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Species Composition of Aquatic Resources in Lantebung Mangrove Ecotourism Area, Makassar, Indonesia

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The mangrove ecotourism area is an alternative place for recreation for the community, so it is thought to disturb aquatic resources. This study aims to analyze the species composition of aquatic resources in the Lantebung mangrove ecotourism area. Data collection used a survey method, and the research was conducted from October to November 2023 in the Lantebung mangrove ecotourism area in Makassar, Indonesia. The results showed that the composition of fish species consisted of five dominating fish species, namely Tawes (Garres abbreviatus) 3904 fish (39.40%), Peperek (Nuchequula nuchalis) 2389 fish (24.11%), Peperek (Eubleekeria splendens) 1021 fish (10.30%), Rejung fish (Sillago robusta) 975 fish (9.84%), and Peperek (Leiognathus longispinis) 910 fish (9.18%). The diversity of aquatic resources included 29 species of fish with 9985 individuals, 19 species of crustaceans with 117 individuals, ten species of Mollusca with one individual in each species, and one species of Cnidaria with one individual. The highest fish species composition is Tawes fish (Garres abbreviatus), and the lowest type is Cnidaria.

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1. INTRODUCTION

Mangrove forests in Indonesia are scattered in several provinces, one of which is in Makassar, South Sulawesi Province. Makassar City is one of the cities with mangrove potential with an area of 25 ha. The northern area is approximately 1,000 x 250 m, and the southern area is approximately 700 x 50 m [1]. The mangrove area provides ecological benefits as a spawning, nurturing, and feeding location for various fish, shrimp, crabs, and other marine life [2].

Mangroves have ecosystem services to maintain the diversity of aquatic resources. According to Duke et al. [3], mangroves can provide direct and indirect benefits, such as fishing around mangrove forests. In addition to the internal value and beauty of mangroves, mangrove ecosystems provide services, such as absorbing CO_2 in the air and shelter for fish, crabs, shellfish, seagrass, and coral reef zones.

Mangrove ecosystems also have a wide range of physical, biological, and economic functions. In addition, marine organisms also use mangrove ecosystems to start the food chain by utilizing mangrove litter. On the other hand, people also often use the area around mangroves as ponds. Mangroves are cut down as firewood and medicinal materials [4].

However, over time, the diversity of aquatic resources can be threatened by human activities and habitat factors resulting from mangrove habitat degradation, pollution, climate change, overfishing and resource extraction, mangrove diseases, and species invasions. Degraded mangroves can threaten the survival of many species that depend on these ecosystems. It can lead to the disruption of the balance of the mangrove ecosystem.

This research is necessary because the diversity of aquatic resources plays an essential role in natural resource conservation efforts. In addition, aquatic resources include various organisms, including fish, microorganisms, and aquatic plants, that help maintain the balance and stability of aquatic ecosystems. This study aims to analyze the species composition of aquatic resources in the Lantebung mangrove ecosystem in Makassar City.

2. METHODS

2.1 Research Location

This research was conducted in the Lantebung mangrove ecotourism area from October to November 2023.

