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Species diversity of critically endangered pristid sawfishes (Elasmobranchii: Pristidae) of Nusantara waters (Malay Archipelago)

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ABSTRACT

Sutarno, Setyawan AD, Suyatna I. 2012. Species diversity of critically endangered pristid sawfishes (Elasmobranchii: Pristidae) of Nusantara waters (Malay Archipelago). Biodiversitas 13: 161-171. The pristid sawfishes (Pristidae) are notable because of their saw-like rostrum and large body size (up to seven meters). All pristids are listed as critically endangered by IUCN, since decreasing population; Nusantara is home for five pristid species, namely: *Anoxypristis cuspidata* Latham, 1794, *Pristis clavata* Garman, 1906, *Pristis microdon* Latham, 1794, *Pristis zijsron* Bleeker, 1851, and *Pristis pectinata* Latham, 1794. *A. cuspidata* differ from *Pristid* spp. by the presence of a very narrow rostral saw, with 16 to 29 pairs of teeth except for the part along the quarter of the rostral saw near the head. *P. microdon* has a highly defined groove that runs along the entire posterior edge of the tooth into and beyond its confluence with the rostrum. This groove is absent in juvenile of *P. clavata* and whilst it develops in larger individuals it rarely runs along the entire posterior edge of the tooth or reach its confluence with the rostrum. *P. clavata* possibly have been misidentified as *P. pectinata*, whose distribution in the Indo-West Pacific is uncertain. *P. clavata* can be distinguished from *P. pectinata* and *P. zijsron* by the possession of fewer rostral teeth (18 to 22 in *P. clavata* cf. 24 to 28 in *P. zijsron* and 24 to 34 in *P. pectinata*), and by its smaller body size (i.e. less than 250 cm TL in *P. clavata*). *P. microdon* indicates different sexes of the number of rostral teeth, i.e. 17-21 in female cf. 19-23 in male, but in *P. clavata*, it can not be used to differentiate male from female, with both sexes possessing an average of 42 rostral teeth. In *P. clavata* the dorsal fin origin is opposite or slightly behind the pelvic fin origin, the rostum is relatively shorter (22-24% of TL), the lower cauda fin lobe is smaller.

Key words: *Anoxypristis*, pristid, *Pristis*, sawfish, Nusantara, Malay Archipelago.

INTRODUCTION

The pristids sawfishes (Family Pristidae Bonaparte, 1838; Greek: *pristēs* meaning *a sawyer* or *a saw*) are a group of iconic-benthic species of elasmobranchs that are notable because of their large body size (up to seven meters) and saw-like projection of the upper jaw bearing lateral teeth-like denticles, termed as rostrum (Bigelow and Schroeder 1953; Last and Stevens 2009), that is used to hunt and stun prey (Compagno 1977; Last and Stevens 2009). The rostral teeth grow continuously from the base and attach to the rostrum via alveoli (Slaughter and Springer 1968; Compagno and Last 1999). The peduncle is not expanded and the dentine cap is easily worn off (Slaughter and Springer 1968).

The taxonomy of the pristid family is chaotic and one of the most problematic in the elasmobranch families (Ishihara et al. 1991; Compagno and Cook 1995; van Oijen et al. 2007; Wiley et al. 2008), with uncertainty regarding the true number of species (Ishihara et al. 1991; Deynat 2005). The single family Pristidae is divided into two genera, *Pristis* Linck 1790 and *Anoxypristis* White & Moy-Thomas, 1941. The genus *Pristis* comprises six putative species; two species are distributed in the Atlantic East Pacific (AEP), i.e. *Pristis pristis* L, 1758 (Common sawfish) and *Pristis perotteti* Muller & Henle, 1841 (Large-tooth sawfish); three species are distributed in the Indo West Pacific (IWP), i.e. *Pristis clavata* Garman, 1906 (Dwarf sawfish), *Pristis microdon* Latham, 1794 (Freshwater sawfish), and *Pristis zijsron* Bleeker, 1851 (Green sawfish); and one species *Pristis pectinata* Latham, 1794 (Smalltooth sawfish) is distributed worldwide, although AEP is the main distribution area. The genus *Anoxypristis* is represented by a single IWP species, *Anoxypristis cuspidata* Latham, 1794 (Knifetooth sawfish) (Compagno 1999; Compagno and Last 1999; McEachran and de Cavarlho 2002). All IWP pristids have been identified in Nusantara, although it is rarely found.

Pistids are rarely found and the whole body rarely collected completely, since they have large body size, then a few description is based on parts of speciment. Species descriptions of pristids based on isolated body parts have caused confusion and often misidentification. *P. zijsron* was described solely on the basis of its rostrum; *Pristis dubius* Bleeker 1852 (syn. *P. zijsron*) was described solely on the basis of its caudal fin; and *Pristis leichardti* Whitley 1945 (syn. *P. microdon*) was described only from a single photograph (Thorburn et al. 2003; van Oijen et al. 2007). The problems associated with the systematics of pristids

may only be solved with genetic analyses, for some species may be morphologically identical (Thorburn et al. 2003). Resolving this taxonomic uncertainty has been a major problem, since it is difficult to obtain tissue samples from these increasingly rare animals for taxonomic research.

Pristids have a large body size and are thought to have high longevity, late maturity, viviparous reproduction, and low fecundity (Thorburn et al. 2007; Peverell 2008). On the basis that they are large, mobile, and marine, adult pristids seemingly have the potential to distribute over vast distances. However, virtually all of the available data on pristid movements pertain to juveniles and sub-adults found in coastal or riverine nursery areas (e.g. Peverell 2005; Thorburn et al. 2007; Whitty et al. 2009). There is a suggestion that the dispersal in elasmobranchs is often dictated by individual or social behavior, and female philopatry appears to be common in species where adult and juvenile habitats are spatially removed (Feldheim et al. 2001; Keeney et al. 2005).

