

A Review of Parrotfishes (Perciformes: Scaridae) of Taiwan with Descriptions of Four New Records and One Doubtful Species

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Yun-Chih Liao, Li-Shu Chen, Kwang-Tsao Shao, and I-Shiung Chen (2004) A review of parrotfishes (Perciformes: Scaridae) of Taiwan with descriptions of four new records and one doubtful species. *Zoological Studies* 43(3): 519-536. In total, 30 species belonging to 7 genera and 2 subfamilies of the family Scaridae are found in Taiwan. Among them, 4 species, *Calotomus japonicus*, *Scarus chameleon*, *S. quoyi*, and *S. spinus*, are recorded for the 1st time from Taiwan. The biogeographical distribution of *Calotomus japonicus* is extended southwards to southern Taiwan. According to Bellwood (1994), 5 species previously classified into the genus *Scarus* in Shen et al. (1993) should be placed in the genus *Chlorurus*: *C. bowersi*, *C. japonensis*, *C. microrhinos*, *C. oedema*, and *C. sordidus*. The 2nd and 3rd species mentioned above were respectively used as junior synonyms of *S. pyrrhurus* and *S. gibbus*. Furthermore, we found specimens which would be a new species of *Scarus* since its morphological and molecular data show significant differences from other congeneric species. Because most of the parrotfish specimens in Shao and Chen (1989) were damaged or discarded, we recollected and re-deposited almost all of them to the Research Museum of the Institute of Zoology, Academia Sinica, Taipei. In addition to detailed descriptions of the 4 newly recorded species and 1 doubtful species, the synonym lists, catalog numbers of deposited specimens, and distributions of the remaining 26 species were also compiled. A diagnostic key to the species, and color plates of all parrotfish species of Taiwan are also provided in this paper. <http://www.sinica.edu.tw/zool/zoolstud/43.3/519.pdf>

Key words: Fish fauna, Parrotfishes, Taxonomy, New records, Zoogeography.

In Taiwan, the Chinese names of parrotfishes (*Scarus* spp.) are "green-clothed fish" or "red-clothed fish" because of their bright greenish or reddish body coloration. They are important economic species and are popular in local seafood restaurants. Among them, *Scarus ghobban* is even listed as an important harvested fish in the annual *Taiwan Fishery Report* (<http://www.fa.gov.tw>). Parrotfishes are reef-dwellers and are widely distributed in all tropical oceans including the Pacific, Indian, and Atlantic Oceans. There are only a few species, such as *Bolbometopon muricatum* and terminal males of the genus *Chlorurus* (Choat and Randall 1986, Bellwood 1994), which scrape living corals to procure their diet. They are dominant herbivores in coral reefs

after they settle down from the postlarval stage. They scrape off epilithic algae which cover the surfaces of substrata or dead coral using their beak-like dental plate; therefore, they inhibit the growth of algae. After being scraped by parrotfishes, the newly exposed surface of the substratum is used by other reef epifauna. This feeding behavior plays an important role in reef community structure and the meiofauna (Bellwood 1995, Chen 2002).

Parrotfishes belong to the family Scaridae (Rafinesques 1810). They are characterized by a compressed and elongated body, a rounded snout, a continuous dorsal fin with 9 spines and 10 soft rays, an anal fin with 3 spines and 9 rays, a pectoral fin with 13~17 rays, and a pelvic fin with 1 spine and 5 rays. The body scales are large and

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cycloid. The lateral line is interrupted and composed of 22~24 pored scales; there are 1~4 cheek scale rows and 2~8 median predorsal scales; the pharyngeal bones are well developed; and there is a beak-like dental plate on each jaw. Most species of parrotfishes exhibit protogynous hermaphroditism. The color pattern varies between different growth stages and sexes. The initial phase, IP, includes the female and primary male; the terminal phase, TP, represents secondary males after a sex change. There are 79 parrotfish species recognized in the world (Bellwood 1994).

Before Liang (1951) initiated scarid research in Taiwan, all taxonomic papers of the family Scaridae had been reported by foreign researchers (Jordan and Evermann 1902, Jordan and Richardson 1909, Fowler and Bean 1922, De Beaufort 1940, Fowler 1956). Later on, Chen (1953 1969) listed 7 and 11 species of parrotfishes, respectively. Shen (1984a b) listed 13 species, and Chen and Yu (1986) compiled 22 species in their synopsis book. But these studies neither provided data of specimens nor cited papers for evidence. In 1989, Shao and Chen (1989) reviewed this family, based on all specimens available in Taiwan. In total, 27 species of parrotfishes including 8 newly recorded species were presented. The species of parrotfishes compiled in the *Fishes of Taiwan* (Shen et al. 1993) are identical to those in Shao and Chen (1989). However, in the past 10 years, the classification system of the Scaridae has been changed. Based on phylogenetic results using both morphological and molecular characters (Bellwood 1994, Shi 2002, Streelman et al. 2002), the genus *Chlorurus* was separated from *Scarus* (Bellwood 1994), Randall et al. (1996) pointed out that the appropriate name for *Scarus pyrrhurus* was *Chlorurus japonensis*, and other name changes were made as well. The historical records of these name changes and detailed distributions of all parrotfishes are compiled in Table 1. Another purpose in publishing this paper is that almost all previous established voucher specimens on parrotfishes by Shao and Chen (1989) in the Institute of Zoology, Academia Sinica, were damaged or discarded before the Research Museum of the Institute was officially founded in 1997. Thus, recollecting all parrotfish species of Taiwan has been on our wish list for several years. Fortunately, for the most part, this mission has been achieved after carrying out a 3-yr research project of parrotfishes by the 2nd author (LSC), sponsored by the National Science Council. All 27 species in 6 genera and 2 subfamilies, except for

Scarus atropectoralis, have been recollected. The former species can still be seen occasionally in the waters of Kenting, Green I., and Orchid I., southern Taiwan, but the latter species has not been observed in the last 15 years. Among all 31 species of parrotfishes, 4 of them are new additions to the Taiwan fish fauna, and their worldwide geographic distributions have thus been extended. One specimen that was collected could potentially be a new species, but its identification has to wait for the collection of additional specimens, including their different color phases. Therefore, it is important that its specimen photo be published so that the public and other researches can be on the lookout for this particular species.

MATERIALS AND METHODS

Fish were mainly collected from local fish markets at Hoppingdao, Keelung City, northern Taiwan and Hengchun, Pingtung County, southern Taiwan. A few of them were collected by scuba diving from 1999 to 2002. Specimens were photographed, and muscle tissues were taken and preserved in 70% alcohol when the fish were still fresh. Specimens were then preserved in 10% formalin before being transferred to 80% alcohol for permanent preservation. Most specimens examined were deposited at the Research Museum of the Institute of Zoology, Academia Sinica (ASIZP). Some were also placed in the National Museum of Marine Science and Technology (NMSMP). Images of specimens were digitized and have been combined into a curatorial database in the Fish Database of Taiwan (<http://fishdb.sinica.edu.tw>) for public enquiry (Shao et al. 2002). Abbreviations used in the paper are: SL for standard length; P. for pectoral fin ray; Pred. S. for predorsal scale; IP for initial phase; TP for terminal phase; and NTUM for the Museum of the Department of Zoology, National Taiwan University.

