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Composition, Conservation Status, and Market Value of Fish Landed at the Labuhan Haji Fishing Port, Aceh, Indonesia

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Abstract: Labuhan Haji Fishing Port (PPP) is the only type C port in the South Aceh. Several types of fish categorised as near threatened and vulnerable, including sharks and rays, are still caught and traded at Labuhan Haji PPP.. This research aims to determine the species composition, species conservation status, and economic value of fish landed at Labuhan Haji PPP South Aceh. This research was conducted in July-August 2022 at the Labuhan Haji Coastal Fishing Port (PPP), Pasar Lama Village, Labuhan Haji District, South Aceh Regency. Identification of fish types is carried out by matching the morphological characteristics of the fish with the morphological characters referring to https://www.fishbase.se/se/search.php. The conservation status of fish species refers to the red lists from IUCN (International Union for the Conservation of Nature), CITES (Convention on International Trade in Endangered of Wild Flora and Fauna), and KEPMEN-KP/1/2021 regarding protected fish species. The economic value of fish was obtained through brief interviews with fish traders at the research site. Besides, the data collected includes the selling price range for fish at Labuhan Haji PPP. The research results showed that Perciformes was the most frequently found order at 37% (26 species, 10 families), and Carangidae was the most frequently found family at 19% (13 species). Based on the IUCN red list, 64% Least concern, 9% Not evaluated, 7% Data deficient, 7% Vulnerable, 6% Near Threatened, 4% Endangered, and 3% Critically endangered. Based on CITES, 7% is recorded as Appendix II, and 93% is not evaluated. Based on Ministerial Decree No.1 KEPMEN-KP/2021 concerning Protected Fish Types, no species are listed as protected fish species in Indonesia. The fish with the highest economic value are from the Serranidae family, with an average price of IDR. 63,333 /Kg and the type of fish with the lowest selling price is from the Mobulidae family, which has an average price of Rp. 8,500/Kg. The types of fish landed at Labuhan Haji PPP are caught using purse seines, gill nets, fishing rods, and floating charts (fish aggregating devices).

Keywords: Conservation; Critically endangered; Endangered; Near threatened; Vulnerable.

Introduction

South Aceh encompasses an area of 4,173.82 km² or 417,382.50 hectares, situated along the West-South coast of Aceh Province. The region has 260 *gampongs* (villages) and 18 sub-districts (BAPPEDA South Aceh, 2016). Located on the West-South coast of Aceh, South Aceh faces the Indian Ocean and falls within Fisheries Management Area (known with WPP) 572. As of 2020, 7,008 residents are employed as fishermen, operating 1,862 fishing fleets, with a total capture fisheries production reaching 31,621.56 tons (DKP South Aceh, 2021). Based on the Decree of the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia Number 45 of 2014 concerning the National Fishing Port Master Plan, it is stated that South Aceh has 19 units of

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Fishing Ports, including 18 Fish Landing Base class Fishing Port units (PPI) and 1 PPP class Fishing Port unit, namely Port Labuhan Haji Beach Fisheries (KKP, 2014). State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

The number of fishing vessels recorded in the Fishing Vessel Data Base at UPTD Labuhan Haji PPP is 124 fishing fleet units with a size of 1 to 60 GT operating at the Labuhan Haji Beach Fishing Harbor. The fishing gear consists of several types; they are purse seine fishing gear, fishing rods, *bagan apung*, and gill nets (UPTD Labuhan Haji PPP). The total fisheries production in Labuhan Haji PPP recorded in 2021 was 5,837.77 tons with a production value of Rp. 96,247,760.00 in 2021.

Thus far, several types of fish that are categorised as near threatened and vulnerable are still caught and traded at several ports in Indonesia, including Labuhan Haji PPP, South Aceh. Ilham & Marasabessy (2021) stated that based on the Indonesian Fisheries Management Area (WPP), one of the areas that have the potential to become a fishing location for threatened categories such as sharks and rays is the West Sumatra region (WPP-572), including Aceh. Landing locations for sharks and rays in Aceh include Lampulo Banda Aceh, Meulaboh West Aceh, Krueng Mane North Aceh, Ujung Seurangga Abdya, and Labuhan Haji South Aceh.

An initial survey conducted at the Labuhan Haji Fishing Port (PPP) found several types of sharks and rays that were landed at the Labuhan Haji PPP, including *Hemitrygon akajei* (NT), *Carcharhinus melanopterus* (VU), and *Carcharhinus falciformis* (VU). Survey results indicate that fish species with a conservation status of vulnerable to extinction (VU) are present at Labuhan Haji PPP. This underscores the importance of identifying fish species and assessing their conservation status to inform and implement appropriate conservation measures.

Research related to fish species identification has been carried out in several locations, such as Balik Papan City, East Kalimantan, by Alfian et al. (2020), while in the Aceh region similar research was conducted by Zulfahmi et al. (2022) which is located on Pulau Weh, Melanie et al. (2019) on Siumat Island, Simeulu, Damora et al. (2020) in Pusong Bay, Lhokseumawe. However, information regarding species composition, species conservation status, and economic value of fish landed at Labuhan Haji PPP South Aceh has not been reported. This information is needed to assess its level of sustainability. In the Regulation of the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia Number 29 of 2012 concerning Guidelines for Preparing Fisheries Management Plans, it is stated that data and information regarding the conservation status of fish species is one of the aspects required in preparing Fisheries Management Plans (RPP), conservation strategies and sustainable/continuing exploitation (KKP, 2021)(KKP, 2021).

One of the reasons for the widespread fishing of sharks and rays is because shark and ray products have high economic value and are marketed in domestic and international markets. The economic value of each fish landed at Labuhan Haji PPP has a different economic value. The economic value of fish varies from time to time, and one thing that determines the high and low prices of fish is the amount of fish produced. Alfian et al. (2020) revealed that the selling value of fish is closely related to its abundance. Low or decreasing stocks will cause the selling value of several types of fish to increase on the market (Nur et al., 2022). In this case, it is not yet known for certain what types of fish with high economic or low economic value are landed at Labuhan Haji PPP. For this reason, this research needs to be carried out to obtain scientific information regarding the conservation status of the types of fish landed at Labuhan Haji PPP and their economic value. This research aims to identify the types of fish landed at Labuhan Haji PPP South Aceh, explore the conservation status of fish species landed at Labuhan Haji PPP South Aceh, and describe the economic value of fish landed at Labuhan Haji PPP South Aceh.

Method

Study area and data collection

This research was conducted in July – August 2022. The research site will be carried out at the Labuhan Haji Coastal Fishing Port (PPP), Pasar Lama Village, Labuhan Haji District, South Aceh Regency (WPP 572) (Figure 1). The research method used is a descriptive method, which is a survey and direct observation in the field. This method collects data by focusing on a case intensively and in detail to get a comprehensive picture because of data collection and analysis within a certain period and in a certain area (Nazir, 1988).

Data was collected for 30 days, from 15 July to 15 August 2022. Data collection was carried out in the morning at 6.30-10.00 WIB. The data collected in the research is primary and secondary data. Primary data is collected or taken directly in the field through observation or interviews. Meanwhile, secondary data is data obtained from data sources that are already available, whether from books, journals, institutions, and others.

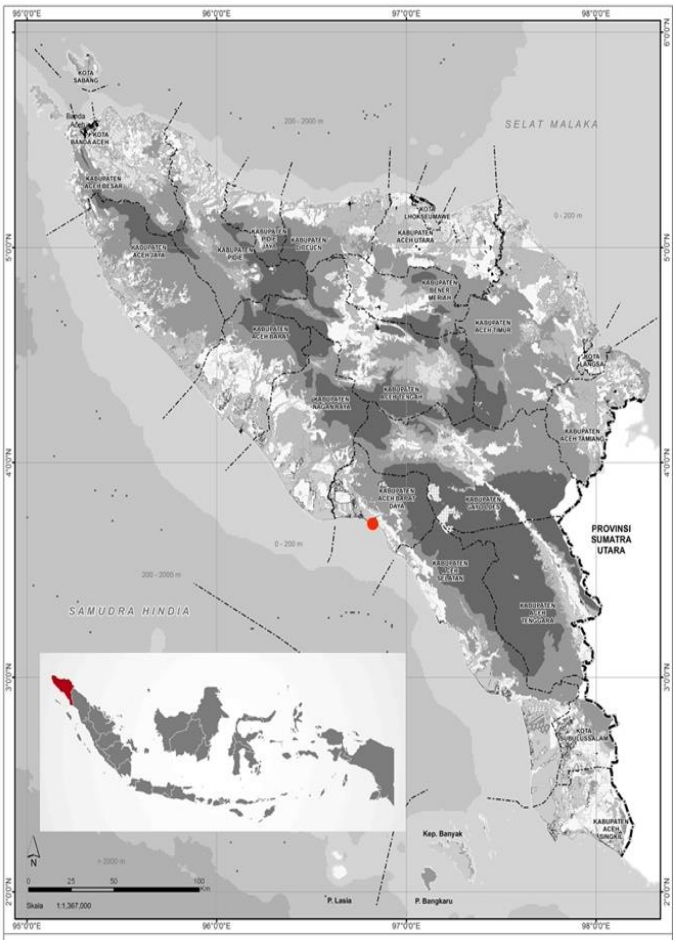

Figure 1. Map showing the location of the study sites

Fish identification, conservation status, and economic importance

The identification of the composition of the catch aims to determine the fish species types landed at the Labuan Haji Fishery Port (PPP). The data collected includes the local names of the fish, their Indonesian names, and photographic documentation. Identification of fish species is carried out by matching the morphological characteristics of the fish that have been documented with the morphological characters referring to the identification book of White et al. (2006) Market Fishes of Indonesia and Fishbase, which can be accessed via (https://www.fishbase.se/se/search.php). The composition identification results are presented in the form of tables and diagrams.

