Juvenile recruitment of the seabob *Xiphopenaeus kroyeri* (Heller,1862) (Decapoda, Penaeidea) in the Fortaleza Bay, Ubatuba, SP, Brazil

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Abstract

The purpose of the present study is to identify the nursery area and define the recruitment season of young *Xiphopenaeus kroyeri* (Heller, 1862) in Fortaleza Bay, Ubatuba (SP). Monthly samples were carried out with a shrimp fishery boat from November 1988 to October 1989 along seven transects. From each trawl, 100-g shrimp subsamples were separated. Each individual was measured at its carapace length (CL) and the sex recorded. Shrimps smaller than 13.7 mm CL were considered young. A total of 2,183 shrimps was obtained, from which 24% were young shrimps. Juvenile recruitment was verified year-round as expected for the species which continuous breeding is reported for the region. High percentage of young shrimps observed between November and March ($p < 0.05$) is attributed to the main spawning seasons during spring and summer. The considerably high proportion of juveniles found within the sampling area suggests that requirements for growth and survivorship of young are found outside the estuarine habitat. Therefore, the Fortaleza Bay may be considered as a nursery area, thus of most importance for the development early stages of *X. kroyeri*.

Keys words: recruitment, population structure, *Xiphopenaeus kroyeri*, Ubatuba, Brazil

Introduction

The penaeid *Xiphopenaeus kroyeri* is considered the species of most economical interest and the second fishery resource in São Paulo State. In spite of its importance, there are only a few studies on its population biology (Mota-Alves and Rodrigues, 1977; Rodrigues *et al.*, 1993; Branco *et al.*, 1994 and Nakagaki and Negreiros-Fransozo, 1998) and taxonomy and abundance (D'Incao, 1995, Nakagaki *et al.*, 1995 and Costa *et al.*, 2000). At Southeastern of Brazil, fishery activity is ruled according to the recruitment season of the pink-shrimp species *Farfantepenaeus brasiliensis* (Latreille, 1817) and *F. paulensis.* (Pérez Farfante, 1967. However, there are no specific studies defining such season for *X. kroyeri* in this region.

The objective of this study is to characterize the population structure of *X. kroyeri* in Ubatuba Bay, with emphasis on the identification of the nursery area and the definition of the recruitment season. Such information may aid the local preservation of the species and contribute to a better understanding of its life cycle.

Material and Methods

Monthly collections were performed from November 1988 to October 1989 in Fortaleza Bay (23°30'54"S and 45°08'00"W), Ubatuba (SP), along seven transects of 1km each (Fig.-1). Trawlings were carried out using a shrimp fishery boat supplied with double rig nets 7.5 m long with a mesh size of 10 mm in the cod end