Pristids occur inshore, in freshwater and in marine environments to a maximum depth of 122 m (McEachran and de Cavarlho 2002; Simpfendorfer 2006). *P. microdon* has habitat partitioning in different life stages, with juveniles utilising freshwaters as nursery grounds and penetrating long distances into freshwater while adults use marine waters (Taniuchi et al. 1991; Thorburn et al. 2003, 2007; Peverell 2005). While *P. clavata* may adopt a strategy similar to that of *P. microdon*, where juveniles remain within rivers and move offshore upon maturation (Thorburn et al. 2007). The juvenile of *P. clavata* appear to utilise estuarine waters only (Thorburn et al. 2008), and was not encountered in freshwaters above the tidal limit (Morgan et al. 2004; Thorburn et al. 2004). Female philopatry coupled with male-dispersal is common in elasmobranch species in which adult and juvenile habitat is spatially removed (Springer 1967; Ebert 1996; Feldheim et al. 2001, 2004; Keeney et al. 2005).

The biology of *P. zijsron*, *P. clavata*, and *P. microdon* is generally believed to be similar with the exceptions of adult size and juvenile habitat use. The adults of *P. zijsron* and *P. microdon* are both relatively large (up to seven meters) (Last and Stevens 2009), while those of *P. clavata* are smaller (up to at least three meters) (Peverell 2005; Last and Stevens 2009). This size difference is potentially relevant as it might influence the potential dispersal of the species (assuming that larger adults can traverse greater distances) and therefore the amount of metapopulation (Jenkins et al. 2007). The life cycles of *P. zijsron* and *P. clavata* are fairly typical of pristids because they are completed entirely in marine waters; the juveniles are predominantly found in inshore waters and mangrove areas (Peverell 2005). In contrast, *P. microdon* are marine-estuarine as adults, but spend the juveniles in the upper reaches of estuaries and freshwater rivers (Thorburn et al. 2007; Whitty et al. 2009). This life history strategy would make them especially vulnerable to over-exploitation (Stobutzki et al. 2002). There is disparity in the size at maturity of *P. microdon* suggesting there may be more than one species. A two meters male *P. microdon* in a Hong Kong aquarium (collected from Australia) was sexually mature, while a 3.7 m male specimen in a Paris aquarium was immature (Stevens et al. 2005).

Sawfish populations have been declining worldwide (Stevens et al. 2000; Cavanagh et al. 2003), especially in the Indo-West Pacific (Compagno and Cook 1995) and the southern hemisphere (Cavanagh et al. 2003). All pristid species have undergone dramatic declines in range and abundance in recent times. A range of factors contributes to this vulnerability, including that pristids (i) have a relatively slow rate of population growth (K-selected life history) (Simpfendorfer 2000; Compagno et al. 2006); (ii) are actively exploited for a range of reasons, including as trophies and decorations (Peverell 2005; Thorburn et al. 2007; Siriraksophon 2012), aquarium and museum collections (Cook et al. 1995), cultural and spiritual purposes (Peverell 2005; Berra 2006) as well as sport/ recreational fishing (Seitz and Poulakis 2002; Peverell 2005); (iii) are feature in the by-catch of several fisheries and as a consequence suffers significant amounts of mortality (Simpfendorfer 2000; 2002; Pogonoski et al. 2002; Stobutzki et al. 2002; Gribble 2004), and (iv) have habitat degradation (Simpfendorfer 2000; 2002). Since the juveniles likely depend on rivers for their survival, pristids are vulnerable to the effects of the degradation of freshwater systems, as well as to the effects of coastal influences, and they are more susceptible to be captured in rivers (Saunders et al. 2002). A combination of their coastal shallow water distribution and their heavily toothed rostrum make all classes of pristid vulnerable to be captured by net and long line fisheries (Peverell 2005). *P. microdon, P. zijsron*, and *P. clavata* were once broadly distributed in the Indo-West Pacific region (Last and Stevens 2009); but, these species are now restricted to northern Australia (Pogonoski et al. 2002; Thorburn et al. 2003; Stevens et al. 2005; Last and Stevens 2009). Although the number of pristids in Australian have declined in recent times, these declines are probably not as extreme as those happened in other regions, such as Indonesia (Thorson 1982; Simpfendorfer 2000).

All pristids are currently listed as critically endangered worldwide by the World Conservation Union (IUCN 2010) and some of them are among the most endangered fishes (Stevens et al. 2000; Cavanagh et al. 2003). In the end of this year only four pristids species are listed in the Red List, namely *A. cuspidata*, *P. clavata*, *P. pectinata* and *P. zijron* (IUCN 2012). The taxonomic problem is the main reason for deleting the list of other species (Scott J, IUCN Red List Unit, pers. com. 2012). Trading of pristid sawfishes are also banned. In June 2007, all pristids were listed in Appendix I of CITES, except for *P. microdon*, which was listed in Appendix II; and has been annotated as follows: "for the exclusive purpose of allowing international trade in live animals to appropriate and acceptable aquaria for primary conservation purposes" (CITES 2008). Long before that, in 1999, the Indonesian government established that all species of pristid sawfishes are protected animals, then it is prohibited to hunt, to kill, to trade, and to consume (PP 7/1999). *P. microdon* breeding efforts has been attempted in Indonesia, but did not succeed due to lack of live fish as broodstock (Fahmi and Dharmadi 2005).

Pristids have been studied for a long time in Nusantara. One species, *P. zijsron*, was named and described after a specimen collected from Banjarmasin, South Kalimantan. Unfortunately, this research was not continued due to rarity of the specimen collection (large body size is the reason). The main objective of this study was to assess taxonomic diversity of Pristidae in Nusantara waters (Islands of Southeast Asia or Malay Archipelago, Malesia).

MATERIALS AND METHODS

The research materials are preserved specimens of pristid sawfishes (Pristidae) and data from previous research by literature review. Previous field studies have been conducted to trace the existence of pristids in Nusantara. As we know, Nusantara (Malay Archipelago) includes all Indonesian Archipelago, the Malay Peninsula, the Philippines, and New Guinea. The study was conducted by interviewing the fishermen, fish traders, coastal communities, government officials and local officials of the Marine and Fisheries Department, and also the interviews with fisheries experts, and did field surveys to sites known as a pristids habitat.

