CULTIVATION OF "SUGPO" (JUMBO TIGER SHRIMP), PENAEUS MONODON FABRICIUS IN THE PHILIPPINES [1]

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SIX TEXT FIGURES

The cultivation of "sugpo" (jumbo tiger shrimp), *Penaeus monodon* Fabricius, has become an important and lucrative undertaking in estuarine fishponds. In the Philippines, juveniles of this species rank next to *Chanos* fry in market demand and value compared with other salt water stocking material. Sugpo are caught in almost all places where *Chanos* fry are collected but they appear at a somewhat later period.

Among the species of commercial shrimps of the genus *Penaeus, P. monodon* is the most highly esteemed by the consumers. Being considered a table delicacy it commands the best price whenever present in local markets. A kilogram of marketable sugpo costs from five to eight pesos, whereas other shrimps like the "hipong-suahe" (*Penaeus canaliculatus*), "hipong-puti" (*Penaeus indicus*) and "hipong-culot" (*Penaeus sp.*) cost from two pesos [2] to five pesos per kilogram.

Shrimps, when present in fishponds in addition to the cultivated species, are found to be harmless to the main crop of cultivated milkfish. Further, they provide an additional income to the culturist. Hence, it is that sugpo are deliberately gathered and stocked in the ponds to be grown to a marketable size.

The production of *Penaeus* in estuarine fishponds in the Philippines resulting from the normal shrimp population that enter the pond during the cultivation period is estimated to range from 50 to 200 kilograms per hectare per year. If, however, in addition to this normal stock, sugpo fry is introduced into the ponds, shrimp production per hectare per year may be raised to 500 kilograms of which about 70 per cent may consist of *P. monodon.*

[1] Presented at the Indo-Pacific Fish Council Meeting, 1961
[2] Two pesos equal one U.S. dollar

In spite of the promising aspect of the shrimp culture industry, scientific studies along this line are still meager. The present paper embodies the results of an attempt to study the rate of growth of sugpo in ponds, with notes on some problems and the technique of its cultivation in the Philippines. The study was undertaken at the Dagat-dagatan Salt Water Fishery Experimental Station, Malabon, Navotas, Rizal Province, Luzon and covered the periods of September 1943 to April 1944 and September 1950 to August 1952.

Sugpo fry bought from dealers in addition to those collected in the Dagat-dagatan lagoon were stocked in the nurseries of the Bureau of Fisheries at Dagat-dagatan. Weekly samples were taken and measured from the time they were stocked in the nursery ponds until they were transplanted to the bigger rearing ponds and monthly measurements of samples from these latter ponds were subsequently made. Sampling the nursery ponds was effected by using fry lures or bon-bon. When the sugpo abandoned its clinging habit, sampling was made by random catches by hand or by traps.

The juvenile sugpo is dark brown to almost black in colour. The body is firm and straight when undisturbed in the water and could easily be mistaken for a small fragment of stick or debris. The physical features of a young sugpo are similar to those of a mature one except that the body colouring changes in the course of growth. The fry is dark blackish, being opaque, while the bigger size is dark bluegreen and somewhat translucent.

The sugpo fry (Fig. I) caught from the fry grounds measured on the average 15.3 mm. in total length, 1.6 mm. in body depth and weigh 0.025 grams.

Although the shrimps were subsequently carefully measured and weighed at monthly intervals, their subsequent growth cannot be said to show any conclusive results as there was considerable variation during the three periods of observation (as much as one order of magnitude during the earlier months). Moreover, the experiment was carried to the twelfth month during the 1951–1952 season only. The average figures shown in Table 1 are, therefore, for the present given merely as a rough guide as to the approximate sizes likely to be encountered at monthly intervals after capture. The exact age of the fry at commencement of the experiments is not known.

