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TRADE OF LIVE BROODERS OF THE BLACK TIGER SHRIMP, *PENAEUS (PENAEUS) MONODON* Fabricius 1798 AT VISAKHAPATNAM, ANDHRA PRADESH

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ABSTRACT

The demand for brooders of *Penaeus monodon* by the hatcheries, which are solely dependant on wild brooders for their seed production, has resulted in a vigorous fishery and trade for this species, especially along the Visakhapatnam coast. More than three hundred brooders are brought in per day for trading during the peak landing season from December to March every year. The price of gravid brooders has been declining over the years but on an average is about Rs. 30,000 per brooder. The total length of male brooders ranged from 190 to 246 mm during the three years under study and for females it varied between 210 and 330 mm. A specialized methodology for transportation, storage and trade of *P. monodon* brooders has been evolved over the years at Visakhapatnam Fishing Harbour. Concentrated exploitation of brooders from the wild and presence of pathogens in them makes a strong case for development of specific pathogen free brooders and conservation of wild stock.

Keywords : Live brooders, black tiger shrimp, conservation, wild stock.

INTRODUCTION

The traditional shrimp culture methods such as "Bhasabada" in West Bengal and "Pokkali" in Kerala were in vogue for centuries but the practices gained momentum and the activities intensified in the eighties of last century. (Alagarswami, 1990). Wide areas of brackishwater bodies were brought under cultivation and shrimp seed stocked for monoculture or polyculture, mainly by collecting seed from the wild (Pillay, 1990). *Penaeus monodon* and *p. indicus* were the favoured species in the initial period though the latter gradually gave way to the former due to faster growth rate and higher profits from its culture. Shrimp culture created an opportunity to acquire quick monetary gains in relatively short period of time and several private entrepreneurs, from small scale farmers to corporate sector entered the scene, escalating the demand of seed shrimp seed. As the demand for seed far exceeded its supply from the wild (Alagarswami, 1989; Kurien and Sebastian, 2002), more than 250 hatcheries were established along the

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coasts. Shrimp culture was vigorous and the period from 1991 to 95 was the Golden Period for the hatchery industry.

All hatcheries depended upon broodstock and gravid females collected from the sea. Eyestalk ablation was the established technique used to induce maturation of broodstock (Bray and Lawrence, 1992; Rao, 1995). Gravid females after spawning were also subjected to eyestalk ablation. Broodstock in most hatcheries responded well to eyestalk ablation until 1995. Since the eyestalk ablation technique failed in the latter years until around 2000, all hatcheries began to concentrate on procuring gravid *P. monodon* from the sea resulting in the escalation of the price of brooders. The fishers took advantage of this opportunity and resorted to auction for selling brooders. Visakhapatnam has emerged as the one of the most important centres for collection and disbursal of *P. monodon* brooders. It is estimated that the existing 268 hatcheries currently require 120,000 brooders to produce 12 billion seeds per annum and the requirement is projected to go up to 140,000 by 2005 (Swamy, 2003). Despite its high fecundity *P. monodon* contributes less than 2% to shrimp fishery along the east coast. The annual catch ranged from 404 t to 1389 t with an average of 739 t during 1991-2000 (Maheswarudu, 2003) Gravid *P. monodon* females are most prized catch for all fishers along the Visakhapatnam coast.

MATERIAL AND METHODS

The fishery for *P. monodon* brooders and trade for the brooder of the species at Visakhapatnam Fishing Harbour was investigated between February 2000 and April 2003. Weekly visits were made to the Visakhapatnam Fishing Harbour and the landings of brooders were recorded. The sex of the brooders and maturity stage wise among the females was noted. Total length (in mm) of brooders was recorded. The number of brooders landed per observation day were pooled and raised to the month catch depending upon the number of fishing days. Auctions were also attended to ascertain the price of the brooders. The method of fishing, storage, transportation, seasonality and trends in the market were investigated.

