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BIOMETRIC COMPARISON OF CHUB MACKEREL (Scomber japonicus Houttuyn, 1782) FROM THE MEDITERRANEAN AND RED SEA, EGYPT

By

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ABSTRACT

*Morphological differentiations between chub mackerel (**Scomber japonicus**) populations from the Egyptian Mediterranean and Red Sea waters were investigated. Mediterranean mackerel forms a distinct population as compared with that of the Red Sea one. The latter population is found to have comparatively larger morphometric dimensions specially in head, mandible, eye diameter, inter-orbital, ventral and pectoral fins . Concerning meristic counts, Mediterranean population shows non-overlap in the number of first dorsal fin spines as compared with that of the Red Sea . Also it shows larger number of rays in second dorsal and anal fins while the reverse is true in the case of other meristic characters (pectoral rays and vertebrae) .*

INTRODUCTION

Chub mackerel (***Scomber japonicus*** Houttuyn, 1782) is a cosmopolitan species inhabiting warm and temperate waters of Atlantic, Indian and Pacific oceans and adjacent seas . It is one of the most important fish constituents of the Egyptian purse-seining (Faltas, 1983).

The importance of determining the identity of fish populations is essential in fisheries investigations. Matsui (1967) differentiated three populations of ***S. japonicus*** in the temperate zones of Pacific and west & east Atlantic oceans . Also Ouchi and Hamasaki (1979) analysed ***S. japonicus*** populations in western

Japan & East China seas and named them as the west Kyushu population, South East and west East China Sea populations.

The aim of the present study is to find the morphological differences of the two populations of the chub mackerel present in the Egyptian Mediterranean and Red Sea waters .

MATERIALS AND METHODS

Fish samples were monthly collected from the catch of purse-seiners landed at Alexandria (Mediterranean Sea) and Suez (Red Sea) during 1994 . A total of 114 and 95 fish of more or less the same sizes (23 - 34 cm. and 22 - 33 cm.) from Alexandria and Suez fishing centres respectively were analysed for the present comparison .

The following morphometric measurements were taken to the nearest millimeter: total (TL), fork (FL) & standard (SL) lengths, pre-first dorsal (PrD_1), post-first dorsal (PD_1), pre-second dorsal (PrD_2), post-second dorsal (PD_2), pre-ventral (PrV), pre-pectoral (PrP), pre- anal (PrA) & post-anal (PA) fins, ventral (VL) & pectoral (PL) fin lengths, body depth (BD), head length (HL), pre-orbital (PrO), post-orbital (PO), eye diameter (ED), inter-orbital (IO), and mandibular (ML) lengths .

The meristic characters included total number of vertebrae, number of spines in first dorsal fin, number of rays in second dorsal, pectoral and anal fins were recorded .

Comparison of morphometric and meristic characters of samples from the two localities were carried out using covariance and variance analyses respectively (Snedecor and Cochran, 1967) .

RESULTS

Covariance analyses performed on morphometric regressions between Mediterranean and Red Sea samples are given in Table (1) . It is clear that fourteen out of the nineteen investigated morphometric characters show

Table (1): Comparison of morphometric characters of *S. japonicus* of the Egyptian Mediterranean and Red Sea populations .

Regression	Locality	b	a	r	F_b	F_a
FL / TL	Mediterr.	0.8299	21.8565	0.9959	2.40	1.70
	Red Sea	0.8787	6.6974	0.9972		
SL /TL	Mediterr.	0.8453	-2.9997	0.9981	0.07	13.81**
	Red Sea	0.8517	-3.5795	0.9978		
PrD_1 /TL	Mediterr.	0.3099	-4.1601	0.9972	1.67	18.57**
	Red Sea	0.3280	-7.0923	0.9934		
PD_1 / TL	Mediterr.	0.4996	-19.0821	0.9941	5.33*	7.95*
	Red Sea	0.4419	-0.2192	0.9918		
PrD_2 / TL	Mediterr.	0.5706	-3.9444	0.9987	2.00	13.92**
	Red Sea	0.5965	-8.7538	0.9965		
PD_2 / TL	Mediterr.	0.6641	-6.3576	0.9980	0.05	28.77**
	Red Sea	0.6677	-4.3154	0.9989		
PrV / TL	Mediterr.	0.2525	3.3159	0.9879	11.61**	38.71**
	Red Sea	0.3009	-6.9846	0.9975		
VL / TL	Mediterr.	0.1126	-6.5541	0.9813	8.36**	28.33**
	Red Sea	0.0893	1.6910	0.9902		
PrP / TL	Mediterr.	0.1976	12.7110	0.9951	16.76**	11.72**
	Red Sea	0.2502	7.6923	0.9901		
PL / TL	Mediterr.	0.1188	4.9945	0.9879	2.94	25.63**
	Red Sea	0.1024	1.3615	0.9740		

