

## Notes on the Biology of Penaeid Shrimp at Gizan, Red Sea

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**ABSTRACT.** Shrimp species of Gizan trawl fishing area were determined by commercial catch sampling from October 1985 to September 1986. *Penaeus semisulcatus* and *Metapenaeus monoceros* are the main species in the shrimp fishery. Analysis of length frequency data of females of these two species together with percentages of females with developed ovaries show that both species have a prolonged spawning season with no trace of seasonal peaks. Remedy of fisheries problems related to overfishing is possible, but remedy of problems related to deterioration of nursery grounds is very difficult.

### Introduction

Penaeid shrimps were known to inhabit the Red Sea since the last century (*e.g.*, de Man 1880). Traditional methods of hand push-net in shallow muddy bottoms remained, until relatively recently, the main fishing methods along the Red Sea coasts (Neve and Al-Aiidy 1973). Commercial shrimp trawlers were first used in Saudi Arabian Red Sea waters in 1981 by Saudi Fisheries Company (S.F.C.) in the region of Gizan (Fig. 1). This is probably the only region along the Saudi Coast which is suitable for trawling. It lies by the side of wadis which bring runoffs from adjacent Asir mountains during flash-floods. The sea bottom, is therefore, muddy both near shore and off-shore, and the intertidal zone is densely covered with mangrove trees, *Avicennia marina*. Lack of muddy bottoms is a limiting factor for both nursery and breeding of penaeids in most other regions along the Saudi Red Sea Coast.

In October 1985, a one year monthly survey was initiated by the Faculty of Marine Sciences, King Abdulaziz University, to obtain biological information required for the management of commercial species fished in Gizan. This paper provides data on

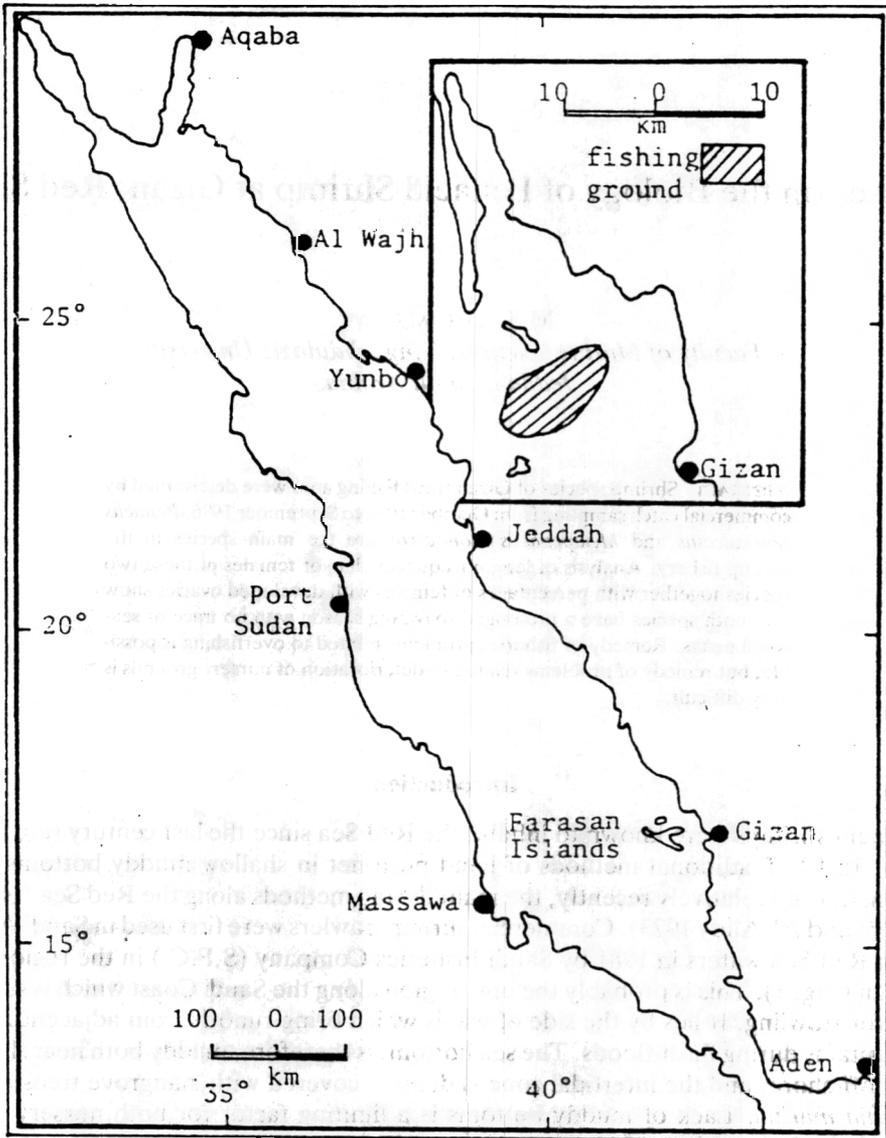


FIG. 1. Position of Gizan along the Red Sea coast of Saudi Arabia (inset shows the region of Gizan enlarged and fishing ground).

penaeid shrimp species composition, monthly size frequency distribution of females of the main species, and their reproductive pattern.

