MANGROVE-AQUACULTURE TECHNOLOGY: PHILIPPINE EXPERIENCE

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I. Introduction

The importance of the mangrove ecosystems in the Philippines has been recognized only during the past years when the mangrove resources were almost at the edge of total destruction. Conversion of mangrove areas to various land uses like fishponds, agricultural, commercial, and housing sites were very rampant, such that out of the 450,000 ha of mangrove forests in 1920 (Brown and Fishes, 1920), only 141,713 ha were in existence in 1988 (Swedish Spare Corporation, SPOT Satellite images, 1988).

Efforts to save the remaining mangrove forests have been a concern of various government agencies and private organizations. Laws were promulgated, but enforcement has been a problem because of the urgent need for livelihood and survival of the foreshore communities associated with mangrove areas.

Cognizant of the dependence of the coastal fisherfolk on the mangrove forest products, the government started to focus its attention on a new approach of integrating the mangrove resource with management and livelihood. Thus, the mangrove-aquaculture was conceived as a good strategy.

This paper presents the history of one of the earliest mangrove-aquaculture projects in the Philippines which started in 1986. The site is part of the Bureau of Fisheries and Aquatic Resources (BFAR) Fish Farm for milkfish production in Son-oc, Poblacion, Ubay, Bohol, central Philippines.

Mangrove seedlings were planted in an area at a ratio of 80%-20%, mangrove to fish culture area. The project proved that mangroves and fish could live and grow in a harmonious relationship.

The project area now serves as a free entry for wild fishes so that fish production of no less than one-half ton yearly has been recorded in an area of over 2.0 ha. Fishes caught are usually grouper, snapper, tarpons, barracuda, siganids, tilapia, mullets, caravalle, slipmouth, whiting, scats, goby, sea bass, shrimps and blue crabs.

The mangrove-aquaculture project in Ubay, Bohol which has been successful, could be easily adapted by the fisherfolk living in coastal areas where mangroves can be grown. The forest products and fishery resources obtained from such activity could contribute to the sustenance of coastal communities.

II. The Project Site

The technology of mangrove-aquaculture was adapted by then Regional Director Fernando Bernardino of the Department of Agriculture Regional Office, Cebu City in 1987 after coming back from a cross-country visit to Indonesia. Upon his return to the Philippines, he decided to adapt the technology in a site which he appropriately selected, the Ubay Brackishwater Demonstration Fish Farm in Son-oc, Poblacion, Ubay, Bohol, in Central Visayas (Fig. 1).

The said project site was actually established in the mid 1980s as a demonstration farm for milkfish production under the Fisheries Regional Office No. VII, Cebu City of BFAR. In 1987, when BFAR was made a Staff Bureau, the administration of the project was turned over to the Department of Agriculture Regional Office No. VII, Cebu City.

The project site covers an area of 16 ha of which 10.24 ha are fully developed and productive. The strategic location of the area where mangrove trees are abundant, served as basis for the selection of the site.

The project then served a dual purpose: as a demonstration farm for milkfish production and as a site for mangrove-aquaculture study. Hence, the farm area was divided into: aqua-silvi pond (4.94 ha); open ponds (4.22 ha); experimental pond (1.0 ha); and infrastructure (0.08 ha) as shown in Fig. 2.

III. Developmental Scheme

The developmental scheme was started in 1987 when mangrove propagules were planted in rows inside the 4.94 ha intended as aqua-silvi pond (2.625 ha as MP#4 and 2.315 ha as RP2 and MP2 fishponds), taking into consideration the sufficient spaces between the dikes and the newly planted trees. About 20% of the pond area was utilized for fish culture, while 80% was planted to mangrove.

During the first five years of the project (1987-1993), the area was stocked with milkfish fingerlings at the rate of 1000-3000 pc/ha. No feed was given, but production was observed to be as much as 1.0 mt/ha/yr. Now that the trees are on its 15th year, still no harvest of mangrove trees has been done. Fully grown trees at the center of the fishpond now reached about 20,000.

In the spaces between the dikes and the trees, aquaculture is undertaken. At present however, the area is no longer stocked with milkfish fingerlings. It is now used as a free-entry area for various marine fish species coming from the sea through the main water supply canal.

