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ON THE DISTRIBUTION AND DEMOGRAPHY OF THE DEEP-WATER PINK SHRIMP AND NORWAY LOBSTER FISHERY STOCKS IN THE SOUTH ADRIATIC SEA

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ABSTRACT

Distributional features and population structures of the Deep-water pink shrimp – *P. longirostris* - and Norway lobster – *N. norvegicus* – in the South Adriatic Sea are reported. Trawl-surveys data (MEDITS project) have been analysed, and abundance indices distributions were mapped by means of G.I.S. techniques together with bottom temperature data. Moreover, length distributions were recorded. Results underlined differential species distribution per geographical area and depths, and the likely influence of water temperature.

Key-words: crustaceans, distribution, South Adriatic Sea.

RASPROSTRANJENOST I DEMOGRAFIJA STOKOVA KOZICE I ŠKAMPA U JUŽNOM JADRANU

REZIME

U radu se iznose rezultati istraživanja distribucije i strukture populacija kozice – *P. longirostris* – i škampa – *N. norvegicus* – u južnom Jadranu. Analizirani su podaci koćarskih istraživanja (MEDITS projekat) i pomoću G.I.S. tehnike napravljene su mape ditribucije indeksa abundancije zajedno sa podacima o pridnenoj temperaturi. Dati su i podaci o dužinskoj raspodjeli. Dobijeni rezultati ukazuju na raznolikost raspodjele vrsta po geografskim područjima i dubini, kao i to da na njihovu raspodjelu vjerovatno utiče temperatura vode.

Ključne riječi: rakovi, distribucija, južni Jadran

INTRODUCTION

The deep-water pink shrimp - *Parapenaeus longirostris* (H. Lucas, 1846) - and Norway lobster – *Nephrops norvegicus* (Linnaeus, 1758) – are widely distributed in the Mediterranean Sea (Fisher *et al.*, 1987) and represent valuable crustacean's resources for the demersal fishery, at least for the Central

Mediterranean (Relini *et al.*, 1999). The two species are the most important for the fishery in the South Adriatic Sea, also because the scarcity or lack of the red shrimps, *Aristeus antennatus* (Risso, 1816) and *Aristaeomorpha foliacea* (Risso, 1827) (Vaso & Gjiknuri, 1993; Pastorelli *et al.*, 1996).

Distributional features as well as biological and demographical aspects of the species have been analysed in some areas of the Central Mediterranean (De Ranieri *et al.*, 1986; Mori *et al.*, 1986; Ardizzone *et al.*, 1990; Biagi *et al.*, 1990a; Biagi *et al.*, 1990b; Andaloro & Vacchi, 1992; Levi *et al.*, 1995; Ragonese *et al.*, 1993; Abella & Righini, 1995; Spedicato *et al.*, 1996; Carbonara *et al.*, 1998; De Ranieri *et al.*, 1998; D'onghia *et al.*, 1998; Tursi *et al.*, 1998). Biological and distributional information from Adriatic Sea came from the western side only (Gramitto & Froglia, 1980; Froglia, 1982; Froglia & Gramitto, 1988; Marano *et al.*, 1998; Ardizzone *et al.*, 1999; Ungaro *et al.*, 2000).

Since from 1996, MEDITS research project (supported by E.U.) allowed the investigation on the demersal resources in the whole South Adriatic basin by means of yearly trawl surveys carried out during summer season. For the first time the whole area has been investigated using the same vessel, sampling gear and methodology (Bertrand et al., 1997).

In the present paper distribution features of the mentioned species in the whole South Adriatic Sea are analysed and discussed on the basis of bottom temperature data, according to the MEDITS survey's results.

