A REVISION OF THE MUGILID FISHES FROM TAIWAN

CHEN-HSIANG LIU and SHIH-CHIEH SHEN

Department of Zoology, National Taiwan University,
Taipei, Taiwan 10765,
Republic of China

(Accepted March 16, 1991)

Chen-Hsiang Liu and Shih-Chieh Shen (1991) A revision of the mugilid fishes from Taiwan. Bull. Inst. Zool., Academia Sinica 30(4): 273–288. The mugilid fishes from Taiwan including five genera and ten species are revised. Among them, one genus, Oedalechilus and three species, Oedalechilus labiosus, Liza alata and L. subviridis are new records for Taiwan. Key, diagnostic characteristics, synonyms and color photographs of each species are given.

Key words: Mugilidae, Fish taxonomy, Taiwan, Mullet.

Fishes of the family Mugilidae, usually called mullet, occur in tropical and temperate oceans. There are 13 genera (Agonostomus, Cestraeus, Chaenomugil, Joturus, Liza, Mugil, Myxus, Rinomugil, Valamugil, Oedalechilus, Crenimugil, Aldrichetta and Trachystoma) with about 95 species known in the world (Nelson, 1984).

The earliest reports on the collections of mullets in Taiwan are from 1919, 1922a and 1922b by Oshima who recorded 11 species: Mugil cephalus, M. oeur, M. japonicus (=M. cephalus), M. carinatus (=Liza affinis), M. antinensis (=L. dussumieri), M. kelaartii (=Valamugil cunnesius), Liza formosae, L. pescaderoensis (=L. macrolepis), L. parva (=L. macrolepis), L. troscheli (=L. macrolepis) and Chelon crenilabris (=Crenimugil crenilabris). Among them, Mugil oeur and M. japonicus were synonymized with M. cephalus by Thomson (1964), Mugil carinata of Oshima (1919) was misidentified as L. affinis (Senou et al., 1987). Therefore, only 8 species listed by Oshima are recognized. Chen (1969) added 5 more species, Mugil tade, Lita vaigiensis, L. melinoptera, L. macrolepis (M. troscheli), and Crenimugil crenilabris to the Taiwan list. The former 3 species which are usually found in the Indo-Australian area, are usually not collected in Taiwan waters. Chen and Yu (1986) added another 4 species: Liza subviridis, Valamugil cunnesius, V. speigleri and V. seheli. Among them only Liza subviridis and Valamugil cunnesius were found in Taiwan, Valamugil speigleri and V. seheli were collected from the Indo-Australian area but this also remains doubtful. Mugilid fishes have been extensively and intensively collected in the Taiwan waters by some workers from 1982 to 1990. The collection reveals that there are 10 species belonging to five genera: Mugil cephalus (Linnaeus, 1758), Liza macrolepis (Smith, 1849) L. affinis (Günther, 1861), L. dussumieri (Cuvier and Valenciennes, 1836), L. subviridis (Valenciennes, 1836), L. alata (Steindachner, 1892), Valamugil cunnesius (Valenciennes, 1836), V. formosae (Oshima, 1921), Crenimugil crenilabris (Forsskal, 1775) and Oedalechilus.
labiosus (Valenciennes, 1836). Among them, one genus, Oedalechilus, and three species: L. alata, V. formosae and O. labiosus, are new records for the adjacent waters around Taiwan. Only the species Valamugil formosae is endemic to southern Taiwan. The following four species listed by Chen and Yu (1986) are either synonyms or erroneous records: Mugil kelaartii Günther is a synonym of Valamugil cunningius, Liza parva and L. pescadorensis are synonyms of L. macrolepis, Mugil tade (Forsskål) has not yet been found in this area.

