

BIOECOLOGY OF AQUATIC ECOSYSTEMS ON KARAMASSANG ISLAND POLEWALI MANDAR

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ABSTRACT

Anthropogenic activities that are often carried out by humans can affect the survival of mangrove, seagrass and coral reef ecosystems in an area. This research aims to determine the species, distribution and condition of the ecosystem on Karamassang Polewali Mandar Island. This research was carried out from April to December 2020 on Karamassang Island in Binuang District, Polewali Mandar Regency, West Sulawesi. Mangrove sampling uses a plot measuring 10 m x 10 m with four observation stations with three repetitions of each station with a repetition distance of 5 m. Data collection on seagrass beds with estimates of seagrass cover was carried out by stretching a line transect along 100 m and placing 0.5 x 0.5 m² quadrants with grids at 20 meters intervals. This transect was carried out at a location that has a seagrass ecosystem and coral reef ecosystem data was collected using the RRA (Rapid Reef Assessment) method. The results of research on the types of mangroves obtained on Karamassang Island were *Rhizophora mucronata*, *Avicennia alba*, and *Sonneratia alba*. In general, the density of mangroves is very dense. In general, seagrass cover is in the good category. In general, the condition of live coral cover is in poor condition.

Keywords: Coastal ecosystem, Species identification, condition, Karamassang Island

INTRODUCTION

In the future, Indonesia's marine and coastal areas will become new growth centers for sustainable development. Rapid population growth and various human activities have made extensive use of coastal and marine resources without paying attention to the sustainability of these resources. These main natural resources include mangrove forest ecosystems, seagrass ecosystems and coral reef ecosystems. Coastal ecosystems act as a source and support for the continuity of germplasm from marine biodiversity. Ecologically, coastal and marine ecosystems that provide natural resources are interconnected with each other, with human behavior and activities. The mangrove ecosystem, for example, is a nesting and rearing place for biota, while the seagrass and coral reef ecosystems contain many types of fish and biota needed by humans. The function of coastal ecosystems is to act as a wave absorber, bind sediment and protect the coast from blowing waves and strong currents. Various problems are still encountered in coastal areas, such as the use of explosives and anesthetics to catch fish, cutting down mangrove trees for ponds and for firewood by communities around coastal areas. West Sulawesi is a province that has a coastline of around 750 kilometers and has several islands, one of which is Karamassang Island. Karamassang Island is a group of small islands that have a coastal ecosystem in the waters of Tonyaman

Polewali Mandar, West Sulawesi. In general, the land of Karamassang Island is covered with quite dense mangrove forests and around the land of the island there are seagrass ecosystems and coral reef ecosystems which function as nursery areas, foraging and spawning areas for various kinds of aquatic biota both living in coastal and offshore waters (Isman *et al.*, 2018). Along with the increase in population and development around Tonyaman waters, some of the mangrove forests on Karamassang Island have experienced damage caused by people converting mangroves into ponds, causing damage to the mangrove and seagrass ecosystems. And there are still people who engage in fishing that is not environmentally friendly which damages coral reef ecosystems (Tamu *et al.*, 2017). From the description above, research was carried out to determine the distribution and condition of the coastal ecosystem on Karamassang Island.

MATERIALS AND METHODS

This research was conducted from April to December 2020 on Karamassang Island, Binuang District, Polewali Mandar Regency, West Sulawesi. Data collection includes preparation of tools and materials used at the research location. Collecting mangrove ecosystem data uses a plot measuring 10 meters x 10 meters, with four observation stations and three repetitions of each station with a repetition distance of 5 m. To determine the condition category of mangroves is based on Minister of

Environment Decree Number 201 of 2004, identify mangrove types using a guidebook introduction of mangroves (Noor, 2006).

Data collection on seagrass ecosystems uses plots with a grid of 0.5 m x 0.5 m² at 20 m intervals, the condition of seagrass cover categories is based on Decree of the Minister of Environment Number 200 of 2004, identification of seagrass types is based on Azkap (1999). Coral reef ecosystem data collection was carried out using the RRA (Rapid Reef Assessment) method by snorkeling for 10 minutes in the coral reef area by observing the form of coral growth and the components of the coral reef shape, the condition category of live coral (Live Coral) is based on Environmental Ministerial Decree Number 4 of 2001.

