Seasonal differences of some biological parameters of Striped Sea Bream (*Lithognathus mormyrus*) from the Eastern Adriatic Coast

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The paper presents the data on some biological parameters of striped sea bream in winter and summer season from two habitats on the eastern Adriatic coast : estuary of the Mirna River-Tar Estuary (western Istrian coast) and Kastela Bay (middle Adriatic). Material was collected in November 1989 and in July, August, and December 1990, and December 1991. A total of 330 specimens were analyzed, of which 197 originated from Tar Estuary.

Length-weight relationship ($W=a \times L^b$), condition factor (PAULY, 1984) and length frequency distribution after Bhattacharya's method (SPARE *et al.*, 1989) were calculated. Length-weight relationship (Fig. 1) shows positive allometric growth of striped sea bream in winter (Tar Estuary) and the negative one for fish collected in summer (Kastala Bay).

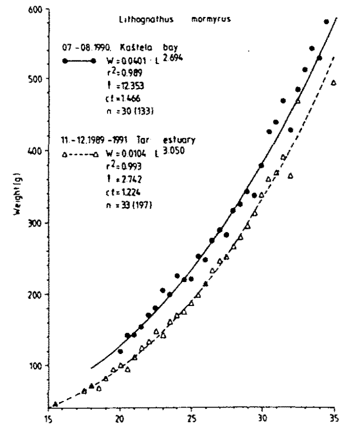
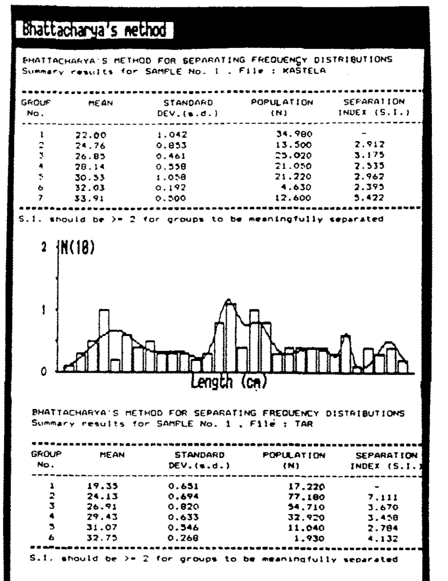


Fig. 1.- Length-weight relatlonship for the striped sea bream (*Lithognathus mormyrus* L.) in summer (Kastela Bay) and winter (Tar Estuary) season.

The value of b (Fig. 1) calculated for fish collected in November and December in Tar Estuary (3.050) does not significantly ($p<0.01$) differ from 3, and that for fishes collected in July and August in Kastela Bay (2. 694) is significantly different from 3.

Condition factor of striped sea bream in summer (c.f.=1.466) fish in winter time (c.f.=1.224). Since striped sea bream mature between the end of July and mid August the condition factor is higher and the value of b is significantly dlfferent from 3 in summer. Method for separating length frequency distribution gave better age structure for fishes collected in November and December in Tar Estuary (Chi-square value = 14.492; χ^2 = 14.067) than for striped sea gream collected in summer from Kastela Bay (Chi-square value = 9.865; $\chi^2_{.05(1)} = 3.841$).


Bhattacharya's method

BHATTACHARYA'S METHOD FOR SEPARATING FREQUENCY DISTRIBUTIONS
Summary results for SAMPLE No. 1 . File : KASTELA

GROUP No.	MEAN	STANDARD DEV.(s.d.)	POPULATION (N)	SEPARATION INDEX (S.I.)
1	22.00	1.042	34.980	-
2	24.76	0.853	13.500	2.912
3	26.85	0.461	25.020	3.175
4	28.14	0.558	21.050	2.535
5	30.53	1.058	21.220	2.962
6	32.03	0.192	4.630	2.395
7	33.91	0.500	12.600	5.422

S.I. should be >= 2 for groups to be meaningfully separated

BHATTACHARYA'S METHOD FOR SEPARATING FREQUENCY DISTRIBUTIONS
Summary results for SAMPLE No. 1 . File : TAR

GROUP No.	MEAN	STANDARD DEV.(s.d.)	POPULATION (N)	SEPARATION INDEX (S.I.)
1	19.35	0.651	17.220	-
2	24.13	0.694	77.180	7.111
3	26.91	0.820	54.710	3.670
4	29.43	0.633	32.920	3.458
5	31.07	0.346	11.040	2.784
6	32.75	0.268	1.930	4.132

S.I. should be >= 2 for groups to be meaningfully separated

Fig. 2.- Total length frequency distribution (0.5 cm) with calculated of striped sea bream (*Lithognathus mormyrus* L.) age groups from the Kastela Bay (summer season) and Tar Estuary (winter season)

At 95% level of confidence, the expected distribution is significantly different from the observed distribution for both seasons, presumably due to small number of young fishes (1°, 2° and 3°).

Therefore, these studies should be continued.

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The demografic modeling of the Mediterranean Loggerhead Sea Turtle Population : First results

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A demographic model is an analysis tool that permits the exploration of the dynamics and the functionning of a population. We have undertaken the demographic modeling of the Mediterranean population of the Loggerhead turtle *Caretta caretta*. Because the data were sparse, we decided to consider different hypotheses, thus we constructed three models. They have been compared to that of CROUSE *et al.* (1987). Our method is more general and our results distinguish themselves from the conclusions of these authors. We present here the results of a sensitivity analysis of the population realized with the most appropriate of the three models, and we present propositions for conservation of the species.