RESULTS

Method of fishing:

There is no special gear used for the capture of *P. monodon* brooders. Artisanal as well as trawling sectors are involved in the fishery and the maximum number of brooders are brought in by the small trawlers and the *Sona* boats, which operate at a depth of 30-50 m. From 2001 onwards there was a tendency among trawler owners to form groups, locally known as "syndicates", which entered into an agreement over transport of captured brooders. One boat from each group would return to the landing center after sufficient number of brooders is collected or if a fully gravid female was captured. In this manner the fishers were able to economise on fuel and devote more effort to fishing. The same principle is made use of in "stay" fishing where boat owners from landing centers such as Bhimunipatnam or Kalingapatnam which are at a distance

from Visakhapatnam Fishing Harbour, would employ their boats to fish in their areas and anchor near shore at their respective landing centers. Small country crafts would then approach the trawler to collect the brooders and supply the crew with provisions. The brooders would then be transported by road to Visakhapatnam Fishing Harbour for auction or sold directly to hatchery agents, whenever possible. Artisanal fishers also market brooders directly from landing centers or sell them to auctioneers at Visakhapatnam Fishing Harbour.

Post harvest handling:

The brooders are transported in oxygenated seawater by road to nearby hatcheries or to Visakhapatnam Fishing Harbour for auction by road or sea (Fig.1). The Visakhapatnam Fishing Harbour receives brooders from as far north as Puri in Orissa, Approximately 25% mortality occurs before sales. Injury during capture is the main cause of mortality. A small rubber tube is inserted to cover the rostrum (Fig.2) as well as the telson of each shrimp to prevent it from injuring other shrimps and puncturing the plastic covers in which they are eventually transported. Since the telson is tapered in shape, the tube inserted over it is often lost. To avoid damage the end of the telson is therefore generally cut before packing. The brooders were fed with artemia flakes in 2000. By 2001 most traders preferred to substitute it with fresh squid meat. After the sale, the brooders are packed in thick polythene bags, generally two bags placed one inside the other and aerated with oxygen up to the beam (3/4 size of the bag), which are then sealed and packed in cardboard cartons. Ripe brooders are packed singly whereas 2-5 less ripe brooders or males may be packed in a single bag. Some traders insert small chunks of ice between the layers of the polythene bags to keep the seawater in the bags cool, thereby lowering the metabolic activity and stress level of the shrimp. This is done especially in the case of ready to spawn brooders. One problem faced by the traders is that the ripe spawners often spawn before reaching their destination due to stress of handling and transportation. To overcome this problem some sort of anesthetic (not disclosed by traders) is used during transportation to reduce metabolic activity. In some occasion where anesthetic are not available, fishers insert fragments of thin sticks into the thelycum immediately after capture of gravid females, which irritates the female and disturbs spawning, eventually leading to reabsorption of the ovary. Delaying spawning by this method benefits the fisher but at the same time the buyer is at a loss as gravid females tampered with in this manner often die in the spawning tank or reabsorb the ovary. Buyers are now able to identify this malpractice by scrutinizing the thelycum and observing initial stages of reabsorption of the ovary and avoid purchase of such brooders or demand them for lower prices.

Trade :

Male *P. monodon* brooders fetch only Rs.50/- to Rs.150/- per piece. Female brooders are classified by the traders according to the ripeness of their ovaries. Females with developing ovaries (Stage II)

