Technical Memo in relation to the presence of sawfish species and the construction of a marina in Port Hedland

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Summary

The Technical Memo provides information on sawfish species in relation to the construction of a marina at the Port Hedland Spoil Bank and whether the proposal is likely to impact these Federally listed species.

Details of the proposed marine can be found at the following web address: https://www.transport.wa.gov.au/projects/port-hedland-spoilbank-marina.asp.

There have been no targeted sawfish surveys in the immediate vicinity of the proposed Port Hedland Marina or on the Spoil Bank, nor have there been targeted sawfish surveys near Port Hedland; the closest being north at Cape Keraudren and south at Onslow. As such, contemporary and historical records of sawfish were collated from a variety of published and unpublished sources. These included the published records in Morgan et al. (2011, 2015) (and references therein), and unpublished records from the Sawfish Conservation Society and Sharks and Rays Australia. These latter records were previously uploaded to either their social media sites or through submissions to the Sharks and Rays Australia sawfish database which began soliciting for public records in 2016.

The absence of targeted sawfish surveys at Port Hedland, and the absence of knowledge as to the degree to which species of sawfish and which life history stages utilise or inhabit the Spoil Bank hinders the ability to provide detailed assumptions as to the potential significant impact of the proposed construction.

It is clear from the literature, database and social media review however, that at least three of Western Australia's four species of sawfish pass through the area, with the Green Sawfish (*Pristis zijsron*) having been captured on the Spoil Bank and at a number of other locations close to the town as recently as 2019. The size ranges of these fish (<1-3 m in total length), suggest that the area is occupied by juvenile fish and sub-adults (see Morgan et al. 2011, 2017). The Spoil Bank is likely to act as a foraging ground as well as post-parturition nursery area for these individuals. There are possible impacts during construction (e.g. dredging), and dredging should occur during daylight hours so as to not impact with these generally nocturnal fishes. Other mitigation strategies could be to use small to moderate size dredge to reduce the broad dispersion of very high turbidity and limit the potential for maceration of sawfish. However, sawfish are likely to move away from the site during dredging, and the use of a 'sawfish spotter' is recommended. Underwater noise from piling activities should be managed through a soft start-up approach with progressively increasing hammer energy to alert sawfish of impending noise increase. Future work should validate use of the Spoil Bank and surrounding tidal creeks to determine the timing and extent of residency following Morgan et al. (2017).

Introduction

Sawfishes are considered to be the most imperiled group of fishes and two of the five species are ranked in the top two for species likely to go extinct on the Evolutionarily Distinct and Globally Endangered (EDGE) Existence programme (Dulvy et al. 2016, Lear et al. 2019). Northern Australia provides habitat for four of the world's five sawfish species, and each is listed as either Critically Endangered or Endangered at the international level (IUCN Red List), with each having a population trend that is decreasing (see Dulvy et al. 2016).

Western Australia's four species include the Freshwater Sawfish (*Pristis pristis*), the Dwarf Sawfish (*Pristis clavata*), the Green Sawfish (*Pristis zijsron*) and the Narrow Sawfish (*Anoxypristis cuspidata*). Within Australian waters, the three species that belong to the genus *Pristis* are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) as Vulnerable, while all species are protected in Western Australian waters under the *Fish Resources Management Act 1994*, with the Green Sawfish (*Pristis zijsron*) listed as Schedule 3 (Fauna that is rare or likely to become extinct as vulnerable fauna) under the *Wildlife Conservation Act 1950*.

Recent studies suggest that the Kimberley and Pilbara regions are hotspots for at least the three *Pristis* species (Thorburn et al. 2009; Morgan et al. 2011, 2015, 2017; Lear et al. 2019); with most records of two species (globally) being from the Kimberley (King Sound for *Pristis clavata* and the Fitzroy River for *Pristis pristis*). In contrast, most recent records of *Pristis zijsron* have come from the south Pilbara in the vicinity of Onslow (see Morgan et al. 2015, 2017).

Here we collate recent records of sawfish from the Pilbara region of Western Australia between 80 Mile Beach and south to Karratha.