MATERIALS AND METHODS

Specimens used were mostly collected by gill net and beach seine from Keelung, Kaohsiung and Penghu. Specimens were photographed when fresh and then preserved in 10% formalin for further observations. Measurements were made with needle-point dividers following the methods of Hubbs and Lagler (1958). The lateral scales (L.S.) were counted along the middle of the left side of the body; transverse scales (Tr. S.) were counted from the most anterior dorsal base to the ventral base; and the predorsal scales (P.S.) were counted from the mid anterior dorsal base to the frontal. Gill rakers (G.R.) were counted both on the outer and inner side of the first gill arch of the left side. The ratio of adipose eyelid length to eye diameter (Lae/ed) was calculated from measurements made as illustrated in Fig. 1. Dorsally, the adipose eyelid almost covered the eye; ventrally, the adipose eyelid was present only at the anterior and the posterior part of the eye. Blotches, spots and pigment patterns were also used as important key characteristics. All specimens are now deposited in the Museum of the Department of Zoology, National Taiwan University (NTUM).

Fig. 1. The adipose eyelid and pectoral base of Mugilidae.
AEL: length of adipose eyelid
ED: eye-diameter
AEL1: length of adipose eyelid (anterior part of eye)
AEL2: length of adipose eyelid (posterior part of eye)

SYSTEMATIC ACCOUNTS

Key to genera and species of Mugilidae
1. Anal fin III, 8; adipose eyelid prominent, Lae/ed 3.2-4.1, a blue blotch on upper pectoral base (Mugil)..................Mugil cephalus
Anal fin III, 9; adipose eyelid developed, Lae/ed 0.3-2.5, dark blue spot on upper end of pectoral base present or absent......................2
2. With a dark blue spot on upper end of pectoral base ..................................3
Without a dark blue spot on upper end of pectoral base (Liza) ..................4
3. Lips with papillae .................................................5
Lips without papillae (Valamugil) .......6
4. Adipose eyelid developed (Lae/ed 1.2–2.2) ...............................................7
Adipose eyelid obsolete (Lae/ed 0.6–1.0) ........................................8
5. Pectoral without axillary scale; upper lip very thick; with a low double symphysial knob (Oedalechilus) ..................................Oedalechilus labiosus
Pectoral with axillary scale; upper lip thin; with a high symphysial knob (Crenimugil) Crenimugil crenilabis
6. Upper and lower lips with teeth ........................................Valamugil cunnnesius
Upper and lower lips toothless .........................................................Valamugil formosae
7. Without keel on the back; lower lip teeth present; pectoral without axillary scale ..........Liza subviridis
With keel on the back; lower lip teeth absent; pectoral with axillary scale ..............Liza affinis
8. Pectoral base golden ...Liza macrolepis
Pectoral base pale .................................................................9
9. Lateral scales 28–29; pectoral base without pigment ..........Liza dussumieri
Lateral scale 32; pectoral base with black pigment ...................................Liza alata

*Mugil cephalus* Linnaeus, 1758

(Figs. 2–3)

*Mugil cephalus* Linnaeus, 1758: 316 (Type locality: European seas).
*Mugil dobula* Günther, 1861: 420.
*Mugil perusi* Hutton, 1872a: 36, 113.
*Mugil occidentalis* Castelnaud, 1873: 135.
*Mugil grandis* Castelnaud, 1875: 32.
*Mugil hypselosoma* Ogilby, 1897b: 74.
*Mugil oer* Ogilby, 1897: 74.


Scale ctenii cone shaped, in many rows. Pectoral axillary scale long. Lips thin, with a high symphysial knob, and 1–4 rows of labial teeth on lower lip and 1–6 rows of labial teeth on upper lip. These teeth are unicusp on outer rows and bicuspid on inner rows. Preorbital bone slender, unnotched, filling only half the space between lip and eye. Color in fresh specimens, olive-green on back, silvery on sides, shading to white ventrally. Lateral side of body with 6 or 7 rows of obscure brownish running with the scale series. Fins are minutely dotted with black, forming a dusky appearance, except for the ventrals which are in pale yellowish color. Upper 1/2 of pectoral base with a blue blotch (Fig. 3). A golden ring around iris.

