

**FIRST RECORD OF THE STRIPED GREY MULLET *MUGIL CEPHALUS*
(PISCES : MUGILIDAE) FROM THAILAND, WITH A KEY
TO ALL LOCAL SPECIES**

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ABSTRACT

Three specimens of the striped grey mullet, *Mugil cephalus*, have been collected from Songkhla, in the Gulf of Thailand. These appear to be the first definite records of this species for Thailand. Twelve species of mugilid fishes are now known to inhabit the Thai waters. An artificial key to them is given.

INTRODUCTION

The morphometric and meristic characters, including colouration, of mugilid fishes are very uniform. This creates difficulties in making good taxonomic collections of all species over a large area. Their identification is also difficult, especially in selecting the best names from amongst the great numbers of available nominal species, which number 282 according to THOMSON (1976).

The first report of a mugilid in Thailand (or Siam, before 1939) was by BLEEKER (1865 : p. 35) who described specimens of a fish under the name *Mugil bontah* (junior synonym of *M. tade*, according to WEBER & DE BEAUFORT, 1922 : p. 236). GÜNTHER (1861 : p. 435) when characterizing the species *M. speigleri*, did not base it on any specimen from Thailand, but SUVATTI (1949 : p. 342; 1982 : p. 131), without giving any reason, erroneously gave "Menam" as a Thai locality for GÜNTHER'S specimens. (This name was probably firstly used by Henri Mouhot in 1858, evidently referring to the historic Chao Phraya river; "menam" merely means river in Thai.)

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From the extensive collections of Thai marine fishes which have been made by the senior author since 1965, only 11 species of this family of fishes have been recognized. Alphabetically, they are: *Liza macrolepis* (A. Smith) (senior syn. of *M. troscheli* and *L. borneensis*), *L. oligolepis* (Bleeker), *L. subviridis* (Valenciennes) (senior syn. of *M. dussumieri*), *L. tade* (Forsskål), *L. vaigiensis* (Quoy and Gaimard), *Oedalechilus labiosus* (Valenciennes), *Valamugil buchanani* (Bleeker), *V. cunnesius* (Valenciennes) (senior syn. of *M. kelaartii* or *longimanus* or *strongylocephalus*), *V. engeli* (Bleeker), *V. ophuyseni* (Bleeker) (senior syn. of *M. speigleri*), and *V. seheli* (Forsskål). Unfortunately, another species from the Gulf of Thailand, which was recorded from Koh Tao and listed as *M. heterochilus* (misprint of *M. heterocheilos*) by SUVATTI (1949 : p. 342; 1981 : p. 131), has never been rediscovered or examined by us. However, two specimens 10.3–10.4 mm SL, labeled as *Mugil heterochilus* from Koh Tao of H.M. Smith's collection maintained at the Kasetsart University Museum of Fisheries, Bangkok, which was probably the basis of Suvatti's records, are certainly *V. seheli*.

DISTRIBUTION OF *MUGIL CEPHALUS*

Mugil cephalus was originally described by LINNAEUS (1758 : p. 316) in his *Systema Naturae*, 10th edition, from 'European Ocean', after P. Artedi. HAMILTON-BUCHANAN (1822 : p. 219) was probably the first to directly study this fish in Asian waters, from the vicinity of the Ganges estuaries. At present, the species is known to be the most widely distributed member of the mugilids, which comprise some 64 valid living species within 14 genera (THOMSON, 1976). BHATIA & WONGRATANA (1974) listed 28 valid species for the whole area between the eastern Indian Ocean and western-central Pacific, but only 10 of these, including *M. cephalus*, are commercially important.

GOPALAKRISHNAN (1973) reported *Mugil cephalus* as "very widely distributed in coastal waters and estuaries of tropical and subtropical zones (roughly between 42°N and 42°S) of Atlantic, Pacific and Indian Ocean." And the fish is known "...to grow up to 914 mm in length."

Economically, *Mugil cephalus* has aroused considerable interest because it has occurred in large numbers and is potentially a suitable food species for culturing in many areas around Thailand and beyond. GOPALAKRISHNAN (1973) reported that, *M. cephalus* "...is very widely cultivated in different countries like Japan, Hong Kong, China, Philippines, Korea, India, Egypt, Israel, Italy, France, Hawaii (USA) etc." On the other hand the FAO Yearbook of Fisheries (1971 : p. 32) indicated that the leading mullet producers during 1964–1970 were USA, Brazil, Japan, Italy and Australia.

