

The Role of Science in The Management of Biodiversity: a Case of Stingrays (Dasyatidae) Research to Provide Basic Data for Aquatic Fauna Conservation in South Sumatra

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Abstract. The study of fish diversity had been reported across the South Sumatran waters, but the study focus on stingrays (family Dasyatidae) were very limited. In general, many stingrays species face high level of direct exploitation. A recent study to provide valid checklist of stingrays in South Sumatran waters found 14 species: *Brevitrygon heterura*, *Fluivtrygon kittipongi*, *Fluivtrygon oxyrhyncha*, *Fluivtrygon signifier*, *Fluivtrygon* sp ‘musi’ 1, *Fluivtrygon* sp ‘musi’ 2, *Himantura undulata*, *Himantura uarnak*, *Maculabatis gerrardi*, *Pateobatis fai*, *Pateobatis uarnacoides*, *Pastinachus ater*, *Telatrygon biasa* and *Urogymnus polylepis*. Following IUCN (The International Union for Conservation of Nature) Red List status 2018, ten species of stingrays are threatened, with four species as Endangered, five species as Vulnerable and one species as Data Deficient. These findings suggest the South Sumatran waters are important habitat for stingrays in Indonesia, and immediate conservation actions plan is needed. In this paper, we demonstrate the role of science in biodiversity management with stingrays (Dasyatidae, an iconic group of rare and threatened fishes) as study case. 1.

1 Introduction

Few species of stingrays are occur in Southeast Asia, particularly in Indonesian waters [1,2,3]. In Indonesia, there are at least 40 valid species of stingrays where wide spread within main seven faunal regions. South Sumatra province is the largest province in Sumatra where located in the southeastern portion of the island . The study of fish diversity had been reported across the South Sumatran waters [4], but the study focus on stingrays were very limited [5-7] . Study on stingrays diversity had been done in in South Sumatran waters, revealed relatively rich number of stingrays diversity[8]. Further review on biodiversity management is required to ensure population survive in the wild. This paper

provide review the role of science to provide basic data for aquatic fauna conservation in south Sumatra

2 Materials and Methods

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) during January 2016 to June 2018; 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.

Systematically reviewed what potential solutions are needed to identify and what consensus and direction it provides to support management biodiversity to ensure population of the stingrays survive in the wild. For this reason, we adopt and modify conservation actions plan of stingrays proposed by [9] as recommendation for management of biodiversity of rare and protected aquatic fauna in South Sumatran waters.

3 Results and Discussions

3.1 Stingrays Diversity in South Sumatran Waters

This study found 14 species of stingrays 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 [2].

Table 1. Annotated checklist, status and habitat of stingrays found in South Sumatran waters, Indonesia

No	Species	IUCN Status	Protected by Indonesian law	Habitat
1	<i>Brevitrygon heterura</i>	Data Deficient		Estuarine and continental shelf
2	<i>Fluvitrygon kittipongi</i>	Endangered		Freshwater
3	<i>Fluvitrygon oxyrhyncha</i>	Endangered	Protected	Freshwater
4	<i>Fluvitrygon signifier</i>	Endangered	Protected	Freshwater
5	<i>Fluvitrygon</i> sp 'musi' 1	-		Freshwater
6	<i>Fluvitrygon</i> sp 'musi' 2	-		Freshwater
7	<i>Himantura undulata</i>	Vulnerable		Estuarine and continental shelf
8	<i>Himantura uarnak</i>	Vulnerable		Estuarine and continental shelf
9	<i>Maculabatis gerrardi</i>	Vulnerable		Freshwater and continental shelf
10	<i>Pateobatis fai</i>	Vulnerable		Estuarine and continental shelf
11	<i>Pateobatis uarnacoides</i>	Vulnerable		Estuarine and continental shelf
12	<i>Pastinachus ater</i>	Least concern		Freshwater and brackish
13	<i>Telatrygon biasa</i>	Least concern		Estuarine and continental shelf
14	<i>Urogymnus polylepis</i>	Endangered	Protected	Estuarine and continental shelf

Stingrays in South Sumatran waters are recorded from of up to more 100 km inland to the coastal zone area (Figure 1). 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 this family in the area.

