FECUNDITY AND REPRODUCTIVE OUTPUT OF THE SPECKLED SWIMMING CRAB *ARENAEUS CRIBRARIUS* (LAMARCK, 1818) (BRACHYURA, PORTUNIDAE)

BY

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ABSTRACT

Arenaeus cribrarius females were collected over a 12-month period with otter-trawl nets in the Ubatuba littoral zone, Brazil. Ovigerous individuals were measured (CW = carapace width excluding lateral spines) and weighed (WW = wet weight). Each egg brood was weighed (WE = wet weight), dried, and the number of eggs (EN) counted. Scatterplots from EN/CW, EN/WW, and EN/WE were submitted to regression analyses. Mean relative fecundity ($\overline{F'}$) was calculated in each month/season to assess seasonal variation of reproductive intensity. The number of eggs showed a positive correlation with CW, WW, and WE. Fecundity of *A. cribrarius* ranged from 135,210 to 682,156 eggs, intermediate in comparison with other portunids. Fecundity in Portunidae is typically high; lower values are found in Polybiinae and higher ones in Portuninae. Mean fecundity did not reveal significant differences over months and seasons, but reproductive activity tended to be more intense in summer and winter, a phenomenon related to reduced temperature oscillations as found in subtropical regions.

RESUMO

Fêmeas de *Arenaeus cribrarius* foram coletadas mensalmente durante um período de 12 meses com redes "otter-trawl" na zona litorânea de Ubatuba, Brasil. Os indivíduos ovígeros foram mensurados (CW = largura da carapaça sem os espinhos laterais) e pesados (WW = peso úmido). Cada massa ovígera foi pesada (WE = peso úmido), seca e o número de ovos (EN) contado. Os gráficos de dispersão resultantes das relações EN/CW, EN/WW e EN/WE foram submetidas a análise de regressão. A fecundidade média relativa ($\overline{F'}$) foi calculada para cada mês/estação do ano, e comparada para verificar a variação sazonal da intensidade reprodutiva. O número de ovos mostrou uma correlação positiva com todas as variáveis independentes (CW, WW, WE). A fecundidade de *A. cribrarius* variou de 135.210 a 682.156 ovos, sendo intermediária em comparação com a de outros portunídeos. A fecundidade nos Portunidae é tipicamente alta, porém valores mais reduzidos são

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encontrados nos Polybiinae e mais altos nos Portuninae. A análise da fecundidade média relativa não revelou diferenças significativas entre os meses e estações do ano, mas a atividade reprodutiva foi mais intensa no verão e inverno, um fenômeno relacionado à reduzida oscilação térmica verificada nas regiões subtropicais.

INTRODUCTION

Brachyurans demonstrate a great diversity of reproductive strategies that maximize survivorship of offspring and maintain population stocks at adequate levels (Hartnoll & Gould, 1988). Fecundity estimates and establishment of the breeding period can contribute to assess the renewal capacity of exploited species, providing a basis for fishery control legislation. The periodicity and intensity of reproduction have been estimated based on the frequency of ovigerous females (Paul, 1982; Potter et al., 1983; Mori, 1987) and/or occurrence of females with fully developed gonads during a 1-year period (Santos, 1994; Pinheiro, 1995).

According to Sastry (1983), fecundity is the number of eggs produced by a female in a single egg batch or during a given period of its life cycle. This definition has been adopted by many carcinologists (Haynes et al., 1976; Swartz, 1978; Bond & Buckup, 1982; Somerton & Meyers, 1983; Negreiros-Fransozo et al., 1992; Pinheiro & Fransozo, 1995) and the estimate of fecundity is always obtained using mathematical models fitted to scatterplots relating number of eggs (EN) to size (usually carapace width, CW or carapace length, CL). Although a linear model has been used by some authors to describe such relationships (Melville-Smith, 1987; Seiple & Salmon, 1987; Sumpton, 1990), the use of the power function $y = \mathrm{a}x^{\mathrm{b}}$ (Thomas, 1964; Haynes et al., 1976; Somerton & Meyers, 1983; Parsons & Tucker, 1986; Pinheiro & Fransozo, 1995) and the cubic function $y = \mathrm{a} + \mathrm{b}x^3$ (Jensen, 1958; Almaça, 1987; Flores, 1993; Reigada & Negreiros-Fransozo, 1995) have been used by most researchers.