The conservation status of each identified fish species is determined by referring to the IUCN (International Union for the Conservation of Nature) red list, which is accessed via: (https://www.iucnredlist.org/), and CITES (Convention on International Trade in Endangered of Wild Flora and Fauna) can be accessed via: (https://checklist.cites.org/#/en). For the Indonesian region, fish species with conservation status have been mentioned in KEPMEN/KP No. 1 of 2021 concerning Protected Fish Types. The results are presented in the form of tables and diagrams and analysed descriptively. The economic value or selling price of fish was obtained through brief interviews with fishermen and fish traders at the research location during the research period. The results consist of a range of fish selling prices at Labuhan Haji PPP. These findings will be analysed descriptively to identify the types of fish with the highest and lowest selling values at Labuhan Haji PPP.

Result and Discussion

Fish composition

A total of seventy types of sea fish landed at the Labuhan Haji Beach Fishing Harbor was successfully collected. The 70 types of fish are divided into 15 orders and 35 families (Table 1; Figure 3-7). Based on the total length, anchovies (*Stolepterus indicus*) have the smallest total length, namely 8 cm (Figure 5), and sailfishes (*Istiophorus platypterus*) have the largest length, namely 180 cm (Figure 4).

Perciformes is the order with the largest number of species collected from the Labuhan Haji Beach Fishing Harbor, with a frequency of occurrence of 37% (26 species, ten families), followed by Carangiformes 21% (15 species, three families), Carcharhiniformes 9% (6 species, two families), Acanthuriformes 7% (5 species, four families), Orectolobiformes 6% (4 species, 4 families), Clupeiformes and Myliformes 4% each (3 species, 2 families), and the orders Beloniformes, Lamniformes, Mugiliformes, Pleuronectiformes, Rhinopristiformes, Siluriformes, Pricanthiformes, Tetraodontiformes with one species and one family each (Figure 2 (a)).

Based on family level, Carangidae is the most dominant family found at 19% (13 species), followed by Scombridae 11% (8 species), Lutjanidae 7% (5 species), Carcharhinidae 6% (4 species), Serranidae and Nemipteridae respectively 4% (3 species), Mullidae, Dasyatidae, Clupeidae, Sphyrnidae, Siganidae 3% each (2 species), and the fewest types of fish found come from the families Balistidae, Ariidae, Rhinidae, Priacanthidae, Psettodidae, Trichiuridae, Terapontidae, Sciaenidae, Pomacentridae, Monodactylidae, Ginglymostomatidae, Mobulidae, Acanthuridae, Mugilidae, Engraulidae, Alopiidae, Coryphaenidae, Istiophoridae, Labotidae, and Leiognathidae where each is 1% (one species) (Figure 2 (b)).

Tabel 1. Taxonomic classification, common name, local name, conservation status, price range and fishing gear used to cacth commercial marine fishes in labuhan haji fishing port.

Order/Family/Species	No	Common Name	Local Name	Conservation Status		Price Range (Rp/Kg)	Fishing Gear			
				IUCN	CITES		PS	GI	LL	LN
ACANTHURIFORMES										
Acanthuridae										
Acanthurus xanthopterus	1	Yellowfin surgeonfish	Cabeh marang	LC	-	15.000-25.000	-	+	+	-
Siganidae										
Siganus javus	2	Streaked spinefoot	Cabeh ek manok	LC	-	15.000-25.000	-	+	-	-
nus canaliculatus	3	White-spotted spinefoot	Cabeh buleun	LC	-	15.000-25.000	-	+	-	+
Leiognathidae										
gnathus berbis	4	Berber ponyfish	Cirik	LC	-	20.000-25.000	-	+	-	+
Labotidae										
otes surinamensis	5	Tripletail	Kakap batee	NE	-	20.000-35.000	-	-	+	-
BELONIFORMES										
Belonidae										
Tylosurus pacificus	6	Pacific agujon needlefish	Todak	LC	-	15.000-20.000	-	+	+	-
CARANGIFORMES										
Carangidae										
Selar crumenophthalmus	7	Bigeye scad	Keelang	LC	-	25.000-35.000	+	+	-	-
Gnathanodon speciosus	8	Golden trevally	Mirah mata	LC	-	25.000-35.000	-	+	-	-
Decapterus russelli	9	Indian scad	Reugak	LC	-	20.000-25.000	+	-	-	-
Alepes kleinii	10	Razorbelly scad	Keelang	LC	-	25.000-30.000	+	+	-	-
Elagatis bipinnulata	11	Rainbow runner	Cumok	LC	-	25.000-30.000	+	+	-	-
Atropus mentalis	12	Longrakered trevally	Rambeu	LC	-	40.000-45.000	-	+	+	-
Caranx sexfasciatus	13	Bigeye trevally	Gabu	LC	-	50.000-70.000	-	-	+	-
Alepes vari	14	Herring scad	Belata	LC	-	20.000-25.000	-	-	+	-
Caranx melampygus	15	Bluefin trevally	Langguran	LC	-	50.000-70.000	-	-	+	-
Platycaranx chrysophrys	16	Longnose trevally	Rambeu	LC	-	40.000-50.000	+	+	-	-
alaspis cordyla	17	Torpedo scad	Turok	LC	-	25.000-30.000	+	+	+	-
roides leptolepis	18	Yellowstripe scad	Keelang	LC	-	35.000-40.000	-	+	-	-
Scomberoides commersonnianus	19	Talang queenfish	Taleung	LC	-	30.000-35.000	-	+	+	-
Istiophoridae										
phorus platypterus	20	Indo-Pacific sailfish	Layaran	VU	-	20.000-30.000	-	-	+	-
Coryphaenidae										
Coryphaena hippurus	21	Common dolphinfish	Tutop rantee	LC	-	25.000-30.000	-	-	+	-
CARCHARHINIFORMES										
Carcharhinidae										
Carcharhinus sorrah	22	Spot-tail shark	Yee tamsirep	NT	-	30.000-40.000	-	-	+	-
Carcharhinus melanopterus	23	Blacktip reef shark	Yee	VU	-	30.000-40.000	-	-	+	-
Lamiopsis temminckii	24	Broadfin shark	Yee	EN	-	30.000-35.000	-	-	+	-

