Floating Fishpens for Rearing Fishes in Malaysia*

Floating fishpens were first introduced in Malaysia in 1973 for rearing groupers, *Epinephelus tauvina,* in the Straits of Penang. Over three years, this method has proved to be technically feasible and commercially viable. Total production of groupers from floating fishpens in Penang is around 10 tons a year, using a coastal area of about half an acre.

MERITS

The system has the following advantages:

1. It takes advantage of the good water quality of the open sea with the adequate circulation of water by tidal flushing hence ensuring adequate oxygen supply and eliminating the accumulation of waste from fishes.

2. In deep reservoir or mining pool where anaerobic condition prevails at the bottom, floating fishpens could take advantage of the upper layer of the water which is rich in plankton and high in oxygen content.

3. It allows easy management at which the floating cages could be periodically checked, repaired, cleaned or even renewed. The condition of the nets used to contain the fish could be easily maintained.

4. Periodic checks on the condition of the cultured fishes in floating fishpens could be done. Fishes could be easily hauled out for examination, weighing or treatment.

5. As the fishpens are not permanently installed to fixed locality the cages could be easily moved from one locality to another if threatened by water pollution.

6. By using off-bottom methods, predators can be controlled with less loss of stock.

7. Fishpens can be used in areas where the bottom is not suitable for traditional shellfish farming, rocky or uneven.

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*From Fisheries Bulletin No. 20, 1977, "Floating Fishpens for Rearing Fishes in Coastal Waters, Reservoirs and Mining Pools in Malaysia" by Chua Thia-Eng and Teng Seng Keh, School of Biological Sciences, University Sains Malaysia. [The Bulletin was published by and available ($5.00) from the Publications Unit, Ministry of Agriculture, Kuala Lumpur.]

Larval Rearing

Milkfish Researchers on Threshold of Another Breakthrough

High mortality of artificially reared milkfish (*Chanos chanos*) larvae — one of the remaining critical problems in the drive toward developing the technology to mass produce *bangos* fry — has apparently been licked by SEAFDEC Aquaculture Department scientists.

They have succeeded in rearing larvae that have survived beyond the critical point which is about 56 hours or 2-1/2 days from hatching. Previous efforts have resulted in 100 percent mortality after the 6th day in the research laboratories in Tigbauan, and survival of only 32 larvae in the research station in Pandan.

35000 Survivors

In May 23 this year, the researchers obtained, at the Tigbauan main station, fertilized eggs from a hormone-induced spawner or *sabalo*. The fertilization rate achieved was around 38 per cent while hatching rate of fertilized eggs was at 73 per cent which provided some 35000 larvae almost all of which survived to post larval stage, the stage marked by the total consumption of the yolk and the formation of the mouth of the fish. In short, when the fish is ready to feed.

Rearing Techniques

Key to the apparent success may lie in the rearing techniques tried. Dr. Jesus Juario, leader of the milkfish research program of the SEAFDEC Aquaculture Department explained that the post larvae were given several types of feed: *Chlorella sp.*, rotifer (*Brachionus sp.*) the

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A concept for the transfer of aquaculture technology... *from p. 2*

ion situation in or out of the agro-climatic zone where the pilot program was done.

It is necessary to incorporate whatever technology is developed in a farming system and then packaged and tested.

The advantages of conducting such controlled experiments in farmers' field are:

1. It will considerably increase production and productivity and will provide immediately visible satisfactory results.
2. It is economically favorable to the farmer.
3. It is manageable by the farmer, and compatible with his farming system.
4. The product is acceptable to the farmer.
5. The product is easily marketed.
6. The inputs are readily available and accessible to the farmer.
7. The risk to the farmer is low.

Subject Matter Experts

Experiments in this phase are designed by researchers and subject matter specialists (SMSs) with the close collaboration of extension workers. Under the present Philippine research system, the SMSs are "commodity experts" who will provide the vital link between research and other technology users by working in the different experiment centers and stations.