MATERIALS AND METHODS

Raw data came from 1996-2000 summer surveys carried out using a 10 mm cod-end trawl net in the South Adriatic Sea (Italian and Albanian waters divided by mid-line, 112 sample stations, sampling from 10 m to 800 m depth) (fig. 1). The sampling design of the first survey was random stratified (five bathymetric strata: 10 – 50 m, 51 - 100 m, 101 - 200 m, 201 - 500 m, 501 - 800 m depth), and selected points were re-sampled the following years (Bertrand et al., 1997).

Deep-water pink shrimp and Norway lobster collected specimens were counted and weighed per haul, and representative sub-samples were measured (carapace length, CL) to the nearest 0.1 mm. Moreover bottom temperature values (°C) were recorded for each haul by means of a net probe (temperature data are available for the surveys 1998-99-00 only).

Species abundance data were standardised to the square kilometre (g/km^2, n° / km^2) by swept-area method (Sparre & Venema, 1992). Abundance indices and bottom temperature data were processed by G.I.S. technique in order to obtain distribution maps.

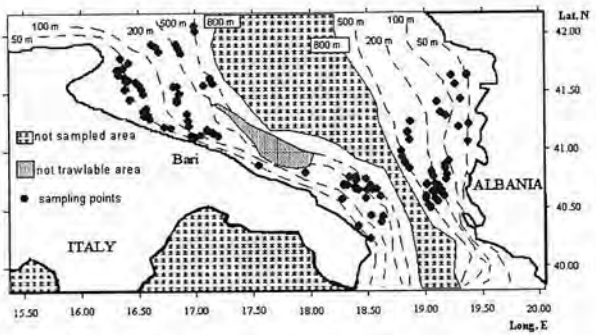

Figure 1. Investigated area and sampling points.

Moreover, size composition (carapace length) was analysed by species, bathymetric range (shelf and slope) and area (western side, eastern side of the Southern Adriatic basin).

RESULTS AND DISCUSSION

Abundance data distribution was analysed by means of variogram technique and the best data fitting resulted from the exponential model. The same model was utilised for kriging processing (abundance indices by species and year). Results from kriging have been subsequently mapped (fig. 2).

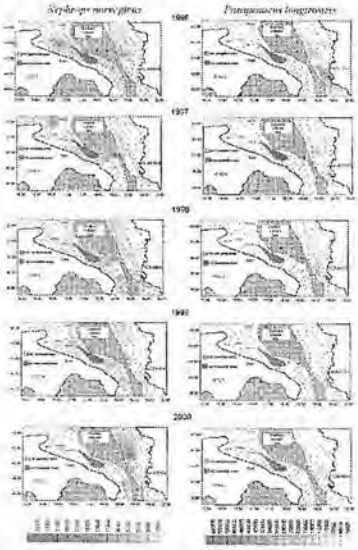

Figure 2. Biomass index distribution by kriging processing (g/km^2; years 1996-2000).

The yearly pictures pointed out different patterns in the spatial distribution of the species, mostly referring to the Deep-water pink shrimp. In fact, *P. longirostris* appeared to be mostly distributed on eastern side of South Adriatic basin, while Norway lobster was patchy distributed in the whole area, mostly at deeper bottoms. With regard to the bathymetric range, highest yield (all surveys) was recorded at depths below 100 m for both the species (150-350 m depth for *P. longirostris*, 150-450 m for *N. norvegicus*) (fig. 3).

