Pertanika 13(1), 17-26 (1990)

Colour Pattern as an Additional Aid to the Identification of *Nemipterus* Species and Their Relationship

MOHD. ZAKI MOHD. SAID, MOHD. AZMI AMBAK
and ABU KHAIR MOHAMMAD MOHSIN
Fakulti Perikanan dan Sains Samudera,
Universiti Pertanian Malaysia,
43400 UPM Serdang, Selangor Darul Ehsan, Malaysia.

Key words: Morphometric and meristic characters, colour pattern, *Nemipterus,* South China Sea.

ABSTRAK

Ciri-ciri morfometrik dan meristik enam species dari genus Nemipterus *yang dikumpul dari Laut China Selatan berhampiran Terengganu adalah bertindih dan berbeza sedikit. Corak warna lima spesimen hidup kelihatan amat berbeza, dan kunci yang digunakan bagi mengenal pasti serta menentukan hubungan spesimen-spesimen tersebut dirasmikan berdasarkan corak ini.*

ABSTRACT

Morphometric and meristic characters of six species of the genus Nemipterus *collected from the South China Sea off Terengganu were found overlapping and differing only very slightly. But the colour pattern of live specimens seemed to differ greatly and on this basis a field key for their identification has been presented.*

INTRODUCTION

The threadfin breams are a group of fishes belonging to the family Nemipteridae. They are remarkably uniform morphologically but individual species are easily recognized by the nature of their colouration. However, careful observation on the fresh specimen is required in order to differentiate minute differences at the species level.

From the commercial point of view, all species are treated as one group under the name "Threadfin," locally known as 'Ikan Kerisi'. In the market, it is often seen with fishes comprising species of at least four genera, *Nemipterus, Parascolopsis, Scolopsis* (Family: Nemipteridae) and *Pristipomoides* (Family: Lutjanidae). Among these, the genus *Nemipterus* is dominant in terms of species abundance and composition. It is widely spread over the Indo-Pacific region as far north to the Sea of Japan, to Australia in the south, India in the East, and the Arabian Sea in the west. The taxonomy of this group of fish needs further study and clarification as to the number of actual species.

Correct identification of the species depends on the fact that the differences between species and forms are exceedingly small. As pointed out by Eggleston (1972) and Wongratana (1972), colour pattern is by far the most important criterion for readily identifying the fish to species level. Even juvenile fish (3-5 cm in length) of different species possess distinct colouration. From Indian waters, Day (1878) described nemipterid fish under the genus *Synagris.* He recorded five species and noted that the fish have a wide geographical distribution including the Malay Archipelago. In recent years, occurrences of other species apart from those recorded by Day (1878) have been reported. Rajagopalan *et al.* (1975) reported *N. delagoae* (Smith) from trawl surveys off the southwest coast of India. This species was earlier known to occur along the east coast of South Africa from Delagoa Bay to Beira (Smith 1949). Murty (1978) reported *N. mesoprion* (Bleeker) in trawl landings off Kakinada. This species was only known to occur around the Malay Archipelago, from east and west of Sumatra and Singapore (Weber and de Beaufort, 1936). Indra (1982) described the occurrence of *N. metopias* off the Madras coast. Mohan and Gopakumar (1982) also reported the

occurence of *N. metopias* in waters of the southwest coast of India.

The actual number of species of nemipterid fishes is not exactly known. Weber and de Beaufort (1936) listed twenty species in the genus *Nemipterus* and noted that the fish have a wide distribution that includes the waters of India, Arabian Sea, Red Sea and West Pacific. The list of Eggleston (1974) includes 39 species of which the identification of 15 needs further confirmation. Hence the aim of this paper is to study the morphometric and meristic characters of the species of *Nemipterus,* prepare a field key on the basis of colouration of live specimens and predict their relationships.

MATERIALS AND METHODS

The specimens were taken from two study areas (Sub-area II and Sub-area III, *Fig. 1).* Specimens of *N. peronii, N. hexodon, N. tolu* and *N. japonicus* were obtained from the Middle Region (Sub-area II), while, *N. nemurus, N. marginatus, N. tambuloides, N. nematophorus, N. mesoprion, N. bathybus* and *N. delagoae* were taken from the Offshore region (Sub-area III). The specimens from Sub-area I were all immature and hence not included in this study. The identification of the species was made following Weber and de Beaufort (1936), Eggleston (1974), Wongratana (1972) and Kyushin *et al.* (1982).