The previous study was conducted on the western coast of West Sumatra and Mentawai Islands, the northern coast of Sumatra (Aceh), the eastern coast of Jambi, the western coast of West Kalimantan (Peniti River estuary and surroundings), Barito River estuary and surroundings in South- and Central Kalimantan, Mahakam River estuary in East Kalimantan, Lake Sentani in Papua, and the river estuaries and coastal area of Merauke, South Papua. Information about the existence of pristids also be traced in some Fish Auction Place (TPI) in Java, particularly in Juwana and Pekalongan. Field studies show that pristids ever present at all of those sites. Around 20-25 years ago, fishermen still caught and sold. But, in mid 2012, when the study was conducted, the live pristids or fresh specimens were not found anymore.

In this study, we successfully collected two pristids rostrum, which is one of *P. microdon* of Lake Sentani, Papua (caught 6 years before), and one of *Pristis* sp. of Merauke water, South Papua (caught one year before). The only information about the living pristids in the wild is in the south coast of Merauke, but in this study the live specimens were not captured. Information about the preserved pristids specimen also be traced to the various research centers and universities, but found only three specimen of pristids, i.e. a juvenile *P. microdon* collected by Bogor Zoological Museum (MZB) Cibinong, Bogor in 1970s from Lake Sentani, Papua; and one pristid specimen collected by Office of Marine and Fisheries, Kutai Kartanegara District in 1975/1976 from Mahakam River Delta, i.e. Sungai Meriam, Anggana, Kutai Kartanegara, East Kalimantan (similar specimen caught from Muara Badak, Mahakan Delta has been lost).

Given the limited pristids specimen, the literature was very important in knowing taxonomy of Pristidae from Nusantara (Malay Archipelago). Some manuscripts were very valuable, i.e. Compagno and Last (1999), Deynat (2005), van Oijen et al. (2007), and Last and Stevens (2009).

RESULTS AND DISCUSSION

Pristidae Bonaparte, 1838

Large to gigantic shark-like batoids (adults reaching 2.4 to 7 m total length (TL), placoid scales; no enlarged denticles, thorns, or spines on dorsal surface of trunk or tail. Moderately depressed trunk, thick and shark-like. Moderately depressed precaudal tail, with lateral ridges on sides, tail which is not abruptly narrower than trunk, with no barbed sting (stinger or stinging spine) and no electric organs in tail. Head narrow, but moderately depressed; snout supported by a stout rostral cartilage, greatly elongated into a flat, rostral saw with a single row of large, transverse teeth on each side that grow continuously from their bases; saw is without small teeth or paired dermal barbels on its underside and without smaller teeth between the large ones on its sides; posteriormost rostral teeth well anterior to nostrils. Five small gill slits are on underside of front half of pectoral-fin bases, not visible in lateral view; no gill sieves or rakers on internal gill slits. Eyes are dorsolateral on head and well anterior to spiracles. Mouth is transverse and straight, without knobs and depressions. Nostrils are well anterior and completely separated from mouth, far apart from each other and not connected to the mouth by nasoral grooves; short anterior nasal flaps, not connected with each other and not reaching mouth. Very small oral teeth, rounded-oval in shape and without cusps on their crowns, not laterally expanded and plate-like, similar in shape and in 60 or more rows in either jaw. Pectoral fins are small, starting from behind mouth, attached to posterior part of head over gills, and ending with well anterior to pelvic-fin bases. No large electric organs at bases of pectoral fins. Pelvic fins are angular, and not divided into anterior and posterior lobes. Two large equal-size and widely separated dorsal fins present. These have similar angular or rounded-angular shape with distinct apices, anterior, posterior, and inner margins, and well-developed free rear tips, varying in shape from triangular to strongly falcate. First dorsal-fin base is anterior and over junction between trunk and tail, over or partially in front of the pelvic fins. Caudal fin is large, shark-like, strongly asymmetrical, with vertebral axis raised above body axis; lower caudal lobe is strong to weak, or absent. Dorsal surface is yellowish, brownish or grey-brown, or greenish above and on flanks, and white below. there are no prominent markings on body or fins though fins may be darker than body (Compagno and Last 1999).

Keys of identification

Key to the species of sawfishes (Pristidae) occuring in Nusantara waters, the Malay Archipelago (Compagno and Last 1999; Figure 1).

1a Posteriormost teeth on rostral saw well anterior to base of saw; rostral teeth greatly flattened, blade-like, and triangular, with single sharp anterior and posterior edges in adults and a posterior barb in young; broad incurrent apertures; long nostrils, narrow, and between edges of head and nostril incurrent apertures; long nostrils, narrow, and diagonal, small and narrow anterior nasal flaps; narrow-based, high and short pectoral fins; first dorsal fin with origin over or slightly posterior to pelvic-fin insertions; a secondary caudal keel below the first one on the caudal-fin base; caudal fin with a shallow subterminal notch and a long, prominent ventral lobe ……..…… *Anoxypristis cuspidata*

1b Posteriormost tooth on rostral saw just anterior to base of saw; elongated, and peg or awl-like, moderately flattened rostral teeth, with rounded anterior edge and double posterior edges with a groove between them in adults of all species and in young of some species (*Pristis microdon*); no incurrent grooves on underside of snout between edges of head and nostril incurrent apertures; short, broad, and transverse nostrils, large and broad anterior nasal flaps; broad-based, low, and long pectoral fins; first dorsal fin with anterior base, over of somewhat posterior to pelvic-fin bases but ahead of pelvic-fin insertions; no secondary caudal keel below the main one on the caudal-fin base; caudal fin without a subterminal notch and with short ventral lobe or none. …….. …… 2 (*Pristis*)

2a Caudal fin with a short but conspicuous ventral lobe; base of first dorsal fin considerably anterior to pelvic-fin.…….... ….…… *Pristis microdon*

2b Caudal fin without definite ventral lobe; base of first dorsal fin varies from over or slightly anterior to pelvic-fin, to slightly behind midbases of pelvic fins …….. 3

3a Base of first dorsal fin over or anterior to pelvic-fin (20 to 32, usually 25 or more, pairs of rostral teeth)...…… ……. *Pristis pectinata*

3b Base of first dorsal fin behind pelvic-fin ……..… 4

4a First dorsal-fin base posterior to midbases of pelvic fins; 23 to 34 pairs to rostral teeth; size to 610 cm or more..… ……. ……..… *Pristis zijsron*

4b First dorsal-fin base anterior to the midbases of pelvic fins; 18 to 22 pairs of rostral teeth; size possibly to about 140 cm. …… …… *Pristis clavata*

Description

Anoxypristis cuspidata Latham, 1794

Synonym: **Pristis cuspidatus* Latham, 1794; **Anoxypristis cuspidate* Latham, 1794; **Anoxypristis cuspidatus* Latham, 1794; **Pristis cuspidate* Latham, 1794; *Squalus semisagittatus* Shaw, 1804; *Pristis semisagittatus* Shaw, 1804. Note: * = misspellings (Froese and Pauly 2011).

