Non detriment finding for the Freshwater Sawfish, *Pristis microdon*

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC)

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Table of Contents

1 Executive Summary

The original non-detriment finding for freshwater sawfish (*Pristis microdon*) was developed in 2007. This revised non-detriment finding has been developed by the Department of the Sustainability, Environment, Water, Population and Communities (DSEWPaC), and was developed considering a workshop initiated by the Australian Government to undertake a review of current research on freshwater sawfish in Australia, independent advice regarding the removal of freshwater sawfish from localised river systems in northern Australia, and new scientific research and information about this species.

Pristis microdon is one of four species of sawfish found in Northern Australia. Sawfish are a unique group of elasmobranchs which are characterised by their large size and elongated saw-like rostrum. *P. microdon* is listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), effective July 2000, and critically endangered by the International Union for the Conservation of Nature (IUCN) Red List.

P. microdon is listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), to which Australia is a signatory. International trade in *P. microdon* is possible only *"for the exclusive purpose of allowing international trade in live animals to appropriate and acceptable aquaria for primarily conservation purposes"*. CITES also requires that the State of export must determine that the export will not be detrimental to the survival of the species (known as a 'non-detriment finding') prior to approving export.

CITES obligations are given effect domestically by the EPBC Act, which requires that, *inter alia*, an export permit for a CITES listed species must not be issued by the Minister unless satisfied that the export will not be detrimental to, or contribute to trade which is detrimental to, the survival or recovery of the species, or a relevant ecosystem. This non-detriment finding has been developed to inform the Minister's consideration of this matter for individual decisions about whether to grant an export permit for *P. microdon*.

Australian populations of *P. microdon* have undergone decline, although the magnitude of decline is unknown. All available data suggest the decline has been significant in population size, fragmentation, range retraction and that the species continues to be at risk from the impacts of fishing (commercial, recreational, Indigenous, domestic and international illegal unregulated and unreported fishing) and habitat modification. It is not possible to quantify the current rate of mortality for *P. microdon* and the species exhibits life history characteristics that indicate it is highly sensitive to impacts. As such, it is not possible to conclude with a reasonable level of certainty that any harvest of *P. microdon* for export purposes would not be detrimental to the survival or recovery of the species. This is consistent with the precautionary principle[1].

2 Introduction

There are four species of sawfish (Family Pristidae) found in northern Australia, including the *P. microdon*, (Last and Stevens, 2009). *P. microdon* inhabits freshwater, estuarine and marine environments from the east coast of Queensland, across the Northern Territory to the west coast of Western Australia (Last and Stevens, 2009). These are considered the last viable populations of *P. microdon* globally, despite once being distributed widely throughout the Indo-west Pacific region (Last & Stevens, 2009).

[1] Object of Part 13A (paragraph 303BA(h)) of the EPBC Act, relating to the international movement of wildlife specimens, to ensure that the precautionary principle is taken into account in making decisions relating to the utilisation of wildlife.

P. microdon exhibits life history characteristics of other elasmobranches, in that they have a large body size, are long lived with late maturity, and have low reproductive output. This life history makes *P. microdon* particularly vulnerable to human disturbances (Peverell, 2008; Thorburn *et al*. 2007; Whitty *et al*. 2008; 2009).

Domestically, the *P. microdon* is listed as vulnerable under the EPBC Act. The International Union for the Conservation of Nature (IUCN) Red List states the species "...is characterised by extreme and continued vulnerability to fisheries (evidenced by serious declines in virtually all known populations), compounded by habitat loss and degradation over most of its range. Remaining populations are now small, fragmented and 'Critically Endangered' globally." (Assessors: Compagno, L.J.V *et al*. 2006).

2.1 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

All sawfish, except *P. microdon*, are listed in Appendix I of CITES. A listing in Appendix I means the species is threatened with extinction and trade in the species is only permitted for certain non-commercial purposes or where an approved captive breeding operation for the species exists. *P. microdon* is listed in Appendix II with the annotation *"for the exclusive purpose of allowing international trade in live animals to appropriate and acceptable aquaria for primarily conservation purposes"*. Appendix II includes species not necessarily threatened with extinction, but for which trade must be controlled in order to avoid utilisation incompatible with their survival.

Before a species listed in Appendix II may be exported, a CITES Scientific Authority of the State of export must determine that the proposed export will not be detrimental to the survival of the species. This is called a non-detriment finding. The document "Guidance for CITES Scientific Authorities: Checklist to assist in making non-detriment findings for Appendix II exports" (Rosser & Haywood 2002) specify that a non-detriment finding is when the sum of all harvests of the species is sustainable, "…in that it does not result in unplanned range reduction, or long-term population decline, or otherwise change the population in a way that might be expected to lead the species being eligible for inclusion in Appendix I". FurtherRosser and Haywood (2002) note that a Scientific Authority "must consider total national harvest" when making a non-detriment finding.

Provided the export is not detrimental to the survival of the species, consistent with the annotation and the specimen was legally obtained, the Management Authority of a CITES Party may issue a permit authorising the export of the specimen.

2.2 Commonwealth legislation

The EPBC Act gives effect to CITES requirements domestically. Under the section 303CA of the Act, the Environment Minister must establish a list of CITES species, which enables domestic application of CITES requirements. Under certain circumstances, the Minister may grant permits for the export and import of species on this list.

Relevantly, paragraph 303CG(3)(a) of the EPBC Act provides that the Minister must not issue a permit for the export or import of a CITES specimen unless the Minister is satisfied that:
a) the action or actions specified in the permit will not be detrimental to, or contribute to trade which is detrimental to:

i) the survival of any taxon[2] to which the specimen belongs; or
ii) the recovery in nature of any taxon to which the specimen belongs; or
iii) any relevant ecosystem (for example, detriment to habitat or biodiversity).

