A TAXONOMIC REVISION OF THE EASTERN ATLANTIC GROUPERS (PISCES: SERRANIDAE)

By P. C. HEEMSTRA *

With 16 figures, 1 plate & 1 table

SUMMARY. Fourteen species of groupers (Subfamily Epinephelinae) are recognized from the eastern Atlantic Ocean and Mediterranean Sea. A key for the identification of these species is presented, and a diagnosis, distribution, synonymy and illustration is given for each species.

Epinephelus marginatus (Lowe, 1834) is a common and wide-ranging species that occurs in the Mediterranean and eastern Atlantic from Britain to South Africa and also along the south coast of Brazil. This species has generally been identified as "*Epinephelus guaza* (Linnaeus, 1758)", but the nominal species of Linnaeus is based on a species of *Mycteroperca* from the coast of Venezuela.

The badejo or island grouper, *Mycteroperca fusca* (Lowe, 1836), was previously considered a synonym of *M. rubra* (Bloch, 1793), but it has significantly fewer gill-rakers (20-24 on the lower limb, *versus* 27-31 in *rubra*). *M. fusca* was recently misidentified at Madeira as "*Epinephelus alexandrinus*", a well-known species of the Mediterranean and eastern Atlantic. The valid name for the species commonly known as "*Epinephelus alexandrinus*" is *Epinephelus costae* (Steindachner, 1878), and this species is not known at Madeira. *Serranus alexandrinus* Valenciennes, 1828 is a synonym of *Epinephelus fasciatus* (Forsskål, 1775), a wide-ranging species known from the Red Sea and Indo-Pacific region.

E. coioides (Hamilton, 1822) is reported for the first time from the eastern Mediterranean. It appears to be a migrant from the Red Sea that was previously misidentified as *E. tauvina* and *E. malabaricus*.

Neotypes for *E. marginatus* and *M. fusca* are designated, because it is essential for resolution of the nomenclatural problems concerning these species.

SUMÁRIO. REVISÃO TAXONÓMICA DAS ESPÉCIES DE EPINEPHELINAE (PISCES: SERRANIDAE) DO OCEANO ATLÂNTICO NORDESTE.

Catorze espécies de peixes desta subfamília são reconhecidas no Oceano Atlântico e Mar Mediterrâneo. É apresentada uma chave de identificação e a diagnose, distribuição, sinonímia e ilustração para cada espécie.

E. marginatus (Lowe, 1834) é uma espécie comum e de larga distribuição, que ocorre no Mediterrâneo e Atlântico oriental desde a costa da Grã-Bretanha até à África do Sul e também da costa sul do Brasil. Esta espécie tem sido geralmente identificada como "*Epinephelus guaza* (Linnaeus, 1758)" mas, a espécie nominal de Lineu é baseada numa espécie de *Mycteroperca* da costa da Venezuela.

* J.L.B. Smith Institute of Ichthyology, Private Bag 1015, Grahamstown 6140, South Africa.

O badejo ou garoupa das ilhas, *Mycteroperca fusca* (Lowe, 1836), foi anteriormente considerado como sinónimo de *M. rubra* (Bloch, 1793) mas, possui um número de apêndices lameliformes das brânquias significativamente menor (20-24 no limbo inferior, *versus* 27-31 em *rubra*). *M. fusca* foi recentemente confundida na Madeira com *"Epinephelus alexandrinus"*, uma conhecida espécie do Mediterrâneo e Atlântico oriental. O nome válido para a espécie comumente conhecida por *"Epinephelus alexandrinus"* é *Epinephelus costae* (Steindachner, 1878), espécie não conhecida na Madeira. *Serranus alexandrinus* Valenciennes, 1828 é um sinónimo de *Epinephelus fasciatus* (Forsskål, 1775), uma espécie do Mar Vermelho e região Indo-Pacífica.

E. coioides (Hamilton, 1822) é assinalada pela primeira vez para o Mediterrâneo oriental. Parece ser um imigrante do Mar Vermelho que foi anteriormente confundido com *E. tauvina* e *E. malabaricus*.

São designados neótipos para *E. marginatus* e *M. fusca*, por ser considerado essencial para a resolução dos problemas nomenclaturais relativos a estas espécies.

In the course of research for a World Catalogue of Groupers (to be published by the United Nations Food and Agricultural Organization, with co-author JOHN E. RANDALL), it became apparent that some of the supposedly well-known groupers of the Mediterranean and eastern Atlantic Ocean were commonly misidentified and that their putative "valid" names were incorrect. It is the purpose of this paper to resolve this confusion by a detailed explication of the nomenclatural and taxonomic complexities of these species.

METHODS

Methods for taking counts and measurements generally follow HUBBS and LAGLER (1964), except that pectoral fin length is the length of the longest fin ray. The maxilla width is the greatest width measured perpendicular to the long axis of the bone and includes the supramaxilla but not the upper lip (Fig. 1). Gill-raker counts include all evenly-spaced rudiments. Lateral-line scale counts are of tubed scales in the lateral line and do not include scales on the caudal fin. Lateral scale series are the oblique series of scales dorsal to the lateral line; they are counted from above the first lateral-line scale to the base of the caudal fin. Neotypes are deposited in the Museu Municipal do Funchal (MMF). A list of specimens examined is given at the end of each species account; abbreviations of names of institutions follow LEVITON *et al.* (1985). The synonymies given here are limited to primary synonyms and additional references that provide substantive information.The generic and species accounts are presented in alphabetical order.

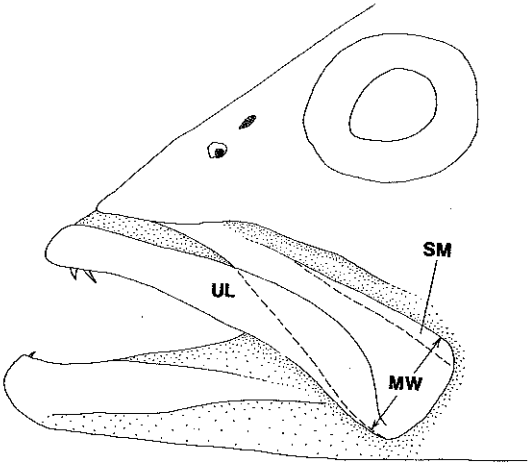

Fig. 1 - Diagramatic illustration of a grouper's head to show method of measuring maxilla width (MW); UL=upper lip; SM=supramaxilla.

KEY TO EASTERN ATLANTIC AND MEDITERRANEAN SPECIES OF GROUPERS

1a. Caudal fin distinctly forked; dorsal fin spines 9 ..... *Paranthias furcifer*

1b. Caudal fin rounded, truncate, emarginate or concave 2

2a. Dorsal fin spines 9; caudal fin rounded (*Cephalopholis*) 3

2b. Dorsal fin spines 11; caudal fin rounded, truncate or emarginate 4

3a. Anal fin rays 8; dorsal fin rays 14; body dark brown with faint dark bars posteriorly, belly reddish; head with close-set reddish spots, forming a dark reticulum ..... *C. nigri*

3b. Anal rays 9; dorsal rays 15; head and body reddish orange (rarely black), covered with small dark-edged blue ocelli; rear margin of median fins bright blue; ground colour of juveniles brown or olive ..... *C. taeniops*

4a. Anal fin rays 7-9; gill-rakers shorter than or subequal to gill filaments, 14-20 on lower limb of first arch (*Epinephelus*) 6

4b. Anal rays 10-12; gill-rakers distinctly longer than gill filaments; 20-31 gill-rakers on lower limb (*Mycteroperca*) 5

5a. Lower gill-rakers 20-24 ..... *M. fusca*

5b. Lower gill-rakers 27-31 ..... *M. rubra*

6a. Dorsal fin rays 16-18; caudal fin truncate to concave; body depth contained 3.1-3.3 times in SL; greatest body width less than half of the depth; juveniles with 3 or 4 dark longitudinal streaks on dorsal part of body; adults brownish, often with an irregular golden yellow blotch on dorsal part of body below spinous dorsal fin ..... *E. costae*

6b. Dorsal fin rays 13-18; body without dark streaks or golden blotch 7

7a. Dorsal fin rays 13 or 14; caudal fin truncate; body dark reddish brown to greyish violet; median fins with white edge; juveniles with 2 oblique dark lines running down and backwards from eye ..... *E. caninus*

7b. Dorsal rays 14-18; caudal fin rounded, convex or truncate 8

8a. Body depth contained 2.8-3.7 times in SL, the greatest width half or more than half of body depth; head and/or body of fish less than 40 cm. SL with dark (orange, reddish-brown or black) spots 9

8b. Body depth 2.4-3.2 times in SL, the width usually less than half body depth; no dark spots on head or body 12

9a. Head and body covered with small dark spots (spots reddish brown or orange in life); 3rd or 4th dorsal spine distinctly longer than last spine or first dorsal soft ray 10

9b. Black spots on body are either indistinct or confined to anterior part of body; 3rd to 11th dorsal fin spines subequal and not longer than first dorsal soft ray 11

10a. Dorsal fin rays 16-18; distinct dark brown blotch on top of caudal peduncle; lower limb gill-rakers 16-19 ..... *E. adscensionis*

10b. Dorsal rays 14-16; no dark saddle blotch on peduncle; lower gill-rakers 13-16 ..... *E. coioides*

11a. Head with dark spots (in juveniles) but no pale stripes; interspinous dorsal fin membranes distinctly incised; lower gill-rakers 13-15 ..... *E. itajara*

11a. No dark spots on head; 2 or 3 oblique black-edged pale blue (or white) stripes across cheek and operculum; interspinous dorsal fin membranes only slightly incised; lower gill-rakers 15-17 ..... *E. aeneus*

12a. Anal fin rays 9; pectoral fin rays 18-21; body depth 2.4-2.8 in SL; pelvic fins subequal to pectorals, reaching to or beyond anus in fish of 10-30 cm. SL ..... *E. haifensis*

12b. Anal rays 8; pectoral rays 17-19; body depth 2.6-3.2 in SL; pelvic fins distinctly shorter than pectorals (and not reaching anus in fish larger than 20 cm. SL) 13

13a. Head length 2.5-2.7 times in SL; body depth 2.9-3.2 times in SL; lateral scale series 120-

129; colour generally brownish; 5 faint dark bars sometimes visible on dorsal part of body ..... *E. goreensis*

13b. Head length 2.3-2.5 times in SL; body depth 2.6-3.0 times in SL; lateral scale series 102-116; head and body dark brown or greyish dorsally, often golden yellow ventrally; irregular white blotches usually visible on head and body; median fins dark brown, the lower margin of anal fin and rear margin of caudal fin with a white edge; margin of spinous dorsal fin and base of paired fins often golden yellow ... . *E. marginatus*

Genus *CEPHALOPHOLIS* BLOCH & SCHNEIDER, 1801

Cephalopholis BLOCH & SCHNEIDER, 1801: 311 (type-species, *Cephalopholis argus* BLOCH & SCHNEIDER, 1801 by monotypy).

Enneacentrus GILL, 1865: 105 (type-species, *Serranus ouatalibi* VALENCIENNES, 1828 [= *Cephalopholis fulva*] by original designation.

Petrometopon GILL, 1865: 105 (type-species, "*Serranus guttatus* POEY" [an unpublished species description presumably taken from a POEY manuscript and apparently based on *Perca guttatus* (*non* LINNAEUS): BLOCH, 1792 = *Cephalopholis cruentata*] by original designation).

Diagnosis: Body oblong, robust, not strongly compressed, the depth contained 2.0-3.2 times in SL, the body width contained 1.9-2.6 times in the depth; head length 2.2-3.1 in SL; dorsal head profile convex or concave, the interorbital area flat to slightly convex; preorbital depth less than eye diameter, contained 8-13 times in head length; preopercle rounded, finely serrate, but without enlarged serrae at the "corner" and no antrorse spines on lower edge; ventral edge of interopercle may be finely serrate posteriorly, but there is no broad indentation; upper edge of operculum distinctly convex; anterior and posterior nostrils subequal. Dorsal fin with 9 spines and 13-17 rays, the fin membranes distinctly incised between the spines; no dorsal fin spines or rays elongated; anal fin with 3 spines and 7-10 rays; caudal fin rounded or convex posteriorly, with 8+7 branched rays and 6-9 + 6-9 procurrent rays; soft dorsal and anal fins rounded; pectoral fins symmetrically rounded, the middle rays longest. Midlateral body scales ctenoid. Jaws with small canines at the front; teeth present on palatines; maxilla of adults with a distinct bony knob on the ventroposterior corner; supramaxilla well developed.

Supraneural bones 2, the posterior one straight or curved posteriorly, much smaller than the first one and situated just anterior to or above tip of second neural spine; dorsal fin with the last 4-7 pterygiophores trisegmental; anal fin with 3-5 trisegmental pterygiophores; rear edge of first dorsal fin pterygiophore slightly to deeply excavated for tip of third neural spine; epipleural ribs on first 9 or 10 vertebrae.

Cranium distinctly narrowed at interorbital region, the least interorbital width subequal to the vomer width and half or less than half of the width at lateral ethmoids; frontals separated anteriorly by the supraethmoid; no median crest on frontals; me-

dial and lateral processes of epiotics subequal; parasphenoid straight or nearly so.

GEOGRAPHIC DISTRIBUTION

The genus is represented in all three major oceans, including both sides of the Atlantic, but it has not yet been found in the Mediterranean Sea.

REMARKS

JORDAN and EVERMANN (1905) resurrected the genus *Cephalopholis* from the synonymy of *Epinephelus* (= "*Serranus*") where it had lain dormant since its original description by BLOCH and SCHNEIDER in 1801. *Cephalopholis* was widely used as a valid genus until C.L. SMITH (1971) demoted it to subgeneric status, but in subsequent publications (SMITH, 1978, 1981) he again recognized *Cephalopholis* as a valid genus. Recognition of *Cephalopholis* as either a genus or subgenus is a moot point, and (as pointed out by SMITH-VANIZ *et al.*, 1988) the monophyly of this genus has yet to be demonstrated. Nevertheless, *Cephalopholis* is a convenient taxon that is readily separable from other genera of groupers. Species of *Cephalopholis* have only 9 dorsal fin spines, whereas species of *Alphestes*, *Dermatolepis*, *Mycteroperca*, *Triso* and *Epinephelus* have 11 dorsal fin spines (except for 3 species of *Epinephelus* which have 10 dorsal spines and *E. acanthistius* (GILBERT, 1892) of the eastern Pacific which has only 9 dorsal spines).

Another useful generic character separating *Cephalopholis* and *Epinephelus* may be the presence of 3-6 trisegmental pterygiophores in the dorsal fin of *Cephalopholis* species (radiographs of 21 species examined). Whereas, all of the *Epinephelus* that were x-rayed (48 spp) lack trisegmental pterygiophores (the middle piece being fused with the proximal element).

Although only a few larvae of each genus are known, LEIS (1986) has found that preflexion larvae of at least 6 species of *Cephalopholis* have a ventral series of 15-23 small melanophores on the tail. In postflexion larvae, the ventral melanophores are reduced to 1-4 and shift to a mid-lateral position on the peduncle. By contrast, *Epinephelus* preflexion larvae of at least 7 species have a single large ventral melanophore on the tail, and this shifts to the mid-lateral position on the peduncle in postflexion larvae.

SMITH-VANIZ *et al.* (1988) compared *Cephalopholis* with the two other epinepheline genera with 9 dorsal fin spines (*Gracila* and *Aethaloperca*, which occur in the Indo-Pacific region). This matter will also be discussed by HEEMSTRA and RANDALL (in press).

The genus *Cephalopholis* comprises 22 species: two in the western Atlantic, two in the eastern Atlantic (*nigri* & *taeniops*), one in the eastern Pacific and 17 in the

Indo-Pacific region. Only the eastern Atlantic species are treated in the present paper; the other species are discussed by RANDALL and HEEMSTRA (in press) and HEEMSTRA and RANDALL (in press).

Cephalopholis nigri (GÜNTHER, 1859)
Fig. 2

Serranus nigri GÜNTHER, 1859: 112 (type locality, mouth of the River Niger; holotype at the BMNH). STEINDACHNER, 1867: 517; 1879: 172; 1882: 21.
Serranus lineo-ocellatus GUICHENOT, in DUMÉRIL, 1861: 244 (type locality, Gabon, Gorée; syntypes MNHN 7370 (118 mm.) Gabon, MNHN 7371 (159 mm.) Goreé); STEINDACHNER, 1870: 582.
Epinephelus nigri: BLEEKER, 1863: 45; BOULENGER, 1895: 178, Pl. 3, Fig. A; PELLEGRIN, 1914: 38; MONOD, 1927: 686; CADENAT, 1935: 391, Fig. 6 (copied from BOULENGER, 1895); *Serranus cruentatus* (*non* LACEPÈDE): PETERS: 1877: 244, Pl. 1, Fig. 1.
Petrometopon nigri: FOWLER, 1936: 747; POLL, 1954: 45, Fig. 11.

Diagnosis: Dorsal fin IX,14-15; anal fin III,8-9; pectoral fin rays 17-18; lateral-line scales 45-50; lateral scale series 73-80; gill-rakers 8-10 + 14-17; 5 or 6 rudiments on each limb. Body depth distinctly less than head length, contained 2.8-3.0 times in SL (for fish 11-15 cm. SL); head length 2.5-2.6 times in SL; pectoral fins 1.4-1.7 times in head length; pelvic fins reach anus, 1.6-1.9 times in head length. Caudal fin rounded; dorsal fin membranes distinctly indented between the spines. Eye diameter greater than interorbital width, 4.6-5.5 times in head length. Interorbital area flat; preopercle rounded, finely serrate, the lower edge fleshy; subopercle and interopercle smooth; upper edge of operculum convex. Maxilla scaly, reaching well past eye. Lateral body scales ctenoid, without auxiliary scales.

Colour: Dark brownish, with 3 or 4 indistinct dark bars on body (extending onto dorsal fin) and 2 more on caudal peduncle; belly reddish; sides of head with close-set reddish spots forming a reticulated pattern of dark lines; pelvic and anal fins dusky, with small pale (silvery?) spots; tips of interspinous dorsal fin membranes black.

Maximum total length: 30 cm.

GEOGRAPHICAL DISTRIBUTION

Tropical eastern Atlantic from Sénégal to Lobito, Angola.

REMARKS

Cephalopholis nigri occurs on mud, sand and rock bottoms from shore to depths

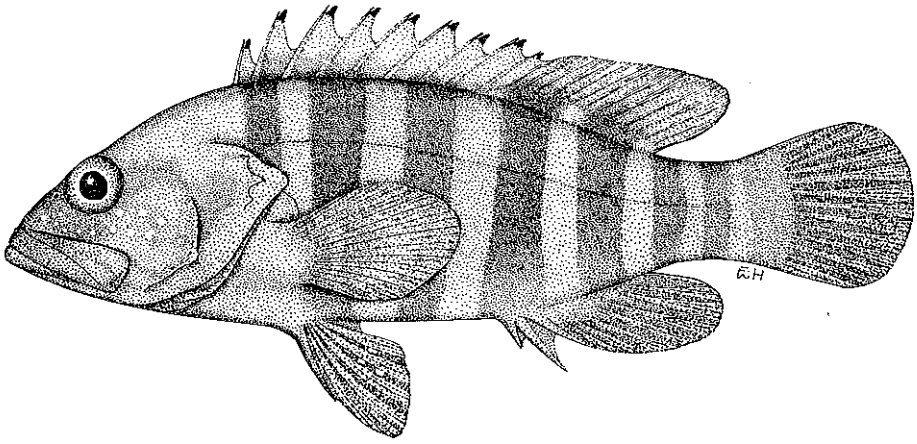

Fig. 2 - *Cephalopholis nigri,* about 20 cm. SL, Ghana from BOULENGER, 1895.

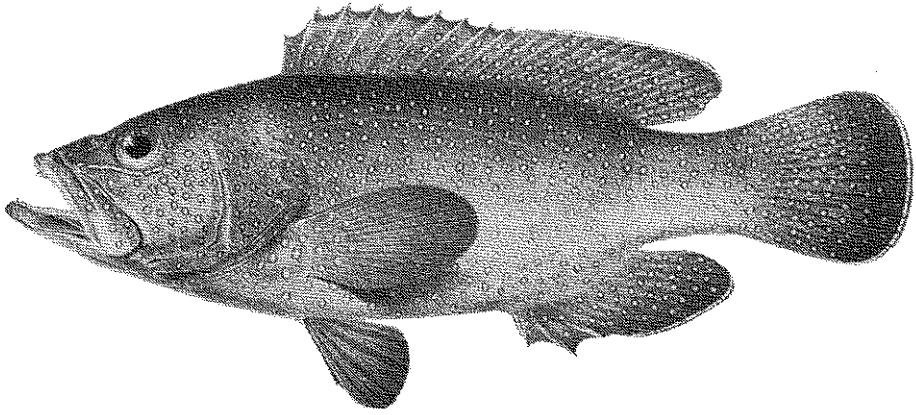

Fig. 3 - *Cephalopholis taeniops,* 16 cm. SL, Sénégal, from STEINDACHNER, 1882.

of 50 (?) m. It is occasionally found in estuaries.

MATERIAL EXAMINED

LIBERIA: CAS/SU 15900 (2, 110-152 mm.). CAMEROUN: CAS/SU 55618 (111 mm.). GABON: MNHN 7370 (116 mm., holotype of *Serranus lineo-ocellatus* GUICHENOT). ANGOLA: Lobito: RUSI 2704 (156 mm.); SAM 24988 (3, 101-185 mm.); UMML 30494 (2, 78-116 mm.); Baia Farta: MB 154 (233 mm.).

Cephalopholis taeniops (VALENCIENNES, 1828)
Fig. 3

Serranus taeniops VALENCIENNES, in CUV. & VAL., 1828: 307 (type locality, Cape Verde Islands; syntypes at MNHN [see BAUCHOT *et al.*, 1984]). DUMÉRIL, 1861: 261; GÜNTHER, 1859: 121; TROSCHEL, 1866: 195; CAPELLO, 1871: 194; STEINDACHNER, 1882: 20, Pl. 1, Fig. 1.

Epinephelus taeniops: BOULENGER, 1895: 186; PELLEGRIN, 1914: 39; CHABANAUD & MONOD, 1927: 262.

Cephalopholis taeniops: FOWLER, 1919: 209; 1936: 750, Fig. 332; CADENAT, 1935: 393, Fig. 7 (copied from STEINDACHNER, 1882); 1951: 189, Fig. 121; POLL, 1954: 47, Fig. 12, Pl. 3; SÉRET, 1981: 150 (excellent colour painting).

Diagnosis: Dorsal fin IX,15-16; anal fin III,9-10; pectoral fin rays 18-19; lateral-line scales 68-72; lateral scale series 114-122; gill-rakers 8 + 15-16; 5 or 6 rudiments on each limb. Body depth distinctly less than head length, contained 2.8-3.2 times in SL (for fish 22-34 cm. SL); head length 2.7-3.0 times in SL; pectoral fins 1.5-1.7 times in head length; pelvic fins reaching or nearly reaching anus. Caudal fin rounded; dorsal fin membranes distinctly indented between the spines. Interorbital area convex; preopercle rounded, finely serrate, the lower edge fleshy; subopercle and interopercle with a few small serrae covered with skin; upper edge of operculum convex. Maxilla scaly, reaching vertical at rear edge of eye or beyond. Lateral body scales ctenoid, without auxiliary scales.

