CMFRI
bulletin 44
Part One

JUNE 1989

NATIONAL SYMPOSIUM ON RESEARCH AND DEVELOPMENT IN MARINE FISHERIES

MANDAPAM CAMP
16-18 September 1987

Papers Presented
Sessions I & II

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
P. B. No. 2704, E. R. G. Road, Cochin-682 031, India

Central Marine Fisheries Research Institute
40
YEARS
1947-1987

Paper 27

PRESENT STATUS OF PERCH FISHERRY RESOURCES IN INDIA AND ITS PROSPECTS

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ABSTRACT

The perch resources and fisheries in india have been dealt with. As seen from the Statewise perch production during 1969-1981, on an average 27,184 tonnes of perches were landed in India with fluctuation from 12,865 in 1969 to 49,312 in 1978. The gearwise and Statewise perch production from 1982-83 to 1984-85 indicates that the mechanised units contributed 72.4 % and non-mechanised 27.6 %. Anong mechanised units, tne trawlers have landed the major portion of the catch (68 4 %). The Statewise species composition of perch landings indicate that the threadfin breams formed more than 50% of the catch. During 1982-83 and 1983-84, the perch production of Tamil Nadu was higher than all other states, whereas during 1984 85, Kerala was the first in perch production followed by Andhrapradesh and Tamil Nadu. The different groups of perches landed by trawl and gill net units at different important landing centres on the east and west coast of indian show that in all the centres the catch rates of trawlers were higher. The higher catch rate in trawl net operations in Sasoons Dock and New Ferry Wharf was due to voyage fishing for more than a day.

Among threadfin breams, *Nemipterus japonicus* and among pig face breams, *Lethrinus nebulosus* are the dominant species. The growth, mortality rates, optimum age of exploitation, potential yield per recruit and yield per recruitment at different combination of age at first capture and fishing mortality coefficients of these species have been dealt with in detail. The prospects of the perch fishery by commercial trawlers and the possible increase in production by the introduction of pair trawling with high opening trawl net in Gulf of Mannar is discussed.

INTRODUCTION

Perches are an important marine fishery resource, but exploitation of this is limited to the narrow belt of this continental shelf of about 50 m depth covering an area of 1,80,539 sq. km. Annually on an average 59,215.6 t of perches are landed by different types of gears

operated by both mechanised and non-mechanised vessels along east and west coasts of India (Jones and Banerji, 1973; Anon, 1981, 1983, 1986). The common perches landed in India belong to thirty seven genera of five different groups i. e., 1. rock cods, 2. snappers, 3 pig-face breams, 4. threadfin breams and 5. other perches. Considering the commercial and economic importance of this resource a systematic study was undertaken to investigate the fishery of perches and the population dynamics of the dominant perch, *Lethrinus nebulosus* at Tuticorin.

METHODS

The data on the Statewise, gearwise and centrewise perch landings and species composition of these landings were obtained from the Fishery Resource Assessment Division which employs multistratum random sampling method for collecting the catch statistics of different marine fishery resources in India.

Weekly observations were made to collect the data on the gearwise catch, effort, species composition of perch landings and length frequency of dominant species *L. nebulosus* (Forskal) at Tuticorin. The length-weight relationship of *L. nebulosus* was obtained by least square method (Snedecor and Cochran, 1967). The growth estimates of *L. nebulosus* and *N. japonicus* were obtained by the integrated modal progression analysis (Pauly, 1980) and Bagenal (1955) method. The natural mortality coefficient (M) was estimated from the maximum life span of the species as per Sekharan (1974) and also by "independent method' (Pauly, 1980). the total mortality coefficient (Z) by Beverton and Holt (1956) method, the gear selection factor by the catch curve method (Pauly, 1984) and the yield per recruitment by the method of Beverton and Holt (1957) simplified by Ricker (1958).

PERCH FISHERY

Perches are caught by different types of gear such as trawl net, drift and bottom set gill net, hooks and line, fixed bag net, purse seine, shore seine, boat seine, traps etc., operated by various kinds of mechanised and non-mechanised craft all along the east and west coast of India.

Catch and effort: During 1961-65, perches formed on an average 1.47% of the marine fish catch and were the most abundant in Madras State (Tamil Nadu), where they formed 4.1 % of the marine fish landings, Kerala, Maharashtra and Andhra ranking next in the order given (Rao, 1973). The all India perch and total marine fish landings for the period from 1969-1981 indicate that perches formed on an average 2.2 % of the total marine fish catch. The perch catch increased steadily from 12,865 t in 1969 to 49,312 t in 1978 and the statewise annual average perch production during that period was 11,341 t in Kerala, 6,830 t in Tamil Nadu, 2,743 t in Maharashtra, 2,504 t in Andhrapradesh, 2. 227 t in Gujarat, 496 t in Pondicherry, 404 t in Karnataka, 257 t in Goa, 170 t in Lakshadweep, 153 t in Andamans, 146 t in Orissa and 46 t in West Bengal. During 1979-1981 the landing fluctuated between 31,325 and 38,541 t and during 1982-1985 annual average perch production was 59,215.6 t constituting 3.5 % of the annual average marine fish production in India.

