

Population characteristics of the neustonic isopod *Idotea metallica* (Crustacea, Isopoda, Idoteidae) in the western Mediterranean (June 1993)*

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SUMMARY: The population structure and reproductive condition of the neustonic isopod *Idotea metallica* was determined from samples collected in June 1993 during a plankton cruise off the Catalan coast (western Mediterranean). Sexes were distinguishable from a size of around 4 mm total length. Both male and female size population structure were found to be polymodal. Ovigerous females were found at sizes larger than 13 mm and a mean size at sexual maturity of 14.9 mm was estimated. Brood size varied between 30 and 182 embryos per female and was positively correlated with female size.

Key words: *Idotea metallica*, Isopoda, western Mediterranean, population structure, neuston.

RESUMEN: CARACTERÍSTICAS POBLACIONALES DEL ISÓPODO NEUSTÓNICO *Idotea metallica* (CRUSTACEA, ISOPODA, IDOTEIDAE) EN EL MEDITERRÁNEO OCCIDENTAL (JUNIO 1993). – La estructura poblacional y condición reproductiva del isópodo neustónico *Idotea metallica* han sido estudiadas en junio 1993 durante una campaña de plancton realizada en el Mediterráneo occidental. El sexo de los individuos empieza a ser reconocible a partir de una talla de alrededor de 4 mm de longitud total. La estructura de tallas de la población es polimodal tanto en machos como en hembras. Se encontraron hembras ovígeras en tallas superiores a 13 mm y se estimó una talla media de madurez sexual de 14.9 mm. El número de huevos transportados osciló entre 30 y 182 por hembra y estuvo correlacionado positivamente con la talla de la hembra.

Palabras clave: *Idotea metallica*, Isopoda, Mediterráneo occidental, estructura poblacional, neuston.

INTRODUCTION

Many planktonic organisms occupy the neustonic zone (i.e. the top few centimetres of the surface layer) of the oceans, either temporarily, forming part of the merohyponeuston, such as larvae of many invertebrates, or more permanently, constituting the holohyponeuston (Pérès, 1982), such as some siphonophores, copepods and some other crustaceans. All of these organisms must be adapted to

the high environmental variability taking place at the surface of the oceans (turbulence, UV rays, temperature and salinity variations, etc.) and must also be highly affected by the characteristics of the surface hydrography such as currents and frontal structures.

The isopod *Idotea metallica* (Bosc, 1802) is a macrozooplanktonic oceanic crustacean whose geographically widespread habitat appears to be almost strictly neustonic (Naylor, 1957; Hempel and Weickert, 1972; Olivar *et al.*, in press). Its abundance in the neuston does not vary diurnally (Locke and Corey, 1989), so its patterns of distribution at the mesoscale

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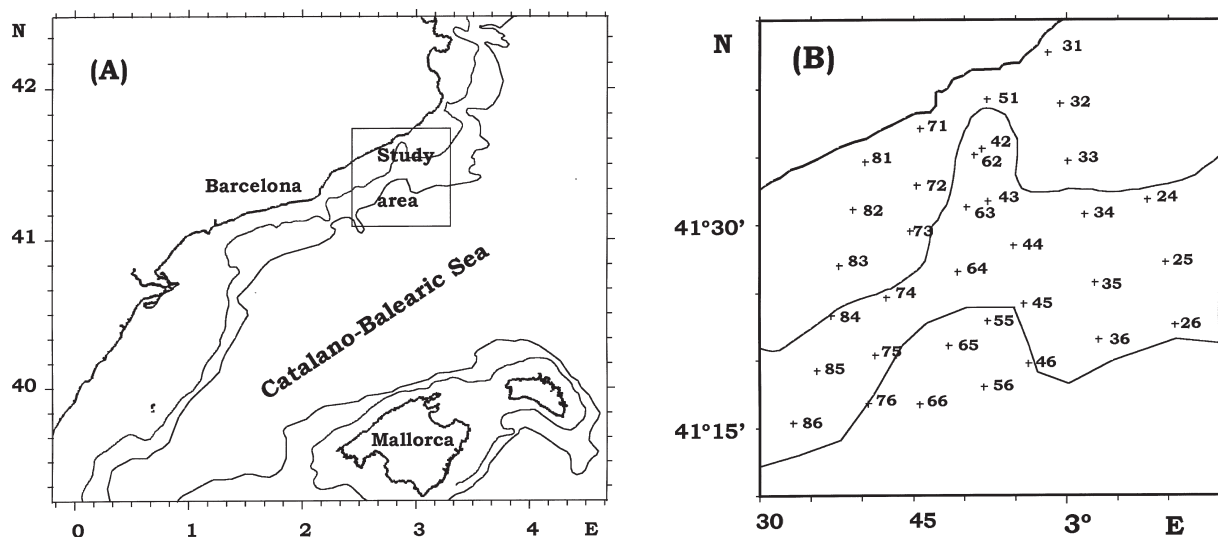


