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"COEXISTENCE OF CONGENERIC PELAGIC COPEPODS: THE Acartia COMPLEX IN THE RIA OF VIGO (NW OF SPAIN)"

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Introduction

The holoplankton of temperate estuarine systems is mainly constitued by a monotonous series of few copepod species, which maintain the specific diversity in low values if it is compared with the off shore systems. However, as it has been pointed out by several authors (Jeffries, 1962, 1967), copepod species playing a significative rol in the energy transfer of the system consist, in general, on series of congeneric associates.

Saturation of estuaries by these group of species seems to be a consequence of a more efficient exploitation of the ecosystem: the high environmental variability of estuaries leads a successful colonization by both polymorphic or congeneric species (Margalef, 1974).

Regarding the copepods, the genus Acartia is one of the most important in estuaries and other coastal areas, where their congeneric associates are the dominant component of the holoplankton.

This paper leads a description of the species composition and spatial distribution of the Acartia complex in the Ria of Vigo, an estuary of the NW Spanish coast.

Methods

Discrete zooplankton samples were taken at 0, 5 and 15 m depth by means of Van Dorn type bottles, at five stations located in the axis of the Ria of Vigo (fig. 1) during 15 month, with a mean sampling

frequency of 18 days, from April 1972 to June 1973; 20 liter water samples were filtered through 45 um nylon filters, and all the copepods belonging to the genus Acartia were identified, counted and measured (Alcaraz, 1976, 1977 a,b); other ecological parameters were simultaneously recorded.

The genus Acartia in the Ria of Vigo

The copepods of the genus Acartia are the most important component (80 %) of the holoplankton in the Ria of Vigo; four species have been recorded:

Acartia (Acartiura) margalefi, Alcaraz, 1976
Acartia (Acartiura) clausi, Giesbrecht, 1889
Acartia (Acartiura) discaudata, Giesbrecht, 1881
Acartia (Paracartia) grani, G.O. Sars, 1904

The first species was recently described (Alcaraz, 1976), and has been also recorded in the Mediterranean Sea (Port of Barcelona, Banyuls, etc.). The other three species are very common in estuaries, harbours and semi-enclosed marine areas.

A. margalefi, A. clausi and A. discaudata have been found all over the studied cycle in the Ria of Vigo, while A. grani, a spring-summer species, dissapears in autumn and winter (fig. 2).

From the zooplanktonic point of view, the Ria of Vigo present single features as regards to other temperate estuarine systems: in general the congeneric components have a short period of coexistence, being one of them the seasonal dominant as a consequence of the competitive exclussion mechanisms, while in the Ria of Vigo there is a continous coexistence of at least three of the four related Acartia species (fig. 2).

Spatial segregation

The Acartia species coexist mainly on the inner third of the Ria, while the outer part is only occupied by two species: A. clausi and

A. discaudata. The populations of the four species show certain spatial segregation: A. margalefi and A. grani decrease from the head to the mouth of the estuary, and never have been recorded outside of the station Nº 3 (fig. 1); A. discaudata has its maximum density in station Nº 2, decreasing progressively towards both ends of the estuary, while A. clausi greater abundances has been found in the outer station (Nº 5), decreasing progressively towards the head of the Ria.

Such spatial distribution suggest the partitioning of the estuary by the Acartia species, following the dierction of the maximum gradient, in the sense of the ecological factors and in their time variability (Alcaraz, 1977 a,).

From the spatial distribution of the Acartia species, it could be considerated that such organisms have reduced reproduction areas in the Ria of Vigo, coinciding with the gravity center of the populations; the population density can be related to the distance to the reproduction center by fitting a negative exponential model.

The model which has been used to describe the spatial mean distribution of the Acartia in the Ria of Vigo, is the linear relationship between the logarithm of the population density and the distance to the reproduction center (Margalef, 1957):

$$N_j = N_o \cdot e^{-kj} \quad (1), \text{ and after a log. transform:}$$

$$\ln N_j = \ln N_o - kj \quad (2)$$

being N_j the density of the population at the distance j from the reproduction center; e the base of the neparian logarithms, and k the extinction coefficient of the population.