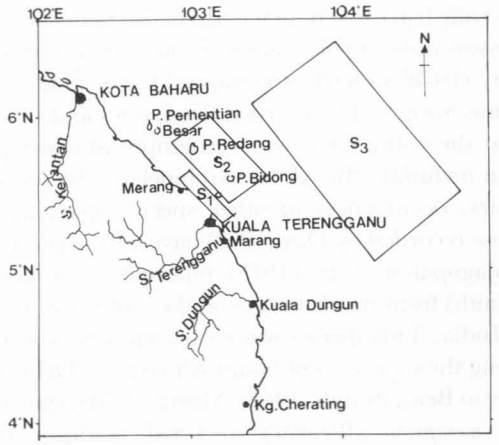


Fig. 1: Study area, S_1 = Sub-area I, S_2 = Sub-area II and S_3 = Sub-area III.

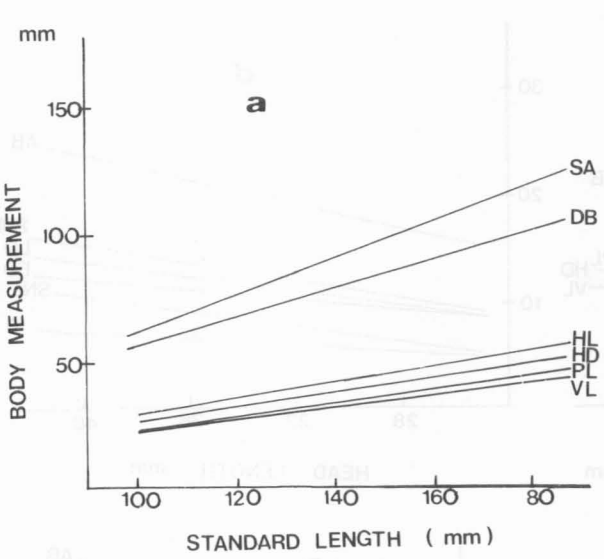
Morphometric and Meristic Characters

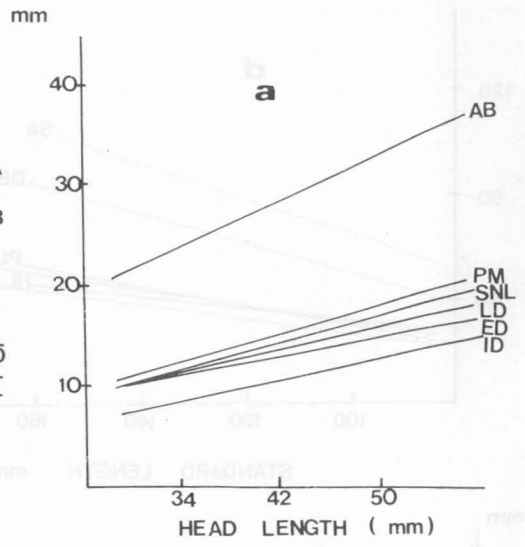
For the morphometric and meristic study, a series of measurements and counts were taken following Hubbs and Lagler (1958) and Lowe-Mc Connell (1975). Six dominant species were used for a detailed study of the growth of morphometric characters. The species were *N. marginatus, N. nemurus, N. bathybus, N. tambuloides* and *N. peronii.* In differentiating the growth of morphometric characters, the standard length and head length of the fish were used as basic characters *(independent variables),* against which regression lines for other dependent variables (characters) were drawn with a view towards finding a relationship between the various parameters and the basic character (standard or head length). The general equation: $y = a + bx$ was employed, where x = *standard or head length,* y = dependent variable (morphometric character), a = y intercept and b = the regression coefficient. Twelve morphometric characters were taken, six of which were regressed separately against the standard and head length. The characters were used to regress separately against the standard and head length. The characters used to regress against standard length were head length and snout length to anal fin length, dorsal fin base length, head depth, ventral fin length and pectoral length. Snout length, anal fin base length, eye diameter, interorbital distance, least depth and upper jaw length were used to regress against head length. The intercept and slope were tabulated and the regression lines graphically presented.

