

LEONARD P. SCHULTZ

*The Taxonomic Status
of the Controversial
Genera and Species
of Parrotfishes
with a Descriptive List
(Family Scaridae)*

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Leonard P. Schultz

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ABSTRACT

Schultz, Leonard P. The Taxonomic Status of the Controversial Genera and Species of Parrotfishes with a Descriptive List (Family Scaridae). *Smithsonian Contributions to Zoology*, 17:1-49, 2 figures, 8 color plates. 1969.—This, the second major paper on scarid fishes by the author, discusses several difficult-to-identify species and brings together under one taxon certain males and females, previously thought to represent two or more species. Taxonomically controversial genera and species in the late Dr. J. L. B. Smith's two major papers (1956, 1958) on parrotfishes are correlated with conclusions reached in this report.

Included is a current descriptive list (with 38 color illustrations) of 11 genera, 5 subgenera, 68 species, and 5 subspecies. Important taxonomic changes: *Scarus fehlmanni*, new species from the Red Sea, is placed in the subgenus *Xenoscarops* Schultz along with *Scarus perrico* (Jordan and Gilbert). The genus *Scarus* Forskål is divided into three subgenera: *Scarus* Forskål, *Xenoscarops* Schultz, and *Callyodon* Scopoli. *Sparisoma* Swainson is divided into two subgenera: *Callyodontichthys* Bleeker and *Sparisoma* Swainson. *Scarops* Schultz is monotypic. *Pseudoscarus jordani* Jenkins, *Callyodon africanus* Smith, and *Scarus paluca* Gosline and Brock are synonyms of *Scarops rubroviolaceus* (Bleeker). *Bolbometopon* Smith, with *Cetoscarus* Smith as a synonym, has two species: *B. muricatus* Cuvier and Valenciennes and *B. bicolor* (Rüppell). *Scarus pulchellus* Rüppell is the adult female of *B. bicolor*. *Ypsiscarus* Schultz has two species, *Y. ovifrons* (Temminck and Schlegel) and *Y. oedema* Snyder. *Scarus harid* Forskål has three subspecies: *harid* Forskål, *longiceps* Cuvier and Valenciennes, and *vexillus* (Smith). *Hipposcarus schultzi* Smith is a synonym of *S. h. longiceps*. *Scarus microrhinos* Bleeker and *S. strongylocephalus* Bleeker are synonyms of *S. gibbus* Rüppell.

Neotypes were established for *Scarus psittacus* Forskål, *Scarus forsteri* Cuvier and Valenciennes, and *S. sordidus* Forskål. A lectotype was selected for *Scarus quoyi* Cuvier and Valenciennes. Also lectotypes were selected for *Scarus baliensis* Bleeker, *S. batakensis* Bleeker, *S. quoyi* Cuvier and Valenciennes.

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Leonard P. Schultz

The Taxonomic Status of the Controversial Genera and Species of Parrotfishes with a Descriptive List (Family Scaridae)

Introduction

One of the most perplexing problems in parrotfish taxonomy is the identification of species described by early authors; for example, Forskål (1775), Bloch (1786–1791), Rüppell (1828, 1835), and Cuvier and Valenciennes (1839). Most of the earlier descriptions lack details of color pattern and diagnostic anatomical features at the generic and specific levels. In addition, some types still in museums have lost most of their essential characteristics of color pattern or are otherwise so poorly preserved that verification of their identity is rendered doubtful. Certain species illustrated by published color plates are inaccurate and do not show the important details of the species they were intended to represent; nevertheless, the identification of taxonomically important type-species and holotypes should be given careful consideration before they are rejected as unidentifiable.

The purposes of this study are: (1) to present information on certain difficult-to-identify species, (2) to correlate Dr. J. L. B. Smith's (1956, 1959) conclusions with those of Schultz (1958) concerning taxonomically controversial genera and species, and (3) to give a descriptive list of genera and species currently recognized.

Schultz (1958, pp. 11–12) listed 34 nominal species that he considered unidentifiable, among which the following have since been identified:

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Scarus enneacanthus Cuvier and Valenciennes is a valid species; *Scarus flavescens* Bloch and Schneider and *Callyodon flavescens* Cuvier and Valenciennes (erroneously listed as *Scarus flavescens*) are synonyms of *Sparisoma chrysopterygium*; *Scarus nigricans* Cuvier and Valenciennes was misspelled "nigrans"; *Scarus prasiognathos* Cuvier and Valenciennes is a synonym of *S. aeruginosus* Cuvier and Valenciennes; *Scarus quadrispinosus* Cuvier and Valenciennes is a synonym of *S. vetula*; *Scarus sexvittatus* Rüppell is a synonym of *S. frenatus*; *Scarus toshi* Whitley is a synonym of *S. harid longiceps*.

Since 1958 the following nominal species have been found that were not included in Schultz (1958) and are now considered unidentifiable:

Pseudoscarus dumerilli Castelnau, 1875 (p. 41)
P. flavipinnis De Vis, 1885 (p. 886)
P. flavolineatus Alleyne and Macleay, 1877 (p. 346)
P. fuscus De Vis, 1885 (p. 887)
P. modestus Castelnau, 1875 (p. 41)
P. nudirostris Alleyne and Macleay, 1877 (p. 346)
P. obscurus Castelnau, 1875 (p. 41)
P. richardsoni Castelnau, 1875 (p. 41)
P. strigipinnis De Vis, 1885 (p. 886)
P. viridescens Castelnau, 1875 (p. 42)

Possibly an examination of the types on which these nominal species were based might enable an identification; however, I have not had the opportunity to see them.

In this paper nominal species are placed as synonyms of valid species on the basis of (1) examination of types and other material, (2) interpretation of descriptions, and (3) study of illustrations of the species. Whenever a nominal species is not recognized, it is referred to the list of unidentifiable species. The latter

may be validated by further research when the type-specimens become available for study.

My contributions and those of Smith indicate the great need for further study of many complex and confusing problems: for example, sexual dichromatism, sex reversal, color change with age and sex, and problems of subspecies or population differences, especially for widely ranging species. Many of these problems are being worked out by investigators (e.g., Dr. John Randall, J. Howard Choat, Dr. Richard H. Rosenblatt, and Edmund S. Hobson) who are studying local living populations and freshly caught specimens before the colors have disappeared.

The synonymy given for genera and species by Schultz (1958) is not repeated in this paper unless changes, additions, or corrections have been made.

Bauchot and Guibè (1960, pp. 290-300; 1961, p. 259) published a list of types in the Paris Museum. The only types listed in this paper are those not mentioned in Schultz (1958).

My thanks are given to Dr. John Randall, Bishop Museum, Honolulu, and to Dr. Richard H. Rosenblatt, Scripps Institution of Oceanography, La Jolla, California, for their kindness in reading and commenting on the manuscript. Also, I wish to compliment Mr. Albert Ruffin, a senior editor, Smithsonian Institution Press, for his expertise in preparing my manuscript for the printer.

Finally I wish to here record a special debt of gratitude to Dr. Herbert R. Axelrod, president of T.F.H. Publications, Jersey City, N.J., who not only financed completely the expensive color plates but also printed them in his own plant at a cost of much valuable time and attention from his personnel. Such kind generosity and technical skill has resulted in color plates of a quality so exceptional as not to have been otherwise possible.

Family SCARIDAE

Subfamily SCARINAE

Genus *Scarops* Schultz

Scarops Schultz, 1958, p. 18.

I have placed the subgenus *Xenoscarops* Schultz in the genus *Scarops* on the basis of a rudimentary row of teeth (in juveniles) next to the main row on the upper pharyngeals in combination with 5 to 7 median predorsal scales and only 2 rows of scales on the cheek.

This change results from the discovery in the Red Sea of a new species with certain characteristics similar to those of *Xenoscarops perrico* of the eastern Pacific Ocean.

RANGE.—Eastern, central, and western Pacific Ocean, and Indian Ocean.

Scarops rubroviolaceus (Bleeker)

PLATE 1A, B

Scarops rubroviolaceus Bleeker, 1849, p. 52.

Callyodon rubroviolaceus.—Smith, 1956, p. 11, pl. 43j.

Scarops rubroviolaceus.—Schultz, 1958, p. 21, pls. 3d, 6a.—Munro, 1967, p. 437, fig. 830 [New Guinea].

Callyodon (Scarops) rubroviolaceus.—Smith, 1959, pp. 270, 278, pl. 43j.

Pseudoscarus jordani Jenkins, 1900, p. 63, fig. 21.

Scarops jordani.—Schultz, 1958, p. 21, fig. 2, pls. 2c, 6b.—

Hobson, 1965, p. 295.—Munro, 1967, p. 437, fig. 831 [New Guinea].

Callyodon africanus Smith, 1955, p. 19, fig. 26, pl. 3: fig. 26.

Margaritodon africanus.—Smith, 1956, p. 15, pl. 42a.

Callyodon (Margaritodon) africanus.—Smith, 1959, pp. 272, 280, pl. 42a.

Scarops africanus.—Schultz, 1958, p. 75, pls. 18e, 19e.

Scarops paluca Gosline and Brock, 1960, p. 237 [Hawaiian Islands].

See Schultz (1958, p. 21) for other synonyms.

Characterized by having 5 to 7 predorsal scales, 3 rows of scales on cheek, with 2 scales in ventral row, ii,13 pectoral rays, teeth white in young and females, blue or green in adult males; upper pharyngeal with a single enlarged row of teeth, rarely with a rudimentary row present.

Coloration of adult males: Edge of upper lip orange or red extending to below eye, then blue or green shading into brown above; edge of lower lip blue or green, thence a red or orange cross band, followed posteriorly by a blue or green cross band; lower part of head orange, usually with another blue or green blotch; edge of pelvic green; dorsal edge of pectoral green, and upper half purplish brown; distal edge of dorsal blue or green, remaining four-fifths of dorsal orange; distal half of anal blue or green, basal half orange or pink; outer edges of caudal fin green or blue; dorsal part of body orange to purplish, ventrally green or blue.

Coloration of adult females: Bright purplish red or dark brownish red, fins red, except pectoral, which is bluish with red streak dorsally, and dorsal fin is margined with dark blue distally. Nearly each scale dorso-laterally has one or more short blackish or brownish

lengthwise streaks that remain visible on scales after many years of alcoholic preservation.

Juveniles reddish brown.

Margaritodon africanus Smith, 1956 (p. 15, pl. 42A), has an almost identical color pattern with that of the following specimens: USNM 202638 and 202641 (IIOE, FT-5, 20 November 1964, Latham Island, SE of Zanzibar, 2 spec., 400–490 mm). An examination of the upper pharyngeals of one of these specimens has revealed a single enlarged row of teeth as in *Scarops*. A comparison of the color pattern of Smith's Plate 42A with the description of a mature male of *jordani* furnished by Dr. Rosenblatt in Schultz (1958, p. 22) indicates almost identical color patterns. Tentatively, in the absence of a description of the upper pharyngeals of *africanus* by Smith, I consider *africanus* as a junior synonym of *jordani*.

Briggs (1964, p. 707) reports *Scarops rubroviolaceus* from Cocos Island in the eastern Pacific, and Schultz (1958, p. 22) recorded *S. jordani* from Cocos Island also, as well as from Socorra Island and Roqueto Island. Schultz reports *S. rubroviolaceus* from the Hawaiian Islands, central and western Pacific Ocean, and Smith (1956, 1959) records it from the western Indian Ocean. The range, habitat, color patterns, and pharyngeal teeth indicate that only one species should be recognized and that *rubroviolaceus* is the female and *jordani* the mature male.

Mr. Howard Choat independently reached this same conclusion, which he stated in a letter to me dated 6 December 1965. Dr. John Randall, University of Hawaii, expressed the same opinion during a recent visit with me.

RANGE.—Hawaiian Islands, eastern, central, and western Pacific Ocean, and Indian Ocean.

Genus *Bolbometopon* Smith

Bolbometopon J. L. B. Smith, 1956, p. 8 [type-species: *Scarus muricatus* Cuvier and Valenciennes]; 1959, p. 269.
Cetoscarus J. L. B. Smith, 1956, p. 16 [type-species: *Scarus pulchellus* Rüppell] 1959, p. 274.

Smith (1959, p. 272) has shown that I incorrectly identified *Scarus gibbus* Rüppell, 1828, type-species of *Chlorurus* Swainson, 1839, from the Red Sea. It is *S. microrhinos* Bleeker. This important discovery places the genus *Chlorurus* as a synonym of the genus *Scarus*, which left two species of parrotfishes (*Scarus muri-*

catus Cuvier and Valenciennes, and *Scarus bicolor* Rüppell=*Scarus pulchellus* Rüppell) that formed a natural group without a generic name. Smith (1956, pp. 8, 16) established two new generic names, *Bolbometopon* and *Cetoscarus*, for them and, in 1959, he again recognized both genera as valid.

An analysis of the characters that Smith used to distinguish the two genera shows that the number of predorsal scales overlap as follows: *muricatus* has 4 or 5, *bicolor* 5 to 7; *muricatus* has ii,13 or ii,14 (usually ii,14) pectoral fin rays, whereas *bicolor* usually has ii,12 rarely ii,13 pectoral fin rays. These species have 3 series of scales on the cheek and according to Smith the ventral row in *bicolor* varies from 1 to 6, normally 3 to 6, whereas my counts range from 2 to 8 and that for *muricatus* 2 or 3.

Since the three characters (i.e., the number of predorsal scales, the pectoral fin rays, and the cheek scales) overlap, much like that for several species in the genus *Scarus*, I do not consider them as valid characters to distinguish genera; however, the pharyngeal mill (not mentioned by Smith, 1956 or 1959) distinguishes the two species in this relationship from all other species of parrotfishes as follows:

The upper pharyngeal bones bear 3 rows of teeth on each side: 2 inner rows of large teeth and an outer row of rudimentary teeth next to middle row; the lower pharyngeal plate has a concave dental surface as broad as long or a little longer than broad. No other parrotfish in the subfamily Scarinae has 3 rows of teeth; instead, they have only 1 or 2 rows of teeth on the upper pharyngeals, whereas all species of parrotfishes in the subfamily Sparisomatinae have 3 rows of teeth. I conclude, therefore, that *Bolbometopon*, with page priority, should be recognized as the valid genus for this relationship, and that *Cetoscarus* is a junior synonym.

RANGE.—Central and western Pacific Ocean, Indian Ocean, and Red Sea.

Bolbometopon muricatus (Cuvier and Valenciennes)

Scarus muricatus Cuvier and Valenciennes, 1839, p. 208, pl. 402.

Pseudoscarus muricatus.—Bleeker, 1862, p. 26, pl. 7: fig. 3.
Bolbometopon muricatus.—Smith, 1956, p. 8, pls. 42H, 45A–D; 1959, pp. 269, 278, pls. 42H, 45.—Munro, 1967, p. 437, fig. 829 [New Guinea].

Pseudoscarus frontalis [not Cuvier and Valenciennes].—Macleay, 1883, p. 590.

Callyodon macleayi Jordan and Seale, 1906, p. 331.
Callyodon shimoniensis Smith, 1953, p. 622, pls. 15, 16.
Chlorurus gibbus [not Rüppell].—Schultz, 1958, p. 26, pls. 1A, 7.

Characterized by having 4 or 5 median predorsal scales, 3 rows of scales on cheek, with 1 or 2 scales in ventral row; ii,14 pectoral fin rays, occasionally ii,13; lips not covering white teeth; snout with a nearly straight dorsal profile that bends abruptly over eyes; snout longer than postorbital length of head.

Coloration: Uniform brown; young and half-grown specimens with several white scales on sides; large adults have a fleshy knob on forehead over eyes.

RANGE.—Central and western Pacific Ocean, Indian Ocean, and Red Sea.

Bolbometopon bicolor (Rüppell)

PLATE 1C, D

Scarus bicolor Rüppell, 1828, p. 82, pl. 21.
Pseudoscarus bicolor.—Bleeker, 1862, p. 33, pl. 14.—Gohar and Latif, 1961, pp. 127–146 [Red Sea].
Cetoscarus bicolor.—Smith, 1956, p. 17, pl. 44 c,d,e; 1959, pp. 274, 275, 280, pl. 44c,d,e.
Chlorurus bicolor.—Schultz, 1958, p. 27, pls. 1B, 8A–C; 1960, p. 242, pls. 108B, 109B.—Kamohara, 1963, p. 3, pl. 1: fig. 3 [Japan].
Callyodon bicolor.—Marshall, 1965, p. 323.
Scarus pulchellus Rüppell, 1835, p. 25, pl. 8: fig. 3.
Pseudoscarus pulchellus.—Bleeker, 1862, p. 34, pl. 10: fig. 3.
Cetoscarus pulchellus.—Smith, 1956, p. 17, pl. 43E; 1959, pp. 274, 280, pl. 43E.—Munro, 1967, p. 441, fig. 843 [New Guinea].
Chlorurus pulchellus.—Schultz, 1958, p. 28, pls. 1c, 6c; 1960, p. 242.—Woodland and Slack-Smith, 1963, p. 46 [Heron Island].
Callyodon pulchellus.—Marshall, 1965, p. 322.
Scarus ocellatus Cuvier and Valenciennes, 1839, p. 278.
? *Scarus acroptilus* Richardson, 1846, p. 69.
Callyodon scriptus (Gronow) Gray, 1854, p. 85.
Pseudoscarus nigripinnis Playfair and Günther, 1866, p. 105, pl. 15: fig. 2.
Chlorurus nigripinnis.—Schultz, 1958, p. 29, pl. 6D.
Scarus ophthalmistius Herre, 1933, p. 21.

Characterized by having 5 to 7 median predorsal scales, 3 rows of scales on cheek, with ventral row usually having 3 to 6 (range 1 to 8), pectoral fin rays usually ii,12; lips mostly covering white teeth. Coloration of young show a dark ocellate spot at front of dorsal fin and larger fishes have black spots on scales on lower half of body.

Coloration of adult females: Bright green to purplish green with red spots on head and anterior

part of body; red or orange streak extends from corner of mouth and pectoral base, thence to anal fin origin, below which is a broad, green band. Under side of head and belly, orange. I found the types of *Pseudoscarus nigripinnis* Playfair and Günther, 1866 (p. 105, pl. 15; fig. 2), in the British Museum (Catalog no. 1865.2.27.80, standard length 151 mm; no. 1866.1.-19.16, standard length 172 mm) with 2 scales in ventral row on both sides of each type. The color pattern was typically that of *bicolor*, and I accept Smith's opinion that *nigripinnis* is a synonym of *bicolor*.

Randall (1963, pp. 225–227) has shown that *S. pulchellus* Rüppell is the adult female of *S. bicolor* Rüppell.

Recently collected specimen: USNM 202695, *Te Vega Sta.* TV-247, 11 March 1965, Solomon Islands, 1 spec.

RANGE.—Central and western Pacific Ocean, Indian Ocean, and Red Sea.

Genus *Ypsiscarus* Schultz

Ypsiscarus Schultz, 1958, p. 47 [type-species: *Callyodon oedema* Snyder].

Characterized by having 3 median predorsal scales, 2 or 3 scale rows on cheek, ii,13 pectoral rays, teeth white.

Schultz (1958, p. 47) proposed *Ypsiscarus* as a subgenus under *Scarus*. Now that two species have been found with 3 predorsal scales and gibbus snouts, I believe they represent a distinct phyletic line that should be assigned full generic rank.

Ypsiscarus ovifrons (Temminck and Schlegel)

PLATE 1E

Scarus ovifrons Temminck and Schlegel, 1846, p. 173, pl. 88.—Kamohara, 1963, p. 16 [Japan].
Callyodon viridifucatus Smith, 1956, p. 12, pl. 42 B, I.
Callyodon (Ypsiscarus) viridifucatus.—Smith, 1959, pp. 270, 278, pl. 42 B, I.

Characterized by having 3 rows of scales on cheek, with 1 to 3 scales in ventral row.

The plate of *Scarus ovifrons* Temminck and Schlegel, 1846 (pl. 88), shows 2 scales in the 3rd or ventral row on the cheek, which agrees with Smith's (1959, p. 270) observation of 2 or 3 scales on the preopercular flange of *Callyodon (Ypsiscarus) viridifucatus* Smith. Smith made two important changes in the description of *C. viridifucatus* between 1956 (p. 12)

and 1959 (p. 270) by altering "4 to 6 predorsal scales" to "3 median scales and pectoral fin rays from ii,12 to ii,13."

Among the color drawings from the *Albatross* expedition in 1910 is a beautiful painting, Plate Ie (original No. A1596), of *Ypsiscarus ovifrons* with a projecting gibbus snout, cheek scales in three rows, 7-7-1, and ii,13 pectoral fin rays, collected 29 January 1910 at Hokeido, Formosa. I have not located this specimen. It must have been larger than the holotype (450 mm) of *Y. oedema* Snyder, USNM 62951, and longer (355 mm) than USNM 112224 and 112232 on which Plate 80 in Schultz (1958) was based.

The color pattern of drawing A1596 shows paired and median fins orange, with narrow blue distal edges; body posteriorly dark grayish green becoming purple forward toward tip of depressed pectorals and ventrally below pectoral purple forward to isthmus. The body above depressed pectoral is bright orange, forward to eye and nape; gibbus snout green with a yellow cross band; cheek greenish; opercle blue; edge upper lip yellow; corner of mouth dark blue; edge lower lip bluish, then posteriorly a yellow cross bar.

The color pattern of preserved specimens available furnish no information on how to distinguish one or more species; however, *Ypsiscarus oedema* (Snyder) has 2 rows of scales on the cheek, and *Y. ovifrons* (Temminck and Schlegel) has 1 to 3 scales on "preopercular flange," making 3 rows on the cheek. *Callyodon viridifucatus* Smith, 1956 (p. 12) is a junior synonym of *Y. ovifrons*.

RANGE.—Western Pacific Ocean and Indian Ocean.

Ypsiscarus oedema (Snyder)

PLATE 2A

Callyodon oedema Snyder, 1909, p. 603.

Scarus oedema—Schultz, 1958, p. 48, pls. 1D, 8D.—Kamohara, 1963, p. 7, pl. 1: fig. 4.

Characterized by having 2 rows of scales on the cheek; otherwise, this species is very close to *Y. ovifrons*.

None of the following twelve specimens has a scale representing the third row on the cheek: USNM 112232 (1) and USNM 157033 (4) from Celebes Sea; USNM 112224 (1), 147251 (1), and 160088 (1) from the Philippines; USNM 147300 (1) and 147305 (1) from Dutch East Indies; USNM 62451 (1) from Okinawa; and USNM 202696 (1) from Tahiti. The latter, collected by Dr. Randall, is 360 mm in stand-

ard length. Large series of specimens are needed to adequately define the species in this relationship, which have 3 median predorsal scales, clearly seen in radiographs, and usually with a pair of overlapping scales in front of the third median predorsal scale.

RANGE.—Western Pacific Ocean.

Genus *Scarus* Forskal

Scarus Forskål, 1775, p. 25.—Linnaeus, 1789, p. 1280.

Subgenus *Scarus* Forskal

Chlorurus Swainson, 1839, p. 227.

Petronason Swainson, 1839, p. 226.

Pseudoscarus Bleeker, 1861, p. 230.

Xanophon Smith, 1956, p. 4.

Margaritodon Smith, 1956, p. 15.

Hipposcarus Smith, 1956, p. 17.

Characterized by having 4 median predorsal scales and 2 or 3 rows of scales on cheek.

RANGE.—Atlantic, Pacific, and Indian Oceans, and Red Sea.

Scarus harid Forskal

Scarus harid Forskål, 1775, pp. x, 30.

Scarus psittacus Forskål, 1775, pp. x, 29.

For additional synonyms, see each subspecies of *Scarus harid*.

The identity of *Scarus psittacus* Forskål (type-species of the genus *Scarus* Forskål): Dr. Smith (1959, pp. 265-282) made a major contribution toward an understanding of the identity of the widely ranging species of parrotfish, *Scarid harid* Forskål of the Western tropical Pacific Ocean, Indian Ocean, and Red Sea, when he differentiated three forms that comprise the *harid*-complex of species. Jordan and Gilbert (1882, p. 938) designated *Scarus psittacus* Forskål as the type-species of the genus *Scarus* Forskål; however, Smith (loc. cit.) rejected Schultz's interpretation of *S. psittacus*, which he (1958 p. 29) accepted as being the same species on *S. harid* on the basis of Forskål's description. With this difference of opinion prevailing, the problem of the identity of *S. psittacus* is given further consideration.

Smith (1956, pp. 4, 17) established the new genus *Hipposcarus*, with *Scarus harid* Forskål as its type-species, thus rejecting *Scarus*, which had been accepted and in use for over a century and a half (Block and

Schneider, 1801, p. 294; Rüppell, 1828; Bennett, 1828, p. 37; Cuvier and Valenciennes, 1839).

Since the holotype of *Scarus psittacus* Forskål is no longer in existence, I have translated the Latin description by Forskål (1775, p. 29) as follows:

[Diagnosis] Green; golden yellow lines; fins marked by borders, band ventrally; characteristic blue head.

Description. Maxillary of two parts, separated at middle, crenulate; on both sides above three teeth project; the lower [jaw] both sides, one. They are blue, the margins of both lips. Curved line extends from upper lip to below eye; a line transverses each side of each lower lip. A median longitudinal line on lower part of head, longitudinal line to lower [posterior] border of opercle. Opercle completely covered with large scales. Fins mostly crimson, borders blue, pectorals only marked above, ventrally opposite the dorsal. Caudal forked, fin blue spotted, middle truncate, both marginal angles produced. Scales striate. Lateral line with little branches, double, first straight, near back, ending under end of dorsal fin, the other located below [behind] in middle of body and extends straight to middle caudal. Base caudal fin on both sides with 3 large scales. In dorsal fin first 9 rays simple, nonridged, not pungent. Eye small, free. From Djiddah [Red Sea].

Smith (1959, pp. 275–276) described *Scarus harid* Forskål as follows:

In our work in the W. Indian Ocean we got large numbers of "harid." From the beginning I was puzzled by certain constant differences in markings from the descriptions of Rüppell and Klunzinger (and Rüppell 1828, pl. 21, figs. 1, 2); both state Red Sea fishes have a yellow line from rictus to operculum: several lines of blue spots along mid-side above anus, and the body of the caudal uniform; the only recent account of *harid* from the Red Sea is one of a few lines by Roux-Estève (1956:94), he mentions this yellow line on the cheek, and the uniform dark violet caudal.

Smith (1959, pp. 276, 280) gives the following diagnosis of *Hipposcarus harid harid* (Forskål): "... yellow line from rictus to operculum; lines of blue spots on mid-side above anus; body of caudal uniform." Forskål's diagnosis of "golden yellow lines" and his "Description" of a median longitudinal line on lower part of head, "Longitudinal line to lower [posterior] border of operculum," appears to be the same as Smith's "yellow line from rictus to operculum."

Forskål (1775, p. 29), Rüppell (1828, pl. 21: figs. 1, 2), Klunzinger (1871, p. 561), Roux-Estève (1956, p. 94), and Smith (1959, p. 276) mention or illustrate a Red Sea parrotfish ("harid") with a yellow line across the lower side of the head from the corner of the mouth to the rear of the opercle, and since no other

species of parrotfish with such a golden line has been described, it is concluded that *Scarus psittacus* Forskål is the same species that Smith recognized as *Scarus harid* Forskål. Actually, Forskål's description is more diagnostic for *S. psittacus* than his description is for that of *S. harid*. I conclude that the identification of *S. psittacus* (not Linnaeus) Forskål is not in doubt and should be accepted.

As the logotype for *Petronason* Swainson, Jordan (1919, p. 199) gave *Coryphaena psittacus* Linnaeus (= *Xyrichthys psittacus* Linnaeus), confusing that labrid with the scarid *Labrus psittacus* Linnaeus (= *Scarus psittacus* Forskål). Although *S. psittacus* Forskål is available for the scarid with the golden yellow line across the cheek, I prefer to continue, as first reviser (1958, p. 50), the long-time use of *Scarus harid* Forskål, because of the considerable confusion of the name *Labrus psittacus* Linnaeus, a labrid, with *Coryphaena psittacus* Linnaeus, a scarid.

The remnants of the type-specimen of *Scarus harid* Forskål was illustrated by Smith (1959, p. 275, fig. 6) and Klausewitz and Nielsen (1965, p. 14, pl. 3: fig. 7). It no longer retains any important identifying characteristics; the identity of *harid* must be determined on the basis of Forskål's descriptions and later descriptions of *harid* by Rüppell and by Klunzinger, both of whom may have seen the type of *Scarus harid* when it was in better condition. For the sake of stability of nomenclature, I accept the identity of *harid* as defined by Smith (1959) and redefined in this paper.

Klausewitz and Nielsen (1965, p. 12) did not find the type of *Scarus psittacus* Forskål. Dr. Jergen Nielsen in a letter dated 21 May 1960, sent four photographs to me that represented all of the existing types of Forskål's species of *Scarus* as follows: "*Scarus harid*, *Scarus niger*, *Scarus siganus*, and *Scaris gallus*." The last two are not parrotfishes. Dr. Nielsen made the following comments:

A few days ago I received the photographs of the types of *Scarus* from the collection of Forskål. They are all enclosed in this letter.

Unfortunately, nearly all of the 72 Forskål fishes have only the skin preserved. A few specimens also have some ribs and headbones left, but none of the four species of *Scarus* has the faintest trace of pharyngeals. So I am afraid I can help you only with photographs.

In order to stabilize the nomenclature of the family

Scaridae (in case the identity of the genotype *Scarus psittacus* Forskål is still in some doubt), because no type-specimen exists, and because this paper is a continuation of my revision (1958, pp. 29, 50-52), I herewith select a neotype for *Scarus psittacus* Forskål: USNM 201805, a specimen from the Red Sea, 182 mm in standard length, with characteristics as defined in this paper for *S. h. harid* Forskål. This action is based on Article 75 of the *International Code of Zoological Nomenclature* (1961, pp. 81-82).

Among the forms composing the *Scarus harid* complex, Smith (1959, pp. 174-288) recognized *harid* (Red Sea), *vexillus* (Western Indian Ocean), and *schultzi* (tropical western Pacific Ocean). Smith distinguished *harid* and *vexillus* from *longiceps* (= *schultzi*) by the fact that the width of the patch of cheek scales are less than the width of the interorbital in *harid-vexillus* and wider than the interorbital for *longiceps* (= *schultzi*). I have measured both characters to the nearest tenth of a millimeter, divided the maximum width of the patch of cheek-scales into the width of the fleshy interorbital, and obtained the ratio for each specimen correlated with its standard length

(Table 1). This table shows that the ratio decreases with increased size of the specimens and that the ranges of the ratios overlap for the three forms, with the result that this character alone cannot be used for the separation of the species.

I have made a comparison of certain body dimensions for the three subspecies of *S. harid* (Table 2). This table shows that the greatest width of the patch of cheek scales averages a little wider (75 to 99 thousandths of standard length) in *S. h. longiceps* compared with that (55 to 89) in the other two subspecies. It is, however, the only character measured that showed a significant difference. Although *S. h. vexillus* has a greater number of cheek scales than *S. h. longiceps*, the cheek scale patch is narrower in the latter.