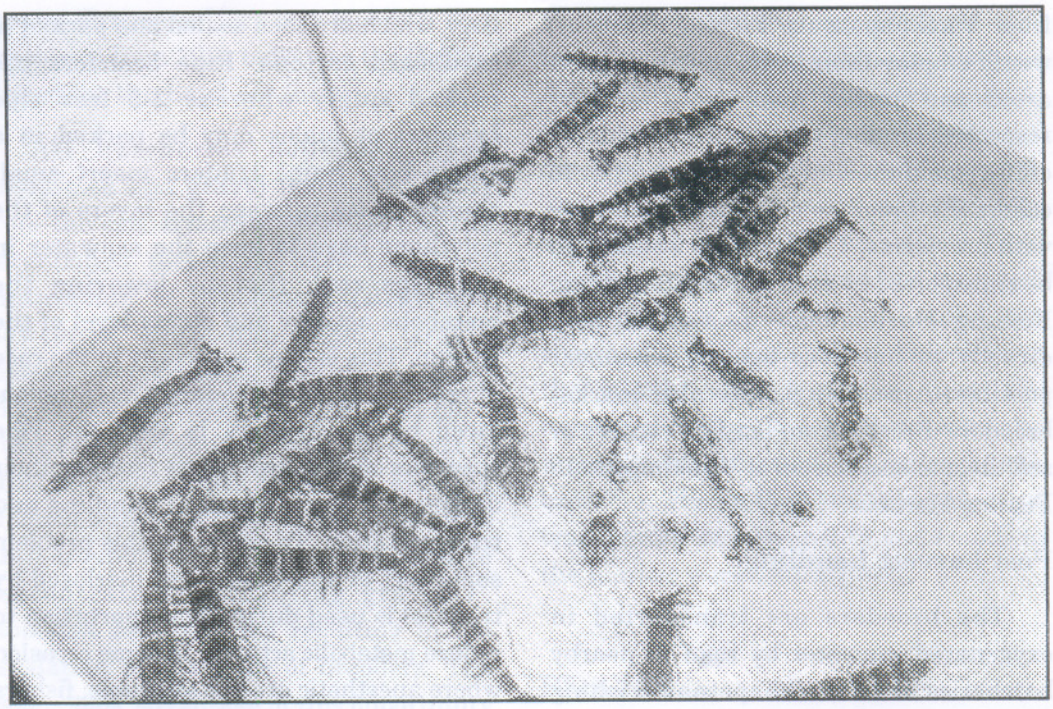

Fig. 1 : Brooders stored in aerated waterproofed wooden box at Visakhapatnam Fishing Harbour