RESULTS AND DISCUSSION

Distribution and Density of Mangroves

Mangroves are plants or plant communities that are found living in coastal areas or near coastal estuaries. The type of mangrove that is commonly found among several true mangrove species is *Rhizophora* sp., *Avicennia* sp., *Brugueira* sp., and *Sonneratia* sp (Isman *et al.*, 2019). Mangroves on Karamassang Island are generally in the very dense category except at station 4 where no mangroves were found. The results of identifying mangrove species at 4 station locations found 3 types, namely *Rhizophora mucronata*, *Avicennia alba* and *Sonneratia alba*. The number of mangrove species found at each station was 2 species each, except for station 4 where no mangroves were found. The mangrove types at station 1 are *Rhizophora mucronata* and *Avicennia alba*, at station 2 are *Rhizophora mucronata* and *Sonneratia alba* and at station 3 are *Rhizophora mucronata* and *Avicennia alba*.

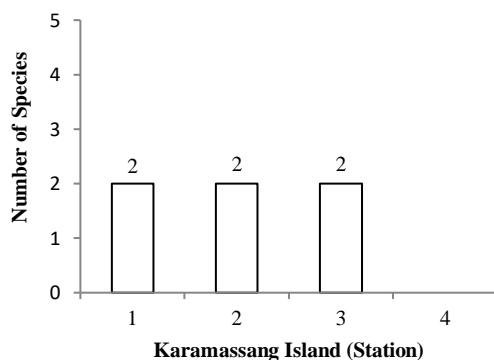


Figure 1. Number of mangrove species at each station in Karamassang Island

Mangrove density in hectare units (Ha) on Karamassang Island ranges from 1867–2400

trees/ha. The highest density was obtained at station 3 while the lowest density was obtained at station 4 (Figure 2). Based on the Decree of the Minister of Environment Number 201 of 2004, the density of mangroves on Karamassang Island is in the very dense category, except at station 4 which is in the damaged category. In general, the density of mangroves on Karamassang Island is relatively good, except at station 4 which was damaged. The damage to the mangroves at this station was due to the conversion of mangroves into ponds by the community. Likewise, Akram (2022), more damage to mangrove forests is due to the conversion of mangroves into ponds, settlement and plantations. According to Kusmana *et al.* (2003) there are three factors that greatly influence mangrove damage, namely pollution, environmentally unfriendly conversion of mangrove forests and excessive logging of mangroves. Pollution that often occurs includes oil and heavy metal pollution, conversion of mangrove land for ponds, agriculture, roads, settlements and sand excavation.

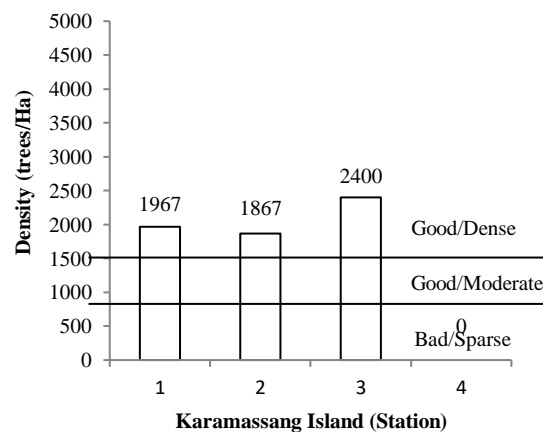


Figure 2. Mangrove density (ha) at each station at Karamassang Island

Distribution and Percentage of Seagrass Cover Types

Seagrass is a group of plants that commonly forms an ecosystem in shallow seas known as seagrass beds. Seagrass beds function as sediment retainers, feeding areas, nursery and spawning grounds and hiding places for small biota (Sitaba *et al.*, 2021). The seagrass species found in the waters of Karamassang Island are *Enhalus acoroides*, *Thalassia hemprichii*, *Halophila ovalis*, and *Syringodium isoetifolium* (Table 1). The distribution of seagrass types found at station K1 was *Enhalus acoroides*, station K2 was *Enhalus acoroides*, station K3 was *Enhalus acoroides*, *Thalassia hemprichii* and *Halophila ovalis* while station K4 was *Enhalus acoroides*, *Halophila ovalis*, *Thalassia hemprichii* and *Syringodium isoetifolium*.

