INTRODUCTION

The family Echeneidae, order Perciformes, comprises 8 species and 3 genera worldwide (Gray et al., 2009), 7 species and 3 genera in Japan (Hatooka and Kai, 2013), and 4 species and 3 genera in Korea (Lee and Joo, 2006). The Korean species are *Echeneis naucrates* Linnaeus, 1758, *Remora remora* (Linnaeus, 1758), *Remora albescens* (Temminck and Schlegel, 1850), and *Phtheirichthys lineatus* (Menzies, 1791). Echeneidae are distributed worldwide in tropical and subtropical seas (Nelson, 2006). The family is characterized by an elongate body, flattened head, sucking disc on the dorsal surface of the head, lower jaw projecting past the upper jaw, absence of spines on the dorsal and anal fins, and no swim bladder (Nelson, 2006). Echeneidae species attach to numerous species of marine vertebrates including sharks, rays, marlins, sea turtles, whales, and dugong (Carpenter, 2002), and also to ships and various floating objects. Some species show considerable host specificity (Paulin and Habib, 1982), and some are free-swimming (Gomon et al., 2008). Some *Remora* species feed on the ectoparasites of their host, as well as on any available small prey (Heemstra, 1986).

The remoras have been the subject of numerous studies, including studies on the ontogeny and homology of the skeletal elements (Britz and Johnson, 2012), molecular phylogeny (Gray et al., 2009), morphological phylogeny (O’Toole, 2002), and geographic distribution (Dennis et al., 2004; Lee and Joo, 2006; Tuncer et al., 2012).

In the present study, two specimens of *R. brachyptera* and one specimen of *R. osteochir* were collected off Korea; both species, are unrecorded in the Korean fish fauna. Therefore, the aim of the present study is that we described the two newly recorded species. We also provide descriptions and morphological character about two species.

MATERIALS AND METHODS

Specimens of *R. brachyptera* were collected by purse seine and stationary nets off southern Jeju Island (33°33′N, 128°03′E) in July 2013 and off Ganggu-myeon, Yeongdeok-gun, Gyeongsangbuk-do in June 2014. *Remora brachyptera* is characterized by a sucker with 16 pairs of disc laminae and a dorsal fin that originates anterior of the origin of the anal fin. *Remora osteochir* is characterized by a sucker with 18 pairs of disc laminae and a sucking disc that extends beyond the posterior end of the pectoral fin. New Korean names proposed for the species are “Meo-ri-ppal-pan-i” for *R. brachyptera* and “Pyeo-dae-ppal-pan-i” for *R. osteochir*.

**Keywords:** *Remora brachyptera*, *Remora osteochir*, new record, Echeneidae, Korea
SYSTEMATIC ACCOUNTS

Order Perciformes
Family Echeneidae
Genus Remora Gill, 1862

1 Remora brachyptera (Lowe, 1839) (Table 1, Fig. 1)
(new Korean name: Meoririppalpani)

Echeneis brachyptera Lowe, 1839: 89 (type locality: Madeira, eastern Atlantic).
Echeneis nieuhoffii Bleeker, 1853: 279 (Indonesia).
Echeneis pallida Temminck and Schlegel, 1850: 271, Pl. 120 (Japan).
Echeneis quatuordecimlaminatus Storer, 1839: 496 (USA).
Echeneis sexdecimlamellata Eydoux and Gervais, 1837: 1, Pl. 16 (Indian Ocean); Bauchot and Desoutter, 1989: 14 (France).

Remora brachyptera: Lachner, 1973: 639 (northeastern Atlantic, Mediterranean); Bañón et al., 2010: 16 (Spain); Hatooka and Kai, 2013: 874 (Japan); Wirtz et al., 2013: 123 (Australia).

Material examined. One specimen, 209.0 mm standard length (SL), collected by purse seine net off southern Jeju Island, Korea (33°33′N, 128°03′E), Jul 2013, PKU 9440; one specimen, 180.2 mm SL, collected by stationary net, Ganggu-myeon, Yeongdeok-gun, Gyeongsangbuk-do, Korea (36°21′N, 129°28′E), Jun 2014, PKU 11044.