In order to maintain ample spaces between the trees, regular thinning or removal of small old branches at the lower portion of the trees is undertaken every three months. This is done to avoid the overcrowding of trees and total shading of the pond bottom which could lead to anaerobic condition in the pond area.

Planting mangrove trees inside the fishponds along the periphery of the main dikes of the different pond compartments used for milkfish production was also done. The trees not only prevent dike erosion, but also make the soil compact and firm.

Likewise, along the outside portion of main dike and water supply canal, fully grown mangrove trees are also luxuriantly growing. Other benefits derived from mangrove trees could be the fertilizing effect of liters or fallen leaves that decay outside and inside the ponds. This provides organic fertilizer to the pond water enhancing the growth of natural food.

Noting the beneficial impact of the mangrove trees in the project, another pond compartment (1.6 ha) was planted with mangrove trees in 1995 with 20:80 percent ratio (20% pond space and 80% planted to mangrove). The trees are now five years old, and the area is used to grow milkfish fingerlings to marketable sizes. Figure 2 shows the pond compartments where mangrove-aquaculture is presently undertaken.

IV. Fish Production

Fish production in the mangrove-aquaculture ponds may not be much, but this consisted of several species of high commercial value fish. Although, no actual recording was made. reports seemed to indicate that about 500 kg of fish were recovered in 1998 from the 2.265 ha pond compartment. The fish were caught near the gate of the main water canal at the entrance of the pond.

The harvest consisted of siganids, tilapia, groupers, shrimps, mullets, barracudas, caravalle, slipmouth, whiting, milkfish, ten pounder, tarpons, scats, goby, snappers and sea bass. Crustaceans consisted of blue crabs and shrimps. Shellfish like oysters, clams and snails were also collected. The fishes collected were big, some weighing over 1.0 kg each (grouper barracuda, snapper, etc.).

V. Other Observations

The project area also serves as a refuge/sanctuary for marine aquatic fishes as well as wild birds and ducks which are observed in the area everyday usually in the morning. Birds usually found only in the forests, could now be seen in the mangrove trees.

The luxuriant growth of mangrove trees within the fishpond area and those along the main water supply canal and the areas between the creek and the fishpond proper indicate a harmonious co-existence of aquaculture and silvi-culture if properly managed. Benefits can therefore be derived from mangrove-forests products as well as fisheries from the aquaculture area.

VI. Problems Encountered

1. Fish monitoring and harvesting

The presence of mangrove roots and watered depressions in the mangrove forests inside the pond area could pose a problem in assessing the fish stocks. Likewise, recording the total fish harvest also became a problem particularly for groupers. The fish usually seek refuge in the roots of the trees or bury in the mud when the water has receded. During harvest, the fish becomes weak and sometimes dead, affecting the marketing of the fish, since live grouper are still preferred by customers.

2. Death of mangrove trees

Some species of mangroves are not resistant to prolong submersion of its aerial roots. This led to the high mortality of the mangrove trees.

3. Thick growth of filamentous algae

Mangrove-aquaculture ponds are usually observed to have overgrowth of filamentous green algae, covering the entire pond surface. Such condition is not very favorable to fish stock as it leads to oxygen depletion at night and oftentimes resulting to fish kill due to asphyxiation.

VII. Comments and Recommendations

1. Mangrove-aquaculture technology could increase the income of the fisherfolk from forest products and also from fish production. The technology will therefore, serve as a livelihood and also in promoting biodiversity conservation.

2. In ponds, polyculture should be practiced where herbivorous species like milkfish and tilapia should be stocked first. Carnivorous species can be added when the herbivores are already big enough to escape the predators. This will result to bigger fish at harvest because predation could be minimized.

3. Species selection of mangrove trees to be planted should be considered. Mangrove species with aerial roots that could resist prolong submersion in water, like the *Rhizophora* should be selected.

4. Water management is very important in mangrove-aquaculture systems. Canals maintained at appropriate water depth is necessary for the fish culture. Appropriate design should be taken into consideration to provide the needs of both resources..