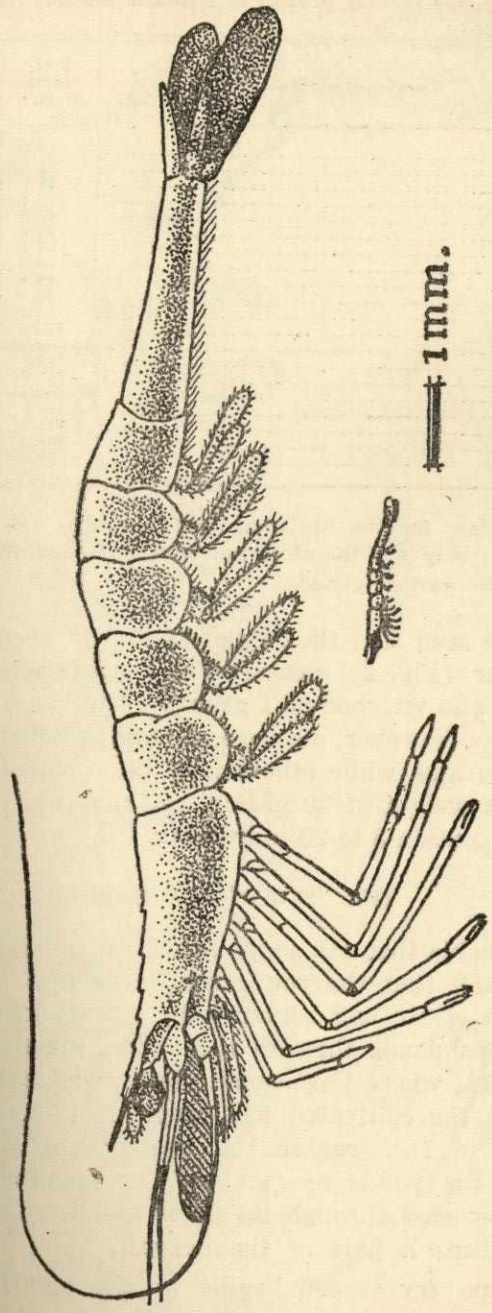


FIGURE 1.—The fry of sugpo, *Penaeus monodon*.

TABLE 1.—*Average rate of growth of Penaeus Monodon under cultivation.*

Duration of culture	Total length (mm)	Body depth (mm)	Weight (g)
Fry	15.3	1.6	0.025
One week	21.5	2.5	0·06
Two weeks	28.2	3.6	0·08
Three weeks	38.8	4.5	0·92
Four weeks	45.3	5.7	0·78
Four weeks	45.3	5.7	0·78
Five weeks	57.1	7.8	1·63
Six weeks	60 3	9.7	3.39
Seven weeks	69.5	10.9	4.36
Two months	79.0	9.8	4.34
Three months	94 7	11.1	6.88
Four months	120.0	15 3	1.45
Five months	Incomplete	Incomplete	Incomplete
Six months	141.9	18.3	22.3
Seven months	152.6	16. 4	25.1
Eight months	Incomplete	Incomplete	Incomplete
Nine months	178.0	27.8	57.3
Ten months	211.6	30.2	62.8
Eleven months	223.0	32.0	70.7
One year	229.8	32.0	95.1

Note: The data for the ninth to twelfth months are for the 1951–52 season only are therefore not strictly comparable with averages for the earlier periods.

It will be seen that the sugpo which had been held in ponds for one year (Fig. 2) measured on the average 229.8 mm. in body depth and weighed 95.1 grams. The largest specimens of this age may, however, measure as long as 250.0 mm. weighing about 120 grams while others may be as small as 180.0 mm. long with a weight of 50 grams. A kilogram of one year old sugpo may contain 8 to 20 individuals.

THE "SUGPO" FRY INDUSTRY

It is probable that the sugpo spawn in the sea, not far from the coast and that the young are carried to shallow coastal areas, tidal rivers and estuaries by the incoming tide. They also enter fishponds through the coarse screens of the water control gates, where they constitute a welcome and gratuitous addition to the cultivated fish crop. Not a few uninformed caretakers in fact regard the presence of these unstocked species in the ponds as "singaw" or spontaneous products because they pass through the gates unnoticed when small but later constitute a part of the harvest.

The sugpo fry season begins in the month of May and extends up to October, the peak of the season occurring in August and September. The shrimp fry industry consists of

