再刊編號：12
Reprint No. 12

抽印自　亞洲水產學會第二次大會
Reprinted from
The Second Asian Fisheries
Forum. Asian Fisheries Society
pp. 369-372. 1990

12

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臺灣西南沿岸海域之草蝦生活史

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國科會補助計畫編號：
NSC-74-0409-B056-05
NSC-75-0209-b056a-01

LIFE HISTORY OF GRASS PRAWN, PENAEUS MONODON, IN THE COASTAL WATERS OF SOUTHWEST TAIWAN*

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Abstract

The spawning season of grass prawn, Penaeus monodon, in the coastal waters of southwest Taiwan is from September to November. The spawning ground is located in the waters between Kuhsi and Nanshufu at depths of 10-40 m. The postlarvae are transported by currents into estuarine waters of the adjacent bays or rivers. In Dapong Bay, the largest bay in this area, P. monodon grow to a size of about 25.0 mm in carapace length (CL) in July. They begin to migrate into the offshore waters with the peak season in July to September. They feed mainly on crustaceans, detritus, chaetomorphs and sand granules in Dapong Bay and on detritus and sand granules in the offshore waters. P. monodon grow from 20 to 40 mm CL in Dapong Bay at a rate of 8 mm CL/month or 16.98 g/month.

Introduction

The establishment of stock enhancement techniques to augment the production of coastal fisheries has drawn much attention in Taiwan. To promote this venture, the Tungkang Marine Laboratory (TML) of the Taiwan Fisheries Research Institute (TFRI) selected the coastal waters along southwest Taiwan (Fig. 1) as an experimental area for the release of prawns. To ascertain the effects of such a step, it is needed to clarify the life history of the target species. A series of ecological studies on commercially important prawns in this area was carried out from July 1982 to December 1987 by the research group of TML. This paper reviews the life history of the P. monodon in this area. Based on findings, the strategy of stock enhancement is proposed.

Distribution

The distribution patterns of P. monodon in the offshore waters are shown in Fig. 2. In January to June, few prawns were found in the waters between Kuhsi and Fangliao at depths less than 10 m. Their number increased from July to September. In July, the prawns were rather concentrated in the waters between the estuary of the Linpien River and Fangliao at depths around 10 m. In August, they were mainly distributed in the waters between Dapong Bay and Fangliao at depths less than 25 m. In September, the prawns moved southward to the waters between the estuary of the Linpien River and Fangshan at depths less than 30 m. The highest density (41-50 prawns/hour , by prawn trawler) was found in the waters between Kuhsi and Fangliao at depths of 10-20 m in September. After October, the number of prawns decreased abruptly and very few could be found in December (Su and Liao 1984, 1986; Su 1988).

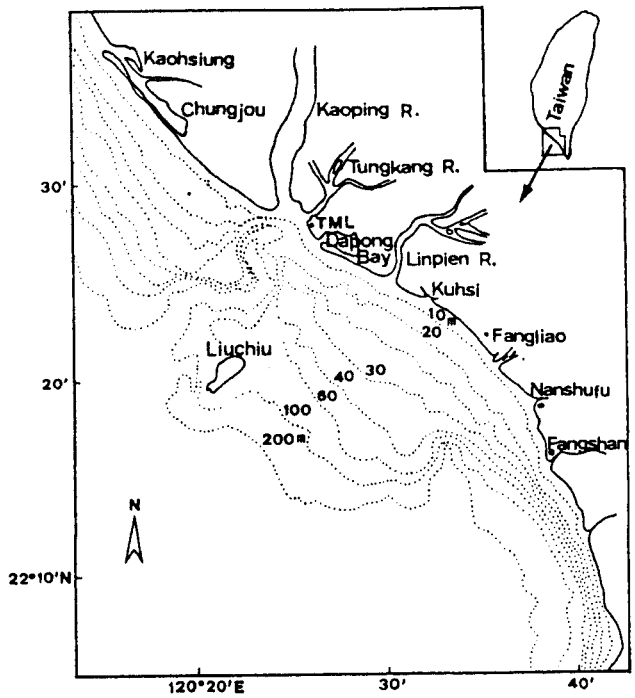

Fig. 1. Map showing the study area on the southwest coast of Taiwan.

Reproduction

As shown in Fig. 2, P. monodon spawn from May to December with the peak season from September to November. The main spawning ground is in the waters between Kuhsi and Nanshufu at depths of 10-40 m. The carapace length (CL) of mature females ranged from 44 to 66 mm with the majority measuring between 52 and 57 mm, while that of mature males were from 28 to 55 mm with the majority between 33 and 44 mm (Su and Liao 1986; Su 1988).

