

Summary

Monitoring eel recruitment is crucial for understanding trends in population size and to ensure that there are a sufficient number of adults to sustain future generations. In this manual, we provide a practical guide for the morphological identification of eel species in Asia and Oceania, with a focus on species endemic to East Asia. The identification key is based on two external characters: the position of the dorsal fin and the pigmentation patterns on the caudal peduncle and caudal fin. This manual is intended to be useful for fishers and authorities to allow rapid, on-site classification in the field, especially for commercially important species.

Morphological species identification of glass eels

The following external characters will be used for species identification, as illustrated in Figure 1:

- Pigmentation on the caudal peduncle and caudal fin: Using this feature, eels can be sorted out into three groups: (1) no pigmentation on the caudal region, (2) pigmentation on the caudal peduncle (tail bud), (3) and pigmentation on the caudal fin (Tabeta et al. 1976, Reveillac et al. 2009, Leander et al. 2012, see Section 2.1).
- Position of dorsal fin origin relative to the anus: This character has been widely used in previous papers (Tesch 2003, Watanabe et al. 2004, Silfvergrip 2009, Leander et al. 2012) in the form of the ratio of the length from the dorsal fin origin to the anus (anodorsal or dorsoanal fin length; ADL) and the total length (TL). This character allows for the classification of eels into two groups: shortfin eels and longfin eels. And in some cases, it is also useful to differentiate the closely related species (see Section 2.1).

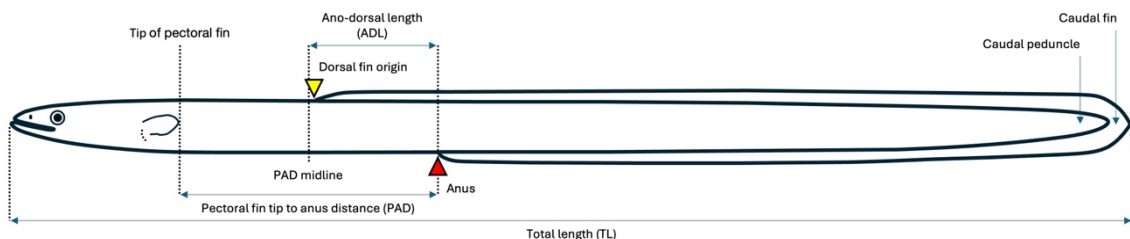


Figure 1. Terminology used for morphological identification of glass eels (after Nakabo (ed.)2002, Watanabe et al. 2004, Leander et al. 2012).

1) Identification of glass eels from the East Asia region (China, Japan, Republic of Korea and Chinese Taipei)

Several temperate and tropical eel species are distributed in East Asia and this region is an important area for eel trading worldwide, particularly for the Japanese eel (*A. japonica*). According to previous publications, three to four *Anguilla* species are known to occur in this area: *A. japonica*, the Indian shortfin eel (*Anguilla bicolor pacifica*), the giant mottled eel (*Anguilla marmorata*), and the Luzon mottled eel (*Anguilla luzonensis*). *Anguilla luzonensis* is rare in this area.

Herein, we provide identification keys for eel species in East Asia based on morphological characters.

Dichotomous key using caudal pigmentation (Figure 2):

- 1. Weak caudal pigmentation *A. japonica*
 Specific caudal pigmentation 2
- 2. Pigmentation on caudal peduncle (tail bud) *A. marmorata* or *A. luzonensis*
 Pigmentation on caudal fin *A. bicolor pacifica*

