Dynamics of the small-scale spatial structure of a local population of the spider crab, *Maja brachydactyla*

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INTRODUCTION:

The spider crab, *Maja brachydactyla*, constitutes meroplanktonic metapopulations comprising a chain of several coastal local populations connected to deep-water (mating grounds) populations by reproductive migrations (CORGOS, 2004). Shallow areas are inhabited by juveniles that carry out non-directional movements in restricted areas (González-Gurriarán & Freire, 1994) and show a complex aggregating behaviour (Corgos, 2004). During the summer of their 2nd year juveniles attain sexual maturity and start a mating migration in early autumn (Corgos, 2004; González-Gurriarán et al., 2002). The objective of the present study is to analyze the dynamics of the small-scale spatial structure of a shallow-water local population using geostatistical modelling.

METHODOLOGY:

Sampling: Monthly samplings were carried out from December 1997 to November 1999 (although only data from May to December 1998 will be represented in this work) using experimental traps (Fig. 1). The sampling area shows a bathymetric range of 5-15 m and it is inhabited by the main spider crab local population. Sampling was done along a transect of seven sampling points in the longitudinal axis of the ría (Fig. 2). Every month 7 to 10 tows were carried out, each one consisting in the soak of a group of six baited traps (separated 35m, and disposed parallel to the coast) during 24 hours. Each tow was separated approx. 180 m from each other, covering a total area of 3.2 km^2.

Spatial structure: Spatial distribution of spider crabs was analysed in each month by means of geostatistical analysis (Petitgas, 1996; Rivoirard et al., 2000). Adult spider crabs were only analyzed during the summer, the only season when they are caught in the study area. The spatial autocovariance in spider crab density (estimated as catch per unit effort, CPUE, crabs/trap) was analysed using semivariograms, where "lag" distance was set to 50 m (a total of 24 lags) to cover 1200 m (max distance among sampling points). The experimental variograms were fitted to a spherical model. Mapping was carried out by the kriging technique. Semivariograms and point kriging were performed each month for juvenile total catch and male and female adult crabs, since adult males and females showed differences on the timing of the onset of terminal moult and migration (CORGOS, 2004).

RESULTS:

Juveniles: The experimental variograms obtained are indicative of the spatial structure (except in September and November) and pointed the existence of a distribution in patches (Table 1). Juveniles showed persistent aggregations of approx. 150-300 m without any large-scale movements (among local populations). Juvenile patches were highly stable occupying only a small fraction of the available habitat, and showed small-scale movements with ranges of less than 100 m per month. In summer, most of juvenile crabs attained sexual maturity and started a migration in September-October, so the aggregation was broken. After October-November, when there was a great recruitment of new juveniles, the aggregation was re-established (Fig. 3).

Adults: Adults didn't show spatial structure in most cases (Table 2). Only in June (males) and September (both sexes) spatial structure was found. Adult spatial distribution constituted waves of displacement from locations close to the coastline, where they attained maturity, to the outer part of the sampling area, closer to migration corridor in deeper waters (Fig. 4). Both mean CPUE and spatial distribution pointed out differences in timing of the onset of maturity and breeding migration. Males attained maturity mainly in June and July and started breeding migration by the end of September and October, whereas females attained maturity in July and August and started breeding migration in October.

LITERATURE CITED:

Corgos, A. (2004). PhD. Thesis. Universidad de A Coruña.

González Gurriarán, E & J. Freire (1994). J. Exp. Biol. Ecol. 184: 269-291

González-Gurriarán, E.; J. Ferire & C. Bernárdez (2002) J. Crust. Biol. 22(1): 91-97

Petitgas, P. (1996) Chapman & Hall, London, pp 113-142

Rivoirard, J., Simmonds, J., Foote, KG., Fernandes, PG. & Bez,N. (2000) Blackwell Science, Oxford.

Figures:

Figure 1. Experimental traps used in the study.