Hirano, R. and I. Hanyu, editors. 1990. The Second Asian Fisheries Forum. 991 p. Asian Fisheries Society, Manila, Philippines.

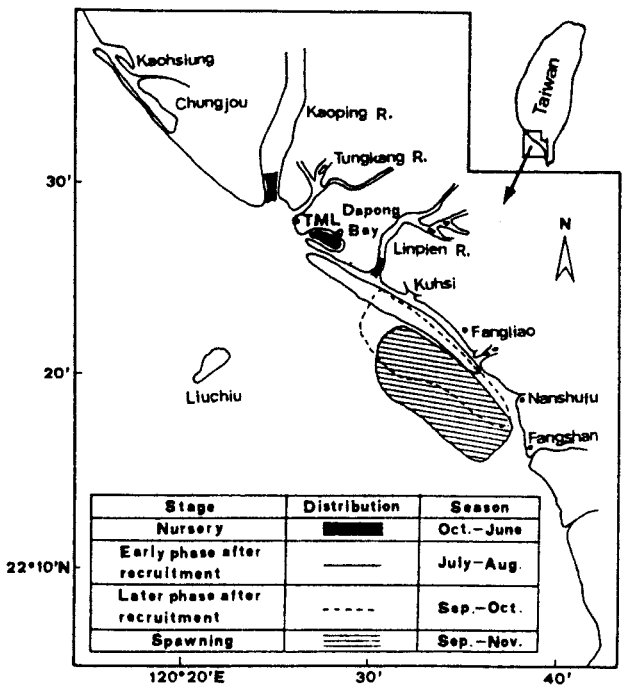

Fig. 2. Distribution of P. monodon along the coastal waters of southwest Taiwan.

Emigration from Nursery Ground

The emigration of P. monodon from Dapong Bay, the largest nursery ground for this species around southwest Taiwan, was investigated by Su and Liao (1987). The peak emigrations occurred from April to December. Most of the prawns emigrated 1-2 months after the rainy season (May-October). The prawns preferred to emigrate at the new moon or first quarter moon phases (Fig. 3). Their sizes fluctuate throughout the year with large variations

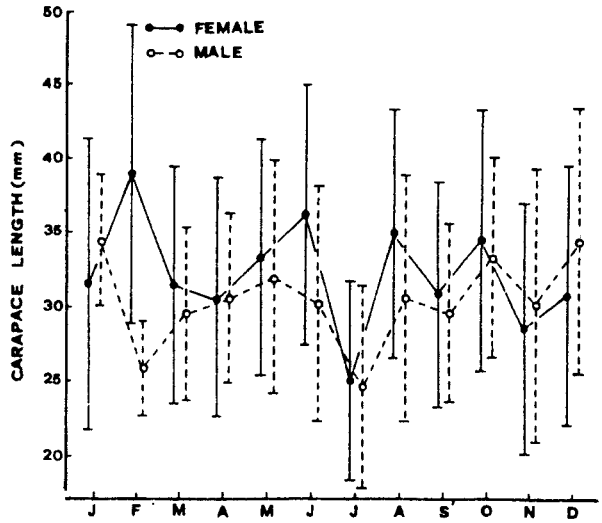

Fig. 4. Seasonal variation in the carapace length (x̄ ± SD) of the emigrating prawns trapped at the mouth of Dapong Bay from August 1984 to December 1986.

within each month. The minimum mean size occurred in July with 25.0 mm CL for females and 24.6 mm CL for males. The maximum mean sizes of 39.0 mm CL for females and 34.5 mm CL for males occurred in February and January, respectively. Early emigrants were the smaller ones which migrate mainly in March, July, September and November (Fig. 4). The ovaries of all females sampled were undeveloped. The pro-portion of males with spermatophores was about 50 % at a carapace length of 36 mm.

Food and Feeding

The frequency of occurrence of food types by locality and by season for P.

