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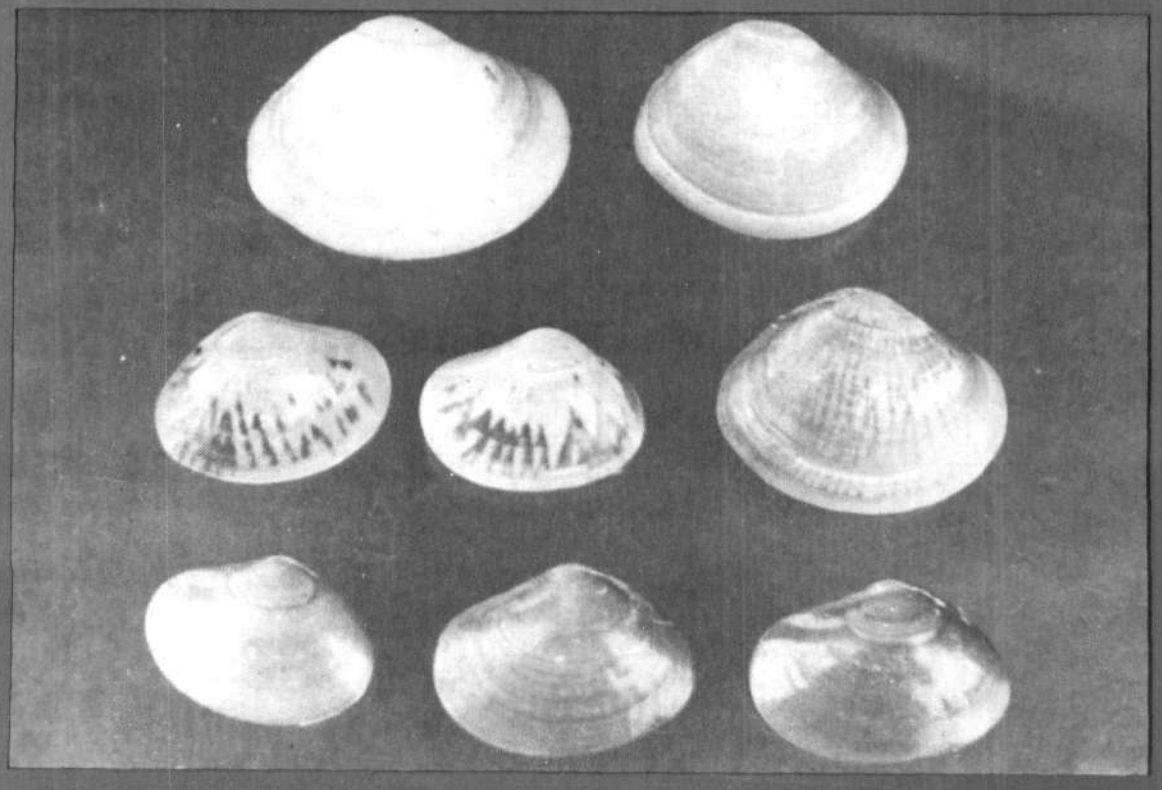

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SEA RANCHING OF PRAWN*

Sea ranching of prawns is an idea conceived by Japanese. In Japan, the Kuruma shrimp (*Penaeus japonicus*) culture techniques are highly developed and the average annual production through farming was about 1800 tonnes in the early eighties. As the demand for this species was ever increasing and they have only limited culture grounds, they thought of increasing the natural production of this species by releasing large number of hatchery and nursery raised postlarvae/ juveniles into the natural environment which in turn will grow and ultimately get recruited in the commercial catches.

To carryout preliminary experiments, Japanese researchers have selected a lagoon — Hamana-ko Lagoon —one of the largest lagoons having 6900 ha surface area and maximum depth of 12 m and is connected to the sea through a narrow mouth 200 m wide. A good fishery existed for *P. japonicus* in the lagoon which is sustained by naturally recruited seeds of this species from the sea. Large number of hatchery raised seeds were released into this lagoon. Continuous sampling at 5 days interval, during fishing season was made and growth and catch of the released and naturally recruited populations were statistically estimated. By releasing 6.98 million seeds of *P. japonicus* (30mm) in one part of the lagoon (Shirashu) having 200 ha area the production had increased 2.4 times (Uno Yukata, 1984). These trial releases of post larva/juvenile, which grew and subsequently got recruited in capture fishery formed the basis of sea ranching.

