

The status of fishery for *Aristeus antennatus* in Majorca Island waters

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Introduction

The deep-water shrimp *A. antennatus* is the deepest exploited species of the Western Mediterranean. *A. antennatus* is one of the most important resource for the bottom trawl fishing fleet based in Majorca. The trawling fleet consists of about 60 vessels, with 40 boats specializing in fishing for shrimp. The characteristics of these vessels are 200-450 HP, and 40-70 gross registered tonnes. Although the catches constitute only 5-7% of the total catch, it is among the main species, in terms of commercial importance, contributing more than 25% of total incomes.

Exploitation

The gear is the bottom trawl: the mesh size for these trawls is 38 mm and the vertical opening is about 2 m maximum.

Since the '70s, annual landings of *A. antennatus* for the Balearic Islands appear to be quite stable and are between 200-450 t. Nevertheless, catches show marked changes, annually as well as interannually. The catch ranges between 3-50 t per month. The highest catches are between May and September. Shrimp landings present a periodic cycle of 6-8 years, observed by others authors and also observed in our landings. Daily landings of *A. antennatus* on board commercial trawler in 1991 showed that densities usually vary between 4-25 kg/h.

Demography

The demography of *A. antennatus*, by mean length composition of the catches by sex, in 1992, showed sexual differences in the size structure of the catches. The mean size of females in the catch is greater than for males. Longevity in females is greater than that for males, with females reaching 5 years and males only 4 years (mortality rates from Demestre and Martin).

The parameters of the von Bertalanffy growth equation L_{∞} and k were estimated by sex using the program ELEFAN.

Yield models

The methodology used to analyze these data is the package VIT. The virtual population analysis (VPA) used to study the population dynamic was performed using pseudocohorts of length classes (length cohort analysis, LCA).

The LCA assumes a steady state and VIT was run using the catch equation. Virtual population analysis (VPA) was obtained by sex and also the yield-per-recruit analysis (Y/R).

Following are the population estimates from the analysis of female pseudocohort, ($M=0.5$):

recruits= 22 million; mean number= 19 million; mean biomass= 168 t; mean length= 25.6 mm CL; mean age= 1.23 year; virgin biomass= 1245 t; biomass balance= 274 t; turnover= 163.4%; Y/R= 8.62 g; MSY/R= 9.29 g; $E_{msy}= 0.46$.

Following are the population estimates from the analysis of male pseudocohort ($M=0.8$):

recruits= 30 million; mean number= 23 million; mean biomass= 81 t; mean length= 20.6 mm CL; mean age= 1.43 year; virgin biomass= 232 t; biomass balance= 136 t; turnover= 167.5%; Y/R= 2.31 g; MSY/R= 2.38 g.

The results of the analysis of yield-per-recruit, by sex, using the fishing mortality vector obtained in LCA, show that the stock does not appear to be overexploited. Nevertheless, in females the maximum sustainable yield-per-recruit is placed to the left of the yield-per-recruit curve. Males show a yield-per-recruit monotonically increasing.

Conclusions

The fact that *A. antennatus* appears to be near the optimum exploitation, in contrast to the majority of demersal resources, is due to at least two characteristics of this species: first, the whole stock is not fully available for fishing, and second, the turnover rate is high.

Finally, another project permitted a study of this resource in the 3 main areas of exploitation in the Spanish Mediterranean: a comparative analysis of the dynamics of these fisheries shows similar results in the 3 areas. The differences are due more to different von Bertalanffy's growth parameters than to the demographic structure of the populations.