During the study period, all fishing companies in Gizan together operated a maximum of ten trawlers at one time, out of which seven belonged to S.F.C. and the rest to other small companies. Personal communication with fishing companies revealed a sharp decline in shrimp landings in the region.

### Material and Methods

The Research Vessel Ibn Magid, under the auspices of the Ministry of Agriculture and Water, was used from October 1985 to April 1986 to obtain the required data. From May 1986 till the end of the study, commercial vessels were used. In both cases, two 20 kg samples of two successive night hauls, each of 3-hr duration, were divided into the different groups of animal components.

Penaeid shrimps species were identified, sexed, measured and examined for gonad maturity. The carapace length (C.L.) from orbit of the eye of the mid dorsal line was measured using a vernier caliper. Measured specimens were divided into 0.2 cm-size groups.

The state of maturity was judged macroscopically by examining abdominal, middle and front lobes of the ovaries. This method has been described in various publications and no further description is needed (Thomas 1974, Price and Jones 1975, and Gwyther 1980). The sea surface temperature at about 1 m depth was measured by a reversing thermometer in the fishing area. The fishing area was between 25 to 30 m deep.

### Results

#### *Penaeid Shrimp Species Composition*

In all, eight shrimp species were identified from the samples. These were *Penaeus semisulcatus* De Haan, *P. japonicus* Bate, *P. monodon* Fabricius, *P. indicus* H. Milne Edwards, *P. latisulcatus* Kishionuya, *Metapenaeus monoceros* Fabricius, *M. stebbingi* Nobili and *Trachypenaeus curvirostris* (Stimpson).

The composition of species was, more or less, the same all over for the study period. Table 1 gives the percentages of species in the combined samples of the period studied. *P. semisulcatus* and *M. monoceros* were the most dominant species, constituting 90.1% of the total catch. The third abundant species, *T. curvirostris* (6.5%), was a small sized shrimp (0.5-1.1 cm) and usually discarded back to sea. In order of abundance, the rare species were *P. japonicus*, *P. monodon*, *P. indicus*, *M. stebbingi*, and *P. latisulcatus*.

#### *Size Frequency Distribution*

Figures 2 and 3 show the size frequency distribution of the two main shrimp

TABLE 1. Average species composition in the combined samples of the study.

Species	%
<i>Penaeus semisulcatus</i>	58.3
<i>Metapenaeus monoceros</i>	31.8
<i>Trachypenaeus curvirostris</i>	6.5
<i>Penaeus japonicus</i>	1.7
<i>Penaeus monodon</i>	0.8
<i>Penaeus indicus</i>	0.4
<i>Metapenaeus stebbingi</i>	0.3
<i>Penaeus latisulcatus</i>	0.2

species, *P. semisulcatus* and *P. monoceros*, respectively. It is evident from these figures that both species are present in all months in a wide range of sizes.

