

ENVIRONMENTALISM VS SUBSISTENCE AQUACULTURE IN UTILIZATION OF FORMER OPEN-PIT COAL MINES AS RESERVOIRS FOR AQUACULTURE IN INDONESIA

ASFIE MAIDIE, ISMAIL FAHMY ALMADI AND HENNY PAGORAY

In *World Aquaculture* magazine December 2004, Miller *et al.* (2004) reported that the effluent from open-pit coal mines can be used to produce fish that are safe for human consumption. Based on this report, in 2006 we grew fish in net pens in an abandoned former open-pit coal mine that had filled with water (Fig. 1). Culture in the abandoned former open-pit mine was done for two reasons: 1) to make use of the reservoirs created following the cessation of mining activities that are present in almost every part of country, especially to help local people who find it difficult to get cheap animal protein, and 2) to provide scientific research information on the feasibility of the use of a reservoir created from a former open-pit coal mine for fish culture.

The culture trial was successful and it was the first scientific report of fish culture in a former coal mining reservoir in Indonesia (Maidie *et al.* 2010). The report was cited by a local newspaper and a fisheries background researcher and an environmental NGO in East Kalimantan Province did not accept this for two reasons. First, they believe that the use of former open-pit coal mines for fish culture relieves coal mining enterprises of the responsibility for reclamation of the giant open holes in the landscape. Second, they believe that all reservoirs in coal mining areas are contaminated with high levels of toxic heavy metals, as reported by Greenpeace (2005). Although scientific reports show that fish culture can be done in water from reservoirs created by former open-pit coal mines (Simmons *et al.* 2001, Miller *et al.* 2004, Otchere *et al.* 2005, Environment Agency 2008), an international environmental NGO did not agree, seemingly influenced by the



FIGURE 1. Net pens in an abandoned open-pit coal mine in 2006. The 3-mm cage mesh was made with aluminum wire to prevent the entrance of predators such as snakes, monitor lizards, water otters or turtles.



FIGURE 2. A reservoir formed in a former open-pit coal mine in 2021, five years after filling. The reservoir is about 15 ha and 30 m deep. Water quality measurements indicated its suitability for fish culture. This reservoir is used by nearby villagers to culture fish in net pens.

environmental NGO in Indonesia.

As a large exporter of coal to the world, Indonesia has many coal mining enterprises. East Kalimantan Province is where coal mining plays the main role in the local economy, responsible for almost half of Indonesia's total coal production. There are more than 127,000 ha of open mines scattered throughout every district of the province, even in remote areas.

In open-pit mining, coal is extracted from subsurface seams after removing surface soil layers, leaving a large hole in the land surface. As a practical matter, this hole is difficult to fill with soil because considerable environmental destruction elsewhere is necessary to obtain the fill material. Filling open-pit mines after coal extraction is complete is also a heavy financial burden to the coal mining companies. The Environmental Agency of Samarinda City of East Kalimantan Province calculated that it costs about US\$ 23 million to fill a 1-ha open-pit coal mining hole to a depth of 30 m (Kaltim Post 2015). Because of these difficulties, a high number of former open-pit coal mines have not been filled, even though government regulations require land reclamation. In East Kalimantan Province alone, there are 1753 coal mining pits open at present (Woodbury and

Arbainsyah 2020, JawaPos 2021), representing at least 87,000 ha of potential reservoirs, a number that will only increase.

NGOs AGAINST FISH CULTURE IN FORMER COAL MINING RESERVOIRS

In response to these giant reservoirs, some environmental NGOs have organized protests against coal mining enterprises and the government because they failed to fill them in. However, this

protest does not seem fair because insufficient soil was available to fill former open-pit mines entirely and also because reservoirs were already in use by local people for subsistence aquaculture, as fish habitat for fishing, recreation, and as a freshwater source for agriculture and households. The protests against coal mining and the use of reservoirs still continued.

The NGOs were not in direct confrontation with subsistence aquaculturists but did not agree with mining where giant reservoirs remained after coal extraction. The NGOs made confrontational statements that coal mining will result in reservoirs with high levels of heavy metals that are toxic to fish and will accumulate in cultured fish. This statement was noted in many local newspapers and social media (Tribun 2015, Prokaltim 2017, Nebulasolution 2018, Mongabay 2021). In mid-2010, an NGO and some researchers claimed that 10 t of dead cultured fish in a netpen, mainly striped catfish, common carp and Nile tilapia, was caused by heavy metals in a former coal mining reservoir. This statement hit those three cultured species hard. Even fish that did not originate from former coal mining reservoirs could not be sold in markets. Water quality analysis showed that water quality in this former coal mining reservoir was very poor (dissolved oxygen concentration near zero, pH < 5, and high concentrations of sulfide, ammonia and nitrite). The cause of the fish kill was actually self-contamination by fish cultured at high density using high-protein feed in intensive culture. After this issue, the subsistence fish farmers lost a lot of money. Fortunately, consumers returned to buy fish normally with no specification where the fish was cultured.

ARE FORMER COAL MINING RESERVOIRS BARREN ENVIRONMENTAL AREAS FOREVER?

There is still no method or technique available for filling giant former coal mining open holes without destroying the environment elsewhere. NGOs also believe that, after coal mining is finished, the land will become dry and barren but, with good management doing re-planting after one year, the surrounding area of former coal mining reservoirs should grow vegetation that will become dense some years later, and wild animals will live there (Fig. 2). The surrounding reservoirs of former coal mines would be mostly green with vegetation making beautiful scenes, therefore attracting the local people to take time to rest personally or with family. Local people enjoy recreational activities in reservoir area. Most fishers use pole and line to catch fish in these reservoirs.

IS THE ENVIRONMENTAL NGO A FRIEND OR FOE TO AQUACULTURE?

Neither friend nor foe to aquaculture in former coal mining reservoirs, the environmental NGO is seemingly important to aquaculture in that aquaculture production must be done in the best manner and the safest product for human consumption. The NGOs not agreeing with coal mining is one protection against environmental destruction. However, if the country's economics must be for the benefit of the people, then the consequences of coal mining must be managed to make it useful for people's livelihoods and also minimize environmental damage. To make aquaculture important to users of a former coal mining reservoir, there should be valid data and consideration of water quality, including heavy metals concentration and the carrying capacity of the aquatic environment for aquaculture.

The government should be responsible and make an official statement of guarantee that fish products from these reservoirs are safe for human consumption. Lastly, the reservoirs formed in former open-pit coal mines should be opened and managed by the government or by a credible institution for safe use by people.

Notes

Asfie Maidie and Henny Pagoray, Fisheries Development Laboratory, Faculty of Fisheries and Marine Science, Mulawarman University, Indonesia. Email: asfiemaidie@gmail.com; pagoray.henny@gmail.com

Ismail Fahmy Almadi, Analytical Fisheries Laboratory, Faculty of Fisheries and Marine Science, Mulawarman University, Indonesia E-mail: ismailfahmyalmadi@gmail.com.

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