

Pisces Pleuronectiformes :
A review of the genus *Tosarhombus* (Bothidae)
with descriptions of two new species from Saya de Malha
Bank (Indian Ocean) and the
Chesterfield Islands (Coral Sea)

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ABSTRACT

The bothid genus *Tosarhombus* is reviewed by comparing four species : *T. octoculatus* Amaoka, 1969, *T. smithi* (Nielsen, 1964), *T. nielseni* sp. nov. and *T. neocaledonicus* sp. nov. A description of the genus is given in addition to descriptions and a key to the four species. *T. smithi* from the western Indian Ocean is transferred from the genus *Engyprosopon* based on high numbers of dorsal fin rays, anal fin rays, lateral-line scales and total vertebrae, unsplit parhypural and hypural plates, and the tip of isthmus not extending to the middle part of the lower eye. *T. nielseni* sp. nov. from Saya de Malha Bank, western Indian Ocean and *T. neocaledonicus*

sp. nov. from the Chesterfield Islands, west of New Caledonia, are described based on several male and female specimens. The former new species is distinguished by having the posterior 2/3 of the body on the ocular side in males colored pale violet, short pectoral fin on the ocular side (1.7-2.0 times in head length), and a long snout and upper jaw on the blind side (4.4-4.7 times and 2.5-2.6 times in head length respectively). The latter new species has a high number of scales in lateral line (more than 80), and the filamentous pectoral fin ray on the ocular side of males.

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RÉSUMÉ

Pisces Pleuronectiformes : Révision du genre *Tosarhombus* (Bothidae) comprenant la description de deux espèces nouvelles provenant du banc Saya de Malha (océan Indien) et des îles Chesterfield (mer du Corail).

Le genre *Tosarhombus* est révisé en comparant quatre espèces : *T. octoculatus* Amaoka, 1969, *T. smithi* (Nielsen, 1964), *T. nielseni* sp. nov. et *T. neocaledonicus* sp. nov. Une description du genre et des espèces est donnée ainsi qu'une clef de détermination. *Engyprosopon smithi*, décrit de l'ouest de l'océan Indien, est transféré dans le genre *Tosarhombus* à cause du nombre élevé de rayons aux nageoires dorsale et anale, du nombre élevé de vertèbres et d'écaillés sur la ligne latérale, des plaques parhypurale et hypurale non divisées et

de la pointe de l'isthme n'atteignant pas le milieu de l'œil inférieur. *T. nielseni* sp. nov., qui provient du Banc Saya de Malha dans l'ouest de l'Océan Indien, se distingue des autres espèces en ayant, sur le côté oculé des mâles, les 2/3 postérieurs du corps colorés en violet pâle et une courte nageoire pectorale (contenue 1.7-2.0 fois dans la longueur de la tête), sur le côté aveugle, un long museau et une grande mâchoire supérieure (contenus respectivement 4.4-4.7 fois et 2.5-2.6 fois dans la longueur de la tête). *T. neocaledonicus* sp. nov., capturé aux îles Chesterfield dans l'ouest de la Nouvelle-Calédonie, se caractérise par un grand nombre d'écaillés sur la ligne latérale (plus de 80) et une nageoire pectorale filamenteuse sur le côté oculé des mâles.

INTRODUCTION

The monotypic genus *Tosarhombus* was established by AMAOKA (1969) based on *T. octoculatus* from southern Japan. The genus was distinguished from related genera by a combination of the following characteristics : ovate body, males with rostral and orbital spines, a wide interorbital space, high meristic counts, lack of sexual differences in the coloration of the blind side, strongly ctenoid scales, biserial teeth on the upper jaw and uniserial on the lower jaw, three infraorbital bones on the blind side, the lack of splits on the parhypural and hypural plates, and haemapophyses with triangular tips.

HENSLEY (1986) examined *Engyprosopon smi-*

thi Nielsen, 1964 from off Durban and Kenya, and pointed out that the generic placement of the species was questionable and that it was possibly closely related to *Tosarhombus octoculatus* from Japan.

Recently we collected several specimens of two undescribed *Tosarhombus* species, one from Saya de Malha Bank and another from the Chesterfield Islands, west of New Caledonia. Thus, we review the genus *Tosarhombus* based on the comparison of these four species. A description of the genus is given in addition to descriptions and a key to the four species.

METHODS

Counts and measurements were made according to HUBBS and LAGLER (1958), with the exception that all fin-ray bases in the dorsal and anal fins were counted as individual rays. Vertebral counts and osteological observations are

based on radiographs and dissections. Specimens used in the study are deposited in the FAKU, HUMZ, MNHN, RUSI and ZMUC ; the abbreviations follow LEVITON *et al.* (1985).

Genus *TOSARHOMBUS* Amaoka, 1969

Tosarhombus Amaoka, 1969 : 64 (type-species by original designation : *Tosarhombus octoculatus* Amaoka)

Body ovate, compressed. Caudal peduncle narrow. Tip of isthmus below posterior margin of lower eye. Anterior dorsal profile steeper in

males than in females or young. Eyes separated by a wide concave space, broader in males than in females and young. Males with a strong rostral spine, females and young with or without a feeble rostral spine; males with or without an orbital spine on anterior margin of upper eye.

Mouth large, maxilla extending beyond anterior margin level of lower eye. Teeth uniserial or biserial on upper jaw and uniserial on lower jaw. Gill rakers moderate in size, not serrated on posterior margin, developed on lower limb only (AMAOKA, 1969, fig. 37 E). Scales on ocular side ctenoid with elongate or moderate spinules (AMAOKA, 1969, fig. 37 C; Figs 7, 10, 14); those on blind side cycloid. Lateral line on ocular side with distinct curve above pectoral fin; lateral line absent on blind side. Dorsal and anal fin rays unbranched. Pectoral fins unequal, all rays simple. Pelvic fin on ocular side inserted slightly behind and below tip of isthmus and below a line through posterior margin of lower eye. Caudal rays branched except for upper and lower two rays.

Three infraorbital bones on blind side (Fig. 1). Urohyal bone fishhook-shaped, sciatic part with tapering anterior end and slightly longer than main part. First haemal spine not greatly expanded (Fig. 2). Haemapophysis on abdominal vertebrae with triangular tips (Fig. 2). Hypural and parhypural plates not split (Fig. 3).

REMARKS. — This genus closely resembles *Crossorhombus*, *Engyprosopon*, and *Bothus* in having a deep ovate body and marked sexual dimorphism in the head profile and interorbital width, and *Parabothus* in having the isthmus tip extending to below the posterior margin of the lower eye and sexual dimorphism in interorbital width (Figs 12, 13, 15). However, it differs from *Crossorhombus* and *Engyprosopon* in having more lateral line scales (59-90 vs. 51-63 in the latter), dorsal (96-109 vs. 78-96) and anal (76-85 vs. 58-74) fin rays and vertebrae (10 + 28-32 vs. 10 + 24-28), and the isthmus tip is below the posterior margin of the lower eye (below middle or anterior half of the lower eye in *Crossorhombus* and *Engyprosopon*). In addition, the blind side of the body in males is not colored dark blue as in *Crossorhombus* (AMAOKA, 1969, figs 39, 43), and the distal margins of the parhypural and hypural plates are not split as in *Engyprosopon*

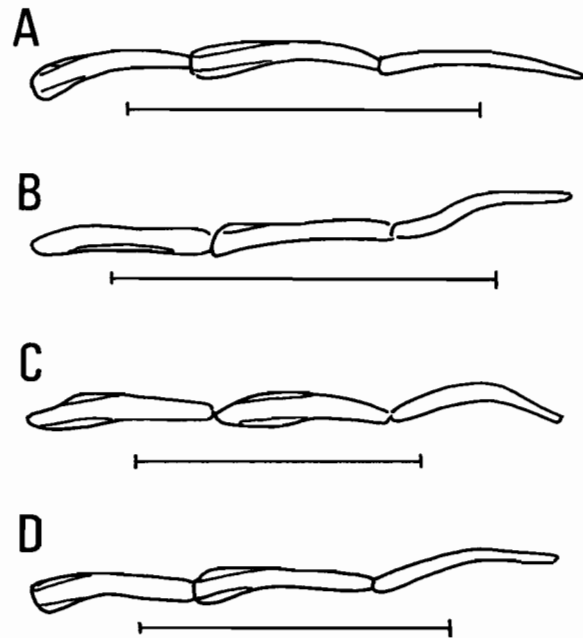


FIG. 1. — Infraorbital bones on blind side in four species of *Tosarhombus*: *T. octoculatus* (A), *T. smithi* (B), *T. nielseni* (C), and *T. neocaledonicus* (D). Scales indicate 10 mm.

(Fig. 3; AMAOKA, 1969, fig. 127 J). *Tosarhombus* is distinguished from *Bothus* by having the isthmus tip extending to below the posterior margin of lower eye (vs. middle of lower eye), three infraorbital bones on the blind side (vs. four) (Fig. 1; AMAOKA, 1969, fig. 107 E, F), haemapophyses with triangular tips (vs. expanded, square tips) (Fig. 2; AMAOKA, 1969, fig. 121 B1) and the first haemal spine relatively narrow (vs. greatly enlarged) (Fig. 2; AMAOKA, 1969, fig. 121 B1). It differs from *Parabothus* in having a rostral spine in males (vs. males without any spine on head) (NORMAN, 1934; AMAOKA, 1969), wider interorbital width (vs. narrower when compared with same size and same sex) (Fig. 15; AMAOKA, 1969, fig. 35), and deeper body (vs. shallow when compared with same size).

