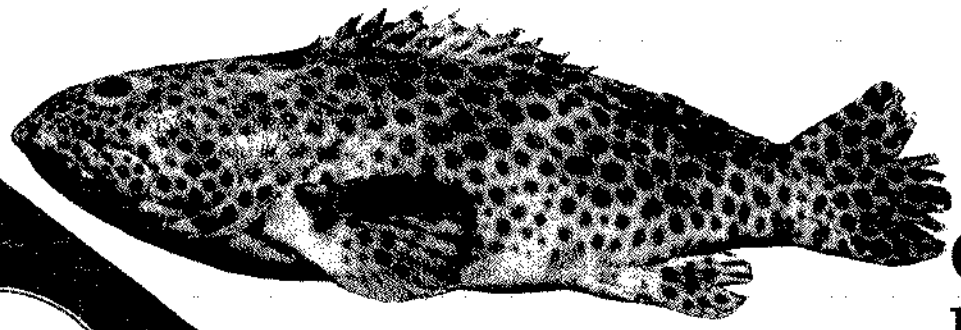

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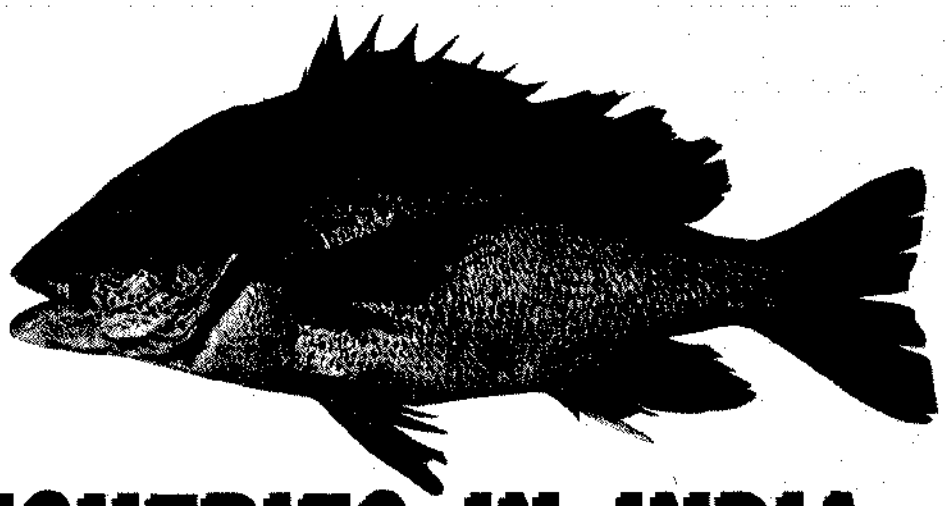

PERCH FISHERIES IN INDIA

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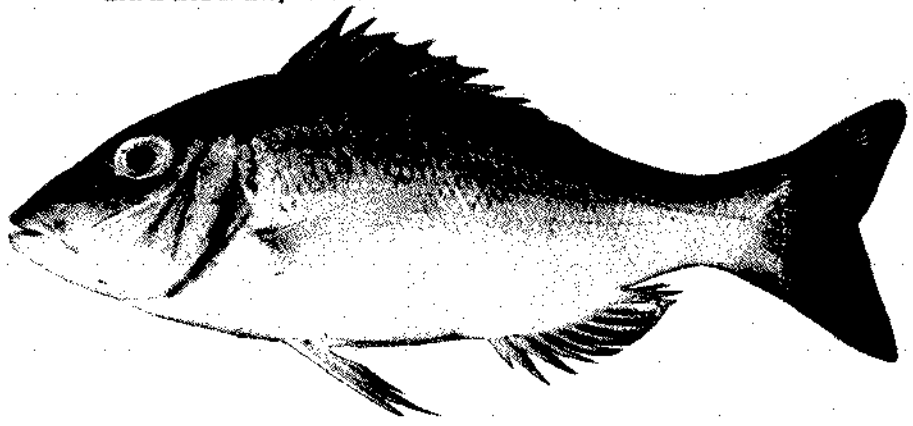

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THE PERCH FISHERY BY TRADITIONAL TRAPS AT KILAKARAI (GULF OF MANNAR) AND SOME ASPECTS OF BIOLOGY OF *LETHRINUS NEBULOSUS* (FORSKÅL)