In fig. 4 is shown the relationship between the observed and computed densities by means of the equation (2); the linear correlation coefficient between observed and computed densities is $r = 0.98$, and the k values for each species taking distance j in miles: A. margalefi, $k = 0.933$; A. clausi, $k = 0.301$; A. discaudata, $k = 0.650$. It is interesting to note the inverse relationship between the k values and the size of the species, which must be related to

the swimming speed.

Conclussions

The Acartia complex in the Ria of Vigo is composed by four species, three of them coexisting all over the year (A. margalefi, A. clausi and A. discaudata); A. grani has been only found in spring and summer time.

The species are segregated along the axis of the Ria, decreasing their density progressively around the population gravity center (fig. 3).

The model used to describe the spatial mean distribution of the Acartia species in the Ria of Vigo is based on the linear relationship between the logarithm of the species density and the distance to the population reproduction center .

The maximum coexistence has been found in the inner part of the Ria, may be due to the unefficiency of the competitive exclusion mechanisms in areas with high time variability of the ecological factors.

References

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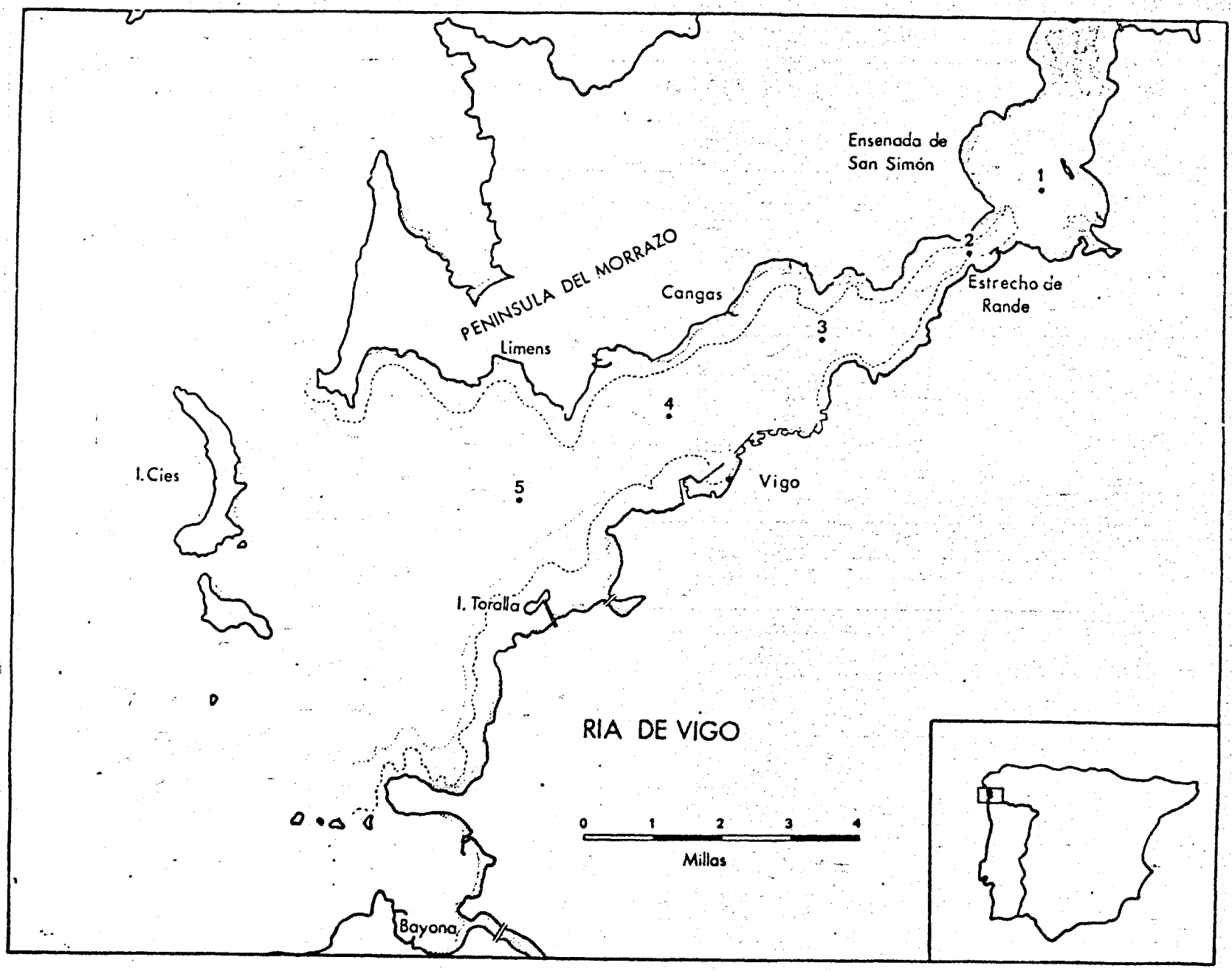
FIG. 1.- The Ria of Vigo, showing the position of the sampled stations.