In general, fecundity is positively correlated with size or weight of the brooded female (Ogawa & Rocha, 1976; Du Preez & Mclachlan, 1984) and may be markedly affected by some environmental factors (Jensen, 1958). Although size of ovigerous female and number of eggs are positively correlated in a given species, comparisons among different sites or populations can not be directly tested. Variability caused by differences in population structure is a major obstacle that prevents reliable comparisons. Therefore, specific mathematical and statistical procedures are required for that purpose.

Arenaeus cribrarius (Lamarck, 1818) belongs to the subfamily Portuninae, and has a geographical distribution along the western Atlantic coast extending from Vineyard Sound (U.S.A.) to La Paloma (Uruguay) (Juanicó, 1978; Williams, 1984). This species lives in shallow coastal domains, and is frequently found in the swash zone buried in the sediment. It is rarely found in estuaries and coastal lagoons (Rathbun, 1930; Melo, 1996). Among the published contributions concerning the species, only a few of them focus on its reproductive biology, such as description of larval stages (Stuck & Truesdale, 1988), reproductive dynamics (Pinheiro, 1995), sexual maturity (Pinheiro & Fransozo, 1998), or reproductive behaviour in captivity (Pinheiro & Fransozo, 1999).

According to Fransozo et al. (1992), *A. cribrarius* represents an important fishing potential in the north littoral zone of São Paulo State, occupying the second place after *Callinectes ornatus* Ordway, 1863. Such information has called the attention to this species, which is still underexploited, and considered as fishery waste by many Brazilian fishermen (Pinheiro, 1995).

This study provides an estimate of the fecundity of *Arenaeus cribrarius*, describes the period of highest reproductive activity in this species, and also provides a comparative analysis with other portunids.

MATERIALS AND METHODS

Crab samples were collected along the northern coast of São Paulo State in the Ubatuba region, Brazil, with a shrimp fishery boat equipped with two otter-trawl 10-mm meshed nets. Monthly samples were obtained in front of Toninhas and Itamambuca Beach (23°30′S) during a 1-year period (August 1996 to July 1997).

Female specimens were classified into three groups based on abdominal morphology: juvenile, non-ovigerous adults, and ovigerous. Juvenile females possess a triangularly shaped abdomen, whereas a suboval-shape characterizes adult females (Pinheiro & Fransozo, 1998). Individual crabs were placed in plastic bags to avoid the loss of eggs or appendages, and frozen until further analysis. After defrosting, each individual was measured with a pair of calipers to 0.05 mm precision (CW = carapace width excluding lateral spines). Total wet weight of ovigerous females (WW) and wet weight of egg broods (WE) were measured on an analytical balance to the nearest 0.01 g, after removing water excess with absorbent paper.

A small sample of each egg batch was examined under a microscope to determine their development stage as described by Boolootian et al. (1959), and then represented by three stages: initial (stages 1-4), intermediate (stages 5-8), and final (stages 9-10). To estimate fecundity, only females with a recently extruded egg batch (final blastula to early gastrula), were used for analyses, thus minimizing underestimates due to egg loss. Pleopods of females were removed and the eggs dehydrated in 70% ethanol (24 h), anhydrous alcohol (12 h), and next oven-dried at 60°C to a constant weight. The number of eggs per brood (EN) was extrapolated from the dry weight of three counted subsamples and the dry weight of the total brood. Egg batches in which the coefficient of variation of the counted subsamples exceeded 15% were discarded from further analysis, thereby minimizing possible errors resulting from dehydration and counting. The dependent variable (EN) was plotted as a function of the independent variables (CW, WW, and WE) and the resulting scatterplots submitted to regression analysis. Models were fitted to these scatterplots, and the one with the highest determination coefficient (R^2) was chosen to represent them. A total of 42 ovigerous females, obtained from January 1989 to January 1993, were used to conclude fecundity analyses. Resulting equations and wet weight percentage of egg brood were compared to equivalent data found in other species of portunids.

Relative average fecundity ($\overline{F'}$), eliminating size effect, was determined for each month and season, according to:

$$\overline{F'} = \frac{1}{n} \sum_{i=1}^{n} \frac{EN_i}{CW_i^b}$$

where: $\overline{F'}$ = relative average fecundity; n = number of ovigerous females in a given month or season; EN_i = number of eggs estimated for the i^{th} female; b = constant of the power function obtained in the relationship EN/CW; CW_i = carapace width of the i^{th} female. Monthly and seasonal $\overline{F'}$ values were compared in an ANOVA, and a Tukey test was performed to verify differences ($P < 0.05$). The percentages of ovigerous females from the total adult females (PO%) were calculated for each month and season, and reproductive intensity indices (RII) were obtained by multiplying these values with that obtained for $\overline{F'}$.