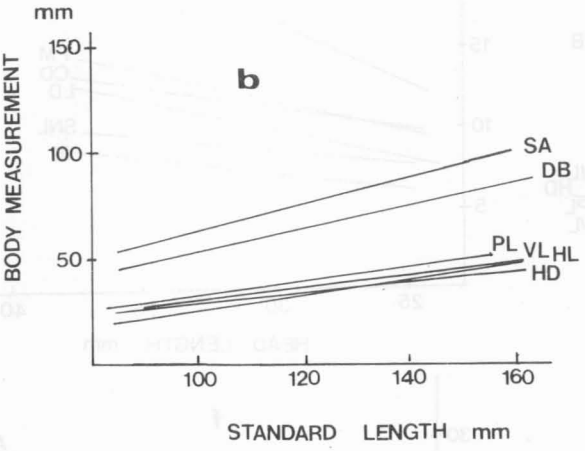
RESULTS AND DISCUSSION

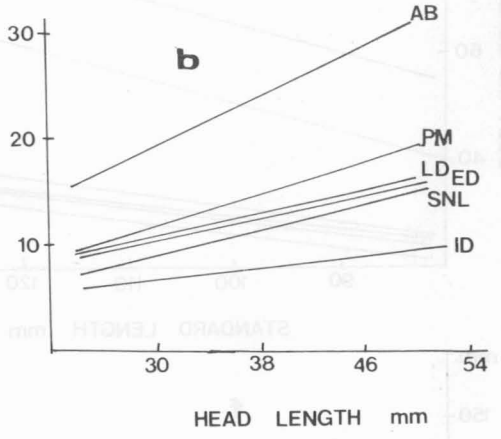
Morphometric characters

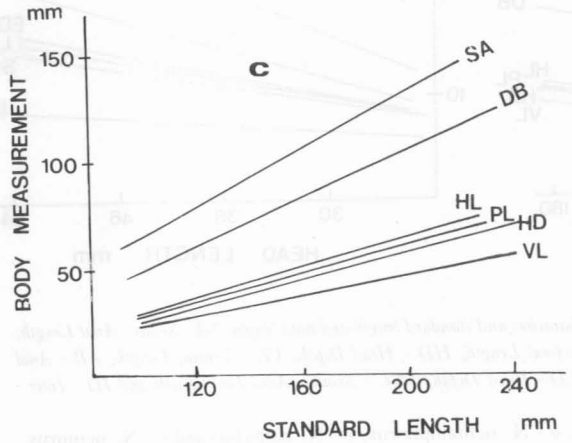
The relationship between several morphometric characters and the standard length/head length for six species are presented in *Figure 2.* The slope of the regression lines show that different parts of the body grow differentially which is indicative of allometric growth trend for all the six species. The character having the highest value (slope of the regression line) indicates a higher rate of growth. Based on the characters studied, it appears that all the species experience the same trend in the growth of body form. The growth rates are highest in length from snout to anal fin base (SA), length of dorsal fin base (DB) and length of anal fin base (AB). Among the six species, *N. tambuloides (Figure 2),* exhibits the highest growth in the length from snout to anal fin base (AB) and the length of the dorsal fin base (DB).

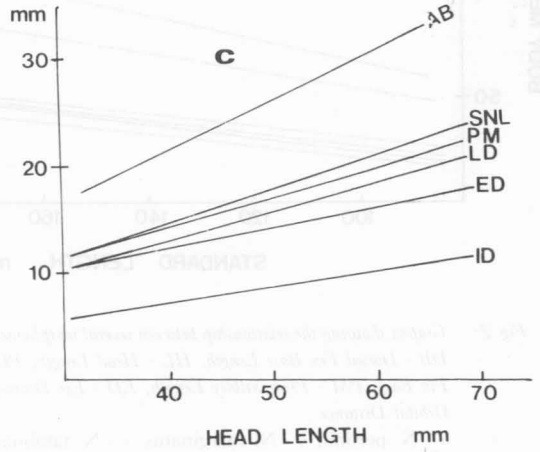

mm
a
BODY MEASUREMENT
150
100
50
SA
DB
HL
HD
PL
VL
100
120
140
160
80
STANDARD LENGTH (mm)


mm
a
40
30
20
10
AB
PM
SNL
LD
ED
ID
34
42
50
HEAD LENGTH (mm)