Description. Disc laminae, 16; dorsal fin rays, 30; anal fin rays, 25–27; pectoral fin rays, 25; pelvic fin rays 1, 5; vertebrae, 27; gill rakers 1 and 10 or 11 (Table 1).

Body stout and elongate (Fig. 1). Head flattened, with an oval and elongate sucking disc on the dorsal surface; sucking disc with 16 pairs of laminae; sucking disc does not extend to the posterior end of the pectoral fin. Scales of small and oval type, and irregularly arranged on body surface. Lower jaw rounded, protruding anteriorly; upper jaw pointed; both jaws with many rows of conical and curved teeth; posterior margin of upper jaw extending slightly beyond a line vertical to the anterior margin of the eye. Eyes small. Two pairs of nostrils; anterior nostrils smaller than posterior nostrils. Dorsal and anal fins without spines; origin of dorsal fin located more anterior than that of anal fin; posterior end of anal fin not reaching to posterior end of dorsal fin; pectoral fin rounded; origin of the pectoral fin anterior to origin of the pelvic fin. Lateral line starts at upper end of gill open-

Table 1. Comparison of counts and measurements for Remora brachyptera

| Morphological characters | Present study | Lowe (1839) | Paulin and Habib (1982) | Hatooka and Kai (2013) |
|--------------------------|--------------|-------------|-------------------------|------------------------|
| No. of specimens         | 1            | 1           | 15                      | –                      |
| Standard length (SL, mm) | 209.0        | 180.2       | 120–244                 | –                      |
| Count                    |              |             |                         |                        |
| Disc laminae             | 16           | 16          | 16–17                   | –                      |
| Dorsal fin rays          | 30           | 30          | 28                      | 26–30                  | 27–37                 |
| Anal fin rays            | 25           | 27          | 24                      | –                      | 22–34                 |
| Pectoral fin rays        | 25           | 25          | 26                      | –                      | 23–28                 |
| Pelvic fin rays          | 1, 5         | 1, 5        | 1, 5                    | –                      | –                     |
| Vertebrae                | 27           | 27          | –                       | –                      | 27                    |
| Gill rakers              | 1+11         | 1+10        | 1–3+9–12                | –                      | –                     |
| As % of SL               |              |             |                         |                        |                        |
| Head length              | 27.7         | 26.4        | 26.5 (25.4–27.7)         | –                      |
| Orbit diameter           | 3.4          | 4.2         | 3.5 (3.2–4.1)           | –                      |
| Snout length             | 13.5         | 13.0        | –                       | –                      |
| Head width at orbit      | 15.4         | 16.2        | 16 (14.3–18)            | –                      |
| Disc length              | 31.1         | 29.3        | 31.3 (29.4–33.1)        | –                      |
| Disc width               | 14.9         | 15.5        | 16.9 (15.2–19.2)        | –                      |
| Predorsal length         | 56.1         | 62.8        | 56.5 (52.4–60.8)        | –                      |
| Body depth               | 15.7         | 17.4        | 15.3 (13.9–17.1)        | –                      |
| Dorsal fin length        | 39.7         | 38.4        | 37.6 (32.5–42.4)        | –                      |
| Anal fin length          | 31.5         | 33.4        | –                       | –                      |
| Pectoral fin length      | 14.2         | 11.6        | –                       | –                      |
| Pelvic fin length        | 12.6         | 9.8         | –                       | –                      |
| Caudal fin length        | 20.2         | 19.2        | –                       | –                      |
| Caudal peduncle depth    | 6.8          | 5.9         | 6.2 (4.5–7.1)           | –                      |

Korean name: 머리빨판이
New Records of *Remora brachyptera* and *Remora osteochir* from Korea

**Color.** When fresh: body uniformly pale brown, except margins of fins are grayish to white. Head and body uniformly white (of PKU 11044) or brown (PKU 9440) (Fig. 1). In ethanol: color similar to that when fresh.

**Distribution.** Korea (present study); worldwide in warm waters (Lachner, 1986; O’Toole, 2002); New Zealand (Weber and de Beaufort, 1962; Paulin and Habib, 1982); Puerto Rico (Williams and Bunkley-Williams, 1996).

