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Review Article

Tempe Lake and Various Problems

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Abstract: Tempe Lake is a lake located in the western part of Wajo Regency, South Sulawesi, precisely in Tempe Sub-district, Belawa Sub-district, Tanah Sitolo Sub-district, Maniangpajo Sub-District and Sabbangparu Sub-district, about 7 km from Sengkang City to Walanae River. Tempe Lake, which covers an area of about 13,000 hectares, has a species of freshwater fish that is rarely found elsewhere. This is because the lake is located on the slab of australia and asia. This lake is one of tectonic lake in Indonesia. Tempe Lake is supplied with water from the River of Bila and its tributaries Bulu Cenrana. In addition to supplying water, the two rivers also cause siltation due to high erosion upstream. The management of Lake Tempe fishery in Wajo Regency that is environmentally friendly must be based on the applicable law that is the Law of Ministry of Environment and the Fisheries Law. In the management of environmentally friendly fisheries, there are regulations in the Forest Management and Fisheries Law. The regulation is a process that must be done to make the management integrated into ecological and economic aspects, namely sustainable management of lake fisheries. Making of environmentally friendly fishing gear, is intended to catch the fish with a width of at least 5 cm, so the existence of fish in Lake Tempe can be sustainable without catching small fish

Keywords: Tempe lake; Fishing gear; Fishermen

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Introduction

Wajo Regency with its capital Sengkang, is located in the central part of the province of South Sulawesi with a distance of 242 km from the provincial capital, extends to the southeast sea and the last is the strait. And 119°52'30" T-120°07'30" S. The boundaries of Wajo Regency are as follows: North: Luwu and Sidrap districts; South: Bone and Soppeng Regencies; East: Bay of Bone; West side: Soppeng and Sidrap districts.

Tempe Lake area is one of the lake area located in South Sulawesi, Sidenreng and Lapongpakka. Administratively the area is in 3 districts, namely Wajo (54.6%), Sidrap (34.6%) and Soppeng (10.7%). According to Putra et al. (2007), the area of Lake Tempe at the time of the tide is estimated at 28643 ha. At the peak of the rainy season of Lake Tempe area and the flooded area reached 47800 ha and in the dry season the area reaches only 3000 ha (Bappeda Wajo, 2006).

Koeshendrajana (2007) stated that the area of Lake Tempe is experiencing ecosystem problems such as the limited volume of lake water, decreasing the quality of water, the decreasing of plants around the lake and the loss of some fauna species, especially some bird species. This is in line with the data from MENLH (2009) which establishes nine lakes that need to be handled in the priorities of Lake Toba, Maninjau, Singkarak, Tempe, Tondano, Poso, Limboto, Batur and Rawa Pening. The condition of most of the lake is damaged and decreased function. Utilization of fishery resources in the area is considered to have undergone a change as a result of some fishermen not obeying arrest rules, such as the installation of excessive bungka toddo (fishing gear). In the aspect of Lake Tempe resource management, the three districts have no coordination between each other in the utilization and development of fishery and agriculture potential.

The economic potential in the area of Lake Tempe was mainly used for fisheries and agriculture activities in the three districts, in 1957 and 1959 fishery production reached 50000 tons/year, but decreased in the period between 1999 and 2000, which only reached 17000 tons/year (Bappeda Wajo, 2006). In the period from 2001 to 2005 there was an average production decline of 6.45% per year. As a result of changing conditions, both physically natural and human activities, the productivity of the lake is currently continuously decreasing. Production of general aquatic fishery products in three districts in the area of Lake Tempe in 2010 was recorded at 11272 ton/year (BPS Statistic) (Wajo, 2013).