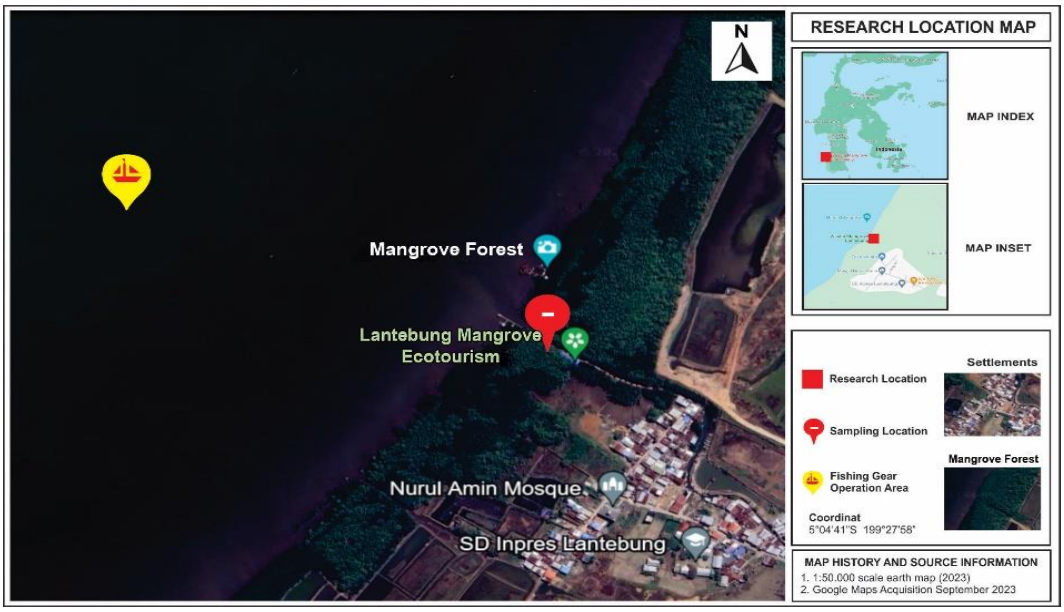

Fig. 1. Research Location Map

2.2 Data Collection Methods

The data collected are primary data and secondary data. Primary data, such as samples of aquatic resource species composition, are collected by survey and direct involvement in the fishing process. Fishing surveys carry out data collection to identify types of aquatic resources. Fishing surveys are carried out in collaboration with local fishermen. Secondary data is data taken from literature studies.

Species composition of aquatic resources was done by identifying and recording species of fish and aquatic organisms using guidelines from the web pages www.fishbase.se and www.fishider.org.

2.3 Data Analysis

The species composition of aquatic resources can be calculated based on the equation [5]:

$$Ks = \frac{ni}{N} \, x \, 100\%$$

Description:

Ks : fish species composition (%)
Ni : number of individuals of each fish species
N : number of individuals of all fish species

3. RESULTS AND DISCUSSION

Lantebung mangrove forest provides an environment for various fish and other aquatic resources. Various fish species, crustaceans, mollusca, and Cnidaria were obtained during the study. The following aquatic resource analyses were conducted, with fish species composition as the representative.

3.1 Composition of Fish Species

Fish collected during the study from various fishing gear (Gill nets, Rakkang, and Bubu (Fig 2)) totaled 9985 fish consisting of 29 fish species. Of the 29 species recorded, only one type of fish is classified as cartilaginous fish, namely stingray (*Hypanus sp.*), while the other 28 fish species are classified as true bony fish. The types of fish recorded from various types of net catches, Rakkang, and Bubu gear during the study are shown in Fig. 3.

The top five fish species were Tawes (*Garres abbreviatus*) with 3904 fish (39.40%), Peperek (*Nuchequula nuchalis*) with 2389 fish (24.11%), Peperek (*Eubleekeria splendens*) with 1021 fish (10.30%) and Rejung (*Sillago robusta*) with 975 fish (9.84%) and Peperek (*Leiognathus longispinis*) with 910 fish (9.18%).

Meanwhile, the least number of fish caught were grouper (*Epinephelus sexfasciatus*), puffer fish (*Arothron manilensis*), Jangki Timun fish (*Scolopsis vosmeri*), Hayam fish (*Aluterus scriptus*), Stingray fish (*Hypanus sp*), glass fish (*Ambassis interrupta*), Mud Stargazer fish (*Uranoscopus scaber*), and Glodok fish (*Boleophthalmus boddarti*).

The most fish samples collected in this study were Tawes (*Garres abbreviatus*). However, when viewed from the species based on the family, the peperek species from the Leiognathidae family dominates the species composition with four species. According to Kottelat and Whitten [6], this species prefers the waters of river estuaries, inhabits shallow waters, and can also be found in estuary areas. Then, [7] added that the Leiognathidae tribe is dominant in the waters around Jakarta Bay.

The species composition of Peperek fish was 2389 (24.11%), *Eubleekeria splendens* (1021 (10.30%)), *Leiognathus longispinis* (910 (9.18%)) and *Gazza minuta* (368 (3.71%)) with the total number of Peperek fish species being 4688 (47.30%) of the total catch.

The diversity of fish caught around the Lantebung mangrove greatly impacts the ecosystem ecologically and economically on fishermen. Fachrul [5] argues that species diversity and wide fish distribution are essential in maintaining the water's food chain cycle balance.

The presence of mangrove forests around these water areas causes the environment to be fertile because mangroves provide organic matter that supports the life of aquatic biota in the ecosystem. This condition makes mangroves a suitable habitat for biota to find food. Peperek fish utilize zooplankton, molluscs, crustaceans, nematodes, and phytoplankton as food [8]. Meanwhile, Tawes or Selanget fish inhabit habitats at the bottom of coastal and estuary waters. They obtain their food from bottom organisms and detritus, with bacillariophyceae as the primary food, microcrustaceans as supplementary food, and molluscs larvae as supplementary food [9].