Against this background a research programme — "Sea ranching of prawns" — was initiated in CMFRI for the first time in the country in 1985 and continued upto 1992. The technical programme envisaged for the project were :

i) Selection of a species and suitable area for the release of postlarvae/ juveniles

ii) Development of a low cost technology for the large scale production of postlarvae

iii) Study of seasonal movements of the postlarvae in the area selected for ranching

iv) Comparative study of the sturdiness of the hatchery produced seeds *viz-a-viz* those in the natural environment

v) Collection of information on the migration and growth of the sea ranched postlarvae and their recruitment to the commercial fishery

vi) Estimation of the quantum of seed to be released at a time to make a perceptible increase in the local fishery.

Penaeus semisulcatus was selected as the candidate species. Mandapam was selected as the project site considering its suitable topographical features, facilities to establish a hatchery and the existence of *P. semisulcatus* fishery round the year. This species does not show any long range migration. The luxuriant growth of sea grass in this area serves as an ideal nursery ground for this species. The species at its juvenile stage supports a substantial fishery. During 1987, the survey conducted by this Institute revealed that the landings of juveniles in this area equals that of the trawl net fishery for the adults. Survey also revealed the existence of a naturally protected area in Palk Bay side of Mandapam coast where the fishery for juveniles does not exist, due to the presence of patches of corals and rocks. Hence this protected area in the Palk Bay has been selected for sea ranching experiments of *P. semisulcatus*.

CMFRI had already developed a low cost technology for the large scale seed production of *P. indicus* (Silas *et al.*, 1985). This technology has been suitably modified for the seed production of *P. semisulcatus* and a hatchery established at Mandapam. This hatchery having a production capacity of 1 lakh post larvae XV-XX per run was established at a cost of Rs. 50,000/-. The production cost of 1,000 seeds came to Rs.20/-.

* This article is based on the work carried out by the following personnel of sea ranching team of Crustacean Fisheries Division of CMFRI: P. Vedavyasa Rao, N. N. Pillai, E. V. Radhakrishnan, P. E. Sampson Manickam, G. Maheswarudu, M. R. Arputharaj and K. N. Gopalakrishnan. The article was prepared and presented by N. N. Pillai.

Detailed survey revealed that juveniles of *P. semisulcatus* occur in large numbers in shallow inshore areas of Palk Bay and Gulf of Mannar where there are luxuriant sea grass beds. Although *P. semisulcatus* breed through-out the year, peak breeding seasons are January-February and July-August and peak recruitment of juveniles into the fishery is in April-June and October-December.

To study survival, growth and recruitment pattern of the hatchery produced and sea ranched stock, a batch of postlarvae (16-35 mm) numbering 70,366 were released in Pillaimadam lagoon about 1.5 kilometres away from its bar mouth (Rao *et al.*, 1991) . After the release, fixed-bag net made of mosquito netting was operated against the current at regular intervals during the low and high tides. It was observed that the incoming tides were not bringing post larvae of *P. semisulcatus* to this lagoon. But after 24 hrs of release the postlarvae were caught in the bag nets operated during low tide while they were moving out into the sea. Thus it was observed that the post larvae released in to the lagoon, got acclimatised and started moving towards the sea after 24 hrs.

Hatchery produced postlarvae of *P. semisulcatus* (PL XV-XX) were reared in the marine ponds of the institute to study their survival and growth. The experiments revealed that the growth rate of 1.3 mm/day occurred during the first sixty days. The survival of during this period was found to be 85-90%. Further, their growth rate in the pond was found to be equal to that of the wild. Thus it was clearly shown that the hatchery produced postlarvae of *P. semisulcatus* are sturdy as that of the wild and registered the same rate of growth.