Colour: Reddish orange, the head, body and median fins covered with small blue spots; fins blackish distally, the soft dorsal, caudal and anal fins with a narrow bluish margin; horizontal blue line just below eye. CADENAT (1951) and SÉRET (1981) mentioned a black variety that also has blue spots; it is much less common than the orange variety.

According to SÉRET (1981), *C. taeniops* attains 40 cm. Reports of larger specimens are dubious.

GEOGRAPHICAL DISTRIBUTION

Eastern Atlantic from West Sahara to Angola, including the Cape Verde Islands, Principe Island and São Tomé Island. Reports from the Western Atlantic (STEINDACHNER, 1882) are probably the result of confusion with *Cephalopholis fulva*.

REMARKS

Cephalopholis taeniops prefers sandy and rocky bottoms in depths of 20-200 m. B. SÉRET informs me that this species is now imported from Sénégal and marketted in France. It is an important species in the fishery at Dakar.

MATERIAL EXAMINED

CAPE VERDE ISLANDS: MNHN A.7720 (31 cm.), holotype of *Serranus taeniops* VALENCIENNES; MNHN 1962-74 (162 mm.); Porto Praia, MNHN 6233 (220 mm.). SÉNÉGAL: Dakar, CAS/SU 15899 (130 mm.); MNHN 7263 (175 mm.). SÃO TOMÉ: MNHN 1900-293 (134 mm.).

Genus *EPINEPHELUS* BLOCH, 1793

Epinephelus BLOCH, 1793: 11 (type species, *Epinephelus marginalis* BLOCH, 1793 [= *E. fasciatus* (FORSSKÅL, 1775)], designated under the plenary powers of the International Commission on Zoological Nomenclature, Opinion 93).

Merou BONAPARTE, 1831: 167 (type species, *Perca gigas* BRÜNNICH, 1768 [*nomen dubium*] by subsequent designation of JORDAN, 1919: 175).

Cerna BONAPARTE, 1833: puntàta 10 (type species, *Perca gigas* BRÜNNICH by monotypy).

Cynichthys SWAINSON, 1839: 168, 201 (type species, *C. flavo-purpuratus* [= *Perca flavapurpurea* BENNETT, 1830 = *E. flavocaeruleus* (LACEPÈDE, 1802)]).

Cernua COSTA, 1849: 1 (not available; unjustified emendation of *Cerna* BONAPARTE; preoccupied by *Cernua* FLEMING, 1828: 212 (a genus of percid fish).

Hyporthodus GILL, 1861: 98 (type species, *Hyporthodus flavicauda* GILL [= *E. niveatus* VALENCIENNES, 1828] by monotypy.

Schistorus GILL, 1862: 236 (type species, *Serranus mystacinus* POEY, 1852 by monotypy).

Labroperca GILL, 1862: 236 (type species, *Serranus labriformis* JENYNS, 1843 by monotypy).

Promicrops POEY, 1868: 287 (type species, *Serranus Guasa* POEY, 1861 [= *E. itajara* (LICHTENSTEIN, 1822)] by monotypy; genus attributed to GILL by POEY, but the diagnosis is POEY's).

Priacanthichthys DAY, 1868: 193 (type species, *Priacanthichthys maderaspatensis* DAY, 1868 [= *E. latifasciatus* (TEMMINCK & SCHLEGEL, 1842)] by monotypy).

Merus POEY, 1874: 39 (type species, *Epinephelus marginalis* BLOCH; proposed as a replacement name for *Epinephelus* BLOCH).

Homalogrystes ALLEYNE & MACLEAY, 1877: 268 (type species, *Homalogrystes guntheri* ALLEYNE & MACLEAY, 1877 [= *E. coioides* (HAMILTON, 1822)] by monotypy).

Itaiara VAILLANT & BOCOURT, 1878: 70 (type species, *Serranus itajara* LICHTENSTEIN, by monotypy).

Hyposerranus KLUNZINGER, 1884: 3 (type species, *Serranus morrhua* VALENCIENNES, 1833 by subsequent designation of JORDAN, 1920; proposed as a subgenus of *Serranus*).

Phrynotitan GILL, 1885: 225 (type species, *Batrachus gigas* GÜNTHER, [= *E. lancolatus*] by monotypy).

Garrupa JORDAN, in JORDAN & EIGENMANN, 1890: 350, 353 (type species, *Serranus nigritus* HOLBROOK, 1855 by original designation; proposed as a subgenus of *Epinephelus*).

Enneistus JORDAN & EVERMANN, 1896: 1147 (type species, *Bodianus acanthistius* GILBERT, 1892 by monotypy; proposed as a subgenus of *Bodianus*).

Stereolepoides FOWLER, 1923: 382 (type species, *Stereolepoides thompsoni* FOWLER, 1923 [= *E. lanceolatus*] by monotypy.

Vivero JORDAN & EVERMANN, 1927: 505 (type species, *Serranus morio* VALENCIENNES, 1828 by monotypy; proposed as a subgenus of *Epinephelus*).

Serrihastaperca FOWLER, 1944: 384 (type species, *Serrihastaperca exsul* FOWLER, 1944 by original designation).

Altiserranus WHITLEY, 1947: 150 (type-species *Serranus jayakari* BOULENGER, 1889 [= *E. multinotatus* (PETERS, 1876)] by original designation).

Diagnosis: Body elongate, robust (subcylindrical), oblong or deep and compressed; body depth greater than, subequal to or less than head length and contained 2.3-3.7 times in SL, the body width 1.8-2.8 in the depth; head length 2.1-2.8 in SL; preorbital depth 6.7-15 times in head length; preopercle rounded or angular, the posterior edge serrate, with the serrae at the angle more or less enlarged; a few species with small serrae (mostly covered by skin) on the ventral edge. Dorsal fin usually with 11 spines (10 spines in *E. analogus*, *exsul* and *nigritus*, 9 in *E. acanthistius*) and 12-19 rays; length of base of soft-rayed part of dorsal fin not more than base of spinous part. Anal fin with 3 distinct spines and 7-10 (very rarely 7 or 10) rays. Caudal fin rounded, truncate or concave, with 8+7 branched rays and 8-10 + 7-10 procurrent rays. Pectoral fin rounded, with the middle rays longest. Scales on body ctenoid or smooth. Canines present at front of jaws, but they may be small in some species; no distinctly enlarged canine tooth at midside of lower jaw; teeth present on palatines; maxilla of adults without a distinct bony knob on ventroposterior corner, but there may be an abrupt step or hook-like process (covered by the upper lip) on the distal part of the ventral edge; supramaxilla well developed.

Supraneural bones 2; dorsal and anal fins without trisegmental pterygiophores; rear edge of first dorsal pterygiophore with or without excavation for tip of 2nd neural spine; epipleural ribs on first 8-10 vertebrae. The diversity of cranial morphology of the many species assigned to *Epinephelus* makes it difficult to recognize diagnostic cranial characters for the genus.

GEOGRAPHICAL DISTRIBUTION

The genus *Epinephelus* is represented in tropical and subtropical latitudes of

all three major oceans, as well as in the Mediterranean Sea.

REMARKS

C. L. SMITH (1971) demoted the genus *Promicrops* (comprising *E. itajara* and *E. lanceolatus* of the Indo-West Pacific) to a subgenus of *Epinephelus* and stated that these two species "are highly specialized and distinctive although their alliance with other species of *Epinephelus* is clear". As justification for his recognition of *Promicrops* as a subgenus, SMITH (1971: 152) mentioned some distinctive features of the cranium of *E. itajara*, especially "a heavy strut of bone connecting the posterior face of each lateral ethmoid with the shaft of the parasphenoid (fig. 17)." This posterior ethmoid strut is not known for any other species of grouper.

E. itajara and *E. lanceolatus* also differ from most other species of the genus in having the tubes of the lateral-line scales with 4-6 radiating branches. Except for large adults of *E. malabaricus* and *E. coioides* (which have a few anterior lateral-line scales with branched tubules), the lateral-line scales of other species of *Epinephelus* have unbranched tubes.

Epinephelus is compared with the genus *Cephalopholis* in the account of that genus (above). The relationships of the genus *Epinephelus* are obscure, because this taxon (like other grouper genera) is defined by superficial (not clearly synapomorphic) characters that may or may not indicate the congeneric status of the included species. Nevertheless, the genus can easily be separated from the other eastern Atlantic genera, as indicated in the key to species (above). A comparison of *Epinephelus* with the grouper genera that are not represented in the eastern Atlantic is given in the papers of RANDALL and HEEMSTRA (in press) and HEEMSTRA and RANDALL (in press).

The genus *Epinephelus*, as here defined, comprises some 97 species and is thus the most speciose genus of serranid fishes. It is well represented in the tropical and subtropical waters of all three major oceans. Most species (67) are found in the vast Indo-West Pacific region (see RANDALL and HEEMSTRA, in press, for a revision of the Indo-West Pacific species). Eight species occur in the eastern Pacific; 11 are known from the western Atlantic, and 9 species are found in the eastern Atlantic and Mediterranean.

Epinephelus species are generally found on coral or rocky reefs, but a few species (*e.g.*, *E. aeneus*) are commonly taken with trawls over sandy/mud bottoms. Some species occur in deep water (to at least 525 m.), but most are found in depths of 10-200 m. The two largest species (*E. itajara* and *E. lanceolatus*), which grow to well over 2 metres in length and a weight of over 400 kg, are often found in estuaries and harbours.

The reproduction of a few species has been studied, and they appear to be pro-

togynous hermaphrodites; but the picture is complicated in some species by the occurence of males that are much smaller than some females. It may be that not all females change sex, and perhaps some males do not go through a previous female stage.

Epinephelus adscensionis (OSBECK, 1765)
Fig. 4

Perca tota maculis... SEBA, 1758: 76, Pl. 27, Fig. 7 (type locality, unknown).
Trachinus adscensionis OSBECK, 1765: 388 (type locality, Ascension Island, South Atlantic Ocean; holotype not located).
Perca stellio WALBAUM, 1792: 349 (based on *Perca tota maculis* of SEBA).
Trachinus osbeck LACEPÈDE, 1800: 364 (substitute for *Trachinus adscensionis* OSBECK; type locality, Ascension Island).
Serranus pixanga VALENCIENNES, in CUV. & VAL., 1828: 383 (type locality unknown [presumably Brazil]; based on a description by MARCGRAVE).
Serranus nigriceps VALENCIENNES, in CUV. & VAL., 1830: 517 (type locality unknown; holotype MNHN 7393 (264 mm.).
Serranus impetiginosus MÜLLER & TROSCHEL, 1848: 665 (type locality, Barbados; holotype not located).
Serranus capreolus POEY, 1860: 145 (type locality, Cuba; holotype not located).
Serranus varius BOCOURT, 1868: 222 (type locality, Gulf of Mexico; holotype MNHN 5190 (166 mm.).
Epinephelus adscensionis: See C. L. SMITH (1971: 145) for numerous additional references.

Diagnosis: Dorsal fin XI,16-18; anal fin III,8; pectoral fin rays 18-20; lateral-line scales 48-53; lateral scale series 92-108; gill-rakers 7-9 + 16-19 including 2-7 rudiments on each limb. Body depth less than head length, contained 2.6-3.2 times in SL (for fish 13-38 cm. SL); head length 2.1-2.5 times in SL; pectoral fins longer than pelvics, 1.5-2.1 times in head length; pelvic fins 1.8-2.3 times in head length for fish 10-19 cm. SL, 2.2-2.7 times in head length for fish 20-38 cm. SL. Rear margin of caudal fin convex; dorsal fin with the fourth or fifth spine longest and the interspinous membranes distinctly incised. Interorbital area flat or slightly concave; preopercle evenly serrate, without salient angle; subopercle and interopercle smooth; nostrils subequal. Lateral body scales distinctly ctenoid, with auxiliary scales.

Colour: Head, body and fins generally buff or pale greenish, covered with reddish brown spots (spots fewer but larger on small juveniles) and scattered pale blotches; usually 3-5 dark brown blotches (groups of dark spots) at base of dorsal fin and a blackish-brown blotch on top of caudal peduncle (on some specimens, only the dark blotch at base of last dorsal spines is apparent); rear edge of caudal fin with a row of dark brown spots forming a dark margin.

According to LUBBOCK (1980), the rock hind at Ascension Island may attain a

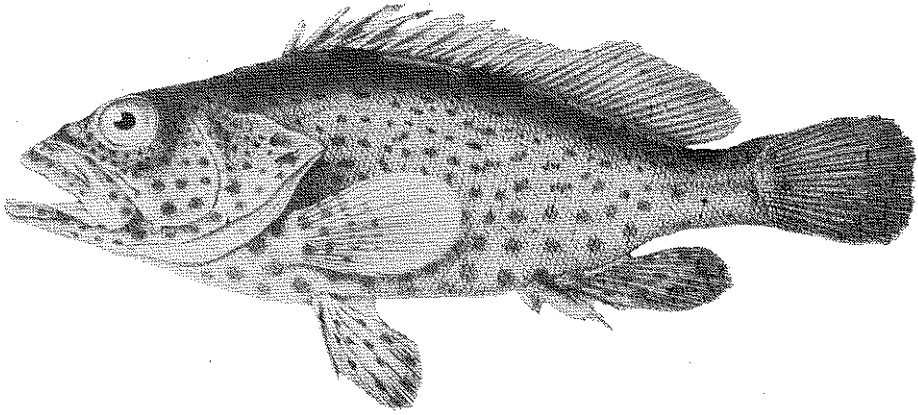

Fig. 4 - *Epinephelus adscensionis*, 17 cm. SL, Ascension Islands, from VAILLANT & BOCOURT, 1875.

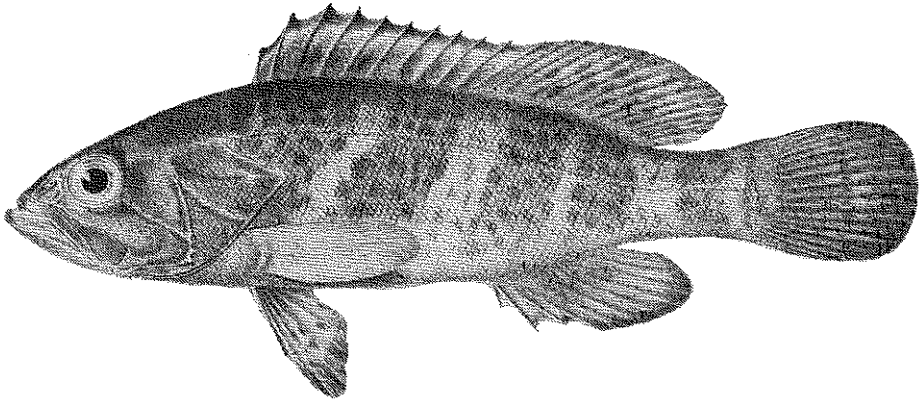

Fig. 5 - *Epinephelus aeneus*, 136 mm. SL, Sénégal, from STEINDACHNER, 1882.

length of "about one metre".

GEOGRAPHICAL DISTRIBUTION

E. adscensionis is a wide-ranging species known from the mid-Atlantic islands of Ascension and St. Helena and, in the western Atlantic, from Bermuda, Massachusetts (one record), South Carolina, Georgia, Florida, Gulf of Mexico, and from the Caribbean to southern Brazil. Reports by C.L. SMITH (1971: 148) of *E. adscensionis* at the Canary Islands, Cape Verde Islands and South Africa are unsubstantiated (see Remarks, below). This species was not reported by DOOLEY *et al.*, (1985) in their extensive survey of the fish fauna of the Canary Islands. Records from the Portuguese islands in the Gulf of Guinea (OSÓRIO, 1898) require verification.

REMARKS

E. adscensionis occurs on rocky reefs in depths of 2 to 100 m. At Saint Helena, it is common in shallow water and represents 90% of "groundfish" landings; large adults (over 50 cm.) are taken regularly in 50 to 100 m., but are rare in shallow water (EDWARDS & GLASS, 1987). *E. adscensionis* is also of major importance to the fisheries at Ascension Island. It is caught with hook and line, in traps and with spears.

Records of *E. adscensionis* from South Africa (BARNARD, 1927; SMITH, 1949; C.L. SMITH, 1971) are apparently based on two dried juveniles sent to the British Museum by ANDREW SMITH in the early 1800's. These specimens were said to be from "Cape Seas" (BOULENGER, 1895); but as no others have been reported from South Africa, it seems likely that ANDREW SMITH may have obtained these fish from St. Helena or Ascension Island. There are no *E. adscensionis* from South Africa in either the South African Museum or the J.L.B. Smith Institute.

The report of *E. adscensionis* from the Cape Verde Islands (C.L. SMITH, 1971: 145) is based on the holotype of *Serranus aspersus* JENYNS (1843). Although JORDAN and EIGENMANN (1890) recognized *S. aspersus* as a valid (but dubious) species, BOULENGER (1895) and C.L. SMITH (1971) regarded it as a synonym of *E. adscensionis*. JENYNS' (1843) original description of a 4.25 inch fish collected by CHARLES DARWIN, does not accord with adscensionis: the dorsal fin rays are too few (15, vs. 16-18), and the colour pattern does not fit (no mention of the characteristic dark reddish brown spots on the head and body of *adscensionis*). This holotype is probably a specimen of *E. marginatus*, because the original description agrees well with juveniles of this species and they are common at the Cape Verde Islands.

Serranus nigriculus VALENCIENNES, 1828 was listed in the synonymy of *E. adscensionis* by SMITH (1971), but BAUCHOT *et al.* (1984) correctly assigned these two syntypes

to *Cephalopholis cruentata*.

MATERIAL EXAMINED

ASCENSION ISLAND: GMBL 80-20 (295 mm.); RUSI 12884 (310 mm.); RUSI 28229 (16, 42-205 mm.). ST. HELENA: RUSI 29410 (5, 330-381 mm.); USNM (2, 334-355). SOUTH CAROLINA: GMBL 71-211 (285 mm.). PUERTO RICO: UPRM 3688 (35 mm. SL). PANAMA: MCZ 43743 (187 mm.). BRAZIL: MZUSP (240 mm.); Salvador, MZUSP (2, 120-137 mm.); São Paulo, MZUSP (329 mm.).

Epinephelus aeneus (E. GEOFFROY SAINT-HILAIRE, 1817)
Fig. 5

Serranus aeneus E. GEOFFROY SAINT-HILAIRE, 1817: Pl. 21, Fig. 3 (description by I. GEOFFROY SAINT-HILAIRE, 1827: 317; type locality, Mediterranean coast of Egypt; holotype MNHN 6326 (266 mm.) DAMIETTE); GÜNTHER, 1859: 134; STEINDACHNER, 1882: 21, Pl. 2, Fig. 1; FOWLER, 1936: 756.

?*Perca robusta* COUCH, 1832: 21, Fig 7 (type locality, Cornwall, England; holotype not preserved?).

Serranus gigas: DAY, 1880: 16, Pl. 5 (in part).

Cerna aenea: DODERLEIN, 1882: 201, Pl. 2, Fig. 3.

Epinephelus aeneus: BOULENGER, 1895: 222; CADENAT, 1951: 191, Fig. 120; POLL, 1954: 50, Fig. 14; TORTONESE, 1973; SÉRET, 1981: 154.

Additional references are given by FOWLER (1936), BRUSLÉ (1985) and HEEMSTRA and RANDALL (1992).

Diagnosis: Dorsal fin XI,14-16; anal fin III,7-9; pectoral fin rays 18-19; lateral-line scales 67-72; lateral scale series 98-102; gill-rakers 8-10 + 15-17 including 4-8 rudiments on each limb. Body depth distinctly less than head length, contained 3.0-3.6 times in SL; head length 2.5-2.9 times in SL; pectoral fins longer than pelvics, 1.5-1.9 times in head length; pelvic fins 1.8-2.0 times in head length for fish 10-20 cm. SL. Caudal fin rounded; dorsal fin with the third or fourth spine longest and the interspinous membranes only slightly incised. Interorbital area convex; preopercle angular, with 3-6 large spines at the angle, the lowermost directed ventrally; maxilla reaches about to vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth; rear nostrils slightly bigger than front ones. Eye diameter equals interorbital width in fish of 20-25 cm. SL and is distinctly less than the interorbital width in larger specimens. Lateral body scales distinctly ctenoid, with auxiliary scales. Pyloric caeca 12-14.

Colour: Greenish bronze, the fins darker, brownish violet, bordered with white or pale mauve; 2 or 3 pale blue (or white) lines across operculum, the lowest from rear end of maxilla to interopercle, the next from eye across preopercle just above the angle and onto subopercle, the uppermost line from eye to upper end of pre-

opercle where it usually bifurcates and continues to rear edge of operculum. Juveniles with faint dark spots on body forming 5 indistinct dark bars; fins also with faint dark spots. In large adults the white lines on the head may be indistinct.

Maximum size: 120 cm. total length, weight 25 kg.

GEOGRAPHICAL DISTRIBUTION

E. aeneus occurs throughout the Mediterranean and along the west coast of Africa to southern Angola; also reported from the Canaries and Cape Verde Islands. The seasonal migration of *E. aeneus* off the coast of Sénégal is influenced by the seasonal upwellings off Sénégal and Mauritania (CURY & ROY, 1988). The description of *Perca robusta* COUCH (1832) was based on a fish "3 ft. in length" that was caught off the south coast of England, but *E. aeneus* does not normally occur in British waters.

REMARKS

Adults are found on rocky or mud and sand bottoms in depths of 20-200 m.; juveniles have been taken in coastal lagoons and estuaries. BRUSLÉ (1985) summarized the published information on the ecology, distribution and biology of this species.

Perca robusta COUCH, 1832 was listed as a synonym of "*Epinephelus guaza*" [= *E. marginatus*] by C.L. SMITH (1971). In his original description, COUCH (1832: 21) gives the length of his holotype as 3 feet and the body depth as 7 inches (depth 5.1 in total length). The original illustration of *Perca robusta* is a somewhat crude and diagrammatic woodcut, with the body depth contained 3.3 times in the total length. Although the fin counts given by COUCH (dorsal fin with 11 spines and 16 rays; anal with 2 spines [the small first spine was probably overlooked] and 8 rays; pectoral fin rays 19) fit *E. marginatus*, the body depth of "7 inches" is much too small for a 3-ft fish (the depth would be at least 9 inches in a *marginatus* this size). A more likely candidate for *P. robusta* is *Epinephelus aeneus*, which is more elongate than *marginatus* (body depth 3.0-3.6 times in SL, versus 2.6-3.1 in SL) and has virtually the same fin counts. Unlike *E. marginatus, E. aeneus* has 2 or 3 oblique, pale blue or white stripes across the operculum, and COUCH (1867: 199) mentioned "Two slightly marked pale lines on the gill-covers, one on each plate, running obliquely downward." The description and illustration of *Serranus gigas* in *The Fishes of Great Britain and Ireland* by DAY (1880) is based on *E. aeneus*, but his synonymy applies mainly to *E. marginatus*. DAY's figure (1880: Pl. 5) was done from a specimen supplied by W.C.H. PETERS of the Berlin Museum. No locality or length was given for this fish, but judging from the size of the eye, it was probably about 20 cm. SL. The ratio

of SL/body depth taken from the drawing is 3.4, which is well outside the range for *E. marginatus*, but within the range for *E. aeneus*. DAY's illustration also shows two faint pale bands running backwards across the cheek, as seen on some faded preserved specimens of *E. aeneus*. CADENAT (1935) clearly distinguished *E. marginatus* [as "*Epinephelus gigas*"] from *E. aeneus*, and he listed DAY's (1880) account of *Serranus gigas* in the synonymy of *E. aeneus*; but he inexplicably used DAY's (1880: Pl. 5) illustration of *E. aeneus* as if it were *Epinephelus gigas*.