**Liza affinis** (Günther, 1861)

(Figs. 4 and 12)

*Mugil affinis* Günther, 1861: 433 (Type locality: Amoy, China).
*Myxus profugus* Mohr, 1927: 186. (Type locality: Japan and Formosa).

**Diagnosis:** D. IV+I, 8; A. III, 9; P. 16–17; V. I, 5; L.S. 40–41; Tr. S. 11; P.S. 21–22; G.R.: 68–84 (outer) and 72–85 (inner). Head length, 25–27%, head width, 16–17% of standard length. Adipose eyelid well.
developed. Lae/ed 1.7-2.2. With a keel on back. Scales ctenoid.

Scale ctenii cone shaped, in many rows. Pectoral axillary scale long. Lip thin, with a high symphysial knob and toothless on lower lip, and a row of primary teeth on upper lip. Preorbital bone, unnotched, filling the space between lip and eye. Color in fresh dark brown dorsally, white on sides and belly. Fins olive-green except for the ventral which are in white color. Pectoral base colorless (Fig. 12).

**Liza dussumieri** (Cuvier & Valenciennes, 1836)

(Figs. 5 and 12)

*Mugil dussumieri* Cuvier & Valenciennes, 1836: 147 (Type locality: Bombay; Coramandel).

*Mugil sundanensis* Bleeker, 1853: 245.

*Liza compressa* Jordan and Seale, 1908: 17.

*Mugil stevensi* Ogilby, 1908: 17.

*Mugil tadopsis* Ogilby, 1908: 27.


**Diagnosis:** D. IV+I, 8; A. III, 9; P. 15; L. S. 28-29; Tr. S. 9; P. S. 17-19; G. R.: 90-97 (outer) and 92-101 (inner). Head length, 24-26%, head width, 15-19% of standard length. Adipose eyelid obsolete, Lae/ed 0.9-1.0. No keel on back. Scales ctenoid.

Scale ctenii cone shaped, in many rows. Pectoral axillary scale absent. Lips thin, with a high symphysial knob and toothless on lower lip, and a row of labial teeth on upper lip. Teeth on the pterygoids and tongue but not on the vomer or palatines. Preorbital bone broad and strongly serrated, very slightly notched. Color of fresh specimens greyish green posterodorsally, brownish over head, silvery laterally shading to white ventrally, about 5-6 faint stripes along upper rows of scales. Dorsal fins greyish, ventrals white. Caudal dark bluish, black marginally. Pectorals yellowish, base colorless (Fig. 12), and without pigment. A slight golden segment on the upper part of the iris.

**Liza macrolepis** (Smith, 1846)

(Figs. 6-9)

*Mugil macrolepis* Smith, 1846: 28 (Type locality: South Africa).

*Mugil smithii* Günther, 1861: 477.


**Diagnosis:** D. IV+I, 8; A. III, 9; P. 16; V. I, 5; L.S. 30-34; Tr. S. 10; P. S. 19-21; G. R.: 97-117 (outer) and 190-117 (inner). Head length, 25-27%, head width, 17-19% of standard length. Adipose eyelid slight, Lae/ed 0.61-0.91. No keel on back. Scales finely ctenoid.

Scale ctenii cone shaped, in many rows. Without pectoral axillary scale. Lips thin, with a high symphysial knob and toothless on lower lip, and a row of peg-like labial teeth on upper lip. Teeth on vomer, pterygoid and tongue, none on palatines. Preorbital bone moderately wide, filling the space between lip and eye, notched anteriorly. Color in fresh specimens greenish grey dorsally, silvery on sides and belly. Dorsal fins greyish, ventrals off-white. Caudal dark bluish, black marginally. Pectoral yellowish, base golden colored (Fig. 8) and with special pigments (Fig. 9) aggregated together under epidermis. A golden ring around the iris.