**Remarks.** The examined specimens belong to the genus *Remora* on the basis of body not elongate, pectoral fins rounded, and 18–28 anal fin soft rays (Carpenter, 2002). On the other hand, the other two genera occurring in Korea, *Phtheirichthys*, and *Echeneis*, are characterized by having a very elongate body, pectoral fins pointed, usually a dark longitudinal band on the sides, and 29–41 anal fin soft rays (Carpenter, 2002). The specimens were identified as *R. brachyptera* based on the sucking disc with 16 pairs of laminae, a total of 11–20 gill rakers, and 27–34 dorsal fin soft rays (Paulin and Habib, 1982; Carpenter, 2002; O’Toole, 2002; Hatooka and Kai, 2013). *Remora brachyptera* is similar to *R. remora* (Linnaeus, 1758) in having 27 vertebrae and 15–19 sucking disc pairs of laminae on the sucking disc, but differs from the latter in having a total of 10–16 gill rakers (vs. 28–37 in *R. remora*) (Paulin and Habib, 1982), the location of the dorsal fin origin before the anal fin origin (vs. corresponding to the anal fin origin in the *R. remora*), and truncate shape of the caudal fin (vs. forked in *R. remora*) (Carpenter, 2002).

The two specimens showed large differences in body color. Their heads and bodies were uniformly purple in PKU 9440 but uniformly white in PKU 11044; similar variations in color have been mentioned by Hatooka and Kai (2013). We propose the new Korean name “Meo-ri-ppal-pan-i” for *R. brachyptera*.

**Remora osteochir** (Cuvier, 1829) (Table 2, Fig. 2)

(new Korean name: Ppyeo-daep-ppal-pan-i)

*Echeneis osteochir* Cuvier, 1829: 348 (type locality: Martinique Island, West Indies, western Atlantic); Bauchot and Desoutter, 1989: 13 (France).

*Echeneis jacobaea* Lowe, 1839: 89 (Portugal).

*Echeneis musignani* Costa, 1840: 9 (Mediterranean Sea); Vanni, 1991: 225 (Italy).

*Echeneis tetrapturorum* Poey, 1868: 256 (Cuba); Howell-Rivero, 1938: 216 (USA).

*Echeneis pediculus* Girard, 1893: 611 (Portugal).

*Echeneis megalodiscus* Franz, 1910: 69 (Japan); Neumann, 2006: 274 (Germany).
Remora osteochir: Lachner, 1973: 639 (north-eastern Atlantic, Mediterranean); Randall et al., 2005: 121 (Marshall Islands); McCosker and Rosenblatt, 2010: 192 (Galápagos Archipelago); Hatooka and Kai, 2013: 874 (Japan); Page et al., 2013: 146 (USA, Canada, and Mexico).

Material examined. PKU 9646, one specimen, 241.5 mm SL, collected by purse sein off southern Jeju Island, Korea (33°39′N, 127°13′E) in Aug 2013.

Description. Disc laminae, 18; dorsal fin rays, 25; anal fin rays, 24; pectoral fin rays, 22; pelvic fin rays 1, 5; vertebrae, 27; gill rakers 2 and 13 (Table 2).

Body stout and elongate. Scales small and irregularly arranged over entire body surface. Head flattened and short. Sucking disc oval and elongate on dorsal surface. Eye moderately small. Lower jaw rounded, projecting past upper jaw; both jaws with many rows of conical and curved teeth; upper jaw does not extend to anterior margin of eye. Two pairs of nostrils; anterior nostril with a well-developed membranous rim; posterior nostril smaller than anterior nostril.

| Morphological characters | Present study PKU 9646 | Paulin and Habib (1982) | Carpenter (2002) | Tuncer et al. (2012) |
|--------------------------|------------------------|-------------------------|------------------|---------------------|
| No. of specimens         | 1                      | 2                       | –                | 1                   |
| Standard length (SL, mm) | 241.5                  | 278-350                 | –                | 131                 |
| Count                    |                        |                         |                  |                     |
| Disc laminae             | 18                     | 17-18                   | 15-20            | 18                  |
| Dorsal fin rays          | 25                     | 25                      | 21-27            | 24                  |
| Anal fin rays            | 24                     | –                       | 18-28            | 24                  |
| Pectoral fin rays        | 22                     | –                       | 20-24            | 20                  |
| Pelvic fin rays          | 1, 5                   | –                       | –                | 5                   |
| Vertebrae                | 27                     | –                       | 27               | –                   |
| Gill rakers              | 2+13                   | 1+6.7                   | 11-17            | 2+12                |