Environmental management basically requires morality which means human ability to live together with other living creatures in the level of mutual need, dependency, relation and mutual build so that harmonious life states that the surrounding community is very dependent on the existence of resources utilized for various purposes among others, to meet the needs of food and sources of family income (Nudroho, 2007; Son, 2011). The dependence on the resources available in the area of Lake Tempe, ultimately creates a harmonization between nature and humankind, as well as trust between humans in the region. The harmonized relationships or networking that exists then strengthen the social capital of the local community and develop into a sense of common ownership. Therefore, the networks and social capital associated with informal relationships in the community can be used in the development of the region, by developing ties within the village cluster population network, such as kinship, marriage, historical or similar linkages or locations that arise as the implications of the use equal and cross-village resources.

Physical Condition of Lake Tempe

Lake Tempe is a lake located in the western part of Wajo Regency, South Sulawesi. Wajo located on the coast of Tempe lake is Tempe Sub district, Belawa district, Tanahsitolo Sub-district, Maniangpajo Sub-District and Sabbangparu Sub-district, located about 7 km from Sengkang City to Walanae River. Lake Tempe, which covers an area of about 13000 hectares, has a species of freshwater fish that is rarely found elsewhere. This is because the lake is located on the continental plate of Australia and Asia. Danau is one of tectonic lake in Indonesia.

Lake Tempe is supplied with water from the River of Bila and its tributaries Bulu Cenrana. In addition to supplying water, the two rivers also cause siltation due to high erosion upstream. Tempeh Lake is one of the major lakes located in South Sulawesi Province, precisely in Wajo Regency (70%), Sidrap Regency and Soppeng Regency. The Tempe lake formed from the depression of the Asian-Australian Plate is located in the Walannae Cenranae River Region and has an area of 47,800 ha at an altitude of 10 m above sea level with a catchment area of 4,587 km^2. The annual rainfall in the lake area is 1400-1800 mm/year while in the basin area is 1.40-04.00 mm/year. The water level (TMA) of Tempe Lake until 2001 shows normal conditions, with the average TMA being in the range of 4,078 m-7,780 m asl. The depth of the lake is currently 3 m during the rainy season and 1 m during the dry season. The surface area of the lake in the rainy season is 48,000 ha and inundates the rice fields, plantations, houses, roads and bridges and other social infrastructure that cause considerable losses. In the dry season the area of the lake only reaches 1000 ha whereas in normal condition the area reaches 15.000-20.000 ha. The river that leads to the lake consists of 23 rivers that are included in the two watersheds and the watershed Walanae, while the river flow from the lake (outlet) only one of the Cenranae River which has a long river 70 km.

Functions and Benefits of Lakes

Land around the lake is used for residential and *glosogobius guiris* agricultural areas. Biodiversity of Lake Tempe is evident from the many species of fish in the lake, among others: carp (*Cyprinus corpio*), tawes (*Osteochillus hasselltti*), cork (*Ophiocephalus striatus*), fish sepat siam (*Tricogaster pectoralis*), Bungo fish, Fish Pond (*Helostoma temmicki*) and Tilapia (*Oreochromis niloticus*). In addition to the biodiversity of Lake Tempe, there is also a local culture that can be used as a tourist attraction of the area.

Lake Tempe in its management covers 6 districts, among others,

Maros District, Bone, Soppeng, Wajo, Sidrap and Enrekang. Four of them (Bone, Wajo, Sidrap, Soppeng) are food crop production areas that contribute as a national rice barn, while the other two districts (Maros and Enrekang) are upstream of the Walana E Watershed, Lake Tempe as a conservation area of water resources has characteristics and natural resources that are different from other areas, in the development of Lake Tempe is directed to the following activities:

• Supporting areas of food crops production centers of freshwater fisheries.

• Source of raw water reserves that can also be utilized for irrigation and plantation purposes around the lake.

• Potential areas for the development of water tourism and cultural tourism in South Sulawesi.

Lake Ecosystem Issues

Damage to the Watershed Area (DTA) the destruction of Upper Lake Tempe area is caused by uncontrolled logging, such as forest encroachment, shifting cultivation, illegal logging, causing the number of critical area of Lake Tempe to be 308,962,56 ha from the total area of 830,485 ha. The occurrence of conversion of catchment areas and drought pockets, the area of the lake catchment area is decreasing, so the reserves of water that can be stored more and more thinning.