RESULTS

During the study period from August 1996 to July 1997, 1,336 *A. cribrarius* females were obtained: 664 juveniles (49.7%), 603 non-ovigerous adults (45.1%), and 69 ovigerous individuals (5.2%). Total percentage of ovigerous females (PO%) was 10.3%, with highest percentages recorded from December to March (11.5-22.2%), and in August (21.1%) (table I). From September to November and April to June, the number of ovigerous females decreased, with percentages ranging from 4.9 to 9.7. No ovigerous females were obtained in July. Spawning activity was particularly high in August and February.

Most females bore newly extruded eggs (65.2%). Females carrying eggs in intermediate and final embryonic stages accounted for 24.6 and 10.1% of all ovigerous specimens, respectively (table II).

Of 92 ovigerous females, some individuals were excluded from analyses (EN/CW, $N = 6$; EN/WW, $N = 12$; and EN/WE, $N = 16$), because the

TABLE I

Arenaeus cribrarius (Lamarck). Monthly abundance of each group of females from August 1996 to July 1997 (PO% = percentage of ovigerous individuals from total number of adult females)

Month	Young females	Adult females (without eggs)	Ovigerous females	Total	PO%
August 1996	3	56	15	74	21.1
September	10	28	3	41	9.7
October	35	117	6	158	4.9
November	18	68	6	92	8.1
December	33	46	6	85	11.5
January 1997	47	38	6	91	13.6
February	120	35	10	165	22.2
March	38	33	6	77	15.4
April	26	54	4	84	6.9
May	78	52	4	134	7.1
June	86	37	3	126	7.5
July	170	39	–	209	–
Total	664	603	69	1,336	10.3

TABLE II

Arenaeus cribrarius (Lamarck). Monthly abundance of ovigerous females from August 1996 to July 1997, according to stage of embryonic development of the eggs

Month	Embryonic stages			Total
	Initial	Intermediate	Final	
August 1996	11	3	1	15
September	3	–	–	3
October	3	2	1	6
November	5	1	–	6
December	2	3	1	6
January 1997	5	1	–	6
February	5	3	2	10
March	2	3	1	6
April	3	–	1	4
May	3	1	–	4
June	3	–	–	3
July	–	–	–	–
Total	45	17	7	69

coefficient of variation exceeded 15%. Individual fecundity and size of the 86 females analysed varied from 135,210 to 682,156 eggs (340,101 ± 130,767 eggs) and CW from 54.7 to 92.3 mm (73.5 ± 7.7 mm), respectively. Wet weight of the egg brood (WE) varied from 3.1 to 14.0 g (7.3±2.6 g), corresponding to 8.4-27.2% (12.3 ± 3.2%) of total wet weight of the female.

Regression analyses indicated that the number of eggs (EN) is positively correlated with CW, WW and WE ($P < 0.001$, in all cases). Scatterplots revealed an exponential association in the relationship EN/CW (fig. 1), while the

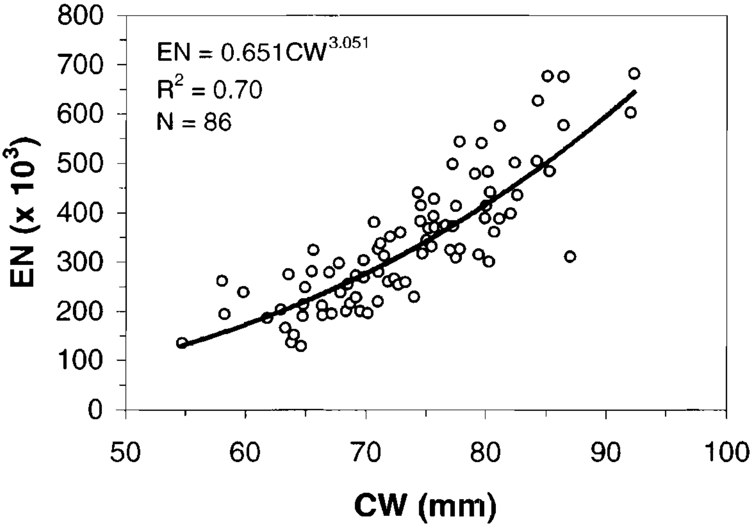

Fig. 1. *Arenaeus cribrarius* (Lamarck,1818). Relationship of number of eggs (EN) to carapace width excluding lateral spines (CW).