Common name: Knifetooth sawfish (Aust.), Narrow sawfish (FAO), Pointed sawfish.

Description: Maximum length 470 cm TL (max. lengths of up to 610 cm TL are based on unconfirmed reports). Length at first maturity 246-282 cm. Greyish above, pale below; fins usually pale. shark-like body, distinct pectoral fins; flattened head, with a blade-like snout bearing 18-22 pairs of lateral teeth; slender blade, not tapering distally. Nostrils are very narrow with small nasal flaps. Short rostral teeth, flattened, broadly triangular, lack of groove along posterior margins; no teeth on basal quarter of blade. Adults are with widely spaced denticles, whilest young with naked skin (Compagno and Last 1999).

Ecology: A marine, euryhaline (moving between fresh and salt water) or marginal (brackish water), these species are found from inshore in the intertidal waters to a depth of 40 m, frequents river deltas and estuaries, and may go upstream in rivers. They are common in sheltered bays with sandy bottoms. Feeds on small fish and cuttlefish (Compagno and Last 1999; Riede 2004). Though details of its ecology are not precisely known, it probably spends most of its time on or near the bottom in the shallow coastal waters and estuaries it inhabits. The sawfishes are all ovoviviparous (Dulvy and Reynolds 1997). Females of this species can be pregnant at 246 to 282 cm. Litters range from 6 to 23 young. Age at maturity, longevity and average generation time are unknown (Compagno et al. 2005, 2006, Last and Stevens 2009). Generally harmless but its saw-like snout may cause serious injury when it is caught: it is known to thrash violently and vigorously (Compagno and Last 1999).

Distribution: This large sawfish was formerly distributed through much of the Indo-West Pacific region in shallow inshore coastal waters and estuaries, apparently declining in some areas (Compagno et al. 2005). Historically, it is a relatively common euryhaline or marginal of the Indo-West Pacific. It has been reported in inshore and estuarine environments from the mouth of the Suez Canal, throughout the Red Sea, the Persian (Arabian) Gulf, the northern Indian Ocean, the Malay Archipelago to the northern Australia. In mainland Asia it was reported from the Gulf of Thailand, Cambodia, Vietnam, China to Korea and out to the southern portion of Japan (Honshu), as well as the north west of Taiwan (Compagno and Cook 1995a; Compagno and Last 1999; Compagno et al. 2006; Last and Stevens 2009). Brackish water records have been reported from the Oriomo River estuary, Papua-New Guinea (Taniuchi et al. 1991).

In Nusantara, it has been reported from Kalimantan: Kinabatangan River of Sabah (Fowler 2002), estuaries and inshore coastal waters of Sabah and Brunei (Manjaji 2002; Siriraksophon 2012); the Philippines; Malay Peninsula: Malacca, Pinang, and Singapore (Siriraksophon 2012; van Oijen et al. 2007); Java: Jakarta (Batavia) and Semarang in sea waters (van Oijen et al. 2007); New Guinea: Oriomo River of Papua New Guinea (Compagno 2002; Taniuchi 2002; Fowler 2002), and somewhere in Indonesia (Siriraksophon 2012) (Figure 2A).

Conservation status: Critically Endangered (CR) (A2bcd+3cd+4bcd) (IUCN 2012); Appendix I (CITES 2008); Protected (PP 7/1999).

Human uses: Commercial fisheries, caught for its flesh and liver (Last and Stevens 2009), gamefish.

Taxonomic note: *A. cuspidata* is distinguished from sawfish of the genus *Pristis* by the presence of a very narrow rostral saw, with 16 to 29 pairs of distinctive dagger-shaped teeth on the rostrum but no teeth along the quarter of the rostral saw nearest to the head . It has a distinct lower caudal lobe (Compagno et al. 2006).

