I. INTRODUCTION

1.1 Background

Rice field ecosystems are one of the sources of natural wealth in Indonesia. Rice fields are man-made wetlands with calm water conditions, which are home to various types of living things both flora and fauna. Rice fields produce rice, which is the main food in Indonesia and an important food source. Both the land and aquatic parts of the rice field ecosystem are very important for increasing rice production (Schoelny et al., 1998). Besides being the main source of food in Indonesia, rice fields also have an important role for nature and culture. Rice fields are part of a freshwater area that is watered or flooded, which provides a place for various types of living things. This diversity is essential for nutrient cycling and food chains. Diversity in the soil and water components of rice field ecosystems are correlated with agricultural production (Luo et al., 2014).

One aspect of diversity in the rice field ecosystem is the macroinvertebrates. According to Rusyana (2016), macroinvertebrates are classified into several groups, namely Protozoa, Porifera, Coelenterata, Platyhelmintes, Nemathelminthes, Annelida, Mollusca, Echinodermata, and Arthopoda. Macroinvertebrates are widely used in studying aquatic ecosystems because they have different tolerances depending on water conditions. In addition, macroinvertebrates have a wide distribution and relatively long lifespan (Putro, 2014). Environmental conditions, such as bottom substrate and depth, cause different types of macroinvertebrates found in different environments. In addition, the way macroinvertebrates adapt to

hard substrates are different from the way they live in soft substrates (Mann & Barnes, 1991).

In the rice field ecosystem, macroinvertebrates play an important role in contributing to the nutrient cycle by serving as food for other animals in the ecosystem. In addition, macroinvertebrates also act as sensitive indicators of environmental changes. Macroinvertebrates also play an important role in pest control in rice field agroecosystems (Ko et al., 2021). These diverse roles underscore the importance of macroinvertebrates in ecological processes and sustainable agriculture within the rice field ecosystem.

Temporal changes in macroinvertebrates in rice field ecosystems refer to fluctuations in their composition within a certain period. These fluctuations are influenced by various factors, such as environmental conditions, water quality, and agricultural activities. Environmental conditions can include natural disturbances, predators, and weather. Water quality includes the physical, chemical and biological properties of water as macroinvertebrates are directly affected by changes in water quality. Meanwhile, agricultural practices can impact the presence of macroinvertebrates, which affects the overall health of the rice field ecosystem. Both conventional and organic farming methods can affect the abundance and richness of aquatic biota in rice fields (Leitao et al., 2007).

The study by Bunyangha (2022) observed the response of macroinvertebrates in a rice field from a smallholder to a large-scale commercial rice field and an adjacent natural wetland in Mpologoma catchment, Uganda. The results showed that Decapoda, Chilopoda, Diplopoda, and Blattodea taxa showed

habitat exclusivity in natural wetlands, Diplura and Ephemeroptera groups in large-scale commercial rice fields, while Diptera, Odonata, and Trichoptera groups were in both rice fields. These findings indicate that conversion of wetlands to rice paddies may impact macroinvertebrate richness and diversity.

Research led by Stenert (2018) examined the short-term temporal dynamics of macroinvertebrates after farmers used pesticides in rice fields. The purpose of this study was to determine how the macroinvertebrate community recovered with the rice growing season. The study was conducted in Capivari do Sul, Brazil on three rice fields and compared to three nearby natural ponds. The results showed that pesticides have a negative impact on macroinvertebrate communities. During the observation period, it was shown that the less pesticide remains in the rice fields, the more macroinvertebrates were found.

Earlier research by Brraich (2017) studied temporal macroinvertebrates living in wetlands in Nangal, India and found 24 genera from 10 macroinvertebrate groups: Ephemeroptera, Plecoptera, Hemiptera, Diptera, Trichoptera, Coleoptera, Araneae, Odonata, Annelida, and Gastropoda. The location with the highest number of macroinvertebrates is influenced by the abundance of underwater plants for shelter, different types of living space, and clean water conditions compared to other spots.

In Indonesia, especially in West Sumatra, researchers have studied macroinvertebrates in rivers (Ibrahim, 2021; Bima, 2021; Badjoeri et al., 2022; Putri, 2023), lakes (Novita, 2017; Ayu, 2016; Sindi, 2016), and beaches (Siboro, 2017; Sumartin, 2023) but not much research about aquatic macroinvertebrates in

rice fields. Research conducted by Aadrean (2011) revealed the diversity of fauna in the Lubuk Alung rice field ecosystem that are potential prey for otters, including eight types of aquatic insects, seven types of molluscs, ten types of fish, five types of frogs, four types of reptiles, eight types of water birds, and one type of small mammal. Further research conducted by Andeska (2020) revealed that macroinvertebrates are part of the food composition of small-clawed otters (*Aonyx cinereus*) in the rice fields of Lubuk Alung, Padang Pariaman. The study identified several types of macroinvertebrates, including 11 types of insects and 8 types of molluscs.

From previous studies, there is no research about the changes of aquatic macroinvertebrates in rice fields, especially in the Lubuk Alung, Padang Pariaman, West Sumatra. Some farmers in this rice field area implemented the use of *banda keong* or snails borders, which is border side of the rice field plot that is made slightly deeper than the surface planted with paddies to control golden-apple snail. This activity helps minimize snail damage to the rice plants and helps farmers reduce the use of pesticides.

This research is important because it can help determine the presence of macroinvertebrates that have important roles in this ecosystem, one of which is as a source of food for animals such as otters found in this area. Changes in the number and types of macroinvertebrates over time will show how the rice growth and the presence of water in the rice fields affect aquatic macroinvertebrates.

1.2 Problem Formulations

1. What is the pattern of temporal changes of aquatic macroinvertebrates in Lubuk Alung rice fields?

2. What is the pattern of temporal changes of environmental factors in Lubuk Alung rice fields?

1.3 Research Objectives

The objectives of this research are as follows:

1. To determine the temporal changes of aquatic macroinvertebrates in Lubuk Alung rice fields.

2. To determine the temporal changes of environmental factors in Lubuk Alung rice fields.

1.4 Research Benefits

This research is intended to enhance knowledge of temporal changes in the presence of aquatic macroinvertebrates as part of the ecosystem. The environmental factor data collected are also expected to provide valuable insights into the environmental conditions of the Lubuk Alung rice fields.