Since the three newly added species in the genus, *T. smithi*, *T. nielseni*, and *T. neocaledonicus*, are more closely related to the genus *Tosarhombus* than to any other genera in the characters as discussed above, it is best that the following characters for the generic description based on *T. octoculatus* given by AMAOKA (1969)

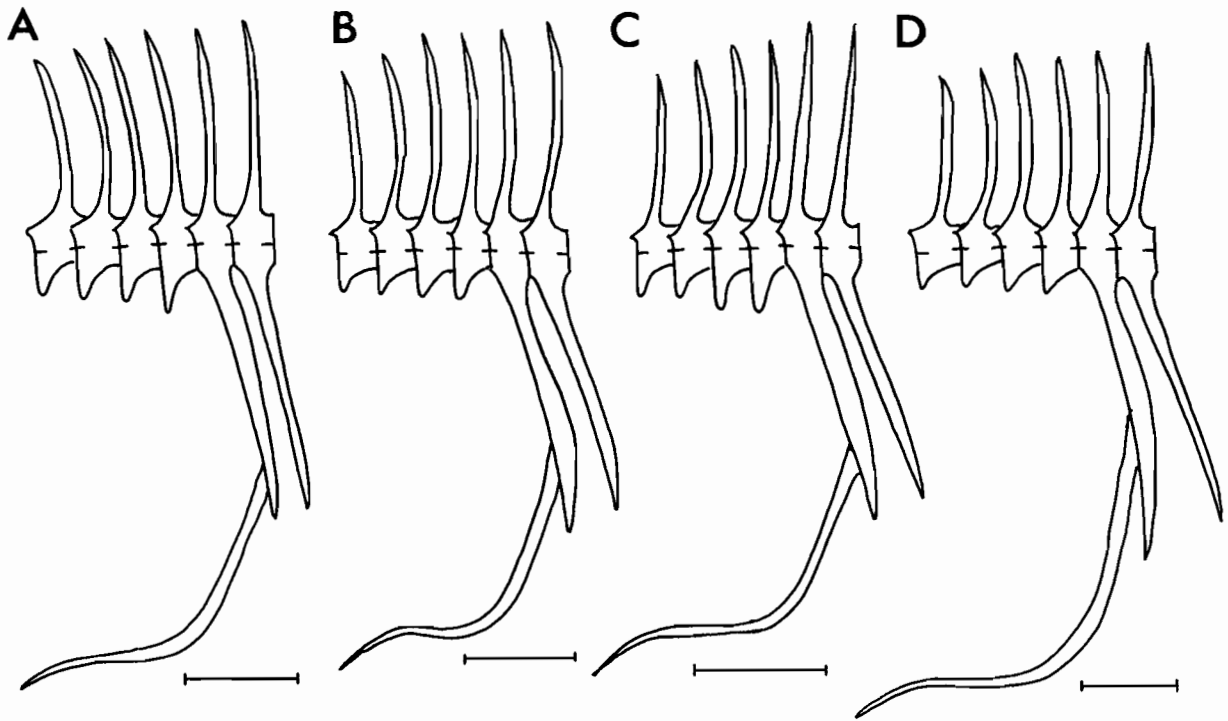


FIG. 2. — Posterior precaudal and anterior caudal vertebrae and first interhaemal spine in four species of *Tosarhombus*: *T. octoculatus* (A), *T. neocaledonicus* (B), *T. smithi* (C), and *T. nielsenii* (D). Scales indicate 10 mm.

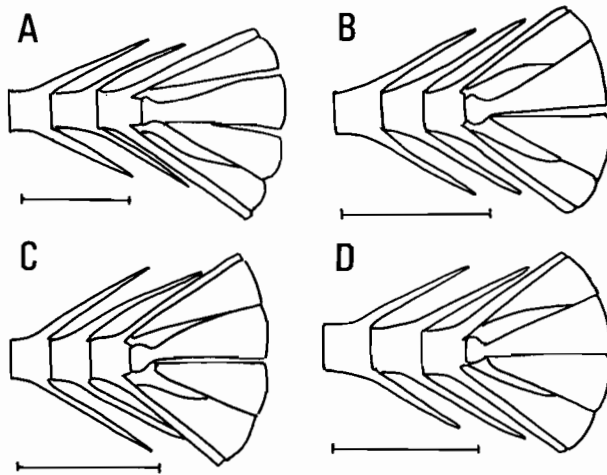


FIG. 3. — Caudal skeletons in four species of *Tosarhombus*: *T. octoculatus* (A), *T. smithi* (B), *T. nielsenii* (C), and *T. neocaledonicus* (D). Scales indicate 10 mm.

be eliminated: the third ray of the pelvic fin on the ocular side is opposite to the first ray on the blind side (the fourth ray opposite to the first ray in *T. smithi*, *T. nielsenii*, and *T. neocaledonicus*), finely ctenoid scales on the ocular side armed with elongate spinules (spinules not so elongate in *T. smithi*, *T. nielsenii* and *T. neocaledonicus*) (Figs 7, 10, 14), and biserial teeth on upper jaw and uniserial on lower jaw (uniserial on both jaws in *T. neocaledonicus*), body on the blind side lacks dark coloration in males (presence in *T. smithi*), and males have an orbital spine (no orbital spine in *T. smithi* and *T. nielsenii*).

Key to species of *Tosarhombus*

- A1 Scales large, less than 71 in lateral line ; pectoral fin on ocular side not greatly elongated, length 0.9-1.8 times in head length in males, 1.3-2.0 in females ; vertebrae 10 + 28-30 = 38-40.
- B1 Skin on ocular side of body not colored dark blue or pale violet in either sex ; third pelvic ray on ocular side opposite to first pelvic ray on blind side ; pectoral fin on ocular side moderate length, 0.9-1.5 times in head length (Fig. 5) ; length of upper jaw on blind side 3.0-3.3 times in head length (Fig. 11), of lower jaw on blind side 2.0-2.3 ; ctenoid scales with fine elongated spinules..... *T. octoculatus*
- B2 Skin on posterior 2/3 of body on ocular side in males colored dark blue or pale violet : fourth pelvic ray on ocular side opposite to first ray on blind side ; pectoral fin on ocular side short, 1.5-2.0 times in head length (Fig. 5) ; length of upper jaw on blind side 2.5-2.6 times in head length (Fig. 11), of lower jaw on blind side 1.8-2.0 ; ctenoid scales with fine spinules of moderate length.
- C1 Pelvic fins elongated on males (unexamined in female), length 1.1-1.3 in head length on ocular side, 2.3-2.5 on blind side (Fig. 8) ; pectoral fin rays 9-10 on blind side ; length of pectoral fin 1.5-1.7 in head length on ocular side, 2.8-2.9 on blind side (Fig. 5) ; lower eye large, diameter 3.3-3.4 in head length..... *T. smithi*
- C2 Pelvic fins moderate in both sexes, length 2.4-2.9 in head length on ocular side, 3.0-3.4 on blind side (Fig. 8) ; pectoral fin rays 11-12 on blind side ; length of pectoral fin 1.7-2.0 in head length on ocular side, 2.4-2.7 on blind side (Fig. 5) ; lower eye small, its diameter 4.0-4.9 in head length *T. nielsenii*
- A2 Scales small, more than 80 in lateral line ; pectoral fin on ocular side in males elongated into a filament, length 0.5-0.6 times in head length in males, 1.2-1.5 in females (Fig. 5) ; vertebrae 10 + 31-32 = 41-42
..... *T. neocaledonicus*

***Tosarhombus octoculatus* Amaoka, 1969**

Fig. 4

Tosarhombus octoculatus Amaoka, 1969 : 65, fig. 36 (original description, Kochi Prefecture, Japan) ; 1984 : 348, pl. 368 F. — OZAWA & FUKUI, 1986 : 336, pl. 1A-1B (description of larvae).

MATERIAL EXAMINED. — **Japan.** *Males* : 8 specimens, FAKU 29431 (holotype), 161.8 mm SL, Urado, Kochi Pref., November 20, 1958. — FAKU 29432-29438 (paratypes), 123.2-147.5 mm SL, Urado, Kochi Pref., November 20-24, 1958. — *Females* : 17 specimens, FAKU 29439-29454 (paratypes), 90.5-143.4 mm SL, Urado, Kochi Pref., November 20-24, 1958. — FAKU 33830 (paratype), 129.5 mm SL, Urado, Kochi Pref., December 12, 1959.

DIAGNOSIS. — Ocular side of body violet-blue when covered with scales ; a series of distinct yellowish white large blotches along head margin

in front of interorbital space and upper eye ; third pelvic ray on ocular side opposite first on blind side ; lengths of pectoral fin and pelvic fin on ocular side 0.9-1.5 and 2.4-2.9 times in head length, respectively (Figs 5, 8).

DESCRIPTION. — The mode for meristic data or the mean for morphometric data is given in parentheses. Morphometrics as percent of SL are shown in Table 1.