Systematic Account

Key to species of the family Scaridae of Taiwan

1. Cheek with 1 row; pectoral fin with 13 rays.....2
- Cheek with 2 or 3 rows; pectoral fin with 13~17 rays.....5
2. Teeth fused as dental plate; upper jaw enclosed by lower jaw when mouth is closed.....*Leptoscarus vaigiensis*
- Teeth not fused as dental plate; upper and lower jaws opposed when mouth is closed.....3

3. Caudal fin acute in juvenile stage, concave in adult; lateral margin of caudal fin white; teeth imbricate.....*Calotomus carolinus*
 -. Caudal fin rounded in all sizes; caudal fin without white margin.....4
4. One row of teeth on each jaw; dorsal fin with black spot on 2nd spine and following membrane.....*C. spinidens*
 -. Teeth imbricate; dorsal fin without black spot.....*C. japonicus*
5. Outer surface of dental plate with individual teeth; each upper pharyngeal bone with 3 rows of molariform teeth; gill rakers 16~24.....6
 -. Outer surface of dental plate smooth; each upper pharyngeal bone with 1 row of molariform teeth; more than 35 gill rakers.....7
6. Dorsal profile of head with a hump anterodorsal to eye; 1 row of scales on interopercle; median predorsal scales 2~5 (usually 4); gill rakers 16~18.....*Bolbometopon muricatum*
 -. Dorsal profile of head rounded or slightly convex; 2 rows of scales on interopercle; median predorsal scales 5~7; gill rakers 20~24.....*Cetoscarus bicolor*
7. Dental plate narrow; head pointed; eye near dorsal profile; cheek scales small; caudal fin double-emarginate.....*Hipposcarus longiceps*
 -. Dental plate not narrow; head not pointed; eye not near dorsal profile; cheek scales not small and not in isolated patch; caudal fin rounded to lunate.....8
8. Dental plate not completely covered by upper lip; vertical tooth rows alternating in possessing a tooth on the cutting edge; cutting edge crenate.....9
 -. Dental plate almost covered by upper lip; each vertical tooth row possessing a tooth on the cutting edge; cutting edge even.....13
9. Head with 2 rows of cheek scales.....10
 -. Head with 3 rows of cheek scales.....*Chlorurus microrhinos*
10. Above eye, head with humped profile.....*C. oedema*
 -. Humped profile of head absent.....11
11. Membrane of dorsal fin of TP with 2 longitudinal bands.....*C. bowersi*
 -. Membrane of dorsal fin of TP with 1 longitudinal band...12
12. IP with dark pectoral fin, caudal fin orangish red.....*C. japonensis*
 -. IP with dark pectoral fin but transparent on lower 1/2, base of caudal fin with large black blotch.....*C. sordidus*
13. Cheek scales arranged in 2 rows.....14
 -. Cheek scales arranged in 3 rows.....15
14. Caudal fin of IP rounded, lateral body with 5 bands, body color of TP with prominent yellow area below the region between 3 or 4 spines of dorsal fin.....*Scarus schlegeli*
 -. Caudal fin of IP truncated or slightly emarginate, lateral body band absent, body color of TP without yellow area.....*S. psittacus*
15. Dental plate almost covered by upper lip.....16
 -. Dental plate green and exposed, not covered by upper lip, TP with head hump.....*S. ovifrons*
16. Dorsal profile of head rising steeply from snout to level of eye, then turning abruptly straight, upper lateral scales with dark margins *S. rubroviolaceus*
 -. Head rounded, dorsal profile of snout without prominent convexity.....17
17. Upper part of eye with 1 or 2 blue bands, dorsal profile of head convex.....18
 -. Upper part of eye without blue band, dorsal profile of head rounded.....19
18. Upper part of eye with 1 blue band, caudal fin of TP with prominent D-shaped orange band.....*S. chameleon*
 -. Upper part of eye with 2 blue bands, dorsal profile of head with prominent convexity.....*S. festivus*
19. Ventral part of body with 1~3 longitudinal lines.....20
 -. Ventral part of body without longitudinal lines.....22
20. Head with numerous irregular stripes around eye, gill cover of TP orange, lower part of eye without green area.....*S. rivulatus*
 -. Head without irregular stripes around eye, area below eye and upper lip green.....21
21. Scales of dorsal part of body with irregular bars.....*S. globiceps*
 -. Scales of dorsal part of body without irregular bars.....*S. quoyi*
22. Lateral part of body of IP with 4 or 5 dark oblique bands; head and anterior upper body forming dark triangular area on TP.....23
 -. Lateral part of body of IP without dark bar; head and body not forming dark area on TP.....24
23. Caudal fin emarginate*S. oviceps*
 -. Caudal fin rounded or truncate.....*S. dimidiatus*
24. Dental plate green.....25
 -. Dental plate not green.....26
25. Upper gill cover with 1 green strip.....*S. niger*
 -. Upper gill cover without green strip.....30
26. Body scales of TP with blue margin.....27
 -. Body scales of TP without blue margin.....28
27. Body color of IP reddish brown, midlateral body with longitudinal dark area; head of TP without blue bar around eye.....*S. forsteni*
 -. Body color of IP yellow with 5 blue bands; head of TP with blue bars around eye.....*S. ghobban*
28. Apex margin of head rounded; gill cover of TP with prominent yellow area *S. spinus*
 -. Apex margin of head bluntly triangular.....29
29. Body color of IP red; caudal fin emarginate.....*S. atropectoralis*
 -. Body color of IP reddish brown, lateral part of body with several longitudinal stripes, caudal peduncle yellowish brown; body color of TP greenish brown, anterior upper with irregular bars, lower 1/2 of head green with numerous irregular bars, caudal peduncle green.....*S. frenatus*
30. Area of lower head and gill covered with prominent green, body depth less than 2.5 in SL, and caudal fin truncated without slender prolongation.....*S. prasiognathos*
 -. Only anterior head green, body depth more than 2.5 in SL, and caudal fin emarginate with slender prolongation.....*Scarus* sp.

Family Scaridae
Subfamily Sparisomatinae
Genus *Calotomus* Gilbert, 1890
***Calotomus carolinus* (Valenciennes, 1840)**
 (Figs. 1, 2)

Callyodon carolinus Valenciennes, in Cuvier and Valenciennes 1840: 291.

Leptoscarus vaigiensis Fowler and Bean 1928: 3803-3881.

Calotomus carolinus: Bruce and Randall 1985: 8; Choat and Randall 1986: 193; Shao and Chen 1989: 20; Shen et al. 1993: 478; Bellwood 1994: 64.