MATERIAL EXAMINED

NIGERIA: MNHN 1896-354 (207 mm.); MNHN 1896-355 (126 mm.). BENIN: MNHN 1967-946 (3, 125-152 mm.).

Epinephelus caninus (VALENCIENNES, 1843)
Fig. 6

Serranus caninus VALENCIENNES, 1843: 10 (type locality, Canary Islands; holotype apparently not preserved); STEINDACHNER, 1883: 65, Pl. 2, Fig. 1.
Cerna canina: DODERLEIN, 1882: 193, Pl. 1, Fig. 2.
Epinephelus caninus: BOULENGER, 1895: 205; CADENAT, 1935: 398, Fig. 11; CADENAT, 1951: 193; MAURIN, 1968: 70, Fig. 37; SÉRET, 1981: 158, fig.; TORTONESE, 1986: 785; BELLEMANS *et al.*, 1988: 95.
Epinephelus alexandrinus (*non* VALENCIENNES): Poll, 1954: 56, Fig. 15, Pl. 3, Figs. 3-6.

Diagnosis: Dorsal fin XI,13-14; anal fin III,8; pectoral fin rays 17-18; lateral-line scales 70-79; lateral scale series 120-135; gill-rakers 8-10 + 15-17 including 4-6 rudiments on each limb. Body depth less than head length, contained 2.7-3.0 times in SL; head large, its length 2.3-2.5 times in SL; pectoral fins longer than pelvics, 1.7-2.2 times in head length; pelvic fins fall well short of anus. Caudal fin truncate or emarginate; dorsal fin with the third or fourth spine longest and the interspinous membranes deeply incised. Interorbital area convex; preopercle angular, with 3-6 large spines at the angle, the lowermost directed ventrally or slightly anteriorly; rear edge of interopercle and lower edge of subopercle serrate; upper edge of operculum distinctly convex; maxilla scaly, reaching to or beyond vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth; a pair of large canine teeth at front of both jaws; rear nostrils 2 or 3 times bigger than front ones. Eye diameter more than interorbital width in fish of 10-28 cm SL and distinctly less than interorbital width in fish more than 45 cm SL. Lateral body scales distinctly ctenoid, with auxiliary scales.

Colour: Uniformly dark reddish brown or greyish violet to yellowish grey; posterior parts of median fins with a distinct white edge. Usually two or three dark

bands across the cheek, the uppermost extends from eye to lower opercular spine, the second runs from lower edge of eye across angle of preopercle to juncture of interopercle and subopercle, and the third band (usually the faintest) extends from the dark moustache streak at the upper edge of the maxilla to the lower edge of the preopercle. The dark bands on the head are not discernible in fish larger than 45 cm SL. A good colour photograph was published by MANZONI (1987). The illustration in SERET's (1981) book is also a good likeness.

Maximum size: 157 cm. total length, and at least 35 kg.

GEOGRAPHICAL DISTRIBUTION

Mediterranean and eastern Atlantic from Portugal to Angola; DOOLEY *et al.*, (1985) reported that it is rare in the Canaries.

REMARKS

E. caninus occurs on sandy mud bottoms in depths of 30 to 400 m.

E. goreensis is similar to *E. caninus*; but it has 16 dorsal fin rays, a smaller head (2.5-2.7 times in SL), and the upper edge of the operculum is almost straight. Another similar species, *E. haifensis*, has a rounded caudal fin, 9 anal fin rays, body depth usually greater (2.4-2.8 times in SL), pelvic fins subequal to pectorals and reaching to or beyond the anus, no scales on maxilla, and fewer lateral scale series (104-112). *E. costae* has a more elongate body (depth 3.0-3.4 times in SL), smaller head (2.5-2.7 times in SL), 15-17 dorsal fin rays, and no scales on the maxilla. *E. marginatus* differs in having a rounded caudal fin, 14-16 dorsal fin rays, no scales on maxilla, and 98-116 lateral scale series.

The specimen from Angola that FRANÇA (1957) described as "*Epinephelus* sp.-- B_2" was examined at the Museu Bocage; it appears to be *E. caninus*.

MATERIAL EXAMINED

ITALY: Sicily, RUSI 28245 (156 mm.). ISRAEL: HUJ 10958 (497 mm.). TOGO: MNHN 1987-1635 (214 mm.). SÉNÉGAL: MNHN 1983-554 (268 mm.). ANGOLA: MB 2336 (780 mm.).

Epinephelus coioides (HAMILTON, 1822)

Fig. 7

Bola? coioides HAMILTON, 1822: 82 (type locality, Ganges estuaries, India; holotype not preserved).

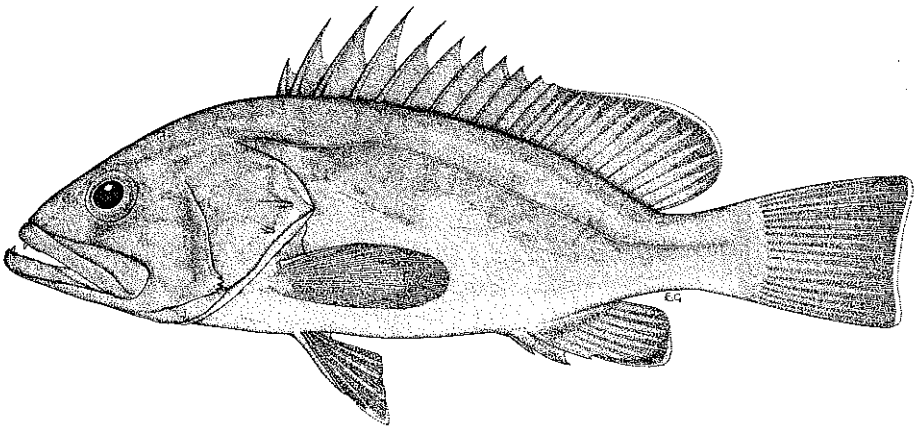

Fig. 6 - *Epinephelus caninus*, 417 mm. SL, Israel, HUJ 10958, drawn by ELAINE HEEMSTRA.

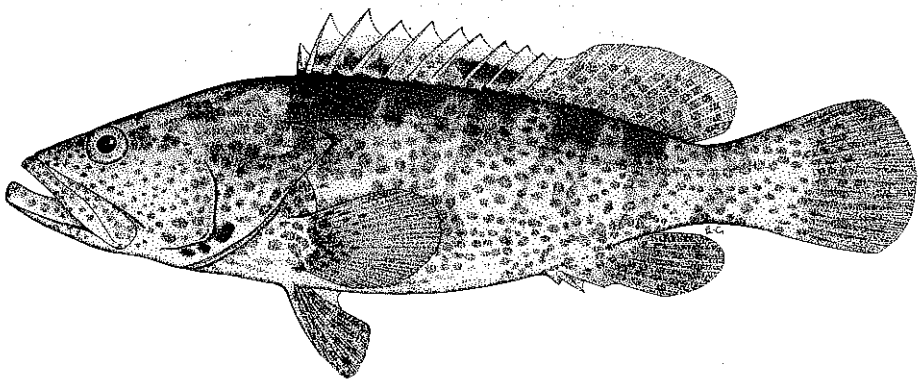

Fig. 7 - *Epinephelus coioides*, 33 cm. SL, Persian Gulf, from photograph of J. E. RANDALL.

Serranus nebulosus VALENCIENNES, in CUV. & VAL., 1828: 313 (type locality, unknown; holotype MNHN 7421, dry specimen, 172 mm. SL, incorrectly identified as *Paranthias furcifer* by BAUCHOT *et al.*, 1984).

Serranus suillus VALENCIENNES, in CUV. & VAL., 1828: 335 (type locality, Coromandel coast of India; syntypes MNHN A.7710, dry specimen, 275 mm. SL; MNHN 7288, 109 mm. SL).

Homalogrystes Guntheri ALLEYNE & MACLEAY, 1877: 269, Pl. 6, Fig. 3 (type locality, Katow, New Guinea; holotype not located).

Diagnosis: Dorsal fin XI,14-16; anal fin III,8; pectoral fin rays 18-20; lateral-line scales 58-65; lateral scale series 100-118; gill-rakers 8-10 + 14-17, total 23-26 (including 3-8 rudiments on each limb. Body elongate, the depth contained 2.9-3.7 times in SL (for fish 10-78 cm. SL); body width 1.4-2.0 times in the depth; head length 2.3-2.6 times in SL; pectoral fins 1.6-2.2 times and pelvic fins 1.9-2.7 times in head length. Caudal fin rounded; dorsal fin with 3rd or 4th spines longest, 2.9-4.0 times in head length, the interspinous membranes distinctly incised; anal fin with 3rd spine usually longer than the 2nd; the fin margin rounded; pectoral fins fleshy. Interorbital flat or slightly convex; preopercle subangular, the posterior edge with enlarged serrae at the angle and a broad shallow notch just above the angle; upper edge of operculum straight or somewhat convex. Maxilla reaches to or slightly past a vertical at rear edge of eye; midlateral part of lower jaw with 2 or 3 rows of subequal teeth. Nostrils subequal. Lateral body scales ctenoid, with minute auxiliary scales; lateral-line tubes of anterior scales branched in adults; adults with small bony platelets on lateral side of 1st gill arch. Pyloric caeca numerous (about 50-60).

Colour: Head and body tan dorsally, shading to whitish ventrally; numerous small brownish orange or reddish brown spots on head, body and median fins; body with 5 faint, irregular, oblique, dark bars which bifurcate ventrally; first dark bar below anterior dorsal fin spines, last bar on caudal peduncle; 2 dark spots on interopercle and another 1 or 2 at junction of sub- and interopercles. Orange spots turn brown on exposure to air and become fainter (more diffuse) in preservative.

GEOGRAPHICAL DISTRIBUTION

E. coioides occurs from the Red Sea south to at least Durban and east to the western Pacific, where it ranges from the Ryukyu Islands of Japan to New South Wales and out to the islands of Palau and Fiji. Other localities include the Persian Gulf, India, Réunion, Mauritius, Andaman Islands, Singapore, Hong Kong, Taiwan, Philippines and north coast of Australia from Western Australia to Queensland. BEN-TUVIA and LOURIE (1969) reported a 420 mm. specimen of "*Epinephelus tauvina*" from the Mediterranean coast of Israel. Without further discussion of this fish, RANDALL and BEN-TUVIA (1983) changed this identification to "*E. malabaricus*" (Note: the account of *E. malabaricus* in this paper is a compostite of *E. coioides* and *E. mal-*

abaricus.). In the original description of this specimen, BEN-TUVIA and LOURIE (1969: 246) state "Head and body covered with bright orange spots more or less regularly dispersed ...", which would rule out *malabaricus*. In addition to the colour pattern, the meristic and morphometric data given by BEN-TUVIA and LOURIE also fit *coioides* better than *tauvina*. This fish is, therefore, regarded as *E. coioides*.

Dr. BEN-TUVIA has kindly sent the author a specimen of *E. coioides* (HUJ 10751) that was collected in Haifa Bay in October of 1981.

REMARKS

E. coioides is known from continental shores and large islands. It is often found in estuaries, and is also taken offshore to depths of 100 m. As implied by numerous recent misidentifications, *E. coioides* is often mistaken for *E. malabaricus* (BLOCH & SCHNEIDER, 1801) and *E. tauvina* (FORSSKÅL, 1775). The colour patterns of all 3 species are similar, but the dark spots of *E. malabaricus* are smaller, blackish-brown (not reddish-brown or brownish-orange, as on *coioides*) and remain distinct in preservative; *malabaricus* also has irregular white spots on the head and body (no white spots on *coioides*). *E. tauvina* often has a black blotch (larger than eye) on body at base of last 4 dorsal fin spines and extending onto lower part of fin, and juveniles have the dark spots on the median fins so closely set that the pale interspaces appear as a pale reticulum; *E. tauvina* also has a longer jaw (upper jaw length 21-24% SL, versus 17-20% in coioides), usually more gill-rakers (17-20 on lower limb, versus 14-17 in *coioides*), and no small bony platelets on lateral side of 1st gill arch.

MATERIAL EXAMINED

MEDITERRANEAN: ISRAEL (Haifa Bay): HUJ 10751 (221 mm.) KENYA: RUSI 10929 (166 mm.), 11463 (266 mm.). TANZANIA: RUSI 13028 (343 mm.), RUSI 15911 (125 mm.), RUSI 15912 (4, 164-224 mm.), RUSI 16483 (130), RUSI 18020 (190 mm.). MOZAMBIQUE: 600 mm., not preserved; RUSI 10811 (189 mm.). SOUTH AFRICA (Natal): 517 mm., not preserved; RUSI 12930 (335 mm.), RUSI 28136 (194 mm). INDIA: MNHN 7288 (109 mm.), syntype of *Serranus suillus*; RUSI 11379 (2, 105-136 mm.) RUSI 11407 (136 mm.), RUSI 11408 (3, 180-218 mm.), RUSI 11410 (207 mm.), RUSI 11413 (192 mm.), RUSI 26040 (6, 97-122 mm). GULF OF THAILAND: CAS 61600 (196 mm.). AUSTRALIA: USNM 174317 (380 mm.), RUSI 30139 (3, 140-216 mm.). LOCALITY UNKNOWN: MNHN 7421, dry specimen, holotype of *Serranus nebulosus*.

Epinephelus costae (STEINDACHNER, 1878)
Figs. 8a & 8b

Plectropoma fasciatus COSTA, 1836: 1, Pl. 6 (type locality, southern Italy; holotype not preserved; preoccupied in *Epinephelus* by *Perca fasciata* FORSSKÅL, 1775).

Serranus costae STEINDACHNER, 1878: 389 (type locality, Messina, Sicily, Italy; holotype at

NMW?).

Serranus chrysotaenia DODERLEIN, 1882: 208, Pl. 2, Fig. 4 (type locality, Sicily; holotype not located).

Cerna costae: DODERLEIN, 1882: 214, Pl. 3, Fig. 7.

Cerna alexandrina [*non* VALENCIENNES]: DODERLEIN, 1882: 221, Pl. 4, Fig. 9.

Epinephelus alexandrinus [*non* VALENCIENNES]: DODERLEIN, 1889: 71; JORDAN & EIGENMANN, 1890: 358; BOULENGER, 1895: 200; CADENAT, 1935: 396, Fig. 9, 1951: 193, Fig. 126; FURNESTIN *et al.*, 1958: 432; BINI, 1968: 67, fig.; TORTONESE, 1973: 359; 1975: 66, Fig. 25; 1986: 784, Figs.; SMITH, 1981; BIANCHI, 1986: 42, Fig.; BAUCHOT, 1987: 1309, Fig.; MANZONI, 1987: 66, Fig.; BELLEMANS *et al.*, 1988: 95, Pl. 11, Fig. 81.

Cerna catalonica GIBERT, 1913: 38 (type locality, Catalonia, Spain; holotype apparently not preserved).

Epinephelus zaslavskii POLL, 1949: 191, Fig. 12 (type locality, Baie des Eléphants, Angola; holotype IRSNB); 1954: 66, Fig. 18.

Epinephelus goreensis [*non* VALENCIENNES]: CADENAT, 1951: 193; BLACHE *et al.*, 1970: 284, Fig. 757; Séret, 1981: 160, Fig.

Epinephelus sp. - A1 FRANCA, 1957: 33

Epinephelus sp. - A2 FRANCA, 1957: 34

Epinephelus costae: SCHNEIDER, 1990.

Diagnosis: Dorsal fin XI,15-17; anal fin III,8; pectoral fin rays 18-19; lateral-line scales 70-73; lateral scale series 113-130; gill-rakers 8-10 + 16-18, including 2--7 rudiments on each limb. Body depth distinctly less than head length, contained 3.0-3.4 times in SL (for fish 10-46 cm. SL); head length 2.5-2.7 times in SL; pectoral fins usually longer than pelvics, 1.6-2.1 times in head length. Caudal fin truncate or slightly convex in juveniles, becoming concave or lunate in adults larger than 40 cm. SL; dorsal fin with the third or fourth spine longest and the interspinous membranes distinctly incised. Interorbital area convex; preopercle angular, with 2 or 3 greatly enlarged serrae at the angle; in adults larger than 40 cm. SL, the preopercle angle is produced into a rounded lobe, with an indentation immediately above the lobe; middle and lower opercular spines flat but distinct, the upper spine not apparent; upper edge of operculum straight or slightly convex. Maxilla reaches about to vertical at rear edge of eye; ventral edge of maxilla with a low step; no scales on maxilla; midlateral part of lower jaw with 2 rows of teeth. Nostrils subequal in specimens less than 30 cm. SL; rear nostril diameter about twice that of front ones in fish of 40-50 cm. SL. Lateral body scales ctenoid; adults with auxiliary scales. Pyloric caeca 17.

Colour: Head and body brownish, the fins darker. Juveniles less than 15 cm. SL with 3-5 narrow dark stripes (blue in life?) paralleling the lateral line on dorsal part of body, with 2 stripes above and 1-3 stripes below lateral line. Two dark lines on head: one from lower edge of eye to ventral rear edge of interopercle, the second from dark maxillary streak to lower edge of preopercle. Adults brown or greyish

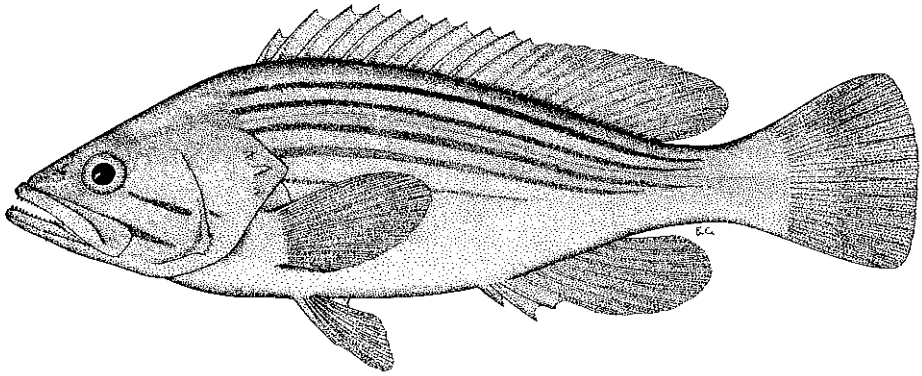

Fig. 8a - *Epinephelus costae,* 14 cm. SL, Italy, redrawn from DODERLEIN (1882) by E. HEEMSTRA.

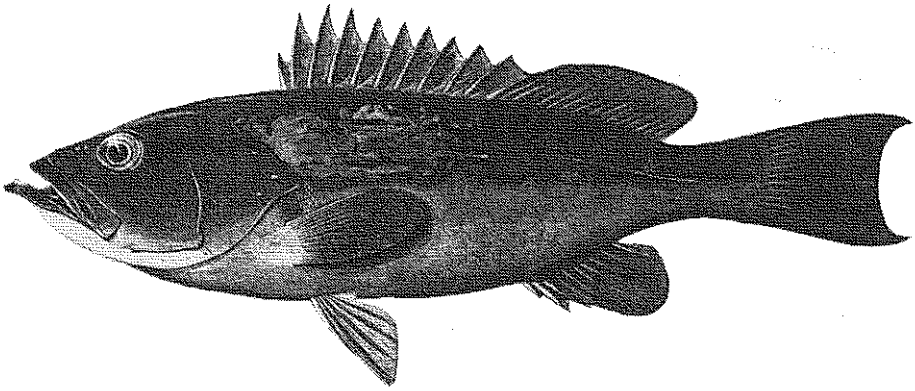

Fig. 8b - *Epinephelus costae*, 40 cm. SL, Sénégal, from SÉRET (1981, identified as *E. goreensis*; painting by PIERRE OPIC).

brown, often with a large golden yellow blotch, vaguely defined at periphery, on body below spinous dorsal fin. Two specimens from Angola, (Museu Bocage nos. MB 2087 and 2091, 46 and 42 cm. SL) are distinctly bicolored, the body dark brown dorsally and abruptly paler ventrally, the two parts separated by a wavy boundary. Both fish are males, with flaccid testes containing a large empty lumen. If the condition of the testes is indicative of recent spawning, the bicolored pattern may be the spawning coloration of this species.

Maximum size, at least 80 cm. total length; according to TORTONESE (1986), *E. costae* attains 140 cm.

GEOGRAPHICAL DISTRIBUTION

E. costae occurs in the Eastern Atlantic and Mediterranean. I have examined specimens from Greece, (Corfu Island), the Cape Verde Islands, and Angola. Reliable literature records document its occurrence on the Mediterranean coasts of Italy, France, Spain, Egypt, Tunisia, also along the south coast of Portugal and along the west coast of Africa to southern Angola. Records of "*Epinephelus alexandrinus*" from Madeira are apparently based on misidentifications of *Mycteroperca fusca* (see Remarks for *M. fusca* and also below).

REMARKS

Following BOULENGER's (1895) authoritative work on serranid fishes, this species has generally been referred to as *Epinephelus alexandrinus* (VALENCIENNES, 1828). However, a recent examination of VALENCIENNES' holotype of *Serranus alexandrinus* (MNHN 7325), which was collected in Egypt by E. GEOFFROY SAINT-HILAIRE revealed that it is a specimen of the well-known *Epinephelus fasciatus* of the Red Sea and Indo-Pacific region. This holotype differs significantly from the species here recognized as *E. costae* in having fewer scales (lateral-line 54, versus 70-73; lateral scale series about 100, versus 113-130), deeper body (depth 2.8 in SL, versus 3.0-3.4 in SL), 3 or 4 rows of teeth at midside of lower jaw (versus 2 rows), fewer gill-rakers (7+15 = 22, versus 8-10 + 16-18 = 24-27); and a rounded caudal fin (The shape of the caudal fin of the holotype cannot now be determined, as it is damaged; but in his description of *Serranus goreensis*, VALENCIENNES (in CUVIER & VALENCIENNES, 1830) mentions that the caudal fin of *alexandrinus* is rounded.). In his original description, VALENCIENNES (1828) mentions that "Sa couleur paraît avoir été brune, sans taches ni marbrures, sur tout le corps et sur les nageoires." *E. fasciatus* has distinctive black triangles at the margin of the interspinous dorsal fin membranes, and these are clearly seen on the holotype of *S. alexandrinus* if the fin is erected. This feature was overlooked by VALENCIENNES and subsequent workers. The holotype

also still shows the dark pigment on the edge of the orbit that is typical of *E. fasciatus*. Although VALENCIENNES gives the provenance of his holotype as "rapportée de l'Égypte par M. GEOFFROY.", his choice of name for his new species (*Serranus alexandrinus*) implied that it was a Mediterranean species; and this accounts for the misapplication of this species name by subsequent authors.