Dorsal fin rays 96-104 (101) ; anal fin rays 76-82 (79) ; pectoral fin rays 12-13 (13) on ocular side, 10-12 (11) on blind side ; scales in lateral line 59-66 (63) ; gill rakers 0 + 6-8 (0 + 7) ; vertebrae 10 + 28-30 (10 + 29). Head length 3.6-4.0 (3.79) in SL ; body depth 2.0-2.2 (2.10). Snout length 5.2-6.0 (5.60) ; upper eye diameter 3.1-4.0 (3.46) ; lower eye diameter 3.0-3.8 (3.44) ; interorbital width 2.0-2.9 (2.45) in males, 3.6-6.3



FIG. 4. — *Tosarhombus octoculatus*. **Top** : holotype, FAKU 29431, male 161.8 mm SL, from Urado, Kochi Prefecture. — **Bottom** : paratype, FAKU 29441, female 136.2 mm SL, from Urado, Kochi Prefecture.

TABLE 1. — Ranges of variation and means (in parentheses) of morphometric proportions expressed as percent of SL for four species of *Tosarhombus*.
o, ocular side ; b, blind side ; m, male ; f, female. Means included holotype.

	<i>T. octoculatus</i>	<i>T. smithi</i>	<i>T. nielseni</i>		<i>T. neocaledonicus</i>	
	8 males 17 females	3 males	Holotype male	Paratypes 1 male 3 females	Holotype male	Paratypes and others 2 males 11 females
SL (mm)	90.5-161.8	118.9-156.2	159.5	150.8-172.2	166.5	98.4-183.1
Head length	25.1-27.8 (26.4)	23.7-27.3 (25.7)	27.6	26.5-28.4 (27.3)	27.9	24.5-28.5 (26.7)
Body length	45.4-50.7 (47.8)	45.1-48.9 (47.0)	48.3	46.4-49.9 (48.5)	44.0	42.7-47.4 (44.4)
Snout length	4.4-5.1 (4.7)	5.7-6.0 (5.8)	6.3	5.9-6.5 (6.1)	4.9	4.4-5.7 (5.0)
Upper eye diameter	6.4-8.5 (7.7)	7.1-7.7 (7.4)	6.9	7.1-7.2 (7.1)	6.7	5.9-8.4 (7.1)
Lower eye diameter	6.7-8.7 (7.7)	7.1-8.1 (7.6)	6.9	5.4-6.7 (6.4)	6.5	6.0-8.3 (7.3)
Interorbital width (m)	9.1-12.9 (6.2)	7.4-8.1 (7.7)	10.0	9.0 (9.5)	11.8	9.8-12.0 (11.2)
Interorbital width (f)	4.2-7.6 (10.9)			4.2-5.5 (4.8)		4.6-7.4 (6.1)
Upper jaw length (o)	7.8-8.9 (8.3)	8.8-10.3 (9.5)	10.3	9.2-10.4 (9.9)	9.6	8.3-9.7 (9.1)
Upper jaw length (b)	8.0-9.2 (8.5)	9.5-10.5 (10.1)	10.8	10.0-11.4 (10.7)	10.3	8.7-10.4 (9.6)
Lower jaw length (o)	11.0-12.0 (11.4)	11.6-12.6 (12.3)	13.2	12.0-13.4 (12.9)	12.0	10.4-12.6 (11.8)
Lower jaw length (b)	11.6-13.3 (12.4)	12.9-14.1 (13.5)	14.5	13.6-14.5 (14.2)	13.3	11.5-13.7 (13.0)
Caudal peduncle length	9.4-11.1 (10.1)	10.4-10.8 (10.6)	10.5	10.0-10.6 (10.4)	9.1	9.0-9.9 (9.5)
Pectoral fin length (o, m)	22.4-31.4 (26.6)	15.9-17.3 (16.5)	15.1	15.1-16.1 (15.6)	52.6	44.8-46.0 (47.8)
Pectoral fin length (o, f)	18.5-20.4 (19.6)			13.1-15.6 (14.7)		18.1-26.2 (20.0)
Pectoral fin length (b)	10.2-12.0 (11.1)	8.3-9.7 (9.1)	10.1	10.1-11.3 (10.9)	11.6	10.9-12.7 (11.6)
Pelvic fin length (o)	9.3-10.9 (10.0)	19.7-25.2 (21.9)	9.5	9.5-11.7 (10.5)	12.7	11.4-14.2 (12.9)
Pelvic fin length (b)	8.7-10.3 (9.5)	9.6-11.9 (10.8)	8.8	8.3-8.8 (8.5)	9.7	9.0-11.3 (10.0)
Pelvic fin base length (o)	6.4-8.2 (7.6)	8.2-8.6 (8.4)	7.6	7.6-9.6 (8.6)	9.0	8.4-9.6 (8.9)
Pelvic fin base length (b)	3.7-5.3 (4.5)	4.5-5.0 (4.9)	3.5	3.5-4.6 (4.1)	4.3	4.1-4.9 (4.5)
Longest D fin ray	10.4-14.4 (11.9)	10.3-12.2 (11.5)	11.3	11.0-12.1 (11.6)	9.9	9.9-12.5 (11.7)
Longest A fin ray	10.6-13.7 (12.1)	10.8-12.7 (11.6)	11.3	11.3-12.3 (11.8)	11.4	10.6-13.0 (11.7)

(4.37) in females ; upper jaw length 3.0-3.3 (3.18) on ocular side, 3.0-3.3 (3.10) on blind side ; lower jaw length 2.2-2.5 (2.31) on ocular side, 2.0-2.3 (2.13) on blind side ; depth of caudal peduncle 2.3-2.9 (2.61) ; pectoral fin length 0.9-1.2 (1.02) on ocular side in males, 1.3-1.5 (1.35) in females, 2.2-2.7 (2.39) on blind side ; pelvic fin length 2.4-2.9 (2.65) on ocular side, 2.5-3.0 (2.77) on blind side ; pelvic fin-base length 3.3-4.0 (3.50) on ocular side, 5.0-7.5 (5.85) on blind side ; longest dorsal fin ray 1.9-2.5 (2.23) ; longest anal fin rays 2.0-2.4 (2.19).

For description, coloration, and sexual dimorphism see AMAOKA (1969).

REMARKS. — *Tosarhombus octoculatus*, from Kochi Prefecture, southern Japan, is separated from the three other species of this genus from the Indian Ocean and the southern Pacific, by a short upper jaw on the blind side (Fig. 11 ; 3.0-3.3 times in head length vs. less than 2.9). It differs from *T. smithi* and *T. nielseni* in having a short snout (Fig. 11 ; 5.2-6.0 times in head length vs. less than 4.7), short upper jaw on the ocular

side (3.0-3.3 in head length vs. less than 2.9), short lower jaw on the blind side (2.0-2.3 vs. less than 2.0), long pectoral fin on the ocular side in males (Fig. 5 ; 0.9-1.2 vs. more than 1.5), and a lower number of lateral line scales (59-66 vs. more than 64).

DISTRIBUTION. — Adults are only known from Tosa Bay, larvae from seas around Ryukyu Islands and east of Taiwan. All adult specimens were trawled from 200-500 m depth.

Tosarhombus smithi (Nielsen, 1964)

Fig. 6

Engyproson smithi Nielsen, 1964 : 127, fig. 1 and pl. 17, figs A, B (original description, off Durban, South Africa). — HENSLEY, 1986 : 858, fig. 259.10.

MATERIAL EXAMINED. — East African Coast. ZMUC P-853157 (holotype), 156.2 mm SL, male, off Durban, 230 m, sand, August 27, 1929. — RUSI 14026-1-2, 118.9-135.0 mm SL, males, Kenya, 02°10'S, 41°15'E, 124 m, December 13, 1980.

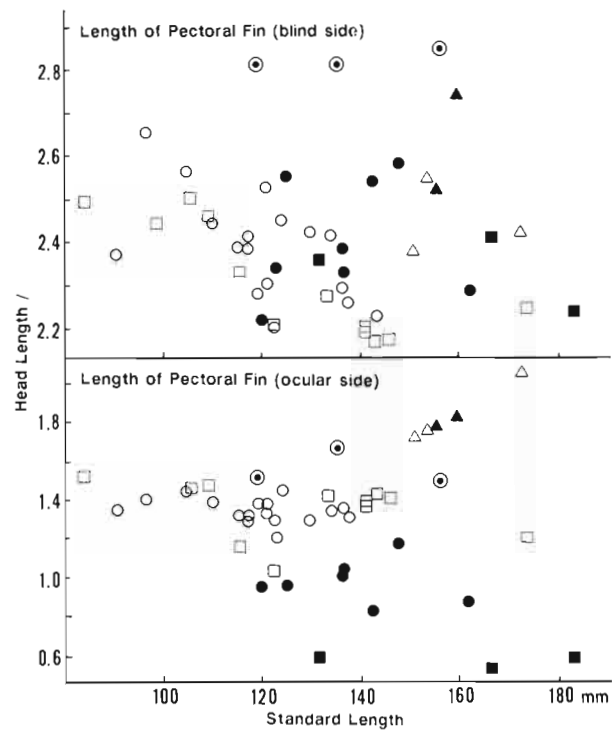


FIG. 5. — Comparison of pectoral fin length on blind side (top) and on ocular side (bottom) in four species of *Tosarhombus*: *T. octoculatus* (closed circles for males; open circles for females), *T. smithi* (double circles for males), *T. nielsenii* (closed triangles for males; open triangles for females), and *T. neocaledonicus* (closed squares for males; open squares for females).