**Liza subviridis** (Cuvier and Valenciennes, 1836)

(Figs. 10-12)

*Mugil subviridis* Cuvier and Valenciennes, 1836: 115 (Type locality: Ganges, Northern India).


*Mugil alocoki* Ogilby, 1908: 21.


**Diagnosis:** D. IV+I, 8; A. III, 9; P. 16; V. I, 5; L.S. 30-32; Tr. S. 10; P. S. 18-21;
G.R.: 90-99 (outer) and 103-120 (inner). Head length, 22-25%, head width, 16-17% of standard length. Adipose eyelid developed, Læ/ed 1.2-1.9. No keel on back. Scales ctenoid.

Scale ctenii with rows and cone shaped. Pectoral axillary scale rudimentary or absent. Lips thin, with a high symphysial knob and a row of villiform labial teeth on lower lip, and several rows of fine teeth on upper lip. Preorbital bone narrow, filling only 3/4 between lip and eye, anteriorly notched. Color in fresh, dark greenish on dorsally and white below, caudal fin edged with black. Pectoral base pale colored, with few pigment spots (about 50). A slight golden ring around the iris.

*Liza alata* (Steindachner, 1892)  
(Fig. 13)

*Mugil alata* Steindachner, 1892: 133 (Type locality: Madagascar).
*Mugil diadema* Gilchrist and Thompson, 1911: 42.
*Liza alata*, Smith, 1975: 64.

*Diagnosis:* D. IV+I, 8; A. III, 9; P. 17-18; V. I, 5; L.S. 33-36; Tr. S. 12; P.S. 18-20; G.S.; 62-71 (outer) and 66-74 (inner). Head length, 24-26%, head width, 18-19% of standard length. Adipose eyelid obsolescent, Læ/ed 0.6-0.75.

No keel on back. Scales ctenoid.

Scale ctenii with rows and cone shaped. Pectoral axillary scale absent. Lips thin, with a high symphysial knob and tooth-less on lower lip, and 3-5 rows of unicusp labial teeth on the upper lip. Pterygoids and tongue with villiform teeth, vomers and palatines edentate. Preorbital bone wide, filling the space between lip and eye, slightly notched anteriorly. Color in fresh, dark greenish dorsally, silvery on sides and ventrally. Scale margins dark, especially dorsally, giving the dull grey body the characteristic reticulate ("diamond") appearance. Light brown dorsally, silvery laterally. Pectoral base with many pigment spots (more than 300). Fins greyish.

*Oedalechilus labiosus* (Valenciennes, 1836)  
(Fig. 14)

*Mugil labiosus* Valenciennes, 1836: 7 (Type locality: Red Sea).
*Oedalechilus labro* Fowler, 1904: 748.

*Diagnosis:* D. IV+I, 8; A. III, 9; P. 17-18; V. I, 5; L.S. 33-36; Tr. S. 12; P.S. 18-20; G.S.; 62-71 (outer) and 66-74 (inner). Head length, 24-26%, head width, 18-19% of standard length. Adipose eyelid obsolescent, Læ/ed 0.3-0.36. No keel on back. Scales ctenoid.

Scale ctenii with rows and cone shaped. Without pectoral axillary scale. Lips toothless, with a low double symphysial knob and a single row of papillae on lower lip, and upper lip very thick, with 3-4 rows of papillae. No teeth on palatines, a few teeth on tongue. Preorbital bone wide, filling the space between lip and eye, deeply notched anteriorly. Color in fresh, olive-brown dorsally, silvery on sides and ventrally. Pectoral base colorless but with a dark spot on upper end (Fig. 16).

*Valamugil cunnesenus* (Valenciennes, 1836)  
(Figs. 15-16)

*Mugil cunnesenus* Valenciennes, 1836: 114 (Type locality: Moluccas, Malabar, Bombay); Cantor, 1850: 1082; Günther, 1859-1861: 434; Klunzinger, 1884: 132; Ogilby, 1908: 26.
*Valamugil cunnesenus*, Smith, 1975: 64.

