**Elasmobranch catch composition of North Sumatera Fishers**

A Fadhilah¹*, I E Susetya¹ and B M Simeon²

¹ Department of Aquatic Resources Management, Universitas Sumatera Utara, Medan, Sumatera Utara, Indonesia.
² International Non-Government Organization.

E-mail: amanatul_fadhilah@usu.ac.id or dillaamanatul@gmail.com

**Abstract.** Indonesia is known to contribute nearly 20% of elasmobranch diversity in the world. Presently, elasmobranch biodiversity research had only conducted in particular waters. However, the distribution of Elasmobranch distributed throughout all Indonesia including in the waters of North Sumatra province. This study aims to examine the diversity of Elasmobranch in North Sumatera waters as Elasmobranch preliminary study. We used landing monitoring method in three landing sites from May to June 2018. We recorded species, total length, and fishing unit information. Sharks and rays commonly were caught by net in coastal waters. We found 8 species from 323 sharks and Rays which caught and landed. Sharks were dominated by big eye six gill sharks and rays were dominated by pale-edge stingray. Based on length data, we found that sharks and rays which landed also dominated by immature individual. This condition should be concerned in order to it is conservation management related to gear selectivity, considering coastal area is an important habitat for Elasmobranch.

1. Introduction
Species diversity of marine biota in Indonesia is very diverse both for teleost and cartilaginous. Indonesia is one of the countries with a high diversity of species of sharks and rays [1][2]. From more than 1300 elasmobranch species around the world, Indonesia have more than, Indonesia contribute more than 200 species [3][4]. More than 110 shark species, 100 ray’s species and about 3 chimaera species have been caught and recorded in Indonesia.

Several species of elasmobranch listed into protected species in Indonesia and the trade of some species must be regulated. This is related to it is biological characteristics is a longlife span, slow growth and maturity and low fecundity [5][6] so overfishing will impact its vulnerability [7][8]. In the last years, global and national elasmobranch production significantly depleted [3]. In other side, high market demand could lead to overfishing condition. Sharks and rays were caught as target and by-catch in Indonesia [3][9].

Impacted by international demand for its fin, shark and rays were being valuable by-catch. [10] said that the status of shark resources in the world is threatened by extinction due to overfishing. Most shark fishery products in Indonesia dominated as by-catch (72%), and only 28% for targeted fishery. In order to managing sharks and rays in Indonesia, the Ministry of Maritime Affairs and Fisheries has established National Plan of Action (NPOA) for the period 2010 - 2014 which is then continued by the NPOA for...
2016-2020. NPOA is a reference document for stakeholders related to the development and implementation of shark and ray conservation and management programs [11].

Landing monitoring was the one of national commitment in NPOA. Some landing monitoring for elasmobranch has been conducted in Indonesia, but it centralized only in certain area. North Sumatera was not known as popular landing monitoring point, however Medan as capital city of North Sumatera known as one of shark export gate in Indonesia [9].

Gap about lack of elasmobranch information in North Sumatera importantly should be filled. The aims of this study are to examine the diversity of Elasmobranch in North Sumatera waters as Elasmobranch preliminary study.

2. Methodology
This research conducted in two months, since May 2018 to June 2018. Landing monitoring was conducted in three fish auctions, there were TPI Belawan and TPI Batubara (Figure 1). We used landing monitoring method refer to [12], which collected data about fishing unit, fishing ground, species, and measured its length. Fishing unit data collected by survey and interview. Species identification we referred to rays of the world and economically important sharks and rays of Indonesia [13][4]. Data which we used were primary data from each location.

![Figure 1. Map of research.](image)

Data analysis used in monitoring the types of sharks is the analysis of total length frequency distribution. The purpose of this analysis is to find out the frequency of the total length of sharks and Pari, the most and the least. The first thing to do to do this analysis is to compile a long frequency distribution table.

1. The stages of making the total long frequency distribution of sharks according to [14] are:
   Determine the range by subtracting the largest total length value to the smallest value for each species
2. Determine the number of classes using the formula Number of Classes = 1+ (3.3) x log N. N is the number of samples.
3. Determine the class width by dividing the area (range) by the number of classes.
4. smallest length value is then added to the class width so that a size interval is formed and continues to add up to the last class.

3. Results and discussion

3.1. Catch composition of sharks and rays
We found 323 individuals of sharks and rays which consist of 8 species. The number of species which caught and landed in TPI Batu Bara, we found 8 species in each both site in two months. However, the catch of shark in TPI Belawan and Batu Bara, we only found two shark species. From two landing locations TPI Belawan known have the lowest species diversity, which only found 2 species.

All two locations have different dominant species. Dominant species in TPI Belawan is blacktip reef shark (Carcharhinus melanopterus), the most dominant species that landed in TPI Batu Barawas big eye six-gill shark. Ray species which landed were dominated by Indonesia Sharpnose ray where commonly found in TPI Belawan and TPI Batubara (Table 1).