After developing a viable technology for postlarval production of *P. semisulcatus* as well as finding out that the post larvae produced under controlled conditions are as sturdy as those from the wild with reference to growth and survival, efforts were directed to find out the percentage of sea ranched postlarvae that grow, migrate and get recruited into the fishery. With the available hatchery facility, 7 lakh postlarvae are ranched annually into Palk Bay. Considering the magnitude of the fishery of this species in this area, the number of sea ranched postlarvae was negligible to attempt any meaningful statistical interpretation. Further the size of the ranched postlarvae was too small to be tagged to obtain direct evidence of its growth and recruitment. Hence it was decided to grow the postlarvae XV-XX in the departmental farm to a size above 60 mm in total length. Thus 2,964 laboratory reared and farm grown *P. semisulcatus* of 60-110 mm size were tagged and released into the Palk Bay (Pillai, 1991). One per cent of these prawns were obtained from the commercial trawl catches landed in 2 near by landing centres within a period of 5 to 53 days (Anon., 1992). During this period the tagged prawns have migrated to a distance of 30-35 kilometres. The possibility of tagged prawns getting caught and landed at other landing centres of the Palk Bay area cannot be ruled out as the recovery efforts were restricted to the nearby landing centre and for a limited period.

The above experiments showed that the sea ranched postlarvae of *P. semisulcatus* survive, migrate, grow and get recruited into the fishery at Palk Bay.

As stated earlier, at an average of 7 lakh PL XV-XX the *P. semisulcatus* were annually released into the Palk Bay area under the sea ranching programme. The series of experiments carried out revealed that in the life history of *P.semisulcatus*, maximum mortality occurs during its development from Nauplius to Post larvae XV-XX. Afterwards the survival was found to be above 85%. Thus when PL XV-XX are sea ranched, their chance of survival, growth and getting recruited into local fishery is very high.

On an average 1,00,000 nauplii are obtained from one spawning of *P. semisulcatus* under laboratory conditions. Providing proper feeding and maintaining good water quality the survival from nauplius to PL XV is 33% (average). But in nature it will be far below and will be less than 0.1%. Taking the survival in nature as 0.1% upto PL XV, sea ranching of seven lakh PL XV obtained at 33% survival rate from 21 spawners in one spawning in the hatchery is equivalent to the product of one spawning of 7,000 animals in the wild.

To make a perceptible increase in the local prawn fishery by increasing the annual production of *P. semisulcatus* by 100 tonnes over the present production, 2,500 lakh PL XV-XX will have to be ranched. For this purpose a hatchery with a production capacity of 2,500 lakh PL XV-XX, will have to be established. This calls for an investment of Rs. 350 lakhs as initial investment

and Rs. 50 lakhs as working capital. At the present market rate of Rs. 200/kg of prawns, the envisaged increase of 100 tonnes is equivalent to Rs. 200 lakhs per annum. In real terms this increase will be reflected in the overall prawn catch of this area and hence an addition to the resources. The social benefit deriving out of it to the local population is tremendous, as also to the direct increase in export earnings of the country. CMFRI being a research organisation has played its part by developing a suitable technology and perfecting the same, and it is available for adoption. Therefore the Govt. or a developmental agency should consider the funding for this project for the social benefits which can be derived out.

Discussion

K. Rangarajan: Are tagging of prawns and sea ranching of their seed correlated? Since the tagged prawns are larger and more aclimatized, is the rate of survival more in them?

N. N. Pillai: The rate of survival in hatchery from nauplii to PL 15 is about 33%. Afterwards, upto juveniles of about 70 days, survival was found to be 95%. A very reasonable estimate will be that 10% of the ranched seed grow to get recruited in to the fishery.

K. H. Mohamed: The idea of sea ranching came up in Japan because of the surplus seed produced by the hatcheries whereas in our country, though there are a number of prawn hatcheries, the production is far below the needs. Therefore, sea ranching has to be attempted with caution. More over, this species (*Penaeus semisulcatus*) does not seem to be ideal for sea ranching because of many disadvantages: the demand for this prawn is much less than for others, its growth is very slow, and the species is highly localised. Nevertheless, since we have already developed the technology, we can try to get funding from other agencies for pursuing the work.