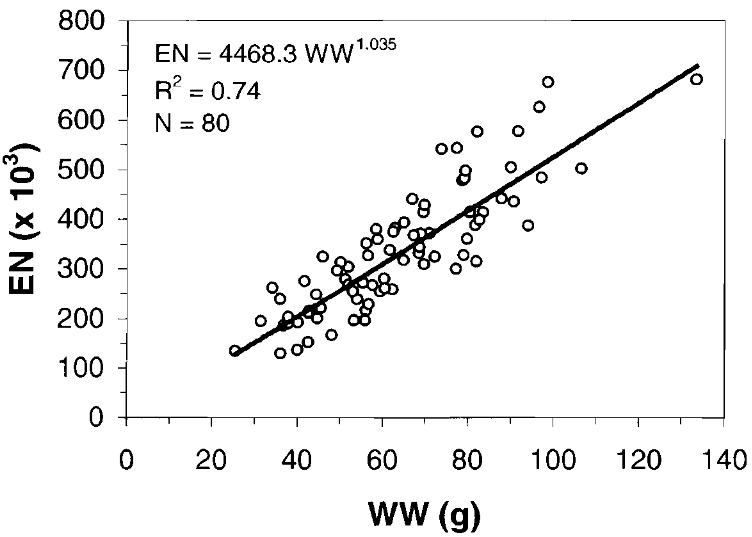

Fig. 2. *Arenaeus cribrarius* (Lamarck, 1818). Relationship of number of eggs (EN) to total wet weight of female including egg mass (WW).

relationships EN/WW (fig. 2) and EN/WE (fig. 3) come close to straight lines. The power function $y = ax^b$ was the mathematical model providing the better fit in all regression analyses. Resulting equations, determination coefficients, and statistical significance are shown in table III.

Values of average relative fecundity ($\overline{F'}$) varied per month from 0.55 to 0.72, and ranged seasonally from 0.62 to 0.67. However, no statistical differences were found in both cases ($P > 0.05$). Monthly reproductive intensity indices (RII's) varied by season, with higher values obtained for August and February (fig. 4A), and with higher values recorded for summer and winter (fig. 4B). Spring and autumn values were similar.

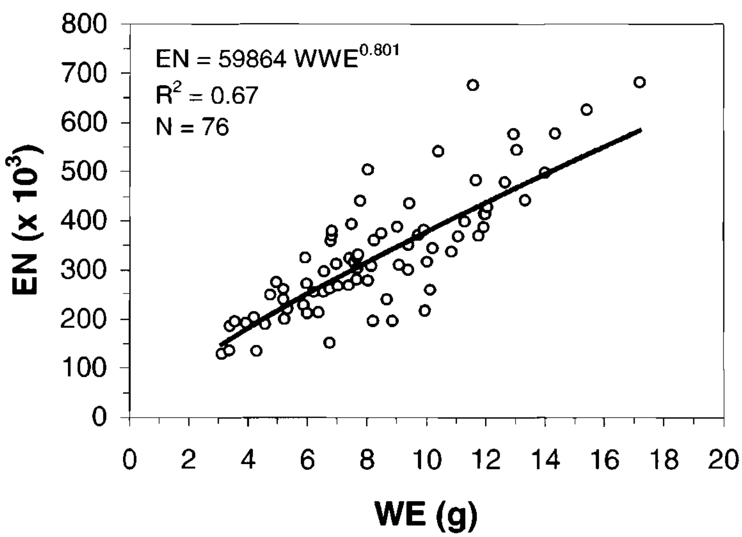

Fig. 3. *Arenaeus cribrarius* (Lamarck, 1818). Relationship of number of eggs (EN) to wet weight of egg mass (WE).

