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The valid Species and Distribution of Stingrays (Myliobatiformes: Dasyatidae) in South Sumatran waters, Indonesia

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abstract

A recent study to providing valid checklist of stingrays species in South Sumatran waters provide 14 species: *Brevitrygon heterura, Fluvitrygon kittipongi, Fluvitrygon oxyrhyncha, Fluvitrygon signifier, Fluvitrygon* sp 'musi' 1, *Fluvitrygon* sp 'musi' 2, *Himantura undulata, Himantura uarnak, Maculabatis gerrardi, Pateobatis fai, Pateobatis uarnacoides, Pastinachus ater, Telatrygon biasa* and *Urogymnus polylepis*. Distributional patterns of stingrays in South Sumatran waters are depend on species or (at least) genus level. Stingrays in South Sumatran waters are recorded from of up to more 100 km inland to the coastal zone area. Following IUCN Red List status, 10 species of stingrays are threatened with status Endangered, Vulnerable and Data Deficient; suggest the South Sumatran waters are important habitat for stingrays in Indonesia.

1. Introduction

Indonesia has 4.743 species of fishes, making one the greatest diversity of fish fauna in the world (Froese & Pauly 2018). Many iconic group of fishes known collectively as the 'ray' (Myliobatiformes) occur in Southeast Asia, particularly in Indonesian waters (Compagno & Roberts 1982, Last *et al.* 2016, Kottelat 2013). One of 'ray' is stingrays (family Dasyatidae), groups of small to very large myliobatiform fishes (adults from 22 cm to 260 cm disc wide) and distinguished by the following combination of characters: body variably depressed with a well-formed oval, circular or rhombic disc that fully incorporates head; snout angular to obtuse and sometimes very elongate; nasal curtain well developed, skirt-shaped, rectangular or bilobed; five gill slits; oral papillae usually present on floor of mouth; tail moderately stout to slender-based and more or less elongated (sometimes very elongate and whip-like); dorsal surface variably covered with dermal denticles, thorns and/or tubercles, smooth to very spiny and often with a median thorn row and/or a median denticle band; no dorsal or caudal fins; 1-4 prominent caudal stings, positioned on tail well posterior to pelvic fins; skin folds variably developed on the ventral and sometimes dorsal midline of tail; dorsal surface plain to strongly patterned, usually darker than ventral surface (Last & Compagno 1999, Last *et al.* 2016a, Last *et al.* 2016b, Nelson 2006).

Recent phylogenetic studies, supported by morphological data, have provided evidence that the Dasyatidae is monophyletic and consists of four major subgroups, the subfamilies Dasyatinae, Neotrygoninae, Urogymninae and Hypolophinae; and a morphologically based review of 89 currently recognised species (Last *et al.*, 2016b). Stingrays are highly adapted and successful fishes that occur in marine, estuarine and freshwater habitat in temperate and tropical areas worldwide (Last & Compagno 1999). In Indonesia, there are 40 valid species of stingrays that occur in main seven faunal regions (Windusari & Iqbal 2018).

South Sumatra province is the largest province in Sumatra which located in the southeastern portion of the island (Whitten *et al.* 2000). The study of fish diversity had been reported accross the South Sumatran waters (Utomo *et al.* 2007, Husnah *et al.* 2008), but the study focus on stingrays were very limited (Iqbal & Yustian 2016, Iqbal *et al.* 2017, Iqbal *et al.* 2018). To facilitate on stingrays information in South Sumatran waters, a comprehensive study is required. This paper provide first review on all valid species and distributional records of stingrays in South Sumatran waters.

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2. Material And Method

Records of stingrays in South Sumatran waters were obtained from local social media (mainly Facebook group of local anglers in South Sumatra province) and internet supported with photographs or other evidence (e. g. location, habitat type, morphology and description from anglers); provide an extension to the known distribution of this species and from unpublished data collected by first author. All specimens recorded were mainly from Musi River drainage (the largest and major drainage in South Sumatra) and east coast of Banyuasin. All records included herein were verified; and unconfirmed or ambiguous records were rejected. In addition, three field surveys were conducted in April 2018.

3. Results And Discussion

There are 14 species of stingrays considered valid occur in South Sumatran waters. The species checklist and localities are presented in table 1. Taxonomy and scientific name follow recent update revision of family Dasyatidae by Last et al. (2016a) and Last et al. (2016b).