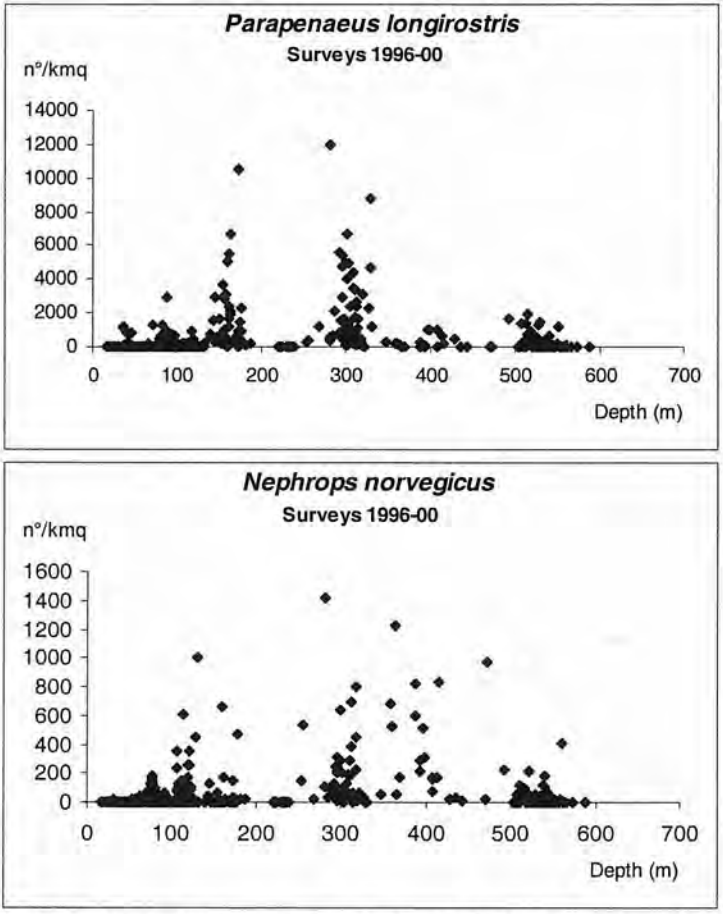

Figure 3. Abundance distribution by depth of *P. longirostris* and *N. norvegicus* (data from all the surveys).

Bottom temperature values have been mapped after kriging processing also. The deep waters below 100 m depths of the eastern side of the basin resulted

warmer than western side as a rule. Species spatial distribution, mostly referring to *P. longirostris*, appeared to be linked to the bottom temperature pattern (fig. 4).

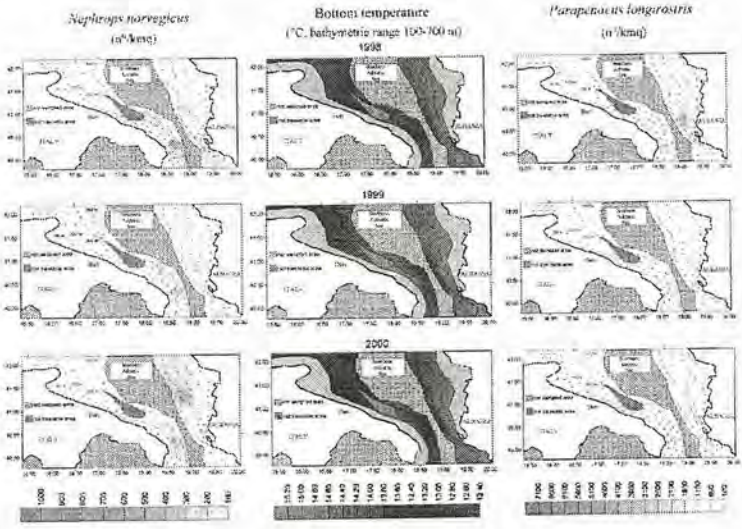

Figure 4. Mapping of Norway lobster / Deep-water pink shrimp density indices and bottom temperature data distribution.

With regard to the bottom temperature data, highest catch yields were mostly recorded at values between 14-15 °C and 13.5-14.5 for *P. longirostris* and *N. norvegicus* respectively (fig. 5). Moreover, mean values of catch yields per survey and geographical area (western basin and eastern basin) have been plotted against mean bottom temperature values in the same years. Results underlined an exponential increase of *P. longirostris* abundance up to around 14.5 °C bottom temperature, while *N. norvegicus* specimens seem to prefer colder waters (fig. 6).