Loxodon macrorhinus	25	Sliteye shark	Yee urot	NT	-	30.000-35.000	-	+	+	-
Sphyrnidae										
Sphyrna lewini	26	Scalloped hammerhead	Yee bajo	CR	A. II	30.000-35.000	-	+	+	-
Sphyrna zygaena	27	Smooth hammerhead	Yee bajo	VU	A. II	30.000-35.000	-	+	+	-
LAMNIFORMES										
Alopiidae										
Alopias pelagicus	28	Pelagic thresher	Yee tikoh	EN	A. II	30.000-35.000	-	-	+	-
CLUPEIFORMES										
Clupeidae										
Amblygaster sirm	29	Spotted sardinella	Krimen	LC	-	15.000-20.000	-	-	-	+
Sardinella albella	30	White sardinella	Kasee	LC	-	15.000-20.000	-	+	-	+
Engraulidae										
Stolepterus indicus	31	Indian anchovy	Bileh	NE	-	20.000-30.000	-	-	-	+
Planiliza subviridis	32	Greenback mullet	Beulaneut	LC	-	20.000-30.000	-	+	-	-
MYLIOBATIFORMES										
Dasyatidae										
Taeniura lymma	33	Ribbontail stingray	Paro	LC	-	15.000-25.000	-	+	+	-
Neotrygon kuhlii	34	Blue-spotted stingray	Paro	DD	-	15.000-25.000	-	+	+	-
Mobulidae										
Mobula thurstoni	35	Smoothtail mobula	Paro juhang	EN	A. II	5.000-12.000	+	-	+	-
ORECTOLOBIFORMES										
Ginglymostomatidae										
Nebrius ferrugineus	36	Tawny nurse shark	Yee pakak	VU	-	30.000-35.000	-	-	+	-
Hemiscyllidae										
Chiloscyllium griseum	37	Grey bambooshark	Yee	VU	-	30.000-35.000	-	-	+	-
PERCIFORMES										
Haemulidae										
Pomadasys kaakan	38	Javelin grunter	Kapeh	LC	-	25.000-35.000	-	+	-	-
Kyphosidae										
Kyphosus vaigiensis	39	Brassy chub	Elak	LC	-	20.000-30.000	-	+	-	-
Lutjanidae										
Lutjanus monostigma	40	One-spot snapper	Tubai bibi	LC	-	50.000-60.000	-	-	+	-
Lutjanus gibbus	41	Humpback red snapper	Jeumihong	LC	-	60.000-80.000	-	-	+	-
Lutjanus johnii	42	John's snapper	Burucung	LC	-	35.000-45.000	-	-	+	-
Lutjanus fulvus	43	Blacktail snapper	Seureundeeng	LC	-	35.000-45.000	-	-	+	-
Lutjanus lineolatus	44	Bigeye snapper	Reumong anoe	LC	-	35.000-45.000	-	+	+	-
Monodactylidae										
Monodactylus falciformis	45	Full moony	Tapee	LC	-	15.000-20.000	-	+	-	-
Mullidae										
Upeneus moluccensis	46	Goldband goatfish	Kantup	LC	-	25.000-35.000	-	+	-	-
Parupeneus heptacanthus	47	Cinnabar goatfish	Kantup	LC	-	30.000-35.000	-	+	-	-
Nemipteridae										

Pentapodus vitta	48	Western butterfish	Reumong ceu	LC	-	25.000-35.000	-	+	+	-
Nemipterus bipunctatus	49	Delagoa threadfin bream	Cuwih	LC	-	30.000-35.000	-	+	+	-
Nemipterus isacanthus	50	Teardrop threadfin bream	Cuwih	NE	-	40.000-60.000	-	+	+	-
Pomacentridae										
Abudefduf vaigiensis	51	Indo-Pacific sergeant	Bungong siron	LC	-	15.000-20.000	-	+	-	-
Sciaenidae										
Atrobucca nibe	52	Blackmouth croaker	Gulamee	LC	-	20.000-35.000	-	+	-	-
Scombridae										
Rastrelliger kanagurta	53	Indian mackerel	Jinara	DD	-	40.000-60.000	+	+	-	+
Rastrelliger faughni	54	Island mackerel	Aneuk leu	DD	-	35.000-40.000	+	-	-	+
Katsuwonus pelamis	55	Skipjack tuna	Suree musang	LC	-	15.000-30.000	+	-	+	-
Euthynnus affinis	56	Kawakawa	Suree keumong	LC	-	15.000-30.000	+	+	+	-
Thunnus orientalis	57	Pacific bluefin tuna	Suree sisek	NT	-	20.000-35.000	+	-	+	-
Scomberomorus commerson	58	Narrow-barred Spanish mackerel	Tanggiri	NT	-	35.000-50.000	+	-	+	-
Thunnus tonggol	59	Longtail tuna	Suree siseek	DD	-	20.000-35.000	+	-	+	-
Thunnus albacares	60	Yellowfin tuna	Suree siseek	LC	-	20.000-35.000	+	-	+	-
Serranidae					-					
Epinephelus faveatus	61	Barred-chest grouper	Bandi	LC	-	40.000-60.000	-	-	+	-
Epinephelus bleekeri	62	Duskytail grouper	Bandi	DD	-	40.000-60.000	-	-	+	-
Cephalopholis miniata	63	Coral hind	Leupoeh apui	LC	-	80.000-100.000	-	-	+	-
Terapontidae										
Terapon puta	64	Small-scaled terapon	Kirong	LC	-	25.000-35.000	-	+	-	-
Trichiuridae										
Trichiurus lepturus	65	Largehead hairtail	Cualle	LC	-	10.000-15.000	-	+	-	-
PLEURONECTIFORMES										
Psettodidae										
Psettodes erumei	66	Indian halibut	Siblah	DD	-	30.000-35.000	-	+	-	-
PRIACANTHIFORMES										
Priacanthidae										
Priacanthus macracanthus	67	Red bigeye	Dompet	LC	-	35.000-40.000	-	-	+	-
RHINOPRISTIFORMES										
Rhinidae										
Rhynchobatus australiae	68	Bottlenose wedgefish	Paro kiwi-kiwi	CR	A. II	30.000-35.000	-	-	+	-
SILURIFORMES										
Ariidae										
Plicofollis dussumieri	69	Blacktip sea catfish	Bagok	LC	-	25.000-30.000	-	+	+	-
TETRAODONTIFORMES										
Balistidae										
Canthidermis maculata	70	Rough triggerfish	Lubiem	NE	-	15.000-25.000	-	-	+	-

Note: Global conservation and international trade status according to IUCN (2022) and CITES (2022). LC=Least concern; NE= Not evaluated; DD= Data deficient; VU= Vulnerable; NT= Near threatened; EN= Endangered; CR= Critically endangered.. A.II: Appendices II. Price range presented in Indonesian Rupiah (1USD = Rp 14,500). Fishing gear abbreviation, PS: purse seine; GI: gillnet, LL: longline; LN: lift net

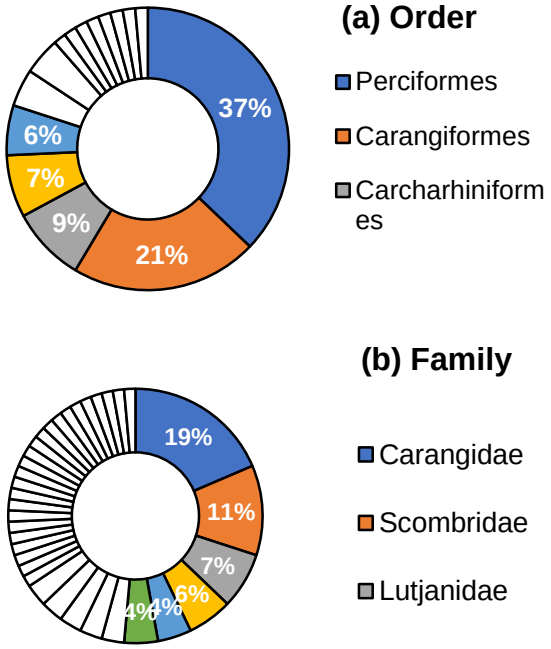

Figure 2 (a and b). Percentage of commercial marine fish orders (upper graphic) and families (lower graphic) from Labuhan Haji Fishing Port. The blank segments represent families with less than 4% of the total species richness.

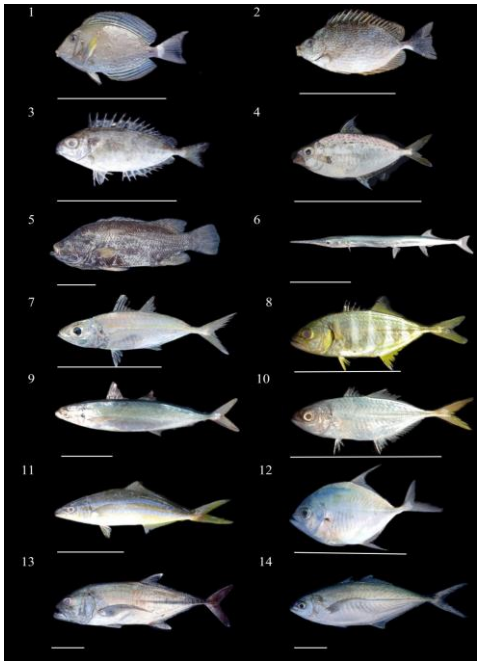

Figure 3. Fishes from family Acanturidae (1. *Acanthurus xanthopterus*), Siganidae (2. *Siganus javus*; 3. *Siganus canaliculatus*), Leiognathidae (4. *Leiognathus berbis*), Labotidae (5. *Lobotes surinamensis*), Belonidae (6. *Tylosurus pacificus*), Carangidae (7. *Selar crumenophthalmus*; 8. *Gnathanodon speciosus*; 9. *Decapterus russelli*; 10. *Alepes kleinii*; 11. *Elagatis bipinnulata*; 12. *Atropus mentalis*; 13. *Caranx sexfasciatus*; 14. *Alepes vari*). Scale bar = 10 cm (All photographs by Musda fina).