Eight genera of stingrays are recorded in South Sumatran waters: *Brevitrygon, Fluvitrygon, Himantura, Maculabatis, Pateobatis, Pastinachus, Telatrygon* and *Urogymnus*. Five species of *Fluvitrygon* are recorded (*Fluvitrygon kittipongi, Fluvitrygon oxyrhyncha, Fluvitrygon signifer, Fluvitrygon* sp 'musi' 1 and *Fluvitrygon* sp 'musi' 2), consisting largest genus of family Dasyatidae occur in the area.

Table 1. Annotated checklist, localities and IUCN (The International Union for Conservation of Nature) Red List status of stingrays in South Sumatran waters, Indonesia.

No	Species [IUCN status]	Localities	Coordinates	Source
1	*Brevitrygon heterura* [Data Deficient]	Sembilang River, Banyuasin	01°59'53" S, 104°41'40" E	This study
		Jentolo River, Banyuasin	02°3'1.90"S, 104°53'04"E	This study
		Barong River, Banyuasin	02°13'10."S, 104°53'15"E	This study
2	*Fluvitrygon kittipongi* [Endangered]	Musi Dua market, Palembang	03°01'00"S, 104°43'15"E	This study
		Musi River, Palembang	03°01'07"S, 104°41'50"E	This study
3	*Fluvitrygon oxyrhyncha* [Endangered]	Upang, Banyuasin	02°38'38"S, 104°56'12" E	Iqbal et al., 2017b
4	*Fluvitrygon signifier* [Endangered]	Tanjung Lago, Banyuasin	02°41'04"S, 104°45'58"E	Iqbal et al., 2018
		Pengage, Banyuasin	02°45'43"S, 103°24'58"E	Iqbal et al., 2018
		Lawang Kidul, Palembang	02°58'50"S, 104°46'39"E	Iqbal et al., 2018
		Tiga Belas Ulu, Palembang	03°28'59"S, 103°47'43"E	Iqbal et al., 2018
		Jakabaring, Palembang	03°01'27"S, 104°46'14"E	Iqbal et al., 2018
		Gandus, Palembang	03°01'01"S, 104°43'15"E	Iqbal et al., 2018
		Sedupi, Penukal Abab Lematang Timur	03°19'41"S, 104°11'02"E	Iqbal et al., 2018
		Tanjug Raja, Ogan Komering Ilir	03°20'20"S, 104°46'41"E	Iqbal et al., 2018
		Gunung Megang, Muara Enim	03°28'59"S, 103°47'43"E	Iqbal et al., 2018
		Sungai Naik, Musi Rawas	03°28'47"S, 103°17'52"E	Iqbal et al., 2018
5	*Fluvitrygon* sp 'musi' 1 [-]	Near Ampera bridge, Palembang	02°59'24"S, 104°45'52"E	Mancing Mania Palembang Facebook Group
		Kertapati, Palembang	03°0'20"S, 104°45'14"E	Mancing Mania Palembang Facebook Group
6	*Fluvitrygon* sp 'musi' 2 [-]	Near Ampera bridge, Palembang	02°59'24"S, 104°45'52"E	Mancing Mania Palembang Facebook Group
		Kertapati, Palembang	03°0'20"S, 104°45'14"E	Mancing Mania Palembang Facebook Group
7	*Himantura undulata* [Vulnerable]	Bungin River, Banyuasin	02°14'38.39"S , 04°51'30"E	Mancing Mania Palembang Facebook Group
8	*Himantura uarnak* [Vulnerable]	Tanjung Api-api, Banyuasin	02°20'90"S, 104°50'50"E	Mancing Mania Palembang Facebook Group
9	*Maculabatis gerrardi* [Vulnerable]	Sembilang River, Banyuasin	01°59'53" S, 104°41'40" E	This study
		Lalan River, Banyuasin	02°26'55"S, 104°32'49" E	Mancing Mania Palembang Facebook Group
10	*Pateobatis fai* [Vulnerable]	Sembilang River, Banyuasin	01°59'53" S, 104°41'40" E	This study
		Jentolo River, Banyuasin	02°3'10"S, 104°53'00"E	This study
		Bungin River, Banyuasin	02°14'38.39"S , 04°51'30"E	This study
11	*Pateobatis uarnacoides* [Vulnerable]	Sembilang River, Banyuasin	01°59'53" S, 104°41'40" E	This study
12	*Pastinachus ater* [Least concern]	Lalan River, Banyuasin	02°26'55"S, 104°32'49" E	Mancing Mania Palembang Facebook Group
13	*Telatrygon biasa* [Least concern]	Sembilang River, Banyuasin	01°59'53" S, 104°41'40" E	This study
		Jentolo River, Banyuasin	02°3'10"S, 104°53'00"E	This study
		Bungin River, Banyuasin	02°14'38.39"S , 04°51'30"E	This study
14	*Urogymnus polylepis* [Endangered]	Bungin River, Banyuasin	02°15'12"S, 104°50'04"E	Iqbal & Yustian 2016
		Babat Toman, Musi Banyuasin	02°43'21"S, 103°26'00"E	Iqbal & Yustian 2016
		Sanga Desa, Musi Banyuasin	02°46'45"S, 103°23'50"E	Iqbal & Yustian 2016
		Lawang Wetan, Musi Banyuasin	02°46'57"S, 103°40'13"E	Iqbal & Yustian 2016
		Musi Dua, Palembang	03°01'05"S, 104°43'08"E	Iqbal & Yustian 2016
		Tanah Abang, Penukal Abab Lematang Ilir 1	03°18'57"S, 104°10'16"E	Iqbal & Yustian 2016
		Tanah Abang, Penukal Abab Lematang Ilir 2	03°19'41"S, 104°11'02"E	Iqbal & Yustian 2016