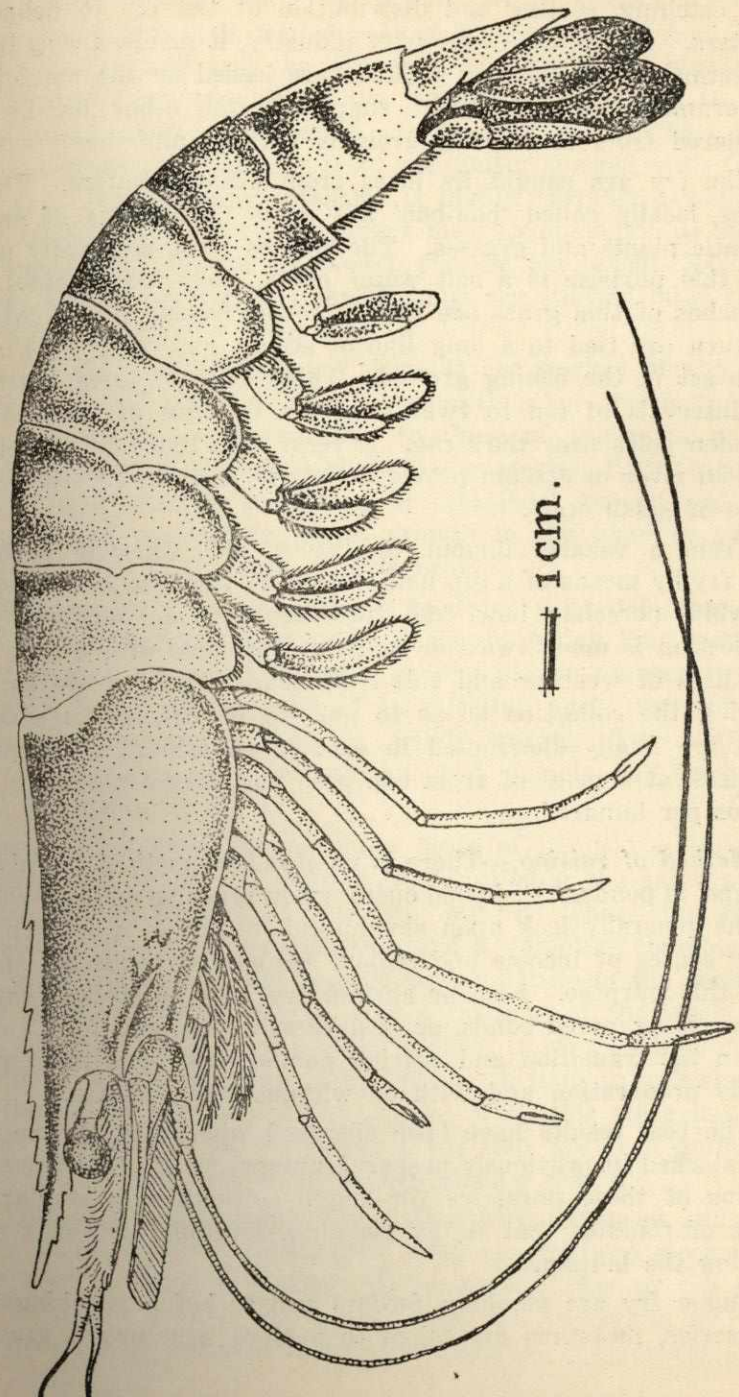


FIGURE 2.—A full grown sugpo, *Penaeus monodon.*

the catching, sorting and distribution of the fry to fishpond centers. Unlike the *Chanos* fry industry, it involves very little investment. *Chanos* fry grounds are leased by the municipal government to individuals; sugpo, on the other hand, are gathered from the fishing grounds without any fee.

The fry are caught by lures from natural waters. These lures, locally called 'bon-bon' are made of bunches of small aquatic plants and grasses. The species most commonly used for this purpose is a salt water grass, *Paspalum vaginatum*. Bunches of this grass are tied to form circular pieces, which in turn are tied to a long line of string, rattan or wire, and then set in the fishing ground. These lines of lures are tied at intervals of ten to twenty meters to lines of bamboo or wooden poles near the bank. Several such lines can be set in a tidal river or stream provided they do not obstruct the passage of small craft.

From a wooden dugout or 'banca' the collector gathers the fry by means of a dip net. They are then scooped up with a white porcelain bowl and transferred to an earthern jar. Collection is made twice or more at any time of the day, regardless of weather and tide conditions. The fry are sorted during the collection so as to get rid of extraneous species and are finally distributed in earthen containers of fishpond owners, at a price of from one peso and fifty centavos to six pesos per hundred.

Method of raising.—There is no standard method of raising 'sugpo' in ponds. Fishpond operators in brackish and salt-water areas generally look upon shrimp cultivation as a supplementary source of income and seldom are special ponds set apart for this purpose. Fish or shrimp fry may be stocked exclusively in prepared ponds, or in nursery ponds used for *Chanos* or in the transition and rearing ponds, with or without previous preparation and with or without other species.

The best results have been observed where the shrimp fry are stocked in previously prepared nursery ponds. The preparation of these nurseries for sugpo cultivation is similar to that of *Chanos*, that is, by cleaning, levelling, draining and drying the bottom.

Sugpo fry are plankton feeders and so before stocking the nurseries, measures are taken to achieve a luxuriant growth

of the micro-benthic biota or 'lab-lab' as in *Chanos* culture. Once this fish food is well developed in the pond bottom, the water is renewed and the nurseries are ready for stocking. In a pure type of culture the jumbo tiger shrimp is the only stock reared in the ponds. In a mixed culture the sugpo fry are planted in nursery pond previously stocked with *Chanos* fry. The stocking intensity is highly variable depending on supply but a hectare of nursery may accommodate as many shrimp fry as bangos (*Chanos*) fry, or say about 500,000. Care is taken to see that the shrimps are stocked later than the *Chanos* to avoid predation.