Water pollution Sedimentation rate at Lake Tempe is 1-3 cm per year. As a result of this sedimentation, the lake has a siltation and caused the flood disaster in the rainy season and drought in the dry season. If the sedimentation rate is assumed to be 0.38 cm per year, then it is estimated that in 2018 Tempe Lake will be lost in the dry season. The siltation occurring in Lake Tempe is naturally caused by sedimentation carried by river inlets that empty into this lake like S. Lawo, S. Stones, S. Belokka, S. Bila and Walannae River. The occurrence of the siltation resulted in a decrease in capacity for the lake to trigger the occurrence of flood disasters in the surrounding area. Land management that exceeds the carrying capacity of the lake and decreases land productivity increased population.

Lake Tempe is a lake located in the western part of Wajo regency of South Sulawesi, precisely in the subdistrict of Tempe about 7 km from Sengkang city to the bank of Walanae River. The lake with an area of about 13,000 hectares is known to have freshwater fish species that are rarely found elsewhere. The fish is popular in the local community with the name Bale Bungo is categorized as including the type of rare fish.

The result of Ministry of Environment (2009) reconstruction of Tempe Lake change voyage is now known that Tempe Lake was originally part of the strait connecting the Makassar Strait of Pare-pare Bay in the West and Bone Bay in the East. Lake Tempe is part of the strait that separates South Sulawesi and other parts of Sulawesi in the North. The statement is based on the La Galigo Manuscript, Bompeng Ri Langi (Enrekang) and others quoted by Cristian Perlas in The Bugis (Ministry of Environment, 2009). Lake Tempe is loaded with events of civilization of Sulawesi past. The area of Lake Tempe is historically a trade center that has been known to traders from outside Sulawesi, before Bandar Makassar which later became the center of trade of Eastern Indonesia (Tang, 2005).

The movement of the earth plate and the continuous sedimentation process over time make the strait narrow and shallow, so that what remains today are the three separate water territories, namely Lake Tempe, Lake Buaya, and Lake Sidenreng (which was originally a unit of Tempe Lake), as well as the Cenrana River that connects Lake Tempe to the Bay of Bone. If the three lakes were united by a puddle at an elevation of 10 m above sea level will have an area up to 47800 ha (Adrianto, 2009).

Lake Tempe has been known to be the largest freshwater fish producer in the world, as the base of this lake holds abundant sources of fish food. Fisheries history is the oldest in the field of fisheries where the work of coastal lake community is known as a fisherman from generation to generation. In the 1970, Lake Tempe was one of the main suppliers to meet the needs of fish for consumption in Java. Even at that time, Lake Tempe had become the largest source of eel fish for export needs of Indonesia. Marketing even reach the continent of Europe and America.

Lake Tempe is now one of the research media of academics who come from various parts of the world. In addition to being a great tourist attraction, various forms of research are conducted mainly regarding endemic fauna. Lake Tempe is also a place to hold various cultural performances and ritual ceremonies on the lake. The typical event of this area is usually held every year in August and become one of the interesting tourist attractions in South Sulawesi **(Figure 1)**.

Utilization Issues

Fisheries management is all efforts, including an integrated process of gathering information, analysis, planning, consultation, decision making, allocation of fish resources, and the implementation and law enforcement and legislation in the

Figure 1: Tempe Lake.

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field of fisheries, conducted by the government or other directed authorities to achieve sustainable productivity of resources and objectives that have been agreed (Ministry of Environment, 2009).

The management of Lake Tempe fisheries in Wajo Regency that is environmentally friendly must be based on the applicable law, that is the Law of marine biological Ministry of Environment (PLH) and the Fisheries Law. In the management of environmentally friendly fisheries, there are regulations in the Law on Forestry Law and Fisheries Law. The regulation is a process that must be done so that the management is integrated into ecological and economic aspects, that is sustainable management of lake fisheries.