Another character used by Smith for distinguishing the species in the *harid-complex* is the number of scales on the cheek (Table 3). This table reveals that *vexillus* has 22 to 31 scales on the cheek whereas *harid* and *longiceps* range from 15 to 22, the range overlapping at 22. Without doubt, *S. h. vexillus* may be distinguished from the other two by the number of scales in the patch on the cheek of adults.

TABLE 1.—Ratio of maximum width of patch of cheek scales into width of fleshy interorbital space correlated with the standard length of each specimen (h=*harid*, l=*longiceps*, v=*vexillus*)

Width of patch of cheek scales into interorbital width	Standard length in millimeters																			
	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	
	69	79	89	99	109	119	129	139	149	159	169	179	189	199	209	219	229	239	249	
1.80-1.89	l																			
1.70-1.79	v																			
1.60-1.69	v																			
1.50-1.59	h																			
1.40-1.49	v	h	h					v					v							
1.30-1.39			vv	h					h	v										
1.20-1.29			h	h				vh		h			hh		vv	h				
1.10-1.19					l					l		l	h	h	h				h	
1.00-1.09													l			h	ll			
.90-.99																				
.80-.89																l		l		

TABLE 2.—A comparison of frequency distributions of certain body dimensions for three subspecies of *Scarus harid* (in thousandths of standard length)

Species	Depth of body										Least depth caudal peduncle					Length of snout					
	340	350	360	370	380	390	400	410	420	100	110	120	130	140	150	120	130	140	150	160	170
	349	359	369	379	389	399	409	419	429	109	119	129	139	149	159	129	139	149	159	169	179
<i>harid</i>			1	3	6	4	1	1	1	1	1	11	3		1	4	1	4	7	1	
<i>vexillus</i>	1	1	2	2	4					4	4			1		4	3	1	2		
<i>longiceps</i>	1		1	3	3		1			2	4	2			1	1	1	4	1	2	1

Species	Greatest width of patch of cheek scales										Width of interorbital								Greatest width naked preopercular flange				
	55	60	65	70	75	80	85	90	95	75	80	85	90	95	100	105	110	115	20	25	30	35	40
	59	64	69	74	79	84	89	94	99	79	84	89	94	99	104	109	114	119	24	29	34	39	44
<i>harid</i>	1		4	6	4	1	1			1	4	5	3	2	1		1	1	3	5	6	2	
<i>vexillus</i>		1	4	4	1						3	1	4	2				1	3	4	2		
<i>longiceps</i>					1	2	2	3	1	1	2	1	3	2	1			3	2	2	2		

Species	Least width preorbital											Least width of naked area between orbit and cheek scales						
	65	70	75	80	85	90	95	100	105	110	115	10	15	20	25			
	69	74	79	84	89	94	99	104	109	114	119	14	19	24	29			
<i>harid</i>			3			1	2	3	3	2	2	1			10	6	1	
<i>vexillus</i>		1	3				3	2	1						6	4		
<i>longiceps</i>		1		1				4	2	2	1			1	2	6	1	1

TABLE 3.—Frequency distribution of the number of scales in each row in the patch of cheek scales of subspecies of *Scarus harid*

Subspecies	Number of scales in each row																							
	dorsal row				second row						third row						ventral row							
	6	7	8	9	5	6	7	8	9	10	2	3	4	5	6	7	8	2	3	4	5	6	7	8
<i>harid</i>	2	12	5		2	4	9	4			4	6	7	2			1							
<i>longiceps</i>	15	14	1	2	2	15	9	5		1	3	16	13	1										
<i>vexillus</i>		2	7	10		2	6	7	3	1	1	3	2	3	2	5	3	3	5	1	4	2	1	2

Subspecies	Total number of cheek scales																
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	<i>harid</i>			3	4	5	1	6	1	1							
<i>longiceps</i>	1		6	3	3												
<i>vexillus</i>								2		4	3	1	3	1	3	1	

Key to the Subspecies of *Scarus harid*

- 1a. Golden yellow line from rear corner of mouth across middle of side of head to rear of opercle; blue spots occur on mature males on mid-side above anal fin to opposite the depressed pelvics; total number of scales in patch on cheek 16 to 22; usually 3 rows of scales on the cheek (Red Sea) *harid*
- 1b. No golden yellow line on side of head; no blue spots on lower side as in 1a, tips of outer rays of caudal fin dusky.
- 2a. Total number of scales in cheek patch 22 to 29; usually 4 rows of scales on the cheek (western Indian Ocean) *vexillus*
- 2b. Total number of scales in cheek patch 16 to 19; 3 rows of scales on the cheek (western tropical Pacific Ocean) *longiceps*

Scarus harid harid Forskal

Scarus psittacus Forskål, 1775, pp. x, 29 [type-locality: Red Sea; = *Labrus psittacus* Linnaeus, 1789, p. 1285; not *Coryphaena psittacus* Linnaeus, 1789, p. 1194, which has been confused with *Scarus psittacus* (not Linnaeus) Forskål; neotype USNM 201805, a specimen 182 mm standard length from Red Sea (see p. 7)].

Scarus harid Forskål, 1775, pp. x, 29 [type-locality: Red Sea].—Linnaeus, 1789, p. 1282 [Arabia].—Rüppell, 1828, p. 80, pl. 21: fig. 1 [Red Sea].—Cuvier and Valenciennes, 1839, pp. 249–250, pl. 404 [Djidda, Red Sea].—Schultz, 1958, p. 50.

Hipposcarus harid harid.—Smith, 1959, p. 280.

Pseudoscarus harid.—Gohar and Latif, 1961, pp. 97–126, figs. 1–10 [Red Sea; anatomy of alimentary tract]; 1961, pp. 127–146.

Scarus mastax Rüppell, 1828, p. 80, pl. 21: fig. 2 [Red Sea].

Pseudoscarus harid var. *mastax*.—Klunzinger, 1871, p. 562 [Red Sea].

?*Scarus collana* Rüppell, 1835, p. 25, pl. 8: fig. 2 [type-locality: Red Sea].

Scarus cyanurus Cuvier and Valenciennes, 1839, p. 261.—Bauchot and Guibè, 1960, p. 293 [syntypes 1724 and 1725].

Scarus collaris Cuvier and Valenciennes, 1839, p. 265 [type-locality: Red Sea].

Scarus latus Cuvier and Valenciennes, 1839, p. 245 [type-locality: Red Sea].

Scarus ruppeli Cuvier and Valenciennes, 1839, p. 259 [type-locality: Red Sea].

The specimen that I have designated as the neotype for *Scarus psittacus* Forskål, USNM 201805, was sent to me by Dr. Steinetz, Hebrew University: serial no. BT 100, Sherm a Shekh, Red Sea, 182 mm standard length. The streak from rictus to opercle (golden yellow line) on this specimen followed the same course as shown by Rüppell (1828, pl. 21: fig. 2). It has cheek scales 9–7–3–6 on right side, and 8–7–6 on left side. Another specimen (serial no. E62–597a, Nocra, Red Sea, 48 mm) is nearly identical in color pattern to Smith's (1959, p. 280, fig. 9) illustration.

The number of pectoral fin rays is given in Table 4.

TABLE 4.—Frequency distribution of number of pectoral fin rays for *Scarus gibbus* and *Scarus harid*

Species and subspecies	Number of pectoral rays			
	ii,12	ii,13	ii,14	ii,15
<i>gibbus</i>				
Red Sea			6	
Central and western Pacific Ocean		1	62	6
<i>gibbus</i> *				2
<i>microrhinos</i> *				2
<i>strongylocephalus</i> *				2
<i>microcheilus</i> *				2
<i>harid harid</i>	1	33	2	
<i>h. longiceps</i>	1	61	2	
<i>h. vexillus</i>		21	1	

*Type-specimens.

Additional specimens recently collected by the IIOE in the Red Sea: USNM 202290, Sta. HA–36, 7 January 1965, 4 spec., 183–210 mm; USNM 202289, Sta. HA–38, 10 January 1965, 3 spec., 96–245 mm; USNM 202274, Sta. HA–26, 30 December 1964, 1 spec., 94 mm; USNM 202288 Sta. HA–34, 5 January 1965, 4 spec., 137–197 mm; USNM 202273, Sta. HA–30, 2 January 1965, 1 spec., 146 mm.

RANGE.—Red Sea.

Scarus harid vexillus (Smith)

Hipposcarus harid vexillus Smith, 1959, p. 277, fig. 9, pl. 44A, B [type-locality: Shimon].

Pseudoscarus mastax [not Rüppell] Bleeker, 1862, p. 35, pl. 10: fig. 2 [Java; Smith, 1959, p. 275, found this specimen, 495 mm long, with 29 scales in 4 rows on the cheek and thinks it is a synonym of his *S. vexillus*].

Hipposcarus harid.—Smith, 1956, p. 17, pl. 44A, B [Western Indian Ocean southward along East African coast to latitude 21°30' S].

The following specimens were collected by the *Anton Bruun*, Cruise 9, IIOE: USNM 202296, Sta. RS-41KA, 8 December 1964, Amirantes Island, 1 spec., 134 mm; USNM 202293 Sta. HA-9, 24 December 1964, Comoro Islands, 1 spec., 205 mm; USNM 202292, Sta. HA-19, 8 December 1964, Amirantes Island, 7 spec., 65 to 183 mm; USNM 202294 Sta. RS-37, 6 December 1964, Fraquhar Islands, 1 spec., 203 mm.

Scarus harid longiceps Cuvier and Valenciennes

PLATE 2B

Scarus longiceps Cuvier and Valenciennes, 1839, p. 241.—Bauchot and Guibé, 1960, p. 295 [holotype no. 2479 in Paris Museum].

Hipposcarus longiceps.—Munro, 1967, p. 441, fig. 844 [New Guinea].

Scarus macrocheilos Bleeker, 1854, p. 60 [type-locality: Halmahera; type examined in British Museum, Catalog no. 1864.5.15.31, standard length 88 mm, total length 111 mm]; 1862, p. 38, pl. 15: fig. 1 [Halmahera].

Scarus pinguirostratus Fowler, 1904, p. 541, pl. 21: upper figure [type-locality: Padang, Sumatra].

Scarus harid [not Forskål].—Schultz, 1958, p. 50, pl. 9B; 1960, p. 243 [Marshall and Marianas Islands].—Kamohara, 1963, p. 8, pl. 2: fig. 2 [Japan].—Kamohara and Yamakawa, 1967, p. 14 [Ishigakijima].

Hipposcarus schultzi Smith, 1959, p. 277, fig. 8 [type-locality: Philippines].

Callyodon toshi Whitley, 1966, p. 239, fig. 3.

Smith (1959, p. 277) described *Hipposcarus harid schultzi* and considered that it represented the species of parrotfish from the Philippines and adjacent Pacific Ocean that Schultz (1958, p. 50) recognized as a wide-ranging species under the name *Scarus harid*. Since other names predate that of Smith, however, each name is herewith considered in regard to its possible identity with that of *S. h. schultzi*.

Fowler (1904, p. 541, pl. 21: upper fig.) was the most recent author to name this species, *S. pinguirostratus*, from Sumatra. Two other names are still older.

The next name available that might replace *Scarus schultzi* Smith is *Scarus macrocheilos* Bleeker, 1854 (p. 50), from Halmahera, situated in the East Indies, just north of the equator at about 129°E longitude. I have examined Bleeker's type of that species in the British Museum (Catalog no. 1864.5.15.31, standard length 88 mm). It has the following characteristics: predorsal scales 4, scales on cheek in 3 rows, 6 scales next to orbit, 6 in middle row, and 4 in ventral row, pectoral rays ii,13. When I saw the type in 1953, I

identified it without any doubt as *harid*. Although Smith rejected the name *macrocheilos* because he thought the type was too small (88 mm standard length, "111 mm. in length") for positive identification, I do not agree with him because I have identified several specimens in the "*harid*" complex, without doubt as to species, that were much smaller in size than the type of *macrocheilos*. Bleeker's type has the typical juvenile color pattern (1862, pl. 15: fig. 1).

Schultz (1958, p. 50) placed *Scarus longiceps* Cuvier and Valenciennes, 1839 (pp. 14, 24), as a junior synonym of *Scarus harid* Forskål. Bauchot and Guibé (1960, p. 295) found the holotype of *S. longiceps* (Catalog no. 2479) in the Paris Museum and also placed it as a synonym of *S. harid*. I conclude that *S. longiceps* is the oldest available name and that *H. schultzi* Smith, *S. pinguirostratus* Fowler, and *S. macrocheilos* Bleeker are junior synonyms of *S. harid longiceps* Cuvier and Valenciennes.

Recently collected specimens: USNM 202298, IIOE, Cruise I, Patong, Phuket, Thailand, 22 March 1963, 1 spec., 49 mm; USNM 202295, Society Islands, Tikahou Atoll, 15 April 1957, 2 spec., 57–201 mm.

Dr. V. G. Springer collected the following at One Tree Island off Queensland: Sta. VGS66-13, 30 November 1966, 11 spec., 42–116 mm; Sta. VGS66-19, 11 December 1966, 2 spec., 134–166 mm.

RANGE.—Central and western Pacific Ocean.

Scarus gibbus Rüppell

PLATE 2C

Scarus gibbus Rüppell, 1828, p. 81, pl. 20: fig. 2.

Chlorurus gibbus.—Smith, 1959, p. 280, fig. 5.

Scarus microrhinos Bleeker, 1854, p. 200.—Schultz, 1958, p. 48, fig. 4, pl. 9A; 1960, p. 243.—Kamohara and Yamakawa, 1967, p. 13 [Okinawa].

Pseudoscarus microrhinos.—Bleeker, 1862, p. 22, pl. 3.

Chlorurus microrhinos.—Smith, 1956, p. 16; 1959, pp. 272–274, 260, fig. 4.—Munro, 1967, p. 442, fig. 846 [New Guinea].

Scarus strongylocephalus Bleeker, 1854, p. 439; 1862, p. 23, pl. 4: fig. 3.

Chlorurus strongylocephalus.—Smith, 1956, p. 16, pl. 42c, F; 1959, pp. 272–274, 280, pls. 42c, F, 44g.—Munro, 1967, p. 441, fig. 845 [New Guinea].

Pseudoscarus microcheilos Bleeker, 1861, p. 231; 1862, p. 24, pl. 4: fig. 2.

Chlorurus microcheilus.—Smith, 1956, p. 16, pl. 44g.

Callyodon microcheilus.—Fourmanoir, 1957, p. 188 [Nossi-Bé].

Callyodon ultramarinus Jordan and Seale, 1906b, p. 63, fig. 16; 1906a, p. 332, fig. 64.

Characterized by having 4 median predorsal scales, 3 rows of scales on cheek, with 3 to 7 scales in ventral row, ii,14 (occasionally ii,13 and ii,15) pectoral fin rays; lips not covering white teeth, which become blue or green in adults. For a detailed color description, see Schultz (1958, pp. 49-50).

Chlorurus Swainson (a junior synonym of *Scarus* Forskål): Dr. J. L. B. Smith (1959, pp. 272-274) recognized the genus *Chlorurus* Swainson, with *Scarus gibbus* Rüppell as its type. Since that species has a single main row of teeth and a rudimentary one beside it on each upper pharyngeal bone, it is referable to the subfamily Scarinae. In this subfamily a large group of species is distinguished from all others by having 4 median predorsal scales, to which *S. gibbus* and *S. harid* (type-species of the genus *Scarus*) belong.

The genus *Chlorurus* is defined by Smith (loc. cit.) as having ii,14 or ii,15 pectoral fin rays, 3 rows of scales on the cheek, and small circular nostrils. Each of these characters is evaluated below on the basis of observations made on numerous species in this group.

The number of pectoral fin rays vary in number from ii,11 to ii,15 in the Scarinae and for most of the species in this relationship in which many specimens have been studied, the pectoral rays usually vary about 3 in number. *Scarus gibbus* with a range of ii,13 to ii,15, usually ii,14, pectoral fin rays overlaps that for *S. harid*, which has ii,12 to ii,14, usually ii,13 (see Table 4). Also, *S. sordidus*, *S. jonesi*, *S. chlorodon*, *S. marshalli*, *S. guacamaia*, and *S. collectinus*, may have ii,14 pectoral fin rays. In my opinion, the number of pectoral fin rays in this subfamily is of considerable value in distinguishing species but is of little or no importance at the generic level.

Smith's next character, 3 rows of scales on the cheek of *S. gibbus* is not unique since *S. harid* (type of the genus *Scarus*) has at least 3 rows and there are five other species (*javanicus*, *formosus*, *lunula*, *lauia*, and *flavipectoralis*) (Schultz, 1958, p. 31) in this subgenus with 3 rows of scales on the cheek. In addition, among 44 specimens examined of *S. dubius* Bennett (Schultz, loc. cit.) one-half had 2 rows and the other half, 3 rows. Because of the variability described above, I conclude that the number of rows of scales on the cheek is of considerable value in distinguishing species but it is of lesser importance at the generic level in the genus *Scarus*.

The size and shape of the nasal openings are also variable, especially with increase in size, with the result

that this character too is of limited value at the generic level but of possible importance at the specific level.

Because of the variability and overlap of the characters used by Smith to distinguish *Chlorurus* from *Scarus* in this group and because I am unable to find any additional character that always distinguishes *Chlorurus* from *Scarus*, I conclude that *Chlorurus* is a junior synonym of *Scarus*.

Scarus microrhinos Bleeker and *S. strongylocephalus* Bleeker (junior synonyms of *Scarus gibbus* Rüppell): Another problem needing consideration is the number of valid species centering around *Scarus gibbus*. Smith (1959, p. 273) recognized three (*gibbus*, *microrhinos*, and *strongylocephalus*) as nominal species. He distinguished *gibbus* and *strongylocephalus* by "forehead not above snout" as contrasted with "forehead in large males to almost over snout" in *microrhinos*.

The numerous specimens of *S. gibbus* that I have studied from the Indo-Pacific-Red Sea areas have a highly variable snout profile, especially in the presumed males, in the largest specimens of which it becomes nearly vertical. I have measured the angle between the snout profile and a line extending from the midcaudal fin base forward through the upper edge of the pectoral fin base and have recorded these data as a correlation with the standard length (Table 5). My data show that the angle of the snout profile becomes greater with increased length.

Four specimens of *S. gibbus* from the Red Sea may be located in Table 5 by the footnote symbol. The largest (probably a female) is 355 mm in standard length, with a snout profile angle of 45° whereas the smaller ones, 166 and 200 mm, have angles of 40° and 50°, respectively. I do not have enough large specimens available to establish a more exact relationship between snout profile and standard length; however, it is amply clear from the table that the angle becomes greater with increase in length and that the Red Sea specimens have angles of snout profile within the limits of variation of specimens from the Pacific Ocean.

Adult mature males of other species of parrotfishes develop a strong elevated snout profile, even knoblike; for example, *Bolbometopon muricatus* and *Scarops ovi-frons*, a condition undoubtedly occurring in *S. gibbus*. Because of the variability of the angle of the snout profile, I conclude that it is of doubtful significance in distinguishing supposed species centering around *S. gibbus*.

Another character used by Smith (loc. cit.) to distinguish three supposed species in this complex was color pattern. I have tabulated for comparison the chief color pattern characteristics recorded by Rüp-

pell (1828), Bleeker (1862), Smith (1956, 1959), Schultz (1958) with color photographs and color drawings in the files of the Division of Fishes at the United States National Museum (Table 6).

TABLE 5.—Correlation between angle of snout profile and standard length of *Scarus gibbus*

Angle of snout profile in degrees	Standard length in millimeters																				
	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	
	99	119	139	159	179	199	219	239	259	279	299	319	339	359	379	399	419	439	459	479	
80-84																					1 ♂
75-79								1													
70-74								1													
65-69						1	3		1												
60-64					1	2	1	1			1										
55-59					1																
50-54		1		2	1	1	1*	1			1	1									
45-49	1	1																			2 ♀ *
40-44					1*																
35-39							1 ♀														

*Red Sea specimens.

TABLE 6.—A comparison of color patterns of supposed parrotfish species centering around *Scarus gibbus*

Location of patterns	<i>gibbus</i>		<i>strongylocephalus</i>		<i>microrhinus</i>	
	Rüppell	Smith	Smith	Bleeker	Bleeker	Philippine Islands and Marshall Islands
Spots or bars on chin	purple, green, or red	2 red spots	blue ♂ or green bars on ♀	blue	green	red and blue bars
Pelvics edged with:	green	blue	♂ blue	blue	green	blue or green with purple center
Lips edged with:	green		♂ blue ♀ blue-green	blue	pink and then green	red and green blue or green
Green streak from rictus to opercle on adults	no bar, lower part of head green		♂ blue-green below eye then to opercle	blue bar to eye and behind	green to opposite pectoral base	green straight back to base pectoral
Head dorsally	purple	purple	♀ absent ♂ purple ♀ green	purple brown	greenish purple	purple-brown
Cheek below green bar (if present)			♂ yellow green ♀ light blue	yellowish	pink	yellowish pink or green
Scales			♂ red or green spotted ♀ red	red spotted	red spotted	red and green spotted
Caudal fin base	blue		♂ blue or green ♀ yellow red-brown	blue to pink	pink scales light blue	green with purplish-brown reddish-brown
Immature						

Characterized by having 4 median predorsal scales, 3 rows of scales on cheek with 1 scale in ventral row, ii,12 pectoral fin rays; and lips not quite covering the white teeth, canines present at corner of mouth; dorsal edge of pectoral fin base with black spot. Anterior half of body dark (brownish green when alive), posterior half of body pale (light green when alive); middle of caudal peduncle yellow; pectoral fin yellow with a blue base; caudal fin orange with blue outer edges; anal fin blue with a dark red band basally; dorsal fin with blue distal edge, then submarginally an orange streak, middle of fin green; green streak from snout past lower edge of eye.

RANGE.—Western Pacific Ocean.

Scarus dubius Bennett

PLATE 3A

Scarus dubius Bennett, 1828, p. 37.—Schultz, 1958, p. 54, pl. 10A.—Kamohara, 1960, p. 26; 1963, p. 8, pl. 2: fig. 3 [Japan].—Woodland and Slack-Smith, 1963, p. 45 [Heron Island].—Gosline and Brock, 1960, p. 237 [Hawaiian Islands].

Callyodon dubius.—Marshall, 1965, p. 323.—Munro, 1967, p. 438, fig. 833 [New Guinea].

See Schultz (1958, p. 54) for other synonyms.

Characterized by having 4 median predorsal scales, 3 rows of scales on at least one side of cheek, the ventral row consisting of 1 scale, or it may be lacking; ii,12 pectoral fin rays; lips not quite covering white teeth; dorsal edge of pectoral fin base with a small black spot; coloration brownish, median fins pale, caudal and dorsal fins yellowish when alive, caudal peduncle yellowish; 3 light streaks, 1 on each scale, on abdomen; dorsal and anal fins narrowly edged with blue distally.

RANGE.—Hawaiian Islands and Western Pacific Ocean.

Scarus lunula (Snyder)

PLATE 3B

Callyodon lunula Snyder, 1908, p. 99; 1912, p. 509, pl. 66: fig. 2.

Margaritodon verweyi Smith, 1956, p. 15, pl. 43D, f.

Scarus lunula.—Schultz, 1958, p. 54, fig. 6, pl. 10B; 1960, p. 244.—Kamohara, 1963, p. 9, pl. 2: fig. 4 [Japan].

Callyodon (Margaritodon) lunula.—Smith, 1959, p. 272, pl. 43D, f.

Characterized by having 4 median predorsal scales with a pair in front overlapping that might be counted

(incorrectly) as a total of 5; 3 rows of scales on cheek with 2 or 3 scales in ventral row; ii,12 pectoral rays; lips not quite covering white teeth; 2 or 3 canines in corner of mouth; 3 color streaks in both dorsal and anal fins, the middle one red, outer edge blue or green, base greenish; edge of upper lip green, then pink, then a green streak from snout past lower edge of eye; especially important: distal edge of operculum red in front of pectoral base; 1 or 2 green streaks connecting eyes across interorbital space. All adults observed have the area of head in front of orbits enlarged, and in largest specimens this area is in the form of a hump.

Schultz (1958, p. 54) referred *Pseudoscarus rostratus* [not Poey and not Seale] Günther, 1909 (p. 315, pl. 154), to the synonymy of *S. lunula*, but I now observe 5 or 6 predorsal scales and the color pattern suggests *S. hobban*.

Schultz (1958, p. 54) referred with doubt *Callyodon viridifucatus* Smith, 1956 (p. 12, pl. 42B, 1), to the synonymy of *S. lunula*; however, Smith (1959, p. 270) states that his *C. viridifurcatus* has only 3 median predorsal scales instead of "4 to 6" as originally described and in 1959 he believed it was related to *Callyodon oedema* Snyder. I, however, have referred it to *Ypsiscarus ovifrons* on page 5.

A specimen, USNM 202623, was collected by the *Te Vega*, Station 104, off Pulo Siburu, Mentawai Islands, 30 November 1963.

RANGE.—Central and western Pacific Ocean and Indian Ocean.

Scarus formosus Cuvier and Valenciennes

PLATE 3C

Scarus formosus Cuvier and Valenciennes, 1839, p. 283.—Schultz, 1958, p. 56; 1960, p. 244.—Kamohara, 1963, p. 9 [Okinawa].

Callyodon formosus.—Smith, 1959, p. 279 [Mauritius].—Munro, 1967, p. 438, fig. 832 [New Guinea].

See Schultz (1958, p. 56) for other synonyms.

Characterized by having 4 median predorsal scales, 3 rows of scales on cheek with 1 or 2 scales in ventral row; ii,12 pectoral fin rays; lips not quite covering white teeth, large adults have forehead enlarged. Dorsal and anal fins crossed with 3 streaks, distal one blue, center orange, basally green; 3 blue spots on mid-ventral line anterior to pelvic bases.

RANGE.—Hawaiian Islands, central and western Pacific Ocean, and western Indian Ocean.

Scarus lauia Jordan and Evermann

PLATE 3D

Scarus lauia Jordan and Evermann, 1903, p. 196; 1905, p. 355, pl. 43.

Characterized by having 4 median predorsal scales, 3 rows of scales on cheek, with 2 scales in ventral row; ii,12 or ii,13 pectoral fin rays; lips nearly covering white teeth. Margin of both lips blue, blue streak from snout tip to below eye; dorsal and anal fins broadly green edged; center of fin orange; bases with green spots.

RANGE.—Hawaiian Islands.

Scarus perspicillatus Steindachner

PLATE 3E

Scarus perspicillatus Steindachner, 1879, p. 16, pl. 4: fig. 1.—Gosline and Brock, 1960, p. 238 [Hawaiian Islands].

See Schultz (1958, p. 57) for other synonyms.

Characterized by having 4 median predorsal scales, 2 rows of scales on cheek, with only 0 to 3 scales in 2nd row (all other species in this genus have 5 to 8 scales in 2nd row), ii,13 pectoral fin rays; lips not covering white teeth. See Schultz (1958, p. 58, fig. 21) for a description of the color pattern.

The United States Coast Guard has sent to me one specimen, USNM 201173, taken at Kure Atoll, Hawaiian Islands.

RANGE.—Hawaiian Islands.

Scarus venosus Cuvier and Valenciennes

PLATE 4A

Scarus venosus Cuvier and Valenciennes, 1839, p. 212.—Schultz, 1958, p. 60, fig. 22.—Kamohara, 1963, p. 11, pl. 3: fig. 3 [Okinawa].

Xanothon venosus.—Smith, 1959, p. 268, 278, pl. 44H.—Munro, 1967, p. 435, fig. 823 [New Guinea].

Pseudoscarus pentazona Bleeker, 1861, p. 241.

Xanothon pentazona.—Smith, 1956, p. 7, pl. 44H.

Pseudoscarus schlegeli Bleeker, 1861, p. 242.

Scarus schlegeli.—Schultz, 1958, p. 59, pl. 10D; 1960, p. 245.—Kamohara, 1963, p. 11, pl. 3: fig. 4 [Japan].

Scarus cypho Seale, 1901, p. 95.

Pseudoscarus collana var. *eques* Steindachner, 1907, p. 151.

Characterized by having 4 median predorsal scales, 2 rows of scales on cheek, ii,12 pectoral fin rays, lips almost covering white teeth; black spot at dorsal edge of pectoral base; immature and females with 5 vertical dark bars on side of body separated by yellow coloration; canines at corner of mouth of adult males, latter with 2 pale bars (yellowish when alive) below dorsal

fin, separated by a brownish bar, sometimes anterior pale bar expanded to cover dorsal half of head; dorsal and anal fins edged with a dusky streak (green when alive); background coloration purplish red, each scale marked with a green bar; center of dorsal and anal fins pinkish except for streaks formed by green spots.

Mr. J. Howard Choat in a letter dated 6 December 1965 suggested that *S. venosus* and *S. schlegeli* represented female and male, respectively. My recent study of this problem tends to confirm his opinion.

RANGE.—Western Pacific Ocean and Indian Ocean.

Scarus taeniurus Cuvier and Valenciennes

Scarus ghobban [not Forskål] Rüppell, 1828, p. 78 [Catalog no. 1860.11.9.98 in British Museum].—Smith, 1959, p. 268.

Scarus taeniurus Cuvier and Valenciennes, 1839, p. 257 [lectotype: Catalog no. 554 in Paris Museum].—Schultz, 1958, p. 61, fig. 8; 1960, p. 245.—Kamohara, 1963, p. 12, pl. 4: fig. 2 [Japan].

Scarus baliensis Bleeker, 1849, p. 8 [lectotype: Catalog no. 1861.2.28.48 in British Museum].

Pseudoscarus baliensis [in part].—Bleeker, 1862, p. 39 [not pl. 16: fig. 3].

Scarus bataviensis Bleeker, 1857, p. 342.

Pseudoscarus bataviensis.—Bleeker, 1862, p. 48, pl. 12: fig. 3.

Pseudoscarus forskalii var. *fuscopurpureus* Klunzinger, 1871, p. 567 [lectotype: Catalog no. 1871.7.15.13 in British Museum].

Xanothon carifanus Smith, 1956, p. 6, pl. 42D; 1959, pp. 268, 278, pl. 42D.

Pseudoscarus oktodon Bleeker, 1861, p. 235; 1862, p. 33, pl. 13: fig. 2.

Callyodon oktodon Fourmanoir, 1957, p. 187 [Nossi-bè].

Xanothon oktodon.—Smith, 1956, p. 7, pl. 51K; 1959, p. 278, pl. 41K.—Munro, 1967, p. 436, fig. 825 [New Guinea].

Xanothon frenatus [not Lacepède] Smith, 1956, p. 5, pl. 42C.

Xanothon fowleri Smith, 1956, p. 5, pl. 42G; 1959, p. 268, pl. 42G.

See Schultz (1958, p. 61) for other synonyms.

Characterized by having 4 median predorsal scales, 2 rows of scales on cheek; pectoral rays ii,12; lips covering white teeth; black spot at upper base of pectoral fin.

