Two New Records of Juvenile *Oedalechilus labiosus* and *Ellochelon vaigiensis* (Mugiliformes: Mugilidae) from Jeju Island, Korea, as Revealed by Molecular Analysis

Hyuck Joon Kwun, Young Sun Song, Se Hun Myoung and Jin-Koo Kim*

Department of Marine Biology, Pukyong National University, Busan 608-737, Korea

**Abstract**

Eighteen specimens of juvenile Mugilidae were collected in October 2012 from the southern coastal waters of Jeju Island, and identified based on analysis of their mitochondrial DNA16S rRNA sequences. Seventeen specimens of *Oedalechilus labiosus* and a single specimen of *Ellochelon vaigiensis* were found, constituting a new record for these species among Korean ichthyofauna. *O. labiosus* is identified by the angle at the posterior end of its mouth, which contains a round notch, a darkish dorsal margin of the pectoral fin, the presence of 33-36 lateral line scales, and 23-24 vertebrae. *E. vaigiensis* is identified by dark dorsal and pectoral fins, the presence of 26 lateral line scales, and 25 vertebrae. The proposed Korean name for *Oedalechilus* is ‘Sol-ip-sung-eo-sok’ and that for *Ellochelon* is ‘Nup-jeok-ggo-ri-sung-eo-sok.’ The proposed Korean names for the species are ‘Sol-ip-sung-eo’ and ‘Nup-jeok-ggo-ri-sung-eo’ for *O. labiosus* and *E. vaigiensis*, respectively. We present a key for identification of the Mugilidae family of species from Korea, and include these two newly recorded species.

**Key words:** New records, *Ellochelon vaigiensis*, *Oedalechilus labiosus*, Mugilidae, Juvenile, 16S rRNA, Jeju Island

**Introduction**

Various subtropical fish can be found in the waters surrounding Jeju Island, Korea (Kim and Lee, 1994), and numerous fish previously unrecorded in these waters have recently been reported (Kim, 2009). The family Mugilidae (order Mugiliformes) is widely distributed in tropical and temperate waters, with 72 species divided into 17 genera described worldwide (Nelson, 2006), among which 15 species and 7 genera have been reported from Japan (Senou, 2002). Jordan and Starks (1905) were the first to report the presence of *Mugil cephalus* Linnaeus 1758 in Korea. Subsequently, Jordan and Metz (1913) and Mori (1952) reported the presence of *Chelon haematocheilus* (Temminck and Schlegel, 1845) and *Chelon affinis* (Günther, 1861), respectively. No other species were recorded until 2012, when *Chelon macrolepis* (Smith, 1846) and *Moolgarda seheli* (Forsskål, 1775) were collected near Jeju Island (Kwun et al., 2012a, 2012b), making a total of 5 species and 3 genera reported in Korea to date. Mugilid species are usually identified by their morphological characteristics, including the number of lateral line scales, the location and shape of the maxilla, and the development of the adipose eyelid (Thomson, 1997; Harrison and Senou, 1999; Senou, 2002). However, mugilid species are difficult to identify because their morphological characters are very similar (Thomson, 1997), and thus molecular analysis has recently been applied to the identification of juveniles of the species (Ke et al., 2009; Kwun et al., 2012b). Molecular methods have been used to identify larval and juvenile fish (Kim et al., 2008; Vandersea et al., 2008; Victor et al., 2009; Kwun and Kim, 2010; Kwun et
al., 2012b), and have revealed a cryptic fish species (Colborn et al., 2001; Kwun et al., 2011).

In this study, mugilid juveniles were collected by scoop net in October 2012 from the southern coastal waters of Jeju Island. Among the specimens collected, we identified *Oedalechilus labiosus* (Valenciennes, 1836) and *Ellochelon vaigien-sis* (Quoy and Gaimard, 1825) using molecular methods. Only two species of *Oedalechilus* Fowler, 1903 and a single species of *Ellochelon* Whitley, 1930 are recognized worldwide, and none has previously been reported in Korea. In this study, we report two unrecorded mugilid species from Jeju Island.