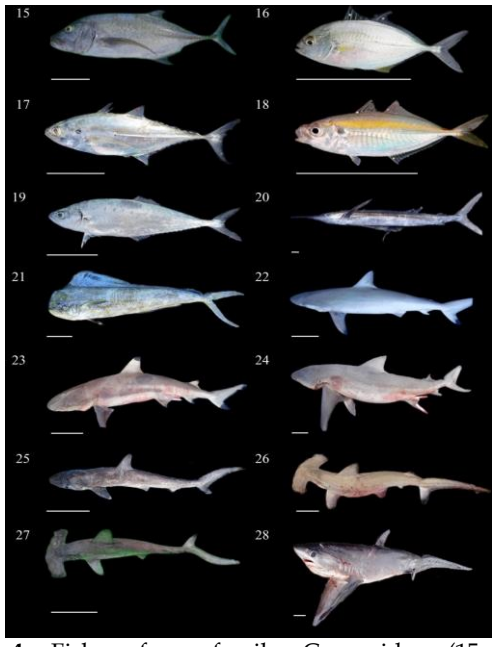

Figure 4. Fishes from family Carangidae (15. *Caranx melampygus*; 16. *Platycaranx chrysophrys*; 17. *Megalaspis cordyla*; 18. *Selaroides leptolepis*; 19. *Scomberoides commersonnianus*), Istiophoridae (20. *Istiophorus platypterus)* Coryphaenidae (21. *Coryphaena hippurus*), Carcharhinidae (22. *Carcharhinus sorrah;* 23. *Carcharhinus melanopterus*; 24. *Lamiopsis temminckii*; 25. *Loxodon macrorhinus*), Sphyrnidae (26. *Sphyrna lewini*; 27. *Sphyrna zygaena*), Alopiidae (28. *Alopias pelagicus*). Scale bar = 10 cm. (All photographs by Musda fina).

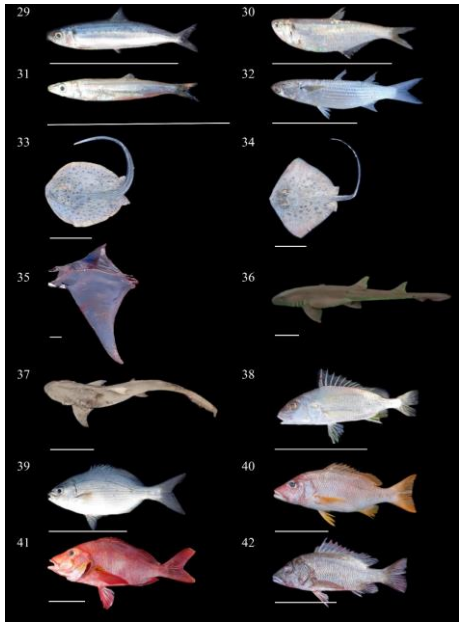

Figure. 5. Fishes from family Clupeidae (29. *Amblygaster sirm*; 30. *Sardinella albella),* Engraulidae (31. *Stolepterus indicus*), Mugilidae (32. *Planiliza subviridis*), Dasyatidae (33. *Taeniura lymma*; 34. *Neotrygon kuhlii*), Mobulidae (35. *Mobula thurstoni*), Ginglymostomatidae (36. *Nebrius ferrugineus*), Hemiscyllidae (37. *Chiloscyllium griseum*), Haemulidae (38. *Pomadasys kaakan*), Kyphosidae (39. *Kyphosus vaigiensis*), Lutjanidae (40. *Lutjanus onostigma*; 41. *Lutjanus gibbus*; 42. *Lutjanus johnii*). Scale bar = 10 cm. (All photographs by Musda fina).

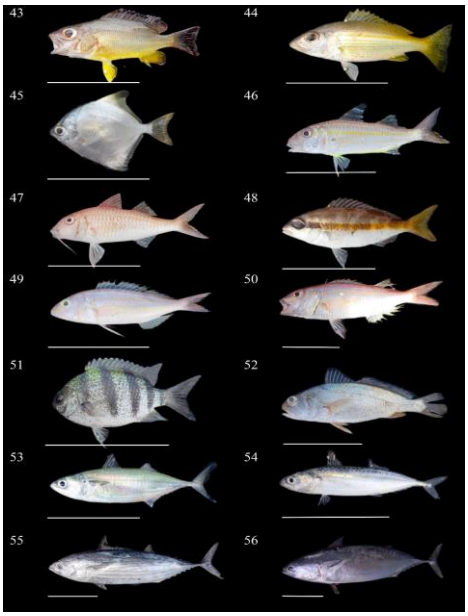

Figure 6. Fishes from family Lutjanidae (43. *Lutjanus fulvus*; *44. Lutjanus lineolatus),* Monodactylidae (45. *Monodactylus falciformis),* Mullidae (46. *Upeneus moluccensis*; 47. *Parupeneus heptacanthus),* Nemipteridae (48. *Pentapodus vitta*; 49. *Nemipterus bipunctatus;* 50. *Nemipterus isacanthus),* Pomacentridae (51. *Abudefduf vaigiensis),* Scianidae (52. *Atrobucca nibe),* Scombridae (53. *Rastrelliger kanagurta*; *54. Rastrelliger faughni*; *55. Katsuwonus pelamis*; *56. Euthynnus affinis)*. Scale bar = 10 cm. (All photographs by Musda fina).

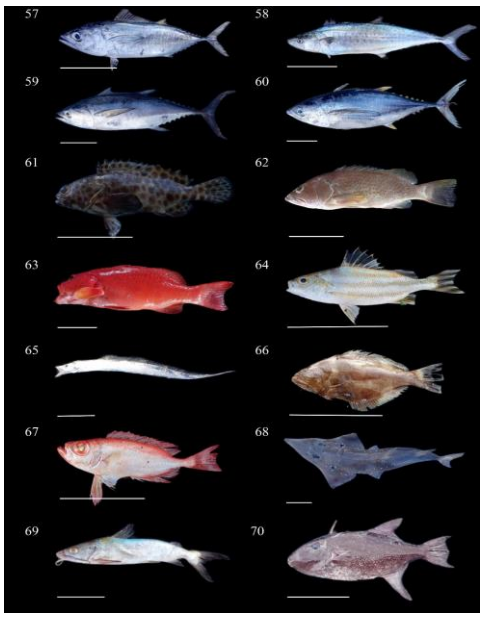

Figure 7. Fishes from family Scombridae (57. Thunnus orientalis; 58. Scomberomorus commerson; 59. Thunnus tonggol; 60. Thunnus albacares), Serranidae (61. Epinephelus faveatus; 62. Epinephelus bleekeri; 63. Cephalopholis miniata), Terapotidae (64. Terapon puta), Trichiuridae (65. Trichiurus lepturus), Psettodidae (66. Psettodes erumei), Priacantidae (67. Priacanthus macracanthus), Rhinidae (68. Rhynchobatus australiae), Ariidae (69. Plicofollis dussumieri), Balistidae (70. Canthidermis maculata). Scale bar = 10 cm. (All photographs by Musda fina.

The number of fish orders collected in this study was greater than in previous research conducted in several locations in Aceh, including 8 orders on Weh Sabang Island (Zulfahmi et al., 2022), 7 orders on Simeulue (Batubara et al., 2017), and 7 orders on Pante Raja Pidie Jaya (Marliani, 2018). However, compared to the research conducted by Damora et al. (2020) in Pusong Bay, the number of orders collected was the same, namely 15 orders.

Perciformes is the most dominant order found in this study; the frequency of occurrence is 40% (28 species, 12 families). The same results were also obtained from several previous studies. The Perciformes order is reported to dominate the composition of fish species in the waters of Weh Island by 84% (Zulfahmi et al., 2022), Pusong Bay by 46% (Damora et al., 2020), Simeulue Island by 87% (Batubara et al., 2017), Pante Raja Pidie Jaya by 57% (Marliani, 2018). This is because the Perciformes order has a greater number of families than other orders, reaching 170 families (Carpenter & Niem, 1999, 2001). Chu et al. (2019) also revealed that Asian waters contain more Perciformes order composition than other water areas, reaching 48 families.