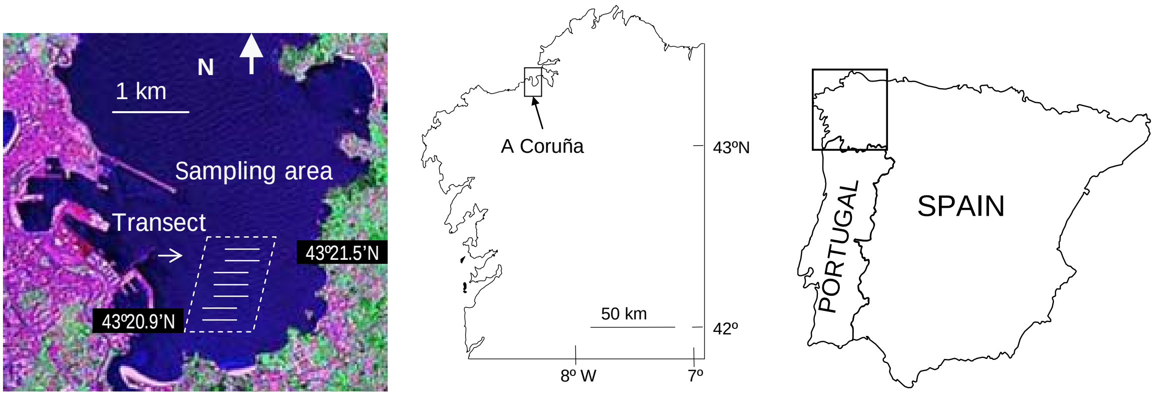

Figure 2. Location and sampling area in the Ría de A Coruña. The transect comprising 7 trap tows of the inner area is shown.

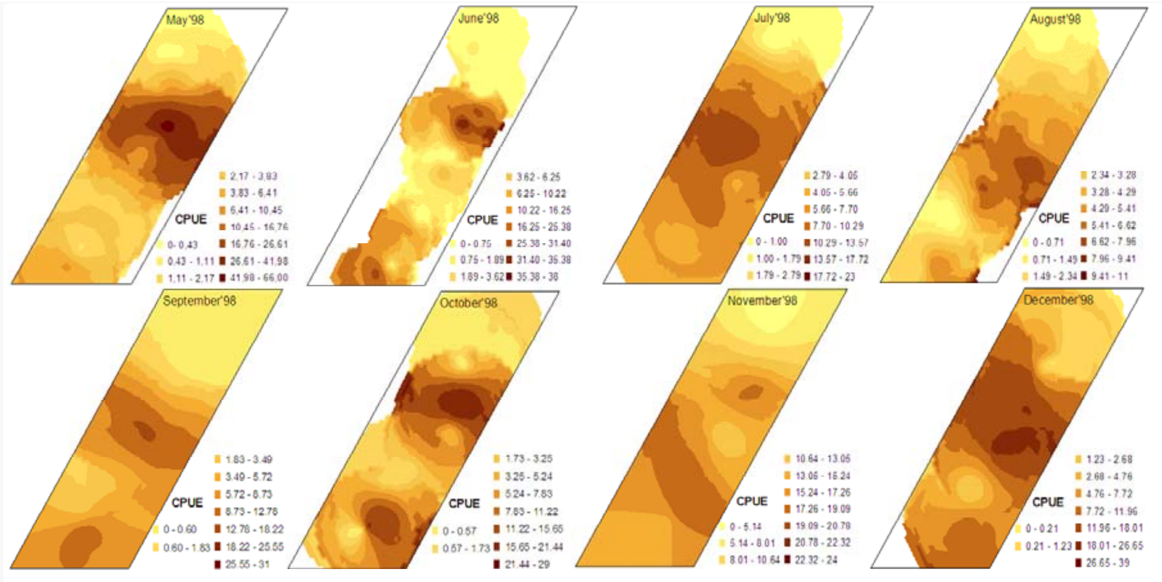

Figure 3. Monthly spatial distribution of juvenile crabs obtained by point kriging