Methods

We used published records of sawfish that were either collected through targeted sawfish surveys, or via the collections of rostra donated to various studies (see Stevens et al. 2008, Morgan et al. 2011, Phillips et al. 2017,) and unpublished records from the Sharks and Rays Australia database and social media searches (mainly via the Sawfish Conservation Society). Since 2016, Sharks And Rays Australia (SARA) accepts submissions of sawfish sightings by members of the general public. On average, 12 submissions are received per year. In January 2019, SARA ran a media campaign specifically asking members of the general public to submit sawfish sightings to our homepage www.cytags.com. Over 420 sightings were received in 2019 (as of 30 November). Records included newspaper articles of sawfish captures, accidental captures, details of saws in private collections as well as information on saws displayed in public locations. Every single submission that included contact details by

the submitter was queried. People often did not provide images or videos with the initial submission, but were quite happy to provide them upon contact.

Presented here are sawfish sightings submitted to SARA that fulfilled the following criteria: a sighting occurred after 2010 (=recent sighting), and included sufficient information to determine an exact location of where the sawfish was encountered. This either means that GPS coordinates were submitted with the sighting, or that submission of a location plus nearest landmark (example 'mouth of Airport Creek, Karratha') allowed narrowing down the location sufficiently to create a GPS mark. Names of localities and fishing spots were identified with the help of a local fishing guidebook (anonymous, 2016), or camping homepage (www.exploreoz.com.au), in the respective order. Sightings or captures from the SARA, SCS or published records included only those between longitude 116.60939^{o}E and 121.27^{o}E. Most published data was from prior to 2009. Only sightings that included a picture of the animal or an ID was a sawfish researcher are presented. Some animals could be identified to species level, after the characters provided by Whitty et al. (2014), in combination with the position of dorsal and other fins (Last and Stevens 1994, Morgan et al. 2011).

Results

A total of 66 sightings of sawfish fell within a 400 km radius around Port Headland from west of Karratha to 80-Mile Beach. Of the 58 individuals where length could be estimated, these ranged from new born pups (~60-70 cm total length) to individuals that would have been mature and exceeded 4 m total length. We positively identified two species (*P. zijsron* and *P. clavata*), while one sample was identified as either *P. clavata* or *P. pristis.* Thirteen individuals were positively identified as *Pristis clavata*, while 38 were identified as *P. zijsron*, the remainder identified only to genus. Within Port Hedland, a total of 16 individual sawfish were recorded, 11 of which were positively identified as *P. zijsron*, the remaining 5 individuals only identifiable to genus. Locations in Port Hedland included two on the Spoil

A Green Sawfish (*Pristis zijsron*) captured at the Spoil Bank (2017) (source facebook)

Bank, one at the Port Hedland jetty, 6 which gave a location as Port Hedland, two as Cooke Point, one as Intakes and two as 6 Mile Creek, one as south of Port Hedland and one as Pretty Pool. These fish ranged in length from ~0.6 m to 3 m in total length and are thus considered to be pups, juveniles or sub-adults, noting that maturity is not attained until lengths greater than 3 m are achieved (Morgan et al. 2011, 2017).