N. N. Pillai: We have studied the growth of this species. The seed prawn grows at the rate of 1-1.3 mm/day. When it grows to 60-80 mm, the growth gets stunted in farm conditions. Tagging and releasing of 60-80 mm size groups revealed that in the sea there is continuous growth. As for funding by other agencies, we have already submitted two projects.

K. H. Mohamed: To overcome such a stage of stunted growth, a smaller size, about 40-45 mm, can be suggested for ranching into the sea.

N. N. Pillai: It will be very expensive to grow the prawns upto 45 mm in hatchery/nursery and then ranch into sea.

P. R. S. Thampi: Private agencies will be interested only in farming and not in sea ranching where monitary returns is uncertain and therefore no funding can be excepted from them.

K. A. Narasimham : Private agencies may not be interested but Government bodies can help. For information, the MPEDA is funding two CMFRI projects for sea ranching of clams and sea cucumber.

E. V. Radhakrishnan: We have not attempted culture of this species in ideal conditions, but since it was found that the seed grows to a weight of 30 g in five months, it cannot be said that this is not an ideal species for farming or ranching.

C. Suseelan: The results obtained so far (with many constraints, mainly financial) in hatchery rearing and ranching are not adequate enough to advice any agency about ranching. More research has to be done in this field. State governments should take up such studies for conserving and enhancing the resources.

Joe Kizhakudan: Does the breeding period of sea ranched prawns coincide with that of the natural population? Does sea ranching affect recruitment pattern?

N. N. Pillai: We have adequate data at present to show that *P. semisulcatus* is an ideal species for sea ranching at Mandapam. Regarding the aspect whether there is coincidence of breeding periods, it remains to be studied.

S. Sivakami: How long it will take for sea ranching to reflect on the fishery? Can't we grow the seed to a larger size and then release them so as to increase the survival?

N. N. Pillai: We will get some idea about the contribution of sea ranching to the fishery if the juvenile fishery is prevented. The number of seed ranched is at present small to come to any conclusion. Ranching of larger seed may be more expensive.

V. Sriramachandra Murti: If induced breeding is done during the non-breeding period of the wild prawns, it will enable us to sea ranch continuously and increase the population in the natural habitat.

K. Raman: The team deserves praise for the work it has done. We have to demonstrate a complete proposition in a ranched area and in stocked area.

Winding up the discussion on sea ranching of prawns, the Chairman concluded that sea ranching of this species cannot go on for many reasons but studies on its scientific aspects will have to continue with the farming prospects in view, since this is a potential species next to *Penaeus indicus* and *P. monodon*.

References

ANON. 1992. Research highlights 1991-92. *CMFRI Publ.*, pp.11.

PILLAI, N. N., E. V. RADHAKRISHNAN, G. MAHESWARUDU, M. R. ARPUTHARAJ, AND K. N. GOPALAKRISHNAN. 1991. Successful sea ranching programme for shrimps by CMFRI. *CMFRI Newsletter*, 52, 1-3.

RAO, P. VEDAVYASA, N. N. PILLAI, P. E. SAMPSON MANICKAM, G. MAHESWARUDU AND M. R. ARPUTHARAJ 1991. Shrimp Ranching. In: R. NATARAJAN, S. N. DWIDEVI AND S. RAMACHANDRAN (Ed.), *Coastal zone Management (In Tamil Nadu State, India)* , 198-204.

SILAS, E. G., K. H. MOHAMED , M. S. MUTHU, N. N. PILLAI, A. LAXMINARAYANA, S. K. PANDIYAN, A. R. THIRUVAVUKKARASU AND SYED AHMED ALI 1985. Hatchery production of penaeid prawns, *Spl. Publication* No. 23, CMFRI, 1-14.

UNO YUTAKA, 1984. An ecological approach to mariculture of shrimp : Shrimp ranching fisheries. *Proc. I Intl. Conf. on Culture of Penaeid Prawns/Shrimps*. Iloilo city, Philippines, SEAFDEC Aquaculture Department, 37-45.