Kepur, Muara Enim	03°37'29"S, 103°45'59"E	Iqbal & Yustian 2016
Cempaka, Ogan Komering Ulu	03°41'38"S, 104°41'06"E	This study
Muara Lawai, Lahat	03°38'48"S, 103°44'23"E	This study

Valid species accounts and distributional records of stingrays in South Sumatran waters

This section discusses details all stingrays species that occur in South Sumatran waters. Synonym and global distribution of each species are given. Distributional patterns of stingrays in South Sumatran waters are depend on species or (at least) genus level. Stingrays in South Sumatran waters are recorded from of up to more 100 km inland to the coastal zone area (Figure 1-3).

Brevitrygon heterura (Bleeker, 1852). Synonym: *Trygon heterurus* Bleeker, 1852; *Himantura heterurus* (Bleeker, 1852). Distribution: Thailand, Peninsular Malaysia, Borneo, Sumatra and Java. This species recorded at three localities in South Sumatran waters (Table 1 and Figure 1). All records arein coastal zone area.

Fluvitrygon kittipongi (Vidthayanon & Roberts, 2005). Synonym: *Himantura kittipongi* Vidthayanon & Roberts, 2005. Distribution: Thailand and Borneo.

Not yet reported in Sumatran or in South Sumatran waters. Two records of *Fluvitrygon kittipongi* in Musi River supported with photographics evidence suggest the first record for Sumatra (Table 1, Figure 1 and Figure 4c).

Fluvitrygon oxyrhyncha (Sauvage, 1878). Synonym: *Dasybatus krempfi* Chabanaud, 1923; *Himantura krempfi* (Chabanaud, 1923); *Himantura oxyrhyncha* (Sauvage, 1878); *Himantura oxyrhynchus* (Sauvage, 1878); *Trygon oxyrhynchus* Sauvage, 1878. Distribution: Previously recorded in Cambodia, Thailand and Borneo. Recently reported from Sumatra (Iqbal et al. 2017).

Fluvitrygon signifer (Compagno & Roberts, 1982). Synonym: *Dasyatis signifer* (Compagno & Roberts, 1982); *Himantura signifer* Compagno & Roberts, 1982. Distribution: Thailand, Peninsular Malaysia, Sumatra and Borneo. In Sumatra, it was only reported from Riau (Compagno Roberts 1982, Last et al. 2016). Recent report of *Fluvitrygon signifier* in South Sumatran waters provided by Iqbal et al. (2018).

Fluvitrygon sp 'musi' 1. Synonym: None. Distribution: Possibly new undescribed species (Peter Last, Pers. Comm). It is look like very limited in Musi River. This species differ from other *Fluvitrygon* by dorsal plain colour, no white edge at dorsal side and elongated snout (Figure 3e).