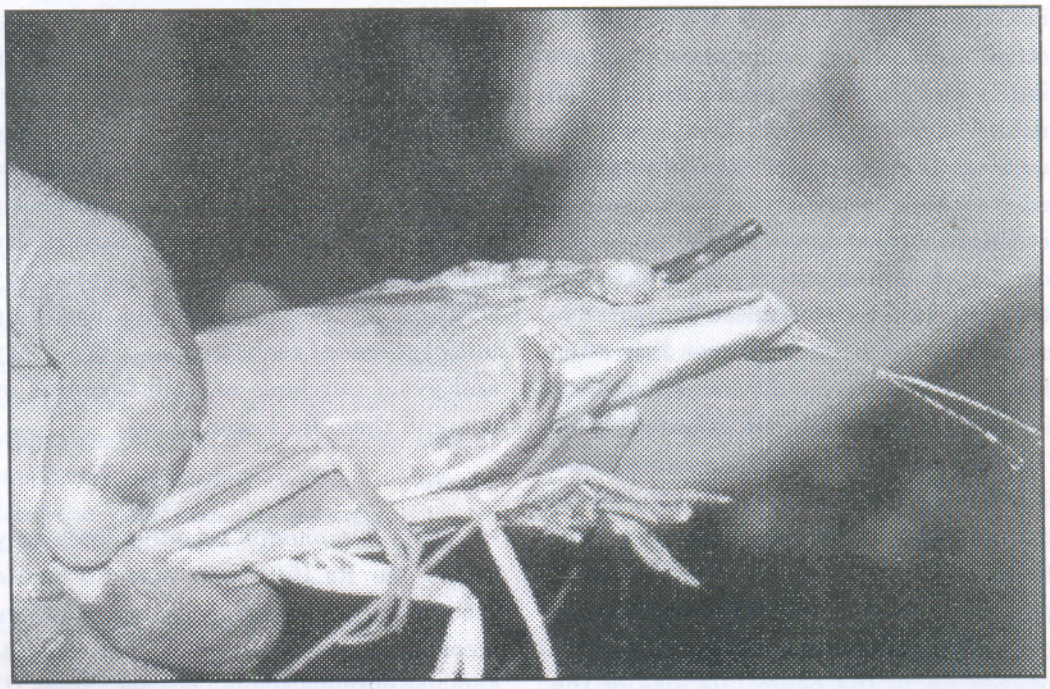

Fig. 2 : Brooder with rubber tube covering rostrum

are classified as "empties", those with ovaries in the ripening condition (Stage III) are termed as "stages" and those with ripe ovaries (Stage IV) are called "gravid". Ready to spawn females are called "spawner" or "full gravid". The sale of "empties" and "stages" was very poor during 2000 as the response to eyestalk ablation in hatcheries was poor but it picked up rapidly from 2001 onwards as eyestalk ablation began producing better results. "Spawners" are in much demand for local hatcheries. Auctioning of the brooders takes place once or twice a day at Visakhapatnam Fishing Harbour. Only female brooders are auctioned. Agents from various hatcheries or brooder dealers participate in the auction. During the auction the bidders are free to handle the brooders who try to assess the condition of the ovaries by holding them against the light. The thelycum and appendages re also visually examined for the presence of heavy ciliate/fungal infestations or any other disease and to determine any signs of tampering with the thelycum. The price of brooders varies according to their classification. The maximum price reported for a "spawner" was Rs.56,000/- in 2001-02 and Rs.32,500/- in 2002-03. "Empties" are generally sold within a range of Rs.400-800/-, "stages" from Rs.1200-18, 000/-. The price of "stage" has infact declined from a maximum of Rs.30,000/- in 2000-01 to Rs.25,000/- in 2001-02 to the present figure in 2002-03. The price of "gravids" was Rs.17,000-40,000/- in 2000-01. This had fallen to Rs.6000-20,000/- by 2002-03. Upon enquiry, it has been learnt that the price structure for brooders has declined rapidly with the crash in *P. monodon* culture on the East coast due to the persistence of WSSV and Monodon Bacculovirus disease in the grow-out sector, forcing a shift to "scampi" *(Macrobrachium rosenbergii)* culture. The maximum price obtained for each type of brooder is compared in Table1.

Trends in fishery :

From the data collected from April 2000-April 2003 it is evident that the fishery is seasonal, the intensity fluctuating as per the operations of hatcheries, mostly taking place from late November to the end of August with peak landings between December and March. Usually the peak season commences with the demand for brooders from hatchery

Table 1: Comparison of catch details of *P. monodon* brooders (April 2000- March 2003)

	2000-01	2001-02	2002-03
Total nos. landed	18,660	23,190	25,920
Percentage in landings:			
Empties	0	20	28
Stages	69	52	42
Gravids	21	19	20
Males	10	10	10

owners who begin operations around the first week of December. The maximum numbers are landed from December to mid January when on an average 250-300 brooders are landed per day. The fishery gradually draws to a close by early April due to reduced landings of brooders. It resumes again briefly in June after the trawling ban (16th April to 31st May) when 50-60 brooders are landed per day and it tapers to a stop by late August, after which there is less demand for brooders until late November or early December in the next season (Figs. 3 & 4). The figures for total number of brooders landed annually shows an increasing trend over the years, in contrast with the maximum prices obtained for the "stages" and "gravids" (Table 1 & Fig. 4). The percentage of the verious types of brooders also shows a shift from a dominance of "stages" and "gravids" to the inclusion of "empties" also due to ready market for reasons mentioned earlier.

The size range in the total length of male brooders was 190 to 246 mm during the three years under study and 210 to 330 mm for females.

DISCUSSION

It is evident from the findings that a well-established fishery and trade practice is in place, at Visakhapatnam for the exploitation of wild brooders. The methodology evolved by the fishers and traders cater to the practicality of the trade, keeping in view the requirements of the animal, and needs of the industry. While the initial demand was for gravid brooders alone, the renewed reliance on the eyestalk ablation technique has brought maturing stages of brooders within the purview of marketability. The declining trend in the price of brooders is indicative of the general debilities in shrimp culture along the East coast. Hatcheries demur from investing in brooders when returns are not assured in terms of seed marketability. The ecological and economic sustainability of brooder exploitation will predictably depend on fishing pressure as well as the recovery and revival of the shrimp culture industry.

The concentrated hunt and continued removal of ripe brooders from the wild stock is identified as a matter of concern for future recruitment by local environmentalists and a section of the fisher community who pointed out that it would lead to depletion of stock in the long run. This issue was also raised during a strike undertaken to mitigate other problems faced by the trawler operators during August-September 2002. A self imposed ban was effected for a few months by the fishers in what was seen as an attempt to conserve *P. monodon* stock. However, fishing for brooders resumed in full scale in December 2002 at the advent of the regular season. In the present scenario, a ban on brooder fishing will decrease the fishing pressure on the brooders from the wild but will be a set back to the hatchery sector of the shrimp culture industry resulting in heavy financial loss to the grow-out sector, which is solely dependant on wild broodstock. A recent survey has revealed that 50% of wild broodstock tests positive for WSSV

