

Checklist of commercially important Scombridae in Aceh, Indonesia

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Abstract. The Scombridae family represents one of the most commercially valuable groups of pelagic fish, widely consumed across the globe. Despite their economic importance and high market demand, scientific data on Scombridae species in Aceh remains scarce. This study aimed to document Scombridae landings from Aceh waters. Fish samples belonging to the Scombridae family were collected from several Fish Landing Sites (TPIs) across Aceh Province. The collected samples were subsequently analyzed at the Genetics and Aquatic Biodiversity Laboratory, Faculty of Marine and Fisheries, Universitas Syiah Kuala. A total of ten Scombridae species were identified from the collected samples: *Auxis rochei*, *Auxis thazard*, *Euthynnus affinis*, *Katsuwonus pelamis*, *Rastrelliger brachysoma*, *Rastrelliger kanagurta*, *Scomberomorus commerson*, *Scomberomorus guttatus*, *Sarda orientalis*, and *Thunnus albacares*. Banda Aceh had the highest distribution of fish of the Scombridae family, followed by Meulaboh. The findings of this study provide critical baseline data for the future management and conservation of Scombridae fish, particularly in Aceh and Indonesia more broadly.

1 Introduction

The Scombridae family comprises pelagic fishes, including tuna, skipjack, and mackerel [1]. These fishes are known for their fast-swimming capabilities and wide-ranging behavior [2].

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Globally, the family includes 51 species distributed across 15 genera, divided into two sub-families: Scombrinae and Gasteriocismatinae. In Indonesia, 18 species within 11 genera from this family have been identified [2]. The most commonly caught Scombridae fishes in Indonesian waters belong to the genera *Katsuwonus*, *Rastrelliger*, *Thunnus*, *Scomberomorus*, and *Euthynnus* [3].

Scombridae fishes are of significant commercial importance. According to data from the Ministry of Marine Affairs and Fisheries (KKP) in 2022, Scombridae fish production in Indonesia reached 1,666,430 tons annually. Furthermore, over the past two years, Indonesia successfully exported various Scombridae products, including fillets and frozen forms of tuna, skipjack, and mackerel, with a market value exceeding 13 trillion rupiah (<https://www.tridge.com/>). Due to high market demand, several Scombridae species have been classified as endangered on the IUCN Red List, including *Scomberomorus munroi*, *Scomberomorus concolor*, *Thunnus maccoyii*, *Scomberomorus commerson*, *Thunnus obesus*, and *Thunnus orientalis* [4].

Scientific information, particularly species list and molecular data, plays a critical role in fisheries management. Over the past two decades, molecular studies have become widely employed to support fisheries management efforts [5-6], including for Scombridae species [7-10]. For instance, [10] utilized genetic approaches to investigate the relatedness of 18 species of the genus *Scomberomorus* in India. Similarly, [7] demonstrated that Atlantic mackerel (*Scomber colias*) populations in the Middle East Atlantic form a single genetic stock. The present study aims to document Scombridae species landed at fish landing sites in Aceh, providing essential reference data to inform fisheries management strategies in the region.

2 Material and methods

Scombridae fish samples were collected from several fish landing sites in Aceh, including Banda Aceh, Meulaboh, Langsa, and Simeulue from May to October 2024 (Fig. 1). Species identification was conducted following the guidelines of Froese and Pauly (2024). The collected specimens were transported to the Laboratory of Aquatic Genetics and Biodiversity, Faculty of Marine and Fisheries, Universitas Syiah Kuala, for further analysis. The sample size adhered to the recommendations of [11], with five specimens collected per species. Additionally, the conservation and trade status of the identified Scombridae species was determined using data from the International Union for Conservation of Nature (IUCN) Red List (<http://www.iucnredlist.org>) and the Convention on International Trade in Endangered Species (CITES) (<http://www.cites.org>). Local distribution data were analyzed based on the methodology outlined in [12] as follows:

$$D = \frac{N_{i.st}}{N.st} \times 100 \quad (1)$$

Where:

D = Local Distribution

$N_{i.st}$ = Total number of sites where fish were found

$N.st$ = Total number of sampling sites

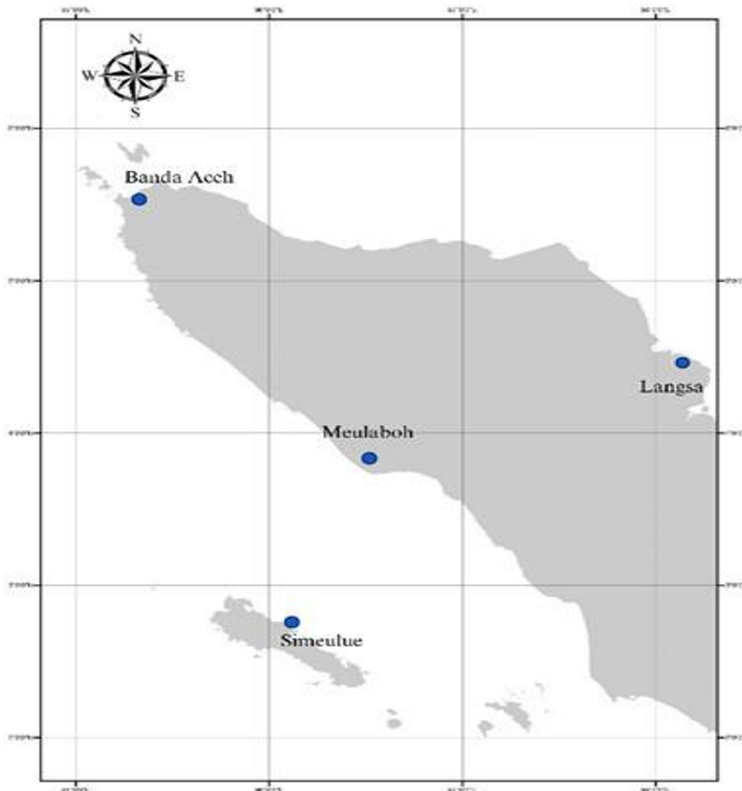


Fig. 1. Map of Aceh showing sampling site.

3 Result and Discussion

3.1. Distribution and species composition

In total, 10 species from 7 genera of the Scombridae family were identified across four fish landing sites in Aceh (Table 1). Banda Aceh exhibited the highest species distribution, followed by Meulaboh. In contrast, Simeulue and Langsa had lower species diversity, with only two species recorded in Simeulue and one species in Langsa. *Auxis rochei*, *Euthynnus affinis*, and *Rastrelliger kanagurta* were the most abundant species across all study sites. According to [13], tuna, a key member of the Scombridae family, represents an essential resource in international trade and contributes significantly to the economies of fishing-dependent countries. However, overfishing and unsustainable fishing practices pose a severe threat to global Scombridae populations [14].

In terms of local distribution, *Euthynnus affinis*, *Auxis rochei*, and *Rastrelliger kanagurta* demonstrated the highest local distribution rates (75%), being present in Banda Aceh, Meulaboh, and Simeulue. Conversely, *Auxis thazard*, *Scomberomorus commerson*, *Scomberomorus guttatus*, *Rastrelliger brachysoma*, and *Sarda orientalis* exhibited the lowest local distribution rates (25%) and were absent in many sampling locations.

The Scombridae family is among the most widely distributed fish groups globally and is recognized as one of the most commercially significant fish families in various countries, including the United Arab Emirates [15], Malaysia [16], China [17], India [18], and Indonesia [19].

Table 1. List of groupers in Aceh fish landings.