Fluvitrygon sp 'musi' 2. Synonym: None. Distribution: Possibly new undescribed species (Peter Last, Pers. Comm). It is look like very limited in Musi River. This species differ from other *Fluvitrygon* by pale dorsal plain colour, lacking of white edge at dorsal side and very sharp elongated snout (Figure 3f).

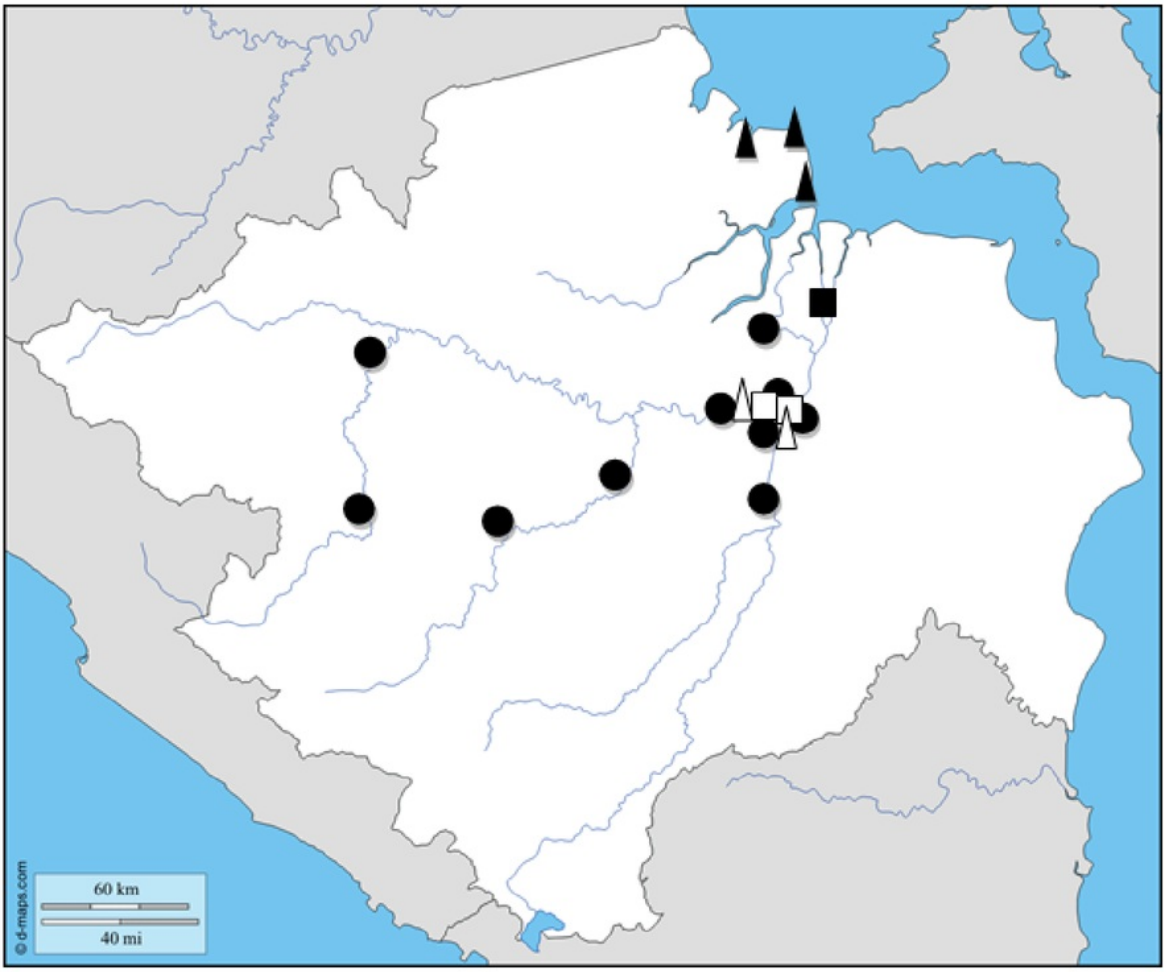

Figure 1. Map of distributional records of Genus *Brevitrygon* and *Fluvitrygon* in South Sumatran waters. Solid triangle is *Brevitrygon heterura*, solid circle is *Fluvitrygon signifer*, solid square is *Fluvitrygon oxyrhyncha*, open square is *Fluvitrygon* sp 'musi' 1 and *Fluvitrygon* sp 'musi' 2, and open triangle is *Fluvitrygon kittipongi*.