mm
b
BODY MEASUREMENT
150
100
50
SA
DB
PL
VL
HL
HD
100
120
140
160
STANDARD LENGTH mm


b
30
20
10
AB
PM
LD
ED
SNL
ID
30
38
46
54
HEAD LENGTH mm


mm
c
BODY MEASUREMENT
150
100
50
SA
DB
HL
PL
HD
VL
120
160
200
240
STANDARD LENGTH mm


mm
c
30
20
10
AB
SNL
PM
LD
ED
ID
40
50
60
70
HEAD LENGTH mm

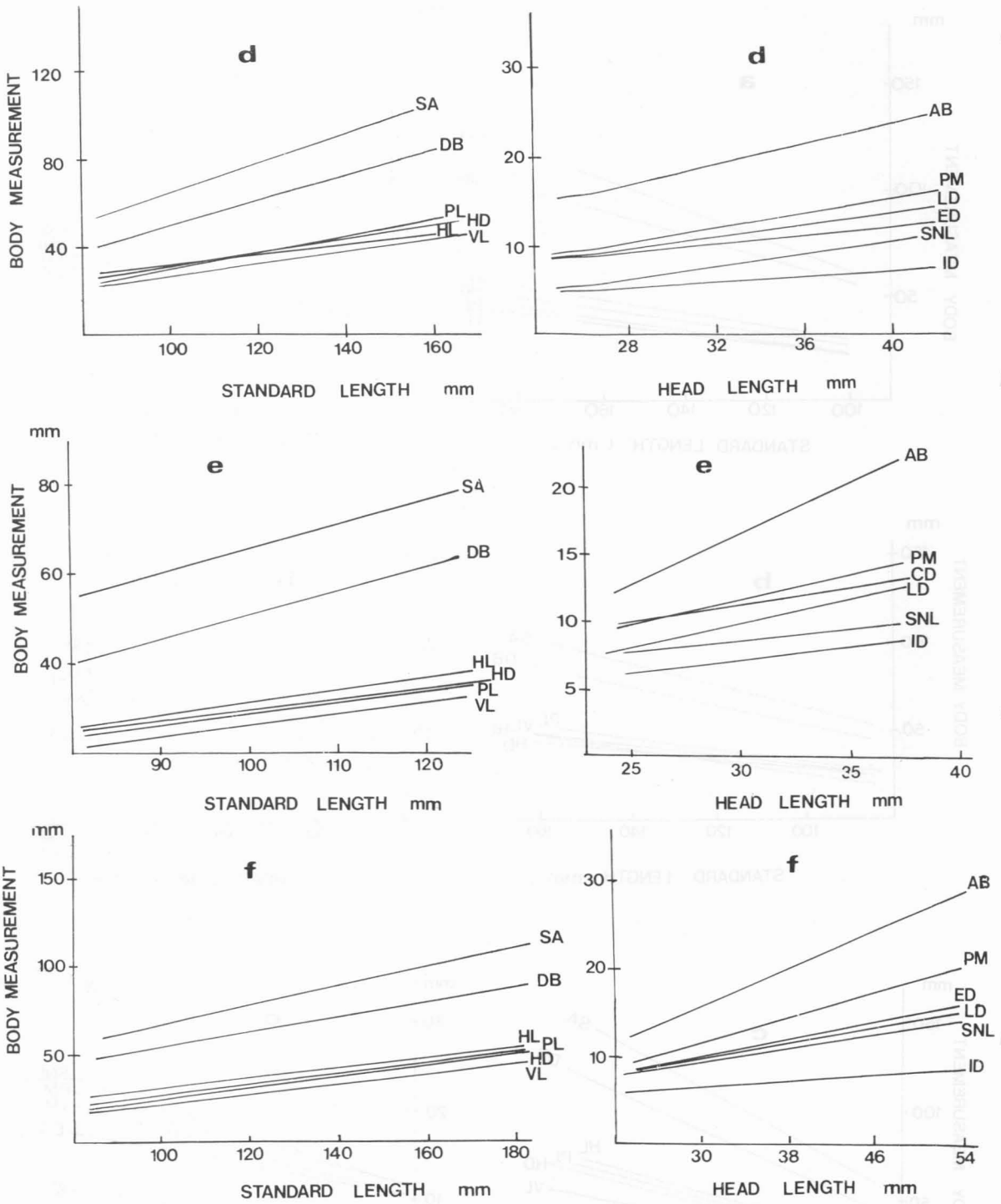


Fig 2: Graphs showing the relationship between several morphometric characters and standard length and head length: SA - Snout - Anal Length, DB - Dorsal Fin Base Length, HL - Head Length, PL - Pectoral Length, HD - Head Depth, VL - Ventral Length, AB - Anal Fin Base, PM - Premaxillary Length, ED - Eye Diameter, LD - Least Depth, SNL - Snout - Anal Fin Length and ID - Inter - Orbital Distance.

a - N. peronii, *b* - N. marginatus, *c* - N. tambuloides, *d* - N. nematophorus, *e* - N. bathybus *and f* - N. nemurus.

Meristic Characters

The meristic characters of six most dominant species are presented in Table 1. Characters were compared to those reported by Wongratana (1972) and Weber and de Beaufort (1936). However, the species *N. bathybus* were not recorded by Wongratana (1972 & 1974) and Weber and de Beaufort (1936), hence characters of *N. bathybus* were compared to Kyushin *et al.* (1982) and Masuda *et al.* (1984).

The data from the Table suggests that meristic characters in threadfin fish differ only slightly. The number of spines and rays of fins are almost constant in all the species studied. However, lateral line scales are relatively good characters for determining species, but this character alone is not enough because the lateral line scale count overlaps in a few species. In general there is a broad agreement in the meristic counts described here and those described by Wongratana (1974) and Weber and de Beaufort (1936). In cases where differences occur, they are only in the lower or upper limits of the ranges, which in most cases, determined by only very few specimens. For the field identifications of *Nemipterus,* colour pattern was found to be the most suitable guide particularly for the separation of the species.

