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Population Parameters of *Penaeus californiensis* in the Gulf of Guayaquil, Ecuador

Paramètres de croissance chez la population de* Penaeus californiensis *dans le Golfe de Guayaquil en Equateur

Jaime Barragan V.

Abstract

The growth, mortality, and recruitment pattern of *Penaeus californiensis* were investigated using tail length (TL) -frequency data obtained from the Gulf of Guayaquil shrimp population. Computer-based methods of tail-frequency analysis Compleat ELEFAN software were used. Results obtained gave relatively high growth and mortality estimates for both males and females. The recruitment pattern indicated two pulses annually, one significantly larger than the other.

Les rapports longueur caudale (LC)-données de fréquence de la population de crevettes du Golfe de Guayaquil,* Penaeus californiensis, *ont été analysés à l'aide du logiciel Compleat ELEFAN pour déterminer sa croissance, sa mortalité et son schéma de recrutement. Les résultats obtenus reflétaient une croissance et une mortalité relativement élevées tant pour les mâles que les femelles. Le schéma de recrutement signalait deux pics annuels, l'un significativement plus important que l'autre.

Introduction

In 1988, the Gulf of Guayaquil trawl fishery landed a total of 82 580 tonnes of shrimp tails for a total export revenue of US$342 million. The target species, *Penaeus occidentalis, P. stylirostris* and *P. vannamei*, comprised 70% of the catch, while the remaining 30% consisted of *P. brevirostris* and *P. californiensis*.

The trawling grounds of the Gulf of Guayaquil are situated in a wide margin of the continental shelf in front of the largest mangrove area of the East Pacific (Fig. 1). The coastline is characterized by a number of small river systems originating from the highland region. These rivers enter the sea either directly or as part of the River Guayas. The Gulf of Guayaquil is also directly affected by the Humboldt cold water current which comes from the south. The period from November to April-May is the "wet season", when rainfall is abundant and temperatures are higher than in other months.

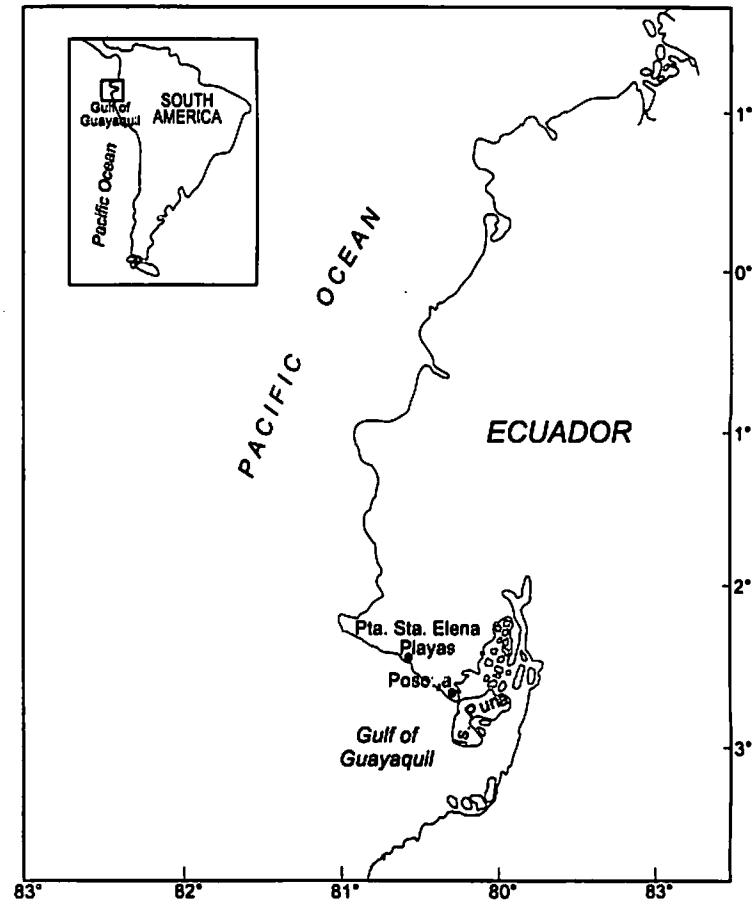

Fig. 1. Map of the Ecuadorian Pacific waters, showing the Gulf of Guayaquil.

