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The Deep-Water Red Shrimp Fishery in the Spanish Mediterranean Sea

by

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Abstract

The red shrimp has being exploited for 50'years. Out of a total of hundred harbours, about 40% have developed a deep-water red shrimp fishery. Abundance of this species increased between 500 to 800 m., although their distribution reach 2000 m. The red shrimp contribute between 900-1500 Tn per year for all Spanish deep trawl fisheries. In the framework of several projects co-financed by the European Union DG XIV and The Spanish Oceanographic Institute (IEO) data are being obtained on several demersal target species including the red shrimp (*Aristeus antennatus*, Risso 1816) which is the target species of the deep-bottom fishery. The sampling program began in 1991 by means of collaboration with fishermen associations and sampling at landing sites. Data about catch and effort are obtained continuously since that year. By means an on board observers program are obtained dates about: fleet characteristics, gears type, fishing grounds, mean depth, effective effort values, biomass and abundance of species values, both commercial discarded fractions, and size distribution of the target species. Estimation of biological parameters are obtained periodically. A computerised database is being developed to store all data recorded. Considering the fishery the total area was divided in several Subareas. It shows some resilience to overexploitation, although the fleet increase their fishing capacity continuously. Global discards for this fishery represent around 30% of the total catch. Nevertheless the discard of the target species is practically zero and is considered an accidental discard. The fishery exploits adults, which represent near 75% of the catches in biomass.

Introduction

The ECC fishery management measures (CEE 3760/92 and EC 847/96, 1626/94 Council Regulation, etc) for the trawl fishery are, among others, the mesh size (40 mm in the codend) and the power and effort permitted by vessel and for the whole trawl fleets (which cannot be increased) and these measures are the most important for the deep water red shrimp trawl Mediterranean fishery.

Management units for demersal species have been defined in the Mediterranean for the GFCM in 2001 (General Fisheries Commission for the Mediterranean, Scientific Advisory Committee. Working group on management units. Alicante (Spain) 23-25 January 2001). Previously, most of the assessments have been carried out locally (Demestre and Lleonart, 1993; Garcia and Esteban 1999a, b; Carbonell *et al*, 2001). Those papers established a exploitation pattern close to the optimum. The dynamic models used to obtain these assessments (VPA and LCA) produced figures which estimated the fishing biomass around 10-20% of the virgin stock biomass, and the yield per recruit curves were flatted or slight decreasing. Nevertheless, repeated assessment during the 90s showed a decline

parental stock and an increase recruitment dependence. In concordance of those assessments, landings are being decreasing in the last decade (1990-2000), in their whole fishing area. Nevertheless, a slight recuperation could be detected for the most recent years 2000 and follows.

Most of the assessments for this species are been produced for the Balearic management unit using population dynamics models (Pseudochorts Length Analysis (LCA) and Virtual population analysis (VPA) and assessment using C.P.U.E. indices (Production models). Both types of assessments have inherent uncertainties. The former are characterised by uncertainties in the input data and the appropriate biological parameters. The assumptions under these model are not used be accomplished. The CPUE assessments considering the non-equilibrium models could be biased due to the inherent errors of the sampling models and catch statistics. Nevertheless its could be considered useful and the correct use of these models can provide an insight into the species/fishery dynamics and can be used to analyse the effect of changes in the fishing level on catches.

For the Deep water red shrimp Spanish Mediterranean fishery the first step was establish a sampling program, obtaining landings, catches per unit effort, and biological parameters. At the beginning this program was developed for each laboratory in the midland (Levantin and Alboran zone) and in the islands (Balearic Islands) in their own influence zone and were developed in the framework of several projects co-financed by the European Union DG XIV and The Spanish Oceanographic Institute (IEO). The ports choose were those where landings and fleet are more important in weight of red shrimp and number of vessels.

In January 2001 the General Fisheries Commission for the Mediterranean (GFCM) Scientific Advisory Committee Working Group on management units, propose individual. Management units for the Mediterranean Sea. Species as the red shrimp will be in the future analysed considering these management units.

At the moment nothing it have been done in order to assess the precision of the key parameters obtained by the models. Nevertheless it will be the next works in the future, after have a well-established sampling program by each management unit.