At the family level, Carangidae is the most dominant family identified in this study, comprising 19% of the total, with 13 species. These results are in line with previous research on *Weh Sabang* Island, 13% (6 species) (Zulfahmi et al., 2022), and in Pusong Bay, 11% (8 species) (Damora et al., 2020). The high composition of fish species from the Carangidae family is thought to be influenced by the characteristics of the surrounding waters in the form of coral reef ecosystems (Apriansyah, 2022). One of the coral reef ecosystems found in the Aceh region is in the waters of South Aceh (Ulfah et al., 2018). The coastal area of South Aceh, which is included in one of the Regional Water Protection Areas, includes the waters around Labuhan Haji District, Samadua District, Bakongan District, East Bakongan District, and Trumon District, with an area of approximately 3,590.34 Hectares with a proposed nomenclature in the form of a Fisheries Nature Reserve (KKP, 2020). Allen (1999) stated that the habitat of the Carangidae family is found in coastal waters, up to offshore. Several species are found on coral reefs (Campbell et al., 2011).

Conservation Status

The conservation status of fish species is seen based on three sources, namely IUCN (International Union for the Conservation of Nature), CITES (Convention on International Trade in Endangered of Wild Flora and Fauna), and KEPMEN No 1/KEPMEN-KP/2021 concerning Protected Fish Types. Judging from the IUCN red list, 45 species (64%) have LC (Least concern/low risk), 6 species (9%) NE (not evaluated), 5 species (7%) DD (Data deficient/lack of information), 5

species (7%) VU (Vulnerable/vulnerable), 4 species (6%) NT (Near Threatened), 3 species (4%) EN (Endangered/threatened) (Bentfin Devil rays/Mobula thurstoni, Pelagic thresher shark/Alopias pelagicus, Broadfin shark/Lamiopsis temminckii), 2 species (3%) CR (Critically endangered/very threatened) (white-spotted wedgefish/Rhynchobatus australiae, Scalloped hammerhead shark/Sphyrna lewini). Based on CITES, 7% (5 species) are recorded: Scalloped hammerhead shark (Sphyrna lewini), white-spotted wedgefish (Rhynchobatus australiae), Pelagic thresher shark (Alopias pelagiscus), Bentfin Devil rays (Mobula thurstoni) and Scalloped hammerhead shark (Sphyrna zygaena). This type of fish is included in the Appendix II category; the other 93% (65 species) were not evaluated (Figure 8; Table 1).

Based on the Decree of the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia Number 1 of 2021 concerning Protected Fish Types, among the seventy species collected from Labuhan Haji PPP, there are no species recorded as protected fish species in Indonesia.

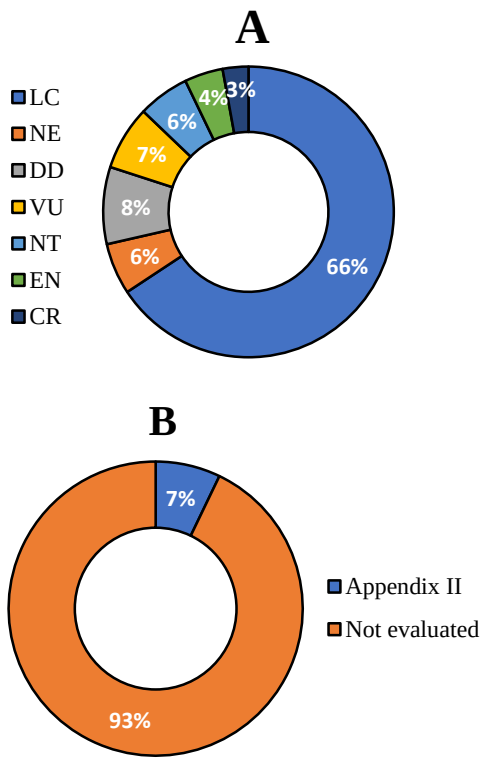

Figure 8. Diagram showed the percentage of conservation and international trade status of 70 fish collected from labuhan haji fishing port according to IUCN red list (A) and CITES (B): LC: Least concern; NE: Not evaluated; DD: Data deficient; VU: Vulnerable; NT: Near threatened; EN: Endangered; CR: Critically endangered.

The conservation status of fish species collected from the Labuhan Haji Beach Fishing Harbor is included in 7 (seven) IUCN categories (LC 64%, NE 9%, DD 7%, VU 7%, NT 6%, EN 4%, CR 3%,). These results indicate that the conservation status of fish species in this study is more diverse compared to the results of previous similar studies in Pusong Bay 3 (three) categories (LC 62%, DD 3%, NE 35%) (Damora et al., 2020), Pulau Weh 4 (four) categories (LC 78%, NT 4%, DD 4%, NE 14%). The conservation status of fish species collected from Labuhan Haji PPP is dominated by the Least Concern category (LC 64%). These results are the same as those reported from LC-dominated Weh Island (78%) and LC-dominated Pusong Bay (62%).

The types of fish included in the IUCN red list in the high threat category are known to be 3% in the Critically Endangered category (*Rhynchobatus australiae, Sphyrna lewini*) and 4% in the Endangered category (*Mobula thurstoni, Alopias pelagicus, Lomiopsis temminckii*). These types of sharks and rays are also found in several other locations in Indonesia, including *Rhyncobatus australiae* found in the waters of North Aceh (Lesmana et al., 2018), PPI Rigaih Aceh Jaya (Simeon et al., 2018), Bali Strait (Oktaviyani et al., 2020), Muara Angke North Jakarta (Wijayanti et al., 2018), northern waters of Central Java (Yuwandana et al., 2020), waters of West Kalimantan (Hidayat et al., 2019), Kunyuk Bay (Simeon et al., 2018) Labuan Bajo (Alaydrus et al., 2014). *Sphyrna lewini* is also found in the waters of North Aceh (Lesmana et al., 2018), PPS Kutaraja Lampulo; PPI Rigaih Aceh Jaya (Simeon et al., 2020), Makassar strait (Efendi et al., 2019), Bali strait (Oktaviyani et al., 2020), West Kalimantan waters (Hidayat et al., 2019), north coast of Central Java (Setiati et al., 2018), Lunyuk Bay (Simeon et al., 2018), East Lombok (Sentosa, 2017), Java Sea (Dharmadi et al., 2016), East Java (Yulita & Susiono, 2020). *Mobula thurstoni* is also found in Muncar (East Java), and Tanjung Luar (West Nusa Tenggara). *Lamiopsis temminckii* is also found in the Makassar Strait (Efendi et al., 2019), the waters of West Kalimantan (Hidayat et al., 2019), the north coast of Central Java (Setiati et al., 2018).

The conservation status of fish species based on CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) shows that 5 types (7%) of fish are classified as Appendix II. The list of fish species included in Appendix II is also included in the IUCN red list, including *Sphyrna lewini, Rhynchobatus australiae* (Appendix II; CR), *Alopias pelagiscus; Mobula thurstoni* (Appendix II; EN), and *Sphyrna zygaena* (Appendix II; VU). This means that trade between countries in sharks and rays must be managed to ensure their use does not threaten sustainability (Rahman et al., 2017).

Judging from the Decree of the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia Number 1 of 2021 concerning protected fish types, those

are included in the IUCN red list and CITES Appendix II are not listed as protected fish species in KEPMEN-KP No. 1 of 2021. At least 116 types of sharks belong to 25 tribes found in Indonesian waters (Fahmi and Dharmadi, 2013). Shark production in Indonesia is quite high; as recorded in 2015, national shark production reached 52,268 tons. This large catch can cause the loss of a commodity (elasmobranchii) in the world. The depletion of sharks and rays (elasmobranchii) in many marine ecosystems is now recognized as a global conservation priority (Dulvy et al., 2014). A conservative life history (Mardhiah et al., 2019) makes elasmobranchii vulnerable to excessive fisheries exploitation (Reynolds et al., 2005), which at some point can damage ecosystem structure (Sherman et al., 2023), ultimately reducing global functional diversity (Pimiento et al., 2020). The classic Elasmobranchii problem currently being faced globally is fishing that is not environmentally friendly, over-fishing, and not considering aspects of resource sustainability; several indicators causing this are the high market demand for stingray meat and skin (Wijayanti et al., 2018). The protection category in KEPMEN-KP No. 1 of 2021 consists of 2 categories: full protection and limited protection based on a certain time period and size. Full protection status is protection carried out at all stages of the life cycle, including body parts and derivative products. Limited protection is preservation carried out with the provision of a prohibition on catching at all times, except that juveniles measuring 3 cm to 5 cm can be caught in November, December, January, and February (KKP, 2021). One form of protection that can be applied to shark and ray species listed in the IUCN and CITES is limited protection based on specific time periods or sizes. A government review of the types of fish protected in Indonesia is necessary to ensure the conservation of species at high risk of extinction.

