected. Small boys were restricted in the amount of

cherabin they were allowed to eat. It was believed that they shouldn't eat too many as their penises would droop (in the same fashion that the cherabin bends in half when cooked) and appear red. Little girls were also restricted in the number of cherabin they ate, as it was believed that they would end up with very long pubic hair. The boys in particular, and their mothers were taught about this and the boys were encouraged to use them for bait, rather than eating them themselves.

The boys were also unable to eat freshwater mussels as it represents a woman's vagina. Although this story is very old and has been passed through the generations, Josephine, Amy and Annette discussed how this one is no longer followed as much and males tend to eat mussels anyway.

One tradition that continues is the one that occurs when an eel is caught. When people caught one, they would use it to hit the person who caught it and some of the younger children. If you could stand the hit, then you would gain strength from it.

A song called 'Ruwa' has been written in Walmajarri and talks about taking the children fishing and hunting to experience different types of traditional events. Due to intellectual property issues, it is not possibly to reproduce the lyrics or their meanings within this report, however it may be purchased from Mangkaja Arts in Fitzroy Crossing and the Fitzroy Electrical Shop.

Overview

Focus was given throughout the project to each of the language groups individually. The conversations were opened with queries regarding the Freshwater Sawfish and its importance to each individual language group. The conversations that ensued during and after the field visits were open and provided varying information.

The Nyikina people spoke about different totems of the river and the land, as well as changes in the surrounding landscape that would indicate when different species including the sawfish were ready for eating. Alternatively, the Bunuba people spoke a great deal about bush tucker and the many ways to cook and eat the different fish species that they catch on the Fitzroy River.

This was quite different to the Gooniyandi people, who spoke about different stories that make reference to fish in the river. Particular reference was made of the larger ones such as the crocodiles, Freshwater Sawfish and the sharks. Whereas the discussions that were held with the Walmajarri language group focused on the different types of fish and crustaceans that they catch in the rivers and cultural beliefs as to who can eat each one.

The Freshwater Sawfish itself has been traditionally used for food (particularly in times of hardship due to the large quantities of meat that it provides), plays a role in the cultural beliefs of the Fitzroy River and contributes to environmental indicators that have been observed for generations of Indigenous people in the region. Today, art depicting the Freshwater Sawfish are produced in many forms including paintings, screenprints and at times the rostrums themselves are painted (pers.comm. Dayman, 2004). They have also been included in murals that have been produced of the fish of the Fitzroy River including the large one situated near Fitzroy Crossing and in the remote community of Jarlmadangah Burru.

The information provided by each language group related not only to the Freshwater Sawfish, but to the fish found on the whole of the Fitzroy River and provides an insight into the cultural significance of these species to the people of the Nyikina, Bunuba, Gooniyandi and Walmajarri language groups.

References

Morgan, D.L., Allen, M.G., Bedford, P. and Horstman, M. (2002). *Inland Fish Fauna of the Fitzroy River Western Australia, including the Bunuba, Gooniyandi, Ngarinyin, Nyikina and Walmajarri Aboriginal names.* Report to the Natural Heritage Trust: 56 pp.

Morgan, D.L., Allen, M.G., Bedford, P. and Horstman, M. (2004). Fish fauna of the Fitzroy River in the Kimberley Region of Western Australia – including the Bunuba, Gooniyandi, Ngarinyin, Nyikina and Walmajarri Aboriginal names. *Records of the Western Australian Museum* 22:147-161.

APPENDIX I

Artwork competition

Freshwater sawfish are often incorporated into the artwork of traditional people of the Fitzroy River. To promote the project, Mangkaja Arts hosted a competition to paint sawfish for use in poster artwork for the project. That is, the winning artwork would be used as a background for a poster highlighting the importance of conserving the endangered freshwater sawfish. The winning entry, which was chosen at a meeting in August 2004 was won by Joy Nuggett. The second prize was won by Terry Murray. We would like to thank all those that entered the competition, including local school groups.