Now, in this paper, is described the most relevant results obtained during the last years, although relevant information obtained during the whole period is also included. Nevertheless the programs start now to be systematic and to have clear goals. In the future when management will be developed information generated by the program, should be used in any management measure as the adoption of the precautionary reference points.

Material and Methods

Selected sampling ports (Figure 1) in relationship to the most important landings zones are monthly visited by the on board observers. Once a month, a representative vessel is selected at random and the location and duration of its haul was recorded, catch and discards by species in weight are obtained. In the laboratory a biological sampling is being carried out for the target species to obtain biological and size frequency distribution. Details concerning to the on board sampling program and data base storage are given in Carbonell *et al*, 1997.

Monthly and annual data on commercial landings were provided by the fishermen's associations. Landings by the sampling ports include at least 90% to the catches of their zones and fishing grounds.

All the information is being stored in a national database computer software (ORACLE developer).

The classical models used until now to assess are the structural dynamic models as Length Cohort Analysis (LCA), Virtual Population Analysis (VPA) and Production Models. The LCA models have been run in order to obtain some estimation as virgis biomass, mean biomass, Spawning Stock Biomass (SSB) yield per recruit curves (Y/R) and optimum effort (Emsy).

Results

The red shrimp contribute between 900-1500 Tn per year for all Spanish deep trawl fisheries. The fishery started in late 1940s and landings rapidly increased reaching maximum landings in the late fifties. Then from these years to the present have been increasing. However, this increment is not constant for the whole period, reaching

some maximum in different moment. In 1992 landings are the highest value of the series, and decline to levels of the sixties since that year (Figure 2). Whilst in landing the species represents 5 to 16% (Martinez Baños, Carbonel *et al*., 1999) of the total landings for demersal species, landed by the trawl fishery as a whole depended on the port, in price the species reaches one of the firsts incomes of the trawl fishery.

Out of a total of hundred harbours, about 40% have developed a deep-water red shrimp fishery in the Spanish Mediterranean Sea. In figure 1 are shown the most important ports of the red shrimp fishery. Landings have composed for a great proportion of females, which represent around to 70% of the total catches in weight (Figure 3).

Similarity between size distribution in the different sampling ports showed a great concordance in the Balearic area and some differences between the Alborán and Balearic management units, although the size distribution between this two zones reached 90% of similarity (Figure 4). Size distribution for these two management units show a greater mean size for the Alborán sea (Figure 5) but a similar size-range for both areas. The Alborán management unit seems have a best exploitation pattern, with a bigger mean size for both females and males. Individual smaller than 25 mm CL are scarce and represent around of 20% of the total catches in both areas.

The results of the assessment for Garcia and Esteban, 1999a, b, and Carbonell *et al*., 2001 for the Balearic are presented in Table 1. Those analyses showed a decline of the virgin biomass and an increase of the recruitment dependance (30%). Yield per recruit models showed slight over-exploited curves (Figure 6). The CPUE models for the Balearic zone (Pereiro and Fernández, 1974, Carbonell comm. pers.) showed a more optimistic perception of the exploitation.

Discussion

Any model for management species should include monitoring and assessment (Stokes, 1999) and also it should consider the uncertainty of the models applied. Then other considerations should be taken into account as the components of the ecosystems, which produce natural variation. In this sense the time series analysis for the Balearic Islands (Carbonell *et al*., 1999) predicted a cycle of 8-9 years and it was expected a recuperation of the catches in the early 2000' years. At the moment this recuperation is being produced, although it could be necessary more time to confirm these results.

Size parameters could be considered quite constants, and this could be an index of the stability in the exploitation pattern. The fishery catches almost all adult individual and juveniles represent a small proportion of the catches (10-20%) an these characteristics of the exploitation model could be the best assurance to maintain the resource. Nevertheless differences of the size composition between the Balearic and Alborán management seems indicate there are a decrease in the mean size in the former area and it could be related with the exploitation pattern or the long history of the exploitation in this area.

