THE THREAT OF ALIEN SPESIES IN LAKE MAHALONA, EAST LUWU, SOUTH SULAWESI

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Abstract

The presence of alien fish in inland waters has the potential to disrupt the community structure of endemic fish. Mahalona Lake has a high level of endemicity, although there are now several threats one of which is the existence of alien fish in Mahalona Lake. The purpose of this study was to examine the risks of having alien fish in Mahalona Lake. The research was carried out between January and March of 2023. Gill nets with mesh sizes of 0.75, 1.0, 1.5, and 2.0 inches were used to collect fish samples. The Freshwater Fish Risk Assessment Model (FRAM) with a scoring system was used to conduct the risk assessment. Six invasive fish species obtained in Mahalona Lake were subjected to FRAM analysis. The sedentary risk and impact on introduced fish risk values revealed that three species had high invasive potential, namely *Amphilopus trimaculatus, Channa striata,* and *Oreochromis niloticus*, while the other three species had moderate risk values, namely *Anabas testudineus, Barbonymous gonionotus,* and *Trichopodus trichopterus*. *Amphilopus trimaculatus* is an alien fish with the highest risk value, while *Trichopodus trichopterus* is a fish with the lowest risk value.

Keywords*: Alien Species, Sedentary Risk, Impact Risk, FRAM, Mahalona Lake*

Introduction

Mahalona Lake is waters that have high endemic biodiversity. This lake contains eight endemic fish species [19]. However, the impact of the emergence of alien species that can dominate water bodies poses a threat to the survival of these endemic fish species. Ecological pressure is a result, and both native and endemic fish species are affected [16]. This is a result of environmental management in public waters, particularly for alien fish that were introduced without first undergoing an effect risk assessment process on native ecosystems and fish species in the Mahalona Lake area. The flower horn fish (*Amphilophus trimaculatus*), one of which is in Mahalona Lake, dominates the Malili Lake Complex Area at present, providing clear evidence of the negative effects of the presence of alien fish species [7]. However, the majority of the alien fish in Mahlona Lake have never undergone a risk assessment.

It is critical to conduct a risk assessment of Mahalona Lake because of its high endemicity to identify which alien fishes are likely to become invasive [1,3]. Risk assessment is a component for determining the status and impact of alien fish introductions into waters [4] , The majority of alien fish enter waters through human introduction [5]. The Freshwater Fish Risk Assessment Model (FRAM) method established by [2,4] can be used to assess risk. FRAM is a method for assessing alien fishes to determine the risk of settling in a new environment and the impact it may have on that environment. Several invasive fish researchers in Indonesia have adopted the FRAM approach, most notably in Beratan Lake, Bali [20] and in the Ir. H. Djuanda reservoir [8].

To address the lack of assessment of the potentially detrimental effects of alien fishes, this study aims to identify the potential impact of alien fish risks in Lake Mahalona, which may spread further. The results of this risk assessment are the initial stage in the process of alien species risk

analysis and serve as the information for environmental managers and policymakers on which alien species deserve a more comprehensive risk assessment. The findings of this study might help with alien fish management strategies and the conservation of endemic fishes in Mahalona Lake.

Methods

a. Research site and time

This study was carried out from January 2023 to March 2023. The study took place in Mahalona Lake, East Luwu Regency, South Sulawesi Province (Figure 1). Fish samples were identified at Fisheries Biology Laboratory, Department of Fisheries, Faculty of Marine and Fisheries Sciences, Hasanuddin University, Makassar.