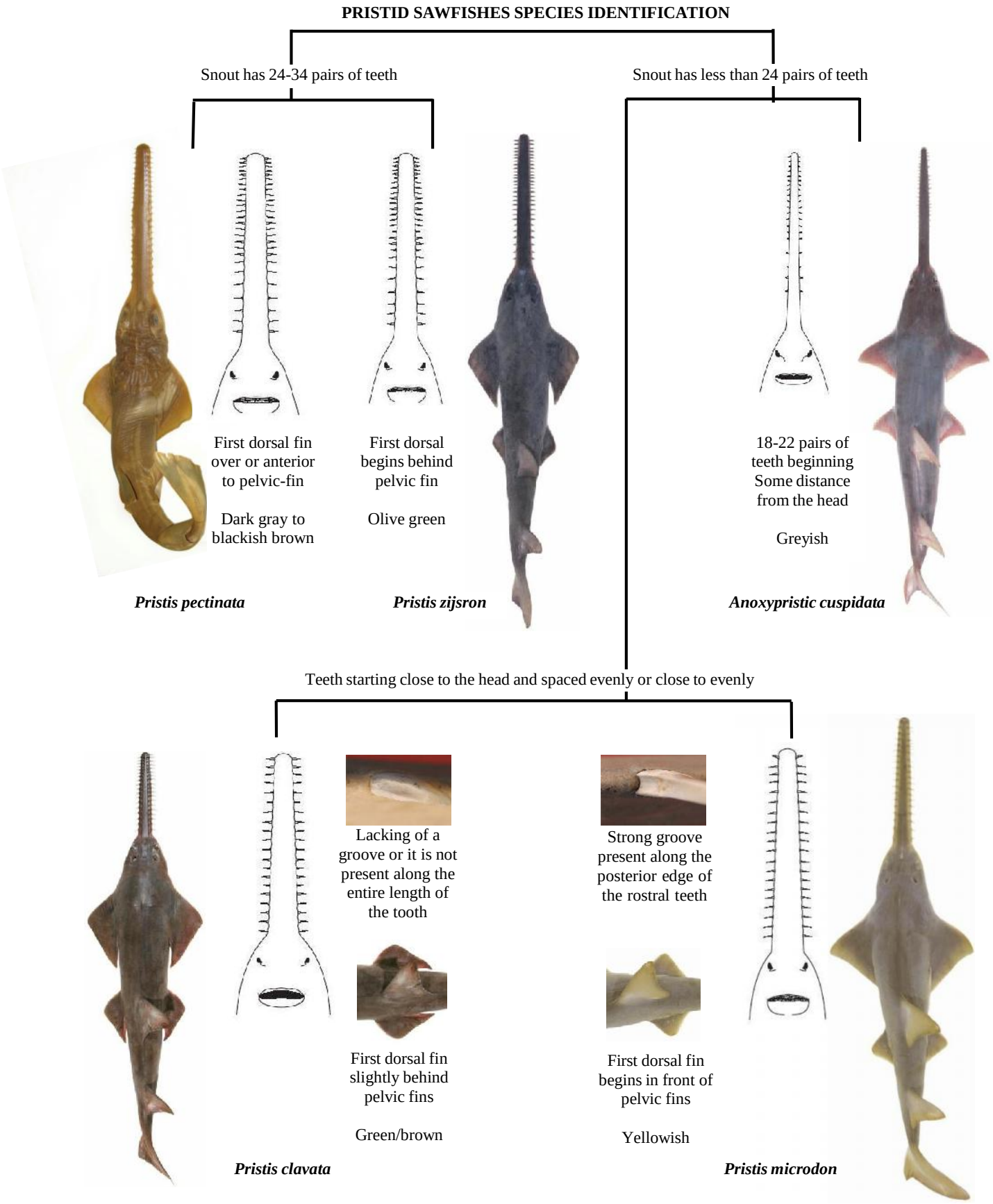

Figure 1. The key identification of pristid sawfishes in Nusantara waters, the Malay Archipelago (after Daley et al. 2002; McAuley et al. 2002; Thorburn 2006).

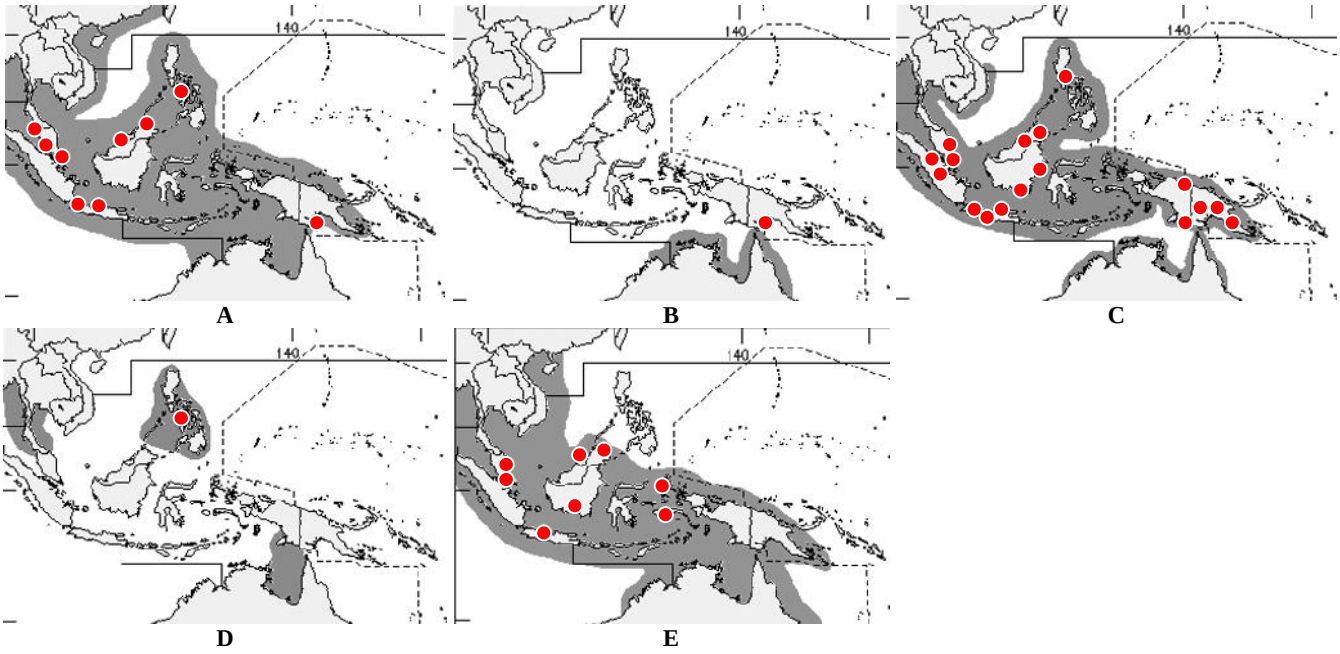

Figure 2. Species distribution of pristid sawfishes in Nusantara waters, the Malay Archipelago. A. *A. cuspidata*, B. *P. clavata*, C. *P. microdon*, D. *P. pectinata* and E. *P. zijron*. Note: grey area = formerly or potential area distribution of pristids (Compagno and Last 1999); ● = pristids record.

***Pristis clavata* Garman, 1906**

Synonym: Misapplied name: *Pristis pectinata* (non Latham, 1794) (Froese and Pauly 2011).

Common name: Dwarf sawfish (Aust.), Queensland sawfish

Description: Maximum length is 140 cm TL. Greenish brown, rarely yellowish; ventrally white; paler fins. shark-like body, distinct pectoral fins; flattened head, with a blade-like snout bearing 18-22 pairs of lateral teeth; broad blade, not tapering distally. Broad nostrils with large nasal flaps. Slender rostral teeth, with a groove along posterior margins; teeth reaching basal quarter of blade. Skin with denticles (Compagno and Last 1999). Biology little known (Compagno and Last 1999).

