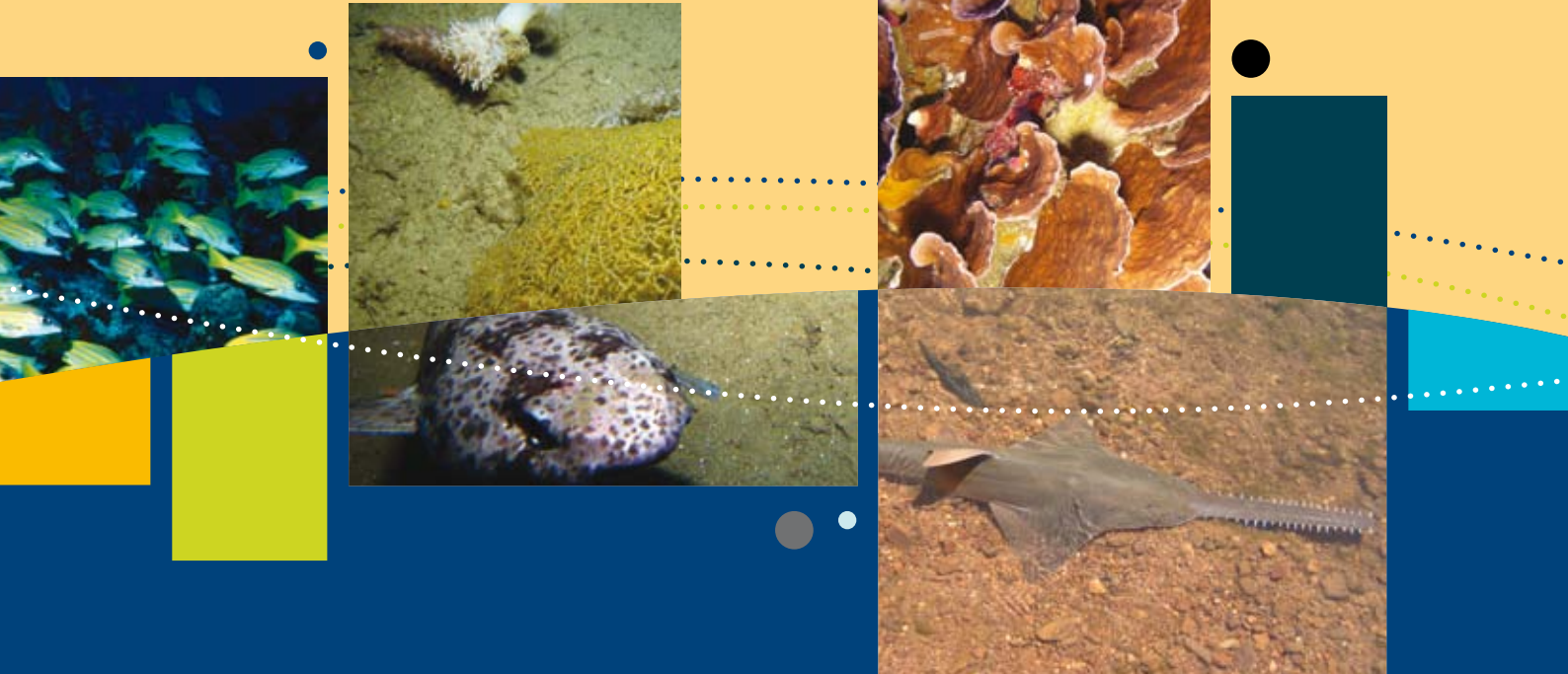




Australian Government

Department of Sustainability, Environment,
Water, Population and Communities



Species group report card – sawfishes and river sharks

Supporting the marine bioregional plan
for the North Marine Region

prepared under the *Environment Protection and Biodiversity Conservation Act 1999*

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Images:

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SPECIES GROUP REPORT CARD – SAWFISHES AND RIVER SHARKS

Supporting the marine bioregional plan for the North Marine Region prepared under the *Environment Protection and Biodiversity Conservation Act 1999*

Report cards

The primary objective of the report cards is to provide accessible information on the conservation values found in Commonwealth marine regions. This information is maintained by the Department of Sustainability, Environment, Water, Population and Communities and is available online through the department's website (www.environment.gov.au). A glossary of terms relevant to marine bioregional planning is located at www.environment.gov.au/marineplans.

Reflecting the categories of conservation values, there are three types of report cards:

- species group report cards
- marine environment report cards
- protected places report cards.

While the focus of these report cards is the Commonwealth marine environment, in some instances pressures and ecological processes occurring in state waters are referred to where there is connectivity between pressures and ecological processes in state and Commonwealth waters. d





Species group report cards

Species group report cards are prepared for large taxonomic groups that include species identified as conservation values in a region; that is, species that are listed under Part 13 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and live in the Commonwealth marine area for all or part of their lifecycle. All listed threatened, migratory and marine species and all cetaceans occurring in Commonwealth waters are protected under the EPBC Act and are identified in the relevant marine bioregional plans as conservation values.

Species group report cards focus on species for which the region is important from a conservation perspective; for example, species of which a significant proportion of the population or an important life stage occurs in the region's waters.

For these species, the report cards:

- outline the conservation status of the species and the current state of knowledge about its ecology in the region
- define biologically important areas; that is, areas where aggregations of individuals of a species display biologically important behaviours
- assess the level of concern in relation to different pressures.