The occurrence 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 [9]. Two unidentified of *Fluvitrygon* from Musi River, tentatively identified as *Fluvitrygon* sp ‘musi’ 1 and *Fluvitrygon* sp ‘musi’ 2, probably represent new undescribed species. Recently, four species of stingrays are protected by Indonesian law under decree of the Ministry of Environment and Forestry Number P.20/MENLHK/SETJEN/KUM.1/6/2018 about protected species in Indonesia, and three of them recorded in South Sumatran waters (*Fluvitrygon oxyrhyncha*, *Fluvitrygon signifer* and *Urogymnus polylepis*) (Table 1).

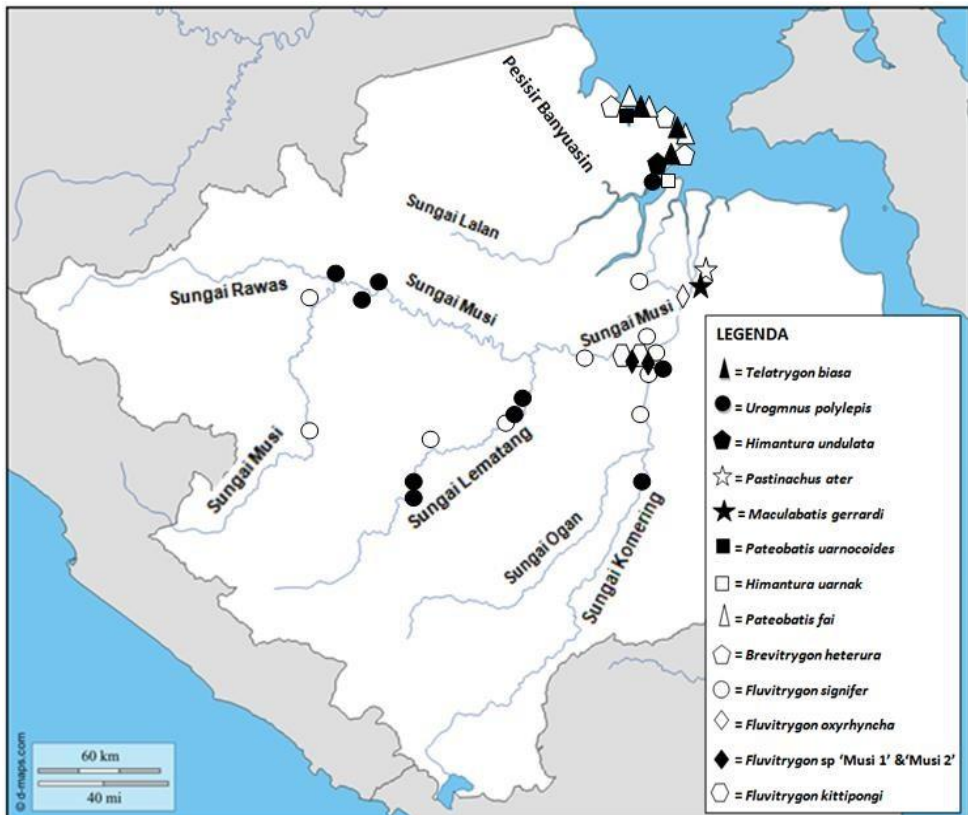


Fig. 1. Map of distributional records of stingrays found in South Sumatran waters

3.2 Recommendation for Conservation Action Plan

Conservation action plan is a powerful guide conservation to develop focused strategies and measures of success. Proposed conservation action plan for each species of stingrays recorded in South Sumatran waters are proposed in table 2. This recommendation adopt and modify conservation actions plan of stingrays proposed by [9].

In the case of other parts of many countries, many stingray species in South Sumatran waters also face high level of direct exploitation, mainly for their skin or low-value meat. As reported by [2], there is considerable number of threatened stingrays in South-East Asia where catches are very high but declining, with fishers having to travel much further from port to maintain catches. Net and trawl fisheries in Indonesia and elsewhere are very extensive and, as a result, many shallow-water ray species are heavily exploited. The general lack of management measures based on scientific research and stock assessment is hindering the sustainable utilisation of these resources. Furthermore, the extensive loss and degradation of habitat such as coastal mangroves and embayments are other key threats to these coastal and inshore species.