FIG. 1. – (A) Location of the study area in the Catalano-Balearic Sea (NW Mediterranean); (B) location of the neuston samples (200 m and 1000 m isobaths are also shown).

level must be strongly influenced by the distribution of the surface water masses and currents (Locke and Corey, 1989). These isopods are known to cling to the undersides of flotsam (Naylor, 1957; McGrath, 1980; Holdway and Maddock, 1983a,b; Tully and McGrath, 1987; Locke and Corey, 1989), but they are also able to swim rapidly and actively (Dow and Menzies, 1957; Tully and McGrath, 1987; personal observations). *I. metallica* is preyed upon by a wide range of marine organisms, ranging from seabirds (Furness and Todd, 1984), to pelagic and neustonic fish such as garfish *Belone belone* (Tully and McGrath, 1987) and dolphinfish *Coryphaena hippurus* (Massutí *et al.*, 1998).

The present study set out to determine the size composition of *Idotea metallica* and some reproductive characteristics, such as brood size and size at sexual maturity in a northwestern Mediterranean population sampled in June 1993.

MATERIAL AND METHODS

The study area was located off the Catalan coast (NW Mediterranean) over the Blanes submarine canyon, where a hydrographic and zooplankton survey was performed between 17 and 22 June 1993 on board R/V "Hespérides" (Rojas *et al.*, 1995; Olivar *et al.*, in press). The sampling stations were placed about 9 km apart in a series of radials which extended from the coast (from depths of over 50 m) to the isobath of 1000 m over the slope (Fig. 1).

Sampling of *Idotea metallica* was performed by surface tows using a neuston net with a rectangular mouth aperture of 1 m width and 0.5 m height and 0.8 mm mesh at a ship speed of 2 knots for 10 min. The volume of water filtered by the net was estimated by a flowmeter at an average of 426 m³ per tow.

Samples were fixed in buffered 4% formalin. All *Idotea metallica* captured were sorted in the laboratory under a binocular microscope, sexed and measured (total length, TL) from the front of the cephalon to the posterior edge of the pleotelson with an accuracy of 0.5 mm. All ovigerous females were isolated, and the eggs and embryos carried by 39 of them (those which did not appear damaged or which had lost embryos in the samples) were separated out and counted.

Size frequency distributions were constructed for each sample analyzed, and for the overall population sampled. Similarities between samples based on the pooled male and female size frequency distributions were analyzed by clustering methods using Czekanowski's percentage similarity index (Goodall 1978) and the Unweighted Pair Group Method using Arithmetic Averages (UPGMA) as the aggregation algorithm.

Results concerning abundance and distribution of *Idotea metallica* are analyzed in Olivar *et al.* (in press). The methodology and results of the hydrographic study have been reported by Rojas *et al.* (1995).