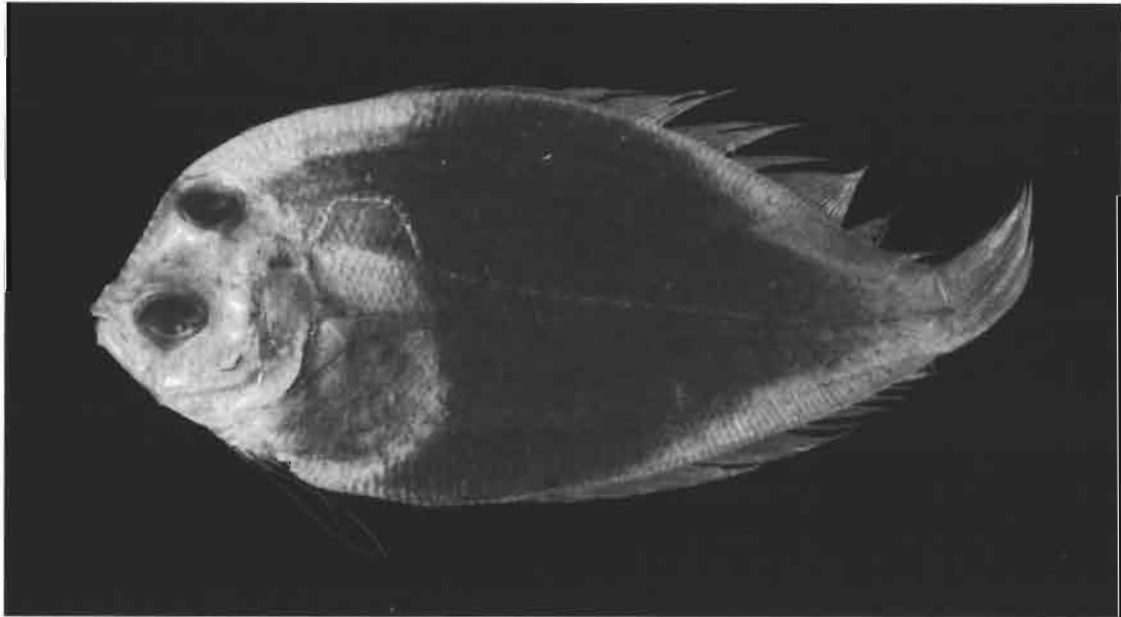


FIG. 6. — *Tosarhombus smithi*, RUSI 14026-1, male 135.0 mm SL, from Kenya.

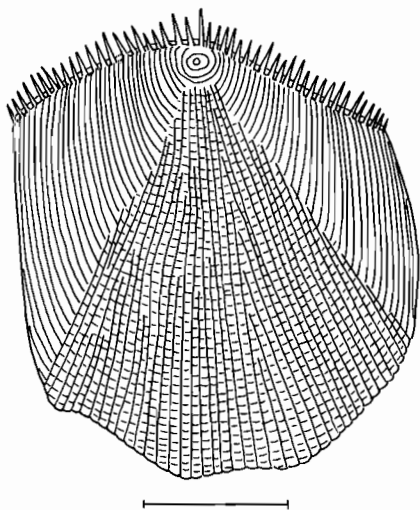


FIG. 7. — Scale from ocular side of *Tosarhombus smithi*. Scale bar indicates 1 mm.

DIAGNOSIS. — Posterior 2/3 of body on ocular side in males (not checked in female) colored dark brown; fourth pelvic ray on ocular side opposite to first ray on blind side; pelvic fins elongated, 1.1-1.3 times in head length on ocular side, 2.3-2.5 times on blind side (Fig. 8); eyes rather large, lower eye diameter 3.3-3.4 times in head length.

DESCRIPTION. — The mode for meristic data or the mean for morphometric data is given in parentheses. Morphometrics as percent of SL are shown in Table 1.

Dorsal fin rays 104-108 (104); anal fin rays 81-85 (-); pectoral fin rays 12-13 (12) on ocular side, 9-10 (10) on blind side; scales in lateral line 65-67 (65); gill rakers 0 + 7 (0 + 7); vertebrae 10 + 29-30 (10 + 30). Head 3.7-4.2 (3.90); body depth 2.1-2.2 (2.13). Snout length 4.2-4.5 (4.41); upper eye diameter 3.3-3.7 (3.48); lower eye diameter 3.3-3.4 (3.38); interorbital width 3.2-3.5 (3.34) in males; upper jaw length 2.7-2.8 (2.71) on ocular side, 2.5-2.6 (2.56) on blind side; lower jaw length 2.0-2.2 (2.10) on ocular side, 1.8-2.0 (1.91) on blind side; depth of caudal peduncle 2.2-2.6 (2.43); pectoral fin length 1.5-1.7 (1.56) on ocular side in males, 2.8-2.9 (2.82) on blind side; pelvic fin length 1.1-1.3 (1.18) on ocular side, 2.3-2.5 (2.38) on blind side; pelvic fin-base length 2.8-3.3 (3.07) on ocular side, 5.2-5.4 (5.27)

on blind side; longest dorsal fin ray 2.2-2.3 (2.25); longest anal fin ray 2.2-2.3 (2.22).

Body slightly elongated, ovate and compressed, greatest depth at anterior 1/3 of body, body depth a little shallower than half its length. Dorsal and ventral contours, except for head, gently arched. Caudal peduncle rather deep, its depth slightly greater than 1/5 body depth.

Head somewhat small, length about 1.8-1.9 times in body depth, head profile with a distinct notch in front of upper margin of lower eye, somewhat steeply elevated above upper eye. Snout obtuse and long (Fig. 11), a little shorter than eye diameter. Rostral spine strong, with blunt tip. Both eyes rather large, about equal to 1/6 body depth, anterior edge of upper eye above middle of lower eye. Orbital spine absent. Interorbital wide and shallowly concaved, width varying with growth 3.2-3.5 times in head length (Fig. 15). Anterior nostril on both sides tubular with short flap anteriorly, posterior one not tubular.

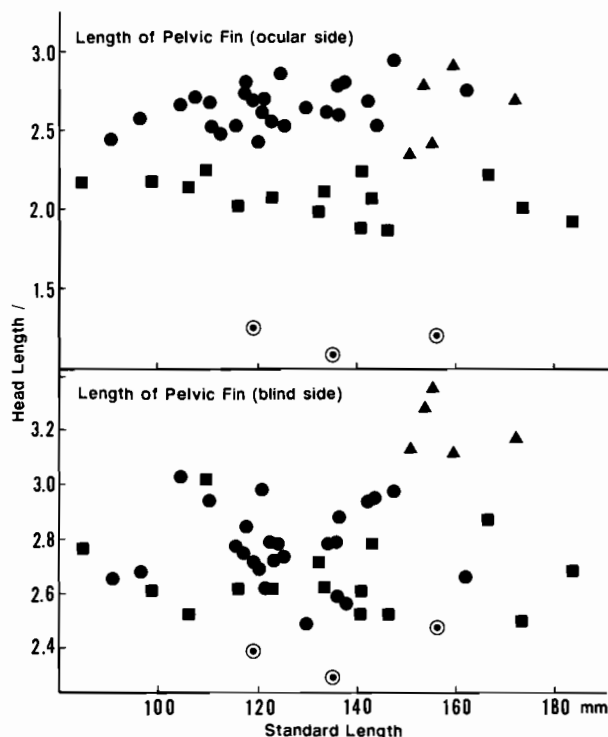


FIG. 8. — Comparison of pelvic fin length on ocular side (top) and on blind side (bottom) in four species of *Tosarhombus*: *T. octoculatus* (circles), *T. smithi* (double circles), *T. nielseni* (triangles), and *T. neocaledonicus* (squares).

Mouth large (Fig. 11) and gently curved, both jaws on ocular side shorter than those on blind side; maxilla extending slightly beyond anterior margin of lower eye, length of upper jaw about 1.2-1.4 times eye diameter. Lower jaw long, that on ocular side a little shorter than half head length, that on blind side a little longer than half head length. Teeth on upper jaw biserial, those in outer series much stronger and more widely spaced than those in inner series; several anterior teeth on both series enlarged as canines; teeth on lower jaw uniserial, about similar to those in outer series in size except for anterior canines. Gill rakers slender, blunt, not serrated on posterior margin, but covered by skin with fine papillae; gill rakers developed on lower limb only.

Scales moderate, those on ocular side ctenoid with spines of moderate length (Fig. 7); scales on blind side cycloid; snout, both jaws, head margin in front of interorbital area all naked; all fins naked except on basal area. Lateral line on ocular side with a curve above pectoral fin, length about equal to half head length.

Dorsal fin rays longest above slightly behind middle body. Anal fin similar in shape and structure to dorsal fin except for head portion. Pectoral fin rather short, not filamentous in males (Fig. 5), its length on ocular side about equal to 2/3 head length, 1.7-1.8 times that on blind side. Pelvic fins elongated (Fig. 8), that on ocular side as long as or a little shorter than head length; each pelvic fin distinctly longer than pectoral fins on respective sides; fourth ray on ocular side opposite to first on blind side.