BAUCHOT *et al.* (1960) discussed the synonymy of "*Epinephelus alexandrinus*", in which they included *Epinephelus zaslavskii* POLL, 1949, but they did not give any information on the holotype of *alexandrinus*.

E. costae is similar to *E. goreensis* in meristic and most morphometric features. These two species differ in their colour patterns. The dark longitudinal lines on the body of juvenile *costae* are never seen on *goreensis* and the dark bars that are usually visible on *goreensis* are absent on *costae*. Also, *E. goreensis* never shows the golden blotch that is often seen on the dorsal part of the body of *costae* in life.

Reports of "*Epinephelus alexandrinus*" from Madeira (WASCHKEWITZ and WIRTZ, 1990; visual identification of a live fish underwater) and the Azores (SALDANHA, 1979; underwater photograph of live fish) are apparently misidentifications of *Mycteroperca fusca* (see above), which is superficially similar to *E. costae* (both species are relatively elongate, somewhat compressed groupers with concave or lunate caudal fins in adults and a protruding lower jaw). The Spanish common name "falso abadejo" for *E. costae* alludes to its similarity to *M. fusca*, the true "abadejo". *M. fusca* is common at Madeira, and is well known to the fishermen as "badejo". According to G.E. MAUL, ichthyologist at the Funchal Municipal Museum for the past 50 years, *M. fusca* and the mero (*E. marginatus*) are the only two species of groupers that occur in Madeiran waters. My examination of Madeiran specimens in the Funchal Museum, at the market in Funchal and at the British Museum (Natural History) also confirms Mr. MAUL's statement.

MATERIAL EXAMINED

GREECE: RUSI 74-4 (103 mm.). CAPE VERDE ISLANDS: MNHN 1941-25 (273 mm); MNHN 1941-26 (3, 174-212 mm.). ANGOLA: MB 1033 (227 mm.); MB 1449 (166 mm.); MB 1597 (193 mm.); MB 2087 (462 mm.); MB 2091 (421 mm.); MB 2275 (352 mm); MB 2829 (246 mm.); RUSI 10713 (87 mm.); SAM 24984 (92 & 93 mm.).

Epinephelus goreensis (VALENCIENNES, 1830)
Fig. 9

Serranus goreensis VALENCIENNES, in CUV. & VAL., 1830: 511 (type locality, Gorée [Dakar] Senegal; syntypes MNHN 7323 (321 & 427 mm.), MNHN 7324 (224 mm.)); STEINDACHNER,

1882: 6, Pl. 1, Fig. 2.

Epinephelus goreensis: BOULENGER, 1895: 204; CADENAT, 1935: 397, Fig. 10 (from STEINDACHNER, 1882).

Diagnosis: Dorsal fin XI,16; anal fin III,8; pectoral fin rays 17-19; lateral-line scales 68-74; lateral scale series 120-129; gill-rakers 8-9 + 16-17, including 2-7 rudiments on each limb. Body depth distinctly less than head length, contained 2.9-3.2 times in SL (for fish 22-42 cm. SL); head length 2.5-2.7 times in SL; pectoral fins usually longer than pelvics, 1.8-2.1 times in head length. Caudal fin truncate or slightly convex in juveniles, becoming concave in adults larger than 40 cm. SL; dorsal fin with the third or fourth spine longest and the interspinous membranes distinctly incised. Interorbital area flat or slightly convex; preopercle angular, with 3 or 4 enlarged serrae at the angle, the lowermost directed ventrally; middle and lower opercular spines distinct, the upper spine not apparent; upper edge of operculum straight or slightly convex. Maxilla reaches vertical at rear edge of eye; no step on ventral edge of maxilla; maxilla naked or with a few minute scales dorsally; midlateral part of lower jaw with 2 rows of teeth. Rear nostril diameter about twice that of front ones. Lateral body scales ctenoid; no auxiliary scales. Pyloric caeca 13, long and slender.

Colour: Head and body brownish; juveniles with 3 or 4 broad, oblique, dark bars usually visible on dorsal part of body and another on dorsal half of peduncle; 2 narrow, faint dark bands extending posteriorly from lower half of eye; dark moustache streak present, but not extending past rear end of maxilla. The dark markings on juveniles are probably not visible on large adults.

Maximum size, at least 55 cm. total length.

GEOGRAPHICAL DISTRIBUTION

E. goreensis is known from Sénégal to southern Angola, and it has also been reported from the Canary and Cape Verde Islands.

REMARKS

POLL (1954) reported this species from a variety of habitats (rock, mud and sand) at depths of 80-100 m.

E. goreensis is most similar to *E. costae*; see the Remarks section of the account of *E. costae* (above) for a comparison of these two species.

E. goreensis is readily separated from *E. caninus*, which has only 13 or 14 dorsal fin rays and usually a larger head (2.3-2.5 times in SL).

In addition to the characters in the key to eastern Atlantic species of groupers

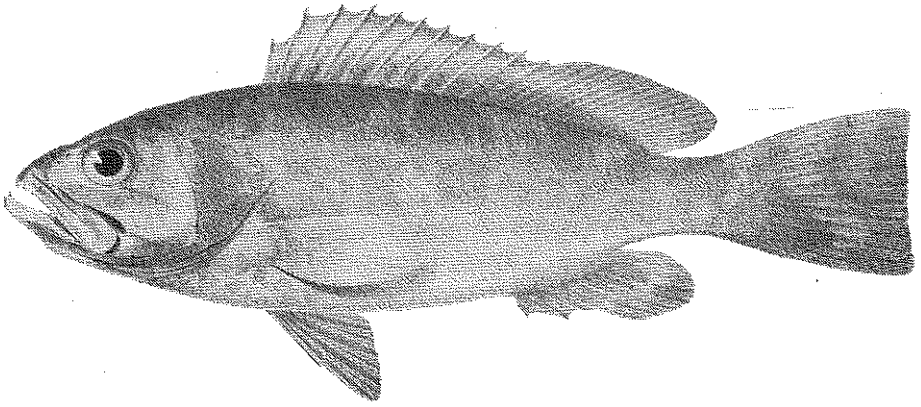

Fig. 9 - *Epinephelus goreensis,* 20 cm. SL, Sénégal (?), from STEINDACHNER, 1882.

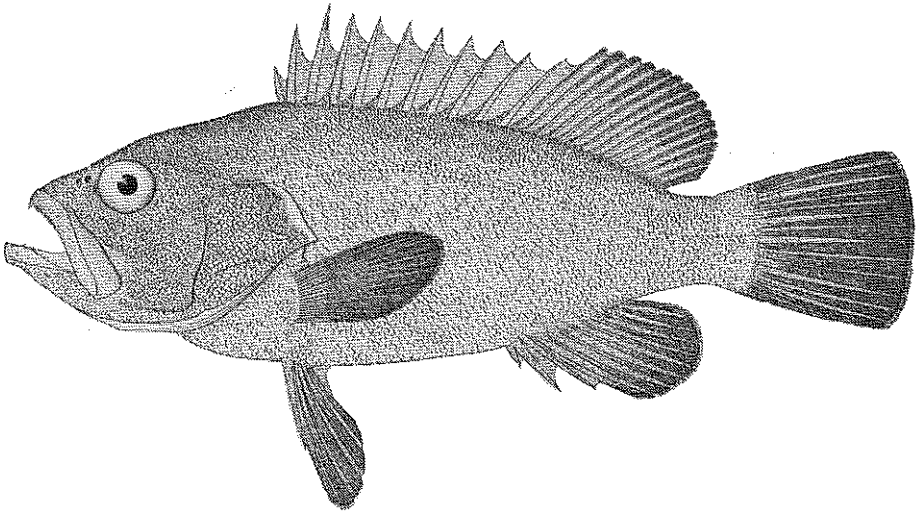

Fig. 10 - *Epinephelus haifensis*, 31 cm. SL, Angola, from POLL, 1954.

(see above), *E. goreensis* differs from *E. marginatus* in having more lower-limb gill--rakers (16-17 versus 14-16), and a ventrally directed spine at the angle of the preopercle.

MATERIAL EXAMINED

SÉNÉGAL: Goreé (= Dakar) MNHN 7323 (2, 320-422 mm.), syntypes of *Serranus goreensis* VALENCIENNES; MNHN 7324 (221 mm.), syntype of *S. goreensis*; MNHN 1987-1038 (222 mm.). TOGO: Le Nizery MNHN 1987-1031 (237 mm.); MNHN 1987-1630 (230 mm.).

Epinephelus haifensis BEN-TUVIA, 1953
Fig. 10

?Perca gigas BRÜNNICH, 1768: 65 (type locality, Marseille; holotype not preserved)
?Cerna sicana DODERLEIN, 1882: 250 (Palermo, Sicily; holotype at MZUSP).
Epinephelus haifensis BEN-TUVIA, 1953: 21, Fig. 14 (Mediterranean coast of Israel, off Caesarea, 120 fms.; holotype SFRS M411 (320 mm.)).
Epinephelus gigas: POLL, 1954: 62, Fig. 17, Pl. 3, Figs. 3,7 & 8.

Diagnosis: Dorsal fin XI,14-15; anal fin III,9; pectoral fin rays 18-21; lateral-line scales 64-75; lateral scale series 104-112; gill-rakers 7-10 + 13-15, including 2-6 rudiments on each limb. Body deep, the greatest depth contained 2.4-2.8 times in SL (for fish 10-39 cm. SL); head large, the length contained 2.2-2.5 times in SL; pectoral fins length 1.4-1.9 times in head length; pelvic fins subequal to pectorals, reaching to or beyond anus in fish of 10-30 cm. Caudal fin rounded; dorsal fin with the third or fourth spine longest, but distinctly shorter than the longest rays; interspinous membranes of dorsal fin deeply incised. Interorbital area convex; eye diameter greater than interorbital width in fish less than 30 cm. SL and distinctly less than interorbital width in a fish of 39 cm. SL. Preopercle with enlarged serrae at the angle, and 1-6 small serrae (usually covered by skin) on ventral edge; opercular spines distinct; upper edge of operculum convex. Maxilla naked, usually not reaching past vertical at rear edge of eye; no step on ventral edge of maxilla; midlateral part of lower jaw with 2 rows of teeth, the inner teeth about twice as long as the outer ones. Rear nostrils 2 or 3 times larger than front ones. Lateral body scales ctenoid; no auxiliary scales. Pyloric caeca very numerous, forming a large dendritic mass.

Colour: Head and body dark brown; soft dorsal, caudal and anal fins blackish distally (where there are no scales), the basal (scaly) part of these fins not so dark; soft dorsal, caudal, anal and pectoral fins usually with white edge; pelvic fins blackish; prominent black streak on cheek at upper edge of maxilla.

Maximum size, 110 cm. total length, 25 kg. (POLL, 1954).

GEOGRAPHICAL DISTRIBUTION

Eastern Mediterranean to southern Angola (14° S). I have examined specimens from the coasts of Israel, Togo, Nigeria, Cameroun, Congo and Angola.

REMARKS

Found on bottoms of mud, sand or rock in depths of 90-220 m. (POLL, 1954). In the literature on Mediterranean and west African groupers (CADENAT, 1935; TORTONESE, 1970; BAUCHOT & PRAS, 1980; etc.) *E. haifensis* may have been confused with *E. marginatus* under the name of "*Epinephelus guaza*" or "*Epinephelus gigas*". Although only 19 specimens of *E. haifensis* have been examined, they all have 9 anal fin rays; whereas, 79 of the 80 specimens of *E. marginatus* that were counted have 8 anal fin rays. Consequently, references to *E. guaza* with 8 or 9 anal fin rays could apply to either or both species.

The species described as *Perca gigas* by BRÜNNICH (1768) may be the same as *E. haifensis*, but the pectoral fin count of 16 given by BRÜNNICH is too low, and the colour description ("*corporis ochraceus, obscuro fuscoque nebulosus; caput subtus rubrum ut & pinnae pectorales extrorsum.*" [body yellowish, with indistinct dark blotches; lower part of head and margin of pectoral fins reddish]) is more similar to the colour pattern of *E. marginatus*. Without a type specimen, *Perca gigas* is probably best regarded as a *nomen dubium*.

The stuffed holotype of *Cerna sicana* DODERLEIN from Sicily has only 10 dorsal fin spines. TORTONESE (1956) redescribed this specimen and concluded that it was not the western Atlantic species *E. nigritus*, which normally has 10 dorsal fin spines. Except for having only 10 dorsal fin spines, this specimen fits the description of *E. haifensis* given above. *Cerna sicana* may represent a rare species with 10 dorsal fin spines that is known from only a single specimen, but it seems more likely that this holotype is simply an abnormal specimen of *E. haifensis*. Rather than use *E. sicana* as the valid name for a species that normally has 11 dorsal fin spines, *Epinephelus haifensis* is here accepted as the valid name for this species.

MATERIAL EXAMINED

MEDITERRANEAN: ISRAEL: ANSP 128518 (125 mm.), paratype of *E. haifensis*; BMNH 195.9.25.5 (100 mm.); HUJ (147 mm.); TAU 804 (81 mm.); TAU 826 (100 mm.); TAU 2275 (144 mm.); USNM (117 mm.). EGYPT: TAU 8840 (90 mm.). EASTERN ATLANTIC: TOGO: MNHN 1987-1034 (182 mm.). GULF OF GUINEA: RUSI 26548 (132 mm.). NIGERIA: UMML 21464 (187 mm.). CONGO: IRSNB 9521 (230 mm.); MNHN 1967-811 (223 mm.). ANGOLA: MB 2606 (140 mm.); MB 3053 (202 mm.); MB 118 (391 mm.); IRSNB 9522 (298 mm.); IRSNB 9523 (223 mm.).

Epinephelus itajara (LICHTENSTEIN, 1822)
Figs. 11a & 11b

Serranus itajara LICHTENSTEIN, 1822: 278 (type locality, Brazil; holotype not located).
?Serranus Mentzelii VALENCIENNES, 1828: 291 (type locality, Brazil; holotype lost [see Remarks, below]).
?Serranus galeus MÜLLER & TROSCHEL, 1848: 621 (type locality, Guyana; holotype not located).
?Serranus quinquefasciatus BOCOURT, 1868: 223 (type locality, Pacific coast of Guatemala; holotype, MNHN 5211, 326 mm.).
?Promicrops esonue EHRENBAUM, 1914: 293; 1915: 54, fig. (type locality, Cameroun; holotype not located).
?Promicrops ditobo ROUX & COLLIGNON, 1954: 473 (type locality, Congo: Kouilou River estuary; syntypes, 200 & 186 cm., apparently not preserved).

Diagnosis: Dorsal fin XI,15-16; anal fin III,8; pectoral fin rays 18-19; lateral-line scales 61-64; lateral scale series 89-112; gill-rakers 8-10 + 13-15 including 4-8 rudiments on each limb. Body robust, elongate, the greatest width more than half of body depth, which is distinctly less than head length (in fish 15-160 cm.); body depth contained 2.7-3.4 times in SL; head length 2.3-2.9 times in SL. Caudal fin rounded; dorsal fin spines short, 3rd to 11th subequal and shorter than the first ray, the membranes distinctly indented between the spines; anal fin with 3 spines and 8 rays; pectoral fin rays 18-19. Head extremely broad; interorbital flat, the width equals eye diameter in fish 10-15 cm. SL, distinctly greater than eye diameter in fish 18-25 cm. SL, and 1.5-3.4 times greater than eye diameter in fish 30-160 cm. SL; eye diameter contained 5-8 times in head length for fish 10-30 cm. SL and 8-13 times in head length for fish 35-160 cm. SL. Preopercle rounded, finely serrate; nostrils round, subequal. Maxilla scaly, reaching well past eye; midlateral part of lower jaw with 3-5 rows of subequal teeth; no canines at front of jaws. Body scales strongly ctenoid; lateral-line scales with 4-6 radiating ridges. Gill-rakers short, the gill arches covered with small bony plates.

Colour: Generally brownish yellow, grey or greenish; head, dorsal part of body and fins with small black spots, becoming smaller with growth. Fish less than about 1 metre often show 3 or 4 irregular, subvertical, faint dark bars on body and another covering rear half of caudal peduncle; large adults darker and more uniformly coloured than juveniles.

Maximum total length of *itajara* is about 240 cm.; maximum weight at least 320 kg. The IGFA all-tackle record (as of 1990) is 308.44 kg.

GEOGRAPHICAL DISTRIBUTION

Tropical and subtropical waters of the Atlantic and eastern Pacific oceans. In

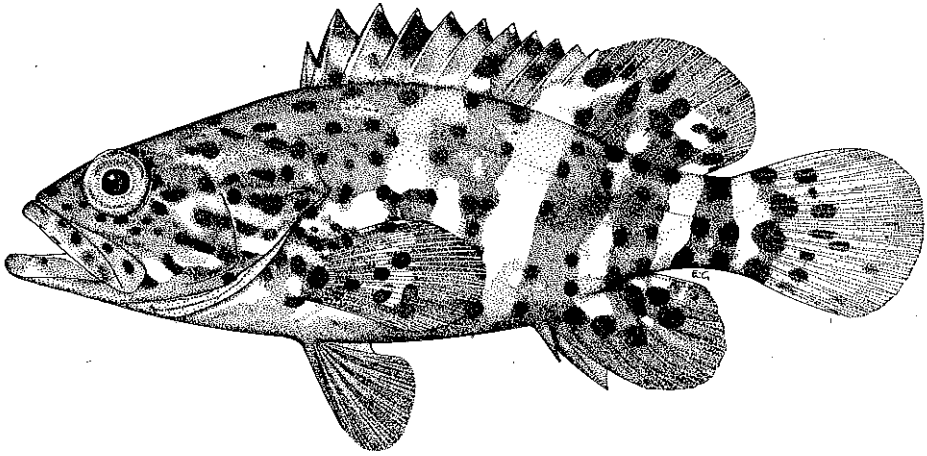

Fig. 11a - *Epinephelus itajara*, 7 cm. SL, Gulf of Mexico, from a photograph of LEWIS BULLOCK and GREGORY SMITH (ms.).

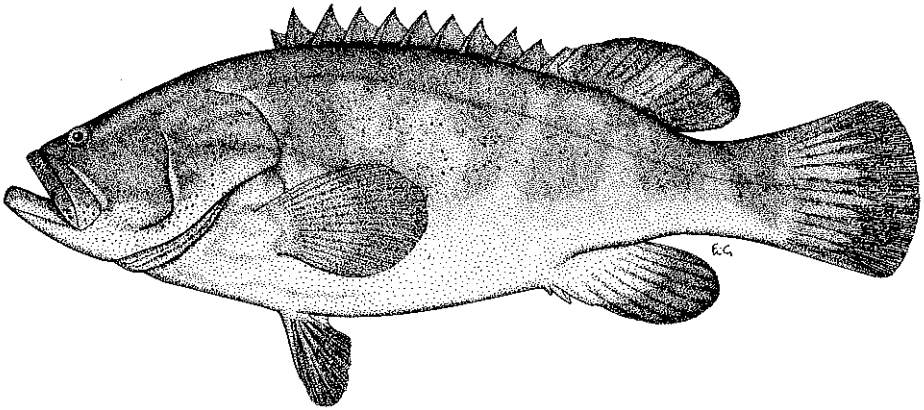

Fig. 11b - *Epinephelus itajara*, 140 cm. SL, Caribbean (Virgin Islands), from a photograph J. E. RANDALL.

the western Atlantic, it ranges from Florida to southern Brazil, and is caught throughout the Gulf of Mexico and most of the Caribbean. In the eastern Atlantic, *E. itajara* is reported (as *Epinephelus esonue*) by SÉRET (1981) and SMITH (1981) from Sénégal to the Congo. In the eastern Pacific, it occurs from the Gulf of California to Peru.

REMARKS

This giant grouper is often found in shallow water; juveniles are common in mangrove swamps and both juveniles and adults occur in bays and harbours. Large adults are also encountered offshore on wrecks and in areas of high relief.

Although it is unlikely that *E. itajara* of the eastern and western Atlantic and the eastern Pacific share a common gene pool, I am unable to find any significant differences in the published data or the specimens examined from these three areas. If there is any species of American grouper that occurs on both sides of the Central American Isthmus, it would be *E. itajara*, with its predilection for estuarine and mangrove habitats. It seems feasible that juveniles could traverse the Isthmus via the Panama Canal.

JOHNSON and KEENER (1984) illustrated the second dorsal and pelvic fin spines of the larvae.

Serranus Mentzelii VALENCIENNES, 1828 was considered a synonym of "*Epinephelus guaza*" by C.L. SMITH (1971) and BAUCHOT *et al.* (1984: 31), and they listed three supposed "syntypes" collected in Brazil by DELALANDE. The two alcoholic "syntypes" (MNHN 137 & 7368) were recently examined and found to be specimens of *Mycteroperca* (the species not readily apparent) with 11 anal fin rays. In the original description of *S. Mentzelii* (CUVIER and VALENCIENNES, 1828: 291), VALENCIENNES gives an anal fin count of III,8; and he mentions only a single specimen "qui est long de deux pieds huit pouces" (2 feet, 8 inches long). Consequently, neither of these "syntypes" (MNHN 137 & 7368) nor the dry specimen (MNHN A.5777, 256 mm. total length) also listed as a "syntype" by BAUCHOT *et al.* (1984) can be considered a type specimen, as they are much shorter than the only specimen (holotype) mentioned in the original description; and they do not agree with the description of this species. The holotype is apparently lost. Dr M.L. BAUCHOT sent a photograph of the large charcoal drawing from the collection of Prince Maurice, which VALENCIENNES mentioned in the original description. Although this drawing is crude, it looks like *Epinephelus itajara* (LICHTENSTEIN, 1822), and it shows the dark cross-bars on the base of the caudal fin and peduncle that are typical of large specimens of this species. The description of the colour pattern given by VALENCIENNES also fits *E. itajara* much better than *E. marginatus*.

MATERIAL EXAMINED

EASTERN ATLANTIC: DAHOMEY (BENIN): MNHN 1964-570 (367). WESTERN ATLANTIC: HONDURAS: FMNH 95957 (2, 87-111 mm.). BRAZIL: Camamu, MCZ 10063 (198 mm.); Bahia, MCZ 10144 (181 mm.); Alegre, MZUSP (132).