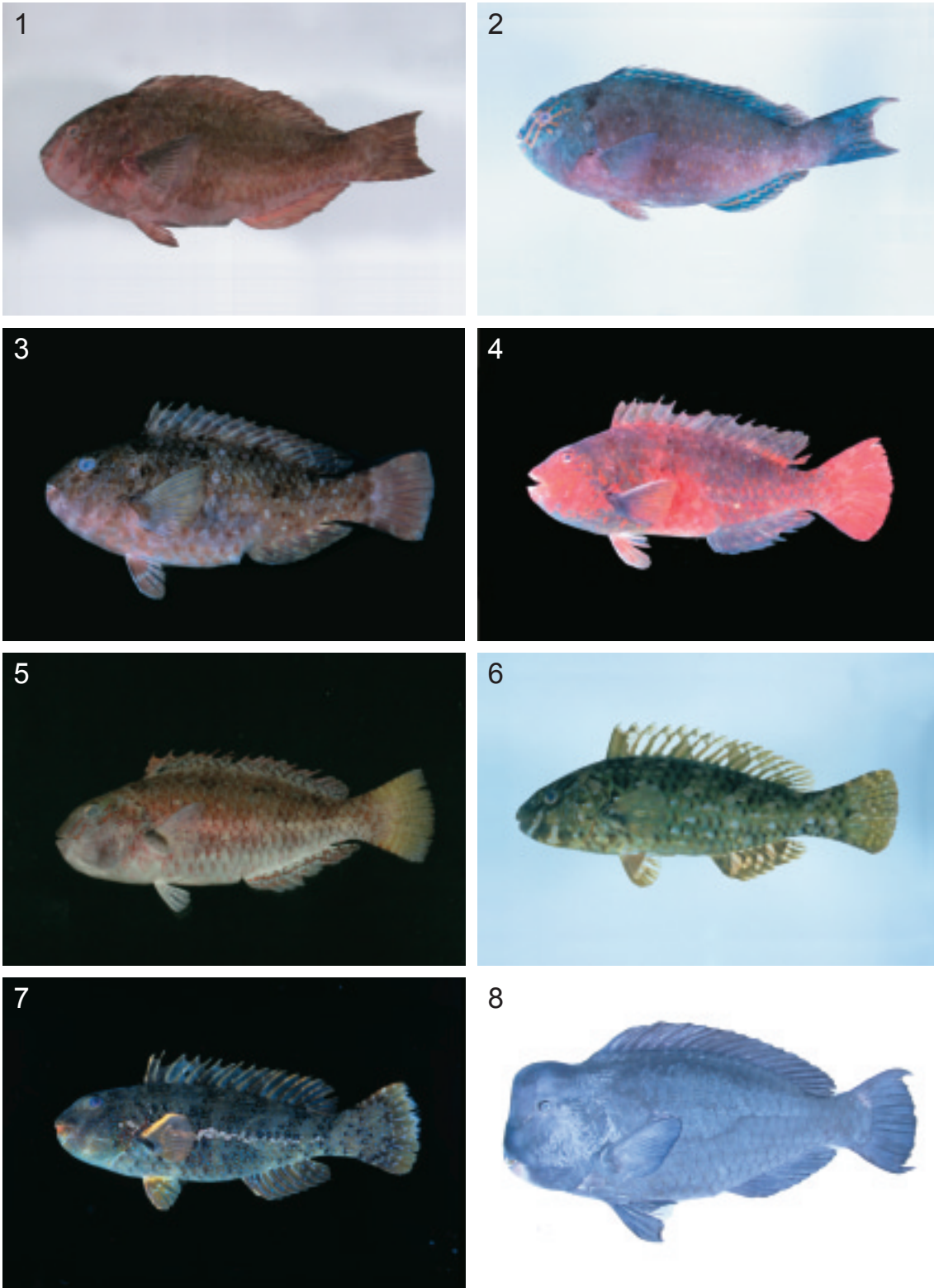


Fig. 1. *Calotomus carolinus*, ASIZP 060979, IP, 207 mm SL.
 Fig. 3. *Calotomus japonicus*, ASIZP 061908, IP, 214 mm SL.
 Fig. 5. *Calotomus spinidens*, ASIZP 061578, TP, 140 mm SL.
 Fig. 7. *Leptoscarus vaigiensis*, ASIZP 061910, TP, 281 mm SL.

Fig. 2. *Calotomus carolinus*, ASIZP 060981, TP, 248 mm SL.
 Fig. 4. *Calotomus japonicus*, ASIZP 061917, TP, 354 mm SL.
 Fig. 6. *Leptoscarus vaigiensis*, ASIZP 060719, IP, 166 mm SL.
 Fig. 8. *Bolbometopon muricatum*, ASIZP 063367, TP, 710 mm SL.

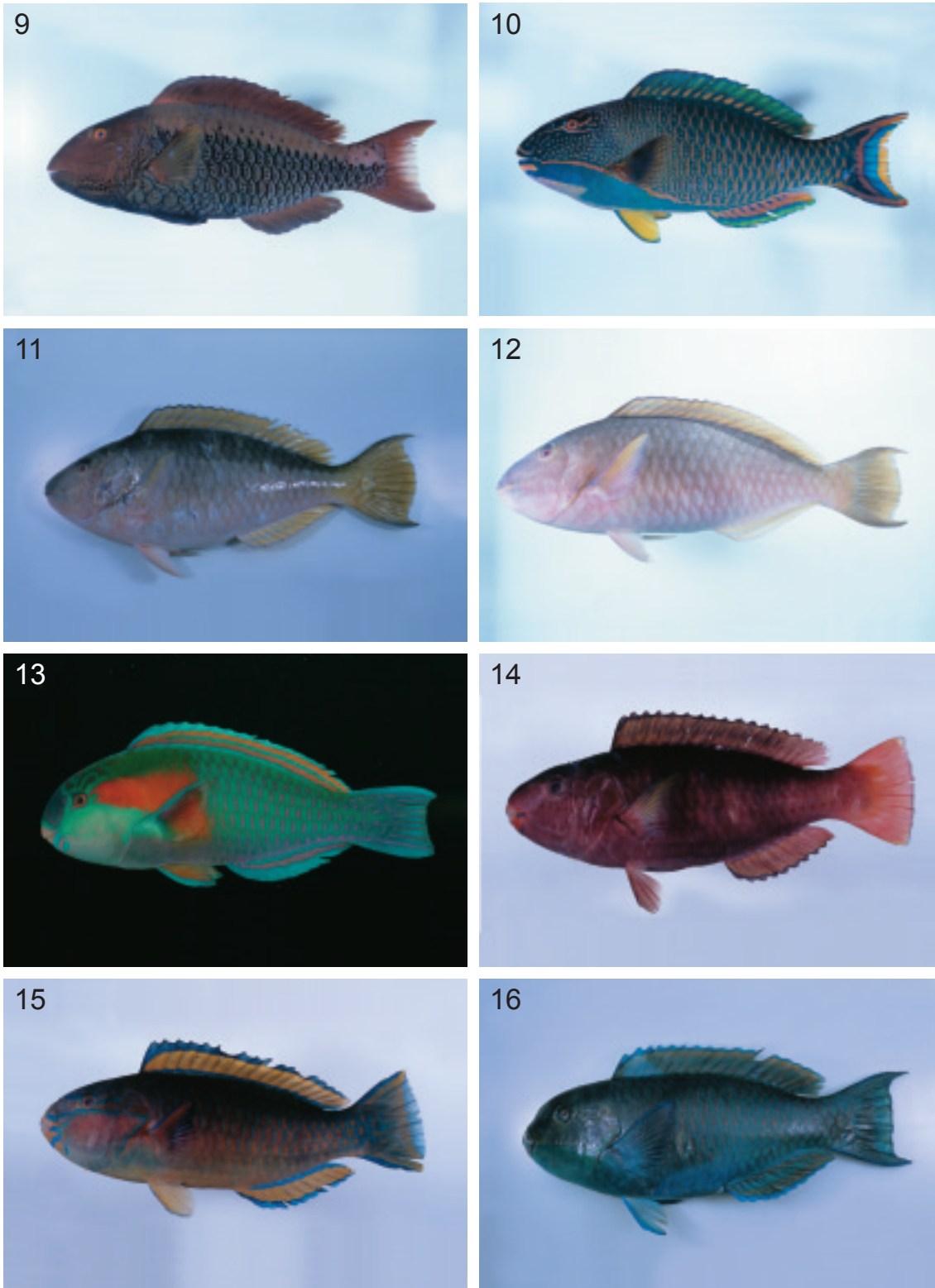


Fig. 9. *Cetoscarus bicolor*, ASIZP 060817, IP, 345 mm SL.

Fig. 11. *Hipposcarus longiceps*, ASIZP 060799, IP, 305 mm SL.

Fig. 13. *Chlorurus bowersi*, ASIZP 061579, TP, 202 mm SL.

Fig. 15. *Chlorurus japonensis*, ASIZP 060814, TP, 222 mm SL.

Fig. 10. *Cetoscarus bicolor*, ASIZP 060818, TP, 379 mm SL.

Fig. 12. *Hipposcarus longiceps*, ASIZP 060982, TP, 370 mm SL.

Fig. 14. *Chlorurus japonensis*, ASIZP 060811, IP, 187 mm SL.

Fig. 16. *Chlorurus microrhinos*, ASIZP 060797, TP, 315 mm SL.

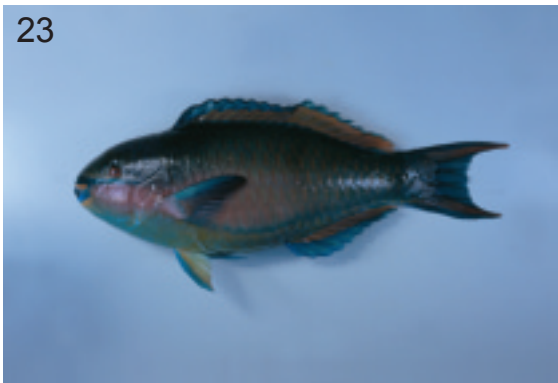
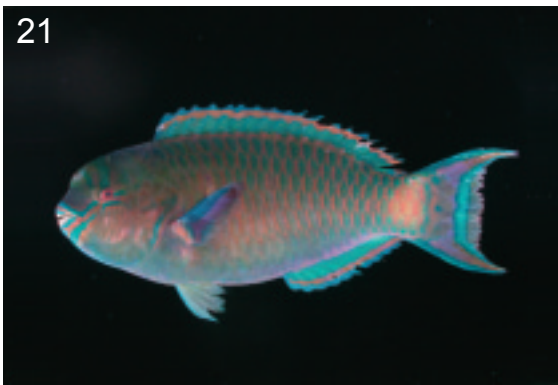
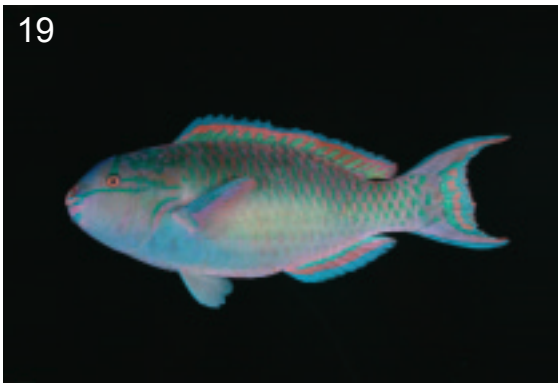


Fig. 17. *Chlorurus oedema*, ASIZP 060722, adult, 410 mm SL.