Key to the Species of Nemipterus *Found off the Trengganu coast*

1. Caudal fin lobes, about equal in length and not extended into filament 2

   Caudal fin lobes not equal in length but extended into a filament 7

2. Interspinous membranes of the dorsal fin distinctly and deeply notched *(Figure 3)* .....

   .....*N. tolu* (Valenciennes, 1830

   Interspinous membrane normal, not notched 3

3. Body colouration rosy without any yellow longitudinal band; 9 indistinct bloches on back, with the third blotch most conspicous situated laterally, below the region of the second to fifth dorsal spine; belly silvery; caudal fin rosy, with outermost ray of the margin (Figure 4).....

   .....*N. peronii* (Valenciennes, 1830)

   Body with distinct yellow longitudinal bands.....4

4. Two conspicious yellow longitudinal bands on the body below lateral line; first line begins in the upper region of the opercle, stretched behind the caudal peduncle; second line begins in the region below the first dorsal spine and ends short before reaching caudal peduncle; faint yellowish patches distributed randomly on dorsal fin membrances (Figure 5).....

   .....*N. marginatus* (Valenciennes, 1830).

   More than two yellow longitudinal bands on the body.....5

5. Belly with yellow line. Five yellow longitudinal bands; shoulder without spot *(Figure 6)*.....

   .....*N. tambuloides* (Bleeker, 1853)

   Belly without yellow line 6

6. Six yellow longitudinal bands; shoulder with distinct spot. *(Figure 7)*.....

   .....*N. hexodon* (Quay & Gaimard, 1824)

   Five yellow faint bands on the body; first line superimposes on lateral line; second band (immediately

TABLE 1
Variation in some meristic characters

Character	This study	Wongratana (1972)	Eggleston (1974)	Kyushin *et al.* (1982)	Masuda *et al.* (1982)
Pectoral fin	(a) 16(49)-17(1)	16-17	16	-	-
	(b) 16(46)-17(4)	-	-	17	16
	(c) 16	16	16	-	-
	(d) 16(15)-17(3)	16-18	17	-	-
	(e) 16	-	-	16	16
	(f) 16	16	16	-	-
Lateral line scale	(a) 48(24)-49(23)-50(3)	47-50	48-50	-	-
	(b) 48(17)-49(33)	-	-	46-49	51
	(c) 48(6)-48(21)-50(16)-51(7)	47-48	50	-	-
	(d) 48(7)-49(11)	47-49	47-48	-	-
	(e) 48(3)-49(12)	-	-	47	46-47
	(f) 48(9)-49(26)-50(8)-51(7)	47-48	51-52	-	-
Upper trunk	(a) 3½	3½	3½	-	-
	(b) 3(14)-3½(36)	-	-	3½	3½
	(c) 3½	3½	3½	-	-
	(d) 3½	-	-	NA	NA
	(f) 3½	3½	3½	-	-
Lower trunk	(a) 12	12	12-13	-	-
	(b) 11	-	-	11	11
	(c) 11	11	11	-	-
	(d) 11	10-11	11	-	-
	(e) 10(11)-11(4)	-	-	NA	NA
	(f) 11	11	11	-	-
Upper gill rakers	(a) 7(49)-8(1)	6	NA	-	-
	(b) 7(37)-8(7)-9(6)	-	-	7-8	NA
	(c) 8(21)-9(29)	6-8	NA	-	-
	(d) 7(1)-8(3)-9(13)-10(1)	7-9	NA	-	-
	(e) 8(2)-9(3)	-	-	9	12-15
	(f) 7(42)-8(5)-9(3)	7-9	NA	-	-
Lower gill rakers	(a) 4(9)-5(31)-6(10)	NA	NA	-	-
	(b) 5(19)-6(31)	-	-	NA	NA
	(c) 5	NA	NA	-	-
	(d) 4(1)-5(10)-6(7)	NA	NA	-	-
	(e) 5(4)-6(11)	-	-	6	NA
	(f) 5(20)-6(30)	NA	NA	-	-

Dorsal, anal and ventral fins have X,9; III,7 and I,5 in all species described above respectively.

(a) - *Nemipterus peronii,* (b) - *N. marginatus,* (c) - *N. tambuloides,* (d) - *N. nematophorus,* (e) - *N. bathybus* and (f) - *N. nemurus.*