5. Fish production in mangrove-aquaculture may be low compared to other fish production systems. However, since inputs are kept low and stocking is kept at a minimum or barely nothing as in the case of free-entry of species, fish production can reach 300-500 kg/ha/cropping. This is still profitable considering that production sustainability is attained and harmonious relationship with the environment is maintained.

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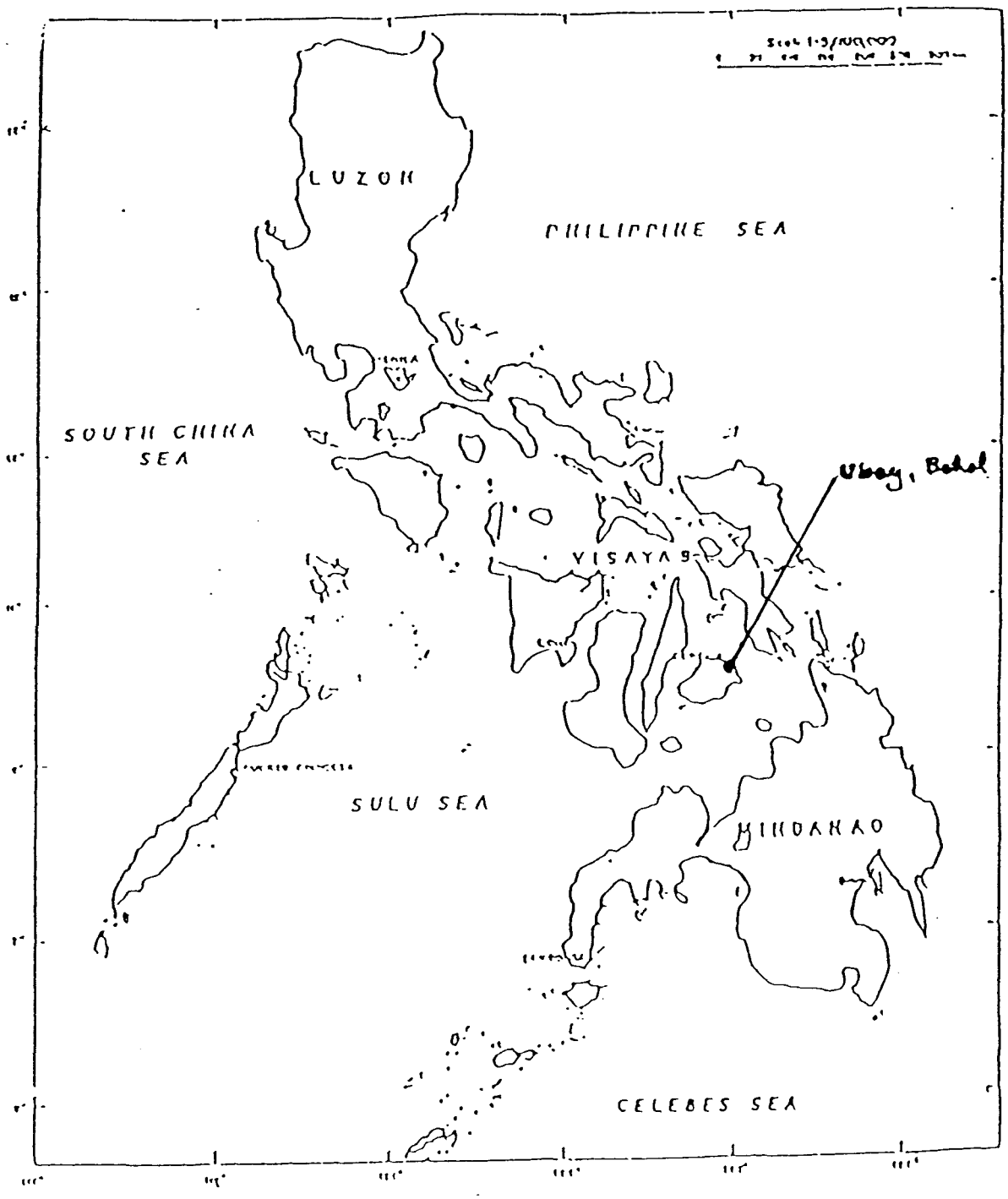