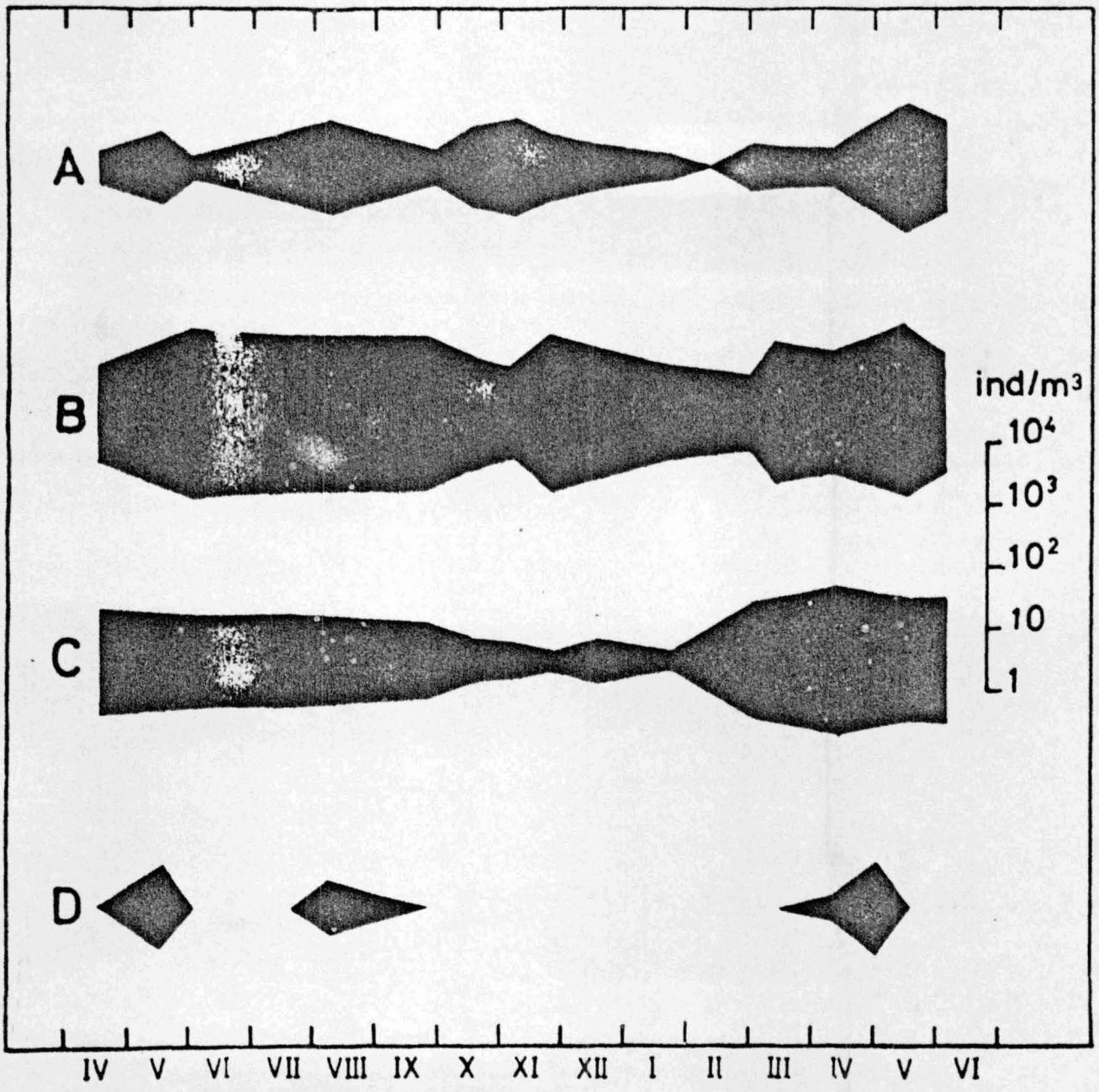
