

Aquaculture Practices and Their Impact on Philippine Lakes

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Araullo DB. 2001. Aquaculture practices and their impact on Philippine lakes, pp. 25-28. *In* CB Santiago, ML Cuvin-Aralar and ZU Basiao (eds.). Conservation and Ecological Management of Philippine Lakes in Relation to Fisheries and Aquaculture. Southeast Asian Fisheries Development Center, Aquaculture Department, Iloilo, Philippines; Philippine Council for Aquatic and Marine Research and Development, Los Baños, Laguna, Philippines; and Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines. 187 pp.

Introduction

The rapid progress and development in the aquaculture sector during the past years has made an important contribution to the overall fish production in the Philippines. In 1996, 35.4% of the total fish production or 980,857 mt came from the aquaculture sector. Although milkfish from brackishwater ponds comprise the bulk of the produce, tilapia production from freshwater aquaculture in lakes, ponds and reservoirs is increasing annually. Fish cages and fish pens proliferate in most inland waters. The operation of such structures as livelihood for the coastal inhabitants has been recognized as a profitable venture.

Many have gone into tilapia culture in ponds and small experimental cages in lakes and reservoirs in the 1980's. The success of tilapia culture in cages in the Bicol Region and Magat Dam in Isabela triggered the interest of other enterprising businessmen to expand the practice to other inland waters. However, problems of mass fish kill caused by deteriorating water quality have been reported.

There is a need to strictly regulate the aquaculture practices; otherwise, more problems in the aquatic environment will be encountered. As freshwater aquaculture production is intensified, negative impact on the environment is also magnified. Under the Local Government Code, the management of inland waters is within the jurisdiction of the local government units with the assistance of the national government.

For the proper management and sustainable use of inland water resources, this paper highlights the positive and negative impact of aquaculture practices on the aquatic environment.

Aquaculture Practices

Fish cages and fish pens are the major aquaculture structures used in inland waters. The sizes vary according to the financial capability of the operators.

In Laguna de Bay, the lake where the first fish pens were established, pens covered more than 20,000 ha in 1980 - 1985. However, more than 80% of the structures were destroyed by typhoons.

To date, the area for fish pen and fish cage belt allowed by the Laguna Lake Development Authority (LLDA) is only 5,000 - 10,000 ha. Milkfish is the primary species stocked in fish pens and tilapia in cages.

Other lakes where fish cages proliferated are Lake Buhi and Lake Bato in Bicol Region; Taal Lake, Batangas; seven lakes of San Pablo, Laguna; Lake Sebu and Buluan Lake, South Cotabato. In addition, other bodies of water like reservoirs and rivers are being used for fish culture.

Impacts of Aquaculture

Biological impact

According to the Malaysian-based Third World Networks, an activist group concerned with sustainable development in developing countries, aquaculture spawns a host of problems (Peoples Journal Tonight, 28 Oct. 1996). The impact could be both on the existing endemic species and the ecosystems. This statement is supported by various scientific studies on some Philippine lakes.

Some lakes in the country have their own endemic fishery. Introduction of exotic species could alter the existing fish population through interbreeding, predation, and competition for food, space, and habitat. To a certain extent, genetic pollution could take place. Some good examples are the dominance of tilapia in most freshwater areas in the country. Lake Buhi, the home of 'sinarapan' *Mistichthys luzonensis* - the world's smallest commercial fish, is now dominated by tilapia. The population of *Mirogobius lacustris* in Laguna de Bay, *Sardinella tawilis* in Taal Lake, and the small cyprinids in Lake Lanao and Lake Sebu has been reported to have declined greatly after the introduction of some exotic species.

An example of genetic pollution is the interbreeding between the native *Clarias macrocephalus* and the introduced *C. batrachus*. The hardy *C. batrachus* displaced *C. macrocephalus* such that the native species is now found only in areas where the exotic fish has not been introduced. The golden 'kuhol' is an introduced snail which now dominates the black native snails.