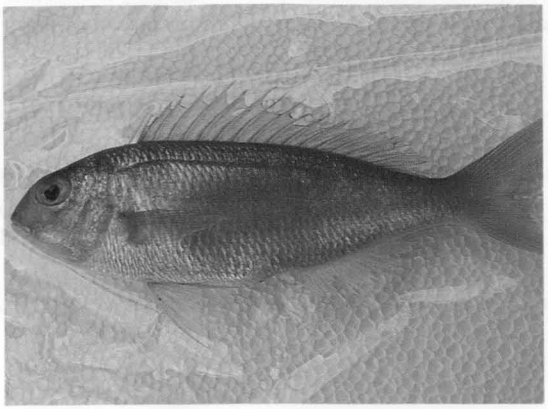


Fig 3: Nemipterus tolu

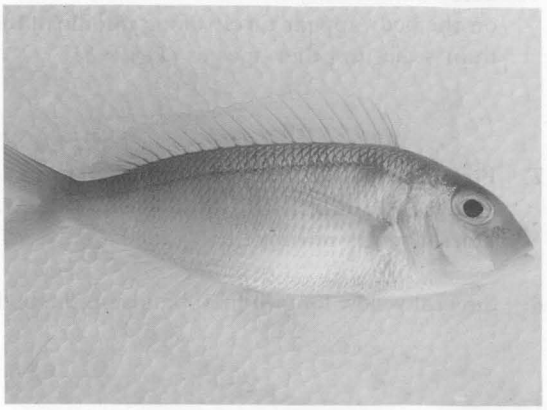


Fig. 4: Nemipterus peronii

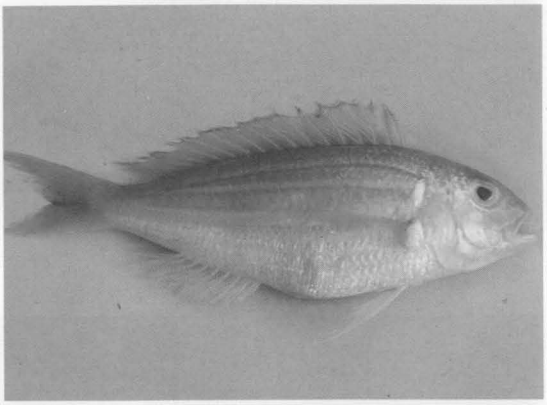


Fig. 5: Nemipterus marginatus

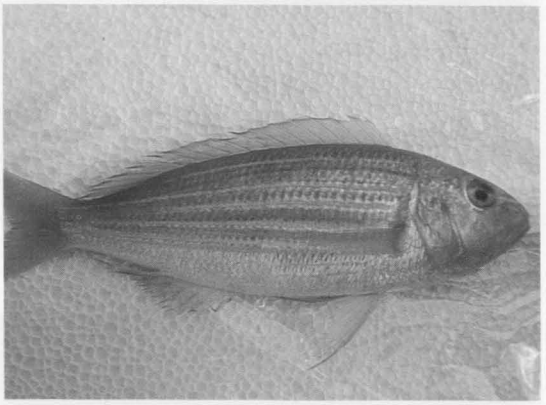


Fig. 6: Nemipterus tambuloides

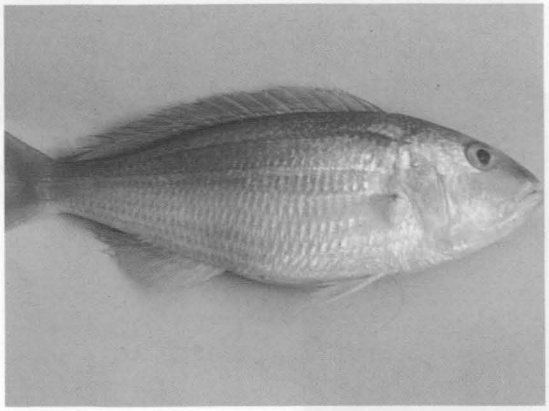


Fig. 7: Nemipterus hexodon

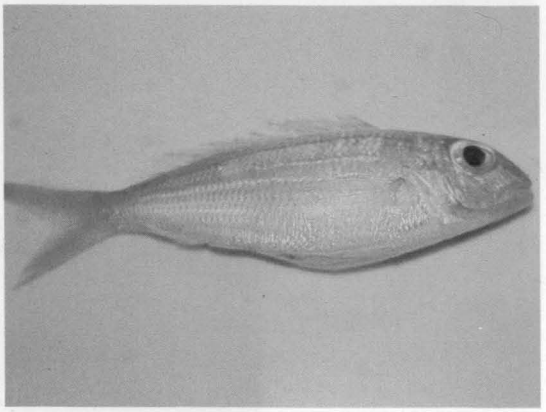


Fig. 8: Nemipterus delagoae

below lateral line) stretches backward and crosses lateral line at caudal peduncle. All yellow lines on the body appear nicely along middle of the scales; scale appears distinctly and relatively bigger than scales in other species *(Figure 8)*

.....*N. delagoae* Smith, 1941).