### Materials and Methods

Eighteen specimens of mugilid juvenile were collected from Yerae Port, Seogwipo, Jeju Island, by scoop net in October 2012, and fixed in 99% ethanol as whole fish (Table 1). Counts and measurements were carried out according to Thomson (1997) and recorded to the nearest 0.1 mm using vernier calipers. All fin rays and vertebrae were counted using radiograph images (HA-100; Softex, Tokyo, Japan) and lateral line scales were counted under a stereo microscope (SZX-16; Olympus, Tokyo, Japan). The specimens were kept at the Pukyong National University (PKU) and the National Institute of Biological Resources (NIBR-P), Korea (Table 1).

Genomic DNA extraction and polymerase chain reaction (PCR) for molecular identification were performed according to Kwun and Kim (2010) and Kwun et al. (2012b). Genomic DNA was extracted from muscle tissues using Chelex 100 resin (Bio-Rad, Hercules, CA, USA). PCR was used to amplify the mitochondrial DNA 16S rRNA region using a universal primer set (Palumbi, 1996): 16Sar-L (5′-CGCCTGTT-TATCAAAAAACAT-3′), 16Sbr-H (5′-CCGGTCTGAACTCA-GATCAGT-3′). The PCR was conducted using an MJ Mini Thermal Cycler PTC-1148 (Bio-Rad) with the PCR solution containing 10 μL of genomic DNA, 5 μL of 10× PCR buffer, 2.4 μL of 2.5 mM dNTPs, 1 μL of each primer, 0.5 μL of FR-Taq polymerase (BioMedics, Seoul, Korea), and distilled water to bring the final volume to 50 μL. The PCR was carried out under the following conditions: initial denaturation at 95°C for 5 min, 35 cycles of denaturation at 95°C for 1 min, annealing at 50°C for 1 min, extension at 72°C for 1 min, and a final extension at 72°C for 5 min. DNA was sequenced on an ABI 3730XL Sequencer (Applied Biosystems, Foster City, CA, USA) using the ABI PRISM BigDye Terminator v3.1 Ready Reaction Cycle Sequencing Kit (Applied Biosystems). The nucleotide sequences were deposited in the DDBJ/EMBL/GenBank databases (accession nos. KC741193-KC741194).

Sequences were aligned using ClustalW (Thompson et al., 1994) in BioEdit ver. 7 (Hall, 1999), and sequences of *O. labiosus* (JQ060872) and *E. vaigien-sis* (JQ060692) from the National Center for Biological Information (NCBI) database, and *C. macrolepis* (PKU 7595, KC741195) and *M. seheli* (PKU 7596, KC741196), were used for molecular comparisons (Table 1). *Girella punctata* and *Terapon jarbua* from the NCBI database were selected as outgroups (Table 1). Genetic distances were calculated using the Kimura two-parameter method (Kimura, 1980) and MEGA 5 (Tamura et al., 2011). A neighbor-joining (NJ) tree was constructed with the Kimura two-parameter method (Kimura, 1980) and 10,000 bootstrap replications using MEGA 5 (Tamura et al., 2011).

### Results and Discussion

***Oedalechilus Fowler, 1903***

(new Korean name: Sol-ip-sung-ee-sok)

*Oedalechilus* Fowler, 1903: 748 (type species: *Mugil labeo* Cuvier, 1829).


**Description**

Preorbital containing deep notch and round posterior tip; slender maxilla, slightly curved downward, and with the posterior tip slightly visible when mouth is closed; upper lip thick and broad, lower lip thin; lip with file-like margins; teeth on