a. Gill nets b. Rakkang c. Bubu

Fig. 2. Lantebung fishermen's fishing gear

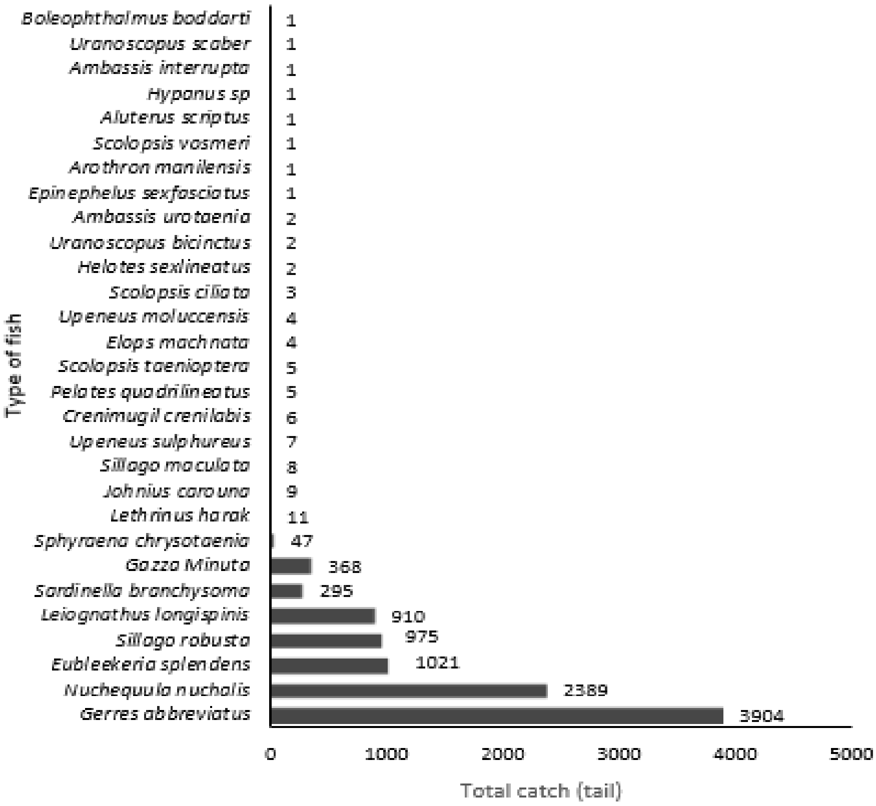

Fig. 3. Types of fish caught in Lantebung

The abundance of Peperek fish and Tawes fish is thought to be influenced by the availability of food in their habitat in the mangrove ecosystem. [10] stated that the availability of fish food in a habitat will affect the individual, then will have an impact on higher trophic levels, such as populations and communities, and this relationship contributes to species interactions [11]. Even [12] found a positive relationship between food availability and individual growth and abundance.

For several reasons, other fish species caught with low species composition entered the mangrove ecosystem. According to Laegdsgaard and Johnson [13], these are (1) protection against predators; prey fish will enter mangrove areas to shelter from predators. This situation arises due to the complex root structure of mangroves, which inhibits the movement of predators, and the high level of turbidity reduces the visibility of predators; (2) food-related, which indicates that this ecosystem provides a variety of food associated with high productivity. It leads to high abundance and diversity of fish in the mangrove ecosystem.

Fish diversity in the Lantebung mangrove ecosystem is relatively high compared to the results of research from the Ciporeang River in Leuweung Sancang Nature Reserve, which only obtained six fish species [14]. In comparison, research conducted [15] collected 15 species of fish in the mangrove waters of the Donan River and Sapuregel River, Cilacap.

3.2 Diversity of Aquatic Resources

The diversity of aquatic resources in Lantebung mangrove ecotourism waters consists of 29 species of fish, 19 species of crustaceans, ten species of mollusks, and one species of Cnidaria. There are 59 types of resources with 10113 species in the mangrove ecotourism waters, with the following description.

3.2.1 Fish species

Fig 2 shows that 29 types of fish samples were found during the study, with a total of 9985 fish. Samples of various fish species were obtained through fishing gear used by fishermen in the waters around the Lantebung mangrove, except for Glodok fish (*Boleophthalmus boddarti*), which was obtained through hand-catching at the Lantebung mangrove site. Glodok fish species are often found around mangrove forest habitats at low tide [16]. Glodok fish, commonly known as mudskipper, is one of the bioindicator fish species in mangrove ecosystems.