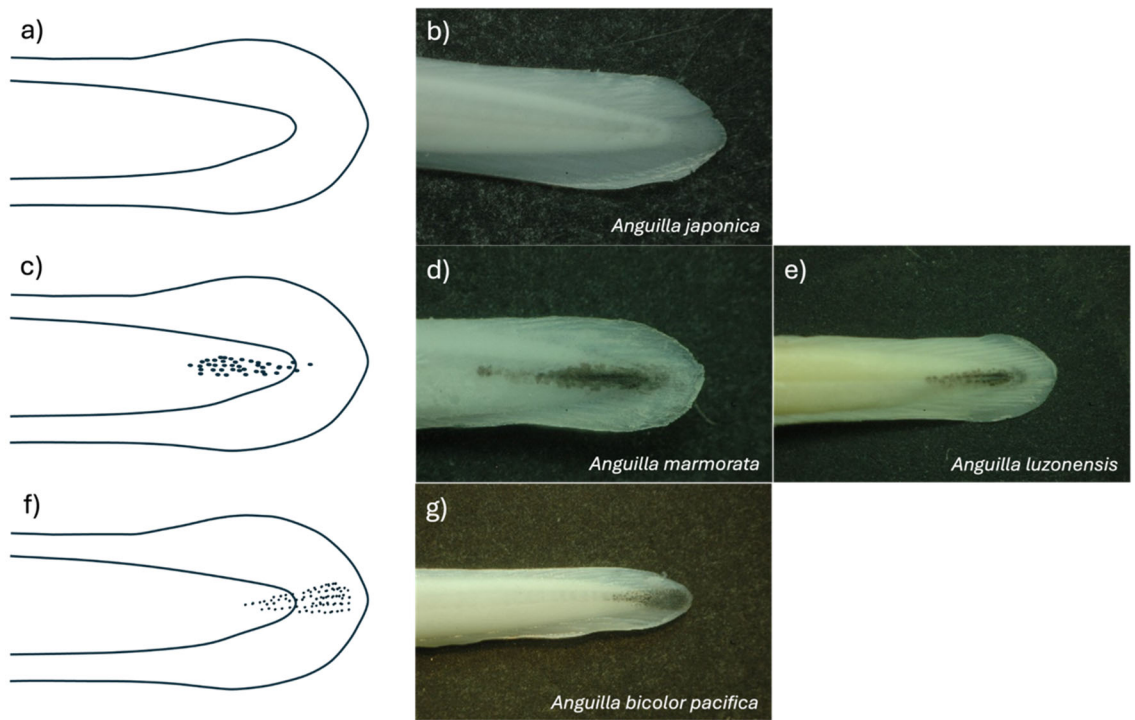


Figure 2. Illustration showing differences in caudal pigmentation among eel species in Japan: a-b) *Anguilla japonica*,

c-d-e) *A. marmorata* and/or *A. luzonensis*, and f-g) *A. bicolor pacifica* (after Tabeta et al 1976, Leander et al. 2012).

Photos by Yu-San Han.

Dichotomous key using position of dorsal fin origin (Figure 3):

1. Short-finned eel; dorsal fin origin located just above the anus *A. bicolor pacifica*
 Long-finned eel; dorsal fin origin located anterior to the anal fin 2
2. Dorsal fin origin located at or posterior to the midpoint between the tip of the pectoral fin and the anus *A. japonica* or *A. luzonensis*
 Dorsal fin origin located anterior to the midpoint between the tip of the pectoral fin and the anus..... *A. marmorata*