The gearwise and statewise perch production during 1982-85 in India indicate that the mechanised units contributed 72.4 % and non-mechanised 27.6 %. Among mechanised units, the trawlers have landed the major portion of the catch (68 4%). The order of average perch production among different states during 1982-85, Kerala 17,106 t Tamil Nadu 12,324 t, Andhrapradesh 9,230 t, Gujarat 6,689 t, Maharashtra 6,508 t Karnataka 2,623 t Goa 1,474 t, Pondicherry 1,181 t, Orissa 1,135 t and West Bengal 66 t. Gearwis average annual CPUE of perches landed in different states indicate that the catch rate of trawl net was higher than the rest of gears and it was 52.5 kg in Gujarat, 40 98 kg in Andhrapradesh, 39.2 kg in Kerala, 36.3 kg in Maharashtra, 27.9 kg in Pondicherry and 10.5 kg in Tamil Nadu. The catch rates of drift gill net in Andhraprades and of hook and line in Tamil Nadu were higher than the rest of the states.

Catch composition: The common perches landed in India belong to thirty seven genera of five important groups i. e., Rock cods: *Holocentrus Serranus, Epinephelus* (Serranidae), 2. Snappers: *Apsion, Pristipomoides, Lutianus* (Lutienidae), 3. Pig face breams: *Lethrinella, Lethrinus* (Lethrinidae), 4. Threadfin breams: *Nemipterus* (Nemipteridae), 5. Others: *Lates* and *Psammoperca* (Latidae), ambassids (Ambassidae), *Peletes, Eutherapon, Therepon,* (Theraponidae), *Priacanthus* (Priacanthidae), *Apogon, Apogonichthss* (Apogonidae), *Sillago* (Sillaginidae), *Lobotes* (Lobotidae), *Pentaprion, Gerres, Pertica* (Gerridae), *Pomadasys* (Pomadosyidae), *Scolopsis* (Scolopsidae), *Diagramma* (Plectorhynchidae), *Argyropes, Acanthopagrus* (Sparidae), *Ephippus* (Ephippidae) *Platax* (Platacidae), *Drepane* (Drepanidae), *Pomacentrus, Amphiprion, Abudefduf* (Pomacentridae), *Siganus* (Siganidae), *Acanthurus* (Acanthuridae) *Kurtus* (Kurtidae) etc.

The statewise catch composition of these major groups of perches indicates that threadfin breams formed 51. 5% of the catch, snappers 5.8%, rock cods 4.5%, pig face breams 3.7% and the rest by other perches (34.5%). Out off annual average of 30,488.3 t of threadfin breams, Kerala alone landed 13,018t (Table 1). Among the threadfin breams *Nemipterus japonicus* is the dominat species, though other species *N. tolu, N. marginatus, N. hexodon* and *N. mesoprion* also support the fishery to certain extent. The different groups of perches landed by trawl net, gill net, purse seine, hooks and line and dol net units at different landing centres on the east and west coast of india show that in all the centres the catch rates of trawlers were higher than the other units. The higher catch rate of trawlers along the Andhra coast declined along the Tamil Nadu coast and then it increased along the west coast from Kerala to Maharashtra: The highest catch rate in trawl net operations in Sasoon Dock and New Ferry Wharf was due to voyage fishing for more than a day.

Fishing at Tuticorin: Perchas are caught by different types of gear such as trawl net, drift and bottom set gillnets, hooks and lines etc. Operated by various kinds of mechanised and non-mechanised crafts along Tuticorin coast. The monthwise catch composition of perches landed by trawlers during 1984-85 to 1986-87 is given in Tables 2, 3, and 4. On an average

TABLE 1.

Statewise average annual landings of different groups of perches (in tonnes) during 1982 - '85.

STATE	ROCK CODS	SNAPPERS	PIG FACE BREAMS	THREAD FIN BREAMS	OTHERS	TOTAL	%
WEST BENGAL	5.7	—	—	—	60.3	66.0	0.1
ORISSA	5.5	15.5	20.5	626.0	467.5	1135.0	1.9
ANDHRA PRADESH	16.0	1461.0	4.3	2338.7	5410.0	9230.0	15.6
TAMIL NADU	1322.0	904.0	2019.0	3162.3	4916.7	12324.0	20.8
PONDICHERRY	13.5	7·3	21.3	568.6	570.4	1181.0	2.0
KERALA	399.3	125.7	89.0	13018.0	3474.0	17106.0	28.9
KARNATAKA	41.0	19.7	6.3	2059 0	497.0	2623.0	4.4
GOA	210.0	3.0	0.5	978.5	282.0	1474.0	2.5
MAHARASHTRA	224.0	279.7	8.0	4779.3	1217.0	6508.0	11.0
GUJARAT	437.7	605.3	49.7	2358.0	2638.3	6689.0	11.3
ANDAMANS	—	—	—	—	671.3	671.3	1.1
LAKSHADWEEP	—	16.3	—	—	192.0	208.3	0.4
TOTAL	2674.7	3437.5	2218.6	30488.3	20396.5	59215.6	—
%	4.5	5.8	3 7	51.5	34.5	—	—

TABLE 2

Perch landings (in tonnes) during 1984 - '85 by mechanised trawlers at Tuticorin.