Epinephelus marginatus (LOWE, 1834)
Figs. 12 & 13, Plate I, Fig. 1

?Perca gigas BRÜNNICH, 1768: 65 (type locality, Marseilles, France; holotype lost?).
?Holocentrus merou LACEPÈDE, 1802: 376 (replacement name for *Perca gigas* BRÜNNICH, 1768).
Serranus gigas: VALENCIENNES, in CUV. & VAL., 1828: 270, Pl. 33; GÜNTHER, 1859: 132; STEINDACHNER, 1877: 175.
Serranus marginatus LOWE, 1834: 142 (type locality, Madeira; no type specimens indicated; neotype MMF 3388, 200 mm. SL, Madeira).
Serranus fimbriatus LOWE, 1836: 195, Pl. I, Fig. 1 (unnecessary replacement name for *Serranus marginatus* LOWE, thought to be preoccupied by *Serranus marginalis* VALENCIENNES, 1828 [which was based on *Holocentrus marginatus* LACEPÈDE, 1802, an incorrect spelling of *Epinephelus marginalis* BLOCH, 1793]).
Cerna gigas: DODERLEIN, 1882: 177, Pl.1, Fig. 1.
Serranus aspersus JENYNS, 1843: 6 (type locality, Cape Verde Islands; holotype BMNH 1917.7.14.36).
?Serranus cernioides CAPELLO, 1868: 156, Pl. 4, Fig. 1 (type locality, Lisbon; holotype lost).
Epinephelus brachysoma COPE, 1871: 466 (type locality, Rio de Janeiro; holotype ANSP 13372).
Epinephelus gigas: JORDAN & SWAIN, 1885: 388 (synonymy based on STEINDACHNER, 1877; no description); JORDAN & EIGENMANN, 1890: 359; BOULENGER, 1895; 232; BARNARD, 1927: 482; CADENAT, 1951: 191, Fig. 125.
Epinephelus guaza (*non* LINNAEUS): JORDAN & EVERMANN, 1896: 1154; J. L. B. SMITH, 1949: 195, Pl. 18; RIVAS, 1964: 29; C. L. SMITH, 1971: 137, 1981; SÉRET, 1981: 156, fig.; HEEMSTRA & RANDALL, 1984, 1986: 525, Pls. 36 & 39; TORTONESE, 1986: 785, fig.; BIANCHI, 1986: 43, fig.; BAUCHOT, 1987: 1311, fig.; MANZONI, 1987: 67, fig.; BELLEMANS *et al.*, 1988: 96, Pl. 11, Fig. 83; SCHNEIDER, 1990: 105. Pl. 11, Fig. 82 (labelled "*Epinephelus marginatus*").

Diagnosis: Dorsal fin XI,14-16; anal fin III,8 (1 of 89 fish counted had 9 anal fin rays); pectoral fin rays 17-19; lateral-line scales 62-73; lateral scale series 98-113; gill-rakers 7-10 + 14-16 (including 2-5 rudiments on each limb). Body depth less than head length, contained 2.6-3.1 times in SL (for fish 8-62 cm. SL); head length contained 2.3-2.5 times in SL; body moderately compressed, the greatest width contained 1.7-2.3 times in the depth. Eye diameter contained 4.3-7.9 times in head length, equal to snout length of fish 8-10 cm. SL and about half snout length of fish 50 cm.; eye diameter greater than or subequal to interorbital width for fish 10-30 cm. SL, less than interorbital width of fish over 40 cm. SL; interorbital width 5.0-7.3 times in head length; caudal peduncle depth contained 7.5-9.5 times in SL. Caudal fin rounded (juveniles) or truncate with rounded corners (adults, Fig. 12); 3rd or 4th dorsal fin spines longest, longer than longest dorsal rays and contained 2.2-2.8 times in head

length, the interspinous membranes distinctly incised; anal fin margin rounded, the 2nd and 3rd spines subequal in juveniles, but the 3rd spine longest in adults, 2.2-3.3 times in head; pectoral fins fleshy, the fin length contained 1.6-2.0 times in head length; pelvic fins not reaching anus, shorter than pectorals, their length contained 1.8-2.4 times in head length; pelvic fin origin below or slightly posterior to base of pectorals.

Interorbital area convex; dorsal profile of head slightly convex. Preopercle rounded or subangular, the rear edge finely serrate, with the serrae at the "angle" slightly enlarged; adults with a shallow indentation on rear edge just above the angle; no serrae on ventral edge of preopercle; opercle with middle and lower spines distinct, the upper spine hidden by skin and scales; upper edge of operculum convex; edge of subopercle and interopercle smooth. Nostrils rounded, subequal, or rear nostril slightly larger; anterior nostril set in a short tube, the posterior edge produced into a flap. Maxilla naked, reaching to or slightly past a vertical at rear edge of eye; ventral edge of maxilla smoothly curved from distal expansion to narrow middle part (no step-like discontinuity on ventral edge of maxilla). Mid-lateral part of lower jaw with 2-4 rows of subequal teeth, the inner teeth depressible medially; premaxilla with a band of small, depressible, conical teeth; juveniles with a pair of small fixed canines (enlarged conical teeth) at front of both jaws, but in large adults (> 60 cm. SL) there are no apparent canines in the jaws. Gill-raker at angle subequal to adjacent raker on lower limb and also subequal to longest gill filaments. Mid-lateral body scales ctenoid (at least in area covered by pectoral fins); adults with numerous auxiliary scales. Pyloric caeca 26-50.

Colour: Head and body dark reddish brown or greyish dorsally, usually yellowish gold ventrally; irregular white, pale yellowish-green or silvery-grey blotches usually visible on body and head; a black, more or less distinct "moustache" streak along maxillary groove below eye (mostly covered by upper part of maxilla when the mouth is closed); lower edge of anal fin and rear edge of caudal fin narrowly white; pelvic fins blackish distally; pectoral fins dark reddish brown or grey; margin of spinous part of dorsal fin and basal part of paired fins often golden yellow. First gill arch and gill-rakers densely covered with minute melanophores.

Description of neotype: (Measurements are given in Table 1.) Body depth contained 2.6 times in SL; head length contained 2.5 times in SL; body width equals half of its depth; snout length 3.7 times in head; orbit 6.2 times in head; interorbital 5.3 times in head; preorbital depth 10.5 times in head; upper jaw 2.2 times in head; maxilla width 8.6 times in head; lower jaw 1.8 times in head; caudal peduncle depth 3.1 times in head; peduncle length 2.7 times in head. Caudal fin rounded. Dorsal fin with 11 spines and 15 rays; anal fin with 3 spines and 8 rays; pectoral fin rays 19 (both sides); pectoral fin length contained 1.5 times in head length; pelvic fin length contained 1.9 times in head length. Midlateral part of lower jaw with 2 rows

of subequal teeth. Gill-rakers 10 + 16 (including 5 rudiments on upper limb and 3 on lower limb). Lateral-line scales 69; lateral scale series 110.

Colour in alcohol: Head and body brown, with irregular pale silvery grey spots and blotches, those on rear part of body arranged in vertical series; fins darker than body; median fins with a few indistinct pale spots; maxillary streak blackish brown.

GEOGRAPHICAL DISTRIBUTION

Epinephelus marginatus occurs on both sides of the Atlantic Ocean, throughout the Mediterranean Sea, along the west coast of Africa, and round the south coast of Africa to southern Mozambique. I have examined specimens from Madeira, the Azores, Spain, France, Italy, Greece, Lebanon, Israel, Algeria, Cape Verde Islands, Angola, South Africa, Mozambique and Brazil. Based on identifiable records of "*Epinephelus guaza*", the species is also known from Egypt, Tunisia, Morocco, Mauritania, Sénégal, Ivory Coast and the Congo. According to WHEELER (1969) *E. marginatus* (identified as "*Epinephelus guaza*") is rare in British seas. Reported from India by REDDY (1984; as *Epinephelus guaza*), but I have not seen any Indian Ocean specimens from north of 24° S. In the western Atlantic, *E. marginatus* is known from southern Brazil, and it was reported from Uruguay and Argentina by RINGUELET and ARAMBURU (1960).

REMARKS

In the literature on Mediterranean groupers, two similar species (the yellow-belly grouper, *E. marginatus*, and the dusky grouper, *E. haifensis* BEN-TUVIA, 1953) have been confused under the names *Epinephelus* (or *Serranus*) *guaza* or *gigas*. *E. marginatus* differs in having 8 anal fin rays (9 in *haifensis*), more elongate body (depth 2.6-3.1 versus 2.4-2.8 in SL), pelvic fins distinctly shorter than pectorals and not reaching the anus (pelvic fins subequal to pectorals and reaching to or beyond anus in *haifensis*), 17-19 pectoral fin rays (19-21 in *haifensis*) and the head and body usually showing irregular pale blotches (no pale blotches in *haifensis*).

JORDAN and EVERMANN (1896), in their influential and comprehensive work, *The Fishes of North and Middle America*, were the first to use the Linnaean name *guaza* [*sic*] for the species that currently bears this name. Previously, the species had been identified as *Serranus gigas* (BRÜNNICH, 1768) by VALENCIENNES (1828), GÜNTHER (1859) and STEINDACHNER (1877) or *Cerna gigas* by DODERLEIN, 1882 or *Epinephelus gigas* by JORDAN and SWAIN (1885), JORDAN and EIGENMANN (1890), BOULENGER (1895) etc.; or it was described as a new species (*Serranus marginatus* LOWE, 1834 and *Epinephelus brachysoma* COPE, 1871). After JORDAN and EVERMANN's (1896) publication, *E. marginatus* and *E. haifensis* were confused under the names *E. guaza* or *E. gigas*.

Unfortunately, the species name "*Epinephelus guaza*" (originally *Labrus Gvaza* LINNAEUS, 1758) cannot be used for this well-known species, because the original description clearly applies to a species of the genus *Mycteroperca* from the coast of Venezuela. Linnaeus's description of *Labrus Gvaza* (1758: 285) was taken verbatim from the travel diary of his student PEHR LÖFLING (spelt "LOEFLING" on the title page). This diary was published in 1758, two years after the death of LÖFLING and in the same year as the tenth edition of LINNAEUS's *Systema Naturae*. LÖFLING spent two years in Spain waiting for the Spanish to organize the expedition to South America in which he was to participate (WHEELER, 1980). While he was in Spain, LÖFLING collected plants and animals, recording descriptions of the various species in his travel diary. In South America, LÖFLING added descriptions of more plants and animals to his journal, but he died not long after his arrival. In the published version of this diary (LOEFLING, 1758) the page with the description of *Labrus guaza* is headed with the rubric "CUMANA", which is the name of a port on the Caribbean coast of Venezuela; and all of the animals described on this page are from this locality. Although most of the species descriptions by LÖFLING that were incorporated in the *Systema Nature* (indicated by the reference "Loefl. *epist.*") are of plants and animals that he observed in Spain, that of *Labrus guaza* is clearly not from Spain. For some reason or perhaps as an oversight, LINNAEUS gave as the type-locality of this species "*in pelago*", rather than the more explicit mention of Cumana or South America or the Caribbean.

The original description of *Labrus Gvaza*, as given by LINNAEUS (1758) is typically brief:

> "*L. [Labrus] fuscus, cauda rotundata, radiis caudatus membranam superantibus. Loefl. epist. D.11/27. P.16. V.6. A.13. C.15. Habitat in Pelago.*" ("Dusky *Labrus*, caudal fin rounded, the rays projecting past the membrane. Dorsal fin with 27 rays, of which the first 11 are spines and the last 16 soft-rays; pectoral fin rays 16; pelvic fin rays 6 [*i.e.*, I,5]; anal fin with 13 rays [= 3 spines + 10 soft-rays]. Habitat: in the open ocean.") .

This description does not fit the well-known amphi-Atlantic/Mediterranean yellowbelly grouper that is commonly identified as *Epinephelus guaza*. In fact, it cannot apply to any species of *Epinephelus*, as they all have 7-9 anal fin rays (one specimen of 29 *E. morio* that were counted has 10 anal rays), and no *Epinephelus* species has the caudal fin rays projecting beyond the membrane. The description does, however, fit *Mycteroperca cidi* CERVIGON, 1966 and *M. interstitialis* (POEY, 1860); and these two species are common in the vicinity of Cumana (the type locality given by LÖFLING for *Labrus guaza*). Since the description applies equally well to both of these species of *Mycteroperca* and there is no extant type-specimen, the name *Labrus gvaza* LIN-

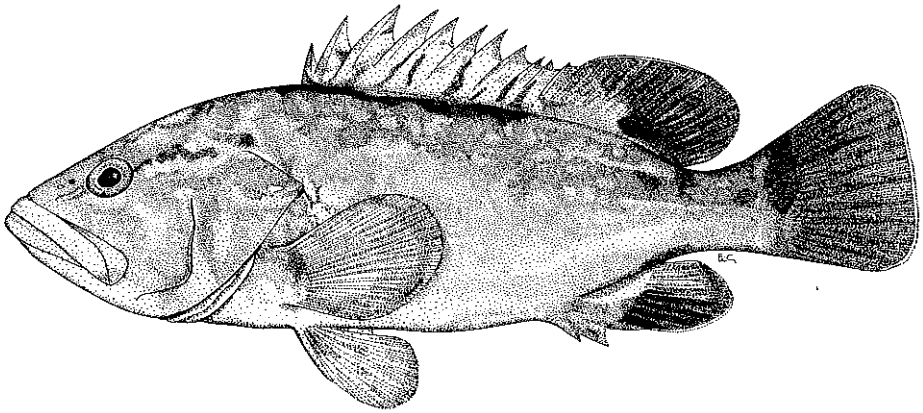

Fig. 12 - *Epinephelus marginatus*, 45 cm. SL, Cape Vidal, South Africa, RUSI 12922. Drawn by E. HEEMSTRA.

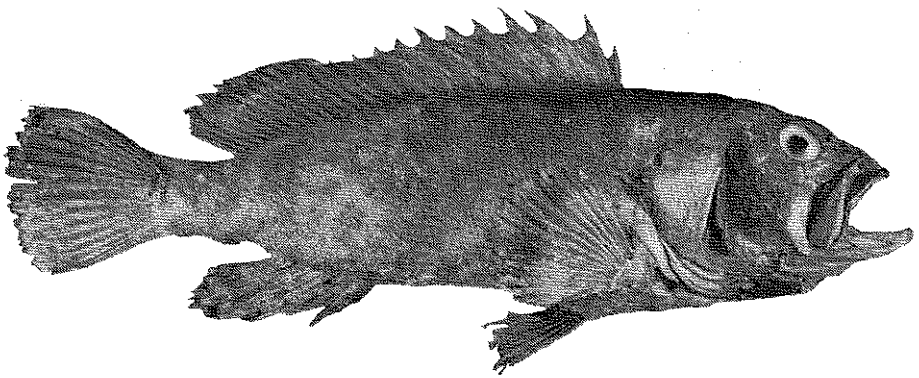

Fig. 13 - *Epinephelus marginatus*, 29 cm. SL, Madeira, BMNH 1858.4.2.81; presented to the Zoological Society of London by the Rev. R. T. LOWE. Photograph courtesy of the British Museum (Natural History).

Fig. 1 - *Epinephelus marginatus,* 84 mm. SL, Caniçal, Madeira; MMF 24939.

Fig. 2 - *Mycteroperca fusca*, 143 mm. SL, Caniçal; MMF 24932.

NAEUS must be considered a doubtful name (*nomen dubium*) and is thus not available as the valid name of any species.

The next oldest name that has been listed in the synonymy of "*Epinephelus guaza*" is *Perca gigas* BRÜNNICH, 1768: 65 (type locality, Marseilles). The fin-ray counts given by BRÜNNICH do not fit *E. marginatus* or *E. haifensis*, although this description was apparently based on one or (perhaps) both of these species. The anal fin count ("3/12"; *i.e*, 3 spines and 9 soft-rays) would apply to *haifensis*, rather than *marginatus*, but the pectoral fin count of 16 is too low even for *marginatus*, which has fewer pectoral rays. The brief colour notes fit *marginatus* better than *haifensis*. Since there is no existing type-specimen of *Perca gigas*, this name must also be considered a *nomen dubium*.

Serranus Mentzelii VALENCIENNES, 1828 was considered a synonym of "*Epinephelus guaza*" by C.L. SMITH (1971) and BAUCHOT *et al.* (1984: 31), and they listed three supposed "syntypes" collected in Brazil by DELALANDE. The two alcoholic "syntypes" (MNHN 137 & 7368) were recently examined and found to be specimens of *Mycteroperca* (the species not readily apparent) with 11 anal fin rays. In the original description of *S. Mentzelii* (CUVIER and VALENCIENNES, 1828: 291), VALENCIENNES gives an anal fin count of III,8; and he mentions only a single specimen "qui est long de deux pieds huit pouces" (2 feet, 8 inches long). Consequently, neither of these "syntypes" (MNHN 137 & 7368) nor the dry specimen (MNHN A.5777, 256 mm. total length) also listed as a "syntype" by BAUCHOT *et al.* (1984) can be considered a type specimen, as they are much shorter than the only specimen (holotype) mentioned in the original description; and they do not agree with the description of this species. The holotype is apparently lost. Dr M. L. BAUCHOT sent a photograph of the large charcoal drawing from the collection of Prince Maurice, which VALENCIENNES mentioned in the original description. Although this drawing is crude, it looks like *Epinephelus itajara* (LICHTENSTEIN, 1822), and it shows the dark cross-bars on the base of the caudal fin and peduncle that are typical of large specimens of this species. The description of the colour pattern given by VALENCIENNES also fits *E. itajara* much better than *E. marginatus*.

Serranus dichropterus VALENCIENNES, 1828 was listed as a synonym of "*Epinephelus guaza*" by C. L. SMITH (1971) and BAUCHOT *et al.* (1984: 27). But VALENCIENNES proposed *Serranus dichropterus* as a replacement name for *Holocentrus ongus* BLOCH,1790; consequently (according to Article 72[e] of the *International Code of Zoological Nomenclature*, 1985 edition) *Serranus dichropterus* is automatically an objective synonym of *Epinephelus ongus* (BLOCH).

Perca robusta COUCH (1832) was also listed in the synonymy of *Epinephelus guaza* by C. L. SMITH (1971). In his original description, COUCH (1832: 21) gave the length of his holotype (which was apparently not preserved) as 3 feet and the body depth as 7 inches. Although the fin counts given by COUCH (dorsal fin with 11 spines and

16 rays; anal fin with 2 spines [the small first spine was probably overlooked] and 8 rays; pectoral fin rays 19) fit *E. marginatus*, the body depth of "7 inches" is much too small for a *marginatus* of 3 ft. total length (the depth would be at least 9 inches in a fish this size). A more likely candidate for *P. robusta* is *Epinephelus aeneus*, which is more elongate than *marginatus* (body depth 3.0-3.6 times in SL), and it has virtually the same fin counts. Unlike *E. marginatus*, *E. aeneus* also has 3 or 4 oblique, pale blue stripes across the operculum, and COUCH mentions "two slightly marked lines on the gill covers running obliquely downward, one on each plate." The original illustration of *Perca robusta* is too crude to be recognizable as any of the grouper species that are known from the eastern Atlantic; the body depth of the illustrated fish is contained 3.4 times in the total length. In view of the deficiencies of the original description and illustration of *P. robusta*, this species is regarded as unidentifiable.

The oldest available name that can definitely be ascribed to the yellowbelly grouper is *Serranus marginatus* LOWE (1834). This original description is also brief:

> "*Serranus marginatus. Serr. nigrescens, luteo maculatus; pinnis dorsali, anali, caudalique nigris, albo marginatis; pinna dorsali filamentoso.* D.11+17. P.18. V.1+5. A.3+9. C.18. This fish is very nearly related to *Serr. Gigas*, CUV. & VAL.; but appears to be distinguished by the greater number of the soft rays of its dorsal and anal fins, as well as by the white margin of these and the caudal."

In 1836 LOWE redescribed his species with a replacement name, *Serranus fimbriatus*, and he gave slightly different fin-ray counts (D 11+15-16; A 3+8) for the dorsal and anal fins. These revised counts fit exactly the species here recognized as *E. marginatus*; and, combined with the brief colour notes and LOWE's illustration (Plate I, Fig. 1, labelled *Serranus marginatus*) leave no doubt of the identity of his species. A stuffed specimen of *Serranus marginatus* (29 cm. SL, BMNH 1858.4.2.81) from Madeira was donated to the Zoological Society of London by the Rev. R.T. LOWE and later incorporated in the fish collection of the British Museum. This specimen (Fig. 3) probably was one of those exhibited at the December 24, 1833 meeting of the Zoological Society at which the description of *Serranus marginatus* was read. Although LOWE (1834) mentioned that the species "attains a length of 2 feet, and the weight of 8 pounds", he did not give a length for the fish on which his description was based; hence, it is not possible to definitely identify a type specimen.

Serranus aspersus JENYNS, based on a fish 4.25 inches from the Cape Verde Islands, was listed as a synonym of *Epinephelus adscensionis* by BOULENGER (1895) and C.L. SMITH (1971). But JENYNS' (1843) counts of 15 dorsal and 17 pectoral fin rays for *S. aspersus* are too low for *E. adscensionis* (with 16-18 dorsal and 18-20 pectoral rays), and the colour description (which is unlike the colour pattern of *E. adscensionis*) matches juveniles of *E. marginatus*. Furthermore, *E. adscensionis* is not

known from the Cape Verde Islands.

MATERIAL EXAMINED

EASTERN ATLANTIC: Madeira: Neotype, MMF 3388 (200 mm.); BMNH 1858.4.2.81 (290 mm.); BMNH 1862.4.22.30 (430 mm.); BMNH 1922.1.13.30 (168 mm.); BMNH 1928.1.21.30 (212 mm.); BMNH 1935.3.5.14 (205 mm.); BMNH 1962.6.25.10 (233 mm. SL); MMF 24939 (84 mm.); MMF 3118 (118 mm.); MMF 3884 (162 mm.); MMF 3885 (151 mm.); MMF 7580 (150 mm.); RUSI 35667 (51 & 63 mm.). Azores: BMNH 1962.6.25.10 (233 mm.); RUSI 36079 (97 mm.); RUSI 36102 (3, 104-181 mm.); USNM 94487 (262 mm.). Cape Verde Islands: MB 503 (109 mm.).
MEDITERRANEAN: Spain: IIPB 1052/1987 (158 mm.); IIPB 1053/1987 (175 mm.); IIPB 1054/1987 (232 mm.); IIPB 1055/1987 (239 mm.); IIPB 1056/1987 (254 mm.); IIPB 1057/1987 (194 mm.). France: MNHN 4215 (171 mm.); MNHN 1898-554 (106 mm.). Italy: IRSNB 2013 (310 mm.); MNHN 7229 (208 mm.). Greece: BMNH 1928.1.21.30 (212 mm.); MNHN 1975-641 (152 mm.). Lebanon: USNM 198881 (4, 56-88 mm.); USNM (uncat.) (6, 61-106 mm.). Israel: BMNH 1935.3.5.14 (205 mm.); MNHN 1958-15 (154 mm.); TAU 61 (166 mm.). Algeria: MNHN 264 (211 mm.).
ANGOLA: RUSI 2598 (195 mm.); MB 414 (89 mm.); MB 2053 (340 mm); MB 2063 (354 mm.); MB 2342 (445 mm.); MB 2545 (147 mm.).
SOUTH AFRICA: BMNH 1906.11.19.48 (316 mm.); BMNH 1922.1.13.30 (168 mm.); RUSI 2656 (339 mm.); RUSI 11952 (155 mm.); RUSI 12922 (451 mm. SL); RUSI 13143 (620 mm.); RUSI 13309 (370 mm.); RUSI 13410 (303 mm.); RUSI 17330 (280 mm.); RUSI 17487 (3, 98-204 mm.); RUSI 74-345 (6, 57-134 mm.); RUSI 76-15 (3, 85-139 mm.); RUSI 77-16 (6, 77-98 mm.); RUSI 76-20 (228 mm.); RUSI 77-3 (7, 96-165 mm.); RUSI 77-6 (4, 83-131 mm.); SAM 13803 (8, 54-185 mm.); BPBM (uncat.) (209 mm.).
MOZAMBIQUE: RUSI 16304 (443 mm.); RUSI 17150 (378 & 390 mm.); RUSI 17597 (115 mm.); RUSI 17599 (165 mm).
WESTERN ATLANTIC: Brazil: ANSP 13372, 149 mm., holotype of *E. brachysoma* COPE, 1871; CAS/SU 68129 (247 mm.); CAS/SU 68130 (223 mm.); MCZ 10147 (194 mm.); MNHN 7403 (168 mm.); MZUSP (uncat.) (4, 124-208 mm.); USNM 100823 (161 mm.); USNM 100886 (178 & 187 mm.).