1. Sawfishes and river sharks of the North Marine Region

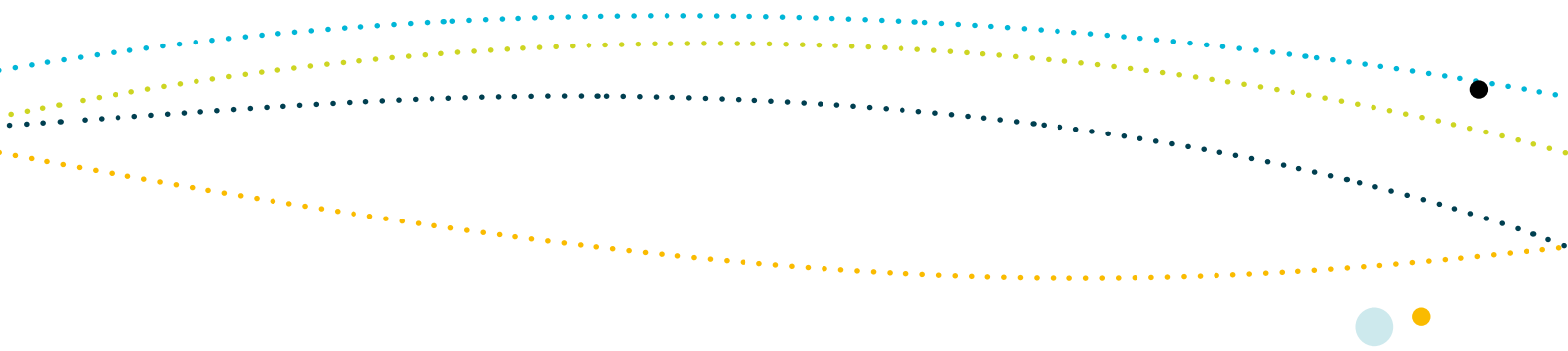
While relatively little is known about the distribution and abundance of sawfishes and river sharks (*Glyphis* species) in northern Australia, the North Marine Region is considered an important area for the species group. Five species of sawfish and river shark listed under the EPBC Act are known to occur in the North Marine Region; two other species of listed shark may infrequently occur in the region (see Attachment 1).

The shallow inshore and estuarine coastal waters adjacent to the North Marine Region form significant habitat for a wide range of sawfish and river shark species. For example, all of the major river systems in Queensland's Gulf of Carpentaria region support juvenile and subadult freshwater sawfish and are considered as important areas for the species. The Adelaide and Alligator river systems in the Northern Territory support populations of spartooth sharks and northern river sharks. The Ducie River and Wenlock River area in the Port Musgrave region adjacent to the North Marine Region is the only area in Queensland where the spartooth shark has been identified in the past 20 years. The Wenlock River also supports a healthy population of juvenile freshwater sawfish (DEWHA 2008).

Of the listed sharks known to occur in the North Marine Region, this report card focuses on the five species listed in Table A1. These species were selected following consideration of their conservation status, distribution and population structure in the region, life history characteristics and the potential for the population(s) in the region to be genetically distinct from populations elsewhere.

Dwarf sawfish

The dwarf sawfish (*Pristis clavata*) is known to occur only in northern Australia, although it was possibly once more widespread throughout parts of South-east Asia (Cook et al. 2006; Last & Stevens 2009). The Australian population of the species is therefore considered likely to comprise most, or all, of the total global population. The dwarf sawfish is primarily a coastal marine and estuarine species (Thorburn et al. 2008). However, the species also occurs in the Commonwealth marine environment. For example, it has been recorded as trawl bycatch in the Northern Prawn Fishery, which operates in Commonwealth waters (Stobutzki et al. 2002). There is a single record from a riverine environment, more than 100 kilometres from the estuary (Thorburn et al. 2003). Short-term tracking of movement patterns has shown that dwarf sawfish occupy a range in the coastal fringe of a few square kilometres and show site fidelity (Stevens et al. 2008). The species breeds in estuarine or fresh waters during the wet season, after which it may move into marine waters (Peverell 2005 in Larson et al. 2006). In the Queensland Gulf of Carpentaria, abundance is low (Peverell 2005). The species spends



the high tide period resting in mangrove areas and becomes active on mud and sand flats while the tide is moving, presumably feeding (Stevens et al. 2008). Sawfishes feed close to the benthos—pop-eye mullet (*Rhinomugil nasutus*), other teleosts and prawns have been identified in the dwarf sawfish's diet (Thorburn et al. 2008). Popping may occur through the wet season until the beginning of the dry season (Peverell 2005).

Freshwater sawfish

The freshwater sawfish (*Pristis microdon*) has been recorded in northern Australia in rivers (including isolated water holes), estuaries and marine environments (Stevens et al. 2005). The species has also been recorded in offshore waters in northern Australia (Stobutzki et al. 2002). Freshwater sawfish appear to have an ontogenetic shift in habitat use, with neonates and juveniles primarily occurring in the freshwater reaches of rivers and in estuaries, while most adults have been recorded in marine and estuarine environments (Peverell 2005; Thorburn et al. 2007). It is believed that mature freshwater sawfish enter less saline waters during the wet season to give birth (Peverell 2005) and that freshwater river reaches play an important role as nursery areas. Popping appears to occur late in the wet season in the Gulf of Carpentaria (Peverell 2005) and the strength of recruitment may be related to high water levels during the late wet season (Whitty et al. 2008). Riverine reaches can fragment into a series of pools in the dry season, reducing the available habitat (Stevens et al. 2005). The diet of freshwater sawfish is predominantly teleost fishes and benthic invertebrates, with important prey including blue catfish (*Arius graeffei*) and cherabin (*Macrobrachium rosenbergii*) (Thorburn et al. 2007).

Green sawfish

The green sawfish (*Pristis zijsron*) occurs across northern Australia and, given the considerable decline in its global (including Australian) range, the North Marine Region may support the last significant populations of the species (Stevens et al. 2005). The species has predominantly been recorded in inshore coastal areas, including estuaries and river mouths with a soft substrate; however, green sawfish has been recorded in offshore waters up to 70 metres deep (Stevens et al. 2005). In the Queensland Gulf of Carpentaria, abundance is low (Peverell 2005). Records indicate green sawfish occur in the Arafura Sea and around Groote Eylandt (Stirrat & Larson 2002). The species does not penetrate into freshwater habitats. Short-term tracking of movement patterns has shown that green sawfish appears to have limited movements that are tidally influenced, and it is likely to occupy a restricted range of only a few square kilometres in the coastal fringe, with a strong association with mangroves and adjacent mudflats (Stevens et al. 2008). Green sawfish prey on shoaling teleost fishes, crustaceans and molluscs, although information is limited (Pogonoski et al. 2002). Popping may occur during the wet season (Peverell 2005).