Coloration of adult male in alcohol: Rear half of body pale (light green when alive) from below base of dorsal spines VII or VIII to just in front of anus, then anteriorly body dark (brownish green when alive); edges of both lips pale (green when alive); when alive, a red or green band to corner of mouth; behind crossband on chin a green band connecting with a green streak along midventral line to base of pelvis; lower side of head with a green blotch; on snout, dorsal to red (2nd) band a green band extend-

TABLE 8.—A comparison of certain features of the color pattern of *Scarus forsteri* and *S. taeniurus*

Characters	<i>forsteri</i>	<i>taeniurus</i>
Dark spot between dorsal spines I and II in juveniles and immature adults	absent	present
Distal margin of caudal fin with:	dusky band with a submarginal dark line	pale or very narrow white edge; no submarginal dark line
Caudal fin with dark vertical bars or cross-bars	absent	present
Caudal fin with lengthwise dark streaks	present	absent
Color pattern of snout and edges of upper lips of adults	green, forming a band that extends to the eye; no red interspace in green band across snout	very narrow green margin, then a pale interspace (red when alive) separating the broad band across snout that extends to eye

ing to below eye, thence to rear of operculum; distal edges of anal and of dorsal green, bounded submarginally by a black line; center of anal crossed by a narrow dusky streak; outer edges of caudal lobes green with a submarginal black line. Center of cheek pale, bright yellow when alive.

This species occurs abundantly in collections made in the Pacific Ocean, Indian Ocean, and Red Sea.

Among the species of *Scarus* with 4 predorsal scales, 2 rows of scales on cheek, ii,12 pectoral rays, and with lips mostly covering white teeth, great confusion exists as to how many species should be recognized.

Smith (1959, p. 278) recognized the following species in this relationship: *S. fowleri* (Smith), *S. bataviensis* Bleeker, *S. carifanus* (Smith), *S. venosus* Cuvier and Valenciennes, *S. oktodon* (Bleeker), and *S. margaritus* Cartier.

Scarus venosus with 4 vertical dark bars on the side was recognized by Schultz (1958, p. 60) as a valid species. *Scarus margaritus*, with the dark spot in the center of a pale caudal peduncular area, I reaffirm is a synonym of *Scarus sordidus*, which has ii,13 or less frequently ii,12 pectoral fin rays (Table 8). This leaves four of Smith's nominal species that I refer to the *taeniurus-forsteri* complex.

Fortunately the IIOE and other recent expeditions have collected specimens that make it possible for me to re-examine this complex problem. In general, two clearly defined species can be distinguished. They share certain characteristics such as a black spot at the dorsal base of the pectoral fin; and a dark submarginal line bordering the inner edge of the distinctly blue-edged dorsal and anal fins on the half-grown specimens and

adults. Table 8 lists the significant differences between the two species.

Smith (1959, pl. 42G) illustrates a parrotfish of this relationship as *S. fowleri* Smith 1956, and among the newly collected specimens is one, 275 mm standard length, on loan from Dr. Steinitz, from the Red Sea, and another, 220 mm, collected by the IIOE from the Indian Ocean. Both have color patterns as shown on Smith's Plate 42G (1959). Since both specimens have dark vertical color bars in the caudal fin, the distal blue edges of both dorsal and anal fins have black submarginal lines, a black spot at the upper edge of the pectoral base, exactly as shown in the illustration of *S. fowleri* (Smith), I conclude that the latter nominal species is probably the male of *S. taeniurus* Cuvier and Valenciennes. Smith seems to have been confused about the black pectoral spot because he states (1956, p. 5): "There is a black mark in the pectoral axil," but later (1959, p. 268) he says: "No dark spot on pectoral base." *Scarus fowleri*, however, does have the black spot at the upper edge of the pectoral base.

Schultz (1958, p. 52) incorrectly referred *fowleri* Smith to the synonymy of *Scarus javanicus* Bleeker; the latter differs by having 3 rows of scales on the cheek instead of 2 as in *S. fowleri*.

Scarus carifanus (Smith) (1956, p. 6, pl. 42D; 1959, p. 268, pl. 42D) also appears to be *S. taeniurus*. Smith (1959, p. 268) states: "I am inclined to suspect that *carifanus* Smith, 1956, is the female [of *fowleri*]."

Scarus baliensis Bleeker, 1849 (p. 8), presents confusion; the two types examined by me in the British Museum belong to different species. The one from Bali (Catalog No. 1861.2.28.48, standard length 98 mm,

with 4 predorsal scales, 2 rows of scales on the cheek, ii,12 pectoral rays, and dorsal edge of pectoral base with a black spot) is the same as *S. taeniurus* Cuvier and Valenciennes. I select this specimen as lectotype. The other specimen in the British Museum (Catalog no. 1864.5.15.23, with 3 rows of scales on the cheek) appears to be *S. formosus* Cuvier and Valenciennes.

Schultz (1958, p. 61) referred *Pseudoscarus baliensis* Bleeker [not Bleeker, 1849], 1862 (pl. 16: fig. 3), to *S. taeniurus*, but a reexamination of this plate shows 6 or 7 predorsal scales and 3 rows of scales on the cheek. Possibly the artist made an error in number of predorsal scales when he drew specimen number 1864.5.-15.23 since this type-specimen has only 4 predorsal scales. That plate is not positively identifiable.

An examination of the type of *Scarus bataviensis* Bleeker, 1857 (p. 342) (British Museum Catalog no. 1864.5.15.45, standard length 280 mm), reveals that the type has the same coloration as shown by Bleeker (1862, pl. 12: fig. 3). This type is selected as lectotype. *Scarus bataviensis* Bleeker therefore becomes a junior synonym of *S. taeniurus* Cuvier and Valenciennes.

Scarus scaber [in part] Cuvier and Valenciennes, 1839 (p. 14), is represented by two types in the Paris Museum, one of which (Catalog no. 588) was selected as lectotype by Schultz (1958, p. 92). The other (Catalog no. 1733) with 4 predorsal scales, 2 rows of scales on the cheek, ii,12 pectoral rays, black spot upper edge of pectoral base, and a brown spot between dorsal spines I and II is *S. taeniurus*.

The following are from the Chagas Archipelago, Diego Garcia Atoll, collected by the IIOE in 1967: Sta. HA67-3, 12 June, 5 spec., 39-69 mm; Sta. HA67-6, 14 June, 3 spec., 107-149 mm; Sta. HA67-38, 9 July, 3 spec., 91-122 mm; Sta. HA67-51, 23 July, 8 spec., 56-126 mm.

Dr. V. G. Springer collected the following in 1966 from One Tree Island off Queensland: Sta. VGS-66-13, 30 November, 1 spec., 102 mm; Sta. VGS-66-14, 1 December, 3 spec., 67-134 mm; Sta. VGS-66-19, 11 December, 6 spec., 58-100 mm.

Recently collected specimens: USNM 202519, Nossi-Bè, 1 spec.; USNM 202520, 1 from entrance Port Kilindini, 4°5'12"S, 39°40'45" E; USNM 202522, 1 from Comoro Islands; USNM 202521, 1 from Fiji; USNM 202523, 1 from Mentawai Islands, Indonesia; USNM 202524, 2 from Tulear Harbor, Madagascar; USNM 202525, 7 from Fiji; USNM 202574, 1 from near Aden;

USNM 202575, 6 from Red Sea; USNM 202577, 3 from Nossi-Bè; USNM 202579 and 202604, 23 from Amirantes Islands; USNM 202580, 1 from Comoro Islands; USNM 202595, 2 from Mauritius; USNM 202601 and 202603, 4 from North Island, Farquhar Islands; USNM 202605, 19 from Guam; USNM 202606, 1 from Bora Bora Island.

RANGE.—Hawaiian Islands, central and western Pacific Ocean, Indian Ocean, and Red Sea.

Scarus forsteri Cuvier and Valenciennes

Scarus forsteri Cuvier and Valenciennes, 1839, p. 275 [neotype: USNM 202607 from Tahiti].—Schultz, 1958, p. 64, figs. 2, 23; 1960, p. 246.

Scarus quoyi [in part] Cuvier and Valenciennes, 1839, p. 273, [only type no. A9292].

Pseudoscarus forskalii [in part] Klunzinger, 1871, p. 566 [type no. 71.7.15.4, in British Museum, seen by Smith, 1959, p. 268], and identified as *S. bataviensis* Bleeker].

Pseudoscarus filholi Sauvage, 1879, p. 225.

Scarus gilberti Jenkins, 1900, p. 59, fig. 17.

Scarus jenkinsi Jordan and Evermann, 1903, p. 195.

Xanothon bataviensis [not Bleeker] Smith, 1956, p. 6, pl. 41A; 1959, p. 268, pl. 41A.—Munro, 1967, p. 435, fig. 824 [New Guinea].

Xanothon parvidens Smith, 1956, p. 7, pl. 45e.

Schultz (1958, p. 64, figs. 9, 23) characterized this species as having 4 median predorsal scales, 2 rows of scales on cheek, ii,12 pectoral rays, lips nearly covering white teeth, black spot at upper base of pectoral fin, and both lips green edged, the green on upper lip forming a green band from snout to below eye, blackish submarginal line bordering blue distal edges of median fins, including caudal fin, latter with dark lengthwise streaks and rays red.

The validity of *Scarus forsteri* Cuvier and Valenciennes, 1839 (p. 275), as recognized by Schultz (1958, p. 64) was rejected by Smith (1956; 1959, p. 268) as unidentifiable. Unfortunately, Schultz (1958, pp. 64-66) did not give reasons for his identification and recognition of the earliest name, *S. forsteri*.

Following is a comparison of my translation of Cuvier and Valenciennes' description with that of Smith (1956, pl. 41A) (the latter description in brackets):

. . . green with red spots on the scales [blue-green with red margins on scales]; ventrally blue with 2 series of green spots [belly blue with 3 lengthwise purple streaks]; head green with blue lips [head blue-green with blue lips]; lower part of breast purple [this area green]; dorsal red with rays green [dorsal red], border blue [border blue]; anal with same color as dorsal [anal red, rays blue]; caudal crescent shaped [same with its borders blue, and rays red [borders blue, rays red].

Since the type of *S. forsteri* Cuvier and Valenciennes has been lost (Smith, 1959, p. 268), however, and confusion may exist as to its identity, I herewith select a neotype, USNM 202607, from its type-locality, Tahiti, collected by Dr. John Randall 21 April 1957. This specimen is 220 mm in standard length and exhibits all the characteristics listed above for the species.

Smith (1959) rejected *Scarus forsteri* and accepted *Xanothon bataviensis* Bleeker, 1857 (p. 342), as the valid name for this species; however, an examination of the type in the British Museum (Catalog no. 1864.5.15.45) reveals it is *S. taeniurus* and not this species.

The color illustration by Smith (1956, pl. 41A; 1959, pl. 41A) of *Xanothon bataviensis* has the characteristics of *S. forsteri* in regard to the blue distal edge of the caudal fin, the lengthwise red streaks on the caudal fin, the broad green band from the upper lip to the eye, and the absence of pale (red) edges on both lips. It appears that *S. forsteri* was not distinguished from *S. taeniurus* by Smith and this may explain some of the confusion in regard to the *foresteri-taeniurus* complex.

Smith (1959) and I agree that the following names are junior synonyms of *S. forsteri*: *Pseudoscarus forskalii* Klunzinger, 1871 (p. 566), and *Xanothon parvidens* Smith, 1956 (p. 7, pl. 45E).

Another available name is *Scarus quoyi* Cuvier and Valenciennes, 1839 (p. 273). This name, however, introduces some confusion because the two types in the Paris Museum represent two different species. Dr. Smith and I have examined these types and agree on their identification. One (Catalog no. A9292) is *Scarus forsteri*. The other (no. 579) is a junior synonym of *Scarus blochi* Cuvier and Valenciennes, 1839 (p. 219), and, for the purpose of greater stability in nomenclature, I select specimen number 579 as lectotype for *Scarus quoyi* Cuvier and Valenciennes.

Recently the following specimens were collected by the *Anton Bruun* (IIOE): USNM 202578, Sta. RS-41, KA39, 12 February 1968, Seychelles, 4 spec.; uncataloged, Sta. HA67-51, 23 July 1967, Diego Garcia Atoll, 2 spec., 140-141 mm.

RANGE.—Hawaiian Islands, central and western Pacific Ocean, and Indian Ocean.

Scarus enneacanthus Lacepède

Scarus enneacanthus Lacepède, 1802, p. 6 [Ile de France, holotype no. 2476 in Paris Museum; also a syntype of *S. capitaneus* Cuvier and Valenciennes].—Bauchot and Guibè, 1960, p. 293.

Scarus cyanescens Cuvier and Valenciennes, 1839, p. 254.—Schultz, 1958, p. 66, pl. 11A.

Scarus capitaneus Cuvier and Valenciennes, 1839, p. 228, pl. 403.—Bauchot and Guibè, 1960, p. 292 [syntypes 2473, 2475, 2476, B. 2040 and B. 2039].

Xanothon capitaneus.—Smith, 1956, p. 5, pl. 41F; 1959, pp. 268, 278, pl. 41F.

Callyodon capitaneus.—Fourmanoir, 1957, p. 185 [Anjouan Island].

?*Pseudoscarus chloromelas* Playfair and Günther, 1866, p. 109, pl. 15: fig. 1.—Smith, 1956, p. 6; 1959, p. 278.

Xanothon chloromelas.—Smith, 1959, p. 278.

?*Xanothon cyanotaenia* Smith [not Bleeker], 1956, p. 5, pl. 42E; 1959, pl. 42E [not identified in legend].

Callyodon cyanotaenia.—Marshall, 1965, p. 322.

Characterized by having 4 predorsal scales, 2 rows of scales on cheek, ii,13 pectoral rays; no black spot on base of pectoral; edges of all median fins and pelvics sharply margined with white, probably blue when alive, body brown in alcohol, head with a frontal swelling.

The syntype (no. 2476) of *S. capitaneus* Cuvier and Valenciennes, in the Paris Museum, is a dried skin without any coloration remaining. It has 4 predorsal scales, 2 rows of scales on the cheek; ii,13 pectoral rays and not ii,12 as recorded by Smith (1959, p. 268). Smith's Plate 41F (*X. capitaneus*) looks very much like Plate 403 (*S. capitaneus*) in Cuvier and Valenciennes (1839). Bauchot and Guibè (1960, p. 292) have identified *S. capitaneus* Cuvier and Valenciennes as the same as *S. enneacanthus* Lacepède, and I have identified *S. cyanescens* Cuvier and Valenciennes (type no. 586) as the same as *S. capitaneus*. Since the holotype (no. 2476) of *S. enneacanthus* is also a syntype of *S. capitaneus*, the latter species is an objective synonym of *S. enneacanthus* Lacepède.

RANGE.—Western Indian Ocean.

Scarus rhoduropterus (Bleeker)

PLATE 4B

Pseudoscarus rhoduropterus Bleeker, 1861, p. 233; 1862, p. 27, pl. 4: fig. 1.

Xanothon rhoduropterus.—Smith, 1956, p. 6, pl. 44K; 1959, p. 278, pl. 44K.

Scarus rhoduropterus.—Schultz, 1958, p. 67, pl. 11B.

Characterized by having 4 median predorsal scales, 2 rows of scales on cheek, ii,13 pectoral rays, lips not covering bluish-gray to white teeth; base pectoral same color as body, latter reddish brown; 4 or 5 vertical dark bars on side.

I have studied three specimens, 141–185 mm, USNM 202383, recently collected by the IIOE in the Indian Ocean, and 24 others. 74–190 mm, USNM 202276, 202352, 202353, and 202620, collected by the *Te Vega* Expeditions in the tropical western Pacific Ocean. The IIOE also collected one specimen, USNM 202386, in the Red Sea and two, 103–124 mm, from the Chagas Archipelago, Diego Garcia Atoll, Sta. HA67–6, 14 July 1967.

RANGE.—Central and western Pacific Ocean and western Indian Ocean.

Scarus sordidus Forskal

PLATE 4C

Scarus sordidus Forskål, 1775, pp. x, 80 [neotype: USNM 202297; Red Sea].—Schultz, 1958, p. 68, fig. 11, pl. 12A, B; 1960, p. 246.—Gosline and Brock, 1960, p. 238 [Hawaiian Islands].—Kamohara, 1963, p. 60, pl. 3: fig. 1 [Japan].—Woodland and Slack-Smith, 1963, p. 46 [Heron Island].

Callyodon sordidus.—Fourmanoir, 1957, p. 187 [Nossi-Bé].

Xanothon sordidus.—Munro, 1967, p. 437, fig. 827 [New Guinea].

Scarus purpureus Cuvier and Valenciennes, 1839, p. 277.

Callyodon purpureus.—Jordan and Seale, 1906, p. 316, fig. 57.

Callyodon bipallidus Smith, 1955, p. 936.

Xanothon bipallidus.—Smith, 1956, p. 5, pl. 41D; 1959, pp. 266, 268, 278, pl. 41D.

Xanothon margaritus Smith, 1956, p. 7, pl. 45G; 1959, pp. 269, 278.

Xanothon erythrodon Smith, 1956, p. 7, pl. 45F; 1959, pp. 269, 278.—Munro, 1967, p. 436, fig. 826 [New Guinea].

See Schultz (1958, pp. 68–69) for other synonyms.

Characterized by having 4 median predorsal scales, 2 rows of scales on cheek, pectoral rays ii,13, occasion-

ally ii,12; lips not covering white teeth, which become greenish in adult males. Juveniles brown to reddish brown with a pale (pink) caudal area that has a round, dark blotch at base of caudal fin. See Schultz (1958, pp. 69–71) for color description of adults.

In 1956 J. L. B. Smith established the new species *Xanothon bipallidus* with this comment: "Recorded by many workers as *sordidus* Forskål, 1775, but it is not possible to be certain of Forskål's species. This name is assigned until it can be settled which has valid priority." Schultz (1958, p. 131) accepted *Scarus bipallidus* (Smith) as distinct from the species that he recognized as *Scarus sordidus* from the western tropical Pacific Ocean. Because Schultz did not have enough adult specimens of the Red Sea *sordidus* nor the Indian Ocean *bipallidus*, he was unable to evaluate the *sordidus* complex. Since then the International Indian Ocean Expeditions collected excellent series of specimens of *sordidus* from the Red Sea and the Indian Ocean.

Fortunately, this excellent series of specimens, along with additional material from the western Pacific listed by Schultz (1958, pp. 71–72) has made it possible to compare the populations of the *S. sordidus* complex in the Red Sea and in the Pacific and Indian Oceans. *Scarus sordidus* is one of the most abundant parrotfishes in the Indian and Pacific Oceans. It occurs more often and in greater numbers in the collections I have studied than any other species.

I counted the number of fin rays and scales (Table 9) and observed that no significant differences occur in counts among the three localities.

I compared the color patterns of juveniles, females, and of adults in the green color phase from the Red

TABLE 9.—Frequency distribution of number of fin rays and cheek scales for *Scarus sordidus*

Locality	Number of cheek scales										Number of pectoral rays			Total pectoral rays and cheek scales											
	dorsal row				ventral row				total		ii, 12	ii, 13	ii, 14	average	36	37	38	39	40	average					
	5	6	7	average	5	6	7	8	average	10											11	12	13	14	average
Red Sea	8	21	1	5.77	7	17	4	5.89	2	11	15	3	11.61	13	57	4	12.89	5	11	10	4	1	37.74		
Indian Ocean	8	12		5.60	1	9	10	1	6.52		4	11	3	1	12.05	6	45	12.88	1	6	8	4	1	37.97	
Pacific Ocean	21	39	3	5.71	4	30	24	1	6.37		12	9	6	2	11.66	6	131	4	12.98	1	12	10	4	2	37.90

Sea, Indian Ocean, and Pacific Ocean directly by use of preserved specimens, color slides, color drawings, and color illustrations in the literature from all three areas.

The most characteristic color pattern for juveniles (preserved in alcohol) between 12 and 60 mm is the striped color phase described by Schultz (1958, p. 70). The description needs no changes because of the additional specimens examined from the Red Sea, Indian, and Pacific Oceans.

The reddish-brown color phase is found on specimens from 50 to 200 mm and my description (Schultz 1958, p. 70) needs little change. It applies to specimens from all three areas except that I have not found juveniles or immature specimens with a few silvery scales as occasionally has occurred in the large series examined from the Marshall Islands and Philippine Islands and illustrated by Schultz (1958, pl. 12A). The dark caudal spot in the center of the light caudal area may disappear as this color phase passes into the adult green color phase (probably males).

The pale caudal peduncle begins at a line connecting the rear basal edges of the dorsal and anal fins and appears to be of similar extent in specimens from the Red Sea, the Indian Ocean, and the Pacific Ocean (Table 10).

I compared the color markings of the head and find considerable variability around a basic pattern (Plate 4c). I did not observe any consistent differences in color patterns for the populations of *S. sordidus* in the three seas.

The width of the two color bands of the anal fin were measured at the midlength of the base of the anal fin, and the width of the distal band was calculated as a percentage of the length of the middle anal ray. These data, recorded in Table 11, show a possibility of

TABLE 10.—Frequency distribution of the length of the pale portion of the caudal peduncle of *Scarus sordidus* (in thousandths of standard length)

Locality	131	141	151	161	171	181	191	201	211
	140	150	160	170	180	190	200	210	220
Red Sea				1	1	2	1		
Indian Ocean				2		1	2		
Pacific Ocean	2	2	2	3				1	1

TABLE 11.—Frequency distribution of the width of the distal color band of the anal fin of *Scarus sordidus* (in percentages of the length of the middle soft anal ray)

Locality	36	41	46	51	56	61	66	71
	40	45	50	55	60	65	70	75
Red Sea	1					1		
Indian Ocean			1	2	2			
Pacific Ocean		1		1	2	1	5	2

being wider in the western Pacific than in the Indian Ocean and Red Sea. The variability, however, is so great that I conclude a subspecies should not be recognized until a larger series of adult specimens are studied to determine if a significant difference exists. The only other character that might indicate a population difference is the occasional occurrence of light scales (Schultz 1958, pl. 12A) on the immature stage. This, too, needs further study before a population is recognized subspecifically.

I have shown in this study that the Red Sea and Indian Ocean populations of *S. sordidus* are identical. It must be concluded, therefore, that *X. bipallidus* Smith is a junior synonym of *Scarus sordidus* Forskål.

NEOTYPE.—The identity of *Scarus sordidus* Forskål has not been universally accepted. In order to bring greater nomenclatural stability to the Scaridae since the type material of *S. sordidus* Forskål no longer exists (Klausewitz and Nielson, 1965, p. 12), I herewith select a neotype for *Scarus sordidus* Forskål: USNM 202297, adult male, 210 mm standard length, collected by IIOE, Red Sea off Hurghada, Egypt, Sta. HA-36.

The following collections from the Red Sea were loaned for study by Dr. H. Steinitz: E62-3676-C-1, 6 April 1962, Um Aabak, 1 spec., 49 mm; E-62-3676-C, 18 March 1962, Nacra, 2 spec., 46-90 mm; E62-3342, 4 April 1962, Entedebir, 1 spec., 138 mm; E62-518, 23 March 1962, Um Aabak, 1 spec., 47 mm.

The following specimens were collected by the IIOE in the Red Sea: USNM 202388, Sta. HA-26, 30 December 1964, Strait of Jubal, 4 spec., 44-105 mm; USNM 202382, Sta. HA-29, 1 January 1965, 12 spec., 38 to 69 mm; USNM 202393, Sta. HA-30, 2 January 1965, 1 spec., 48 mm; USNM 202397, Sta. HA-31, 3 January 1965, 5 spec. 32 to 57 mm; USNM 202481, Sta. HA-32, 4 January 1965, 1 spec.; USNM 202405, Sta. HA-34, 5 January 1965, 3 spec., 36 to 57 mm;

uncataloged, Sta. HA-35, 6 January 1965, 4 spec., 33-59 mm; USNM 202297, and 202391, Sta. HA-36, 7 January 1965, 19 spec. 37 to 210 mm (photo of 210-mm specimen neg. no. 283); USNM 202402, Sta. HA-38, 10 January 1965, 1 spec., 57 mm.

The following specimens were collected by the IIOE in the Indian Ocean: From Nossi-Bè, Madagascar: USNM 202410, Sta. JR-72, 14 February 1964, 1 spec., 150 mm; USNM 202404, Sta. JR-76, 18 February 1964, 1 spec., 69 mm; USNM 202411, Cruise 6, 12 June 1964, reef off Port Louis Harbor, 1 spec., 115 mm. From the Comoro Islands: USNM 202395, Sta. HA-9, 24 November 1964, 2 spec., 37-38 mm; USNM 202412, Sta. HA-12, 26 November 1964, 2 spec., 164-180 mm; USNM 202359, FT-12, 26 November 1964, 1 spec., 225 mm. From Aldabra Island: USNM 202392, Sta. HA-16, 3 December 1964, 11 spec., 23 to 57 mm; USNM 202361, Sta. HA-17, 4 December 1964, 6 spec., 22-210 mm; USNM 202360, Sta. RS-37, 6 December 1964, Farquhar Islands, 10°07'S, 51°10'E, 35 spec. 61-190 mm. From Amirantes Islands: USNM 202408, Sta. HA-19, 8 December 1964, 27 spec., 28 to 82 mm; USNM 202362, Sta. RS-41 KA-39, 8 December 1964, 23 spec., 65-180 mm; USNM 202358, FT-26, 21 December 1964, Gold Mohur Bay, Aden, 1 spec., 225 mm.

The following specimens were collected by the *Te Vega* Expeditions in the western Pacific Ocean: From off Thailand, uncataloged, Sta. 56, 3 November 1963, 1 spec., 79 mm, and USNM 202406, Sta. 78, 3 November 1963, 5 spec.; USNM 202407, Sta. 104, 30 November 1963, off Pulo Siburu, Mentawai Islands, Indonesia 4 spec., 33-109 mm; USNM 202396, Sta. 112, 6 December 1963, Pulo Stupai, Sanding Island, Mentawai Islands, 2 spec., 63-68 mm; USNM 202400, Sta. 213, 1 February 1965, Pulau Gaya, Darvel Bay, Borneo; USNM 202409 and 202625, Sta. 216, 2 February 1965, Pulav Bohidulong east end Borneo, 6 spec., 22-122 mm; USNM 202399, Sta. 234, 25 February 1965, Keraward Island, St. George's Channel, 3 spec., 13-46 mm; USNM 202363, Sta. 247, 11 March 1965, Solomon Islands, Tautsina Island, Bougainville, 7 spec., 36 to 185 mm; USNM 202413 and 202482, Sta. 259, 16 April 1965, Vanikoro Island, Peu Bay, 4 spec., 40-120 mm; USNM 202394, Sta. 278, 8 May 1965, Great Astrolabe Reef, north of Vuro Island, 7 spec., 35-85 mm; USNM 202398, Sta. 295, 26 May 1965, Wailangilala Island, Fiji, 1 spec., 55 mm. Uncataloged: From Tutuila Island: Sta. 21, 19 August 1963,

8 spec., 29-73 mm; Sta. 35, 3 September 1963, 1 spec., 23 mm.

The following specimens were collected by Dr. John Randall: USNM 202401, Maiai Island, Takahau Atoll, Tuomotu Islands, 14 April 1957, 1 spec., 23 mm; USNM 202364, Takahau Atoll, Matite Island, 15 April 1957, 39 spec., 23-195 mm; USNM 202366, Papeete, Tahiti, Market, 18-21 April 1957, 205-230 mm.

Dr. V. G. Springer collected 8 lots, totaling 27 specimens, 28-200 mm, at One Tree Island off Queensland during November and December 1966.

The IIOE collected the following specimens during 1967 from the Chagas Archipelago, Diego Garcia Atoll: Sta. HA3, 12 June, 4 spec., 48-187 mm; Sta. HA7, 15 June, 14 spec., 59-147 mm; Sta. HA8, 16 June, 2 spec., 49-66 mm; Sta. HA11, 18 June, 1 spec., 72 mm; Sta. HA14, 21 June, 2 spec., 109-124 mm; Sta. HA16, 22 June, 4 spec., 69-178 mm; Sta. HA36, 7 July, 11 spec., 55-97 mm; Sta. HA38, 9 July, 7 spec., 117-175 mm; Sta. HA45, 16 July, 1 spec. 210 mm; Sta. HA49, 12 spec., 25-52 mm.

RANGE.—Hawaiian Islands, central and western Pacific Ocean, Indian Ocean, and Red Sea.

Scarus troscheli Bleeker

Scarus troscheli Bleeker, 1853, p. 498.—Schultz, 1958, p. 67, fig. 10.

Pseudoscarus troschelli.—Bleeker, 1862, p. 25, pl. 7: fig. 2. *Scarus quoyi* [not Cuvier and Valenciennes].—Bleeker, 1853, p. 607.

Pseudoscarus quoyi [not Cuvier and Valenciennes].—Bleeker, 1862, p. 29, pl. 6: fig. 3.

Callyodon bleekeri Weber and de Beaufort, 1940, p. 318.

Scarus bleekeri.—Schultz, 1958, p. 68, pl. 11c.

Xanothon bleekeri.—Munro, 1967, p. 436, fig. 827 [New Guinea].

Characterized by 4 median predorsal scales, 2 rows of scales on cheek, ii, 13 pectoral rays; lips not covering yellowish teeth. Color when alive: a yellowish rectangular blotch on side of head bordered by a green streak from corner of mouth past lower edge of eye, thence curving backward and downward toward upper pectoral base, sometimes meeting green streak that extends from corner of mouth across opercle toward lower edge of pectoral base; edge of both lips green; green anal fin crossed at its middle by an oblique reddish or green streak; no dusky edge or streak along distal edge of anal fin; green dorsal fin is crossed by 2 red streaks; caudal fin green with a red streak in outer

part of each caudal lobe. No dark spot on pectoral base.

Specimens: USNM 202691, *Te Vega* Cruise 6, Sta. TV-247, 11 March 1965, Solomon Islands, Tautsina Island, 8 spec., 172-245 mm.

I believe that *Callyodon bleekeri* Weber and de Beaufort (= *Pseudoscarus quoyi* [not Cuvier and Valenciennes] Bleeker) is the same species as *S. troscheli* Bleeker. This opinion is based on identical counts for fin rays and scales, identical color pattern in anal and dorsal fin, especially the anal with an oblique streak across middle of fin in combination with the absence of a dusky edge distally on margin of fin. The color markings of the cheek area are sufficiently similar to be within the range of variability for a species of parrotfish.

RANGE.—Western Pacific Ocean.

Scarus bowersi (Snyder)

FIGURE 1, PLATE 4D

Callyodon bowersi Snyder, 1909, p. 602; 1912, pl. 46: fig. 2. *Scarus bowersi*.—Schultz, 1958, p. 72, pl. 11D.—Kamohara, 1963, p. 10, pl. 3: fig. 2 [Japan].

Characterized by having 4 median predorsal scales, 2 rows of scales on cheek; ii,13 pectoral rays; white

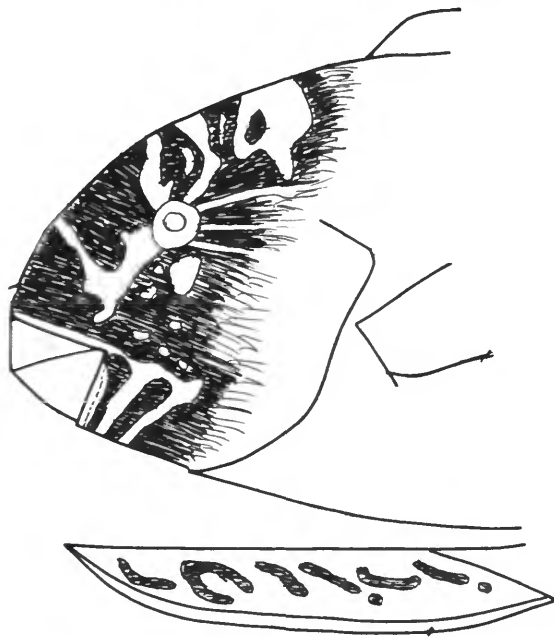


FIGURE 1.—*Scarus bowersi*, a specimen from Tahiti, 305 mm, collected by Dr. Randall, 21 April 1957.

teeth; a purplish or brownish blotch on dorsal surface of snout, a red or orange area behind eye that extends from level of eye to behind head a distance about equal to postorbital length of head thence ventrally to pectoral fin base, a red streak across base of anal fin and no dusky margin distally on anal fin; outer two-thirds of anal green; red or green streaks across inter-orbital space.