No	Genus	Species	1	2	3	4	D	IUCN Status	Population Trend
1	<i>Thunnus</i>	<i>Thunnus albacares</i>	+		+		50	LC	Decreasing
2	<i>Auxis</i>	<i>Auxis rochei</i>	+		+	+	75	LC	Stable
3		<i>Auxis thazard</i>	+				25	LC	Stable
4	<i>Katsuwonus</i>	<i>Katsuwonus pelamis</i>	+		+		50	LC	Decreasing
5	<i>Scomberomorus</i>	<i>Scomberomorus commerson</i>	+				25	NT	Decreasing
6		<i>Scomberomorus guttatus</i>			+		25	LC	Unknown
7	<i>Euthynnus</i>	<i>Euthynnus affinis</i>	+		+	+	75	LC	Unknown
8	<i>Rastrelliger</i>	<i>Rastrelliger kanagurta</i>	+	+	+		75	LC	Stable
9		<i>Rastrelliger brachysoma</i>	+				25	V	Decreasing
10	<i>Sarda</i>	<i>Sarda orientalis</i>	+				25	LC	Unknown
			9	1	6	2			

Note: 1: Banda Aceh; 2: Langsa; 3: Meulaboh; 4: Simeulue; D: Local distribution (%); LC: Least Concern; NT: Near Threatened; V: Vulnerable.

3.2. Conservation and trade status

Based on the IUCN categories, of the 10 identified species, 8 are listed as Least Concern, 1 as Near Threatened (*Scomberomorus commerson*), and 1 as Vulnerable (*Rastrelliger brachysoma*). Additionally, 4 species exhibited a decreasing population trend, while 3 species were classified as stable. According to [20], excessive fishing pressure on ecosystems, particularly targeting species like *Thunnus albacares*, prevents fish populations from growing and sustaining themselves. Furthermore, [21] reported that *Rastrelliger kanagurta* is predominantly caught using purse seines and gill nets in coastal areas, making it especially vulnerable to overfishing. This vulnerability is reflected in the observed decline in its population.

4 Conclusion

This study provides a comprehensive checklist of Scombridae species identified at key fish landing sites in Aceh. A total of 10 species from 7 genera were recorded. *Auxis rochei*, *Euthynnus affinis*, and *Rastrelliger kanagurta* exhibited the highest local distribution rate (75%). Of the identified species, one (*Rastrelliger brachysoma*) is classified as Vulnerable, and another (*Scomberomorus commerson*) is classified as Near Threatened according to IUCN status. Additionally, the population trend for the Scombridae family indicates that 4 out of 10 species are experiencing a decline, largely attributed to the increasing intensity of fishing activities. The findings of this study provide valuable baseline data for future research and conservation efforts.

References

1. B.B. Collette, C. Reeb, B.A. Block, Systematics of the tunas and mackerels (Scombridae). Fish Physiology. Academic Press (2001)
2. R. Froese, D. Pauly, FishBase. <https://www.fishbase.us/>, accessed on July 20, 2024.
3. A. Andari, Komposisi Hasil Tangkapan Longline Di Pelabuhan Perikanan Nusantara (PPN) Prigi Kabupaten Trenggalek, Jawa Timur. Universitas Brawijaya (2017)
4. IUCN, The IUCN Red List of Threatened Species. Version 2019-1. Online <http://www.iucnredlist.org>, accessed 21 March 2019