Months	Effort (units)	Rock cods	Snappers	Threadfins	Pig face breams	Others	Total	CPUE (kg)
April	—	—	—	—	—	—	—	—
May	—	—	—	—	—	—	—	—
June	4169	—	—	24.9	—	64.2	89.1	21.4
July	3531	—	—	65.4	1.2	65.1	131.7	37.3
August	3767	10.0	5.1	245.4	13.0	137.9	411.4	109 2
Sept.	3000	—	—	177.0	—	33.3	210.3	70.1
Oct.	3417	15.6	1.8	69.5	20.5	25.6	132.8	38.9
Nov.	2080	1.6	0.8	31.3	2.5	8.1	44.3	21.3
Dec.	2520	9.6	1.9	39.2	0.9	58.5	110.1	43.7
Jan.	3594	8.9	0.8	24.4	2.0	35.1	71.2	19 8
Feb.	1712	6.1	—	66.0	1.5	26.5	100.1	58.5
Mar.	1812	8.4	—	20.2	14.9	24 6	68.1	37.6
Total	29602	60.2	10.4	763.3	56.3	478.9	1369.1	46.3
%		4.4	0.7	55.8	4.1	35.0	—	—

TABLE 3.

Perch landings (in tonnes) during 1985 - '86 by mechanised trawlers at Tuticorin.

Months	Effort (units)	Rock cods	Snappers	Thread fins	Pig face breams	Others	Total	CPUE (kg)
April	2350	5.3	—	47.4	33.7	40.3	126.7	53.9
May	2773	2.1	—	23.2	37.6	55.1	118.0	42.6
June	4120	30.3	—	146.1	20.7	114.8	311.9	75.7
July	4088	37.5	—	55.4	44.5	30.4	167.8	41.1
Aug.	4075	40.1	29.7	268.4	82.5	131.3	552.0	135.5
Sep.	3672	74.3	—	200.9	142.0	105.9	523.1	142.5
Oct.	4260	87.2	0.5	262.5	112.2	180.5	642.9	150.9
Nov.	3600	26.1	8.4	132.7	50.6	60.5	278.3	77.3
Dec.	2120	8.7	1.5	12.7	30.2	29.2	82.3	38.8
Jan.	1792	19.4	8.0	6.4	55.0	55.4	144.2	80.5
Feb.	1848	122.3	57.3	8.8	124.0	57.7	370.3	200.4
Mar.	3775	77.3	18.4	95.7	130.6	90.4	412.4	109.3
Total	38473	530.6	124.0	1260.2	863.6	951.5	3729.9	97.0
%	—	14.2	3.3	33.8	23.2	25.5	—	—

TABLE - 4.

Perch landings (in tonnes) during 1986 - '87 by mechanised trawlers at Tuticorin.

Months	Effort (units)	Rock cods	Snapp-ers	Thread-fins	Pig face breams	Others	Total	CPUE (kg)
April	4450	66.8	27.4	90.7	64.1	155.0	403.7	90 7
May	4238	8 i.5	26 8	79.1	148.1	175.8	513.3	121.1
June	4416	87.3	136.2	105.6	206.4	277.2	812.7	184.0
July	3838	21.2	5.5	142.4	30.4	144.5	344 0	89.6
August	5100	6.4	1.7	188.6	9.8	68.7	275.2	54.0
September	4163	81.2	81.2	64.2	48.3	226.6	503.3	121.0
October	2275	7.0	1.6	36.4	6.8	54.5	106.3	46.7
November	4608	52.2	74.5	20.9	94.0	137.1	378.7	82.2
December	3725	44.7	46 3	100.3	79.1	304.0	574.4	154.2
January	4025	48.1	27.8	34.1	57.4	161 1	328.5	81.6
February	3853	81.5	38.8	77.0	131.6	262.4	591.3	153.5
March	3940	72.0	41.5	120 7	147.2	375.4	756.8	192.1
Total	48631	651.9	509.3	1059.7	1023.2	2344.3	5588.4	114.9
%	—	11.7	9.1	19.0	18.3	41.9	—	—

3,562.5 t of perches were landed by 38,902 units of of trawlers at the catch rate of 91.6 kg. The catch rate increased from 46.3kg in 1986-87. The trawl net catches of perches were constituted by almost all the families. The annual average percentage composition was rock cods 11.6%, snappers 6.1%, threadfin breams 28.8%, pig face breams 18.2% and others 35.3%, *Scolopsis, Pomadasys, Therapon* and *Sillago* constituted the major portion of the other perches.