RANGE.—Western Pacific Ocean.

Scarus jonesi (Streets)

Pseudoscarus jonesi Streets, 1877, p. 80.

Scarus jonesi.—Schultz, 1958, p. 72, fig. 12, pl. 13A; 1960, p. 247.

See Schlutz (1958, p. 72) for other synonyms.

Characterized by having 4 median predorsal scales, 2 rows of scales on cheek, ii,13 pectoral rays, lips not covering yellowish teeth. In the young, background brownish with center of each scale brownish; distal margin of caudal fin white, pectoral fin pale. In green color phase, scales green with centers orange; membranes between rays of median fins greenish; dorsal and ventral edges of caudal fin green; outer edge of pelvics green; 2 green streaks extending behind orbit separated by orange coloration; dorsal edge of pectoral green; green blotches on head separated by orange; eye orange. Upper lip edged with red or green.

RANGE.—Central Pacific Ocean.

Scarus capistratoides Bleeker

PLATE 4E

Scarus capistratoides Bleeker, 1849, p. 50.—Schultz, 1958, p. 74, pl. 12C, D.

Xanothon capistratoides.—Smith, 1956, p. 6, pl. 43A, B; 1959, p. 268, pl. 43A, B.

Scarus cyanotaenia Bleeker, 1854 p. 197 [type: Catalog no. 1864.5.15.28 British Museum, has ii, 3 pectoral rays].

Pseudoscarus cyanotaenia.—Bleeker, 1862, p. 28, pl. 6: fig. 1. *?Xanothon erythron* [not Cuvier and Valenciennes].—Smith, 1956, p. 7, pl. 45E.

See Schultz (1958, p. 74) for other synonyms.

Characterized by having 4 median predorsal scales, 2 rows of scales on cheek; ii,13 pectoral fin rays, and lips not covering white teeth; edges of dorsal and anal fins blue or green, middle red, base blue or green; caudal region with red spots, one on each scale; distal part of caudal fin green, basally red; cheek pink; edges of upper and lower lips red, then a green cross-

band, one on snout extends to below eye, thence to rear of opercle; distal margin of operculum red.

A male has the dorsal part of the head dark back to about the base of dorsal spine IV, thence ventrally to the origin of the anal fin; posterior to this dark oblique bar, the body is abruptly pale.

Schultz (1958) referred *Scarus cyanotaenia* Bleeker, 1854 (p. 197), to the synonymy of *S. forsteri*, and Smith (1959, p. 268) identified it as "unquestionable" *Scarus capistratoides* Bleeker, 1849 (p. 50). Both of us have examined the type in the British Museum (Catalog no. 1864.5.15.28). I made the following notes on the type in 1953: ". . . median predorsal scales 4: rows of scales on cheek, both sides, are 6-7-0 and 6-6-0; pectoral rays ii,13-ii,13. Distal edges of both dorsal and anal fins narrowly dusky; dorsal with median dusky streak; rest of fin lighter; anal pale with barely discernable median dusky streak; Weber and de Beaufort mention a dark spot at upper base of pectoral (red-violet spot mentioned by Bleeker) which certainly is not now visible on the type." Without the dark spot and ii,13 pectoral rays I accept Smith's opinion.

Schultz (1958, p. 74) referred Smith (1956, pl. 43B) to the synonymy of *Scarus forsteri*, which probably was an error since that plate represents this species.

Among the reddish-brown parrotfishes reaching up to 9 inches in standard length and having 4 median predorsal scales, 2 rows of scales on the cheek, ii,13 pectoral rays, white teeth, and no black spot at dorsal edge of pectoral base, I find the following nominal species with the above listed characters: *Scarus enneacanthus* Lacépède (= *S. cyanescens* Cuvier and Valenciennes = *S. capitaneus* Cuvier and Valenciennes); *S. rhoduropterus* Bleeker; *S. troscheli* Bleeker (= *C. bleekeri* Weber and de Beaufort); *S. sordidus* Forskål; *S. bowersi* (Snyder); *S. jonesi* (Streets); *S. capistratoides* Bleeker.

The following species listed above may be distinguished from the plain reddish-brown ones by certain characteristic color marks: *S. enneacanthus* has the distal margins of the median fins narrowly margined with blue, and a green body; *S. rhoduropterus* has 4 or 5 dark vertical bars on the side of the body; *S. troscheli* has a dusky color streak across the middle of the anal fin, distinctive color marks on the side of the head (Schultz, 1958, p. 38, fig. 10) and a distinctive yellow blotch on cheek bordered by a narrow green band; *S. sordidus* has a pale peduncular region with a dark spot at base of caudal fin; *S. bowersi* and *S. jonesi*

both have a distinctive coloration as shown by Schultz (1958, p. 72, figs. 12, 13A; pl. 12D).

Scarus capistratoides is known only from adults with the green color pattern, in which the edges of both lips are red. Smith (1956, 1959) recognized *Xanophon erythrodon* (not Cuvier and Valenciennes) Smith as occurring in vast shoals in the western Indian Ocean; however, my examination of the type of *S. erythrodon* Cuvier and Valenciennes (Catalog no. 575), with ii,12-ii,13 pectoral rays, revealed it to be *S. sordidus*, a species the young of which occur in vast schools on the reefs.

Newly collected specimens from the Indian Ocean up to 225 mm in standard length are certainly the same species as *X. erythrodon* (not Cuvier and Valenciennes), Smith 1956 (pl. 45F). In the largest of my specimens the edges of the lips are pale (probably red when alive) as in *S. capistratoides*. I am unable to determine the sex for these specimens. I suggest that these may be the immature stage of *S. capistratoides*, a problem that can best be studied in the field on living specimens—possibly by injection of testosterone.

A recently collected specimen: USNM 202622, *Te Vega* Sta. TV-247, 11 March 1965, Bougainville, Tautsina Island.

RANGE.—Western Pacific Ocean and Indian Ocean.

Subgenus *Xenoscarops* Schultz

Xenoscarops Schultz, 1958, p. 23.

Xenoscarops Schultz is placed as a subgenus of *Scarus* because in *X. perrico* (Jordan and Gilbert) juveniles have a few rudimentary teeth next to the main row on the upper pharyngeals. Also, discovery in the Red Sea of a new species with five median predorsal scales and two rows of scales on the cheek, similar to *X. perrico*, with a rudimentary row of teeth next to the main row on the upper pharyngeals, indicates a relationship to genus *Scarus*. This new arrangement, however, is open to question since *X. perrico* has 9-13+21-28 gill rakers and *S. fehlmanni*, new species, has 25+33 gill rakers on the first arch.

RANGE.—Eastern Pacific Ocean and Red Sea.

Scarus perrico Jordan and Gilbert

Scarus perrico Jordan and Gilbert, 1881, p. 357.

Scarops perrico.—Schultz, 1958, p. 23, fig. 3, pl. 2A,B.—Briggs, 1964, p. 708.—Hobson, 1965, p. 295 [behavior].

See Schultz (1958, p. 23) for other synonyms.

Characterized by having 5 median predorsal scales, 2 rows of scales on cheek; pectoral rays ii,12, rarely ii,13; lips not quite covering green teeth (white in juveniles); coloration plain dark olive green, young with 2 or 3 brown crossbars on underside of head, and sides of young indistinctly barred. Median fins dark blue-green, paired fins green; blue lines scattered around and radiating from eye; snout with hump in adults; caudal fin rounded in young becoming truncate, then with pointed lobes in largest adults.

RANGE.—Eastern Pacific Ocean.

Scarus fehlmanni, new species

FIGURE 2

Holotype, USNM 202419, from the Red Sea, Strait of Jubal, 27°16'40" N, 33°46'50" E, collected by H. A. Fehlmann and Hussein K. Badawi, IIOE Sta. HA-34, 5 January 1965, 0–15 ft; standard length 248 mm, total length 295 mm, immature male.

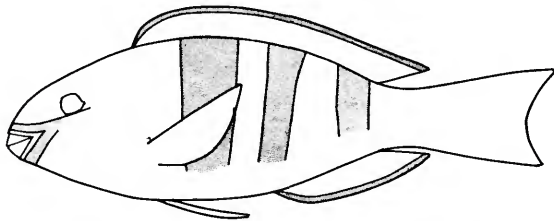


FIGURE 2.—Diagrammatic sketch, by author, of *Scarus fehlmanni*, new species, based on holotype, USNM 202419, and a paratype, USNM 202415.

Paratypes collected by IIOE, Red Sea: USNM 202415, Sta. HA-29, 1 January 1965, 27°16'46" N, 33°46'25" E, 8 ft, 1 spec., 173 mm; USNM 202417, Sta. HA-35, 6 January 1965, 27°16'15" N, 33°47'30" E, 0–10 ft, 1 spec., 97 mm; USNM 202418, Sta. HA-38, 10 January 1965, 27°18'50" N, 33°47'35" E, 0–15 ft, 1 spec., 96.5 mm; USNM 202416, Sta. HA-34, 5 January 1965, 27°16'40" N, 33°46'50" E, 0–15 ft, 2 spec. 99–104 mm.

The following counts made on the holotype and 5 paratypes were constant: dorsal rays IX,10; anal, III, 9; pectoral ii,13 on both sides; pelvic I,5; branched caudal 6+5; pores in lateral line 18+5; median predorsal scales 6, scales in 2 rows on cheek.

The scales on the cheek varied from 5 to 6 in both rows. No specimen had a scale that formed a third row of cheek scales. The holotype has 25+33=58 gill rakers on the first arch.

Upper pharyngeals with one main row of teeth and a rudimentary outer row beside the main row. Lips not quite covering white teeth. Gill membranes attached far forward with a free fold across isthmus. Interorbital area strongly convex.

Measurements made on the holotype and five paratypes are recorded in thousandths of the standard length (Table 12).

Color in alcohol: Head and body light brown, straw colored ventrally, including caudal peduncle; side of body with 3 dusky vertical bars, 1st below bases of dorsal spines 4 to 8, 2nd below bases of soft dorsal rays 1 to 3, and 3rd below soft dorsal rays 6 to 8. Dorsal edge of pectoral dark and outer edges of pelvic fins dusky. Distal edges of dorsal and anal fins with a dark band. Possibly a narrow band along base on anal. Edge of lower lip pale, behind which appears a dusky crossbar. Dorsal part of head dusky with a trace of dark band extending from snout to just below eye. Coloration has faded in preservation so much that no additional color pattern can be detected.

This new species of parrotfish combines 6 predorsal scales with only 2 rows of scales on the cheek. All species in the subgenus *Callyodon* have 5 to 8 predorsal scales and 3 or 4 rows on the cheek. It differs from *S. perrico* in having 25+44 gill rakers instead of 9 to 13 + 21 to 28, and ii,13 pectoral rays instead of ii,12 as in *S. perrico*.

The species is named in honor of my colleague, Dr. H. Adair Fehlmann, of the Smithsonian Institution, who made a special effort to collect parrotfishes in the Red Sea for my studies. I gratefully acknowledge his full cooperation.

RANGE.—Red Sea.

Subgenus *Callyodon* Scopoli

Callyodon [on Gronow] Scopoli, 1777, p. 449.

Calliodon.—Walbaum, 1792, p. 649.

Hemistoma Swainson, 1839, p. 226.—Schultz, 1958, p. 74.

Erychthys Swainson, 1839, p. 226.

Loro Jordan and Evermann, 1896 [1895], p. 418.

Characterized by having 5 to 8 median predorsal scales and 3 or 4 rows of scales on cheek.

RANGE.—Atlantic, Pacific, and Indian Oceans.

Scarus dimidiatus Bleeker

PLATE 5A

Scarus dimidiatus Bleeker, 1859, p. 17.—Schultz, 1958, p. 74, pl. 14A, B.

TABLE 12.—Measurements made on *Scarus* (*Xenoscarops*) *fehlmanni*, new species (in thousandths of the standard length)

Characters	Holotype	Paratypes				
	USNM 202419	USNM 202415	USNM 202416	USNM 202416	USNM 202417	USNM 202418
Standard length	248	173	104	99	97	96.5
Length of head	344	370	340	354	361	352
Greatest depth	362	358	355	352	356	361
Snout length	147	144	128	131	134	125
Eye diameter	58	61	71	73	72	71
Preorbital width	78	75	63	67	65	66
Least fleshy interorbital width	113	107	108	104	113	107
Postorbital length head	164	166	163	170	168	170
Least depth caudal peduncle	128	139	134	136	141	145
Length caudal peduncle	141	165	153	127	139	145
Longest fin rays						
Spine of dorsal	145	142	125	134	149	150
Soft dorsal	121	130	123	136	124	142
Spine of anal	115	116	109	105	115	108
Soft anal	117	113	102	115	115	118
Pectoral	214	211	214	222	215	212
Pelvic	182	162	192	195	186	178
Caudal	238	234	241	252	241	223
Length shortest caudal ray	185	222	232	252	—	218

Characterized by having 5 or 6 median predorsal scales; 3 rows of scales on cheek, with 2 to 4 scales in ventral row; ii,12 pectoral rays, and lips not covering white teeth. Coloration consists of a conspicuous arch-shaped light (green when alive) band from below corner of mouth to just under orbit, thence toward pectoral fin base; this band is bordered above behind eye by a broad dark brown band that curves downward to upper pectoral base; anterior half of body pale, posteriorly abruptly darker, beginning below, dorsal spines VI or VII; middorsal part of snout in front of eyes with a large squarish dark blotch; upper lip with a broad pale band; distal four-fifths of anal fins green when alive and basal one-fourth red; distal edge of dorsal fin dark, then submarginally a pale streak, the basal three-fourths darker.

Synonymy unchanged from Schultz (1958, p. 74).

Specimens: USNM 202518, *Te Vega* Expedition, Sta. 216, Darval Bay, Borneo, 2 February 1965, 3 spec., 116–137 mm.

RANGE.—Central and western Pacific Ocean.

Scarus globiceps Cuvier and Valenciennes

Scarus globiceps Cuvier and Valenciennes, 1839, p. 242.—Schultz, 1958, p. 75, pl. 14c; 1960, p. 247.—Kamohara,

1963, p. 13 [Japan].—Woodland and Slack-Smith, 1963, p. 45 [Heron Island].

Pseudoscarus spilonotus Kner, 1868, p. 352, pl. 9: fig. 26.—Ladiges, 1958, p. 169 [location of type].

Scarus pronus Fowler, 1899, p. 490, pl. 18: lower fig. 3. *Callyodon globiceps*.—Smith, 1956, p. 14, pl. 44L; 1959, p. 279, pl. 44L.—Marshall, 1965, p. 323.

Characterized by having 5 or 6 median predorsal scales, 3 rows on cheek with 2 or 3 scales in ventral row; ii,12 pectoral rays; lips almost covering white teeth, green in large adults; coloration of body of adults generally bluish green, center of scales green on posteroventral sides of body, anterodorsally scales with few to several small green spots; lower half of head below eye green; pale streak from middle of snout to eye separates green streak above from the green snout below pale streak; base of pectoral purplish black; black ocellate spot near bases of dorsal spines III or IV, in the drab color phase may be absent in large adults; outer third of anal fin dusky (green when alive), center pale (red when alive) and base with dusky (green) spots between rays, dorsal fin of similar coloration.

RANGE.—Central and western Pacific Ocean and Indian Ocean.

Scarus chlorodon Jenyns

PLATE 5B

Scarus chlorodon Jenyns, 1842, p. 105, pl. 21.—Schultz, 1958, p. 86, fig. 15, pl. 17B, c; 1960, p. 249.—Kamohara and Yamakawa, 1967, p. 14 [Ishigakijima].

Callyodon chlorodon.—Munro, 1967, p. 439, fig. 835 [New Guinea].

Scarus singaporensis Bleeker, 1852, p. 69.

Pseudoscarus singaporensis.—Bleeker, 1862, p. 31, pl. 13: fig. 1.

Callyodon singaporensis.—Smith, 1956, p. 12; 1959, pp. 272, 279.

Scarus xanthopleura Bleeker, 1853, p. 499.

Pseudoscarus xanthopleura.—Bleeker, 1862, p. 24, pl. 7: fig. 1.

Pseudoscarus altipinnis Steindachner, 1879, p. 18.—Günther, 1909, p. 326, pl. 160.

Callyodon waitei Seale, 1906, p. 60, fig. 15.

Pseudoscarus godeffroyi Günther, 1909, p. 326, pl. 159.

Pseudoscarus brevifilis Günther, 1909, p. 327, pl. 161.

Scarus brevifilis.—Schultz, 1958, p. 76, pl. 13B-D; 1960, p. 248.—Kamohara, 1963, p. 14.

Callyodon improvisus Smith, 1956, p. 12, pl. 41E; 1959, pp. 272, 279, pl. 41E.

Callyodon aeruginosus [not Cuvier and Valenciennes; in part *C. pindae*].—Smith, 1959, p. 279.

Callyodon pindae Smith, 1956, p. 11, pl. 45I; 1959, p. 272.

Callyodon ovifrons [not Temminck and Schlegel].—Masuda and Tanaka, 1962, p. 91, figs. 40, 41 [young from Japan].

Characterized by having 5 to 7 medium predorsal scales, 3 rows of scales on cheek, with 1 to 3 scales in ventral row; ii,13 pectoral rays; lips not covering green teeth. Large adults with a characteristically elongate dorsal fin ray near middle of length of that fin. Coloration of immature brownish violet or greenish violet; numerous scales with a white spot, a few white spots as large as pupil; some white on pectoral base; greenish spots may occur on head; lips dark red; distal edge of dorsal and anal fins violet or brownish violet.

Coloration of large adult males dark greenish with lighter green spots on scales, mostly posteriorly; head marked with orange bars, brightest around mouth; eye orange; dorsal and anal fins edged with dark green or blue, then yellowish submarginally, green elongate blotches near rays; central area of anal fin orange basally green; caudal fin green, except that distal margin orange, basally there is mixture of orange and brownish-green blotches.

Lower part of head behind mouth with characteristically V-shaped or double V-shaped green blotches, sometimes joined so as to cover most of underside of head.

Schultz (1958, p. 96) placed *Callyodon pindae* Smith as a synonym of *S. aeruginosus* Cuvier and Valenciennes; however, a restudy indicates it is the juvenile of *S. singaporensis* Bleeker. The young of *S. aeruginosus* do not have a white caudal peduncle or a white caudal fin.

A study of recently collected specimens from the Indian Ocean indicates that the white spots on the side of the body of this species are variable in number and position, making it quite impossible to distinguish two distinct color patterns; the specimens have the same general number of scales and pectoral fin rays. Therefore, it is probable that *S. brevifilis* is the central Pacific population of *S. singaporensis*. This problem needs a field study made on freshly caught specimens. Until this is done, the two species tentatively are considered as one.

Dr. Randall has suggested that *S. chlorodon* Jenyns is the large adult male, an opinion with which I concur.

RANGE.—Central and western Pacific Ocean and Indian Ocean.

Scarus rubrofasciatus (Smith)

Callyodon rubrofasciatus Smith, 1955, p. 934; 1956, p. 10, pl. 43I; 1959, p. 279, pl. 43I.

Scarus rubrofasciatus.—Schultz, 1958, p. 79, pl. 14E.

Pseudoscarus caudofasciatus [not Günther, 1862].—Günther, 1909, pl. 153A.

Characterized by having 6 or 7 predorsal scales, 3 series of scales on cheek, 2 to 4 scales in lower row, and ii,13 pectoral rays; lips not covering white teeth. Anterior half of body dark, with 3 vertical dark bars posteriorly; Smith's Plate 43I shows the dark areas as brown and light areas red.

The IIOE collected 4 specimens, USNM 202667 (Sta. 34A, near Nossi-Bè, Madagascar, 13°24'23"S, and 48°12'12"E, 16 January 1964). They vary in standard length from 155 to 245 mm, and are characterized by 6 or 7 predorsal scales, 3 rows of scales on cheek with 1 or 2 scales in ventral row, and ii,13 pectoral rays. Coloration in life was a plain reddish brown, distal margins of dorsal and anal fins are edged with a light brown (in alcohol), and at base of each of these fins is a narrow dark streak. In all four specimens, the scale just posterior to lower edge of pectoral base is blackish and another scale in same position at upper edge of pectoral fin base is dusky in alcohol. Caudal lobes are slightly produced except in smallest specimens.

Their identification is tentative depending on a study of a large series of specimens in the field.

RANGE.—Western Indian Ocean.

Scarus caudofasciatus (Günther)

PLATE 5C

Pseudoscarus caudofasciatus Günther, 1862, p. 238.—Playfair and Günther, 1866, p. 108.

Callyodon caudofasciatus.—Smith, 1956, p. 10; 1959, pp. 271, 279.

Scarus atropectoralis Schultz, 1958, p. 79, pl. 15A.

Characterized by having 6 median predorsal scales, 3 rows of scales on cheek, with 2 scales in ventral row, ii,13 pectoral fin rays, lips not covering white teeth; pectoral fin base black, general coloration reddish brown, overlaid with 5 dusky vertical bars on side of body extending to midventral line of body; distal edges of median fins same coloration as rest of fin.

Dr. H. Steinitz sent one specimen, 149 mm in standard length, from the Red Sea, which has helped to confirm the opinion of Smith (1958, p. 271) that *S. atropectoralis* Schultz is a synonym of this species.

Other specimens: IIOE Sta. RS-40, FT-19, 8 December 1964, Amirantes, 1 spec., 121 mm; IIOE Sta. RS-41, KA39, 8 December 1964, Amirantes, 2 spec., 101–139 mm; IIOE Sta. JR-75, 17 February 1964, Madagascar 1 spec., 69 mm.

The above-listed specimens, ranging from 69 to 139 mm in standard length, do not show the vertical dark bars but appear to belong to this species. The base of the pectoral is blackish and the edges of the scales on the side of the body are brown, giving a netlike appearance much like the 149-mm specimen from the Red Sea.

RANGE.—Western Pacific Ocean, western Indian Ocean, and Red Sea.

Scarus lepidus Jenyns

PLATE 5D, E

Scarus lepidus Jenyns, 1842, p. 108.—Schultz, 1958, p. 81, pls. 3c, 15b, c.—Kamohara, 1963, p. 13, pl. 4: fig. 3 [Japan].

Callyodon lepidus.—Smith, 1959, p. 279, pl. 41j.

Callyodon forsteni.—Kamohara, 1960, p. 26.

See Schultz (1958, p. 81) for other synonyms.

Characterized by 5 to 7 median predorsal scales, 3 rows of scales on cheek with 2 to 6 (usually 3 or 4) scales in 3rd or ventral row; pectoral rays ii,12, very

rarely ii,13; lips not covering pink or white teeth. Color in alcohol: body brownish or blackish above level of lower edge of pectoral base, lower part of head and lower side pale; pectoral base dark brown. When alive, a brilliant blue area extending posteriorly from gill opening lengthwise along body, ending just beyond tip of depressed pectoral fin; throat, chin, and upper and lower lips pink; dorsal and caudal fins orange; anal pink.

I have examined from the *Te Vega* expeditions recently collected specimens as follows: USNM 202737, Guam, Tumon Bay, 2 spec. 85–136 mm; Solomons, 4 spec., 131–180 mm; Moorea, 3 spec., 43–135 mm; Tuomotu, 12 spec., 34–83 mm; USNM 202692, Papeete Market, 1 spec., 275 mm.

RANGE.—Central and western Pacific Ocean, and Indian Ocean.

Scarus fasciatus Cuvier and Valenciennes

PLATE 6A

Scarus fasciatus Cuvier and Valenciennes 1839, p. 222.—Schultz, 1958, p. 82, pl. 15d.—Kamohara, 1963, p. 14, pl. 4: fig. 4 [Japan].—Woodland and Slack-Smith, 1963, p. 45 [Heron Island].—Kamohara and Yamakawa, 1967, p. 14 [Ishigakijima].

Callyodon fasciatus.—Marshall, 1965, p. 322.—Munro, 1967, p. 440, fig. 840 [New Guinea].

Scarus rivulatus Cuvier and Valenciennes, 1839, p. 223.—Bauchot and Guibè, 1960, p. 297 [holotype no. 1738 in Paris Musuem].

Characterized by having 6 or 7 median predorsal scales, 3 rows of scales on cheek, with 2 or 3 scales in ventral row; ii,12 pectoral fin rays; lips nearly covering white teeth; base of pectoral fin dusky; anal with blue or green edges, basal three-fourths of anal reddish brown; middle of dorsal fin with green spots, the edge blue or green, then submarginally orange, then basally reddish brown, base narrowly green; head reticulated with narrow red and green streaks, those on lower jaws bluish; edges of pectoral and pelvics blue, then a red streak on pelvics, remainder of fin greenish; caudal fin may have large spots.

RANGE.—Western Pacific Ocean.

Scarus frenatus Lacepède

PLATE 6B

Scarus frenatus Lacepède, 1802, pp. 3, 12, pl. 1: fig. 1.—Schultz, 1958, p. 83, fig. 13.—Randall, 1963, p. 226, pl. 1d, e.

- Callyodon frenatus*.—Smith, 1959, pp. 271, 279, pl. 41c.—Fourmanoir, 1957, p. 187 [Nossi-Bé].
Scarus sexvittatus Rüppell, 1835, p. 26.—Randall, 1963, pl. 1D, E.
Callyodon sexvittatus.—Smith, 1959, pp. 270, 279, fig. 2, pl. 41H, I.
Callyodon vermiculatus Fowler and Bean, 1928, p. 472, pl. 49 [holotype USNM 89978].—Smith, 1956, p. 11, pl. 41c.
Scarus vermiculatus.—Schultz, 1958, p. 82, pl. 16A.—Kamohara, 1963, p. 14, pl. 5: fig. 1 [Japan].—Woodland and Slack-Smith, 1963, p. 46 [Heron Island].
Callyodon upolensis [not Jordan and Seale] Smith, 1956, p. 11, pl. 41H, I.
Scarus randalli Schultz, 1958, p. 97, fig. 20, pls. 19c, 27A.

Characterized by having 6 or 7 median predorsal scales, 3 rows on cheek with 2 or 3 scales in ventral row, ii, 12 pectoral rays, rarely ii,13; lips not covering teeth, white in young and females, green in adult males. Color pattern of adult males and females strikingly different: juveniles and adult females reddish brown, 5 dark lengthwise streaks alternating with light yellowish brown interspaces; all fins red; caudal peduncle and basal portion of caudal fin abruptly light yellowish or whitish. Mature males bright green, spotted with orange dorsally above lower edge of eye, below which head is green (pale in alcohol) with red markings; scales with vermiculations on lower sides. Caudal peduncle and caudal fin bright green (pale in alcohol), with an orange new-moon-shaped mark occupying basal part of that fin; anal and dorsal orange margined with blue; edges of both lips narrowly red then submarginally green.

Smith (1959, pp. 270, 279, fig. 2, pl. 41H, I) has correctly referred *S. randalli* Schultz to the synonymy of this species and Randall (1963, p. 226) has shown that *S. frenatus* Lacepède is the adult male and *S. sexvittatus* is the female and immature stages.

Through an oversight, *Pseudoscarus frenatus* (not Lacepède) Bleeker, 1862 (p. 40, pl. 16: fig. 2), was not removed by Schultz (1958, p. 83) from the synonymy of *S. frenatus* Lacepède to that of *S. flavipectoralis* Schultz, 1958 (p. 52), where it belongs.

Callyodon pectoralis [not Cuvier and Valenciennes] Smith, 1956 (p. 15, pl. 42J), has been found to be an illustration of *S. cyanognatus* Bleeker, to which it is assigned in this paper.

I have studied recently collected specimens as follows: Dr. Steinitz loaned one 290-mm specimen from the Red Sea; two 96- and 210-mm specimens were collected by the IIOE in the Aldabra Islands; USNM 202666 was collected by the IIOE at the Comoro Is-

lands; one specimen from Sta. HA67-5, Diego Garcia Atoll, 13 June 1967, is 290 mm in length. Dr. Randall collected three, 255-295 mm, at Papeete, USNM 202693 and 202694.

RANGE.—Central and western Pacific Ocean, Indian Ocean, and Red Sea.

Scarus janthochir Bleeker

PLATE 6C

- Scarus janthochir* Bleeker, 1853, p. 139.—Schultz, 1958, p. 83, pl. 16B.
Pseudoscarus janthochir.—Bleeker, 1862, p. 30, pl. 5.
Callyodon janthochir.—Smith, 1956, p. 14; 1959, p. 279.
Pseudoscarus falcipinnis Playfair, 1867, p. 865, fig. 3.
Callyodon falcipinnis.—Smith, 1956, p. 12, pl. 44i [*Xanodon falcipinnis* on pl. 44]; 1959, p. 279, pl. 44i.

Characterized by having 6 median predorsal scales, 3 rows of scales on cheek with 1 or 2 scales in ventral row, pectoral fin rays ii,13, and green teeth. Coloration green or blue-green, with dorsal half of head reddish or light brownish, contrasting sharply with bright green side of head below a line from middle of snout past lower edge of eye toward pectoral base; upper and lower lips set off by a wide red band (nearly equal to eye diameter) that may continue to eye; wide green band extending forward from eye across middle of snout, above which head is reddish brown. Edges of dorsal and anal fins blue, centers of these fins yellowish brown to reddish with green blotches on interradiation membranes; pectoral fin dark blue. Center of anal fin crossed with red stripe; middle rays of caudal fin green, lobes with red streak, and edges blue.

Smith (1956, p. 12; 1959, p. 279) recognized *S. falcipinnis* as a valid species. A study of additional specimens indicates that *S. falcipinnis* should be removed from the synonymy of *S. globiceps* where Schultz (1958, p. 75) placed it; however, there are ii,12 pectoral rays in *globiceps* and ii,13 in *falcipinnis*. The type of *S. falcipinnis* (Playfair) in the British Museum (no. 820) is 350 mm in standard length and has predorsal scales 6; cheek scales dorsal row 5 and 6; middle row 7 and 6, and ventral row 1 and 1; pectoral rays ii,13-ii,13; green teeth; base of pectoral brown; anal fin with a single pale streak through middle of fin; no ocellate spot in spiny dorsal fin. These characters are the same as found in *S. janthochir*, to which *falcipinnis* is referred as a synonym.

Recently the following specimens were collected on the *Te Vega* Cruise 6: USNM 202669, Sta. 216, 2

February 1965, Borneo, 2 spec., 116–180 mm; Sta. TV-247, 11 March 1965, Tautsina Island, Bougainville, Solomon Islands, 2 spec., 133–183 mm. Specimens 116–183 mm in standard length are plain dark chocolate brown, including all fins; teeth green; no color marks in any fins.

One specimen was collected by the *Anton Bruun*, 16 October 1964, Sta. 408F, Chesterfield Island, 16°21' S, 43°59' E.