Ecology: Inshore and intertidal species found in estuaries and on tidal mudflats. Ascends brackish areas of rivers (Compagno and Last 1999). Coastal and estuarine habitats in tropical Australia, particularly over mudflats in the Gulf of Carpentaria (Pogonoski et al. 2002). It occurs some distance upriver, almost into freshwater (Last and Stevens 2009). This relatively small sawfish may be restricted to the tropical coasts and estuaries of north and north-western Australia, or more widely distributed through the Indo-Pacific. Australian populations have declined significantly as a result of bycatch in commercial gillnet and trawl fisheries throughout this limited range and this bycatch continues, in commercial and recreational fisheries. When this sawfish occurs outside Australian waters, these areas are fished even more intensive and populations over there are likely to be nearing extirpation (IUCN 2012). Ovoviviparous (Dulvy and Reynolds 1997).

Distribution: Confirmation comes from tropical coastal and estuarine habitats in Northern and Northwestern Australia. Other records are unconfirmed, but it may occur or have occurred more widely in Indo-West Pacific areas (IUCN 2012). A record of the occurence of *P. clavata* in the Canary Islands may not be this species. The species is likely *P. pristis* that naturally spread in the eastern Atlantic. Both species are known similar and needs further research to determine if the two species are distinct (Compagno and Last 1999).

In Nusantara, it was recorded from New Guinea: south coast of Papua New Guinea (e.g. Macaraeg RA, 2002, blogroll/pers. com; need more confirmation) (Figure 2B).

Conservation status: Critically Endangered (CR) (A2bcd+3cd+4bcd ver 3.1) (IUCN 2012); Appendix I (CITES 2008); Protected (PP 7/1999)

Human uses: Flesh may be good to eat (Last and Stevens 2009).

Taxonomic note: On the basis of rostral tooth morphology, *P. clavata* may be different from *P. microdon*, which possesses a similar number of rostral teeth. In *P. microdon*, a highly defined groove runs along the entire posterior edge of the tooth into and beyond its confluence with the blade of the rostrum (Thorburn et al. 2007). In contrast, this groove is absent in juvenile of *P. clavata* and whilst it develops in larger individuals. It rarely runs along the entire posterior edge of the tooth or reachs its confluence with the rostrum. Furthermore, *P. clavata* can be distinguished from *P. pectinata* and *P. zijsron* by the possession of fewer rostral teeth (18 to 22 in *P. clavata* cf. 24 to 28 in *P. zijsron* and 24 to 34 in *P. pectinata*) (Thorburn et al. 2007; Last and Stevens 2009), and by its

smaller size (i.e. less than 250 cm TL in *P. clavata*). In *P. microdon* different sexes can be indicated by the number of rostral teeth, i.e. 17-21 in female cf. 19-23 in male, but in *P. clavata*, it can not be used to differentiate male from female, for both sexes possesses an average of 42 rostral teeth (Thorburn et al. 2008). In *P. clavata* the dorsal fin origin is opposite or slightly behind the pelvic fin origin, the rostum is relatively shorter (22-24% of TL), the lower cauda fin lobe is smaller (Compagno and Last 1998).

***Pristis microdon* Latham, 1794**

Synonym: Misapplied name: *Pristis antiquorum* (non Latham, 1794); *Pristis perotteti* (non Müller & Henle, 1841); *Pristis pristis* (non Linneaus, 1758). Ambiguous synonym: *Pristiopsis leichhardti* Whitley, 1945; *Pristis zephyreus* Jordan & Starks, 1895 (Froese and Pauly 2011), *Pristis leichardti* Whitley 1945.

Common name: Freshwater sawfish (Aust.), Largetooth sawfish (FAO), Leichhardt's sawfish

Description: Maximum length is 700 cm TL (White et al. 2005); common length is 500 cm TL (Schneider 1990); max. published weight is 600 kg (Stehmann 1981); max. reported age is 30 years (Compagno and Last 1999) (up to 44 years). Length at first maturity is 240-300 cm; slow to mature (about seven years) and has low fecundity (a litter size of 1-12 young) (Tanaka 1991; Thorburn et al. 2007). A heavily-bodied sawfish with a short but massive saw which is broad-based, strongly tapering and with 14-22-(23) very large teeth on each side; space between last 2 saw-teeth on sides less than 2 times space between first 2 teeth (Compagno et al. 1989). Interspace between the posterior rostral teeth is once or twice greater than that between the anterior teeth. Origin of the first dorsal fin is in front of level of the origin pelvic fin. Caudal fin has a small but distinct ventral lobe (Seret 2006). Pectoral fins are high and angular, first dorsal fin is mostly in front of pelvic fins, and caudal fin with pronounced lower lobe (Compagno et al. 1989). Greenish, grey or golden-brown above, cream below (Compagno et al. 1989).

Ecology: Inhabits sandy or muddy bottoms of shallow coastal waters, estuaries, river mouths, and freshwater rivers and lakes, until 10 m depth (Riede 2004); Reiner 1996). Usually found in turbid channels of large rivers over soft mud bottoms (Allen et al. 2002). Adults are usually found in estuaries and coastal areas, and the juveniles in fresh water. Most of the rivers in which it becomes into a series of pools in the dry season, reducing its available habitat (Last 2002). Large adults can also be found in fresh water, but are rarely caught (Rainboth 1996). They are the bottom dweller of estuaries and large river systems. Feeds on benthic animals and small schooling species. Ovoviviparous, producing 15-20 embryos (Dulvy and Reynolds 1997). The saw is used for grubbing and attacking prey as well as for defense. The saws are sold as tourist souvenirs (Skelton 1993). Occasionally, they are caught by demersal tangle net and trawl fisheries in the Arafura Sea; they possibly have been extinct in parts of the Indo-Pacific; they are highly susceptible to gill nets. They are utilized for the fins and meat (both are very expensive), and also their skin and cartilage (White et al. 2006).

Distribution: Indo-West Pacific, from East Africa to New Guinea, north to the Philippines and Vietnam, south to Australia. Also Atlantic East Pacific, if *Pristis perotteti* and *Pristis zephyreus* are synonymized with *P. microdon*. The original description of *P. microdon* did not give further explaination, but most authors have used the name *Pristis microdon* for the Indo-West Pacific sawfishes of this species group as contrasted from the Atlantic *P. perotteti* and the eastern Pacific *P. zephyreus* (Compagno and Last 1999).