### Table 1. List of specimens of the present study

<table>
<thead>
<tr>
<th>Species</th>
<th>No. of specimens</th>
<th>Locality</th>
<th>Date</th>
<th>Voucher no.</th>
<th>Accession no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mugilidae sp. 1</td>
<td>16</td>
<td>Jeju, Jeju-do</td>
<td>5 Oct 2012</td>
<td>PKU 7610-7625</td>
<td>KC741193</td>
</tr>
<tr>
<td>Mugilidae sp. 1</td>
<td>1</td>
<td>Jeju, Jeju-do</td>
<td>5 Oct 2012</td>
<td>NIBR-P19910</td>
<td>PKU 7610</td>
</tr>
<tr>
<td>Mugilidae sp. 2</td>
<td>1</td>
<td>Jeju, Jeju-do</td>
<td>5 Oct 2012</td>
<td>NIBR-P19911</td>
<td>KC741194</td>
</tr>
<tr>
<td>Chelon macrolepis</td>
<td>1</td>
<td>Jeju, Jeju-do</td>
<td>5 Oct 2012</td>
<td>PKU 7595</td>
<td>KC741195</td>
</tr>
<tr>
<td>Moolgarda seheli</td>
<td>1</td>
<td>Jeju, Jeju-do</td>
<td>5 Oct 2012</td>
<td>PKU 7596</td>
<td>KC741196</td>
</tr>
<tr>
<td>Girella punctata</td>
<td>1</td>
<td>Goseong, Gyeongsangnam-do</td>
<td>29 Nov 2008</td>
<td>PKU 1160</td>
<td>HQ018813</td>
</tr>
<tr>
<td>Terapon jarbua</td>
<td>1</td>
<td>Jeju, Jeju-do</td>
<td>1 Jul 2011</td>
<td>PKU 6485</td>
<td>JQ178232</td>
</tr>
</tbody>
</table>

http://dx.doi.org/10.5657/FAS.2013.0109
Material examined
PKU 7610-7625, 16 specimens, 23.0-29.1 mm standard length (SL); NIBR-P19910, 1 specimen, 26.7 mm SL, Yerae Port, Seogwipo, Jeju Island, Scoop net, 5 Oct 2012 (Fig. 1).

Description
Counts are shown in Table 2. Measurements, expressed as a percentage (mean in parentheses) of the SL, include the following: body depth 24.5-29.2 (27.9); head length 26.6-30.9 (28.9); head width 16.1-19.4 (17.7); snout length 6.5-8.0 (7.2); interorbital width 11.5-15.0 (13.6); eye diameter 9.1-11.2 (10.0); upper lip height 1.7-2.6 (2.2); predorsal length 53.3-62.3 (57.6); pectoral fin length 20.0-23.3 (22.0); and caudal peduncle depth 11.7-12.8 (12.3).

Head broad, and depressed dorsally; body deep and compressed posteriorly; mouth terminal; posterior tip of maxilla beyond the anterior margin of the eye; symphysis blunt; posterior margin of preorbital with 5-6 spines (Fig. 2A); upper lip thicker than lower lip; posterior end of mouth angle with round notch (Fig. 2A); posterior tip of maxilla beyond mouth angle; 1 or 2 rows of curved conical teeth on each jaw; snout short and blunt; interorbital region slightly convex; adipose eyelid absent; 2 dorsal fins completely separated, and origin of 1st dorsal fin located in the middle of the body; posterior tip of pectoral fin extending beyond the vertical line from the origin of the pelvic fin, and posterior tip of the pelvic fin extending beyond the vertical line from the origin of the 1st dorsal fin;

Table 2, Comparison of meristic characters of Oedalechilus labiosus and Ellochelon vaigiensis

<table>
<thead>
<tr>
<th></th>
<th>Oedalechilus labiosus</th>
<th>Ellochelon vaigiensis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard length (mm)</td>
<td>23.0-29.1</td>
<td>61-180</td>
</tr>
<tr>
<td>Dorsal fin rays</td>
<td>IV-8-9</td>
<td>IV-I, 8</td>
</tr>
<tr>
<td>Anal fin rays</td>
<td>III, 8-9</td>
<td>III, 9</td>
</tr>
<tr>
<td>Vertebræ</td>
<td>23-24</td>
<td>-</td>
</tr>
<tr>
<td>Lateral line scales</td>
<td>33-36</td>
<td>34-36</td>
</tr>
<tr>
<td>Transverse scales</td>
<td>11-12</td>
<td>12</td>
</tr>
</tbody>
</table>

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Fig. 1. Oedalechilus labiosus, PKU 7610 (27.5 mm standard length) collected from the southern waters of Jeju Island.