Table 1. Species composition Elasmobranch.

| No | Local Name         | Common Name           | Scientific Name            | Landing site | Number |
|----|--------------------|-----------------------|----------------------------|--------------|--------|
| 1  | Hiu Sirip Hitam    | Blacktip reef shark   | *Carcharhinus melanopterus*| +            | 99     |
| 2  | Hiu Putih          | Graceful shark        | *Carcharhinus amblyrhyncoides*| -            | 104    |
| 3  | Pari Tuka Hidung Runcing | Indonesian sharpnose ray | *Telatrigon biasa*       | +            | 75     |
| 4  | Pari Kuning        | Yellowmargin stingray | *Hemitrigon akajei*       | -            | 12     |
| 5  | Pari Totol         | Blue spotted fantail stingray | *Taeniura lymma*      | -            | 6      |
| 6  | Pari Kodok         | Blue spotted mask ray | *Neotrigon kuhlii*       | -            | 14     |
| 7  | Pari Kelelawar     | Japanese butterfly ray | *Gymnura japonica*       | -            | 12     |
| 8  | Pari Bintang       | Sharpnose stingray    | *Maculabatis gerrardi*    | -            | 1      |
|    | Total              |                       |                            |              | 323    |

Where : BLW (Belawan); BB (Batu Bara); (+) found; (-) not found

The largest number of shark which landed was graceful shark (*C.amblyrhyncoides*). This species listed as Yellow List species by IUCN [14] and *C.amblyrhyncoides* occurs in continental shelf waters of the tropical Indo-West Pacific, including Australia, Indonesia, Philippines, Viet Nam, Thailand, China, India, Sri Lanka and the Gulf of Aden. From this region, distribution records are not continuous and found throughout the tropical Indian and western central Pacific Oceans. However, with relatively little abundance, and judging by the morphological similarity with the more abundant *C.amblyrhyncoides* species, the distribution is likely to continue towards south Asia [4] [15]. We also
found that graceful sharks were caught as by-catch from purse seine net which operated inshore at morning. The fleet recorded set their net 30 meters depth.

The second largest number of sharks which landed was blacktip reef shark (*C.melanopterus*). Blacktip reef shark is a common tropical Indo-West Pacific and found in the tropical Indian Ocean, western central Pacific, and eastern Mediterranean Sea [2][4]. The size of the Blacktip Reef Sharks is between 30-50 cm at birth, the adult size reaches a total length of up to 180 cm and the mature size is between 90-110 cm [16].

The largest ray which landed was Indonesian sharpnose ray (*Telatrygon biasa*). This species was usual found in North-West Pacific, Indonesia, and Malaysian Borneo. *Telatrygon biasa* is demersal type on continental and insular shelves to 40 m depths [13]. This species similar to the pale-edge sharpnose rays, but since 2016 this population are known to belong member species other member of species complex. The information of its species has not well known due to limit research about its species in Indonesia.

The second largest ray which landed was Blue spotted mask ray (*Neotrigon kuhlii*). This species listed as Red List species by IUCN [8]. We found that this species caught by bottom gillnet which operated nocturnal.

3.2. Length frequency of rays

Indonesian sharpnose ray which were caught were dominated in TL 17-58 cm, 17 individuals caught in TL 87-100 cm. (Figure 2)

![Figure 2. Length frequency of Indonesian Sharpnose Ray.](image)

The most caught yellowmargin stingrays (*H.akajei*) were in the class of 29-45 cm with a total of 8 individual were caught at the interval class of 63-79 cm to 131-147cm. The most blue-spotted stingrays (*T.lymma*) in the 63-79 cm class counted 4 individuals caught in the class interval 29-45 cm, 97-113 cm, 114-130 cm and 131-147 cm counted 0 individual.

Pale-edge stingray commonly caught class of 29-45 cm for 6 individuals, other class were 63-79 cm to 131-147 cm counted 0 individual. Blue spotted mask ray (*N.kuhlii*) were caught in class 46-62 cm interval counted 10 individuals, 29-45 cm, 80-89 cm, 97-113 cm, 114-130 cm and 131-147 cm counted 0 individual. Japanese butterfly ray calculated in class 29-45 cm for 8 individuals the smallest catch recorded in the interval class 63-79 cm to 131-147 cm (Figure 3).
3.3. Length frequency of sharks

Blacktip reef shark mostly caught in class interval 65-70 cm, which counted for 47 individuals. The smallest total length class intervals of blacktip reef shark were 77-82 cm and 69-74 cm which counted for 1 and 3 individuals (Figure 4). Sharks which were caught and landed dominated in TL ~60cm. It means sharks which caught and landed were juvenile. Blacktip reef shark could reach 140 cm TL, possibly up to 180 cm TL; adult male known in 98–113 cm TL and female 96–120 cm TL.

Graceful shark commonly caught in class of 58-61 cm TL and 62-65 cm TL, which counted for 36 individuals. The smallest graceful sharks were caught in class 70-73 cm TL and 74-77 cm TL counted for 0 individual. Landing monitoring showed that the graceful shark mostly caught in juvenile size. Refer to [21], graceful sharks can reach up to 180 cm TL; adult male at size ~123 cm TL and female at size ~ 142 cm TL; size when born ~ 43 cm TL.