As in the case of *Chanos* the ponds are stocked during the cooler part of the day and the conditions of the water in the jar are first approximated to those of the pond water to be stocked. After stocking the nurseries, little care is needed and rearing is limited to occasional renewal of the pond water, maintaining algal growth in the pond or given artificial feed in the form of rice bran.

With proper care and enough food for a period from one to two months the sugpo attain a size at which they may be transplanted from the nurseries to the bigger rearing ponds. Some difficulty is encountered in effecting such transfer because they burrow in the soft, muddy bottom. Two methods of transplanting are generally adopted, namely (a) trapping and (b) draining.

In the first case, shrimp traps made of bamboo screens or 'baklad' are set in the pond bottom, utilizing the same principles used in trapping fish in wild waters. There is a guide screen or leader, a forechamber and a catching chamber or cod end. Because of the non-gregarious nature of the shrimps and their burrowing habits, only a fraction of the stock can be caught by this method so that in order to effect a total catch the pond is drained slowly, allowing the shrimps to seek shelter in the deeper portions of the ponds. Once this stock has become concentrated in the deeper areas they are then gathered by hand for transfer to the bigger rearing ponds.

When the young sugpo are sufficiently advanced and are big enough to escape from their enemies, they are stocked in the rearing ponds regardless of the time of day or the condition of the ponds. Although better quality sugpo may be produced when cultured alone by themselves, the general prac-

tice is to raise them with *Chanos* inasmuch as these two species are compatible. About 10,000 sugpo may be stocked per hectare of rearing pond.

Not much care is given to the sugpo under cultivation in the rearing ponds and with enough food they are expected to attain marketable size in the period raging from six months to one year.

Cropping.—Unlike bañgos which are easily caught by nets or confined by renewal or draining of the water, marketable sugpo are harder to catch. This is because the shrimp usually move around individually and are burrowing in habit. In fact, some loss occurs on account of this both during transplantation from one pond to another and when harvesting marketable sugpo from the rearing ponds, although several means are employed to minimize such losses. Methods of capture by hand, by bamboo traps, by nets and by draining, are described in the following paragraphs.

(a) *Bamboo screen traps.*—Varied types of screen traps are used in harvesting sugpo. These traps utilize the same principle as ordinary fish traps encountered throughout the Indo-Pacific region. Essentially, they consist of a guide screen or leader and a cod end or catching chamber. An example of one such trap is the *bakikong* as shown in Fig. 3. The leader of this trap consists of one or two bamboo screens staked and oriented perpendicularly or diagonally from the pond dike. This leads the shrimp to a fore chamber from which the shrimps are led into the cod end or catching chamber. These traps are specially effective during dark nights, particularly if there is water movement caused by renewal or draining. The catch is enhanced by installing a light in the catching chamber at night. The catches consist mostly of hipon suahe (*Penaeus canaliculatus*). They may also include sugpo if present but rarely 'hipon puti' (*P. indicus*).

Another type of bamboo screen trap is the *paabang* (Fig. 4). This is set so as to intercept the shrimp at some narrow gap in the fishpond system. It consists essentially of the catching chamber which is centrally and posteriorly located and two wings to screen the water passage. These traps are more effective during dark nights and when strong currents of water can be made to flow through the passage