Coloration in alcohol: General ground color on ocular side colored dark brown in specimens preserved for a long time or dark blue in fresher specimens, except for areas anterior to the posterior border of abdominal cavity, anterior to the junction of the straight and curved portions of lateral line, and on the margin of the posterior 1/3 of body, or on posterior 1/3 of body; a series of six or seven whitish blotches located along the head margin in front of interorbital area and upper eye, each blotch bordered by a dark blotch; a dark line connects posterior margins of the dark blotches, and runs through the anterior margin of the upper eye to above middle of dorsal margin of upper eye. Vertical fins with many small dots; pelvic fins dark; pectoral fins pale. Body on blind side colored dark except for head with light brown.

Sexual dimorphism: Three male specimens examined in this study, females are unknown. HENSLEY (1986) suggested that females probably lack a rostral spine and have a narrow interorbital. In addition to these characters, it is considered that females do not have a dark blue area on the ocular side, because females of the closely related species, *T. nielsenii*, are uncolored on the ocular side of body.

DISTRIBUTION. — Known from off Durban and Kenya. Holotype was trawled from a sandy bottom at 230 m depth.

REMARKS. — This species was described by NIELSEN (1964) as *Engyproson smithi* based on a male specimen from off Durban. HENSLEY (1986), who examined three specimens (including the holotype) from off Durban and Kenya, pointed out that this species is possibly closely related to *Tosarhombus octoculatus*.

Our reexamination of these specimens showed that all characters defining the genus *Tosarhombus* are present in this species, hence we transfer it to this genus.

T. smithi is closely related to *T. nielsenii* in the characteristic body coloration on males (Fig. 9), long snout (Fig. 11; 4.2-4.5 times in head length vs. 4.4-4.7), long upper and lower jaws on the blind side (Fig. 11; 2.5-2.6 vs. 2.5-2.6; 1.8-2.0 vs. 1.9-2.0, respectively), but *T. smithi* differs from *T. nielsenii* by many characters described below. Both these species are easily separated from the other two species having a shorter snout (Fig. 11; 4.8-6.0 times in head length) and shorter upper and lower jaws on the blind side (Fig. 11; 2.7-3.3 and 2.0-2.3 respectively).

Tosarhombus nielsenii sp. nov.

Fig. 9

MATERIAL EXAMINED AND TYPES. — **Saya de Malha Bank**. *Holotype*: HUMZ 73467, 159.5 mm SL, male, 11°20'S, 60°43'E, 147 m, September 2, 1977. — *Paratypes*: HUMZ 74080, 155.1 mm SL, male, 10°51'S, 61°17'E, 124 m, September 4, 1977. — HUMZ 73466, 172.2 mm SL, female, 11°20'S, 60°43'E, 147 m, September 2, 1977. — HUMZ 73468-73469, 150.8-153.5 mm SL, females, 11°20'S, 60°43'E, 147 m, September 2, 1977.



FIG. 9. — *Tosarhombus nielseni* sp. nov. **Top** : holotype, HUMZ 73467, male 159.5 mm SL, from Saya de Malha Bank. — **Bottom** : paratype, HUMZ 73469, female 153.5 mm SL, from Saya de Malha Bank.

DIAGNOSIS. — Middle part of body on ocular side of males colored pale violet ; fourth pelvic ray on ocular side opposite to first ray on blind side ; long snout and upper jaw on blind side 4.4-4.7 and 2.5-2.6 in head length respectively (Fig. 11) ; length of pectoral fin on ocular side 1.7-2.0 times in head length (Fig. 5).

DESCRIPTION. — Data for the holotype are

given first, followed in parentheses by the ranges for the paratypes and holotype, plus the mode for meristic data or the mean for morphometric data. Morphometrics as percent of SL are shown in Table 1.

Dorsal fin rays 100 (100-102, 100) ; anal fin rays 81 (77-81, 80) ; pectoral fin rays 13 (12-13, 13) on ocular side, 11 (11-12, 11) on blind side ; scales in lateral line 67 (66-70, 66) ; gill rakers 0

+ 8 (0 + 8-9, 0 + 8); vertebrae 10 + 29 (10 + 29-30, 10 + 29). Head length 3.6 (3.5-3.8, 3.66); body depth 2.1 (2.0-2.2, 2.06). Snout length 4.4 (4.4-4.7, 4.47); upper eye diameter 4.0 (3.7-4.0, 3.85); lower eye diameter 4.0 (4.0-4.9, 4.28); interorbital width 2.8 (2.8-3.2, 2.96) in males, (4.8-6.3, 5.72) in females; upper jaw length 2.7 (2.7-2.9, 2.76) on ocular side, 2.6 (2.5-2.6, 2.56) on blind side; lower jaw length 2.1 (2.0-2.2, 2.12) on ocular side, 1.9 (1.9-2.0, 1.93) on blind side; depth of caudal peduncle 2.6 (2.6-2.7, 2.62); pectoral fin length 1.8 (1.8, 1.80) on ocular side in males, (1.7-2.0, 1.83) in females, 2.4 (2.4-2.7, 2.52) on blind side; pelvic fin length 2.7 (2.4-2.9, 2.63) on ocular side, 3.2 (3.1-3.4, 3.22) on blind side; pelvic fin-base length 3.0 (3.0-3.6, 3.21) on ocular side, 6.7 (6.2-7.9, 6.77) on blind side; longest dorsal fin ray 2.4 (2.3-2.5, 2.38); longest anal fin ray 2.3 (2.2-2.4, 2.31).

Body ovate and compressed, greatest depth at junction of straight and curved parts of lateral line, body depth about equal to half its length. Dorsal and ventral contours except for the head, with a shallow arch. Caudal peduncle somewhat narrow, its depth a little greater than 1/5 body depth.

Head large, length more than half body depth, head profile with a slight notch in front of upper margin of lower eye, somewhat steeply elevated before interorbital area and evenly curved above upper eye. Snout obtuse and long (Fig. 11), almost equal to lower eye diameter. Rostral spine very short and indistinct, somewhat stronger in males. Both eyes small, about equal to half the lower jaw length, anterior edge of upper eye above posterior or middle part of lower eye. No orbital spine present. Interorbital space wide, and shallowly concave, its width varying with sex and age (Fig. 15). Anterior nostril on both sides tubular with a short flap anteriorly, posterior one not tubular.

Mouth large (Fig. 11) and gently curved, both jaws on ocular side shorter than those on blind side; maxilla extending beyond anterior margin of lower eye, length of upper jaw about 1.5 times eye diameter. Lower jaw long, about half head length, and about equal to distance from snout tip to posterior margin of lower eye. Teeth on upper jaw biserial, those in outer series much shorter, stronger and more widely spaced than those in inner series; several anterior teeth on both series enlarged; teeth on lower jaw unise-

rial, larger than those in inner series of upper jaw. Gill rakers moderate in length, pointed, not serrate on posterior margin, developed on lower limb only.

Scales moderate, deciduous; those on ocular side ctenoid with feeble spines of moderate length (Fig. 10); scales on blind side cycloid; snout, anterior parts of both jaws, and anterior margin of body in front of interorbital area all naked; all fins naked except on basal areas. Lateral line on ocular side with a curve above pectoral fin, its length a little longer than half head length.

Dorsal fin rays longest above middle part of body, longest ray a little shorter than half head length. Anal fin similar in shape and structure to dorsal fin except for head portion. Pectoral fin on ocular side very short, about half head length, longer than that on blind side, not filamentous in either sex (Figs 5, 15). Length of pelvic-fin base on ocular side about twice that on blind side; fourth ray on ocular side opposite first on blind side. Caudal fin rounded.

Coloration in alcohol: General ground color on ocular side distinctly different in both sexes (see below); a series of six white blotches located along head margin in front of interorbital space and upper eye, boundary of each blotch somewhat indistinct. Many small dark spots scattered on body and dorsal and anal fins. Body on blind side light brown.

Sexual dimorphism: This species shows sexual differences in several characters. Males have a very wide interorbital space (Fig. 15; 2.8-3.2 times in head length), small rostral spine and steep head profile in front of the interorbital area and upper eye. However, the most obvious difference is coloration on the ocular side. In males, it is colored pale violet, except for the area anterior to the junction of the straight and curved portions of the lateral line and the posterior 1/3 of the body is light brown.

Females have a concave narrow interorbital region (Fig. 15; 4.8-6.3 times in head length), feeble rostral spine, and the dorsal profile of the head is gently curved, like the ventral one. The ocular side of the body is a uniform light brown.

DISTRIBUTION. — Known from Saya de Malha Bank, western Indian Ocean. Specimens were trawled from 124-230 m depth.