From the start of the fishery to now, the puissance of the vessels have been increased several times, although catches seem reached their maximum. Assessment using classic and standard models indicates a non-overexploited or a close to optimum exploitation pattern for the fishery. Some consideration to explain these against assertions are: first the catchability of the species could be low, then the increase of the effort will be more related to the vessel competence than to obtain best yields. Secondary it could be considered the increased puissance of the vessels increase the effort over the species and yields are maintained, then the species is in over-exploitation. In these sense, in the future, the effort measures, biological estimation and models used should be evaluated and probably some of these could be rejected, although at the moment it need a deep background in this field for this species.

References

Anonim, 2001. Report. GFCM Working Group on Management Units. Alicante (Spain) 23-25 January 2001.

Carbonell, A., P, Martin,. and S. Di-Ranieri 1998. Discards of the Western Mediterranean trawl fleets. Study Contract EC-DGXIV-94/027.

Carbonell, A., V. Lauronce, E. Román and M. Demestre, 2001. Application of dynamic models of the rose shrimp (Aristeus antennatus) from SW Mallorcan waters (Balearic sea, western Mediterranean. Sci. Mar. Submitted.

Demestre, M. and J. Lleonart, 1993. Population dynamics of Aristeus antennatus (Decapoda: Dendrobranchiata) in the Northwestern Mediterranean. Sci. Mar., 57 (2-3): 183-189.

Garcia-Rodriguez, M. and A. Esteban, 1999. On the biology and fishery of Aristeus antennatus (Risso, 1816), (Decapoda, Dendrobranchiata) in the Ibiza channel (Balearic Islands, Spain). Sci. Mar., 63 (1): 27-37. 1999.

Garcia-Rodriguez, M and A. Esteban, 1999. A comparison on the exploitation level of two populations of Aristeus antennatus, Risso 1818 (Decapoda,Dendrobranchiata) in two different areas in the Spanish Mediterranean. The Biodiversity Crisis and Crustacea: Proceedings of the Fourth International Crsutacean Congress, Amsterdam, the Netherlands, July 20-28, 1998.

Goodall, D.W., 1978. Sample similarity and species correlation. *In*: H. Whittaker (ed.). *Ordination of plant communities*, pp. 99-149, Dr. W. Junk b. V. Publishers. The Hague.

Pereiro, J. A. y A. Fernández., 1974. Aplicación de los modelos de producción de Schaefer y Fox a las Pesquerias de Palinurus, Aristeus, Mullus, Pagellus y Solea de la plataforma balear. Bol. Inst. Esp. de Oceanografia. Nº 181. 1974.

Stokes, T. K.; D. S. Butterworth, R. L. stephenson, A. I. L. Payne. 1999. Confronting in the Evaluation and Implementation of Fisheries-Management Systems. ICES Journal of Marine Science, 56: 795-796.