In Nusantara, its occurence has been reported from Sumatra: Indragiri River, Riau (Taniuchi 1979, 2002), Batanghari River, Jambi (Tan and Lim 1998); Kalimantan: Kinabatangan River, Sabah (Fowler 2002; Compagno 2002), Kampong Batu Putih in Kinabatangan River, Kampong Tetabuan in Labuk Bay, Kampong Tomanggong in Segama, Sabah (Manjaji 2002), Brunei (Siriraksophon 2012); Banjarmasin, South Kalimantan in river waters (van Oijen et al. 2007); somewhere in Indonesian Borneo (Compagno 2002); Sungai Meriam, Anggana, Mahakan Delta, East Kalimantan (collection of Office of Marine and Fisheries, Kutai Kartanegara District, but need molecular identification, since it is only rostrum without teeth); the Philippines: Luzon (Compagno and Last 1999); Malay Peninsula and Singapore (Siriraksophon 2012); Java: Jakarta (Batavia) and Gresik in sea waters, Surakarta in river of Kali Pepe, caught in 1846 (van Oijen et al. 2007), somewhere in Java (Compagno and Last 1999), New Guinea: Oriomo River (Papua New Guinea), Lake Murray (Papua New Guinea), Sepik River (Papua New Guinea) (Taniuchi 2002; Fowler 2002), Sentani Lake, Jayapura, Papua (our personal collection and MZB collection), Merauke, South Papua (our personal collection, but need more investigation); somewhere in Papua New Guinea and Indonesia (Morgan et al. 2011) (Figure 2C).

Conservation status: Critically Endangered (CR) (A2bcd+3cd+4bcd ver 3.1) (IUCN 2012); Appendix II (CITES 2008); Protected (PP 7/1999)

Human uses: Minor commercial fisheries (marketed salted); the saws are sold as tourist souvenirs (Skelton 1993), gamefish.

***Pristis pectinata* Latham, 1794**

Synonym: *Pristis acutirostris* Duméril, 1865; *Pristis annandalei* Chaudhuri, 1908; *Pristis granulosa* Bloch & Schneider, 1801; *Pristis leptodon* Duméril, 1865; *Pristis megalodon* Duméril, 1865; **Pristis pectinatus* Latham, 1794. Misapplied name: *Pristis antiquorum* (non Latham, 1794); *Pristis clavata* (non Garman, 1906); *Pristis zijsron* (non Bleeker, 1851). Ambiguous synonym: **Pristis evermanni* Fischer, 1884; *Pristis occa* (Duméril, 1865); *Pristis serra* Bloch & Schneider, 1801; *Pristis woermanni* Fischer, 1884; *Pristobatus occa* Duméril, 1865. Note: * = misspellings name (Froese and Pauly 2011).

Common name: Smalltooth sawfish (FAO), Wide sawfish

Description: Maximum length is 760 cm TL; common length is 550 cm TL (Last and Stevens 2009); max. published weight is 350 kg (Stehmann 1981). Long, flat, blade-like rostrum with (20)-24 to 32 pairs of teeth along

the edges. Interspace between the posterior rostral teeth is 2 to 4 times greater than that between the anterior teeth. Base of the first dorsal fin is at level of the pelvic fin base. Caudal fin is large and oblique without a distinct ventral lobe (Seret 2006). Dark gray to blackish brown above, paler along margins of fins. White to grayish white or pale yellow below (Bigelow et al. 1953). In Nusantara, it present has been reported from the Philippines.

Ecology: Inshore and intertidal species; in shallow bays, lagoons and estuaries, also in freshwater (Riede 2004), until depth of 10 m (Stehmann 1990). it may cross deep water to reach offshore islands; and swim up rivers for it can tolerate fresh water (Compagno and Last 1999). It commonly be seen in bays, lagoons, estuaries, and river mouths. Also it can be found in rivers and lakes (Michael 1993). Feeding on fishes and shellfishes (Vidthayanon 2005). Ovoviviparous (Dulvy and Reynolds 1997). Using its saw to stir the bottom when feeding on bottom invertebrates and to kill pelagic fishes (Compagno and Last 1999). It is utilized as a food fish; its oil is used as medicine, soap and in leather tanning (Last and Stevens 2009). Adults stuffed is for decoration (Last and Stevens 2009). It is reported to be aggressive towards sharks when it is kept in tanks (Michael 1993). Because it grows slowly, it is believed to mature late and large individuals are thought to be very old. The four-generation period could be 100 years or more. Bigelow and Schroeder (1953b) suggest that large females produce between 15 and 20 young per year; the young are born at 70 to 80 cm TL. Size at maturity is estimated as 320 cm TL. Maximum life span is estimated to be 40 to 70 yrs and generation times are approximately 27 yr. Annual rate of population increase estimated as 0.08 to 0.13. (Adams and Williams 1995, Bigelow and Schroeder 1953, Simpfendorfer 2000, 2002, Adams 2005). Juveniles are common in very shallow waters, but adults occur to depths over 100 m (Poulakis and Seitz 2004, Simpfendorfer and Wiley 2005). They are thought to spend most time on or near the seabed, but occasionally swim at the surface. There are many records from coastal lagoons, estuarine environments and the lower, brackish drainages of rivers (Yarrow 1877, Bigelow and Schroeder 1953b, Swingle 1971). The food of *P. pectinata* is primarily fish, but it also consumes crustaceans and other bottom dwelling organisms (Bigelow and Schroeder 1953b). Breder (1952) summarized the function of the saw in the feeding strategy of *P. pectinata*, noting that prey is impaled on the rostral teeth then scraped-off on the bottom and consumed (Adam et al. 2006).

Distribution: It is known from tropical and warm temperate nearshore ocean waters; circumglobal. It is in Western Atlantic from North Carolina (USA), Caribbean and northern Gulf of Mexico (Robins and Ray 1986) to Argentina (Menni and Lucifora 2007). It is in Eastern Atlantic from Gibraltar to southern Angola (possibly northern Namibia), it is possibly in the Mediterranean Sea. It can be found in Indo-West Pacific from the Red Sea and East Africa to the Philippines, and south to the tropical Australia. Possibly, it occurrs in the eastern Pacific (Compagno and Last 1999). This large, widely distributed sawfish has been wholly or nearly extirpated from large areas of its former range in the North Atlantic (Mediterranean, US Atlantic and Gulf of Mexico) and the Southwest Atlantic coast due to fishing and habitat changes. The remaining populations are now small, fragmented and critically endangered globally. It is apparently extinct in the Mediterranean and likely also the Northeast Atlantic. Reports of this species outside the Atlantic are now considered to have been misidentifications of other *Pristis* species.