An estimated annual average catch of 114.8 t of perches were landed by 9,660 units of hooks and lines at the catch rate of 11.9 kg per unit. In a year on an average 73.8 t of perchas were landed by 3368 units of *paruvalai* (drift gill net - mesh size 120-170 mm) at the catch rate of 21.9 kg and 19.96 t by 1162 t units of *podivalai* (mesh size 70-100 mm) at the catch rate of 17.2 kg. Trawlers contributed 94.5% of the total perches landed at Tuticorin and the rest by hooks and line and drift gill nets.

The monthwise catch composition of perches landed by pair trawl operations during 1986-87 is given in Table 5. An estimated 1,613.4 t of perches were landed by 3828 units (pairs) at the catch rate of 421.5 kg. Pig face breams constituted 54.5% followed by rock cods (20.2%), other perches (15 0%) and snappers (10%). Threadfin breams constituted more 0.3% of the total perch catch by pair trawlers (Table 5).

POPULATION PARAMETERS

LETHRINUS NEBULOSUS

Length-weight relationship: The log values of total length in mm and weight in g of *Lethrinus nebulosus* were regressed to obtain the length weight relationship and it is expressed as

Log W = — 1.6846 + 2.9551 Log L.

TABLE - 5.

Perch landings (in tonnes) during 1986-'87 by mechanised pair trawlers at Tuticorin.

Months	Effort (units)	Rock cods	Snap-pers	Thread fins	Pig face breams	Others	Total	CPUE (kg)
April	250	12.5	1.4	0.2	31.9	17.5	63 5	251.0
May	234	9.5	1.7	0.7	30.6	9.1	51.6	220.5
June	212	14.5	2.1	0.4	54.9	27.1	99.0	467.0
July	182	9.0	0.7	0.3	18.5	10.9	39.4	216.5
August	312	9.8	1.1	0.5	30.0	10.1	51.5	165.1
September	338	44.5	20.1	0.2	44.9	67.1	176.8	523.1
October	480	48 5	15.7	0.3	98.9	27.8	191.2	398.3
November	625	57.3	90.6	0.6	123.3	24.6	296.4	474.2
December	348	42.3	21.4	0.2	140.2	12.7	216.8	623.0
January	278	37.5	2.4	0.5	127.4	15 5	183.3	659.4
February	324	25.4	1.9	—	92.7	10.8	130 8	403.7
March	245	15.7	2.0	0.7	85.2	9.5	113.1	461.6
Total	3828	326 5	161.1	4 6	878.5	242.7	1613.4	421.5
%	—	20.2	10.0	0.3	54.5	15.0	—	—

Growth: The growth of *L. nebulosus* has been estimated from the pooled data of weighted length frequency obtained during the years 3 from 1982-83 to 1984-85 at Tuticorin. The integrated method (Pauly, 1980) of tracing model progression in accordance to time was used in which different modes available in a month's length frequency were plotted against respective months as shown in Fig. 1. These data were further plotted against respective months on an arithmatic graph and a curve was fitted through the plots and this curve may be expected to be the growth curve of this species (Fig. 2) and it can be seen from

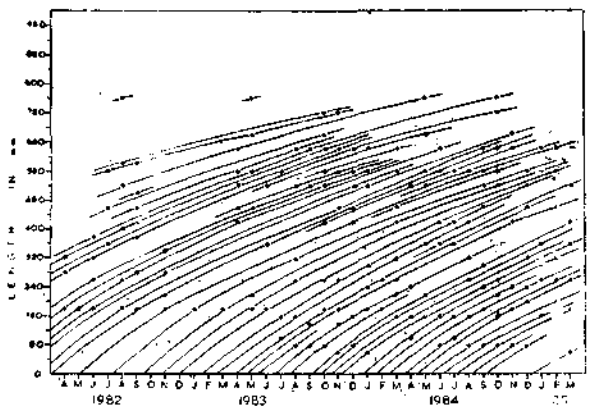

Fig. 1. Plots of modes in the length frequency against respective months and tracing of the progression of the modes to subsequent months for *Lethrinus nebulosus* from Tuticorin.

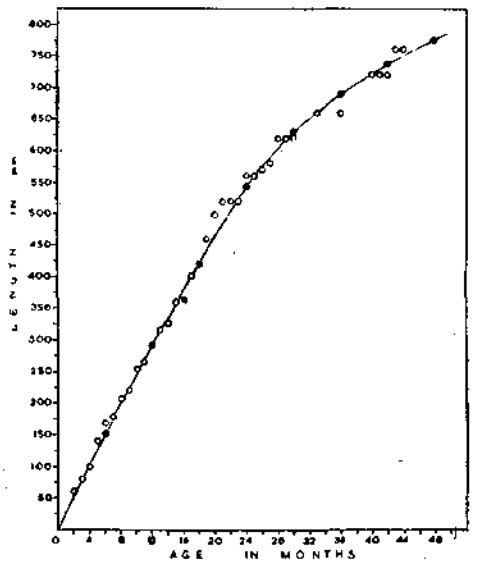

Fig. 2. Fitting a growth curve through the plots of average lengths attained by *Lethrinus nebulosus* in consecutive months obtained from the analysis shown in Table 10.