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ABSTRACT

Exploitation of perch resources off Kilakarai in the Gulf of Mannar, by traditional traps is studied. The increase in perch landings and the change in succession of species are attributed to the change in mode of operation, area of operation and increase in the usage of prawn peelings predominantly as baits in place of traditional baits. The biology of the dominant species *Lethrinus nebulosus* is studied. The age and growth of this species is described from the length frequency data collected from the landings of perch traps. The length-weight relationship and food and feeding are dealt in detail. The mortality coefficient namely natural (M), total (Z) and fishing (F), exploitation rate (U) and yield per recruit in relation to different F, M/K ratios keeping the age at first capture constantly at the prevailing level (0.2913 yr) have been estimated to assess the present status of the fishery of this species. It is inferred that this species is exposed to higher fishing intensity by the perch trap units as the prevailing fishing mortality coefficients are higher than the F_{max} which can bring about the yield max for the prevailing M/K ratio. This finding is attributed as one of the possible reasons for the continued decline in the percentage composition of *L. nebulosus* in the perch trap landings since 1950s.

INTRODUCTION

Perch fishery in India is sustained by a large number of species belonging to thirty seven genera and the perch production by mechanised units have been assessed to be higher (72.4%) than the non-mechanised units (Kasim *et al.*, 1989). On exploitation of this resource by traditional gear only a few accounts by Prabhu (1954), Lal Mohan (1985) and others are available. Among the traditional gear, the trap of Kilakarai centre is unique in exploiting the perches in the Gulf of Mannar. Initially the perch-traps have been described in detail by Hornell (1950) followed by Prabhu (1954) and the latter has given not only on the fabrication and mode of operation of the traps, but fairly a good account on the fishery also. There had been a subtle change in the mode of operation and consequently a change in the catch composition also in 1970s (Lal Mohan, 1985). Present account deals not only with the mode of fishing, area of fishing, catch statistics, species composition, but also the growth, food and feeding and some aspects of population dynamics of *Lethrinus nebulosus* which is the dominant species among the perches landed by trap fishing units at Kilakarai.

MATERIAL AND METHODS

Weekly observations were made at Kilakarai (09° 14' N, 78° 47' E) fish landing centre and data on catch, effort and species composition were collected during 1983 - 1985. The catch estimate on the sampling day was obtained by raising the observed catch to total number of trap fishing units operated on that day. Subsequently, the monthly catch and effort estimates were obtained by raising the sampling days catch and effort to the total number of fishing days in that respective month. Length frequency of the dominant species *Lethrinus nebulosus* was also collected on the sampling days and samples of this species were obtained for biological studies whenever possible.

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FISHERY

Mode and area of fishing : There has been no change in the structural design and material used for the fabrication of perch traps at Kilakarai from that described by Hornell (1950) and Prabhu (1954). During 1970s, consequent to the installation of prawn processing plants in and around Mandapam area, the perch trap fishermen started using the prawn peels and heads as the dominant baits in traps in addition to the traditional baits like the cephalopods, crabs, holothurians, clupeid fishes and jellyfishes. Lal Mohan (1985) has attributed the increase in the catch in traps in the Gulf of Mannar when compared to the Palk Bay to the use of prawn peels and prawn heads as bait in the traps since early 1970s. It appears from the account of Prabhu (1954) the area of operation of perch traps were limited to near shore waters and the distance of operation varied from 20 to 300 m from shore where the bottom is sandy and it was 600 to 800 m where the bottom is rocky. Now the operation of the perch traps is not near shore, but located around the nearby islands namely Anai Par, Valiamunai, Kilinjan Par, Appa Island, Valai Island and Mulli Island which are about 8 - 10 km away from Kilakarai (Fig. 1).

Catch statistics : As seen from the data on estimated fishing effort of trap fishing units and catch of perches by traps at Kilakarai given in Table 1, the catch increased in subsequent years from 1983 to 1985 not only due to the increase in the effort input, but also due to the increase in the abundance of perches in subsequent years as indicated by the catch per unit effort which increased from 7.26 kg/unit in 1983 to 9.00 kg/unit in 1984 and then to 9.64 kg/unit in 1985. During 1983, it is seen from the catch rate, the abundance of perch was good in January, March, April, October and November whereas the catch was better in all the months except in February, May, July and September. In 1984, the catch was good in almost all the months, but the abundance was good only in January, April, May, August, October, November and December. On the other hand the catch was good in all the months in 1985 except in January and the abundance was good in March, May to september and December (Table 1). During the period of this study on an average 267 trap fishing units were operated and 2327 kg of perch were landed at the catch rate of 8.59 kg/unit in a month.