RANGE.—Western Pacific Ocean and Indian Ocean.

Scarus ghobban Forskal

PLATE 6D

Scarus ghobban Forskål, 1775, p. 28.—Schultz, 1958, p. 84, pl. 16c, D; 1960, p. 248.—Kamohara, 1963, p. 15 [Japan].—Woodland and Slack-Smith, 1963, p. 45 [Heron Island]. *Callyodon ghobban*.—Smith, 1959, p. 279, pl. 43H.—Kamohara, 1960, p. 26.—Munro, 1967, p. 439, fig. 836 [New Guinea].

Pseudoscarus ghobban.—Gohar and Latif, 1961, pp. 97–126, figs. 1–10 [Red Sea; anatomy of alimentary tract]; 1961, pp. 127–146.

Scarus guttatus Bloch and Schneider, 1801, p. 294.—Schultz, 1958, p. 85, fig. 14, pl. 17A.

Callyodon guttatus.—Smith, 1949, p. 296, pl. 62: fig. 824.—Fourmanoir, 1957, p. 186, fig. 30 [Mozambique Channel].

Scarus maculosus Lacepède, 1802, pp. 5, 21, pl. 1: fig. 3.—Bauchot and Guibé, 1960, p. 295 [holotype no. 2478 in Paris Museum].

Scarus psittacus [not Forskål] Rüppell, 1828, pl. 20: fig. 1. *Scarus pepo* Bennett, 1834, p. 28, fig. 28.

Scarus dussumieri Cuvier and Valenciennes, 1839, p. 252.—Schultz, 1958, p. 100, pl. 20b.

Scarus scabriculus Cuvier and Valenciennes, 1839, p. 271.

Scarus hertit Cuvier and Valenciennes, 1839, p. 215.

Scarus reticulata Swainson, 1839, p. 226.

Scarus haridoides Bleeker, 1853, p. 344.

Scarus pyrostethus Richardson, 1846 [1845], p. 262.

Pseudoscarus cantori Bleeker, 1862, p. 43, pl. 9: fig. 2.

Pseudoscarus californiensis Pellegrin, 1901, p. 163.

Scarus noyesi Heller and Snodgrass, 1903, p. 206, pl. 9.—Schultz, 1958, p. 91, fig. 18.

Pseudoscarus natalensis Gilchrist and Thompson, 1909, p. 259.

Pseudoscarus rostratus [not Poey, not Seale] Günther, 1909, p. 315, pl. 154.

Scarus garretti Günther, 1909, p. 306, pl. 153c.

Scarus pyrostethus australianus Paradise, 1927, p. 103.

Scarus azureus Meek and Hildebrand, 1928, p. 742, pl. 72: fig. 1.—Schultz, 1958, p. 89, fig. 16.

Callyodon apridentatus Smith, 1956, pp. 10, 14, 19, pl. 44F; 1959, pp. 270, 278, 279, pl. 44F [large male of *S. ghobban*].

Callyodon pyrrhostethus.—Marshall, 1965, p. 323.

Characterized by 5 or 6 median predorsal scales, 3 rows of scales on cheek, with 1 to 3 scales in ventral

row, ii,13 pectoral rays, rarely ii,12; lips not quite covering white teeth; background coloration light orange to yellowish, centers of scales marked with bright blue spots that are arranged to form 5 vertical bars separated by 1 to 3 yellow-orange or pale interspaces; vertical blue bars not always present. Dorsal and anal fins edged with narrow blue band and center of fins orange; anal with basal blue streak; blue streak from corner of mouth past lower edge of eye; edge of upper lip orange, that of lower lip green.

Schultz (1958) recognized two species of parrotfishes that are closely related, *S. ghobban* and *S. dussumieri*. There is full agreement between Smith (1959) and Schultz (1958) on the identity of *ghobban*. The latter recognized *S. dussumieri* Cuvier and Valenciennes as distinct, and since the types of *S. dussumieri* have ii,13, rarely ii,12 pectoral fin rays, I agree with Smith (1959) that *S. dussumieri* is a synonym of *ghobban*, whereas *S. dussumieri* [not Cuvier and Valenciennes] Schultz, 1958 (p. 100, pl. 20A) is actually *S. mus* (Smith).

USNM 202642, a specimen 270 mm in standard length from the Mombasa fish market, Kenya (IIOE, Sta. FT-2, 15 November 1964), appears to be an example of *Scarus apridentatus* Smith, 1956 (also 1958, pl. 42F). Since this specimen is a male and is very close to *S. ghobban* in all respects except the vertical blue bars, I agree that *S. apridentatus* is the adult male of *S. ghobban* as suggested by Smith (1959). Schultz (1958, p. 51) referred *S. apridentatus* to the synonymy of *S. harid* because Smith's illustration appeared to have only 4 median predorsal scales.

A recent examination of Plate 154 (*Pseudoscarus rostratus* Günther, 1909, p. 315) indicates 5 or 6 median predorsal scales, which removes this species from the synonymy of *S. lunula*, where Schultz (1958, p. 54) placed it. The color pattern suggests it is *S. ghobban*.

Since no specimen of *S. guttatus* Bloch and Schneider has been collected to establish the validity of this species, I tentatively follow Smith (1956) and refer it to *S. ghobban* as a synonym.

The following specimens were recently collected by the *Anton Bruun* (IIOE): From Mombasa Market, Kenya: Sta. FT-2, 16 November 1964, 2 spec., 235–270 mm; USNM 202665 and 202689, Sta. FT-2, 16 November 1964, 2 spec., 235–420 mm. From Amirantes Island: USNM 202662, Sta. RS-41, KA-39, 8 December 1964, 1 spec., 205 mm; Sta. HA-19, 8 December 1964, 1 spec., 71 mm; USNM 202664, Sta. HA-16,

3 December 1964, Aldabra Island, 14 spec., 35–177 mm; Sta. FT-11, 30 November 1964, Dar-es-Salaam Market, 1 spec., 49 mm. Uncataloged from Diego Garcia Atoll; Sta. HA-67-16, 22 June 1967, 1 spec., 167 mm; Sta. HA-67-17, 23 June 1967, 1 spec. 290 mm.

The *Te Vega* collected the following: Sta. 21, at Tutuila Island, 19 August 1963, 2 spec., 75 and 86 mm; Sta. 57, at Halmahera, off Teluk Kau village, 26 September 1963, 1 spec. 159 mm.

RANGE.—Eastern, central and western Pacific Ocean, Indian Ocean, and Red Sea.

Scarus marshalli Schultz

Scarus marshalli Schultz 1958, p. 88, fig. 24.

Callyodon marshalli.—Smith, 1959, p. 280, fig. 10.

The following counts were made on specimens from IIOE (Sta. HA-36, 7 January 1969, Red Sea, 27° 17' 23" N, 33° 48' 52" E, 6 spec., 173–323 mm standard length): predorsal scales 6 in each specimen, pectoral rays ii,13 in 12 counts and ii,14 in one. Cheek scales: dorsal row, 5 in 1, 6 in 11 counts; middle row, 5 in 4 counts, and 6 in 8 counts; ventral row, 1 scale in 2 counts, 2 in 5, 3 in 4 and 4 in 1 count; lips not covering the green teeth.

Dr. Steinitz loaned a 370-mm specimen from the Red Sea, which has 3 indistinct broad vertical bars and the posterior part of the body with lengthwise dark streaks on each scale row.

Six specimens from the Red Sea confirm the validity of this species: USNM 202663 and 202668 (collected by IIOE, Sta. HA36, 7 January 1965). The color pattern shows 3 vertical bars on side below dorsal fin instead of one as illustrated by Schultz (1958, fig. 24). Two Kodachrome slides show caudal peduncle and caudal fin to be yellow, anal fins orange, soft dorsal fin yellow on one and green for the other. There is no yellow bar at base of pectoral fin.

RANGE.—Western Indian Ocean and Red Sea.

Scarus compressus (Osburn and Nichols)

Callyodon compressus Osburn and Nichols, 1916, p. 171, fig. 13).

Scarus californiensis [not Pellegrin] Schultz, 1958, p. 91, fig. 18.—Hobson, 1965, p. 294 [behavior].

Characterized by having 6 median predorsal scales, 3 rows of scales on the cheek, usually 1 scale in 3rd row

(rarely 2 or 0 on one side); ii,12 pectoral fin rays; lips usually not covering green teeth of adults; caudal fin truncate; body 2.0 to 2.4 times in length.

Coloration (by permission from Rosenblatt and Hobson, in ms.) bright green or blue, centers of scales green, margins orange, caudal peduncle becoming plain green; head pink, with green streaks radiating from eye; band from eye to mouth, thence across snout; bar across chin; distal margin of pectoral pale; dorsal with base and distal edge blue, center orange; anal blue or green, with pink streaks along interradial membranes.

RANGE.—Eastern tropical Pacific Ocean.

Scarus scaber Cuvier and Valenciennes

Scarus scaber [in part] Cuvier and Valenciennes, 1839, p. 239 [lectotype selected by Schultz (1958, p. 92) at Paris Museum, Catalog no. 588; the other specimen, Catalog no. 1733, is *S. taeniurus* Cuvier and Valenciennes].—Schultz, 1958, p. 92, pls. 3c, 18a.

Callyodon mutabilis Gray, 1854, p. 86.—Marshall, 1965, p. 322.

Pseudoscarus flavomaculatus Bliss, 1883, p. 57.

Callyodon zonularis Jordan and Seale, 1906, p. 321, fig. 60.

Pseudoscarus caudofasciatus var. *zonularis*.—Günther, 1909, p. 312, pl. 153b [not pl. 153a, which is *S. rubrofasciatus*].

Callyodon fuscocuneus Fowler, 1935, p. 158, fig. 28.

Callyodon scaber.—Smith, 1956, p. 10, pl. 41c; 1959, p. 279, pl. 41c.

Characterized by having 5 or 6 median predorsal scales, 3 rows of scales on cheek, with 2 or 3 scales in ventral row, ii,12 pectoral fin rays; lips covering white teeth. Coloration consists of 4 or 5 dark bars, mostly on upper sides, separated by pale (yellowish when alive) interspaces; no black spot at dorsal edge of pectoral base; median fins pink; pelvics pink; pectoral with upper half pink.

Schultz incorrectly included *Pseudoscarus caudofasciatus* Günther, 1862 (p. 238), Playfair and Günther, 1866 (p. 108), and *Callyodon caudofasciatus* Smith, 1956 (p. 10), as a synonym of *S. Scaber*. *Scarus caudofasciatus* is a valid species.

I have examined 19 specimens, 20 to 162 mm, USNM 202377, 202379, and 202385, recently collected by the *Te Vega* Expedition in the Solomon Islands and Indonesia.

RANGE.—Central and western Pacific Ocean and Indian Ocean.

Scarus oviceps Cuvier and Valenciennes

Scarus oviceps Cuvier and Valenciennes, 1839, p. 244.—Schultz, 1958, p. 93, pl. 18b.—Kamohara, 1963, p. 17, pl. 5: fig. 3 [Japan].—Kamohara and Yamakawa, 1967, p. 14 [Isigakijima].

Callyodon oviceps.—Fourmanoir, 1957, p. 185 [Nosy Iranja].—Munro, 1967, p. 439, fig. 837 [New Guinea].

Scarus pectoralis Cuvier and Valenciennes, 1839, p. 269.—Schultz, 1958, p. 99, fig. 25, pl. 19d.—Kamohara, 1963, p. 9, pl. 6: fig. 2 [Japan].—Kamohara and Yamakawa, 1967, p. 14 [Isigakijima].

Pseudoscarus pectoralis.—Günther, 1909, p. 324, pl. 158.

Pseudoscarus zonatus Macleay, 1883, p. 591.

Pseudoscarus knerii Steindachner, 1887, 96, p. 64, pl. 4: fig. 1.

Callyodon lazulinus Jordan and Seale, 1906, p. 333, fig. 65.—Smith, 1956, 13, pl. 42k.

Callyodon elerae Jordan and Seale, 1907, p. 31, fig. 11.

Callyodon cyanognathus.—Smith, 1959, p. 271, pl. 42k.

Characterized by having 6 or 7 median predorsal scales, 3 rows of scales on cheek with 3 or 4 scales in ventral row; ii,12 pectoral fin rays; lips nearly covering white teeth, blue in adult males. Color pattern of probable females: head dark dorsally, abruptly pale below a line from snout past lower edge of orbit to above dorsal edge of pectoral fin base near angle of opercle; dark back broken by 2, rarely 3, light yellowish bars that slant ventrally as they extend anteriorly.

Male: A blue streak extends from middle of snout past lower edge of eye to rear of opercle, separating the dark dorso-anterior coloration from the yellowish color below blue streak; body abruptly pale behind dorsal spines VII or VIII; anal fin broadly blue distally, pink basally, dorsal fin with similar color pattern; teeth blue. No yellowish bars along back.

Randall (1963, p. 226) has suggested that *Scarus pectoralis* Cuvier and Valenciennes is the adult male of *Scarus oviceps* Cuvier and Valenciennes. This suggestion by Dr. Randall, although probably correct, needs further confirmation in the field.

Schultz confused *Scarus cyanognathus* Bleeker, 1849, with this species; Smith (1959, p. 271) thinks *S. cyanognathus* is a valid species. The anal fin of "*pectoralis*" has a very wide color band distally, and a narrower one basally, whereas *S. cyanognathos* as illustrated by Bleeker has 3 bands.

I have studied the following specimens recently collected by John Randall: USNM 202390, Papeete Market, Tahiti, 21 April 1963, 4 spec., 195–230 mm; USNM 202378, Matiti Island, Takahou Atoll, Tuomotu Islands, 15 April 1957, 3 spec. 205–225 mm.

Other specimens: *Te Vega* Expedition: USNM 202380, Cruise 6, Sta. 216, 2 February 1965, Borneo, 1 spec., 178 mm; USNM 202384 and 202387, Cruise 7, Sta. 259, 16 April 1965, Pen Bay, Vanikoro Island, 4 spec., 87–205 mm; USNM 202389, Sta. 104, 30 November 1963, Mentawai Island, Indonesia, 4 spec., 124–166 mm.

The IIOE collected one specimen at Diego Garcia Atoll, Sta. HA-67-7, 15 June 1967, 200 mm.

RANGE.—Central and western Pacific Ocean, the Indian Ocean, and the Red Sea.

Scarus niger Forskal

PLATE 6E

Scarus niger Forskål, 1775, pp. x, 28.—Schultz, 1958, p. 93, fig. 19, pls. 18c, 27b.—Kamohara, 1963, p. 19.

Callyodon niger.—Smith, 1959, p. 279, pl. 43c, o.—Fourmanoir, 1957, p. 184, fig. 129 [Comoro Islands].—Munro, 1967, p. 439, fig. 838 [New Guinea].

Scarus nuchipunctatus Cuvier and Valenciennes, 1839, p. 271.—Bauchot and Guibè, 1961, p. 259 [holotype no. 2470 in Paris Museum].

Scarus limbatus Cuvier and Valenciennes, 1839, p. 271.—Bauchot and Guibè, 1961, p. 259 [holotype no. 2472 in Paris Museum].

Characterized by having 6 to 8 median predorsal scales, 3 rows of scales on cheek with 3 to 5 scales in ventral row, ii,11 to ii,12 (rarely ii,11), pectoral fin rays; lips partly cover green teeth. Coloration generally dark brown, with pale (blue when alive) distal margins in dorsal and anal fins contrasting sharply (in alcohol) with dark brown basal four-fifths of those fins, inner edge of this distal pale band bordered by a dark line; distal margin of caudal fin narrowly white (in alcohol); edges of both lips pale, upper one broadly so, lower with a narrow line; a dark bar (greenish when alive) may run from the corner of mouth to the eye, thence beyond; pale streaks (pink when alive) may extend forward and aft of the eye; usually a pale spot occurring on a lateral line scale at upper edge of gill opening; some specimens black, except pale edges of median fins.

Dr. Steinitz kindly loaned two specimens from the Red Sea, and the IIOE caught the following: USNM 202269, Amirantes Island, 2 spec., 260–280 mm; 202275, Red Sea, 1 spec., 245 mm. I have examined ten other specimens, 134 to 280 mm standard length, USNM 202271 and 202291, from off Borneo and near Bougainville recently caught by the *Te Vega* Expeditions.

Dr. V. G. Springer collected the following at One Tree Island off Queensland: Sta. VGS 66-14, 1 December 1966, 1 spec., 133 mm; Sta. VGS 66-19, 11 December 1966, 2 spec., 145-163 mm.

RANGE.—Central and western Pacific Ocean, Indian Ocean, and Red Sea.

Scarus cyanognathus Bleeker

PLATE 7A

Scarus cyanognathus Bleeker, 1849, p. 63.

Pseudoscarus cyanognathos.—Bleeker, 1862, p. 32, pl. 11: fig. 2.

Callyodon cyanognathos.—Smith, 1959, p. 279, pl. 42κ.—Munro, 1967, p. 441, fig. 842 [New Guinea].

Callyodon pectoralis [not Cuvier and Valenciennes].—Smith, 1956, p. 15, pl. 42j.

Callyodon urbanus Smith, 1959, p. 272, pl. 42j.

Characterized by 6 or 7 predorsal scales, 3 rows of scales on cheek with 3 or 5 scales in ventral row, and ii,12 pectoral rays; green or blue teeth when adult; dorsal fin with blue edge, the broad center orange, sometimes a green streak at middle, and base narrowly blue; anal with color pattern same as the dorsal fin. Blue streak from snout past lower edge of eye; upper lip pink, lower with blue edge; middle of pectoral fin purple, upper edge blue or green; underside of head with two blue bars behind blue lip, separated by yellow.

I examined Bleeker's type of *S. cyanognathus* in the British Museum (Catalog no. 1862.2.28.4, standard length 182 mm) and found 6 predorsal scales, ii,12 pectoral rays, and the upper row of cheek scales numbered 7 and 7, middle row 7 and 8, and ventral row 4 and 5, upper lip pale, with a darker streak from snout past lower edge of eye as shown in Bleeker (1862, pl. 11: fig. 2). *Scarus cyanognathus* Bleeker, 1849 (p. 63; also 1862, pl. 11: fig. 2), appears to be valid and is not a synonym of *S. pectoralis*=*S. oviceps* as indicated by Schultz (1958, p. 100).

Randall (1963, pp. 225-237) has shown that *Scarus pectoralis* Cuvier and Valenciennes is the female of *S. oviceps*; and an examination of the type of *Callyodon lazulinus* Jordan and Seale and that of *C. elerae* Jordan and Seale has revealed that these nominal species are junior synonyms of *S. oviceps*. *Callyodon lazulinus* Smith, 1956 (pl. 42κ) (= *C. cyanognathus* Smith, 1959, pl. 42κ), is *Scarus oviceps*. *Callyodon urbanus* Smith, 1959 (p. 272, pl. 42j), appears to be the same as *S. cyanognathos*

Bleeker. Smith's figure shows a yellow bar at base of pectoral. Obviously the species involved here needs a further investigation.

RANGE.—Western Pacific Ocean and Indian Ocean.

Scarus madagascariensis (Steindachner)

Pseudoscarus madagascariensis Steindachner, 1887, p. 61, pl. 2: fig. 1.

Callyodon madagascariensis.—Smith, 1956, p. 11, pl. 44j; 1959, p. 29, pl. 44j.—Fourmanoir, 1957, p. 186 [Nossi-Bé].

Characterized by 7 median predorsal scales; 3 rows of scales on cheek with 3 to 5 scales in ventral row; pectoral rays ii,12, occasionally ii,13, green or blue teeth; coloration dark brown (reddish brown when alive) with numerous horizontal or lengthwise violet brown streaks on sides; lower posterior side of head with numerous green spots when alive; edge of upper lip red, then a blue or green band; lower lip red, below is a green or blue band; second green bar on chin extends to corner of mouth, thence to lower edge of eye; dorsal and anal fins with blue-green edge.

I have examined the following recently collected specimens: USNM 202347, IIOE, Sta. HA-36, Red Sea, 7 January, 1965, 6 spec., 108-210 mm; USNM 202268 *Te Vega*, Sta. 104, Indonesia, 30 November, 1963, 1 spec., 147 mm; USNM 202272 *Te Vega*, Sta. 78, Thailand, 3 November, 1963, 2 spec., 143-160 mm; USNM 202596, Rabaul, 1 spec.

RANGE.—Western Pacific Ocean, Indian Ocean, and Red Sea.

Scarus mus (Smith)

PLATE 7B

Pseudoscarus dussumieri [not Cuvier and Valenciennes] Bleeker, 1862, pl. 8: fig. 1.

Scarus dussumieri [not Cuvier and Valenciennes].—Schultz, 1958, p. 100, pl. 20A.—Kamohara, 1963, p. 18, pl. 5: fig. 4.

Callyodon mus Smith, 1956, p. 13, pl. 41B.

Callyodon speigleri Smith, 1956, p. 14 [on Bleeker, 1862, pl. 8: fig. 1].

Characterized by having 5 or 6 median predorsal scales, 3 rows of scales on cheek with 1 to 4 (usually 1 to 3) in ventral row, ii,12 pectoral fin rays; lips not covering white teeth. Dorsal fin distally edged with blue or green and a blue or green base, the central four-fifths plain

pink; anal fin with similar coloration but the central pink portion occupies one-half to two-thirds of anal fin.

I agree with Smith (1959) that *S. dussumieri* Cuvier and Valenciennes, 1839 (p. 252), is a synonym of *S. ghobban* Forskål. Smith (1956, p. 14) proposed *Callyodon speigleri* as a new species based on *Pseudoscarus dussumieri* Bleeker [not Cuvier and Valenciennes], 1862 (pl. 8: fig. 1). Smith (1956, p. 14) describes *C. speigleri* as having 5 or 6 predorsal scales; 3 rows of scales on cheek with 1 or 2 in ventral row and ii,12 pectoral rays. I have carefully examined Bleeker's figure, and the pectoral fin (his pl. 3: fig. 1) does have ii,12 pectoral fin rays. This count agrees very well with counts made by Schultz (1958, p. 100) and reported upon as *S. dussumieri*; however, Smith (1959, p. 271) after examining Bleeker's supposed "types" changed the pectoral fin ray count to ii,13. Bleeker (1862, p. 46) gives ii,13 in the description, but in the diagnosis he says it has ii,12 pectoral rays. Undoubtedly Bleeker was confused and probably was mixing two species. Smith (1959, p. 271) reports on two of Bleeker's specimens as follows: "In Leiden are 2 specimens labelled *Pseudoscarus dussumieri* Bleeker, No. 6664, of length 390 mm., 6 median scales pre D, 2 rows on cheek, 2 scales on flange, P 2, 13 . . . exactly as in Bleeker 1862, pl. 8, f 1." With ii,13 pectoral rays, however, I seriously doubt that these are the same as Plate 8: figure 1. Further, since Bleeker was not describing a new species, these are not "types," only ordinary specimens. The specimen used by the artist for the illustration does not appear to have been seen by Smith.

Schultz (1958, pl. 20A) shows an illustration (USNM 112229) of *S. dussumieri* [not Cuvier and Valenciennes] that is identical in color pattern to Bleeker (1862, pl. 8: fig. 1) and to that of Smith (1956, pl. 41B), which represents *Callyodon mus* Smith. The pectoral fin rays of this species number ii,12, and the ventral row of scales on the cheek may vary from 1 to 4.

Smith (1956, p. 13; 1959, p. 270) described *Callyodon mus* as having 4 scales in the 3rd or ventral row on the cheek. Apparently this row occasionally has 4 scales. A color drawing of USNM 157103 in the Philippine Albatross collection has 4 scales in the ventral row.

I conclude, therefore, from the material so far studied, that *Scarus mus* Smith (1956, p. 13) appears to be a valid species with the junior synonyms, *Callyo-*

don speigleri Smith, 1956 (p. 14), *Pseudoscarus dussumieri* [not Cuvier and Valenciennes] Bleeker, 1862, (pl. 8: fig. 1), *Scarus dussumieri* [not Cuvier and Valenciennes] Schultz, 1958 (p. 100, pl. 20A).

RANGE.—Western Pacific Ocean and western Indian Ocean.

Scarus blochi Cuvier and Valenciennes

PLATE 7C

Scarus blochi Cuvier and Valenciennes, 1839, p. 219.—Schultz, 1958, p. 95, pl. 19A.—Kamohara, 1963, p. 18, pl. 6: fig. 1.

Callyodon blochi.—Munro, 1967, p. 440, fig. 841 [New Guinea].

Characterized by having 6 median predorsal scales, 3 rows of scales on cheek, with 2 or 3 scales in ventral row, ii,12 pectoral fin rays; lips not covering white to yellowish teeth.

Coloration of body greenish red dorsally, brownish red ventrally, peduncular area green; edges of dorsal and anal fins blue, basal three-fourths of anal reddish brown, basal four-fifths of dorsal orange; outer edges of paired fins blue, with a red stripe submarginally on pectoral fin; green or blue upper lip continues to below eye; 2 or 3 short blue streaks behind eye, one forward; lower lip blue; under side of head orange with narrow, characteristically reticulated blue streaks; outer edges of caudal blue, yellow green posteriorly, base blue.

RANGE.—Western Pacific Ocean and Indian Ocean.

Scarus aeruginosus Cuvier and Valenciennes

PLATE 7D

Scarus aeruginosus Cuvier and Valenciennes, 1839, p. 257.—Schultz, 1958, p. 96, pls. 3A, 19B; 1960, p. 249, pl. 108E.—Kamohara, 1963, p. 15 [Japan].—Bauchot and Guibè, 1960, p. 291 [holotype no. 2487 in the Paris Museum].

Pseudoscarus aeruginosus.—Bleeker, 1862, p. 40, pl. 17: fig. 2. *Callyodon aeruginosus*.—Kamohara, 1959, p. 4; 1960, p. 26.—Munro, 1967, p. 440, fig. 839 [New Guinea].

Scarus prasiognathos Cuvier and Valenciennes, 1839, p. 272.—Bauchot and Guibè, 1960, p. 295 [holotype no. 561 in Paris Museum].

Scarus lacerta Cuvier and Valenciennes, 1839, p. 217.—Bauchot and Guibè, 1960, p. 294 [syntype nos. 578 and 1742 in Paris Museum].

Scarus dubius [not Bennett].—Weber and de Beaufort, 1940, p. 300.

Callyodon dubius.—Smith, 1956, p. 12, pl. 45J; 1964, p. 297 [off Durban].

Callyodon malindiensis Smith, 1956, p. 13, pl. 45H.

Characterized by having 5 or 6 median predorsal scales; 3 rows of scales on cheek, with 1 to 3 scales in ventral row; ii,12 (occasionally ii,13) pectoral rays; lips almost covering white teeth; canine teeth occurring at corner of mouth on specimens 100 to 150 mm in length and longer.

Coloration plain brown or grayish (reddish brown when alive), usually with 3 pale streaks, 1 on each scale row of belly; no black spot on pectoral base; fins tinged with red when alive; edges of dorsal and anal fins very dark; iris yellow.

RANGE.—Central and western Pacific Ocean, Indian Ocean, and Red Sea.

Scarus croicensis Bloch

Scarus croicensis Bloch, 1790, p. 27, pl. 221.—Schultz, 1958, p. 106, pls. 21c, 27c.—Winn and Bardach, 1959, p. 296.—Randall, 1963, pp. 228–230, fig. 1, pl. 2A, B.—Randall and Randall, 1963, pp. 53–54.—Caldwell, 1963, p. 7 [Costa Rica].—Cervigon, 1966, p. 633, fig. 273.—Stark and Davis, 1966, p. 338 [night habits].

Scarus alternans Cuvier and Valenciennes, 1839, p. 200.—Bauchot and Guibè, 1960, p. 291 [syntypes nos. 2468 and 2469 in the Paris Museum].

Scarus punctulatus Cuvier and Valenciennes, 1839, p. 195.—Bauchot and Guibè, 1960, p. 296 [holotype no. 2466 in Paris Museum].

Characterized by having 6 to 8 median predorsal scales; 3 rows of scales on cheek and usually 2 or 3 in ventral row; 5 to 7 (usually 6) scales in the dorsal row on cheek; ii,12, rarely ii,11 or ii,13, pectoral rays; lips almost covering white teeth.

Females and small males characterized by having distinct light and dark stripes on upper half of body; caudal fin uniform whitish to light dusky without any dark on upper and lower edges of caudal fin; upper pale streak on body not extending to eye but ending slightly above and behind eye.

Adult male: Snout yellowish; underside of head pink; area over pectoral pink, with streak extending forward on head above orbit; caudal fin with upper and lower edges blue, center of fin with alternating yellow and blue streaks parallel with rays; edges of dorsal and anal fins blue, center yellow with blue markings. Bright yellow spot just above pectoral base.

RANGE.—Central and western Atlantic Ocean.

Scarus taeniopterus Desmarest

Scarus taeniopterus Desmarest in Cuvier and Valenciennes, 1839, p. 195.—Bauchot and Guibè, 1960, p. 298 [holotype no. 1750 in the Paris Museum].—Randall, 1963, pp. 228–230, fig. 1, pl. 2c, D.—Cervigon, 1966, p. 635.—Stark and Davis, 1966, p. 338 [night habits].

Characterized by having 6 to 8 median predorsal scales; 3 rows of scales on cheek and usually 2 or 3 in ventral row; 6 to 8 scales (usually 7) in the dorsal row just below eye; ii,12 pectoral rays; lips almost covering white teeth.

Females and small males characterized by having distinct light and dark stripes on upper half of body; caudal fin uniform light blue with upper and lower edges yellowish; upper pale streak on body extending forward to dorsal part of eye.

Adult male: snout white and light blue, underside of head light blue; area over pectoral white, this light color extending forward on cheek below eye; caudal fin with dorsal and ventral edges yellow, center of fin uniform blue; edges of dorsal and anal fins blue, center yellow, largely without blue marks; no bright yellow spot over pectoral base.

I examined the type of *Scarus taeniopterus* Cuvier and Valenciennes in the Paris Museum (Catalog no. 1750) and found predorsal scales 6, cheek scales 6–6 in dorsal row, 6–7 in middle row and 4–4 in ventral row, ii,12 pectoral fin rays. Color pattern was greatly faded; however, 6–6 scales in the dorsal row of cheek scales fits Dr. Randall's discovery that *taeniopterus* usually has 6 scales in the dorsal row on cheek whereas there usually are 7 scales for *croicensis*.

RANGE.—Western Atlantic Ocean.

Scarus guacamaia Cuvier

Scarus guacamaia Cuvier, 1829, p. 265.—Cuvier and Valenciennes, 1839, p. 178.—Schultz, 1958, p. 104, fig. 27, pl. 20D.—Bauchot and Guibè, 1960, p. 294 [holotype no. 1734 in Paris Museum].—Winn, Salmon, and Roberts, 1962, p. 180 [behavior].—Randall, 1963, pp. 230, 234, fig. 2–3.—Cervigon, 1966, p. 630, fig. 271.—Stark and Davis, 1966, p. 338 [night habits].

Scarus turchesius Cuvier and Valenciennes, 1839, p. 181.—Bauchot and Guibè, 1960, p. 298 [holotype no. 2460 in Paris Museum].

Characterized by having 6 median predorsal scales, 3 rows of scales on cheek, usually 1, more frequently 2 in ventral row; ii,14 pectoral fin rays; lips not cover-

ing green teeth of adults; canines present at corner of mouth but fewer than for *coelestinus*.