[2] Under section 528 of the EPBC Act, ***Taxon*** "means any taxonomic category (for example, a species or a genus), and includes a particular population".

This non-detriment finding has been developed to inform the Minister's consideration of this matter for individual decisions about whether to grant an export permit for sawfish.

2.3 Current state and territory legislative requirements and management arrangements

Northern Territory

P. microdon is listed as vulnerable under the *Territory Parks and Wildlife Conservation Act 2000*. This is based on a suspected population reduction of more than 30% from 1996-2006 or three generations based on potential levels of exploitation.

Both recreational and commercial fishers are prohibited from retaining specimens without a permit. Recreational fishing regulations in the Northern Territory prohibited the retention of sawfish by recreational fisheries as of 1 January 2010. The Northern Territory government are also currently in the process of strengthening legislation which protects *P. microdon* through amendments to the *Fisheries Act 1988.* All commercial fishing operators are legally required to report any interaction with *P. microdon*. As with all jurisdictions, the level of Indigenous harvest of sawfish is unknown for the Northern Territory.

Queensland

P. microdon is a protected species in Queensland and take of specimens is prohibited for commercial and recreational fishers without a permit. Queensland currently permits the removal of a number of *P. microdon* specimens from the Queensland Gulf of Carpentaria for aquarium use.

The Queensland N3 (inshore net) fishery has been identified as a current major threat (DEWHA 2009). The Queensland government banned the take of sawfish by the fishery in 2008, which has reduced the risk to *P. microdon*. It is believed that Illegal, Unregulated and Unreported (IUU) fishing remains a threat in Queensland waters, particularly in the southern, western and north-eastern Gulf of Carpentaria, but the level of IUU fishing in the region appears to have declined (DEWHA 2009). The level of Australian Indigenous harvest of sawfish in Queensland is unknown, however sawfish are of cultural and spiritual significance to Indigenous Australians in the Gulf of Carpentaria (McDavitt 2001).

Western Australia

P. microdon are listed as totally protected under the Government of Western Australia's *Fish Resources Management Act 1994.* Under the Act, all commercial and recreational take, including incidental mortality has been prohibited since 2005. Customary (Indigenous) fishers are still able to take sawfish species (or any other fish species) for customary purposes in their native title regions. There is currently no information on levels of Indigenous take of *P. microdon* in Western Australia.

2.4 Purpose of the review

A non-detriment finding was prepared in October 2007 for proposed Australian export of wild caught *P. microdon*. The 2007 assessment determined that the removal from the wild of up to 10 juvenile *P. microdon* per year was not detrimental to the survival of the remaining population.

In March 2009, the then Department of Environment, Water, Heritage and the Arts (DEWHA) convened a workshop of the Freshwater Sawfish Expert Review Committee to undertake a review of current research and prepare independent scientific advice, relating to the removal of *P.*

microdon from localised river systems in northern Australia (DEWHA 2009). Since this meeting, there has been emerging genetic research on *P. microdon* from Murdoch University (Phillips *et al*. 2009). This review also considers evidence of a decline in sawfish abundance in the Fitzroy River between 2002 and 2008 (Whitty *et al*. 2009).

As the non-detriment finding is eligible for periodic review, DSEWPaC has reviewed the previous non-detriment finding in light of developments since 2007, such as recent research and the Freshwater Sawfish Expert Review Committee's report (DEWHA 2009).

3 Review

The review presented in this document comprises a summary of the harvest regime of *P. microdon* at the national level (part 3.1), an analysis of factors affecting the management regime of *P. microdon* at the national level (part 3.2) and a summary of the outcomes of a workshop held in March 2009, by the Freshwater Sawfish Expert Review Committee DEWHA 2009) and findings of recent research from Murdoch University (Whitty *et al*. 2009 & Phillips *et al*. 2009) (part 3.3).

3.1 Summary of harvest regime for freshwater sawfish

There are several sources of mortality of *P. microdon* in northern Australia which are addressed in detail within Stevens *et al*. (2005). Although quantitative data are lacking, there is undoubtedly some level of incidental mortality of *P. microdon* from interactions with commercial and recreational fisheries. Indigenous people across northern Australia are permitted to take *P. microdon* in the course of traditional fishing. The level of indigenous take has not been quantified. There may also be some level of IUU fishing for *P. microdon*, as the sawfish species are considered to provide valuable, high quality meat and fin. In many regions, there are likely impacts from habitat modification, including from dams, weirs, barrages and mining operations (Doupé_et_al._2005; Morgan_et_al._2005).

A summary of the harvest regime for *P. microdon* in Australia is presented in **Table 1**, as outlined in Rosser and Haywood 2002. It includes: all sources of mortality or take of *P. microdon*; which demographic of the population is targeted; the level and reason for harvest; and the commercial destination of the harvest. It is designed to give an initial view, at the national level, of the likely effects of harvesting the species.