Based on Table 1, the highest diversity of seagrass species found on Karamasang Island at station K4 was found to be 4 types, namely *Enhalus acoroides*, *Halopila ovalis*, *Thalassia hemprichii* and *Syringodium isoetifolium*, while the lowest diversity of seagrass species was found at stations K1 and K2 with 1 type of seagrass each. The low number of seagrass species found on Karamassang Island means that there is still human activity

around the island. Parawansa (2020) found the low number of seagrass species on Karamasang Island, apart from the poor physical condition of the waters, is the high level of fishing activity carried out by the community around the island. The highest individual density of seagrass species was found at station K4, the *Syringodium isoetifolium* species 106.67 ind/m², while the lowest was found at station K4, the *Thalassia hemprichii*, 1.33 ind/m².

Table 1. Distribution and percentage cover of each type of seagrass

| No. | Island | Station | Seagrass species | Density (ind/m ²) | Coverage (%) | Seagrass Condition |
|-----|--|----------------------------------|--|-------------------------------|--------------|-----------------------|
| 1 | Karamassang | K1 | <i>Enhalus acoroides</i> | 51,00 | 60,94 | Good/ Healthy |
| | | K2 | <i>Enhalus acoroides</i> | 50,29 | 45,54 | Damaged/ less Healthy |
| | | K3 | <i>Enhalus acoroides</i> | 57,14 | 71,43 | Good/Healthy |
| | | | <i>Thalassia hemprichii</i> <i>Halophila ovalis</i> | 12,57 8,00 | | |
| K4 | <i>Enhalus acoroides</i> <i>Halopila ovalis</i> <i>Thalassia hemprichii</i> <i>Syringodium isoetifolium</i> | 60,00 68,00 1,33 106,67 | 93,54 | Good/Healthy | | |

Number of seagrass species distribution in Karamassang Island waters (Figure 3). Station 4 is the station where the most species of seagrass are found, i.e., 4 species, while stations 1 and 2 are the stations where the fewest species are found, i.e., 1 species. The species of seagrass that is often found at every research station is *Enhalus acoroides*. The dominance of the *Enhalus acoroides* at each station is due to the sandy substrate type in the waters of Karamassang Island. According to Nugraha (2020) *Enhalus acoroides* is often found on sandy, muddy substrates and at the base of dead coral reefs. According to Haumahu (2021), *Enhalus acoroides* lives in waters with a sandy substrate. Nybakken (1992) stated that the *Enhalus acoroides* has a higher growth rate compared to other seagrass species.

Seagrass coverage at each station

Based on Figure 4, the seagrass cover value on Karamassang Island ranges from 45.54 – 93.54%. The highest seagrass cover value was obtained at station K4 at 93.54%, while the lowest seagrass cover value was at station K2 at 45.54%. Based on the Decree of the State Minister for the Environment Number 200 of 2004, the condition of

seagrass cover on Karamassang Island is in the Good category >60% except at station K2 which is in the poor category <60%. The relatively good seagrass cover has an effect if the water conditions are in good condition, similarly Aisyah (2020) water conditions are one of the factors that influence seagrass growth. According to Sehartian (2017) oceanographic factors that influence seagrass growth are salinity, temperature, optimal currents, and wave speed, apart from that, substrate is a factor that influences seagrass growth.