In Nusantara: the Philippines (Compagno and Last 1999; Siriraksophon 2012) (Figure 2D).

Conservation status: Critically Endangered (CR) (A2bcd+3cd+4bcd ver 3.1) (IUCN 2012); Appendix I (CITES 2008); Protected (PP 7/1999)

Human uses: Minor commercial fisheriy; gamefish; remedies for Asthma, rheumatism, arthritis (Alves and Rosa 2006; Alves et al. 2007; Alves and Rosa 2007)

Taxonomic note: *P. clavata* possibly have been misidentified as *P. pectinata*, whose distribution in the Indo-Pacific is uncertain (Thorburn et al. 2007).

***Pristis zijsron* Bleeker, 1851**

Synonym: *Pristis granulosa* Schneider & Bloch 1801; *Pristis occa* Duméril 1865; *Pristis woermanni* Fischer 1884; **Pristis zyrson* Bleeker, 1851; **Pristis zysron* Bleeker, 1851; **Pristis zysross* Bleeker, 1851; Misapplied name: *Pristis antiquorum* Latham 1794; *Pristis clavata* Garman 1906; **Pristis zisron* Bleeker, 1851; *Pristis pectinata* (non Latham, 1794); *Pristis pectinatus* Latham 1794. Note: * = misspellings name (Froese and Pauly 2011), *Pristis dubius* Bleeker 1852 (van Oijen et al. 2007).

Common name: Green sawfish (Aust.), Longcomb sawfish (FAO), Narrowsnout sawfish

Description: Maximum length 730 cm TL (Compagno et al. 1989); common length 550 cm TL. Length at first maturity 430 cm (Last and Stevens 2009). It is ovoviviparous (Dulvy and Reynolds 1997), giving birth to large young. Grant (1978) suggested that adult males use their saws during mating battles. Sawfishes generally feed on slow-moving shoaling fish such as mullet, which are stunned by sideswipes of the snout. Molluscs and small crustaceans are also swept out of the sand and mud by the saw (Allen 1982, Cliff and Wilson 1994). A male captured as a juvenile survived 35 years in captivity. Dark grey to blackish brown on above part, white to yellowish on below part (Heemstra 1995).

Ecology: Inshore and intertidal species are known to enter freshwater in some areas (Compagno and Last 1999). They are found in shallow (demersal) bays, estuaries, and lagoons, with depth range of 5 m (Heemstra 1995; Compagno and Last 1999). They inhabits muddy bottom habitats and enters estuaries (Allen 1997). Often on the bottom, they lay with their saw elevated at an angle to the body axis (Compagno and Last 1999). Feeds on fishes and shellfishes (Vidthayanon 2005). It has been recorded in inshore marine waters to at least 40 m depth, in brackish water (estuaries and coastal lakes) and in rivers. Its habitat is heavily fished and often also subject to pollution, leading to habitat loss and degradation from coastal, riverine and catchment developments. A very large, formerly common,

Indo-West Pacific sawfish is recorded mainly in inshore marine habitats, also reported from freshwater. Like all sawfishes, it is extremely vulnerable to capture by target and bycatch fishing throughout its range, which has contracted significantly as a result. All populations are now very seriously depleted, with records having become extremely infrequent over the last 30 to 40 years (Froese and Pauly 2011).

Distribution: Indo-West Pacific from South Africa to the Persian Gulf, and eastwards to southern China, Papua New Guinea, south to New South Wales, Australia (Last and Stevens 2009).

In Nusantara, it has been reported from Kalimantan: Kampong Tetabuan in Labuk Bay, Sabah (Manjaji 2002), Brunei (Siriraksophon 2012); Banjarmasin (Banjermassing), South Kalimantan (van Oijen et al. 2007); Malay Peninsula and Singapore (Siriraksophon 2012); Java (Compagno 2002); Moluccas: Ternate (Compagno 2002), Ambon (van Oijen et al. 2007) (Figure 2E).

Conservation status: Critically Endangered (CR) (A2bcd+3cd+4bcd ver 3.1) (IUCN 2012); Appendix I (CITES 2008); Protected (PP 7/1999)

Human uses: commercial fishery; gamefish

Taxonomic notes: *P. zijsron* is a member of the *Pristis pectinata* complex, probably also containing *P. clavata*, with narrow-based, less tapered, lighter rostral saws, with more numerous (usually over 23), smaller teeth than species of the *Pristis pristis* complex. (Compagno et al. 2006).

CONCLUSION

Five pristids species were found in Nusantara, namely: *Anoxypristis cuspidata* Latham, 1794, *Pristis clavata* Garman, 1906, *Pristis microdon* Latham, 1794, *Pistis zijsron* Bleeker 1851, and *Pristis pectinata* Latham, 1794. *A. cuspidata* differs from *Pristid* spp. by the presence of a very narrow rostral saw, with 16 to 29 pairs of teeth but no teeth along the quarter of the rostral saw nearest to the head. *P. microdon* has a highly defined groove runs along the entire posterior edge of the tooth into and beyond its confluence with the rostrum. This groove is absent in juvenile of *P. clavata* and whilst in larger individuals, it develops, and it rarely runs along the entire posterior edge of the tooth or reach its confluence with the rostrum. *P. clavata* possibly have been misidentified as *P. pectinata*, whose distribution in the Indo-West Pacific is uncertain. *P. clavata* can be distinguished from *P. pectinata* and *P. zijsron* by the possession of fewer rostral teeth (18 to 22 in *P. clavata* cf. 24 to 28 in *P. zijsron* and 24 to 34 in *P. pectinata*), and by its smaller body size (i.e. less than 250 cm TL in *P. clavata*). *P. microdon* indicate different sexes of the number of rostral teeth, i.e. 17-21 in female cf. 19-23 in male, but in *P. clavata*, it can not be used to differentiate male from female, with both sexes possessing an average of 42 rostral teeth. In *P. clavata* the dorsal fin origin is opposite or slightly behind the pelvic fin origin, the rostum is relatively shorter (22-24% of TL), the lower cauda fin lobe is smaller.

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