BIOLOGICAL PARAMETERS OF THE BROWN RAY, *RAJA MIRALETUS*, IN THE SOUTHERN ADRIATIC BASIN

by

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RÉSUMÉ. - Caractéristiques biologiques de la raie-miroir, *Raja miraletus*, de la mer Adriatique méridionale.

Les caractéristiques biologiques de la raie-miroir de la mer Adriatique méridionale sont données. Les relations taille-poids ont été établies et aucune différence significative n'a été trouvée entre les sexes. La taille à la maturité sexuelle (L 50%) se situe à 364 mm LT chez les mâles et 423 mm LT chez les femelles. Ces résultats sont comparés aux caractéristiques biologiques des autres populations de *Raja miraletus* de Méditerranée.

Key words. - Rajidae - *Raja miraletus* - MED - Adriatic Sea - Biology.

The brown ray is widely distributed in the Mediterranean (Tortonese, 1956; Bini, 1967; Whitehead *et al*., 1986; Fisher *et al*., 1987), and it is one of the most abundant cartilaginous fish on Adriatic trawlable bottoms (Jukic *et al*., 2001). Information on distribution and species biology is reported for some Mediterranean areas (Capapé and Quignard, 1974a, 1974b, 1975; Capapé and Azouz, 1976; Abdel-Aziz, 1992; Relini *et al*., 1999) including the Central Adriatic Sea (Zupanovic, 1961; Jardas, 1973; Jardas 1981), but data from Southern Adriatic are scanty. In the present paper some features of the brown ray biology in the Southern Adriatic are reported, in order to add information referring to the just mentioned basin. These data were compared with results from other Mediterranean marine areas, in order to highlight possible intraspecific variations of life parameters among different populations.

MATERIALS AND METHODS

Samples of *Raja miraletus* came from international trawl surveys (MEDITS Project, funded by the E.U.) carried out from 1994 to 2002 during Spring-Summer period in the Southern Adriatic basin (Central Mediterranean; latitude 39°40'-42°15'N, longitude 15°30'-20°15'E) (Bertrand *et al*., 1997) and from Gru.N.D. National trawl surveys (years 1993-2000) carried out in the Western side of the same area (Italian waters) (AA.VV., 1999).

The collected specimens were measured to the nearest millimetre and weighed (g) by sex; the total length (TL) and the disc width (DW) were recorded (mm). Sexual maturity was assessed both in females and males by means of Holden and Raitt (1974) maturity scale for elasmobranchs. Moreover, in male specimens, CL length was measured (mm) from the cloaca opening to the tip of claspers.

Morphometric relationships have been analysed and results by sex were compared by means of statistical test (*t*-test). Length-weight relationships were fitted by power functions. The comparison between the male and female length-weight equations was performed by using a statistical test after data log-transformation (parallelism test, comparison between the slope values from different linear regressions).

Lengths at maturity ($TL_{50\%}$) were estimated by means of logistic curve parameters (Saila *et al*., 1988). Piece-wise regression analysis was utilised to identify male's maturity phases (software STATISTICA).

RESULTS

One hundred and forty-six specimens (85 females and 61 males) were sampled. The total length (TL) range was 165-510 mm and 150-495 mm TL (total length) for female and male individuals respectively, including both young and adult specimens.

Disk width / total length ratio values were between 0.56 and 0.70 (mean value = 0.65) and no size-dependent trend was detected, according to Jardas (1973) results. Moreover, the difference between sexes wasn't significant (*t*-test).

Length-weight relationships by sex resulted mostly overlapped and no significant differences were found (parallelism statistical test). The overall curve parameters are reported in the figure 1.

Spawning of the brown ray occurs throughout the year in the Mediterranean with a peak in Spring-Summer season as Capapé and Quignard (1975) reported it; thus the specimens collected during the Medits and Gru.N.D. surveys could be utilised for the investigation on reproductive features. Results from macroscopic analysis of sexual maturity underlined the presence of fully mature individuals (stage III from Holden and Raitt maturity scale) at total

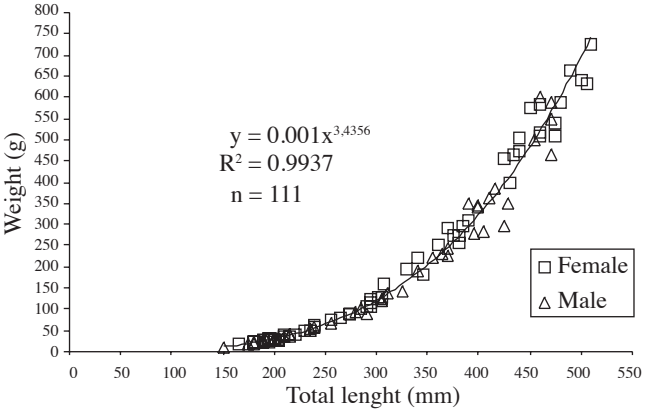

Figure 1. - *Raja miraletus*. Length-weight relationship in the Southern Adriatic Sea.