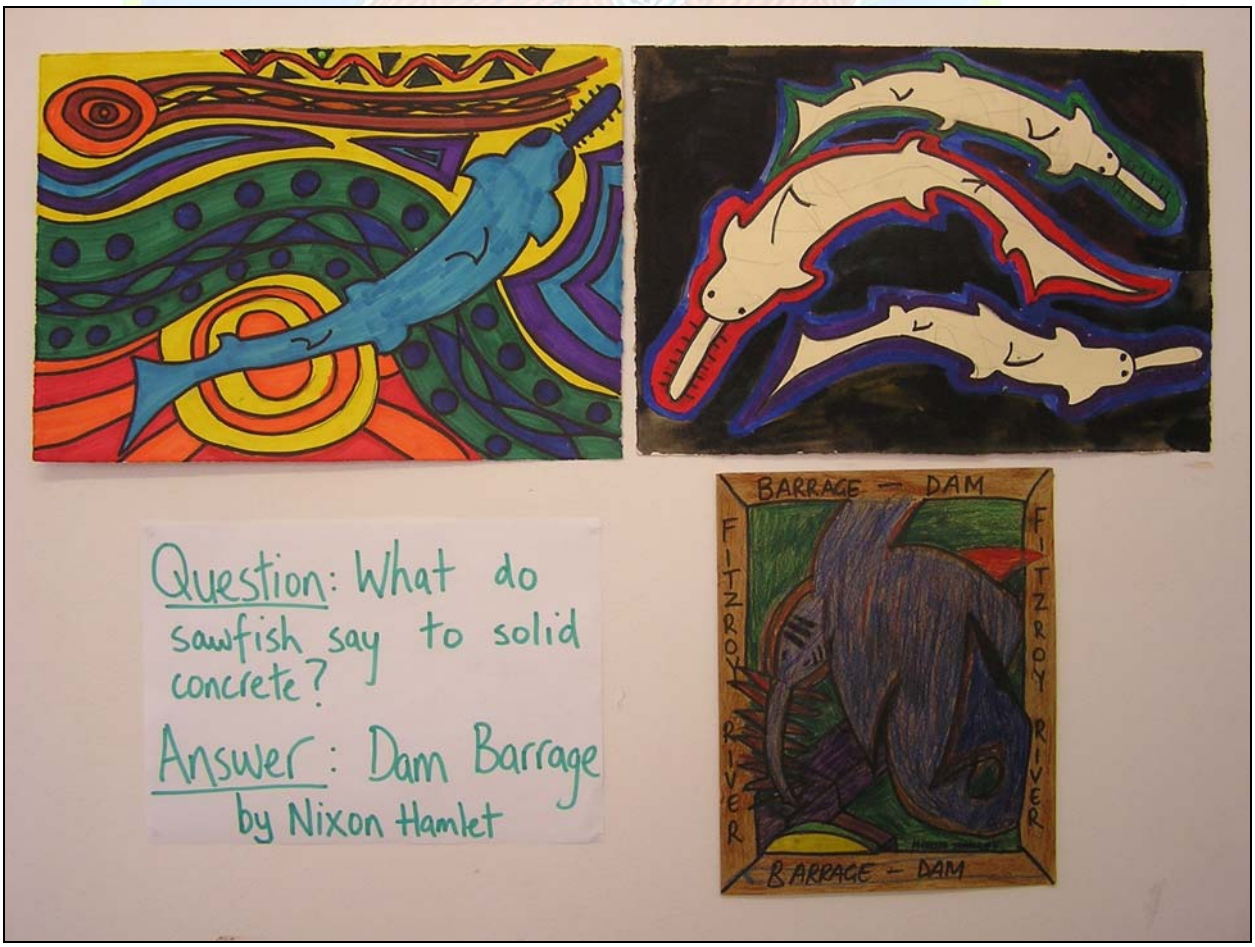
Competition winner painting by Joy Nuggett