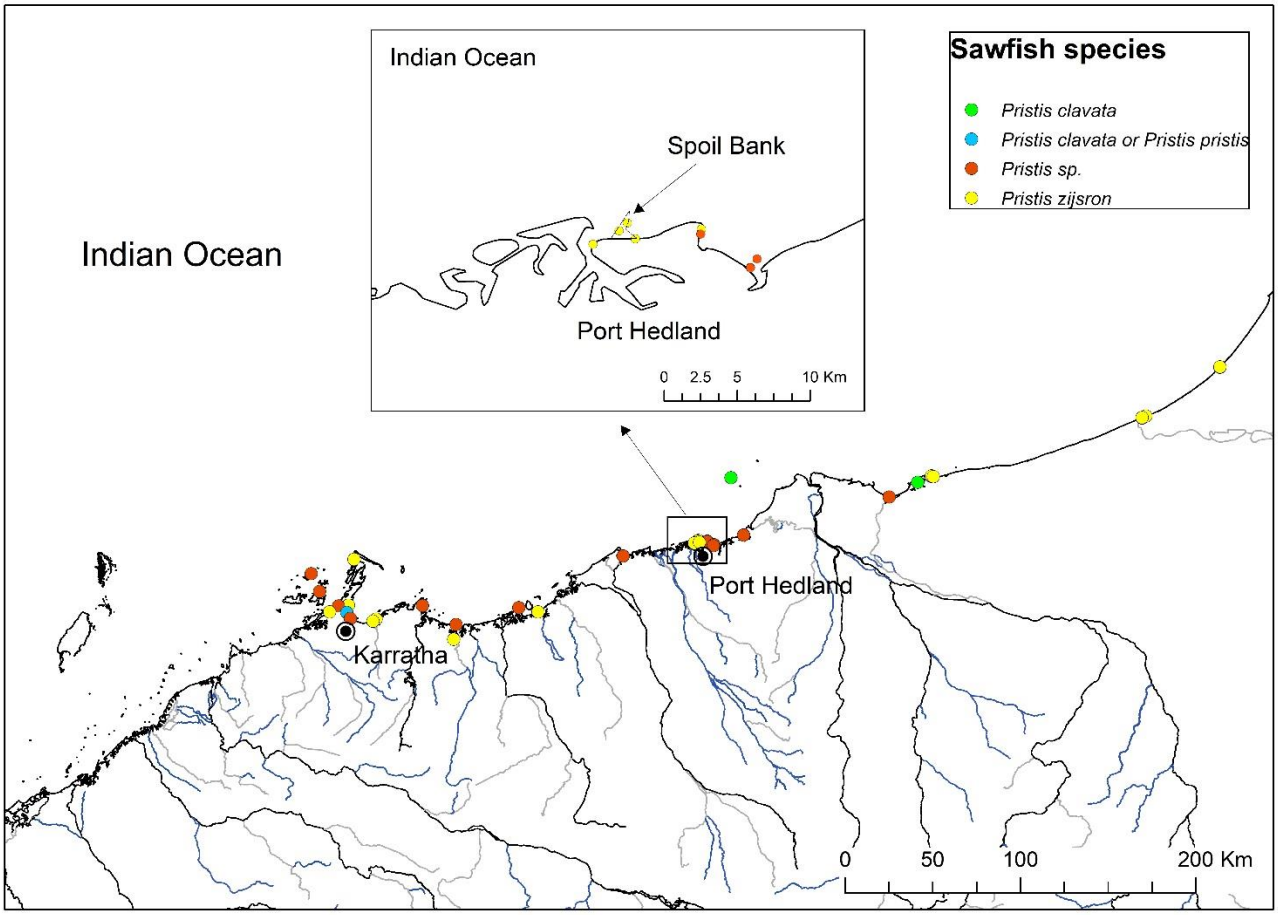

Figure 1 Recent sightings or captures of sawfish from a 400 km stretch of coastline between Karratha and Eighty Mile Beach. Inset includes sightings from around the Spoil Bank at Port Hedland (N.B. Some data points are represented by multiple captures (n = 16 from Port Hedland).

Discussion

There is increasing evidence that the Pilbara is a global hotspot for sawfish. For example, Morgan et al. (2015, 2017) provide important data on a pupping location for Green Sawfish (*Pristis zijsron*) and detail the intercreek and nearshore movement patterns over two years near Onslow using passive acoustic telemetry. Morgan et al. (2011, 2015) also detail a potential sub-adult and adult migratory route for Kimberley (Fitzroy River) Freshwater Sawfish (*Pristis pristis*) into the Pilbara which Phillips et al. (2017) demonstrates is a phylopatric migration for adult females; with females returning to their natal river to release their pups. Both *P. zijsron* and *P. clavata* exhibit regional philopatry in northern Australia, with genetic divergence between Western Australian populations and those elsewhere in northern Australia (Phillips et al. 2017). Of the 16 individual sawfish that were recorded in the vicinity of Port Hedland, 11 of which were identified as *P. zijsron*, but although this does not preclude *P. clavata* or *P. pristis* being present in the area, both species have been recorded south of Port Hedland, and presumably migrated passed the area from their primary nursery sites in King Sound or the Fitzroy River, respectively, to the north.

