THREADFIN BREAM (*NEMIPTERUS*) RESOURCES ALONG THE KERALA COAST WITH NOTES ON BIOLOGY OF *NEMIPTERUS JAPONICUS*

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ABSTRACT

Nemipterids are a group of quantitatively important fish along the Kerala coast. The greater concentration of *Nemipterus* is in 30-50m depth and the peak landing is in September. This is a carnivorous fish and feeding does not cease during spawning season. *N. Japonicus* attains a length of 136 mm at the end of 1 year, 186 mm at the end of II year and 236 mm at the end of III year.

INTRODUCTION

Nemipterids form an important component of the demersal fish catches in Kerala. Even though five species of *Nemipterus* have been recorded from the Indian waters *Nemipterus japonicus* is the dominant one along the Kerala coast. The average catch of *Nemipterus* spp. at Cochin is about 35 tonnes a year. In the offseason the smaller vessels which fish mainly for prawn also catch *Nemipterus*. With the introduction of more and more deep-sea fishing vessels, *Nemipterus* is likely to become an important group in the catches and to ultimately influence the operational economics of these vessels.

Eggleston (1970,1972) described the biology of *N. virgatus* and gave details of patterns of biology of Nemipteridae of the South China Sea. Krishnamoorthi (1971, 1973, 1974, 1976) described the biology and fishery of *Nemipterus japonicus* along the Andhra-Orissa coast of India.

MATERIAL AND METHODS

Data sheets maintained by the vessels of Integrated Fisheries Project, Central Institute of Fisheries Operatives and Offshore Fishing Station, Cochin, for the years 1970-72 were analysed to study the *Nemipterus* resources. Weekly random samples were also collected for detailed biological studies from the landings at the Integrated Fisheries Project. A total of 2565 fish ranging in size

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75-294 mm were examined. The feeding intensity was determined only by recording the condition of stomach which was classified as gorged, full, 3/4 full, 1/2 full, 1/4 full and empty, depending on the degree of distention of the gut and the amount of food present in it, from which a classification was made as very good (gorged and full), moderate (3/4 full and 1/2 full) and poor (1/4 full and empty). The gear employed were mainly fish trawl and shrimp trawl and occasionally Russian trawl and Sewedish trawl.

FISHERY

Area-wise landings

The fishing grounds off Kerala divided into 10 squares and 10' sub-areas are shown in Fig. 1. The catch rates of each sub-area are given in table 1.

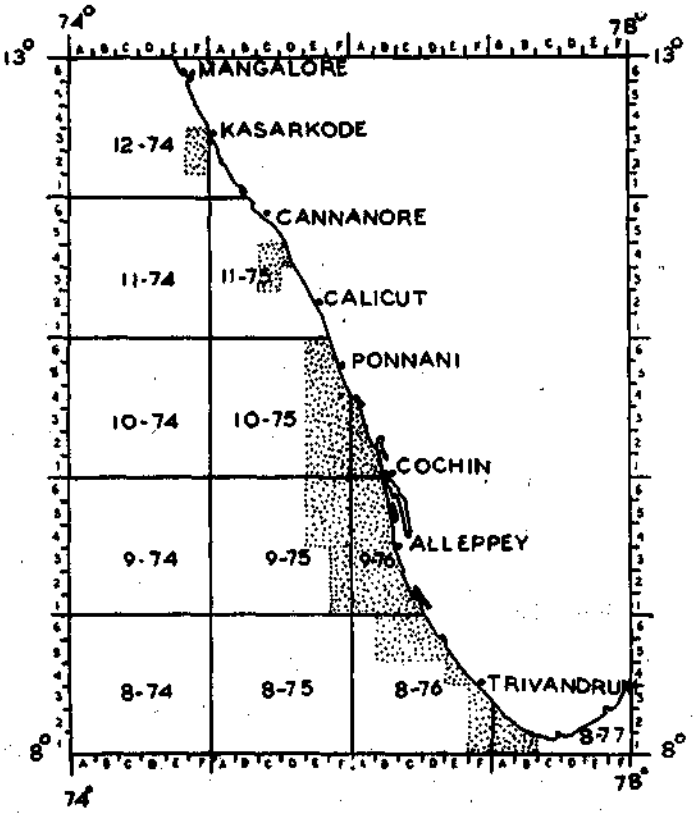

FIG. 1. Fishing grounds for *Nemipterus* along the Kerala coast.