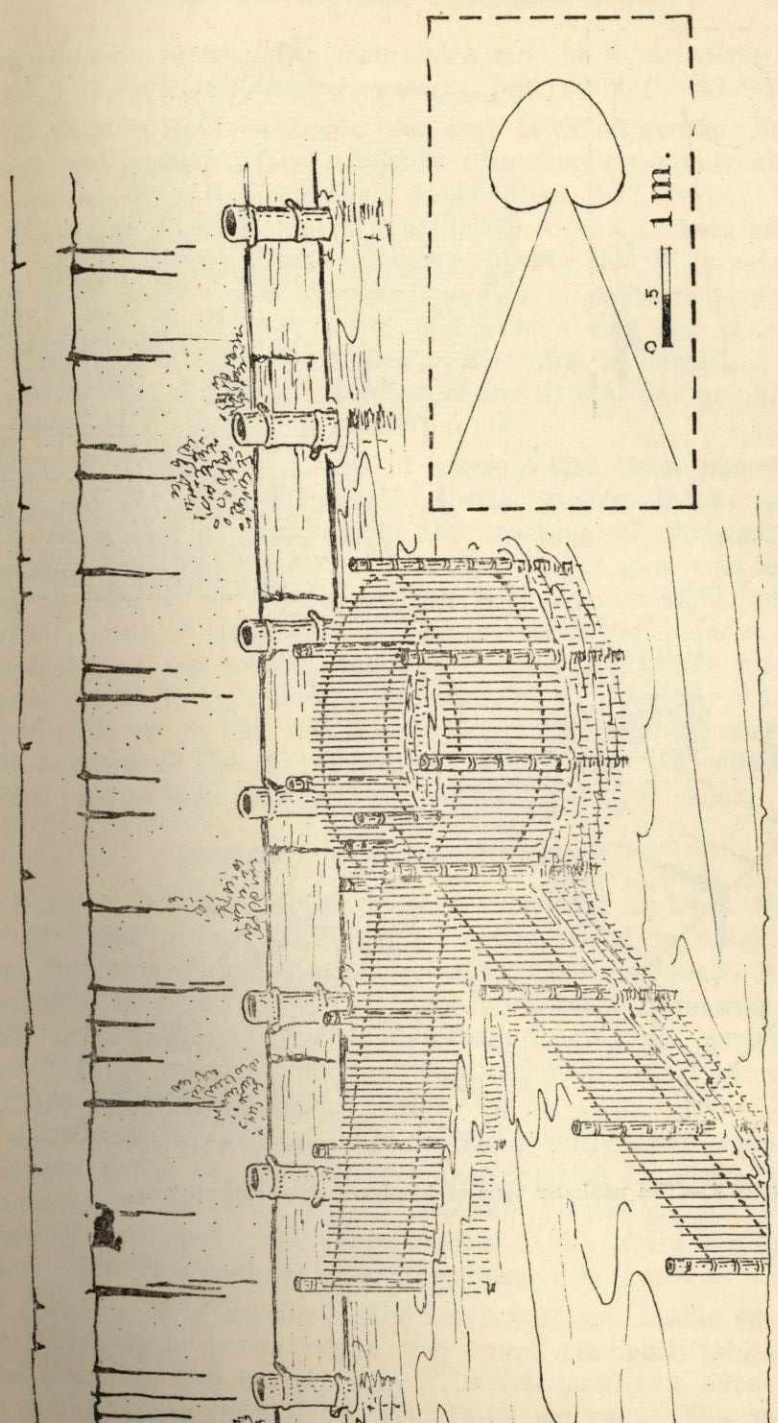


FIGURE 3.—The bakikong type of bamboo screen shrimp trap.