Fig. 1. Map of the Philippines

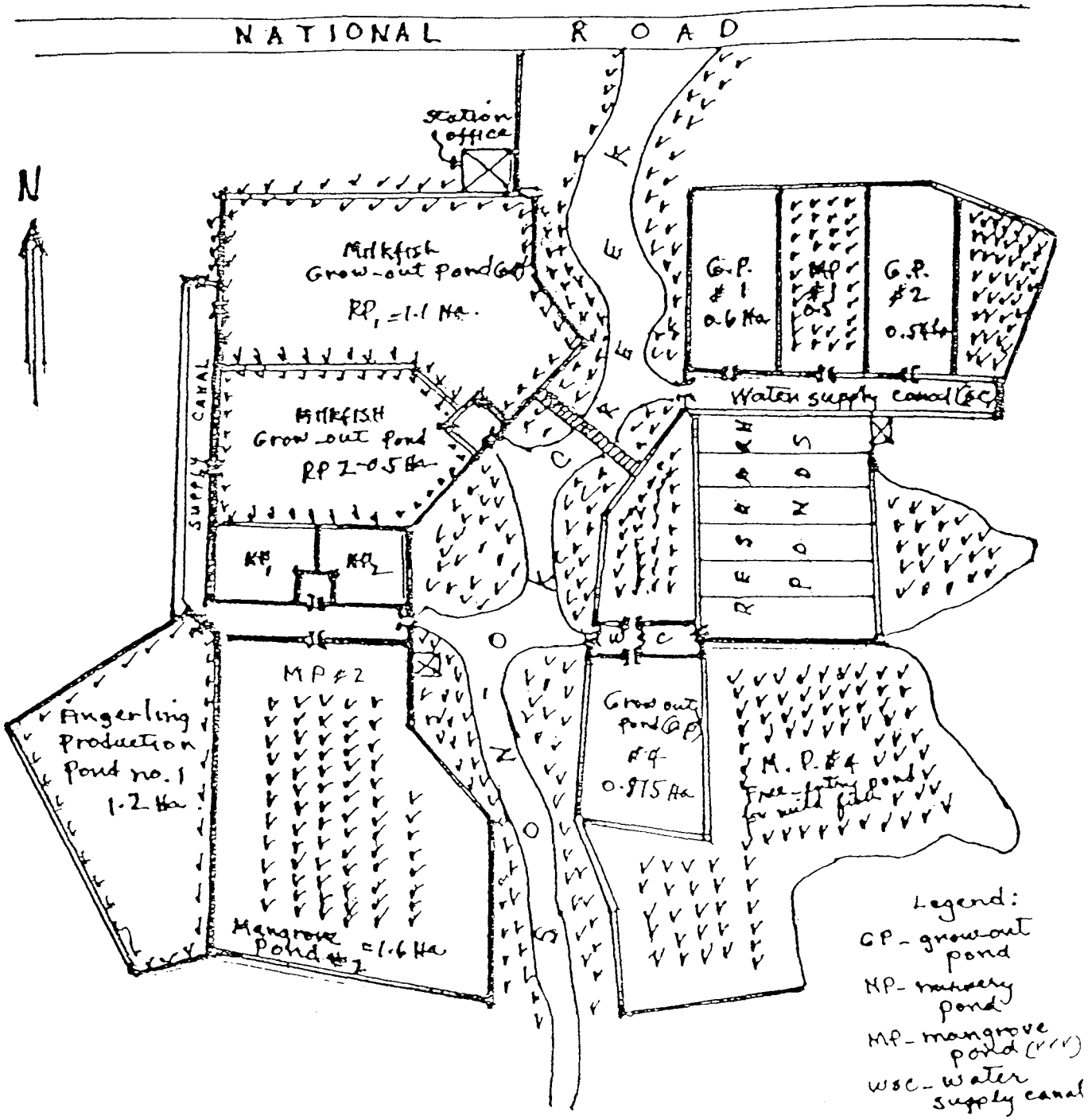

Fig. 2. Diagrammatic layout of Ubay Brackishwater Demonstration Farm, Son-oc, Poblacion, Ubay, Bohol, the Philippines