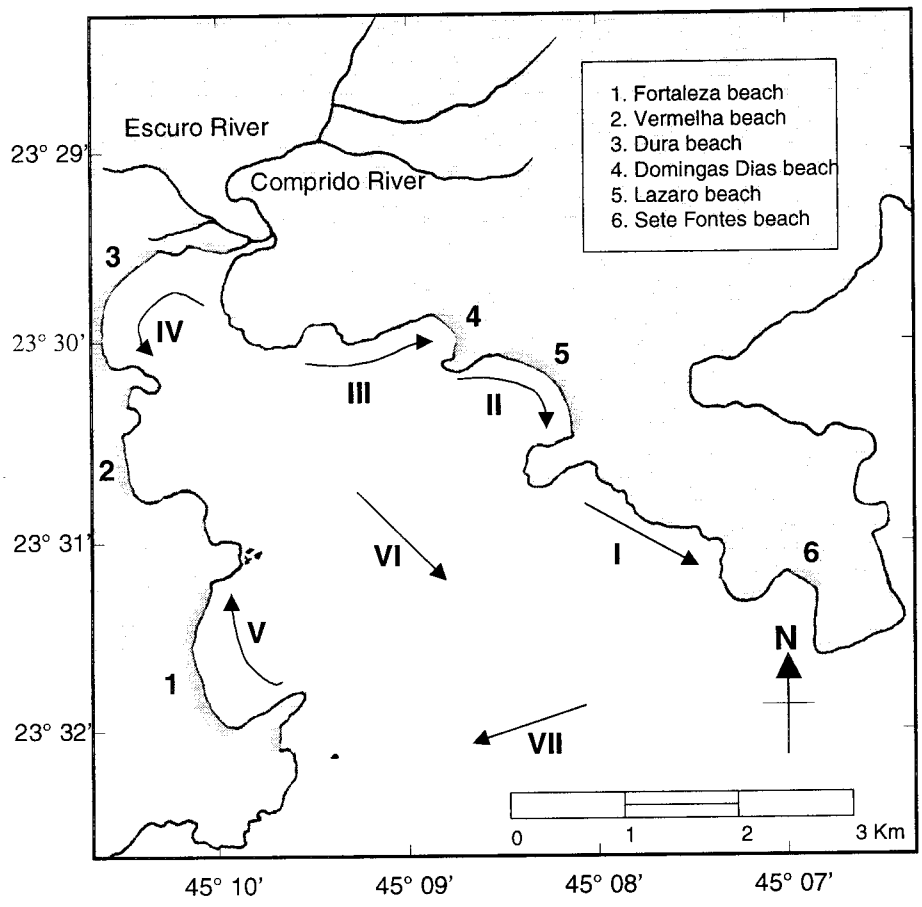

Figure 1: The Fortaleza bay map with the indication of the transects.

In each trawl, a shrimp subsample of 100 g was separated, and each shrimp had its sex recorded, and after that, shrimps were measured at its carapace length (CL) from the orbital angle to the posterior margin of carapace. The size of the juvenile shrimps (smaller than 13.7mm CL) was established based on the size at which half of population is physiologically mature ($CL_{50\%}$) (Rodrigues *et al.*, 1993). Size frequency distributions for each month and transect were examined to describe the population structure of the species.

In each transect and month, proportions of juveniles individuals were statistically compared by means of a Goodman´s test (Goodman, 1964 and 1965). This analysis is based on the binomial proportion comparison for contrast between and within multinomial populations. These results were analyzed at the 5% significance level.

Results

Shrimps were grouped in thirteen 2.5-mm size classes (Table-I). Size frequency distributions for each month and transect are shown in figures 2 and 3.

A total of 2,183 individuals was obtained, comprising 1,242 females (average size 16.94 ± 4.33 mm, ranging from 4.1 to 34.7 mm) and 941 males (average size 16.2 ± 3.04 mm, ranging from 7.5 to 25.8 mm). The results of the Goodman's test analysis for the proportion of the juveniles within each month and transect can be verified in Table 2 and 3. Recruitment of young was verified throughout the year, with the occurrence of a major peak from November to March (Table II and Fig.-3). The highest juvenile abundance was observed at transects IV and VI (Fig.-2), with significative differences in relation to the other transects (Goodman's test, $p<0.05$, Table III).

Table I: Size frequency distributions for all shrimps obtained, including both juveniles and adults collected in Fortaleza Bay over the study period.

Size Classes (mm)	Juveniles		Adults		Total	
	(n)	%	(n)	%	(n)	%
4.1--]6.6	2	0.09	0	0	2	0.09
6.6--]9.1	27	1.24	0	0	27	1.24
9.1--]11.6	182	8.34	0	0	182	8.34
11.6--]14.1	313	14.34	69	3.16	382	17.50
14.1--]16.6	0	0	466	21.35	466	21.35
16.6--]19.1	0	0	590	27.03	590	27.03
19.1--]21.6	0	0	317	14.52	317	14.52
21.6--]24.1	0	0	154	7.05	154	7.05
24.1--]26.6	0	0	46	2.11	46	2.11
26.6--]29.1	0	0	12	0.55	12	0.55
29.1--]31.6	0	0	3	0.14	3	0.14
31.6--]34.1	0	0	1	0.05	1	0.05
34.1--]36.6	0	0	1	0.05	1	0.05
Total	524	24.00	1659	76.00	2183	100.00

Table II: Comparison of the juveniles proportion within each month.

Months	N	D	J	F	M	A	M	J	J	A	S	O
Juveniles	0.38	0.53	0.41	0.05	0.44	0.15	0.16	0.05	0.15	0.17	0.09	0.12
Adults	0.62	0.47	0.59	0.95	0.56	0.85	0.84	0.95	0.85	0.83	0.91	0.88
Goodman's test	A	A	A	BC	A	BC	B	C	B	B	B	B

Table III: Comparison of the juveniles proportion within each transects.

Transects	I	II	III	IV	V	VI	VII
Juveniles	0.20	0.19	0.19	0.33	0.21	0.31	0.21
Adults	0.80	0.81	0.81	0.67	0.79	0.69	0.79
Goodman's test	B	B	B	A	B	A	B

Discussion

Larger shrimps were scarce in samples probably due to migration to the deeper grounds for breeding. The juvenile recruitment occurred year-round, which corroborates previous data suggesting continuous breeding for this species. Recruitment peaks found in this study are considered to follow periods of high spawning activity taking place during spring and summer (Castro, 1997; Nakagaki and Negreiros-Fransozo, 1998).

