Netcage culture in SEA

By **ET Aldon**

Japan, Thailand, Malaysia and Singapore have cage culture industries that contribute significantly to their food production. The cage culture industry in the Philippines is discussed on pages 26-27.

Japan

Yellowtail is one of the most popular fishes in Japan and its culture is one of the earliest forms of marine enclosure fish farming in the world. The floating net cage industry in this country developed in 1960 (Beveridge 1987).

Fry are reared in small to large (2-50 m^2) synthetic net cages. Regular size-grading are done until the fry are transferred to grow-out cages at size 5-10cm (8-50g).

Cage culture of yellowtail may either be floating or submersible with few fixed cages used in shallow water.

Floating cages for yellowtail were originally small and square (2 x 2 m), with rigid collars constructed from 10-15 cm diameter bamboo poles, and held afloat by steel drums. Floating units are now around 300m^2 by 3-6 m deep. Materials like 3-5 cm galvanized steel pipe and polydrums or polystyrene cylinders covered in polyethylene sheeting are used instead of the traditional bamboo, cedar wood and steel drum collars. Most cages have single net synthetic fiber bags fitted with a top net. Some farms use galvanized or nylon-coated steel mesh bags to minimize fouling and reduce net changing to once per year. Some use anti-fouling chemicals to treat their nets.

Large, flexible rubber collar cages are popularly used in more exposed but less polluted offshore sites. Submersible cages are also used in some exposed sites. Typical design has a net chimney in the top net with 1-2 m diameter held afloat by buoys which can be closed after feeding or during rough weather. The cage can then be lowered to a depth of 10-15m. Cage volume is maintained by a combination of floats on the top rope and weights on the toe rope. A rigid cage frame made of galvanised steel or sand-filled plastic pipe is attached to the bottom of the bag for protection against strong currents. The size of submersible cages is between 1,200-1,500m^3.

The prefectural governments regulate the siting of cages. Dr. Taizo Sakata, JICA expert, recommends strict regulation of the use of marine waters for aquaculture. Japan is now trying to control the number of netcage operators, number of cages, and stocking density among others. But the control measure, he said, should be based on the recommendation of scientists.

Other control measures include the right food for particular species. A feed must be developed to minimize pollution. Raw fish pollutes more than artificial feeds. Japan is now into developing a high nutrient and lost-cost feed, which is a mixture of raw fish and artificial feeds. He noted that aquaculture activities are self polluting in addition to human, industrial and agricultural wastes that are drained into the sea. Hence, he said, it is important that the sea should not exceed its carrying capacity due to over-intensification and proliferation of sea cages.

Beveridge (1987) noted that stocking density which can be between 0.9 kg per m^3 and 20 kg per m^3 depends on the size of the fish and the prevailing environmental conditions. About 80% survival can be achieved with fish reaching 2 kg after 12 months or 4-6 kg after 18 months.

Seabream and globefish cage culture in Kagoshima Prefecture, Japan
(PHOTOS COURTESY OF DR. TAIZO SAKATA)

Thailand

Seabass and grouper are the two important marine species being cultured in cages in various parts of Thailand. The nursery phase is carried out in 1 x 2 x 1 m where 1,000-2,000 grouper fry are stocked per cage. The fry are fed small shrimps and gradually trained to accept minced trash fish or shrimp meat diet. Feeding to satiation is done 2-6 times a day at 10% BW and regularly size-graded to reduce cannibalism (de Silva 1998).

Fish at size 6-7.5 cm are transferred to growout cages which may either be stationary or floating. Floating cages are preferred where they can be adjusted to tidal fluctuations. Stationary cages are fixed in position by wooden poles in shallow areas with less than 1-m depth. Stocking density is 20-30 fish per m^2. Fish are harvested after 7-8 months upon reaching 600-800 g. Size can be 1,200-1,400 g after 10-12 months.

Stocking densities can be increased in sites with good water quality and environmental conditions. Grouper can be stocked in a netcage at 75-457 fry per m^2 to produce 500 g fish or at 40-244 fry per m^2 to obtain 1,200 g fish. Teng & Chua (1977) as cited in de Silva (1998) reported that artificial hides can be placed in net cages to increase stocking density.