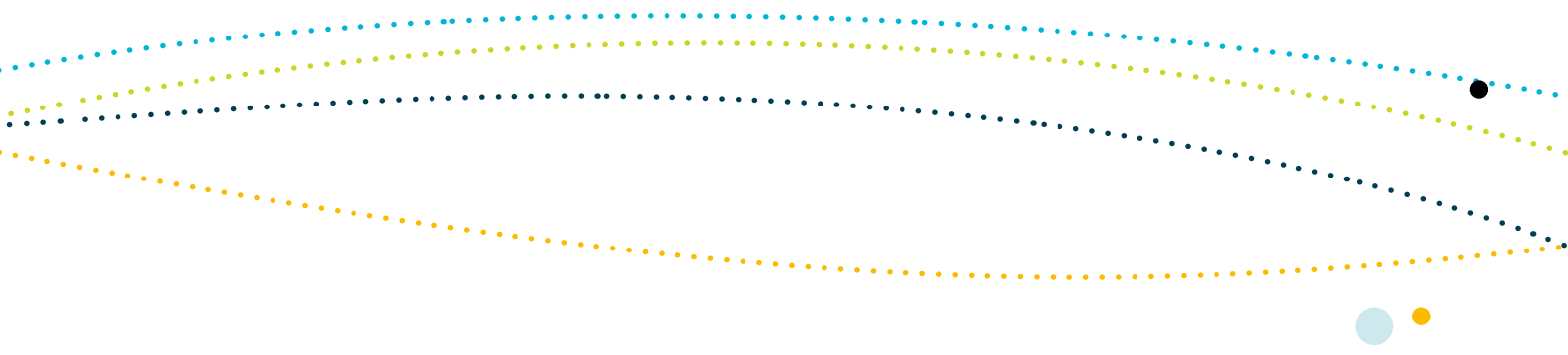


Northern river shark

The northern river shark (*Glyphis garricki*) occurs in the waters of north and north-western Australia. In the Northern Territory it has been recorded in the Adelaide River, South and East Alligator rivers and the Wessel Islands (Pillans et al. 2010). The species' range also includes New Guinea, but the Australian population represents a significant proportion of the global population. The habitat of the northern river shark includes large tropical river systems and macrotidal embayments, as well as coastal marine environments (Pillans et al. 2010; Thorburn & Morgan 2004). Adults have been recorded only in marine environments, whereas neonates, juveniles and subadults have been recorded in freshwater, estuarine and marine environments (Pillans et al. 2010). Northern river shark specimens have been identified in the bycatch of offshore net fisheries (Sly, pers. comm., 2007 in DEWHA 2008). Characteristic of northern river shark habitats are large tides, fine muddy or silty substrate, and high turbidity. Available data suggests population numbers are low (Pillans et al. 2010). The diet of northern river shark consists primarily of teleost fishes, including ariid catfish and threadfin salmon (*Polydactylus macrochir*) (Thorburn & Morgan 2004). Limited observations suggest that northern river sharks give birth just before the wet season (around October) (Pillans et al. 2010). Research indicates that rivers act as nursery habitats for the species (Field et al. 2008).

Spertooth shark

The spertooth shark (*Glyphis glyphis*) is distributed in three geographically distinct areas of northern Australia: the Van Diemen Gulf drainage in the Northern Territory, which incorporates the Adelaide River, South, East and West Alligator rivers and Murganella Creek; Port Musgrave in Queensland, which includes the Wenlock and Ducie rivers; and historically, the Princess Charlotte Bay region of eastern Cape York Peninsula (Pillans et al. 2010). Current evidence suggests there is no genetic difference between Northern Territory and Queensland populations (Wynen et al. 2009). Neonates, juveniles and subadults use turbid, tidal riverine and estuarine habitats, while larger subadults use more saline habitats; adults of this species have never been documented (in any habitat) but there are unconfirmed reports of mature animals from offshore marine environments (Pillans et al. 2008, 2010). This suggests that juveniles and neonates utilise riverine and estuarine habitats, and adults occur offshore (Pillans et al. 2008). Jaw trophies of the species and anecdotal reports by commercial fishers operating in the North Marine Region indicate that the species does inhabit the region (DEWHA 2008).



Short-term tracking of movement patterns has shown that juvenile and subadult speartooth sharks show upstream and downstream tidally assisted movements, with repeated use of available habitat (Pillans et al. 2010). Speartooth sharks are adapted to finding prey in turbid, benthic-associated environments and prey includes a variety of teleost fishes and cherabin (*Macrobrachium rosenbergii*) (Peeverell et al. 2006). Specific lifecycle characteristics are unknown, although pupping may occur around October to December based on records of young individuals with umbilical scars (Pillans et al. 2010).

Biologically important areas

Biologically important areas are areas that are particularly important for the conservation of the protected species and where aggregations of individuals display biologically important behaviour such as breeding, foraging, resting or migration. The presence of the observed behaviour is assumed to indicate that the habitat required for the behaviour is also present. Biologically important areas have been identified for some EPBC Act listed species found in the North Marine Region, using expert scientific knowledge about species' distribution, abundance and behaviour in the region. The selection of species was informed by the availability of scientific information, the conservation status of listed species and the importance of the region for the species. The range of species for which biologically important areas are identified will continue to expand as reliable spatial and scientific information becomes available.

Biologically important areas have not yet been identified for sawfishes and river shark species in the North Marine Region.

Biologically important areas are included in the North Marine Region Conservation Values Atlas (www.environment.gov.au/cva).



2. Vulnerabilities and pressures

Vulnerabilities

Biologically, elasmobranchs are characterised by their 'limited' life history (late age at maturity, slow growth rate, low fecundity, longevity, low rate of natural mortality), which results in restricted productivity. Subsequently, they have a limited capacity to withstand human-induced pressures and to recover from population depletion as a result of these pressures. Sawfish and river shark species are all large, top-level predators, occupying a high trophic level. They are viviparous, giving birth to well-developed live young. However, most aspects of the reproductive biology of sawfish and river shark species are unknown and the sawfish and river shark species of northern Australia are generally poorly understood. Mature spartooth sharks have never been documented or examined, and therefore virtually nothing is known about spartooth sharks' reproductive parameters (Pillans et al. 2010). One northern river shark has been recorded carrying nine embryos (Pillans et al. 2010), conforming to the usual elasmobranch condition of low fecundity. Litter size in the narrow sawfish is about 15 young, and in the green sawfish about 12 young (Last & Stevens 2009), but is not known for dwarf and freshwater sawfish. Reproductive periodicity is unknown for all species.

Freshwater environments are important nursery habitats for freshwater sawfish and river shark species (Peverell 2005; Pillans et al. 2010; Thorburn et al. 2007). This reliance on a physically restricted environment contributes to their susceptibility to human pressures by limiting their ability to evade exploitation and habitat degradation (Compagno & Cook 1995). Repeated use of small areas of habitat—which has been demonstrated in dwarf sawfish, green sawfish and spartooth shark (Pillans et al. 2010; Stevens et al. 2008)—means that these species are susceptible to localised depletion. In the case of freshwater sawfish, dry season riverine habitat can retract into a series of pools, reducing available habitat and increasing susceptibility to pressures. Additionally, the relative rarity of several species (the spartooth and northern river sharks are assumed to have very small population sizes) increases their inherent vulnerability.