5. R.D. Ward, Genetics in fisheries management. *Hydrobiologia*, **420**, 191-201 (2000)
6. A. Pavan-Kumar, A.K. Jaiswar, P. Gireesh-Babu, A. Chaudhari, G. Krishna Applications of Dna Barcoding In Fisheries. In: Trivedi, S., Rehman, H., Saggi, S., Panneerselvam, C. & Ghosh, S. K. (eds.) DNA barcoding and molecular phylogeny. Cham: Springer International Publishing (2018)
7. A.N. Stroganov, A.I. Nikitenko, T. A. Rakitskaya, V.A. Belyaev, Study of Population Genetic Structure of Atlantic Mackerel *Scomber colias* Gmelin, 1789 (Scombridae) in the Central East Atlantic. *Russian Journal of Genetics*, **59**, 66-72 (2023)
8. J. Ollé, L. Vilà-Valls, J. Alvarado-Bremer, G. Cerdaneres, T.Y. Duong, G. Hajjej, P. G. Lino, R. Muñoz-Lechuga, F.N. Sow, N. G.C. Diaha, R.M. Araguas, N. Sanz, J. Viñas, Population genetics meets phylogenetics: new insights into the relationships among members of the genus *Euthynnus* (family Scombridae). *Hydrobiologia*, **849**, 47-62 (2022)
9. X.S. Zeng, C.H. Sun, X.Y. Huang, Y.L. Lao, J.L. Huang, S. Li, Q. Zhang, DNA barcoding of *Scomberomorus* (Scombridae, Actinopterygii) reveals cryptic diversity and misidentifications. *Zookeys*, **1135**, 157-170 (2022)
10. N.S. Jeena, S. Rahuman, S.K. Roul, P.A. Azeez, R. Vinothkumar, H.M. Manas, E.A. Nesnas, A.M.M. Rathinam, S. Surya, P. Rohit, E.M. Abdussamad, A. Gopalakrishnan, Resolved and Redeemed: A New Fleck to the Evolutionary Divergence in the Genus *Scomberomorus* Lacepède, 1801 (Scombridae) With Cryptic Speciation. *Frontiers in Marine Science*, **9** (2022)
11. J. Keyse, E.D. Crandall, R.J. Toonen, C.P. Meyer, E.A. Treml, C. Riginos, The scope of published population genetic data for Indo-Pacific marine fauna and future research opportunities in the region. *Bulletin of Marine Science*, **90**, 47-78 (2014)
12. Z.A. Muchlisin, M. Siti-Azizah, Diversity and distribution of freshwater fishes in Aceh waters, northern Sumatra Indonesia *International Journal of Zoological Research* **5** 62-79 (2009)
13. T.E. Essington, P.E. Moriarty, H.E. Froehlich, E.E. Hodgson, L.E. Koehn, K.L. Oken, M.C. Siple, C.C. Stawitz, *Fishing amplifies* (2015)
14. C. Willis, M. Bailey, Tuna trade-offs: Balancing profit and social benefits in one of the world's largest fisheries. *Fish and Fisheries*, **21**, 740-759 (2020)
15. E. Farrag, A. Al-Zaabi, & M. Alshaer, Catch analysis of the speed boat fishery in the united arab emirates. *International Journal of Development Research*, **11**(02), 44891-44899. (2021)
16. Farhana-Azmi, B. Nur, Mabel Manjaji-Matsumoto, Nasrulkhakim Maidin, Jonathan Balang John, Elvin Michael Bavoh, and Ejria Saleh. "Checklist of coral reef fishes of Darvel Bay, Sabah, Malaysian Coral Triangle, with a note on the biodiversity and community structure." *Biodiversity Data Journal* **10** (2022)
17. J. Cheng, T. Gao, Z. Miao, & T. Yanagimoto, Molecular phylogeny and evolution of *Scomber* (Teleostei: Scombridae) based on mitochondrial and nuclear DNA sequences. *Chinese Journal of Oceanology and Limnology*, **29**(2), 297-310. (2011)
18. Rajan, P. Rajkumar, T. Rajan, S. S. Mishra, C.N. Abdul Raheem, and A.T. Damodhar, "Fishes of Lakshadweep archipelago: new records, review and a revised checklist." *Marine Biodiversity Records* **14**, no. 1, 14 (2021)
19. Z. Ilham, M. Apriansyah, A.S. Batubara, N. Kautsari, K.A. Sumon, M.M. Rahman, and F.M. Nur. "Commercial marine fish species from Weh Island, Indonesia: Checklist, distribution pattern and conservation status." *Biodiversitas Journal of Biological Diversity* **23**, no. 4 (2022)
20. D. Agustian, E.N. Megantara, Y.N. Ihsan, M.F. Cahyandito, Analisis Tren Ukuran Tuna Mata Besar (*Thunnus obesus*) dan Tuna Sirip Kuning (*Thunnus albacares*) di Pelabuhan

Perikanan Nusantara Palabuhan Ratu. *JFMR-Journal of Fisheries and Marine Research*, **5**(3), 685-693 (2021)

21. A. Wujdi, H.J. Kim, C.W. Oh, Population structure of Indian mackerel (*Rastrelliger kanagurta*) in Java and Bali Island, Indonesia inferred from otolith shape. *Sains Malays*, **51**(1), 39-50 (2022)