

In the literature on Mediterranean and eastern Atlantic groupers, two similar species (the dusky grouper, *E. marginatus*, and the Haifa grouper, *E. haifensis*) have been confused under the names *Epinephelus* (or *Serranus*) *guaza* or *gigas*. *E. marginatus* differs in having 8 anal-fin rays (9 in *E. haifensis*), more elongate body (depth 2.6 to 3.1 versus 2.4 to 2.8 times in standard length), pelvic fins distinctly shorter than pectoral fins and not reaching the anus (pelvic fins subequal to pectoral fins and reaching to or beyond anus in *E. haifensis* less than 30 cm standard length), 17 to 19 pectoral-fin rays (18 to 21 in *E. haifensis*), and the head and body usually showing irregular pale blotches (no pale blotches in *E. haifensis*).

Of the eastern Atlantic groupers, *E. marginatus* is most similar to *E. goreensis* and *E. haifensis*. See the Key to Eastern Atlantic Groupers (above) for differences that will distinguish these species. In the western Indian Ocean, *E. marginatus* is most likely to be confused with *E. chabaudi*, which has 9 anal-fin rays and does not show the irregular pale blotches that are usually visible on *E. marginatus*; also, *E. chabaudi* is usually pinkish grey ventrally (rather than yellowish, the usual colour for *E. marginatus*).

Epinephelus melanostigma Schultz, 1953

Fig. 355; Pl. XVIIIIC

SERRAN Epin 39

Epinephelus melanostigma Schultz, 1953:331, 348, fig. 54 (type locality: Swains Island, Samoa Islands).

Synonyms: None.

FAO Names: En - One-blotch grouper; Fr - Mérou dossard; Sp - Mero espaldaron.

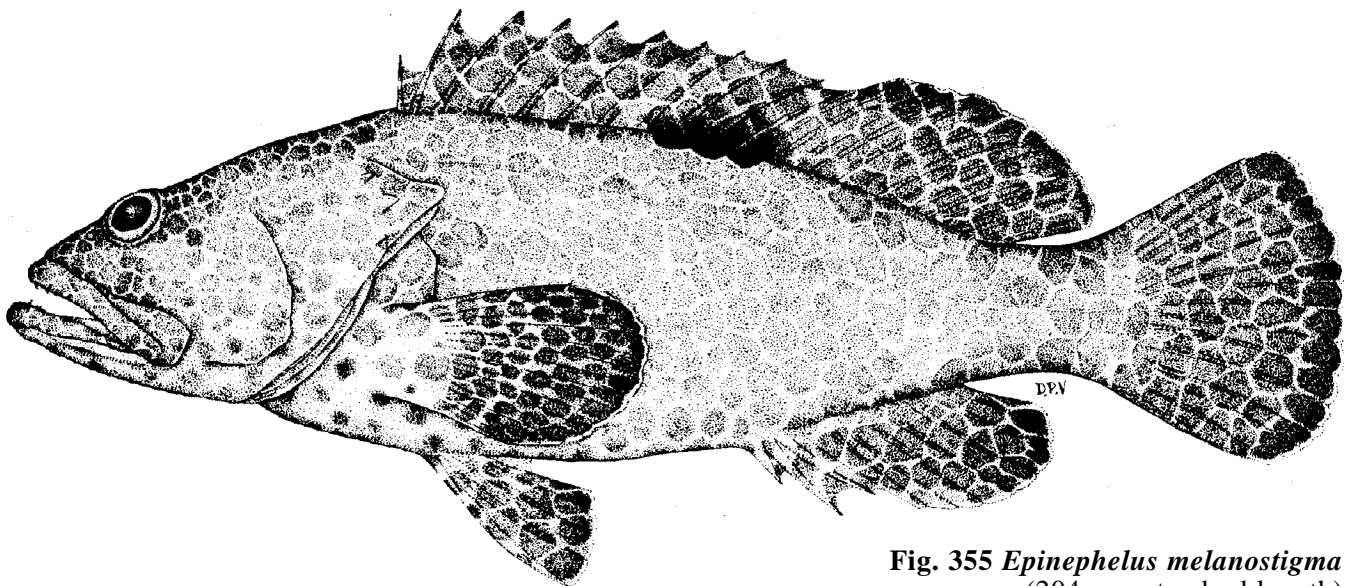


Fig. 355 *Epinephelus melanostigma*
(204 mm standard length)

Diagnostic Features: Body elongate, the depth contained 3.0 to 3.4 times in standard length (for fish 10 to 27 cm standard length). Head length contained 2.2 to 2.4 times in standard length; interorbital area flat or slightly concave; preopercle rounded, the serrae mostly covered by skin; upper edge of operculum straight or slightly convex; nostrils subequal; maxilla reaches past vertical at rear edge of eye; midlateral part of lower jaw with 3 to 5 rows of teeth, the inner teeth about twice as long as the outer ones. Gill rakers 7 to 10 on upper limb, 16 to 19 on lower limb. Dorsal fin with XI spines and 14 to 16 rays, the third to tenth spines subequal, the fourth spine 2.8 to 3.8 times in head length, the interspinous membranes incised; anal fin with III spines and 8 rays, the second spine less than or subequal to third spine, length of second spine contained 2.6 to 3.6 times in head length and usually less than depth of caudal peduncle; pectoral-fin rays 17 to 19; pectoral-fin length contained 1.6 to 2.2 times in head length; pelvic-fin length 2.0 to 2.6 times in head length; caudal-peduncle depth contained 3.2 to 3.8 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with numerous auxiliary scales; lateral-line scales 56 to 68; lateral-scale series 83 to 99. **Colour:** Head, body, and fins covered with close-set dark brown spots, the pale interspaces forming a network pattern; spots on ventral parts of head and body are reddish brown and not so closely set; spots on head progressively smaller anteriorly; a prominent black blotch on body at base of last 4 dorsal-fin spines and extending onto fin at least halfway to margin; no other black blotches at base of dorsal fin or on caudal peduncle; median and pectoral fins with narrow white edge.

Geographical Distribution:

Indo-West Pacific from South Africa (Natal) to the central Pacific, including, Mozambique, Mauritius, Indonesia, Philippines, Hong Kong, Taiwan, Okinawa, Papua New Guinea (Bougainville), Solomon Islands, Palau, Caroline Islands, Gilbert Islands, Samoa, Phoenix Islands, Baker, Howland, Cook Islands, and Line Islands (Fig. 356). The apparent absence of *E. melanostigma* at intermediate localities may be a result of confusion with similar species (e.g., *E. tauvina*).

Paxton et al. (1989) recorded the species from Australia, but we have not seen any material from there. Not known from the Red Sea or Persian Gulf.

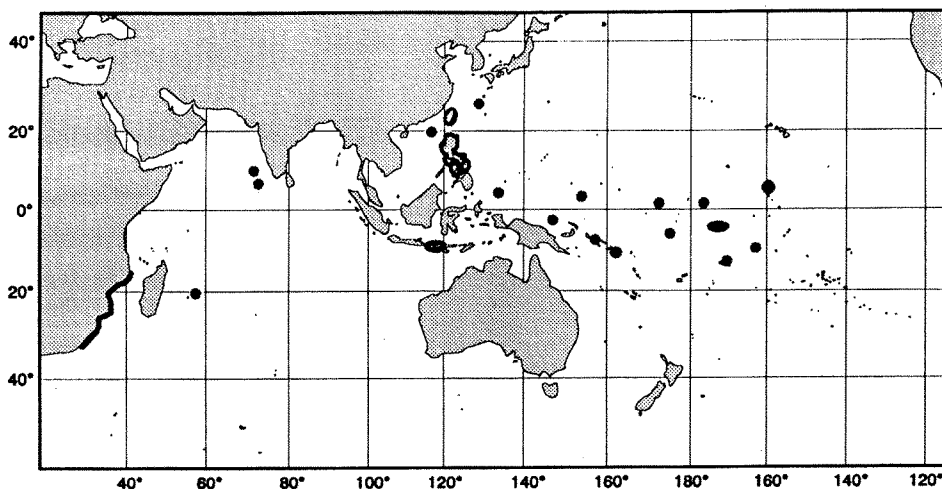


Fig. 356

Habitat and Biology: *E. melanostigma* is a coral-reef species that is known only from depths less than 7 m. However, the specimen illustrated by Gloerfelt-Tarp and Kailola (1984) was taken in a trawl, and it was presumably caught somewhat deeper than 7 m.