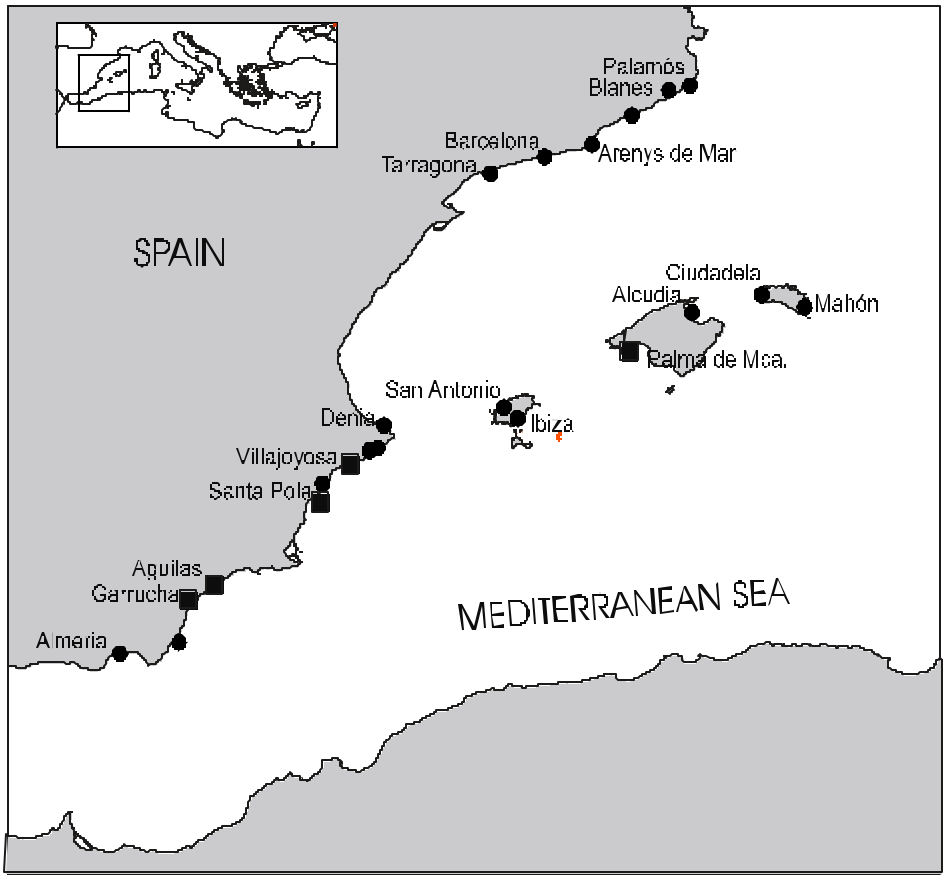

Fig. 1. Study area showing the red shrimp fishing ports. Black square = sampling ports. Spots = red shrimp fishery ports.

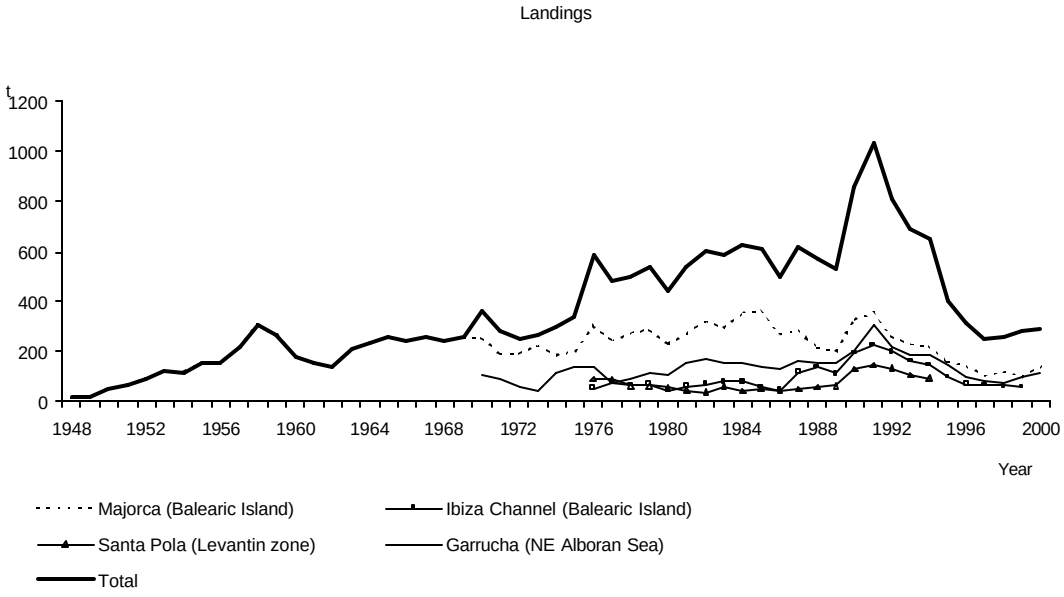

Fig. 2. Landings tons (t) of the red shrimp fishery for the Spanish Mediterranean sea. 1999.