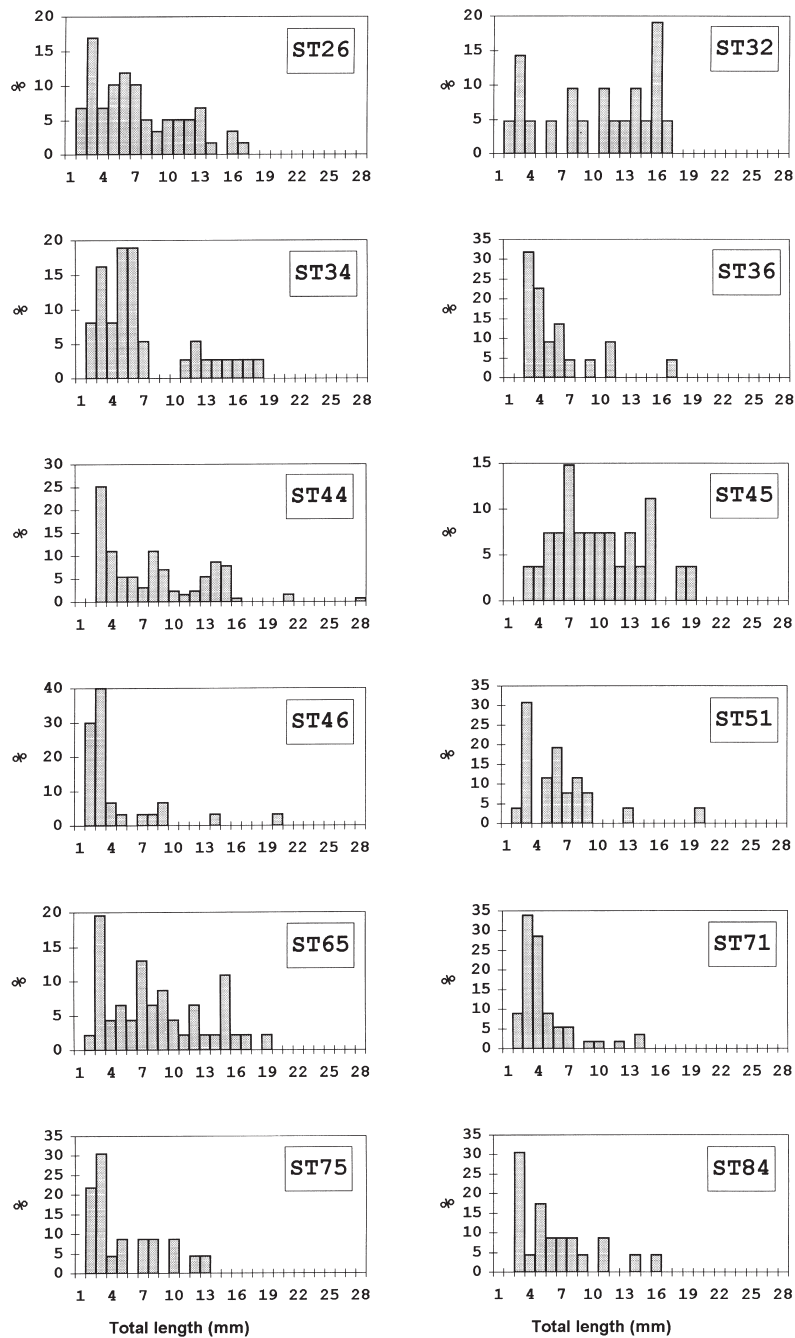


FIG. 2. – Size frequency distributions of *Idotea metallica* for stations where more than 20 individuals were captured.

RESULTS

Size frequency distributions are presented for those samples with more than 20 individuals present (Fig. 2). Juveniles dominated most of the samples, with adults occurring in different proportions. The two main groups of samples obtained by comparing

the resemblance of the size frequency distributions (Fig. 3) correspond to those samples (group A) in which juveniles clearly dominated and to those (group B) in which the relative importance of adults was higher. The heterogeneity of the size structure of the samples is indicative of patchiness in the spatial distribution of the species.