During the period of this study, fishing for *Nemipterus* was conducted in latitude squares 8-76, 8-77, 9-75, 9-76, 10-75, 10-76, 11-75 and 12-74.The square 9-76

TABLE 1. *Average catch per unit effort* (kg|h) *in different sub-areas*

Sub-area	Average CPUE	Sub-area	Average CPUE
8.76/5B	31 42	9.76/1B	35.60
8.76/6B	21.50	9.76/2B	106.75
8.76/5C	27.50	9.76/3B	87.45
8.76/6C	73.56	9.76/4B	154.66
8.76/5D	84.37	9.76/5B	78.36
8.76/6D	149.85	9.76/6B	3.33
8.76/4E	71.56	9.76/1C	53.63
8.76/5E	640.00	9.76/2C	50.00
8.76/1F	149.01	10.75/1E	33.33
8.76/2F	110.40	10.75/2E	28.67
8.76/3F	11.20	10.75/3E	18.00
8.77/1A	31.82	10.75/4E	83.47
8.77/2A	10.64	10.75/5E	63.33
8.77/1B	4.63	10.75/6E	63.11
9.75/4E	125.77	10.75/1F	189.39
9.75/5E	139.85	10.75/2F	274.09
9.75/6E	115.64	10.75/3F	11.69
9.75/1F	400.00	10.75/4F	75.18
9.75/2F	57.41	10.75/6F	271.16
9.75/3F	55.79	10.76/1A	8.32
9.75/4F	51.26	10.76/2A	69.81
9.75/5F	156.34	10.76/3A	2.50
9.75/6F	17.69	10.76/1B	129.59
9.76/1A	72.98	11.25/3C	15.00
9.76/2A	53.00	11.75/4C	6.66
9.76/3A	80.68	11.75/4D	6.66
9.76/4A	52.72	12.74/2F	20.00
9.76/5A	107.13	12.74/3F	6.66
9.76/6A	56.75		

was most intensively fished during 1970-1972. The total effort spent here was 2855.67 h and the catch obtained was 91,131 kg. But based on the catch per unit of effort, square 9-75 was the most productive for *Nemipterus* (Fig. 2).

In 1970, twelve sub-areas in 9-76 were fished. The effort spent ranged from 1.00 h in 9-76/2c to 64.85 h in 9-76/6A and the catch per unit of effort was 50.00 and 9.52 kg/h respectively. The square 10-75 was the most productive in 1970 yielding 437.83 kg/h. Square 10-76 with a catch rate of 205.50 kg/h was followed by the square 9-76 with 159.32 kg/h. The high yielding sub-areas according to their CUPE were 8-76|5E (640 kg|h). 10-75|2F (528 kg|h), 9-76|5A (396 kg|h), 9-76|6A (278 kg|h), 10-76|2A (205 kg|h) and 9-76|2B (136 kg|h).

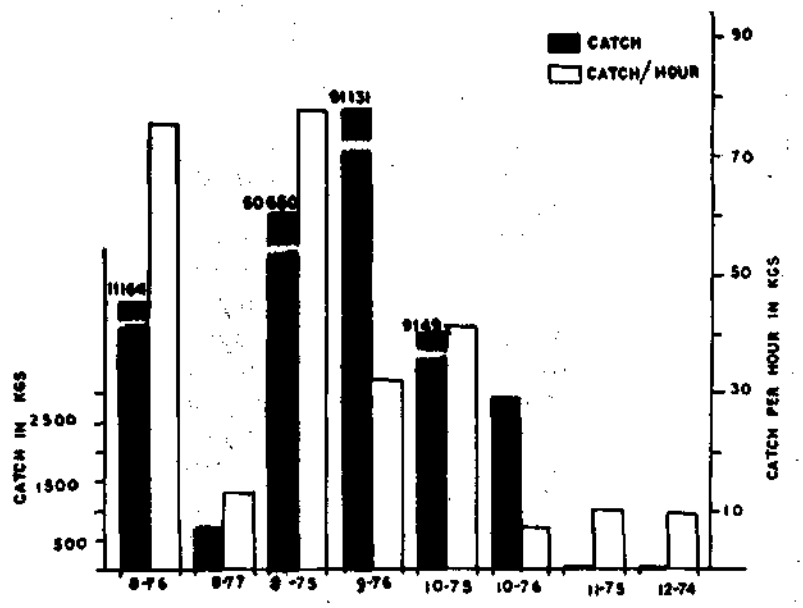

FIG. 2. Combined areawise variation in *Nemipterus* catch over the three years, 1970-72.