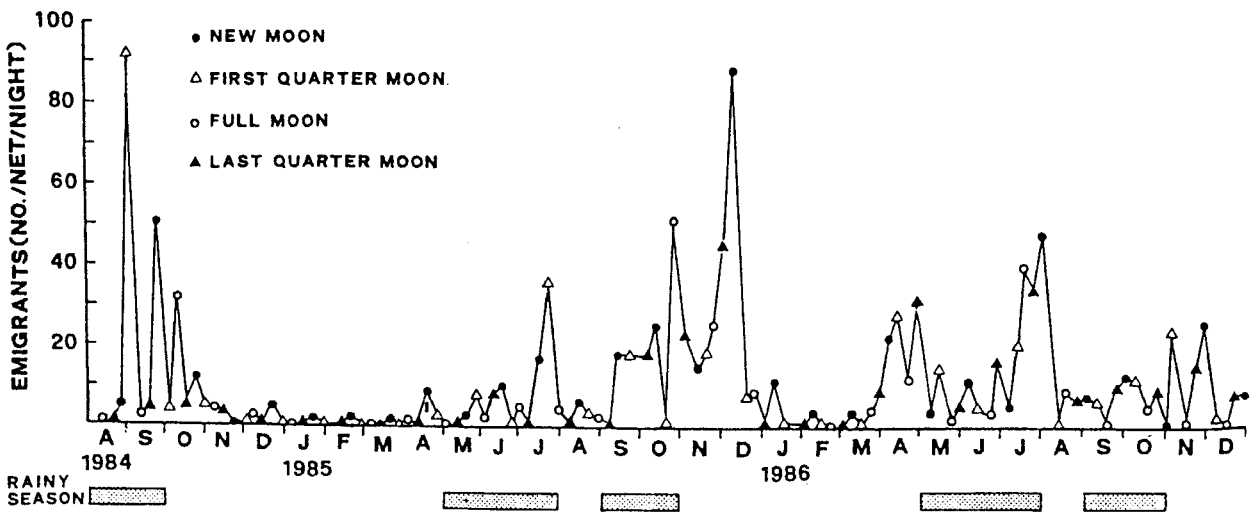

Fig. 3. Seasonal changes in emigration of P. monodon from Dapong Bay.

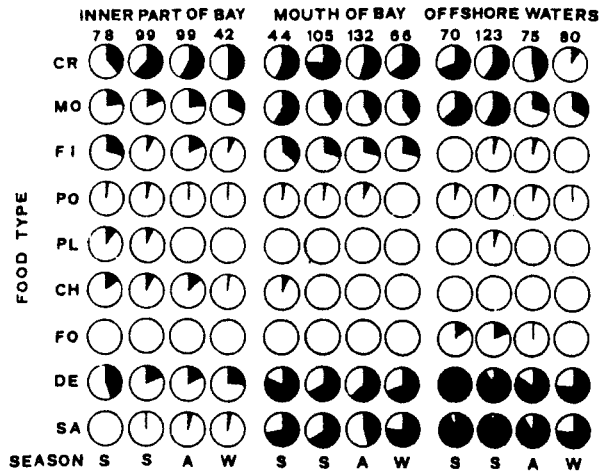

Fig. 5. Occurrence of different food types (shaded area) in stomach of P. monodon by area and season, from July 1982 to December 1986. The number indicates sample size. CR-Crustaceans, MO-Molluscs, FI-Fish, PO-Polychaetes, PL-Plant materials, CH-Chaetomorphs, FO-Foraminifera, DE-Detritus, SA-Sand granules.

monodon is shown in Fig. 5. In Dapong Bay, the order of relative importance was crustaceans, molluscs, detritus and fish. Crustaceans occurred more often in summer and autumn, molluscs in winter, detritus and fish in spring. At the mouth of Dapong Bay, the order was detritus, sand granules, crustaceans, molluscs and fish. Detritus, molluscs and fish were found more often in spring, crustaceans in summer and sand granules in winter. In offshore waters, the order was detritus, sand granules, molluscs, crustaceans and foraminifera. Detritus, molluscs and foraminifera occurred more often in spring and summer, sand granules and crustaceans in spring, summer and autumn. (Su and Liao 1986, Su 1988).

Growth

Fig. 6 shows the growth curves of P. monodon by sex in Dapong Bay and in the offshore waters. In Dapong Bay, the difference in growth between sex is not apparent. The growth of the females in the offshore waters is similar to that in the Bay. The curves reveal that P. monodon of 20 mm CL in July grow to 44 mm CL in October, showing a growth of 8 mm CL/month. Based on the equation of carapace length and body weight relationship, the estimated growth in weight is about 16.98 g/month (Su and Liao, unpublished data).

Life History and Stock Enhancement

P. monodon spawn in the waters between Kuhsi and Nanshufu at depths of 10-40 m from September to November. The postlarvae are transported by currents into Dapong Bay or the estuaries of the Tungkang and Linpien Rivers. In the Bay, the prawns grow to the size of about 25.0 mm CL in July and then begin to emigrate into the offshore waters with peak season between July and September. Then, they grow into adults and become mature between September and November. To augment the recruits of the different growth stages of P. monodon described earlier, the strategy of releasing postlarvae and juveniles is proposed.

