

Abundance and size frequency of postlarvae of *Penaeus occidentalis* in the Gulf of Nicoya, Costa Rica

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Abstract: Postlarvae of the Genus *Penaeus* were collected once a month from November/94 to April/95 at Cocoroca beach in the Gulf of Nicoya, Costa Rica. They were identified morphologically, and those of *P. occidentalis* were studied. It was revealed that the postlarvae of *P. occidentalis* occupied 65.6 % of the total individuals collected, and 24.1 - 94.9% of the monthly composition, and their distribution density varied from 0.7-5.8 individuals/m². The carapace length(CL) of the postlarvae of *P. occidentalis* ranged from 1.55 to 9.58 mm, which suggested a migratory size of them. The frequency of the CL showed a skewed distribution, which suggested a migratory pattern of the postlarvae of that species. The relative growths of the 6th abdominal somite and the carpus of the third pereopod of the postlarvae of *P. occidentalis* were also examined against the CL.

Key words: Marine shrimp, *Penaeus occidentalis*, postlarvae, size frequency, species composition, morphology, Costa Rica.

Marine shrimps of the Genus *Penaeus* are globally important from biological and commercial standpoints. On the Pacific coast of Central America, five species of that genus are present. In the Gulf of Nicoya, Costa Rica, two species named locally "camarón blanco", i.e. *P. occidentalis* and *P. stylirostris*, are fished by artisanal fishermen using gill nets, while the former species is dominant in annual commercial catches (Palacios *et al.* 1995).

There are few ecological studies on *P. occidentalis*, and Palacios *et al.* (1995) reported on the annual production in conjunction with other *Penaeus* shrimps. Meanwhile, no studies on the wild postlarvae of *P. occidentalis* have been reported, although they are essential for managing the shrimp resources and for introducing them for shrimp culture. The main reason why there have been few studies on them seems to be a difficult identification of the postlarvae. Kitani (1994) reviewed the identification of the *Penaeus* postlarvae distributed in the

Pacific coast of Central America, which makes it possible to carry out ecological studies on them.

The present study intends to clarify the ecology of the wild postlarvae of *P. occidentalis* in the Gulf of Nicoya, and to contribute to the development of fisheries.

MATERIALS AND METHODS

Postlarvae were collected at Cocoroca beach near Punta Morales in the Gulf of Nicoya. The area is a small inlet opening widely to the Gulf, without inflow of fresh water, with a muddy bed being exposed during low tide, and had a water depth of 20-30cm during the sampling. The sampling was carried out once a month, for six months from November/1994 to April/1995, on the 5th day after the new moon, and at the flowing tide. A wooden pole was fixed on the ground for an indication of water depth, and the sampling was always started at the same depth. A handnet of small mesh with

dimensions of 33 (width) x 20(height) x 35(depth) cm was used, and the sampling lasted exactly 10 min. The specimens were fixed with 10% formalin, and examined in the laboratory of the National University in Heredia.

In this paper, the term of "postlarvae" refers to small shrimps collected in the present study, and some of them may correspond to a juvenile shrimp. The identification of them was made following Kitani(1994), Kobayashi and

Chan(1991), and Perez Farfante(1989). The measurement and the morphological terminology follow Kitani(1994).

RESULTS

The individual number of the postlarvae collected at each sampling and that by species are listed in Table 1. The postlarvae of four

TABLE 1

Individual number of *Penaeus* postlarvae collected with a scoop-net for 10 min at Playa Cocorooca in the Gulf of Nicoya, Costa Rica. Nov. 7, 1994-Apr. 3, 1995

Date/especies	<i>P. occidentalis</i>	<i>P. stylirostris</i>	<i>P. vannamei</i>	<i>P. brevirostris</i>	<i>P. californiensis</i>	Total
1994/Nov. 7	316	1	0	16	0	333
1994/Dec. 6	151	1	0	461	1	614
1995/Jan. 5	444	0	0	60	0	504
1995/Feb. 3	427	0	0	30	1	458
1995/Mar. 5	53	0	0	167	0	220
1995/Apr. 3	66	0	0	26	0	92
Total	1457	2	0	760	2	2221

species, i.e. *P. occidentalis*, *P. stylirostris*, *P. brevirostris*, and *P. californiensis*, were founded, while the postlarvae of *P. vannamei* were not. The total number of the postlarvae collected was 2221, and the postlarvae of *P. occidentalis* occupied 65.6% of them. The individual number of the postlarvae of *P. occidentalis* collected at each sampling varied from 53 to 444. The postlarvae were mostly collected at the sampling in Dec./94, amounting to 614.