Himantura undulata (Bleeker, 1852). Synonym: *Trygon undulata* Bleeker, 1852. Distribution: India, Myanmar, Thailand, Peninsular Malaysia, Sumatra, Borneo, Java and Sulawesi. Only one valid individual record in South Sumatran waters which supported by a photographic evidence (Table 1).

Himantura uarnak (Gmelin, 1789). Synonym: *Dasyatis uarnak* (Gmelin, 1789); *Dasybatus uarnak* (Gmelin, 1789); *Himantura punctata* (Günther, 1870); *Raja sephen* uarnak Forsskål, 1775; *Raja sephen* var. uarnak Forsskål, 1775; *Raja uarnak* Gmelin, 1789; *Trygon punctata* Günther, 1870; *Trygon uarnak* (Gmelin, 1789). Distribution: Widely distributed, from South Africa, India, Srilanka, Myanmar, Thailand, Vietnam, Phillippines, Sumatra, Borneo, Java and Sulawesi. Only one valid individual record in South Sumatran waters which supported by a photographic evidence (Table 1).

Maculabatis gerrardi (Gray, 1851). Synonym: *Dasyatis gerrardi* (Gray, 1851); *Himantura alcockii* (Annandale, 1909); *Himantura gerrardi* (Gray, 1851); *H. gerrardii* (Gray, 1851); *Himantura macrurus* (Bleeker, 1852); *Trygon gerrardi* Gray, 1851; *Trygon liocephalus* Klunzinger, 1871. Distribution: Taiwan, China, Vietnam, Thailand, Peninsular Malaysia, Sumatra, Borneo, Phillippines, Java, Sulawesi and West Nusa Tanggara. Recorded twice in brackish and coastal zone of South Sumatran water (Table 1 and Figure 2).

Pateobatis fai (Jordan & Seale, 1906). Synonym: *Himantura fai* Jordan & Seale, 1906. Distribution: widely distributed from South Africa, India, Souteast Asia, Japan, Indonesia, Australia, Papua New Guinea and Melanesia. Recorded at coastal zone of South Sumatran waters (Table 1 and Figure 2).

Pateobatis uarnacoides (Bleeker, 1852). Synonym: *Himantura uarnacoides* (Bleeker, 1852); *Raia scherit* Bonnaterre, 1788; *Raja uarnak* Gmelin, 1789; *R. sephen* var. uarnak Forsskal, 1775; *R. uarnata* Walbaum, 1792; *Trygon maculata* Kuhl & van Hasselt in Bleeker, 1852; *T. punctata* Günther, 1870; *T. uarnacoides* Bleeker, 1852. Distribution: Thailand, Vietnam, Peninsular Malaysia, Sumatra, Borneo and Java. Only one valid individual record in South Sumatran waters which supported by a photographic evidence (Table 1 and Figure 2).

Pastinachus ater (Macleay, 1883). Synonym: *Pastinachus atrus* (Macleay, 1883); *Taeniura atra* Macleay, 1883. Distribution: widely distributed from South Africa, India, Souteast Asia, Japan, Indonesia, Australia, Papua New Guinea and Melanesia. Recorded at brackish waters of South Sumatran waters (Table 1 and Figure 2).

