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SEAFARMING AND SEARANCHING DEVELOPMENT IN THE PHILIPPINES

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ABSTRACT

The paper reviews developments in Seafarming and searanching in the Philippines. Seafarming activities concentrated on seaweeds and molluscs, technology for which are already widely practiced. In Seafarming of oysters and mussels, technology is mature but only applied in traditional sites. As such, the quality of products and consumption is low due to known pollution of oyster and mussel farming areas. Seafarming of giant clams is just beginning. Hatchery techniques of producing juveniles are being refined for mass production and seeding of reef areas to enhance giant clam population. Seafarming of marine fishes is also practiced but constrained by the lack of seed stock. Sea cage fanning operators mainly depend on wild-caught fry and juveniles although the hatchery technology for sea bass has been developed. There is more research work to be done to mass-produce fry and juveniles for Seafarming of other fish species.

Seafarming and searanching appear to be the future major means of supplementing the production of animal protein by year 2000 as arable land continues to dwindle. Declining arable land area would not be sufficient to produce the food needs of the increasing population.

There is great potential for Seafarming and searanching to enhance coastal resources and produce more food. However, there is a need to provide stronger legal and institutional support for these activities to sustain development efforts.

INTRODUCTION

Searanching is a "culture-based fisheries", which is beyond the traditional practice of fish culture in an enclosed system such as fishponds. Searanching activities include increasing production in natural waters by seeding, stabilizing, and facilitating the production process for aquatic organisms of economic value.

Seafarming is a means to promote or improve growth, hence production of marine and brackishwater plants and animals for commercial use by protection and nurture on areas leased or owned (Milne 1972). Some people also consider the rearing and releasing of young fish into open bodies of water to supplement commercial fish catches as Seafarming (Iversen 1968).

Searanching and Seafarming might well be the answer to produce the animal protein requirement of the world population by year 2000. In the Philippines, arable land per capita decreased from 0.48 hectares in 1979 to 0.44 hectares in 1981 (Delmendo 1990). The industrialization process going on even use up available agricultural lands which further exacerbate reduction of agriculture production. Small land area per capita cannot produce the food needs of the population unless higher technological methods are applied.

About 70 percent of the earth is composed of marine waters. Total marine fishery production is projected to be about 150-160 million tons by year 2000, which is estimated to supply only about 30% of the projected animal protein food requirement worldwide and about 3% of the total caloric requirement. Further intensification of marine fisheries could lead to a situation in which this resource alone could supply 75% of the animal protein food requirement and about 7.5% of the caloric requirement of the world's population by year 2000 (Hanson 1974). Therefore, there is a big possibility that Seafarming and searanching will supply the greater percentage of animal protein food requirement in the near future. Technologies of Seafarming and searanching are fast developing in many parts of the globe, particularly in recent years when fish is considered a more desirable health food compared with livestock products. Seafarming zones which could be utilized for food production are illustrated in Fig. 1.

SPECIES USED FOR SEAFARMING

Molluscs, crustaceans, fishes, and seaweeds are the major organisms farmed in marine waters. Crustaceans and a few fishes are cultured in brackishwater. Molluscs are the easiest to culture as they are primary consumers. Seaweeds are also quite easy to farm but sites have to be ideal for growth. Molluscs can be moved from shallow to deeper waters without much problem.

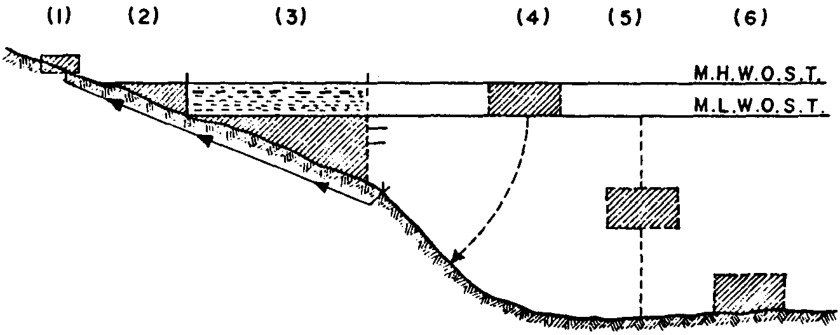

Fig. 1. The six possible zones for seafarming in coastal waters: (1) shore, (2) intertidal, (3) sublittoral, (4) surface floating, (5) mid-water, and (6) seabed. Redrawn from Milne (1972)