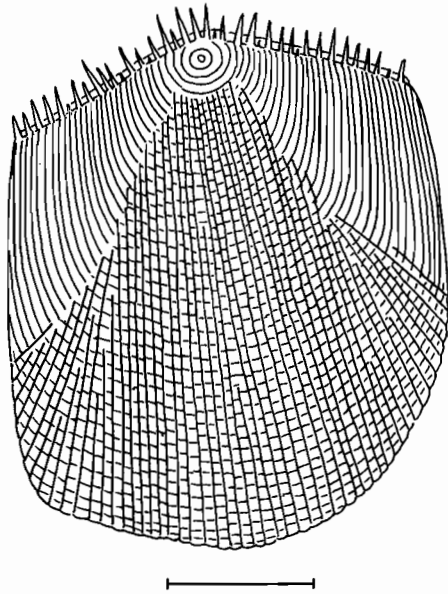


FIG. 10. — Scale from ocular side of *Tosarhombus nielsenii*. Scale bar indicate 1 mm.

ETYMOLOGY. — Named in honor of the flatfish systematist, Dr. J. NIELSEN, who described one species in this genus.

REMARKS. — From the characters discussed in the remarks of the genus *Tosarhombus*, this species clearly belongs in this genus. *T. nielsenii* resembles *T. smithi* in body shape and a distinct body coloration on the ocular side with dark brown (probably pale violet in fresh) or pale violet area on about the posterior 2/3, but differs from it in not having elongated pelvic fin rays on both sides (Fig. 8; 2.4-2.9 times in head length on ocular side and 3.0-3.4 on blind side in *T. nielsenii* vs. 1.1-1.3 and 2.3-2.5 in *T. smithi*), small upper eye (3.7-4.0 times in head length vs. 3.3-3.7), small lower eye (4.0-4.9 vs. 3.3-3.4), short pectoral fins on ocular side and long on blind side (Fig. 5; 1.7-2.0 times in head length on ocular side and 2.4-2.7 on blind side vs. 1.5-1.7 and 2.8-2.9), a low number of dorsal fin rays (100-102 vs. 104-108), a low number of anal fin rays (77-81 vs. 81-85), a high number of pectoral fin rays on blind side (11-12 vs. 9-10), and a high number of gill rakers (0 + 8-9 vs. 0 + 7).

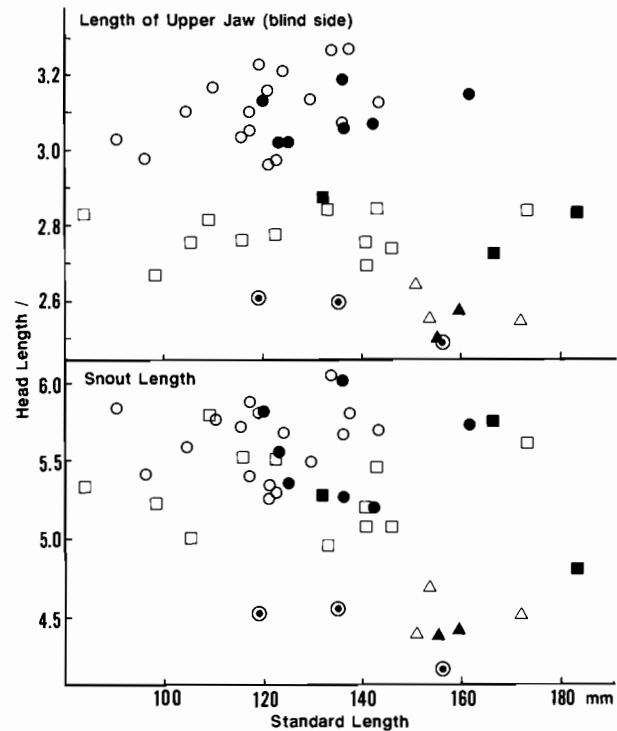


FIG. 11. — Comparison of upper jaw length on blind side (top) and snout length (bottom) in four species of *Tosarhombus*: *T. octoculatus* (closed circles for males; open circles for females), *T. smithi* (double circles for males), *T. nielsenii* (closed triangles for males; open triangles for females), and *T. neocaledonicus* (closed squares for males; open squares for females).

The pale violet area on the ocular side of males in *T. nielsenii* is unique in the family Bothidae, although there is similar coloration on the blind side of males in species of *Crossorhombus*.

Tosarhombus neocaledonicus sp. nov. ¹

Figs 12, 13

Bothus sp. Richer de Forges & Pianet, 1984, annexe 2.

Tosarhombus sp. nov. Rivaton, 1989 : 155 (in part).

MATERIAL EXAMINED AND TYPES. — **Chesterfield Plateau.** CHALCAL I. *Holotype*: MNHN 1988-686, 166.5 mm SL, male, stn CP 10, 20°00.20'S, 158°46.60'E,

1. The species name *T. novaensis* was released with drawings to a daily newspaper "Les Nouvelles Calédoniennes" on 20 January 1991 in a report by Luc DELANNOY to whom we gave this information without forethought. As a result, this species name is a *nomen nudum*, since its publication does not satisfy the provisions of Article 13 of the International Code of Zoological Nomenclature. This situation causes us to herein give a new scientific name to our new taxon with its full description.

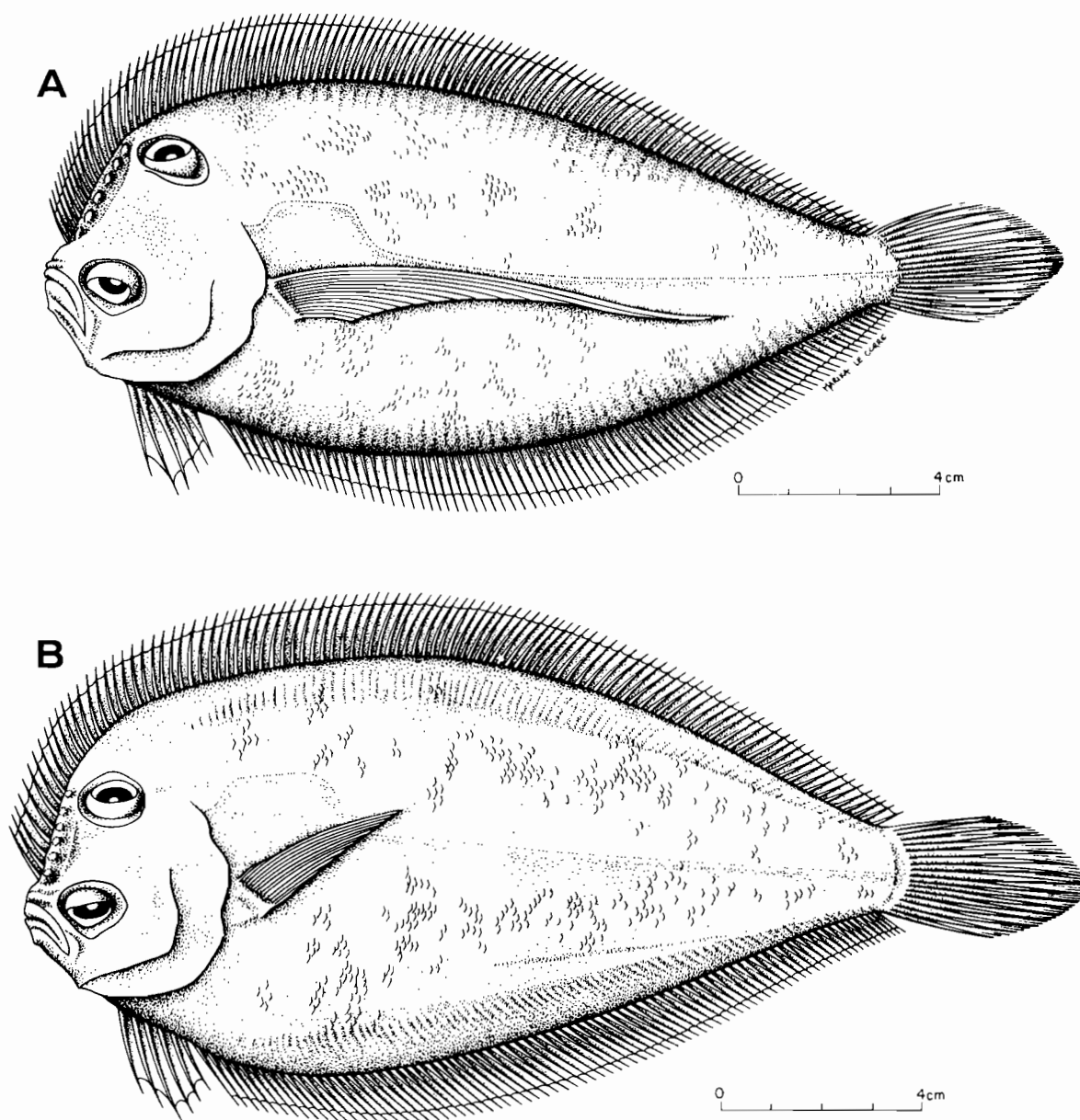


FIG. 12. — *Tosarhombus neocaledonicus* sp. nov. : A, holotype, MNHN 1988-686, male 166.5 mm SL, from Chesterfield Plateau, west of New Caledonia. — B, paratype, MNHN 1988-687, female 173.2 mm SL, from Nova Bank, west of New Caledonia.

beam trawl, 225 m, July 22, 1984. — *Paratypes* : MNHN 1988-687 (part), 109.0 mm SL, female, stn CP 10, 20°00.20'S, 158°46.60'E, beam trawl, 225 m, July 22, 1984. — HUMZ 114940, 114942, 105.3-143.0 mm SL, females, stn CP 10, 20°00.20'S, 158°46.60'E, beam trawl, 225 m, July 22, 1984.