Size: Maximum size known is 33 cm total length.

Interest to Fisheries: Because of its small size and apparent rarity, *E. melanostigma* is of little or no commercial importance.

Local Names: JAPAN: Sumitsukihata.

Literature: Randall and Heemstra (1991).

Remarks: *E. melanostigma* is one of the "reticulated groupers", which comprise 9 shallow-water coral-reef species that have a rounded caudal fin and close-set dark brown spots, with the pale interspaces forming a network on the body. These species have been much confused in the literature, and many museum specimens have been misidentified; the other reticulated groupers differ from *E. melanostigma* as follows:

E. bilobatus has 3 large bilobed dark blotches or close-set pairs of dark brown spots on body and base of dorsal fin, dorsal-fin rays 17 or 18, lateral-line scales 48 to 52, and lower gill rakers 14 to 16.

E. faveatus has the lateral-body scales smooth (except for area covered by pectoral fins), dorsal-fin rays 16 to 18, length of second anal-fin spine contained 3.6 to 4.3 times in head length, and sides of lower jaw with 2 rows of teeth.

E. hexagonatus has conspicuous white dots on the body between the dark spots, fifth to ninth dorsal-fin spines subequal (length contained 2.5 to 2.8 times in head length), head length contained 2.5 to 2.6 times in standard length, length of second anal-fin spine contained 2.1 to 2.5 times in head length and distinctly longer than third spine or depth of caudal peduncle.

E. macrospilos has the lateral-body scales mostly smooth, lateral-line scales 48 to 52, and no large black blotch at middle of dorsal-fin base.

E. maculatus has the dorsal-fin membranes not incised between the spines; third or fourth dorsal-fin spine longest, its length contained 2.1 to 2.6 times in head length and usually longer than dorsal-fin rays.

E. merra has pectoral fins covered with small black spots largely confined to the rays, third to last dorsal-fin spines subequal (the longest contained 2.6 to 2.9 times in head length), and second anal-fin spine subequal to third and much longer than depth of caudal peduncle.

E. quoyanus has the pectoral fins with indistinct dark brown spots, the base with a large semicircular dark brown spot edged posteriorly with white, 2 dark brown bands or blotches linked by bands on sides of chest, dorsal-fin rays 16 to 18, and longest dorsal-fin spine contained 2.4 to 3.0 times in head length.

E. spilotoceps has 3 black saddle blotches at base of dorsal fin and tiny (nostril size) black spots on the snout; caudal-peduncle depth contained 3.5 to 4.1 times in head length and usually less than length of second anal-fin spine, shallow notch in rear edge of preopercle just above the corner, and lateral-line scales 59 to 69.

E. tauvina is similar to *E. melanostigma* in having a black blotch at middle of dorsal-fin base, but the dark spots on the head and body are poorly defined and well separated (distance between spots about equal to their diameter); *E. tauvina* also has 63 to 74 lateral-line scales and 95 to 112 lateral-scale series.

Epinephelus merra Bloch, 1793

Fig. 357; Pl. XVIII D, E

SERRAN Epin 40

Epinephelus merra Bloch, 1793:17, pl. 329 (type locality: Japanese Sea).

Synonyms: None.

FAO Names: En - Honeycomb grouper; Fr - Mérou gâteau de cire; Sp - Mero panal.

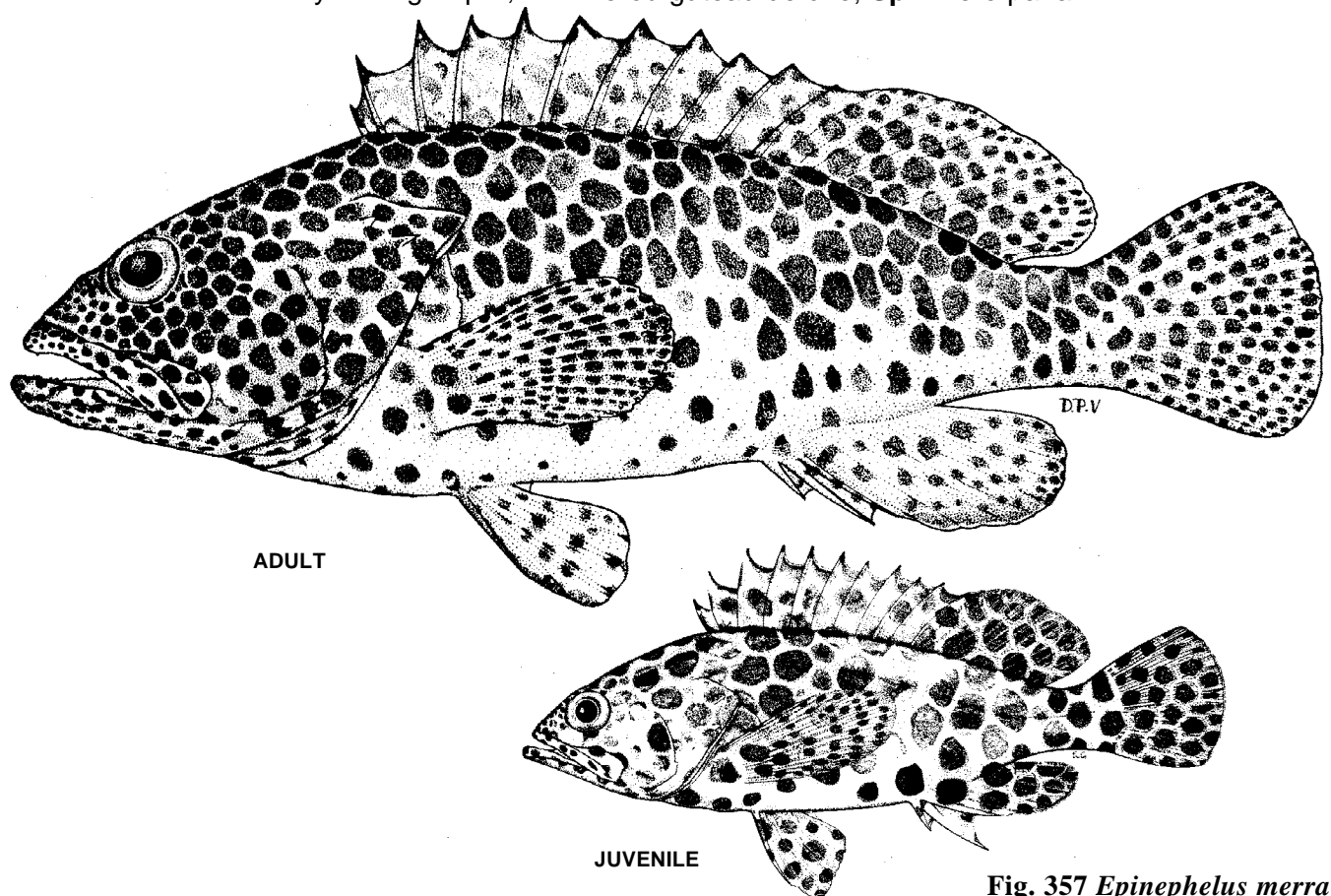


Fig. 357 *Epinephelus merra*

(adult 170 mm standard length, juvenile 63 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.3 times in standard length (for fish 10 to 22 cm standard length). Head length contained 2.3 to 2.6 times in standard length; interorbital area flat, the dorsal head profile convex: preopercle rounded or subangular, the serrae at angle enlarged; upper edge of operculum almost straight; nostrils subequal or rear nostrils larger; maxilla reaches past vertical at rear edge of eye; midlateral part of lower jaw with 2 to 4 rows of teeth, the inner teeth about twice the length of outer ones. Gill rakers 6 to 9 on upper limb, 14 to 17 on lower limb. Dorsal fin with XI spines and 15 to 17 rays, the third to last spines subequal, the longest contained 2.4 to 3.2 times in head length; anal fin with III spines and 8 rays, the second spine subequal to the third, its length contained 2.1 to 3.0 times in head length and much longer than depth of peduncle; pectoral-fin rays 16 to 18; pectoral-fin length contained 1.5 to 1.8 times in head length; pelvic-fin length contained 1.8 to 2.2 times in head length; caudal-peduncle depth contained 3.2 to 4.1 times in head length; caudal fin rounded. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 48 to 54; lateral-scale series 98 to 114. Pyloric caeca 8. **Colour:** Head, body, and fins pale, covered with close-set, dark brown or reddish brown spots, the interspaces forming an irregular pale reticulum; spots on ventral part of body paler, more widely spaced and diffuse in outline; some midlateral spots often joined to form horizontal bands; 5 irregular dark bars can be displayed by differential darkening of some body spots, but black dorsal blotches never present; dark spots on median fins become smaller towards the fin margin; pectoral fins covered with distinct small black spots, largely confined to the rays (the best diagnostic colour character for *E. merra*); tips of interspinous dorsal-fin membranes white or pale yellow, with a small submarginal black spot.