As % of SL

|                         | Present study PKU 9646 | Paulin and Habib (1982) | Carpenter (2002) | Tuncer et al. (2012) |
|-------------------------|------------------------|-------------------------|------------------|---------------------|
| Head length             | 20.5                   | 19.4-19.8               | –                | 22.4                |
| Orbit diameter          | 2.3                    | 2.0-2.1                 | –                | 3.0                 |
| Snout length            | 9.4                    | –                       | –                | 10.5                |
| Head width at orbit     | 14.3                   | 14.3-14.7               | –                | 14.4                |
| Disc length             | 45.2                   | 41.3-42.0               | 37-49            | 46.4                |
| Width                   | 19.2                   | 17.2-18.1               | –                | 18.6                |
| Predorsal length        | 62.4                   | 62.5-64.3               | –                | 63.1                |
| Body depth              | 11.2                   | 9.8-11.4                | –                | 9.6                 |
| Dorsal fin length       | 36.2                   | 33.4-34.2               | –                | 33.9                |
| Anal fin length         | 35.5                   | –                       | –                | 31.1                |
| Pectoral fin length     | 15.8                   | –                       | –                | 13.6                |
| Pelvic fin length       | 12.9                   | –                       | –                | 12.8                |
| Caudal fin length       | 19.5                   | –                       | –                | 18.5                |
| Caudal peduncle depth   | 3.9                    | 3.4-3.8                 | –                | 3.7                 |

Fig. 2. A, Remora osteochir (Cuvier, 1829); PKU 9646, standard length (SL), 241.5 mm; B, Laminae (dorsal view). Red arrows represent posterior end of the disc (a), posterior end of the pectoral fin (b), origin of the dorsal fin (c), and origin of the anal fin (d).
Posterior end of sucking disc posterior to the posterior end of the pectoral fin. Pectoral fin obtuse; posterior end of pelvic fin extending beyond the posterior end of pectoral fin; shape of dorsal fin similar to anal fin; both dorsal and anal fins begin behind middle of body; dorsal and anal fins long and without spines; origin of dorsal fin located slightly anterior to that of anal fin; posterior end of anal fin not reaching to posterior end of dorsal fin; soft portions of dorsal and anal fins angular; pectoral fin rounded; origin of pectoral fin anterior to origin of pelvic fin; caudal peduncle slender; caudal fin truncated.

**Color.** When fresh: upper part of body blackish and lower part of body dark greyish; dorsal, anal, and caudal fins blackish; pectoral and pelvic fins dark greyish; iris dark brownish (Fig. 2). In ethanol: coloration shows no change after fixation.

**Distribution.** Korea (present study), worldwide in most tropical and subtropical pelagic environments (Lachner, 1986; O’Toole, 2002); Papua New Guinea and North Atlantic (Maul 1956; Paulin and Habib, 1982); Mediterranean (Tortonese, 1973); southeastern Aegean Sea (Kaspiris and Ondrias, 1984); Turkish waters, Aegean Sea (Tuncer et al., 2012); Japan (Hatooka and Kai, 2013).

**Remarks.** The examined specimen was identified as *R. osteochir* based on the presence of 18 disc laminae and a sucking disc extending well beyond the posterior end of the pectoral fin. *Remora osteochir* is easily distinguished from the four other Korean remoras by the location of the sucking disc (extending beyond the posterior end of the pectoral fin vs. not extending to the posterior end of the pectoral fin) (Hatooka and Kai, 2013). *Remora osteochir* is most similar to *Remora australis* (Bennett, 1840) in external shape, but differs in the number of disc laminae (18 in *R. osteochir* vs. 24–28 in *R. australis*) and total number of gill rakers (16 in *R. osteochir* vs. 17–20 in *R. australis*) (Carpenter, 2002). Therefore, we propose the new Korean name ‘Ppyeo-daep-pal-pan-i’ for *R. osteochir*.

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