Fig. 19. *Scarus chameleom*, ASIZP 061909, TP, 248 mm SL.

Fig. 21. *Scarus festivus*, ASIZP 061913, TP, 286 mm SL.

Fig. 23. *Scarus forsteni*, ASIZP 060728, TP, 303 mm SL.

Fig. 18. *Chlorurus sordidus*, ASIZP 060720, TP, 215 mm SL.

Fig. 20. *Scarus festivus*, ASIZP 061907, IP, 195 mm SL.

Fig. 22. *Scarus forsteni*, ASIZP 060794, IP, 335 mm SL.

Fig. 24. *Scarus frenatus*, ASIZP 060978, IP, 161 mm SL.

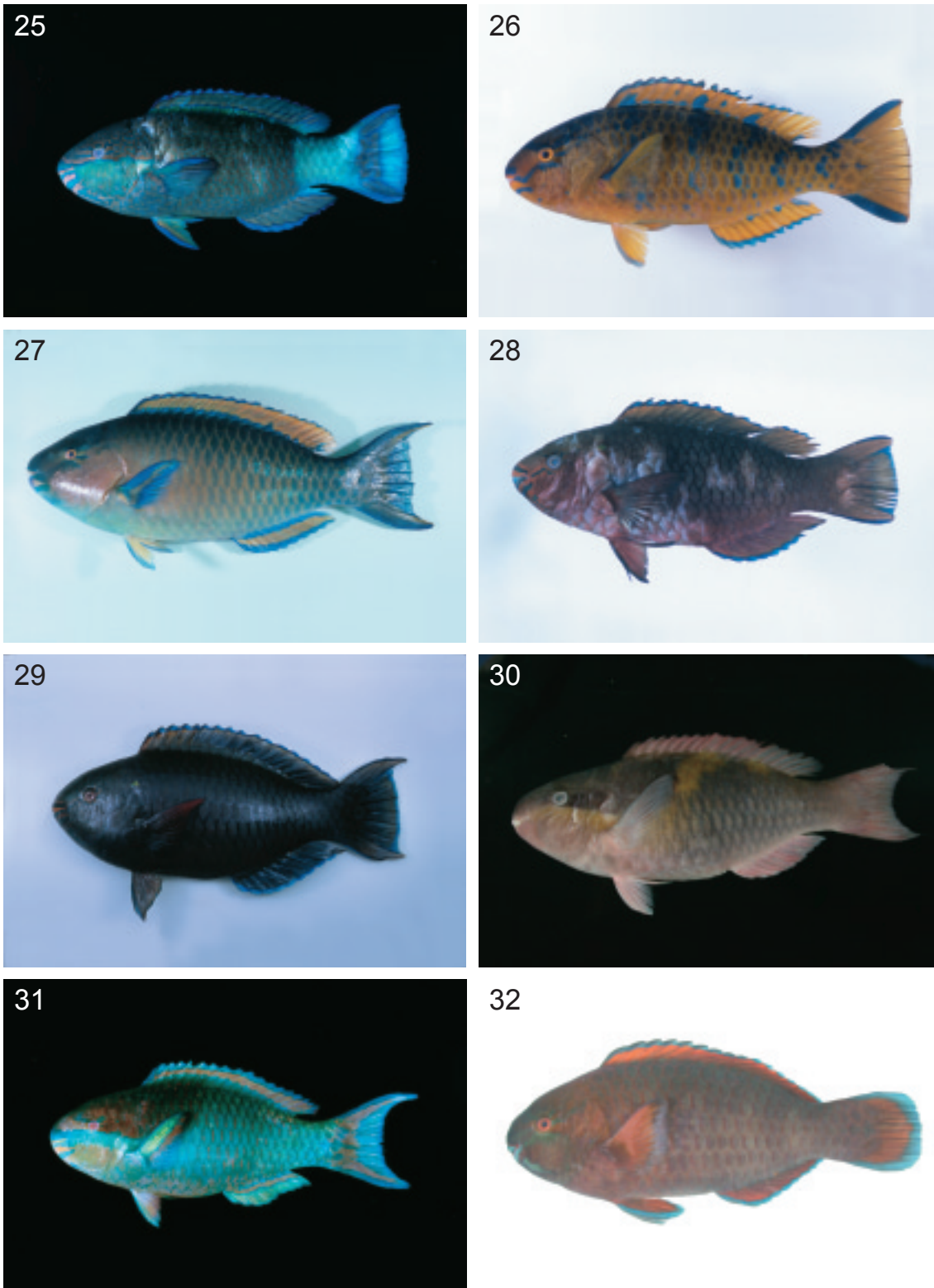


Fig. 25. *Scarus frenatus*, ASIZP 061916, TP, 226 mm SL.
Fig. 27. *Scarus niger*, ASIZP 060793, TP, 260 mm SL.
Fig. 31. *Scarus oviceps*, ASIZP 061915, TP, 254 mm SL.

Fig. 26. *Scarus ghobban*, ASIZP 060809, IP, 259 mm SL.
Fig. 28. *Scarus niger*, ASIZP 060983, IP, 193 mm SL.
Fig. 30. *Scarus oviceps*, ASIZP 060999, IP, 215 mm SL.
Fig. 32. *Scarus ovifrons*, ASIZP 060977, IP, 226 mm SL.



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Fig. 33. *Scarus prasiognathos*, ASIZP 060729, IP, 339 mm SL.

Fig. 35. *Scarus psittacus*, ASIZP 061582, IP, 146 mm SL.

Fig. 37. *Scarus quoyi*, ASIZP 061912, TP, 182 mm SL.

Fig. 39. *Scarus rivulatus*, ASIZP 061580, IP-TP interphase, 234 mm SL.

Fig. 34. *Scarus prasiognathos*, ASIZP 060725, TP, 335 mm SL.

Fig. 36. *Scarus psittacus*, ASIZP 060803, TP, 218 mm SL.

Fig. 38. *Scarus rivulatus*, ASIZP 060800, IP, 280 mm SL.

Fig. 40. *Scarus rubroviolaceus*, ASIZP 060807, IP-TP interphase, 249 mm SL.

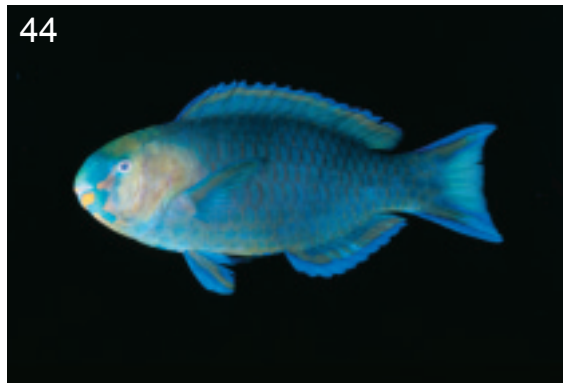


Fig. 41. *Scarus rubroviolaceus*, ASIZP 060806, TP, 343 mm SL.

Fig. 42. *Scarus schlegeli*, ASIZP 061581, IP, 169 mm SL.

Fig. 43. *Scarus schlegeli*, ASIZP 060815, TP, 353 mm SL.

Fig. 44. *Scarus spinus*, ASIZP 061911, TP, 174 mm SL.

Fig. 45. *Scarus* sp., LFNMMST-S-78, TP, 318 mm SL.

Specimens examined: ASIZP 058291, IP, 85 mm SL, Oct. 1975, Maopitou; ASIZP 060727, TP, 315 mm SL, 21 Sept. 2000, Hengchun; ASIZP 060979, IP, 207 mm SL, 14 Oct. 2001, Hengchun; ASIZP 060981, TP, 248 mm SL, 28 Nov. 2001, Hengchun; NMSMP 561, IP, 158 mm SL; IP, 178 mm SL, 18 Sept. 1990, Hsiaoliuchiu.