Geographical Distribution: *E. merra*

is widely distributed in the Indo-Pacific region from South Africa to French Polynesia in the central Pacific (Fig. 358). Except in the western Indian Ocean, where it is known (but not common) along the African coast from Kenya to South Africa (juveniles occur south to Port Alfred), *E. merra* seems to be an insular species. It is not known from the Red Sea, Persian Gulf, or Asian mainland. It occurs at most (probably all) of the tropical islands in the Indian Ocean. In the Pacific, it ranges from Japan to Australia (from Western Australia to New

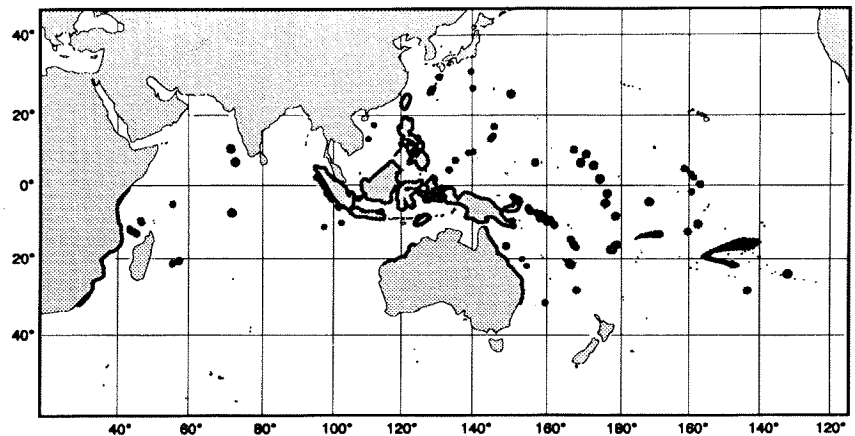


Fig. 358

South Wales) and Lord Howe Island and eastward to the Tuamotu Archipelago. It occurs at most Pacific islands, both on and off the Pacific Plate, but it is not found at the Hawaiian Islands (although its introduction there has been attempted), Marquesas, Pitcairn Group, or at Easter Island.

Habitat and Biology: *E. merra* is a shallow-water coral reef species and is typically found around patch reefs in lagoons and bays. It is usually seen in depths less than 20 m, but is occasionally found as deep as 50 m. Randall and Brock (1960) found that 68% of the fish with food in their stomach had eaten crustaceans (primarily crabs) and 29% contained fishes. But during periods when postlarval fishes were settling out on the reef, *E. merra* fed mainly on these small fishes. Harmelin-Vivien and Bouchon (1976) determined that juveniles (at Madagascar) fed more on crustaceans (brachyurans, 63% by weight) than on fishes (35%), but in adults these proportions were reversed (22% brachyurans and 68% fishes and 8% cephalopods). This increase of piscivory with age is common in groupers. These authors also found that brachyurans were the most common prey at night, and fishes were taken more often during the day. At Okinawa in Japan, Sano et al. (1984) examined the prey of 12 *E. merra* that contained food; they found a preference for crabs (50%) and blennioid fishes (25%).

Randall (1955) provided evidence that this species is a protogynous hermaphrodite: of 1 067 fish examined, all of the small adults (less than 16 cm standard length) were females; the average size of adult males was 20 cm, and the largest was 25 cm standard length; the mean for adult females was 16 cm, and the largest was 21 cm standard length. The gonads of some fish contained both testicular and ovarian tissue. At the Society Islands, *E. merra* spawn between January and April for 3 or 4 days at the time of the full moon. Like most groupers, this species spends its entire life in one small area. Of 1 000 fish tagged at Moorea, 45 were recovered over a period of two years; except for some fish that were displaced from the capture site, none showed any significant movement from their home reef. A 10 cm marked specimen released on 15 January 1968 at Oahu, Hawaiian Islands, was 24 cm total length when it was recaptured on 14 July 1971.

Size: *E. merra* attains a maximum of 26 cm standard length (about 32 cm total length).

Interest to Fisheries: This species is of importance in artisanal fisheries because of its abundance in shallow water. Caught with handlines, fish traps, and spear.

Local Names: AUSTRALIA: Honeycomb cod, Wire-netting cod; COMORO ISLANDS: Ntsehele; JAPAN: Tammonhata; KENYA: Tewa ndudu, Kivongui (Swahili); MAURITIUS: Vieille Voleuse; NEW CALEDONIA: Loche rayon de miel, Macabit; REUNION: Macabit; SOUTH AFRICA: Honeycomb rockcod; TAHITI: Tarao maraurau, Veve.

Literature: Myers (1989); Randall and Heemstra (1991).

Remarks: *E. merra* is one of the "reticulated groupers," which comprise 9 shallow-water coral reef species that have a rounded caudal fin and close-set dark brown spots with the pale interspaces forming a network on the body. These species have been much confused in the literature, and many museum specimens have been misidentified. *E. merra* can be distinguished from the other reticulated groupers by its pectoral-fin pattern of conspicuous black dots that are largely confined to the rays of the fin. Other differences between *E. merra* and the reticulated groupers are as follows:

E. bilobatus has 3 bilobed dark blotches or close-set pairs of dark brown spots on body and base of dorsal fin, dark spots on median fins not much smaller distally, and dorsal-fin rays 17 or 18.

E. faveatus has the lateral-body scales smooth (except for area covered by pectoral fins), longest anal-fin spine contained 3.6 to 4.3 times in head length, dark bands on the chest, and 83 to 98 lateral-scale series.

E. hexagonatus has conspicuous white dots on the body between the dark spots, 4 or 5 brownish black blotches on body at base of dorsal fin, a large olive-brown spot or band just behind eye, and lateral-line scales 61 to 70.

E. macropilos has the lateral-body scales mostly smooth and the pectoral fins dusky with narrow white edge.

E. maculatus has the interspinous dorsal-fin membranes not incised, third or fourth dorsal-fin spine longest (its length contained 2.1 to 2.6 times in head length and longer than dorsal-fin rays); and juveniles are yellowish brown with irregular white blotches on the body.

E. melanostigma has a large black blotch at base of last 4 dorsal-fin spines, length of second anal-fin spine not longer than caudal-peduncle depth, and lateral-line scales 56 to 68.

E. quoyanus has the pectoral fins with indistinct dark brown spots and the base with a large semicircular dark brown spot edged posteriorly with white, 2 oblique dark brown bands or blotches linked by bands on sides of chest, dorsal-fin rays 16 to 18, and third to fifth dorsal-fin spines longest (length contained 2.4 to 3.0 times in head length).

E. spilotoceps has dark spots on the snout very small (about the size of the nostrils), 3 black blotches at base of dorsal fin and another on top of caudal peduncle, and lateral-line scales 59 to 69.

Epinephelus miliaris (Valenciennes, 1830)

Fig. 359; Pl. XVIIIIF

SERRAN Epin 42

Serranus miliaris Valenciennes in Cuv. and Val., 1830:520 (type locality: Vanikolo, Santa Cruz Islands [*vide* Bauchot et al., 1984]).