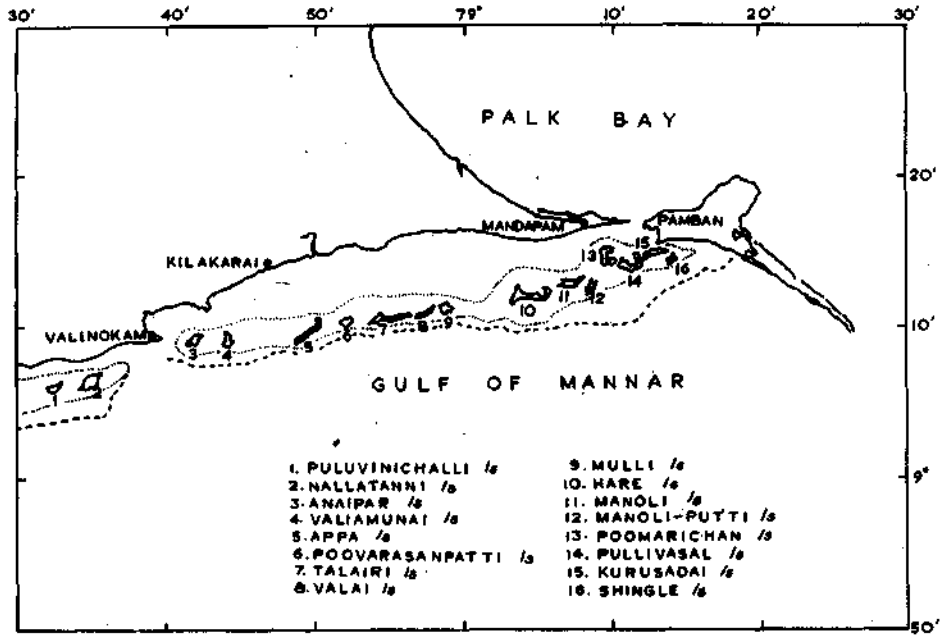

Fig. 1. Location of Kilakarai in the Gulf of Mannar and the area of trap fishing in the nearby islands such as Anai par, Valiamunai, Appa Island, Mulli Island and other islands.

Species composition : There appears to be a perceptible change in the species composition in

the catches by perch traps at Kilakarai since 1950s, when Prabhu (1954) reported that composition of *L. nebulosus* (45%) and *C. ghobban* (10%) whereas *Siganus canaliculatus*

TABLE 1. *Estimated effort of perch trap units, catch in kg of perch and catch per unit of effort in kg of perches landed at Kilakarai in the Gulf of Mannar during 1983 - 1985*

	1983			1984			1985		
	E	C	C/E	E	C	C/E	E	C	C/E
January	300	3120	10.4	260	2706	10.4	208	1248	6.0
February	280	960	3.4	230	1736	7.5	286	2470	8.6
March	264	2753	10.4	234	1521	6.5	338	3425	10.0
April	248	2769	11.2	210	3120	14.8	286	2418	8.4
May	300	832	2.7	312	2890	9.2	312	4708	15.0
June	338	2080	6.0	364	2908	8.0	288	3424	11.9
July	182	773	4.2	286	1978	6.9	338	3458	10.2
August	156	1125	7.2	208	1898	9.0	364	3454	9.5
September	130	734	5.6	260	1872	7.2	286	2550	9.0
October	156	1508	9.6	234	2319	9.9	286	2064	7.2
November	286	2600	9.1	286	2662	9.3	275	2408	8.7
December	208	1430	6.9	260	2704	10.4	340	3146	9.2
Total	2848	20684	-	3144	28314	-	3607	34773	-
(Mean)	(237)	(1724)	(7.26)	(262)	(2360)	(9.00)	(301)	(2898)	(9.64)

Lethrinus nebulosus (*L. cinereus*) formed 56.8%, *Callyodon ghobban* 25.9% and *Teuthis* constituted 26.2% of the perch trap catches during early 1970s. During the period of this

TABLE 2. *Average annual catch of perches (kg) caught by Traps (Koodu) at Kilakarai in the Gulf of Mannar during 1983 - 1985*