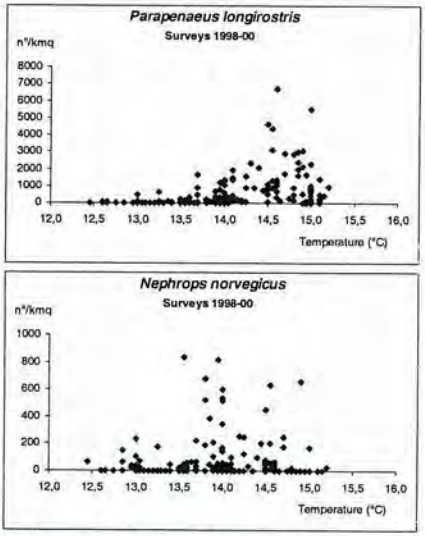

Figure 5. Abundance distribution per bottom temperature of *P. longirostris* and *N. norvegicus* (data from 1998-00 surveys, depths below 100 m).

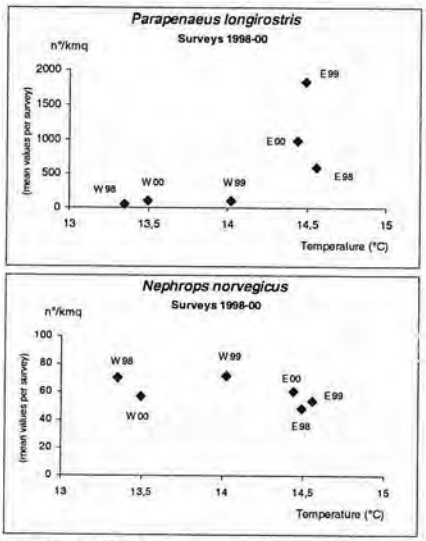

Figure 6. *P. longirostris* and *N. norvegicus:* relationship between abundance and bottom temperature (mean values per survey, depths below 100 m; W = western side, E = eastern side).

Size distribution of *P. longirostris* pointed out well-defined shapes by depth and area. Higher number of recruits (younger specimens) has been found on eastern side of the South Adriatic Sea, mostly on shelf bottoms (fig. 7). As a rule, *N. norvegicus* length distributions highlight the presence of a larger number of recruits on western side of the basin, and small differences between shelf and slope bottoms (fig. 8).

