



Sulphur phenomenon in Lake Batur : A Disaster to Local Fisherman

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ABSTRACT

Lake Batur provides a perfect area for fisheries. one of the amazing products from lake Batur is *Oreochromis mossambicus*, or in the local language called *Mujair*. The fish has a high economic value for the community. However, in 2009, the villager claimed there was a sudden change in the water quality of Lake Batur. Many anglers often lose their fortune because of the sudden dead fish phenomenon. The lake water was no longer as safe as it used to be for both humans and fish. The local community accused sulphur as the cause of their unfortunate. Several studies have been conducted in Lake Batur every year and indicate several sulphur spots near Buahan Village that appear in January, April, or August. Entering July 2021, around 70 fish in floating net cages owned by farmers in the Lake Batur area died. The case in July 2021 was the worst in history. Research on floating net cells mentioned that the public could predict this mass death event to reduce the fishers' future losses.

Keywords: Lake Batur, Fish, sulphur.

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INTRODUCTION

The story of Dewi Danu, the Goddess who rules Lake Batur, is one of the mythologies that marks the significance of Lake Batur as the primary freshwater reservoir in Bali. The caldera lake is located in the Kintamani region, Bangli. Since the Dutch East Indies government days, Kintamani has been a tourist concern. Ancient volcanic craters, valleys, lakes, and forests as its background prompted the Dutch East Indies government to build a guesthouse and include it in tour packages for tourists in the colonialism era.¹

Lake Batur is included in the 15 National Priority Lakes.³ Referred to as the largest Lake in Bali, and it has approximately 21.⁴ km coastline. The lake is surrounded by land with two different topography: in the west, the lake is bordered by the lowland of Mount Batur, whereas in the north, east and south are hill areas of Mount Abang. With all its charms, Lake Batur offers an attraction for tourists to enjoy the view with a cup of Kintamani coffee or simply for those visitors who love religious tourism. Those are some options that travelers can do when visiting the lake. Located thirty kilometers to the northeast Ubud

Traditional Village, Gianyar Regency, at an altitude of 1,050 meters above sea level with a maximum depth of about 60-70 m. In addition to being a freshwater source for the island, Lake Batur provides a suitable area for agriculture and fisheries. These two sectors provide great economic benefits for the people around the lake. one of which is the people in Buahan Village, Kintamani sub-district, Bangli Regency.

The community has used the lake in

the fisheries and tourism sectors, which has developed previously.³ When observed from the Penelokan village area, a higher location than Lake Batur, the traveler would see hundreds of boxes of floating fish cages belonging to residents around Lake Batur. *Oreochromis mossambicus*, or in the local language called *Mujair*, is the most famous fish with economic value for the local community. *Mujair* fish is an icon of the Bangli Regency, especially for



Figure 1.² View of Lake Batur.



Figure 2.⁵ *Oreochromis mossambicus*, or in the local language called Mujair, is the most famous fish with economic value for the local community.



Figure 3.¹⁵ A great number of dead fishes were reported on Thursday (15/7/2021). The death of tens of tons of fish occurred after bad weather conditions triggered the rise of sulphur from the lake's bottom, known as upwelling.

the Kintamani area. The fish is served as favorite menus, in various preparations in almost every stall and restaurant around Kintamani. Mujair species was discovered in 1939 by Mr. Mujair at Serang River on the south coast of Blitar, East Java.⁴

One of the local fishermen, Nengah Udayana, since his childhood, has been accustomed to spending time helping his parents by the lake to take care of their floating cage or catch wild fish. At that time, circa early 2000, it was common for the

folk to drink lake water directly. However, when he was 20 years, in 2009, he felt a change in Lake Batur. Many anglers often lose their fortune because of the sudden dead fish phenomenon. He argued the lake water was no longer as safe as it used to be for both humans and fish. Besides Nengah Udayana, another fisherman and farmer named Wayan Rantes also admit that sulphur poses a serious threat to anglers on the coast of the lake. According to a Study by BKSDA in 2005, the Kintamani

forest area, which includes Mount and Lake Batur, is an upstream area with a fairly critical environmental damage level.⁶

Another study by Suryono et al. (2008) showed that the condition of Lake Batur's waters tends to change, especially its quality due to community activities around the lake.⁷ The state of Lake Batur, as a closed water system with no outlet, greatly affects the water quality. Furthermore, the lake experienced silting and waning due to increased community fishing activities that cause waste, such as vegetable farming areas, tourist areas, fish cultivation in floating net cages (KJA) and other uses.⁸ The pollutant sources of Lake Batur were identified as coming from organic waste that can come from agricultural activities on the lake border, settlements, tourism and fish farming activities with floating net cages. The volume of waste that enters the lake waters from residential activities was 229,588 m³. Lake Batur's level of water pollution was classified as lightly polluted, with a pollution index of 1.50 to 2.82.⁹ Meanwhile, according to research in 2012, It was stated that the water quality in Lake Batur, in general, is fairly supportive of the fish's existence in their natural habitat. The conclusion was according to the estimated average production potential of fish resources based on chlorophyll-a content in Lake Batur ranging from 221.2 to 270.3 kg/ha/year.¹⁰

Nevertheless, the local community accused sulphur as the cause of their unfortunate. Several studies have been conducted in Lake Batur every year and indicate several sulphur spots near Buahan Village that appear in January, April, or August. Entering July 2021, around 70 fish in floating net cages owned by farmers in the Lake Batur area died. The phenomenon was caused by a sudden sulphur blast from the bottom of Lake Batur. The first burst occurred from July 13 to 23, 2021. According to local authorities, initially, the lake water started to change color. The color change was caused by rain and strong winds around Lake Batur. Then, on Wednesday (14/7/2021), dead fishes began to float.