	Lethrinus nebulosus	*Lutjanus* spp.	*Epinephelus* spp.	*Siganus* spp.	*Callyodon ghobban*	*Plectorhynchus* spp.	Other fishes	Total
January	1449	228	118	180	48	-	335	2358
February	761	103	139	204	219	9	287	1722
March	929	208	193	464	299	39	434	2566
April	1095	204	317	438	407	-	308	2769
May	537	173	247	741	465	52	595	2810
June	511	52	417	1025	512	22	265	2804
July	355	113	226	749	300	67	260	2070
August	377	152	286	709	230	80	325	2159
September	461	81	149	535	241	69	183	1719
October	784	182	152	507	151	-	188	1964
November	1138	270	170	514	162	63	240	2557
December	1426	247	182	225	69	18	260	2427
Total	9823	2013	2596	6291	3103	419	3680	27925
%	35.18	7.21	9.30	22.53	11.11	1.50	13.18	-

marmorata 1.9%. Subsequently, Lal Mohan (1985) observed a decline in the percentage study (1983 - 85) *L. nebulosus* continued to be the dominant species among the 30 species

which supported the perch trap fishery at Kilakarai. There was further decline in the

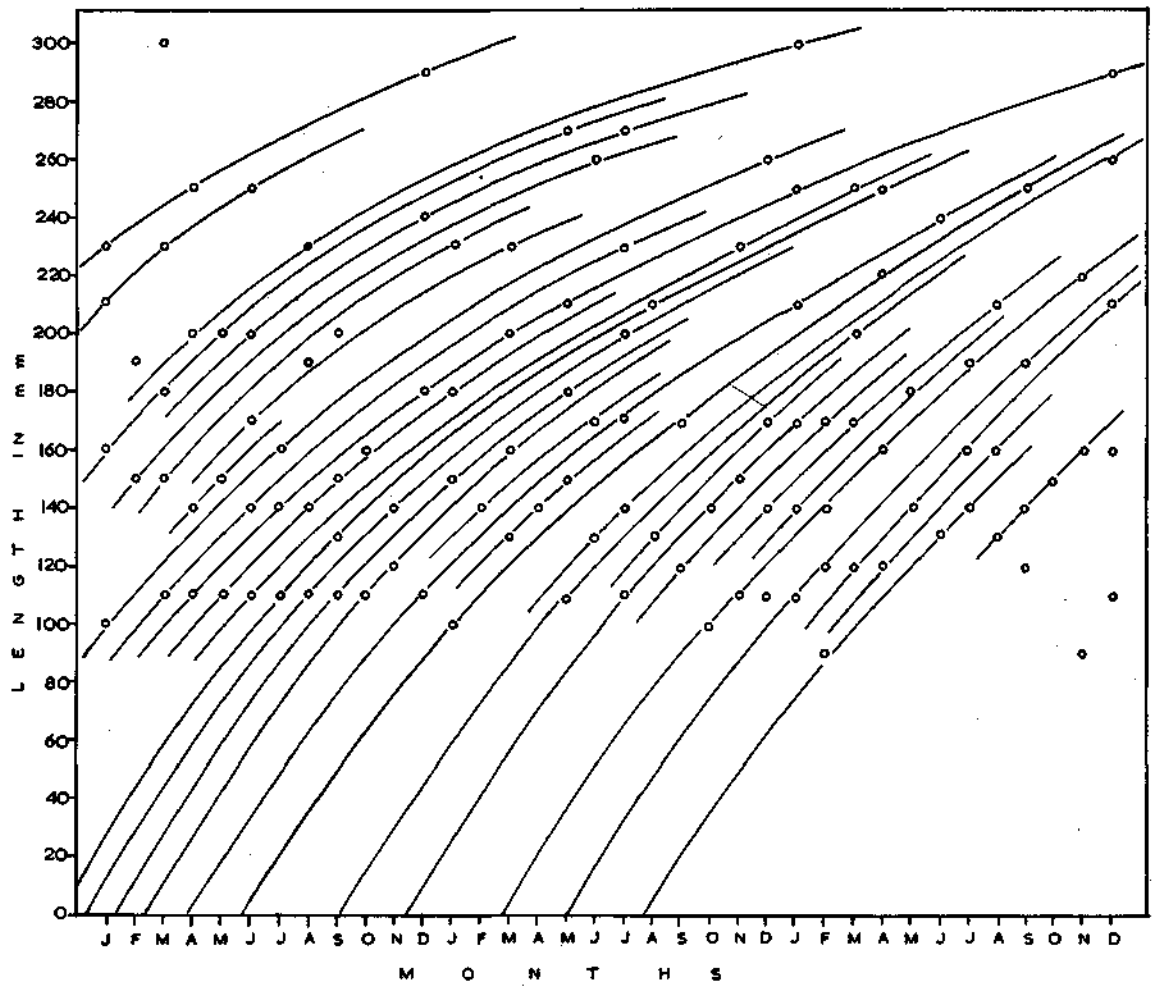

Fig. 2. Tracing the progression of different modes in relation to time as per the integrated method (Pauly, 1980).