The species composition is shown in Fig. 1. The combined individual number of the two species, i.e. *P. occidentalis* and *P. brevirostris*, occupied more than 99% of the total number of each sampling. The postlarvae of *P. occidentalis* dominated in Nov./94, Jan., Feb., and Apr./95, occupying 94.9, 88.1, 93.2, and 71.7% of the monthly total number, respectively, while those of *P. brevirostris* in Dec./94 and Mar./95 occupied 75.1 and 75.9% of the same number, respectively.

The frequencies of the CL of postlarvae of *P. occidentalis* on Nov. and Dec./94 (Fig. 2) showed positive skewed distributions with the modes of 3.01 - 3.20 mm CL and 1.81 - 2.00mm CL, respectively. The ranges of the CL

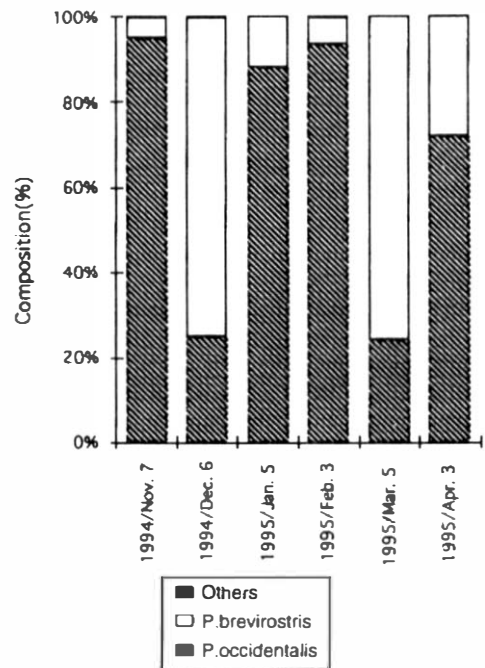


Fig. 1. Species composition of *Penaeus* postlarvae collected with a scoop-net for 10 min at Playa Cocorooca in the Gulf of Nicoya, Costa Rica, No. 7, 1994 - Apr. 3., 1995.

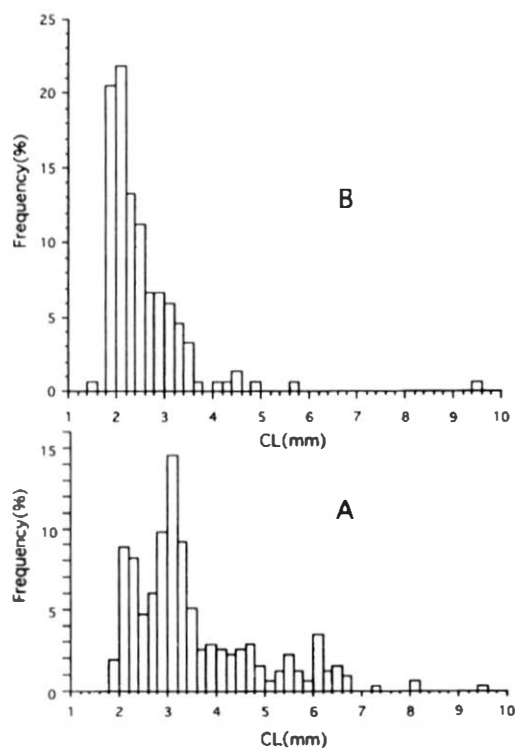


Fig. 2. Frequency distribution of carapace length (CL) of *P. occidentalis* collected on Nov. 7, 1994 (A), and Dec. 6, 1994 (B), at Playa Cocoroca in the Gulf of Nicoya, Costa Rica.

were 1.85 - 9.58mm and 1.55 - 9.50mm, respectively.

The relationship between the CL and the length of the carpus of 3rd pereopod (CP), and that between the CL and the length of the 6th abdominal somite (AS) of *P. occidentalis* in Nov. 1994 are shown (Fig. 3). The relationship of the CL/CP was clearly linear with the correlation coefficient of 0.995, while that of the CL/AS showed rather a curve between 1.75-3.00mm CL and more variance than the CL/CP relationship observed above.