Fig. 2. Illustration of head of two Mugilidae species. (A) Oedalechilus labiosus, PKU 7610 and (B) Ellochelon vaigiensis, NIBR-P19911.

Remarks
Only two species, Oedalechilus labeo and O. labiosus, have been reported in the genus Oedalechilus, and they are distinguishable by the number of lateral line scales (48-52 in O. labeo vs. 32-37 in O. labiosus) and their distributions (Mediterranean Sea for O. labeo vs. the Indo-Pacific Ocean for O. labiosus) (Thomson, 1997; Harrison and Senou, 1999).

Oedalechilus labiosus (Valenciennes, 1836) (Table 2, Fig. 1)
(new Korean name: Sol-ip-sung-eo)

Mugil labiosus Valenciennes in Cuvier and Valenciennes, 1836: 125 (type locality: Red Sea).
Mugil joloensis Seale, 1910: 500 (type locality: Philippines).
Table 3. Nucleotide variable position in consensus sequences of the 16S rRNA

| Position | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Species  | Mugilidae sp. 1 (KC741193) | T | T | C | T | - | C | C | G | T | A | T | T | T | C | G | G | T | C | A | T | C | T | - | T | C | - |
|          | Oedalechilus labiosus (JQ060872) | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | - | - | - |
|          | Mugilidae sp. 2 (KC741194) | C | C | • | • | • | - | • | • | • | • | • | • | • | • | • | • | - | T | A | • | • | G | • | • | - | - | - | - |
|          | Ellochelon vaigiensis (JQ060692) | C | C | • | • | • | - | • | • | • | • | • | • | • | • | • | • | T | A | • | • | G | • | • | - | - | - | - |
|          | Chelon macrolepis (KC741195) | C | C | • | T | G | T | A | • | • | C | C | A | • | • | A | A | C | A | G | C | • | • | A | G | T | - | - | - |
|          | Moolganda sechel (KC741196) | C | • | • | • | C | A | T | • | A | C | G | C | C | • | C | • | A | A | C | G | C | T | C | C | • | • | T | - |
|          |          | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
|          |          | 8 | 8 | 9 | 9 | 9 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 8 |
|          |          | 1 | 5 | 0 | 7 | 8 | 4 | 5 | 6 | 7 | 9 | 6 | 9 | 8 | 5 | 2 | 9 | 0 | 1 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 9 | 0 |
| Species  | Mugilidae sp. 1 (KC741193) | A | A | T | A | C | T | C | T | C | C | - | T | C | G | A | T | T | G | G | C | - | - | - | C | T | C | C | C |
|          | Oedalechilus labiosus (JQ060872) | • | • | • | • | • | • | • | • | • | - | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
|          | Mugilidae sp. 2 (KC741194) | C | C | • | C | • | • | - | • | • | • | • | • | C | • | A | A | - | - | - | - | • | T | T | • | - | - | - |
|          | Ellochelon vaigiensis (JQ060692) | C | C | • | C | • | • | - | • | • | • | • | • | C | • | A | A | - | - | - | - | • | T | T | • | - | - | - |
|          | Chelon macrolepis (KC741195) | G | • | • | T | • | T | C | • | C | C | T | T | C | C | A | • | A | - | - | - | T | • | A | • | T | - | - | - |
|          | Moolganda sechel (KC741196) | G | • | • | G | • | T | C | T | - | • | • | T | • | C | • | • | A | A | T | C | T | C | A | • | • | - | - | - |
|          |          | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | - | - | - | - | - | - | - | - | - | - | - | - |
|          |          | 8 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 5 | 5 | 9 | 9 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          |          | 8 | 7 | 0 | 3 | 4 | 6 | 4 | 3 | 4 | 7 | 8 | 1 | 5 | 5 | 7 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Species  | Mugilidae sp. 1 (KC741193) | T | A | G | T | T | C | - | A | A | - | A | G | C | A | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | Oedalechilus labiosus (JQ060872) | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
|          | Mugilidae sp. 2 (KC741194) | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
|          | Ellochelon vaigiensis (JQ060692) | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
|          | Chelon macrolepis (KC741195) | • | A | C | A | T | - | T | - | • | - | G | A | T | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
|          | Moolganda sechel (KC741196) | C | G | • | C | • | A | T | T | C | T | G | • | • | C | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

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origin of the anal fin located in front of the vertical line from the origin of the 2nd dorsal fin; pectoral fin with small axillary scales; caudal fin emarginated; head and body covered with cycloid scales.