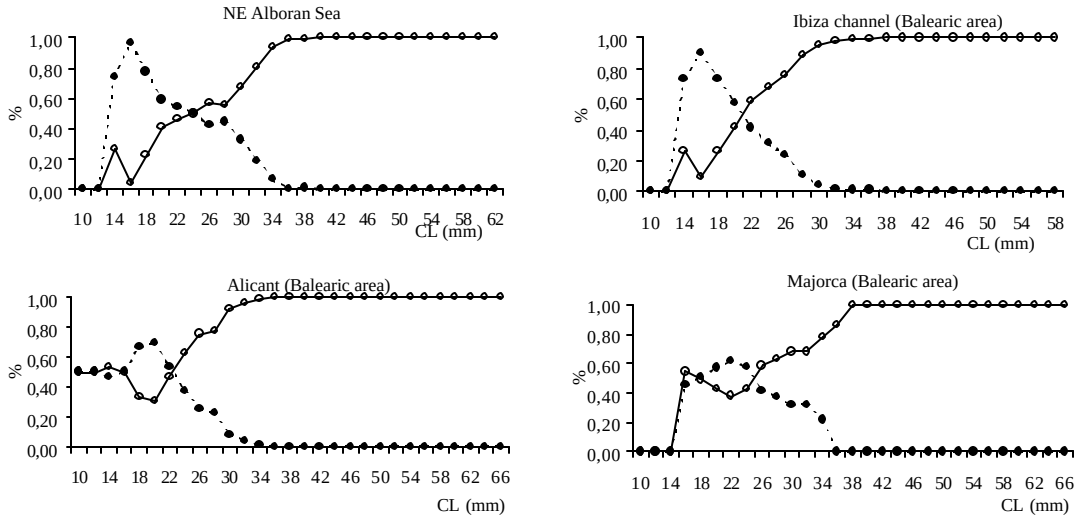

Fig. 3. Sex-ratio of the red shrimp in the different fishing zones.

Females

	Palma	S. Pola	V.jiosa	Almería
Palma		0,99	0,99	0,93
Santa Pola			0,98	0,92
Vilajoiosa				0,94
Almería				

Males

	Palma	S. Pola	V.joiosa	Almería
Palma	1	1,00	1,00	0,97
Santa Pola		1	0,99	0,97
Vilajoiosa			1	0,97
Almería				1

Fig. 4. Size distribution similarity percentage for females and males was compared using the similarity percentage (PS) as a measure of the similarity between the different ports (Goodall, 1978).

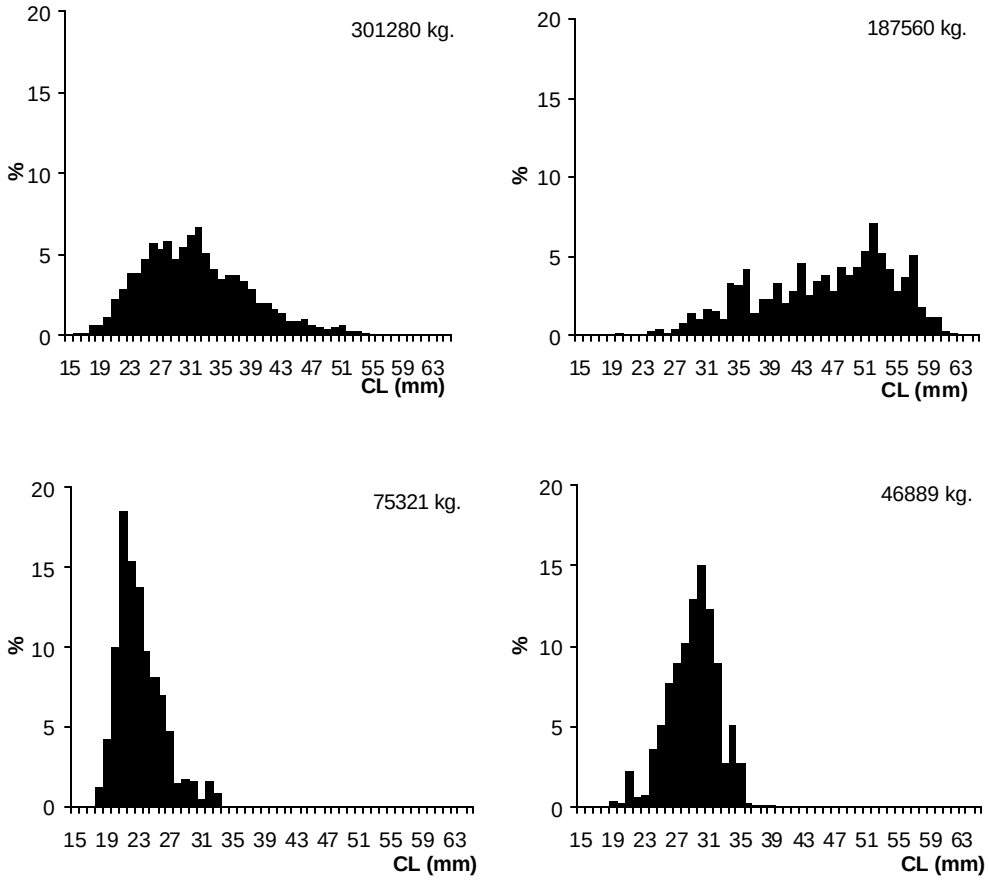

Fig. 5. Size distribution for females and males. Balearic and Alboran management units.