CORAIL II. *Paratypes* : HUMZ 114938, 183.1 mm SL, male, stn 131, 19°25.49'S, 158°37.96'E, beam trawl, 217 m, July 29, 1988. — HUMZ 114939, 140.8 mm SL,

female, stn 142, 19°36.16'S, 158°26.79'E, beam trawl, 193 m, July 30, 1988. — HUMZ 114941, 119270, 115.5-140.8 mm SL, females, stn 162, 19°46.24'S, 158°25.67'E, beam trawl, 203 m, August 1, 1988. — *Other specimens* : MNHN 1991-451, 133.1 mm SL, female, stn 131, 19°25.49'S, 158°37.96'E, beam trawl, 217 m, July 29, 1988 ; 145.8 mm SL, female, stn 142, 19°36.16'S, 158°26.79'E, beam trawl, 193 m, July 30, 1988. — MNHN 1991-452, 132.1 mm, male, stn 162,

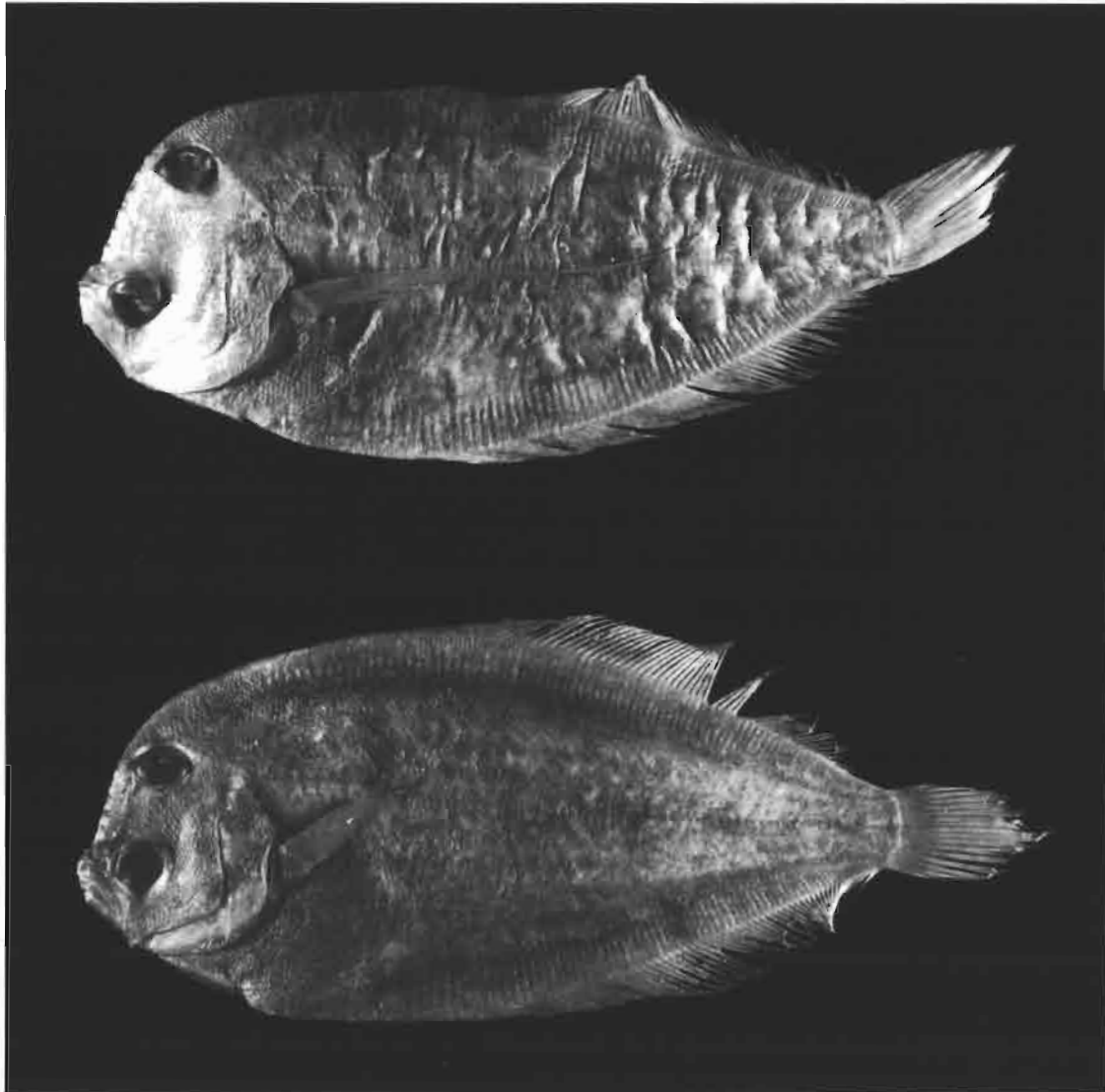


FIG. 13. — *Tosarhombus neocaledonicus* sp. nov. : **Top**, holotype, MNHN 1988-686, male 166.5 mm SL. — **Bottom**, paratype, MNHN 1988-687, female 173.2 mm SL.

beam trawl, 19°46.24'S, 158°25.67'E, 203 m, August 1, 1988; 84.2-122.3 mm SL, 3 females, stn CP 10, 20°00.20'S, 158°46.60'E, beam trawl, 225 m, July 22, 1984.

Nova Bank. CHALCAL 1. *Paratype* : MNHN 1988-687 (part), 173.2 mm SL, female, stn CP 17, 22°34.70'S, 159°15.30'E, 295 m, July 28, 1984.

DIAGNOSIS. — High number of scales, more than 80 in lateral line; pectoral fin on ocular side elongated into a filament in males, much longer than head (Fig. 5; 0.5-0.6 times in head length).

DESCRIPTION. — Data for the holotype are given first, followed in parentheses by ranges for the paratypes and holotype, plus the mode for meristic data or the mean for morphometric data. Morphometrics as percent of SL are shown in Table 1.

Dorsal fin rays 103 (101-109, 104); anal fin rays 83 (82-85, 83); pectoral fin rays 14 (13-14, 13) on ocular side, 12 (11-12, 11) on blind side; scales in lateral line 90 (81-90, 86); gill rakers 0 + 7, (0 + 7-9, 0 + 8); vertebrae 10 + 31 (10 +

31-32, 10 + 32). Head length 3.6 in SL (3.5-4.1, 3.76); body depth 2.3 (2.1-2.3, 2.26). Snout length 5.7 in head length (4.8-5.8, 5.30); upper eye diameter 4.2 (3.2-4.5, 3.76); lower eye diameter 4.3 (3.3-4.4, 3.70); interorbital width 2.4 (2.2-2.8, 2.45) in males, (3.7-5.8, 4.41) in females; upper jaw length 2.9 (2.8-3.2, 2.92) on ocular side, 2.7 (2.7-2.9, 2.78) on blind side; lower jaw length 2.3 (2.2-2.5, 2.27) on ocular side, 2.1 (2.0-2.2, 2.06) on blind side; depth of caudal peduncle 3.1 (2.6-3.1, 2.82). Pectoral fin length 0.5 (0.5-0.6, 0.56) on ocular side in males, (1.2-1.5, 1.38) in females, 2.4 (2.2-2.5, 2.31) on blind side; pelvic fin length 2.2 (1.9-2.3, 2.08) on ocular side, 2.9 (2.5-3.0, 2.66) on blind side; pelvic fin-base length 3.1 (2.7-3.2, 2.99), on ocular side, 6.6 (5.4-6.6, 5.89) on blind side; longest dorsal fin ray 2.8 (2.2-2.8, 2.30); anal fin ray 2.5 (2.0-2.5, 2.28).

Body ovate and compressed, greatest depth just anterior to middle part of body, and less than half body length. Dorsal and ventral contours except for head gently arched. Caudal peduncle shallow in depth, about 1/5 body depth.

Head large, length a little shorter than 2/3 body depth. Head profile with a deep notch in front of upper margin of lower eye, steeply elevated before interorbital area, with sharp curve above upper eye. Snout obtuse and short, shorter than eye diameter. Rostral spine short and blunt in males, feeble or absent in females. Eyes large, about equal to half the lower jaw length on blind side, anterior edge of upper eye located over middle of lower eye. A small orbital spine on anterior margin of upper eye in males, absent in females and young, no spine on anterior margin of lower eye. Interorbital space wide, shallowly concave, its width varying with sex and growth (Fig. 15). Each nostril on both sides tubular, posterior margin of anterior nostril with a flap.

Mouth moderate (Fig. 11) and gently arched, both jaws on ocular side shorter than those on blind side; maxilla extending to middle of lower eye, its length much longer than eye diameter. Length of lower jaw about equal to distance from snout tip to posterior margin of lower eye. Teeth on both jaws uniserial; teeth on upper jaw enlarged and canine-like anteriorly, decreasing in size posteriorly; teeth on lower jaw a little longer than lateral ones of upper jaw. Gill rakers

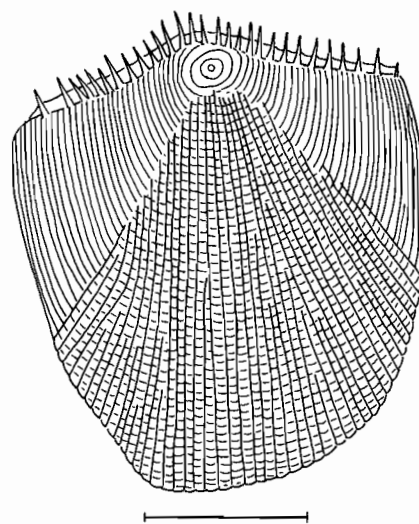


FIG. 14. — Scale from ocular side of *Tosarhombus neocaledonicus*. Scale bar indicates 1 mm.