Synonyms: *Serranus Gaimardi* Valenciennes in Cuv. and Val., 1830:520 (type locality: Vanikolo [*vide* Bauchot et al., 1984]). *Serranus diktiophorus* Bleeker, 1856a:38 (type locality: Manado, Sulawesi [Celebes] Indonesia). *Epinephelus diktiophorus*: Bleeker, 1873-76:65, pl. 284, fig. 3. *Epinephelus* sp. Fourmanoir, 1954:214 (Anjouan, Comoro Islands). *Epinephelus fuscus* Fourmanoir, 1961:92 (type locality: Comoro Islands, northwest of Madagascar; no holotype designated); Fourmanoir, 1963:140, fig. (a second "original" description, type locality: west coast of Madagascar; holotype, 45 cm [total length] deposited in the Museum National d'Histoire Naturelle in Paris).

FAO Names: En - Netfin grouper (formerly: Honeyfin grouper); Fr - M erou abeille (formerly: Vieille abeille); Sp - Mero colmenar.

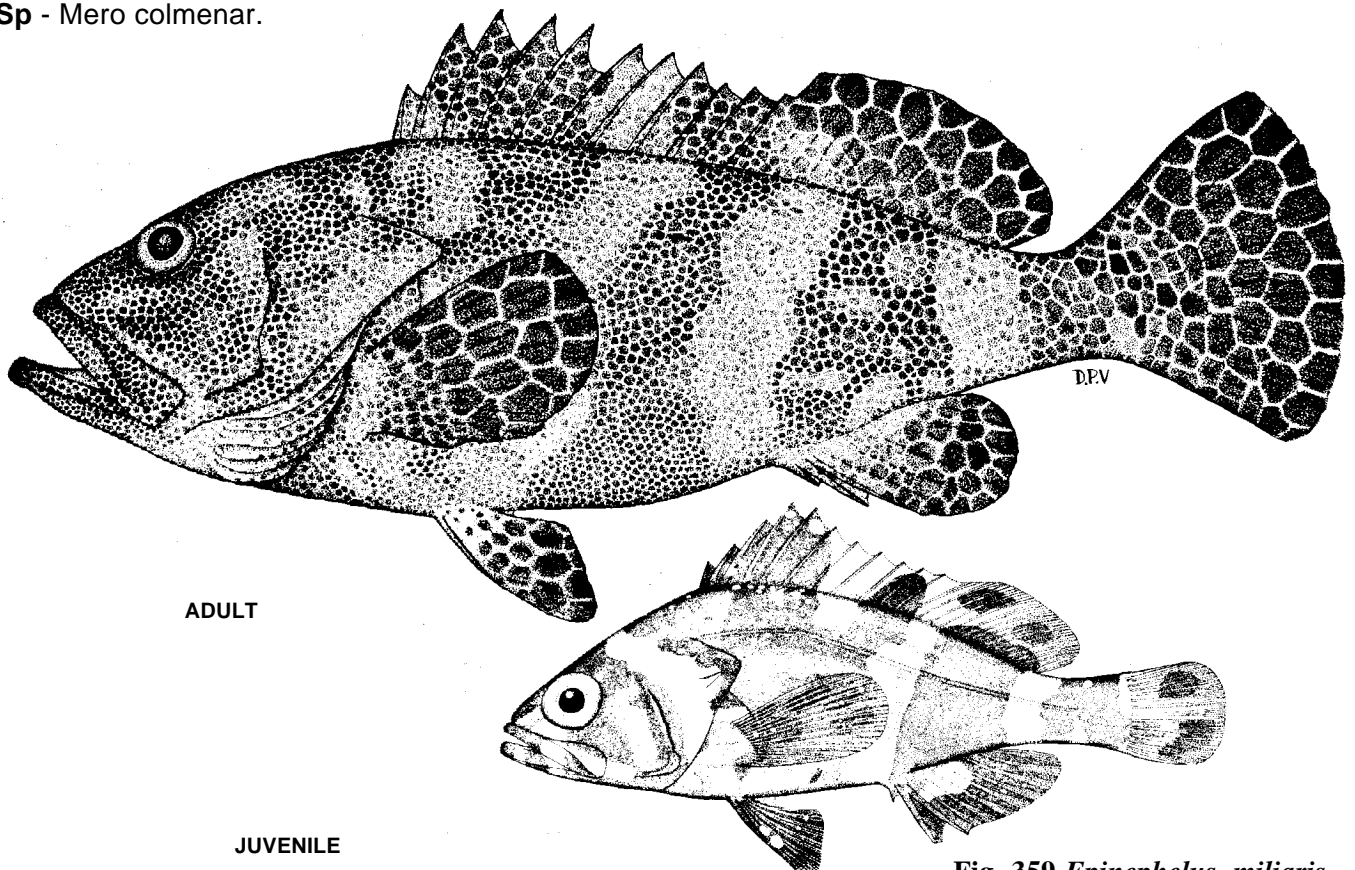


Fig. 359 *Epinephelus miliaris* (adult about 300 mm standard length, juvenile 28 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.2 times in standard length (for fish 15 to 43 cm standard length). Head length contained 2.4 to 2.6 times in standard length; interorbital convex, but dorsal head profile with a slight concavity at eyes; preopercle subangular, with a shallow notch just above the angle and the serrae at the angle enlarged in juveniles; upper edge of operculum straight; diameter of posterior nostrils about twice that of anteriors; maxilla reaches vertical at rear edge of eye or thereabouts; adults larger than 25 cm standard length with a low step on lower edge of maxilla at distal expansion; midlateral part of lower jaw with 2 to 4 rows of teeth. Gill rakers 8 or 9 on upper limb, 14 to 16 on lower limb. Dorsal fin with XI spines and 16 or 17 rays, the third or fourth spine longest, its length contained 2.2 to 2.7 times in head length and distinctly longer than the longest rays, the interspinous membranes distinctly incised; anal fin with III spines and 8 rays, the third spine usually slightly longer than second, length of second spine contained 3.2 to 4.0 times in head length; pectoral-fin rays 17 or 18; pectoral-fin length contained 1.6 to 1.9 times in head length; pelvic fins reach slightly past anus or not so far, their length contained 1.7 to 2.1 times in head length; caudal fin rounded. Lateral-body scales distinctly ctenoid, with a few auxiliary scales; lateral-line scales 48 to 52; lateral-scale series 92 to 108. Pyloric caeca 30. **Colour:** Head and body pale, covered with small, close-set, polygonal, dark brown, reddish brown, or yellowish brown spots, the ground colour forming a pale, irregular, small-mesh network; fins with pattern similar to the body, but the dark spots are darker and distinctly larger than on the body. Some spots on body and dorsal fin are darker than others, forming 4 or 5 broad, oblique, dark bars (1 on nape, 3 extending into dorsal fin and 1 at base of caudal fin).

Geographical Distribution: *E. miliaris* is known from the western Indian Ocean (but not the Red Sea or Persian Gulf) to the Gilbert Islands and Samoa in the central Pacific. It is an insular species that has been reported from Pemba and Zanzibar (off Tanzania), Bassa da India (in Mozambique Channel), Comoros, Aldabra, Madagascar, Mauritius, Seychelles, Chagos, East Burma Sea, Andaman Islands, Indonesia (Sulawesi [Celebes] only), South China Sea, Ryukyu Islands, New Guinea, New Ireland, New Georgia, Solomon Islands, Santa Cruz Islands, Palau, Caroline Islands, and Fiji (Fig. 360).