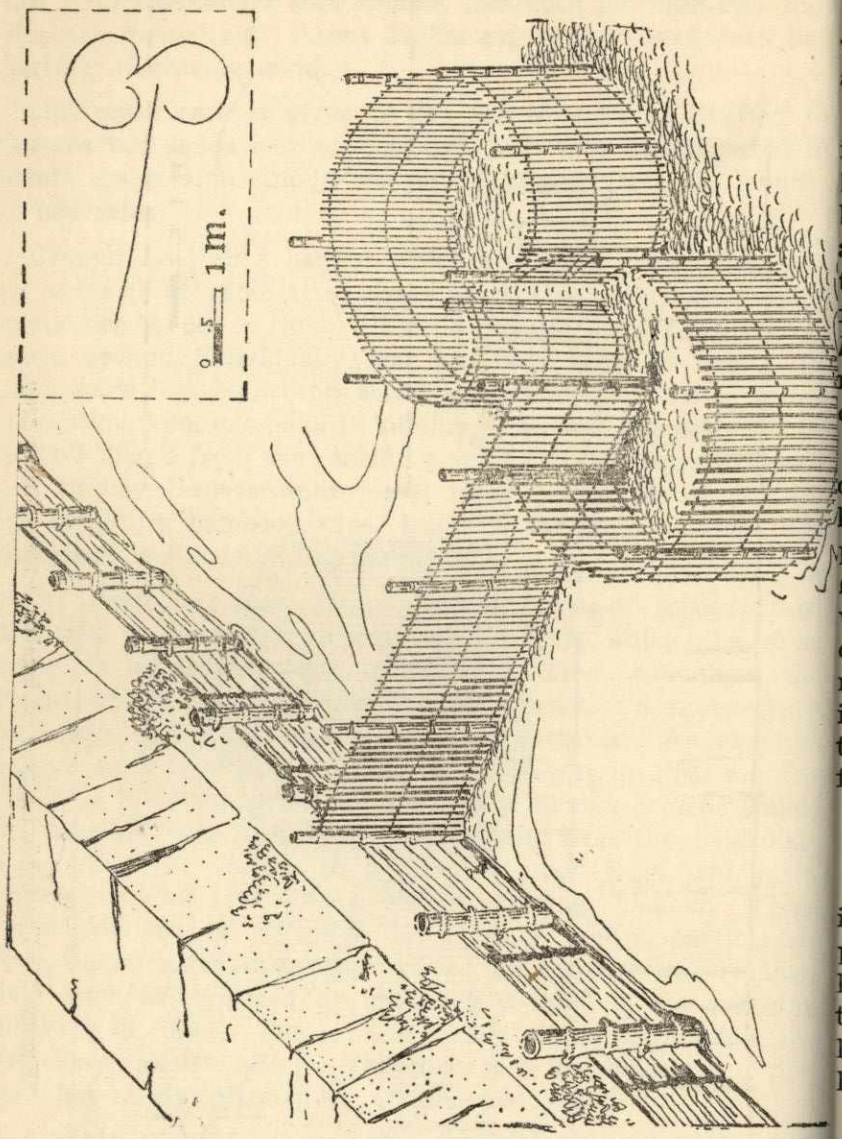


FIGURE 4.—The paabang type of bamboo screen shrimp trap.

where they are set. The main catch may be *P. canaliculatus* and possibly *P. monodon* if present, but rarely *P. indicus*.

A third type of bamboo screen trap is called aguila. This is a modification of the bakikong consisting essentially of a leader which is comparatively longer than that used in the bakikong and two chambers strategically located at both sides at the end of the leader as shown in Fig. 5. It is set in the deepest portion of the pond and is intended principally for catching *P. indicus*, although the catch may also include *P. monodon* if present. Although the catch is limited, it is more or less continuous regardless of the time of day or night, or whether the flow is regulated or not.

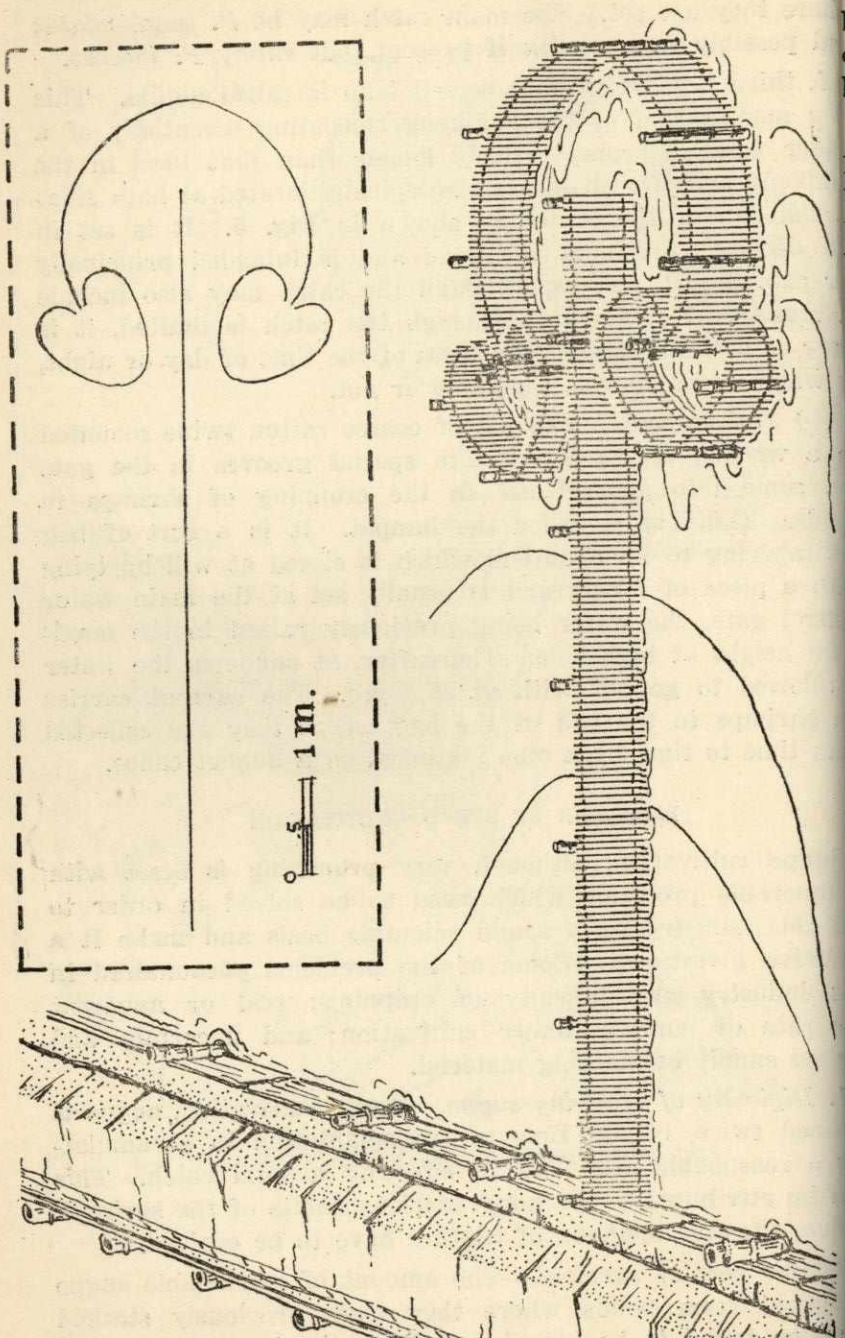
(b) *Net traps.*—A bag net of coarse cotton twine mounted on a wooden frame fitting into special grooves in the gate has come into general use in the cropping of shrimps in ponds. This net is called the lumpot. It is a sort of bag net tapering to an open end which is closed at will by tying with a piece of string and is usually set at the main water control gate, the water being previously raised to the maximum height at high tide. Thereafter, at sundown the water is allowed to go out with great force. The current carries the shrimps to the end of the bag where they are collected from time to time by a man stationed on a dugout canoe.

