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POPULATION STUDIES ON THE FISHES OF THE GENUS *CHIROCENTRUS* CUVIER*

G. LUTHER** AND S. K. DHARMA RAJA

Central Marine Fisheries Research Institute, Cochin 682031

ABSTRACT

Four important morphometric characters namely, head length, predorsal distance, depth of body and pectoral fin length have been analysed in respect of the two species of *Chirocentrus* namely, *C. nudus* and *C. dorab* from the Palk Bay and the Gulf of Mannar around the Rameswaram Island. The method of regression was used and comparisons were made using the analysis of covariance to find out the significant difference in the regressions between the sexes and localities. The significance of the difference was tested at 1% level of probability. The results indicate that in the case of *C. nudus* the pectoral fin is longer in male than in female and that each species of *Chirocentrus* occurring in the two localities could belong to the same popu- lation.

INTRODUCTION

DISTRIBUTION of fish with mature gonads was found to be not homogeneous between the two adjacent localities namely, the Palk Bay and the Gulf of Mannar around the Rameswaram Island (Lat. 9°17′ N; Long. 79° 17′ E) in respect of both the species of *Chirocentrus* namely, *C. dorab* (Forskal) and *C. nudus* Swainson. More fish in advanced stages of maturity was found in the Gulf of Mannar than in the Palk Bay (Luther, 1975). For the commercially exploited species of fishes it is important to know whether their catch from different localities come from a single population or different populations. If the catch from different localities belongs to the same population, the corresponding fishing intensity at one place will have its effect in due course at other centres too. Knowledge of the different populations of a species is also important in understanding its biology and life history. In view of these factors, an attempt has been made to ascertain whether or not fish of each of the two species of *Chirocentrus* that occur in the fisheries of the two localities belong to the same population. Four important morphometric characters were examined for this purpose and the results are presented in this account.

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MATERIAL AND METHODS

Material for this study was collected during the intense spawning period, March - June of 1969 for both the species, namely, *C. nudus* and *C. dorab* from the Palk Bay and the Gulf of Mannar around the Rameswaram Island under the limited proposition that the adult fish belonging to a particular stock would return to the same fixed spawning ground year after year (Cushing, 1968). Measurements were taken on fresh fish in the field. For the present study four morphometric characters were selected. They are defined as follows:

Head length : Distance from the tip of snout to end of operculum.

* Formed a part of Ph. D. Thesis, Andhra University, Waltair.

***Present address*: Waltair Research Centre of CMFRI, Waltair.

Predorsal distance : Distance from snout to origin of dorsal fin.

Depth of body : Depth at base of pelvic fin.

Pectoral fin length : Maximum length of the fin from base to tip.

Standard length measured from tip of snout to mid base of caudal fin was taken as an independent character and other measurements as dependent ones. Males and females from the two localities were treated separately. Thus the four regressions obtained for each character (designated as Y) on standard length (X) were compared by the method of analysis of covariance to find out if significant differences existed in the regressions between sexes and localities at 1% probability level.

Regression Analysis of Morphometric Characters

C. nudus

The analyses of covariance for testing the significance of the difference in the four regressions of each character are presented in Table 1 and Fig. 1, 2. The results of analyses briefly are as follows:

Table 1. *Analysis of variance for comparison of regression lines fitted on data of four morphometric characters on standard length relating to males and females of* C. nudus *from the Palk Bay and the Gulf of Mannar*

Test for equality of	Source of variation	Head length df	SS	MS	F	Predorsal distance df	SS	MS	F
Regression Coefficients	Deviation from hypothesis	3	18.32	6.11	(NS)	3	37.35	12.45	(NS)
	Residuals due to separate regressions	141	1441.91	10.23		141	2176.36	15.44	
	Residuals due to pooled regression (W)	144	1460.23	10.14		144	2213.71	15.37	
Elevation	Deviation from hypothesis	3	109.52	36.51	3.60 (NS)	3	16.75	5.58	(NS)
	Residuals due to common regression	147	1569.75			147	2230.46		