3.2.2 Types of crustaceans

Crustaceans were caught using two types of fishing gear, Rakkang and Bubu. Some crustaceans were also caught by hand around the mangrove habitat. The total number of crustaceans identified was 19 species, with 117 individuals (Figure 4). Gazami crab (*Portunus trituberculatus*) was the most dominant species with 30 species, and then the second most species was king crab (*Portunus pelagicus*), followed by the third most species was Vaname shrimp (*Litopenaeus vannamei*) with 17 species. Samples found in the mangrove forest included several species, including: Fiddler crab (*Uca annulipes*, *Uca acuta, Uca tetragonon*), Beach crab (*Metopograpsus frontalis*, *Metopograpsus thukuhar*), and Krama crab (*Episaserma sp*), each with one species.

In crustaceans, catches are dominated by crabs because sandy and muddy habitats are habitats favoured by crabs. According to Kangas [17], crabs prefer sand and muddy-sand substrate types. Sand substrates make it easier to move to other places, while mud substrates usually contain little oxygen, so the organisms that live in them must be able to adapt to this situation. As for the opinion of Moosa and Burhanuddin [18], it strengthens the assumption that the Portunus clan lives in various habitats, namely sandy mud, sand, and muddy sand.

The catch is Vaname shrimp (*Litopenaeus vannamei*) around the Lantebung mangrove. The research results [19] state that mangrove leaf litter increases the immune response and survival of Vaname shrimp (*Litopenaeus vannamei*). The samples obtained in the mangrove forest habitat of one tail each, among others: Fiddler crab (*Uca annulipes*, *Uca acuta*, and *Uca tetragonon*), Beach crab (*Metopograpsus frontalis*, *Metopograpsus thukuhar*) and Krama crab (*Episaserma sp*).

Many types of crustaceans are found during low tides, such as the Fiddler crab, which consists of *Uca annulipes*, *Uca acuta*, and *Uca tetragonon*. According to Wilsey [20], several types of Uca can live together in the same habitat, but these types usually have different behavioral patterns and microhabitats so that the ecological niches of these crabs can be separated. The density of Biola crab species, namely Uca tetragonon, can be found near the mouth of the river towards the sea at low tide. Yulianto [21] stated that the density of Uca tetragonon species is influenced by the high frequency of submerged habitats.

While in mangrove trees, beach crabs or crabs of *Metopograpsus frontalis* and *Metopograpsus thukuhar* were found. Among the mangrove trees were krama crabs (*Episaserma* sp) and holes in the muddy soil as habitat and shelter. Arsana [22] argues that substrate grain size determines crab distribution because crabs have shown morphological adaptations to substrate conditions.

3.2.3 Types of mollusca and cnidaria

There are 11 species of Mollusca and Cnidaria, divided into 10 Mollusca and one Cnidaria (Fig 5). Each resource totaled one species. The Cnidaria species Jellyfish (*Aurelia aurita*) was found during high tide and entered the mangrove area.