this curve that this species attains on an average 152. 292, 422.5, 546, 628.5, 689, 737 and 775 mm in 0.5, 1.0, 1.5, 2.0, 2.5, 3 0, and 4.0 years. These data were subjected to further analysis as per Bagenal method (Bagenel, 1955) and the growth in length (mm) of this species may be expressed as per Von Bertalanffy growth equation $Lt = 968\ (1-e^{-0.4172(t-0.0718)})$. As per the length weight relationship the growth in weight of this species is also computed by Bagenal method and this may be expressed as:

$$Wt = 23.4581\ (1-e^{-0.4800\ (t-0.0521)^3}).$$

Mortality rates: The natural mortality coefficient (M) is estimated from the life span of this species i.e., T max is $= \frac{3}{K} = 7.19$ years and $M = \frac{1}{(7.19-1)} \times \text{Ln}\ \frac{100}{1} = 0.74$ and the independent estimate of M as per Pauly (1980) method is 073. The M is taken as 0.74 for this study. The total mortality coefficient (Z) is estimated as per Beverton and Holt (1956) method based on the equation $Z = \frac{K\ (L\infty - \bar{L})}{\bar{L} - Lc}$ where in $\bar{L}$ is the annual average size, Lc is the size at first capture, $L\infty$ asymptotic length and K growth constant. The Z was higher in podivalai and olaivalai, moderate in hooks and line, low in paruvalai and trawl net and the average Z for this species in Tuticorin waters is 3 94 (Table 6).

Yield per recruitment: The yield per recruitment of this species for the age at first capture 0.6456 years at different fishing mortality coefficients and M,K ratios 1.0, 1.5, 2.0, 2.5 and 3.0 are shown in Fig. 3. For the prevailing M/K ratio 1.5 and age at first capture, the maximum fishing mortality coefficient which can bring the maximum yield of 666 g is 0.75 [Fig. 3]. Beyond this fishing mortality rate the yield per recruit declines from the maximum level. Higher the M/K ratio and lower the yield per recruit and the F max increases in accordance with M/K ratio [Fig. 3].

The yield isopleth diagram drawn from the yield per recruitment obtained at varying age at first capture and fishing mortality coefficients for the M/K ratio 1.5 is shown in Fig. 4, The line A-A and B-B represent the eumetric fishing

TABLE 6

Estimates of total mortality coefficient (2) obtained as per Beverton and Holt (1956) method for different gears for Lethrinus nebulosus *from the length freguency data collected at Tuticorin.*

Gear	Year	L (mm)	Lc (mm)	Lr (mm)	Z	F
	1982-83	210.1	158.0	148.0	6.07	5.33
Podivalai	1983-84	180.7	148.0	136.0	10.05	9.31
	1984-85	178.4	138.0	130.0	8.15	7.41
Paruvalai	1983-84	533.2	440.0	395.0	1.95	1.21
	1984-85	525.0	445.0	402.0	2.31	1.57
Hooks &	1983-84	480.5	435.0	310.0	4.37	3.73
Line	1984-85	482.0	438.0	315.0	4.61	3.87
Olaivalai	1982-83	97.5	50.0	46.0	7.65	6.91
	1983-84	127.0	55.0	43.0	4.87	4.13
Trawl net	1985-86	375.75	196.0	158.0	1.38	0.64
Average		319.0	250.3	208.3	3.94	3.20
					tc = 0.6456 Yrs.	tr = 0.5092 Yrs.

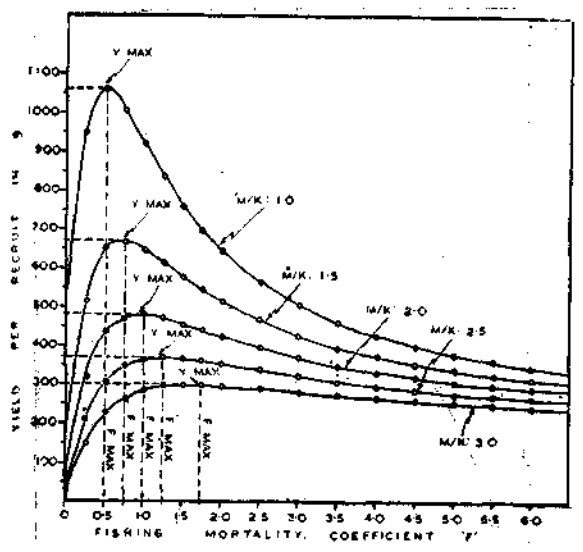

Fig. 3. Yield per recruitment of *Lethrinus nebulosus* for the prevailing age at first capture (0.6456 Yrs) at different M/K ratios and various fishing mortality coefficients and the yield max and F max are indicated for each M/K ratio.

curve and maximum sustainable yield curve respectively. The yield per recruit is diretcly proportionate to the increase in age at first capture and fishing mortality rate upto a certain level, beyond which the yield does not increase and it is not commensurate with the effort input. Hence, further increase in effort beyond this level may become uneconomical. In podivalai the average size at first capture is 148 mm which can yield 580 g at the F max of 0.5. Whereas the F during 1982-85 was on an average nearly 15 times higher and the same condition prevailed in respect of olaivalai and hooks and line with little variation in F. However, in paruvalai and trawl net the effort expended just coincided with F max which could bring in the yield max for the respective age at first capture.