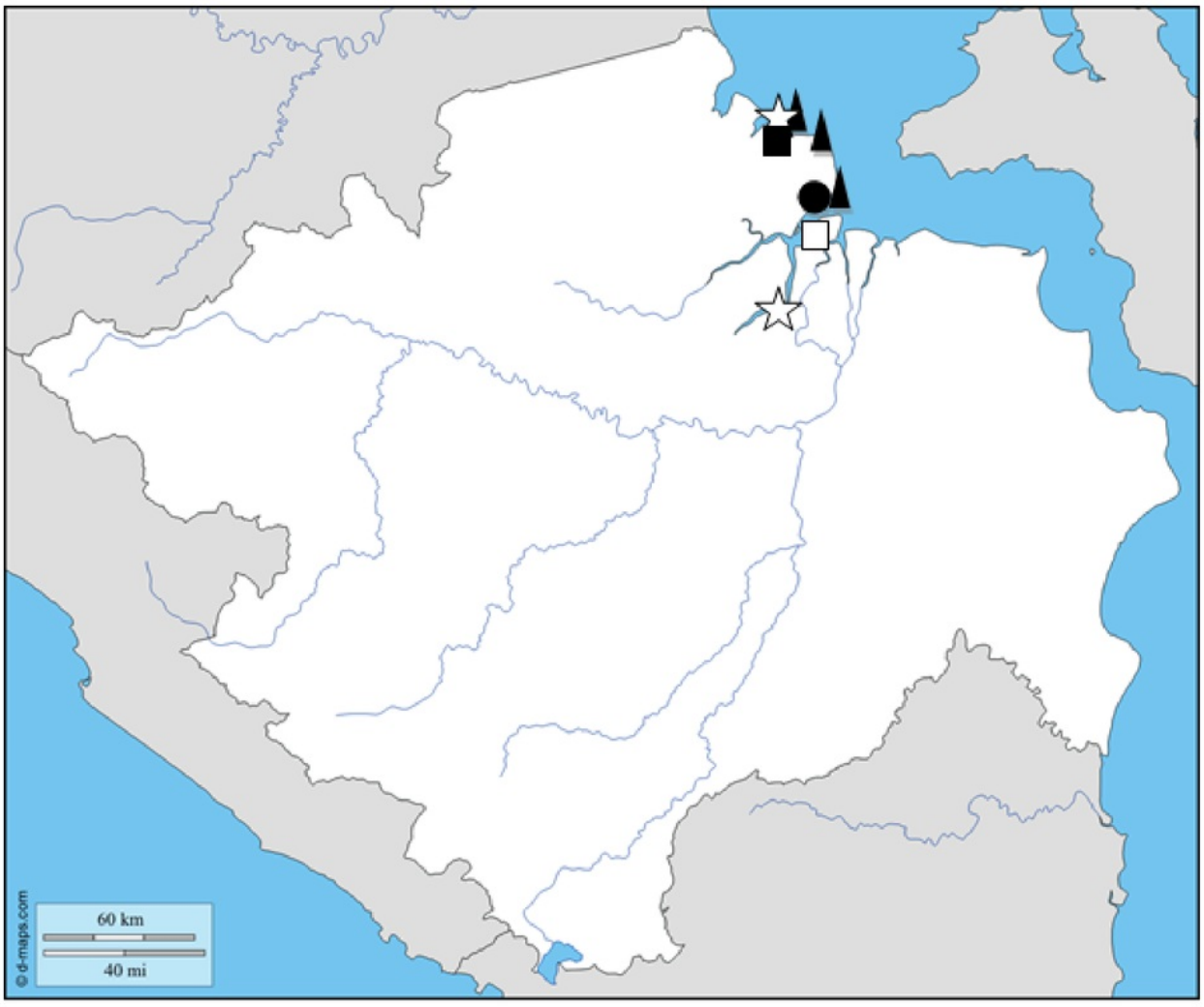

Figure 2. Map of distributional records of Genus *Himantura*, *Maculabatis* and *Pateobatis* in South Sumatran waters. Solid circle is *Himantura undulata*, open square is *Himantura uarnak*, open star is *Maculabatis gerrardi*, solid triangle is *Pateobatis fai* and solid square is *Pateobatis uarnocoides*.