A great number of dead fishes were reported on Thursday (15/7/2021). The death of tens of tons of fish occurred after bad weather conditions triggered the

rise of sulphur from the lake's bottom, known as upwelling. The situation caused all pollutants on the lake to mix and endangered the biota in the lake. Substances in the lake such as sulfates and phosphorus bonded oxygen in the lake water. As a result, the oxygen content in the water decreased drastically. Further, sulphur eruption worsened the situation; thus, the fish belonging to the residents' farm died instantly.¹¹

After a few days of stopping, sulphur bursts appeared in several locations on Lake Batur. The event was the second burst in a month. As a result of the sulphur burst, the fish farmers suffered other losses. The Agriculture, Food Security and Fisheries Department (PKP) Bangli evacuated 25.9 tons of fish carcasses from Lake Batur. It was reported, 331 fish cultivators were affected.¹²

All the dead fishes have been evacuated to avoid contamination of the lake water and avoid bad smells. According to Jero Agus Jambe, head of the Mujair fishing group in Lake Batur, around 18,000 fish died. That has not been counted to the fish belonging to other farmers. The total fish weighed approximately three tonnes. It was matured and ready to harvest. Jero said the loss reached Rp 84 million. It was calculated that every one kilogram of tilapia was priced at IDR 28000 in the market.

The release of Sulphur in Lake Batur is an annual phenomenon, usually occurs between July and September. The toxic sulphur kills the fish every time it rises from the lake's bottom, and farmers are prepared for the risk. Jero said he hoped there would be assistance from the Bangli Regency Government for the fish farmers. He added the current conditions were difficult because people's buying power had decreased due to the Covid-19 pandemic and Emergency PPKM. Even so, the Head of the Department of Agriculture, Food Security and Fisheries (D-PKP) Bangli Regency, I Wayan Sarma, explained that the recent sulphur poisoning case in July 2021 was the worst in history. The sulphur killed thousands of fish belonging to farmers in the Kedisan Village area to the east to Abang Batu Dinding Village.¹³ He admitted, the phenomenon had occurred every year. However, previously

the sulphur flares stopped after four days or a week. These eruptions occur every year. Even in 2021, previous bursts have happened before the end of February. There were 12,200 floating cages in the Lake Batur area and more than 500 fish farmers. However, not all of them were affected by the sulphur eruption.¹⁴ Sarma said that sulphur flares occurred around Seked Village, Kedisan Village, and Buahon Village, Kintamani District. The sulphur flare had stopped on July 23. Nevertheless, suddenly there was another burst.

Sarma encouraged farmers to set the time for stocking their fish seeds. Thus, its harvest period would not be in mid-July to September to avoid significant losses. Due to the event being a natural phenomenon, the only thing that could be done was to prevent it. His party would be collecting data on all fish farmers who have suffered losses due to this phenomenon. After that, he would propose to the Bangli Regent; thus, the farmers could receive business capital assistance after losing money due to the sulphur phenomenon.

Meanwhile, Bangli Deputy Regent I Wayan Diar handed over food packages for representatives of Lake Batur fish cultivators who were affected by the sulphur blast at the Bangli Regent's Office. Diar said the donations were collected from the regency's civil servant as a symbol of solidarity to reduce the burden on the people affected by the pandemic and sulphur phenomenon in Lake Batur. "The sulphur blast causes the fish in the cage to die. According to reports, more than 70 tons of fish in Lake Batur have died," the vice-regent said.

Research on floating net cages (KJA) by Gede Raka Angga Kartika from Udayana University published that the public can predict this mass death event. This research was published at the end of 2017 with the title "Supporting Capacity Study and the Zoning of Floating Net Cages (KJA) in Batur Lake, Bangli Regency." Mount Batur emerged from the caldera of Mount Batur, which erupted in the past. Since Batur is an active volcano, sulphur content may occasionally appear on the surface. The risk also increases due to the accumulation of animal feed residue mixed with fish feces. This residue accumulates at the lake's bottom and does not decompose because it

does not pass through the ground filtering phase. Therefore, the phenomenon of dead fish would indeed occur every year. Researchers recommended using a filter at the base of the floating cage; thus, the food residue and fish manure would not add more sedimentation to the lake.

Further, the cage location needs to be arranged. In addition, the farmer should use natural materials and add aquatic plants to reduce contamination. The recommendation can be applied in several villages that have experienced similar cases with Buahon Village. However, this effort certainly requires a fairly long process. Another measure that can be given to the townsfolk is providing fish seeds.¹⁶

CONCLUSION

Oreochromis mossambicus has a high economic value for the community. However, in 2009, the villager claimed there was a sudden change in the water quality of Lake Batur. Many anglers often lose their fortune because of the sudden dead fish phenomenon. It was said the lake water was no longer as safe as it used to be for both humans and fish. The local community accused sulphur as the cause of their unfortunate. Several studies have been conducted in Lake Batur every year and indicate several sulphur spots near Buahon Village that appear in January, April, or August. Entering July 2021, around 70 fish in floating net cages owned by farmers in the Lake Batur area died. The case in July 2021 was the worst in history. Research on floating net cells mentioned that the public could predict this mass death event to reduce the fishers' future losses.

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