Optimum age of exploitation and potential yield per recruit:

The optimum age of exploitation [ty] is defined as the age when the brood attains its maximum weight and the potential yield [Y'] is the quantity corresponding to this weight as a function of infinite fishing intensity [Berverton and Holt, 1967]. The optimum age or exploitation is estimated to be 2.15 years when it attains a size of 561 mm and the potential yield per recruit estimated by the method of Krishnan Kutty and Qasim [1968] is 1340 g which is indicated in the yield isopleth diagram.

NEMIPTERUS JAPONICUS

Growth: The growth of *N. japonicus* was estimated to be

	1964-65	1965-66	1966-67
$L\infty$	305.43 mm	208.7 mm	302.63 mm
K	0.3141	0.648	0.2941

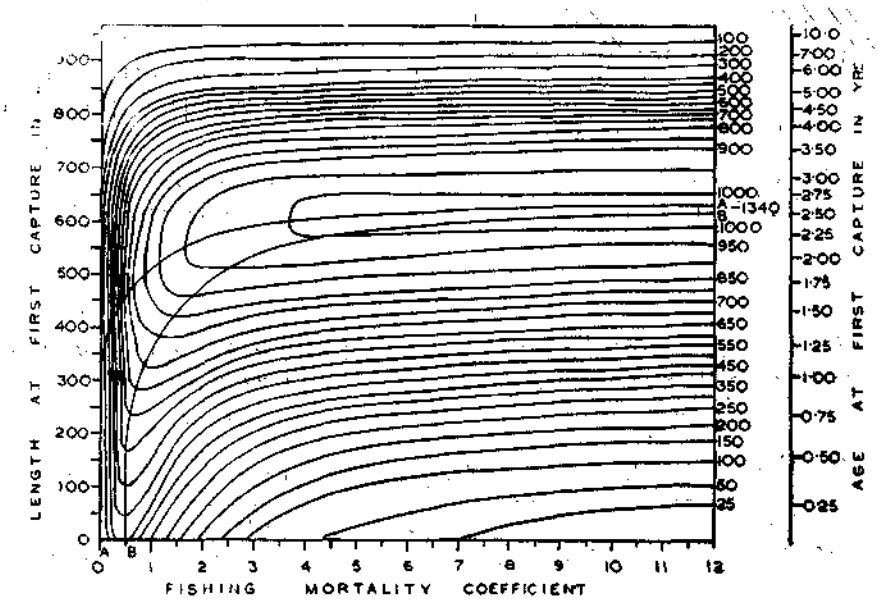

Fig. 4. Isopleth diagram for yield per recruit in gram of *Lethrinus nebulosus* population in Tuticorin waters, Gulf of Mannar. The eumetric fishing curve (line AA), maximum sustainable yield curve (line BB) and potential yield per recruit of 1340 g are also shown.

by Krishnamoorthi [1971] from the data collected from landing of Government of India vessels [trawlers] operated along Andhra-Orissa coast. The same data were subjected to the integrated modal progression analysis as already explained [Pauly, 1980] and the tracing of modes are shown in Fig. 5. The average lengths are shown in Fig. 6 wherein the empirical growth curve of this species is fitted through the plots. From this curve it is estimated that this species attains a length of 102, 150, 183, 211, 235.5, 255, 271.5 and 284.5 mm in 0.25, 0.50, 0.75, 1.08, 1.25, 1.50, 1.75 and 2.00 years and based on these data growth parameter, L &, K and t_0 were estimated as per Begenal [1955] method. The growth in length [mm] of this species may be expressed as non Bertalanffy growth equation $Lt = 336\ [1-e^{-0.8806\ (t+0.0411)}]$. The growth in weight based on the length weight relationship Log W = - 3.7432 + 2.5239 Log L.

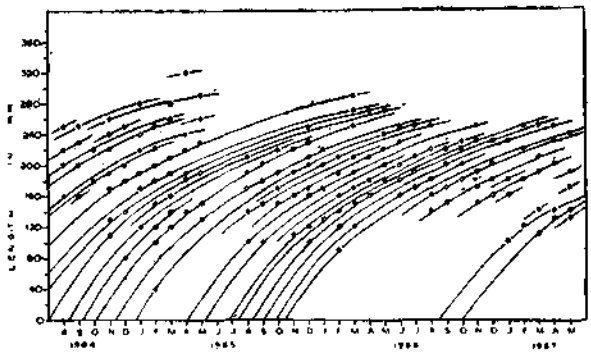

Fig. 5. Plots of modes in the length frequency against respective months and tracing of the progression of modes in subsequent months for *Nemipterus japonicus* from Andhra and Orissa coast.