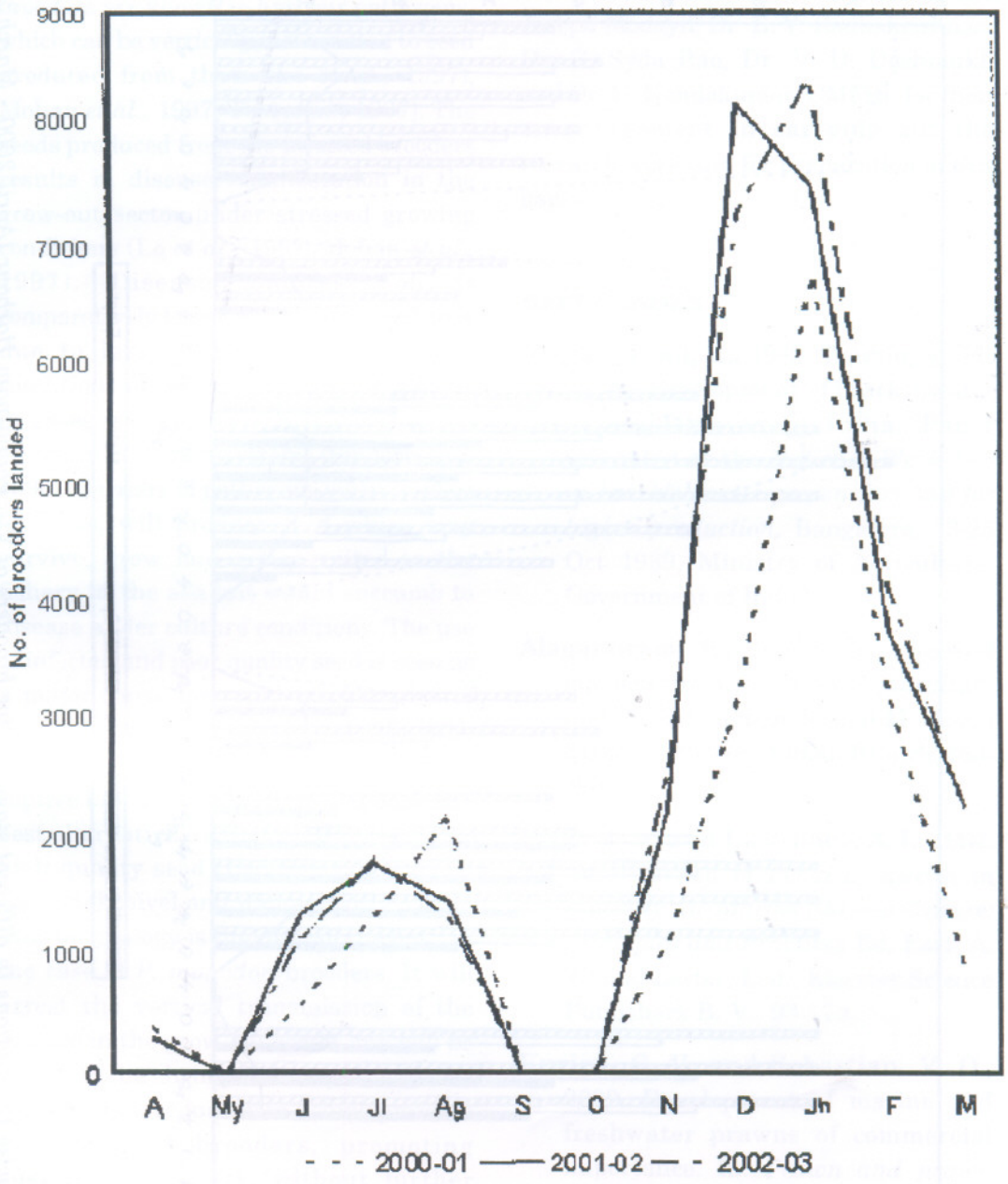

Fig. 3 : Monthwise trend in landings of P. monodon *brooders (April 2000 - March 2003)*