TABLE 2. *Depth-wise percentage distribution of thread-fin in the catches of the vessel* Blue-fin (*the months during which there was no* Nemipterus *catch are omitted*)

Months	Depth in metres 1-10	11-20	21-30	31-40	41-50	51-60
1970						
Apr	—	—	—	50.00	50.00	—
Jul	—	—	—	100.00	—	—
Aug	—	—	—	91.16	8.84	—
Sep	3.41	6.23	35.29	54.82	0.25	—
Oct	—	—	15.94	60.98	23.08	—
Dec	—	—	28.41	71.59	—	—
1971						
Jan	—	3.80	35.36	58.94	1.90	—
Feb	—	—	94.35	5.65	—	—
May	—	—	40.15	59.85	—	—
Aug	—	—	—	100.00	—	—
Sep	—	—	4.10	15.93	11.55	68.42
Oct	—	28.13	25.00	28.13	12.50	6.24
Nov	—	6.79	4.92	88.29	—	—
Dec	—	—	—	96.59	3.41	—
1972						
Jan	—	—	75.23	24.77	—	—
Mar	—	—	—	100.00	—	—
Apr	—	—	22.30	77.70	—	—
Jun	—	—	—	25.93	74.07	—
Jul	—	—	—	1.30	72.74	25.96
Aug	—	—	10.73	—	58.98	30.29
Sep	—	—	—	100.00	—	—
Nov	—	—	—	37.70	62.30	—
Dec	—	—	—	100.00	—	—

TABLE 3. *Depth-wise percentage distribution of thread-fin bream in the catches of the vessel* M.F.V. Flying Fish.

Months	Depth in meters 1-10	11-20	21-30	31.40	41-50	51-60
1972						
Jan	20.72	56.76	——	9.01	13.51	——
Feb	7.87	5.51	78.74	3.94	3.94	——
Mar	——	7.89	65.79	26.32	——	——
Apr	18.18	9.09	24.25	39.39	0.09	——
May	——	——	83.33	16.67	——	——
Sep	——	——	——	4.89	73.30	21.81

TABLE 4. *Depth-wise percentage distribution of thread-fin bream in the catches of the vessel* M. L. Durga.

Months	Depth in meters 1-10	11-20	21-30	31-40	41-50
1972					
Jan	1.27	51.48	40.92	2.11	4.22
Feb	——	91.41	8.59	——	——
Mar	——	8.59	66.74	23.57	1.10
Apr	——	2.86	85.71	9.71	1.72

TABLE 5. *Depth-wise percentage distribution of thread-fin bream in the catches of the vessel* Meena Sangrahak.

Months	Depth in meters 1-10	11-20	21-30	31-40	41-50
1972					
June	——	28.98	62.32	8.70	——
July	——	——	14.10	27.73	58.17
August	——	——	——	47.39	52.61
September	——	——	1.29	60.72	37.99
October	——	4.06	3.91	92.03	——
November	——	——	——	100.00	——
December	——	——	71.74	28.26	——

TABLE 6. *Depth-wise percentage distribution of thread-fin bream in the catches of the vessel* Meena Utpadak.

Months	Depth in metres 1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80
1972								
March	—	1.00	73.00	26.00	—	—	—	—
April	—	—	—	15.20	77.78	3.12	3.47	0.43
May	—	—	53.95	7.20	38.85	—	—	—
June	—	—	15.97	35.03	47.90	1.10	—	—
August	—	—	10.32	9.91	79.34	0.43	—	—
September	—	—	—	16.75	83.25	—	—	—
October	—	0.21	0.53	24.72	70.91	3.63	—	—
November	—	9.46	19.35	65.90	5.29	—	—	—
December	0.13	2.88	22.74	69.89	4.36	—	—	—