Locally, it has been thirty-two years since NA NAKARA (1952) anticipated our findings by indicating that his several specimens (23–90 cm) of mullet were *Mugil cephalus*, without close examination. The only criterion used by him in differentiating the fish from other mullets was the number of lateral scale series, which he merely said fell in the range of *M. cephalus*, in addition to the very shiny scales. The latter, however, are not a significant character of the fish by present standards. Until the present study no other specimens of this fish have been known to be captured, examined and kept from Thailand.

On the basis of previous records of neighbouring countries, and because of its importance, the fish has nevertheless been presumed to occur also in Thai waters, and was illustrated upon the recommendation of J.M. Thomson in *FAO species identification sheets for fisheries purposes of the Eastern Indian Ocean and Western Central Pacific* (BHATHIA & WONGRATANA, 1974).

During a visit by the junior authors (H.S. and C.V.) to the National Institute of Coastal Aquaculture (NICA) at Songkhla on the southern coast of the Gulf of Thailand from 21 to 27 October 1983, three unnamed or misidentified specimens of *Mugil cephalus*, 168, 391, and 393 mmSL, were found in that collection, which form the basis of the present study. However, because of the rarity of the fish in Thai waters and even in the local market, no known population or habitat has been established for detailed study. Interestingly, in *The Fishes of the Indo-Australian Archipelago*, WEBER & DE BEAUFORT (1922: p. 255) stated "It is an extraordinary fact, that *M. cephalus* L., known from so many localities in tropical and temperate seas all over the world, is very rare in the Archipelago and with any certainty only represented in New Guinea and Borneo." BHATHIA & WONGRATANA (1974) give the geographical distribution of the fish as "Throughout area but not common in tropical areas (especially Indo-Australian archipelago)." The appearance of only three specimens during the long search for the fish is therefore due to its rarity in Thai waters.

In Thailand, according to WONGRATANA (1968), only very few individuals of *Liza vaigiensis*, *Valamugil buchanani* and *V. cunnesius* (as *Mugil kelaartii*) have been caught far off shore by bottom trawls. Two species of mugilids, *Oedalechilus labiosus* and *Mugil cephalus*, are now so far known only from Songkhla. Most of the other species are more widespread. On the basis of the high species diversity found in the area, it seems likely that Songkhla Lake and nearby coastal environments provide the favoured habitats for mugilids in Thailand. Other favourable places are along the coasts of Phuket and Chanthaburi. To our present knowledge, the common species of Thai mugilids are *Liza tade*, *L. vaigiensis*, *L. subviridis*, *Valamugil cunnesius*, *V. buchanani* and *V. seheli* (WONGRATANA, 1981; *V. buchanani* not included). In contrast, *V. engeli*, *M. cephalus*, *L. macrolepis* and *Oedalechilus labiosus* are rare species; the rest are seen seldomly.

Description of *Mugil cephalus* from Songkhla

(Figures 1-2; Table 1)

Specimens studied:

NICA 168 mmSL, from mullet culturing cage, Boh Keng, east coast of the outer part of Songkhla Lake; coll. T. Watanabe, 16 January 1982.

NICA 391 mmSL, mouth of Songkhla Lake; coll. S. Sukhawongs, during 1973-1974. It was figured by SUKHAWONGS (1974) under the name *Mugil longimanus* or *cunnesius* but referred to as *Liza strongylocephalus* in the text.

NICA 393 mmSL, Songkhla fish market; coll. T. Watanabe, October, 1982.

The precise measurements and essential countings are recorded in Table 1. Measurements were taken with fine point dividers or dial calipers, and expressed in hundredths of standard length (SL).

Greatest depth of body (opposite origin of spiny dorsal fin) 4.0 in SL in the smallest to 4.2-4.4 in SL in large specimens; head 3.9-4.0 in SL.

First dorsal spine about equal in length to longest second dorsal ray, when depressed its tip reaching to just behind base of the fin; first anal spine 2.5-3.0 in second spine and 3.5-4.3 in third spine; pelvic spine about 1.6 in longest ray; pectoral fin 1.4-1.6 in head, its tip reaching to 9th lateral scale; tip of depressed pelvic fin reaching to below space between 3rd and 4th dorsal spines in the smallest, but only to below 1st or 2nd dorsal spines in the large fish; 2nd dorsal originating over 5th to 6th anal rays, posterior margins of 2nd dorsal and anal fins broadly emarginated, inner lobes of both fins about equal in length, their outer lobes about 1.8-2.0 (in the 2 larger fish) to 2.4 (in the smallest fish) times longer than inner lobes; caudal fin with posterior margin deeply emarginate.

