

## Life cycle of *Aristeus antennatus* on Majorca Island waters

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### Fishing grounds

The study area lies to the South of the Island of Mallorca, where this species is one of main resources of demersal fisheries.

*A. antennatus* is mainly fished between 400-800 m on muddy bottoms. The study area lies to the South of Majorca, where the deep-water shrimp is currently exploited mainly in 4 fishing grounds. The shrimp fishing grounds change during the year: from October to May they are located mainly to the South and South-East of this area while from May to October they are located in the South-West but principally towards North-West of Majorca. In general, the depth of fishing depends on the fishing ground and the period of the year. The fishing ground called "Cabrera" to the South-East of Majorca extends deeper (500-750 m depth) than the others and is exploited in winter by few trawlers. Two other areas (called "Es Gambussí" and "Sa Badia") are mainly exploited in winter and the depth of fishing is between 400-700 m. In summer the main exploited area is "Soller" and the fishing reaches greater depths, up to 750 m. In the last few years another fishing area called "Emile Baudot" has been exploited but only at the end of the year. This area is situated to the South-East of Cabrera Island.

### Methods

A research project on the shrimp *A. antennatus* has been carried out by the Centro Oceanográfico de Baleares (IEO) since 1991.

A total of 6212 females and 1960 males of *A. antennatus* were collected by commercial bottom-trawl gear during 1992; monthly and quarterly sampling was carried out during the reproduction period, either on board commercial trawlers or from landings. Sex and size (CL, carapace length, in mm) was noted. In each sample, some 200 individuals of both sexes were collected at random and transported to the laboratory for further measurements.

Since sexual dimorphism is present in *A. antennatus*, some population parameters, in particular those related to growth present different values for females and males; consequently, a separate study must be made for each sex of *A. antennatus*.

### Morphometry

The annual length frequency distribution, obtained from the monthly samplings, showed exploited sizes ranging between 15-61 mm CL in females and between 15-38 mm CL in males. The mean size was 32 mm CL in females and 26 mm CL in males.

The parameters of the length-weight relationship were estimated as: females  $a = 0.00299$ ,  $b = 2.4139$  ( $n = 2447$ ,  $r = 0.95$ ); males  $a = 0.00511$ ,  $b = 2.1470$  ( $n = 630$ ,  $r = 0.91$ ).

### Reproduction

The size at first maturity was estimated by running the program LIONOR and was found to be 26 mm CL in females and 20 mm CL in males. The sex-ratio estimated from catches was very far from the 1:1 ratio; females constituted the majority of the catch, between 61% and 87%. The reproduction period lasts several months, from May to September. The highest proportion of spawning females was found during June, July and August. The gonadosomatic index is maximum in June, July and August.

### **Population dynamics**

The Bhattacharya's method was used to identify the different normally-distributed size groups in the polymodal distributions for each sex. Five normally-distributed size groups have been identified in females, around 22 mm, 30 mm, 40 mm, 48 mm and 59 mm CL; in males 4 normally-distributed size classes have been detected around 18 mm, 22 mm, 27 mm and 32 mm CL.

The parameters of the von Bertalanffy growth equation  $L_{\infty}$  and  $k$  were estimated for each sex by running the program ELEFAN on the overall size distribution, thus obtaining: for females  $L_{\infty}=74.0$  mm CL,  $k/y=0.38$ ,  $t_0=-0.07$  year; for males  $L_{\infty}=46.0$  mm CL,  $k/y=0.47$ ,  $t_0=-0.13$  year.

### **Conclusions**

All these results showed a demography of the exploited population of *A. antennatus* similar to that occurring in other areas of the Mediterranean and the Atlantic where the fishery is well established.