In 1971, the maximum-exploited square was 9-76. The total effort spent here was 376.50 h and CPUE was 44 kg/h. This was the maximum catch rate for the year. Square 9-75 which was not fished in 1970 came next with an yield of 33 kg|h. The squares 11-75 and 12-74 were fished but were not very suitable for *Nemipterus* fishery compared to other squares. The sub-area 9-75|1F yielded the maximum catch rate of 400 kg/h. Other productive sub-areas were 9-76/3B (288 kg/h), 8-76/D (210 kg/h), 9-76|4B (154 kg|h), 9-76|1C (116 kg/h), 8-76/2F (110 kg/h) and 9-75/3F (100 kg|h).

In 1972 also the more intensively fished square was 9-76 with a catch of 21,560 kg for 756 h. The CPUE was 28 kg|h. The square 10-75 yielded a catch of 120 kg/h. The square 9-75 had only 83 kg/h. The highest catch of this year was recorded from sub-area 10-75/1F (556 kg/h).

Depth-wise distribution

The depth-wise percentage distribution of *Nemipterus* in the catches of of different vessels in different months is shown in Tables 2-6. The fished depth was divided into 8 depth-wise divisions at 10 metres interval. The maximum depth fished was 80 m.

The general feature of the catch is that during the early months of the year up to May, the depth-wise sub-areas 1-10, 11-20 and 21-30 m yield the bulk of the catches. In the latter parts of the year better catches are from 30-50 m depth.

Seasonal fluctuation

The trend of the monthly landings of *Nemipterus* during the years 1970-1972 is representd in Fig.3. The fishery was moderately good with a total catch

of 31,505 kg in 1970. In 1971 the fishery decreased and the total landings was only 31,242 kg. The fishery of 1972 showed a remarkable three fold increase with a total landing of 1,02,893 kg. The height of the season was during August to October with a peak in September. In September 1972 the catch amounted to 31,571 kg which was higher than the total landings of the previous years. The seasonal fluctuations in the catch per unit of effort is given in Table7.

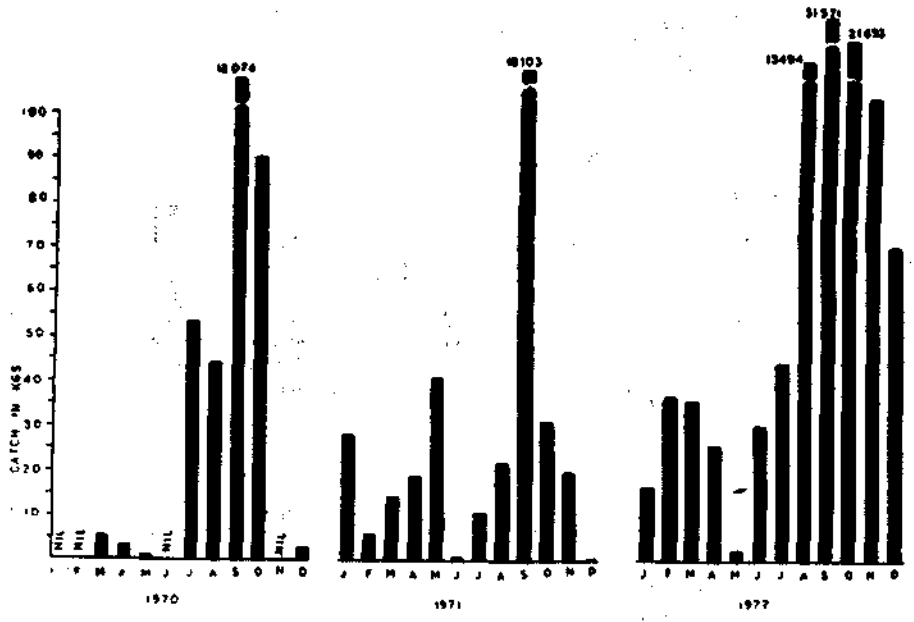

FIG. 3. Seasonal fluctuations in *Nemipterus* catch.