Oyster and Mussel

Of the molluscan species, the oysters are perhaps the earliest known marine organisms cultivated by man as early as the 4th century A.D. in Naples, Italy (Anon. 1989). This consisted of nothing but scattering broken pieces of tiles on the seabed.

Oyster farming started in 1935 in Hinigaran, Negros Occidental in central Philippines by the Bureau of Fisheries using stake method. In the same year, experimental oyster farming was expanded to Binakayan, Cavite in Luzon where different methods of farming oysters and mussels were developed. They include stake, hanging, and longline methods. The farm sites are usually shallow coastal areas on intertidal flats.

Oysters most commonly farmed in the Philippines include *Crassostrea iredalei, C. malabonensis,* and *C. cuculata.* For mussel, it is *Perna viridis.* The Philippines ranked eighth among the top 10 oyster and mussel producers worldwide (Chew 1989). In 1990, the total oyster and mussel production of the Philippines was 31,000 tons (BFAR 1990).

The methods of oyster and mussel farming are still considered traditional because farming sites used are shallow areas near coastal population centers. As such, local consumption of the product is constrained by poor water quality. Consumers are wary of eating oysters too often. Because of this, export quality standard for oysters required by importing countries cannot be met.

The Philippines can expand oyster and mussel production by shifting farming activities from shallow polluted waters to deeper, cleaner areas. The raft-type hanging and longline hanging method of oyster culture can be carried out in water depths of 5-10 meters as found in Japan and the Republic of Korea.

There are several advantages in this practice (Delmendo 1989):

1. Growth and fattening of oysters are improved.

2. Less area is needed for an equivalent production as the three dimensional use of the water is effected.

3. Culture operation can be conducted irrespective of seabed quality.
4. Available deeper areas can be used.
5. Work can be done regardless of tide condition.
6. Predator organisms are avoided.
7. Water quality is better.

In 1982, a study on the feasibility of oyster and mussel farming by municipal fishermen was conducted by the South China Sea Fisheries Development and Coordination Programme. The number of existing oyster and mussel farms were inventoried and potential areas for development were identified. There were 1,202 units of oyster farms with a total area of 429 hectares. About 9,145 hectares were available for expansion. On the other hand, there were 692 mussel farms aggregating a total area of about 300 hectares. About 4,925 hectares were potential areas available for development.

At present, neither the status of existing oyster and mussel farms nor the rate of expansion in new areas identified are known. These can be attributed to the following problems and constraints:

1. Poor monitoring and evaluation of farming operations. There is no established mechanism of monitoring and data gathering of mollusc farming operations and state of Seafarming activities of fishing households along shallow coastal areas.

2. Lack of information on larvae or spatfall density in oyster and mussel grounds. There has been no intensive survey of spatfall and distribution of oyster and mussel larvae other than empirical knowledge from oyster and mussel farmers based on their experience. They keep their oyster and mussel farming operations close to their homes. Due to lack of information on spatfall density, expansion of oyster and mussel farms could not be promoted.

3. Inadequate post-harvest processing, marketing, and distribution facilities. Some areas in the Philippines produce large quantities of mussels, but transportation and distribution network to market are not adequate. Farmers are therefore constrained to produce more due to low farm gate price.

4. Lack of demonstration of improved oyster and mussel farming management system. Oysters and mussels are sedentary animals. Therefore, their growth is dependent on the availability of food passing through. Overcrowding results in heavy competition for food. The spacing of oyster and mussel collectors should be taken into account.

