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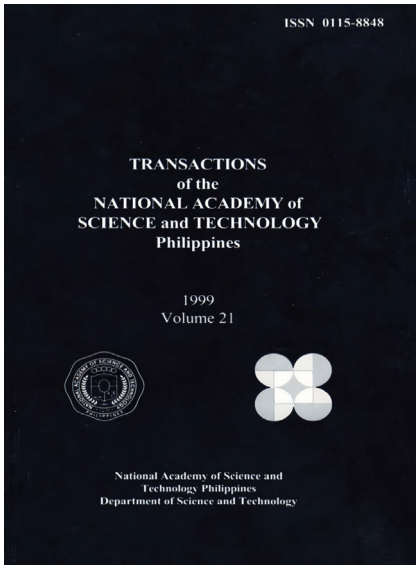

Philippine Lakes: Status and Strategies for Sustainable Development

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PHILIPPINE LAKES: STATUS AND STRATEGIES FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

The Philippines is blessed with more than 100 freshwater lakes ranging from a few to a thousand hectares in size. The lakes are either tectonic, kettle or maare in type. These bodies of water are important for fisheries because of their domestic, agricultural, industrial and recreational uses.

An assessment of 36 major Philippine lakes indicated that 55.5% are threatened, 41.7% are in good condition and 2.7% are in critical condition.

With the exception of Laguna de Bay which is managed by an authority, the management responsibility of the other lakes in the country falls on the local government units. Despite the existence of laws and ordinances for conservation and protection of inland waters, however, there is poor enforcement of such measures due to lack of capability and political will on the part of the implementors.

The strengthening of the LGUs in cooperation with the Fisheries and Aquatic Resources Management Councils mandated by law and the bolstering of the technical and political capability of LGUs to formulate and implement integrated lake management plans are recommended as the key strategies for the sustainable development of Philippine lakes.

Keywords: Lakes, lake management, inland waters, sustainable development, management strategies

INTRODUCTION

Lakes are natural inland bodies of standing water. From the Latin word *lacus* (meaning pond), the term "lake" refers to a depression in the ground that gets filled with water. There are three types of lakes according to how they were formed. Tectonic lakes come about as a result of "mountain-producing forces of

the earth". Kettle lakes on the other hand are formed by "craters of extinct volcanoes". Finally, maare lakes are small, circular, deep bodies produced by "explosions of volcanic gas chambers" (Ruttner, 1952).

The lakes in the Philippines with a total area of over 200,000 hectares are of the tectonic, kettle and maare types. These water bodies range from a few to a thousand hectares in size varying in depth locations. The largest lake in the country is Laguna de Bay (90,000 ha) while the deepest and highest lakes are Lake Taal (200 m) and Lake Venado (2,666 m), respectively.

Lakes are not only important for their water and fisheries but also for their varied domestic, agricultural, industrial and recreational uses. As much as 15% of the country's total fisheries production comes from lakes (Fellizar, 1995). Laguna de Bay is being tapped as a source of domestic water supply of Metro Manila as well as for hydroelectric power, irrigation and for cooling industrial plants. The hydroelectric power plants that is run by the Agus River which is supplied by Lanao Lake is expected to provide 70% of the power needs of Mindanao by the year 2000 (Anon., 1997).

With population growth, urbanization and industrial development, human impacts on the country's aquatic resources such as lakes have increased. Problems like lake sedimentation, overexploitation of fisheries and pollution have come about (Guerrero, 1996). There is an urgent need for effective management of these lakes to ensure their sustainability.

This paper will assess the status of the major Philippine lakes and recommend strategies for their sustainable development.

STATUS OF MAJOR PHILIPPINE LAKES

There are over 100 recorded lakes in the Philippines (Table 1). The region with the most number of lakes is Southern Tagalog (22) followed by the Cordillera Autonomous Region (21). Within the Southern Tagalog region, the province of Laguna has the most number of lakes (12).