Table 2. Proposed conservation action plan for management of stingrays in South Sumatran waters, Indonesia.

No	Species	Conservation Actions	Source
1	<i>Brevitrygon heterura</i>	Further research is required on data abundance and/or distribution, as well as assessing the interactions of the species with commercial fisheries, which will allow a more accurate monitoring of population trends	White et al., 2016a
2	<i>Fluivtrygon kittipongi</i>	Monitoring of quality of its habitat and the number of mature individuals is inferred as a result of habitat destruction and pollution, and bycatch in freshwater fisheries	Vidthayanon, & Manjaji-Matsumoto, 2016
3	<i>Fluivtrygon oxyrhyncha</i>	Monitoring of intensive threat from fisheries, pollution, logging in the catchment areas and river engineering projects and is a desirable aquarium species	Compagno, 2016a
4	<i>Fluivtrygon signifier</i>	Monitoring of freshwater habitats that are under intensive threat from fisheries, pollution, logging in the catchment areas and river engineering projects	Compagno, 2016a
5	<i>Fluivtrygon</i> sp 'musi' 1	Specimen collection and examination of the study skin and DNA are needed for confirmation of the proper identification as well as to ensure taxonomic status	Our recommendation
6	<i>Fluivtrygon</i> sp 'musi' 2	Specimen collection and examination of the study skin and DNA are needed for confirmation of the proper identification as well as to ensure taxonomic status	Our recommendation
7	<i>Himantura undulata</i>	Research is required to assess catches of Bleeker's Variegated Whipray throughout its range, and to examine its habitat, ecology and life history parameters including confirmation of its distributional range. The fisheries that	Rigby, 2012

		capture this species are largely unregulated (licenses are issued but catches and landings are not properly monitored), and presently there are no specific conservation actions in place to help address this problem	
8	<i>Himantura uarnak</i>	Further research is required on the speciebiology, as is assessment of catches throughout its range	Manjanji-Matsumoto et al., 2016c
9	<i>Maculabatis gerrardi</i>	Monitoring surveys should to ascertain the statusand possible threats to this species here, as well as in other portions of its range (New Guinea and Indonesia), efforts in further research should be directed to also obtain the population, habitat and ecology and life history parameters	Manjanji-Matsumoto et al., 2016c
10	<i>Pateobatis fai</i>	Further research is required to defined its rangethroughout the Indo-West Pacific where It is frequently misidentified as <i>P. jenkinsii</i> , which can complicate species-specific catch data, and monitoring high levels of exploitation throughout its range in Southeast Asia where the species is commonly caught in multiple types of fisheries	Manjanji-Matsumoto et al., 2016c
11	<i>Pateobatis uarnacoides</i>	Further survey regarding specific information oncatches in other parts of the species' range, monitoring population declines elsewhere from Indonesia, and monitoring coastal degradation that impacted to this species	White et al., 2016a
12	<i>Pastinachus ater</i>	Further research is required on the species' life-history', as well as assessing the interactions of the species with commercial fisheries, which will allow a more accurate monitoring of population trends	Morgan et al., 2016
13	<i>Telatrygon biasa</i>	Further research is required on the species' life-history', as well as assessing the interactions of the species with commercial fisheries, which will allow a more accurate monitoring of population trends	Our reccomendation
14	<i>Urogymnus polylepis</i>	Further research and survey are required to confirm the presence, population trend, and taxonomic status of populations of the species from all parts of its range, especially India, Bangladesh, Myanmar, Viet Nam, parts of Indonesia and Malaysia, and Papua New Guinea	Vidhayanon, et al., 2016

4 Conclusion

When regional priorities have been set, conservation action planning is used to determine the plan of action for these priorities. The conservation action plans above would have not been possible without information on basic data information of each stingrays species. Providing basic data of stingrays diversity and distribution in South Sumatra

demonstrate the role of science in management of rare, globally threatened and protected aquatic biodiversity. As actions are taken and outcomes are measured, conservation action plans are revised to incorporate new knowledge. It is hope that the proposed conservation action above will beguideline for stake holders authority in the development of conservation of rare and protected aquatic species in South Sumatran waters.

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