percentage composition of *L. nebulosus* (35.18%) comparatively, *S. canaliculatus* constituted the second place (22.53%), *C. ghobban* occupied the third place (11.11%) and *Lutjanus* spp., *Epinephelus* spp., constituted 7.21% and 9.30% respectively (Table 2). The rest of the catch was constituted by *Plectorhynchus* spp., *Diagramma* spp., *Upeneus* spp., *Plotosus* spp., *Psammoperca waigiensis*, *Therapon* spp., *Serranus* spp., *Chaetodon* spp., *Acanthurus* spp., etc.

BILOGY OF *LETHRINUS NEBULOSUS*

Food and feeding : Gut content analysis of *Lethrinus nebulosus* ranging in size from 80 to 200 mm in total length reveals that fishes with empty stomach were dominant forming 61.1%, followed by fishes with little quantity of food (22.2%). Fishes with gorged, full and 3/4 full stomach were totally absent, indicating that either the fishes which are always in search of food enter the traps and get caught or as the fishes remain alive in the traps for longer duration of time, may be 24 hours, the food in the stomach gets digested. The average volume of the food content in the stomach was 1.0 ml in 1/2 full, 0.4 ml in 1/4 full and 0.15 ml in stomachs containing little quantity of food items.

The qualitative analysis of gut content revealed that prawn appendages formed the major items and it constituted 57.14% followed by digested matter (28.57%), partly digested fish (7.15%) and coral stone bits (7.14%). The

occurrence of higher percentage of prawn appendages in the stomach content indicates that more and more prawn peelings are being used predominantly as baits and the usage of traditional baits such as holothurians, crabs, fishes, jellyfishes, etc. in the perch traps (Prabhu, 1954) is on the decline.

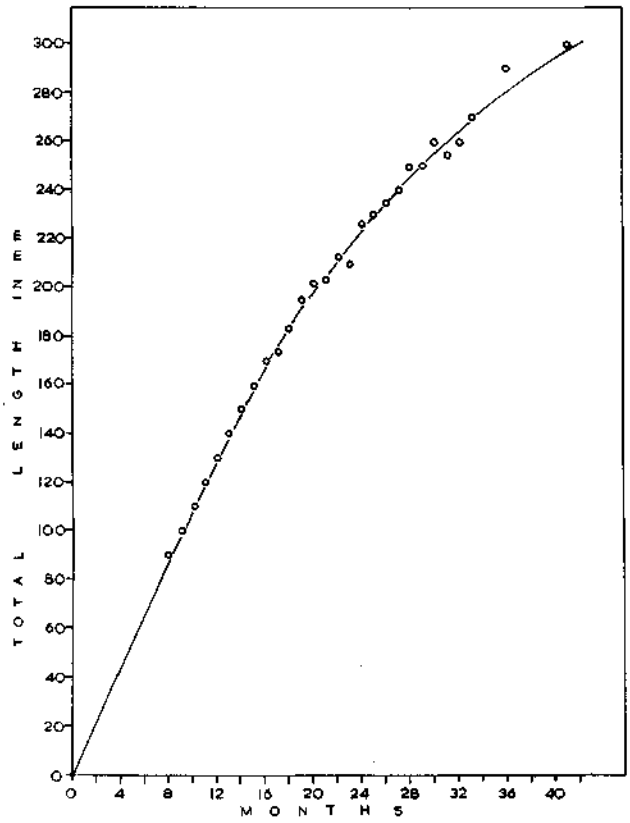

Fig. 3. Empirical growth curve of *Lethrinus nebulosus* obtained by plotting the average sizes attained by this species, estimated as per George and Banerji (1968) against their respective months.

