V-V9

ON THE ASSESSMENT OF THE PELAGIC FISHERY RESOURCES IN GREEK WATERS

Konstantinos I. STERGIOU

National Centre for Marine Research, Athens (Greece)

ABSTRACT

The state of the pelagic fishery resources is examined using catches and fishing effort of the purse seiners for 1964-1982, treated by the exponential surplus-yield model (Fox, 1970), in order to assess the state of the pelagic fishery resources, optimize fishing effort and maximum sustained yield.

INTRODUCTION

Fishery mathematical models, used for a rational management of fishery resources, are oriented towards (a) modelling in the ligth of recruitment, growth and natural mortality (e.g. Beverton and Holt, 1957), and (b) modelling based on catch and fishing effort data (Schaefer, 1954; Fox, 1970). The latter are particularly advantageous when data on population variables are lacking (Fox, 1970). In the present work, the fishing effort and the catches of the pelagic (purse-seine) fishery for 1964-1982, accounting for 47% of the total catch in Greek waters, are used for the assessment of the pelagic resources and the optimization of fishing effort and maximum sustained yield in Greek waters, applying the exponential surplus-yield model proposed by Fox (1970).

MATERIAL AND METHODS

Greek catches of the pelagic (purse-seine) fishery as well as the total number and HP of purse-seiners have been recorded on a monthly basis through the local custom authorities for 1964-1982 (National Statistical Service of Greece, 1968-1985). On the assumption that enviromental factors other than fishing do not influence marine populations, the catch per unit of fishing effort U, fishing effort F and equilibrium yield are used in the linear surplus-yield model (Schaefer, 1954), assuming logistic growth, and in the exponential surplus-yield model (Fox, 1970), assuming Gompertz exponential growth. Since the coefficient of determination was found to be higher in the case of an exponential (r^2= 0.86) than linear (r^2= 0.77) relationship, Fox's (1970) model was applied.

The following relationships were used:

$$U = U_\infty e^{-bF} \quad (1)$$

$$Ye = FU_\infty e \quad (2)$$

where: U= catch per unit of fishing effort
U_∞= catch/effort proportional to maximum population size
b= functional regression coefficient
F= fishing effort
Ye= equilibrium yield

and according which:

$$Fopt = b^{-1} \quad (3)$$

$$Uopt = U_\infty e^{-1} \quad (4)$$

$$\text{and } Ymax = U_\infty b^{-1} e^{-1} \quad (5)$$

Greek pelagic catch/effort, in other words abundance, is given as kg /HP, whereas time period in concern is the "year".

RESULTS AND DISCUSSION

Two assumptions are inherent in the model: 1) the mean population size P is a function of F, and 2) Ye is a function of P and F, both of which are not always fully met inasmuch as climatic conditions influence P. Both, however, may be treated as the edge deviations from the mean conditions predicted by the model (Fox, 1970). The value of the coefficient of determination (r^2 =0.86) satisfied the first assumption. The equation that describes the catch/effort as a function of fishing effort F is:

$$U = 1165{,}21 e^{-0.0000127F}$$

the optimum effort Fopt=78,697 HP, the optimum catch per (optimum) effort Uopt=430 kgr/HP, and the maximum sustained yield Ymax= 33,930 tons . The equilibrium yield curve and the relationship among catch/effort and effort are shown in Figures 1 and 2 from where it becomes clear that the pelagic

TABLE 1
Annual pelagic catches, HP of the purse-seiners, and catch per effort, in Greek waters, 1964-1982.