Table 1. Summary of harvest regime of freshwater sawfish (*Pristis microdon*) in Australia

Is the species endemic, found in a few countries only, or widespread? Found in Australia, Indonesia, New Guinea, possibly west to India (Last & Stevens, 2009)
Conservation status of the species (if known): IUCN Global status: Critically endangered

Type of Harvest	**Main product**	**Degree of control**	**Demographic segment of population harvested**					**Relative level of harvest (include no. or quantity if known)**				**Reason for harvest and percentage (if known)**			**Commercial destination of harvest, and percentage**		
			Eggs	Juveniles	Adult male	Adult female	Non selective	Low	Med	High	Un-known	Subsistence	Commercial	Others	Local	National	Inter-national
1.5 Live capture	Specimens for domestic & international public aquaria	a) Regulated		✓ 0-2 yrs				*Uncertain: medium or low* Approx10 per year	*Uncertain: medium or low* Approx10 per year				Public aquaria (<50%)[3]	Exhibition in Public aquaria (>50%)			100%
1.6 Killing of individuals	Incidental capture & mortality: commercial & recreational fishing	a) Regulated					✓ Commercial – release required ✓ Recreational – release required				Unknown			By-catch	N/A	N/A	N/A
	Fin/meat/rostra – from IUU fishing	Illegal & Unregulated					Unknown				Unknown	Food	Supply shark fin and rostra market			Unknown	Unknown
	Fin/meat/rostrum – Indigenous take	Un-regulated					Unknown				Unknown	Food		Cultural & spiritual significance	N/A	N/A	N/A

[3] Each individual export occurs for both commercial and non-commercial purposes, with the non-commercial purpose being the primary reason for export.

3.2 Analysis of factors affecting the management regime of freshwater sawfish

The second component of this review involves an analysis of the general biological and management information for *P. microdon*. Rosser and Haywood (2002) provide a checklist of questions to achieve this (**Table 2**), which are subsequently presented graphically in **Figure 1**.

For each possible answer in the checklist, a ranking is given from one to five. Answers apply at the national level, with the most precautionary answer (i.e. worst scenario) being applied as per instructions in Rosser and Haywood (2002). Responses to the questions indicate the sensitivity of the species to the impacts of harvesting (mortality from all sources), with lower numbers indicating greater confidence in sustainability of the harvest.

In some instances, the checklist criteria apply to a variety of sectors that utilise *P. microdon*, and for each of these sectors there may be a different 'most appropriate response'. In these cases, to achieve ranking that is suitable to the national level and to better communicate the available information, an appropriate intermediate score has been selected to represent the relative importance and certainty associated with each of the component sectors. As a result, in some cases the IUCN Guideline (Rosser and Haywood, 2002) description that corresponds with the chosen intermediate ranking will not describe the national situation or any individual sector; however this method is seen as more accurate than applying the worst sectoral answer, particularly when that sector may be relatively unimportant in terms of risk posed to the species. Where this methodology has been used, the chosen ranking is identified in the explanatory text rather than in alongside the ranking descriptor and it should be noted that caution is required (and has been used) in applying this rating and interpreting the non detriment finding based on these ratings.

Note that this checklist (and subsequent graph in **Figure 1**) does not necessarily constitute a finding of non-detriment. Rather, its use informs the non-detriment finding (Rosser & Haywood, 2002).

Table 2. Factors affecting management of the harvesting regime

Biological characteristics		
2.1 Life history: What is the species' life history?	High reproductive rate, long-lived	
	High reproductive rate, short-lived	
	Low reproductive rate, long-lived	3
	Low reproductive rate, short-lived	
	Uncertain	
It is widely recognised that *P. microdon* has a low reproductive rate and is long lived (Peverell, 2008; Thorburn *et al*. 2007; Whitty *et al*. 2008; 2009).		
2.2 Ecological adaptability: To what extent is the species adaptable (habitat, diet, environmental tolerance etc.)?	Extreme generalist	
	Generalist	
	Specialist	
	Extreme specialist	4
	Uncertain	
The species appears to shift in habitat utilisation at various life stages whereby neonate and juveniles are primarily dependant on freshwater reaches of rivers and estuaries (Thorburn *et al*. 2007) and adults are recorded in estuarine and marine environments (Peverell, 2008). Although this reflects use of a range of habitat types, the species reliance on specialised habitat types at particular stages of life warrants its classification as an extreme specialist.		
2.3 Dispersal efficiency: How efficient is the species' dispersal mechanism at key life stages?	Very good	
	Good	
	Medium	
	Poor	4
	Uncertain	
Recent studies on *P. microdon* genetic diversity indicate that the species may exhibit sex-biased dispersal (female philopatry coupled with male-dispersal). As a result, a decline in the number of		

females from a specific region would not be replaced by females from another region. In addition, a decline in *P. microdon* in one region may impact the abundance of *P. microdon* in another through reduced male dispersal (Phillips *et al.* 2009).

The species appears to shift in habitat utilisation with neonate and juveniles occurring mainly in freshwater reaches of rivers and estuaries (Thorburn *et al*. 2007) and adults recorded in estuarine and marine environments (Peverell, 2008). Many of the rivers which *P. microdon* use as nursery areas fragment into a series of pools in the dry season, reducing the available habitat (Last 2002).

2.4 Interaction with humans: Is the species tolerant to human activity other than harvest?	No interaction	
	Pest/Commensal	
	Tolerant	
	Sensitive	4
	Uncertain	

The dependence on freshwater by neonate and juvenile *P. microdon* means that the modification of river flows by weirs, barrages and causeways may restrict the upstream and downstream movement of juvenile *P. microdon* (Morgan *et al.* 2005, Peverell 2008). Entrapped *P. microdon* are therefore more vulnerable to water quality issues (stagnant drying waterholes), available food resources, line and illegal net fishing. The species is also highly susceptible to incidental capture as a result of commercial and recreational fishing operations.

National status

2.5 National distribution: How is the species distributed nationally?	Widespread, contiguous in country	
	Widespread, fragmented in country	
	Restricted and fragmented	
	Localized	4
	Uncertain	

P. microdon is not an obligate freshwater species, with adults exhibiting a high use of marine environments. Across northern Australia this species is not fragmented in suitable habitat. Along the east coast of Queensland it is fragmented and restricted (Pillans et al. 2009). Localized would therefore be the most appropriate description.

2.6 National abundance: What is the abundance nationally?	Very abundant	
	Common	
	Uncommon	3
	Rare	
	Uncertain	

National abundance is unknown but thought to best fit the category ‘uncommon’, noting the population decline and the role of the species as an apex predator (which are naturally relatively uncommon).