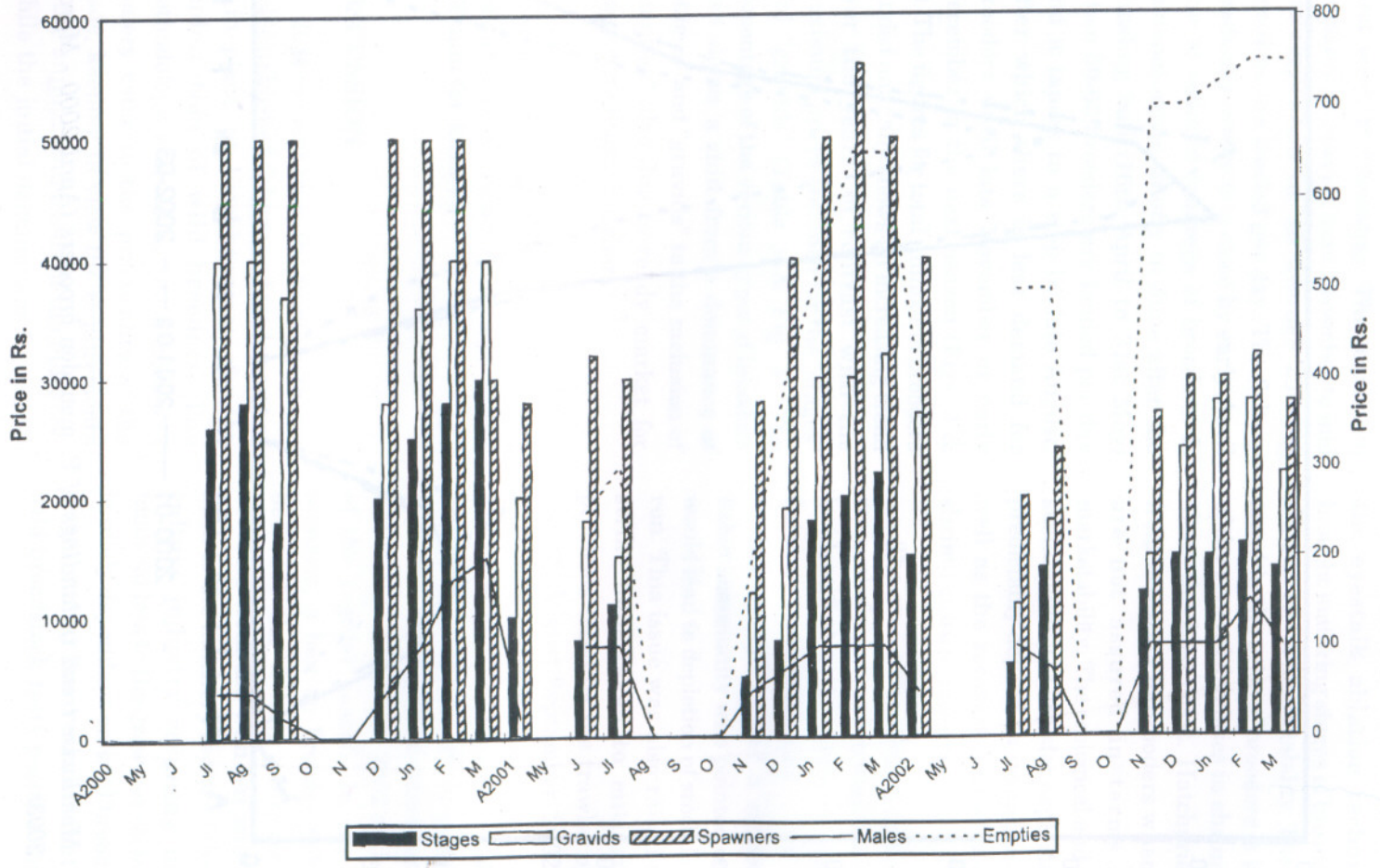

Fig. 4 : Monthwise fluctuations in different stages of live brooders at Visakhapatnam Harbour (April 2000 - March 2003)

when subjected to Polymer Chain Reaction (PCR) test (Maheshwarudu, 2003). Wild brooders are known to harbour pathogens, which can be vertically transmitted to seed produced from them (Lo *et al.*, 1997), Mohan *et al.*, 1997; Tsai *et al.*, 1997). The seeds produced from the infected brooders results in disease manifestation in the grow-out sector under stressed growing conditions (Lo *et al.*, 1997; Mohan *et al.*, 1997). Disease manifestation is comparatively lesser in the wild broodstock due to less stressful environmental conditions of the natural habitat. Latent diseases may be provoked into potency by stressors in culture systems (Sindermann, 1990). Carriers of pathogens when used as brooders, will produce seed which may survive, grow and get recruited to the fishery in the sea but would succumb to disease under culture conditions. The use of infected and poor quality seed is seen as a major cause for rapid transmission of disease (Panchayuthapani, 1997). The development of Specific Pathogen Free captive broodstock is recommended as the best alternative for producing disease free high quality seed (Lightner, 1993; Lotz, 1997; Sakthivel and Ramamurthy, 2003). This technology is the need of the hour in the case of *P. monodon* brooders. It will arrest the vertical transmission of the disease in the grow-out sector and will be a boon to the shrimp industry. It will also bring about a reduction in fishing pressure on the wild brooders, promoting sustainable fishery, without further damage to the existing wild stock.