The rapid expansion of the sea bass and grouper culture, however, gave rise to the incidence of pathogenic infection on crop. The loss of US$35.5 million in 1988 and US$53.8 million in 1989 was due to massive mortality brought about by parasitic infestation of the fish. Ruangpan & Tubkaew (1993) investigated the incidence and intensity of parasite infection of sea bass and grouper in cages in five provinces in eastern and southern parts of Thailand. It was found out that there is similarity in the composition of parasitic fauna in both grouper and sea bass where they were kept either on same cage or separate cages.

A study on water and sediment by Songsangjinda et al. (1993) showed that water quality within cages is poorer than outside the cages because of accumulation of metabolic wastes for cultured fish. A strong tidal current can promote removal of these wastes. This indicated that production would tend to decline after three continuous years of cage culture of any species because the accumulation of organic wastes would increase eutrophication levels.

For pen culture, Tookwinas (1993) stocked tiger prawns at 4,000 fry per pen of 6 x 6 x 5 m, stationary with corners of the net fastened to wooden or bamboo poles. Fry were fed artificial diet at 4-5 times a day at a rate of 10-20% BW per day. The pen is designed not to submerge during high water of the spring tide. The mesh size of the nylon net is 1.4 mm for the nursery phase and to a bigger mesh size during the juvenile stage.

Growth and survival of prawns were checked by using cast net once a week in the first month, then once every two weeks. Selective harvesting is done after three culture months when the prawns reach 28 g. Tookwinas (1993) reported a yield of 100 kg prawns per pen.

Malaysia

According to Chua (1978) aquaculture in floating fishpens was first introduced in Malaysia in 1973 for rearing groupers in the Straits of Penang and has been found viable for commercial purposes. Total production was reportedly been 10 tons per year for 0.5 acre.

Size and shape of the rearing cage depends on the farmed fish in both nursery and grow-out phases. The size of the net cages ranges from 1 m^2 to 100 m^2 for easier maintenance of the nets. For less mobile fishes like grouper, cage size is 12 m^2 for fingerlings of size between 3-6 cm and 35 m^2-100 m^2 for fish above 10cm. The fish are then grown to a marketable sizes of 0.5-1kg.

Chua and Teng (1978) recommend rectangular cage for culture in mining pools and reservoirs while hexagonal is ideal in waters with strong tidal currents. Hexagonal cage reduces resistance of the tidal currents and stabilizes cages but difficult to construct. Each net cage is suspended from a floating platform or a number of smaller net cages are suspended from a larger and common platform. The platform is then anchored at four corners to the seabed by using heavy anchor or wooden pegs driven into the seabed. Local Meranti wood or changi batus as platforms can last 2-3 years while Nibong is ideal for framework. Nets of 21-24 ply polyethylene thread is strong enough. The sides are reinforced by polythene rope and bricks or concrete weights are attached to the corner of the net cage. The floating fishpens are either arranged in a row or in zigzag manner for intensive culture. Simpler cage design can be used in areas where tidal current is not a problem, i.e. mining pools or reservoirs. Chua and Teng (1978) also studied the possible effects of use of hiding space in floating cages. Seven combinations of hiding spaces were compared. results indicated that the use of hiding space could help reduce stress on the fish, decrease the crowding effect and reduce the velocity of the water currents inside the net cage.

Chua (1978) identified fishes suitable for culture in floating cages in Malaysia which include: sea bass, grouper, rabbitfish, threadfin, bighead carp, marble goby and silver carp. Leong (1993) added snapper to the list. He studied diseases of marine finfishes in floating cages. He pointed out that the outbreak of diseases occurred in the hatcheries or soon after the fingerlings are introduced into the floating cage and throughout the growout phase. This he said was more common in groupers.

Leong (1993) described Malaysian aquaculture as an art rather than a science as fish farming is implemented without serious study. This he said is the reason why the country's aquaculture industry is beset with problems like disease outbreaks and fry supply. Fry are imported from Thailand, Sri Lanka and the Philippines where fish have been subjected to transport stress.

