

CHAPTER I

INTRODUCTION

1.1 Background

Humans live side by side with the natural environment. Several attempts were made for survivability, such as providing food, recreation and the search sources of livelihood. Human activities have the potential to disrupt the balance of the ecosystem. One ecosystem that is vulnerable to disruption by human activities is the coastal area. The impact of human activities towards the environment in the long term includes loss of habitat for biota and decreased biodiversity. Disrupted natural environment will eventually affects how humans maintain their livelihood, such as food scarcity, pollutions, and many more (Dube, 2024). Ecological disturbances in coastal areas can be caused by changes in water quality and sedimentation. Environmental changes can affect the ecological stability, including the biotas that lives in it. Biotas are dependent towards its habitat condition. These impacts include changes in community structure, decreased abundance and changes in composition. One of the aquatic biotas that will be affected are macrobenthos.

Macrobenthos are organisms that live on the bottom of the water or in the sediments of the bottom of the water, measured more than 1 mm (can be seen clearly). Macrobenthos includes organisms that live in mud, sand, gravel, and organic waste at the bottom of the waters, living attached or

burrowing at the bottom of the waters. In general, macrobenthos are detritivores or scavengers. The living nature of macrobenthos provides an advantage to be used as a biological indicator, including having a settled living habitat. Thus, changes in the quality of the water in which they live will affect their composition and abundance. Macrobenthos is a biological component for monitoring the quality of waters affected by changes in the ecological conditions of waters in that area. Macrobenthic organisms are known as bioindicator agents. The response of macrobenthic to environmental changes is the reason why these organisms are used as bioindicator agents. The variability of macrobenthic is commonly studied as a subject of organic enrichment research in aquatic areas (Putro et al., 2023a). The distribution of macrobenthic is widespread in various substrates. Macrobenthic can be found in coastal areas. The coastline has been widely utilized by humans as a source of livelihood, one of which is as a cultivation zone (Abdullah et al., 2021).

Activities that occur in the cultivation zone in coastal areas increase the potential for pollution. Cultivation management activities, such as feeding activities, supplementation, and structure establishment, can cause changes in the aquatic ecosystem. Unregulated cultivation management can negatively affect the surrounding water ecosystem, both the biotas and the environmental parameters. Environmental parameters, both physical and chemical parameters, holds important role for biotas survivability. The addition of chemicals in cultivation can reduce oxygen in the water column, causing algal

blooms (Castro and Huber, 2016). Observations in the last decade have shown that cultivation zones cause a decline in water quality. Native aquatic biota will be threatened as water quality declines. The decline in water quality will occur over time and the sustainability of cultivation activities (Tom et al., 2021). Research by Farantika et al. (2020) proved an increase in the abundance and number of macrobenthic species due to fish farming activities, it was believed that the effect of activities, such as feeding residue, changed the physico-chemical properties of the surrounding water quality parameters. Environmental parameters will determine the variability of organisms inhabiting the area. The variability of macrobenthic in the cultivation zone will be different from that of macrobenthic in protected areas.

The Karimunjawa Islands were designated as a National Park in the Decree of the Minister of Forestry and Plantations No. 78/Kpts-II/1999. The zoning of protected areas in the Karimunjawa Islands includes cultivation zones and mangrove ecosystems (Karimunjawa, 2017). Anthropogenic activities can cause a decline in ecosystem quality. Efforts in the form of supervision by officers and researchers are needed to preserve protected areas (Rivera-Monroy et al., 2017). Publication by Choeronawati and Prayitno (2019) shows that there is a decline in environmental quality due to the accumulation of leftover feed and waste from cultivated organisms. Menjangan Besar Island is one of the islands in Karimunjawa Regency. This island is used as a floating net cage (FNC) cultivation pond for the Integrated Multi-Trophic Aquaculture (IMTA) system. Cultivation is an activity of

maintaining biological resources which is carried out in a controlled manner to extract the yields of the harvest. One of the important things in fish farming is natural food which is a limiting factor for the success of aquaculture. The need for natural food is still supplied from wild catches whose availability is very volatile. Therefore, to anticipate this, an aquaculture is needed. The application of floating net cages (FNC) has become one of the ways to increase sustainability and productivity for fish farming in recent years. The floating net cage cultivation system (FNC) is developed rapidly, the FNC system cultivation is one solution to the problems that often arise in pond system cultivation, namely flood due to high rainfall intensity in certain seasons so that it can leave or sweep the cultivated biota.

Based on the previous explanation, the impact of human activities can disrupt marine ecosystems. The accumulation of chemical substances from aquaculture and fish farming will continue to increase along with the implementation of cultivation activities. Data updates are needed to determine the significance impact of aquaculture activities towards the surrounding ecosystem. Updates can be done by examining the comparison of macrobenthic community structures in the aquaculture zone and reference site in the Karimunjawa National Park.

1.2 Problems Formulation

The problems in this study are:

1. How is the structure of macrobenthic communities in the integrated multi-thropic aquaculture (IMTA), monoculture area, and reference site at Karimunjava National Park?
2. How is the correlation between the structure of macrobenthic communities and the organic content of the substrate in the Karimunjava National Park?
3. How is the correlation between the structure of macrobenthic communities and substrate grain composition as well as abiotic factors in the integrated multi-thropic aquaculture (IMTA), monoculture area, and reference site at Karimunjava National Park?

1.3 Research Objectives

The aims of this research activity are:

1. To compare the structure of macrobenthic communities in the integrated multi-thropic aquaculture (IMTA), monoculture areas, and reference site at Karimunjava National Park.
2. To study the correlation between the structure of macrobenthic communities and the organic content of the substrate in the Karimunjava National Park.
3. To analyze the correlation between the structure of the microbenthic community and substrate grain composition as well as abiotic factors in the integrated multi-thropic aquaculture (IMTA), monoculture area, and reference site at Karimunjava National Park.

1.4 Research Benefits

This research activity has clear benefits, including:

1. For Researchers

This research is expected to add references and discourses to develop researcher's knowledge and experiences to apply things during lectures. The research results obtained expected to be the foundation for further research.

2. For Academics

This research will show data about the comparison of macrobenthos community structure in the integrated multi-thropic aquaculture (IMTA), monoculture area, and reference site along with guidance to conservation scientist on their use. This research can be used as material for further research in order to add insight and knowledge about the community structure of macrobenthos and also the importance of the benefits of macrobenthos for the ecosystem

3. For Society

This research will increase public knowledge and understanding that the diversity of macrobenthos community structures is very important as a bioindicator of seawater quality in Karimunjawa National Park.