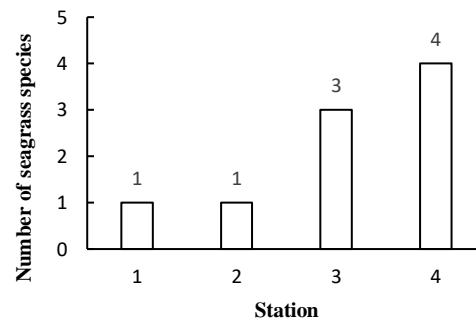


Figure 3. Number of seagrass species in Karamassang Island

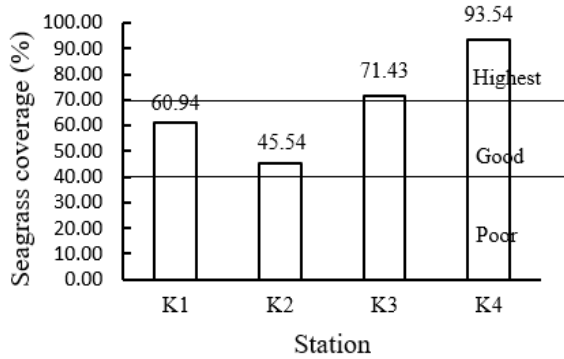


Figure 4. Coverage condition of seagrass in each station

Condition of Coral Coverage

Coral reefs are dynamic ecosystems that live at the bottom of the waters that are strong enough to withstand sea waves and function as a shelter for organisms, a place to find food and a place of care (Widhiatmoko, 2020). According to Wiyanto (2011), damage to coral reefs is currently caused by

large-scale exploitation without paying attention to the sustainability of the coral reefs. The main threats to coral reefs are overfishing, fishing using bombs and anesthetics, sedimentation and pollution originating from land. The percentage value of dead coral cover (DC) at station 1 (17%), station 2 (22%), station 3 (27%) and station 4 (25%), while the percentage of dead coral covered by algae (DCA) at the station 1 (10%), station 2 (10%), station 3 (18%) and station 4 (10%) (Figure 5). Coral death (Dead coral) is caused by one of the sedimentation factors because it is located close to the mangrove ecosystem, there is a supply of sediment originating from the mangrove which covers the coral reef which has an impact on death. Likewise (Suryono *et al.*, 2020) in general the death of coral reefs is caused by high sedimentation. The percentage cover of abiotic elements at each station is 35%, 35%, 33% and 35%, making it difficult to restore the condition of coral reefs in the waters of Karamassang Island.

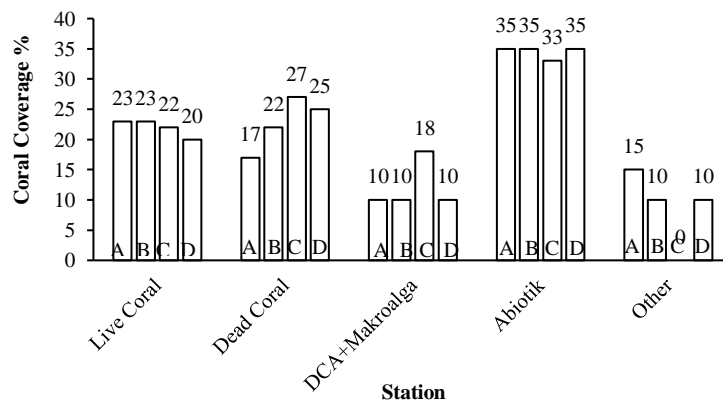


Figure 5. Coverage of biotic and abiotic elements at station 1 (A), station 2 (B), station 3 (C) and station 4 (D)

The condition of live coral reefs in the waters of Karamassang Island is in the category (badly damaged) with percentages at station 1 (23%), station 2 (23%), station 3 (22%) and station 4 (20%) (Figure 6). According to the Decree of the Minister of Environment Number 4 of 2001, the percentage of live coral cover is 0 – 25%. The low percentage of live coral in the waters of Karamassang Island is caused by human activities carrying out environmentally unfriendly fishing in coral reef areas. According to Sudarmaji (2021) the use of fishing gear that is not environmentally friendly has an impact on damage to coral reefs. Another factor in damage or dead coral covered in algae is caused by sedimentation. Sedimentation caused by runoff during the rainy season can cause the death of coral reefs. High rainfall and the flow of surface material

from land (mainland run off) can increase sedimentation and reduce sea water salinity. The next effect is excess nutrients (nutrient overload) which contributes to an increase in abundant macroalgae growth (overgrowth) on coral (Indrabudi, 2017).

CONCLUSION

The species of mangroves found on Karamassang Island are *Rhizophora mucronata*, *Avicennia alba* and *Sonneratia alba* which are generally categorized as very dense. The species of seagrass found were *Enhalus acoroides*, *Thalassia hemprichii*, *Halophila ovalis*, and *Syringodium isoetifolium* which were generally in the good category, while the coral reefs which generally had live coral cover were in damaged condition.

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