5. Inadequate knowledge of growth processes of oysters and mussels. The Philippines has a year-round spawning of oysters and mussels. Some knowledge of the growth processes of oysters and mussels would be useful in the preparation of the farming schedule which synchronizes production with seed collection and growing patterns. This will stabilize the availability and price of products in the market.

Giant Clam

There has been an uncontrolled exploitation of giant clams to support the shellcraft industry because of the increasing demand for the adductor muscle of the clam. Furthermore, destruction of the coral reef habitats where these clams live account for the decline of tridacnids. *Tridacna gigas* and *T. derasa* have been seldom found in the reef areas of the Philippines, Indonesia, Papua New Guinea, Micronesia, and southern Japan (Heslinga and Fitt 1987).

Seafarming of the giant clam is needed to repopulate or replenish the wild stocks, rehabilitate the resource, and provide alternative livelihood for fishing communities. However, as an income-generating activity for small fishermen, giant clams are very slow growing; as food, not commonly consumed except in localized areas in the country.

To date, experimental work is in progress in the Philippines at the Marine Science Laboratory of the University of the Philippines-Marine Science Institute (UPMSI) in Bolinao, Pangasinan and the Silliman University (SU), Dumaguete, to mass-produce the seed to replenish the fast dwindling resources. Some results of studies conducted by these institutions have been published by the Philippine Council for Aquatic and Marine Research and Development (1988) and International Center for Living Aquatic Resources Management (ICLARM) (Munro 1993). A hatchery and culture manual on giant clam has been published by the Australian Centre for International Agricultural Research (ACIAR) in 1992 based on the collaborative research between the UPMSI, SU, the Micronesian Marine Demonstration Centre (MMDC) in Palau, and ICLARM at its Solomon Islands facility. Cultivation techniques have been developed for giant clams. However, the slow growth rate of the clam is not attractive to farmers. Government institutions may have to continue to undertake searanching of giant clam to enhance this resource. At present, exploitation of giant clam is still banned.

Better management of giant clam resources would result if shellcraft manufacturers undertake Seafarming of these clams in close cooperation with fishermen to ensure regulation of harvest.

Seaweeds

Farming of seaweeds in the Philippines has grown fast in the last decade. It was initiated in the early 1960s through the initiative of Dr. Maxwell Doty of the University of Hawaii with the collaboration of the Bureau of Fisheries. The methods of farming were demonstrated in different places in the country until extensive farming activities developed in southern Philippines, particularly, in Sitangkai, Tawi-tawi in Mindanao (Delmendo et al. 1992).

The major species cultivated are the red seaweeds, *Eucheuma cottonii, E. spinosum,* and *E. alvarezii.* The method used is the monoline technique described in the Manual of Seaweed Farming: 1. *Eucheuma* spp. (Godardo 1988). There are about 3,000 hectares of seaweed farms in Mindanao and central Visayas (Smith 1987). The extent of *Eucheuma* seaweed farming fluctuates depending on the local buying price and demand for the raw material. This particular industry is characterized by output price fluctuations and cost shocks due to the oligopsonistic structure of the industry. *Eucheuma* farming is an industry that is composed of closely related groups of buyers and sellers organized to perform the economic activity of seaweed marketing in a particular manner (Hollenbeck III 1983).

Dried seaweed is one of the major export products of the Philippines. In 1990, a total of 35,346 tons of dried seaweeds were exported with a total amount of Pl,192,331 (US$49,883) Freight on Board. This excludes the seaweed extracts, the carrageenan, processed by seaweed processors based in the country (BFAR 1990). The Philippines is the major source of *Eucheuma,* which is the raw material for carrageenan extracts.