Based on physico-chemical and biological criterias, the status of the 36 major lakes (with areas of 100 hectares and larger) in the Philippines was assessed. Lakes that are in good condition have water quality within acceptable standards, little or no sedimentation and no overfishing stress. Lakes that are threatened show moderate pollution, sedimentation and overfishing stresses. Lakes in the critical list are under heavy pollution, sedimentation and overfishing pressures.

The assessment which was based on reports and personal observations showed that 41.7% of the lakes are in good condition, 55.5% are threatened and 2.7% are in critical condition (Table 2).

Laguna de Bay is the most heavily stressed lake in the country. The forest cover of the lake's watershed has been reduced from 93,000 ha in 1963 to less than 18,000 ha in 1988 because of human activities (Valerio, 1990). Soil erosion from deforested areas is the main contributor of sediment to the lake. The sediment

Table 1. Distribution and number of Philippine lakes

Region	Provinnce	Number
I	Ilocos Norte	
	Ilocos Sur	
	Pangasinan	2
II	Cagayan	1
CAR	Abra	4
	Ifugao	2
	Kalinga	5
	Benguet	7
	Mt. Province	3
III	Tarlac	3
	Zambales	4
	Nueva Ecija	
IV	Laguna/Rizal	
	Laguna	
	Batangas	1
	Quezon	4
	Mindoro Oriental	3
	Palawan	1
V	Camarines Sur	8
	Sorsogon	1
VI	Iloilo	
VII	Negros Oriental	
	Cebu	1
VIII	Leyte	8
IX	Zamboanga del Sur	1
X	Bukidnon	3
XI	South Cotabato	5
XII	North Cotabato	5
XIII	Surigao del Norte–Agusan	
	Agusan	
ARMM	Lanao del Sur	4
	Maguindanao	
	Total	101

Table 2. Status of major Philippine lakes

Lake	Region/Province	Condition
Paoay	I, Ilocos Norte	T
Cabalangan	II, Cagayan	T
Alindayat	III, Zambales	T
Paitan	III, Nueva Ecija	T
Laguna de Bay	IV, Laguna and Rizal	C
Sampaloc	IV, Laguna	T
Taal	IV, Batangas	T
Naujan	IV, Oriental Mindoro	T
Caluangan	IV, Oriental Mindoro	T
Mangua	IV, Palawan	T
Bato	V, Camarines Sur	T
Buhi	V, Camarines Sur	T
Balinsasayao	VII, Negros Oriental	G
Mantohod	VII, Negros Oriental	G
Lanao	VII, Negros Oriental	T
Danao	VII, Cebu	G
Danao	VIII, Leyte	T
Bito	VIII, Leyte	T
Wood	IX, Zambaonga del Sur	T
Sebu	XI, South Cotabato	T
Manghan	XI, South Cotabato	T
Balut	XII, North Cotabato	G
Sultan	XII, North Cotabato	G
Malinao	XII, North Cotabato	G
Buranibud	XII, North Cotabato	G
Labas	XII, North Cotabato	G
Nunungan	XII, Lanao del Norte	G
Blingkong	XII, North Cotabato	G
Mainit	XIII, Surigao del Norte-Agusan	T
Pagusi	XIII, Agusan	G
Butig	ARMM, Lanao del Sur	G
Dapao	ARMM, Lanao del Sur	G
Putian	ARMM, Lanao del Sur	G
Lanao	ARMM, Lanao del Sur	T
Buluan	ARMM, Maguindanao	T

C- Critical condition
G- Good condition
T- Threatened

loading has been estimated at 1.5 million m^3/yr (SOGREAH, 1991). A decreasing trend in Secchi disk transparency from 46 to 59 cm in 1986 to 31 to 38 cm in 1992 was noted (Barril *et al.*, 1994).