Coloration
When fresh, the head and body are silver-whit, darkening dorsally. Both lips are dark. All fins are semitransparent. Tiny melanophores are present on the membranes of the dorsal, caudal, and anterior region of anal fins, with no melanophores on the pelvic fin. Dorsally, the margin of the pectoral fin is dark. After alcohol fixation, the head and body turned a darker silver–white.

Molecular identification
Based on analysis of a 592-base pair (bp) mitochondrial DNA 16S rRNA sequence, Mugilidae sp. 1 corresponds to O. labiosus at a genetic distance of 0.000, but differs from Mugilidae sp. 2 and E. vaigiensis with a genetic distance of 0.020, M. seheli at 0.058, and C. macrolepis at 0.068. The differences are shown as DNA variations between position numbers 12 and 497 (Table 3). In the NJ tree, Mugilidae sp. 1 clustered with O. labiosus, which was corroborated by a high bootstrap value of 99% (Fig. 3).

Distribution
Oedalechilus labiosus is distributed throughout the Indo-Pacific Ocean including the Red Sea (Thomson, 1997; Harrison and Senou, 1999), Japan (Senou, 2002), Taiwan (Shen, 2001), the South China Sea (Randall and Lim, 2000), and the Philippines (Seale, 1910). In Korea it occurs in the southern waters of Jeju Island (found in this study).

Remarks
Based on the original description of O. labiosus (Cuvier and Valenciennes, 1836), the 17 specimens of Mugilidae sp. 1 collected from the southern waters of Jeju Island closely resemble this species, notably in having a deep body and an exposed posterior tip of the maxilla, and in the number of dorsal and anal fin rays. They also have a mouth angle with a round notch and 33-36 lateral line scales (Harrison and Senou, 1999; Senou, 2002), just like O. labiosus. According to the NCBI database, they had 100% sequence identity with sequences of O. labiosus. Therefore, our specimens were identified as O. labiosus based on both morphological and molecular evidence.

Ellochelon Whitley, 1930
(new Korean name: Nup-jeok-ggo-ri-sung- eo-sok)

Ellochelon Whitley, 1930: 251 (type species: Mugil vaigiensis Quoy and Gaimard, 1825).

Description
Posterior tip of preorbital broad and square; maxilla slender, curved downward, and the posterior tip visible when mouth is closed; lips thin; lower margin of upper lip smooth; teeth on vomer and palatines; interorbital region slightly convex; adipose eyelid poorly developed; caudal fin truncated; body covered with ctenoid scales (cycloid in juvenile); 24-29 lateral line scales; pectoral fin black (Thomson, 1997; Harrison and Senou, 1999; Senou, 2002).
The 1st dorsal fin; origin of anal fin located in front of a vertical line at the origin of the 2nd dorsal fin; pectoral fin without auxiliary scales; caudal fin truncated; head and body covered with cycloid scales.

**Coloration**

When fresh, the head and body are silver-white and darkish yellow dorsally. Both lips are dark. The dorsal and pectoral fins are black, and the pelvic, anal, and caudal fins are semitransparent. The pelvic and anal fins are yellowish; the caudal fin is light yellow, with tiny melanophores on the membrane. After alcohol fixation, the head and body were darkish silver-white; and the yellow color of the pelvic, anal, and caudal fins graded to colorless.

**Molecular identification**

Based on analysis of a 592-bp mitochondrial DNA 16S rRNA sequence, Mugilidae sp. 2 corresponded to *E. vaigiensis* at a genetic distance of 0.000, and differed from Mugilidae sp. 1 and *O. labiosus* at a distance of 0.020, *C. macrolepis* at 0.068, and *M. seheli* at 0.071. Their differences were shown by DNA variations between positions 12 and 497 (Table 3). In the NJ-tree, Mugilidae sp. 2 clustered with *E. vaigiensis*, which was corroborated by a high bootstrap value of 100% (Fig. 3).