2.7 National population trend: What is the recent national population trend?	Increasing	
	Stable	
	Reduced, but stable	
	Reduced and still decreasing	
	Uncertain	5

The population is reduced, with no evidence to suggest the current trend, whether it remains decreasing, has stabilised or is increasing. It is noted that many initiatives have been implemented including fishery closures, protected areas, fisher education and community awareness. However, the impact on populations due to these recent changes is unknown.

2.8 Quality of information: What type of information is available to describe abundance and trend in the national population?	Quantitative data, recent	
	Good local knowledge	
	Quantitative data, outdated	
	Anecdotal information	4
	None	

No quantitative data is available to describe abundance and the trend in the national population. All available evidence suggests populations in Australia have undergone significant decline.

2.9 Major threats: What major threat is the species facing (underline following: overuse/habitat loss and alteration/invasive species/other) and how severe is it?	None	
	Limited/Reversible	
	Substantial	3
	Severe/Irreversible	
	Uncertain	

Threats to the species are substantial, but largely known and documented (Rose & McLoughlin 2001;

Peverell et al. 2004; Stevens et al. 2008). The major threat is unintentional capture in commercial netting, which is expected to be reversible in most regions of the species range in Australia with increased management measures.

In addition, fins from Pristidae species are considered to be of extremely high value, making them susceptible to illegal, unregulated and unreported fishing (Vannuccini. 1999; Rose & McLoughlin 2001). Recreational fishers have also been known to take *P. microdon*. The impact is unquantified, though thought to be a threat (Thorburn *et al*. 2003). Indigenous harvest is also known to occur and is unquantified (Truelove 2003).

Neonate and juvenile *P. microdon* utilise freshwater and evidence suggests they migrate upstream during flood events. This means that weirs, barrages and causeways may restrict the movement of this cohort (Morgan *et al*. 2005; Peverell, 2008), making them particularly susceptible to water quality issues (stagnant, drying waterholes), available food resources, and illegal line and net fishing.

Climate change is likely to result in changes to rainfall (although remains ambiguous for the Gulf of Carpentaria). Increased intensity of tropical cyclones is likely, inundation from storm surge is projected to increase, and global sea level rise is projected to continue (CSIRO, 2007).

The severity of the majority of the above impacts is unquantified.

Harvest management

2.10 Illegal harvest or trade: How significant is the national problem of illegal or unmanaged harvest or trade?	None	
	Small	
	Medium	
	Large	
	Uncertain	5

Fins from Pristidae species are considered to be of extremely high value, making them susceptible to illegal, unregulated and unreported fishing (Vannuccini. 1999; Rose & McLoughlin 2001). Recreational fishers have been known to take *P. microdon*. The impact is unquantified, though thought to be a threat (Thorburn *et al*. 2003).

2.11 Management history: What is the history of harvest?	Managed harvest: ongoing with adaptive framework	
	Managed harvest: ongoing but informal	
	Managed harvest: new	
	Unmanaged harvest: ongoing or new	4
	Uncertain	

Commercial, recreational and Indigenous harvest have been unregulated in the past, and there is a lack of adequate catch data. All range states have implemented no-take requirements for commercial and recreational fishers. Legal harvest is possible under a permit in some range states. Legal Indigenous harvest continues to be unregulated in all range states and the level of take is unquantified.

2.12 Management plan or equivalent: Is there a management plan related to the harvest of the species?	Approved and co-ordinated local and national management plans	
	Approved national/state/provincial management plan(s)	
	Approved local management plan	
	No approved plan: informal unplanned management	
	Uncertain	

All range states have implemented no-take requirements for commercial and recreational fishers. Legal harvest is possible under a permit in some range states. Considering these factors, a score of '2 – Approved national/state/provincial management plan(s)' would be appropriate, although this does not take into account the Indigenous harvest, (which is not covered by a management plan), so there would also be a case to list this as '4 - No approved plan: informal unplanned management' in relation to indigenous take. As such, caution should be taken in applying this rating. To address this issue, in analysing the data in the radar plot, this item has been allocated a 3.

2.13 Aim of harvest regime in management planning: What is harvest aiming to achieve?	Generate conservation benefit	
	Population management/control	
	Maximize economic yield	

	Opportunistic, unselective harvest, or none	
	Uncertain	

Aquarium harvest for export: The *P. microdon* listing in CITES (Appendix II) is accompanied by the annotation "For the exclusive purpose of allowing international trade in live animals to appropriate and acceptable aquaria for primarily conservation purposes". The harvest and subsequent export from Australia, must be consistent with this annotation. For this reason, the score of '1 – generate conservation benefit' could be applied, however this does not consider all harvest.

There is known to be some harvest for the domestic aquarium market, and harvest for this purpose is not constrained by the CITES annotation. Also, Indigenous take is a legal sector harvesting the species, which provides a valuable, traditional source of food and has cultural significance for some communities. Because of these considerations, it would also be possible to attribute a score of '3 – Maximize economic yield', '4 - opportunistic, unselective harvest, or none' or '5 – uncertain'. As such, caution should be taken in applying this score. This is particularly important as the relative importance of these harvest regimes in terms of impact on the species is not known. . To address this issue, in analysing the data in the radar plot, this item has been allocated a 3.

2.14 Quotas: Is the harvest based on a system of quotas?	Ongoing national quota: based on biologically derived local quotas	
	Ongoing quotas: "cautious" national or local	
	Untried quota: recent and based on biologically derived local quotas	
	Market-driven quota(s), arbitrary quota(s), or no quotas	4
	Uncertain	

The previous non-detriment finding for this species recommended a maximum 10 specimens per year should be authorised for export. This was considered a 'cautious' national quota. The Freshwater Sawfish Expert Review Committee's recommendations (DEWHA 2009) provide a Management Unit based maximum take, which can also be considered a 'cautious quota'. State and Territory collection permits are not required to adhere to these 'quotas' and Queensland has in effect provided a quota on aquarium trade related harvest for a 5 year period. There is no quota for Indigenous harvest.