PROBLEMS OF SUGPO CULTIVATION

Sugpo cultivation, although very promising is beset with innumerable problems which need to be solved in order to put this industry on a sound scientific basis and make it a lucrative investment. Some of the problems encountered in this industry are difficulty of cropping; real or apparent low rate of survival under cultivation; and uncertain and limited supply of stocking material.

1. *Difficulty of cropping sugpo.*—Under cultivation, sugpo is cropped twice, i.e., at time of transplantation in accumulating a reasonable crop and in effecting a total catch. This may be attributed to the nongregarious habits of the shrimps. Hence, effective methods of capture have to be evolved.

2. *Low rate of survival.*—The amount of marketable sugpo recovered from ponds where they were previously stocked has been found to be very low. The estimated rate survival



be due to predators, natural mortality or the non-recovery of those shrimps which bury themselves in the soft, muddy bottom.

3. *Uncertain and limited supply.*—Perhaps the most important factor limiting the production of sugpo in ponds is the uncertain and limited supply of the juveniles for stocking purpose. The season for catching sugpo fry varies from year to year and the supply fluctuates considerably. There has been no systematic survey of actual and potential fry grounds except in places where they are incidentally found with the bañgos fry. Even if there is a supply of fry, the price is often exorbitant and the tiny needle-life fry costs from two to six centavos each where *Chanos* fry may cost 0.2 centavos a-piece Around the Manila Bay area most of the tidal creeks produce a limited supply of sugpo fry each year, and the towns bordering the Bacoor Cove along the Cavite Coast constitute a regular source of supply of sugpo fry to the fishponds in this area where the fry catching has developed into a special trade.

LAYOUT, CONSTRUCTION AND MANAGEMENT OF A 'SUGPO' POND PROJECT

A sugpo pond project can be established at any suitable place where adequate stocking material is available. For instance, a 10-hectare swampy area along a tidal stream, if falling within the tidal range and more or less level, with good clay loam or sandy clay loam soil and moderately clear of vegetation may be utilized. The area may be enclosed (Fig. 6) by strong main dikes high enough to keep off tidal water and flooding by freshets.

A concrete main water control gate (Mg) of double-opening type may be provided at a point easily accessible to the main portion. This may open to a head pond (hp) which should be the deepest portion of the system. This pond should lead to two secondary gate (sg) which in turn lead to the two rearing ponds (rp) and there will be a water control system leading to the nursery catching ponds.

The nursery unit, one hectare in area, should be located immediately in front of the head pond, away from the main water control gate and it should be shallower than the rearing