According to Dall *et al.*, (1990), *X. kroyeri* follows a life cycle in which adults migrate to offshore areas to breed, and post larvae return to estuarine regions, where they grow to juveniles. After completing the juvenile development, these shrimps start their offshore migration.

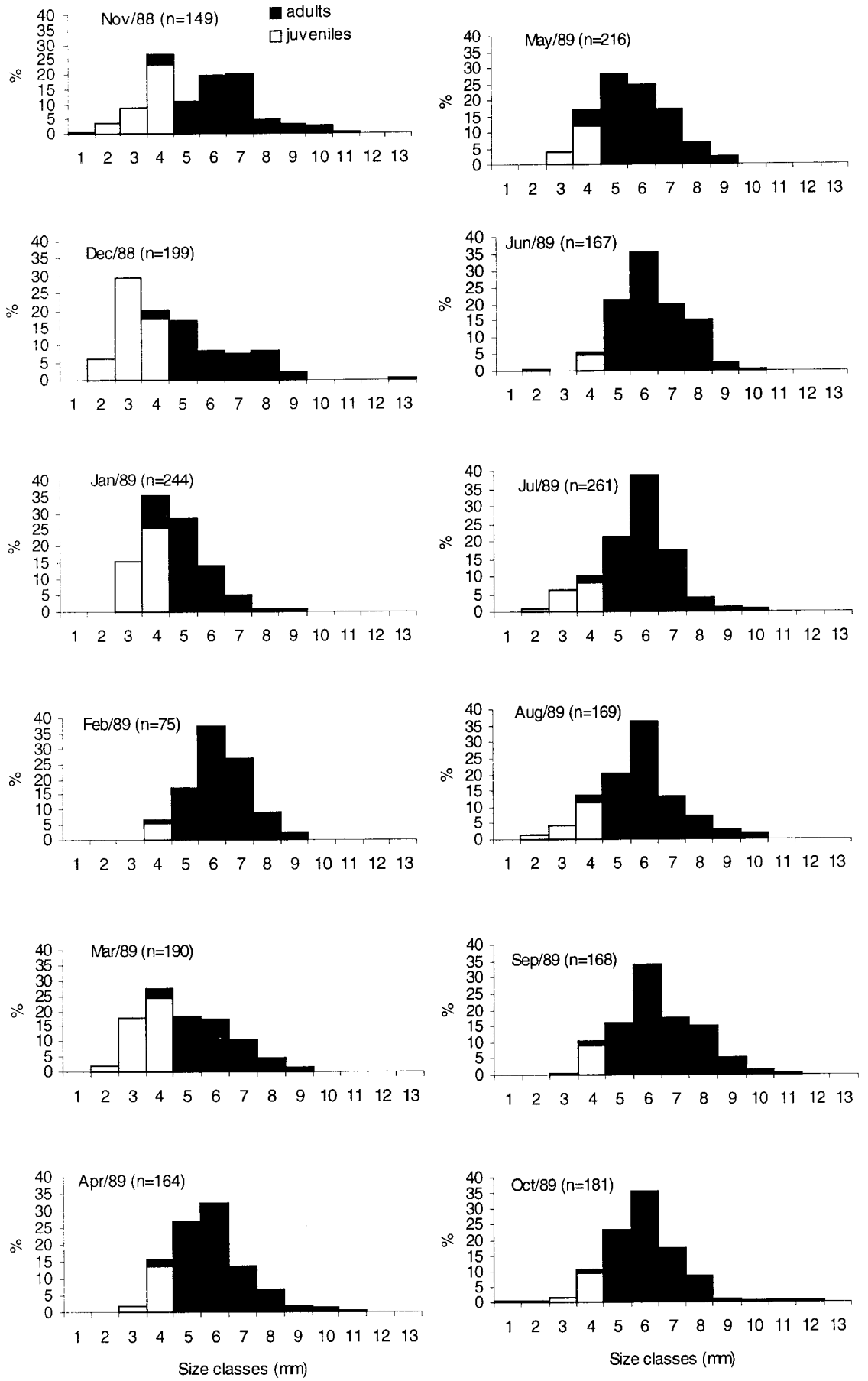

Figure 3: Size frequency distributions for young and adults collected in Ubatuba Bay during the sampled months.