TABLE 7. *Seasonal fluctiation in the catch per unit effort of* N. japonicus (kg|h)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970	——	——	8.15	7.00	9.18	——	57.67	122.56	363.13	189.25	——	4.82
1971	10.31	2.37	6.40	6.28	29.13	5.65	37.81	25.86	85.33	19.61	30.91	Negligible
1972	9.65	9.45	11.36	18.81	10.90	19.64	45.85	168.34	246.65	158.34	43.03	50.73

Gear-wise catch rates

Fish trawl was used by the Integrated Fisheries Project, Central Institute of Fisheries Operatives and Off-shore Fishing Station in all the three years. The catch rate for the fish trawl were 140, 39 and 46 kg per hour during 1970, 1971 and 1972 respectively. Compared to this the landings by srimp trawl were poor with only 8 kg|h in 1970 and 7 kg|h in 1971. But in 1972 a comparatively

higher catch rate of 57 kg|h was obtained by the shrimp trawl. The Sweedish trawl was used only in 1971 and Russian trawl in 1972 yielding 1596 kg (42.12 kg/h) and 800 kg (30.09 kg/h) respectively (Fig. 4).

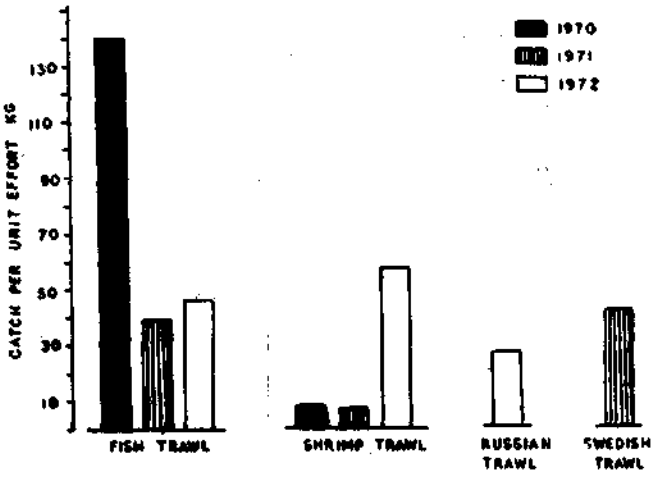

FIG. 4. Gearwise catch rate of *Nemipterus*.

Food and Feeding Habit

It is observed that *N. japonicus* is a carnivore, voraciouly feeding on crustaceans and fishes as already stated by Kuthalingam (1969), George et al (1968), Krishnamoorthi (1971), Eggleston (1972) and Qasim (1972). Items of food and the intensity of feeding varied according to season. The months January, February, March and April showed a very poor intensity of feeding. The major items were crustaceans with *Acetes indicus* as the main individual item followed by *Squilla* and crabs. The intensity of feeding was very good in May and moderate for the next two months, June and July. During monsoon, fishes mainly anchovy and detritus were the dominating item of food. In August the intensity of feeding was very poor, the main item of food was crustacean especially prawns; and almost all fishes examined were severly parasitised. From September onwards there was an increase on the feeding; October, November and December witnessd a vry good feeding activity. The important items during this period were detritus and fishes.

Size Groups in the Catch

Size range in the commercial catch was from 75 mm to 294 mm in furcal length. The annual mean size was 138 mm. The monthly mean size is shown in Fig. 5, according to which from May to January larger size groups are observed.

Age and Growth

The month of September was taken as the peak breeding season based on the material collected by the author (unpublished) and published work (Krishnamoorthi 1971). Recruitment to the fishery started during December,