At present the SMSs are turning out the *"Philippines Recommends* Series." The series is a "one-story" package of alternative recommendations designed to simplify technology to be used by extension specialists in helping farmers improve their production.

In summary, the objectives of the field trials are:

- To validate technology results.
- To obtain feedback information to guide research programs.
- To better understand traditional farming practices and possibly improve on them.
- To evaluate practices and technologies both technically and economically.
- To learn how the farmer receives, evaluates and eventually uses the technology.
- To modify technologies for specific areas.
- To introduce new technologies to extension workers and to farmers.
- To train professionals working in farmer level experimentation, the researchers and farmers
- To serve as an interphase or planned linkage between Research and Extension

Technology Dissemination/Utilization

Three aspects are worth considering in technology dissemination. These are: (a) farm demonstrations, (b) extension, and (c) acceptance of the technology by farmers in the form of its application to actual production. But unlike in technology verification and packaging where the researchers take the lead responsibility, with the extension workers closely collaborating, this time it is the extension worker who plays the lead role in technology dissemination and utilization.

AIA created... *from p. 1*

search agencies in a concerted effort of solving the myriad problems of aquaculture development. Hopefully, this cooperation will not only strengthen efforts in producing desired high-quality graduates at both the M.S. and Ph.D. levels, but will also successfully integrate and interchange faculty, researchers, students, and course areas in the field of aquaculture.

The AIA is also envisioned to serve as a forum through which the best minds in fisheries can work together to map out solutions to problems, strategies, plans and policies for hastening aquaculture development. This way, the drafting of inter-agency or inter-country plans, the undertaking of problem-oriented research projects, the laying out of policies to service Asian universities and other institutions, among others, will be facilitated and implemented sooner.

R & D Notes

Floating fishpens... *from p. 4*

Production and Yield

The floating fishpen system is among the most productive means of fish production through aquaculture. The present grouper farm produced 8 tons of fish in a total area of 619 sq m, including the area between two cages, or approximately 12.2 kg/sg m. The yield per hectare (122 tons) is many times higher than that of pond culture of Chinese carps (3-5 tons/ha), milkfish culture (0.45-1 ton/ha) or mullet culture (150-300 kg/ha). The yield of bighead carps from productive reservoir is also extremely high. The production is estimated to be 296 tons per hectare if only the net area is considered under culture.

Technical Considerations

Floating Cages

Both fingerlings and adults can be reared in floating cages. The size and shape of the rearing cage depends on the types of fish cultured and the physical condition of the site.

The floating fishpen consists of a floating platform and net cages suspended from the platform.

It is important to ensure that the cage and the platform are strong enough to resist strong currents, winds or waves during a heavy storm. Size of the net-cages used ranges from 1 to 100 sq m but not to exceed 100 sq m as periodic change of the nets and maintenance is difficult. Cage depth is about 2 meters.

The netting used for making the net-cage should be of sufficient thickness and able to resist seawater and heat. Nets made of 21 to 24 ply polythene thread is suitable as it is sufficiently strong to resist tearing by crabs or cutting by the edges by oyster shells. Unlike nylon, polythene netting appears to be able to stand the strong heat of the sun for a considerable period of time.

Culture Site

In selecting a site for cages, consider the following:

1. The location should be calm and protected from strong wind and current.

2. Tidal range should not be too large; best range should be around 1-2 meters allowing sufficient exchange of water through the cages

3. The dissolved oxygen content of the water of the site for cages should not be less than 3 cc/l.

4. Clear water is an advantage for cages as the nets will not be clogged by fouling organisms and silt particles.

5. For coastal aquaculture, water salinity should not be less than 15°/oo for groupers, 25°/oo for rabbitfishes, snappers and threadfins but a wider fluctuation of the salinity from 10°/oo to 30°/oo is suitable for the rearing of sea bass, *Lates calcacifer.*

6. Site should be easily accessible for the transportation of feeds as well as for bringing the fish out to market.

7. Site should be as much as possible free from otters which are rather common around mining pools, rivers or coastal waters. Otters are known to tear nets with their strong teeth.