Economic Importance

The economic value of sea fish landed at the Labuhan Haji Beach Fishing Harbor varies by species. Among the types collected, fish from the Serranidae family have the highest economic value, with an average price of IDR 63,333 per kilogram. Conversely, fish from the Mobulidae family have the lowest selling price, averaging IDR 8,500 per kilogram. Fish with a price of less than IDR 20,000 per kilogram belong to 10 families, those between IDR 20,000 and IDR 40,000 belong to 21 families, and those above IDR 40,000 belong to 3 families (Figure 9).

The number of sharks and rays identified in this study was 13 species, which is notably higher compared to previous research on Pulau Weh, which recorded only one species. This difference is attributed to the preferred habitat of sharks and rays, which includes shallow coastal waters with sand and mud substrates, areas near coral reef flats, lagoons, bays, river estuaries, and freshwater. Some species also inhabit the open sea, ranging from the surface to depths exceeding 2000 meters above sea level (Henningsen & Leaf, 2010; Syahara, 2019). Additionally, the high diversity of shark species found in Labuhan Haji can be attributed to the varying sizes of fishing hooks and nets used by fishermen at Labuhan Haji PPP. According to Jarwanto et al. (2014), the size and type of fishing gear significantly influence the efficiency of fishing operations; the more varied the fishing gear, the broader the fishing area covered. This increases the potential for catching a wider variety of fish species.

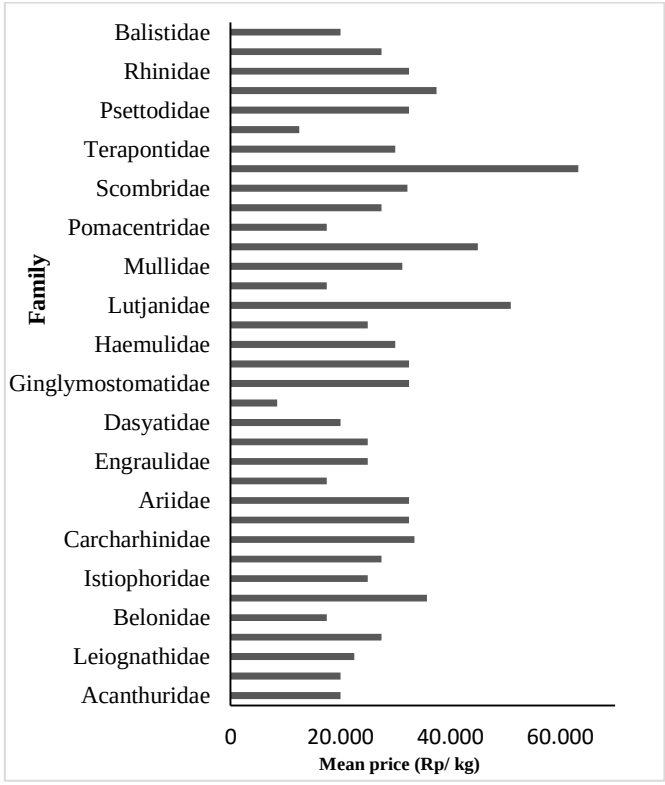

Figure 9. Mean price value of fish family at labuhan haji fishing port (1 USD = Rp 14,500).

Several aspects support shark and ray fishing activities, particularly their economic value. Almost all parts of a shark's body can be utilized and hold significant economic value, including the meat, skin, fins, and bones. Simeon et al. (2020) states that shark fin prices are higher than those of meat, skin, and bones. The price of shark fins starts from IDR 90,000 - IDR 900,000/kg, while the meat is sold at a price range of IDR 20,000 - IDR 30,000/kg, the bones are sold at IDR 50,000/kg, and certain types of skin can be sold for Rp.10,000 - Rp.15,000/inch^2. Indonesia is also listed as one of the countries that utilize the world's largest cartilaginous fish resources (sharks and rays), with an

estimated catch of 105,000 tonnes in 2002 and 118,000 tonnes in 2003 (White et al., 2006). Shark fins are the main export product for destination countries such as China, Hong Kong, Taiwan, and Singapore (Ichsan et al., 2019). A total of 67% of sharks and 58% of rays recorded at Singapore's Jurong Fishing Harbor and Senoko Fishing Harbor in 2017-2020 were imported from Indonesia (Aceh, Kuala Tungkal, Tembilahan, Bangka Belitung, Bali, Kalimantan, Pontianak and Riau Islands) (Clark-Shen et al., 2021). For non-fin products, international trade products consist of meat, liver oil, skin, cartilage, and gill rakers of *Mobulidae rays,* with the main destination countries being China (44%), Malaysia (21.1%), Taiwan (17.4%), South Korea (8.3%), and Thailand (5.4%) (Muttaqin et al., 2018).

From the type of rays, *Mobula Thurstoni*one of the ray species from the *Mobulidae* family was successfully collected from the Labuhan Haji Beach Fishing Harbor, which has Appendix II (CITES) and Endangered (IUCN) status. The selling value of this type of fish is around Rp. 5,000-Rp. 12,000. The selling value is not higher than other types of fish, which are also landed at Labuhan Haji PPP. From an economic perspective, *Mobula Thurston* meat is not very profitable, and from an ecosystem perspective, it will cause extinction if fishing continues without regulation. Compared with other groups of rays, the Mobulidae family has a lower fecundity level, a relatively long reproductive period, slower growth, and reaches adulthood at an average of 10 years (Marshall et al., 2016). This makes this fish resource very vulnerable to excessive exploitation.

Overall, the economic value of fish landed at Labuhan Haji PPP varies considerably. The fish with the highest selling price comes from the Serranidae (grouper) family with a price range of IDR 40,000-IDR 100,000/kg, and the type of fish with the lowest selling price range is from the Mobulide family with a selling price of around IDR 5,000 - IDR 10,000/kg. However, the dominant price of fish landed at Labuhan Haji PPP has an average selling value of IDR 20,000 - IDR 40,000. This result is the same as that reported on Weh Island, where grouper fish has the highest selling value compared to other types of fish with a price range of Rp. 30,000-Rp. 90,000 (Zulfahmi et al., 2022). These results show that the price of grouper on Weh Island is lower than on Labuhan Haji. This is because the grouper fishing area on Weh Island is in an area that is easy to reach, so the selling price is lower than in other areas in Indonesia (Apriansyah, 2022). Grouper is a fish with high economic value and is a leading export commodity with increasing market demand. The main export destination country for grouper is Hong Kong (Yesayas & Sugito, 2021). Serranidae (grouper) fisheries production in 2020 amounted to 147.29 tons (BPS South Aceh, 2020).

Fishing Gear

The types of fishing gear used by fishermen in Labuhan Haji PPP are 4 types of fishing gear, namely purse seines, gill nets, fishing rods, and bagan apung. The fishing gear that catches the most types of fish is fishing rods, with a total of 47 species from 23 families. This was followed by gillnets with 38 species from 26 families, purse seines with 15 species from four families, and floating nets, which caught 7 species from 5 families (Figure 10). The number of fish caught using 1 (one) type of fishing gear in this study was 35 types, caught using 2 (two) types of fishing gear totaling 29 types of fish, and with 3 (three) types of fishing gear totaling 2 types of fish (Table 1). Each dominant type of fish is caught with 2 (two) or 3 (three) fishing gears as the target catch.

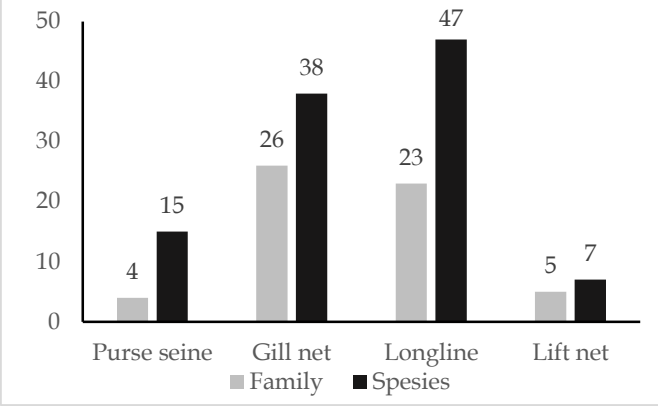

Figure 10. Composition of fish species and families according to fishing gear used at the Labuhan Haji Fishing Port

Fishing rods catch more types of fish than other fishing equipment, with a total of 44 types. In contrast, *bagan apung* catches the fewest types of fish, with only seven types. This difference can be attributed to the versatility of fishing rods, which can catch almost all types of fish. Factors that influence the catch of fishing rods include the size of the hook, the type of bait, and the fishing area. Thus, fishing rods are the most effective gear for capturing a diverse range of fish species, whereas floating fishing gear is more limited in its effectiveness.