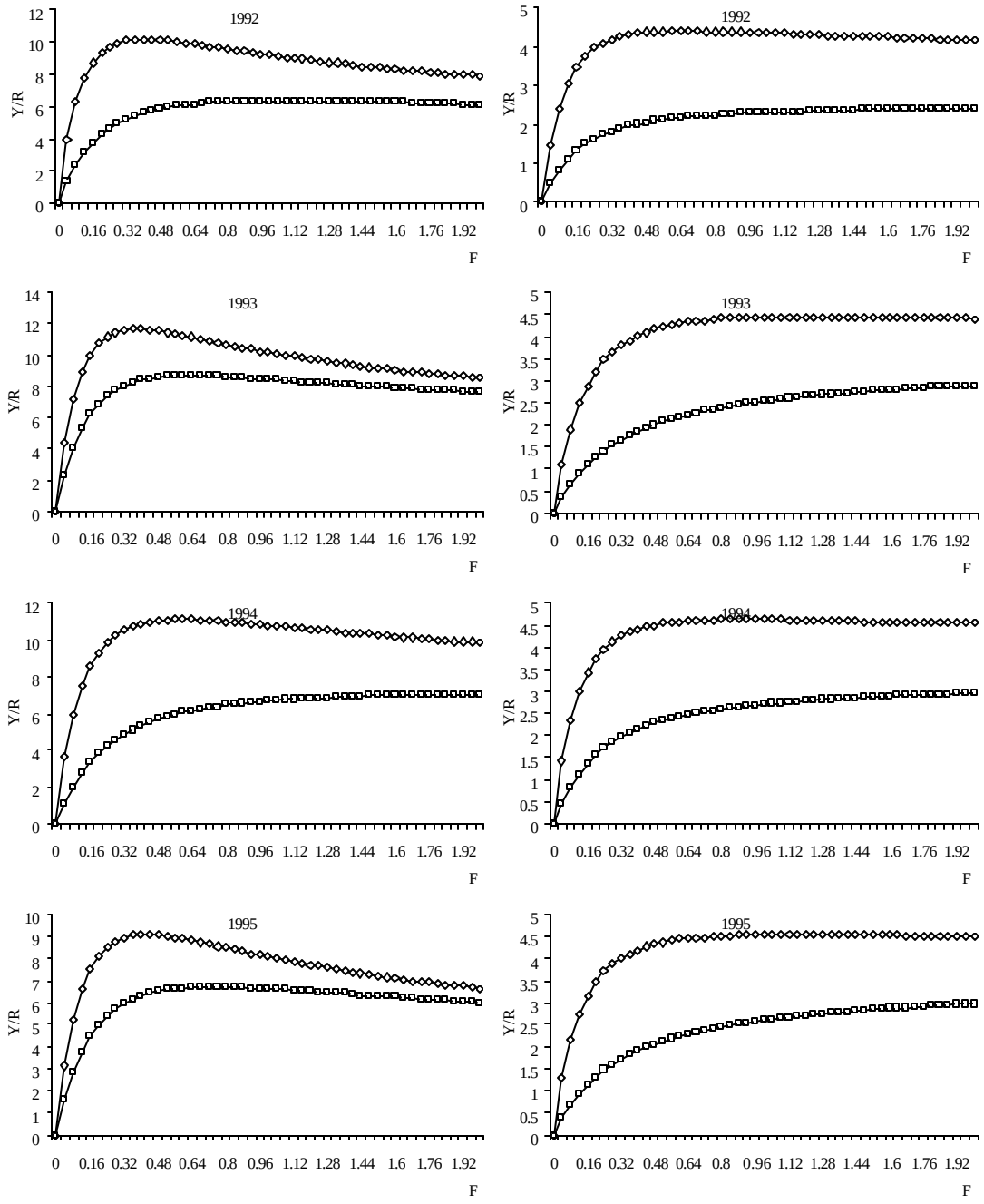

Fig. 6. Curves of yield per recruit *versus* effort for females (a) and males (b) of red shrimps for different M (Natural mortality) rates. (Data from Carbonell *et al.*, 2001).