Scales sampled at axis of body and vertically above origin of anal fin weakly ctenoid in both small and large fish, radii uniform and distinct in the small fish but uneven and proportionally much shorter in the large fish (Figure 2,A,B). Basal halves of 2nd dorsal, anal, pectoral and inner surface of pelvic fins minutely scaled, except spiny dorsal fin and region near posterior margins of pectoral and caudal fins, which are naked. Obbasal pectoral scale only 2.0-2.5 (in the larger fish) to 2.8 (in the smallest fish) in longest pectoral fin ray; obbasal pelvic scale 1.9-2.2 in its longest fin ray.

Mouth terminal, with a prominent symphyseal knob at tip of lower jaw; from ventral view of mouth, both rami (from point to point) form an angle of about 87° from each other. Lips not thick, upper lip forming anterior tip of the head, lower lip directed horizontally forward, maxillary not exposed when mouth is closed and not curved downwards posteriorly; mandible smooth without fleshy lobes or lamellae.

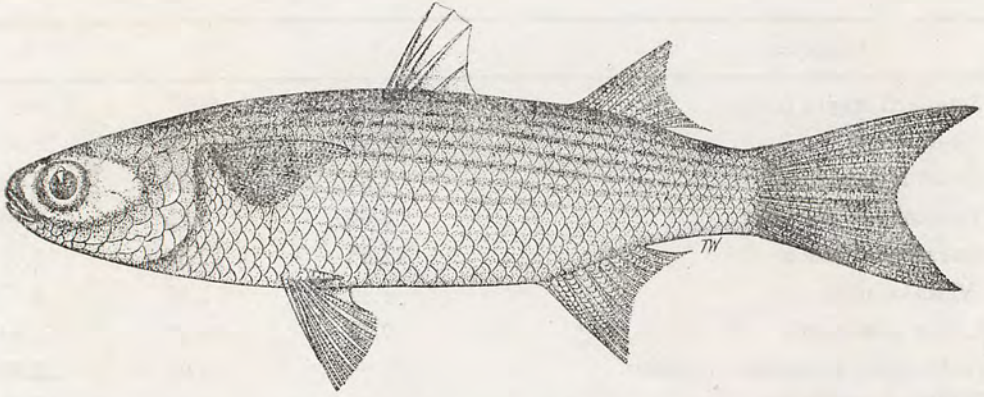


Figure 1. *Mugil cephalus*, 168 mmSL, collected from Boh Keng, east coast of the outer part of Songkhla Lake, on 16 January 1982. Drawn by T. Wongratana.

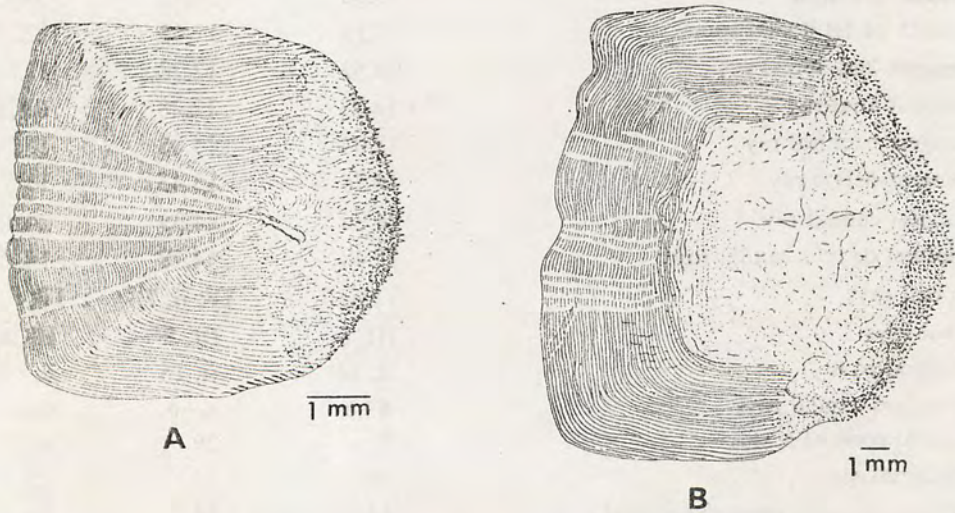


Figure 2. Lateral scales on the axis of body and vertically above anal fin origin of *Mugil cephalus*. A: of 168 mmSL; and B: of 393 mmSL specimen. Drawn by T. Wongratana.

Table 1. Measurements and countings made on 3 specimens of *Mugil cephalus* from Songkhla, expressed in hundredths of standard length (SL).