There has not been research into the movement patterns of sawfish in the Port Hedland area, and although the majority of records found during this study appear to be *P. zijsron*, from

multiple juvenile size classes (i.e. new born pups to 3 m total length), the area may be a key nursery habitat for the species. At least further south, larger individuals are more nomadic than small age classes, which have a comparatively smaller home range (see Morgan et al. 2017). If *P. zijsron* are pupped in the tidal creeks around Port Hedland, it is hypothesised that their narrow home range may render them susceptible to any habitat modification. This may cause fragmentation or adversely impact juvenile movement patterns as a result of the construction of breakwaters and resulting shift is sediments as well as through the construction of a deeper channel (Table 1). Small Green Sawfish generally have a very small home range and occupy very shallow waters (see Morgan et al. 2017).

During construction of a marina, the possible impacts to foraging are unknown but may lead to short-term increases in turbidity from dredging. As the key movement periods of *P. zijsron* were found to be between 18:00 and 09:00 in the southern Pilbara (Morgan et al. 2017), any proposed dredging should occur during daylight hours so as to not impact with these generally nocturnal fishes. Other mitigation strategies could be to use small to moderate size dredge to reduce the broad dispersion of very high turbidity and limit the potential for maceration of sawfish. However, sawfish are likely to move away from the site during dredging. Underwater noise from piling activities should be managed through a soft start-up approach with progressively increasing hammer energy to alert sawfish of impending noise increase. A ‘sawfish spotter’ should be employed during any construction work that may been impacting with the substrate.

Future work should validate use of the Spoil Bank and surrounding tidal creeks to determine the timing and extent of residency following Morgan et al. (2017); particularly as the area may represent a significant stronghold for the species.

Table 1: Potential impact predictions and assessments during and post-construction in relation to sawfishes.

Consideration	Impact prediction and assessment
Lead to a long-term decrease in the size of an important population of a species	Without fine-scale population genetic studies for all species within the Pilbara region, the information to suggest that the proposal will lead to a long-term decrease in the populations is lacking. Broadly, there are population differences between Western Australian sawfishes and those elsewhere, and there are also know morphological differences. Some studies suggest that each population requires individual management and that there is fine scale differences (e.g. Feutry et al. 2015), and Phillips et al. (2017) recommend the preservation of the remaining genetic diversity as a high conservation priority for the three *Pristis* spp.
Reduce the area of occupancy of an important population	The proposal is unlikely to noticeably reduce the AOO for any sawfish species.
Fragment an existing important population into two or more populations	Some fragmentation of juvenile habitat may occur as a result of the development, although the main port is potentially a greater cause of any fragmentation should it be occurring. There is some likelihood that disturbance of the Spoil Bank through construction of the marina may disturb sawfish in the immediate vicinity of the impact site. The loss of shallow habitats, construction of breakwaters and subsequent redistribution of sediment and the dredge channel may disrupt the ability of small juvenile Green Sawfish, which typically inhabit water depths of <1 m (Morgan et al. 2017), to migrate around the site. It is less likely to impact larger individuals (of all species) which typically utilise deeper waters (Whitty et al. 2009, 2017; Morgan et al. 2017).
Adversely affect habitat critical to the survival of a species	It is unknown as to the importance of the Spoil Bank as juvenile sawfish habitat; although records of small individuals appear to frequent the area. The shallow, sandy substrate appears suitable as feeding grounds during high and low tides. There are similar suitable habitats along the Pilbara coast. Home range of Green Sawfish increases with growth, and therefore impact to resident sawfish is most likely for small juveniles of *P. zijsron* only (<1.2 m TL).
Disruption of breeding cycles	Very little is known in relation to the breeding biology of sawfishes in Western Australia. It is known that maturity occurs at

	sizes >3 m in Green Sawfish and Freshwater Sawfish. New-born pups of Freshwater Sawfish, in Western Australia, are generally known only from the Kimberley, but sub-adults and adults are found along the Pilbara coast, where they are thought to breed, with females returning to their natal river to breed. In contrast, while Green Sawfish also are believed to be philopatric, pups have been recorded along the Pilbara coast. Breeding is likely to occur offshore in both species, and should not be impacted during or post construction.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely to occur as a result of the proposed development; most likely to occur as a result of transportation to the area via international shipping routes into the Port Hedland harbour.
Introduce disease that may cause the species to decline	Unlikely (see above).
Interfere substantially with the recovery of a species.	All sawfishes have decline substantially over the last few decades (Dulvy et al. 2016); Western Australia remains a stronghold for the species. Although the current project will have an unknown localised impact, it is likely to be minor compared to the cumulative impacts of other larger proposals occurring along the Pilbara coastline.