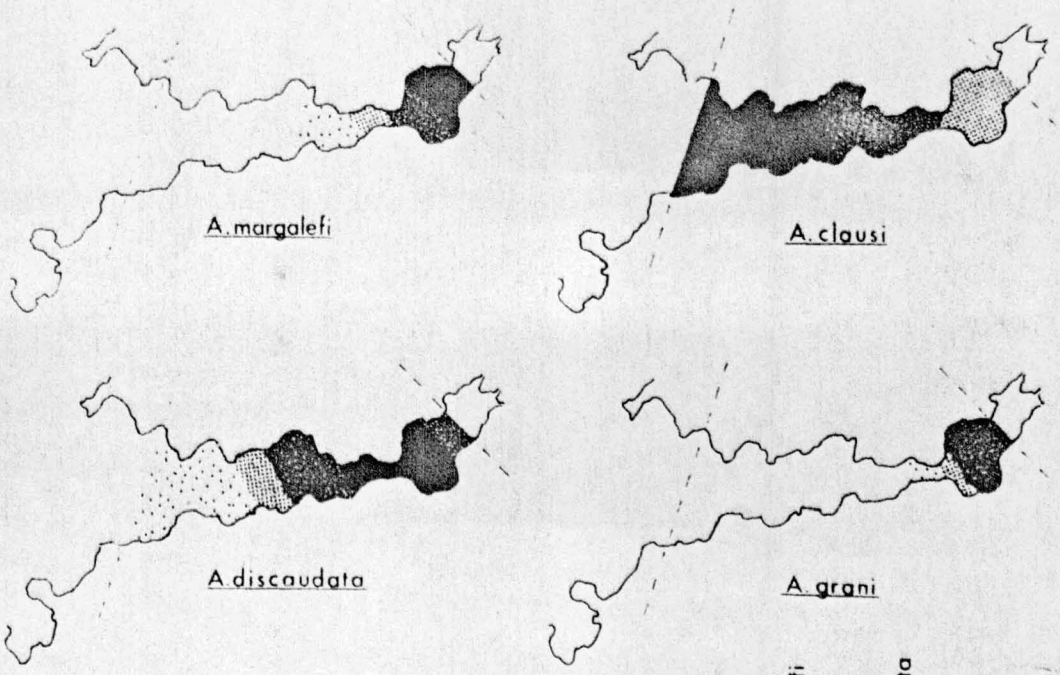