Genus *Mycteroperca* GILL, 1863

Mycteroperca GILL, 1863: 236 (type-species, *Serranus olfax* JENYNS, 1843 by subsequent designation of GILL, 1865: 105).
Trisotropis GILL, 1865: 104 (type-species, *Johnius guttatus* BLOCH & SCHNEIDER, 1801 [= *Mycteroperca venenosa*], by original designation).
Parepinephelus BLEEKER, 1876: 257 (type-species, *Serranus acutirostris* VALENCIENNES, [= *Mycteroperca acutirostris*] by monotypy).
Archoperca Jordan & EVERMANN, 1896: 1171 (type-species, *Mycteroperca boulengeri* JORDAN & STARKS [= *Mycteroperca xenarcha*] by monotypy).
Xystroperca JORDAN & EVERMANN, 1896: 1169 (type-species, *Mycteroperca pardalis* GILBERT [= *Mycteroperca rosacea*] by monotypy).

Diagnosis: Body oblong, the depth less than head length and contained 2.7-3.6 times in standard length; head length 2.5-3.0 times in SL. Dorsal head profile

evenly convex; snout distinctly longer than eye diameter (except in fish less than 10 cm SL); interorbital convex, the width greater than eye diameter in fish more than 20 cm. SL; preorbital depth more than half eye diameter (except fish less than 15 cm SL), 8-13 times in head length; preopercle finely serrate, the serrae at corner enlarged or not; upper edge of operculum convex; rear nostrils equal to or distinctly larger than anteriors. Caudal fin usually truncate or distinctly concave, with 8+7 branched rays and 9-12 + 9-12 procurrent rays. Dorsal fin with 11 spines and 15-18 rays, the base of the soft-rayed part shorter than base of spinous part; anal fin with 3 spines and 10-13 rays, the fin margin of adults angular or pointed; paired fins subequal; pectoral fins rounded, with 15-18 rays, the middle rays longest. Midlateral body scales ctenoid. Lower jaw projecting in front of upper jaw; well-developed canines at front of jaws; teeth present on palatines; distal part of ventral edge of maxilla straight, no knob, distinct step or hook; supramaxilla well developed. Supraneural bones 2, the second one distinctly smaller than the first; no trisegmental pterygiophores supporting dorsal or anal fin rays; epipleural ribs on first 10 vertebrae. Cranial crests well developed, the frontoparietal crests parallel, joining supraorbital ridge; anterior ends of frontals contiguous, meeting transverse wall of supraethmoid; supraoccipital crest not carried forward onto frontals; interorbital width greater than vomer width; parasphenoid straight.

GEOGRAPHICAL DISTRIBUTION

Tropical and subtropical waters of the Atlantic and eastern Pacific oceans. In the eastern Atlantic, the genus is represented by two species: *M. rubra*, known from the Mediterranean to the Bay of Biscay and along the west coast of Africa south to Angola, and *M. fusca* which occurs at Madeira, the Azores, and the Canary and Cape Verde Islands.

REMARKS

Adults occur on coral reefs and rocky bottoms in depths of 20-200 m.; juveniles occur in shallow water on rocky bottoms, seagrass beds, and in estuaries. The genus comprises 15 species: 2 in the eastern Atlantic, 8 in the western Atlantic and 5 in the eastern Pacific.

The genus *Mycteroperca* appears to be closely related to *Epinephelus*. Species of both genera have 11 dorsal fin spines and lack the trisegmental pterygiophores in the dorsal and anal fins and the terminal knob on the lower corner of the maxilla

that are characteristic of species of *Cephalopholis*.

M. fusca, M. rubra and *M. acutirostris* (VALENCIENNES, 1828) are three allopatric sibling species that comprise the *Mycteroperca rubra* species complex. These species can be distinguished by the following key:

1a. Total gill-rakers 48-55; maxilla width 4.4-5.8% SL (for fish 10-34 cm. SL); (western Atlantic) ..... *M. acutirostris*

1b. Total gill-rakers 32-49; maxilla width 3.8-5.2% SL (for fish 13-55 cm. SL); (eastern Atlantic) 2

2a. Lower-limb gill-rakers 28-31 ..... *M. rubra*

2b. Lower-limb gill-rakers 20-24 ..... *M. fusca*

M. acutirostris has generally been known as *M. rubra* and thought to be a single species that occurs on both sides of the Atlantic Ocean. Although SMITH (1971) synonymized nominal species from the eastern and western Atlantic under the name of *M. rubra* and gave the distribution as both sides of the Atlantic plus the Mediterranean, he did not examine any specimens from the eastern Atlantic. I compared 20 specimens, 10-34 cm. SL, of *M. acutirostris* from the western Atlantic with 34 specimens, 6-59 cm., from the eastern Atlantic and Mediterranean. These 34 specimens (which are here identified as *M. rubra*) have fewer gill-rakers (lower-limb rakers = 28-31, versus 32-36 in *acutirostris*) and a narrower maxilla (greatest width 3.8-4.4% SL, for 14 fish 13-45 cm. SL, versus 4.4-5.8% SL, for 13 *acutirostris* of 10-34 cm. SL). These differences between *M. rubra* and *acutirostris* are relatively minor, and in view of the allopatric distributions of these two taxa, they might be considered as only subspecifically distinct. But the presence of a third distinct population (*M. fusca*) that occurs at the Azores, Madeira, Canaries and Cape Verde Islands in the Eastern Atlantic implies that each of these populations is genetically distinct from the other two.

Mycteroperca fusca (LOWE, 1836)
Fig. 14 & Plate I, Fig. 2

Serranus fuscus LOWE, 1836: 196 (type locality, Madeira; no indication of a holotype. Neotype: MMF 24928, 300 mm. SL, Madeira, fresh specimen purchased at the Funchal fish market, 12th June 1990.).

?*Serranus emarginatus* VALENCIENNES, 1843: 10 (type locality, Canary Is.; holotype, MNHN 7437, 32 cm. SL).

Serranus simonyi STEINDACHNER, 1891: 352, Pl. 1, Fig. 1 (type locality, Grand Canary I.; syntypes NMW 39457, 314 & 336 mm. SL).

Diagnosis: (based on 30 specimens, measurements from 18 specimens 13-51 cm. SL). Dorsal fin XI,14-16; anal fin III,10-12; pectoral fin rays 15-17; lateral-line scales 67-78; lateral scale series 89-106; gill-rakers 11-15 + 20-24; total 32-39 (including 0-3 rudiments on each limb). Body depth contained 2.8-3.3 times in SL; head length contained 2.6-2.9 times in SL; maxilla width 3.8-5.2% SL. Rear margin of caudal fin truncate or slightly convex (juveniles) to concave or sinuate (adults); branched caudal rays 8+7; no exserted fin rays. Dorsal fin interspinous membranes distinctly incised, the margin of soft-rayed part rounded; 3rd to 5th dorsal fin spines subequal, the 4th or 5th usually longest, 2.6-3.3 times in head length and distinctly shorter than the longest dorsal fin ray; anal fin margin usually rounded (slightly angular in some fish); pectoral fin length contained 1.7-2.3 times in head length; pelvic fin length contained 1.8-2.6 times in head length. Interorbital area convex; preopercle subangular, finely serrate dorsally, with an indentation above the angle and serrae at the angle enlarged; in adults larger than 50 cm. SL, the preopercular angle is produced into a rounded lobe; ventral edge of preopercle fleshy, without spines. Maxilla reaching to below rear half of eye or slightly past vertical at rear edge of eye; maxilla usually distinctly scaly, but scales reduced on some fish to a narrow strip along dorsal part of lateral surface of maxilla. Mid-lateral part of lower jaw with 2 rows of slender, depressible, teeth, the inner teeth about twice as big as outer teeth. Nostrils set in a shallow depression running forward from eye; anterior nostrils tubular or funnel shaped; rear nostril elliptical, its greatest length about 3 times diameter of front nostril. Eye diameter less than interorbital width in fish larger than 18 cm. SL. Mid-lateral body scales distinctly ctenoid, with minute auxiliary scales. Pyloric caeca 11 (one specimen).

Colour: At Madeira, most adults are brownish or dark grey, with irregular pale blotches and spots and a prominent maxillary streak; a fish under stress may reverse this pattern so that the head and body are pale grey, with irregular dark markings. Juveniles mottled greenish brown, with prominent white spots on the head and body, white streaks on the median fins and hyaline gold pectoral fins; faint, white and dark streaks from eye across operculum; dorsum with 6 faint dark saddle blotches, first on nape, 4 at base of dorsal fin and last on peduncle. A 143 mm. SL juvenile caught in a tidepool at Caniçal (Madeira) is shown on Plate I, Fig 2. Occasionally, a specimen "the colour of a goldfish" is caught at Madeira, and one such xanthic fish was caught in December 1988 and put in an aquarium at the Municipal Museum of Funchal. The Director, MANUEL BISCOITO, photographed this fish when it was first put in the aquarium and observed it change, within a few weeks, to the normal brown colour.

Description of neotype (300 mm. SL): Morphometric data are given in Table 1; most characters given in the Diagnosis (above) are not repeated here. Caudal fin emarginate. Pectoral fin rays 17 (left) and 16 (right), the length of the longest rays

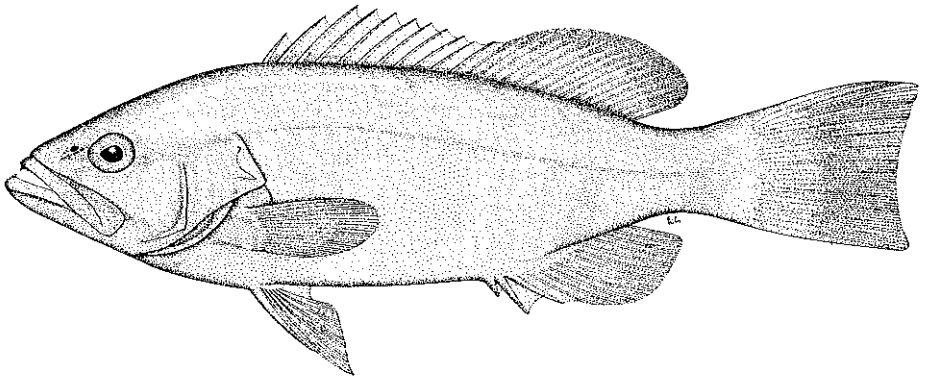

Fig. 14 - *Mycteroperca fusca*, 327 mm. SL, Grand Canary Island, syntype of *Serranus simonyi* STEINDACHNER, 1891; NMW 39457-1. Drawn by E. HEEMSTRA.

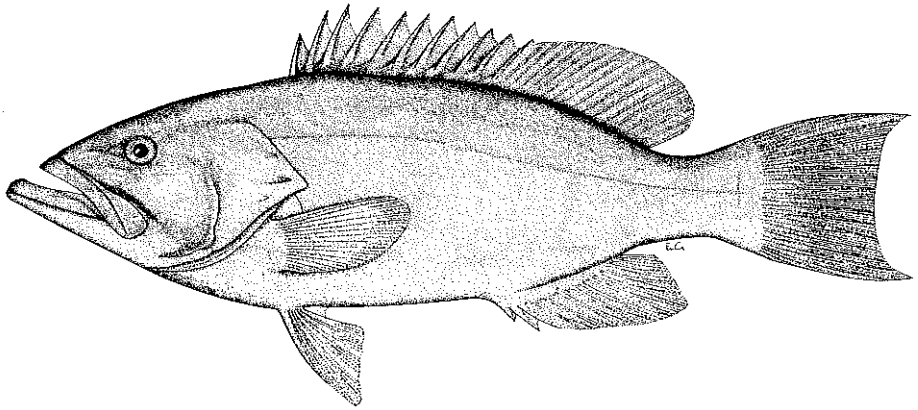

Fig. 15 - *Mycteroperca rubra*, 49 cm. SL, (Sénégal); redrawn from Séret (1981) by E. HEEMSTRA.

contained 1.95 times in head length; pelvic fin length 1.85 times in head length. Dorsal fin XI,15; 5th dorsal fin spine longest, 2.8 times in head length; anal fin III,11; anal fin margin angular. Preopercle slightly angular, with the serrae at the corner enlarged, and a shallow indentation in the rear edge near the corner; interopercle with a few small irregular serrae; middle opercular spine small but exposed, lower spine inconspicuous and uppermost spine not apparent; upper edge of operculum sinuous. Maxilla reaching to vertical at rear edge of eye; most of exposed maxillary surface covered with minute scales; a short, curved, fixed canine tooth (mostly covered by lower lip) on each side of symphysis at front of lower jaw; medial and posterior to each outer canine is a group of 12-14 slender, depressible canines (some shorter and others longer than the outer, fixed canines) with a median diastema separating these two groups of teeth; lateral part of lower jaw with 2 rows of slender depressible canines, the inner teeth about twice length of outer ones; teeth at front of upper jaw similar to those at front of lower jaw; lateral part of upper jaw with 2-4 irregular rows of small, depressible cardiform teeth and an outer row of larger, curved, semi-fixed and well-spaced canines hidden by upper lip and becoming smaller posteriorly; vomer with small, slender canines in a chevron-shaped band 2-5 teeth wide; palatines with similar teeth in a band 5 teeth wide anteriorly and narrowing to a single row posteriorly. Lateral-line scales 78; lateral scale series 100. Gill-rakers 14+23, including 2 rudiments on upper limb and 1 on lower limb.

Colour in preservative: Head and body greyish brown, with irregular, pale grey spots on ventral half of body and median fins; most spots on body have a dark centre; prominent black maxillary streak on cheek along upper edge of maxilla; gill-rakers densely pigmented.

GEOGRAPHICAL DISTRIBUTION

Mycteroperca fusca is known only from the Macaronesian islands: Madeira, the Azores, Canaries, and the Cape Verde Islands. It may also occur in the Mediterranean Sea and along the west coast of Africa, but the only specimens of *Mycteroperca* that I have seen from these localities have been *M. rubra*.

REMARKS

All 18 of the *M. fusca* from Madeira that have been examined have the typical low gill-raker counts (11-15 + 20-24) for this species. It appears, therefore, that *M. rubra* (with gill-raker counts of 16-18 + 28-31) does not occur at Madeira. Although LOWE's (1836) original description of *Serranus fuscus* clearly applies to a species of *Mycteroperca*, he did not give gill-raker counts for his specimen (nor even a length); and the holotype is apparently not extant. However, *Serranus fuscus* is considered

identifiable with the species here recognized as *M. fusca*, because it is the only species of *Mycteroperca* known from Madeira.

The holotype of *Serranus emarginatus* VALENCIENNES, 1843 (MNHN 7437) is from the Canary Islands, but it is a dried specimen, hence the gill-rakers cannot be counted. VALENCIENNES (1843) did not give the gill-raker count in his original description of this species.

Serranus simonyi, described by STEINDACHNER (1891) from two specimens collected at the Canary Islands, was included in the synonymy of *Mycteroperca rubra* by BOULENGER (1895) and FOWLER (1936), but it was overlooked by C. L. SMITH (1971) and DOOLEY *et al.* (1985). The smaller of the two syntypes in the Naturhistorisches Museum of Vienna (NMW 39457, 314 mm. SL) has a misshapen anal fin (evident in STEINDACHNER's original illustration) with only 7 soft-rays, but the 336 mm. SL syntype has a normal anal fin with 12 soft-rays. And the dorsal fin count of 11 spines and 16 rays (XI,15 in the illustrated specimen) also matches the dorsal fin counts for *M. rubra*. However, the gill-raker count of 12+23 given by STEINDACHNER (and confirmed on both syntypes by Dr. BARBARA HERZIG) is considerably fewer than that of *M. rubra* (16-18 + 28-31). In view of this significant difference in the number of gill-rakers, *Serranus simonyi* is here regarded as a synonym of *M. fusca*.

In their checklist of the shorefishes of the Canary Islands, DOOLEY *et al.* (1985) included the paper in which STEINDACHNER described *M. simonyi* in their list of Literature Cited, but they omitted *Serranus simonyi* in their text. They list *Mycteroperca rubra* (with VALENCIENNES' descriptions of *Serranus fuscus*, *S. acutirostris* and *S. emarginatus* as synonyms) as the only species of *Mycteroperca* at the Canary Islands. It is possible that both *M. rubra* and *M. fusca* occur there, but all of the 5 specimens that I have examined from the Canaries were *M. fusca*.

WASCHKEWITZ and WIRTZ (1990) reported on the annual migration and return to the same site in Madeira of a xanthic grouper identified as *Epinephelus alexandrinus*. This fish (which apparently was identified only visually and not collected) is probably *M. fusca*, because 1) "*Epinephelus alexandrinus*" (= *E. costae*) does not occur in Madeira; 2) in a recent book on the marine fauna of Portugal, Madeira and the Azores (Saldanha, 1979) a photograph of *M. fusca* was misidentified as *E. alexandrinus;* and 3) xanthic specimens of *M. fusca* are known at Madeira and the Canary Islands.

MATERIAL EXAMINED

MADEIRA: Neotype, MMF 24928 (300 mm.); BMNH 1898.1.26 (3, 250-420 mm.); BMNH 1934.4.6 (267 & 270 mm.); BMNH 1953.11.1.62 (255 mm.); MMF 3199 (158 mm.); MMF 3517 (150 mm.); MMF 3521 (375 mm.); MMF 19908 (545 mm.); MMF 19910 (518 mm.); MMF 4526 (260 mm.); MMF 24932 (143 mm.); RUSI 34713 (3, 301-315 mm.); USNM 316489 (272 mm.).

AZORES: Santa Maria: RUSI 34607 (4, 221-340 mm.); RUSI 34609 (129 & 140 mm.). CANARY ISLANDS: MNHN 7437, holotype of *Serranus emarginatus* VALENCIENNES, (320 mm., dried specimen). Grand Canary I.: NMW 39457, syntypes of *Serranus simonyi* STEINDACHNER, (314 & 327 mm.). Tenerife: NMW 40787 (3, 86-104 mm.); NMW 40791 (137 & 139 mm.). CAPE VERDE ISLANDS: IRSNB 14376 (345 mm.).

Mycteroperca rubra (BLOCH, 1793)
Fig. 15

Epinephelus ruber BLOCH, 1793: 22, Pl. 331 (type locality probably eastern Atlantic or Mediterranean; given erroneously by BLOCH as "Japan"; holotype ZMB 161, 130 mm.).
?*Serranus nebulosus* COCCO, 1833: 21 (type locality, Messina; holotype not located; preoccupied by *Serranus nebulosus* VALENCIENNES, 1828).
?*Serranus tinca* CANTRAINE, 1835: 207 (type locality, Messina; holotype not located).
Cerna macrogenis SASSI, 1846: 139 (type locality, Ligurian Sea; holotype not located).
?*Serranus armatus* OSORIO, 1895: 174 (type locality, eastern Atlantic, São Tomé; holotype destroyed in the fire of 1978 at the Museu Bocage).

Diagnosis: Dorsal fin XI,15-17; anal fin III,11-12; pectoral fin rays 16-17; lateral-line scales 69-76; lateral scale series 94-108; gill-rakers 16-18 + 28-31, total 44-49 (including 1 or 2 rudiments on each limb). Body oblong, compressed, the depth less than head length, contained 2.8-3.2 times in standard length (for fish 17-59 cm. SL); head length 2.5-2.7 times in SL; maxilla width 3.8-4.5% SL for fish 17-37 cm. SL, 4.8% SL for a fish of 59 cm. SL. Caudal fin margin convex in juveniles less than about 20 cm. SL, truncate in fish of 20-50 cm. SL, and concave in adults over 50 cm. SL; dorsal fin interspinous membranes distinctly indented, the posterior margin of fin rounded; anal fin margin angular in adults. Interorbital area convex; preopercle serrae enlarged at the angle, forming a rounded lobe set off by the indentation immediately above; nostrils subequal in juveniles, the diameter of rear nostrils about twice that of front ones in a fish of 59 cm. SL.

Colour: Generally uniform reddish brown; sometimes mottled with blackish or pale grey spots; a black streak above maxilla. Juveniles with a black saddle blotch on peduncle. BAUCHOT and PRAS (1980: Pl. 10) show a brownish fish with irregular white spots and blotches on body, dorsal part of head and dorsal fin; 2 dark stripes from eye towards pectoral fin.

Maximum total length at least 80 cm.

GEOGRAPHICAL DISTRIBUTION

Continental shores of the eastern Atlantic Ocean from Portugal to southern Angola. Probably all of the records of "*Mycteroperca rubra*" from the Mediterranean

and shores of Europe and Africa are based on this species.

REMARKS

Rocky and sandy bottoms in depths of 15-200 m. In the Mediterranean, it does not seem to be as common as species of *Epinephelus*. BOUAIN *et al.* (1983) state that it is rare in Tunisian waters. According to SÉRET (1981) it is very common along the coast of Sénégal.

Recent authors (SMITH, 1971; TORTONESE, 1975, 1986; BAUCHOT, 1987) have regarded *M. rubra* as an amphi-Atlantic species occurring on both sides of the Atlantic Ocean. This species name is here restricted to the eastern Atlantic continental population, which differs from *M. acutirostris* of the western Atlantic in having fewer gill-rakers and a narrower maxilla (see key above). *M. rubra* is very similar to *M. fusca* of the eastern Atlantic Macaronesian islands, but the latter has only 20-24 lower gill-rakers.

In the original description of *Epinephelus ruber* BLOCH, the type locality was given erroneously as "Japan". Gill-raker counts of the holotype of *M. rubra* (17+31, left side and 18+31, right side) indicate that it came from the continental shores of the eastern Atlantic.

Probably all of the literature based on "*Mycteroperca rubra*" from the continental coast of Africa and the Mediterranean pertains to *M. rubra* rather than *M. fusca* (which is known only from islands of the eastern Atlantic) or *M. acutirostris* (of the western Atlantic). The accounts of *M. rubra* by SMITH (1971) and TORTONESE (1975 & 1986) pertain to all three species, but the gill-raker counts given by SMITH (1971: 208) are of *M. acutirostris*, and those given by TORTONESE are of *M. rubra*.

FURNESTIN *et al.* (1958) and SÉRET (1981) published good illustrations of *M. rubra*.