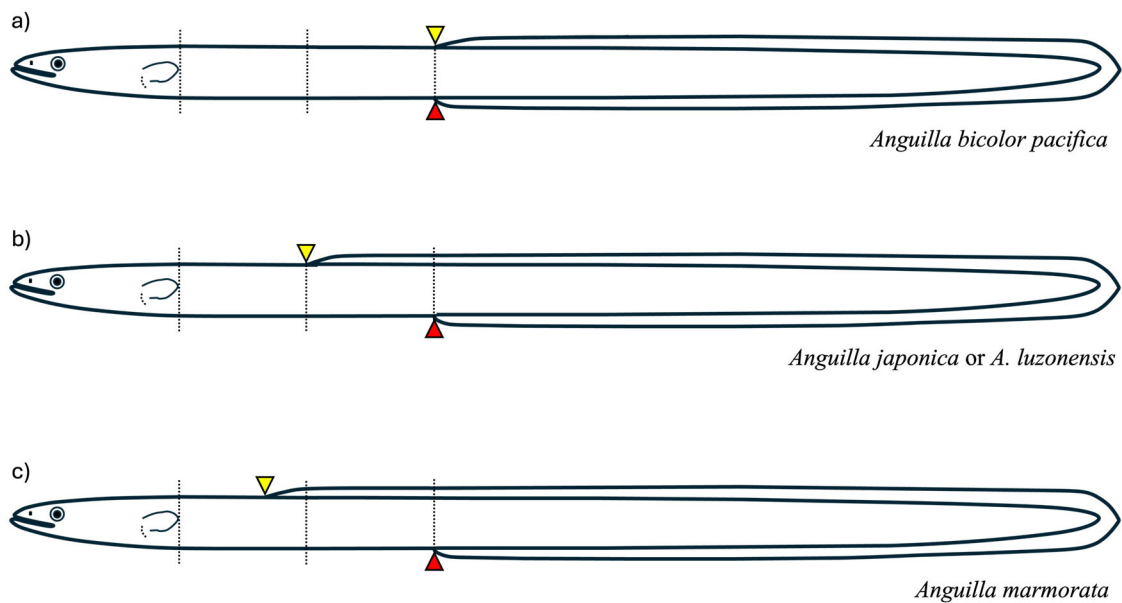


Figure 3. Illustration of differences in the positions of the dorsal fin origin among three eel species in Japan: a) *Anguilla bicolor pacifica*, b) *A. japonica* or *A. luzonensis*, and c) *A. marmorata*. Vertical dotted lines indicate (from left to right) the tip of the pectoral fin, the midpoint between the tip of the pectoral fin and the anus, and the anus. Yellow and red triangles indicate the positions of the dorsal fin origin and the anus, respectively (after Nakabo (ed.) 2002, Tesch 2003, Silfvergrip 2009).

To improve identification, it is recommended to use the above two keys in combination. For glass eels, the primary morphological character to observe is the pigmentation pattern on the caudal region, followed by the position of the dorsal fin origin.

Dichotomous key using both the position of the dorsal fin origin and caudal pigmentation (Figure 4):

1. Weak caudal pigmentation; dorsal fin origin located at or posterior to the midpoint between the tip of the pectoral fin and the anus *A. japonica*
 Caudal pigmentation present 2
2. Short-finned eel; dorsal fin origin located just above the anus; pigmentation present on the caudal fin tip *A. bicolor pacifica*
 Long-finned eel; dorsal fin origin located anterior to the anus, pigmentation on caudal peduncle (tail bud) 3
3. Dorsal fin origin located posterior to the midpoint between the tip of the pectoral fin and the anus..... *A. luzonensis*
 Dorsal fin origin located anterior to the midpoint between the tip of the pectoral fin and the anus..... *A. marmorata*