Domestic sources account for 70% of the organic wastes discharged into the lake. The total nitrogen load originating from municipal wastes is estimated to be about 3,000 t/yr (Lopez, 1989). The nitrogen and phosphorus loadings into the lake from agricultural activities have been estimated to increase from 11,200 t/yr in 1975 to 29,000t/yr in 2000 (Santos-Borja, 1990).

The number of industrial plants (e.g. paper mills and manufacturing firms) around the lake increased from 117 in 1963 to 1,481 in 1995. The majority of these firms (68%) are considered to be pollutive and only about 50% of such industries have wastewater facilities (URSI, 1989).

In terms of water quality, the dissolved levels in Laguna de Bay have been found to be lower than the standard while pH, phosphates and coliform count are higher than the set standards (Juliano, 1998).

Because of overfishing and habitat degradation, the number of indigenous fishes in the lake has also been reduced. Of five species of *kanduli* described by Aldaba (1931), only two species exist at present (Vallejo, 1986).

A socio-economic survey of 3,055 fishermen in Laguna de Bay in 1995-1996 showed that their catch per unit effort was only 0.25 kg/h (Palma, 1998). Lake fisherfolk have low educational attainment and their income is one of the lowest in the country (Juliano, 1998).

The problems of overfishing and other human impacts have also adversely affected the other major lakes in the country. In Lake Lanao, only three endemic *cyprinids* remain out of the 15 species reported by Herre in 1933 because of the introduction of exotic indigenous fishes such as the *Glossogobius giurus and Hypseleotris agilis* (Escudero, 1995).

In Lake Taal, the exploitation rate for the *tawilis (Sardinella tawilis)* exceeds the optimum range indicating overfishing of the resource despite various existing fisheries laws (Villanueva *et al.*, 1996). A declining trend in the catch of migratory fishes like the mullet and milkfish has been observed in Lake Naujan (Pasumbal and Perez, 1997). The disappearance of the *sinarapan* fishery in Lake Buhi in 1978 has been attributed to human activities related to use of motorized push nets, agricultural operations, introduction of exotic fishes, pollution and other activities around the lake (Aypa *et al.*, 1995).

The introduction of aquaculture in many lakes has also caused negative impacts. Milkfish pens in Laguna de Bay limit small fishermen to access their traditional fishing areas. The pens also contribute to sedimentation of the lake by impeding the flow of the water (Guerrero, 1996). Cages used for tilapia culture in Lake Taal and Lake Sebu has increased pollution load due to feeding and has induced fishkills (Mercene, 1997; Mama-ay and Kiman, 1997).

STRATEGIES FOR SUSTAINABLE DEVELOPMENT OF PHILIPPINE LAKES

There are numerous administrative measures that regulate the conservation, protection and management of inland waters including lakes in the Philippines. As early as 1939, Fish and Game Administrative Order 12 imposed a five-year closed season in certain waters of Rizal, Laguna, Batangas and Mindanao for the conservation of aquatic resources which included rivers connected to lakes. Fisheries Administrative Order 106, Series of 1971, set rules and regulations governing fishing in lakes and inland waters within watershed reservations throughout the country including application for permits to fish, use of fishing gear and bag limits (Juliano, 1998).

In 1966, the Laguna Lake Development Authority (LLDA) was organized by virtue of Republic Act 4850 as a quasi-government agency with regulatory and proprietary functions. The mandate of the LLDA is "to lead, promote and accelerate the development and balanced growth of the Laguna de Bay basin within the context of national and regional plans and policies for social and economic development and to carry out the development of the basin with due regard and adequate provision for environmental management and control, preservation of the quality of human life and ecological systems, and the prevention of undue ecological disturbance, deterioration and pollution".

In 1973, the establishment of a 5,000-ha fish sanctuary in Laguna de Bay was promulgated by Fisheries Administrative Order 110. Moreover, rules and regulations governing fishpen operations in Laguna de Bay (FAO 114, Series of 1973) and the construction, establishment, or operation of fishpens and fish cages in Philippine waters were instituted (FAO 160, Series of 1986).