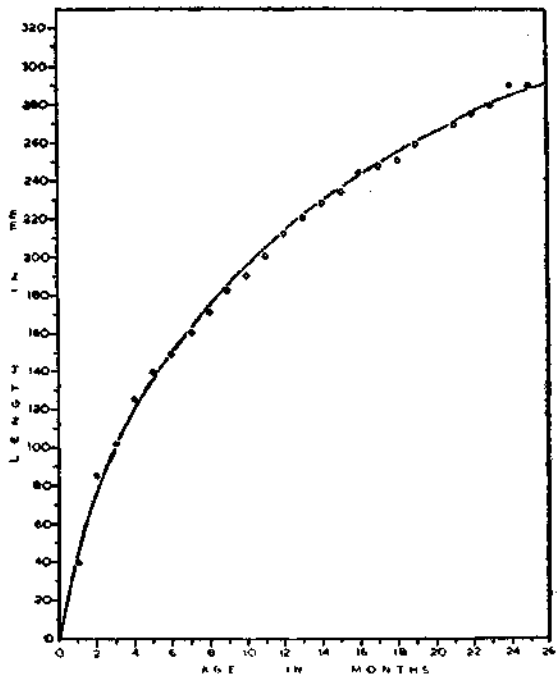

Fig. 6 Fitting of growth curve through the plots of average lengths attained by *Nemipterus japonicus* in consecutive months obtained from the analysis shown in Table 12.

may be expressed as
$Wt = 7.3889\ [1-e^{-0.9689\ (t+0.0679)}]^3$.

Mortality rates: The natural mortality coefficient [M] is estimated to be 1.85 from T max of this species and the independent estimate of M as per Pauly [1980] is 1.6. The M is taken as 1.85 for this species in this study. The total mortality coefficient [Z] estimated according to Beverton and Holt]1956] method are shown in Table 7. The Z increased from 2.91 in 1964-65 to 3.03 in 1965-66 and to 3.83 in 1966-67. The gear selection factor estimated from the left

TABLE - 7.

Estimates of total mortality coefficient (Z) obtained as per Beverton and Holt (1956) method for Nemipterus japonicus *during 1964-67 from the length frequency data collected at Visakhapatnam.*

Gear	Year	L (mm)	Lc (mm)	Lr (mm)	Z	F
Trawlnet	1964-65	199.7	156.0	142.0	2.91	1.06
	1965-66	180.2	136.0	116.0	3.03	1.18
	1966.67	189.0	156.0	144.0	3.83	1.98
	Average	189.6	149.3	134.0	3.13	1.28

side of the catch curve [Pauly, 1984] was used to obtain the age of first capture [t] and the age at recruitment [tr].

Yield per recruit.: The yield per recruitment of this species for different fishing mortality coefficient [F] for the prevailing age at first capture 0.6815 years for 3 different M/K ratios

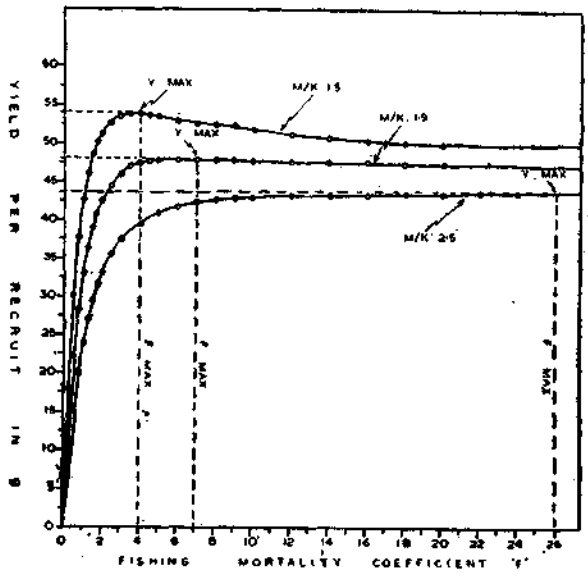

Fig. 7 Yield per recruit of *Nemipterus japonicus* for the age at first capture (0 6815 year) at different M/K ratios and various fishing mortality coefficient and the yield max and F max are indicated for each M/K ratio.

are given in Fig. 7. For the prevailing age at first capture and M/K ratio of 1.9, the fishing intensity which can bring in the highest yield is 7.0 and the yield is 48.2 g. Higher the M/K ratio, lower the yield per recruit and higher the F max, (Fig. 7). The yield isopleth diagram drawn from the yield per recruitment obtained at varying age at first capture and fishing mortality coefficients for M/K ratio 1.9 is shown in Fig. 8. The eumetric fishing [line A-A] and maximum sustainable yield curve [line B-B] are indicated in the figure. The yield isopleth diagram clearly indicates that the then prevailing age at first capture 0.6815 year is sufficiently high enough to permit further increase in effort. The yield also increases with the F upto 7 and commensurates with the effort input [Fig 8].