Materials and Methods

Random samples were taken from the landings of *P. californiensis* from February through December 1989 at the fishing ports of Playas and Posorja, and from processing plants in Guayaquil. Samples were sorted into species before shrimps were sexed and measured. Tail length was measured to the nearest 0.1 cm (from the sixth somite to the posterior and of the telson). Information on fishing sites, number of trawling hours, fishing days, fishing depth, as well as total catches were taken from vessel logbooks or by direct interview.

Table 1. Growth parameters estimated for male and female *Penaeus californiensis* using ELEFAN I.

	L_∞ (cm)	K (year^{-1})	C	WP
Male	14.2	0.67	0.96	0.70
Female	15.5	1.44	0.50	0.58

The tail length-frequency data were analyzed using the Compleat ELEFAN software package of Gayanilo et al. (1989) for both males and females. Growth parameters T, L_∞ and K were estimated with ELEFAN I, while apparent total mortality (Z' = M + F remigration) was estimated using the length-converted catch curve analysis of ELEFAN II. Recruitment patterns for males and females were also estimated using ELEFAN II based on the values of T, L_∞ and K obtained via ELEFAN I.

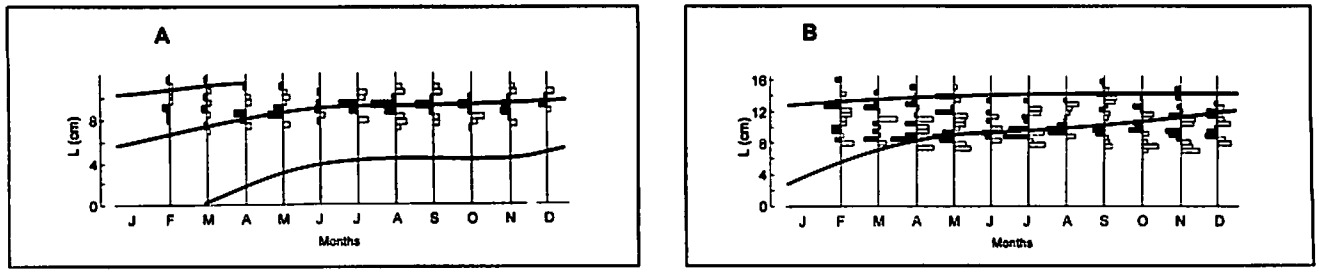

Fig. 2. Growth curve superimposed over the restructured length-frequency data of male (A) and female (B) P. californiensis *from the Gulf of Guayaquil, Ecuador.*

Results and Discussion

Growth parameters of male and female *P. californiensis* estimated via ELEFAN I are summarized in Table 1. Seasonality of shrimp growth is related to the temperature variation in the Gulf of Guayaquil. Results show that seasonality of growth occurs with C = 0.96 and WP = 0.70 for male, and C = 0.50 and WP = 0.58 for female *P. californiensis*. The growth curves using these parameters are shown superimposed over the restructured tail length-frequency distribution of male and female *P. californiensis* in Fig. 2.

Total apparent mortality (Z' = F + M + emigration) for male *P. californiensis* was estimated at 4.08 (year^{-1}), and at 9.54 (year^{-1}) for females for tail lengths from 8.0 cm to 16.0 cm. The length-converted catch curves for both sexes are illustrated in Fig. 3.

Annual recruitment occurs in two pulses (Fig. 4), one of which is much larger than the other. The major recruitment period to the fisheries for this species has been reported to occur between April and September (see MacPadden et al. 1988). The occurrences of these pulses are related to environmental variations associated with the wet and dry seasons.