Distribution: Widely distributed in the Indo-Pacific region; it was found in sea-grass, coral reefs, and rocky shores around Taiwan and adjacent islands including Pengjiayu in the north, and Hsiaoliuchiu, Green I., and Orchid I. in the south. It has not been recorded from the northeast coast or Penghu. It was not found in areas with sandy

substratum along western Taiwan.

***Calotomus japonicus* (Valenciennes, 1840)**
(Figs. 3, 4)

Callyodon japonicus Valenciennes, in Cuvier and Valenciennes 1840: 294-295.

Calotomus japonicus: Masuda et al. 1984: 218; Bruce and Randall 1985: 13-15; Bellwood 1994: 64.

Specimens examined: ASIZP 061908, IP, 214 mm SL, 1 May 2002, Hengchun; ASIZP 061917, TP, 354 mm SL, 13 Nov. 2002, Hopingdao.

Diagnosis: P. 13; Pred. S. 4; 1 cheek scale row with 5 scales; head 3.0 in SL, width of body

2.4 in SL; snout 2.7 in head length, eye 5.3 in head length. Caudal fin rounded in all sizes. Body color reddish brown; all fins similar to body, membrane with dark reddish-brown pigment; pectoral fin light yellow.

Distribution: Distributed in the Indo-West Pacific region. The biogeographical distribution of *Calotomus japonicus* is extended southward from Tokyo to the Ryukyu Is. and down to southern Taiwan. It was found in both Keelung and Hengchun.

Remarks: This is a new record species for Taiwan.

***Calotomus spinidens* (Quoy and Gaimard, 1824)**
(Fig. 5)

Scarus spinidens Quoy and Gaimard 1824: 289.

Calotomus spinidens: Bruce and Randall 1985: 15; Choat and Randall 1986: 194; Shao and Chen 1989: 21; Shen et al. 1993: 478; Bellwood 1994: 64.

Specimens examined: ASIZP 061000, TP, 154 mm SL, 28 Nov. 2001, Penghu; ASIZP 061578, TP, 140 mm SL, 28 Nov. 2001, Penghu.

Distribution: Distributed in the Indo-Pacific region; it was found in seaweed or sea-grass beds around Taiwan and adjacent islands, including Hengchun, Hsiaoliuchiu, Green I., and Penghu.

Remarks: A picture drawn in Shen et al. (1993) of *C. spinidens* shows a head with radiating markings around the eye and a caudal fin truncate with elongate tips; thus, it is a misidentification of *C. carolinus*. No specimens of *C. spinidens* had been deposited in Taiwan before this paper.

Genus *Leptoscarus* Swainson, 1839

Leptoscarus vaigiensis
(Quoy and Gaimard, 1824)
(Figs. 6, 7)

Scarus vaigiensis Quoy and Gaimard 1824: 288; Valenciennes, in Cuvier and Valenciennes 1840: 214.

Scarichthys caeruleopunctatus Fowler and Bean 1928: 375-376.

Leptoscarus vaigiensis: Schultz 1958: 126-127; 1969: 39-40; Bruce and Randall 1985: 24; Choat and Randall 1986: 194; Shao and Chen 1989: 21; Shen et al. 1993: 478; Bellwood 1994: 64.

Specimens examined: ASIZP 057703, 4 specimens, IP, 54~120 mm SL, 1 June 1969, Maopitou; ASIZP 060719, IP, 165.9 mm SL, 13 Sept. 2000, Wanli; ASIZP 061910, TP, 281 mm SL, 10 Oct. 2002, Hoppingdao.

Distribution: Distributed in the Indo-Pacific

region and found in sea-grass. It was recorded in northern Taiwan, and Hengchun, Hsiaoliuchiu, Orchid I., and Green I. in the south. No specimens have been recorded from Penghu. Further sampling effort in that region is needed.

Remarks: This is the only gonochoristic parrotfish species, it does not exhibit sexual change (Roberson et al. 1982). Specimen ASIZP 061910 has an inflated 1st ray of the pectoral fin, which may be a secondary sexual character.

Subfamily Scarinae

Genus *Bolbometopon* Smith, 1956

***Bolbometopon muricatum* (Valenciennes, 1840)**
(Fig. 8)

Scarus muricatum Valenciennes, in Cuvier and Valenciennes 1840: 208.

Bolbometopon muricatum: Masuda et al. 1984: 218; Randall and Bruce 1983: 6; Randall and Choat 1986: 197; Shao and Chen 1989: 21-22; Shen et al. 1993: 471; Bellwood 1994: 65.

Specimens examined: ASIZP 063367, 710 mm SL, 11 Mar. 2004, Oluanpi.

Distribution: Distributed in the Indo-Pacific region; inhabits coral reefs; and scrapes living coral and algae to procure its diet (Choat and Randall 1986). They are difficult to approach.

Remarks: We collected only one specimen during this study. This species was occasionally seen swimming in small schools in Nanwan, southern Taiwan, and has recently been observed by scuba divers at Green I. and Orchid I.

Genus *Cetoscarus* Smith, 1956

***Cetoscarus bicolor* (Rüppell, 1829)**
(Figs. 9, 10)

Scarus bicolor Rüppell 1829: 82.

Cetoscarus pulchellus Smith 1956: 17.

Chlorurus pulchellus: Schultz 1958: 28.

Cetoscarus bicolor: Schultz 1958: 27; Randall and Bruce 1983: 6; Choat and Randall 1986: 195; Shao and Chen 1989: 22; Shen et al. 1993: 471; Bellwood 1994: 65.

Bolbometopon bicolor: Shen 1984b: 111.

Specimens examined: ASIZP 058286, 2 juveniles, 44 mm SL, 69 mm SL, 22 Nov. 1978, Oluanpi; ASIZP 060723, IP, 422 mm SL, Aug. 2000, Hoppingdao; ASIZP 060817, IP, 345 mm SL, 19 May 2001, Pengjiayu; ASIZP 060818, TP, 379 mm SL, 19 May 2001, Pengjiayu.

Distribution: Widely distributed in the Indo-Pacific region; it was found along rocky shores around Taiwan and adjacent islands.

Genus *Hipposcarus* Smith, 1956
***Hipposcarus longiceps* (Valenciennes, 1840)**
 (Figs. 11, 12)

Scarus longiceps Valenciennes, in Cuvier and Valenciennes 1840: 241.

Hipposcarus longiceps: Choat and Randall 1986: 196; Shao and Chen 1989: 22; Shen et al. 1993: 472; Bellwood 1994: 67.

Specimens examined: ASIZP 060799, IP, 305 mm SL, 6 Oct. 2000, Hengchun; ASIZP 060792, IP, 340 mm SL, 7 Oct. 2000, Penghu; ASIZP 060982, TP, 370 mm SL, 28 Nov. 2001, Hengchun.

Distribution: Distributed in the West-Central Pacific region; juveniles inhabit marginal regions of coral reefs while adults inhabit sandy bottoms nearby. It is distributed in Hengchun and Hsiaoliuchiu in southern and eastern coast of Taiwan. We found no specimens from Penghu, Green I., or Orchid I.

Genus *Chlorurus* Swainson, 1839
***Chlorurus bowersi* (Snyder, 1909)**
 (Fig. 13)

Callyodon bowersi Snyder 1909: 602.

Callyodon sordidus Fowler and Bean 1928: 398.

Scarus bowersi: Schults 1958: 72; Shao and Chen 1989: 23; Shen et al. 1993: 473.

Chlorurus bowersi: Bellwood 1994: 66.

Specimens examined: ASIZP 060813, 205 mm SL, 24 Apr. 2001, Penghu; ASIZP 061579, TP, 202 mm SL, 5 Mar. 2002, Keelung.

Distribution: Distributed in the West-Pacific region; it was found around Taiwan and adjacent islands, including Hengchun, Green I., Orchid I., and Hsiaoliuchiu in southern Taiwan, as well as Penghu.

***Chlorurus japonensis* (Bloch, 1789)**
 (Figs. 14, 15)

Callyodon pyrrhurus Jordan and Seale 1906: 314.

Scarus pyrrhurus: Choat and Randall 1986: 216; Shao and Chen 1989: 29; Shen et al. 1993: 476.