Caulerpa sp. is a seaweed species farmed in brackishwater ponds. It is mainly used for domestic consumption. However, recent developments on post harvest handling of the seaweed promoted its export. *Gracilaria* sp. is another species which used to be grown in fishponds. Seedstock used to be obtained from Manila Bay and planted in ponds to serve as food for milkfish, but this is no longer practiced. Wild stocks have decreased due to reclamation of Manila Bay and pollution. Small scale farming of *Gracilaria* is practiced in western Visayas using ponds and drainage canals (Hurtado-Ponce et al. 1992). Production was found higher in canals than in ponds. *Gracilaria* is now being farmed in other parts of the Philippines such as eastern Sorsogon mostly in open coastal waters. A manual on *Gracilaria* farming has been published by the FAO/UNDP project, Seaweed Production Development (Taw 1993). Farming trials are being conducted at various sites to demonstrate techniques of production and determine environmental factors affecting gel quality of agar extracts from *Gracilaria.*

Marine Fishes

Fishes commonly farmed include the sea bass, *Lates calcarifer,* and the grouper, *Epinephelus* spp. These are usually cultured in protected coastal areas or in ponds.

Seeds are obtained by spawning and collection of juveniles from the wild. Spawning the sea bass has been quite developed and hatchery technology for this species had been handed down to farmer level in Thailand, Singapore, and Indonesia. In the Philippines, collection of juveniles from the wild is found to be more practical and economical particularly for grouper. The farming of these species has not expanded as fast as the farming of shrimp because of the lack of feeds and seed stock.

The technology of marine fish cage culture using sea bass and groupers is already a packaged technology which farmers have adopted. The major constraint which needs to be solved is the supply of fish seeds and feeds for grow-out purposes. Much work has been done on hatchery production of sea bass and groupers. However, mass production of seeds of these species has not come about to encourage fish farmers to go into marine fish culture. To ensure a high rate of survival from hatching to juvenile stage, further research work is necessary to mass-produce the seeds for Seafarming purposes. In addition, the search for alternative feed for use in cage culture operations other than trash fish should be developed.

Shrimps

Shrimp farming activities (largely *Penaeus monodon)* take place in brackishwater ponds. There are about 220,000 hectares of brackishwater ponds in the country, which are primarily used for the culture of milkfish *(Chanos chanos).* With the technological advances attained in hatchery production of shrimp juveniles and the high demand for shrimp in the world market, some of the milkfish farms were converted into shrimp farms using the improved farming techniques practiced in Taiwan. A recent survey of brackishwater ponds in specific regions in the country shows the area now used for shrimp farming is about 23,446 hectares (Table 1).

Table 1. Estimated production and area used for shrimp farming in different regions of the Philippines (Anon. 1989)

	Farming System and Area (hectares)				
Region	Extensive	Semi-intensive	Intensive	Total	Estimated Production (tons)
01	86.1	110.4	199.3	395.7	1,886.2
02	52.2	2.0	-	54.2	48.6
03	7,281.6	106.5	12.7	7,400.8	5,511.9
04	171.3	449.9	5.0	621.2	1,492.1
05	666.8	72.0	4.0	742.8	1,838.9
06	3,773.0	3,719.5	430.7	7,923.2	17,029.9
07	1,288.0	625.5	384.8	2,298.3	5,664.1
08	333.8	-	-	333.8	233.7
09	549.3	10.0	-	559.3	414.5
10	825.5	437.0	38.9	1,301.4	2,180.7
11	86.9	37.4	35.0	159.3	435.5
12	1,352.7	270.8	32.5	1,656.0	2,002.8
Total	16,467.2	5,836.0	1,142.9	23,446.0	36,654.5

The aspect of shrimp farming that is closely related to Seafarming is the hatchery production of juveniles. Shrimps spawn in coastal areas. Shrimp hatcheries are often located close to the sea for convenience of seawater supply. Broodstocks collected from the wild are kept in broodstock ponds for maturation and spawning. The technique of spawning by eyestalk ablation has been an established practice.

Spawners collected from the wild are still preferred for spawning purposes. Experience of hatchery operators indicated that it is more economical to use wild-caught spawners than to raise breeders in captivity. Furthermore, it was found that ablated shrimps were not good due to low survival of spawn. Shrimp fry produced from pond-grown ablated broodstocks were not as hardy as those obtained from the wild. Thus, it is important that mature shrimp population in nature should be adequate to provide spawners for the hatchery. Furthermore, there would be better chance of reproduction, thus increase the shrimp resource productivity.