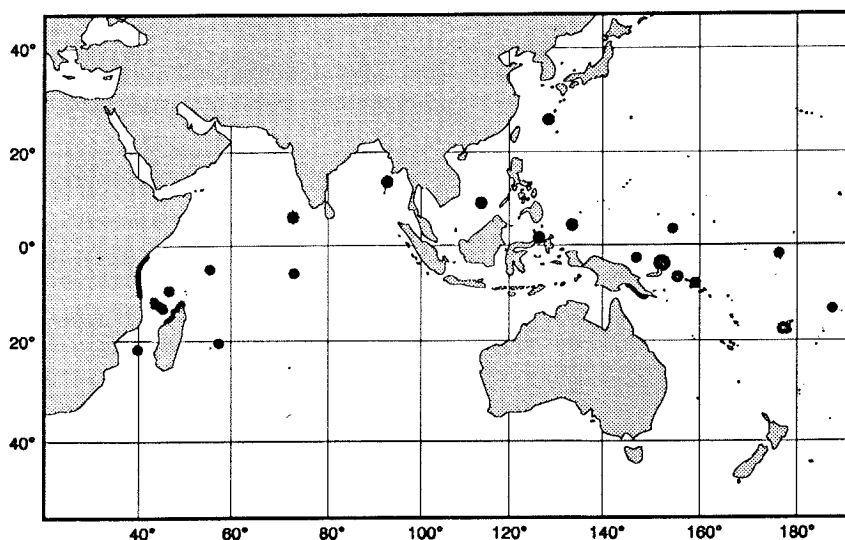


Fig. 360

Habitat and Biology: *E. miliaris* is found in a variety of habitats. Juveniles (8 to 21 cm standard length)

have been taken on mud bottom, seagrass beds, mangrove swamps, and from coral reefs in depths of 1 to 16 m. Adults have been caught on coral reefs in depths of 18 to 180 m. Morgans (1982:24, pl. 6 "*Epinephelus dictiophorus*") reported a mature female of 35 cm standard length; stomach contents of 2 fish that he examined included a juvenile clappid crab, a stomatopod, and a gastropod.

Size: Maximum size known to us is 43 cm standard length (53 cm total length).

Interest to Fisheries: Because of its rarity, *E. miliaris* is of minor importance in local fisheries.

Local Names: JAPAN: Hoosekihata-modoki.

Literature: Randall and Heemstra (1991).

Remarks: *E. miliaris* bears some similarity to *E. maculatus* in colour pattern, long dorsal-fin spines, step on lower edge of maxilla, and meristic characters. But *E. maculatus* has the dark spots on the body notably larger than those on *E. miliaris*, and the dark spots on the soft dorsal, caudal, and anal fins are not larger or darker than those on the body; also, the interspinous dorsal-fin membranes of *E. maculatus* are only slightly incised. *E. fuscoguttatus* and *E. polyphkadion*, which might be mistaken for *E. miliaris*, have only 14 or 15 dorsal-fin rays, and the dark spots on the fins are not larger or darker than those on the body.

Fourmanoir (1961, 1963) gave the dorsal-fin ray count as 14 for his holotype of *E. fuscus*, but our examination and a radiograph of this specimen showed that it has 17 dorsal soft-rays, although the second soft-ray has developed into a spine distally.

Epinephelus morio (Valenciennes 1828)

Fig. 361; Pl. XIXA

SERRAN Epin 18

Serranus Morio Valenciennes in Cuv. and Val., 1828:285 (type locality: New York).

Synonyms: *Serranus erythrogaster* DeKay, 1842:21, pl. 19, fig. 52 (type locality: "New York fish market" [probably caught south of Virginia]). ?*Serranus luridus* Ranzani, 1842:20, pl. 8, fig. 1 (type locality: Brazil). *Serranus remotus* Poey, 1860:140 (type locality: Cuba). *Serranus angustifrons* Steindachner, 1864:230, pl. 7, figs 2,3 (type locality: Cuba).

FAO Names: En - Red grouper; Fr - Mérou rouge; Sp - Mero americano (also: Garaupa).

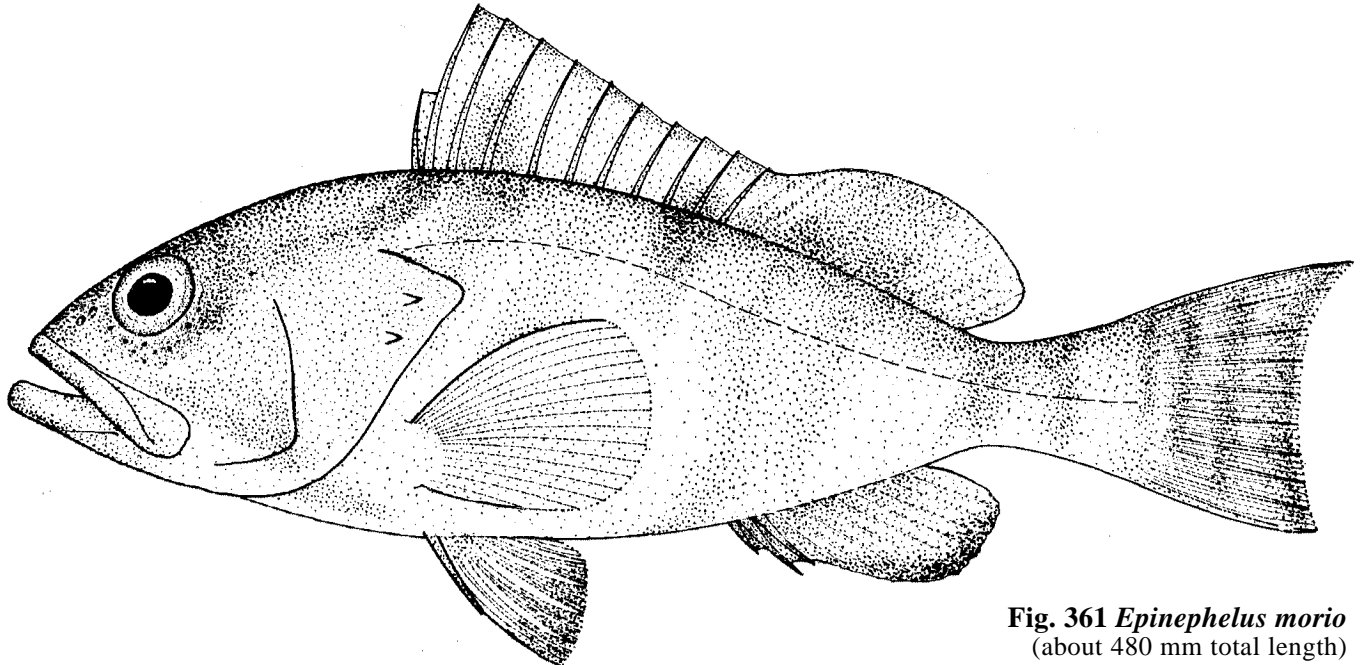


Fig. 361 *Epinephelus morio*
(about 480 mm total length)

Diagnostic Features: Body depth distinctly less than head length, depth contained 2.6 to 3.0 times in standard length (for fish 13 to 26 cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital convex; preopercle subangular, the serrae at angle slightly enlarged; upper edge of operculum straight; nostrils subequal. Gill rakers 8 or 9 on upper limb and 15 or 16 on lower limb, total 23 to 25. Dorsal fin with XI spines and 16 or 17 rays, the membrane not incised between the spines and the second spine longest, giving the fin a triangular sail-like aspect; anal fin with III spines and 8 to 10 rays; pectoral-fin rays 16 to 18; caudal fin convex in fish less than 15 cm standard length, truncate or slightly concave in larger fish. Lateral-body scales ctenoid, with auxiliary scales; lateral-line scales 60 to 68; lateral-scale series 112 to 128. **Colour:** Head and body dark reddish brown, shading to pink or reddish below; soft dorsal, caudal, and anal fins dark distally with a narrow white edge; a few dark dots on snout and/or cheeks; body often with irregular white spots-and/or large pale blotches.

Geographical Distribution: Western Atlantic from North Carolina to southern Brazil, including the Gulf of Mexico, Caribbean, and Bermuda; strays occur north to Massachusetts (Fig. 362).

Habitat and Biology: Moe (1969) has published a comprehensive study of the age, growth, and biology of this species in the Gulf of Mexico. Juveniles of 3 to 20 cm standard length are occasionally found on shallow seagrass beds and inshore reefs. Larger juveniles (20 to 40 cm standard length) are commonly found in crevices and under ledges on rocky reef bottom in depths of 5 to 25 m. At 40 to 50 cm standard length and 4 to 6 years of age, females become mature and begin to migrate to deeper water (50 to 300 m) where they also occur over sandy or mud bottom. Most females transform to males between ages 7 and 14. Maximum age attained is at least 25 years. The von Bertalanffy growth equation $L_t = 672(1 - e^{-0.179(t+0.449)})$ agrees well with empirical data and back calculations of body length. The weight/length function given by Bullock and Smith (1991) and based on Moe's (1969) data is $W = 5.42 \times 10^{-8} L^{2.897}$ where W is weight in grammes and L is standard length in millimetre.