Test for equality of	Source of variation	Depth of body df	SS	MS	F	Pectoral fin length df	SS	MS	F
Regression Coefficients	Deviation from hypothesis	3	91.72	30.57	2.06	3	20.61	6.87	(NS)
	Residuals due to separate regressions	141	2094.65	14.86	(NS)	141	1149.02	8.15	
	Residuals due to pooled regressions (W)	144	2186.37	15.18		144	1169.63	8.12	
Elevation	Deviation from hypothesis	3	141.55	47.18	3.11 (NS)	3	325.63	108.54	13.37 (S)
	Residuals due to common regression	147	2327.92			147	1495.26		

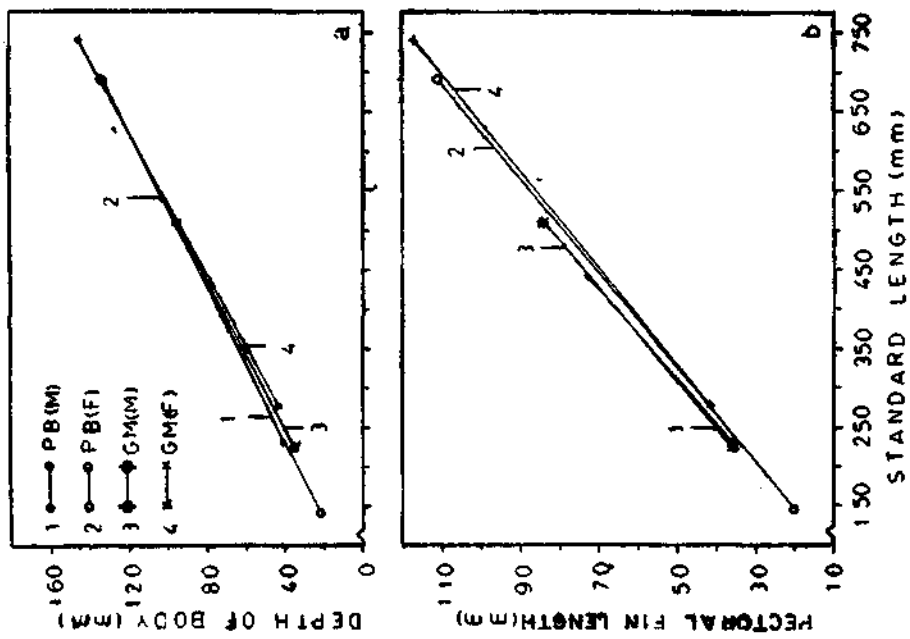

Fig. 2. Comparison of four samples of *C. nudus* for two morphometric characters, namely, depth of body (a) and pectoral fin length (b).

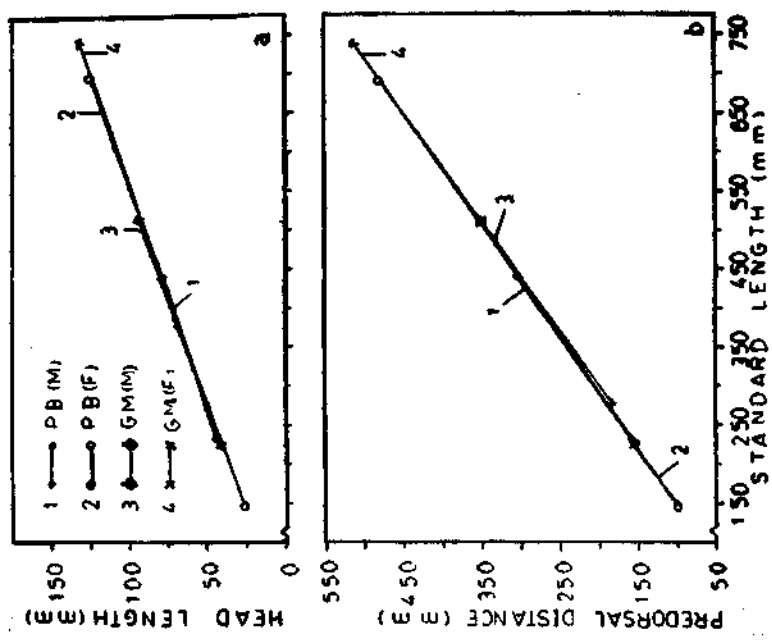

Fig. 1. Comparison of four samples of *C. nudus* for two morphometric characters namely, head length (a) and predorsal distance (b).