Second place painting by Terry Murray

Other entries

Painting by Eileen Forrest

Painting by Janet Williams



APPENDIX II

Fitzroy River Freshwater Fish Meeting
8 March 2004
Fitzroy Crossing Lodge

People who attended:
Dylan Andrews, Dicky Bedford, James Beringal, Christine Brooking, George Brooking, Joe Brown, Justine Brown, Lena Buckle, Percy Bulagardie, Mona Chuguna Thomas Dick, Stanley Hollaway, Daisy Jubudjah, Mabel King, Suzey Lamey, Helen Malo, Ivan Mcphee, Mick Michael, Stanley Mirando, Morton Moore, Rosie Mulligan, Terry Murray, Nugget , Pansy Nulgit, Mona Oscar, Eugene Shaw, Jack Shaw, Laurie Shaw, Rosita Shaw, Sarah Shaw, William Shaw, William Shaw (jnr), Peter Skipper, Dicky Tataya, Basil Thomas (jnr), Jeanie Warbie, Colin Wosie, Lucy Wulgarie.

Kimberley Land Council
Ismahl Croft, Ari Gorring, Charles Prouse, Tom Vigilante, Hugh Wallace-Smith.

Kimberley Language Resource Centre
Patsy Bedford, Edgar Price

World Wide Fund for Nature
Raquel Carter

Murdoch University
Dave Morgan, Dean Thorburn

CALM
Scott Godley

Summary of meeting with ideas for the newsletter:
Dave Morgan from Murdoch Uni gave a summary of fresh water fish research survey findings:

- Number of species found and number of places surveyed
- Comparison with other rivers in WA
- Why Fitz River is important
- Show a couple of pictures of new species with map identifying locations in which they where found.

List threats to fish and river:

- Ferals
- Dams – problems with Camballin Barrage
- Fish farming
- Show couple of pictures of feral fish and let people know that they can get more info from KLC and KLRC offices

Dean Thorburn spoke about the sawfish and why they are so important:

- Explanation of threatened status of species
- Results of surveys across nth Aust.
- Breeding patterns
- Importance of Fitzroy River as sawfish habitat/King Sound as nursery
- Tagging and monitoring – future possibilities for Aboriginal employment
- What to do if you catch one with a tag.
- What to do if you catch one and want to chuck it back. Explanation about looking after not saying people can't eat.

Summary of WWF and threatened species network.

Spoke about proposals for irrigated agriculture and water use from Fitzroy River -
"Big thing we talking about this river. Someone got a plan already sitting up. People know the river from here to the saltwater. All together, that's the way we can make our belief strong – All together" Joe Brown

Workshopped ideas for community education campaign about sawfish and importance of river.

Workshop 1

- Have traditional song for river and fish in background
- People painted up with river/fish paintings and dancing for animals/fish.
- Show that river is a cultural resource spiritually and for food.
- Story of meaning for song.
- Blackfella on mobile phone painted up calling gov/minister asking to come and tell people what is happening

- All tourists packing eskies with fish and blackfellas sitting around near river opening tin fish.
- Stingray, sawfish, bullshark, song, people all travelling down river and irrigation proposals travelling up river crash in the middle.
- Have Josi Lawford doing voice over
- Call out language names for places along the river
- Getting all the people together as one to show footage of people walking on the river (young, old, different language groups)

Signs:

- Welcome to country in English and language
- Story and name for place or feature in area.
- Help us look after our country by:
- It is important place for sawfish
- This is what you do if you catch one and want to chuck back
- What to do if you get one with a tag.
- Need to look at artwork for posters and signs.