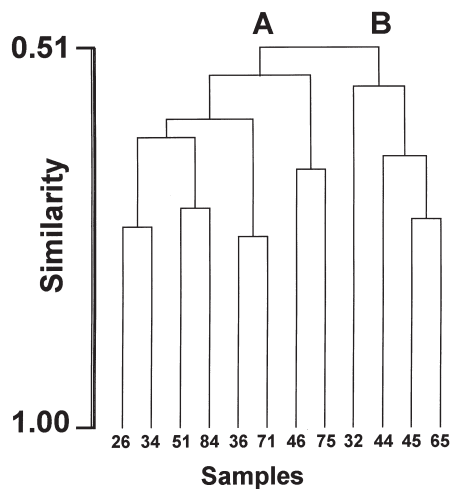


FIG. 3. – Dendrogram of similarity among the samples based on size frequency distribution resemblance.

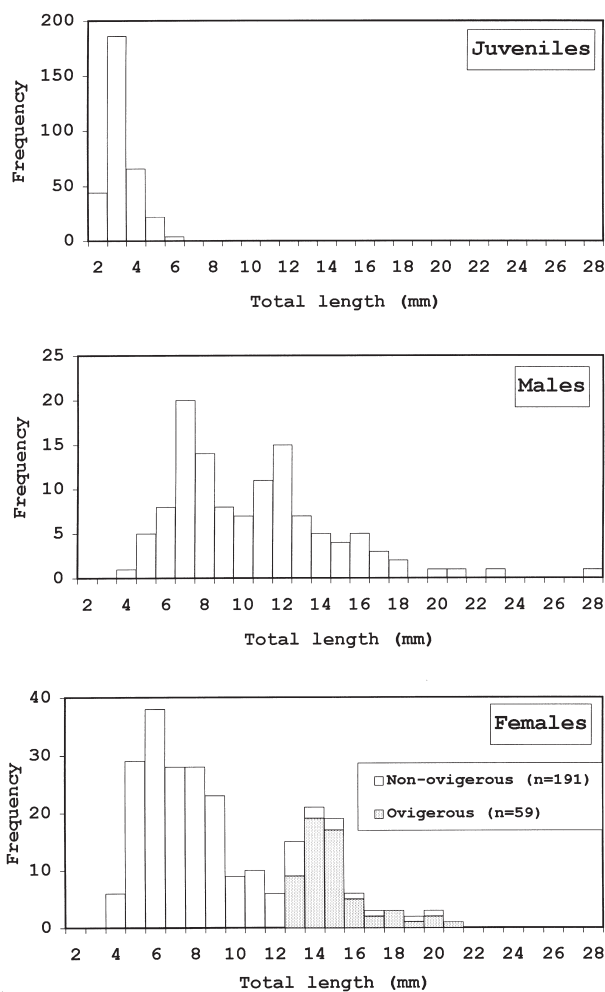


FIG. 4. – Overall size frequency distributions of the neustonic isopod *Idotea metallica* for male, female (plus ovigerous), and juvenile individuals.

The overall size frequency distribution of *Idotea metallica* for male, female and juvenile individuals (Fig. 4) indicates that most of the population consisted of juvenile individuals, whose sizes ranged between 2 and 6 mm TL, with a marked modal value at 3 mm. Sexes were distinguishable from a size of 4 mm TL. Male sizes ranged between 4 and 28 mm TL, and females between 4 and 21 mm TL. Both male and female size distributions were markedly polymodal. Three main modal values were recognised in male distributions: a main one at 7 mm, a second at 12 mm and a third at 16 mm TL. A few individuals larger than 20 mm were also found. Three main modal values were also recognised in females: immatures at 6 mm and ovigerous females at 14 mm and 20 mm TL. Ovigerous females were first recognizable at sizes larger than 13 mm TL and a mean size at female sexual maturity of 14.9 mm was estimated by fitting a cumulative normal distribution to the percentage ovigerous females by size class (Fig. 5).