Constructing the model. We chose a stage-structured matrix population model for two reasons : the very rare demographic data available are linked to size or fecundity stages (no method permits determining the age of sea turtles) and the size rather than the age seems to influence the demography of these marine reptiles. Starting from a synthesis of the information on the size of the individuals captured by different fishing techniques in the Mediterranean, four size-based stage classes have been determined among the young. These stage are defined by carapace length (SCCL, cm): stage classes Yl >12-32≤, Y2 >32-51≤, Y3 >51-70< and Y4 ≥ 70. Two stages were defined for the nesting females : neophyte females and adult females. Fecundity parameters were estimated from Mediterranean and worldwide bibliographic data Transition parameters between the stages were calculated using CASWELL's work (1989), based on stage duration and on age of first reproduction. This age is unknown and three possible values were considered: 15, 20 and 25 years. We propose ranges of the possible variation for survival rates. For each age the lowest and highest values of survival rate were used in our model Hence the sensitivity analysis is based on 6 matrices (Fig. 1). The construction and analysis of the models were realized with the program ULM (LEGENDRE *et al.*, 1992).

Fig. 1. - matrix model and definition of the parameters. Pi=zi*Si, Gi=(1-zi)*Si, zi : probability of remaining in the same stage, Si : annual survival rate, F1SO=d*r*g*w*SO, F2SO=a*r*g*w*SO (F1SO and F2SO representing the fecundity), r : sex ration, d : coefficient of egg productivity in neophytes, a : annual proportion of reproductive adults, g : cluth frequency, w : cluth size, SO : survival from egg to age one year, Sa : adult annual survival rate.

$$\begin{matrix} P1 & 0 & 0 & 0 & F1SO & F2SO \\ G1 & P2 & 0 & 0 & 0 & 0 \\ 0 & G2 & P3 & 0 & 0 & 0 \\ 0 & 0 & G3 & P4 & 0 & 0 \\ 0 & 0 & 0 & G4 & 0 & 0 \\ 0 & 0 & 0 & 0 & Sa & Sa \end{matrix}$$

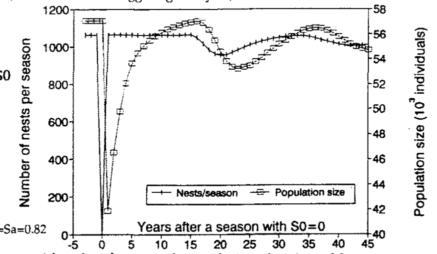

Fig. 2. - Simulation.
age 20 years, S1=0.70, S2=S3=0.81, S4=Sa=0.82

Sensitivity analysis. We first considered a theoretical population that is stable, stationary and non-exploited. The relative contribution of each matrix element (elasticity) to the population growth rate (λ) allows us to rank the importance of these different demographic elements. Fecundity is the element with the weakest contribution to λ, its participation varies from 5.7 to 2.2 %. The adult survival has a contribution which varies from 14.4 to 48 %, the remainder being due to growth of the young. We can illustrate the weak importance of fecundity by an example. For the Zakynthos subpopulation (1061 nests in 1984, STPS 1989), the simulation of one season with a fecundity equal to zero (S0=0) shows that the consequences are limited (Fig. 2).

The exploitation of a stage by fishing corresponds to an increase in the natural mortality (or a decrease in the survival rate). According to the stage considered, the disappearance of an additional individual doesn't have the same impact on the population. That impact is a function of the number of individuals in the stage and of the elasticity of λ with respect to the survival rate. The demographic structure of the model population (stable stage distribution) is given by the right eigenvector w of the matrix. Thus one can obtain the theoretical size of each stage. In the Mediterranean, we can consider that only individuals of size superior to 32 cm (SCCL) are retained (accidentally) by present fishing techniques. Stage Y2 is captured especially by the Spanish long lines, in the Balearic islands (Greenpeace, 1991) and in smaller amount in France (LAURENT, 1991), stage Y3 is captured in Italy (ARGANO, personal comm.), in Tunisia (LAURENT, unpuplished) and Malta (GRAMENTZ, personal comm.). Stage Y4 and the two stages of nesting females are especially taken in the east Mediterranean by trawling (LAURENT *et al.*, 1990, MARGARITOULIS *et al.*, 1991). These three last stages form the stage of individuals with a size equal or superior to 70 cm (SCCL), called stage 70. Sensitivity analysis makes it possible to measure the importance for the population of an individual from different stages. An individual of stage 70 is 75 to 654 times as important as an egg, 7.6 to 26.3 times as important as an individual of stage Y2 and 3.2 to 4.3 times as important as an individual of stage Y3.

Application for the conservation of the Loggerhead in the Mediterranean. Because of perturbation by fishing, reduction of the natural or anthropogenic mortality of eggs should be continued but that measure is not sufficient to assure the survival of the species. A better strategy would be to orient action to protection of the adults as a first priority. In practice of course it would be easier simply to protect stage 70. It is therefore necessary to take a census of all fishing techniques that capture individuals of this stage in order to identify and apply specific measures of protection, especially in the eastern Mediterranean. We have no information on trawling in Libya or Egypt. At laying sites, all adult mortality of human origin should be stopped, in particular boats or coastal fishing should not be allowed near nesting beaches.

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