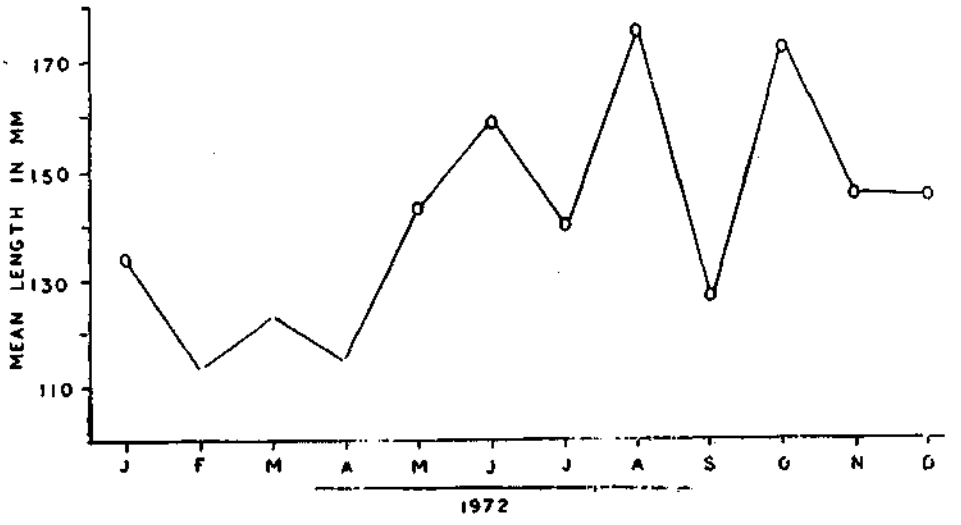

FIG. 5 Monthly mean-size distribution of N. *japonicus* in 1972.

when the fish was 4 months old as could be seen from the appearance of a mode at 76 mm (Fig.6). This mode remained at 76 mm up to February wherefrom it progressed to 136 mm as the fish attained the age of 1 year. The rate of growth at the first year as 7.5 mm per month. The mode at 136 mm progressed at the rate of 6.6 mm per month and attained the length of 186 mm at the end of second year. Similarly the peak at 186 mm could be traced to 236 mm at the end of third year. The growth rate during the third year of life was estimated as 4.17 mm per month. The mode at 236 mm could be traced only up to December when it reached 246 mm. Thus, from the progression of modes in length frequency polygons, it could be assumed that the fish attained a length of 136 mm at the end of I year, 186 mm at the end of II year and 236 mm at the end of III year

Age was determined also by the method of plotting the modes of length groups and drawing straight line (Jhingran and Natarajan 1969). The lengths thus eestimated were 136 mm at the end of I year, 185 mm at the end of II year and 233 mm at the end of III year (Fig.7).

Discussion

Nemipterus is quantitatively so prodominent that during its season it even changes the whole colouration of the coastal areas pinkish. Fishing for *Nemi-*

pterus started in the late sixties only. Though *Nemipterus* is a seasonal fishery it is available throughout the year. Almost all the time, to a certain extent, mixed size groups are seen.

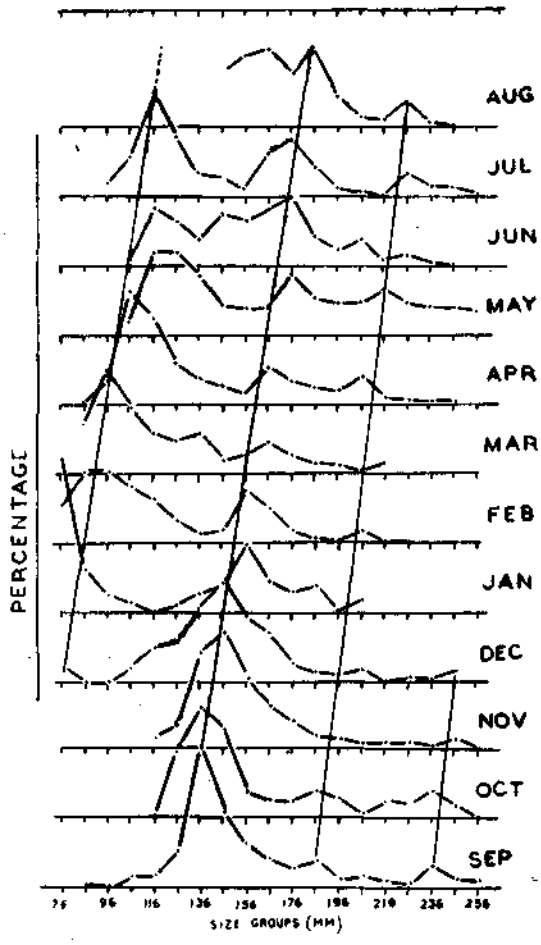

FIG. 6. Length-frequency distribution of N. *japonicus* during the various months in 1972 nd 1973