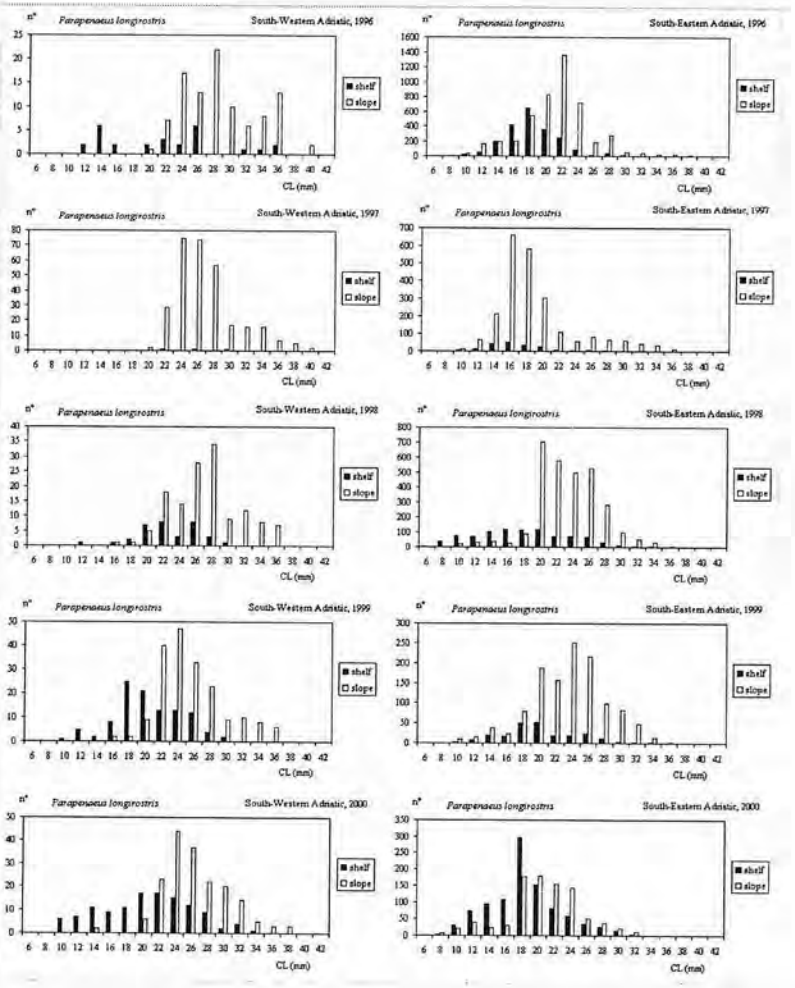

Figure 7. *P. longirostris*: carapace length distribution per survey, geographic area and bathymetric range.

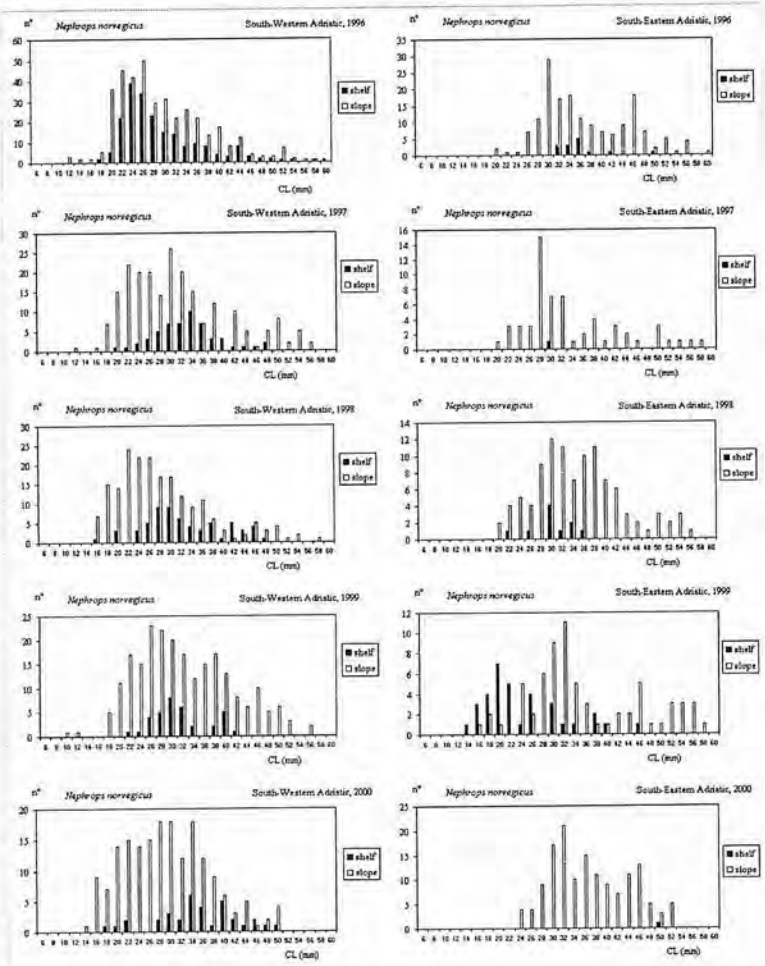

Figure 8. *N. norvegicus*: carapace length distribution per survey, geographic area and bathymetric range.

The reported results underlined once more the potential strong relationship between oceanographic features and distribution of biological resources, at least for crustaceans (Abellò *et al.*, 1988; Ungaro *et al.*, 1999). The better understanding of the links between environmental parameters and biological resources could improve the management of fishery exploitation of the sea at large basin level.

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