A STUDY OF THE POPULATION DYNAMICS OF THE NORTHWESTERN MEDITERRANEAN ANCHOVY (*ENGRAULIS ENCRASICOLUS*) USING LCA (LENGTH COHORT ANALYSIS)

J.P. PERTIERRA and J. LLEONART

Institut de Ciències del Mar. Plaça del Mar. 08039 Barcelona, España

The use of population dynamics in the evaluation of small pelagics is a controversial topic. The small pelagics have a short life, most of the biomass is presumed to belong to a single year class making them highly dependent of uncertain recruitments, and a highly variable natural mortalities. Hence small pelagics gather the wrong features for the proper operation of the population dynamics methodology, while the acoustic techniques and the egg production method have demonstrate to be efficient estimators of actual biomass. Nevertheless, population dynamics can contribute with a sinchronic view to the more precise, but punctual, direct estimations mentioned above. In this paper a Length Cohort Analysis (LCA) of anchovy is presented. LCA has severe limitations, being the steady state the most restrictive, involving constant recruitment and constant mortalities. For this reason this method has received some criticism (HILBORN and WALTERS, 1992). Nevertheless LCA has at least two useful features: first it gives a wide view of the population status, and second, it can take the data arranged into many classes, hence the scale of study is much more precise than those based on anual classes. This last feature is significant in short lived organisms.

In the framework of a FAR project (GARCIA, 1994) 347 samples of anchovy length frequencies of the commercial landings were taken from Castelló (northern part of spanish coast of the Mediterranean) to Savona (septentrional Tirrhenian), incluiding France. In this paper the preliminary results of the analysis of these data are presented.

Data were grouped according to annual seasons starting on July 1st, as the birthday of the year class. Only the season July-92 to June-93 was complete. The samples were grouped in several ways, ranging various levels of agregation (i.e. harbour, country, gulf of Lion, etc.). Samples taken from Catalonian landings from 1987 to 1993 were also included. The length frequencies were smoothed in order to avoid sampling artefacts.

The resulting length frequencies were analyzed by means of the LCA using VIT software (LLEONART and SALAT, 1992).

The biological parameters employed were, for the von Bertalanffy growth equation: L (infinity) = 20.6 cm, K = 0.38, t0 = -0.937 year. Length-weight relationship: a = 0.0022 gr/vol, b = 3.41 (PERTIERRA, 1987), and Natural mortality (PERTIERRA, 1992): M = 0.81. As a general remark on the data, it must be pointed out that the lower standard length limit was 5.5 cm and the upper one was 19 cm.

In table 1, the main general results are presented. Some particularly significant parameters have been choosed in order to synthetize the great ammount of information from each analysis.

Some general conclusions can be stated. The stocks are kept at levels slightly lower than 50% of the virgin biomass. The turnover rates are, in all cases, higher than 100%. The recruitment represents around 50% of biomass when it reaches its maximum biomass. The values of biomass are absolute and refer to different surfaces, so they are hardly comparable between areas. The great differences between the global fishing mortalities are the most surprising results; sensitivity analysis showed, as it was expected, that these values are not affected (at a significant level) by the terminal F. Taking into account the cautions necessary in the interpretation of such analyses, it appears to be an increase in the biomass of catalan stock in the most recent years.

Yield per Recruit Analysis carried out on the fishing mortality vectors reveal an average subexploitation pattern for most (all except Barcelona) of the studied areas with maximun sustainable yields above the current fishing effort.

Table 1. Results of LCAs carried out on different sets of anchovy data.

F : global fishing mortality weighted by numbers of individuals. **B** : Mean anual biomass in tonnes. **%BV** : B expressed ad percentage of estimated mean anual virgin biomass. **%T** : Turnover (production/biomass) expressed as percentage. **%R** : Percentage of the mean annual biomass represented by one year recruitment at the critical (maximum biomass) point.

1992-1993	**F**	**B**	**%BV**	**%T**	**%R**
Castelló	0.334	4748	48	137	65
Barcelona	0.533	2698	26	165	55
Port de la Selva	0.132	2166	60	116	44
Sète	0.200	8464	56	123	51
Savona	0.307	2076	49	131	59
Sestri Levante	0.412	375	42	142	64
Catalonia	**F**	**B**	**%BV**	**%T**	**%R**
1987-1988	0.353	15638	33	154	59
1988-1989	0.344	23321	39	141	53
1989-1990	0.368	20402	32	155	54
1990-1991	0.338	16529	38	144	53
1991-1992	0.188	19091	47	130	49
1992-1993	0.189	28697	52	121	43
1987-93 (6 seasons)	0.254	21264	41	137	49
Gulf of Lions 92-93	0.145	10548	56	121	47

REFERENCES

GARCIA, A. (Coord.).- 1994. Northwestern Mediterranean Anchovy: Distribution, Biology, Fisheries and Biomass estimation by different methods. Final Report. Contract FAR-CEE MA 3730. HILBORN, R. & C.J. WALTERS.- 1992. Quantitative Fisheries Stock Assessment. Choice, Dynamics & Uncertainty. Chapman & Hall. New York, London. 570 pp.

LLEONART J. & J. SALAT.- 1992. VIT. Programa de análisis de pesquerías. *Inf. Técn. Sci. Mar.*, 168-169: 116 pp.

PERTIERRA, J.P.- 1987. Crecimiento del boquerón (*Engraulis encrasicolus*) de la costa catalana. *Inv. Pesq.*, 51:263-275.

PERTIERRA, J.P.- 1992. Biología pesquera de la anchoa *Engraulis encrasicolus* del Mar Catalan (NW Mediterraneo). Tesis Doctoral. Universitat Politècnica de Catalunya. 281 pp.