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Submerged tiered cages for growing shrimp

Aquaculture Department, Southeast Asian Fisheries Development Center

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Multiple harvest

Perhaps the most economically important advantage of the nursery pond use is the increased number of potential harvests per pond for the same fixed costs of time, labor, water, facilities, and overheads. In the above example there can be a harvest of 25-week-old prawns every 14 weeks from each of the two fattening ponds, that is, four harvests every 56 weeks. Without nursery ponds the same fattening ponds could produce only two harvests each year, provided the temperatures are adequate and seed is available.

Since the residence time in each nursery is half as long as in the fattening pond, one set of nursery ponds can support two fattening ponds. The above stocking schedule should be sufficiently flexible to provide a week or ten days between stockings to dry out, lime, clean, or maintain the ponds between crops. It should also permit a crop to be speeded up or held back by a week or two in the event of cold weather, an environmental crisis, or favorable market conditions.

Source: Robert Cordover, "Nursery Ponds," **AustAsia Aquaculture Magazine**, Vol. 3. No. 6. January 1989.

SUBMERGED TIERED CAGES FOR GROWING SHRIMP

The West German firm *Fischtechnik* has developed a new cage method which can be applied to the farming of shrimp (*Penaeus monodon*). The shrimp is a bottom-dweller and so any structure in which it is grown has to provide a suitable floor. This would waste most of the depth of a cage and so *Fischtechnik's* answer is a series of decks or tiers.

The cage is suspended in the sea in mid-water and is anchored to the bottom in suitable areas.

In the prototype version, cages of 40 decks are designed to lie five meters below the surface in water some 20 meters deep. This will protect the cages from damage by wind, rough surface waters, and obstructions such as driftwood.

A center feeding tray tube reaches each deck and allows a flow of dry feed to the growing shrimp. A multi-purpose service boat provides the feed through a connecting pipe and special pump.

In this system any number of cages can be anchored at distances of about 10 meters. As the area of sea covered is relatively small, it ensures effective and economical growing.

For checking the cages and the shrimps, an expert diver is preferred instead of an underwater camera.

The cage is hauled up only for stocking and harvesting. A boat would be equipped to carry out these operations.

One net cage of 40 decks is 4 meters deep and has a diameter of 1.9 meters. Each deck has an area of 2.8 square meters.

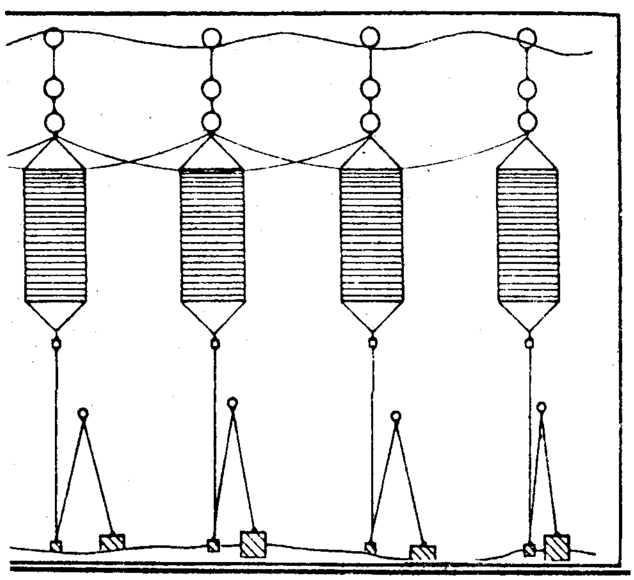
A cage can be stocked with around 10,000 postlarvae each weighing one gram. They would be allowed to grow to 10 grams, when the weight of shrimp in the cage would be about 100 kg at a stocking density of 90 per square meter.

They would then be transferred to another cage of the same size but having 26 decks. This would be stocked with 3,500 shrimps which would then be grown to marketable size of about 45 grams. Stocking density would be around 50 shrimp per square meter.

One cage would yield about 160 kg of tiger shrimp.

Three 26-deck cages will be required to grow 10,000 young shrimp transferred from one 40-deck cage.

A viable commercial unit would have 15 cages of 40 decks and 45 cages of 26 decks to give some seven tons of tiger shrimp in three months. Three harvests could be expected in a year.



Four-tiered shrimp cages anchored below the water surface.

Source: **Fish Farming International**, Vol. 15, No. 10, October 1988.

HOW TO KEEP THE SALINITY DOWN

Dry climates mean full salinity seawater. This has been a problem for farmers trying to raise the brackishwater species *Penaeus monodon* rather than the hypersaline tolerant *Penaeus semisulcatus* or *P. latisulcatus*.

Salt becomes separated from seawater by evaporation. In the dry, sunny, and windy conditions found along most of the tropical and subtropical Australian coast, the evaporation can be 6.5 mm per day or more. For a pond of normal seawater of 35 ppt, this is the equivalent of removing 65 m^3 of pure freshwater from the one hectare pond in one day. The salt that was dissolved in that lost water, all 2,275 kg of it, simply remains in the pond to increase the salinity of the remaining water.

Salinities much higher than 45 ppt are considered stressful to most prawn species, and a limit to their growth. Yet *P. merguiensis* juveniles are found growing at 50 ppt and the two hypersaline species mentioned above can live and perhaps even grow normally at elevated salinities. Just because a prawn can exist under abnormal conditions does not necessarily mean it likes it.

High salinity causes several kinds of physiological stress. Perhaps most important is the additional cost of osmoregulation, that is, the pumping and chemical workings of the body that try to maintain body fluids of say 23 ppt in an environment of twice that salinity. Another complaint is the omnipresent oxygen problem. The amount of oxygen that can be dissolved in seawater decreases as temperature and salinity increase so that at 20°C water of 45 ppt salinity holds about 15% less oxygen than does water at 25 ppt.

The principle is this: At any set of evaporation rates and incoming seawater salinity, there is a daily water exchange rate that will continue to increase salinity until all the water is gone and salinity is 1,000 ppt (i.e., dry salt). At a very high exchange rate, the salinity will remain that of the incoming water. The key is to find the minimal water exchange rate – that is the lowest pumping cost – that can maintain the salinity within an optimal range.

The exchange of water does more than merely keep the salinity level tolerable. Perhaps equally as important, the new water adds oxygen to the pond and flushes out metabolic wastes that reduce the growth rate of prawns. The flushing also removes nutrients released from waste feed that might otherwise cause unwanted planktonic algae blooms and their consequent oxygen depletion of pond water.

When water in a static pond with an evaporation rate of 6.5 mm/day is exchanged daily at 20% per day with seawater at a salinity of 35 ppt, the salinity in that pond increases slowly, at an ever decreasing rate, until it stabilizes at a salinity of 36.14 ppt. At this salinity, the increased salt coming into the pond with the new seawater, plus the salt left by evaporating seawater, is just balanced by the removal of salt along with the 20% of old water released each day.

The salinity increases at a falling rate – 0.19 ppt the first day, 0.14 ppt the second, and by the fourth it is down to 0.09 ppt per day. After that, the salinity remains stable so long as the conditions of evaporation, water exchange rate, and incoming seawater salinity remain the same.

Source: Robert Cordover, "How to Keep the Salinity Down," **AustAsia Aquaculture Magazine,** Vol. 3, No. 5, December 1988.