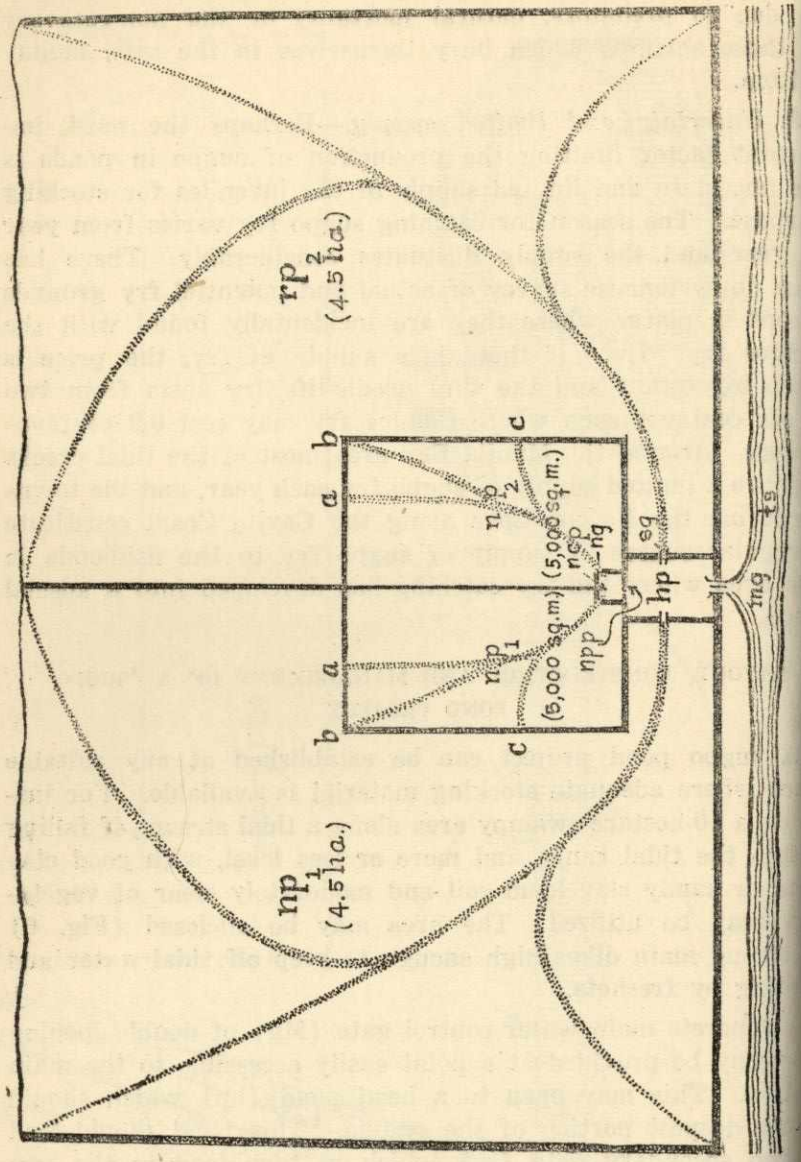


FIGURE 6.—Model layout of a 10-hectare *Penaeus* pond project.

A secondary dike, constructed in line with the main water control gate, would bisect the main area into two main parts, each with a large rearing pond and a nursery catching pond. Such a layout is deemed very convenient for transplanting the stock because the growing sugpo from each nursery can be easily transplanted by simply breaking or opening the dike to the adjacent rearing pond. At the outset, the entire fishpond system should be so leveled that the bottom will gradually slope from the periphery of the pond system to the head pond and the main water control gate. Then a system of special depressions or canals are constructed in each nursery and rearing pond running from the periphery towards the nursery and secondary, gates respectively, as indicated in Fig. 6, so as to facilitate harvesting.

Once established, the unit may conveniently be stocked with sugpo from 300,000 to 500,000 fry per crop, first in the nursery ponds for a period of one to two months for subsequent release in the rearing ponds. Of these fry, about 20 per cent may be expected to survive, leaving an expected crop of about 100,000, marketable shrimp equivalent to about 5,000 kg. valued at ₱15,000 (based on a wholesale price of ₱3.00 per kg.). Two crops a year, 3 crops in two years or one crop a year may be reared.

The desirable food organisms may be developed in the ponds by proper management. While this plan has been deduced from observations of a mixed culture of sugpo and milkfish, such a plan could be adopted in any expirement to find the possibility of pure culture of *Penaeus*. At present, a few of the more progressive *Chanos* fishpond growers in the Philippines are actually practising this system to a limited extent.

SUMMARY AND RECOMMENDATIONS

1. The cultivation of the sugpo in estuarine fishponds in the Philippines either as pure culture or in combination with *Chanos* is found to be a lucrative investment.

2. In order to minimize the losses due to the difficulty of collecting all the growing sugpo in the nurseries, it is recommended that the nursery ponds should be located adjacent to and at a slightly higher level than the rearing ponds where the sugpo are to be grown to marketable size. In this way, transplantation is effected by simply making a cut in the dike

between the nursery and rearing pond where the sugpo sprea without the necessity of handling them.

3. Observations made during limited periods on the rate growth of the shrimp are recorded. Studies should be unde taken to find out suitable feed when the natural food is e hausted.

4. The low rate of survival may be due to predators a well as to the difficulty encountered in the total croppin of the stock. It is necessary to stock sugpo in ponds whic have previously been cleaned, drained and dried so as to redu the danger of predation to a minimum.

5. Proper pond layout and construction may also elimina the cumbersome methods of collecting and transplanting th stock. Studies should also be made to develop appliances t facilitate harvesting such as are used in shrimp capture fro natural waters.

6. The most important factor that may limit the develo ment of this promising industry is the uncertain and limite supply of the stocking material. A nationwide survey shou be made to determine sugpo fry grounds and seasons as we as the feasible methods for their capture.

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ILLUSTRATIONS

TEXT FIGURES