**Distribution**

*Ellochelon vaigiensis* is distributed throughout the Indo-Pacific Ocean (Thomson, 1997; Harrison and Senou, 1999), Japan (Senou, 2002; Motomura et al., 2010), the South China Sea (Randall and Lim, 2000), and Indonesia (Quoy and Gaimard, 1825; Cuvier and Valenciennes, 1836). In Korea, the species occurs in the southern waters of Jeju Island (this study).

**Remarks**

Only one species, *E. vaigiensis*, is recorded in the genus *Ellochelon* (Eschmeyer, 2012), which differs from the genus *Chelon* in pectoral fin coloration (black in the former vs. not black in the latter) and caudal fin shape (truncated vs. forked) (Senou, 2002).

*Ellochelon vaigiensis* (Quoy and Gaimard, 1825)

**(Table 2, Fig. 4)**

(Korean name: Nup-jeok-ggo-ri-sungreo)

*Mugil vaigiensis* Quoy and Gaimard, 1825: 337 (type locality: Indonesia).

*Mugil melanochir* Valenciennes in Cuvier and Valenciennes, 1836: 143 (type locality: Indonesia).


*Ellochelon vaigiensis*: Whitley, 1930: 250; Randall and Lim, 2000: 625; Senou, 2002: 537; Motomura et al., 2010: 79.

**Material examined**

NIBR-P19911, 1 specimen, 16.7 mm SL, Yereae Port, Seogwipo, Jeju Island, Scoop net, 5 Oct 2012 (Fig. 3).

**Description**

Counts are shown in Table 2. Measurements, expressed as a percentage of the SL, include: body depth 28.7; head length 32.9; head width 19.2; snout length 8.4; interorbital width 15.6; eye diameter 10.8; upper lip height 1.8; predorsal length 58.7; pectoral fin length 12.6; and caudal peduncle depth 18.0.

Head broad and depressed dorsally; body deep and compressed posteriorly; mouth terminal, with posterior tip of the maxilla reaching to the anterior margin of the eye; symphysis slightly pointed; posteroventral margin of the preorbital with numerous spines (Fig. 2B); both lips thin; posterior tip of the maxilla beyond the mouth angle; 1-2 rows of curved conical teeth on each jaw; snout short and slightly pointed; interorbital region slightly convex; adipose eyelid absent; 2 dorsal fins completely separated, and origin of the 1st dorsal fin located behind the midline of the body; posterior tip of the pectoral fin beyond a vertical line at the origin of the pelvic fin, and posterior tip of pelvic fin beyond a vertical line at the origin of
vaigiensis, following Kim et al. (2010).

**Key to the species of family Mugilidae from Korea**

1a. Posterior end of mouth angle with round notch. Margin of upper lip with file-like except during early life stage.  
Sol-ip-sung-eo (new Korean name) Oedalechilus labiosus

1b. Posterior end of mouth angle without round notch. margin of upper lip smooth.  

Nup-jeok-ggo-ri-sung-eo Ellochelon vaigiensis

2b. Pectoral fin light or dark gray. Caudal fin emarginate or forked.  

3a. Posterior end of maxilla reaching to mouth angle.  
Cho-seung-ggo-ri-sung-eo Moolgarda seheli

3b. Posterior end of maxilla beyond mouth angle.  

4a. Posterior margin of scales on middle of body with membrane. When mouth closed, posterior tip of maxilla not exposed or slightly visible.  
Deung-jul-sung-eo Chelon affinis

4b. Posterior margin of scales on middle of body without membrane. When mouth closed, posterior tip of maxilla exposed.  

5a. Keel in front of dorsal fin.  
Moolgarda seheli

5b. No keel in front of dorsal fin.  

6a. Lateral line scales 30-34.  
Cho-seung-ggo-ri-sung-eo Moolgarda seheli

6b. Lateral line scales 38-44.  
Gung-eo Chelon haematocheilus

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