Year	Catch	Catch/HP	HP
1964	28,843	1,174	20,316
1965	22,072	1,034	21,353
1966	21,397	884	24,212
1967	22,757	810	28,098
1968	23,341	706	33,075
1969	25,744	758	33,965
1970	21,501	570	37,750
1971	22,761	581	39,165
1972	28,722	725	39,637
1973	32,547	667	48,795
1974	27,087	499	54,252
1975	29,676	496	59,848
1976	35,044	514	68,149
1977	33,017	455	72,511
1978	32,672	426	76,652
1979	34,343	440	77,977
1980	34,858	432	80,779
1981	34,277	393	87,212
1982	39,331	437	90,080

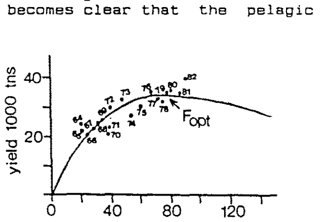

Fig.1. Exponential equillibrium yield curve for pelagic fishery in Greek waters, 1964-1982.

fishery resources are apparently very well described by the exponential surplus-yield model of Fox (1970). In general, there is an indication of overfishing. Fishing effort and catch/effort in 1980-1982 exceeded Fopt and Uopt which were reached in 1979 (Table 1, Fig.1 and 2). The mean 1976-1981 yield is around the Ymax, while it slightly exceeded Ymax in 1982 (Table 1). Fishing effort must be kept at that level, mainly by not issuing new licences.

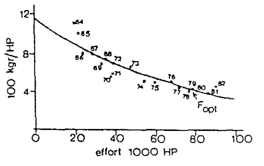

Fig.2. relationship among F and U in Greek waters, 1964-1982.

REFERENCES

Beverton, R. J. H. and S. J. Holt, 1957. Fish. Inv. Lond. Ser. 2 , 19: 533 pp.
Fox, W. W., 1970. Trans. Amer. Fish. Soc. , 1: pp 80-88.
Granic, B. et al , 1980. Acta Adriat. , 21(2): pp 227-236.
National Statistical Service of Greece, 1968-1985. Section G, 15 issues.
Schaefer, M. B., 1954. Bull. Inter-Amer. Trop. Tuna Comm. , 1(2): pp 27-56.

V-V10

ON THE ANCHOVY AND PILCHARD FISHERY IN GREEK WATERS, 1964-1982

Konstantinos I. STERGIOU

National Centre for Marine Research, Athens (Greece)

ABSTRACT

The anchovy and pilchard yield in Greek waters is reviewed for 1964-1982. The mean annual anchovy and pilchard landings number 7,820 tns and 11,390 tns, respectively, acounting for 61% of the mean annual total yield of the Greek pelagic fishery, which changed from a fishery dominated by pilchard, in the late 1960's, to one mainly dominated by anchovy in the late 1970's -early 1980's. Possible factors responsible for such a shift are discussed.

INTRODUCTION

The European pilchard (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*) fisheries ranked 9th and 13th in the 1983 world fishery production, with a mean (1980-1983) annual catch of 926,500 tns and 712,500 tns , respectively (FAO, 1984). The Mediterranean (including the Black Sea) mean (1980-1983) annual catch of anchovy and pilchard accounted for 87.5% (623,400 tns) and 24.2% (224,000 tns) of the world anchovy and pilchard yield, and comprised 47.6% of the mean total annual Mediterranean fishery catch (=1,772,500 tns) (FAO, 1984). Switches in the dominance of catch between pilchard and anchovy has been reported from various areas in the Mediterranean Sea and in other marine regions (e.g. GFCM, 1982). Indications are that this holds for the Greek waters also. In the present work, the fisheries of anchovy and pilchard in Greek waters is reviewed for the 1964-1982 period.

MATERIAL AND METHODS

Greek catches of anchovy and pilchard have been recorded on a monthly basis through the local custom authorities since 1964 (National Statistical Service of Greece, 1968-1985). All mean values are refered to the 1964-1982 period.

RESULTS AND DISCUSSION

The mean annual anchovy and pilchard landings are 7,820 tns and 11,390 tns, respectively, and represent 12.9% and 18.8% of the mean total annual Greek fishery landings accordingly (=60,700 tns). Ninety six percent of the mean annual anchovy catches and 87.6% of the pilchard catches is attributed to the purse seine fishery, accounting for 61% of the mean annual total yield of the purse seine fishery. Greek catches of anchovy and pilchard represent a small portion of the total mean annual catches of these fishes in the Mediterranean Sea (including the Black Sea) (2% and 5% accordingly).