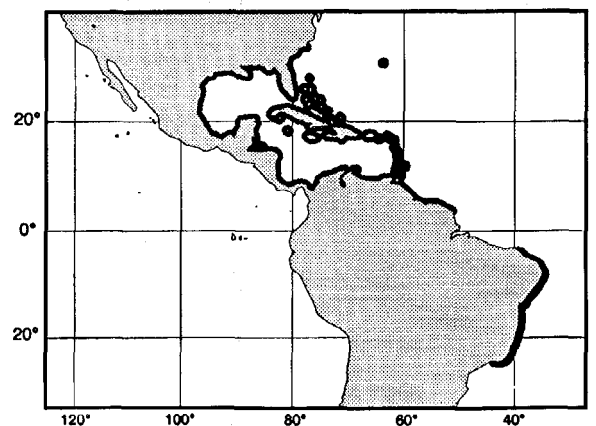


Fig. 362

The eastern Gulf of Mexico population spawns during April and May (Moe, 1969). Fecundity ranged from 312 000 to 5 735 700 eggs per female. Eggs are pelagic, less than 1.0 mm in diameter, contain a single oil droplet, and lack filaments or other appendages. At about 20 mm standard length, the pelagic postlarvae transform to the benthic juvenile stage.

Adults feed on a wide variety of fishes and invertebrates. Red grouper are particularly susceptible to the toxin of red tide (*Plychodiscus brevis*) blooms, and in 1971 the species was exterminated on reefs in 12 to 15 m off Sarasota Florida (Bullock and Smith, 1991).

Size: Attains at least 90 cm total length. As of 1990, the International Game Fish Association lists the all-tackle record for *E. morio* as 14.74 kg for a fish caught off Port Canaveral, Florida.

Interest to Fisheries: *E. morio* is one of the two most important species of the commercial reef fishes caught off the coast of Florida (Bullock and Smith, 1991). On the Campeche Bank off the Yucatan Peninsula, red grouper made up 90% of the total catch of the Cuban otter trawl fisheries. The catch in this area has declined from a peak in 1975 of 54.7 thousand metric tons (TMT) to a low of 2.0 TMT in 1979 (Valdes and Padron, 1980). See Arreguin-Sanchez (1987) for recent information on the Campeche Bank fishery. Red grouper are the most common commercial species in the Isla de Margarita region of Venezuela (Cervigón, 1966). The species is caught with hook-and-line, bottom set longlines, traps, and trawls.

Local Names: BRAZIL: Garoupa-de-SBo Tome; MEXICO: Cherna americana, Cherna de vivero; VENEZUELA: Mero paracamo.

Literature: C.L. Smith (1971); Bauchot et al. (1984); Frias (1982); Gonsales (1982); Figueiredo and Menezes (1980).

Remarks: *Serranus luridus* Ranzani was listed as a synonym of *E. adscensionis* by Smith (1971), but neither the original description (Ranzani, 1842:20, no mention of dark spots) nor the illustration (pl. 8, fig. 1, showing a uniformly coloured fish with an emarginate caudal fin) fit *E. adscensionis*. Except for the slightly low dorsal-fin ray count (15) given by Ranzani, the description and illustration fit *E. morio*. The lack of spots or distinctive dark markings and the combination of truncate caudal fin, long second dorsal-fin spine, and the anal-fin count of 9 rays rule out all other western Atlantic species of *Epinephelus*. The pallid ("*luridus*") condition of Ranzani's fish was probably simply the result of its being a preserved specimen.

Epinephelus morrhua (Valenciennes, 1833)

Fig. 363; Pl. XIXB

SERRAN Epin 44

Serranus morrhua Valenciennes in Cuv. and Val., 1833:434 (type locality: Mauritius).

Synonyms: *Epinephelus cometae* Tanaka, 1927:704, pl. 149, fig. 447 (type locality: Tanabe, Wakayama Prefecture, Japan).

FAO Names: En - Comet grouper; Fr - Mèrou comète; Sp - Mero cometa.

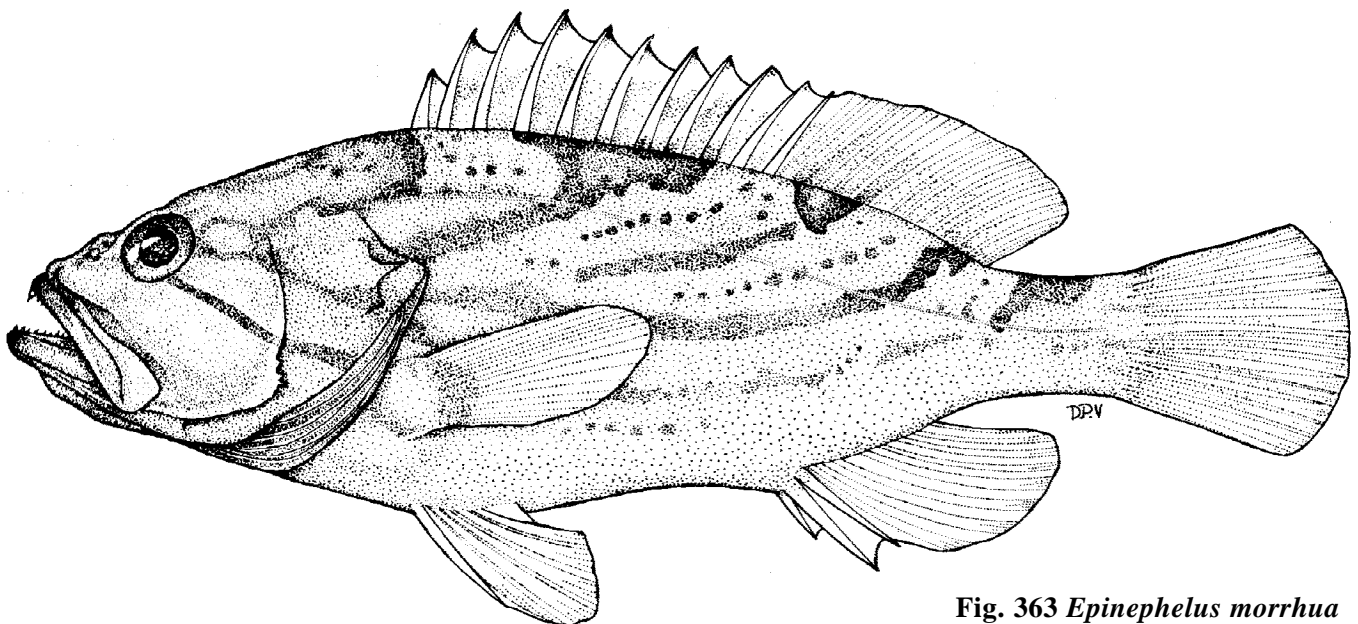


Fig. 363 *Epinephelus morrhua*
(180 mm standard length)

Diagnostic Features: Body depth contained 2.8 to 3.1 times in standard length (for fish 13 to 61. cm standard length). Head length contained 2.3 to 2.5 times in standard length; interorbital area flat to moderately convex, the dorsal head profile slightly convex; preopercle with a shallow indentation just above the enlarged serrae at the corner; upper edge of operculum almost straight; adults with posterior nostril diameter 2 or 3 times larger than anterior nostril; maxilla reaches to or past vertical at rear edge of eye; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 8 to 10 on upper limb, 15 to 18 on lower limb, the longest gill rakers shorter than longest gill filaments. Dorsal fin with XI spines and 14 or 15 rays, the third or fourth spine longest, its length contained 2.6 to 3.3 times in head length and about equal to longest dorsal-fin ray; anal fin with III spines and 7 or 8 rays, the second and third spines subequal; pectoral-fin rays 17 or 18; pectoral-fin length contained 1.8 to 2.2 times in head length; pelvic fins not reaching anus, their length contained 2.0 to 2.7 times in head length; caudal fin convex to moderately rounded. Lateral-body scales distinctly ctenoid, occasionally with a few auxiliary scales; lateral-line scales 55 to 64; lateral-scale series 108 to 125. **Colour:** Head and body buff, with dark brown bands as follows: a bifurcate band begins at rear edge of eye, the upper branch extending to a dark brown saddle blotch on nape just in front of dorsal fin, the lower branch running to lower opercular spine and continuing on body as a midlateral band that bifurcates above the pectoral fin, the upper branch running to a dark blotch at base of third to seventh dorsal-fin rays, the lower branch curving up to base of last 4 dorsal-fin rays; another dark band from upper edge of operculum to base of fifth to ninth dorsal-fin spines; narrow band from lower edge of eye to pectoral-fin base, continued as a broken band along lower part of body and curving up to dorsal part of peduncle; broad band from maxillary groove to rear end of interopercle. Small dark brown spots often present in pale areas between bands and usually arranged in series paralleling the bands; fins generally unmarked; pectoral fins hyaline yellow. In juveniles, the dark bands appear first as series of dark blotches.