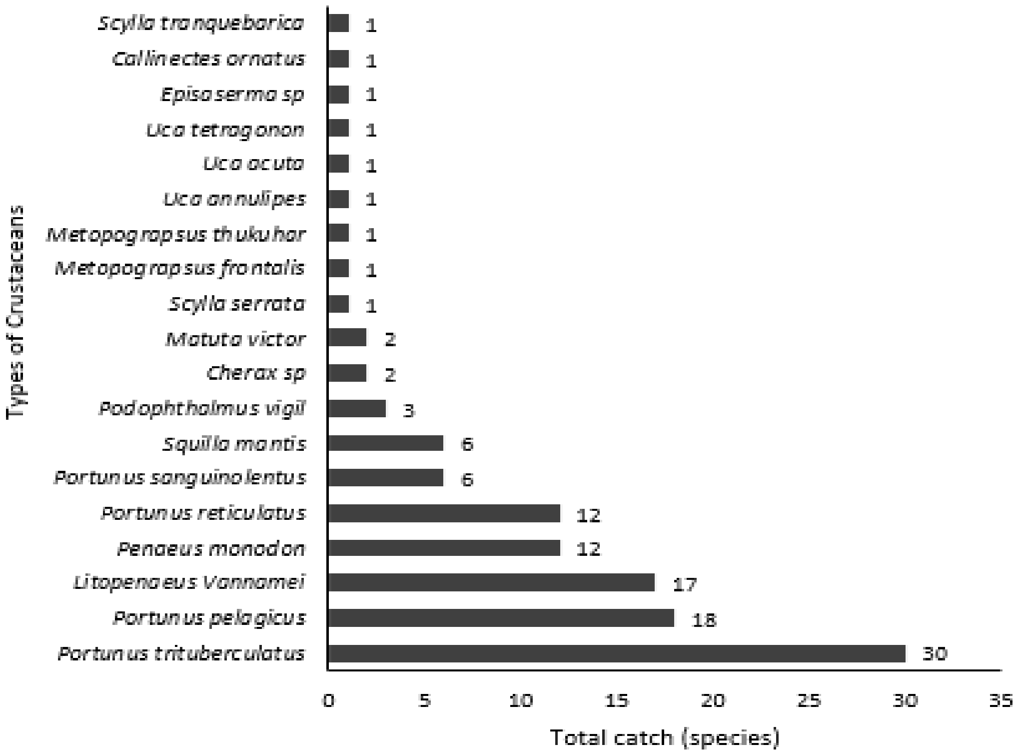

Fig. 4. Crustacean species caught during the study

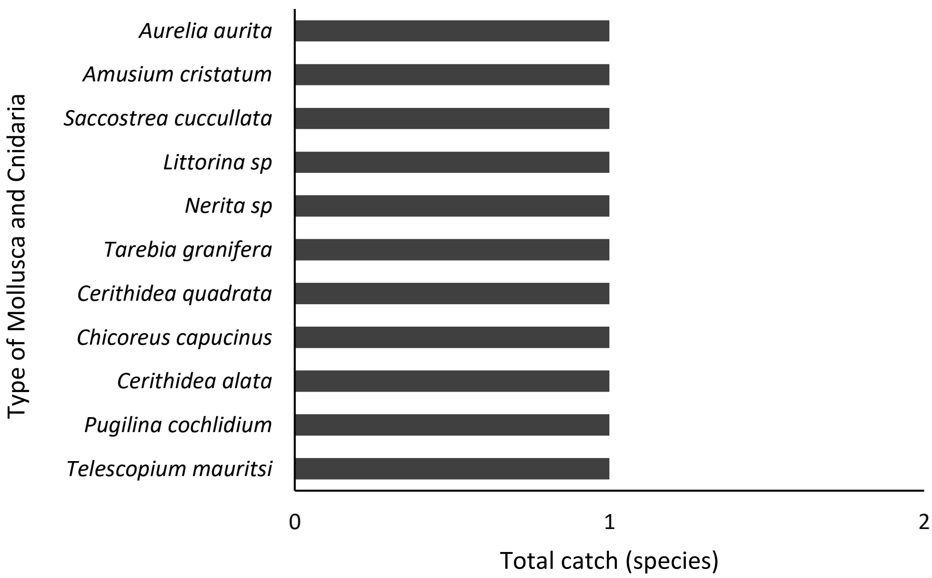

Fig. 5. Types of Mollusca and Cnidaria caught

The types of mollusks caught include Telescope snail (*Telescopium mauritsi*), Unam snail (*Pugilina cochlidium, Chicoreus capucinus*), Belitung snail (*Cerithidea alata, Cerithidea quadrata, Tarebia granifera*), Sea snail (*Nerita sp*., *Littorina sp*.) and While two types of oysters, namely Batu oyster (*Saccostrea cuccullata*) and Simping oyster (*Amusium cristatum*).

According to Rachman and Arianti [23], the mangrove ecosystem area is one of the habitats for mollusk groups. In addition to being a habitat, mangroves also function to provide food and other organic sources. Maturbongs et al. [24] added that environmental factors affecting mollusks' distribution include air temperature and water temperature, water pH, soil pH, and salinity. According to Alfitriatussulus [25], mollusks generally tolerate a temperature range of 0-48°C. Another type of resource is the type of Cnidaria, namely jellyfish species (*Aurelia aurita*). One of the factors causing the discovery of this type of resource is thought to be due to tidal factors. When the tide occurs, jellyfish species enter the mangrove habitat along with the rising water level. According to Barz et al. [26], Aurelia aurita is found more near the coast than in the middle of the sea. Jellyfish are more commonly found in shallow waters, and the presence of freshwater flows from rivers or mangrove swamps [27].

The function of mangrove ecosystems as a feeding, spawning, and nursery ground will gather various types of resources and make mangroves a suitable habitat. According to Mahmudi [28], the influx of nutrients from mangrove leaf litter is one factor affecting the productivity of aquatic biota in coastal areas. Fish resources in the ecosystem, either sedentary or just transit to spawn and raise their young, further add to the diversity of aquatic resources in the area. According to Patty [29], the distribution of aquatic resource diversity in mangrove ecosystems varies temporally, influenced by water temperature and tides.

4. CONCLUSION

1. The highest fish species composition is Tawes (*Garres abbreviatus*), but in terms of numbers, it is dominated by the peperek fish family.
2. Fish species dominate the diversity of aquatic resources, followed by Crustaceans and Mollusca; the lowest is the type of Cnidaria.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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