Age and growth : The growth of *L. nebulosus* has been studied by plotting the modes available in different month as scatter diagram. The progression of the modes in relation to time was traced as per Pauly (1980) as shown in Fig. 2. The average sizes attained by this species were estimated as per George and Banerji (1968) which were plotted on an arithmatic graph against respective months and an empirical growth curve was obtained by fitting a free hand curve through the plots (Fig. 3). Based on this curve a series of another set of growth values were obtained which were subjected to further analysis to obtain the growth parameters L_∞, K and t_o as per Bagenal (1955) and the estimates are L_∞ = 400.2 mm, K = 0.3994 and t_o = -0.0204. Kasim *et al.* (1989) have also studied the growth of *L. nebulosus* in the Gulf of Mannar from Tuticorin and the estimates obtained by them are L_∞ = 968 mm, K = 0.4172 and t_o = -0.0716. The estimates K and t_o do not differ much in these studies whereas the L_∞ is estimated to be lower in the present study than the estimate of Kasim *et al.* (1989). This is mainly due to occurrence of smaller size ranges in the perch trap fishery *i. e.* to 300 mm whereas Kasim *et al.* (1989) have recorded a size range of 60 to 760 mm at Tuticorin. Since the maximum size attainable by this species is much more higher than 400 mm, the L_∞ estimate obtained by Kasim *et al.* (1989) is taken into account for further studies on mortality rates and yeild per recruitment substituting 968 mm as L_∞ the growth in length of this species may be expressed as per von Bertalanffy growth equation $L_t = 968\ (1\text{-}e^{-0.3994\ (t + 0.0204)})$. Based on this estimate *L. nebulosus* attains 324, 536, 678, 774 and 838 mm in 1st, 2nd, 3rd, 4th and 5th year and this estimate is in close agreement with Kasim *et al.* (1989).

Length-weight relationship : The length weight relationship of this species has been obtained as per the least squares method (Snedecor, 1961) from the data on the log length (mm) and log weight (g) and the same may be expressed as per the regression equation Log W = -4.5364 + 2.9078 Log L, with r value 0.9672. Prabhu (1954) has described the length weight relationship of this species by the equation Log W = -2.0830 + 3.1901 Log L from Mandapam waters in the Gulf of Manner and Kasim *et al.* (1989) by the equation Log W = -1.6846 + 2.9551 Log L from Tuticorin waters. There appears to be a very limited variation in the length weight relationship described by Prabhu (1954), Kasim *et al.* (1989) and the present study and all these three equations describe the relationship adequately well (Fig. 4). However, the equation proposed by Kasim *et al.* (1989) indicates a marginal faster weight gain and the equation of Prabhu (1954) a slower increase in weight than that prosped in this study. Based on this length weight relationship the W_∞ is estimated to be 13.993 kg.

Mortality rates : The natural mortality coefficient (M) is estimated from the life span (T_{max}) of the species as per Sekharan (1974). The T_{max} is

estimated to be 7.5 year from the relation T_{max} = 3/K (Pauly, 1980). Assuming 99% of the population die by the time they reach 7.5 years, if there is no fishing, we get an estimate of 0.61 as M, as per the relation M = 1/7.5 Log $e^{0.01}$ (Alagaraja, 1984) and the M/K ratio is 1.53. The total mortality coefficient (Z) is estimated by the length converted catch curve method (Pauly, 1983) and the estimates are 9.4, 10.2 and 8.0 in 1983, 1984 and 1985 respectively. Fishing mortality coefficient (F) were obtained by deducting M from Z and the F is estimated to be 8.79, 9.59 and 7.39 during 1983, 1984 and 1985 respectively.