TABLE III

Arenaeus cribrarius (Lamarck). Regression analyses of the number of eggs per brood (EN) related to carapace width without lateral spines (CW), wet weight of ovigerous female (WW), and wet weight of egg brood (WE)

Relationships	R^2	N
$EN = 0.651CW^{3.051}$	0.70*	86
$EN = 4468.3WW^{1.035}$	0.74*	80
$EN = 59864WE^{0.801}$	0.67*	76

* = $P < 0.001$

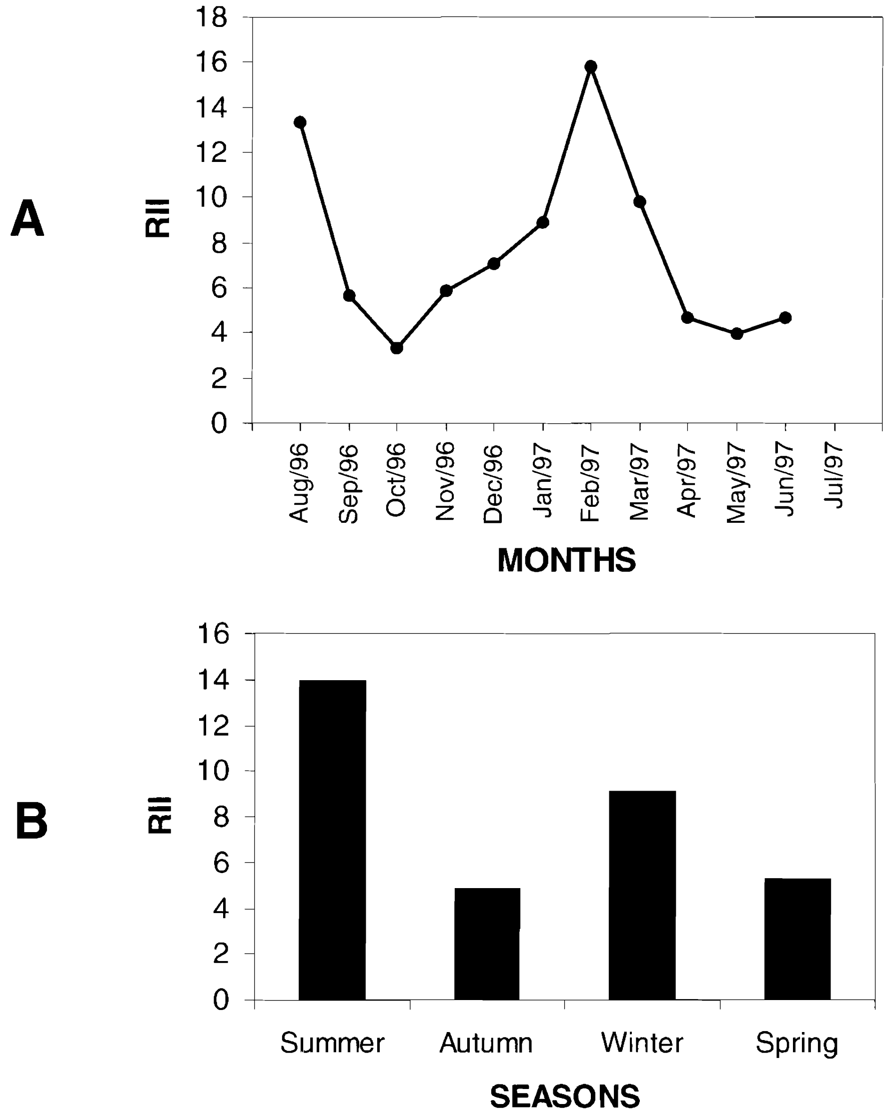

Fig. 4. *Arenaeus cribrarius* (Lamarck, 1818). Reproductive intensity index (RII) from August 1996 to June 1997. A, monthly values; B, seasonal values.

DISCUSSION

Reproduction in decapod crustaceans is the result of co-ordinated action of endogenous and exogenous factors that influence behaviour, maturity, fecundity, and breeding season (Sastry, 1983). In the reproductive cycle of the representatives of the suborder Pleocyemata, spawning and egg incubation are ruled by endogenous as well as environmental factors such as temperature, salinity, and granulometric sediment composition. According to Pinheiro et al. (1996), ovigerous females of *Arenaeus cribrarius* are mainly found in warmer areas, where sandy sediments are largely composed of coarse and intermediate grains (0.25 to 1.0 mm ∅).