Types of sharks in the Critically Endangered (*Sphyrna lewini, Rhynchobatus australiae*) and Endangered (*Alopias pelagiscus, Mobula thurstoni*) categories are caught using fishing gear as target catches. However, in this study, *Mobula thurstoni* and *Sphyrna lewini* were also caught with purse seines and gill nets as non-target catches. According to (Zainudin, 2011), shark fishing activities in Indonesia predominantly result from bycatch, accounting for 72% of the total catch, while only 28% of shark catches are the primary target.

Conclusion

There are 70 types of fish landed at the Labuhan Haji Fishing Port, divided into 15 orders and 35 families. The dominant order found was Perciformes at 37% (26 species, 10 families), followed by Carangiformes 21% (15 species, 3 families), Carcharhiniformes 9% (6 species, 2 families), Acanthuriformes 7% (5 species, 4 families), Orectolobiformes 6% (4 species, 4 families). The most dominant family found was Carangidae 19% (13 species), followed by Scombridae 11% (8 species), Lutjanidae 7% (5 species), Carcharhinidae 6% (4 species), Serranidae and Nemipteridae each 4% (3 species). In the IUCN red list, 6 species (9%) are listed in the not evaluated (NE) category, 5 species (7%) data deficient (DD), 45 species (64%) least concern (LC), 4 species (6%) near threatened (NT), 5 species (7%) vulnerable (VU), 3 species (4%) endangered (EN), and 2 species (3%) critically endangered (CR). Based on CITES, 5 species (7%) are included in the Appendix II category, and the other 65 species (93%) are not evaluated (NE). However, the 70 types of fish recorded in this research are not included in the protected fish types in Indonesia based on the Regulation of the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia Number 1 of 2021 concerning Protected Fish Types. The fish with the highest selling price range comes from the Serranidae family, which has a price range of Rp. 40,000-Rp.100,000 /kg. Additionally, the type of fish with the lowest selling price range is from the Mobulide family, with a selling price of around Rp.5,000-Rp.12,000/kg.

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Author Contributions
For author contributions, Conceptualization, Ilham Zulfahmi and Epa Paujiah; methodology, Musda Fina; software, Musda Fina.; validation, Ilham Zulfahmi and Badratun Nafis; formal analysis, Junaidi M. Affan; investigation, Junaidi M. Affan; resources, Junaidi M. Affan; data curation, Ilham Zulfahmi and Junaidi M. Affan; writing—original draft preparation, Junaidi M. Affan; writing—review and editing, Epa Paujiah; visualization, Junaidi M. Affan and Musda Fina; supervision, Ilham Zulfahmi; project administration, Ilham Zulfahmi; funding acquisition, Syiah Kuala University and UIN Sunan Gunung Djati Bandung.

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Conflicts of Interest
The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

References

Alaydrus, I. S., Fitriana, N., & Jamu, Y. (2014). Jenis dan status konservasi ikan hiu yang tertangkap di tempat pelelangan ikan (TPI) Labuan Bajo, Manggarai Barat, Flores. *Al-Kauniyah: Jurnal Biologi*, *7*(2), 83–88. https://doi.org/10.15408/kauniyah.v7i2.2719

Alfian, R. L., Iskandar, J., Iskandar, B. S., Ermandara, D. P., Mulyanto, D., & Partasasmita, R. (2020). Fish species, traders, and trade in traditional market: Case study in Pasar Baru, Balikpapan City, East Kalimantan, Indonesia. *Biodiversitas Journal of Biological Diversity*, *21*(1). Retrieved from https://smujo.id/biodiv/article/view/4870

Allen, G. (1999). *Marine Fishes of South-East Asia: A field guide for anglers and divers*. Tuttle Publishing.

Apriansyah, M. (2022). *inventarisasi jenis ikan hasil tangkapan nelayan yang didaratkan di Pulau Weh Provinsi Aceh*. uin ar-raniry.

BAPPEDA South Aceh. (2016). *Rencana Pembangunan Jangka Menengah Kabupaten Aceh Selatan Tahun 2013-2018*.

Batubara, A. S., Muchlisin, Z. A., Thamren, M. Y., Usnardi, U., & Fadli, N. (2017). Check list of marine fishes from Simeulue Island waters, Aceh Province, Indonesia. *Aceh Journal of Animal Science*, *2*(2), 77–84. http://dx.doi.org/10.13170/ajas.2.2.9584

Campbell, S. J., Kartawijaya, T., & Sabarini, E. K. (2011). Connectivity in reef fish assemblages between seagrass and coral reef habitats. *Aquatic Biology*, *13*(1), 65–77. http://dx.doi.org/10.3354/ab00352

Carpenter, K. E., & Niem, V. H. (1999). *FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. Volu e 4. Bony fishes part 2 (Mugilidae to Carangidae)*.

Carpenter, K. E., & Niem, V. H. (2001). *FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. Volume 6. Bony fishes part 4 (Labridae to Latimeriidae), estuarine crocodiles, sea turtles, sea snakes and marine mammals*.

Chu, C., Loh, K. H., Ng, C. C., Ooi, A. L., Konishi, Y., Huang, S.-P., & Chong, V. C. (2019). Using DNA Barcodes to Aid the Identification of Larval Fishes in Tropical Estuarine Waters (Malacca Straits, Malaysia). *Zoological Studies*, *58*, e30. https://doi.org/10.6620/ZS.2019.58-30

Clark-Shen, N., Tingting, K. X., Rao, M., Cosentino-Roush, S., Sandrasegeren, R., Gajanur, A. R., Chapman, D. D., Ying, E. L. X., Flowers, K. I., & Feldheim, K. A. (2021). The sharks and rays at

Singapore's fishery ports. *Fisheries Research*, *235*, 105805. https://doi.org/10.1016/j.fishres.2020.105805

Damora, A., Batubara, A. S., Zuhdi, Z., Restiangsih, Y., Amir, F., Irham, M., Fadli, N., Nur, F., & Rizal, R. (2020). Diversity of marine fish and their conservation status in Pusong Bay, Lhokseumawe City, Aceh Province, Indonesia. *European Journal of Environmental Sciences*, *10*(2), 115–123. http://dx.doi.org/10.14712/23361964.2020.13

Dharmadi, D., Fahmi, F., & Triharyuni, S. (2016). Aspek biologi dan fluktuasi hasil tangkapan cucut tikusan,(Alopias pelagicus) di Samudera Hindia. *BAWAL Widya Riset Perikanan Tangkap*, *4*(3), 131–139. http://dx.doi.org/10.15578/bawal.4.3.2012.131-139

DKP South Aceh. (2021). *Statistik Perikanan Kabupaten Aceh Selatan Tahun 2020*.

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, & Francis, M. P. (2014). Extinction risk and conservation of the world's sharks and rays. *Elife*, *3*, e00590. https://doi.org/10.7554/eLife.00590

Efendi, H. P., Dhewi, R. T., & Ricky, R. (2019). Keragaman Jenis dan Distribusi Panjang Ikan Hiu di Perairan Selat Makassar. *Prosiding Pusat Riset Perikanan*, *1*(1), 33–42.

Fahmi;Dharmadi; (2013). *Tinjauan Status Perikanan Hiu dan Upaya Konservasinya di Indonesia*.

Henningsen, A. D., & Leaf, R. T. (2010). Observations on the captive biology of the southern stingray. *Transactions of the American Fisheries Society*, *139*(3), 783–791. http://dx.doi.org/10.1577/T09-124.1

Hidayat, E. H., Alkadrie, S. I. T., Getreda, G., & Sabri, M. (2019). Keragaman jenis ikan hiu dan pari di perairan Kalimantan Barat. *Prosiding Pusat Riset Perikanan*, *1*(1), 89–95.

Ichsan, M., Simeon, B. M., Muttaqin, E., Ula, S., & Booth, H. (2019). Shark fisheries and trade characteristic in North Maluku, Indonesia. *IOP Conference Series: Earth and Environmental Science*, *348*(1), 12013. http://dx.doi.org/10.1088/1755-1315/348/1/012013

Ilham, I., & Marasabessy, I. (2021). Identifikasi Jenis dan Status Konservasi Ikan Pari yang Diperdagangkan Keluar Kota Sorong pada Loka Pengelolaan Sumberdaya Pesisir dan Laut Sorong. *Jurnal Riset Perikanan Dan Kelautan*, *3*(1), 290–302. Retrieved from https://ejournal.um-sorong.ac.id/index.php/jrpk/article/view/1273

Jarwanto, S., Isnaniah, I., & Syofyan, I. (2014). *Efficiency of trawl cod end for catching result in Lambur Luar East Muara Sabak East Tanjung Jabung Jambi Province*. Riau University.