Chlorurus japonensis: Bellwood 1994: 66; Randall et al. 1996: 353.

Specimens examined: ASIZP 060811, IP, 187 mm SL, 24 Apr. 2001, Hengchun; ASIZP 060814, TP, 222 mm SL, 24 Apr. 2001, Hengchun.

Distribution: Distributed in the West-Pacific region; it was found in southern Taiwan at Hengchun and Orchid I., in eastern Taiwan, and

around Penghu. We found no specimens along the western or northern coasts of Taiwan.

***Chlorurus microrhinos* (Bleeker, 1854)**
 (Fig. 16)

Scarus gibbus Rüppell 1829: 81; Choat and Randall 1986: 209; Shao and Chen 1989: 26; Shen et al. 1993: 474-475.

Chlorurus microrhinos: Bellwood 1994: 26.

Specimens examined: ASIZP 060797, TP, 315 mm SL, 6 Oct. 2000, Hengchun; ASIZP 060805, TP, 312 mm SL, 19 Jan. 2001, Pengjiayu.

Distribution: Distributed in the Indo-Pacific region; it was found along rocky shores around Taiwan and adjacent islands, including Hengchun Green I., Orchid I., and Hsiaoliuchiu in southern Taiwan, in eastern Taiwan, and around Penghu. We found no specimens from western or northern Taiwan.

***Chlorurus oedema* (Snyder, 1909)**
 (Fig. 17)

Callyodon oedema Snyder 1909: 603; Fowler and Bean 1928: 385.

Scarus oedema: Masuda et al. 1984: 220; Shao and Chen 1989: 27; Shen et al. 1993: 475.

Chlorurus oedema: Bellwood 1994: 66.

Specimens examined: ASIZP 060722, adult, 410 mm SL, 21 Sept. 2000, Hengchun; ASIZP 060798, adult, 371 mm SL, 6 Oct. 2000, Hengchun.

Distribution: Distributed in the West-Central Pacific region. It was found in coral reefs around Taiwan and adjacent islands, including Hengchun and Green I. in southern Taiwan, in eastern and northeastern Taiwan, and around Penghu.

***Chlorurus sordidus* (Forsskål, 1775)**
 (Fig. 18)

Scarus sordidus Forsskål 1775: 30; Choat and Randall 1986: 221; Shao and Chen 1989: 31; Shen et al. 1993: 477.

Scarus purpureus Valenciennes, in Cuvier and Valenciennes 1840: 277.

Chlorurus sordidus: Bellwood 1994: 66.

Specimens examined: ASIZP 060720, TP, 215 mm SL, 21 Sept. 2000, Hengchun; ASIZP 060810, TP, 219 mm SL, 24 Apr. 2001, Hengchun.

Distribution: Distributed in the Indo-Pacific; it was found in coral reefs around Taiwan and adjacent islands, except along western sandy and northern rocky shores.

Genus *Scarus* Forsskål, 1775
***Scarus atropectoralis* Schultz, 1958**

Scarus atropectoralis Schultz 1958: 79; Masuda et al. 1984: 219; Shao and Chen 1989: 23; Shen et al. 1993: 473; Bellwood 1994: 67.

Distribution: Distributed in the Central-West Pacific region; *Scarus atropectoralis* was once found in Hengchun, southern Taiwan.

Remarks: We collected no specimens of this species during the study. There also have been no observations made by scuba divers or fishermen since 1989. *Scarus atropectoralis* may have become extirpated from Taiwanese coastal waters.

***Scarus chameleon* Choat and Randall, 1986**
 (Fig. 19)

Scarus chameleon Choat and Randall 1986: 199; Bellwood 1994: 67.

Specimen examined: ASIZP 061909, TP, 248 mm SL, 27 Aug. 2002, Penghu.

Diagnosis: P. 14; Pred. S. 4; with 2 rows of cheek scales (upper, 5; lower, 3~5 scales); head 2.8 in SL, body depth 2.5 in SL; snout 3.2 in head length, eye 7.8 in head length; with 0~2 weak canine teeth on posterior part of upper dental plate; caudal fin of adult emarginate; head slightly convex; body color of terminal phase bluish green, anterior scales of upper body with green bars, area behind pectoral fin yellowish green; green stripes distributed above and behind eye then extending to posterior part of opercle, and starting from snout to posterior and inferior part of opercle; outer margin of dorsal and anal fins blue, membrane with a middle orange and basal green band; pectoral fin with green outer margin, orange membrane; caudal fin bluish green, membrane with posterior D-shaped bluish-green and orange bands.

Distribution: Distributed in the West-Pacific region; it was found in coral reefs of Taiwan including Hengchun and Hsiaoliuchiu in southern Taiwan and around Penghu.

Remarks: *Scarus chameleon* is a newly recorded species for Taiwan. Color plate 16 in Shao and Chen (1989) was misidentified as the terminal phase of *S. forsteni*; it should have been identified as the terminal phase of *S. chameleon*, because of the characters of the slight hump of the head and the bluish-green stripe above the eye.

***Scarus dimidiatus* Bleeker, 1859**

Scarus dimidiatus Bleeker 1859: 17; Randall and Choat 1980: 397; 1986: 203; Shao and Chen 1989: 23-24; Shen et al. 1993: 473-474; Bellwood 1994: 67.

Specimens examined: ASIZP 060209, 2 specimens, TP, 158 and 159 mm SL, 8 Apr. 1999, Hengchun.

Distribution: Distributed in the West-Central Pacific region; it was found in coral reefs from Hengchun, Orchid I., and Green I. of southern Taiwan.

***Scarus festivus* Valenciennes 1840**
 (Figs. 20, 21)

Scarus festivus Valenciennes, in Cuvier and Valenciennes 1840: 282; Randall and Bruce 1983: 16; Shao and Chen 1989: 24; Shen et al. 1993: 474; Bellwood 1994: 68.

Specimens examined: ASIZP 060980, TP, 312 mm SL, 28 Nov. 2001, Hengchun; ASIZP 061907, IP, 195 mm SL, 1 May 2002, Hengchun; ASIZP 061913, TP, 286 mm SL, 17 Oct. 2002, Penghu.

Distribution: Distributed in the Indo-Pacific region; it was found in coral reefs or rocky shores around Taiwan and adjacent islands, including Hengchun, Hsiaoliuchiu, Orchid I., and Green I. of southern Taiwan, in northeastern Taiwan, and around Penghu.

***Scarus forsteni* (Bleeker, 1861)**
 (Figs. 22, 23)

Pseudoscarus forsteni Bleeker 1861: 238.

Scarus tricolor (not Bleeker 1849) Randall and Choat 1980: 396.

Scarus forsteni: Choat and Randall 1986: 204; Shao and Chen 1989: 24-25; Shen et al. 1993: 474; Bellwood 1994: 67.

Specimens examined: ASIZP 060728, TP, 303 mm SL, 21 Sept. 2000, Hengchun; ASIZP 060794, IP, 335 mm SL, 7 Oct. 2000, Penghu; ASIZP 060795, TP, 290 mm SL, 6 Oct. 2000, Hengchun; ASIZP 060804, IP, 167 mm SL, 6 Oct. 2000, Hengchun; NMSMP-746, IP, 132 mm SL, 5 May 1991, Tungkang.

Distribution: Distributed in the West-Central Pacific region; it was found in coral reefs around Taiwan and adjacent islands, including Hengchun, Hsiaoliuchiu, Orchid I., and Green I. in southern Taiwan, around Keelung I. in northern Taiwan, and Penghu.

Remarks: A species in color plate 16 in Shao and Chen (1989) was misidentified as the terminal phase of *S. forsteni*; it should have been identified as the terminal phase of *S. chameleon*. Details of the description were also those of *S. chameleon*.

***Scarus frenatus* Lacepède, 1802**
(Figs. 24, 25)

Scarus frenatus Lacepède 1802: 3, 13; Schultz 1958: 83; 1969: 27; Randall and Bruce 1983: 17; Choat and Randall 1986: 205; Shao and Chen 1989: 25; Shen et al. 1993: 474; Bellwood 1994: 68.

Specimens examined: ASIZP 060978, IP, 161 mm SL, 14 Oct. 2001, Hengchun; ASIZP 061916, TP, 226 mm SL, 19 Oct. 2002, Keelung.