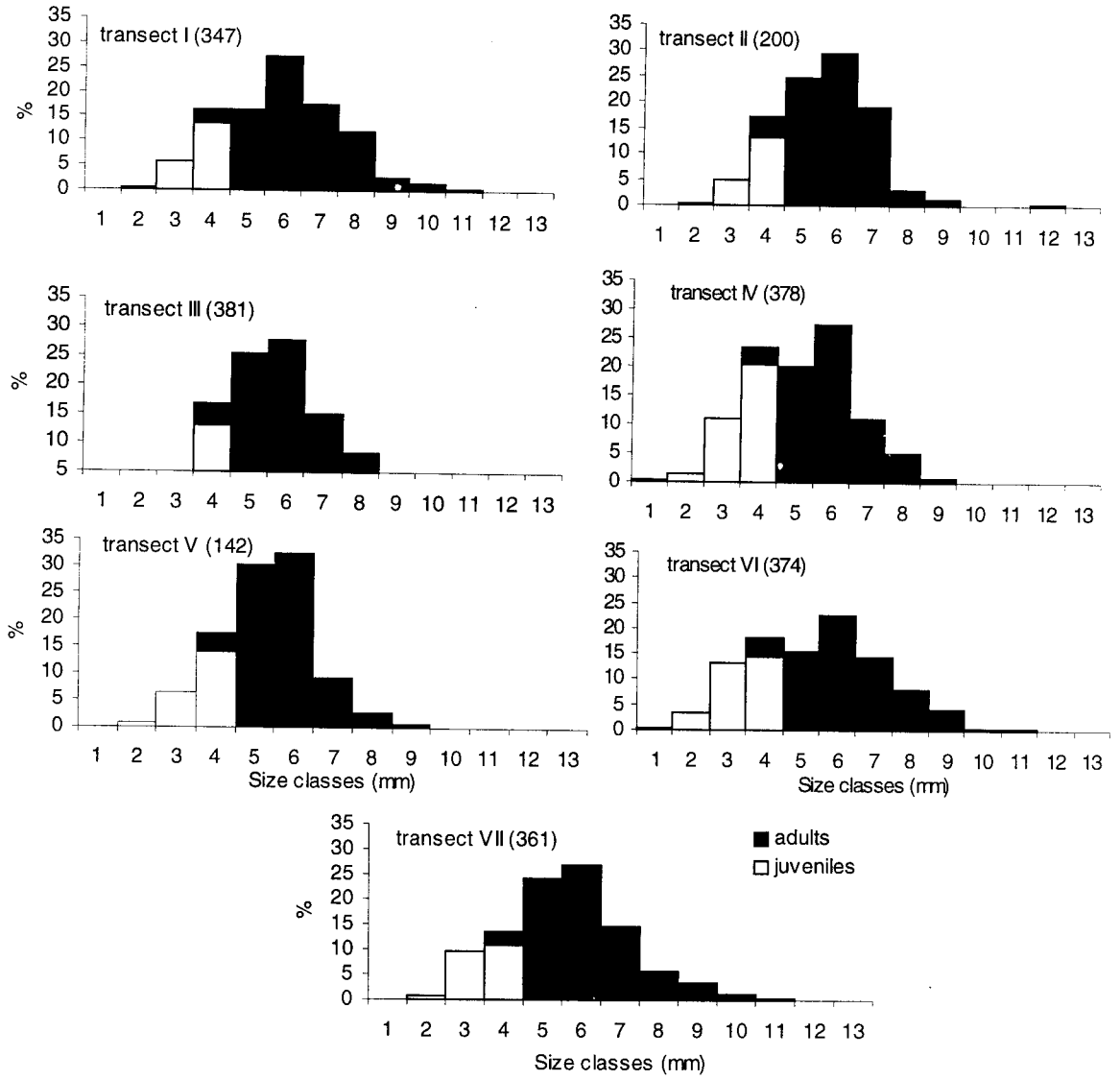

Figure 2: Size frequency distributions for young and adults collected in Ubatuba Bay during the sampled transects.

Due to particular characteristics of the coast line along the northern São Paulo State, Costa and Fransozo (1999) suggested that pink shrimp juveniles may spend a short time in the relatively scarce estuarine areas, remaining in the abundant shallow-water bays which provide adequate conditions for feeding and shelter. A similar tendency may also apply to *X. kroyeri* juveniles. These shrimps may not require the conditions usually found in estuarine systems for survivorship and growth, as suggested by Stoner (1988) for early shrimp stages in the absence of significant estuarine extensions.

Low juvenile abundance at transect VII may be due to a differential bathymetric distribution with juveniles prevailing in shallow areas. Adults are not expected to aggregate in these grounds since their osmorregulatory capabilities decrease as they grow (Dall *et al.*, 1990).

Therefore, it can be considered that shallow areas within the Fortaleza Bay are natural nursery grounds for *X. kroyeri*. Such habitat should be thus regarded of highest importance for the preservation of this population.

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