Geographical Distribution: *E. morrhua* ranges from the Red Sea and western Indian Ocean to the central Pacific Ocean. We examined specimens or verified records from the Sinai Peninsula, Quseir, Jeddah, Djibouti, Zanzibar, Tanzania, Mozambique, South Africa (Natal), Comoros, Aldabra, Madagascar, Mauritius, Réunion, Chagos, Andaman Sea, Indonesia, Viet Nam, Philippines, Hong Kong, southern Japan, Ogasawara Islands, Mariana Islands, Palau, Guam, Papua New Guinea, Australia (Northern Territory to northern New South Wales), New Ireland, New Caledonia, Rotuma, Fiji, and the Cook Islands (Fig. 364).

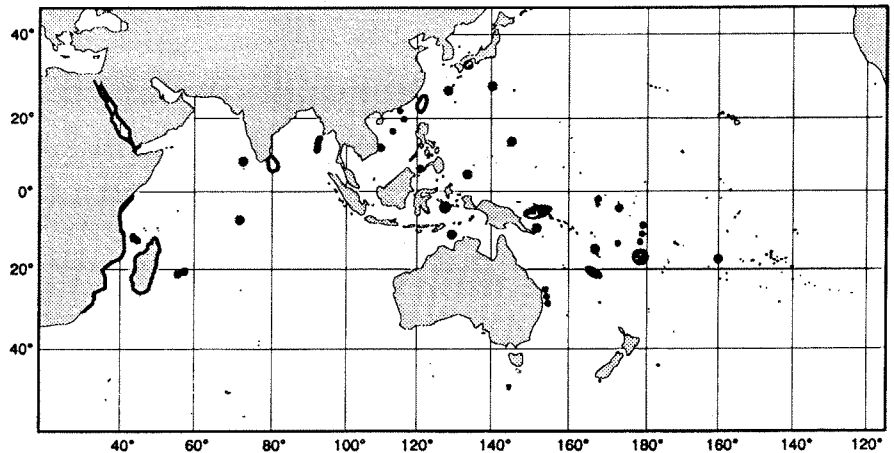


Fig. 364

Habitat and Biology: *E. morrhua* is a deep-water species that is usually found in depths of 80 to 370 m. Morgans (1982) reported a 46 cm standard length, 3.6 kg, mature male (as "*Epinephelus cometae*") from north of Zanzibar Island.

Size: Attains at least 61 cm standard length (73 cm total length) and 5 kg; Fourmanoir and Laboute (1976) gave the maximum total length for *E. morrhua* as 90 cm.

Interest to Fisheries: An excellent food fish, but not common in local markets (probably because of its deep-water habitat). Said to be dangerous (because of ciguatera) at Mauritius (Postel, et al., 1963). Caught with hand-line, longlines, and gill nets.

Local Names: HONG KONG: Yau-paan; JAPAN: Hôkihata; NEW CALEDONIA: Loche à bandes noires; REUNION: Cabot noir; SRI LANKA: Kallu kaleva.

Literature: Randall and Klausewitz (1986); Randall and Heemstra (1991).

Remarks: The Persian Gulf records for *E. morrhua* and *E. radiatus* that were shown on the distribution map of Randall and Klausewitz (1986) should have been placed in the Gulf of Oman instead of in the Persian Gulf.

E. morrhua is one of 4 deep-water groupers that are characterized by having the body depth distinctly less than head length, 2 to 5 distinctly enlarged serrae at corner of preopercle, 2 rows of teeth at sides of lower jaw, dorsal-fin rays 13 to 15, pectoral fins not fleshy, pelvic-fin length contained 2.0 to 2.8 times in head length, lateral-line scales 54 to 66, no auxiliary scales on body, and the colour pattern dominated by curving

dark bands or longitudinal series of dark spots. The other 3 species of this *E. morrhua* species-complex are *E. poecilonotus*, *E. radiatus* and *E. tuamotuensis*. These 4 species have often been confused, and we can find no meristic or morphological characters that will distinguish them.

Juveniles of *E. poecilonotus* have a large dark brown or black saddle blotch on body at base of spinous dorsal fin: this blotch is isolated from other dark bands on the body and extends over front half of spinous dorsal fin; in adults this blotch breaks up into small dark spots, as do the dark bands on the body, and in large adults most of the dark spots and bands have disappeared; juveniles with a dark band from eye to lower opercular spine, continued as a dark curving midlateral stripe or series of spots to a dark saddle blotch on peduncle. On adults, the triangular interspinous dorsal-fin margins are brownish yellow or gold. J.L.B. Smith (1958) confused *E. morrhua* with *E. poecilonotus*; his fig. A is of a 33 cm total length *E. morrhua* from Mozambique and his fig. B is a 55 cm total length *E. poecilonotus* from Kenya.

Juveniles of *E. radiatus* have 5 irregular, solid, dark brown bands (with age only the edges remain dark) that run down and forward from dorsal edge of body, the first from nape to eye, the second from base of middle dorsal-fin spines to upper end of gill opening, the third and fourth dark bands from anterior and posterior dorsal-fin rays, both branching as they pass ventrally, and the last dark band on caudal peduncle; with growth, the dark bands break into spots and disappear ventrally on adults; soft dorsal fin and dorsal part of caudal fin densely spotted.

E. tuamotuensis has the dark bands on head and body forming a coarse reticulum that does not extend to ventral part of body.

Epinephelus multinotatus (Peters, 1876)

Fig. 365; Pl. XIXC,D

SERRAN Epin 45

Serranus multinotatus Peters, 1876:435 (type locality: Mauritius).

Synonyms: *Serranus jayakari* Boulenger, 1889:237 (type locality: Muscat, Oman). *Epinephelus rankini* Whitley, 1945:24 (type locality: Onslow, Western Australia). *Epinephelus* sp. Fourmanoir, 1954:216, pl. 6, fig. 2 (Comoro Islands). *Epinephelus leprosus* Smith, 1955:310, pl. 1A (type locality: Aldabra, Seychelles).

FAO Names: **En** - White-blotched grouper; **Fr** - M  rou plate grise (formerly: Vielle plate grise); **Sp** - Mero de lunares.

