Geographical distribution of *Aristaeomorpha foliacea* (Crustacea: Aristaeidae) in the Sicilian Channel (Mediterranean Sea)

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The distribution of the red giant shrimp (*Aristaeomorpha foliacea*) in the Sicilian Channel (Central Mediterranean Sea) is described and geographical differences suggested by the available data set are qualitatively analysed. The unit stock assumption does not seem an unrealistic hypothesis, considering the state of knowledge.

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**Introduction**

The deepwater shrimps *Aristeus antennatus* (Risso, 1816) and *Aristaeomorpha foliacea* (Risso, 1827) constitute an important resource for the Mediterranean Sea fisheries. In the Sicilian Channel (sensu lato), both the red giant (*A. foliacea*) and the blue-red (*A. antennatus*) shrimp are actively sought by local and foreign trawlers and are often caught together. Exploratory surveys indicate that the red giant shrimp outnumbers the blue-red by 13:1 in the Sicilian Channel, just the opposite of the relationship of these two species elsewhere in the western Mediterranean (Sardà, 1986).

Table 1. Location, depth (m) and source of the geographical zones in Figure 1.

<table>
<thead>
<tr>
<th>UMA zones</th>
<th>Depth range (m)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 West</td>
<td>450—700</td>
<td>Maurin and Di Meglio, 1961</td>
</tr>
<tr>
<td>B1 Cap Blanc</td>
<td>500—1000</td>
<td>Ghidalia and Bourgois, 1961</td>
</tr>
<tr>
<td>B2 Pantelleria</td>
<td>550—750</td>
<td>Ghidalia and Bourgois, 1972</td>
</tr>
<tr>
<td>C Pantelleria</td>
<td>400—750</td>
<td>Bombace and Sardà, 1972</td>
</tr>
<tr>
<td>D West Egardi</td>
<td>500—650</td>
<td>Arena and Li Grechi, 1973</td>
</tr>
<tr>
<td>E1 West Egardi</td>
<td>540—630</td>
<td>Arena, 1985</td>
</tr>
<tr>
<td>E2 South Malta</td>
<td>540—630</td>
<td>Arena, 1985</td>
</tr>
<tr>
<td>E3 Capo Rossello</td>
<td>540—630</td>
<td>Arena, 1985</td>
</tr>
<tr>
<td>F1 Northwest (NW)</td>
<td>410—668</td>
<td>Ragonese, 1989</td>
</tr>
<tr>
<td>F2 Far South (FS)</td>
<td>401—817</td>
<td>Ragonese, 1989</td>
</tr>
<tr>
<td>F3 Southeast (SE)</td>
<td>393—796</td>
<td>Ragonese, 1989</td>
</tr>
<tr>
<td>G Capo Passero</td>
<td>&gt; 400</td>
<td>Local fishermen</td>
</tr>
<tr>
<td>H “Triangle”</td>
<td>&gt; 350</td>
<td>Local fishermen</td>
</tr>
</tbody>
</table>

In spite of its importance, little information is available on the red giant shrimp trawled in the Sicilian Channel. This article provides the first distributional map of the local population(s) of red giant shrimp, plus a preliminary evaluation of the “unit stock” hypothesis.

**Methods**

The area of the central Mediterranean Sea between the Sicilian and North African coasts (the Sicilian Channel sensu lato) is considered a “Unitary Management Area” (UMA; Fig. 1) for demersal resources (Ragonese, 1989). The 1000 m isobaths encompass the northwest (Capo S. Vito, Sicily—Cap Ferrat, Algeria) and the southeast (Capo Murro di Porco, Sicily—Cape Misratah, Libya) limits (Fig. 1).

Information was gathered from the local fishermen, from the available literature on “UMA” zones, and from two years of seasonally stratified random trawl surveys (eight trawls; I and IV: spring 1985 and 1986; II and VI: summer 1985 and 1986; III and VII: autumn 1985 and 1986; and IV and VIII: winter 1986 and 1987) carried out by the I.T.P.P. of Mazara on the Italian side of the “UMA”. The commercial trawler, “S. Anna”, with commercial trawl gear lined with a codend with mesh size of 18 mm on a side was used (see Levi (1990) for details).