Brachyuran crabs living in temperate regions usually present seasonal reproduction with a high intensity during spring and summer (Warner, 1977), whereas tropical and subtropical species tend to breed continuously, due to narrower water temperature fluctuations (Sastry, 1983). According to Pinheiro (1995), *A. cribrarius* exhibits continuous reproduction in the Ubatuba region, but major activity peaks occur in the summer and winter months. The term "seasonal continuous breeding" was proposed for that breeding pattern, which would also apply to any case in which ovigerous females (or individuals with fully developed gonads) are present year-round, but with significant seasonal oscillations. The results reported now agree with those obtained by Pinheiro (1995). Therefore, *A. cribrarius* can be added to a list including other tropical portunids showing the same breeding pattern, e.g., *Callinectes danae* Smith, 1869, *Portunus spinimanus* Latreille, 1819, and *Callinectes ornatus* (see Branco et al., 1992; and Costa, 1995; Santos, 1994; and Mantelatto, 1995, respectively).

Many brachyurans have multiple spawning, an evolved adaptation commonly found in portunids. *Callinectes sapidus* Rathbun, 1896 can extrude two consecutive egg batches from a single mating (Van Engel, 1958), while other portunid species are capable to incubate up to five broods, as observed in *Charybdis feriatus* (Linnaeus, 1758) (cf. Campbell & Fielder, 1988). In the case of *A. cribrarius*, 50% of the females incubating eggs in final embryonic stages present fully developed gonads, which indicates that multiple spawning occurs in this species (Pinheiro, 1995). Pinheiro & Fransozo (1999) recorded up to six consecutive ovipositions in captivity, in which four resulted in successful release of larvae. This would explain the continuous reproductive pattern observed in *A. cribrarius*, while the seasonal component might be related to a possible synchronic spawning among females of different age groups.

Portunids present large egg masses; in some species, fecundity may attain two million eggs (table IV). A number of species shows high fecundity values, e.g., *Callinectes sapidus*, *Callinectes danae*, and *Portunus pelagicus* (Linnaeus, 1758). However, other species show considerably reduced fecundity, ranging from 500,000 to 900,000 eggs, as reported for *Ovalipes punctatus* (De Haan, 1833), *Liocarcinus puber* (Linnaeus, 1767), *Portunus spinimanus*, *Callinectes ornatus*, and *Arenaeus cribrarius*. Maximum values reported for Portuninae are in most cases higher than those established for Polybiinae of similar size. In spite of being a species-specific characteristic, this contrast may result from size differences, since Portuninae usually attain a larger size at the onset of sexual maturity. Differences

TABLE IV

Comparative analyses of the relationships between number of eggs (EN) against carapace width (CW) and total wet weight (WW) among various portunid species (N = number of specimens examined)

Species	Reference	Locality	Latitude	N	CW (mm)	NE min-max (mean)	Relationship EN/CW	Relationship EN/WW
					Subfamily Portuninae			
Callinectes danae Smith	Branco & Avila (1992)	Florianópolis, SC (Brazil)	27°35′00″S	59	75.0-110.0*	111,549-1,292,190 (598,885)	$EN = 5.61CW^{3.58}$ ($R^2 = 0.34$)	$EN = 4.43WW^{1.23}$ ($R^2 = 0.43$)
	Costa & Negreiros-Fransozo (1996)	Ubatuba, SP (Brazil)	23°29′00″S	29	48.0-83.0***	363,660-826,638 (np)	$EN = 103185.2 + 1.4CW^3$ ($R^2 = 0.51$)	$EN = 142664.7 + 11276.8WW$ ($R^2 = 0.47$)
	Medeiros & Oshiro (1990)	Rio de Janeiro, RJ (Brazil)	22°54′00″S	np	72.4-106.8***	447,000-2,190,000 (783,000)	np	np
Callinectes ornatus Ordway	Mantelatto & Fransozo (1997)	Ubatuba, SP (Brazil)	23°30′00″S	38	45.0-62.5***	56,817-379,815 (171,570)	$EN = 0.0006CW^{4.85}$ ($R^2 = 0.25$)	$EN = 1085.72WW^{1.62}$ ($R^2 = 0.37$)
Callinectes sapidus Rathbun	Van Engel (1958)	Chesapeake Bay (U.S.A.)	38°40′00″N	np	np	700,000-2,000,000 (np)	np	np
Portunus pelagicus (Linnaeus)	Potter et al. (1983)	Peel-Harvey System (Australia)	32°32′00″S	18	102.0-136.0***	270,183-847,980 (509,433)	np	$EN = 1741.81WW^{1.13}$ ($R^2 = 0.81$)
	Batoy et al. (1987)	Coast off Leyte de Bohol (Philippines)	10°05′42″N	np	41.0-70.0 **	420,976-1,312,238 (894,284)	np	np
	Ingles & Braum (1989)	Gulf Ragay (Philippines)	13°50′00″N	41	np	142,572-1,131,900 (np)	np	$EN = 972.75WW^{1.23}$ ($R^2 = 0.88$)
Portunus spinimanus Latreille	Santos & Negreiros-Fransozo (1998)	Ubatuba, SP (Brazil)	23°30′00″S	21	56.2-86.6*	188,065-682,992 (429,676)	$EN = 46021.5 + 0.9557CW^3$ ($R^2 = 0.92$)	$EN = 18137.9 + 4713.8WW$ ($R^2 = 0.90$)