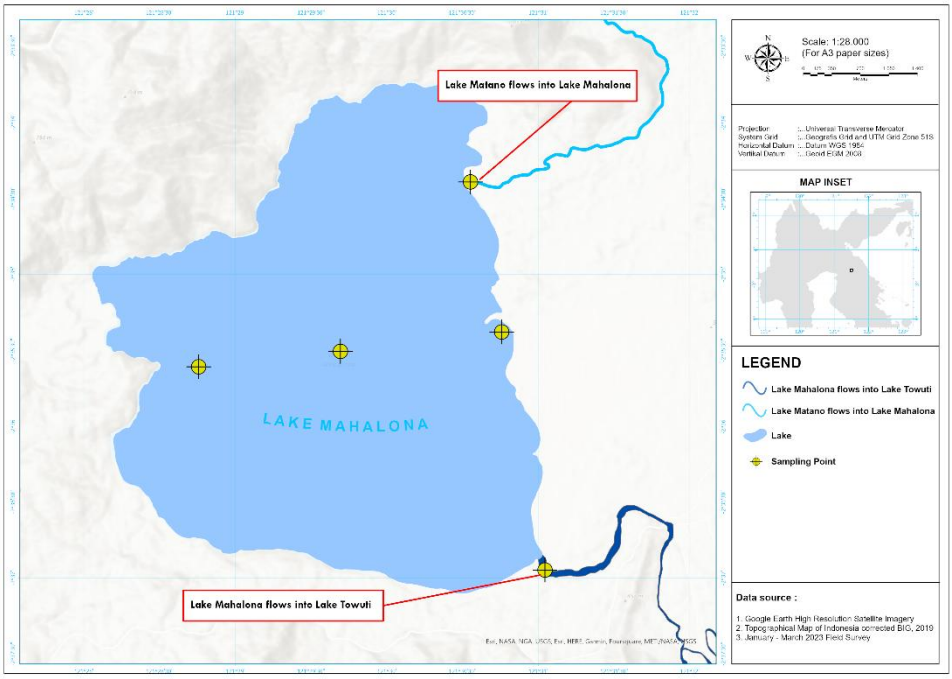

Figure 1. Map of research sites in Mahalona Lake

b. Data collection

Fishing was carried out using gill nets owned by local fishermen with a mesh size of 0.75; 1.0; 1.5; and 2.0 inches. The main target of fishing in this study is alien fish in Mahalona Lake. Alien fish collected were placed in the coolbox for identification. Several libraries [9,10,13,14] and the Fishbase website [6] were used to identify fish species

c. Data analysis

The Freshwater Fish Risk Assessment Model (FRAM) was used to analyze data in this study. There are two types of processed data: primary data and secondary data. Primary data were gathered through sampling, while secondary data were gathered from related research literature. Risk analysis is one of the components used to assess the impact of introducing alien fish into a body of water, particularly inland public waters [4,20]. In the FRAM analysis, a weighting system was used which consists of two groups of questions, namely: (1) establishment risk score and (2) impact risk score [18,8].

Results and Discussion

During research at Lake Mahalona, from January to March 2023, 11 fish species were found, 6 of which were alien species. Alien species caught for this study (Table 1) are *Amphilophus trimaculatus, Anabas testudineus, Barbonymous gonionotus, Channa striata, Oreochromis niloticus,* and *Trichopodus trichopterus.* Other types of fish caught are endemic fish.

Table 1. Types of fish caught in Mahalona Lake from January to March 2023

No.	Local name	Common name	Scientific name	Status
1.	Louhan	Three spot cichlid	*Amphilophus trimaculatus* (Günther, 1867)	Invasive
2	Kosang	Climbing perch	*Anabas testudineus* (Bloch, 1792)	Invasive
3	Tawes	Silver barb	*Barbonymous gonionotus* (Bleeker, 1849)	Invasive
4	Gabus	Striped snakehead	*Channa striata* (Bloch, 1793)	Invasive
5	Butini	-	*Glossogobius matanensis* (Weber, 1913)	Endemic
6	Dui-dui	-	*Nomorhamphus megarrhamphus* (Brembach, 1982)	Endemic
7	Nila	Nile tilapia	*Oreochromis niloticus* (Linnaeus, 1758)	Invasive
8	Pangkilang	Celebes rainbow	*Telmatherina celebensis* Boulenger, 1897	Endemic
9	Opudi	-	*Telmatherina opudi* Kottelat, 1991	Endemic
10	Opudi	-	*Telmatherina prognatha* Kottelat, 1991	Endemic
11	Sepat	Three spot gouramy	*Trichopodus trichopterus* (Pallas, 1770)	Invasive

During the study, the catch of invasive species in Mahalona Lake accounted for up to 66% of the overall catch. This phenomenon endangers the survival of the lake's endemic species. Table 2 shows an analysis of the danger of the presence of alien species on endemic fish.