### Ovarian Maturity

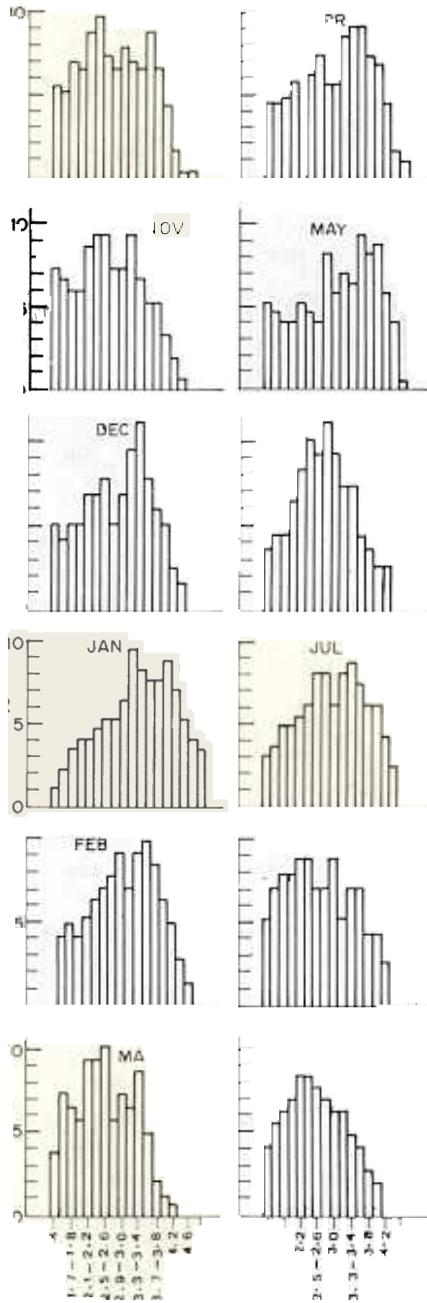
Figure 4 shows the percentages of *P. semisulcatus* and *M. monoceros* females at maturity stages 3 (late maturing) and 4 (mature) at each size class in the compiled samples of the study. The smallest *P. semisulcatus* attaining stage 3 is 2.3 cm C.L. The minimum size to attain stage 4 is 2.7 cm C.L. In *M. monoceros*, maturity is attained at a smaller size, where the minimum sizes to attain stages 3 and 4 are 2.1 cm C.L. and 2.4 cm C.L., respectively. In both species, the percentage of individuals attaining maturity increases with size.

Figure 5 shows the monthly percentages of *P. semisulcatus* and *M. monoceros* at stages 3 and 4 of their ovarian maturity. Around forty percent of females of both species possess developed ovaries in all months of the year.

### Discussion

The shrimp fishery in Gizan region is based mainly on *P. semisulcatus* and *M. monoceros*. Taxonomic characters of these species were discussed by Ghamrawy (1988). The size frequency distribution of females of both species indicate a prolonged spawning season, and show that recruitment occurs during all months of the year. The spawning patterns, as measured by monthly variations in the percentages of females with developed ovaries, also show no trace of seasonal peaks in reproduction. Spawning all year round, with seasonal peaks, has been previously reported for various penaeid shrimps in the middle of the Red Sea as well as elsewhere in the tropics (George 1962, Gopalakrishnan 1971, Subrahmanyam and Ganapati 1971, Thomas 1974, and Ghamrawy 1982). Seasonal reproductive activities in penaeids have been generally related to water temperature and its seasonal changes, (e.g. Rao 1968, Munro *et al.* 1968, Ghamrawy 1982, and Al-Shonaiani 1985).

Temperature measurements, made during the present study, showed a minimum of 27.6°C in February and a maximum of 32.3°C in September. Comparison of these values with those of both coastal and offshore waters in the middle and northern Red



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*semisulcatus*

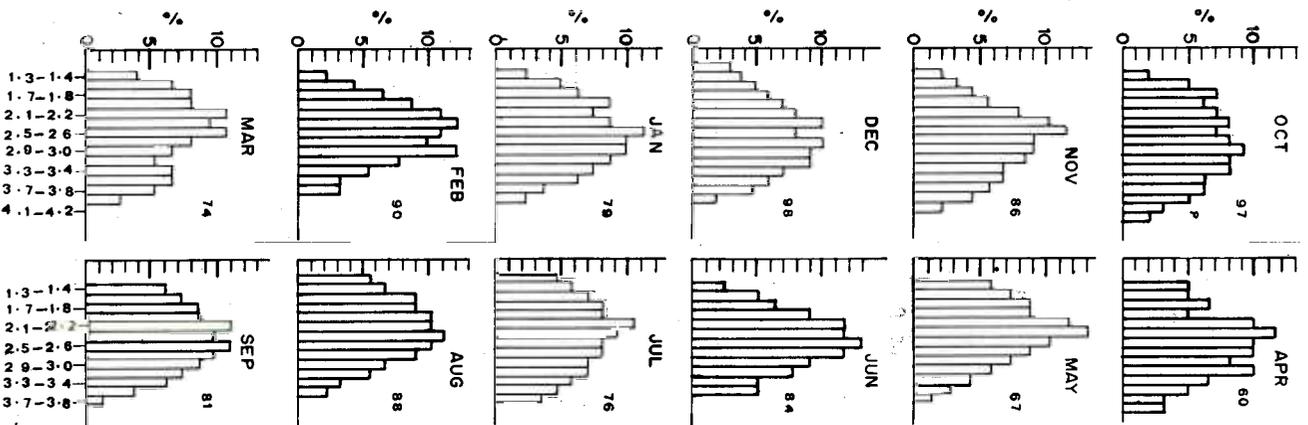


FIG. 3. Monthly size frequency distribution of *M. monoceros* females. Numbers of examined specimens are given for each month.