*Diagnosis:* D. IV+I, 8; A. III, 9; P. 15-16; V. I, 5; L.S. 31-34; Tr. S. 11-12; P.S. 18-19; G.R.; 55-78 (outer) and 55-86 (inner). Head length, 25-28%, head width, 16-18% of standard length. Adipose eyelid developed, Læ/ed 1.8-2.2. No keel on back. Scales with weak ctenoid.

Scale ctenii plate shape, in a single row. Pectoral axillary scale long. Lips
thin, with a high symphysial knob and labial teeth on lower lip, and labial teeth on upper lip. These teeth are short and scattered on upper lip, long, ciliate and spaced on lower lip. No teeth on palatines but vomers, pterygoids and tongue dentate. Preorbital bone wide, filling the space between lip and eye, notched anteriorly but filling with age. Color in fresh, yellow-brown to dark grey dorsally, silvery ventrally. Pectoral fin yellow, with a dark blue spot on the upper end of the base (Fig. 16).

**Valamugil formosae** (Oshima, 1922)
(Figs. 16-17)

*Magil suppositus* ( nec Günther) Day, 1865: 143
(Type locality: Sea of Malabar and Malaysia).

*Lisa formosae* Oshima 1922: 251 (Type locality: Anpin of Taiwan).


**Diagnosis:** D. IV+I, 8; A. III, 9; P. 16; V. I, 5; L. S. 34; Tr. S. 10; P. S. 20; G. R.: 104 (outer) and 95 (inner). Head length, 27%, head width, 17% of standard length. Adipose eyelid developed, Lae/ed 1.9. No keel on back. Scales with weak ctenoid.

Scale ctenii plate shape, in a single row. Pectoral axillary scale long. Lips thin and toothless, a high symphysial knob on lower lip. Preorbital bone slender, filling the space between the lip and eye, notched anteriorly. Color in fresh, dusky grey dorsally, silvery on sides and ventral. A dark blue spot on the upper end of the pectoral base (Fig. 16). First and second dorsal, caudal, anal and pectoral fins yellowish, ventral whitish.

**Remarks:** This species is endemic to southern Taiwan. In the year 1865 Francis Day described a small mullet *Magil suppositus*. It is quite different from Günther’s *M. suppositus* (1861). However, the characteristics of *Lisa formosae* (Oshima, 1922) were identical to the description of Day’s *Magil suppositus*. This species has no generic characteristics of *Liza*, but shares many characteristics of the genus *Valamugil*, for example, a dark blue spot on the upper end of the pectoral base, pectoral axillary scale long and scales with only one row ctenoid membrane, etc. Because of these shared characteristics we placed this species in the genus of *Valamugil*.

**Crenimugil crenilabris** (Forsskål 1775)
(Figs. 16 and 18)

*Magil crenilabris* Forsskål, 1775: 14,73 (Type locality: Red Sea).


*Magil heterochellos* Bleeker, 1873: 143.


*Magil ruppellii* Günther, 1861: 458.

*Magil crenilabris*, Kner, 1865: 229.


*Querimana crenilabris* Jordan and Scale, 1906: 218.

*Liza crenilabris* Kendall and Goldsborough, 1911: 258.

*Chelon crenilabris* Oshima, 1922: 257.

*Oedalechilus cirrhosomus* Whitley, 1941: 19.


**Diagnosis:** D. IV+I, 8; A. III, 9; P. 16; V. I, 5; L. S. 38-39; Tr. S. 12; P. S. 21-24; G. R.: 81-90 (outer) and 88-120 (inner). Head length, 25-29% of standard length. Adipose eyelid developed, Lae/ed 1.4-2.5. No keel on back. Scales with weak ctenoid.