Analysis of pressures

On the basis of current information, pressures have been analysed for the five sawfish and river shark species discussed in this report card. A summary of the pressure analysis for sawfishes and river sharks is provided in Table 1. Only those pressures identified as *of concern* or of potential concern are discussed in further detail below. An explanation of the pressure analysis process, including the definition of substantial impact used in this analysis, is provided in Part 3 and Section 1.1 of Schedule 1 of the plan.

Table 1: Outputs of the sawfish and river shark species pressure analysis for the North Marine Region

Pressure	Source	Species				
		Dwarf sawfish	Freshwater sawfish	Green sawfish	Northern river shark	Speartooth shark
Sea level rise	Climate change					
Changes in sea temperature	Climate change					
Changes in oceanography	Climate change					
Ocean acidification	Climate change					
Chemical pollution/ Contaminants	Shipping					
	Vessels (other)					
	Onshore and offshore mining operations					
Nutrient pollution	Agricultural activities					
	Urban development					
Changes in turbidity	Dredging (spoil dumping)					
Marine debris	Land-based activities					
	Fishing boats					
	Shipping					
	Vessels (other)					
Physical habitat modification	Dredging and/or Dredge spoil					
	Offshore construction and installation of infrastructure					
	Onshore construction					
Extraction of living resources	Commercial fishing (domestic)					
	IUU (domestic or non-domestic)					
	Indigenous harvest					
Bycatch	Commercial fishing					
	Recreational and charter fishing					
Oil pollution	Shipping					
	Vessels (other)					
	Oil rigs					
Changes in hydrological regimes	Land-based activities					
	Climate change (e.g. changes in rainfall, storm frequency)					

Legend ■ of concern ■ of potential concern ■ of less concern ■ not of concern data deficient or not assessed



Sea level rise—climate change

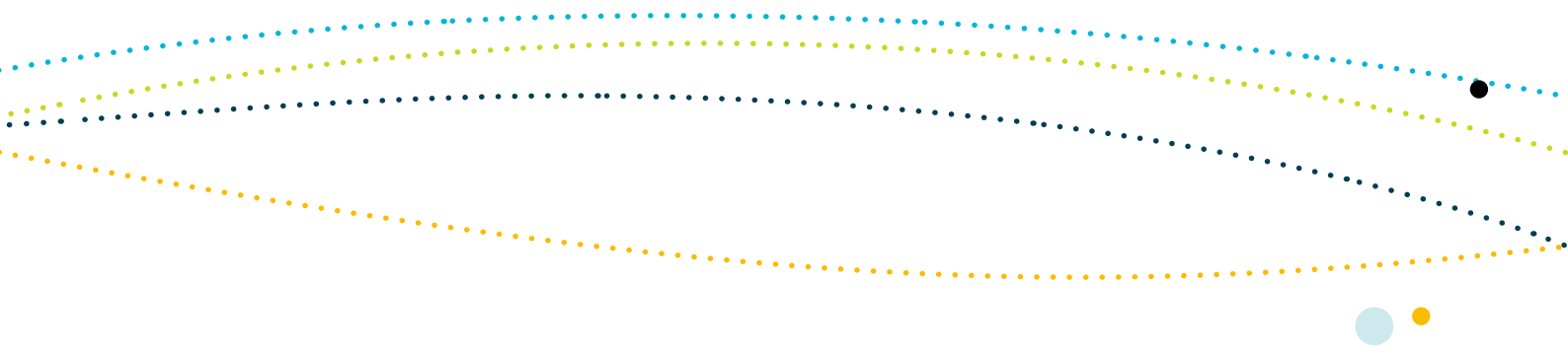
Sea level rise as a result of climate change is assessed as *of potential concern* for sawfishes and river sharks in the North Marine Region. Global sea levels have risen by 20 cm between 1870 and 2004 and predictions estimate a further rise of 5–15 cm by 2030, relative to 1990 levels (Church et al. 2009). Longer term predictions estimate increases of 0.5 – 1 m by 2100, relative to 2000 levels (CC Commission 2011). Sea level rise will have significant effects on coastal habitats, including increasing salinity in estuaries and the lower reaches of creeks and rivers, and altering geophysical processes of erosion and deposition along the coastal zone. Mangroves may decline in some areas but expand in others by replacing salt marsh and freshwater wetland habitats (Chin & Kyne 2007). Sawfish and river shark species use estuarine and freshwater habitats for key life stages (Pillans et al. 2010; Stevens et al. 2008) and some sawfishes are known to use mangrove habitat (Stevens et al. 2008). There is evidence that salinity levels influence species distribution of northern Australian euryhaline elasmobranchs (Thorburn et al. 2003). Sawfishes and spartooth shark have been ranked as moderately vulnerable overall to climate change, having high exposure to the effects of rising sea levels (Chin et al. 2010). Northern river shark was not assessed by Chin et al. (2010) but is likely to have a similar vulnerability to climate change as spartooth shark.

Changes in sea temperature—climate change

Changes in sea temperature as a result of climate change are assessed as *of potential concern* for sawfishes and river sharks in the North Marine Region. Sea temperatures have warmed by 0.7 °C between 1910–1929 and 1989–2008, and current projections estimate ocean temperatures will be 1 °C warmer by 2030 (Lough 2009). Changes in temperature driven by climate change may result in changes in metabolism, behaviour and movement patterns in elasmobranchs (Chin & Kyne 2007). Increased temperature will also result in lower dissolved oxygen concentrations in the water. There is the possibility of respiratory stress due to this decrease in dissolved oxygen levels and increased metabolic rates (Chin & Kyne 2007). Sawfishes and spartooth shark have been ranked as moderately vulnerable overall to climate change, having high exposure to the effects of rising temperatures (Chin et al. 2010).

Chemical pollution/contaminants—onshore and offshore mining operations

Chemical pollution or contamination as a result of onshore and offshore mining operations is assessed as *of potential concern* for sawfishes and river sharks in the North Marine Region. Due largely to the generally remote nature of northern Australian marine environments, chemical pollution and/or contamination is not currently of concern. However, given the medium risk of pollution by noxious and hazardous substances in areas used by sawfish and river shark species, the likely increase in mining activity in the region, and the potentially lethal effect of pollution on individuals and habitats, this pressure is considered to be *of potential concern*.