The impact of aquaculture on lake fisheries, however, is not always negative. In depleted or overfished lakes, aquaculture activities greatly enhance the fish population for open fisheries. Escape of fish from the enclosures and fish breeding during cultivation are sources of indirect stocking in the open waters. This is particularly true in Taal Lake and Laguna de Bay. During the typhoon season in 1995, most of the cages and pens were destroyed and the fishermen caught tilapia and milkfish by tons.

The recovery of 'kanduli' or the landlocked catfish *Arius manilensis* and goby *Glossogobius giurus* in Laguna de Bay is worth mentioning. These species were reportedly depleted before the establishment of the fish pens. When fish pens were installed, they served as breeding areas and refuge for the fishes. Now, the species population in the lake is diversified and the native species are abundantly caught. This condition is also observed in other lakes.

Ecological impact

Scientific findings showed that the greatest impact of aquaculture activities is on water quality. Water pollution is usually due to excessive feeding. Stocking beyond the carrying capacity is a common practice in some lakes.

The environment is not only a recipient of feces and metabolites of the fish but also a catchment basin of uneaten feeds which accumulate at the bottom. The water is enriched with organic phosphorus, nitrite, ammonia, and other toxic substances. Biological oxygen demand in the environment increases, resulting to mass fish kill especially during nighttime.

The change in water quality could also alter the succession of the primary productivity. From the normal growth of beneficial algae, a bloom could occur which would highly deplete dissolved oxygen in the water during die-off. There are also instances when blooms of toxic algae occur.

Physical impact

The physical impact of aquaculture activities varies from lake to lake. Generally, gradual shallowing takes place in lakes saturated with fish pens and fish cages. This is caused by the uncollected deteriorating materials such as bamboos, nets and poles which impede water circulation and flow. Other contributory factors are the accumulation of feces and uneaten feeds and water hyacinth that disintegrate when trapped between cages and fish pens.

In deeper lakes where stratification can occur, upwelling is an annual natural phenomenon during the cool months of the year. Examples are Lake Sebu in South Cotabato; Lakes Sampaloc, Calibato and Mohicap in San Pablo, Laguna; Lake Buhi in Bicol Region; and Taal Lake in Batangas. In these lakes, annual fish kill is experienced by fish cage operators because during the upwelling, the anoxic bottom water which is loaded with toxic substances like hydrogen sulfides and ammonia is brought up to the surface.

Socio-economic impact

The socio-economic impact of aquaculture in lakes can be considered an indirect impact. Aquaculture structures are considered hazards and barriers by fishermen and lake navigators. On the other hand, for fish pen and cage operators, the lake water is a haven that provides livelihood, employment and, most importantly, fish protein.

Lakes have multiple uses. If food security is emphasized, aquaculture should be given a high priority, although other users should also be accommodated. A multi-disciplinary planning approach therefore should be done so as not to affect programs for other lake users.

Remarks and Recommendations

- Aquaculture *per se* is not harmful to the environment provided there is proper management of stocking density and feeding. Stocking density should be based on the carrying capacity of the lake so that feeding will be minimal.
- Lakes should be properly zoned, with areas specifically for aquaculture, navigational lanes, sanctuaries, etc. properly delineated.
- The local government should take particular interest on the conservation and management of lakes within their jurisdiction rather than considering only the revenues from issuance of permits. There should be close coordination with national government agencies like the Department of Environment and Natural Resources (DENR) and Department of Agriculture-BFAR on existing policies and regulations, and proper monitoring of the water quality of lakes.
- The Fisheries and Aquatic Resources Management Council (FARMC) for each lake should be

organized as soon as possible. It should focus on the management and conservation of the resources and enforcement of the law without bias.

- Fish farmers should be required to remove remnants of aquaculture activities like old bamboos and nets to minimize siltation, sedimentation, etc.
- A viable aquaculture industry can co-exist with a healthy water environment if government policies and regulations can be strictly enforced.