MATERIAL EXAMINED

MEDITERRANEAN?: ZMB 161 (136 mm. holotype of *Serranus ruber* BLOCH; type locality given erroneously as "Japanisches Meer". SICILY: MNHN 7230 (365 mm.). NMW 39138 (300 mm.); NMW 40782 (452 mm.). ITALY: BMNH 88.11.29.4 (127 mm.). GREECE: NMW 40783 (186 & 193 mm.); NMW 40785 (147 & 167 mm.); ZMB 12581 (231 mm.). LEBANON: BMNH 1967.2.1.64-68 (4, 53--67 mm.); NMW 40784 (220 mm.); USNM 298686 (180 mm.). ISRAEL: BMNH 1955.9.25.6 (164 mm.); HUJ 7230 (84 mm.); HUJ 10631 (163 mm.); HUJ 12357 (180 mm.). EGYPT: MNHN 5552 (107 mm.). ALGIERS: BMNH 1970.5.30.7 (59 mm.). SÉNÉGAL: NMH 40790 (250 mm.). ANGOLA: MB 1443 (120 mm.); MB 1444 (141 mm.); MB 1586 (128 mm.); MB 2088 (585 mm.). MNHN 1962-269 (171 mm.). SAM 24986 (7, 74-102 mm.); SAM 24991 (165 mm.).

Genus *Paranthias* GUICHENOT, 1868

Paranthias GUICHENOT, 1868: 87 (type species, *Serranus furcifer* VALENCIENNES, 1828 by monotypy).

Brachyrhinus GILL, 1863: 236 (type species, *Serranus creolus* VALENCIENNES, 1828 [= *P. furcifer*] by monotypy; preoccupied by *Brachyrhinus* LATREILLE, 1802).

Creolus JORDAN & GILBERT, 1883: p. xxxvi (type species, *Serranus furcifer* VALENCIENNES by monotypy; listed in Table of Contents as if in Addenda, but replaced on page 973 by *Paranthias* GUICHENOT).

Diagnosis: Body oblong, fusiform, dorsal and ventral profiles almost equally curved, the depth contained 2.7-3.4 times in standard length, the body width 1.8-2.5 times in the depth; head length 3.2-4.0 times in SL. Dorsal head profile convex; snout short, subequal to eye diameter (except in large adults); interorbital area flat or slightly convex; preorbital depth less than half eye diameter, contained 10-14 times in head length; mouth small, the maxilla not reaching past vertical at centre of eye; preopercle subangular, with vertical limb and rear half of lower limb finely serrate; upper edge of operculum convex; anterior and posterior nostrils subequal.

Caudal fin distinctly forked, the middle rays less than half length of upper or lower caudal lobes, with 8+7 branched rays and 12-13 + 11-12 procurrent rays; dorsal fin with 9 spines and 17-21 rays, the fin origin posterior to vertical at upper end of pectoral-fin base; the interspinous membranes slightly indented; no dorsal fin spines or rays elongated; base of spinous part shorter than base of soft-rayed part; soft dorsal fin margin rounded; anal fin with 3 spines and 8-11 rays; anal fin margin straight; pectoral fins large, distinctly longer than pelvics, contained 0.9-1.2 times in head length, the middle rays longest. Midlateral body scales ctenoid. Jaws with rudimentary canines; teeth present on palatines and in an oval patch on vomer; supramaxilla vestigal or absent; no knob or step on ventral edge of maxilla.

Supraneural bones 2, the second about two-thirds length of first; dorsal and anal fins with 3-5 trisegmental pterygiophores at rear end of fin; rear edge of first dorsal pterygiophore not excavated for tip of third neural spine; epipleural ribs on first 9 vertebrae.

Cranium short and wide, the least interorbital width more than half width at lateral ethmoids and twice width of vomer; frontals separated anteriorly by supraethmoid; well developed median crest on frontals, continuous with supraoccipital crest, but the frontal part of crest not visible in lateral view because interorbital area is recessed (concave dorsally); parasphenoid distinctly bent upwards anteriorly.

GEOGRAPHICAL DISTRIBUTION

Tropical and subtropical waters of the Atlantic and eastern Pacific oceans: In

	E. margin. Neotype	*M. fusca* Neotype	*M. fusca* (n=13)	*M. rubra* (n=7)	*M. acuti* (n=13)
SL (mm.)	200	300	129-510	126-585	104-343
Body depth	38	33	30-36	31-36	31-39
Head length	41	37	35-39	36-40	37-42
Snout length	11	11	10-13	9.2-12	9.9-12
Orbit diameter	6.6	5.3	4.5-7.8	4.9-6.2	5.1-8.9
Interorbital width	7.8	8.0	6.5-8.4	6.0-8.6	6.6-8.1
Preorbital depth	3.9	4.0	2.7-4.7	2.9-4.6	2.8-4.1
Upper jaw length	19	17	16-19	17-19	17-20
Maxilla width	4.8	4.3	3.8-5.0	4.1-5.1	4.4-5.8
Caudal peduncle depth	13.2	13	11-13	12-14	13-15

Table 1 - Morphometric data (ranges of mesurements in % SL) for *Epinephelus marginatus, Mycteroperca fusca, M. rubra* and *M. acutirostris.*

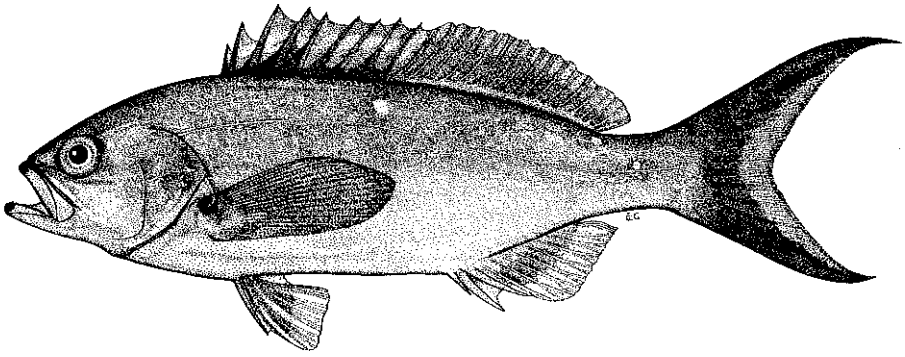

Fig. 16 - *Paranthias furcifer*, 19 cm. SL, Puerto Rico, specimen skeletonized.

the eastern Atlantic, *P. furcifer* is known only from Ascension Island and islands in the Gulf of Guinea. In the western Atlantic, it is known from Bermuda, south Florida, Gulf of Mexico, Cuba, southern Bahamas, Caribbean to southern Brazil.

REMARKS

Paranthias is a unique genus of groupers that have a "small mouth [with upper jaw more protrusile than in other groupers], small teeth, numerous [long] gill rakers, fusiform body, and deeply forked caudal fin – all representing departures from the typical grouper morphology, and all specializations for feeding in mid-water on zooplankton" (RANDALL, 1967). *Paranthias* feed mainly on small planktonic animals that are picked individually from the water, and their shortened snout (compared to other groupers), which facilitates close-range binocular vision, is thus another specialization for this type of plankton feeding. They are usually seen in feeding aggregations well above the reef, but they will retreat to the reef at the approach of danger. They are found in depths of 10-70 m.

The genus *Paranthias* comprises two valid species. The distinction of the eastern Pacific species, *P. colonus* (VALENCIENNES, 1855) and *P. furcifer* is discussed by HEEMSTRA and RANDALL (in press).

Paranthias furcifer (VALENCIENNES, 1828)
Fig. 16

Serranus furcifer VALENCIENNES, in CUV. & VAL., 1828: 264 (type locality, Brazil; holotype MNHN 7028, 137 mm. SL).

Serranus creolus VALENCIENNES, in CUV. & VAL., 1828: 265 (type localities, Haiti, Dominican Republic, Martinique; syntypes MNHN 4326, 172 mm. SL, Martinique, MNHN 4327, 162 mm. SL, Dominican Republic).

Corvina oxyptera DeKAY, 1842: 77, Pl. 30, Fig. 96 (type locality, "New York"; holotype not located).

Centropristes nebulosus CASTELNAU, 1855: 5, Pl. 1, Fig. 4 (type locality, Rio de Janeiro; holotype MNHN 7821, 260 mm. SL, dry specimen).

Serranus castelnaui JORDAN & EIGENMANN, 1890: 490 (type locality, Rio de Janeiro; replacement for *Centropristes nebulosus*, preoccupied in *Serranus*).

Diagnosis: Dorsal fin IX,17-19; anal fin III,8-10; pectoral fin rays 19-20; lateral-line scales 69-77; lateral scale series 124-129; gill-rakers 12-14 + 24-26, total 38. Body depth greater than head length, contained 2.9-3.4 times in standard length (for fish 19-28 cm. SL); head 3.5-3.8 times in SL; length of dorsal fin base 56-58% SL; anal fin base 16-19% SL. Caudal fin deeply forked; dorsal fin interspinous membranes slightly indented. Interorbital area convex, the width greater than eye

diameter of fish larger than 15 cm. SL; preopercle subangular, the vertical edge and rear half of lower edge finely serrate; nostrils subequal. Maxilla scaly, with long slender supramaxilla. Mid-lateral body scales ctenoid.

Colour: Head and body reddish brown, paler ventrally; bright orange-red spot at upper end of pectoral fin base; 3 widely-spaced white spots between lateral line and dorsal fin base; 2 blue lines on cheek, one approximately horizontal and tangent to lower edge of eye, the other along upper edge of maxilla and continued onto lower part of cheek; yellow-green spot on each interspinous dorsal fin membrane and continued on soft-rayed part of fin as a dark green submarginal line.

Maximum size about 35 cm. to tip of middle caudal fin rays.

GEOGRAPHICAL DISTRIBUTION

Tropical and subtropical waters of the Atlantic Ocean. In the eastern Atlantic, *P. furcifer* has been reported from Ascension Island (LUBBOCK, 1980), and the Gulf of Guinea islands of Principe, São Tomé and Annobon (OSÓRIO, 1894). In the western Atlantic, it is known from Bermuda (common), North Carolina to Florida, Gulf of Mexico (rare), Campeche Bank and throughout the Caribbean (except absent in the northern Bahamas) to São Paulo Brazil.

REMARKS

Serranus nebulosus VALENCIENNES, 1828 was incorrectly listed as a synonym of *P. furcifer* by BAUCHOT *et al.* (1984); according to RANDALL and HEEMSTRA (in press), this species is a synonym of *Epinephelus coioides*.

MATERIAL EXAMINED

BERMUDA: ANSP 11799 (212 mm.); FMNH 5265 (244 mm.), FMNH 5266 (215 mm), FMNH 5267 (240 mm.). PUERTO RICO: UPR 3248 (184 mm.). ASCENSION ISLAND: RUSI 11799 (212 mm.).

ACKNOWLEDGEMENTS

My assistant JOAN WRIGHT has done much to alleviate the drudgery of examining hundreds of specimens and literature references; I am grateful for her conscientious work. Several drawings were done by my wife, ELAINE M. HEEMSTRA. I thank my colleague and fellow student of groupers, Dr. JOHN E. RANDALL, for much infor-

mation, numerous excellent photographs, and considerable enlightment via our voluminous correspondence. Mr. ALWYNE WHEELER (formerly of the British Museum (Natural History)) supplied information on CARL LINNAEUS and his *Systema Naturae* that was essential for the resolution of the nomenclatural conundrum known as "*Epinephelus guaza*". I appreciate the excellent technical support provided at my home Institute by ROBIN STOBBS. Our collection manager, BILLY RANCHOD and his assistant EDWARD MATAMA have also been very helpful. I am grateful to Dr. MARIE-LOUISE BAUCHOT, Dr. BARBARA HERZIG and Dr. H.-J. PAEPKE for loans and information on type specimens in their museums.

Specimens were loaned by the Museu Bocage (Prof. LUIS ARRUDA), British Museum (Dr. NIGEL MERRETT) Hebrew University of Jerusalem (Drs. A. BEN-TUVIA and D. GOLANI), Muséum National d'Histoire Naturelle, Paris (Dr. MARIE-LOUISE BAUCHOT), Institut Royal des Sciences Naturales de Belgique (Dr. J.-P. GOSSE), Naturhistorisches Museum Wien (Dr. BARBARA HERZIG), University of Miami, Rosenstiel School of Marine and Atmospheric Sciences (Dr. C. R. ROBINS), Museum of Comparative Zoology, Harvard University (KARSTEN HARTEL) and the University of Tel Aviv (Dr. LEV FISHELSON).

I appreciate the opportunity to examine specimens and the hospitality shown me on visits to some of the museums listed above and also at the Museu de Zoologia da Universidade de São Paulo (Dr. NAERCIO MENEZES), Instituto de Ciencias del Mar, Barcelona (Drs. J. RUCABADO & D. LLORIS), Field Museum of Natural History (B. CHERNOFF, MARY ANNE ROGERS and KARIN DAHL), California Academy of Sciences (W. N. ESCHMEYER, T. IWAMOTO, D. CATANIA, A. SNYDER & P. SONODA), National Museum of Natural History, Washington D.C. (SUSAN JEWETT *et al.*), The Academy of Natural Sciences of Philadelphia (W. F. SMITH-VANIZ, E. B. BOHLKE & W. SAUL), and the University of Puerto Rico Marine Laboratory in Mayaguez (Dr. DANNIE HENSLEY). Mr. JAMES CHAMBERS of the British Museum (Natural History) supplied data from specimens of *Mycteroperca fusca*.

For the opportunity to collect groupers in the Azores, I thank the Departamento de Biologia da Universidade dos Açores (Drs. JOSÉ AZEVEDO and ANA NETO). I am grateful to Dr. BERNARD SÉRET for several useful criticisms of the manuscript. Finally, I must express my sincere appreciation to Mr. G. E. MAUL and MANUEL J. BISCOITO, Director of the Museu Municipal do Funchal, for their hospitality and assistance in collecting groupers at Madeira.

LITERATURE CITED

ALLEYNE, H.G. & W. MACLEAY:
1877. The ichthyology of the Chevert Expedition. Parts I & II. *Proc. Linn. Soc. New South Wales*, 1 (1875-1876), pp. 261-281; 321-359, pls. 3-9; 10-17.

BARNARD, K.H.:
1927. *A Monograph of the Marine Fishes of South Africa*. Part 2: 419-1065. Neill and Co., Ltd., Edinburgh.

BAUCHOT, M.-L.:
1987. Poissons Osseux. (pp. 891-1422) in *Fiches FAO d'identification des espèces pour les besoins de la pêche. (Révision 1). Méditerranée et mer Noire. Zone de pêche 37.* Volume II. Vertébrés. (pp. 762-1529) W. Fischer, M.-L. Bauchot & M. Schneider (eds). Rome, UN/FAO.

BAUCHOT, M.-L., M. BLANC & M. POLL:
1960. A propos d'*Epinephelus alexandrinus* (C.V.) poisson téléostéen de la famille des Serranidae. *Bull. Mus. natn. Hist. nat.*, Paris 2nd Ser., **32** (4): 301-304.

BAUCHOT, M.-L., M. DESOUTTER & J.E. RANDALL:
1984. Catalogue critique des types de Poissons du Muséum national d'Histoire naturelle (Suite) (Famille des Serranidae).) *Bull. Mus. natn. Hist. nat.*, Paris **6** (3): 3-82.

BAUCHOT, M.-L. & A. PRAS:
1980. *Guide des Poissons Marins d'Europe*. Delachaux & Niestlé, éditeurs. Lausanne-Paris. 427 pp.

BELLEMANS, M., A. SAGNA, W. FISCHER & N. SCIALABBA:
1988. *Fiches FAO d'identification des espèces pour les besoins de la pêche. Guide des ressources halieutiques du Sénégal et de la Gambie (espèces marines et d'eaux saumâtres)*. Rome, FAO. 227 pp.

BENNETT, E.T.:
1830. *Catalogue of Zoological Specimens* (Class Pisces, pp. 686-695), *Memoir of the Life and Public Services of Sir Stamford Raffles*, edited by Lady Raffles, London, 1830.

BEN-TUVIA, A.:
1953. Mediterranean fishes of Israel. *Bull. Sea Fish. Res. Stn. Israel*, (8): 1-40, 20 figs.

BEN-TUVIA, A. & A. LOURIE:
1969. A Red Sea grouper *Epinephelus tauvian* caught on the Mediterranean coast of Israel. *Israel J. Zool.*, 18: 245-247, 1 fig.

BIANCHI, G.:
1986. *Fichas FAO de Identificação de Espécies para propósitos comerciais. Guia de campo*

para as espécies comerciais marinhas e de águas salobras de Angola. Rome, FAO. 184 pp.

BINI, G.:

1968. *Atlante dei Pesci delle Coste Italiane. Vol. IV. Osteitti.* Mondo Sommerso Editrice. Rome. 163 pp.

BLACHE, J., J. CADENAT & A. STAUCH:

1970. Clés de détermination des poissons de mer signalés dans l'Atlantique oriental (entre le 20e parallele N. et le 15e parallele S.). *Faune tropicale*, **18**, ORSTOM, Paris; 479 pp., 1152 figs.

BLEEKER, P.:

1863. Mémoire sur les poissons de la côte de Guinée. *Natuurk. Verh. holland. Maatsch. Wet. Haarlem,* (2) 18: 1-136, 28 pls.

1876. "Systema Percarum Revisum, Pars I." *arch. Neerl. Sci. Nat.*, XI: 247-288.

BLOCH, M.E.:

1790. *Naturgeschichte der Auslandischen Fische.* Vol. 4, 128 pp. J. Morino & Comp., Berlin.

1792. *Naturgeschichte der Auslandischen Fische*, 6: 1-126, 36 pls, Berlin.

1793. *Naturgeschichte der Auslandischen Fische*, 7: 1-144, 36 pls, Berlin.

BLOCH, M.E. & J.G SCHNEIDER :

1801. *Systema Ichthyologiae, Iconibus CX Illustratum.* 1x+584 pp. 110 pls. Berlin.

BOCOURT, F.M.:

1868. Descriptions de quelques acanthoptérygiens nouveaux appartenant aux genres *Serran* et *Mesoprion* recueillis dans l'Amérique Centrale. *Ann. Sci. Nat. (Zool).*, ser. 5, vol. 10, pp. 222-224.

BONAPARTE, C.L.:

1831. Saggio di una distribuzione metodica degli animali vertebrati. Prospetto del sistema d'Ittiologia generale. *Giorn. Arcad.*, 52: 167-190.

1832-41. Iconografia della Fauna italica per le quattro classi degli Animali Vertebrati, tomo III, Pesci, Roma. Puntate II-V (7-28), 12 pl. [publ. 1833].

BOUAIN, A., Y. SIAU & J.P. QUIGNARD:

1983. (The Groupers off the southeastern coasts of Tunisia. First part: Systematic and Ecobiology.) *Peche Marit.*, **62** (1262): 276-280.

BOULENGER, G.A.:

1889. Second account of the fishes obtained by Surgeon-Major A.S.G. Jayakar at Muscat, East Coast of Arabia. *Proc. Zool. Soc.* (London) 1889: 236-246, pls. 25-28.

1895. *Catalogue of the Perciform Fishes in the British Museum.* I. Second edition, Taylor and

Francis, London. 394 pp.

BRÜNNICH, M.T.:
1768. *Ichthyologia Massiliensis, sistens piscium descriptiones eorumque apud incolas nomina. Accedunt Spolia Maris Adriatici.* xvi+110 pp. Hafniae et Lipsiae.

BRUSLÉ, J.:
1985. Exposé synoptique des données biologiques sur les mérous *Epinephelus aeneus* (Geoffroy Saint-Hilaire, 1809) et *Epinephelus guaza* (Linnaeus, 1758) de l'Océan Atlantique et de la Méditerranée. *FAO Synop.* Pêches, (129): 64 pp.

CADENAT, J.:
1935. Les Serranidés de la Côte occidentale d'Afrique (du Cap Spartel au Cap Vert). *Rev. Trav. Off. (scient. tech.) Pêch. marit.*, **8** (4): 377-422, 30 figs.

1951. Poissons de mer du Sénégal, Initiations africaines, III. *Inst. fr. Afr. noire, Dakar*, 1950 [1951]: 345 pp., 241, figs.

CANTRAINE, F.J.:
1835. Mémoire sur le *Serranus tinca*. *Bull. Acad. r. Belg. Cl. Sci.*, **2** (4): 207-208.

CAPELLO, F. de B.:
1868. Peixes novos de Portugal e da Africa occidental, e caracteres distinctivos d'outras espécies já conhecidas. *Jorn. Sci. Math. Phys. Nat. Lisboa* 1: 154-169.

1871. Primeira lista dos peixes da Ilha da Madeira, Açores, e das possessões portuguezas d'Africa que existem no Museum de Lisboa. *Jorn. Sci. Math. Phys. Nat., Lisboa*, 2: 194-202.

CASTELNAU, F. de:
1855. Animaux nouveaux ou rares recueillis pendant l'expédition dans les parties centrales de l'Amérique du sud de Rio de Janeiro à Lima, et de Lima au Para *in* Expédition dans les parties centrales de l'Amérique du sud pendant les années 1843 à 1847, 7e partie, Zoologie, 3, Poissons: xiv+112 pp., 50 pls.

CERVIGON, M. F.:
1966. *Mycteroperca cidi* nov. sp. Una nueva especie de *Mycteroperca* de las costas de Venezuela (Pisces-Serranidae). *Inv. Pesq.* 30: 653-660.

CHABANAUD, P. & T. MONOD:
1927. Les Poissons de Port-Étienne, contribution à la faune ichthyologique de la Région du Cap Blanc (Mauritanie Française). *Bull. Com. Étude. his scient. Afr. occid. fr.*, 1926, 9: 225-287, 33 figs, 3 pls.

COCCO, A.:
1833. Su di alcuni pesci de'mari di Messina. *Giorn. Sci. Lett. Arti Sicilia*, 42: 9-21, pl.

COPE, E.D.:
1871. Ichthyology of the Lesser Antilles. *Trans. Amer. Phil. Soc.*, 14: 445 - 483.

COSTA, O. G.:
1836. *Fauna del regno di Napoli, ossia enumerazione di tutti gli animali, Pesci,* Part 1, (published serially, 1829-53, 511 pp., 60 pls).

1849. Di un nuovo pesce della famiglia de' Gadini pescata nel golfo di Napoli ai 3 febb. 1846. *Atti R. Acca. pontan., Napoli* , **5** (3): 171-182.

COUCH, J.:
1832. Fishes new to the British fauna, contained in Couch's 'History of the fishes of Cornwall'. *Mag. nat. Hist., Lond.*, 5: 15-24.

1867. *A History of the Fishes of the British Islands*, 2nd ed., London, 1, 1867: vii+245 pp, col. pls. I-LVII.

CURY, P. & C. ROY:
1988. Migration saisonnière du thiof (*Epinephelus aeneus*) au Sénégal: influence des upwellings senegalais et mauritanien. *Oceanol. Acta.* **11** (1): 25-36, illustr. (In French with English summary).

CUVIER, G. & A. VALENCIENNES:
1828. *Histoire Naturelle des Poissons*. Paris, F.G. Levrault, Vol. 2: xxi+490 pp., pls. 9-40.

1830. *Histoire Naturelle des Poissons*. Paris, F.G. Levrault, Vol. 6: xxiv+559 pp., pls. 141-169.

DAY, F.:
1868. On some new fishes from Madras. *Proc. Zool. Soc. London*: 192-199.

1880. *The Fishes of Great Britain and Ireland*. London-Edinburgh, 2 vols.,vol. 1: 336 pp, 92 pls.