Mining poses a number of contamination risks to estuarine and marine environments, although modern management approaches can mitigate many of these risks (Brereton et al. 2009). Industrial point source pollution can introduce compounds toxic to elasmobranchs and their prey, and mining can introduce heavy metal pollutants and radioactive isotopes into the environment. The mining industry is likely to continue its strong expansion into the future (Ross et al. 2009).

Sources of chemical pollution and contamination in the North Marine Region may include elevated levels of heavy metals in the Finniss River from the rehabilitated Rum Jungle mine site (Brereton et al. 2009) and the potential of uranium mining in Kakadu National Park to pollute or contaminate known habitat of speartooth shark (Compagno et al. 2006). Internationally, the freshwater sawfish is thought to have been extirpated from the Fly River system of Papua New Guinea by recurrent cyanide spills from heap-leach mining operations (Compagno et al. 2006), which serves as an example of the potential impact of this pressure.

Marine debris—fishing vessels; land-based activities; shipping; vessels (other)

Marine debris is assessed as *of potential concern* for sawfishes and river sharks in the North Marine Region. Northern Australia is especially vulnerable to marine debris given the proximity of intensive fishing operations, difficulties in surveillance and enforcement of existing management arrangements, and ocean circulation patterns that are likely to concentrate floating debris before dumping it on coastlines and beaches (Kiessling 2003). Marine debris, including large numbers of derelict fishing nets, accumulates in high concentrations along the coasts of north-western Cape York, Groote Eylandt and north-east Arnhem Land (DEWHA 2009; Limpus 2009; Roelofs et al. 2005).

Because of their saw-like rostrum, sawfishes may be exceptionally susceptible to entanglement in marine debris, and entanglement has been reported in a number of types of marine debris (Seitz & Poulakis 2006). Such entanglement can cause serious or fatal injury. The likelihood of interaction between marine debris and river shark species is unknown; however, the occurrence of sawfish and river shark species in offshore and inshore areas where discarded fishing line, derelict nets and other debris occur suggests that they may be vulnerable to this pressure. Carcharhinid sharks (the same family as *Glyphis* species) have been recorded in derelict nets off northern Australia so, morphologically, *Glyphis* (river shark) species would also be vulnerable to capture. The overall impact of marine debris on sawfish and river shark species populations is also unknown; however, there are records of fatal impacts on individual sawfish outside the North Marine Region.

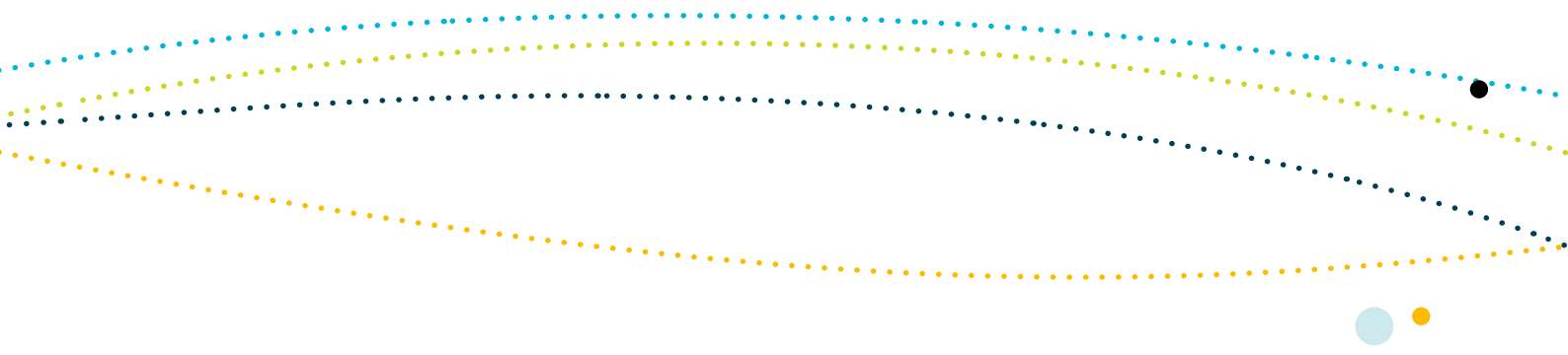


Extraction of living resources—commercial fishing (domestic)

Extraction of living resources as a result of commercial fishing is assessed as *of potential concern* for freshwater sawfish in the North Marine Region. The take of listed sawfish and river shark species is generally prohibited in Northern Territory, Queensland and Commonwealth waters. There is, however, a limited harvest of freshwater sawfish (*Pristis microdon*) permitted in Queensland and the Northern Territory for exhibition in domestic aquaria. Given the vulnerable status of freshwater sawfish in Australian waters, significant uncertainties regarding current populations, and the current level of anthropogenic mortality from all sources (including commercial; recreational; Indigenous; and domestic and international illegal, unregulated and unreported fishing), DSEWPaC has found that, at this stage, 'it is not possible to conclude with a reasonable level of certainty that any harvest of freshwater sawfish for export purposes would not be detrimental to the survival or recovery of the species' (DSEWPaC 2011). While a number of management measures have been implemented, without population data it is unknown whether these measures have been effective in contributing to any recovery of the species.

Extraction of living resources—Indigenous harvest

Extraction of living resources as a result of Indigenous harvest is assessed as *of potential concern* for sawfishes and river sharks in the North Marine Region. Fishing is important to many Indigenous communities across northern Australia and Indigenous people have native title rights to harvest marine species including sawfishes and river sharks. Details of the Indigenous harvest of sawfish and river shark species are unknown and therefore the impacts on their populations are unclear. However, sawfishes have traditionally been an important source of food and cultural significance to Indigenous communities in northern Australia (McDavitt 1996; Thorburn et al. 2004), and areas where sawfish and river shark species occur are known to be fished by Indigenous people. Given their suspected small population sizes and restricted habitats (e.g. dwarf sawfish, green sawfish and spartooth shark have all been shown to repeatedly use restricted areas of habitat: Pillans et al. 2010; Stevens et al. 2008), these species are all vulnerable to localised depletion from harvest. The dry season riverine habitat of freshwater sawfish often retracts into a series of isolated pools, which can make the species more susceptible to harvest.