The problem of lack of broodstock can be solved by searanching, restocking of coastal lagoons with shrimp juveniles to supply spawners for hatchery use.

SEARANCHING

In the Philippines, searanching has not been attempted because government efforts for resource enhancement has not been given appropriate support and attention. Seeding of lakes and reservoirs is a practice continued by the government but releasing of juvenile fish or shrimps into coastal waters has not been attempted. This is due to the vast expanse of the sea compared to inland waters such as lakes and reservoirs. Besides, the mass-production of seeds of marine species has not been attained. Although much work have been carried out in spawning the milkfish, sea bass, and groupers, large quantities of seeds to satisfy the needs of searanching has yet to be attained.

Searanching, to be of significant impact, should be undertaken by the users of coastal fisheries resources. Under the present open access and common property nature prevailing in marine fisheries, searanching would be difficult to launch unless the government is prepared to subsidize the mass-production of seeds. The fishermen themselves, with technical guidance of government, should be able to produce the seeds they need to release within their communal fishing areas. Furthermore, a system of coastal resource use and allocation should be established as a matter of policy of government.

In the case of shrimps, the excess juveniles, produced from existing hatcheries could be released in selected coastal areas particularly when there is an oversupply from the hatcheries. This is one way of stabilizing the price of shrimp fry when production exceeds demand. Searanching of shrimp could be taken up by the shrimp hatchery operators as they would directly benefit from the increase of the broodstock population in the wild.

Experience in Japan showed that shrimp searanching increased production of shrimps in the Hamanako lagoon 2-4 times greater than natural catches in open waters. The advantages of shrimp ranching are: 1) increased supply of shrimp breeders and increased production, 2) stabilized production through adjustment of the time in releasing the postlarvae, and 3) additional recruitment to the natural production of shrimps not caught for breeding purposes (Uno 1985).

Searanching of marine fishes

Searanching of marine fish species, such as milkfish, mullet, snappers, groupers, siganids, spadefish, etc. could be made possible by mass-production of their seedstocks which could be released in coastal waters. Research work must be intensified to develop the technology of cheap mass-production of seedstocks of these species. Otherwise, searanching and even Seafarming would not fully develop in the same magnitude as the brackishwater fish farm industry.

Searanching is a means of resource enhancement and part of this program is the production of seedstocks in hatchery and nursery facilities. Broodstock rearing and maintenance for hatchery use is an aquaculture operation, both in land- or marine-based facility. Once the seeds are already produced and released, these become part of the natural fishery in the coastal waters which are available to the fishermen for harvest.

For searanching to become a universal practice, fishermen and seafarmers must be given appropriate incentive by the government in terms of legal and institutional support.

FUTURE OF SEAFARMING AND SEARANCHING

There is great potential for development and expansion of Seafarming and searanching. However, there is yet a need to mass-produce a large number of marine fish seeds in hatcheries to supplement wild caught species by fishermen. A low-cost mass rearing technique of marine fishes of high economic value has not yet been fully developed. Unless there are inexpensive hatchery rearing techniques to produce large numbers of juvenile fishes, it may not be economical to enhance coastal fishery production through Seafarming or searanching operations. Furthermore, the common property nature of marine waters and open access policy do not promote searanching. There is no ownership of fish seedstocks once released in open waters. Searanching would require collective effort of those who are engaged in fishing activities. On the other hand, seafarmers could claim ownership of seedstock in enclosed facilities such as cages and pens installed in certain water areas for which a lease or permit for their use has been obtained.

The communal nature of coastal waters is subject to dispute by several users. Unless this is specified by law, some legal problems in the occupancy and development of Seafarming sites could arise. The necessary legal and institutional support for Seafarming and searanching as part of coastal fisheries management and development should be established, backed by a strong policy decision and political will of the government.

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