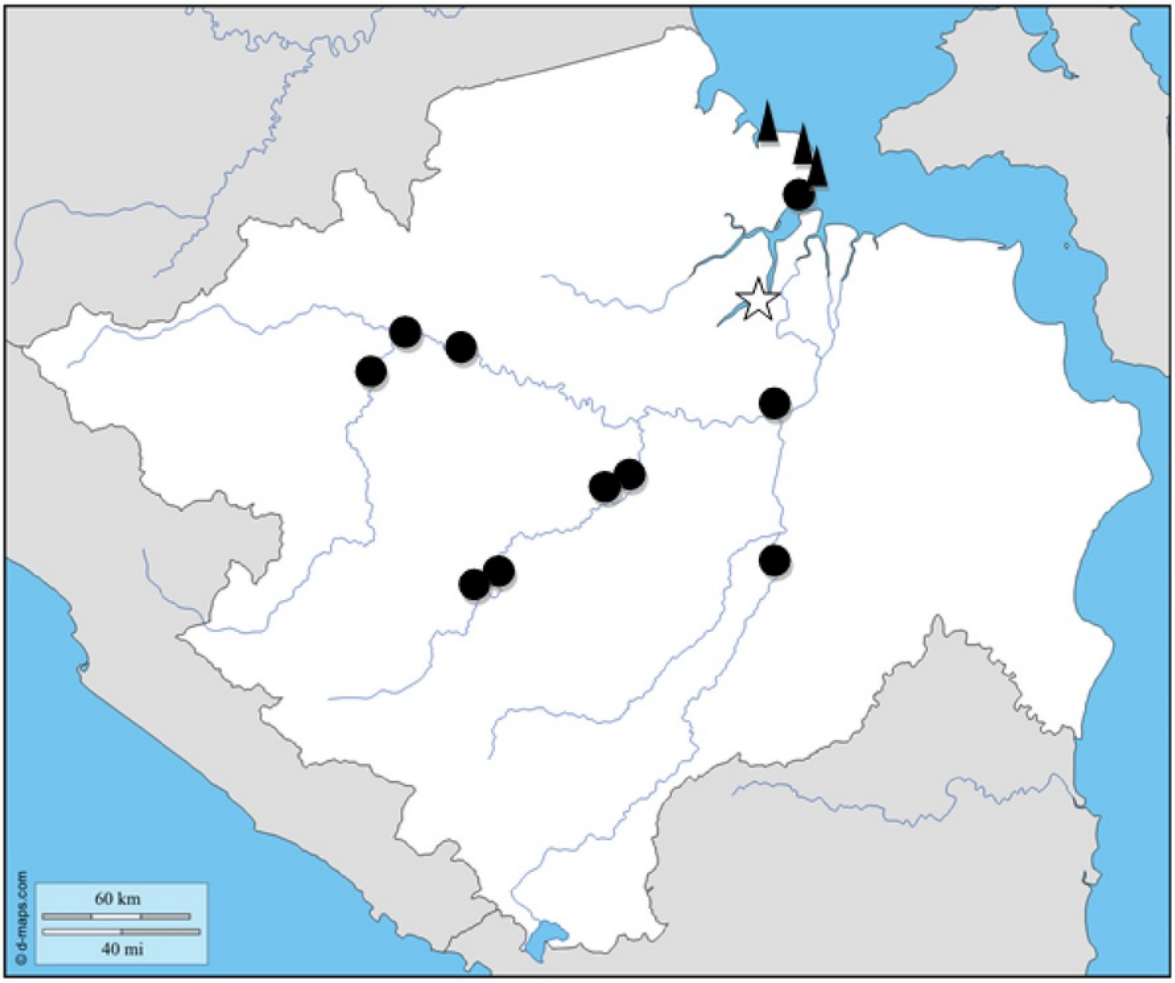

Figure 3. Map of distributional records of Genus *Pastinachus*, *Telatrygon* and *Urogymnus* in South Sumatran waters. Open star is *Pastinachus ater*, solid triangle is *Telatrygon* biasa and solid circle is *Urogymnus polylepis*.

Telatrygon biasa Last, White & Naylor, 2016. Synonym: None. Distribution: Sumatra, Borneo and Java. Recorded at coastal zone in South Sumatran waters (Table 1 and Figure 2).

Urogymnus polylepis (Bleeker, 1852). Synonym: *Dasyatis chaophraya* (Monkolprasit & Roberts, 1990); *Himantura chaophraya* Monkolprasit & Roberts, 1990; *Himantura polylepis* (Bleeker, 1852); *Trygon polylepis* Bleeker, 1852. Distribution: India, Thailand and Borneo. It has not reported yet from Sumatra, until a comprehensive report provided by Iqbal & Yustian (2016).

The importance of South Sumatran waters for stingrays habitat

The occurence of 14 species indicate that South Sumatran waters are important habitat for stingrays of family Dasyatidae. Following IUCN Red List status, the status of stingrays in South Sumatran status covering from *Endangered*, *Vulnerable*, *Data Deficient*, *Least Concern* and not evaluated (IUCN 2018). The occurence of threatened species in South Sumatran waters suggest the importance of area as habitat for endangered species of stingrays in Indonesia. Four species under Endangered status are *Fluvitrygon kittipongi*, *Fluvitrygon oxyrhyncha*, *Fluvitrygon signifer* and *Urogymnus polylepis* (Table 1). All of them are freshwater stingrays. Two unidentified of *Fluvitrygon* from Musi River, tentatively identified as *Fluvitrygon* sp 'musi' 1 and *Fluvitrygon* sp 'musi' 2, probably represent new undescribed species (Peter Last, *Pers.Comm*).