FIG. 2.- Seasonal variation of the four Acartia species found in the Ria of Vigo. In abscissae, months; densities in ind/m^3, log. scale. A: A. margalefi; B: A. clausi; C: A. discaudata; D: A. grani.



		A. margalefi	A. clausi	A. discaudata	A. grani	
µg C/m³	+ - 100	+ 100	+ 10	+ 50	+ 10	ind/m³
"	101 - 200	101 200	11 50	51 200	11 50	"
"	201 - 500	201 400	51 200	201 500	51 100	"
"	> 500	> 400	> 200	> 500	> 100	"

FIG. 3.- Distribution of the mean densities of the four Acartia species in the Ria of Vigo.

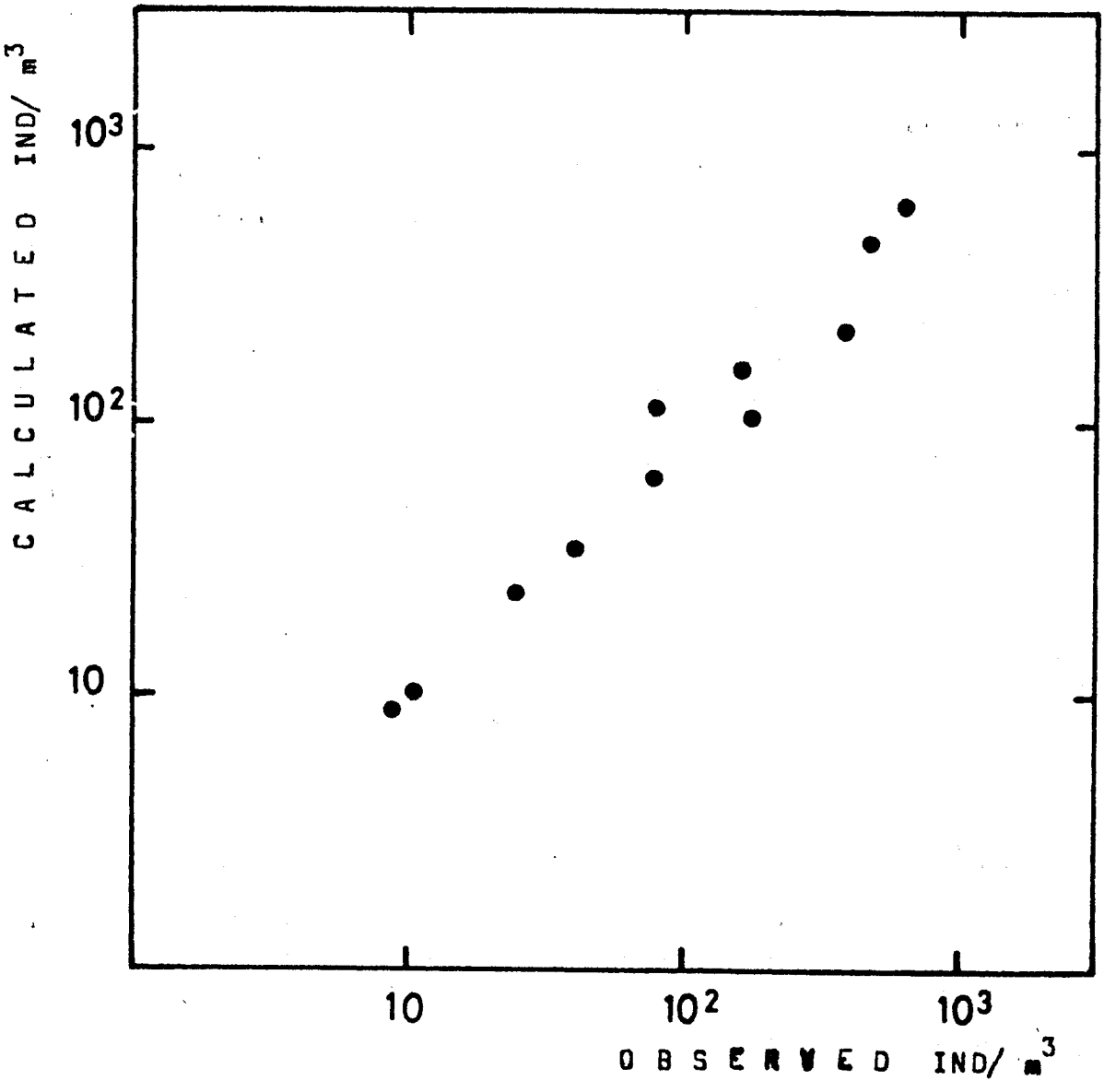


FIG. 4.- Relationship between observed and calculated densities of the Acartia species in the Ria of Vigo, by means of the equation (2). Log. scale.