Coloration of large adults orange and green and on largest adults green becoming progressively restricted to caudal peduncle, and on body at base of anal and dorsal fins. Smaller fish having scales with green centers and borders orange; scaled part of head bright orange, with green streaks around eye, largest one to snout tip; unscaled part and thorax of dull orange; fins dull orange, with margins blue.

RANGE.—Central and western Atlantic Ocean.

Scarus vetula Bloch and Schneider

PLATE 7E

Scarus vetula Bloch and Schneider, 1801, p. 289.—Winn and Bardach, 1957, p. 885.—Schultz, 1958, p. 103, fig. 26, pl. 20c.—Winn and Bardach, 1960, pp. 29–34, pl. 1.—Cervigon, 1966, p. 628.—Stark and Davis, 1966, p. 337 [night habits].

Scarus quadrispinosus Cuvier and Valenciennes, 1839, p. 197.—Bauchot and Guibè, 1960, p. 296 [holotype no. 2467 in Paris Musuem].

Characterized by having 7 median predorsal scales, 4 rows of scales on cheek, with 3 or 4 scales in ventral row (4th); ii,12, occasionally ii,13 pectoral rays; lips not covering teeth; canine teeth occurring at corner of mouth of adults.

Coloration of head and body of small specimens and females brown above mid-lengthwise axis of body, with pale streak just below lateral line; area below eye pale, then extending as pale streak along side of body.

Those slightly longer than 180 mm in standard length have a broad pale band posteriorly on the sides below which is a brown streak.

Mature males grayish with distal half of anal green, basal half pink; dorsal fin similar; middle rays of caudal fin green, upper and lower margins of caudal fin pink; pectoral and pelvics pink, lower lip with narrow pink edge, submarginally green streak extending to below eye, then pink; broad green band across ventral part of head.

RANGE.—Central and western Atlantic Ocean.

Scarus coelestinus Cuvier and Valenciennes

Scarus coelestinus Cuvier and Valenciennes, 1839, p. 180.—Schultz, 1958, p. 105, pl. 21b.—Bauchot and Guibè, 1960, p. 293 [holotype no. 2459 in the Paris Museum].—Winn,

Salmon, and Roberts, 1962, p. 180 [behavior].—Randall, 1963, pp. 230–234, figs. 2–3.—Cervigon, 1966, p. 629, fig. 270.—Stark and Davis, 1966, p. 338 [night habits].

See Schultz (1958, p. 105) for other synonyms.

Characterized by having 5 or 6 median predorsal scales; 3 rows of scales on cheek, with usually 1, occasionally 2, in ventral row; ii,13 or ii,14 pectoral fin rays; canines present in adults at corner of mouth; lips not covering blue-green teeth of adults.

Coloration of adults: edges of scales blackish, centers bright blue; scaled portion of head blackish except for blue band across interorbital and blue centers to median predorsal scales; cheek (except for scales), chin, and region of snout adjacent to mouth bright blue except for blackish area at rictus and dark cross band on chin; fins bluish black with bright blue margins of dorsal and anal.

RANGE.—Central and western Atlantic Ocean.

Scarus coeruleus (Bloch)

PLATE 8A

Corphyæna coerulea Bloch, 1786, p. 148, pl. 176.
Scarus coeruleus.—Schultz, 1958, p. 106, pls. 21A, 22A.—Cervigon, 1966, p. 632, fig. 272.—Stark and Davis, 1966, p. 337 [night habits].

Characterized by having 6 or 7 median predorsal scales, 3 rows of scales on cheek with 1 or 2 scales in ventral row; ii,13 pectoral rays, rarely ii,12; lips nearly covering white teeth.

Coloration generally a uniform robin's-egg blue, washed with yellowish on occiput; inconspicuous stripes may be present; adults with a big humped snout bulging outward even on immature.

Immature with light and dark bars.

RANGE.—Western Atlantic Ocean.

Scarus hoefleri (Steindachner)

Pseudoscarus hoefleri Steindachner, 1881, p. 46, pl. 6: fig. 2.
Scarus hoefleri.—Schultz, 1958, p. 109, pl. 21b.—Bauchot and Blanc, 1961, p. 61 [off Sierra Leone].

Characterized by having 7 median predorsal scales; 3 rows of scales on cheek, with 2 or 3 scales in ventral row; ii,12 pectoral fin rays; lips almost covering green teeth of adults (white in young fish).

Coloration in alcohol brownish with dusky margins on dorsal and anal fins; body posteroventrally pale.

RANGE.—Eastern Atlantic Ocean.

Subfamily SPARISOMATINAE

Characterized by having 4 or 5 median predorsal scales; 1 row of scales on cheek with 2 to 5 scales; front edge of dental plate of upper jaw included within that of lower jaw when mouth closed or edges of both jaws meeting; pectoral fin rays normally ii,11; upper pharyngeal bones each with 3 rows of teeth; gill rakers 2 or 3+1+6 to 12 on 1st arch; abdominal vertebrae 9, caudal 16.

Genus *Scaridea* Jenkins

Scaridea Jenkins, 1903, p. 468.

Characterized by having pungent dorsal fin spines; gill membranes broadly joined to isthmus, without free fold; free, imbricate, incisor-like teeth externally on both jaws.

RANGE.—Hawaiian Islands.

***Scaridea zonarcha* Jenkins**

Scaridea zonarcha Jenkins, 1903, p. 468, fig. 26.—Schultz, 1958, p. 109, pl. 22b.—Gosline and Brock, 1960, p. 236 [Hawaiian Islands].

Characterized by having 4 median predorsal scales; dorsal spines pungent; gill membranes broadly joined to isthmus without free fold across isthmus; free, imbricate, incisor-like teeth present externally on both jaws.

RANGE.—Hawaiian Islands.

Genus *Sparisoma* Swainson

Characterized by having 4 median predorsal scales, 1 row of scales on cheek; gill membranes broadly joined to isthmus without free fold; dorsal spines pungent; teeth of lower jaw closing over those of upper jaw.

Subgenus *Callyodontichthys* Bleeker

Callyodontichthys Bleeker, 1861, pp. 5, 15 [no species listed].—Steindachner, 1863, p. 1111 [type-species: *Callyodontichthys bleekeri* Steindachner=*Scarus radians* Cuvier and Valenciennes.]

Characterized by having ridge on upper dental plate bearing canine teeth, posteriormost canine appearing at small size of 25 mm standard length; at length of 60 mm usually 4 outwardly projecting canines. Size rarely exceeding 160 mm in standard length.

RANGE.—Central and western Atlantic Ocean.

***Sparisoma radians* (Cuvier and Valenciennes)**

Scarus radians Cuvier and Valenciennes, 1839, p. 206.
Sparisoma radians.—Schultz, 1958, p. 113, pl. 22c,d.—Winn and Bardach, 1959, pp. 296–298.—Randall, 1965, pp. 1–9, figs. 1, 3a.—Cervigon, 1966, p. 617, fig. 263.

Characterized by having 2 median scales between bases of pelvic fins; total gill rakers on 1st arch 10 to 13.

RANGE.—Central and western Atlantic Ocean.

***Sparisoma atomarium* (Poey)**

Scarus atomarius Poey, 1861, p. 423.
Sparisoma atomarium.—Randall, 1965, pp. 1–9, figs. 2, 3b.

Characterized by having single median scale between pelvic bases; total gill rakers on 1st arch 12 to 16.

Dr. Randall has clearly differentiated this species from *S. radians*. Both *S. radians* and *S. atomarium* show sexual dichromatism.

The *Oregon* collected on 8 June 1964, one specimen, USNM 258316–F1, off eastern Honduras, 15°46'N, 81°37'W.

RANGE.—Western Atlantic Ocean.

Subgenus *Sparisoma* Swainson

No ridge on upper dental plate bearing canine teeth; size greater than 160 mm in standard length.

***Sparisoma axillare* (Steindachner)**

Scarus (Scarus) axillaris Steindachner, 1878, p. 6, pl. 3: fig. 1.

Sparisoma axillare.—Schultz, 1958, p. 117, pl. 23a.—Randall, 1963, pp. 234–235, pl. 3b.

Scarus rubripinnis Cuvier and Valenciennes, 1839, p. 199.
Sparisoma rubripinne.—Schultz, 1958, p. 118, pl. 23c, d.—Bauchot and Blanc, 1961, p. 61 [St. Thomas Island, eastern Atlantic].—Caldwell, 1963, p. 7 [Costa Rica].—Cervigon, 1966, p. 621, fig. 266.—Stark and Davis, 1966, p. 339 [night habits].

Scarus virens Cuvier and Valenciennes, 1839, p. 203.—Bauchot and Guibè, 1960, p. 299 [syntypes nos. 1768 and 8228 in Paris Museum].

Characterized by having a convex interorbital space, multifid cirri distally on flap of anterior nostril; membraneous tip of dorsal spines with a few cirri; on large males numerous small canine teeth variously placed externally on upper dental plate, those at median suture may overlap.

Dr. Randall (1963, pp. 234–235) gives the following color description:

Adult males (*axillare*) are characterized by dull blue-green coloration dorsally, lighter ventrally, with centers of scales purplish shading through olive to blue-green on edges, unscaled part of head olive; upper lip and chin turquoise, throat white; caudal fin olive, lobes purplish blue, with an orange crescent distally; dorsal and anal fins yellowish to orange brown; black spot on dorsal half of pectoral base; teeth light blue.

Immature and females (*rubripinne*) light grayish brown, nearly white ventrally; edges of scales dark; chin with 2 dark crossbars; caudal peduncle and caudal fin yellow; dorsal yellow; anal and pelvic fins red.

Dr. Randall (loc. cit.) has shown that *S. rubripinne* is the female and immature of *S. axillare*.

RANGE.—Eastern, central, and western Atlantic Ocean.

Sparisoma chrysopteryum (Bloch and Schneider)

PLATE 8B

Scarus chrysopteryum Bloch and Schneider, 1801, p. 286, pl. 57.

Sparisoma chrysopteryum.—Schultz, 1958, p. 120, pl. 4B, 23B.—Winn and Bardach, 1959, pp. 296–298.—Cervigon, 1966, p. 625, fig. 269.—Stark and Davis, 1966, p. 339 [night habits].

Scarus flavescens Bloch and Schneider, 1801, p. 290.—Randall, 1963, pp. 235–237, fig. 4.

See Schultz (1958, p. 120) for other synonyms.

Characterized by having a slightly concave to flat-tish (slightly convex in young) interorbital space; pectoral base with black spot dorsally; anterior nostril with ribbon-like dermal flap bearing 0 to 4 cirri; membranes at rear of tips of dorsal spines without or with 1 to 2 feeble cirri (tip of dorsal spine usually ending in cirrus); caudal fin strongly forked in adults; several canine teeth may occur on sides of dental plates of upper jaw, some of which may interlock at median suture.

Dr. Randall (1963, pp. 235–237) has shown that *S. flavescens* Bloch and Schneider is a synonym of *S. chrysopteryum*. He gave the following description of coloration of males and females:

Centers of scales (males) purplish blue, edges olivaceous green on upper part of body, abruptly turquoise on lower third of body; area under pectoral blue, becoming turquoise ventrally; with a streak of yellowish green extending forward from blue-green part of body at level of anus; caudal lobes green, outer edges black, middle pink, basally orange next green, distal margin white.

Coloration (females) olivaceous tan dorsally, basal part of scales brownish red, and sides and ventrally paler, basal part of scales bright red, rear half yellowish; 2 broad red cross bars on chin; head with numerous light spots on snout, and interorbital space, fewer light spots on scaled part of head; median fins mottled brownish red; lower half of pectoral base, axillary region, dorsally and forward to edge of gill opening just above pectoral base bright red.

RANGE.—Central and western Atlantic Ocean.

Sparisoma viride (Bonnaterre)

PLATE 8C

Scarus viridis Bonnaterre, 1788, p. 96, pl. 50: fig. 193.

Sparisoma viride.—Schultz, 1958, p. 114, fig. 28.—Winn and Bardach, 1960, pp. 31–33, fig. 2B [males].—Randall and Randall, 1963, p. 54.—Cervigon, 1966, p. 623, figs. 267–268.—Stark and Davis, 1966, p. 339 [night habits].

Sparus abildgaardi Bloch, 1791, p. 22, pl. 259.

Sparisoma abildgaardi.—Schultz, 1958, p. 121, pls. 4C, 24A, B.—Winn and Bardach, 1960, p. 33–35 [females].—Randall and Randall, 1963, pp. 54.

See Schultz (1958, pp. 114, 121) for other synonyms.

No ridge on upper dental plate and canines, if present, behind middle of length of dental plate; dermal flap of anterior nostril with multifid cirri in adults, more ribbon-like in young; interorbital space flattish or nearly so; membranes just behind tips of dorsal spines usually without cirrus, or rarely 1 or 2, in addition to tip of dorsal spine, which bears a terminal cirrus.

Coloration of males: opercular flap with round white (yellow) spot, posterior edge of opercle white (red); caudal fin deeply forked, with a lunate white (red) bar submarginally and distal edge green; on base of caudal fin and peduncle 1 to 3 light (orange or yellow) spots; light streak (red) bounded by green from corner of mouth across cheek; no dark spot on base of pectoral.

Coloration of females (*abilgaardi*): margins of scales dark brown, centers pale, several isolated ones white, arranged in 6 vertical rows; posterior margin of gill cover black (reddish brown); lower part of body below level of pectoral base white (blood red), caudal fin red, and in young a broad white bar occurs on basal one-third, distal two-thirds barred.

Winn and Bardach (1960, pp. 31–33) determined that *abilgaardi* represents the immature and females of *viride*.

RANGE. Central and western Atlantic Ocean.

***Sparisoma aurofrenatum* (Cuvier and Valenciennes)**

Scarus aurofrenatus Cuvier and Valenciennes, 1839, p. 191.
Sparisoma aurofrenatum.—Schultz, 1958, p. 115, figs. 29, 30.—Winn and Bardach, 1960, p. 33.—Randall and Randall, 1963, p. 54.—Cervigon, 1966, p. 619, figs. 264–265.

See Schultz (1958, p. 115) for other synonyms.

Characterized by having a flattish interorbital space (slightly convex in young); anterior nasal tentacle ribbon-like without cirri in specimens shorter than 40 mm, but cirri developing on larger ones; membranes behind tips of dorsal spines without cirri; canines occurring on adults, absent on immature.

Coloration of adult males: White streak from corner of mouth past lower edge of orbit ending on naked area behind eye; white spot or dash may occur just behind eye; a few small brown spots occurring on 3rd or 4th scales in row below lateral line, then below or behind them a white spot; tips of outer caudal fin rays brownish; edges of dorsal and anal fins dusky; dorsal base of pectoral dusky.

Females and immature specimens have a white saddle-like spot on the dorsal edge of the caudal peduncle just behind the dorsal fin base; a silvery spot may occur on the middle of the opercle; the young have a row of white scales along the base of the dorsal fin; some immature females are plain dark brown without a white peduncular spot, but with brown crossbars on the under side of the head as in other species of *Sparisoma*.

Both sexes plain dark brown on shoulder area under opercular apparatus; white gland dorsally sharply contrasting with blackish around it.

RANGE.—Central and western Atlantic Ocean.

Genus *Calotomus* Gilbert

Calotomus Gilbert, 1890, p. 70.

Characterized by having 4 median predorsal scales; flexible dorsal spines, gill membranes joined to isthmus without free fold; anterior nasal opening with broad dermal cirrus; internal edge of coalesced teeth serrated; and externally on dental plate 2 to 4 rows (more on adults) of obliquely arranged imbricated pointed incisor-like teeth; midside of upper dental plate may have 1 to 4 canines, hooked out and backward; gill rakers 2 to 4+1+7 to 13.

RANGE.—Eastern, central and western Pacific Ocean, Hawaiian Islands, Indian Ocean, and Red Sea.

***Calotomus spinidens* (Quoy and Gaimard)**

PLATE 8D

Scarus spinidens Quoy and Gaimard, 1824, p. 289.—Bauchot and Guibè, 1960, p. 299 [holotype no. 571 in Paris Museum].

Calotomus spinidens.—Schultz, 1958, p. 124, pls. 5B, 24c; 1960, p. 250, pl. 108c, 109c.—Briggs, 1964, p. 707.—Munro, 1967, p. 430, fig. 821 [New Guinea].

Cryptotomus spinidens.—Kamohara, 1963, p. 21, pl. 6: fig. 4 [Okinawa].—Marshall, 1965, p. 320.

Callyodon carolinus Cuvier and Valenciennes, 1839, p. 291.—Bauchot and Guibè, 1960, p. 290 [holotype no. 560].

Callyodon sandwicensis Cuvier and Valenciennes, 1839, p. 295.—Bauchot and Guibè, 1960, p. 290 [holotype no. 568].

Calotomus sandwicensis.—Gosline and Brock, 1960, p. 236 [Hawaiian Islands].

Callyodon genistriatus Cuvier and Valenciennes, 1839, p. 293.—Bauchot and Guibè, 1960, p. 291 [holotype no. 576].

Characterized by having the caudal fin truncate in young, then concave, finally in adults deeply concave; length of middle rays of caudal fin three-fourths to equal to longest pectoral fin ray.

Coloration a mottled gray and reddish brown background, bright red mottlings in fins, and lower jaw with red blotches; radiating from eye 2 prominent bands (red when alive) extending to rear of mouth; snout barred; dark blotch between dorsal spines I and II and half-grown specimens; base of last 3 soft dorsal rays may have black spot; caudal fin with white distal margin sometimes bordered submarginally with dark line; anus black under scaly sheath; base of pectoral brown in small specimens.

The following collections were made during the IIOE, Cruise 9 of the *Anton Bruun*: USNM 201565 Sta. FT-2, Market, Mombasa, Kenya, 16 November 1964, 1 spec., 235 mm; USNM 201567, Sta. HA-17, channel reef at SE end West Island [Ile Picard], Aldabra Islands, 4 December 1964, 1 spec., 205 mm; USNM 201566, Sta. RS-37, Farquhar Islands, 6 December 1964, 1 spec., 145 mm; USNM 201568, Sta. RS-41, KA39, Amirantes Island, 10 spec.

The following are from Diego Garcia Atoll: Sta. HA67-3, 12 June 1967, 1 spec., 125 mm; Sta. HA67-16, 22 June 1967, 2 spec., 56 and 99 mm.

RANGE. Revillagigedos Islands, Hawaiian Islands, central and western Pacific Ocean, Indian Ocean, and Red Sea.

***Calotomus japonicus* (Cuvier and Valenciennes)**

Callyodon japonicus Cuvier and Valenciennes, 1839, p. 294, pl. 406.—Bauchot and Guibè, 1961, p. 259, [lectotype no. 8229 in Paris Museum].

Calotomus japonicus.—Schultz, 1958, p. 125, pls. 5A, 24D.—Munro, 1967, p. 431, fig. 822 [New Guinea].

Characterized by a rounded caudal fin at all sizes, with the distal edge dusky, not white; length of middle caudal fin rays equal in young to or longer than longest pectoral fin ray.

General background coloration reddish brown, with numerous tiny light spots on scales; also several larger white spots on upper sides; and 2 rows of white spots on lower side; fins mottled; head with numerous white specks; caudal fin barred.

The following specimens were collected during the IIOE by the *Anton Bruun*: From Nossi-Bè, Madagascar: USNM 201510, Field No. JR-53, 30 January 1964, 8 spec., 50–137 mm; USNM 201503, Field No. JR-75, 17 February 1964, 12 spec., 56–126 mm; USNM 201509, Tulear Harbor, Madagascar, 11 August 1964, 5 spec., 46–66 mm. From Andromache Reef, south of entrance to Port Kilindini, Mombasa Harbor: USNM 201513, Sta. HA-1, 15 November 1964; 1 spec., 60 mm; USNM 201507, Sta. HA-2, 16 November 1964, 7 spec., 33 to 85 mm. From the Comoro Islands: USNM 201508, Sta. HA-8, 24 November 1964, 11 spec., 40–67 mm; USNM 201504, Sta. HA-9, 24 November 1964, 0–9 ft., 2 spec., 35–40 mm. From the Farquhar Islands USNM 201506, Sta. RS-37, 6 December 1964, 17 spec., 50–131 mm; USNM 201512, Sta. HA-18, 6 December 1964, 1 spec., 59 mm; USNM 201503, Cruise 9, Sta. RS-41; KA-39, Amirantes Island, 10 spec., 75–154 mm.

In addition, the following were collected at Diego Garcia Atoll, Chagas Archipelago: Sta. HA67-2, 11 June 1967, 2 spec., 26 and 47 mm; Sta. HA67-16, 22 June 1967, 6 spec., 45–93 mm; Sta. HA67-49, 20 July 1967, 3 spec., 68–113 mm.

The following collection is from the *Te Vega* Expedition, Cruise 6: USNM 201511, Sta. 243, lagoon east side of Puk Puk Island, Bougainville, Solomon Islands, 9 March 1965, 1 spec., 93 mm.

RANGE.—Hawaiian Islands, western Pacific Ocean, and Indian Ocean.

Genus *Leptoscarus* Swainson

Leptoscarus Swainson, 1839, pp. 172, 226.

Characterized by having 4 median predorsal scales; flexible dorsal spines, gill membranes broadly joined to isthmus without free fold; no free, imbricate, incisor-like teeth present externally on dental plates; coalesced

teeth of dental plate with external canines on upper jaw of adult males absent in young and on females.

Leptoscarus vaigiensis (Quoy and Gaimard)

Scarus vaigiensis Quoy and Gaimard, 1824, p. 288.—Bauchot and Guibè, 1960, p. 298 [holotype no. 567 in Paris museum].

Leptoscarus vaigiensis.—Schultz, 1958, p. 126, pls. 4A, 25A, B; 1960, p. 251, pls. 108F, 109D, E.—Kamohara, 1963, p. 121, pl. 6: fig. 3 [Japan].—Marshall, 1965, p. 319, pl. 46.—Munro, 1967, p. 430, fig. 820 [New Guinea].

Scarus bottae Cuvier and Valenciennes, 1839, p. 262.—Bauchot and Guibè, 1960, p. 292 [syntypes 2456, 2457, 2458].

Leptoscarus caeruleopunctatus.—Marshall, 1965, p. 319.

Scarichthys coeruleopunctatus.—Ben-Tuvia, 1966, p. 271 [Mediterranean Sea].

See Schultz (1958, p. 126) for other synonyms.

Background coloration reddish brown, lighter brown ventrally; head, body, and fins may be richly speckled with dark brown dots (blue when alive), pectoral base blackish; ventrally 3 lengthwise rows of scales having brown centers, giving appearance of 3 light and dark alternating streaks behind and below pectoral fin base; males with canine teeth on upper dental plates, absent on females.

The following specimens were collected during the IIOE by the *Anton Bruun*: From Nossi-Bè, Madagascar: USNM 201535, Sta. JR-53, 20 January 1964, 7 spec., 64–220 mm; USNM 201528, Sta. JR-76, 18 February 1964, 1 spec., 30 mm; USNM 201532, Tulear Harbor, Madagascar, 11 August 1964, 27 spec., 39–98 mm; USNM 201526, Sta. 420, Field No. LK-64–100, dip net in Sargassum weed, 3°7'S, 40°39'E, 5 November 1964, 1 spec., 36 mm. From Mombosa Harbor: USNM 201539, Sta. HA-2, 2 spec., not measured; USNM 201537, Sta. HA-2, 16 November 1964, 22 spec., 22–190 mm; USNM 201538, Sta. FT-2, 16 November 1964, 1 spec., 225 mm. From the Comoro Islands: USNM 201530, Sta. HA-8, 24 November 1964, 1 spec., 47 mm; USNM 201527, Sta. HA-9, 24 November 1964, 1 spec., 34 mm; USNM 201533, Sta. FT-11, market and Msasani Bay, Dar-es-Salaam, 30 November 1964, 4 spec., 47–104 mm. From the Farquhar Islands: USNM 201531, Sta. HA-18, 6 December 1964, 26 spec., 17–125 mm; USNM 201534, Sta. RS-37, 6 December 1964, 2 spec., 76–95 mm; USNM 201536, Sta. HA-19, Amirante Islands, St. Joseph Island, Resource Island, 10 spec., 22–

185 mm. From Diego Garcia Atoll: Sta. HA-67-16, 22 June 1967, 1 spec., 78 mm.

RANGE.—Central and western Pacific Ocean, Indian Ocean, Red Sea, and Mediterranean Sea through Suez Canal.

Genus *Cryptotomus* Cope

Cryptotomus Cope, 1871, p. 462.

Characterized by having 4 median predorsal scales; dorsal spines flexible; gill membranes broadly joined to isthmus with a narrow free fold across isthmus; elongate form, pointed snout, angle between dorsal and ventral profile of head 40° to 50°; no dermal cirrus on anterior nostril with raised rim; external incisor-like teeth at front of mouth, teeth slanting forward; canine teeth present on side of upper jaw of half-grown specimens and adults.

RANGE.—Western Atlantic Ocean.

Cryptotomus roseus Cope

Cryptotomus roseus Cope, 1871, p. 462, figs. 1, la.—Schultz, 1958, p. 127, pls. 5c, 25c.

Coloration bluish gray dorsally; head green, bluish white ventrally; red stripe from upper edge of opercular opening almost to caudal fin base, bordered above and below by white lines; 2 narrow red or blue lines from corner of mouth to eye; several red spots below and behind eye; orange to red dashes on pectoral base, blue spot at base of upper rays; black spot at upper part of pectoral base may be absent on small young.

RANGE.—Western Atlantic Ocean.

Genus *Nicholsina* Fowler

Nicholsina Fowler, 1915, p. 3.

Characterized by having 4 median predorsal scales; flexible dorsal spines, gill membranes attached to isthmus, with narrow free fold across isthmus; anterior nostril with short free simple dermal flap not quite reaching posterior nasal opening; external incisor-like teeth at front of both jaws, curving and almost opposing each other; canine teeth may occur at sides of upper dental plate in young and adults; angle between dorsal and ventral profiles of head about 70° to 80°.

RANGE.—Eastern, central and western Atlantic Ocean, and eastern Pacific Ocean.

Nicholsina ustus ustus (Cuvier and Valenciennes)

Callyodon ustus Cuvier and Valenciennes, 1839, p. 286, pl. 405.

Nicholsina ustus.—Schultz, 1958, 128, pl. 25b.—Cervigon, 1961, p. 40 [Venezuela]; 1966, p. 636.

Nicholsina ustus ustus Schultz, 1968, pp. 1-5.

This paragraph applies to both subspecies of *N. ustus*: Characterized by having pectoral base same color as body; spiny dorsal rays not ending distally in a filament; distal edge of caudal fin not white; least preorbital width broad, 0.6 to 0.7 into interorbital space; distance from tip of snout to rictus 1.6 to 1.7 times in snout; eye twice in preorbital width.

The following applies only to *N. u. ustus*: Total number of gill rakers on first arch 9 to 12 (rarely 12) average 10.53; number of denticles in outer posterior row of dentary 9 to 20; increasing in number with increase in length.

RANGE.—Central and western Atlantic Ocean.

Nicholsina ustus collettei Schultz

Nicholsina ustus collettei Schultz, 1968, pp. 1-5, pl. 1.

Characterized by having 11 to 13, average 11.93, gill rakers on 1st gill arch; number of denticles in outer posterior row of dentary 9 to 14, rarely 14, and not increasing in number with increase in length.

Specimens: USNM 201582, 201443, 201444, 201445, 201446, 201447, 201448, 201449 and 201450, off Guinea, West Africa between 8°52'–9°53'N and 13°48'–15°56'W, November-December 1963, 30 spec.

RANGE.—Eastern Atlantic off Guinea, West Africa.

Nicholsina denticulatus (Evermann and Radcliffe)

Xenoscarus denticulatus Evermann and Radcliffe, 1917, p. 129, pl. 12: fig. 1.

Nicholsina denticulatus.—Schultz, 1958, p. 129, pls. 5d, 26b, c; 1968, pp. 1-5.

Characterized by having dermal cirrus well developed on anterior nostril but not quite reaching posterior nostril; head rounded, becoming slightly pointed in adults; distal edge of caudal fin with broad white margin; least width of preorbital 1.2 to 1.3 times in interorbital space.

Recently collected specimens: USNM 202270, Lobos de Afuera, Northwest Island, 6 June 1966, 32 spec.

From the Galapagos Islands: USNM 202348, 24 May 1966, 8 spec.; USNM 202350, 21 May 1966, 9 spec.; USNM 202354, Ecuador, Bahía de Santa Elena, 2° 13' 11"S, 80° 52' 22"W, 4 May 1966, 2 spec.

RANGE.—Eastern tropical Pacific.

Genus *Euscarus* Jordan and Evermann

Euscarus Jordan and Evermann, 1896, p. 416.

Characterized by having 5 median predorsal scales; gill membranes broadly joined to isthmus without free fold; dorsal spines pungent; no free imbricated teeth on dental plates; edge of upper jaw included in that of lower jaw when mouth closed.

RANGE.—Eastern Atlantic Ocean, and Mediterranean Sea.

Euscarus cretensis (Linnaeus)

Labrus cretensis Linnaeus, 1758, p. 282 [type-locality: Crete].

Euscarus cretensis.—Schultz, 1958, p. 130, pls. 4c, 26d.—Bauchot and Blanc, 1961, p. 60 [Santa Cruz].—Cadenat and Roux, 1964, p. 97 [São Tiago Island, Cape Verde Islands].

Labrus scarus Linnaeus, 1758, p. 282 [type-locality: Greece].
Scarus canariensis Valenciennes, 1836, p. 68.—Bauchot and Guibè, 1960, p. 292 [syntypes 8221, 8222, 8223 in Paris Museum].

Scarus rubiginosus Cuvier and Valenciennes, 1839, p. 171.—Bauchot and Guibè, 1960, p. 297 [syntypes nos. 1774 and 8223 in Paris Museum].

Background brownish (reddish when alive) with distinct blackish blotch just behind head above pectoral and below lateral line; tip of opercular flap blackish; caudal fin with distal border pale.

RANGE.—Eastern Atlantic and Mediterranean Sea.

Euscarus strigatus (Günther)

Scarus strigatus Günther, 1862, p. 212.

Euscarus strigatus.—Schultz, 1958, p. 130, pl. 25A.—Bauchot and Blanc, 1961, p. 31 [St. Helena Island].

Characterized by having series of blackish or dark brown scales along lateral line, sometimes interrupted fore or aft; white triangular spot behind mouth; underside of head and snout dark brown; no black shoulder spot.

RANGE.—Eastern Atlantic Ocean at St. Helena Island.