Table (1) : cont.

Regression	Locality	b	a	r	F_b	F_a
PrA / TL	Mediterr.	0.5876	-1.6524	0.9969	2.79	0.96
	Red Sea	0.6294	-12.4782	0.9949		
PA / TL	Mediterr.	0.6318	4.4351	0.9965	4.25	6.77*
	Red Sea	0.6788	-6.5244	0.9982		
BD / TL	Mediterr.	0.1461	1.3811	0.9441	0.74	0.22
	Red Sea	0.1609	-2.4833	0.9932		
HL / TL	Mediterr.	0.1732	15.3499	0.9963	25.09**	14.61**
	Red Sea	0.2310	1.4308	0.9898		
PrO / HL	Mediterr.	0.3518	-3.9420	0.9818	0.57	3.11
	Red Sea	0.3303	-2.6830	0.9847		
PO / HL	Mediterr.	0.3419	5.0743	0.9841	2.91	0.005
	Red Sea	0.3929	1.7492	0.9863		
ED / HL	Mediterr.	0.2341	-2.2971	0.9781	7.42*	2.37
	Red Sea	0.2884	0.9750	0.9917		
IO / HL	Mediterr.	0.3858	-11.5945	0.9869	19.61**	1.94
	Red Sea	0.2563	-2.8157	0.9719		
ML / HL	Mediterr.	0.5798	-6.0738	0.9891	1.77	9.99**
	Red Sea	0.5363	-2.5728	0.9956		

F_b : Test of regression coefficient .
F_a : Test of adjusted mean .
* : Significant at 5% .
** : Significant at 1% .

significant differences . These are in order of decreasing importance PD_2, PrV, VL, PL, HL, IO, PrD_1, PrP, PrD_2, SL, ML, PD_1, ED and PA . The differences are highly significant at 1% level except the last three which have significant differences at 5% level . As indicated from the present analysis, the Red Sea fish have posteriorly placed dorsal, pectoral and ventral fins in addition to larger pectoral and ventral fins . The same for head, eye diameter and mandible lengths which seem to be relatively larger in the Red Sea (Fig. 1) .

Concerning meristic characters, their frequency distributions in the two localities are given in Table (2) . It is obvious that Mediterranean population show no-overlapping with those of Red Sea with respect to dorsal fin spines having ranges of 8-9 and 10-12 spines respectively . Also the Mediterranean population shows smaller number of vertebrae and pectoral fin rays while the reverse is true with the other two meristic characters (second dorsal and anal fins rays) .

Results obtained from comparing the five meristic characters in the two localities using variance analysis show significant variations between the two means .

DISCUSSION

Various authors have shown that biometeric characters of the early developmental stages of fishes are influenced by different environmental factors such as temperature and salinity (Schmidt, 1921; Vladykov, 1934; Howard, 1954; Lindsey, 1954 and Barlow, 1961) .

Comparison of morphometric regressions in the present study revealed the presence of statistically significant differences for most of characters . In Red Sea, chub mackerel population have comparatively larger morphometric dimensions in head, mandible, eye diameter, inter-orbital, ventral & pectoral fins. These morphometric differences between the two populations may be an adaptation to the different environmental conditions . Mc Hugh (1951) and Taning (1952) showed that meristic count varies inversely with temperature. This finding is only in parallel in the present study to the rays count of unpaired fins (second dorsal and anal fins) whereas disagreement is observed in the other meristic counts (first dorsal fin spines, pectoral fin rays and vertebrae).