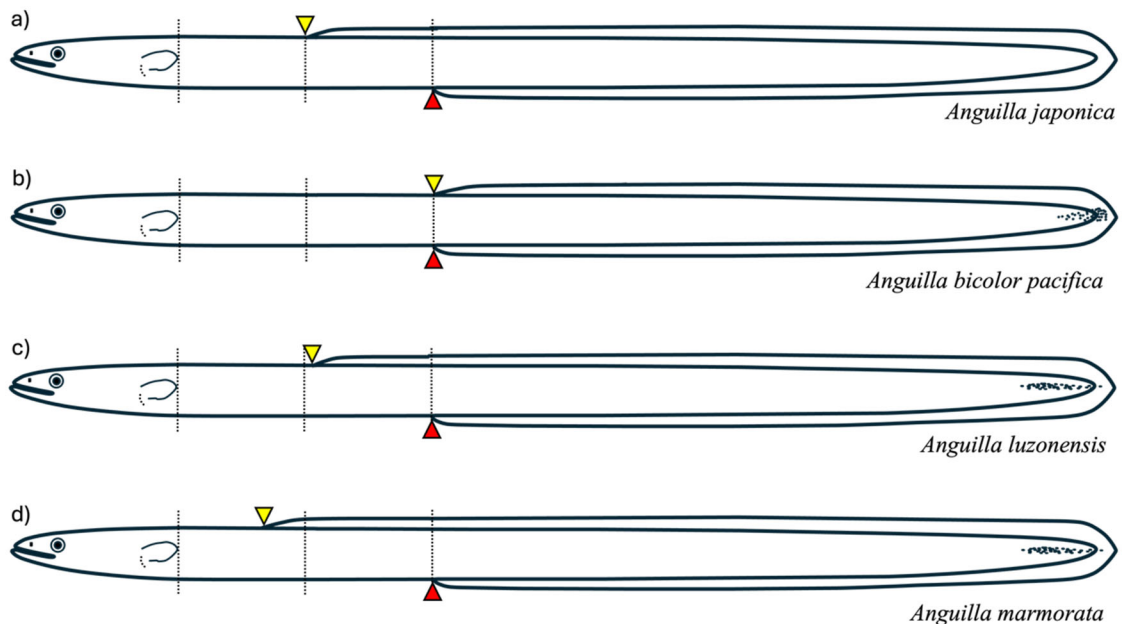


Figure 4. Illustration showing differences in the position of the dorsal fin origin and caudal pigmentation among eel species in Japan: a) *Anguilla japonica*, b) *A. bicolor pacifica*, c) *A. luzonensis*, and d) *A. marmorata*. Vertical dotted

lines indicate (from left to right) the tip of the pectoral fin, the midline between the tip of the pectoral fin and the anus, and the anus. Yellow and red triangles indicate the positions of the dorsal fin origin and the anus, respectively (after Tabeta et al 1976, Tesch 2003, Silfvergrip 2009, Nakabo (ed.) 2002, Leander et al. 2012).

2) Identification of glass eels from the Southeast Asia region (Cambodia, Indonesia, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam)

Among the eight species/subspecies of *Anguilla* that are distributed in Southeast Asian countries, two species of shortfin eels (*Anguilla bicolor bicolor* and *A. bicolor pacifica*) and one species of longfin eel (*A. marmorata*) are of economic importance (SEAFDEC 2018). *Anguilla bicolor* and *A. marmorata* can be distinguished using the morphological identification keys provided above. However, it remains difficult to reliably distinguish between the two subspecies of *A. bicolor* based on either morphological characteristics or the currently available genetic information. Therefore, glass eel fisheries stakeholders are encouraged to use the keys where applicable, while acknowledging the limitations in subspecies-level identification for *A. bicolor*.

3) Identification of glass eels from the Oceania region (Australia, Fiji, and New Zealand)

Oceania is home to about nine species/subspecies of anguillid eels (Stuart et al. 2024) and they can be classified into two groups based on the position of the dorsal fin origin relative to the anal fin origin (i.e. shortfin and longfin eels). Additional external morphological characters, such as pigmentation patterns on the caudal region, can also be used for identification.

4) Morphological identification of glass eels of the species *Anguilla japonica*, *A. rostrata*, and *A. anguilla*

In international trade, *A. japonica*, *A. rostrata*, and *A. anguilla* glass eels are exported to various regions, making accurate identification essential, as the species are morphologically similar at this early life stage. Silfvergrip (2009) proposed a practical identification key for intact specimens smaller than 200 mm total length (TL). According to this key the distinguishing characteristic is the ratio of postanal length to the dorsoanal distance (the distance between the anus and the origin of the dorsal fin, see ADL in Figure 1).

Sample median ($N \geq 15$ recommended) of postanal length 5.6–6.0 times dorsoanal distance *A. dieffenbachii* or *A. japonica*
 Sample median ($N \geq 15$) of postanal length 5.0–5.2 times dorsoanal distance *A. anguilla*

However, there are no clear ways to distinguish *A. rostrata* glass eels using external morphological features (Silfvergrip 2009).

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