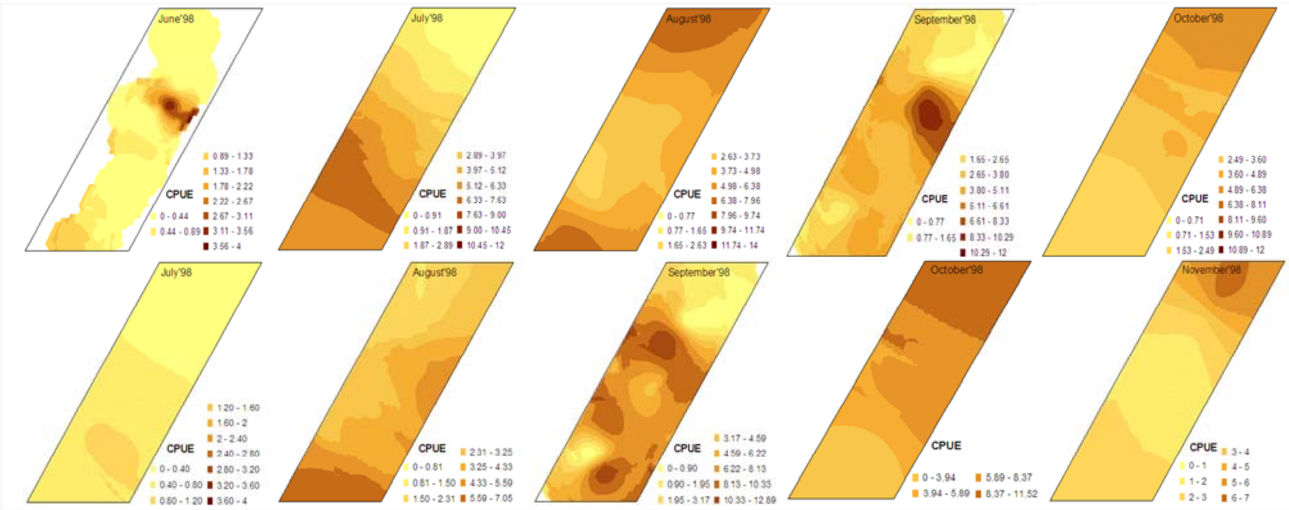

Figure 4. Monthly spatial distribution of adult males (upper) and females (lower) obtained by point kriging

Table 1. Parameters of the variogram models fitted to the juvenile crab distribution for each month. Mean catch-per-unit-effort (CPUE) and standard deviation (S. D.), are also shown.

	May	June	July	August	Sep	October	Nov	Dec
Mean CPUE	**11.9**	**8.0**	**6.5**	**2.9**	**5.3**	**7.1**	**13.8**	**9.9**
S. D.	**16.25**	**11.49**	**5.45**	**2.81**	**8.19**	**8.67**	**6.50**	**10.03**
Range (a)	**254.41**	**151.45**	**285.34**	**231.7**	**649.07**	**269.82**	**1107.4**	**307.43**
Nugget (C_0)	**69.13**	**4.45**	**13.36**	**2.09**	**33.29**	**0.00**	**14.25**	**31.20**
Sill (C)	**292.02**	**136.79**	**32.02**	**8.53**	**73.55**	**84.72**	**71.39**	**114.45**

Table 2. Parameters of the variogram models fitted to the adult crab distribution for each month. Mean catch-per-unit-effort (CPUE) and standard deviation (S. D.), are also shown.

	June	July	August	Sep	October	Nov
Males						
Mean CPUE	**0.5**	**4.2**	**4.4**	**2.7**	**2.7**	
S. D.	**1.07**	**3.50**	**3.49**	**2.95**	**3.13**	
Range (a)	**151.45**	**1196.30**	**1196.30**	**285.15**	**1185.90**	
Nugget (C_0)	**0.34**	**6.65**	**6.18**	**2.79**	**7.88**	
Sill (C)	**1.21**	**17.11**	**17.02**	**10.07**	**11.95**	
Females						
Mean CPUE		**0.5**	**3.8**	**5.3**	**7.1**	**2.6**
S. D.		**0.92**	**3.44**	**4.73**	**7.10**	**2.35**
Range (a)		**1196.30**	**1196.30**	**279.57**	**1185.90**	**1107.40**
Nugget (C_0)		**0.72**	**8.45**	**4.06**	**41.70**	**2.87**
Sill (C)		**0.96**	**13.61**	**26.19**	**59.84**	**8.05**