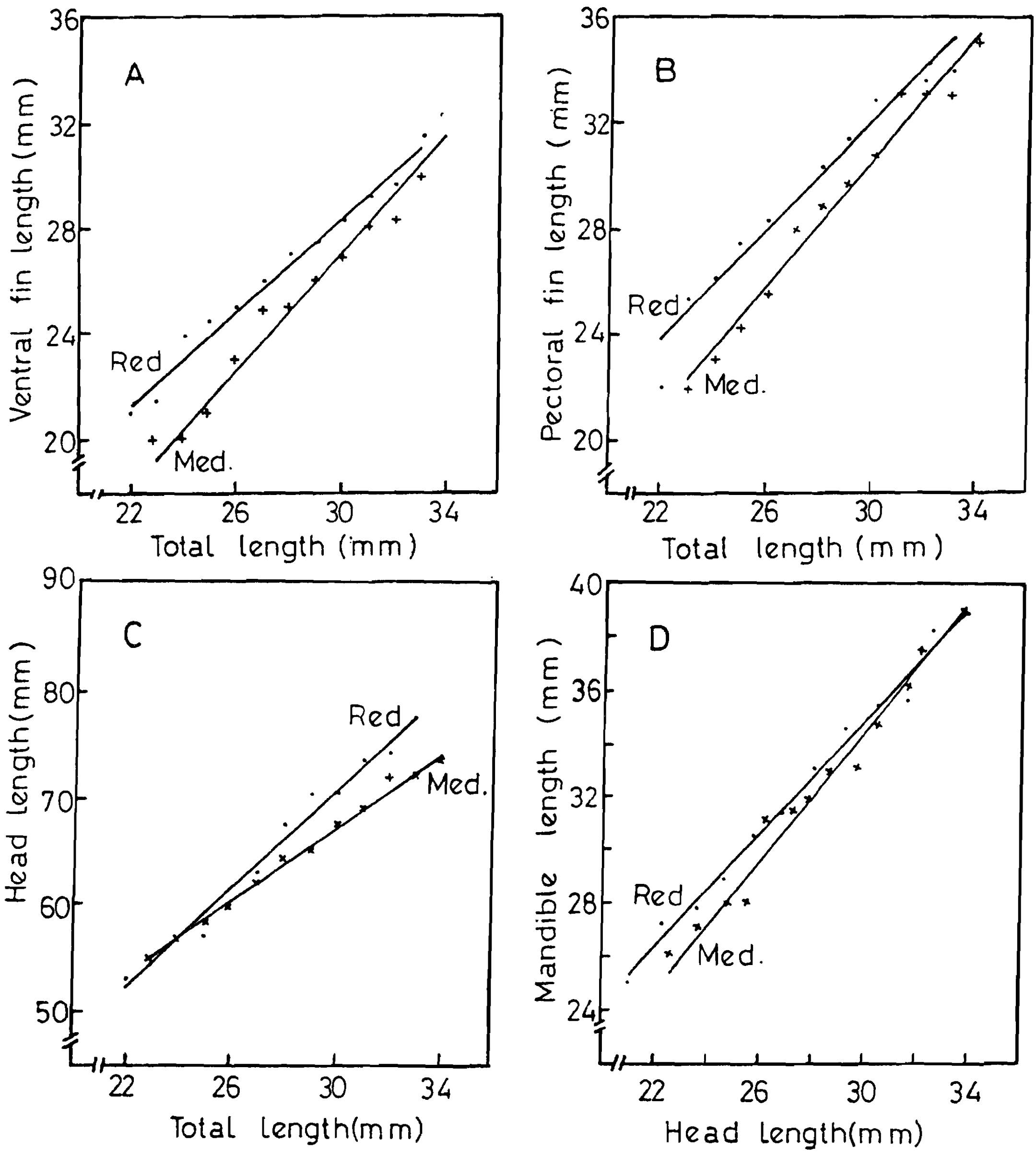

Fig. (1): Regressions between total length and (A) ventral fin length, (B) pectoral fin length, (C) head length and (D) between head length & mandible length for *S. japonicus* of Egyptian Mediterranean and Red Sea populations.