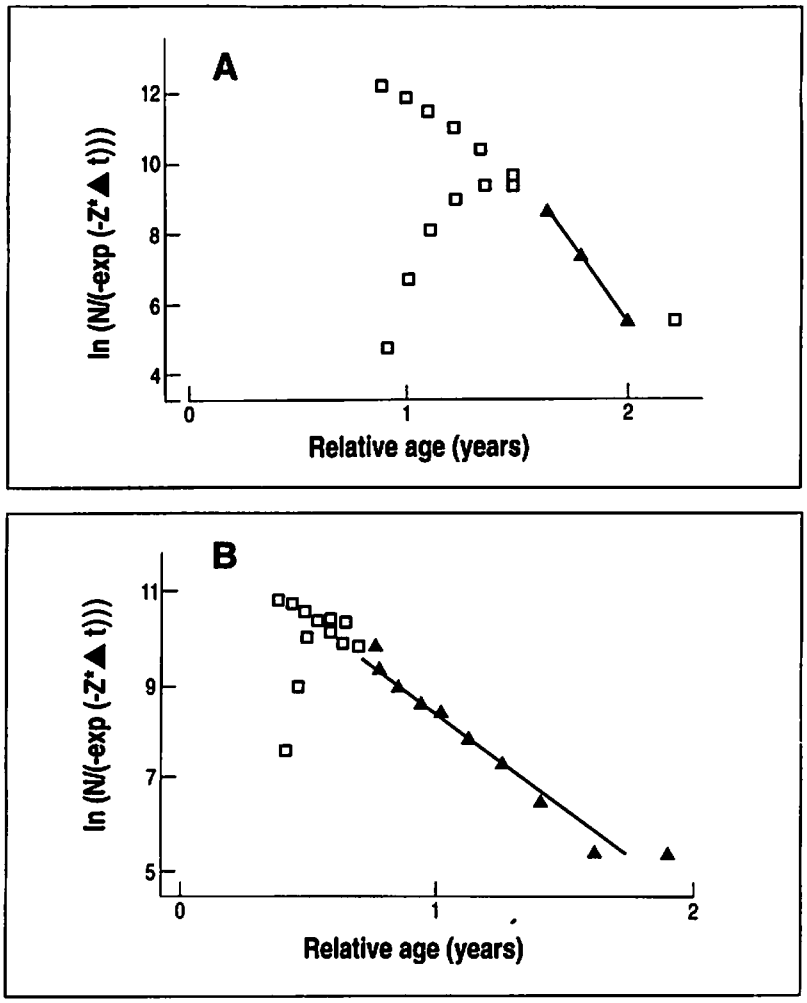

Fig. 3. Length-converted catch curves for male (A) and female (B) **P. californiensis** *from the Gulf of Guayaquil.*

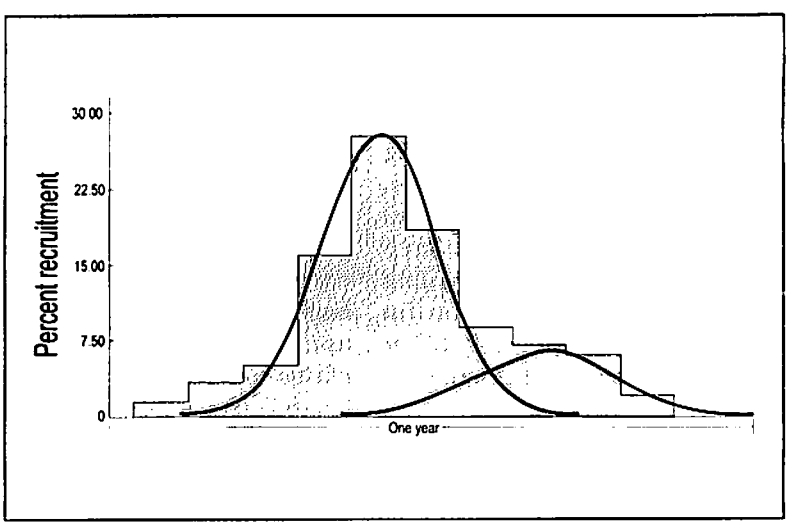

Fig. 4. Annual recruitment pattern of female **Penaeus californiensis** *in the Gulf of Guayaquil.*

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