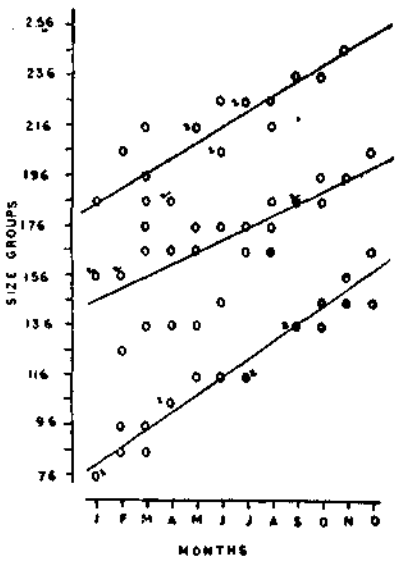

FIG. 7. Regression lines showing average rate of growth and average length at ages in N. *japonicus* during 1972-73.

The major square 9-76 was notable for the intensive fishing of *Nemipterus* during 1970, 1971 and 1972. The reason perhaps, for such intensive fishing in this square may be that it is productive as well as very near to the coast. Earlier survey results have shown that this resource is found in greater abundance in the middle and outer shelf regions off Kerala coast (Silas 1969). A good fishing ground for *Nemipterus* has recently been located off Alleppey-Cochin (square 9-75 to 9-76) in the 25-40 fathom range (Nammalwar, 1973). The Central Institute of Fisheries Operative have located three grounds off Cochin and one south west of Alleppey (Perumal et al 1974).

In the year 1972, the total landings was 1,02,893 kg which was a three fold increase over the previous years. Though the total landing in 1970 is poor compared to 1972, the catch per unit of effort is very high (140 kg/h, Fish trawl) as most of the productive areas were covered during this year. But the catch in 1971 was poor with 31,512 kg. The reason may be sub-areas like 8-76/5E, 10-75/2F which yielded very high rates in 1970 were not fished in 1971. So also the larger vessels like *Master Fisherman*, *Meena Utpadak* and *Meena Sangrahak* were not actively engaged in fishing during this year. According to the study of perumal et al (1974) the year 1970-71 shows the maximum catch of 26,852 kg. This is not a contradiction to the present finding as they covered the result of the vessel, *Bluefin* only.

Krishnamoorthi (1971, 1973) surmised that upwelling influences the fishery. The demersal fishes migrate from the oxygen depleted midwater towards the shore during upwelling (Banse, 1959). In the monsoon season the catch was better than the earlier months. The rough seas of the monsoon months prevent most of the vessels from fishing, otherwise a better catch could be expected during the monsoon season. In September, as the monsoon declines, the landings are exceptionally good. As larger size groups with advanced stages of maturity were recorded at this time, the inshore migration may also be connected with breeding.

Apparently *N. japonious* form schools. Karre Larson (1963) observed, "in September 1963, large schools of *Kilimeen* (Bream) were observed south-west of Cochin. They seemed to be coming from the south and moving north to Calicut, where we lost contact. It was obvious that this fish had come here to spawn, and this is the first time this phenomenon has been investigated." During the course of this study it was observed that the fishes in advanced stages of maturity were caught in September-October. The availability of fish in advanced stages of maturity during this period supports the observation of Larson. The movement of fish towards the shore for spawning is one of the reasons for their heavy landings in September. Eggleston (1972), observed that this fish did not school.

Krishnamoorthi (1971) recorded a relationship between rate of feeding and rate of catch. Unlike some other fishes *Nemipterus* do not cease feeding during the spawning season. The feeding intensity was found to increase in the advanced stages of maturity as Krishnamoorthi (1971) recorded in the east coast. In monsoon season there is an enrichment in the sea. Therefore feeding and spawning aggregations on the inner shelf water might be the reason for such a high catch during these months.

Nemipterids are abundant on muddy bottoms, but least common on sandy or rocky bottoms. Earlier report shows "large concentration of *Nemipterus japonicus* occurred in 16-27 fothom zone at the commencement of the fishing season in September following the break of southwest monsoon. By October and

in the next five months these fish were found between 8 and 23 fathoms but mainly around 10-23 fathom zone. During April-May they again moved to the deeper 24-27 fathom zone, completely disappearing from the shallower 8-15 fathom zone." (Tholasilingam et al 1973). The exploratory fishing by R. V. *Varuna* along the west coast of India found *Nemipterus japonicus* as the most dominant species in the depth zones 75-100 and 101-179 metres. Nemipterus was also recorded from a depth range of 180-450 metres (Silas, 1969). The catches from off Goa region showed that *Nemipterus* was in good concentration in 41-50 m depth (Virabhadra Rao and Dorairaj, 1968). In the South China Sea, Eggleston (1972) found *Nemipterus* from very shallow water to a maximum depth of 30 fathoms. Data from the east coast of West Malaysia showed Nemipteridae were the dominant group in waters 30-60 weters deep (Pathansali et al 1973).