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TABLE 13.—Counts recorded for species

Genera and species	Median predorsal scales						Scale rows on cheek				Number of scales													
											dorsal row							second row						
	3	4	5	6	7	8	1	2	3	4	4	5	6	7	8	9	0	1	2	3	4	5	6	7
Scarops																								
rubroviolaceus				18	3				24		2	24	1									1	17	8
Bolbometopon																								
muricatus		6	3						9		8	2								1	7	1		
bicolor			3	9	14				28		2	15	12	2							5	14	10	
Ypsiscarus																								
ovifrons	1								1				1										1	
oedema	11							11			4	5	3								4	3	4	
Scarus																								
harid harid		17							35	1		2	12	5							2	4	9	
harid vexillus		11								22				2	7	10						2	6	
harid longiceps		32							64				15	14	1	2					2	15	9	
gibbus		94							94		6	25	51	12							2	32	34	
javanicus		35							35			7	7	1							1	13	1	
flavipectoralis		1							2			1	1								2			
dubius		42						11	32		1	17	25	1							16	24	4	
lunula		7							7				6	1								4	3	
formosus		12							12			4	9								4	8	1	
lauia		2							2				2									1	1	
perspicillatus		21					3	18			10	11	1				3	10	6	4				
venosus		26						26				2	23								9	14	2	
taeniurus		82						82			15	11									6	22		
forsteri		100						100			8	16									7	14	3	
enneacanthus		2						3				3										3		
rhoduropturus		23						23			4	17	2									8	14	
sordidus		254						254			41	73	4								12	64	48	
troscheli		19						19				19	10								2	5	17	
bowersi		9						9			3	8										6	5	
jonesi		156						156				1										1		
capistrotoides		9						9			5	6										4	5	
Xenoscarops																								
perrico		22	3					34			30	4					5	24	3					
fehlmanni			6					6			6	6										1	8	1
Callyodon																								
dimidiatus		1	14					15			2	6	8									5	9	
globoceps		4	11					15			2	12	2								1	7	7	
chlorodon		2	63	3				68			4	59	15	1							3	18	34	
rubrofasciatus			3	2				5				8										8		
caudofasciatus			6					6			2	7	2									5	5	
lepidus		1	29	1				31			1	7	18	12						1		8	13	
fasciatus			7	2				9			5	2	1								3	5		
frenatus			9	18				27			1	16	9	2							1	6	16	
janthochir			9					9			2	10										1	3	6
ghobban		2	22	5				35			1	32	2							1	2	26	6	
marshalli			8	2				14			1	19									6	13	1	
compressus*			17					17			2	15									2	15		
scaber		3	14	6				23				9	6									3	9	
oviceps		1	24	5				36				8	29	2								4	19	
niger			1	9	1			11				2	9	1								1	6	

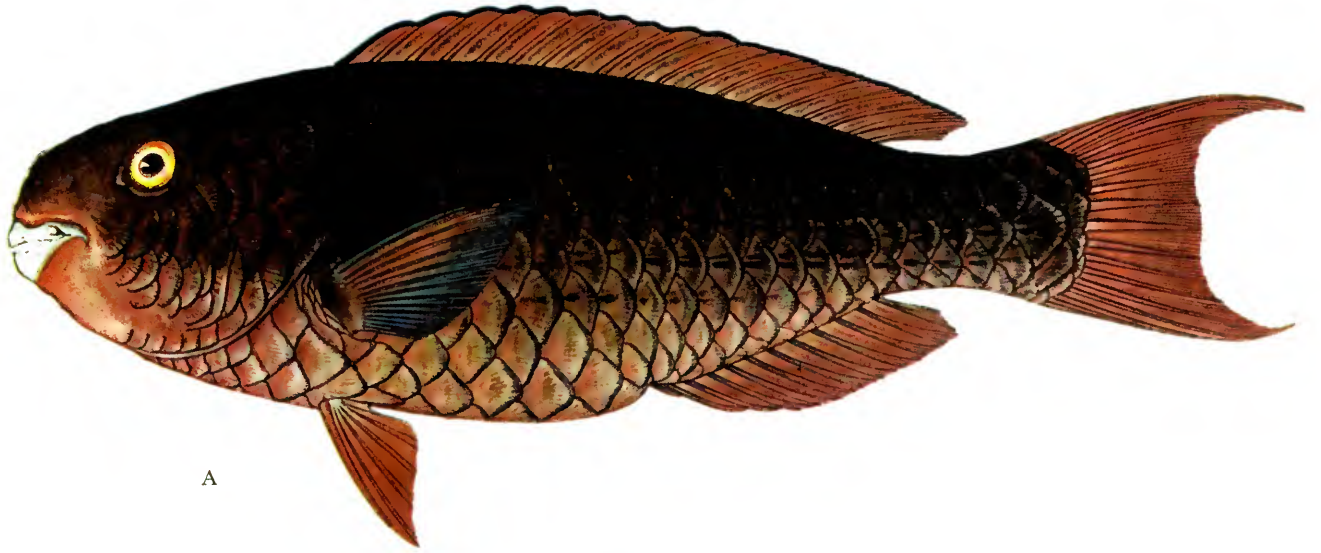
* Counts from literature.

TABLE 13.—Counts recorded for species

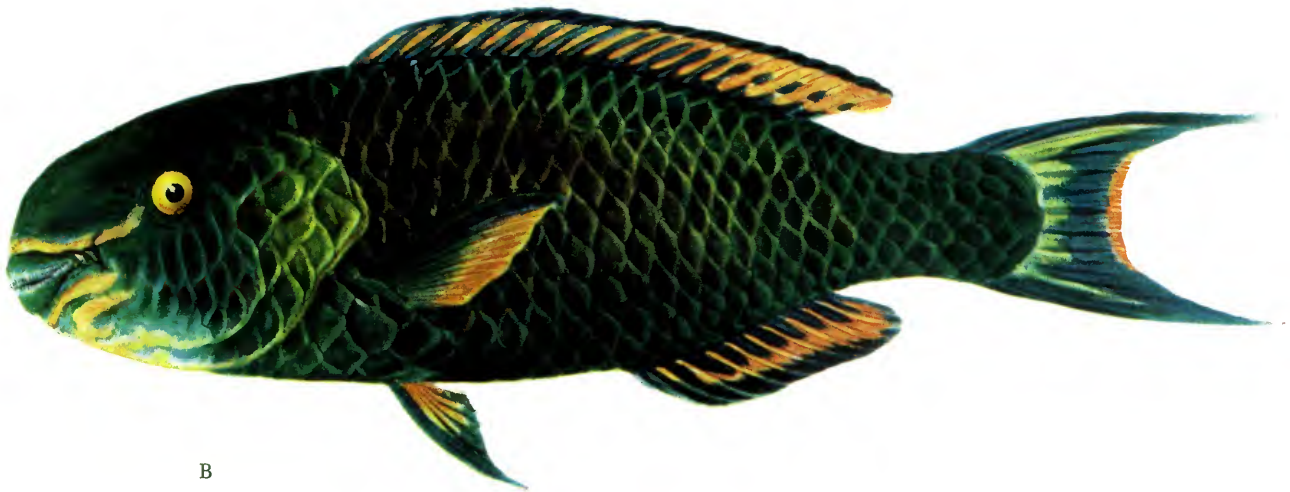
Genera and species	Median predorsal scales						Scale rows on cheek				Number of scales													
	3	4	5	6	7	8	1	2	3	4	dorsal row						second row							
											4	5	6	7	8	9	0	1	2	3	4	5	6	7
Scarus																								
Callyodon																								
cyanognathus				1					2					2										1
madagascariensis					2	1			3					4										2
mus		1	1						2															
blochi			12						15		4	11									2	12	1	
aeruginosus		36	18						78		3	20	4								2	14	9	
croicensis			5	52	1				84		5	59	20	1							6	40	30	
taeniopterus*			1						1			2	49	5									1	1
guacamaia			22						38		18	12									1	13	15	1
vetula				14					24			1	21	2									3	9
coelestinus			1	5					9		3	7	3									1	9	3
coeruleus			21	1					31		3	32									3	22	10	
hoefleri					3				3					4	1							1	4	

*Counts from literature.

PLATES



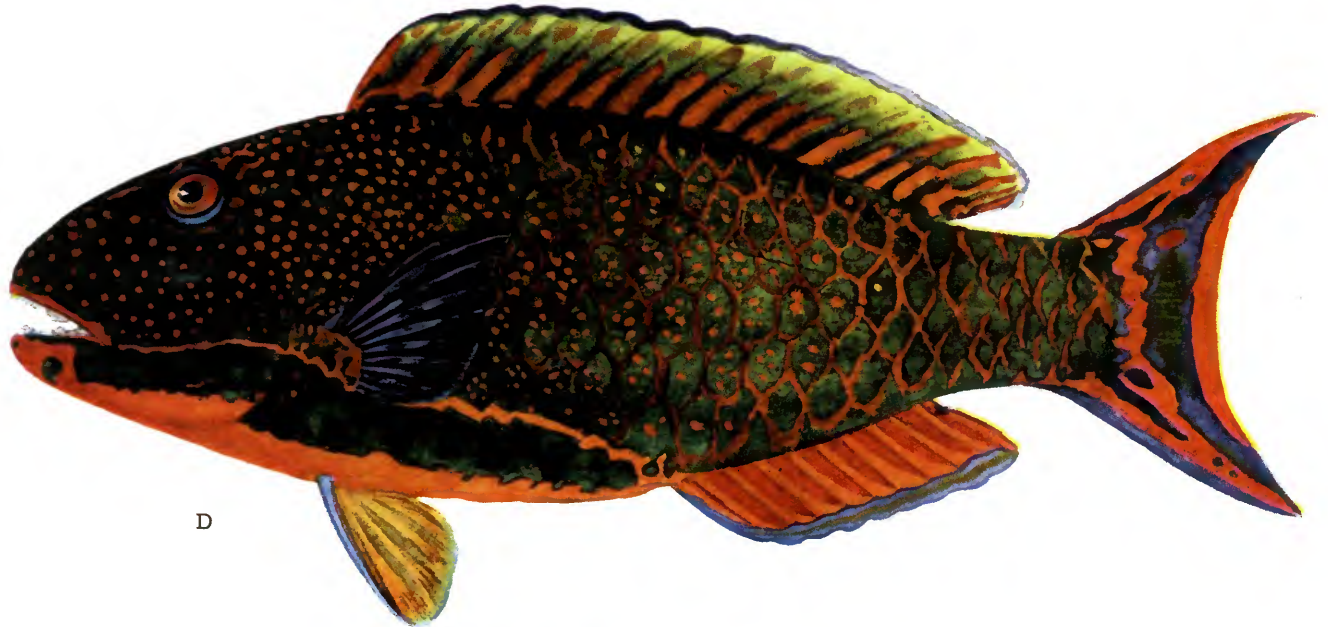
A



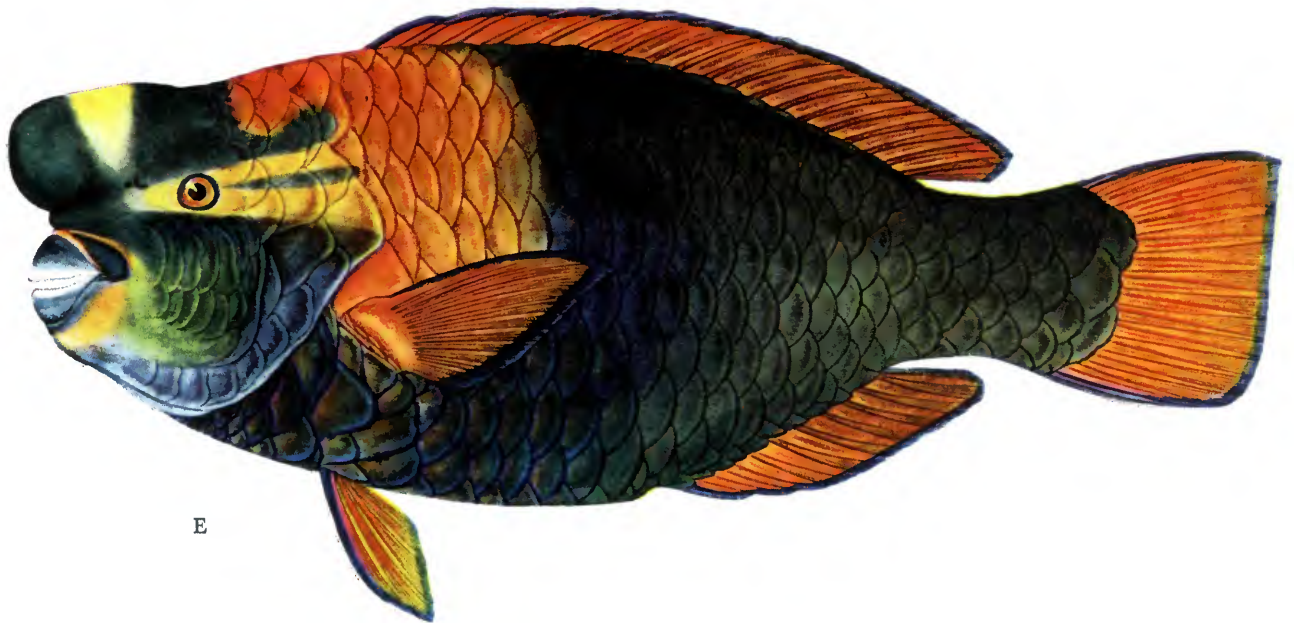
B



C

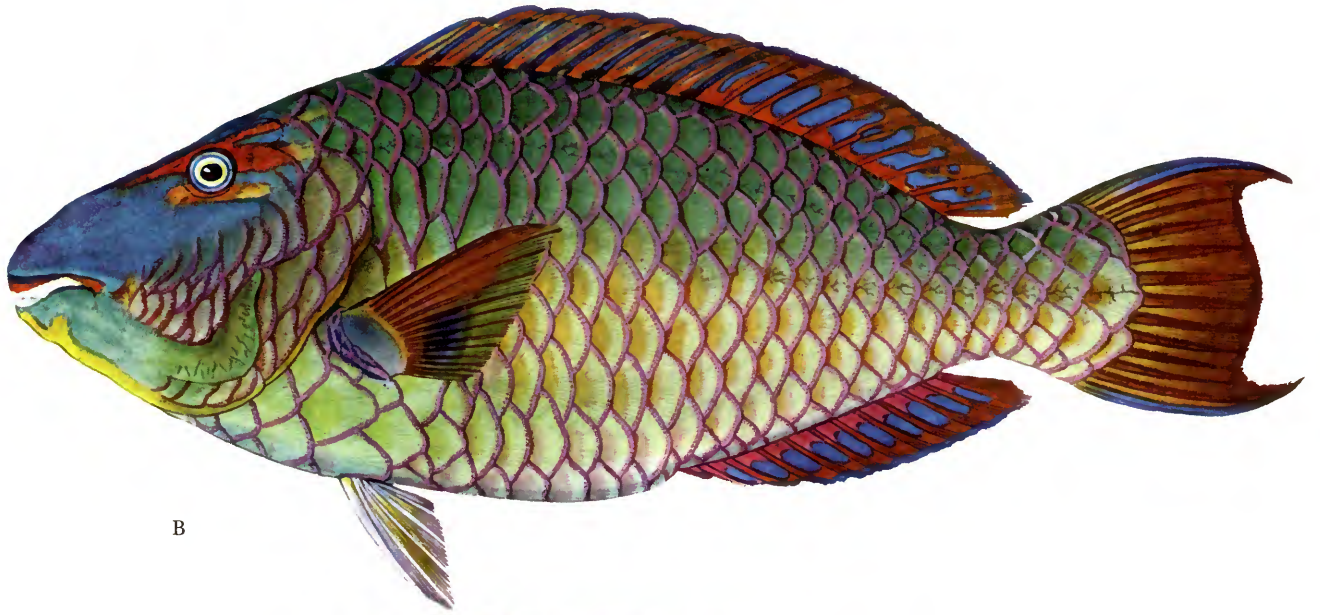


D

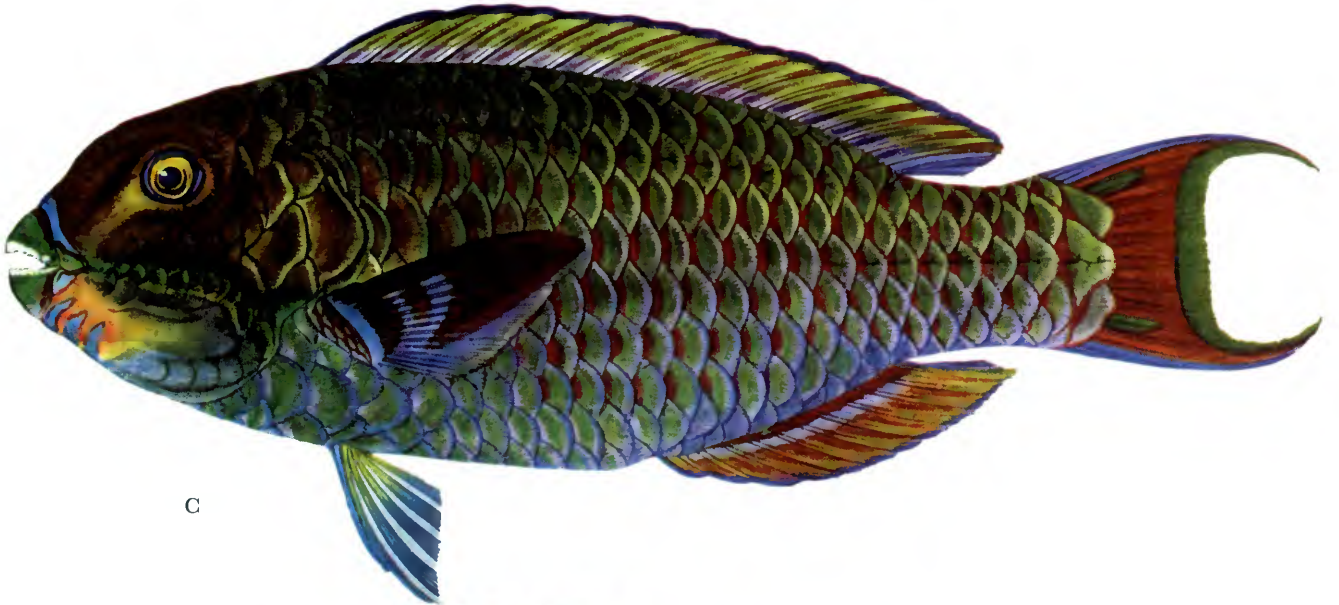


E

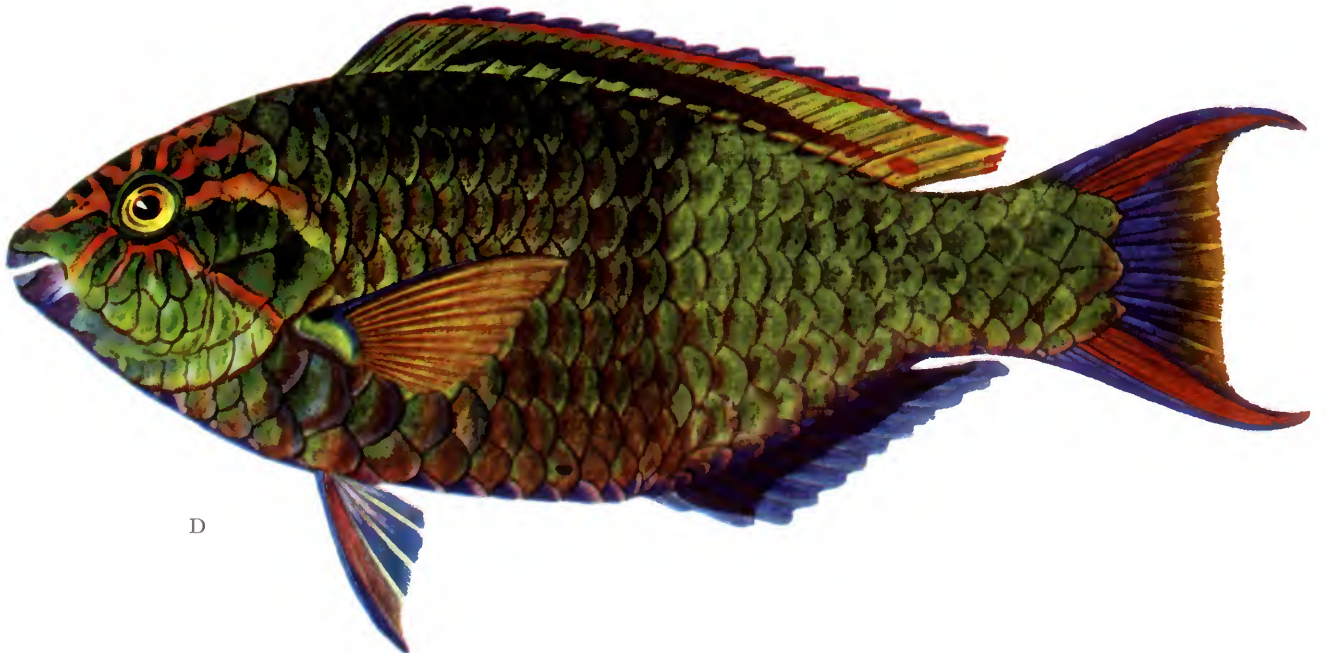
PLATE 1. A, *Scarops rubroviolaceus*, USNM 112219, immature; B, adult male. C, *Bolbometopon bicolor*, USNM 159982, immature; D, adult male. E, *Ypsiscarus ovifrons*. (A, C-E, Philippine Albatross drawings; B, after Jordan and Seale.)



B



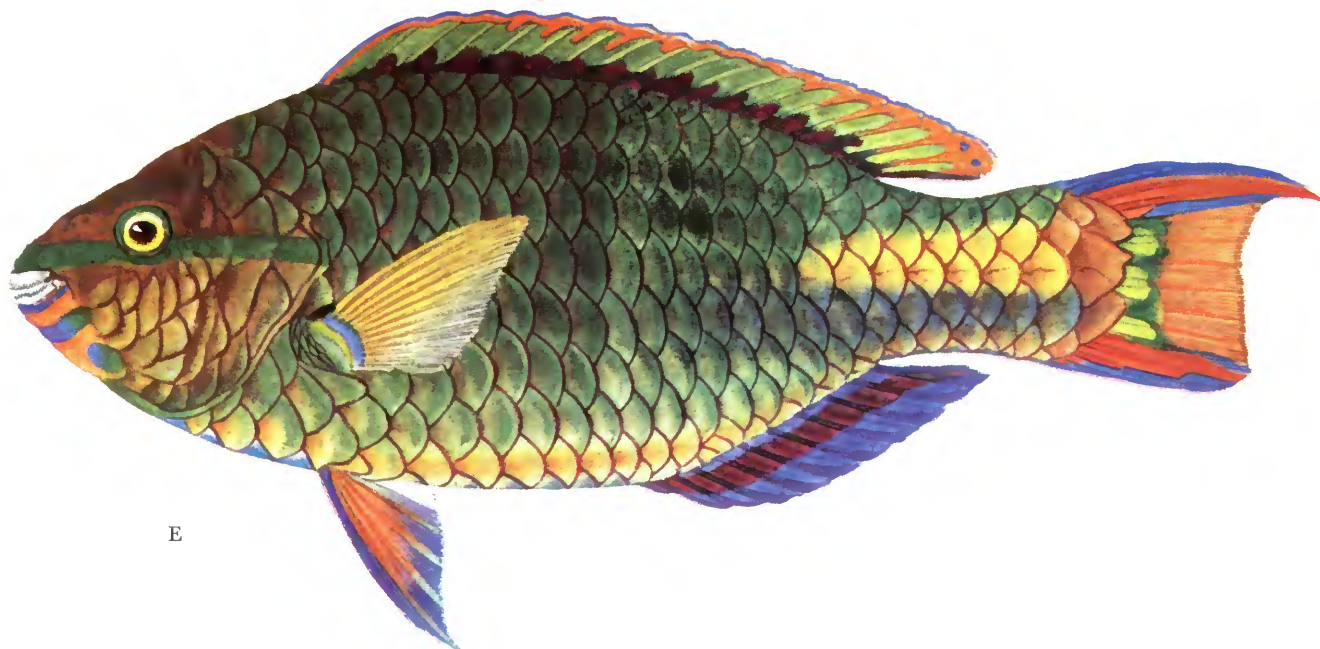
C



D

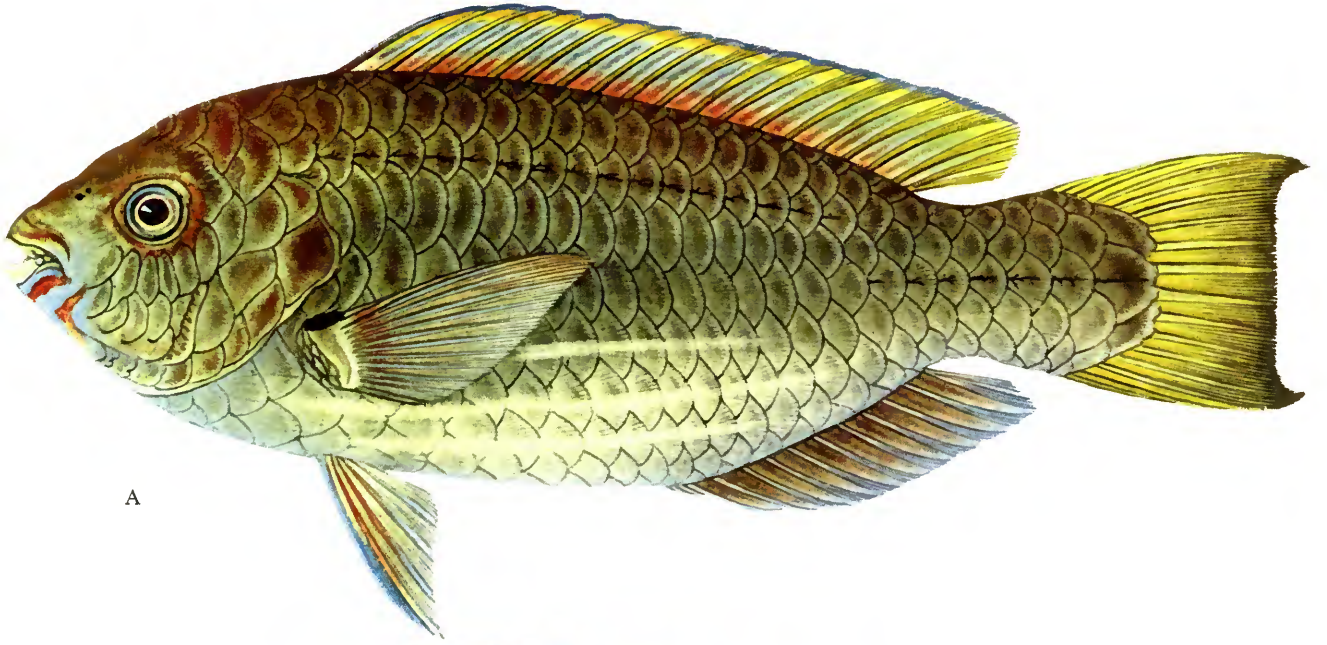


A



E

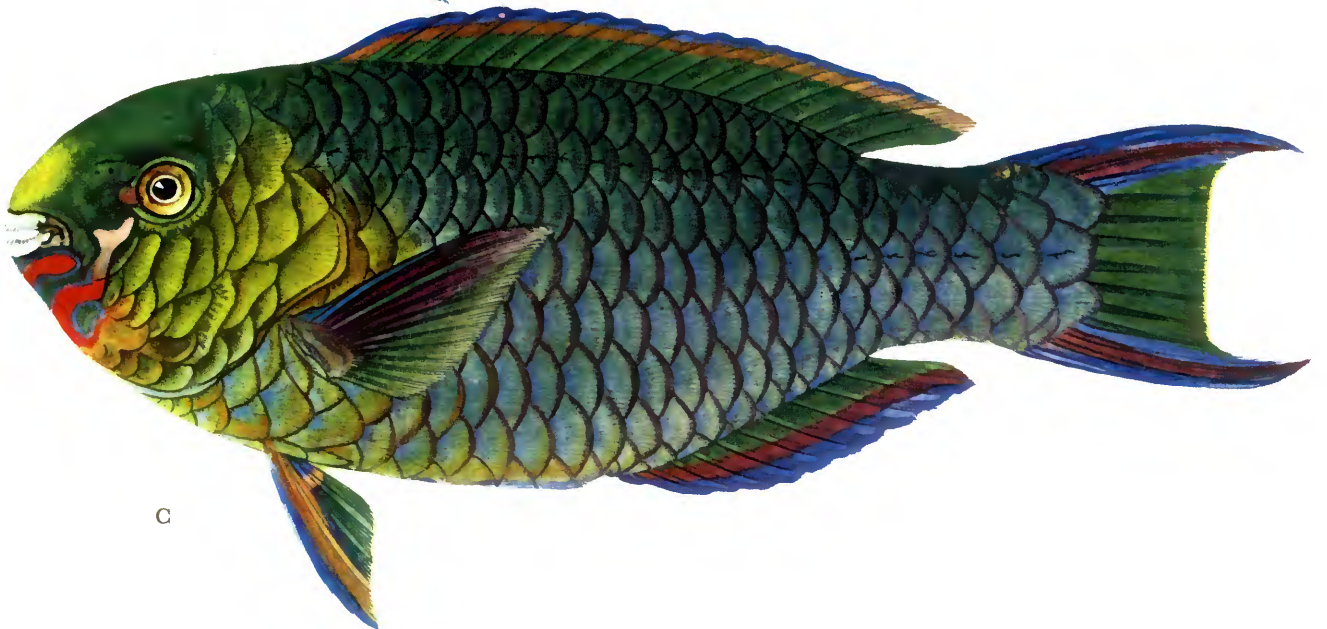
PLATE 2. A, *Ypsiscarus oedema*, USNM 111224, adult, probably a male. B, *Scarus harid longiceps*, USNM 112218, adult, probably a male. C, *Scarus gibbus*, USNM 112228, adult. D, *Scarus javanicus*, USNM 147224, adult. E, *Scarus flavipectoralis*, USNM 112217, adult. (All are Philippine Albatross drawings.)



A



B



C

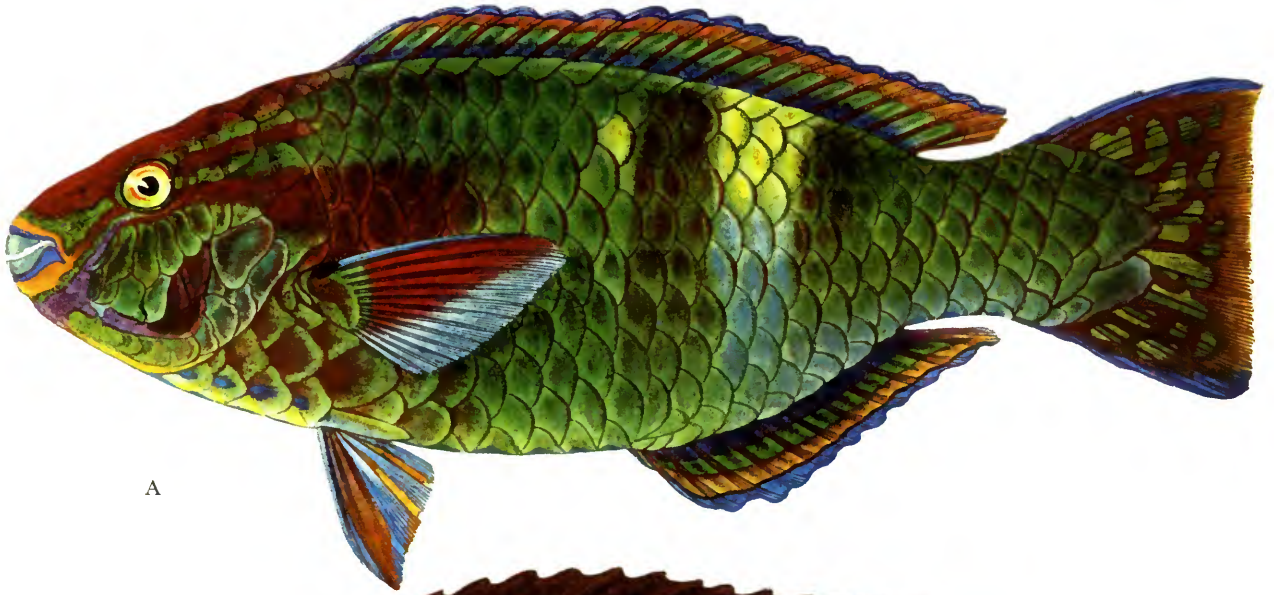


D



E

PLATE 3. A, *Scarus dubius*, USNM 112230, adult. B, *Scarus lunula*, USNM 112215, adult. C, *Scarus formosus*, USNM 112216, adult. D, *Scarus laevis*, USNM 50648. E, *Scarus perspicillatus*, adult male.
(A-C, Philippine Albatross drawings; D, E, after Jordan and Evermann.)