Extraction of living resources—illegal, unregulated and unreported fishing (non-domestic; domestic)

Extraction of living resources as a result of foreign illegal, unregulated and unreported (IUU) fishing is assessed as *of concern* for sawfishes and river sharks in the North Marine Region. While the full extent of IUU foreign fishing for sawfishes and river shark in northern Australia is largely unquantified, sharks are considered to be a target species group and among the most vulnerable resources to IUU foreign fishing. In 2005 it was estimated that illegal foreign fishing catch of shark in the Gulf of Carpentaria was at least equivalent to the legal catch of Australian fishers (Pascoe et al. 2008). The level of illegal non-domestic fishing effort has decreased by as much as 80 per cent since 2005 (Lack & Sant 2008), although there are some concerns that illegal foreign fishers are merely using smaller numbers of more powerful vessels with more sophisticated equipment (Lack & Sant 2008). The high quality and high value of sawfish fins makes sawfishes particularly attractive to shark fin fishers, and an illegal market also exists for their rostra (Lack & Sant 2008); sawfishes have been documented among confiscated non-domestic IUU catches. Illegal activity in places such as the Gulf of Carpentaria, which is important for sawfishes (Peverell 2005), highlights the susceptibility of these species to non-domestic IUU fishing.

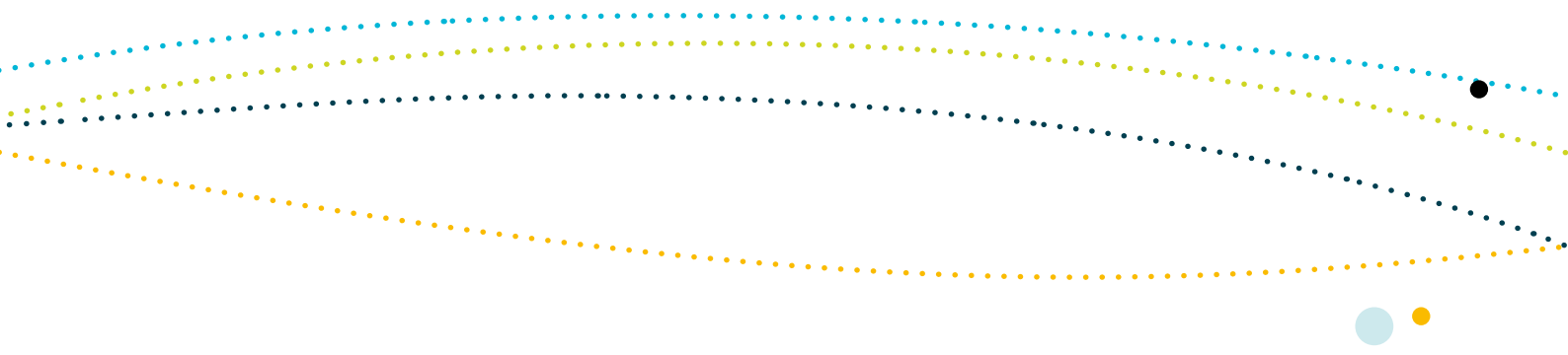
Extraction of living resources as a result of domestic illegal fishing is assessed as *of concern* for sawfish and river shark species in the North Marine Region. The take of sawfish and river shark species is generally prohibited in Northern Territory, Queensland and Commonwealth waters, with the exception of a limited export harvest of freshwater sawfish in Queensland. However, large-scale and well-organised shark finning operations are suspected to operate in northern Australia (Putt & Anderson 2007). The impact on populations of sawfish and river shark species from these activities is unknown. Observations of dead discarded sawfishes and speartooth sharks from recreational fishing highlight that mortality occurs as a direct result of capture and discarding (Stevens et al. 2005; Thorburn et al. 2003). The rostra of sawfishes are often retained as a trophy or curio. The correct identification of river shark species is an ongoing issue for fishers and may result in inadvertent retention. Recreational fishing continues to grow in popularity and with a growing population, improvements in technology, larger recreational boats, greater access to the coast and an increase in fishing tour operators (DRDPIFR 2010), more remote areas of northern Australia are now becoming more accessible to recreational fishing. This will result in increased overlap between recreational and charter fishing activities and the distributions of sawfish and river shark species, which will increase the potential for illegal interactions.



Bycatch—commercial fishing; recreational and charter fishing

Bycatch as a result of domestic commercial fishing is assessed as *of concern* for sawfishes and river sharks in the North Marine Region. Several commercial fisheries operate within the range of sawfish and river shark species in northern Australia and the species have been recorded as bycatch in these fisheries. Commercial fishing has been identified as the major pressure on all sawfish and river shark species in Australia and substantial declines in several species have been attributed to it (Pillans et al. 2008; Stevens et al. 2005, 2008). Some species, including dwarf sawfish and green sawfish, have limited tidally influenced movements and are particularly vulnerable to any net fishing operations when they are actively feeding on mud and sand flats (Stevens et al. 2008). The rostra of sawfishes makes them particularly susceptible to capture in all forms of net fishing gear (Stevens et al. 2008) and entanglement in commercial fishing nets is considered the main threat to sawfish populations in northern Australia (Stevens et al. 2008). Post-release mortality can also occur as a result of capture and handling, although post-release survival rates will be higher for larger, safely released sawfishes (FSERC 2009; Salini 2007). While a number of management measures have been implemented, without population data it is unknown whether these measures have been effective in contributing to any recovery of populations.

Bycatch as a result of recreational and charter fishing is assessed as *of concern* for sawfishes and river sharks in the North Marine Region. The take of sawfish and river shark species is generally prohibited in Northern Territory, Queensland and Commonwealth waters, with the exception of a limited harvest of freshwater sawfish in Queensland. However, there exists considerable potential for mortality from recreational fishing. Parts of the range of sawfish and river shark species overlap with popular recreational fishing locations. Recreational fishing continues to grow in popularity and with a growing population, improvements in technology, larger recreational boats, greater access to the coast and an increase in fishing tour operators (DRDPIFR 2010), more remote areas of northern Australia are now becoming more accessible to recreational fishing. This will result in increased overlap between recreational and charter fishing activities and the distributions of sawfish and river shark species, which will increase the potential mortality from incidental catches. Observations of dead, discarded sawfish and river shark species from recreational fishing highlight that mortality occurs as a direct result of capture and discarding (Stevens et al. 2005; Thorburn et al. 2003). For example, Thorburn et al. (2003) noted the threat that recreational fishing poses to pristid species following the observation of 12 dead *Pristis microdon* specimens on the banks of the Fitzroy River as a result of recreational fishing.