The purpose of restocking postlarvae is to supplement and enhance the stock of postlarvae migrating into the nursery grounds. According to the present findings on the spawning season and the larval development (Liao, et al. 1969), it is estimated that natural postlarvae of P. monodon enter Dapong Bay mostly in October to December. Thus, this period was estimated to be the nursery season for P. monodon. The nursery season is also considered the growing season of postlarvae. Therefore, it is recommended to restock postlarvae during the said nursery season.

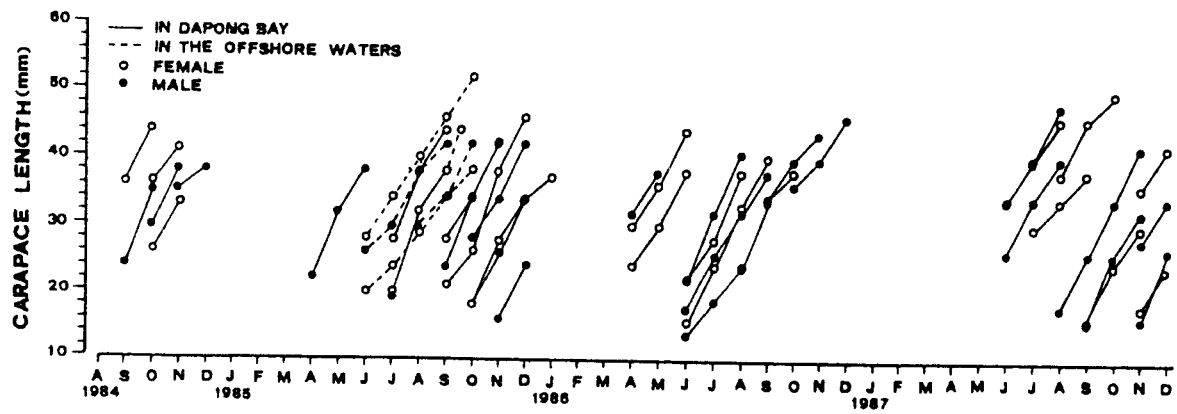

Fig. 6. Growth curves of P. monodon by sex and area based on analysis of size composition of samples caught from August 1984 to December 1987.

The purpose of restocking juveniles into coastal waters is to supplement natural stock in a more direct and effective way. The size of the juveniles for restocking is an important consideration. The larger juveniles survive better. However, when mass production and transportation are considered, use of larger juveniles is not cost effective. Thus, juveniles should be of sizes that can acclimatize well in coastal waters as well as escape from predators. With this consideration, the appropriate size of P. monodon for restocking is 20 mm CL.

Environmental situation, including rainfall, moon phase, coastal water conditions, etc., during the emigration season should be suitable for the new recruits. Therefore, the appropriate emigration season for restocking is critically considered. For P. monodon, this season is from July to September. However, the natural season when juveniles are abundant must also be considered. In this regard, the supply of spawners is the key consideration. The best period for the production of P. monodon juveniles for restocking is from October to December.

The site for restocking is also an important aspect to be considered. It is assumed that the main distribution area of a species should provide the best environment and a sufficient supply of food for that species. In this regard, it is recommended that P. monodon juveniles be restocked in nearshore waters between Linpien and Fanliao.

P. monodon do not emigrate during the daytime as illustrated by the absence of any specimen caught during the daytime in this study. In addition, they prefer to emigrate at the new moon phase. During dark conditions, the emigrating prawns can escape from predators more successfully. Therefore, it is suggested that juveniles be restocked around the new moon phase and during night time.

Food of P. monodon in the coastal waters was composed mainly of detritus and sand granules. These materials are abundant in Taiwan coastal waters (Chinese Naval Hydrographic and Oceanogaphic Office 1979). Kuwabara and Akimoto (1986) noted that the sediment from these coasts is composed mainly of fine sand and very fine sand with a number of silt-clay materials. Many microorganisms may be associated with sand granules. It is anticipated that the P. monodon to be released can feed well in these coastal waters.

Acknowledgments

Thanks are extended to the TML staff, Misses I.F. Chen, C.D. Jong and C.S. Chen for their help in sampling and laboratory work. The project was a research grant by the National Science Council through grants NSC74-0409-B056-05 and NSC75-0209-B056a-01.

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* Contribution B No. 58 from the Tungkang Marine Laboratory