Control of harvest

2.15 Harvesting in Protected Areas: What percentage of the legal national harvest occurs in State-controlled Protected Areas?	High	
	Medium	
	Low	
	None	
	Uncertain	

As described in Rosser & Haywood (2002), "resource ownership and tenure can play an important role in determining the sustainability of harvests. If tenure and ownership are strong, the incentive for good management and regulation is likely to be greater. Protected Areas (PAs) have a variety of designations and purposes, depending on the national legal and political systems in place. The term, 'State Protected Area' may be used to encompasses a variety of PAs and multiple use zone types, where sustainable use and harvest are allowed, including forest, game and marine reserves, and socalled "National Parks"…". "Range States may have several types of such PAs which offer different degrees of protection from harvest. In general, greater confidence can be placed in the likely sustainability of the harvest if most of it occurs either in such State PAs or in other areas with strong tenure".

According to this description, for *P. microdon*, a PA may be best described as areas with strong legislated protection, which may include estuaries situated inside of parks and reserves, or habitat inside marine reserves. Collection for aquaria occurs in managed fisheries (and as such not under what is considered here to be a 'PA' but are considered to have strong resource ownership and tenure). However Indigenous harvest may occur in PAs.

To address this issue, in analysing the data in the radar plot, this item has been allocated a 3.

2.16 Harvesting in areas with strong resource tenure or ownership: What percentage of the legal national harvest occurs outside Protected Areas, in areas with	High	
	Medium	
	Low	
	None	

strong local control over resource use?	Uncertain	
All harvest for aquaria occurs in managed fisheries, which would be considered to have strong resource tenure or ownership. However the percentages of Indigenous harvest undertaken in State controlled geographic regions, private land and areas with Indigenous tenure is unknown. The level of local control over these resources is also unknown. If these factors were considered, the rating for this criterion would be best described as 5, 'uncertain'. To address this issue, in analysing the data in the radar plot, this item has been allocated a 3.		
2.17 Harvesting in areas with open access: What percentage of the legal national harvest occurs in areas where there is no strong local control, giving *de facto* or actual open access?	None	
	Low	
	Medium	
	High	
	Uncertain	
The legal harvest for display in aquaria is managed and could not be described as 'open access'. For this reason, a score of '1 – none' may apply. However the percentages of Indigenous harvest undertaken on State controlled geographic regions, private land and areas with Indigenous tenure is unknown. The level of local control over these resources is also unknown. CITES requires the sum of all harvest to be non-detrimental. To address this issue, in analysing the data in the radar plot, we have allocated this item with a 3.		
2.18 Confidence in harvest management: Do budgetary and other factors allow effective implementation of management plan(s) and harvest controls?	High confidence	
	Medium confidence	
	Low confidence	3
	No confidence	
	Uncertain	
There is high confidence in the effective implementation of the management controls under the State and Territory issued collection permits for the take of *P. microdon* for public aquaria. There is low confidence in relation to incidental and illegal take. There is no data showing the impact of recently implemented harvest controls, including no-take provisions in the Northern Territory and Queensland. It is likely that concerted enforcement action in 2007 has had an impact on IUU fishing, however, this is unquantified. The indigenous harvest of *P. microdon* is unknown as it is managed by custom to varying extent and is unquantified.		
Monitoring of harvest		
2.19 Methods used to monitor the harvest: What is the principal method used to monitor the effects of the harvest?	Direct population estimates	
	Quantitative indices	
	Qualitative indices	
	National monitoring of exports	4
	No monitoring or uncertain	
In terms of monitoring the entire harvest across Australia, at best there are qualitative efforts, however the lack of data across all fisheries and illegal fishing suggest that '5 - no monitoring or uncertain' may be applied. While there is quantitative data for export harvest this represents a small and unquantified proportion of total harvest.		
2.20 Confidence in harvest monitoring: Do budgetary and other factors allow effective harvest monitoring?	High confidence	
	Medium confidence	
	Low confidence	3
	No confidence	
	Uncertain	
There is a high confidence in the harvest monitoring for the State and Territory issued collection permits for the take of sawfish for public aquaria. Incidental take as bycatch by commercial fishers may be reported, but the confidence level in this reporting is uncertain. Indigenous harvest is unquantified and not monitored. There is no confidence in the monitoring of illegal harvest. As a result of these varying scores and the potential impact that the harvest they each represent may have on the species, it is considered appropriate to attribute an overall ranking of '3 – low confidence' to this criterion.		