Scale ctenii plate shape, in a single row. Pectoral axillary scale long; Lips thick and toothless, with a high symphysial knob and 1-10 rows of papillae (the first appearing at about 7 cm S.L.) on lower lip. Teeth on palatines and small patches on the tongue, but none on the vomers or pterygoids. Preorbital bone narrow, filling the space between the lip and eye, slightly notched anteriorly in young, unnotched in adults. Fresh specimens olive-green dorsally, white on sides and belly. Pectoral fin yellowish, with a dark blue spot on the upper end
Fig. 2. *Mugil cephalus* S. L. 427 mm).

Fig. 3. *Mugil cephalus*, its upper 1/2 pectoral base with a blue blotch.
Fig. 4. *Liza affinis* (S.L. 170 mm).

Fig. 5. *Liza dussumieri* (S.L. 181 mm).

Fig. 6. *Liza macrolepis* (S.L. 176 mm).
Fig. 7. *Liza macrolepis* (S. L. 190 mm female).

Fig. 8. Golden colored pectoral base of *Liza macrolepis*. 
Fig. 9. Pectoral base with special pigments (under microscope 40×5), *Liza macrolepis*.

Fig. 10. *Liza subviridis* (S.L. 226 mm female).
Fig. 11. *Liza subviridis* (S.L. 220 mm).

Fig. 12. Pale colored pectoral base, *Liza subviridis*. 
Fig. 13. *Liza alata* (S.L. 196 mm).

Fig. 14. *Oedalechilus labiosus* (S.L. 153 mm).
Fig. 15. *Valamugil cunniesius* (S.L. 154 mm).

Fig. 16. Upper end of pectoral base with a dark blue spot, *Valamugil cunniesius*. 
Fig. 17. Valamugil formosae (S.L. 142 mm).

Fig. 18. Crenimugil crenilabris (S.L. 131 mm).
of the base (Fig. 16), other fins pale yellow.

Remarks: This species mostly inhabits the shallow coastal waters, and seems to not enter rivers like other mullet species reported in the present paper.

Acknowledgements: This research was supported by a grant from the National Science Council: NSC 79-0211-b002-13 to the junior author. We also appreciate Dr. C. Lavett Smith, Curator of American Museum of Natural History; Dr. Kwang-Tsao Shao, Institute of Zoology, Academia Sinica and Dr. H. K. Mok, Institute of Marine Biology, National Sun Yat-Sen University, Taiwan, for reading the manuscript and giving us valuable comments. We would like to thank Dr. Lo-Chai Chen, Professor, Department of Biology, College of Sciences, San Diego State University, for giving references on mugilid fishes; two fishermen, Mr. Shih Huang and Mr. Shih-Chi Lin, for helping to collect specimens; Mr. H.C. Yang for giving us some mugilid specimens and Miss Li-feng Chen for typing the manusript.

REFERENCES
臺灣的鰈科魚類

劉振鄉 沈世傑

臺灣之鰈科魚類最早的報告是大島正滿 (1919–1922)，共記錄 11 種；其中除去日本鰈是鰈的同種異名，澎湖鰈、少鰈是大鰈鰈的同種異名，合計為 8 種，後來陳 (1969) 的記錄為 13 種，隨後張 (1986) 記錄增至 16 種，由於缺乏採集記錄，而無從查證，因此本研究自 1982 年起至 1990 年，重新採集標本，經整理結果共計 5 屬 10 種：鰈 (Mugil cephalus)、鬚鰈鰈 (Liza affinis)、粗鰈鰈 (L. dussumieri)、大鰈鰈 (L. macrolepis)、白鰈 (L. subviridis)、竹筒鰈 (Liza alata)、瘤唇鰈 (Oedalechilus labiosus)、粒唇鰈 (Crenimugil crenilabis)、臺灣凡鰈 (Valamugil formosae)、長鰍凡鰈 (Valamugil cunnesius) 等，比大島正滿的記錄多出三種，其中的白鰈、瘤唇鰈及竹筒鰈為新記錄種，而臺灣凡鰈為臺灣南部之特有種。