Distribution: Distributed in the Indo-Pacific region; it was found in coral reefs and along rocky shores, except in the western and eastern coastal waters of Taiwan.

***Scarus ghobban* (Forsskål, 1775)**
(Figs. 26, 27)

Scarus ghobban Forsskål 1775: 28; Randall and Bruce 1983: 20; Choat and Randall 1986: 207; Shao and Chen 1989: 25; Shen et al. 1993: 474; Bellwood 1994: 68.

Specimens examined: ASIZP 060809, IP, 259 mm SL, 2 Mar. 2001, Bitoujiao; ASIZP 060816, TP, 440 mm SL, 17 May 2001, Keelung; NMSMP 257, juvenile, 55 mm SL, 10 May 1989, Nanwan.

Distribution: Widely distributed in the Indo-Pacific region; it was found in coral reefs and rocky shores around Taiwan and adjacent islands.

***Scarus globiceps* Valenciennes, 1840**

Scarus globiceps Valenciennes, in Cuvier and Valenciennes 1840: 242; Randall and Choat 1980: 391; Choat and Randall 1986: 210; Shao and Chen 1989: 26; Shen et al. 1993: 475.

Callyodon globiceps: Smith 1956: 14.

Specimens examined: ASIZP 060208, 2 specimens, TP, 173 and 173 mm SL, 8 Apr. 1999, Hengchun.

Distribution: Distributed in the Indo-Pacific region; it was found in coral reefs around Taiwan and adjacent islands, including northern Taiwan, Hsiaoliuchiu, Orchid I., and Green I. in southern Taiwan, and around Penghu.

***Scarus niger* Forsskål, 1775**
(Figs. 28, 29)

Scarus niger Forsskål 1775: 28; Schultz 1958: 93; Randall and Bruce 1983: 24; Choat and Randall 1986: 214; Shao and Chen 1989: 26-27; Shen et al. 1993: 475; Bellwood 1994: 68.

Callyodon niger: Smith 1956: 13.

Specimens examined: ASIZP 060207, TP, 193 mm SL, 8 Apr. 1999, Hengchun; ASIZP 060793, TP, 260 mm SL, 7 Oct. 2000, Penghu; ASIZP 060983, IP, 192 mm SL, 28 Nov. 2001, Hengchun.

Distribution: Distributed in the Indo-Pacific region; it was found in coral reefs around Taiwan and adjacent islands, including northern, north-eastern, and eastern Taiwan, Hsiaoliuchiu, Hengchun, Orchid I., and Green I. of southern Taiwan, and around Penghu.

***Scarus oviceps* Valenciennes, 1840**
(Figs. 30, 31)

Scarus oviceps Valenciennes, in Cuvier and Valenciennes 1840: 244; Masuda et al. 1984: 219; Choat and Randall 1986: 214; Shao and Chen 1989: 27-28; Shen et al. 1993: 475; Bellwood 1994: 68.

Specimens examined: ASIZP 060999, IP, 215 mm SL, 21 Jan. 2002, Hongtsai; ASIZP 061914, TP, 266 mm SL, 17 Oct. 2002, Keelung; ASIZP 061915, TP, 254 mm SL, 17 Oct. 2002, Keelung.

Distribution: Distributed in the West-Central Pacific region; it was found in coral reefs in northern and southern Taiwanese coastal waters.

***Scarus ovifrons* Temminck and Schlegel 1846**
(Fig. 32)

Scarus ovifrons Temminck and Schlegel 1846: 73; Masuda et al. 1984: 221; Shao and Chen 1989: 28; Shen et al. 1993: 475-476; Bellwood 1994: 68.

Specimens examined: ASIZP 060726, IP, 312 mm SL, 26 May 2000, Yehliu; ASIZP 060977, IP, 226 mm SL, 22 Oct. 2001, Keelung.

Distribution: Distributed from southern Japan to Taiwan; it was found in rocky shores around Taiwan and adjacent islands, including northern and northeastern Taiwan, Hengchun, Orchid I., and Green I. of southern Taiwan, and around Penghu.

Remarks: Shao and Chen (1989) indicated that Schultz (1969) had examined specimens of *S. ovifrons* from Taiwan, but we had no chance to reexamine any of those specimens. Shen (1984a) showed a color plate of the initial phase of *S. ovifrons*, but the specimen was not available.

Scarus ovifrons is distributed from Japan southwards to Taiwan.

***Scarus prasiognathos* Valenciennes, 1840**
(Figs. 33, 34)

Scarus prasiognathos Valenciennes, in Cuvier and Valenciennes 1840: 272; Randall and Choat 1980: 394; Masuda et al. 1984: 220; Randall and Bruce 1983: 26; Shao and Chen 1989: 28; Shen et al. 1993: 476; Bellwood 1994: 68.

Specimens examined: ASIZP 060724, TP, 360 mm SL, 21 Sept. 2000, Hengchun; ASIZP 060725, TP, 335 mm SL, Mar. 2000, Hengchun; ASIZP 060729, IP, 339 mm SL, 21 Sept. 2000, Hengchun.

Distribution: Distributed in the Indo-Pacific region; it was found in coral reefs or rocky shores around Taiwan and adjacent islands, except in western and northeastern Taiwan.

***Scarus psittacus* Forsskål, 1775**
(Figs. 35, 36)

Scarus psittacus Forsskål 1775: 29; Randall and Bruce 1983: 27; Masuda et al. 1984: 220; Choat and Randall 1986: 215; Shao and Chen 1989: 29; Shen et al. 1993: 476; Bellwood 1994: 68.

Scarus vensosus Valenciennes, in Cuvier and Valenciennes 1840: 212.

Scarus forsteri Valenciennes, in Cuvier and Valenciennes 1840: 275.

Specimens examined: ASIZP 056319, IP, 167 mm SL, 29 May 1986, Hengchun; ASIZP 060721, TP, 235 mm SL, 21 Sept. 2000, Hengchun; ASIZP 060796, TP, 232 mm SL, 6 Oct. 2000, Hengchun; ASIZP 060803, TP, 168 mm SL, 6 Oct. 2000, Hengchun; ASIZP 061582, IP, 146 mm SL, 21 Jan. 2002, Nanwan.

Distribution: Distributed in the Indo-Pacific region; it was found in coral reefs or rocky shores around Taiwan and adjacent islands, including Hengchun, Orchid I., and Green I. in southern Taiwan, and around Penghu.

***Scarus quoyi* Valenciennes, 1840**
(Fig. 37)

Scarus quoyi Valenciennes, in Cuvier and Valenciennes 1840: 223; Randall and Nelson 1979: 210-211; Masuda et al. 1984: 220, Bellwood 1994: 68.

Specimen examined: ASIZP 061912, TP, 182 mm SL, 17 Oct. 2002, Keelung.

Diagnosis: P. 13; Pred. S. 4; with 3 rows of cheek scales (upper, 6; middle, 6; lower, 3 scales); head 2.98 in SL, body depth 2.28 in SL; snout 2.35 in head length, eye 7.01 in head length; with 1 or 2 canine teeth on dental plate; caudal fin in adult slightly rounded; body color of terminal phase reddish brown, anterior area of dorsal body green extending to about 2nd ray, anterior margin of scales green; with 1 green stripe crossing through eye and 1 short green bar behind; lips green; head with green area starting from snout and extending to posterior part of preopercle; with reticular strips on chin, posterior subopercle with green margin; dorsal fin with marginal blue band extending forward to eye, membrane with orange longitudinal band and green base; pectoral fin blue with orange middle band; ventral fin orange with blue outer margin; anal fin with blue marginal band extending forward continuous with isthmus; caudal fin bluish green, 1/2 of upper peduncle green, membrane bluish green and posterior greenish.

Distribution: Distributed in the West-Central Pacific to Central Indian Ocean regions; it was found in coral reefs in northern Taiwan.

Remarks: This is a new record for Taiwan.

***Scarus rivulatus* Valenciennes, 1840**
(Figs. 38, 39)

Scarus rivulatus Valenciennes, in Cuvier and Valenciennes 1840: 223; Randall and Choat 1980: 390; Masuda et al. 1984: 220; Choat and Randall 1986: 217; Shao and Chen 1989: 30; Shen et al. 1993: 476-477; Bellwood 1994: 68.