Incentives and benefits from harvesting:		
2.21 Utilization compared to other threats: What is the effect of the harvest when taken together with the major threat that has been identified for this species?	Beneficial	
	Neutral	
	Harmful	
	Highly negative	
	Uncertain	5
The relative effect of additional harvest for the purpose of trade is uncertain, as current levels of mortality from other sources (eg fishing interactions, IUU, habitat degradation) is unknown. Although unquantified, it is likely that incidental mortality from gillnet and other fishing activities has a comparatively greater impact on the population.		
2.22 Incentives for species conservation: At the national level, how much conservation benefit to this species accrues from harvesting?	High	
	Medium	
	Low	3
	None	
	Uncertain	
P. microdon displayed in overseas aquaria may have a positive conservation impact through education, though there is a lack of consensus as to the effectiveness of zoos and aquaria in getting visitors to change their attitudes and behaviours. Research has presented findings of weak to non-existent learning and attitudinal impacts alongside other studies which show a link between a zoo experience and a new conservation behaviour and significant changes in conservation knowledge and interest following a visit to a zoo or aquarium (Smith *et al*. 2003; Falk *et al.* 2007). While overseas exhibition of *P. microdon* may provide a positive impact overseas, which is likely to be of value given the current international status of the species is 'Critically Endangered' (International Union for the Conservation of Nature (IUCN) Red List), there is no evidence to suggest that these educational benefits will have any impact on the domestic populations. Harvest for export to aquaria has contributed to the understanding of *P. microdon* through providing access to researchers on *P. microdon* collection trips for data collection activities. The benefit of these activities is difficult to quantify. Export arrangements do not require the exporting party to collect data or conduct research. Without initiatives targeted at specific questions needed to assess the status of *P. microdon* and feed directly back to the organisation responsible for the management and conservation, the benefits of harvest will remain low. There is likely to be a conservation benefit from the Indigenous harvest through providing an incentive to communities to protect *P. microdon* and their habitat locally, however this is also unquantified.		
2.23 Incentives for habitat conservation: At the national level, how much habitat conservation benefit is derived from harvesting?	High	
	Medium	
	Low	3
	None	
	Uncertain	
There is likely to be a conservation benefit from the Indigenous harvest through providing an incentive to communities to protect *P. microdon* and their habitat. Improved understanding of habitat requirements for captive *P. microdon* contributes to understanding of in situ habitat requirements. The benefits in both cases have not been effectively demonstrated and, in line with guidance on this question, have consequently been scored as 'low'.		
Protection from harvest:		
2.24 Proportion strictly protected: What percentage of the species' natural range or population is legally excluded from harvest?	>15%	
	5-15%	
	<5%	
	None	
	Uncertain	
Considering only collection for export purposes, it would be reasonable to apply '1 - >15%', however this does not consider Indigenous harvest which is virtually unrestricted, and would result in a more appropriate classification of '4 – None'. Because of this, extreme caution should be taken in application of this ranking. To address this issue, in analysing the data in the radar plot, this item has been allocated a 2.5.		
2.25 Effectiveness of strict protection measures: Do budgetary and other factors give confidence in	High confidence	
	Medium confidence	

the effectiveness of measures taken to afford strict protection?	Low confidence	3
	No confidence	
	Uncertain	
If only considering harvest for aquaria, the appropriate rating is '1 – high confidence'. However this confidence is relatively insignificant when compared to the confidence associated with the strict protection applied to other harvest sectors, such as protection from illegal fishing. The effectiveness of strict protection measure in terms of controlling illegal harvest is unquantified. As such, this score may be appropriately classified as '3 – low confidence' or '5 uncertain' To address this issue, in analysing the data in the radar plot, we have allocated this item with a 3.		
2.26 Regulation of harvest effort: How effective are any restrictions on harvesting (such as age or size, season or equipment) for preventing overuse?	Very effective	
	Effective	
	Ineffective	
	None	
	Uncertain	5
The restrictions under the Queensland General Fisheries Permit require the holder to notify Boating and Fisheries Patrol prior to collection commencing. There are numerous gear restrictions and conditions on deployment, which are assumed to be implemented, however their effectiveness at preventing overuse is unknown as the current status of the population is unknown. There are measures in place to attempt to reduce *P. microdon* mortality due to capture in fishing gear (DPIF, 2009). There is no data on how effective these measures are, however, anecdotal evidence suggests education is having a positive influence on some fishers.		

The results of this checklist are visually represented in a radar plot (**Figure 1**). The Rosser and Haywood (2002) advise that if the harvest is likely to be non-detrimental most of the answers will be depicted near the centre of the circle. Outlying points may indicate low confidence in the probability that the harvest is sustainable.

A number of answers are ranked at a high level of uncertainty, indicating a potential high sensitivity of the species to the impacts of harvesting and commercial use. This is largely due to the lack of information available on the unregulated Indigenous harvest, a lack of information on biological characteristics, distribution, abundance, and the effectiveness of regulating and controlling management arrangements.

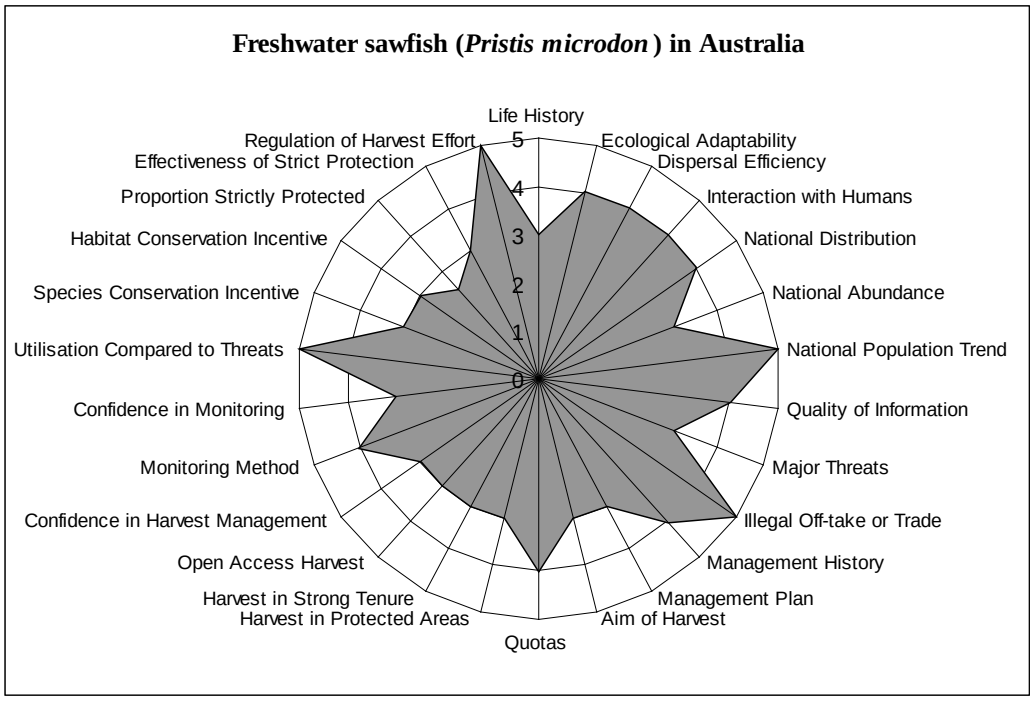

Figure 1: Radar plot of the factors affecting the management of *Pristis microdon* in Australia.