Major diseases have been identified to be Vibriosis, red boil disease (grouper only), swim bladder disease, baldness disease and Lymphocystis.

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host susceptibility. Serological, hybridization, or molecular biological methods may be necessary for a more detailed taxonomic classification of the organisms.

Research on environmental risk factors may help define the conditions responsible for epidemic diseases. There is also a need to examine the rearing protocols in the hatchery that may influence the health and survival of postlarvae in ponds, especially during the first two months of culture.

The rearing process in the farms evidently caused substantial deterioration of bacterial diversity. Since its dramatic appearance in late 1993, luminescent vibriosis has remained prevalent and caused significant reduction of rearing activities. Data that link the disease to water quality and environmental conditions must be obtained and examined for a holistic prevention and control program to be implemented.

LIST OF REFERENCES WILL BE PROVIDED UPON REQUEST

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Pangasinan were demolished by the Task Force created by the national government. After the demolition, it was estimated that only 30% of fishpens and fishcages are still in operation. The offshore cages in Bolinao, Sual and Alaminos, Pangsinan were not affected by the demolition.

The proliferation of pens and cages in marine waters since 1996 coincided with the intensification of culture in ponds particularly in Visayas and Mindanao. These ponds were formerly intensive prawn ponds. So, throughout the country, milkfish is being cultured in high densities.

The price of milkfish continued to increase from 1989 to the first quarter of 1997 (Table 2). But the industry's expansion resulted in oversupply. This became apparent when there was a big drop in prices in the third quarter of 1997. The price increased towards the end of 1997 but it is still low compared to 1996 to early 1997 prices. The decrease in price leads to more losses of most cage, pen and pond operators.

Table 2 Wholesale prices of milkfish (1989-1998)

Year	2-3 pcs per kg	3-4 pcs per kg	4-5 pcs per kg
1989	35	30	25
1990	40	35	30
1991	50	45	40
1992	50	45	42
1993	50	45	42
1994	55	50	45
1995	60	55	50
1996	70	60	50
1997 1st quarter	90	70	60
2nd	80	60	55
3rd	60	50	45
4th	70	60	55
1998 1st quarter	65	60	55
2nd	55	45	38
3rd	55	45	38

At present, the fishpen and fishcage operators who are still in the business are the original operators who were able to make a lot of profit during their first year of operation and those who have efficient systems and low production cost. The latest Typhoon Gading flooded most areas in Pangsinan which resulted to more losses. Even the offshore cages were not spared by the typhoon. The stocks from at least twenty (20) units of Polar Cirkel cages were lost due to damage in nets. Some fishpens in Bolinao were also damaged. Those fishpens which were reinforced with new wooden and bamboo poles prior to the typhoon suffered minimal losses.

In the Visayas and Mindanao areas, most fishpond operators have stopped stocking milkfish in their farms because of low prices. With these developments, most fishpen and fishcage operators are hopeful that the prices will increase in the next few months.

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Singapore

The Primary Production Department (PPD) of Singapore in 1986, identified suitable species for intensive cage culture as: grouper (*Epinephelus tauvina,* sea bass (*Lates calcarifer*) and golden snapper (*Lutjanus johni*). Floating net cage was found to be a more advantageous aquaculture system because it can be adjusted to adverse conditions. The Straits of Johore are suitable sites for floating net cage culture where waves are normally less than 0.5 m in height. PPD recommends the following parameters for net cage culture:

Fingerlings of 7.5-10.0 cm (3-4") can be stocked in hapa nets at 100-150 fish per m^2. Cages of 2 x 2 x 2 m can hold 400-600 fingerlings until they reach a size of 12.5-15.0cm (5-6") which then should be size graded into 44 fish per m^2. A nursery cage of 5 x 5 x 3 m can hold 1,100 fish. After 2-3 months, fish are transferred to grow out cages where they are cultured for 6-8 months. Trash fish are used as feeds, the size of which would depend on the size of the fish. For fingerlings, feeds are chopped finely at 1 cm (0.4") and for grow out, around 2.5 cm (1"). Feeding is done once or twice daily at 10% BW.

Regular net changing would ensure good water exchange in the net and obtain optimal environmental conditions for the fish.

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