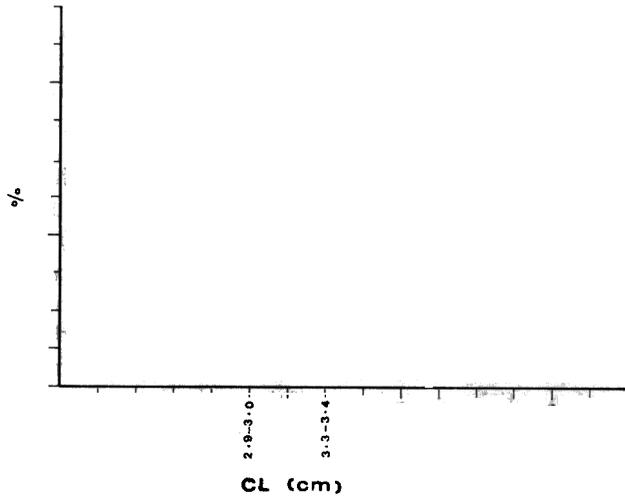


FIG. 4. Percentages of *P. semisulcatus* (▲) and *M. monoceros* (△) with late maturing and mature ovaries at each size class in the compiled samples of the study.

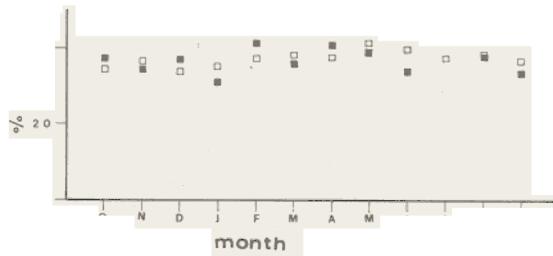


FIG. 5. Monthly percentages of *P. semisulcatus* (■) and *M. monoceros* (□) with late maturing and mature ovaries.

Sea (Morcos 1970, Morley 1975, Saad and Fahmy 1984, and Edwards 1987) show that Gizan region is characterized by a minimal annual temperature variations.

The above annual temperature variation of 4.7°C is very similar to that of the Gulf of Papua, New Guinea, where the annual temperature ranges from 26 to 31°C (Gwyther 1980). This author reported continuous spawning with no peaks for penaeids including *P. semisulcatus*, *P. monodon*, *P. indicus* and *P. japonicus*.

Results of the present study are premature to suggest management regulations, as management problems of shrimp fishery are highly diverse and occur in tropical

shrimp fisheries in many regions of the world (FAO 1985). However, they indicate that the fall in shrimp landing in the region is most probably related to overfishing. Exploitation of adults in different fisheries has been found to affect recruitment (Garcia and Le Reste 1981, Garcia 1984, and Penn and Captui 1985). If so, the problem can be kept under control providing that catch data, which are basic to analytical approaches, are available and are used for the management plan.

Deterioration of nursery grounds harmfully affects fisheries. The sharp decline in shrimp catches experienced in Kuwait is not largely correlated with fishing intensity and is possibly related to intensive land reclamation (Garcia 1984). Nursery grounds of penaeids should be located and demarcated as reserved areas in Gizan. Overfishing may reduce the yield until fishing operations are stopped for economical reasons. This suspension of fishing will continue for a period of time until the stock is rebuilt. The consequence of polluting or reclaiming land from nursery grounds may, however, completely exhaust fishery resources of the region on a permanent basis.

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## ملاحظات على بيولوجية الجمبري ( عائلة البنيدي ) في منطقة جيزان - البحر الأحمر

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المملكة العربية السعودية

### مستخلص

تم تحديد أنواع الجمبري في منطقة جيزان من خلال تصنيف عينات من المصيد في الفترة من أكتوبر ١٩٨٥م إلى سبتمبر ١٩٨٦م. والنوعان بنيس سيميسلكاتس وميتابنيس مونوسيروس هما النوعان الرئيسان. وتوضح تكرار الطول ونسب الإناث ذات المبايض الناضجة الاتساع الزمني لموسم التكاثر، وعدم وجود مواسم ذروة لتكاثر النوعين الرئيسين في المصيد. علاج النقص في كميات المصيد في المنطقة أمر ممكن فيما يتعلق بمشاكل الصيد الجائر، ولا يمكن علاجه إذا ارتبط بتحطيم بيئات الحضانة.