The number of eggs (embryos) carried by the ovigerous females ranged between 30 and 182 (n=39) and was found to be significantly correlated ($p < 0.001$) with female size (Fig. 6).

DISCUSSION

Analysis of the size structure of the samples indicates a high degree of patchiness in the distribution of the population of *Idotea metallica*. No evident relationship appeared to occur with distance from the shore, or with the surface hydrographical characteristics shown by Rojas *et al.* (1995) and Olivar *et al.* (in press).

The polymodal size population structure shown by *Idotea metallica* is indicative of a relatively long lifespan (Fish, 1970), similar to that shown by littoral isopods, which have lifespans ranging from 1 to 2.5 years (Naylor, 1972). Given the scarcity of biological knowledge on this species, it is not clear whether each modal value in the size distribution is associated with a moult or, more likely, with different times of release of young. The size structure of the population is suggestive of a broad reproductive period with occurrence of several cohorts within the same reproductive season, as known for other *Idotea* species (Kroer, 1989; Jormalainen and Tuomi, 1989).

In Mediterranean specimens, sexes were first recognized from a size of around 4 mm TL. This is

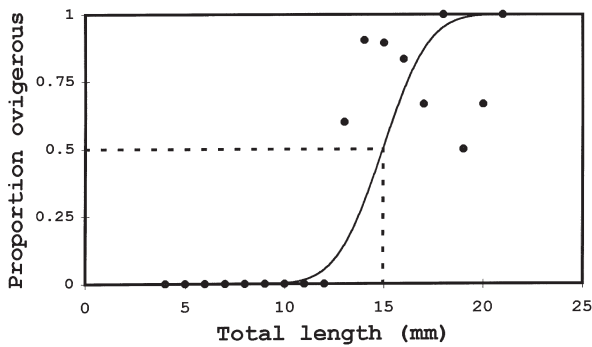


FIG. 5. – Proportion of ovigerous female *Idotea metallica* as a function of size, plus a cumulative normal distribution fitted to the data. A mean size at sexual maturity of 14.9 mm TL was estimated.

much smaller than that reported for British specimens (8-9 mm; Naylor, 1957). In contrast, maximum size is similar in Mediterranean (28 mm males, 21 mm females) and Atlantic (30 mm males, 19 mm females) forms.

Brood size was relatively small, normal in species with direct development (Fish, 1970; Sastry, 1983a,b; Rabalais & Gore, 1985). As in other isopods (Jones, 1970; Naylor, 1972), the number of embryos produced was directly related to female size. Larvae hatched as 'manca', juvenile individuals similar in appearance to adult individuals, apart from the absence of the last pair of pereopods (Naylor, 1972). Direct development in neustonic crustaceans appears to be of adaptive significance in avoiding larval dispersion and hence restricting their distribution to the neustonic zone.

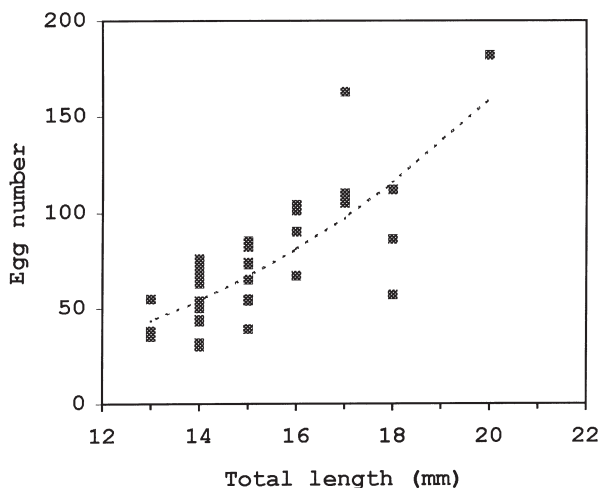


FIG. 6. – Relationship between size and number of eggs carried in ovigerous female *Idotea metallica*.

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