KKP. (2014). *Peraturan Menteri Kelautan Dan Perikanan Republik Indonesia Nomor 18/PERMEN KP/2014 Tentang Wilayah Pengelolaan Negara Republik Indonesia*.

KKP. (2020). *Keputusan Menteri Kelautan dan Perikanan Republik Indonesia Nomor 78 Tahun 2020 Tentang Kawasan Konservasi Perairan Aceh Besar, Kawasan Konservasi Perairan Pulau Pinang, Pulau Siumat, Pulau Simanaha, dan Kawasan Konservasi Perairan Aceh Selatan Di Provins*.

KKP. (2021). *Keputusan Menteri Kelautan dan Perikanan Republik Indonesia Nomor 1 Tahun 2021 Tentang Jenis Ikan Yang Dilindungi*.

Lesmana, F., Ulfah, M., & Rizwan, R. (2018). Identifikasi spesies hiu yang tertangkap di Perairan Utara Aceh. *Jurnal Ilmiah Mahasiswa Kelautan Perikanan Unsyiah*, *3*(1).

Mardhiah, U., Booth, H., Simeon, B. M., Muttaqin, E., Ichsan, M., Prasetyo, A. P., & Yulianto, I. (2019). Quantifying vulnerability of sharks and rays species in Indonesia: Is biological knowledge sufficient enough for the assessment? *IOP Conference Series: Earth and Environmental Science*, *278*(1), 12043. https://doi.org/10.1088/1755-1315/278/1/012043

Marliani, N. (2018). Spesies Ikan Bertulang Keras (Ostheichethes) Hasil Tangkapan Nelayan di Kawasan Pante Raja Kabupaten Pidie Jaya. *Prosiding Seminar Nasional Biologi, Teknologi Dan Kependidikan*, *3*(1).

Marshall, A. D., Bennett, M. B., Kodja, G., Hinojosa-Alvarez, S., Galvan-Magana, F., Harding, M., Stevens, G., & Kashiwagi, T. (2016). *Manta birostris. The IUCN Red List of Threatened Species 2011: e. T198921A9108067*.

Melanie, K., Rianjuanda, D., Zulfahmi, I., Indra, I., & Dirgantara, R. (2019). Fish Species of fishermen's catches in Siumat Island, Simeulue Timur Sub-District, Simeulue, Aceh Province, Indonesia. *IOP Conference Series: Earth and Environmental Science*, *348*(1), 12118. https://doi.org/10.1088/1755-1315/348/1/012118

Muttaqin, E., B.M Simeon., M. Ichsan., Dharmadi., A.P Prasetyo., H. Booth., I. Yulianto., & K. Friedman. (2018). *The Scale, Value and Importance of Non-Fin Shark and Ray Commoditas In Indonesia*. FAO.

Nazir, M. (1988). MetodePenelitian. *Jakarta: Ghalia Indonesia*.

Nur, F. M., Batubara, A. S., Fadli, N., Rizal, S., Siti-Azizah, M. N., & Muchlisin, Z. A. (2022). Diversity, distribution, and conservation status of Betta fish (Teleostei: Osphronemidae) in Aceh Waters, Indonesia. *The European Zoological Journal*, *89*(1), 142–151.

https://doi.org/10.1080/24750263.2022.2029587

Oktaviyani, S., Kurniawan, W., & Fahmi, F. (2020). Species composition and size distribution of sharks and rays caught in Bali Strait and its surrounding area and its relation to fisheries management. *Jurnal Iktiologi Indonesia*, *20*(1), 23–46. https://doi.org/10.32491/jii.v20i1.509

Pimiento, C., Leprieur, F., Silvestro, D., Lefcheck, J. S., Albouy, C., Rasher, D. B., Davis, M., Svenning, J.-C., & Griffin, J. N. (2020). Functional diversity of marine megafauna in the Anthropocene. *Science Advances*, *6*(16), eaay7650. https://doi.org/10.1126/sciadv.aay7650

Rahman, A., Haryadi, J., Sentosa, A. A., & Mujiyanto, M. (2017). Kajian Awal Kemunculan Hiu Paus (Rhyncodon typus, Smith 1828) di Teluk Tomini Dihubungkan dengan Faktor Fisik dan Biologi Perairan. *Jurnal Akuatika Indonesia*, *2*(2), 128–137. Retrieved from https://jurnal.unpad.ac.id/akuatika-indonesia/article/view/23425/

Reynolds, J. D., Dulvy, N. K., Goodwin, N. B., & Hutchings, J. A. (2005). Biology of extinction risk in marine fishes. *Proceedings of the Royal Society B: Biological Sciences*, *272*(1579), 2337–2344.

Sentosa, A. A. (2017). Karakteristik Biologi Hiu dan Pari Appendiks II CITES yang Didaratkan di Tanjung Luar, Lombok Timur. *Seminar Nasional Tahun XIV Hasil Penelitian Perikanan Dan Kelautan*, *22*.

Setiati, N., Peniati, E., & Partaya, P. (2018). Diversity and Conservation Knowledge of Chondrichthyans in Northern Coastal Areas of Central Java. *Biosaintifika: Journal of Biology & Biology Education*, *10*(2), 471–476. https://doi.org/10.15294/biosaintifika.v10i2.15341

Sherman, C. S., Simpfendorfer, C. A., Pacoureau, N., Matsushiba, J. H., Yan, H. F., Walls, R. H. L., Rigby, C. L., VanderWright, W. J., Jabado, R. W., & Pollom, R. A. (2023). Half a century of rising extinction risk of coral reef sharks and rays. *Nature Communications*, *14*(1), 15. https://doi.org/10.1038/s41467-022-35091-x

Simeon, B. M., Fajri, I., Ula, S., Muttaqin, E., Ichsan, M., Dharmadi, D. A., & Sarong, A. (2020). Laporan teknis pemantauan hasil tangkapan hiu dan pari di Provinsi Aceh. *Wildlife Conservation Society*.

Simeon, B. M., Muttaqin, E., Ichsan, M., Tarigan, S., & Yulianto, I. (2018). *Kajian Habitat Penting Hiu Dan Pari Di Lunyuk*.

Syahara, L. (2019). *Identifikasi dan Pertumbuhan Ikan Pari (Dasyatidae) di Perairan Kuala Tanjung-Batubara-Sumatera Utara*. Universitas Sumatera Utara.

Ulfah, S., Agustina, E., & Hidayat, M. (2018). Struktur Komunitas Makroalga Ekosistem Terumbu Karang Perairan Pantai Air Berudangn Kabupaten Aceh Selatan. *Prosiding Seminar Nasional Biologi, Teknologi Dan Kependidikan*, *5*(1).

White, W. T., Last, P. R., Stevens, J. D., & Yearsly, G. K. (2006). *Economically important sharks and rays of Indonesia*.

Wijayanti, F., Abrari, M. P., & Fitriana, N. (2018). Keanekaragaman spesies dan status konservasi ikan pari di tempat pelelangan ikan Muara Angke Jakarta Utara. *Jurnal Biodjati*, *3*(1), 23–35. https://doi.org/10.15575/biodjati.v3i1.1613

Yesayas, N. E., & Sugito, B. (2021). Log-18 Analisis Ekspor Ikan Kerapu Di Wilayah Kantor Pengawasan Dan Pelayanan Beacukai Tipe Madya Pabean C Tual. *Prosiding Seminar Nasional Teknologi Energi Dan Mineral*, *1*(2), 1384–1389.

Yulita, N., & Susiono, D. E. (2020). Nilai Ekologi (Ecological Value) Hiu Hasil Tangkapan Nelayan di PPN Brondong Lamongan Jawa Timur. *Biotropika: Journal of Tropical Biology*, *8*(1), 19–25. https://doi.org/10.21776/ub.biotropika.2020.008.01.04

Yuwandana, D. P., Agustina, S., Haqqi, M. B., & Simeon, B. M. (2020). Studi awal perikanan pari kekeh (Rhynchobatus sp.) dan pari kikir (Glaucostegus sp.) di Perairan Utara Jawa Tengah. *Jurnal Akuatika Indonesia*, *5*(1), 1–6. http://dx.doi.org/10.24198/jaki.v5i1.25938

Zainudin, I. M. (2011). Pengelolaan Perikanan Hiu Berbasis Ekosistem di Indonesia [Tesis]. *Program Pascasarjana Universitas Indonesia. Depok*.

Zulfahmi, I., Apriansyah, M., Batubara, A. S., Kautsari, N., Sumon, K. A., Rahman, M. M., & Nur, F. M. (2022). Commercial marine fish species from Weh Island, Indonesia: Checklist, distribution pattern and conservation status. *Biodiversitas Journal of Biological Diversity*, *23*(4). http://dx.doi.org/10.13057/biodiv/d230432