Suitable Fish for Culture

For floating fishpens, one should consider such factors as the hardiness of the fish, availability of fry in sufficient quantity, disease resistance, larval history, environmental requirements as well as other factors such as the acceptability of the cultured fish to the consumers and its market price.

Feeds

Carnivorous fishes take sliced trash fish readily when they are more than 10 cm in length. Smaller fishes or fry about 2-8 cm in length should be fed with small shrimps such as *Acetes* or mysids. For freshwater fishes such as the bighead and silver carp, no feeding is needed if the reservoir is rich in plankton. But for intensive stocking, supplementary feed such as rice bran is given. Experiments have so far revealed better conversion and growth rate when the estuary groupers are fed once in two days with sliced trash fish rather than intensive feedings. Results also indicated that good conversion rate, less mortaility rate and even growth are ensured.

Feeds should be free from parasites. When trash fish is used as the main feed, ensure that they are fresh and properly cleaned. Pellet feed is considered to be the best as parasites and germs are destroyed in the process of preparation.

Economic Aspects

For profitability, it is important to produce fishes which fetch higher market value and have ready market. Choice of site is important because a wise selection and efficient utilization of the environmental factors such as temperature, salinity, disolved oxygen content and plankton productivity, contribute to the success and profitability of the venture.

Capital investment includes equipment for the preparation of feeds, deep freezer, building for storage and disease treatment, and boat. Operating costs generally include items such as cost of seeds, feeds, disease treatment, electricity, fuel, labor and rent.

Family Unit Floating Fishpens

With the decline of inshore catch, the floating fishpen system of culturing fish may help alleviate the situation by absorbing some of the fishermen into culture fishery.

A family of two can easily handle and operate four floating net-cages of size 28 x 18 x 5 feet, which can contain around 1000 fishes each. With grouper, the ratio of net income over capital cost is calculated to be 51.2 percent excluding labor cost. The net income of each fisherman per month is about M$294.

Small-Scale Hatchery... *from p. 5*

unaffected by inland discharges containing agricultural runoff or industrial wastes; proximity to the source of spawners; road accessibility; and availability of power source, fresh water, and technical personnel needed for hatchery management.

The best method to determine the suitability of seawater for larval rearing is to conduct preliminary tests using pails or small tanks on the probable site. The production of postlarvae with resonable survival rate from eggs in a series of at least 3 runs would indicate likelihood of success in actual operation.

Facilities

Some of the facilities needed are a sand filter to rid the seawater or organisms like fish and jellyfish, including silt and mud during heavy run-off, an air supply system with a compressor or blower that can deliver air at an effective pressure of 1.5 meters column of water, a 2-ton larval rearing tank which may be made of marine plywood, 1-ton shallow wooden tanks for algal culture, 1-ton cubic wooden tanks for *Brachionus* culture, and a roofed structure with walls to house the larval rearing tanks, the algal starters, and as a monitoring area.

Larval Rearing of Milkfish... *from p. 4*

trochophore larvae of oysters and six different types of artificial feeds.

More Trials

The milkfish research program is a continuing one and additional experiments are being done with the postlarvae such as salinity level, food preference and other parameters that could shed light on the development of the technology for successful mass rearing of fry which in turn would considerably help in the establishment of seed banks.

Economic Impact

This latest development is significant in terms of solving the problem of ensuring a steady and reliable supply of fry, a big drawback of the milkfish industry. Fishpond operators still rely on the seasonal supply of fry and thus cannot operate at an optimum level. This however does not mean the displacement of people who depend on the collection of fry for livelihood. The SEAFDEC milkfish experts assure that the extensive present and potential requirements of the milkfish industry can readily absorb all the fry that can be collected from coastal waters and those that may eventually be raised in seedbanks.

SEAFDEC's milkfish program – an integrated and continuing research thrust – has so far hurdled the following problems: domestication of spawners; inducing spawners while in captivity to ovulate through hormonal injection; artificial fertilization and hatching of eggs; and, with this latest advancement, possibly mass rearing of fry until these are ready for release and distribution.