7. First two dorsal spine join together to form a long filament; sometimes yellow in colour (Figure 9)
.....*N. nematophorus* (Bleeker, 1853)
Dorsal spines normal, not joined.....8

8. Several yellow longitudinal bands on the body; shoulder spot near origin of lateral line *(Figure 10)*

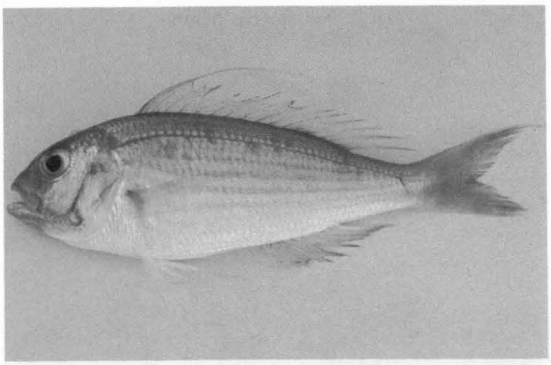


Fig. 9: Nemipterus nematophorus

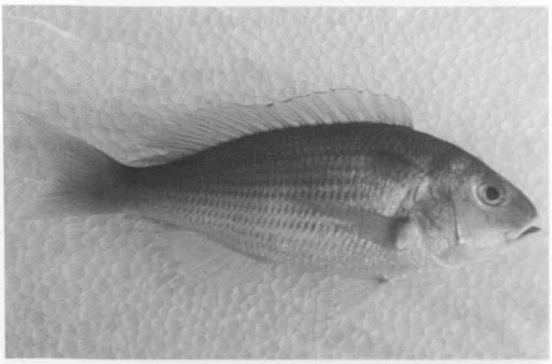


Fig. 10: Nemipterus japonicus

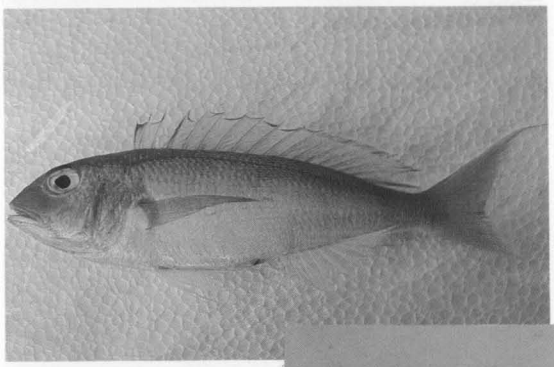


Fig. 11: Nemipterus nemurus

Fig. 12: Nemipterus mesoprion

Fig. 13: Nemipterus bathybus

.....*N. japonicus* (Bloch, 1791)

Two longitudinal bands on the body 9

9. Dorsal fin base without longitudinal line; red spot on membrane between first and second dorsal spines; and with yellow line, first longitudinal band on the body below lateral line, extended forward of the eye and ends at nostril *(Figure 11)*

.....*N. nemurus* (Bleeker, 1857)

Dorsal base with longitudinal line 10

10. Anal fin with two yellow longitudinal lines; dorsal with one yellow band in the middle; a spot on the shoulder; the first longitudinal band on the body commences at shoulder spot, branching into two and join again at below the last dorsal spine *(Figure 12)*

.....*N. mesoprion* (Bleeker, 1853)

Anal fin without yellow longitudinal line; no shoulder spot; belly with a very distinct yellow band, running from throat passing through auxillary scale of pelvic fin into caudal peduncle *(Figure 13)*.

.....*N. bathybus Snyder, 1911*

Probable Phylogenetic Lineage

Eleven species of threadfin found in this study are placed into a probable phylogenetic lineage. The lineage is based on comparative character analysis. By observing the fresh specimens, two major lineage can be established *(Figure 14)*. Lineage 1 is characterised by having caudal fin lobes of equal length while in Lineage 2, the upper caudal lobe extends far beyond the lower one. Lineage 1 consists of three groups. Two species, *N. peronii* and *N. tolu* in Group 1 closely resemble each other. Both share similarity in having 9 indistinct blotches on the body. Another two species in the Lineage 1 are placed in Group 3 in species, *N. marginatus* and *N. tambuloides* posses longitudinal bands on the body that stretch from the shoulder to the caudal peduncle. The next two species in the Lineage 1 are placed in Group 3 in which both the species, *N. hexodon* and *N. delagoae* have a distinct yellow line on the dorsal fin and longitudinal bands on the body. A faint shoulder spot is also common to both species.