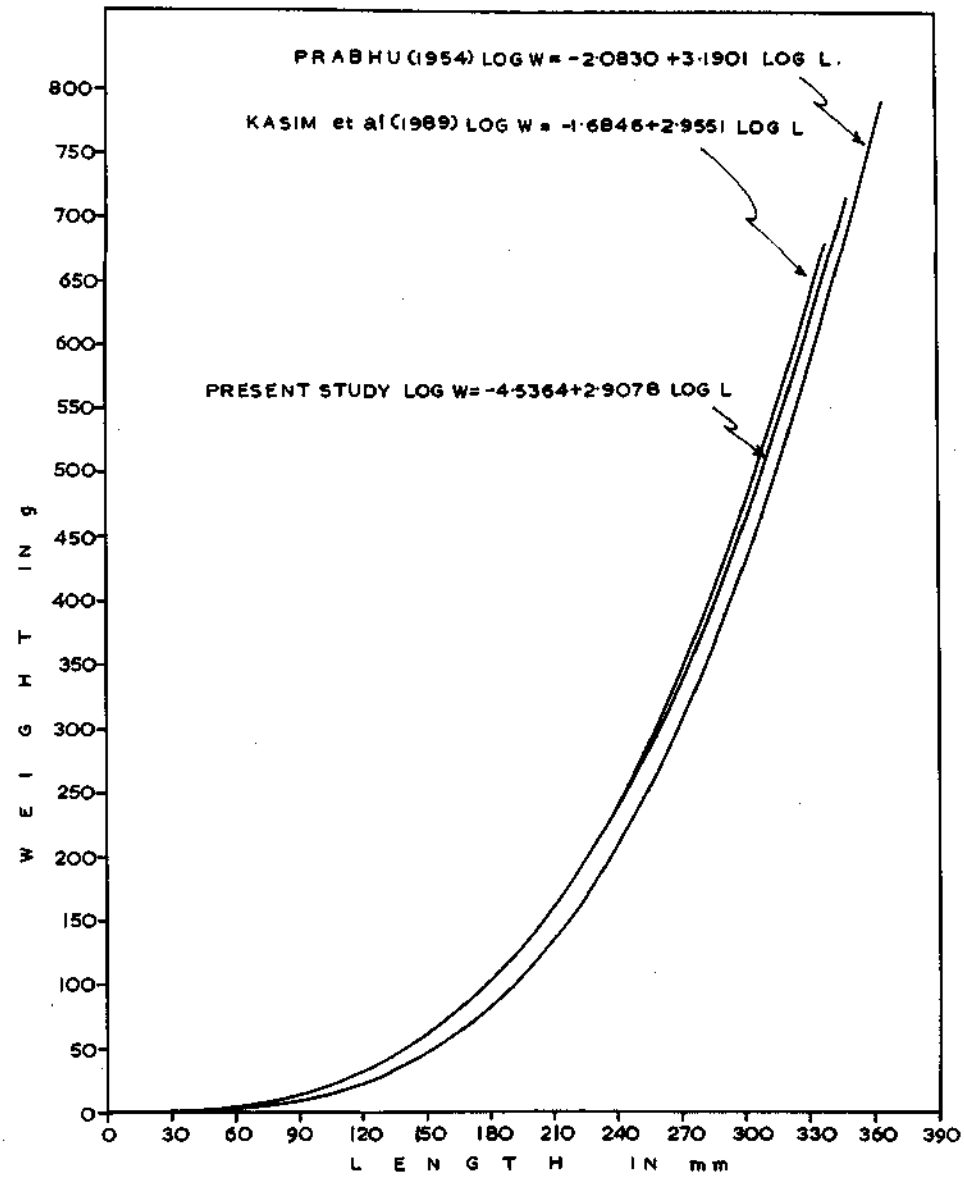

Fig. 4. Length-weight relationship curves drawn as per the equations of Prabhu (1954), Kasim *et al.* (1989) and the present study.

Exploitation rate : The exploitation rate 'U' is estimated from the relation U= F/Z (1 - e^{-Z}) and the estimates are 0.94, 0.94 and 0.92 in 1983, 1984 and 1985 respectively.

Yield per recruitment : Yield per recruit in g estimated as functions of different fishing mortality rates, keeping the age at first capture constant at prevailing level of 0.2913 yr and

varying the M/K ratio as per the method of Beverton and Holt (1957) simplified by Ricker (1958) are shown in Fig. 5. The yield per recruit increases with increase in fishing mortality rate to a certain level in all the M/K ratios and then it tends to decline in higher F. The fishing

Discussion

There has been a gradual increase in the total catch since 1950s (Prabhu, 1954) owing to the change in the mode of operation and probably due to the use of prawn peelings as bait