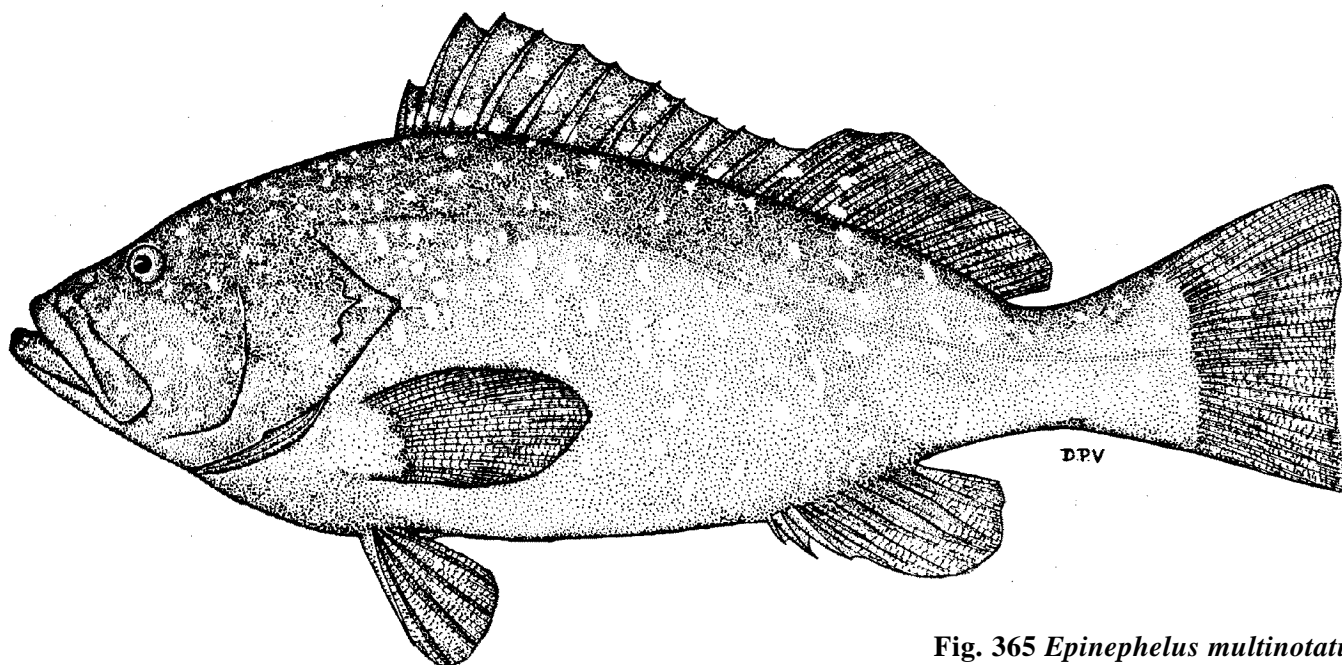


Fig. 365 *Epinephelus multinotatus*
(519 mm standard length)

Diagnostic Features: Body depth contained 2.6 to 2.9 times in standard length (for fish 11 to 63 cm standard length). Head length contained 2.4 to 2.7 times in standard length; interorbital area distinctly convex, the dorsal head profile slightly convex; preopercle subangular, with a shallow notch (more distinct in adults) just above the angle, the serrae at angle not or only slightly enlarged; upper edge of operculum straight or nearly so; posterior nostrils of adults about twice the size of anterior nostrils; maxilla reaches vertical at rear edge of eye or thereabouts; ventral edge of maxilla of adults with distinct step distally; midlateral part of lower jaw with 2 rows of teeth. Gill rakers 9 to 11 on upper limb, 15 to 17 on lower limb. Dorsal fin with XI spines and

15 to 17 rays, the third or fourth spine longest, its length contained 2.3 to 2.9 times in head length, the interspinous membranes not incised, the anterior rays distinctly longer than last spine; anal fin with III spines and 8 rays, the third spine clearly longer than the second, length of third spine contained 3.4 to 4.6 times in head length and less than or subequal to peduncle depth; pectoral-fin rays 18 to 20; pectoral fins subequal to pelvic fins, pectoral-fin length contained 1.7 to 2.3 times in head length; pelvic fins not reaching anus; caudal fin truncate to slightly emarginate. Lateral-body scales distinctly ctenoid, with numerous auxiliary scales; lateral-line scales 64 to 81; lateral-scale series 130 to 162. **Colour:** Head and body of live or fresh fish dark purplish grey, with scattered irregular whitish spots and blotches which are faint or absent on preserved fish; pelvic fins greyish black; rear margins of median fins with narrow white edge. Specimens from the western Indian Ocean (except the Persian Gulf and Gulf of Oman) usually have numerous small dark reddish brown spots over the ventral parts of the head and body. Juveniles (4 to 7 cm standard length) from the Persian Gulf are dark greyish blue with caudal fin, peduncle, soft dorsal, and rear part of anal fin yellow; pelvic fins and ventral margin of anal fin blackish.

Geographical Distribution: *E. multinotatus* is known only from the Indian Ocean (but not the Red Sea). We have examined specimens from Zanzibar, southern Mozambique, Madagascar, Mauritius, Réunion, St. Brandon's Shoals, Seychelles, Persian Gulf, Gulf of Oman, and Western Australia (from Monte Bello Islands to Shark Bay). Literature records include Tanzania (Mafia and Pemba islands), Kenya, Comoros, Chagos, and the Maldive Islands (Fig. 366).

Habitat and Biology: Juveniles are found on in-shore coral reefs, and adults are more common in deeper water (to depths of 90 m). Morgans (1982) reported that females (identified as "*E. leprosus*") were mature at 50 cm standard length (3.6 kg) and possibly at smaller size; stomach contents of 3 fish consisted of small fishes and crabs. The colour

pattern of juveniles in the Persian Gulf (see above) is remarkably similar to that of the damselfish *Neopacetrus sindensis* (Day), which occurs from the Persian Gulf to Pakistan. Nigel Downing (pers. comm.) has suggested that the juveniles of *E. multinotatus* may be a mimic of *N. sindensis*. When it gets larger than the damselfish, it develops whitish spots on the body and begins to lose its yellow coloration. The basis for this mimicry, like that of hamlets (*Hypoplectrus* spp.) mimicking damselfishes in the Caribbean (Randall and Randall, 1960; Thresher, 1978), would seem to be that the grouper, in the guise of a herbivorous pomacentrid, is enabled to get closer to its unsuspecting prey.

Size: According to Allen and Swainston (1988), *E. multinotatus* attains a total length of 100 cm and a weight of 9 kg.

Interest to Fisheries: Probably of some commercial importance in local fisheries. Caught with hook-and-line and traps.

Local Names: AUSTRALIA: White-blotched rockcod.

Literature: Randall and Heemstra (1991).

Remarks: Based on colour pattern and scale counts, *E. multinotatus* appears to have differentiated into 3 separate populations: 1) Western Indian Ocean (east coast of Africa, Comoros, Madagascar, Seychelles, Mauritius, Reunion, St. Brandon Shoals, and Chagos Archipelago); 2) Persian Gulf and Gulf of Oman; and 3) Western Australia. The population in the western Indian Ocean has small dark brown spots on the lower parts of the head and body, but these dark spots are absent in the populations in the gulfs and Western Australia. Australian specimens seem to have higher scale counts (lateral line 71 to 81, lateral-scale series 137 to 162, $n = 5$) than in the populations in the western Indian Ocean and gulfs (lateral line 62 to 77, lateral-scale series 130 to 151, $n = 32$).

E. multinotatus is closely related to *E. flavocaeruleus* of the Indian Ocean and *E. cyanopodus* of the Pacific. These 3 species share the same meristic and morphometric features, fin configurations and ctenoid scales; they are distinguished primarily by differences in colour patterns. The colour pattern of juveniles of *E. multinotatus*, at least in the Persian Gulf, is similar to that of *E. flavocaeruleus* juveniles; this led Randall and Whitehead (1985) to misidentify a 46 mm standard length *E. multinotatus* from the gulf as *E. flavocaeruleus*.

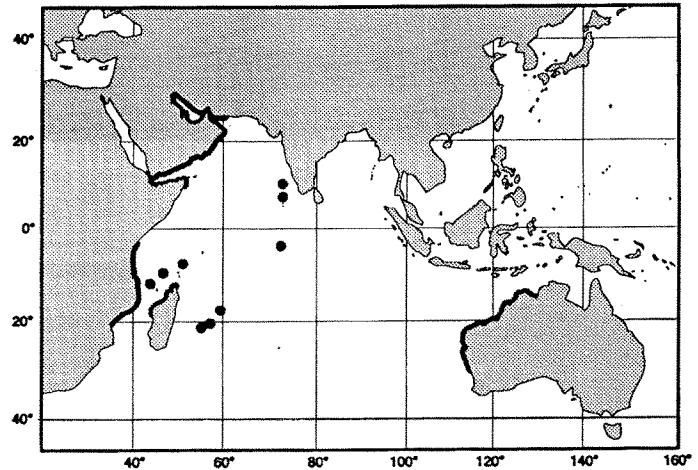


Fig. 366