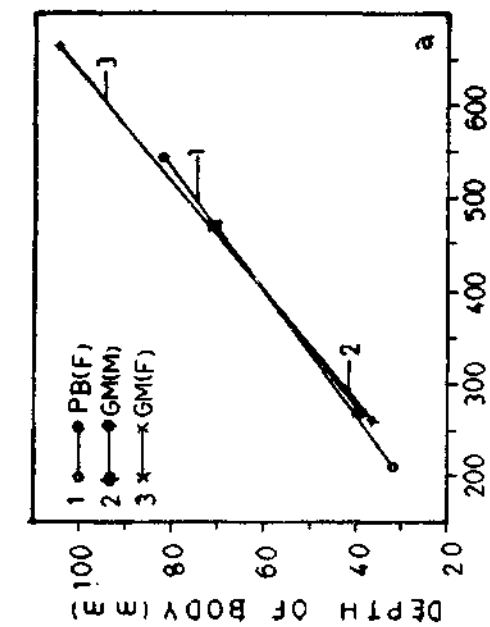

Fig. 4. Comparison of three samples of *C. dorab* for two morphometric characters, namely, depth of body (a) and pectoral fin length (b).

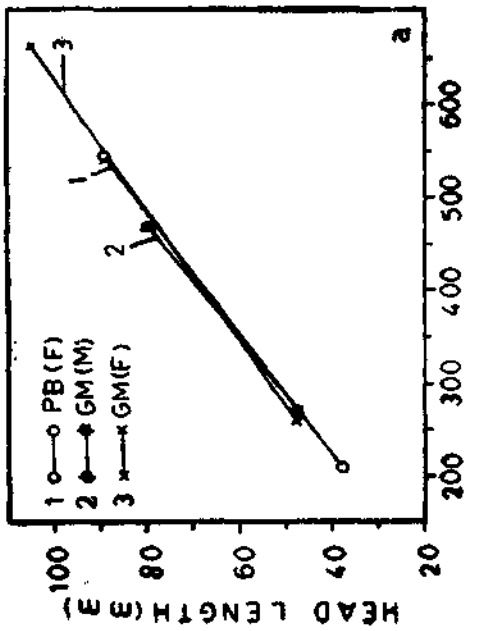

Fig. 3. Comparison of three samples of *C. dorab* for two morphometric characters, namely, head length (a) and predorsal distance (b).

In the comparison of slopes the four morphometric characters examined for male and female of the Palk Bay and the Gulf of Mannar do not show significant differences. In the comparison of elevations, however, the difference in the regression lines is significant for only one character namely, pectoral fin length. Hence data relating to pectoral fin were further analysed by the same method in pairs. The two comparisons made within males and females of the two localities show no significant difference, but comparisons involving opposite sexes from the two localities show significant difference. This would indicate that the difference is related to sex and not to locality. This is clearly seen in Fig. 2 b where it may be noticed that the regression lines of this character relating to male of both the localities have a higher elevation than those of female. This further indicates that male has relatively longer pectoral fin than female. In view of the foregoing observations it may be stated that as far as these four morphometric characters are concerned, *C. nudus* occurring in the Palk Bay and the Gulf of Mannar could belong to the same population.