3.3 Summary of Freshwater Sawfish Workshop Findings and recent research from Murdoch University (Whitty *et al*. 2009 & Phillips *et al*. 2009)

Freshwater sawfish Workshop findings

The Freshwater Sawfish Expert Review Committee (the Expert Committee) met in March 2009 to undertake a review of current research and present independent scientific advice relating to the removal of *P. microdon* from localised river systems in northern Australia (DEWHA 2009).

The Expert Committee considered that *P. microdon* in northern Australia could be divided into five management units, comprising a group of river systems. The Expert Committee concluded that for two management units (the East Australian Coast and the Northern Territory and East Kimberley), there should be no removals from the population, given a significant reduction in abundance, contraction in range, unknown population information and current levels of extraction.

For three management units (the West Coast of Western Australia[4], the Southern and Western Gulf of Carpentaria and the North East Gulf of Carpentaria), the Expert Committee considered that, if four conditions were met, the removal of a small number (maximum four specimens per year from each Management Unit) of *P. microdon* would be non detrimental to the survival of the remaining populations.

The conditions specified are as follows:

- Removals are comprised only of males. The Expert Committee considered that the threat to populations was higher if females were removed.
- Removals should be comprised of neonate and juvenile sawfish less than or equal to 1.5 meters in length (0 – 2+ years of age).
- Removals should be spread across the river systems across their range and restricted in terms of repeated take from the same river system, in order to minimise the likelihood that rare genotypes are over exploited.
- Removals should be sourced from below the lowest barrier in any river system, where natural mortality was likely to be lower and thus the impact of removals on the sustainability of the population also likely to be lower.

Despite this recommendation, the Expert Committee noted that the "… advice is made in the context of having no estimates of current total removals from any Management Unit and that the sample sizes underlying the structure of the populations remain small."[5]

These findings of the Expert Committee were based on expert opinion following a revision of available data and a demographic model of *P. microdon* (Simpfendorfer 2008). It is important to note that data used to develop the demographic model were not validated through peer review and was unpublished but represented the best available data for this species at that time.

The demographic model only included fishing mortality (harvest) from the Gulf of Carpentaria inshore gill net fishery which was assessed as being close to or beyond levels that

[4] The *Fish Resources Management Act 1994* prohibits commercial or recreational take of this species. This includes the incidental mortality by commercial or recreational fishers, and/or Indigenous take.
[5] Report of the Freshwater Sawfish *Pristis microdon* Scientific Workshop of 24 March 2009, page 15 (DEWHA 2009).

would lead to a population decline (Simpfendorfer 2008). No data on mortality associated with illegal fishing, indigenous take, fish or prawn trawl fisheries, recreational fishing, impact of proposed mining developments or habitat modification from weirs and barrages were available and therefore were not included in the model. The model did therefore not include all removals and it is noted that fishing removal rates (harvest) used in the model are likely to be underestimated (Simpfendorfer 2008).

Although there was a general consensus by the Expert Committee that mortality rates in the Gulf of Carpentaria inshore gill net fishery should have declined following implementation of a non retention policy on all sawfish in the Gulf of Carpentaria, there are no data available to demonstrate a reduction in fishing mortality or catch rates prior to and after the legislation, making it impossible to assess any potential change in mortality rates or the sustainability of any removal from the population.

The uncertainty regarding the sustainability of *P. microdon* harvest is highlighted in the Expert Committee's assessment of *P. microdon* populations on a regional level. Despite recommending that the take of four male sawfish per year (subject to conditions) would be sustainable in the West Coast of Western Australia, it was noted that it was not possible to quantify current levels of removals.

Recent research from Murdoch University (Whitty *et al.* 2009, Phillips *et al*. 2009 & Phillips *et al*. 2011)

Phillips *et al.* (2009) conducted an analysis of spatial patterns of microsatellite variation in *P. microdon*, based upon three tetranucleotide microsatellite loci in 22 or more individuals from the Fitzroy River region and 38 or more from the Gulf of Carpentaria region, with at least 60 individuals genotyped for each locus. The research has found that levels of genetic diversity across the two regions were high or moderate. However, it was noted that for long lived species like the *P. microdon*, it can take several generations for a decrease in genetic diversity to become apparent, and would take significant time to recover lost diversity due to low intrinsic rates of increase.

The study also found no evidence of genetic differentiation at the microsatellite loci (which are bi-parentally inherited) in *P. microdon* between the Fitzroy River and Gulf of Carpentaria regions. These results are in contrast to the situation occurring in a maternally inherited mitochondrial marker, which exhibits a relatively high level of differentiation between the two regions (Phillips *et al*. 2008). Phillips *et al*. 2009 suggest that in combination, these results provide evidence that *P. microdon* exhibits sex-biased dispersal, with females demonstrating philopatry (the behaviour of returning to an individual's birthplace), and males being relatively widespread. It is concluded that if dispersal in *P. microdon* is male-biased, this would have significant implications for management. This is because a decline in females in a particular geographic region would not be replaced through immigration of females from another region, and secondly, as a result of male dispersal, a population decline in one region could directly impact its abundance in another region.