Characters	1	2	3
Standard length (mm)	168	391	393
Head length	25.47	24.90	25.39
Snout length	7.62	7.80	7.89
Vertical eye diameter	7.08	5.86	5.14
Interorbital space	12.62	12.38	13.00
Width of upper lip	1.25	1.12	1.17
Upper jaw length	7.20	6.67	7.30
Body depth at 1st dorsal origin	25.00	23.91	22.77
Width at operculum	18.39	16.67	17.68
Least depth of caudal peduncle	10.83	9.28	9.16
Length of caudal peduncle	18.39	17.95	17.05
Snout tip to 1st dorsal origin	50.48	48.75	48.57
Snout tip to 2nd dorsal origin	74.58	73.66	72.52
Preanal length	69.05	72.89	72.11
Prepectoral length	27.20	25.86	25.44
Prepelvic length	37.98	38.44	36.95
Length of 1st dorsal spine	13.15	12.66	12.31
Longest 2nd dorsal ray	14.52	12.28	11.86
Longest anal ray	14.23	12.28	12.26
Longest pectoral ray	18.04	15.06	15.78
Longest pelvic ray	14.76	13.43	13.51
Longest caudal ray	26.90	24.35	24.48
Shortest or mid-caudal ray	15.48	14.78	14.17
Dorsal rays	IV; ii, 7	IV; ii, 7	IV; ii, 7
Anal rays	III, 8	III, 8*	III, 8
Pectoral rays	ii, 16	ii, 15	ii, 16
Branched caudal rays	6+6	6+5	6+6
Lateral rows of scales	39	39	41
Predorsal scales	25	24	25
Transverse scale rows above anal	14	14	14
Circumpeduncular scales	20	20	20
Gill rakers on 1st arch	41+64	64+97	69+80

* Outer half of 6th and 7th anal rays fused together.

Teeth ciliform in bands and depressible, embedded in thin edge of jaws; with about 6 rows on upper and only 4 rows on lower jaws in smallest fish, with simple tip; larger fishes with 3 to 4 rows of ciliform teeth in both jaws (on 391 mmSL fish, only outer row of teeth are present on lower jaw; toothless elsewhere), some teeth in inner rows with bifid tips; no teeth on roof of mouth and tongue.

Preorbital with anterior edge nearly straight and posterior edge nearly truncate; they are strongly serrated.

Adipose eyelid greatly developed, extending over greater part of anterior and posterior fields of iris, leaving an oval slit over pupil, its anterior end reaching to mid-length between anterior and posterior nostrils, and posterior end reaching to about mid-point of post-orbital length.

Nostrils widely separated from each other, the anterior one pore-like and near to upper lip; the posterior one slit-like and much larger, vertically situated just above the level of anterior one, and slightly closer to the eye than to the anterior nostril.

Longest gill rakers on first gill arch about 2.2 (in 168 mmSL fish) to 2.4–2.5 (in 391 and 393 mmSL fish) in corresponding gill filaments, their inner edges with two rows of tiny villi; an additional but very small fan-shaped gill raker is present on the gill arch opposite the inner basal part of each gill raker.

Colour in formalin: uniform creamy white in 391 mmSL specimen, with a transverse dark spot at upper half of the base of pectoral fin, otherwise without any prominent markings; dark brown in 393 mmSL specimen and with 6 to 7 indistinct darker bands along middle of scale rows on upper part of the sides, upper half of the base of pectoral fin with a diffuse transverse dark spot, all fins except pelvic fins more or less dusky, otherwise without other prominent markings. Colour when fresh observed from a colour photograph of 393 mmSL specimen, metallic blue above and bright silvery below, each scale near back with paler margin, 5–6 indistinct lateral stripes along flanks. All fins except pelvic fins more or less darkish, a diffuse transverse dark blue spot on upper part of the base of pectoral fin.

Colour of 168 mmSL specimen, darkish grey on back and top of head, gradually paler on sides and becoming greyish silvery beneath; with about 8 darker stripes along flanks, anterior part of premaxilla and posterior part of maxilla darkish grey, a transverse diffuse dark spot on upper part of pectoral fin base; all fins without prominent markings; pelvic and anal fins, however, paler.