The present study on the growth and age of *N. japonicus* shows that the findings of Krishnamoorthi (1973) along the east coast are comparable with that of the west coast. He found an average size of 150 mm (140-170) in its I year, 210 mm (200-230 mm) at the end of its II year and 240 mm (220-260 mm) at the end of III year.

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References

Banse, K. 1959. On upwelling and bottom trawling off the South West Coast of India. *J. mar. biol Ass. India*, 1: 33-49.

Eggleston, D. 1970. Biology of *Nemipterus virgatus* in the northern part of the South China Sea. *A Symposium on the Japan Current*, Edited by J.C. Mar, pp 417-424.

Eggleston, D. 1972. Patterns of biology in the Nemipteridae. *J. mar. biol. Ass. India*. 14: 357-364,

George, K. C., M. G. Dayanandan and P. Karunakaran Nair. 1968. Food of some demersal fishes from the trawl grounds off Cochin, *Indian J. Fish.*, 15: 81-87.

Jhingran, V. G. and A. V. Natarajan. 1969. A study of the fisheries and fish populations of the Chilka Lake during the period 1957-1965. *J. Inland Fish., Soc. India* 1: 49-126.

Karre Larsen. 1963. Fishing off the west coast of India. *Fishing News International*, 3 (2).

Krishnamoorthi, B. 1971. Biology of the thread-fin bream, *Nemipterus japonicus* (Bloch.) *Indian J. Fish.*, 18: 1-21.

Krishnamoorthi, B. 1973. An assessment of *Nemipterus* fishery off Andhra-Orissa coast based on exploratory fishing, *Proceedings of the Symposium on Living Resources of the Seas Around India* P. 495-516.

Krishnamoorthi, B. 1974. A note on the size difference between males and females of *Nemipterus japonicus* (Bloch.) *Indian J. Fish.*, 21: 608-601.

KRISHNAMOORTHI, B. 1976. A note on mortality rates and yield per recruit in *Nemipterus japonicus* (Bloch.) *Indian J. Fish.*, 23: 252-256.

KUTHALINGAM, M. D. K. 1969. Notes on the fishery and biology of *Nemipterus japonicus* (Bloch.) with special reference to feeding behaviour. *Indian J. Fish.*, 12: 500-506.

NAMMALWAR, P. R. 1973. The resources of the ocean with special reference to the Indian Ocean. *Seafood Export J.*, 5: 15-19.

PATHANSALI, B., G. RAUCK, A. A. JOTHY, MOHD. SHARIF, S. A. LATIFF AND T. B. CURTIN. 1973. Demersal fish resources. Trawl survey of the coastal waters off the east coast of West Malaysia: Ministry of Agriculture, *Fish. Bull.*, 1.

PERUMAL, M. C., P. S. JOY AND V. NARAYANA PILLAI. 1974. Observations on the trawl catches in the shallow waters off the south west coast of India. *Seafood Export J.*, 6 (12). 11-34.

QASIM, S. Z. AND P. G. JACOB. 1972. The estimation of organic carbon in the stomach contents of some marine fishes. *Indian J. Fish.*, 19: 29-34.

SILAS, E. G. 1969. Exploratory fishing by *R. V. Varuna*. *CMFRI, Bulletin* No. 12.

THOLASILINGAM, T., K. C. GEORGE, M. G. DAYANANDAN, P. KARUNAKARAN NAIR AND K. NANDAKUMARAN. 1973. Exploratory trawl fishing and ground fish resources along the Kerala coast and adjacent waters. *Proceedings of the Symposium on Living Resources of the Seas Around India*, pp 241-257.

RAO, K. VIRABHADRA AND K. DORAIRAJ. 1968. Exploratory trawling off Goa by the Government of India fishing vessels. *Indian J. Fish.*, 15: 1-14.