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lengths larger than 360 mm (230 mm disc width) and 435 mm (270 mm disc width), for male and female respectively. Stage two (maturing specimens) was observed at size larger than 365 mm (230 mm disc width) for male and 425 mm (280 mm disc width) for female.

Length-at-maturity values ($TL_{50\%}$) from the fitting of logistic functions were 364.0 mm and 423.0 mm, for males and females respectively. The maturity ranges ($TL_{25\%-75\%}$) were 348-380 mm and 404-444 mm, for males and females respectively (Fig. 2). Clasper's relative growth highlighted two different phases (Fig. 3), and the observed point's distribution was well explained by piece-wise regression model. The break point from the mathematical model was found at 311.0 mm TL, and it probably represents the upper size limit of juvenile phase in the male, as it was suggested for other elasmobranchs also (Ungaro *et al*., 2002).

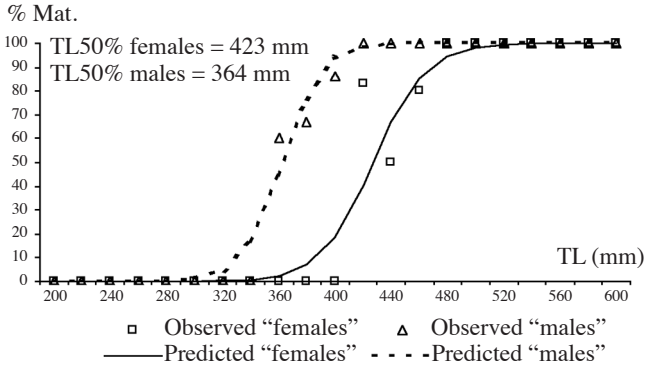

Figure 2. - *Raja miraletus*. Maturity ogives for males and females in the Southern Adriatic Sea.

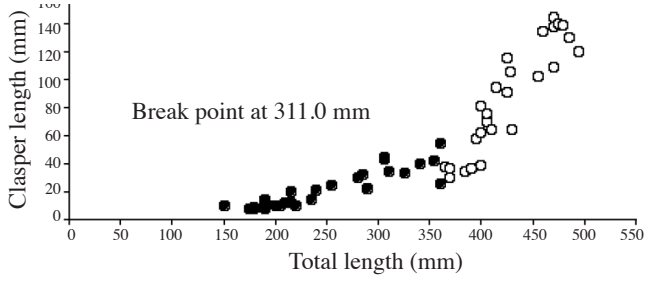

Figure 3. - *Raja miraletus*. Relative growth of claspers in male specimens (white circle = TL > $TL_{50\%}$, 364 mm).

DISCUSSION

Biological features of the brown ray *Raja miraletus* are reported for the first time for the Southern Adriatic Sea (Mediterranean basin).

The length-weight relationship refers to the overall sample because no significant differences were found by sex. The same indication came from Stergiou and Moutopoulos (2001), while other authors report two different curves (male and female) (Jardas, 1973; Capapé and Quignard, 1974a; Relini *et al*., 1999).

The estimated lengths at maturity are slightly larger than referenced data for Western Mediterranean Sea, at least for females (Capapé and Quignard, 1974b, 1975; Fisher *et al*., 1987; Relini *et al*., 1999).

In the Middle Adriatic, Jardas (1973) found results for males very close to the present paper ones, while Zupanovic (1961) reported mature females at 350 mm TL in the same basin.

Intraspecific variations of life parameters between Mediterranean and Atlantic elasmobranchs populations have been supposed due to the geographic and hydrographic characteristics of the areas (Capapé, 1977). Some information on the same subject are reported referring to different zones of the Mediterranean (Ungaro *et al*., 2002). Thus, the variability among the estimated values and the referenced data can be related to above mentioned hypothesis although more information (and samples) are needed to check the significance of the differences.

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