The regression equations for the four characters of *C. nudus* are as follows:

Head length: $Y = 3.209654 + 0.174560\ X$; $r = 0.9906$

Predorsal distance: $Y = -5.896137 + 0.701486\ X$; $r = 0.9992$

Depth of body: $Y = -8.486452 + 0.203812\ X$; $r = 0.9898$

Pectoral fin length

Male: $Y = -2.571890 + 0.170409\ X$; $r = 0.9786$

Female: $Y = -3.090271 + 0.163335\ X$; $r = 0.9911$

C. dorab

The analyses of covariance for testing the significance of the differences in the there regressions of each character are presented separately in Table 2 and Fig. 3, 4. Males were not available for study during the period from the Palk Bay area.

Results of the covariance analyses of the four morphometric characters show no significant difference for all the four characters in the comparison of slopes as well as elevations even at 5% level. Thus the samples drawn from the Palk Bay and the Gulf of Mannar cannot be said to be significantly different and presumably so far as these four characters are concerned. *C. dorab* occurring in the Palk Bay and the Gulf of Mannar belong to the same population.

The regression equations for the four characters of *C. dorab* are as follows:

Head length: $Y = 8.613964 + 0.146605\ X$; $r = 0.9466$

Predorsal distance: $Y = -8.678841 + 0.712848\ X$; $r = 0.9439$

Depth of body: $Y = -5.146628 + 0.163278\ X$; $r = 0.9615$

Pectoral fin length: $Y = 1.095231 + 0.119611\ X$; $r = 0.9794$

Discussion

The two localities from which fish have been compared in the present study are contiguous and the two species of *Chirocentrus* are pelagic and shoaling fish. Observations on the daily catch trends of *Chirocentrus*, particularly of *C. nudus* around the Rameswaram Island, as well as field enquiries with the fishermen have revealed that intense fishing for the wolf herrings around the Rameswaram Island shifts very

TABLE 2. *Analysis of variance for comparison of regression lines fitted on data of four morphometric characters on standard length relating to males and females of* C. dorab *from the Palk Bay and the Gulf of Mannar*

Test for equality of	Source of variation	Head length				Predorsal distance			
		df	SS	MS	F	df	SS	MS	F
Regression Coefficients	Deviation from hypothesis	2	47.85	23.92	1.38 (NS)	2	152.88	76.44	(NS)
	Residuals due to separate regressions	114	1976.94	17.34		114	47105.49	413.21	
	Residuals due to pooled regression (W)	116	2024.79	17.46		116	47258.37	407.40	
Elevation	Deviation from hypothesis	2	16.37	8.19	(NS)	2	24.91	12.46	(NS)
	Residuals due to common regression	118	2041.16			118	47283.28		

Test for equality of	Source of variation	Depth of body				Pectoral fin length			
		df	SS	MS	F	df	SS	MS	F
Regression coefficients	Deviation from hypothesis	2	61.80	30.90	2.22 (NS)	2	14.88	7.44	1.93 (NS)
	Residuals due to separate regressions	114	1585.69	13.91		114	438.84	3.85	
	Residuals due to pooled regressions (W)	116	1647.49	14.20		116	453.72	3.91	
Elevation	Deviation from hypothesis	2	5.66	2.83	(NS)	2	7.24	3.62	(NS)
	Residuals due to common regression	118	1653.15			118	460.96		

frequently, almost twice or thrice in a week, from the Palk Bay to the Gulf of Mannar and *vice versa*. These observations indicate that fish in the two localities mix freely.

Regression analyses of the four morphometric characters of male and female also show no significant difference between samples from the Palk Bay and the Gulf of Mannar for both the species in the comparison of slopes and only for *C. nudus* in the comparison of elevations. This latter difference which is evident only for pectoral fin length of *C. nudus* has been found to be related to sex and not to heterogenity of populations in the two localities. The absence of this difference in the case of *C. dorab* may be due to the smaller number of males that have been employed for comparison. There is, therefore, reason to believe that fish of each species of *Chirocentrus* occurring in the Palk Bay and the Gulf of Mannar around the Rameswaram Island belong to the same population.

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