Apart from Laguna de Bay, the management of the other major lakes in the country has only been cursorily addressed. Lake Lanao, for instance, has no single authority or agency that looks after the conservation and protection of the lake's watershed, basin and fisheries as an integrated ecosystem. This is inspite of the Lake Lanao Watershed Protection Plan proposed by the Lake Lanao Watershed Protection and Development Council (Anon., 1997).

A Presidential Commission on Tagaytay-Taal Lake was formed in 1996 which came up with a zoning plan for the lake. According to the plan, four zones which are comprised of the open fishing zone, fishery reserve zone, aquaculture zone and tourism zone will be established. The plan also limits aquaculture activities in the lake by setting 10% of the total lake area for such activities (Villanueva *et al.*, 1996).

For Lake Naujan, a Naujan Lake Management Plan has been proposed (Anon., 1998). By virtue of a municipal ordinance, a *sinarapan* sanctuary was declared in 1982 (Soliman, 1994). In Lake Sebu, despite a municipal ordinance regulating fish cages which has been in effect since 1994, fish kills in the lake attributed to heavy organic loading from tilapia feeds, have worsened (Beniga, 1997).

In 1975, Presidential Decree (PD) 704 was issued which gave the Bureau of Fisheries and Aquatic Resources management, conservation, development, protection, utilization and disposition responsibilities over all fisheries and aquatic resources in the country except municipal waters which are under the municipal or city government concerned. The decree also provided for the establishment of fish refugees, sanctuaries and fishery reservation. Moreover, the decree declared a certain identification of fish species and prohibited all forms of illegal fishing.

Then in 1998, the Fisheries Code (RA 8550) was enacted superseding PD 704. The code affirmed the rights of the fisherfolk to be protected in the preferential use of municipal waters and in the application of integrated coastal area management within specific natural fishery management areas appropriately supported by research, technical services and guidance. Furthermore, the law institutionalized the Fisheries and Aquatic Resources Management Councils (FARMCs) with members stakeholders. These FARMCs shall assist local government units (LGUs) in the management, conservation, development, protection, utilization and disposition of all fisheries and aquatic resources within their jurisdiction by enacting ordinances in accordance with the National Fisheries Policy and enforce all fisheries laws, rules and regulations enacted by the municipal, city and provincial councils.

It is clear from the above legal framework that the "ball" for the conservation, protection and management of Philippine lakes is in the hands of LGUs in working closely with the FARMCs.

The rational use of lakes on a sustainable basis will require three essential elements: (a) sound planning based on scientific biophysical, ecological and socioeconomic studies; (b) strong political will to carry out the management plan; and (c) strict enforcement of regulatory measures necessary for sustainable development of lakes.

Integrated lake management planning should treat the lake and its watershed as one ecosystem. It must involve other sectors of society, using the lake as a strategy (Juliano, 1998). In the formulation of lake management plans, the holistic or systems approach should be adopted wherein the environmental and socioeconomic profiles of the lake basin are determined and all sectors/stakeholders concerned are consulted and involved in the process. The plans should also identify gaps in knowledge, clearly define issues that need to be addressed as well as lay out a prioritized course of action to be taken in resolving such issues within a timeframe and with necessary human and budgetary support.

An integrated lake management plan should include knowledge of the lake environment and the optimum balance of its various resources, hydraulic management to promote circulation of the water, pollution control, and socioeconomic activities of the adjacent areas (Fortes, 1995).

For the proper formulation and implementation of the integrated lake management plans, a multi-sectoral institutional mechanism such as the FARMC is needed. The proposed structure for a Lake Management Council suggested by Juliano (1998) is recommended.

Strong political will is had with competent leadership and the active support of the FARMCs. The capability of LGUs to implement integrated lake management plans needs enhancing through capability-building strategies like trainings along with the provisions for facilities and funding.

In the final analysis, however, the effectiveness of any lake management plan will depend on how well regulations are enforced to derive the expected benefits.

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