These results are supported by a more recent publication by Phillips *et al*. (2011) which found statistically significant genetic structure that was higher in *P. microdon* than in the other Pristis species studied, and it is hypothesised that this is the result of a much higher and/or localized level of female philopatry in *P. microdon*. This paper suggests that since female migration between regions is unlikely, management should strive to maintain current levels of diversity and abundances in the regional assemblages.

Whitty *et al*. (2009) has demonstrated a decline in the Catch Per Unit Effort (CPUE) of *P. microdon* in the Fitzroy River from 2002 – 2008, suggesting a reduction in abundance of the

species in this river system. The reduced CPUE was attributed to a decline in the number of animals greater than 1 year old (>1+). Whitty *et al*. (2009) attributed this decline in >1+ animals to low recruitment in previous years coinciding with low rainfall. These data highlight the susceptibility of juvenile populations to environmental and human induced fluctuations in water level and subsequent flow rates and illustrate the need for precautionary management.

Recent changes to management measures

There have been a number of changes to State (and Northern Territory) fishery management measures that may have reduced the overall threat fisheries pose to *P. microdon*. These measures include banning retention of sawfish in fisheries as well as a reduction in domestic fishing effort. There has also been a possible reduction in IUU fishing effort. Whilst it may be assumed that the overall threat to *P. microdon* has been reduced as a result of these management initiatives combined with reduced IUU effort, it is important to note that the reduction in risk has not been quantified and that even if the risk from these sources have been substantially reduced, this does not automatically translate to an increase in sustainability. There is currently no data available on the total harvest pressure on *P. microdon* nor whether this level is above or below the level that the species can maintain.

While these domestic measures are likely to be reducing mortality, the lack of data on the extent of historical decline and whether there has been a subsequent holt to this decline or a level of recovery precludes assuming that these management initiatives have been sufficient to ensure sustainability of this population. Until the success of these management initiatives are quantitatively assessed, the sustainability of current mortality rates cannot be determined (i.e. there is no evidence that current levels of mortality are sustainable).

4 Conclusion

Australian populations of *P. microdon* have undergone decline, although the magnitude of decline is unknown. All available data suggest the decline has been significant in population size, fragmentation, range retraction and that the species continues to be at risk from the impacts of fishing (commercial, recreational, Indigenous, domestic and international illegal unregulated and unreported fishing) and habitat modification. It is not possible to quantify the current rate of anthropogenic induced mortality for *P. microdon* and the species exhibits life history characteristics that indicate it is highly sensitive to impacts. As such, it is not possible to conclude with a reasonable level of certainty that any harvest of *P. microdon* for export purposes would not be detrimental to the survival or recovery of the species.

In reaching this conclusion, and in line with CITES advice on the making of non-detriment findings, consideration has been given to:

- the high level of uncertainty surrounding the harvest regime, including sources of mortality or take, the demographic of the population targeted, the level and purpose of harvest, and the destination of the harvest;
- an assessment of the factors affecting the management regime of *P. microdon* that indicates a potential high sensitivity of the species to the impacts of harvesting and commercial use;
- outcomes of a scientific workshop held in March 2009, by the Freshwater Sawfish Expert Review Committee (DEWHA 2009), and emerging research on *P. microdon* from Murdoch University, including:
    - the Freshwater Sawfish Expert Review Committee conclusion that in three out of five selected management units, the removal of four male sawfish under 1.5 meter total length is likely to have a limited impact provided several conditions on harvest are met;

    - demographic analysis showing that if current harvest levels were sustainable, then taking an additional four juvenile animals per year from each management unit would have a negligible impact on sustainability;
    - the same demographic analysis estimating that current fishing mortality rates are likely to be at or above those that would lead to decline;
    - that the Expert Committee could not demonstrate the sustainability of current harvest rates due to a lack of qualitative data;
    - a likely reduction in *P. microdon* in the Fitzroy River;
    - indications that *P. microdon* exhibit sex biased dispersal, with females likely to return to their place of birth to reproduce – and the implications for management;
- Recent research (Phillips *et al*. 2009) demonstrating a likelihood of sex biased dispersal of *P. microdon*, with female philopatry (the behaviour of returning to an individual's birthplace), and relatively widespread male distribution and the associated importance of managing *P. microdon* populations so that current levels of genetic diversity, and thus evolutionary potential, are maintained.
- the number of unquantified threats to *P. microdon* in Australia including: levels of indigenous take; level of mortality associated with capture and release in state or territory commercial fisheries; illegal net fishing by both commercial and recreational fishers; extent of illegal, unregulated and unreported fishing by foreign vessels for this species; and
- impacts on habitats from modification of river flow (weirs, barrages) and mining operations, and subsequent impacts on *P. microdon* habitat use; and impacts as a result of climate change.

This conclusion is consistent with an object of Part 13A (paragraph 303BA(h)) of the EPBC Act, relating to the international movement of wildlife specimens, to ensure that the precautionary principle is taken into account in making decisions relating to the utilisation of wildlife. Additionally, Annex 4 to Resolution Conf. 9.24 of CITES contains a number of precautionary measures that can be applied in the making of non detriment findings, including that, "…the Parties shall, in the case of uncertainty, either as regards the status of a species or the impact of trade on the conservation of a species, act in the best interest of the conservation of the species…".

It is noted that a formal public consultation process for the draft non-detriment finding for *P. microdon* was held from 18 June 2010 to 31 August 2010. All public comments received were reviewed and assessed in detail and the current revised non-detriment finding incorporates comments and suggestions, where appropriate.

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