Optimum age of exploitation and potential yield per recruit:

The optimum age of exploitation for this species is estimated to be 0 86 years when it attains a length of 186 mm and the potential yield is 55 g which is indicated in the yield isopleth diagram (Fig. 8).

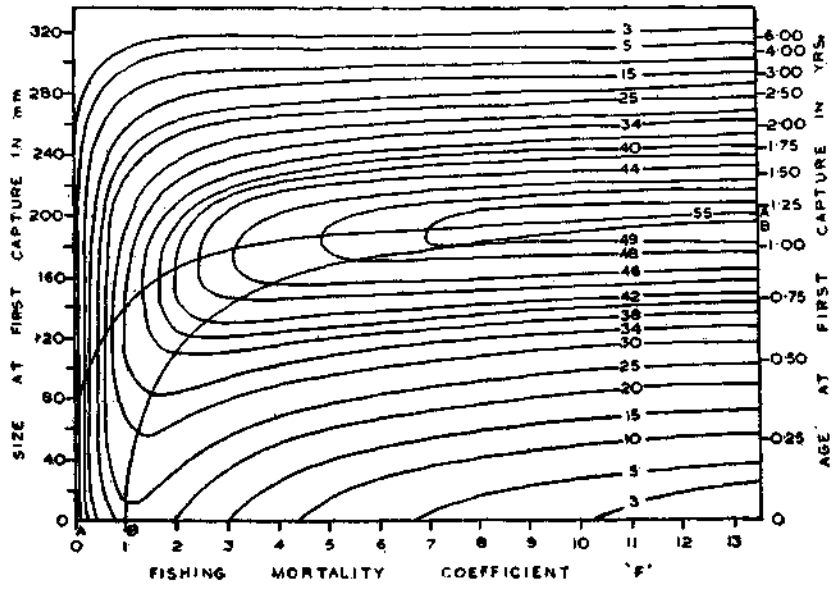

Fig. 8. Isopleth diagram for yield per recruit in gram of *Nemipterus jaoonicus* population in Andhra and Orissa coast. The eumetric fishing curve (line AA),- maximum sustainable yield curve (line BB) and potential yield per recruit of 55 g are also shown.

DISCUSSION

The annual perch production of India has increased three fold compared to the landings in 1969. This is mainly due to mechanisation of the fishing fleet and introduction of small scale mechanised trawlers in India. As seen from the perch catch by different gears, the trawlers have landed the major protion of the catches and threadfin breams were the dominant group. Mechanised fishing over the two decades has changed not only the fishing pattern but the constituent fisheries also. The introduction of high opening bottom trawl for pair trawling operations by gear technologists of the EAO project on development of small-scale fisheries under Bay of Bengal programme (BOBH) founded by Swedish Inter-national Development Authority [SIDA] has generated great interest among the boat owners resulting in intense fishing effort by pair trawling which yield not only higher catch than the conventional trawler but also fishes of large sizes. The perches landed by these units at Tuticorin are always large in size and four times higher in quantity than the other conventional units as the pair trawl units could venture into deeper waters and could sweep wider area also. Further expansion of this type of fishing operation and increase in the fishing effort along the west and east coast of India is expected to increase not only the general fish production but perch production also considerably.

Considering the individual species, the yield per recruitment shown in yield isopleth diagram for *L. nebulosus* [Fig. 4] indicate that this species presently faces higher fishing pressure by gears like podivalai, olaivalai and hooks and line as the prevailing fishing mortality rates are higher than the 'F max' which can bring in the highest yield. As the gears presently employed do not aim at exploiting particularly this species and this study confines only to Tuticorin waters, it is difficult to advocate any regulatory measure at this stage. The study on the population dynamics of *N. japonicus* reveal that the age at first capture [0.6815 year] is sufficiently high enough as it is close to the optimum age of exploitation [0.86 years] and there is scope for increase in the fishing effort as the fishing mortality rate can be as high as 7. Such studies on other component species of threadfin breams are most essential for proper fishery management of the perch resources as the threadfin breams constitute the major portion of the perch catch by trawlers in India.

Nearly a decade ago Jones and Banerji [1973] expressed the scope for the increase in perch production in view of the potential yield from the Indian waters. James *et al* [1986] have mentioned the potential yield of various commercially important species revealing the prospects for increased production in the country. The survey by the Integrated Fisheries Project has revealed apart from the major resources, several potential nonconventional resources like the big eye, *Priacanthus* spp., the Indian drift fish *Psenes indicus* and *Centrolophus niger*. Modernization of small country craft is a good sign of progress in the fishing industry. Diversified fishing operations in relatively deeper waters is also advocated to get increased yield.

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