Crustaceana 67 (3) 1994, © E. J. Brill, Leiden

GROWTH AND MORTALITY OF THE RED SHRIMP *ARISTAEOMORPHA FOLIACEA* IN THE SICILIAN CHANNEL (MEDITERRANEAN SEA)

BY

SERGIO RAGONESE[1]), MARCO L. BIANCHINI[2,3]) and VINCENT F. GALLUCCI[3])

[1]) Ist. Tecnologia Pesca e Pescato, CNR, Via Vaccara, Mazara (TP), Italy; [2]) P.F. RAISA, CNR, Via Tiburtina 770, Roma, Italy; [3]) School of Fisheries, University of Washington, Seattle, WA, U.S.A.

ABSTRACT

The deep water red shrimp *Aristaeomorpha foliacea* is an important commercial species for the trawl fisheries in the Sicilian Channel (Central Mediterranean Sea; FAO statistical area 37.5). An assessment program was recently implemented by ITPP-CNR. Two years of seasonal research trawl surveys were carried out on the Italian side of the Sicilian Channel.

A time series of length-frequency distributions has been analyzed using different techniques; the results are used to estimate growth and mortality parameters of the stock.

In females, two modal pulses can be discriminated for the juveniles while two-to-three "years" are visible for the adults. Female growth can well be represented by a Von Bertalanffy function: as with other species, too, there are two possible growth hypotheses, slower and faster; *A. foliacea* females appear to grow relatively fast anyhow.

Female total annual mortality (Z) is estimated around 0.65, with a natural mortality (M) at 0.42, resulting in an exploitation rate (E) of 0.38.

Male results appear similar to those of females, but the models are less well-defined and valid; male growth data are best fitted with a linear model.

RESUMEN

La gamba de profundidad *Aristaeomorpha foliacea* es una especie comercial importante en la pesqueria de arrastre del Canal de Sicilia (Mar Mediterráneo central; área estadística 37.5 de la FAO). En el marco de un programa de evaluación realizado por el ITPP-CNR, se han llevado a cabo muestreos estacionales de arrastre durante dos años cubriendo la parte italiana del Canal de Sicilia.

El crecimiento y la mortalidad de la población de *A. foliacea* se ha estimado a partir del análisis temporal de sus frecuencias de tallas por métodos distintos.

Las hembras jóvenes y adultas se separan claramente, en las primeras pueden identificarse dos picos modales, mientras que en las segundas pueden observarse dos o tres "años". El crecimiento es expresado, según la función clásica de Von Bertalanffy, con dos hipótesis posibles de crecimiento, más o menos rapido.

La mortalidad total (Z, anual) para hembras es 0,65 y la natural (M) de 0,42 las cuales resultan de una tasa de explotaciòn (E) del 0,38.

Los machos presentan unos patrones similares a las hembras pero menos claros, siendo el crecimiento de los machos mejor representado por un modelo linear.

INTRODUCTION

The deep-sea red shrimp *Aristaeomorpha foliacea* (Risso, 1827) (Decapoda, Aristeidae) is of great economic interest, actual or potential, over all of its wide area of distribution (Holthuis, 1980; Dore & Frimodt, 1987).

Particularly in the Mediterranean, it represents, together with the other red shrimp *Aristeus antennatus* (Risso, 1816) (cf. Demestre, 1990) and the Norway lobster, the target for the demersal trawl fisheries operating between 200 and 800 m, i.e., over the continental slope (Orsi Relini & Relini, 1985; Sardà, 1988; Ragonese, 1989; Ragonese & Bianchini, 1992).

Besides having a scientific interest, the need to evaluate the red shrimp resource arises from its economic importance, since the total landings from the Sicilian Channel are of the order of several hundred tons per year, i.e., a value well over 10,000,000 US$. In fact, the fishing activity truly resembles a monospecific fishery (Sardà, 1988; Demestre, 1990).

The life cycle of the red shrimp in the Sicilian Channel occurs in a deep water environment, homeothermic (about 13.5°C), considered oligotrophic and stable. At present, the red shrimp occupies one of the top positions of its trophic web, because larger predators, such as anglerfish, hake, sharks, etc., are scarce due to overfishing of the demersal resources (CGPM, 1989).

This paper describes the size structure of the populations of *Aristaeomorpha foliacea* living in the Italian part of the Sicilian Channel; afterwards, its temporal evolution is analyzed in order to estimate growth and mortality parameters.

The ultimate objective is to utilize these preliminary estimates to develop production and population dynamics models to be used for a rational exploitation of these resources.

MATERIALS AND METHODS

The red shrimps were collected using an ad hoc chartered commercial trawler in the Sicilian Channel (fig. 1), an area characterized by irregular grounds, strong hydrodynamics (actual deep water gyros have been recorded) and by the presence of shallow banks that separate the mesobathyal bottoms into an Eastern and a Western basin (Ragonese, 1993).

Eight seasonal trawl surveys (Levi, 1990) have been carried out from spring 1985 to winter 1987 using a commercial trawl net (net mouth of 0.7 × 12 m; terminal bag, or cod-end, with mesh of 18-20 mm of side).

All the hauls were made in daylight, during the period of maximum availability of these shrimps (Sardà, 1988), which are presumed to swim in the water column during the night (Lagardère, 1971). The length of each haul was about 5000 m (1 h at 2.8 knots, in a random direction). Whenever possible, the shrimps were measured on board using a pair of calipers (precision 1 mm), recording the oblique length of the carapace (CL; Mayrat, 1964) and also the sex.

The total catch of *A. foliacea* in the eight surveys was 463 kg, corresponding to 19,400 animals, coming from 164 valid hauls, of which 132 were positive.

Length frequency distributions (LFSs) by sex and survey were produced for the overall distribution area, i.e., 17,000 km^2 in a depth range of 400-800 m.