Stock assessment of Sprat Sprattus sprattius L. of Bulgarian Black Sea Coast, using Length Cohort Analysis

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Stock assessment of Sprat *Sprattus sprattius L.* off Bulgarian Black Sea Coast, using Length Cohort Analysis

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First attempt is made, to evaluate the dynamics of abundance and mortality of sprat stock by means of Length Cohort Analysis(LCA) (JONES, 1981).

Length composition data for Bulgarian sprat catches was averaged generally by 3 years over the period 1945-92 and the resulting pseudo-cohorts were assumed to be under steady state conditions.

LCA was performed using ANALEN software package (CHEVAILLIER et LAUREC, 1990), where an iterative procedure for running the analysis was employed. It was also possible to estimate the fishing mortality rates per fishing gear for 1970-92, when separated statistics for coastal(trapnets, beach seines) and trawl fisheries were available. Sensitivity analysis was taken into account, for the optimal choice of parameters.

It was not possible to estimate directly the von Bertalanffy's parameters, because of lack of satisfactory data covering all the period studied. Even though, such estimates were available for 1977-93 (DASKALOV, this vol.) we did not obtain reasonable results using these values. The procedure suggested by JONES(1990) gives closest results with previous studies (DASKALOV, 1993).

Table. A. Parameters used in anlysis

B. Basic results: $R_{7.0}$-recruitment at length 7.0cm in 10^6 numbers, $B_{7.0+}$- mean biomass at length 7.0cm and longer, in tons, $F_{7.0+}$ -average fishing mortality rate

	A.			*B.*		
years	*k(Loo=16)*	*M*	F_{12+}	$R_{7.0}$	$B_{7.0+}$	$F_{7.0+}$
45-49	0.156	1.2	0.026	2799.8	5474.5	0.176
56-59	0.155	1.2	0.048	4778.4	9643.6	0.171
60-62	0.164	1.2	0.025	19932.7	48059.6	0.02
63-65	0.188	1.2	0.021	3296.7	7405.2	0.119
66-68	0.239	1.2	0.011	2810.3	7615.7	0.069
69-71	0.239	1.2	0.026	2821.7	6410.6	0.173
72-74	0.265	1.2	0.048	9910.2	20143.2	0.105
75-77	0.241	0.95	0.06	22552.8	86126.6	0.049
78-80	0.185	0.95	0.0149	61142.7	213290.6	0.027
81-83	0.314	0.95	0.127	12540.5	42178.8	0.199
84-86	0.267	0.95	0.103	11376.2	30239.9	0.297
87-89	0.237	0.95	0.043	9649.1	27284.7	0.201
90-92	0.217	0.95	0.013	4899.0	15920.0	0.115

The average value *Loo*=16cm(1977-92) was assumed for all the period and then *k* was found:

$k=ln((Loo-l1)/(Loo-l2))$

where *l1* and *l2* were respective lengths-at- age 1 and 2 years (*Table,A*). Terminal length group(+) was chosen to be 12cm(75%*Loo*). Natural mortality rate was assumed - 0.95 for 1975-92 and 1.2 for 1945-74 - the last one, for the purpose of reflecting the higher predation in that period (STOYANOV, 1966, IVANOV and BEVERTON, 1985). Terminal fishing mortality rates were obtained according to DASKALOV's VPAestimates (1993). A functional regression built between catches(*C*) and fishing mortality rates(*F*) with coastal gears for 1975-92: was used to determine *F*+ values before 1975

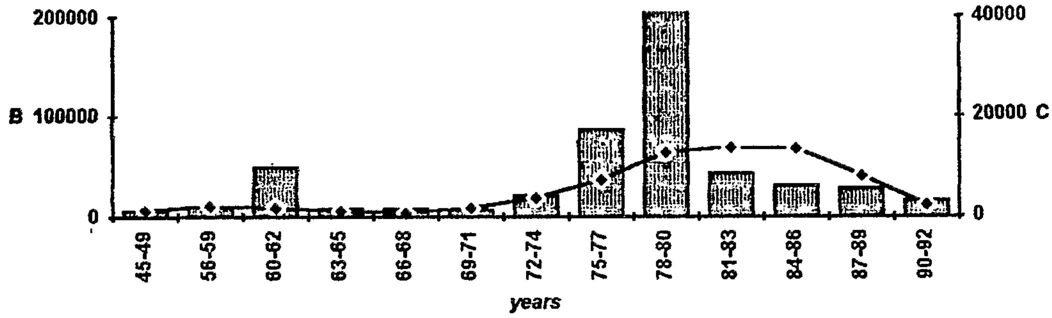

Fig. Sprat mean biomass(**B**) in tons(columns) and catches(**C**: free scale) with line: 1945-92

The evolution of the sprat stock state could be devised into three main stages(*Table,B Fig.*). In the years up to mid 70's, stock biomass remains relatively low in relation with strong predatory press. As an exception, we observe the period 1960-62, which higher abundance is probably resulting from the combination of stable recruitment and favourable environment at the end of 50's.The second stage is characterised by a very strong increase of stock biomass and fishing from mid 70's to mid 80's. Such an "explosion" could be related with the extinction of top predators in late 60's and early 70's, and the rise of the sea trophic level due to progressive eutrophication.The combined action of two factors explains the decrease in sprat biomass after the late 70's. In the beginning, the high nutrient abundance resulted in amelioration of the trophic base, but soon ,the outstanding eutrophication created different negative effects, like hypoxia and increasing domination of gelatinous megaloplancton, which is feeding on fish eggs and larvae and competes planctivorous fish on food. The second factor is obviously the fishing effort remaining too high at the same time when the standing stock is decreasing.

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