The second-highest threat of IUCN status after Endangered is Vulnerable. There four species of stingrays in South Sumatran waters under this category: *Himantura undulata*, *Himantura uarnak*, *Maculabatis gerrardi*, *Pateobatis fai* and *Pateobatis uarnacoides*. Almost of these stingrays lives in the coastal area (Last et al., 2016b), and they are found in coastal zone of Banyuasin. Only one species found into brackish water, *Maculabatis gerrardi* (Table 1, Figure 2 and Figure 4g). One species, *Brevitrygon heterura*, is species under Data Deficient of IUCN status. This species is relatively common in South Sumatran waters, found in the coastal zone of Banyuasin. There are two species considered as Least Concern, the *Pastinachus ater* and *Telatrygon biasa*. Locally, the *Telatrygon biasa* is a relatively common and scattered in the east coast of Banyuasin, while the *Pastinachus ater* is relatively rarer, where only one record can be confirmed. Another species of *Pastinachus*, *Pastinachus solocirostris* is likely to be found in the Musi River or Banyuasin coast, and the possibility of misidentification between these two species is possible. *Pastinachus solocirostris* is a new species that was described in 2005, and distribute in coastal waters of western Indonesia (Last et al. 2005).

Figure 4. Stingrays recorded in South Sumatran waters: **a.** *Brevitrygon heterura*; **b.** *Fluvitrygon signifer*; **c.** *Fluvitrygon kittipongi*; **d.** *Fluvitrygon oxyrhyncha*; **e.** *Fluvitrygon* sp 'musi' 1; **f.** *Fluvitrygon* sp 'musi' 2; **g.** *Maculabatis gerrardi*; **h.** *Telatrygon biasa* (©Muhammad Iqbal, Amran Halim, Febri Ansyah).

Review on distribution of stingrays in the South Sumatran waters suggest that the Musi River in Palembang City is important habitat for at least three freshwater species that have Endangered status: *Fluvitrygon kittipongi, Fluvitrygon signifer* and *Urogymnus polylepis* (Table 1, Figure 1-3). This number will increase if two unidentified species of *Fluvitrygon* (*Fluvitrygon* sp 'musi' 1 and *Fluvitrygon* sp 'musi' 2) can be clarified its taxonomic status, so that the number of Endangered species will increase. As urban area, conservation proposals for endangered stingrays species in Musi River of Palembang city require specific strategies, compared to conservation approach in conservation areas such as Wildlife Reserve of National Park. Urban area with dense human population such as Palembang are sometimes considered unimportant for the protection of a species conservation habitat. The case studies shown by Trzyna (2014) in several major cities in the world show that many urban areas with dense settlements become habitat for rare flora fauna, and are important in supporting the life of the people in the city itself. Musi River in Palembang City which is the capital city of South Sumatra Province has a dense residential population, surrounded by many big factories and crowded human activities. Proposing the Musi River area in Palembang City as a conservation area is something very unlikely. Few strategies that can be done to protecting stingrays species in Musi River since stingrays are not yet protected by the Law of the Republic of Indonesia (Noerdjito & Maryanto 2001). Spreading banners or bulletin boards on the banks of the well-visited by many people in Musi River with a message not to capture or relinquish stingrays caught will help wider community to know that stingrays are groups of fish that are particularly vulnerable to extinction.

Conclusion

A total of 14 species from eight families of stingrays was recorded in South Sumatran water. Following IUCN Red List status, the status of stingrays in South Sumatran status covering from *Endangered, Vulnerable, Data Deficient, Least Concern* and not evaluated. The occurence of threatened species in South Sumatran waters suggest the importance of area as habitat for endangered species of stingrays in Indonesia. It is surprisingly that three freshwater Endangered stingrays (*Fluvitrygon kittipongi, Fluvitrygon signifer* and *Urogymnus polylepis*) found in Musi River of Palembang city. As urban area, conservation of Endangered stingrays species in Musi River of Palembang city is complicated and require specific strategies.

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