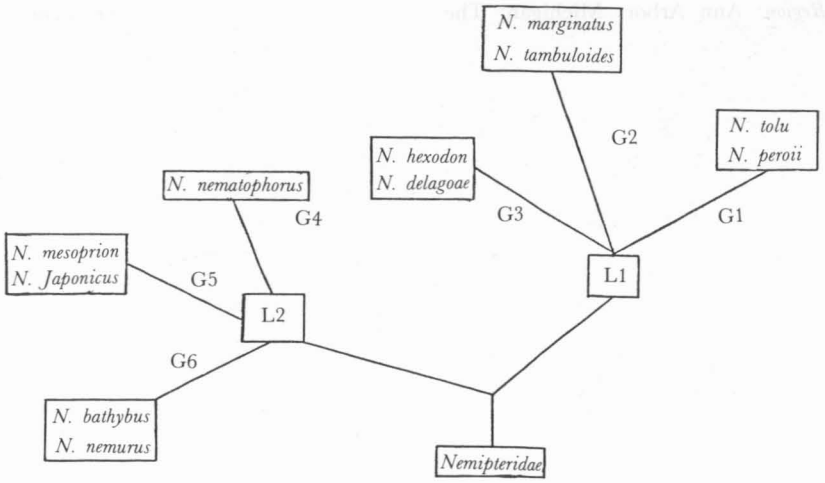


Fig. 14: The probable phycogenetic lineage for nemipterus species.

In Lineage 2, all the species share a common similarity of having caudal lobes of unequal length. There are three groups in this Lineage. The isolated group (Group 4) consists of a single species, *N. nematophorus*. This species is particularly unique in that its first two dorsal spines are joined together into a long filament characterising the modified dorsal spine of the angler fish. Group 5 in Lineage 2 comprises *N. japonicus* and *N. mesoprion*. These two species share a remarkable common character in having a red spot in the shoulder. Other characters common to these species include a median longitudinal band on the dorsal fin and longitudinal bands on the body. In Group 6, two species *N. nemurus* and *N. bathybus* were placed together because they possess a few common characters. Both have their upper caudal lobe extended into a long thread-like filament. The species also share similarity in having two conspicous yellow longitudinal bands on the body and upper lobe of the caudal fin with yellow margin.

REFERENCES

DAY, F. 1878. The Fauna of British India, including Ceylon and Burma: Fishes. *Tailor and Francis, London,* **1:** 526-529.

EGGLESTON, D. 1972. Patterns of Biology in the Nemipteridae. *J. Mar. Biol. Ass. India.* **14(1):** 357-364.

EGGLESTON, 1974. Nemipteridae. *In* FAO Species Identification Sheets for Fishery Purposes, ed. Fischer, W. and P.J.P. Whitehead. Eastern Indian Ocean and Western Central Pacific; Vol. 3. (Fishing areas 57 and 71).

HUBBS, C.L. and K.F. LAGLER. 1958. *Fishes of the Great Lakes Region.* Ann Arbor, Michigan: The University of Michigan Press.

INDRA, T.J. 1982. A Note on the Occurrence of *Nemipterus metopias* (Bleeker) from Madras coast. *Indian J. Fish.* **28:** 290-291.

KYUSHIN, K. K. AMAOKA, H. NAKAYA, Y. IDA, T. TANINO and T. SENTA. 1982. Fishes of the South China Sea. Japan Marine Fishery Resource Research Center.

LOWE-MCCONNEL., R.H. 1975. *Fish Communities in Tropical Freshwaters.* London and New York: Longman.

MASUDA, H., K. AMAOKA, C. ARAGA, T. UYENO and T. YOSHINO. 1984. *The Fishes of the Japanese Archipelago.* Tokai University Press.

MOHAN, M. and G. GOPAKUMAR. 1982. On the Occurrence of *Nemipterus metopias* (Blecker, 1852) (Nemipteridae, pisces) from the South-West Coast of India. *Indian J. Fish.* **28:** 280-282.

MURTY, V.S. 1978. *Nemipterus mesoprion* (Bleeker 1853) (Nemipteridae, Pisces). A New Record from the Seas Around India. *Indian J. Fish.* **25(1 & 2):** 274-276.

RAJAGOPALAN, M., P. KARUPPASWAMY and A. REGUNATHAN. 1975. *Nemipterus delagoe* Smith (Nemipteridae, Pisces) A New Record from India Seas. *Ind. J. Fish.* **24(1 & 2):** 274-276.

SMITH, J.L. B. 1949. The Sea Fishes of Southern Africa. South Africa: Central News Agency Ltd.

WEBER, M. and de BEAUFORT. 1936. The Fishes of the Indo-Australian Archipelago. *E.J. Brill Leiden.* **7:** 352-380.

WONGRATANA, T. 1972. Identification of *Nemipterus* in Thailand. *Proc. of the 2nd CSK Symposium,* p. 456-487. Tokyo, 1970.

_____1974. Additional Paper to the Identification of *Nemipterus* spp. in Thailand, *Proc. of the 3rd CSK Symposium,* p. 400-431. Thailand. 1973.

(Received 7 September, 1990)