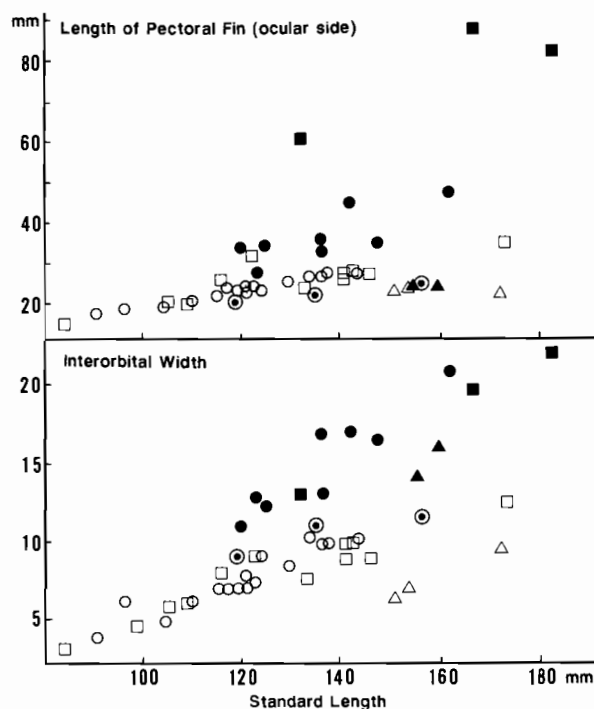


FIG. 15. — Sexual dimorphism of pectoral fin length on ocular side (top) and interorbital width (bottom) in four species of *Tosarhombus*: *T. octoculatus* (closed circles for males; open circles for females), *T. smithi* (double circles for males; open triangles for females), and *T. neocaledonicus* (closed squares for males; open squares for females).

moderate in length, pointed, not serrated, and developed on only lower limb.

Scales small, not deciduous, those on ocular side ctenoid with spinules of moderate length (Fig. 14); scales on blind side cycloid. Snout, both jaws and anterior body margin in front of interorbital area naked; all fins naked except on basal areas. Lateral line on ocular side with a wide, low curve above pectoral fin, its length about $2/3$ head length.

Dorsal fin originating just above nostrils on blind side, rays anterior to middle of body about equal in length, those behind middle of body decreasing in length posteriorly. Anal fin originating below anterior area of pectoral fin base, similar in shape and structure to dorsal fin except for head portion. Pectoral fin on ocular side varying with sex and growth, greatly elongated and filamentous in males (Fig. 15), second ray longest with successive rays becoming shorter toward lowest; longest a little shorter than twice head length in males, shorter than head length in females; that on blind side very short, less than half head length. Pelvic fin fairly long (Fig. 8), fourth ray longest, its length about half head length, longer than fin-base. Length of pelvic-fin base on ocular side about twice that on blind side; fourth ray on ocular side opposite first one on blind side. Caudal fin pointed.

Coloration in alcohol : General ground color on ocular side light brown; a series of six white blotches (pale yellow in fresh specimens) along head margin in front of interorbital space and upper eye; large faint dark blotches on lateral line at the junction of curved and straight sections and on middle and posterior areas of straight section, dark traces of blotches arranged along dorsal and ventral margins of body; vertical fins and pelvic fin on ocular side with scattered small black spots. Blind side pale yellowish white.

Sexual dimorphism : This species shows sexual differences in several characters. Males have a

blunt rostral spine, a small orbital spine on the anterior margin of the upper orbit, and a very wide interorbital space (Fig. 15; 2.2-2.8 times in head length). Anterior profile is steep. Pectoral fin on the ocular side is elongated and filamentous (Figs 5, 15), the longest ray being 1.7-1.9 times of head length. Along the head margin in front of the interorbital space and upper eye, there is a series of six large yellowish blotches. In females (including young) the rostral spine is indistinct or absent, there is no orbital spine, the interorbital area is narrow (Fig. 15; 3.7-5.8 times in head length), the head profile is rounded, and the pectoral fin on the ocular side is short (Figs 5, 15; 1.2-1.5 times in head length). There is a series of six very small yellowish blotches in front of the interorbital space and upper eye.

DISTRIBUTION. — Known only from the Chesterfield group, west of New Caledonia (Coral Sea). All specimens were collected by beam-trawl between 193-295 m depth.

ETYMOLOGY. — Named after the New Caledonian waters where these specimens were collected.

REMARKS. — This species resembles species of the genus *Bothus*, *Parabothus* and *Tosarhombus*. However, it differs from species of these genera in the characters as discussed in the remarks for the genus.

Tosarhombus neocaledonicus resembles the three other species in this genus externally in having six yellowish blotches along the anterior head margin, anterior to the interorbital space, and a similar body shape. It is easily distinguished from these species by its higher number of lateral-line scales (81-90 vs. 56-70) and caudal vertebrae (31-32 vs. 28-30), and the filamentous pectoral fin rays on the ocular side of males (Figs 5, 12, 13; 0.5-0.6 vs. 0.9-1.8; Table 1).

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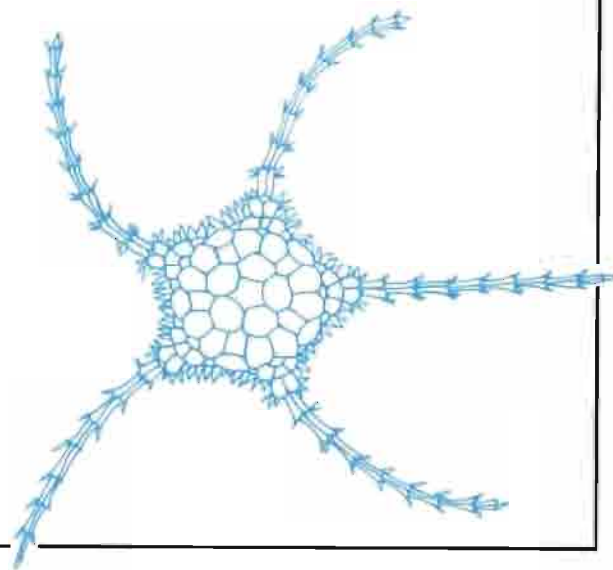
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Ce volume des Résultats des Campagnes MUSORSTOM est dédié au Professeur Claude LÉVI, titulaire de la Chaire de Biologie des Invertébrés marins et Malacologie du Muséum national d'Histoire naturelle de 1966 à 1990 et chef de la mission BIOCAL.

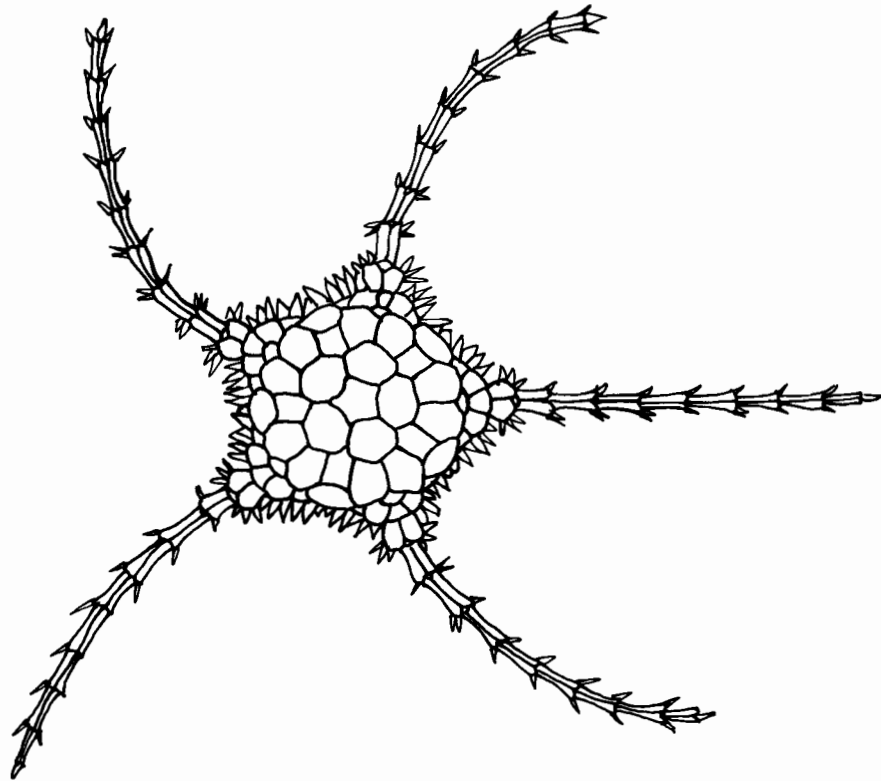
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