AN ARTIFICIAL KEY TO THE MUGILID FISHES
FROM THAILAND

- 1a. Upper lip thick, its thickness 3.2–4.0% SL, with papillae and lobes on the edges; lachrymal deeply notched at mouth corner; ventral surface of mandible without scales *Oedalechilus labiosus*
- 1b. Upper lip thin, its thickness 0.8–2.5% SL, without papillae or lobes; lachrymal not or slightly notched; ventral surface of mandible scaled 2
- 2a. Posterior tip of maxillary not curved down at below tip of premaxillary; secondary squamation developed on scales; chin with patch of minute scales; pyloric caeca only 2; cheek scale rows 3 *Mugil cephalus*
- 2b. Posterior tip of maxillary curved down at below tip of premaxillary; secondary squamation and scales on chin absent; pyloric caeca more than 4; cheek scale rows 3–5 (mostly 4) 3
- 3a. Tip of tongue more or less free; hind margin of lateral scales without disitations 4
- 3b. Tip of tongue adhering to mouth floor; hind margins of lateral scales with disitations 8
- 4a. Pyloric caeca branched, totally with 18–34 tips; median scales on top of head not reaching beyond posterior nostril; caudal fin nearly truncate; branched anal fin rays 8; pectoral fins distinctly black; attains 381 mmSL *Liza vaigiensis*
- 4b. Pyloric caeca 4–9, simple; median scales on top of head reaching to anterior nostril; caudal fin more or less forked; branched anal fin rays 9 (rarely 8 or 10); pectoral fins generally pale; attains 282 mmSL 5
- 5a. Posterior tip of maxillary hidden when mouth closed; upper surface of tongue forming a longitudinal sharp ridge of acute angle in front view; depth at anal fin origin 28.3–32.9% SL; total gill rakers 71–80; lateral scale series 24–25; pyloric caeca 5–8; body with a broad faint band along median rows of scales in preserved specimens; attains only 91 mmSL *Liza oligolepis*
- 5b. Posterior tip of maxillary exposed when mouth closed; upper surface of tongue with a longitudinal lower ridge of right or broader angle in front view; depth at anal fin origin 20.7–25.7% SL; total gill rakers 97–119; lateral scale series 27–33; pyloric caeca 4–6 (mostly 5); body with several faint stripes along upper rows of scales in preserved specimens 6
- 6a. Adipose eyelid poorly developed, its gap 5.0–6.5% SL; pre-first dorsal fin length 52.3–54.5% SL; base of pectoral fin with a diffuse transverse marking in preserved specimens, this marking golden when fresh *Liza macrolepis*

- 6b. Adipose eyelid well developed, its gap 2.5–4.3% SL; pre-first dorsal fin length 48.2–53.9% SL; base of pectoral fins without prominent marking 7
- 7a. Interorbital space slightly convex or nearly flat; snout pointed in lateral view; length of posterior adipose eyelid 2.9–5.6% SL; pre-first dorsal fin length 48.2–51.4% SL; lateral scale series 29–33 (mostly 30–32) *Liza tade*
- 7b. Interorbital space distinctly convex; snout blunt in lateral view; length of posterior adipose eyelid 5.3–7.4% SL; pre-first dorsal length 50.0–53.9% SL; lateral scale series 27–30 (mostly 28–29) *Liza subviridis*
- 8a. Adipose eyelid well developed, length of posterior adipose eyelid 5.9–8.1% SL; pyloric caeca 5–6 (rarely 7, unknown in *Valamugil engeli*); pectoral fins pale or slightly yellowish when fresh; attains 167 mm SL 9
- 8b. Adipose eyelid poorly developed, length of posterior adipose eyelid 1.5–3.6% SL; pyloric caeca 7–9; pectoral fins distinctly yellow; attains 433 mm SL 11
- 9a. Median scales on top of head reaching beyond anterior nostril; pre-first dorsal fin length 52.0% SL; head length 27.5% SL; lateral scale series 33; upper angle of pectoral fin without dark marking *Valamugil engeli*
- 9b. Median scales on top of head not reaching to anterior nostril; pre-first dorsal fin length 46.5–51.4% SL; head length 23.6–27.1% SL; lateral scale series 32–41; upper angle of pectoral fin with a dark spot 10
- 10a. Lateral scale series 32–34; total gill rakers 76–87; angle of lower jaw 92–130 degrees; upper angle of pectoral fin with a prominent dark spot *Valamugil cunnesius*
- 10b. Lateral scale series 38–41; total gill rakers 65–75; angle of lower jaw 88–99 degrees; upper angle of pectoral fin with a diffused dark spot *Valamugil ophuyseni*
- 11a. Height of second dorsal fin 14.5–18.9% SL; pectoral fin length 18.2–24.5% SL; lateral scale series 37–40; upper angle of pectoral fin with a triangular dark spot in preserved specimens, the main fins yellowish when fresh *Valamugil seheli*
- 11b. Height of second dorsal fin 19.5–21.9% SL; pectoral fin length 22.4–30.6% SL (mostly more than 26.1% SL); lateral scale series 32–37; upper angle of pectoral fins with a round dark spot, the main fins with much yellow when fresh *Valamugil buchanani*

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