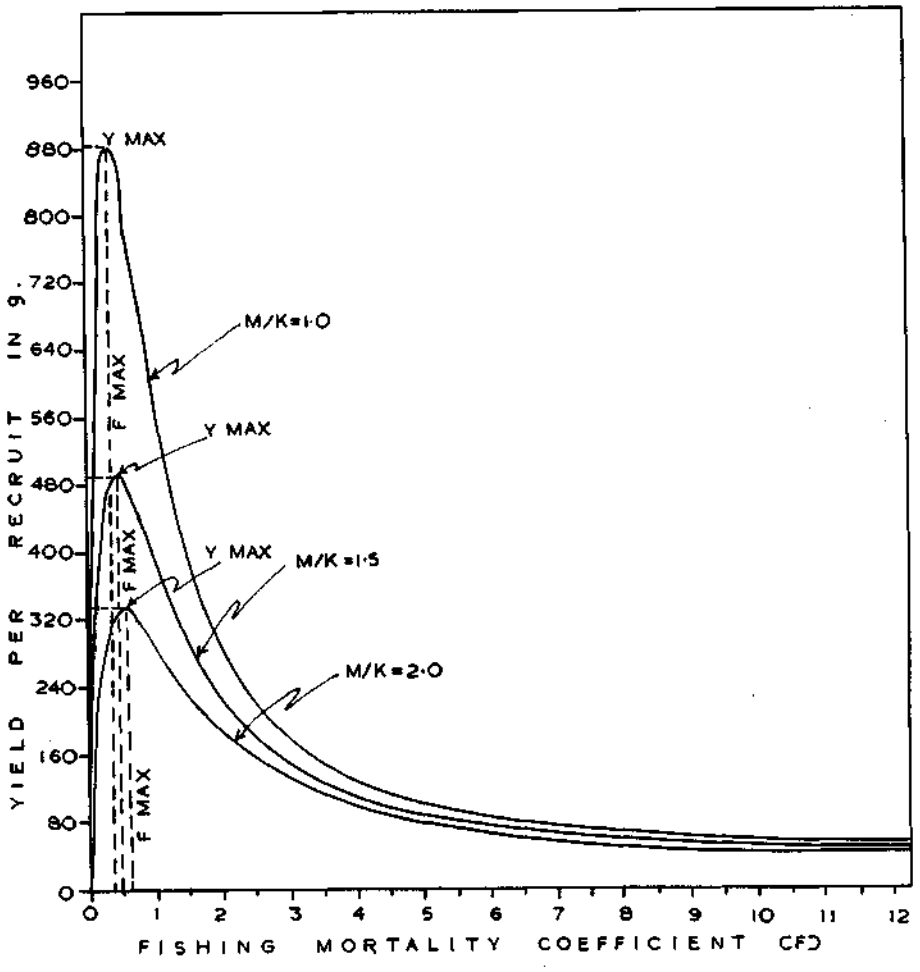

Fig. 5. Yield per recruitment in g of *Lethrinus nebulosus* at different fishing mortality coefficients (F), keeping the age at first capture for 3 different M/K ratios with their respective Y_{max} and F_{max}.

mortality rate which can produce the highest yield (Y_{max}) in each M/K ratio is called as the F_{max}. The F_{max} tends to increase with the increase in M/K ratio whereas the Y_{max} declines with the increase in M/K ratio. Considering the prevailing M/K ratio 1.53, the F_{max} which can produce an Y_{max} of 497.0 g is 0.445 whereas the prevailing average F is 8.59 during 1983-85 indicating higher rate of exploitation. The other two M/K ratios 1.0 and 2.0 are also indicating similar situation (Fig. 5).

in the traps (Lal Mohan, 1985). The change in the succession of species and quantum of landing is attributed not only to the introduction of prawn peelings as bait, but also due to the shifting of fishing area from near shore waters to the nearby island areas. Though there was an increase in the abundance of different species, *L. nebulosus* continued to remain as the dominant species. However, there was a gradual decline in the percentage composition of this species since 1950s.

The studies on the mortality rates, exploitation rate and yield per recruitment reveal that *L. nebulosus* is exposed to higher fishing intensity by perch traps as the prevailing fishing mortality rates are higher in all the 3 years than the F_{max} which can produce the highest yield. Kasim *et al.* (1989) have also reported that this species is being exposed to higher fishing pressure by almost all the gears operated off Tuticorin and the intensity of exploitation is in the order of Podivalai (drift gill net with mesh size 50-70 mm), Olai valai (shore-seine), hooks and line, Paruvalai (drift gill net with mesh size 100-170 mm) and trawl net. The length frequency studies on this species landed by perch traps reveal that only juvenlies and pre-adults measuring 60 - 300 mm are being exploited by these traps and thus generating a high exploitation rate. The selective nature of this gear depends mainly on the oval shape of the entrance of the traps and the length of the entrance varies from 15 to 20 cm depending on the dimension of the traps. In general, considering all exploitation parameters, it appears that perch traps are not a favourable gear for proper exploitation of *L. nebulosus* unless suitable provisions are made in traps to exploit larger specimens also.