A



B



C



D



E

PLATE 4. A, *Scarus venosus*, USNM 160252, adult, probably a male. B, *Scarus rhoduropterus*, USNM 146944, adult. C, *Scarus sordidus*, USNM 160341, adult, probably a male. D, *Scarus bowersi*, USNM 112214, adult, probably a male. E, *Scarus capistratoides*, USNM 157323. (All are Philippine Albatross drawings.)



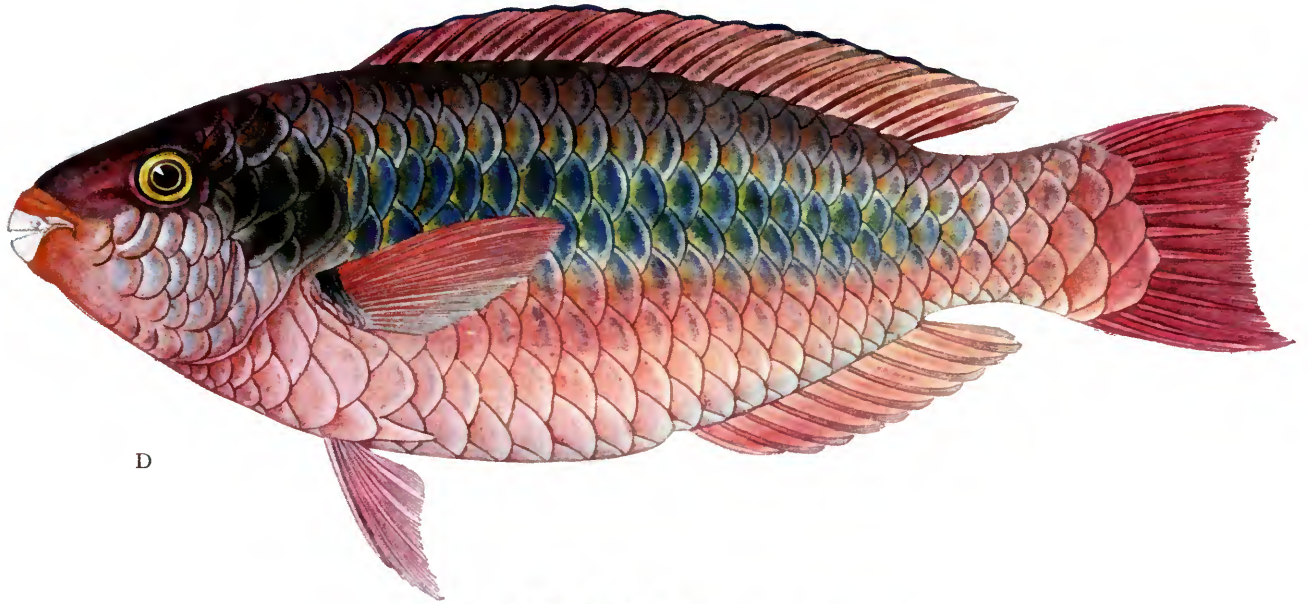
A



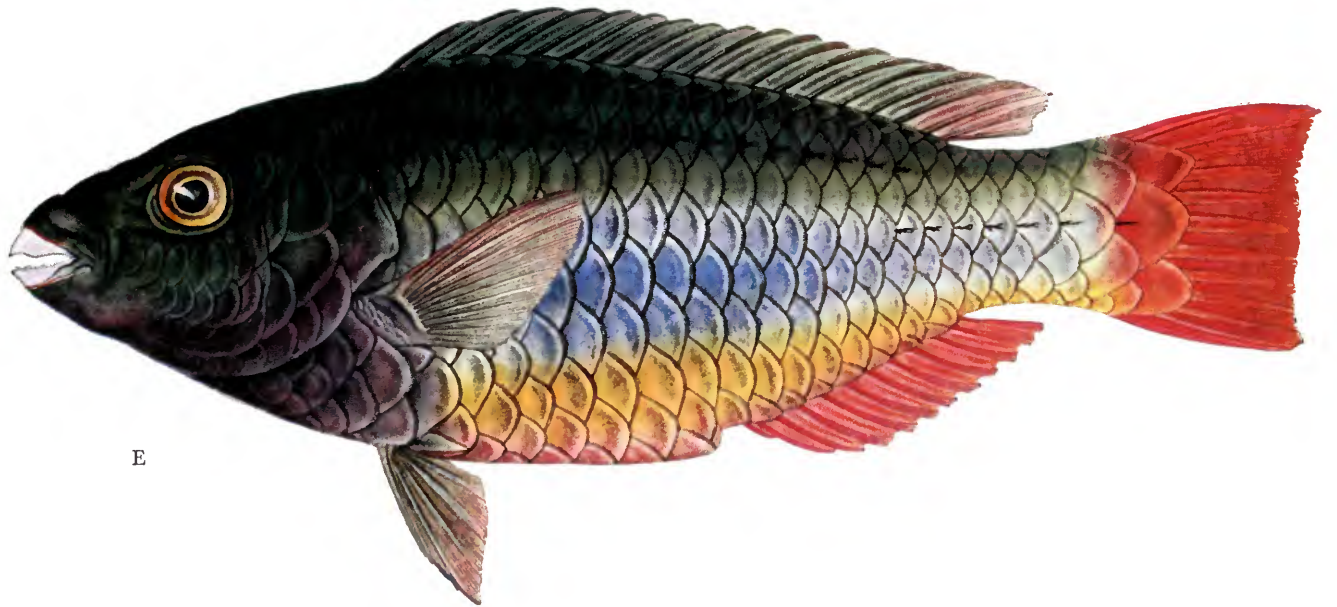
B



C



D

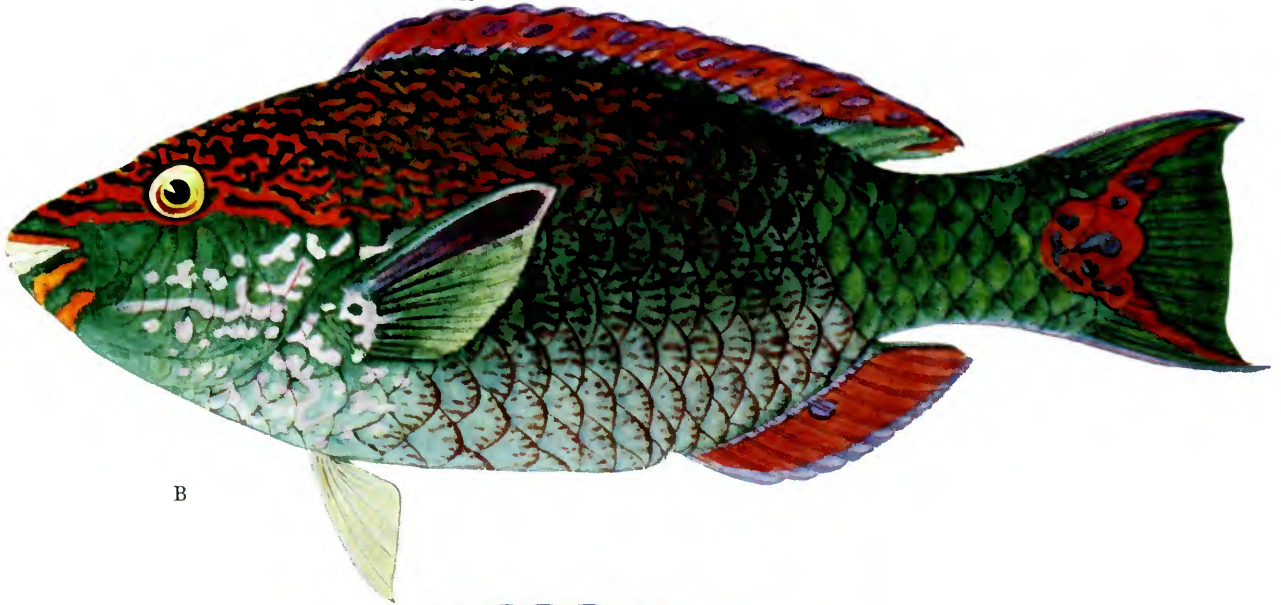


E

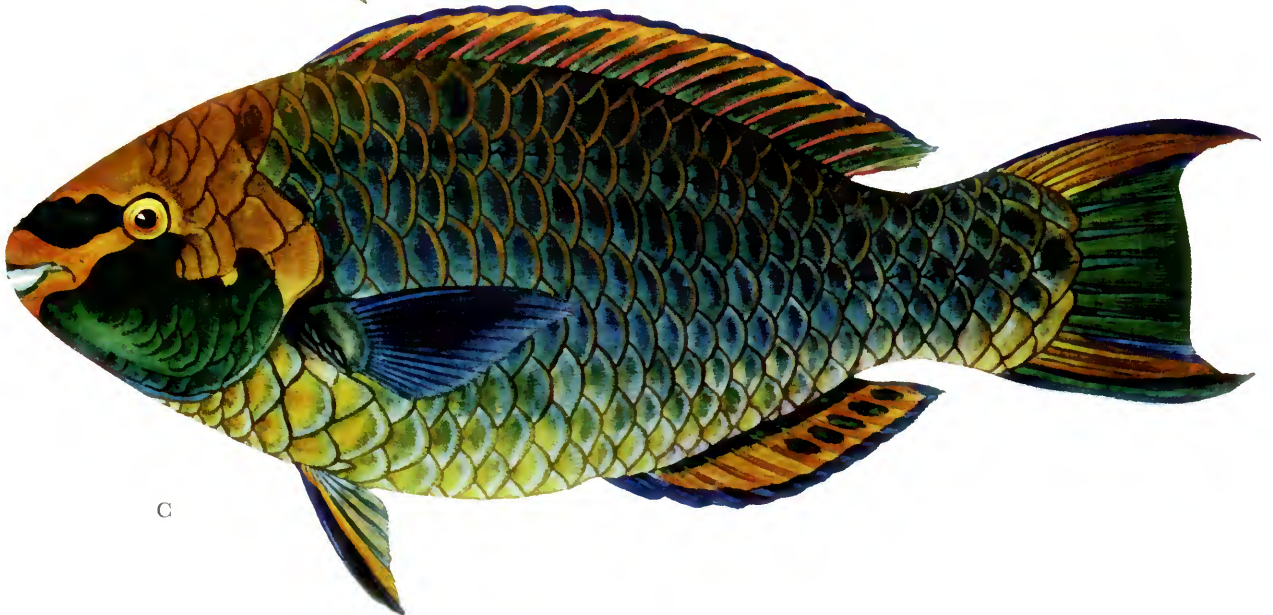
PLATE 5. A, *Scarus dimidiatus*, USNM 112210, adult. B, *Scarus chlorodon*, USNM 112227, immature. C, *Scarus caudofasciatus*, USNM 147217 and 157321, adult. D, *Scarus lepidus*, USNM 160212; E, USNM 160360. (All are Philippine Albatross drawings.)



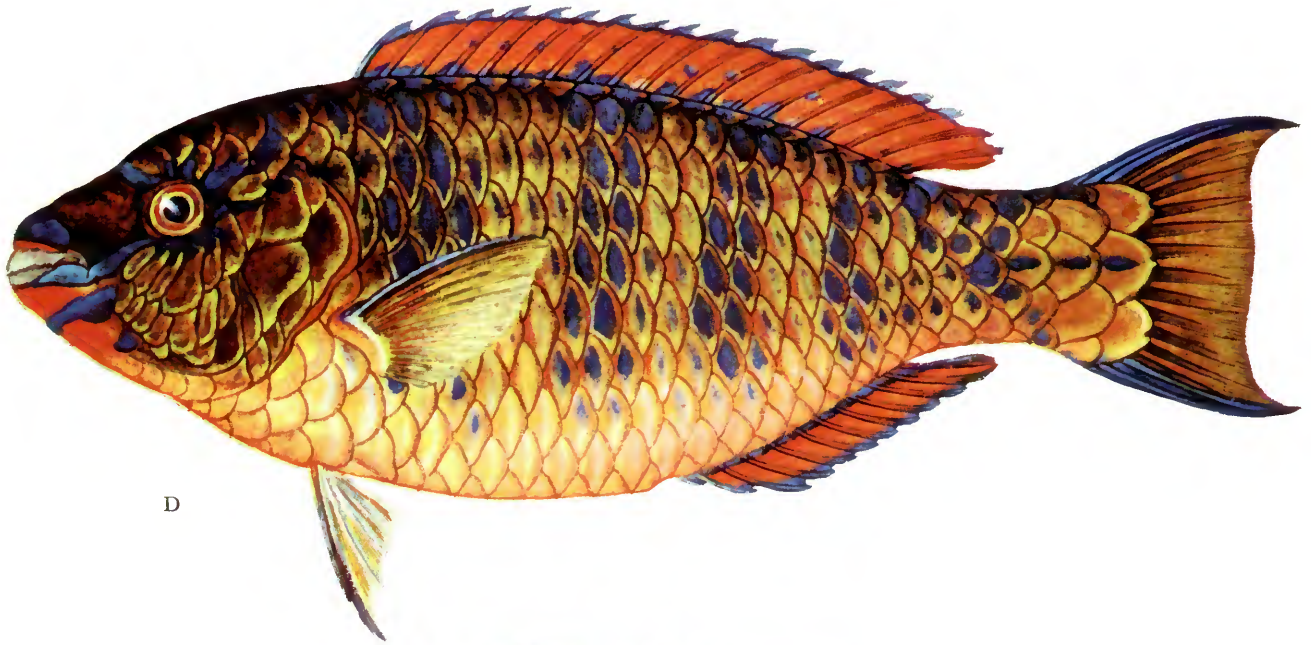
A



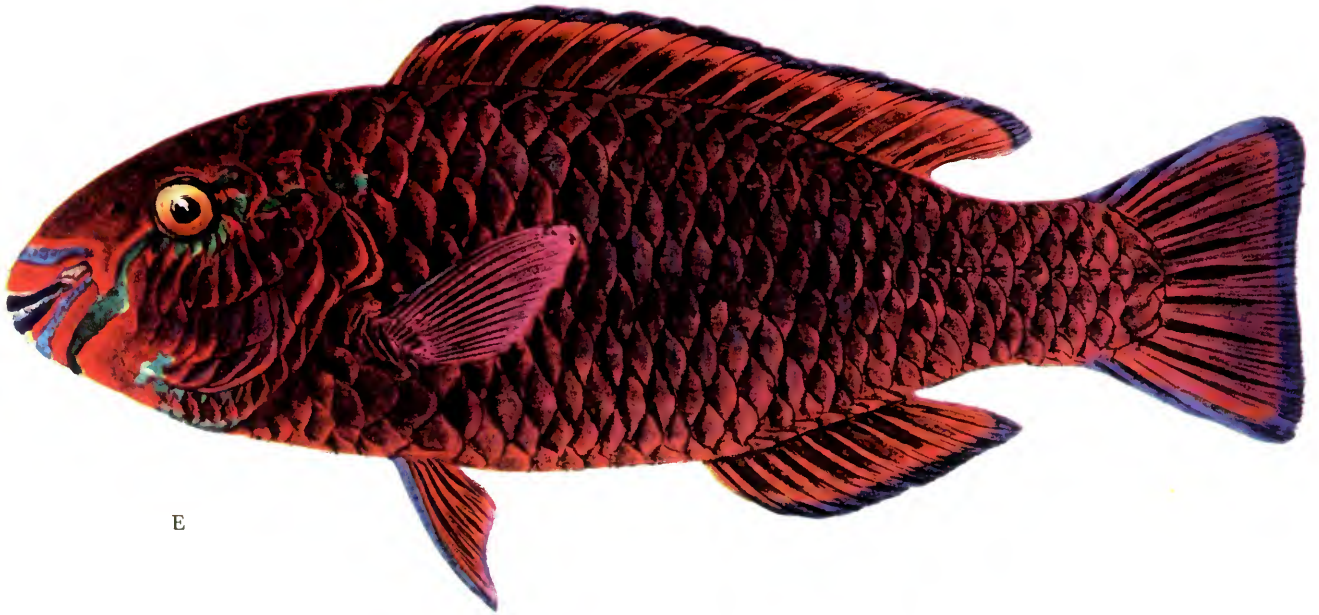
B



C

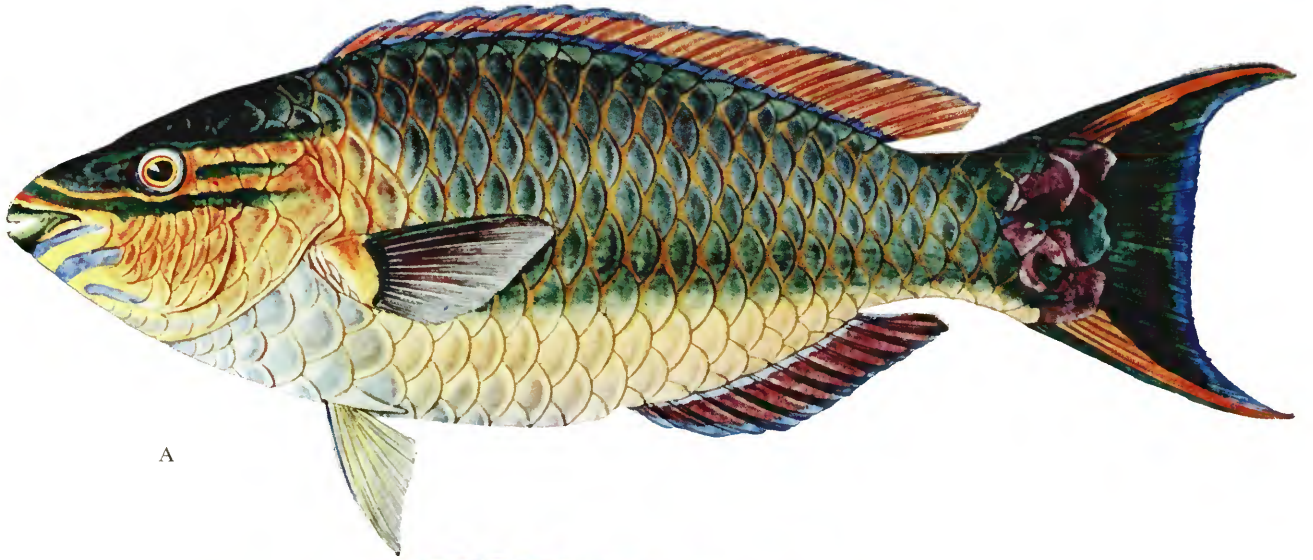


D

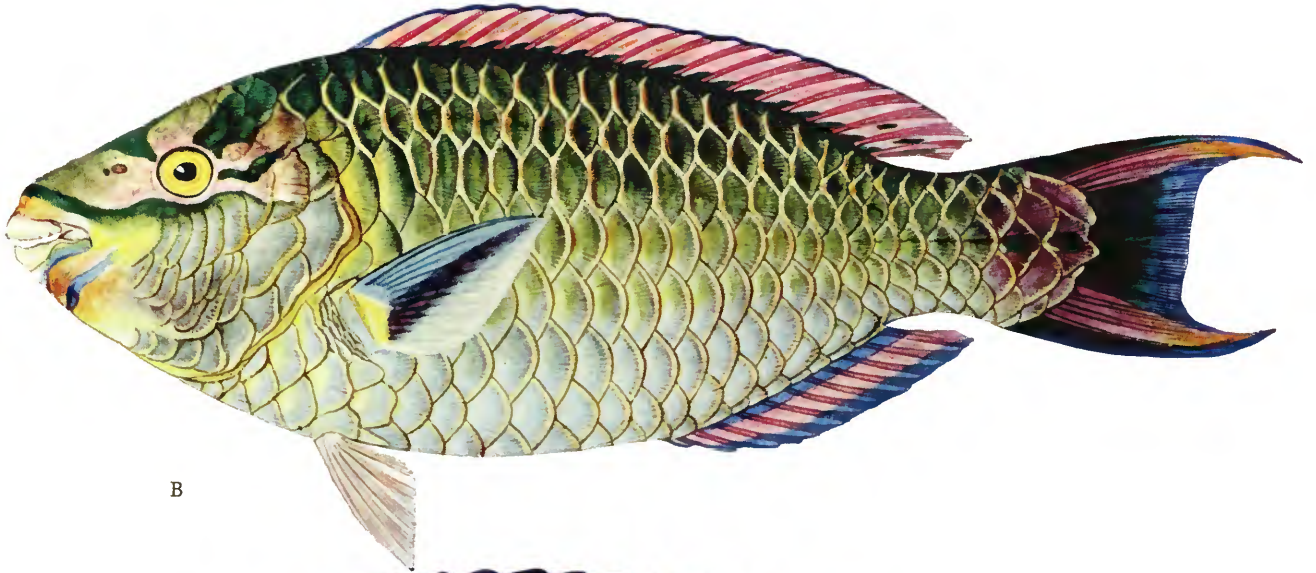


E

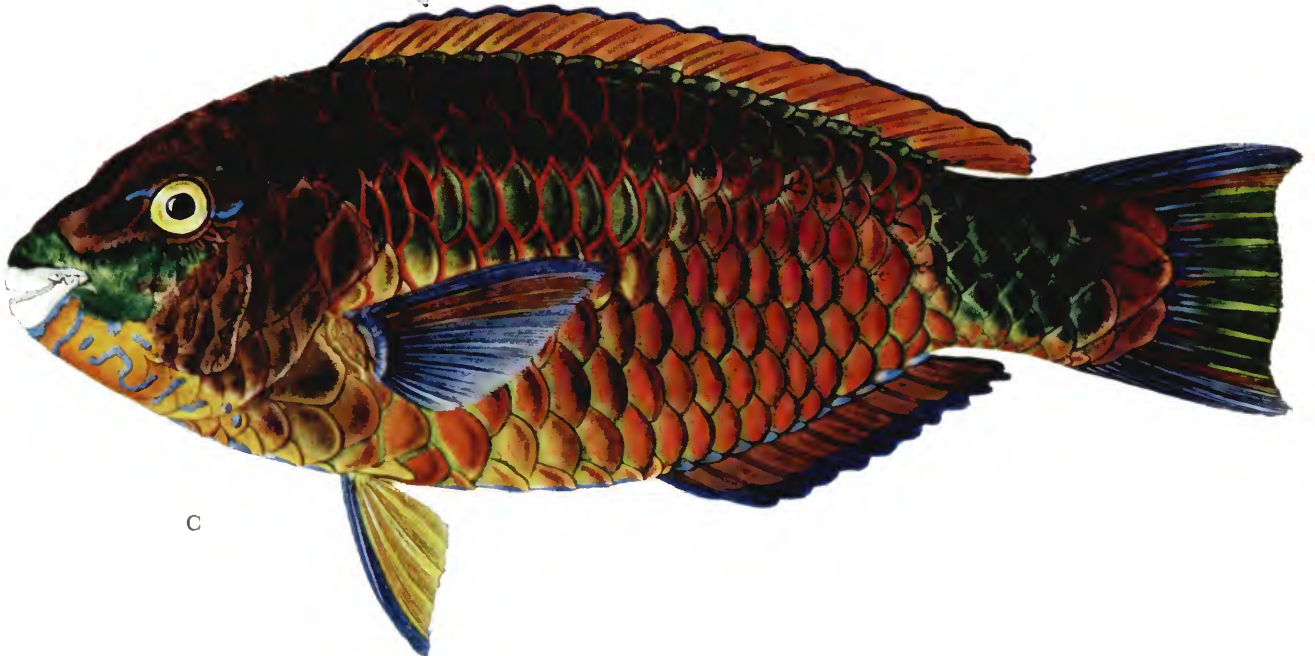
PLATE 6. A, *Scarus fasciatus*, USNM 112211, adult, probably a male. B, *Scarus frenatus*, USNM 89978 (holotype of *S. vermiculatus*), adult, male. C, *Scarus janthochir*, USNM 112225, adult, probably a male. D, *Scarus ghobban*, USNM 160120, adult. E, *Scarus niger*. (A-D, Philippine Albatross drawings; E, after Jordan and Seale.)



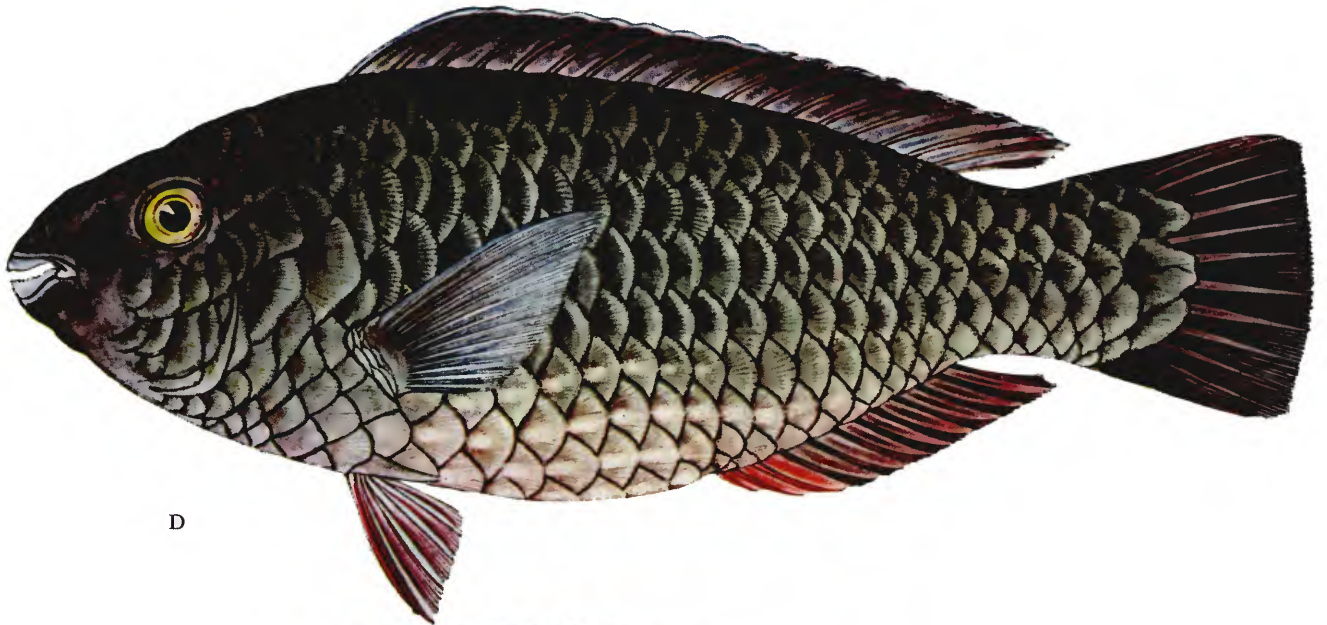
A



B



C



D

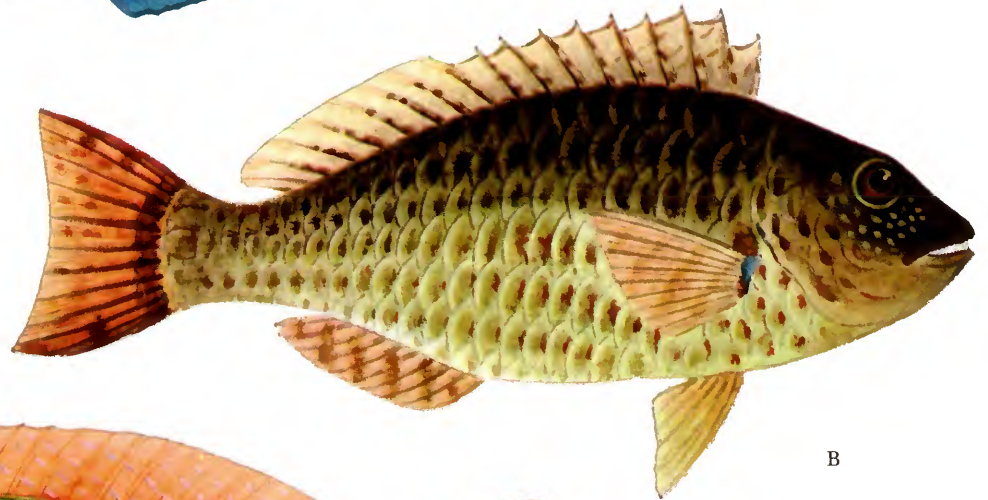


E

PLATE 7. A, *Scarus cyanognathus*, USNM 157103, adult. B, *Scarus mus*, USNM 112229, adult. C, *Scarus blochi*, adult. D, *Scarus aeruginosus*, USNM 112231. E, *Scarus vetula*. (A-D, Philippine Albatross drawings; E, after Evermann and Marsh.)



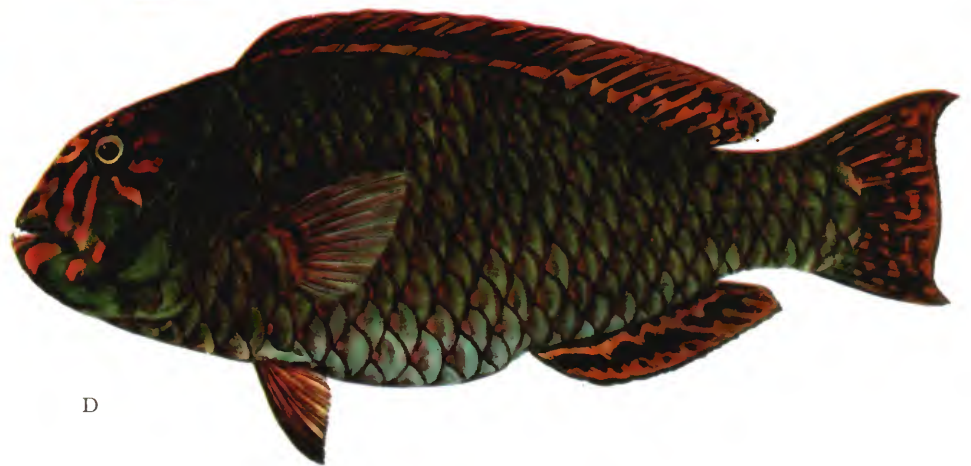
A



B



C



D

PLATE 8. A, *Scarus coeruleus*. B, *Sparisoma chrysopteron*. C, *Sparisoma viride*. D, *Calotomus spinidens*, USNM 160437. (A, C, after Evermann and Marsh; B, from a Bermuda specimen 8 inches long, drawn June 1847; D, a Philippine *Albatross* drawing.)

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