OBSERVATIONS ON THE VARIATION OF GILLRAKER NUMBER IN *SARDINA PILCHARDUS* (WALB.) FROM THE EASTERN ADRIATIC

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SUMMARY: Variations of the number of gillrakers in sardine from five fishing grounds along the eastern Adriatic coast were studied. No significant difference between studied sardine groups was found. However, two subpopulations of this species seem to be present in the Adriatic.

RESUME: On a étudié la variation du nombre de branchiospines chez la sardine provenant de cinq régions de pêche de la zone orientale de l'Adriatique. Même si l'on n'a pas trouvé de différences significatives entre les groupes, il est possible de percevoir la présence de deux subpopulations.

Fundamental property of the Adriatic Sea is, after ŠKRIVANIĆ and ZAVODNIK (1973), its hydrographic polarization. Northern "Alpic" Adriatic is shallower and more dynamic than the southern "Mediterranean" with deeper and more stable waters. In this connection it is assumed that probably two sardine subpopulations are present in the Adriatic the difference between them being in the direction, extent and time of their migrations (MUŽINIĆ, 1973; ŠKRIVANIĆ and ZAVODNIK, 1973). The level of homogeneity of certain sardine population from different fishing grounds may be determined by the variation of the number of gillrakers. This character may be an indicator of the species adaptation to different environments which are liable to changes (ANDREU, 1969).

For this study samples were obtained from five fishing zones going along the eastern Adriatic coast in a north-south directions: 1 - West Istrian coast, 2 - Kvarner Bay, 3 - Kornati, 4 - Kaštela Bay and 5 - off the island Šolta(Fig 1).Functional relations between the total length and total number of gillrakers on the first left branchial arch were calculated. Results are given in Table 1.

Table 1. Values of the allometric relationship between total length and number of gillrakers in sardine from the eastern Adriatic

Ranked localities	n	Total length range (mm)	Gillraker mean number	Gillraker increase rate	$S_{Y.X}^2 (\times 10^{-5})$
1	520	130 - 190	90.211 ± 1.296	0.4303 ± 0.0470	1.52
2	420	125 - 195	89.626 ± 1.505	0.4624 ± 0.0593	3.71
3	261	145 - 195	94.466 ± 1.173	0.4221 ± 0.0898	2.87
4	815	135 - 200	93.575 ± 1.285	0.3966 ± 0.0416	1.42
5	264	145 - 195	94.252 ± 0.947	0.4030 ± 0.0532	1.01

It was observed that the number of gillrakers was reduced and increase rate values greater in individuals from northern fishing grounds.

Pairs of group means were tested by TUKEY-KRAMER method and, even though minimum significant differences calculated have not shown significant differences (Table 2), they still provide a basis for the estimation of the level of distinction between groups.

Table 2. Minimum significant difference values (above the diagonal) and difference between group means (below the diagonal)

Ranked Localities	Ranked localities 1	2	3	4	5
1		5.078	5.490	5.162	5.637
2	0.947		5.319	4.980	5.471
3	4.327	5.274		5.399	5.855
4	3.496	4.443	0.831		5.448
5	3.457	4.404	0.870	0.039	

However, it may be seen that the differences between groups of the localities 1 and 2 (North Adriatic) and the other groups are very close to the critical value of significance, whereas there is no differences between them. No differences between groups from zones of the Middle Adriatic were observed, either.

Employing the concept of overlap described by ROYCE (1957) the extent to which the groups are different may be estimated. The results of overlap comparison between groups from successive areas show that the greater generalized distances correspond to greater differences

between groups (Table 3).

Table 3   Overlap percentages (above the diagonal) and generalized distances (below the diagonal) between groups

Ranked localites	Ranked localities				
	1	2	3	4	5
1		78.72	3.00	4.64	3.84
2	0.572		34.00	6.72	4.24
3	4.338	2.935		64.56	87.28
4	4.051	3.664	0.910		66.00
5	4.146	4.083	0.224	0.888	

It may be concluded that sardine from different study areas show differences in gillraker numbers even though these differences are not significant. By her studies on the number of gillrakers in
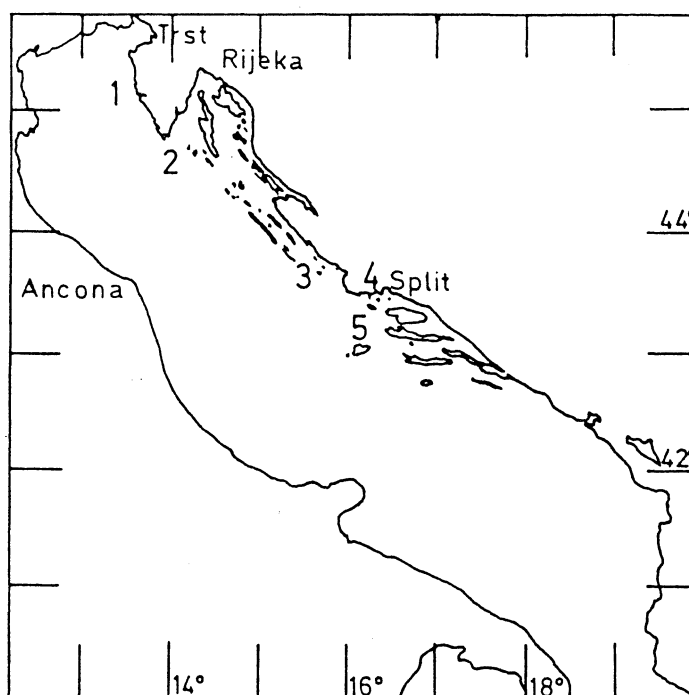

Fig. 1. Studies localities in the Adriatic Sea

sardine from the Northern and Middle Adriatic ALEGRIA HERNANDEZ (1983) proved significant differences between respective pattern of increase in the number of gillrakers in relation to the total body length. The gillraker increase rate is indicative of a tendency to stability of this character in sardine from the quite

stable Middle Adriatic waters. However the greater neotenia in sardine from the northern Adriatic is in agreement with the dynamic properties of the waters of this Adriatic area.

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