TABLE IV
(Continued)

Species	Reference	Locality	Latitude	N	CW (mm)	NE min-max (mean)	Relationship EN/CW	Relationship EN/WW
				Subfamily Portuninae				
Charybdis natator (Herbst)	Sumpton (1990)	Queensland (Australia)	27°00′00″S	18	100.0-117.0*	181,230-976,248 (np)	$EN = 1.78\ 10^4 CW \quad 1.16\ 10^6$ ($R^2 = 0.62$)	np
Arenaeus cribrarius (Lamarck)	Present study	Ubatuba, SP (Brazil)	23°30′00″S	86	54.7-92.3***	135,210-682,156 (373,291)	$EN = 0.651CW^{3.051}$ ($R^2 = 0.70$)	$EN = 4468.3WW^{1.035}$ ($R^2 = 0.74$)
				Subfamily Polibiinae				
Macropipus puber (Linnaeus)	González-Gurriarán (1985)	La Coruña (Spain)	42°18′00″N	63	47.0-89.0 *	34,491-448,786 (np)	$EN = 0.105CW^{3.446}$ ($R^2 = 0.82$)	np
Macropipus tuberculatus (P. Roux)	Mori (1987)	Genova (Italy)	44°19′00″N	27	31.0-45.0*	7,500-65,600 (np)	$EN = 0.00307CW^{4.353}$ ($R^2 = 0.92$)	np
Liocarcinus depurator (Linnaeus)	Mori & Zunino (1987)	Genova (Italy)	44°19′00″N	32	25.0-47.5*	25,000-140,000 (80,180)	$EN = 3912.9\ CW \quad 65820.97$ ($R^2 = 0.49$)	np
Ovalipes catharus (White)	Haddon (1994)	Wellington (New Zealand)	41°45′00″S	30	46.0-106.2*	89,350-608,122 (293,360)	$EN = 6.1371CW^{2.44173}$ ($R^2 = 0.92$)	$EN = 5375.46WW^{0.86}$ ($R^2 = 0.91$)
Ovalipes punctatus (De Haan)	Du Preez & Mclachlan (1984)	Port Elizabeth (South Africa)	34°00′00″S	30	30.8-61.5*	74,131-549,541 (np)	$EN = 1.19CW^{3.102}$ ($R^2 = 0.79$)	$EN = 0.005WW^{1.13}$ ($R^2 = 0.81$)

* = carapace width including lateral spines;
** = carapace length;
*** = carapace width excluding lateral spines;
np = not provided.

may also be attributed to the effect of latitudinal variation (see table IV), as already observed in other crustaceans by Vernberg & Vernberg (1970), and by Dungan et al. (1991).

The linear function ($y = a + bx$) can be fitted to both EN/WW and EN/WE relationships, but the power function ($y = ax^b$) may also be used, since the constant b reached values near unity, and R^2 values are expressive. According to Jensen (1958) linearity of these relationships is to be expected, because weight (WW and WE) and number of eggs (EN) are volumetric variables. The fact that the exponent departs more from unity in the EN/WE relation can be attributed to the experimental error resulting from dehydrating the egg clutches.

In some studies, the equation used to represent fecundity does not satisfactorily fit the empirical data. In such cases, the model does not have sufficient plasticity to represent a biological interpretation of the relationship EN/CW, and fails when used in variation conversions. This problem is particularly common in studies concerning highly fecund brachyurans, as portunids, in which errors during egg counting may add-up to other procedural problems, such as the analysis of a small sample size and the choice of an inadequate model. Common errors in fecundity estimates by means of weight extrapolation are the following: (1) the use of egg broods of different developmental stages for analysis could introduce bias due to incomplete spawning, or else due to egg loss in the case of using final embryonic stages; (2) counting errors due to absence of a mechanical counter or another type of reliable recording device; (3) inadequate dehydration of subsamples, which can be avoided if the coefficient of variation of resulting estimates is analysed in advance; (4) regressions carried out on a small sample, that does not represent the entire range in the population studied.