Table 2. Value of FRAM risk assessment of introduced fish in Mahalona Lake

No.	Species	Establishment risk score (max. 16)	Impact risk score (max. 60)	Overall impact risk score (max. 76)
1	*Amphilophus trimaculatus*	16	26	42
2	*Anabas testudineus*	9	25	34
3	*Barbonymous gonionotus*	13	17	30
4	*Channa striata*	15	25	40
5	*Oreochromis niloticus*	16	21	37
6	*Trichopodus trichopterus*	11	17	28

According to [23], alien species in Mahalona Lake have high danger effect scores. A total score greater than 34 indicates that the fish has a negative influence on the species and its new environment, whilst a value less than 34 suggests that the fish has minimal or no effect on native fish and their habitat. The species *Amphilopus trimaculatus* is a member of the cichlidae which has the ability to adapt to all water conditions, so that the potential to settle in a new environment is higher [5] as stated by[7] hat flowerhorn fish cannot be found in areas that have muddy substrates, but over time flowerhorn fish can be found in all habitat conditions so that potential competition in space utilization can occur. The good reproductive ability allows the flowerhorn to survive in its new environment and even dominate these waters, which might be a hazard to other species because the flowerhorn fish's behavior during the spawning phase is more aggressive towards other species [21].

After *Amphilopus trimaculatus*, *Channa striata* has the second highest risk impact value. One of the predators in the waters is the fish *C. striata*. Furthermore, according to [15], many snakehead fish live in public waterways such as rivers, swamps, and lakes, and are even able to thrive in low oxygen levels. Snakehead fish such as rocky, dark, calm currents, and muddy environments in rivers and swamps with depths of 40 cm. Snakehead fish, on the other hand, can survive in waters with an acidic pH of 7-8, a depth of 1-2 m, a temperature of 23-27ºC, relatively little dissolved oxygen, high CO_2, and may adapt to habitats with high humus formed from peat. Snakehead fish, in addition to being able to adapt to their surroundings, may also live in some periods when conditions in the water are not favorable. *C. striata*'s versatility allows it to exist in a variety of habitat conditions in

Mahalona Lake. *C. striata* is a predator of fish in the waters. A*ccording to* [15] the species *C. striata* is a carnivore that can eat fish, insects, shrimp, frogs, snails, and even snakes, so the fish has the potential to prey on fish larvae and even adult fish because fish endemic to Mahalona Lake tends to have small sizes such as *D. Megarrahamphus T. prognatha, T. celebensis* and other minor endemic species.

Oreocrhomis niloticus is one of the species that can adapt to a wide range of environmental conditions, allowing it to exist in a variety of habitats. Furthermore, good reproductive abilities such as high fecundity and the lack of a need for special spawning habitats enable *O. niloticus* to flourish and expand in Mahalona Lake [22]. However, people's preference for feeding these fish can increase mortality, allowing prospective O. *niloticus* species to dominate water bodies and compete with smaller native fish species such as *A. trimaculatus*.

Anabas testudineus is a species that poses a moderate risk to Mahalona Lake's ecosystem. This is inseparable from its ability to adapt to any habitat condition. This species may adapt to fluctuations in oxygen levels and low pH. In terms of reproduction, this species has high fecundity and is one of the species that spawns throughout the year, this allows the species *A. testudineus* to thrive in Lake Mahalona [17].

Barbonymous gonionotus is a species with a high prevalence of arrest. However, the value of this fish's moderate risk impact is inversely related to other invasive species. Other alien species, except *T. trichopterus*, had higher and had a lower relative abundance than *B. gonionotus*. This could be because other species are favored for food over *B. gonionotus*. According to [12], the lack of knowledge about the nutritional content and the many fine spines in Tawes causes the level of consumption of Tawes to not be as popular as other cultivated fish. This causes the exploitation rate of other alien fish to be higher than that of *B. gonionotus*.

Trichopodus trichopterus was the alien fish with the lowest score, indicating that it poses a low risk to endemic species and habitat in Mahalona Lake. Furthermore, because *T. trichopterus* is a consumption fish, its exploitation rate is higher than that of other alien species that are not consumption fish. As a result, the possibility of these fish dominating water bodies is quite low [11].

The effects of alien fish on endemic fish in Indonesia have not been extensively studied. In that case, information on the biological capacities of alien fish in Mahalona Lake is required to assess its effects on endemic fish [20] .In other words, further research is needed to support sustainable fisheries management.

Conclusion

A. trimaculatus, C. striata, and *O. niloticus* are alien fish species with high-risk scores and can have a detrimental effect on the ecology of Mahalona Lake, whereas *A. tesudineus, B. gonionotus,* and *T. trichopterus* are alien species with a moderate risk score and have minimal effect on native species and their habitat.

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