The regulations in the Law on Environment and Fisheries Law are still common and can be applied operationally by government, public, private and other parties through the regulations below such as Government Regulation (PP), Ministerial Decree (Kepmen) or Regional Regulation Perda). Several government plans and policies have been undertaken to rehabilitate the environment of Lake Tempe, namely Regional Regulation No. 11/1996 on the Processing and Conservation of the Environment and Marine and Fisheries Development Plan of Wajo Regency, which is an elaboration of the Regional Strategic Plan of Wajo Regency 2004-2008, but not specifying and being integrated for the management of the Tempe Lake environment. Then the Tempe Lake Conservation Program from the Wimpang District Environmental Impact Management Agency (Bapedalda) contains a comprehensive action plan for the rehabilitation of Lake Tempe, i.e. the rehabilitation plan from inlet basin, river mouth, Tempe Lake, and Lake Tempe outlet. However, the plan of this program only to the stage of planning and constrained funding and human resources. Other plans that have the same concept are Curative and Proactive Conductive and Conductive Programs for Environmental Preservation of Tempe Lake Area as well as water rescue and watershed rehabilitation programs related to Lake Tempe from the Department of Regional Infrastructure.

Referring to existing laws and regulations, the Regional Government of Wajo District reinforces the Regional Regulation (Perda) no. 4 of 2012 related to the ban on fishing by using Jabba Troll. The regulation has not been allowed to use fishing gear with net eye size below 5 cm, while some fishermen are also looking for shrimp type catches that have to use the eyes of small nets. With the limitation of using fishing tools Jabba Troll fishing community was anxious to find fish, related to the rules that have been issued with the threat of a fine of Rp 50 Million Rupiah.

In fact, fishermen install fishing equipment "Jabba" or "Trap" made of wire rang with large eyes smaller than 5 cm, even up to 2 cm, consequently the entangled fish cannot escape, including small fish that have not feasible for consumption. The types of fishing traps that are commonly found can be seen in **Figure 2**. Making an environmental friendly fishing gear, intended is that fish caught should be fish-sized consumption with a width of at least 5 cm, so the existence of fish in Lake Tempe can be sustainable without catching small fishes.

Solution and Outside Target

This program is a form of community-based activities in the waters of Lake Tempe so that the expected target of this program is to create an environmentally friendly fishing gear and can be an example for fishermen, in addition to providing an understanding to the fishermen about the importance of preservation of fish species in Lake Tempe.

The output of this program is as follows:

Giving an understanding to the fishermen about the importance of preserving fish species and providing training in the making of environmentally friendly fishing gear with selective capability on the big fish caught.

The formation of fishermen groups that manage and provide understanding to other fishermen, so that in time all the fishermen will use environmentally friendly fishing gear **(Figure 3)**.

Implementation Method

Based on the problems faced by partners and the community at large in Lake Tempe Wajo Regency, it needs an innovation from universities and active participation of the community in the application of appropriate technology and social approach.

Figure 2: Type of fishing gear is not selectively used by fishermen in Lake Tempe.

Figure 3: Fish-Friendly fishing equipment.

The main solution to be undertaken with partners is to revitalize the function of "Jabba" or "Trap" fishing gear as a fishing gear in the waters of Lake Tempe through joint community planning and formulate priority activities i.e. train people to create and install fishing gear in accordance with the flow of fish migration in these waters make a model of fishing gear "Jabba" that can last long with the sequence of activities.

Conclusions

- Improving people's ability to utilize science and technology in the field of fishing.
- With the operation of environmentally friendly fishing gear, the small fish is not caught again so it can grow big and continue reproduction.
- Fish caught only large ones, because the small ones will come out again.

Suggestions

1. Need to make the determination of fishing ground area for trap fishing gear (bubu) so that there is no protest of kepentengan between fishermen.

Need to intervene the Regional Government in order to restore the damaged ecosystem of the lake.

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