Given their suspected small population sizes and restricted habitats (e.g. dwarf sawfish, green sawfish and speartooth shark have all been shown to repeatedly use restricted areas of habitat: Pillans et al. 2010; Stevens et al. 2008), sawfish and river shark species are all vulnerable to localised depletion from incidental mortality. The correct identification of river shark species is an ongoing issue for fishers and may result in unintentional mortality. Elsewhere, post-release mortality has been suggested to be the largest source of recreational fishing mortality of elasmobranchs (Lynch et al. 2009), and damage from capture and handling or from retained fishing line and hooks may cause post-release mortality in sawfish and river shark species.

Changes in hydrological regimes—climate change; land-based activities

Changes in hydrological regimes are assessed as *of concern* for sawfishes and river sharks in the North Marine Region. Neonate and juvenile sawfish and river shark species use estuarine and/or freshwater environments, and the latter is an important nursery area for freshwater sawfish. It is thought that pupping in all northern Australian sawfish species and river shark species coincides with the monsoonal wet season (Peverell 2005; Pillans et al. 2010; Whitty et al. 2008). Wet season freshwater flows have been suggested as the cue for triggering sawfish pupping (Peverell 2005) and Whitty et al. (2008) demonstrated that the number of new recruits of freshwater sawfish captured in the dry season of each year is significantly correlated to higher water levels during the late wet season. The alteration of flow could change the timing of reproduction and the level of recruitment. Australian tropical rivers have highly energetic, episodic flows related to the monsoonal wet season that transport sediments downstream with little trapping of materials in waterways (Brodie & Mitchell 2005). Barriers and impoundments on rivers can cause siltation and a reduction in saltwater intrusion, and restrict upstream and downstream movements of sawfish and river shark species. The riverine habitat of freshwater sawfish is often restricted to isolated pools during the dry season, reducing available habitat. Any further reduction of dry season flows would further restrict habitat availability.



3. Relevant protection measures

The dwarf, freshwater and green sawfish are listed as vulnerable species under the EPBC Act. The northern river shark is listed as endangered and the speartooth shark is listed as critically endangered under the Act. Under the Act it is generally an offence to kill, injure, take, trade, keep or move listed marine, migratory or threatened species on Australian Government land or in Commonwealth waters without a permit.

All sawfish species are listed on Appendix I of CITES, except the freshwater sawfish, which is listed on Appendix II accompanied by an annotation that restricts international trade to live animals to appropriate and acceptable aquaria for primarily conservation purposes.

Alongside the EPBC Act, a broad range of sector-specific management measures to address environmental issues and mitigate impacts apply to activities that take place in Commonwealth marine areas. These measures give effect to regulatory and administrative requirements under Commonwealth and state legislation for activities such as commercial and recreational fishing, oil and gas exploration and production, ports activities and maritime transport. In some instances, as in the case of shipping, these measures also fulfil Australia's obligations under a number of international conventions for the protection of the marine environment from pollution and environmental harm.



EPBC Act conservation plans and action plans

- Conservation Overview and Action Plan for Australian Threatened and Potentially Threatened Marine and Estuarine Fishes (Pogonoski, Pollard & Paxton 2002)

International measures

Australia is a signatory to the following international agreements for the conservation of sawfishes and river sharks:

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)—www.cites.org
- International Plan of Action for the Conservation and Management of Sharks (IPOA – Sharks)—<ftp://ftp.fao.org/docrep/fao/006/x3170e/X3170E00.pdf>
- Memorandum of Understanding on the Conservation of Migratory Sharks—www.cms.int/species/sharks/MoU/Migratory_Shark_MoU_Eng.pdf

For more information on conservation listings under the EPBC Act, and related management objectives and protection measures, visit:

- www.environment.gov.au/epbc/protect/species-communities.html
(listed threatened species)
- www.environment.gov.au/epbc/protect/migratory.html
(listed migratory species)
- www.environment.gov.au/cgi-bin/sprat/public/sprat.pl
(species profile and threats database)