DEKAY, J.E.:
1842. Zoology of New York, or the New York fauna. Comprising detailed descriptions of all the animals hitherto observed within the state borders. Class V. Fishes. *Natural History of New York Geological Survey, Albany*, **1** (3-4), Fishes: 415 p., 79 pls.

DODERLEIN, P.:
1882. Rivista delle specie del genere *Epinephelus* Bloch o *Cerna* Bonap. riscontrate sinora nei mari della Sicilia. *G. Sci. nat. econ.*, Palermo, 15: 168-259, 5 pls.

1889. *Manuale Ittiologico del Mediterraneo ossia senossi metodica delle varie specie di pesci riscontrate sin qui nel Mediterraneo ed in particolare nei mari di Sicilia.* Palermo, Part 4: 1-188.

DOOLEY, J.K., J. van TASSELL & A. BRITO:
1985. An annotated checklist of the shorefishes of the Canary Islands. *Amer. Mus. Novit.* 2824: 1-49, 5 figs.

DUMÉRIL, A. H. A.:
1861. Reptiles et poissons de l'Afrique occidentale. Étude précédée de considérations générales sur leur distribution géographique. *Archs Mus. natn. Hist. nat.*, Paris, 10: 137-268, pls. 13-23.

EDWARDS, A.J. & C.W. GLASS:
1987. The fishes of Saint Helena Island, South Atlantic Ocean. *J. Nat. Hist.*, 21: 617-686.

EHRENBAUM, E.:
1914. Über Fische von Westafrika, besonders von Kamerun. *Ficherbote*, 6: 289-296.

1915. Über Küsten Fische von Westafrika, besonders von Kamerun: 1-85, 38 fig., Hamburg.

FLEMMING, J.:
1828. A history of British animals exhibiting the descriptive characters and systematical arrangements of the genera and species of quadrupeds, birds, reptiles, fishes, mollusca and radiata of the U.K.; including the indigenous, extirpated and extinct kinds, together with periodical and occasional visitants. Edinburg-London, xxiii+565 p. (2nd ed., 1842, same pag.).

FORSSKÅL, P.:
1775. Descriptiones animalium...piscium...in itinere orientali observavit.164 pp. Molleri, Hauniae.

FOWLER, H.W.:
1919. Notes on synentognathous fishes. *Proc. Acad. nat. Sci. Philad.*, 71(1): 2-15.

1923. New or little known Hawaiian fishes. *Occ. Pap. B.P. Bishop Mus.* 8: 375-392.

1936. The marine fishes of West Africa based on the collection of the American Museum Congo Expedition, 1909-1915. Part II. *Bull. Amer. Mus. Nat. Hist.*, **70** (2): 607-1493.

1944. The fishes. Results of the fifth George Vanderbilt Expedition, 1941. *Monogr. Acad. nat. Sci. Philad.*, 6: 57-529, fig. 1-268, pl. 1-20.

FRANCA, P. da:
1957. Contribuição para o conhecimento dos Serranidae de Angola. Trabalhos da missão de biologia marítima, No. 12. Anais da Junta de Investigações do Ultramar. 1957: 1-45, pls. 1-4.

FURNESTIN, J, J. DARDIGNAC, C. MAURIN, A. COUPÉ, & H. BOUTIÈRE:
1958. Données nouvelles sur les poissons du Maroc atlantique. *Revue Trav. Inst. (scient. tech.) Pêch. marit.*, Paris, **22** (4): 379-493, 75 figs.

GEOFFROY SAINT-HILAIRE, E.:
1817. Poissons de la Mer Rouge et de la Méditerranée. In, *Description de l'Egypte ou Recueil des observations et des Recherches qui ont été faites en Egypte pendant l'expédition de l'armée française*. Paris, Planches Histoire Naturelle, 1, Poissons, pls. 18-27.

1827. Histoire Naturelle des Poisson de Nil (suite). In, *Description de l'Egypte ou Recueil des observations et des Recherches qui ont été faites en Egypte pendant l'expédition de l'armée française*. Paris, Histoire Naturelle, 1: 265-310. Suivi de: Histoire Naturelle des Poissons de la Mer Rouge et de la Méditerranée, pp. 311-350.

GIBERT, A.M.:
1913. *Fauna ictiologica de Catalunya*. Barcelona. pp. 1-96 + addenda of 11 pp.

GILBERT, C. H.:
1892. Descriptions of Apodal fishes from the tropical Pacific. *Proc. U.S. natn. Mus.*, 14: 347--352.

GILL, T.:
1862. Descriptions of two new species of marine fishes. *Proc. Acad. nat. Sci. Philad.*, (1861), 13: 98-99.

1863. Remarks on the relations of the genera and other groups of Cuban fishes. *Proc. Acad. nat. Sci. Philad.* (1862), 14: 235-242.

1865. On a new genus of Serraninae. *Proc. Acad. nat. Sci. Philad.* (1865), 17: 104-106.

1885. Teleostei, pp. 98-298 *in* J.S. Kingsley, *The Standard of Natural History. Lower Vertebrates.* Vol. III. Boston.

GUICHENOT, A.:
1868. Index generum ac specierum Anthiadidorum hucusque in Museo Parisiensi observatorum. *Ann. Soc. Linée Dépt. Maine Loire*, vol. 10, pp. 80-87.

GÜNTHER, A.:
1859. *Catalogue of the Acanthopterygian fishes in the British Museum* I. British Museum (Natural History), London. xxxi+524 pp.

HAMILTON, F.:
1822. *An Account of the Fishes Found in the River Ganges and its Branches.* 405 pp. Archibald Constable and Company, Edinburgh.

HEEMSTRA, P.C. & J.E. RANDALL:
1984. Serranidae. *In* W. Fischer & G. Bianchi (eds), *FAO species identification sheets for fishery purposes: Western Indian Ocean.* Vol. 4, 241 pp. Rome, UN/FAO.

1986. Serranidae. (pp. 509-537) *in Smiths' Sea Fishes.* M.M. Smith & P.C. Heemstra, eds., Macmillan South Africa (Publishers) (Pty.) Ltd., Johannesburg. 1027 pp.

in press. FAO Species Catalogue. Groupers of the World (Family Serranidae, subfamily Epinephelinae). *FAO Fisheries Synopsis.*

HOLBROOK, J.E.:
1855. *Ichthyology of South Carolina.* Charleston, South Carolina, 182 pp. 27 pls.

HUBBS, C.L. & K.F. LAGLER:
1964. *Fishes of the Great Lakes Region.* Univ. Michigan Press, Ann Arbor. 213 pp.

JENYNS, L.:
1839-1843. Fish *in* C. Darwin, ed., *The Zoology of the Voyage of H.M.S. "Beagle," During*

the Years 1832-1836. Part 4. Smith, Elder and Co., London. 172 pp.

JOHNSON, G.D. & P. KEENER:
1984. Aid to identification of American grouper larvae. *Bull mar. Sci.*, **34** (1): 106-134.

JORDAN, D.S.:
1917-20. The genera of Fishes, from Linnaeus to 1920, with the accepted type of each. A contribution to the stablility of scientific nomenclature. Stanford Univ. Publ., Univ. Ser., 576 pp. in four parts. Part I (Univ. Ser. 27), 1917: 1-161; Part II (Univ. Ser. 36), 1919: 163-284; Part III (Univ. Ser. 39), 1919: 285-410; Part IV (Univ. Ser. 43), 1920: 411-576.

JORDAN, D.S. & C.H. EIGENMANN:
1890. A review of the genera and species of Serranidae found in the waters of America and Europe. *Bull. U.S. Fish Comm.*, 8 (1888): 329-441, pls. 60-69.

JORDAN, D.S. & B.W. EVERMANN:
1896. The fishes of North and Middle America. *Bull. U.S. Natl. Mus.*, **47** (1): ix+1240.

1905. The shore fishes of the Hawaiian Islands. Bull. *U.S. Fish Comm.* (1903)23, pt. 1: xxvii+ 1-574.

1927. New genera and species of North American fishes. *Proc. Calif. Acad. Sci.*, (4)16(15): 501-507.

JORDAN, D.S. & C.H. GILBERT:
1883. Synopsis of the fishes of North America. *Bull. U.S. Natl. Mus.*, 16(1882): lvi+1018.

JORDAN, D.S. & J. SWAIN:
1885. A review of the American species of *Epinephelus* and related genera. *Proc. U.S. Natl. Mus.*, 7(1884): 358-410.

KLUNZINGER, C.B.:
1884. *Die Fische des Rothen Meeres.* I. Theil, Acanthopteri veri Owen. ix+133 pp. E. Schweizerbart'sche, Stuttgart.

LACEPÈDE, B.:
1800. *Histoire naturelle des Poissons.* Vol. 2: lxiv+ 632 pp., Paris.

1802. *Histoire naturelle des Poissons.* Vol. 4: xliv+ 728 pp., Paris.

LEIS, J.M.:
1986. Larval development in four species of Indo-Pacific coral trout *Plectropomus* (Pisces: Serranidae: Epinephelinae) with an analysis of the relationships of the genus. *Bull. mar. Sci.*, **38** (3): 525-552.

LICHTENSTEIN, M.H.G.:
1822. Die Werke von Marcgrave und Piso über die Naturgeschichte Brasiliens, erlautert aus den wieder aufgefundenen original Abbildungen. IV. *Fische. Abhandl. K. Akad. Wiss.* Berlin (1820-1821), pp. 267-288.

LINNAEUS, C.:
1758. *Systema Naturae sive Regna tria Naturae, Systematice Proposita per Classes, Ordines, Genera et Species*...etc. 10th Edition, vol. 1, Regnum Animale. ii+824 pp. Holmiae.

LEVITON, A.E., R.H. GIBBS, Jr., E. HEAL & C.E. DAWSON:
1985. Standards in herpetology and ichthyology: Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia* 1985(3): 802-832.

LÖFLING, P.:
1758. *Iter Hispanicum, eller resa til Spanska landerna uti Europa och America,...utgifven af C. Linnaeus*. Stockholm. xviii+316 pp.

LOWE, R.T.:
1834. Characters of a new genus *Leirus,* and of several new species of fishes from Madeira (*Serranus marginatus, Beryx splendens, Rhombus maderensis, Crenilabrus trutta, Centrina nigra*, etc.) *Proc. Zool. Soc. London* (1883)1: 142-144.

1836. Piscium Maderensium species quaedam novae, vel minus rite cognitae breviter descriptae (*Serranus fimbriatus, S. fuscus, Priacanthus fulgens, Polymixia nobilus, Leirus bennetti*, etc.) *Trans. Cambridge Phil. Soc.* (1836)6: 195-202.

LUBBOCK, R.:
1980. The shore fishes of Ascension Island. *J. Fish Biol.*, 17: 283-303.

MANZONI, P.:
1987. *Enciclopedia illustrata delle specie ittiche marine*. Instituto Geografico de Agostini Camera di Commercio di Como, 127 pp.

MAURIN, C.:
1968. Écologie ichthyologique des fonds chalutables Atlantiques (de la Baie Ibér-Marocaine a la Mauritanie) et de la Méditerranée occidentale. *Rev. Trav. Inst. Pêches marit.*, **32** (1): 1-147.

MONOD, T.:
1927. Contribution à la faune du Cameroun. Pisces I: 643-742, 35 figs. *Faune des Colonies françaises*, 1.

MÜLLER, J. & F.H. TROSCHEL.:
1848. The vertebrate animals. *In* Schomburgk, Robert H., The history of Barbados ... London, Longman, Brown, Green and Longmans, xx+772 pp., 7 pls.

OSBECK, P.:
1765. Reise nach Ostinidien und China, etc. German translation by J.G. Georgius. J.C. Koppe, Rostock, 552 pp., 13 pls.

OSÓRIO, B.:
1894. Estudos ichthyologicos àcerca da fauna dos domínios Portuguezes da África. 3. nota. - Peixes marítimos das ilhas de S. Thomé, do Príncipe e ilheo das Rolas. *Jorn. Sci. Acad.*

Lisboa, 2a Ser. 3: 128-140.

1895. Estudos ichthyológicos àcerca da fauna dos domínios portuguezes da África. 3a nota.--Peixes marítimos da ilhas de S. Thomé, do Príncipe e ilheo das Rolas. *Jorn. Sci. Math. Phys. Nat.*, Lisboa, ser. 2, vol. 3: 173-182.

1898. Da distribuição geográphica dos peixes e crustáceos colhidos nas possessões portuguezas d'África occidental e existentes no Museu Nacional de Lisboa. *Jorn. Sci. Math. Phys. Nat.*, Lisboa, ser. 2, vol. 5: 185-202.

PELLEGRIN, J.:

1914. Mission Gruvel sur la côte occidentale d'Afrique (1905-12). Poissons. *Annls. Inst. océanogr. Monaco*, 6: 1-99, 2 pls., 15 figs.

PETERS, W.C.H.:

1876. Uebersicht der von Hrn. Prof. Dr. K. Mobius in Mauritius und bei den Seychelles gesammelten Fische. *Monatsber. Akad. Wiss. Berlin*: 435-449.

1877. Über die von Dr. Reinhold Bucholz in Westafrika gesammelten Fische. *Mber. dt. Akad. Wiss., Berl.*, 1876[1877]: 244-252, 1 pl.

POEY, F.:

1851-1854. *Memorias sobre la historia natural de la Isla de Cuba ... Havana*, vol. 1, 463 pp., 34 pls.

1858-1861. *Memorias sobre la historia natural de la Isla de Cuba ... Havana*, vol.2, 442 pp., 19 pls.

1868. Synopsis piscium cubensium. Catalogo Razonade de los peces de la isla de Cuba. *Repertor. Fisico-natural de la Isla de Cuba* v. 2: 279-484.

1874. Genres des poissons de la fauna de cuba, appartenant a la famille Percidae, avec une note d'introduction par J. Carson Brevoort. *Ann. Lyc. Nat. Hist. New York* 10: 27-79.

POLL, M.:

1949. Résultats scientifiques des croisières du Navire-école Belge 'Mercator' IV. Poissons des XIe, XIVe et XVIIe croisières. *Mém. Inst. r. Sci. nat. Belg.* (2)33: 173-269, 27 figs.

1954. Poissons IV. Téléostéens Acanthoptérygiens (Première Partie). Rés. Sci. Expéd. océanogr. belg. Eaux côt. afr. Atlan. Sud. (1948-49). *Inst. R. Sci. Nat. Belge*, **4** (3A):1-390, 107 figs., 9 pls.

RANDALL, J.E.:

1967. Food habits of reef fishes of the West Indies. *Stud. Trop. Oceanogr.* (Miami) 5: 665--847.

RANDALL, J.E. & A. BEN-TUVIA:

1983. A review of the groupers (Pisces: Serranidae: Epinephelinae) of the Red Sea, with description of a new species of *Cephalopholis*. *Bull. mar. Sci.*, **33** (2): 373-426.

RANDALL, J.E. & P.C. HEEMSTRA:
in press. Revision of Indo-Pacific Groupers (Perciformes; Serranidae; Epinephelinae), With Descriptions of Five New Species. *Indo-Pacific Fishes.*

RANZANI, C.:
1840. De novis speciebus piscium; dissertationes quatuor. *Nov. Comment. Acad. Sci. Inst. Bonon.*, 4: 65-83, pl. 8-13.

REDDY, N.A.V.P.:
1984. A new record of *Epinephelus guaza* (Linnaeus, 1758) (Serranidae: Pisces) from Indian waters. *Jour. Bombay Nat. Hist. Soc.* (1983), **80** (3): 650-651.

RINGUELET, R.A. & R.H. ARAMBURU:
1960. Pesces marinos de la Republica Argentina. *Agro Publicacion Tecnica,* Año 2, No. 5: 1-141.

RIVAS, L.R.:
1964. Western Atlantic Serranid Fishes (Groupers) of the genus *Epinephelus. Quart. J. Fla. Acad. Sci.* **27** (1): 17-30.

ROUX, C. & J. COLLIGNON:
1957. Poissons marins, 2e partie, Clef pour la détermination des principaux poissons marins fréquentant les côtes de l'A.E.F. *In*: J. Collignon, M. Rossignol et C. Roux, Mollusques, Crustacés, Poissons marins des côtes d'A.E.F. en collection au Centre d' Océanographie de l'Institut d'Études Centrafricaines de Pointe-Noire, Paris, ORSTOM: 255-369, 124 fig.

SALDANHA, L.:
1979. *Fauna Submarina Atlântica.* 222 pp, 57 pls. Publicações Europa-América.

SASSI, A.:
1846. *Pesci. Descriz. Genova e Genovesato* 1. Genova: 111-147.

SCHNEIDER, W.:
1990. *FAO Species Identification Sheets for Fishery Purposes. Field Guide to the Commercial Marine Resources of the Gulf of Guinea.* FAO, Rome. 268 pp.

SEBA, A.:
1734-1765. Locupletissimi rerum naturalium thesauri accurata descriptio, et iconibus artificiossimis expressio, per universam physices historiam ... Amsterdam, J. Wetstenium and Co., 4 vols., 450 pls.

SÉRET, B.:
1981. *Poissons de Mer de l'ouest Africain Tropical.* ORSTOM, Paris. 416 pp.

SMITH, C.L.:
1971. A revision of the American groupers: *Epinephelus* and allied genera. *Bull. Amer. Mus.*

Nat. Hist., 146: 1-241.

1978. Serranidae. In W. Fischer, (ed.) *FAO species identification sheets for fishery purposes: Western Central Atlantic.* UN/FAO, Rome.

1981. Serranidae. In W. Fischer, G. Bianchi & W.B. Scott (eds), *FAO species identification sheets for fishery purposes: Eastern Central Atlantic* Vol. 4. UN/FAO & Dept. of Fish. and Oceans, Ottawa, Canada.

SMITH, J.L.B.:

1949. *The Sea Fishes of Southern Africa.* Central News Agency, Cape Town, South Africa, 550 pp.

SMITH-VANIZ, W.F., G.D. JOHNSON & J.E. RANDALL:

1988. Redescription of *Gracila albomarginata* (Fowler and Bean) and *Cephalopholis polleni* (Bleeker) with comments on the generic limits of selected Indo-Pacific Groupers (Pisces: Serranidae: Epinephelinae). *Proc. Acad. nat. Sci. Phila.*, **140** (2): 1-23.

STEINDACHNER, F.:

1867. Ichthyologische Notizen. IV. *Sber. Akad. Wiss. Wien*, 55: 517-534, 6 pls.

1870. Zur Fischfauna des Senegal. *Sber. Akad. Wiss. Wien*, **61** (1): 533-583, 8 pls.

1877. Ichthyologische Beitrage. V. *Sber. Akad. Wiss. Wien*, **74** (1): 49-240, 15 pls.

1878. Ichthyologische Beitrage. VI. *Sber. Akad. Wiss. Wien*, **77** (1): 379-392, 2 pls.

1879. Ichthyologische Beitrage. VIII. *Sber. Akad. Wiss. Wien*, **80** (1): 119-191, 3 pls.

1882. Beiträge zur Kenntniss der Fische Afrika's I. Beiträge zur Kenntniss der Meeresfische Senegambiens. *Denkschr. Akad. Wiss. Wien*, 41: 19-51.

1883. Ichthyologische Beitrage. XII. *Sber. Akad. Wiss. Wien*, 1882[1883], **86** (1): 61-82, 5 pls.

1891. Ichthyologische Beitrage. XV. *Sber. Akad. Wiss. Wien*, 100: 343-374, 3 pls.

SWAINSON, W.:

1839. *On the natural history and classification of fishes, amphibians and reptiles or monocardian animals.* London, Longman, Orme, Brown, Green and Longmans, and John Taylor, vol. 2, vi+452 pp,. 135 figs.

TEMMINCK C.J. & H. SCHLEGEL:

1842-1850. Pisces in P.F. von Siebold's *Fauna Japonica*. 323 pp. Lugduni Batavorum, Batavia.

TORTONESE, E.:

1956. Sull'identità della *Cerna sicana* Doderlein. *Boll. Zool.*, **28** (1): 51-55.

1970. A note on the Generic name *Cerna* Bp. (Pisces, Serranidae). *Atti Soc. ital. Sci. nat.*, **110** (2): 198-200.

1973. Serranidae. (pp. 355-362) in *Check-list of the Fishes of the North-eastern Atlantic and of the Mediterranean.* J.- C. Hureau & Th. Monod, (eds). Vol. I. UNESCO, Paris. xxii+683 pp.

1975. Osteichthyes, (Pesci ossei). Parte Seconda. Bologna, Ed. Calderini. *Fauna Italia*, (11): i-xviii + 1-636.

1986. Serranidae. (pp. 780-792) in *Fishes of the North-eastern Atlantic and the Mediterranean.* P.J.P. Whitehead, M.-L. Bauchot, J.-C. Hureau, J. Nielsen & E. Tortonese (eds). Vol. II: 515-1007. UNESCO, Paris.

TROSCHEL, F.H.:

1866. Ein Beitrag zur Ichthyologischen Fauna der Inseln des Grünen Vorgebirges. *Arch. Naturgesch., XXXII. Jahr.*, 1: 190-239, pl. 5.

VAILLANT, L.L. & F. BOCOURT:

1874-1916. Etudes sur les poissons. *Mission scientifique au Mexique et dans l'Amérique Centrale*. Pairs, pt. 4, 265 pp., 20 pls. Publication dates as confirmed by M.L. Bauchot: pp. 1-40 (28 Nov. 1874); pp. 41-120 (31 Oct. 1877); pp. 121-200 (1883, *fide* Dean's *Bibliography of Fishes*); pp. 201-265 (26 Jan. 1916).

VALENCIENNES, A.:

1828. See Cuvier & Valenciennes.

1830. See Cuvier & Valenciennes.

1843. Ichthyologie des Iles Canaries ... (pp 9-96) *In* P.B. Webb & S. Berthelot (eds) *Histoire naturelle des Iles Canaries.* Paris, 2(2): 1-109, 26 pls. [Text published in 3 parts, 1842, 1843 & 1844; plates published in several parts from 1837 to 1844.]

1855. Ichthyologie. *In* Petit-Thouars, A. Du, Voyage autour du monde sur le frigate la "Vénus" pendant les années 1836-1839. Paris, Gide et J. Baudry, 355 pp., 79 pls.

WASCHKEWITZ, R. & P. WIRTZ:

1990. Annual migration and return to the same site by an individual grouper, *Epinephelus alexandrinus* (Pisces, Serranidae). *J. Fish Biol.* 36: 781-782.

WHEELER, A.:

1969. *The Fishes of the British Isles and North-West Europe.* Macmillan, London, 613 pp.

1980. The sources of Linnaeus's knowledge of fishes. *Svenska Linnésallskapets Arsskrift* (1978): 156-211.

WALBAUM, J. J.:

1792. Petri Artedi sueci genera Piscium in quibus systema totum ichthyologiae proponitur cum classibus, ordinibus, generum characteribus, specierum differentiis, observationibus plurimis. Ichthyologiae Pars III, Grypeswaldiae, [ed. II], 723 pp., 3 pls.

WHITLEY, G.P.:

1947. New sharks and fishes from Western Australia. Pt. 3. *Aust. Zool.* 11(2): 129-150.

Received 10th August 1991