Scarus fasciatus Valenciennes, in Cuvier and Valenciennes 1840: 222.

Specimens examined: ASIZP 060800, IP, 280 mm SL, 6 Oct. 2000, Hengchun; ASIZP 060801, IP, 255 mm SL, 6 Oct. 2000, Hengchun; ASIZP 060808, IP, 323 mm SL, 17 Mar. 2001, Hengchun; ASIZP 061580, IP-TP interphase, 234 mm SL, 30 Jan. 2002, Keelung.

Distribution: Distributed in the West Pacific region; it was found in rocky shores around Taiwan and adjacent islands, except Orchid I.

***Scarus rubroviolaceus* Bleeker, 1847**
(Figs. 40, 41)

Scarus rubroviolaceus Bleeker 1847: 162; Masuda et al. 1975: 307; 1984: 221; Randall and Bruce 1983: 28; Choat and Randall 1986: 219; Shao and Chen 1989: 30; Shen et al. 1993: 477; Bellwood 1994: 68.

Callyodon rubroviolaceus: Smith 1956: 11.

Scarops rubroviolaceus: Schultz 1958: 21; 1969: 2.

Specimens examined: ASIZP 060802, TP, 385 mm SL, 6 Oct. 2000, Hengchun; ASIZP 060806, TP, 343 mm SL, 19 Jan. 2001, Pengjiayu; ASIZP 060807, IP-TP interphase, 249 mm SL, 28 Feb. 2001, Pengjiayu.

Distribution: Widely distributed in the Indo-Pacific region; it was found in coral reefs or rocky shores around Taiwan and adjacent islands.

***Scarus schlegeli* (Bleeker, 1861)**

(Figs. 42, 43)

Pseudoscarus schlegeli Bleeker 1861: 242.

Scarus schlegeli: Randall and Choat 1980: 401; Masuda et al. 1984: 222; Choat and Randall 1986: 220; Shao and Chen 1989: 31; Shen et al. 1993: 477; Bellwood 1994: 68.

Specimens examined: ASIZP 060812, TP, 182 mm SL, 24 Apr. 2001, Hengchun; ASIZP 060815, TP, 353 mm SL, 8 May 2001, Penghu; ASIZP 061581, IP, 169 mm SL, 21 Jan. 2002, Nanwan.

Distribution: Distributed in the West-Central Pacific region; it was found in coral reefs around Taiwan and adjacent islands, including Hengchun, Hsiaoliuchiu, Orchid I., and Green I. of southern Taiwan, and in eastern Taiwan.

***Scarus spinus* (Kner, 1868)**

(Fig. 44)

Pseudoscarus spinus Kner 1868: 345.

Scarus spinus: Masuda et al. 1984: 212; Choat and Randall 1986: 222-223; Bellwood 1994: 68.

Specimen examined: ASIZP 061911, TP, 174 mm SL, 17 Oct. 2002, Keelung.

Diagnosis: P. 14; Pred. S. 4; with 3 rows of cheek scales (upper, 6; middle, 5; lower, 3 scales); head 2.68 in SL, body depth 2.35 in SL; snout 2.32 in head length, eye 7.56 in head length; with 1 or 2 canine teeth on dental plate; caudal fin slightly emarginate; body color of terminal phase bluish green, posterior parts of scales reddish brown; head yellowish green, gill cover yellow, snout bluish green extending to eye then joining with bluish-green bands on orange chin; upper lip orange, lower lip bluish green; outer margin of dorsal and anal fin blue then extending forward as blue band, membrane with orange middle band and green basal band; pectoral and ventral fins bluish green with orange band; caudal fin bluish green with orange bands.

Distribution: Distributed in the West-Central Pacific region; it was found only in coral reefs of

northern Taiwan and Penghu.

Remarks: *Scarus spinus* is recorded for the 1st time from Taiwan.

***Scarus* sp.**

(Fig. 45)

Specimen examined: LFNMMST-S-78, TP, 318 mm SL, 5 Oct. 2002, Tungkang.

Diagnosis: D. IX, 9 (among them, 1 ray was damaged); P₁. 14; P₂. I, 5; A. II 9; Pred. S. 6; cheek scales in 3 rows (upper, 6; medial, 6; lower, 2 scales); gill rakers 66; almost 3/5 of lip covered by upper dental plates; dental plates green, canine absent; nostrils small; lateral line scales 19+7; head 2.81 in SL, body depth 2.63 in SL; snout 2.15 in head length, eye 8.24 in head length; without canine teeth on upper dental plate; caudal fin of TP emarginate with apical prolongation; body color of terminal phase yellowish green; head bluish green with several irregular yellow bars around eye, lower edge of upper lip yellow; dorsal fin yellowish green, membrane orange with bluish-green longitudinal bands and outer margin bluish green; pectoral fin with bluish-green outer margin, membrane with orange middle band; pelvic fin with bluish-green outer margin and orange membrane; anal fin orange with bluish-green outer and basal membrane; caudal fin with bluish-green outer margin, membrane with irregular orange bands.

Specimen measurements: LFNMMST-S-78, 318 mm SL; head length 113 mm; eye length 13.6 mm; greatest body depth 121.1 mm; body depth 118 mm; body width 58.3 mm; lip length 52 mm.

Distribution: We have only 1 specimen collected from southern Taiwan.

Remarks: Distinguishing this doubtful species of *Scarus* from other Scarids is difficult, because its many characters overlap with those of other species. The specimen of *Scarus* sp. is similar to *S. frenatus* and *S. prasiognathos* in body color and by the area around the lower part of head being bluish green in the terminal phase. *Scarus frenatus* differs from *Scarus* sp. in having body scales with numerous irregular reddish-brown stripes, a green basal membrane of the dorsal fin and caudal peduncle, a caudal fin being green with a brown, basal, lunate band, and a rounded rather than emarginate outer margin of the caudal fin. *Scarus prasiognathos* differs from *Scarus* sp. in having a prominent green area around the lower head and gill cover, a higher body depth, and a caudal fin being acute rather than emarginate with a slender prolongation as in *Scarus* sp.

Other characters compared among these 3 species are listed in table 2. Because we collected only 1 specimen during the study, Dr. J.E. Randall (pers. commun.) first considered this specimen to be a hybrid of *S. frenatus* and *S. prasiognathos*. But there are differences in the skeleton of the caudal fin and in the molecular sequence data. The 1st dorsal fin has 11 spines and 9 soft rays, but other species have 11 spines and 10 soft rays. Also, the anterior projection of the 1st hypural is sharp and slender in *Scarus* sp. rather than triangular as in *S. frenatus* and *S. prasiognathos*. The Neighbor-joining tree of mitochondrial D-loop sequence shows that the phylogenetic relationship of *Scarus* sp. totally differs from those of other congeneric species. The average values and standard deviation of genetic distances between *Scarus* sp. and other species are much higher than average values among all the other *Scarus* species (0.276 ± 0.016 vs. 0.180 ± 0.045). Because mt-DNA is maternally inherited, the hybrid's sequence should be the same as or very close to that of its mother. But the molecular data show that *Scarus* sp. is not in a sister group of either *S. frenatus* or *S. prasiognathos*, the 2 possible parent species. This fact leads us to believe that *Scarus* sp. should be a new species. However, it is inconceivable that just 1 terminal male of this scarid exists in Taiwan. Therefore, it is necessary to publish the photo of *Scarus* sp. so that the public, divers, and researchers can be aware of its existence so we can receive more specimens in the future. For the time being, we have decided not to describe it as a new species, but only as a doubtful species in this paper.

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Table 2. Characters compared among *Scarus frenatus*, *S. prasiognathos*, and *Scarus* sp.

Character	<i>S. frenatus</i>	<i>S. prasiognathos</i>	<i>Scarus</i> sp.
Predorsal scales	6 or 7	6	6
Pectoral fin	14 or 15	15	14
Dorsal fin	11, 10	11, 10	11, 9
Cheek rows	(6 or 7, 6~8, 2~4)	(5, 6 or 7, 1 or 2)	(6, 6, 2)
Gill rakers	44 or 45	56~67	66
Canines	0 or 1	1 or 2	absent
Caudal fin	truncate or rounded	truncate	emarginate
First hypural	triangular	triangular	sharp and slender

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