DISCUSSION

The postlarvae of *P. occidentalis* were dominant, occupying 65.6% of the total catches, Meanwhile, Palacios et al. (1995) reported that the commercial catches of *P.*

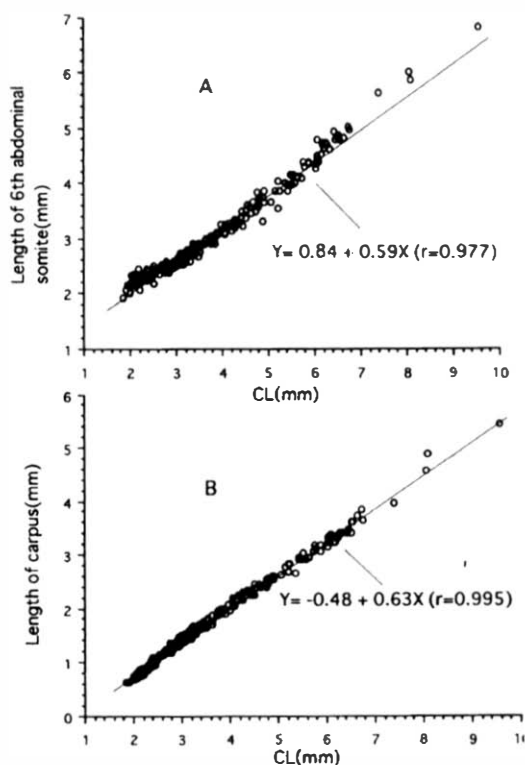


Fig. 3. Relationships between the carapace length and the length of 6th abdominal somite(A), and between the carapace length and the length of carpus(B) of *P. occidentalis* collected on Nov. 7, 1994, at Playa Cocoroca in the Gulf of Nicoya, Costa Rica.

occidentalis occupied 55.06% of the annual shrimp production in the Gulf, which is considered to justify the present result on the dominant species of the wild postlarvae in the Gulf.

The mean distance scooped for 10 min was 230m. Since the width of the handnet is 33cm, the total surface scooped is calculated to be 76m². Accordingly, the distribution density of the postlarvae of *Penaeus* is from 1.2 to 8.1 individuals per m², while that of *P. occidentalis* from 0.7 to 5.8 individuals per m². This density may be useful for estimating the postlarvae resources in coastal waters, however further studies at different sites will be needed.

The present study considers that the frequency distributions of the CL may indicate a migrating pattern of the postlarvae of *P. occidentalis* in the coastal waters. That is: after passing larval stages in the offshore waters, the postlarvae of *P. occidentalis* reach the coastal

area at a minimum CL of 1.55mm. The migration back to the offshore waters or a changing their distribution area from the sampling site occurs gradually after reaching the CL of 2.01-3.20mm CL, and that movement is completed by the maximum CL of 9.58 mm. Motoh and Kojima(1986) reported on the wild postlarvae of *P. japonicus* that the mode of the CL decreased during the summer, and they suggested the possibilities of spawning near shore in summer and an increased developmental rate by warmer temperature. The decreasing tendency of the mode is also observed in the present study, but the surface water temperature and salinity around the sampling site have a tendency of small changes from October to December, ranging 29.0-30.0 °C and 27.5- 30.0 ppt., respectively, however the salinity shows a increasing tendency along a climatic change to the dry season (Brenes & Leon, 1995). Accordingly, it is rather considered that the reason of the decreasing mode of the CL may be caused by different spawner groups, because the local fisherman reported several fishing grounds such as a southern part of Isla Chira about 20 miles far from the sampling site, and an east coast in the Gulf corresponding to an offshore area of the sampling site. The CL distribution in Nov/94 seems to be a polymodal distribution, which is considered to suggest a possibility of several spawner groups.

Kitani(1994) reported that the relative growth of the CP against the CL showed a linear relation between 1.81 and 2.75mm CL. The present study confirmed the relation with a range of 1.26 - 7.56 mm CL, which facilitate the identification of the postlarvae as well as early juveniles.

The postlarvae were collected in turbid waters at flowing tide, and the water turbidity seemed to work as an area protected from the predators, and the turbid waters may also offer an abundant detritus. A huge number of Mysidacea was bycaught at the sampling. No ecological studies on them have been reported, but the distribution of the wild postlarvae of *P. occidentalis* seemed to have a certain correlation with the occurrence of Mysidacea.

Further investigations on these points are required to clarify the ecology of the wild postlarvae of *P. occidentalis*.

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RESUMEN

Postlarvas de camarón del Género *Penaeus* fueron recolectadas mensualmente entre Noviembre de 1994 y Abril de 1995 en La Playa Cocoroca del Golfo de Nicoya, Costa Rica. Las postlarvas fueron identificadas morfológicamente, y las de *P. occidentalis* se estudiaron. El resultado demostró que las postlarvas de *P. occidentalis* fue mayoritarias con un 65.6% del total de las postlarvas recolectadas cuya composición mensual varía entre 24.1 y 94.9%. La densidad de distribución fue entre 0.7 y 5.8 individuos por m². El rango de longitud de caparazón (CL) de las postlarvas fue entre 1.55 y 9.58 mm, lo cual sugiere el tamaño migratorio.

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