Figure 3. Length distribution of rays in Batu Bara.

Figure 4. Length distribution of blacktip reef shark in Belawan.
Several species of sharks and rays which caught and landed were known in juvenile size. This will be a threat to species population in the future, due to fishing pressure [17][18][9][4]. Sharks and rays which landed were dominated caught by coastal fishing gear. However, refer to other research in Indonesia, coastal area identified as critical habitat for sharks and rays [19].

4. Conclusions
This research identified 8 species which caught by fishing gear in coastal area. Sharks and rays which caught and landed dominated by juvenile individuals. This condition should be concerned in order to its conservation management related to gear selectivity, considering coastal area is an important habitat for Elasmobranch.

References
[1] Compagno L J V 1998 Food and Agriculture Organization Rome Italy p 1193–1366.
[2] Compagno L J V 1984 FAO species catalogue FAO Fisheries Synopsis No 125 4 pt 1 (non-carcharhinoids) p viii 1–250 pt 2 (Carcharhiniformes) p x 251–655.
[3] Dulvy N K, Fowler S L, Musick J A, Cavanagh R D, Kyne P M., Harrison L R, Carlson J K, Davidson L N K, Fordham S V et al 2014 Extinction risk and conservation of the world’s sharks and rays Elife 2014 (3) 1-34.
[4] White W T, Last P R., Stevens J D, Yearsley G K, Fahmi and Dharmadi 2006 Economically important sharks and rays of Indonesia Australian Centre for International Agricultural Research Canberra p 329.
[5] Last P R and Stevens J D 1994 Sharks and rays of Australia CSIRO Australia p 513.
[6] Stobutzki I C, Miller M J, Heales D S and Brewer D T 2002 Sustainability of elasmobranchs caught as bycatch in a tropical prawn (shrimp) trawl fishery Fish. Bull 100 800–21.
[7] Gallucci V F, Taylor I G and Erzini K 2006 Conservation and management of exploited shark populations based in reproductive value Can. J Fish Aquat Sci 63 931–42.
[8] Musick JA, Burgess G, Cailliet G, Camhi M and Fordham S 2000 Management of sharks and their relatives (Elasmobranchii) AFS Policy Statement Fisheries 25 (3) 9–13.
[9] Fahmi and Dharmadi 2013 Direktorat Konservasi Kawasan dan Jenis Ikan Direktorat Jenderal Kelautan, Pesisir dan Pulau-Pulau Kecil [Directory of area and species of fish conservation directory general of marine, coastal and small islands] Jakarta p 179.
[10] Emiliya, Pratomo A and Putra R D 2017 Identifikasi Jenis Hiu Hasil Tangkapan Nelayan di Pulau Bintang Provinsi Kepulauan Riau [Identification of the type shark fishermen catch in Bintan Island Riau Islands Province] in preparation.
[11] Sadili D, Dharmadi, Fahmi, Sarmintohadi, Ramli I and Sudarsono 2015 *Direktorat Konservasi dan Keanekaragaman Hayati Laut Ditjen Pengelolaan Ruang Laut Kementerian Kelautan dan Perikanan* [Directory of marine biodiversity and conservation directory general of marine space management ministry of marine affairs and fisheries] Jakarta p 98.

[12] Simeon B M, Agustina S, Muttaqin E, Yulianto I and Ichsan M 2017 *Wildlife Conservation Society: Technical Report Sharks and Rays Fisheries in West Nusa Tenggara* Bogor Indonesia.

[13] Last P R, White W T, de Carvalho M R, Seret B, Stehman M F W, Naylor G J P, Lindsay M, and Eachran M J D 2016 *Rays of The World* USA Cornell University Press.

[14] Walpole R E 1992 *Pengantar Statistika* [Introduction of Statistical] Jakarta PT Gramedia Pustaka Utama.

[15] Simpfendorfer C 2009 *Carcharhinus amblyrhynchoides* The IUCN Red List of Threatened Species Downloaded on 06 September 2018.

[16] Heupel M 2009 *Carcharhinus melanopterus*, blacktip reef shark *The IUCN Red List of Threatened Species* 2008 T39375A10219032

[17] Chodrijah U 2013 *Komposisi ukuran dan nisbah kelamin hiu martil (Sphyrna lewini) yang tertangkap di Samudera Hindia* [Size composition and sex ratio of Hiu Martil (Sphyrna lewini) caught in Indian Ocean] National Forum on Recovery and Conservation

[18] Compagno L J V 2001 *Food and Agriculture Organization* Rome Italy p 269

[19] Simeon B M, Muttaqin E, Ichsan M, Tarigan S, Hernawati and Yulianto I 2018 *Wildlife Conservation Society-Indonesia Program* Bogor Indonesia.

**Acknowledgments**
The authors acknowledge gratefully to the Ministry of Research, Technology and Higher Education of the Republic of Indonesia. The support is under grant Talenta Young Lecturer Universitas Sumatera Utara of the year 2018. Contract Number: 1339/UN5.2.3.1/PPM/2018.