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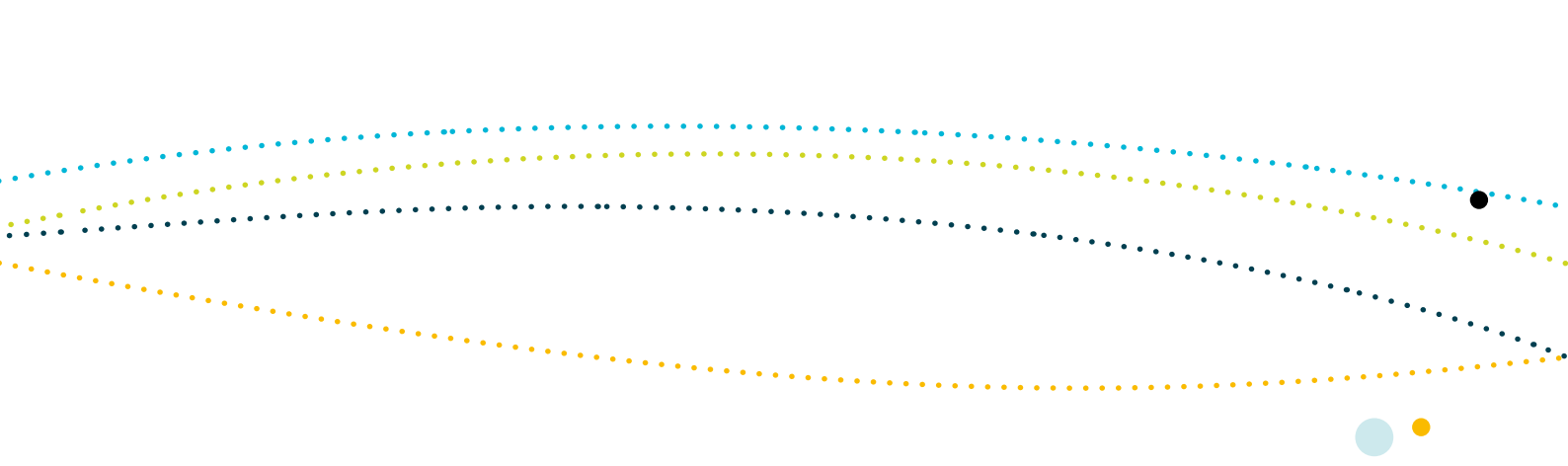
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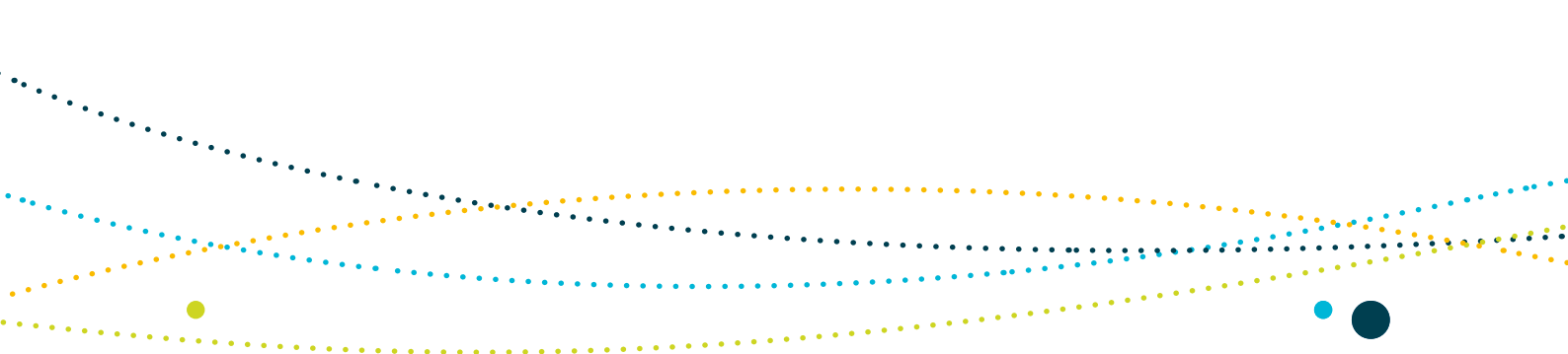
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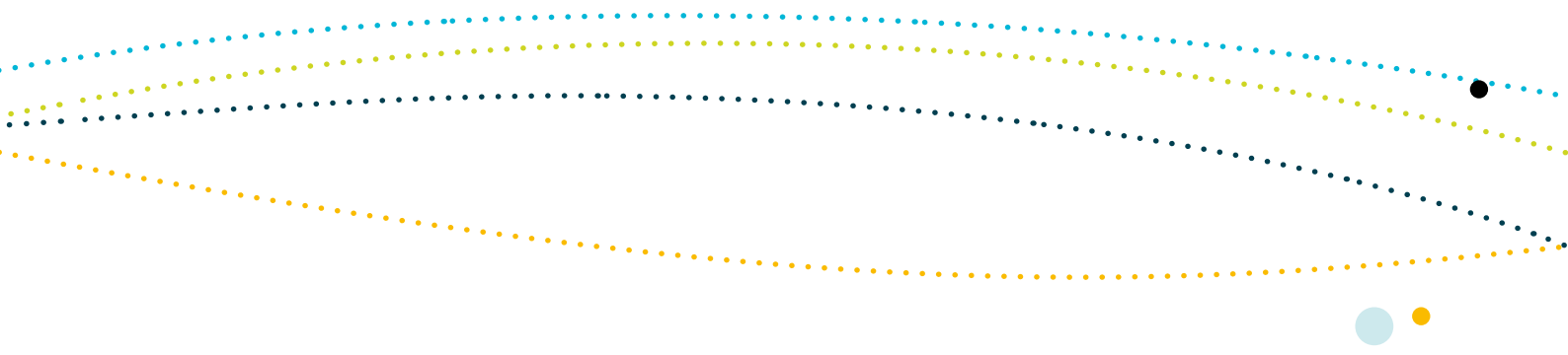
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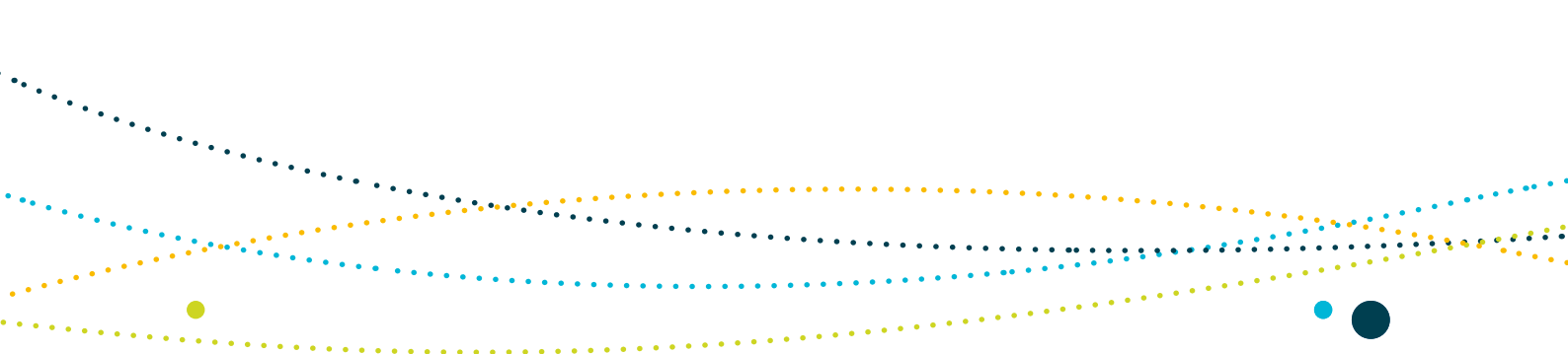
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ATTACHMENT 1: SAWFISHES AND RIVER SHARKS SPECIES OCCURRING IN THE NORTH MARINE REGION

Table A1: Listed sawfish and shark species known to occur in the North Marine Region

Species (common name/scientific name)	Conservation status
Speartooth shark <i>Glyphis glyphis</i>	Critically endangered
Northern river shark <i>Glyphis garricki</i>	Endangered
Dwarf sawfish <i>Pristis clavata</i>	Vulnerable
Freshwater sawfish <i>Pristis microdon</i>	Vulnerable
Green sawfish <i>Pristis zijsron</i>	Vulnerable

Table A2: Listed shark species known to occur in the North Marine Region on an infrequent basis

Species (common name/scientific name)	Conservation status
Grey nurse shark <i>Carcharias taurus</i>	Critically endangered (east coast population), vulnerable (west coast population)
Whale shark <i>Rhincodon typus</i>	Vulnerable, migratory