Table (2) : Frequency distribution of different meristic characters for *S. japonicus* of Egyptian Mediterranean and Red Sea populations.

Locality	No.of first dorsal fin spines	Mean	Standard deviation ±	Standard error ±	F
	8 9 10 11 12				
Mediter. Sea	19 95 (8, 9)	8.83	0.37	0.03	594**
Red Sea	56 35 4 (10, 11, 12)	10.45	0.58	0.59	
	No.of second dorsal fin rays				
	11 12				
Mediter. Sea	9 105	11.92	0.27	0.03	1098**
Red Sea	95 (11)	11.00	0.00	0.00	
	No. of pectoral fin rays				
	17 18 19 20				
Mediter. Sea	9 80 25 (17, 18, 19)	18.14	0.53	0.05	1540**
Red Sea	56 37 2 (18, 19, 20)	18.43	0.54	0.06	
	No. of anal fin rays				
	10 11 12				
Mediter. Sea	52 62 (11, 12)	11.54	0.50	0.05	113**
Red Sea	1 94 (10, 11)	10.99	0.10	0.01	
	No. of vertebrae				
	29 30 31				
Mediter. Sea	13 101 (29, 30)	29.89	0.32	0.03	11.56**
Red Sea	95 (31)	31.00	0.00	0.00	

F : Test of variance **** : Significant at 1%**

coincides with Howard (1954) who found that the variation in temperature did't show any effect on the meristic counts of anchovy populations obtained from the area between Mexico and Peru while salinity may have this effect The complete non-overlap of dorsal spines in the two populations is in agreement with Blouw and Hagen (1987) who concluded that dorsal spine number is strongly constrained by natural selection to local equilibrium values that are highly variable geographically .

A comparison of the different meristic characters of chub mackerel in the present study with those in other localities is given in Table (3) . It is clear that the number of spines in the first dorsal fin of the Mediterranean chub mackerel coincides with that given by Kramer (1969) for those of the Pacific Ocean (8-9 spines) whereas it is situated nearly in the same range (8-10 spines) as reported by Whitehead ***et al.*** (1984) and Fischer ***et al.*** (1987) for those of Eastern Atlantic Ocean and Mediterranean Sea . On the other hand, number of spines in the first dorsal fin for Red Sea chub mackerel is not similar to those given in other localities . The number of vertebrae, in the population of the Mediterranean ***S. japonicus*** in the present study is less than that mentioned in other areas . As regard to the number of fin rays, it is observed to be differentiated from one area to another .

Generally as the two populations of the Mediterranean and Red Sea markedly differ in morphology, these differences may be genetically based or environmentally induced and fixed early in life reflecting phenotypic plasticity, a modification of development in response to different environments (Lindsey and Arnason, 1981; Caswell, 1983; Smith-Gill, 1983 and Meyer, 1987) . Further research is obviously required to distinguish between genetic differentiation and phenotypic plasticity.

Table (3) : A comparison of the different meristic characters of *S. japonicus* in the present study with those given in other localities.

Author	Locality	1st dorsal fin (spines)	2nd dorsal fin (rays)	Anal fin (spines)	(rays)	Verteb.
Fowler, 1936	-----------	9-10	10	2	11	--
Soljan, 1948*	Adriatic	>9	--	--	--	--
Leim and scott, 1966*	Atlantic Ocean	9-10	12	1	11	--
Kramer, 1969	Pacific Ocaen	8-9	9-13	2	9-11	--
Collette and Nauen, 1983	Pacific & Atlantic	9-10	--	--	--	31
Fischer and Bianchi, 1984	Atlantic, Indian & Pacific	9-10	--	--	--	--
Whitehead *et al.*, 1984	Eastern Atlantic & Mediterranean	8-10	--	--	--	31
Fischer *et al.*, 1987	Mediterranean	8-10	--	--	--	--
Present study, 1995	Mediterranean Red Sea	8-9 10-12	11-12 11	1 1	11-12 10-11	29-30 31

* *S. colias* = ***S. japonicus***

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