Workshop 2

Message:

- That the river is home to everybody and the animals
- river is main food source for the people
- stop damming
- river is life, law + culture
- educate people to stick to limits on fish & cherrabuns
- educate people on fish that are endangered
- educate people on cleaning up their rubbish at fishing spots
- river to stay as it is
- don't kill our river
- river is important for dreaming, has sacred meaning to our people eg: water serpent
- what effects it will have on our fish if they dammed, would they be edible due to chemicals from irrigation

APPENDIX III

Sawfish poster

Poster produced for display at various locations in the west Kimberley, including Giekie Gorge, Tarunda Supermarket (Fitzroy Crossing), Kimberley Land Council (Derby and Fitzroy Crossing)

(other posters are currently being produced for the different language groups)

Freshwater Sawfish (*Pristis microdon*) surveys in the Fitzroy River

***Freshwater sawfish* = *Galwanyi* (Bunuba and Gooniyandi), *Wirridanyniny* (Nyikina), *Wirrdani* (Walmajarri)**

The Fitzroy River is home to some of the rarest sharks and stingrays in Australia. One of these species, the Freshwater Sawfish commonly occurs throughout the catchment in both fresh and salt waters, and during a survey of rivers throughout northern Australia conducted in 2002, was found to be in greater numbers in the Fitzroy River than anywhere else. This species is listed by the Commonwealth Government under the EPBC (Environmental Protection Biodiversity and Conservation) Act 1999 as Vulnerable, and Critically Endangered on the IUCN (International Union for the Conservation of Nature) Redlist. Funding has recently become available through the Threatened Species Network by World Wildlife Fund (WWF) Australia, and in collaboration with the Kimberley Land Council (KLC), Murdoch University, the Kimberley Language Resource Centre (KLRC) and communities of the West Kimberley, a survey of the sawfish population and an education/awareness program is being undertaken.

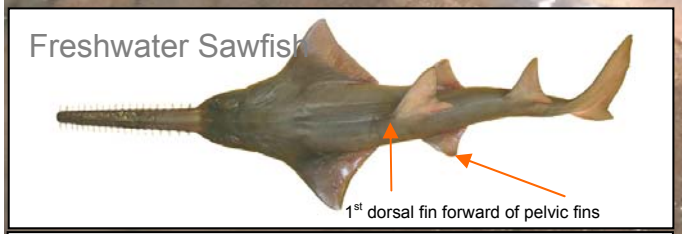
Approximately 70 sawfish were tagged during 2003, using tags provided by the Department of Fisheries WA. Sawfish were tagged on either the pectoral or dorsal fin.

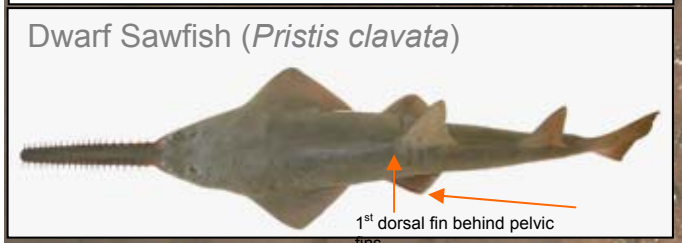
AIMS

1. Determine the distribution and abundance of the Freshwater Sawfish in the Fitzroy River.
2. Provide an insight into the ecology of the Freshwater Sawfish (e.g. is the Fitzroy River a key habitat for juveniles; sex ratios; maturity status).
3. A key part to this project will also be the initiation of a long-term community run tagging and monitoring program.
4. Document the spiritual and cultural values of the Freshwater Sawfish.
5. Aid in the development of best management practices for the protection of the Fitzroy River and the sustainability of the species.

Identification

There are two species of sawfish known from the Fitzroy River – the Freshwater Sawfish and the Dwarf Sawfish. The Dwarf Sawfish is generally found downstream of Telegraph Pool, while the Freshwater Sawfish is widespread throughout the river (well upstream of Geikie Gorge). Both are also found in the ocean. They can be distinguished by the position of the dorsal fin (see below)





Threats

Kimberley Land Council

Kimberley Language Resource Centre

MURDOCH UNIVERSITY PERTH, WESTERN AUSTRALIA

For more information contact:
KLC Fitzroy Crossing (Hugh Wallace-Smith – (08) 9191 5260)
Murdoch University (Dean Thorburn or David Morgan – (08) 9360 6322)

Poster by Dean Thorburn and David Morgan (Murdoch University)

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Thanks to Karen Dayman and Terry Murray from Mangkaja Arts for organising the art competition.

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