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REFERENCES

Alagarswami, K., 1989. Training needs for the development of brackshwater prawn farming in India. Paper presented at the *National Workshop in brackishwater prawn farming for higher production,* Bangalore, 23-25 Oct 1989, Ministry of Agriculture, Government of India.

Alagarswami, K., 1990. Status of coastal aquaculture in India. In: *Aquaculture in Asia.* Ed: Mohan Joseph M., Asian Fisheries Society, Indian Branch: 163-190

Bray, W. A. and Lawrence, A. L. 1992. Reproduction of *Penaeus* species in captivity. In: *Marine Shrimp Culture: Principles and Practices* Ed: Fast, A. W. and Lester, L. J., Elsevier Science Publishers B. V.: 93-170.

Kurien, C. V. and Sebastian, V. O., 2002. Development of marine and freshwater prawns of commercial importance. In: *Prawn and prawn fisheries of India.* Ed: Gopakumar, K. and Pillai, V. N. Hindustan Publishing Corporation (India), New Delhi: 45-73.

Lightner, D. V., 1993. *Diseases of cultured penaeid prawns.* In: CRC handbook of Mariculture, second edition, Vol.1, Crustacean Aquaculture. Ed: McVey, J. P. CRC Press, Boca Raton: 393-486.

Lo, C.F., Ho, C.H., Chen, C.H., Liu, K.F., Chin, Y.L., Yeh, P.Y., Peng, S. F., Hsu, H.C., Liu, H.C., Chang, C.F., Su, U.S., Wang, C.H., and Kou, G. H., 1997. Detection and tissue tropism of white spot syndrom in vaptured brooders of *Penaeus monodon* with special emphasis on reproductive organs. *Diseases of Aquatic Organism,* **30:** 53-72.

Lotz, J.M., 1997. Disease control and pathogen status assurance in an SPF - based shrimp aquaculture industry with particular reference to the United States. In: *Diseases in Asian aquaculture III.* Ed: Flegel, T.W. and MacRae, I.H. Fish Health Section, Asian fisheries Society, Philippines: 243-254.

Maheshwarudu, G., 2003. Personal communication.

Mohan, C. V., Sudha, P.M., Shankar K.M., and Hegde, A., 1997. Vertical transmission of white spot syndrome bacculovirus in shrimps- a possibility? *Current Science,* **74:** 109-110.

Panchayuthapani, D., 1997. A survey of Shrimp diseases in India. In: *Diseases in Asian aquaculture III.* Ed: Flegel, T. W. and MacRae, I. H. Fish Health Section, Asian fisheries Society, Philippines : 225:232.

Pillay, T.V.R., 1990. *Aquaculture Principles and Practices.* Fishing News Books: 425-459.

Rao, A.V.P., 1995. Shrimp hatchery techniques. In: *Shrimp farming: techniques, problems and solutions* Ed. Paul Raj, S. Palani Paramount Publications: 34-54.

Sakthivel, M. and Ramamurthy, B. 2003. What ails shrimp farming and its future development. *Fishing Chimes,* **22 (10&11):** 33-36.

Sindermann, C. J., 1990. Diseases in Shellfish culture. In: *Principal diseases of marine fish and shellfish. Vol.2, second edition.* Academic Press Inc., USA: 311-350.

Swamy, M. S., 2003. Shrimp and prawn hatcheries in India: Current status and future outlook. *Fishing Chimes,* **23(1):** 20-22.

Tasi, M. F., Lo, C.F., Liu, H.C., Liu, K. F. and Kou, G.H., 1997. Detection of white spot syndrome virus (WSSV) in offsprings of a WSSV carrier brooder by *in situ* hybridization. (Abstract) In: *Proceedings of the International Symposium on Diseases in Marine Aquaculture.* Oct. 1997, Japan.