Competition for energetic resources makes growth and reproduction very closely associated processes in decapod crustaceans. Selective pressures act on them and tend to promote maximization of egg production, thus ensuring continuity of the population (Hartnoll & Gould, 1988). Therefore, in many species reproduction is synchronized with increase in temperature and hence food availability, thus enhancing survival of the offspring (Giese, 1959; Wear, 1974). This fact was confirmed in *A. cribrarius* by Pinheiro (1995), who found the highest frequencies of females with fully developed gonads during spring and summer, whereas the occurrence of ovigerous females was especially high in summer and winter. Furthermore, fecundity is also higher during that period, as inferred in this study from within-season comparisons of $\overline{F'}$, resulting also in higher reproductive output. This may be related to spawning of primiparous females during winter months, since mating occurs chiefly in autumn (Pinheiro, 1995).

However, highest reproductive activity in *A. cribrarius* occurs during summer and winter, and declines during spring due to a decreasing percentage of ovigerous females in the population. This may be regarded as a balancing mechanism allowing considerable reproductive activity year-round, which is only possible because of the reduced seasonal temperature fluctuations that are characteristic for tropical and subtropical regions. Therefore, it was concluded earlier that *A. cribrarius* follows a seasonally continuous reproductive pattern, with low reproductive intensity during autumn and winter, when females attain sexual maturity and mate, and water temperature decreases, respectively (Pinheiro, 1995).

Fecundity comparisons within portunids found along the coastline of the Ubatuba region show that *Arenaeus cribrarius* ranks third, after *Callinectes danae* and *Portunus spinimanus* (fig. 5). These species showed a wider size range compared to that obtained for *Callinectes ornatus*, although fecundity analyses on this species by Mantellato & Fransozo (1997) do not include ovigerous females of the larger size classes in that species (see table IV), since *C. ornatus* females can attain CW = 84 mm (Williams, 1984). Higher fecundity, however, should be regarded as an intrinsic feature, characteristic of those species. *A. cribrarius* presents a high reproductive output, a fact also obvious from its relatively high abundance when compared to other sympatric benthic brachyurans (Fransozo et al., 1992; Sartor, 1989). These results evidence that *A. cribrarius* is an important component within local benthic communities and a significant potential fishery resource with excellent prospects for culture.

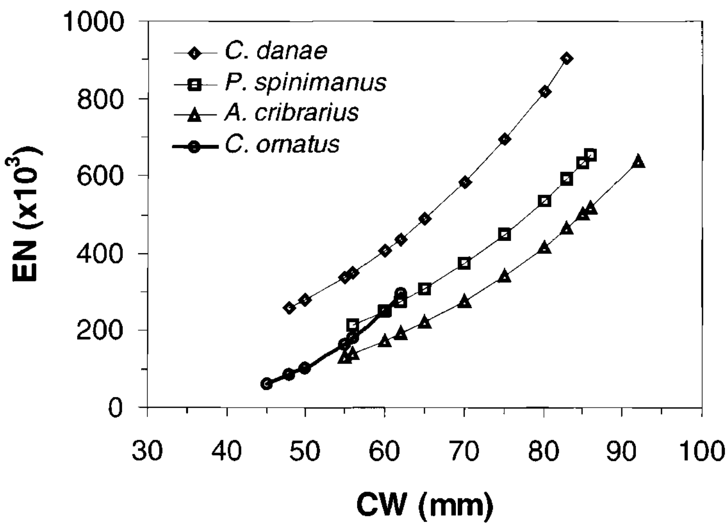

Fig. 5. Comparative analysis of potential fecundity equations previously obtained for some portunids found in the Ubatuba region, SP, Brazil. *Arenaeus cribrarius* (Lamarck, 1818), from the present study; *Callinectes danae* Smith, 1869, from Costa & Negreiros-Fransozo (1996); *Callinectes ornatus* Ordway, 1863, from Manttelatto & Fransozo (1997); *Portunus spinimanus* Latreille, 1819, from Santos & Negreiros-Fransozo (1998).

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