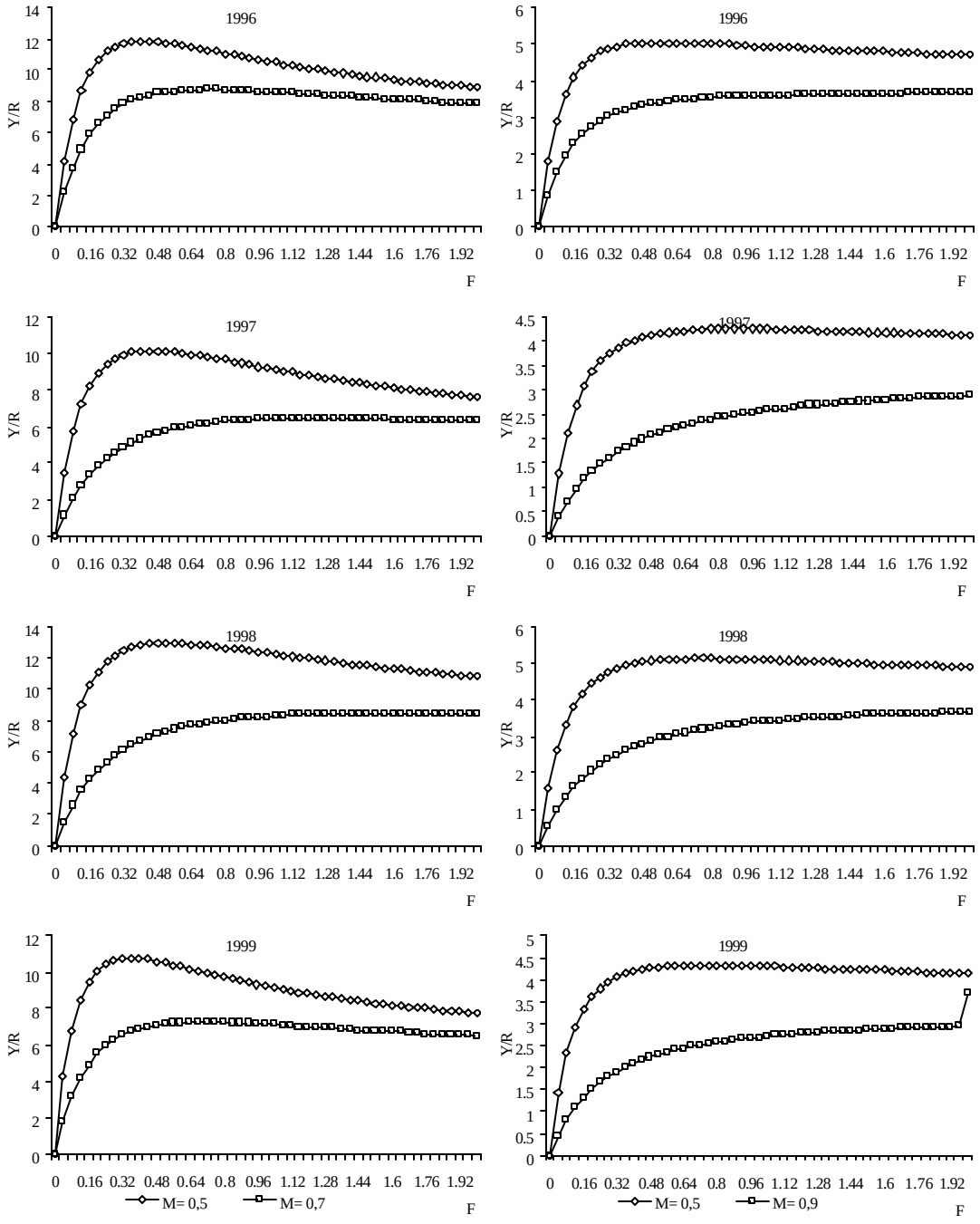

Fig. 6. Continued.