The landings of pilchards decreased from 13,000 in 1964 to 8,800 tns in 1970, then increased to 13,200 tns in 1973 and declined again slightly to stable levels (12,000 tns) for 1975-1982 (Fig. 1), mainly because fishermen do not pursue pilchard intensively since the late 1970's due to low market demand. Anchovy landings, on the other hand, rose from 5,500 tns in 1964 to 8,500 tns in 1972, then declined to 5,600 tns in 1975 and rapidly increased to 14,200 tns by 1982 (Fig. 1). The antiphase for the two curves is evident, especially for the 1964-1975 period.

The anchovy/pilchard catch ratio, which essentially is independent of fishing effort, increased from 0.42 in 1964 to 0.88 in 1971, declined to 0.45 by 1975 and sharply rose to 1.15 by 1982 (Fig. 1). Hence cyclic variations in the relative abundance of these species are observed, and anchovy, representing 22% of the purse seine catches in 1964 and 34% in 1982, partially replaced pilchard, representing 48% of the purse seine fishery in 1964 and 25% in 1982, becoming the dominant species of the Greek pelagic fishery in recent days (Stergiou, unpublished data). Furthermore, the annual percentages of anchovy and pilchard in the Greek purse seine fishery for the 1964-1982 period are highly significant , negatively correlated with each other (r=-0.53, p<0.01) (Stergiou, unpublished data), whereas the same has been found for the Pagasitikos Gulf, Greece (Stergiou, unpublished data), which clearly show a tendency of shifts in dominance of catch between pilchard and anchovy.

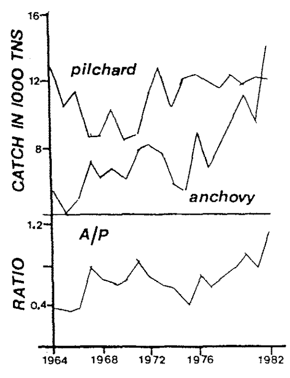

Fig.1. Anchovy and pilchard catches, and catch ratio (A/P) in Greek waters, 1964-1982.

The replacement of pilchard catches by anchovy catches has been also documented for other areas of the world, as for example on the Mediterranean coast of Marocco (Turner and Bencherifi, 1983), at Castellon, Spain, (Larraneta, 1981), in the Spanish Alboran and in the region of Algiers (GFCM, 1983), in the Adriatic Sea (Alegria-Hernandez, 1983) and off California (Soutar and Isaacs, 1974). Moreover, these changes have been attributed to either overexploitation or climatic changes.

The analysis of the Greek pilchard purse-seine catch per unit effort for 1964-1982 showed that pilchard catches were well beyond the optimum catch per effort in 1975-1982, indicative of overfishing (Stergiou, unpublished data). In this case a crash of the pilchard fishery is to be expected in the near future. The fact, however, that the decline of the pilchard population and the increase in anchovy abundance that took place in 1964/1965 at Castellon, Spain, (Larraneta, 1981) went along with a decrease in pilchard catches and a rise of anchovy catches in Greek waters in 1964/1965 (Fig. 1) may reveal that large-scale phenomena, namely climatic changes, are responsible for these widespread shifts in abundance.

REFERENCES

Alegria-Hernandez V., 1983. Acta Adriat. , 24(1/2): p 55-95.
FAO, 1984. Year book of fishery statistics for 1983. Vol. 56.
GFCM, 1983. FAO Fish. Rep. (305): 110 p.
Larraneta, M. G. 1981. Invest. Pesq. , 45(1): p 47-91.
National Statistical Service of Greece, 1968-1985. Section G, 15 issues.
Souter, A. and J. D. Isaacs, 1974. Fish. Bull. , (72): p 257-275.
Turner J. and S. Bencherifi, 1983. FAO Fish. Rep. , (305): p 63-72