Average yields (kg/h), sex-ratio (F/F + M), spawning probability (percentage of “ready to spawn” females) and length–frequency distribution (females only; oblique carapace; 1 mm below) for trawl seasons and for
three specific zones were derived and their shapes compared qualitatively. Overall, the valid hauls (1 hour long) were 30, 69 and 64 in the “northwest” (NW; F1 in Fig. 1), “far south” (FS; F2 in Fig. 1) and “southeast” (SE; F3 in Fig. 1) zones, respectively. The numbers of hauls for each survey were 5-3-3-4-3-4-4-4, 8-10-8-9-10-8-7-9 and 7-7-7-8-9-7-10-9 for the “northwest”, “far south” and “southeast” zones, respectively.

Results and discussion

The red giant shrimp probably migrates vertically (it is almost exclusively trawled during daylight hours), and seems not to be limited to one specific type of soft bottom. For example, it is often captured along with the burrowing Nephrops norvegicus. The red giant also behaves like an opportunistic predator that can survive independently of the benthic facies (e.g., the reduction in numbers of the anthozoan Isidella elongata caused by trawling did not have any appreciable consequence). However, the red giant shrimp supposedly prefers the temperature of the so-called “eastern water” (13.5°C), an intermediate stratum of warm and salty water which originates in the eastern Mediterranean Sea and flows towards the Strait of Gibraltar.

The red giant shrimp is distributed throughout the

Figure 1. Geographical distribution of zones of Aristaeomorpha foliacea in the proposed “Unitary Management Area” (see Table 1).
Figure 2. Mean catch (a), sex ratio (b), and percentage of "ready-to-spawn" females (c) per I.T.P.P. by zone and trawl season. Maturity scale according to Levi and Vacchi (1988): (1° type females not considered in the computation).
Figure 3a. Seasonal variability in length frequencies of females (CL = carapace length in mm) from Spring 1985 to Winter 1986.
Figure 3b: Seasonal variability in length frequencies of females (CL = carapace length in mm) from Spring 1986 to Winter 1987.
UMA over a wide range of depths (300–1000 m), but shows a marked preference for (or a higher vulnerability to trawling on) muddy bottoms at depths between 500 and 750 m (Table 1), especially where narrow depressions or canyons notch the seabed. The lower bathymetric limit for this species is probably deeper than 1000 m, but trawling at these depths is technically difficult and unprofitable because the small number of shrimp captured at those depths is not adequately compensated by the increase in individual size.

The bathymetric map suggests two main distributional zones for this species in the Strait of Sicily (west and east sides, Fig. 1). Between them there is a narrow passage with sufficient depth (200–400 m) to allow adult shrimp to move from one side to the other. In addition, trawl catches of this species suggest that the east zone could be further divided into a “far south” (FS) and a “southeast” (SE) zone, partially separated by two deep depressions (each deeper than 1000 m) known as Pantelleria and Malta (Fig. 1).

Differences between the west and east shrimp (those in the west are larger) have been noted by other authors, but it has been difficult to support an hypothesis of “more than one stock” because of the limited time series of comparable data.

The yields and sex-ratio plots (Fig. 2a, b) show no specific pattern and a high level of “interaction”. The only important feature is the sharp and recurrent spring peak relative to the northwest (NW) area. In contrast, the three zones have similar summer peaks in reproductive pattern (Fig. 2c).

As far as the length-frequency distributions are concerned (Fig. 3), the data show general seasonal variability between and within zones, a relative scarcity of adult females (CL > 40 mm) in the SE, a greater similarity in the adult female component of the NW and FS, and a virtual non-occurrence of spring recruitment in the NW.

According to local fishermen, who fish with a trawl codend mesh size of about 18 mm on a side, large catches of juveniles occur in wintertime, at least over the westernmost seabed on the west side, but the available data do not permit verification.

The red giant shrimp of the Sicilian Channel has a wide geographic and bathymetric distribution, but it is impossible to state from the current data whether these shrimps comprise a single stock or two stocks (west and east UMA) with limited interchange. The unit stock hypothesis is sufficiently realistic to permit preliminary stock assessment and management of this important resource, but the problem of stock identity should not be ignored in the process of developing a management strategy.

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References