References

Anonymous. 2016. North Australian fish finder. 12th edition. Fish Finder TM Fishing Maps. 393pp.

Anonymous. 2019. ExploreOz camping and caravanning community. www.exploreoz.com.au accessed in November 2019

Dulvy, N.K., Davidson, L.N.K., Kyne, P.M., Simpfendorfer, C.A., Harrison, L.R., Carlson, J.K. & Fordham, S.V. (2016). Ghosts of the coast: global extinction risk and conservation of sawfishes. Aquatic Conservation 26: 134−153.

Feutry, P., Kyne, P.M., Pillans, R.D., Chen, X., Marthick, J., Morgan, D.L. & Grewe, P.M. (2015). Whole mitogenome sequencing refines population structure of the Critically Endangered sawfish Pristis pristis. Marine Ecology Progress Series 533: 237-244.

Last, P. R. and Stevens, J. D. (1994). Family Pristidae. Sawfishes. In *Sharks and rays of Australia* (eds. P. R. Last and J. D. Stevens), pp. 360-367. Melbourne: CSIRO Publishing.

Morgan, D.L., Allen, M.G., Ebner, B.C., Whitty, J.M. & Beatty, S.J. (2015). Discovery of a pupping site and nursery for critically endangered Green Sawfish (*Pristis zijsron*). Journal of Fish Biology 86: 1658-1663.

Morgan, D.L., Ebner, B.C., Allen, M.G., Gleiss, A.C., Beatty, S.J. & Whitty, J.M. (2017). Habitat use and site fidelity of neonate and juvenile green sawfish Pristis zijsron in a nursery area in Western Australia. Endangered Species Research 34: 235-249.

Morgan, D.L., Whitty, J.M., Phillips, N.M., Thorburn, D.C., Chaplin, J.A. & McAuley, R. (2011). North-western Australia as a hotspot for endangered elasmobranchs with particular reference to sawfishes and the Northern River Shark. Journal of the Royal Society of Western Australia 94: 345-358.

Phillips, N.M., Chaplin, J.A., Peverell, S.C. & Morgan, D.L. (2017). Contrasting population structures of three Pristis sawfishes with different patterns of habitat use. Marine and Freshwater Research 68: 452-460.

Phillips, N.M., Fearing, A. & Morgan, D.L. (2017). Genetic bottlenecks in Pristis sawfishes in northern Australian waters. Endangered Species Research 32: 363-372.

Whitty, J.M., Keleher, J., Ebner, B.C., Gleiss, A.C., Simpfendorfer, C.A. & Morgan, D.L. (2017). Habitat use of a Critically Endangered elasmobranch, the largetooth sawfish *Pristis pristis*, in an intermittently flowing riverine nursery. Endangered Species Research 34: 211-227.

Whitty, J.M., Phillips, N.M., Thorburn, D.C., Simpfendorfer, C.A., Field, I., Peverell, S.C. & Morgan, D.L. (2014). Utility of rostra in the identification of Australian sawfishes (Chondrichthyes: Pristidae). Aquatic Conservation: Marine and Freshwater Ecosystems 24: 791-804.

Wueringer, B. E., Peverell, S. C., Seymour, J. E., Squire, L. J. & Collin, S.P. (2011a). Sensory systems in sawfishes. 2. The lateral line system. Brain, Behavior and Evolution 78, 150-161.

Wueringer, B. E., Peverell, S. C., Seymour, J. E., Squire, L. J., Kajiura, S. M. & Collin, S. P. (2011b). Sensory systems in sawfishes. 1. The ampullae of Lorenzini. Brain, Behavior and Evolution 78, 139-149.

Wueringer, B. E, Squire, L., Kajiura, S. M., Hart, N. S., Collin, S. P. (2012a). The Function of the Sawfish's Saw. Current Biology 22, R150-R151.

Wueringer, B. E., Squire, L., Kajiura, S. M., Tibbetts, I. R., Hart, N. S. & Collin, S.P. (2012b). Electric field detection in sawfishes and shovelnose rays. PLoS one 7, e41605.