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Halidesmus socotraensis new species and *Haliophis guttatus* (Forsskål), new records of congrogadine fishes from the Socotra Archipelago (Perciformes: Pseudochromidae)

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Abstract.—Halidesmus socotraensis is described from six specimens, 39.6–69.5 mm SL, from the Socotra Archipelago, western Indian Ocean. It is distinguished from all other congrogadine species in having the following combination of characters: three lateral lines (dorsal, middle and ventral complexes); ventral lateral line branched on abdomen, with unpaired median section on ventral midline; and upper lateral line without anterodorsal branch on to nape. *Haliophis guttatus* is also newly recorded from the Socotra Archipelago on the basis of 15 specimens.

The Socotra Archipelago in the western Indian Ocean at the entrance to the Gulf of Aden consists of four main islands (Fig. 1). The largest and most easterly island, Socotra, is located some 400 km south of the Arabian Peninsula and 200 km east of Cape Guardafui, the Horn of Africa. The other islands are Abd al-Kuri in the west and the two smaller southern islands of Samha and Darsah, also known as "The Brothers".

The coastal fishes of the Socotra Archipelago were poorly known until recently. Steindachner (1902, 1903) published the first study of fishes from Socotra, based on material collected by the Austrian Expedition to Socotra and South Arabia in 1898–1899. He listed 57 species of marine and brackish-water fishes. The first detailed study of the fish fauna was a sight survey conducted by Kemp (1998), who provided an account of 215 fish species and a preliminary zoogeographical analysis.

In 1999 and 2000 the Senckenberg Research Institute, Frankfurt, conducted the Marine Habitat, Biodiversity and Fisheries Surveys in the framework of the United Nations Development Programme (UNDP) Global Environment Facility funded project "Conservation and Sustainable Use of Biodiversity of Socotra Archipelago," executed under the auspices of the Environmental Protection Council of Yemen. During two expeditions the second author collected fishes at inter- and subtidal stations throughout the archipelago. Among the collections were several specimens of the pseudochromid subfamily Congrogadinae, a group of eel-like reef fishes commonly called eel blennies or snakelets. The subfamily was revised by Winterbottom (1986) who recognised 19 species in eight genera (one with two subgenera); four additional species (and one new subgenus) have been described subsequently (Winterbottom & Randall 1994, Winterbottom 1996, Gill et al. 2000). Among the collections from the Socotra Archipelago, an additional new species referable to the western-central Indian Ocean endemic genus *Halidesmus* Günther was discovered, and specimens of the widely distributed western Indian Ocean species *Haliophis guttatus* (Forsskål) were

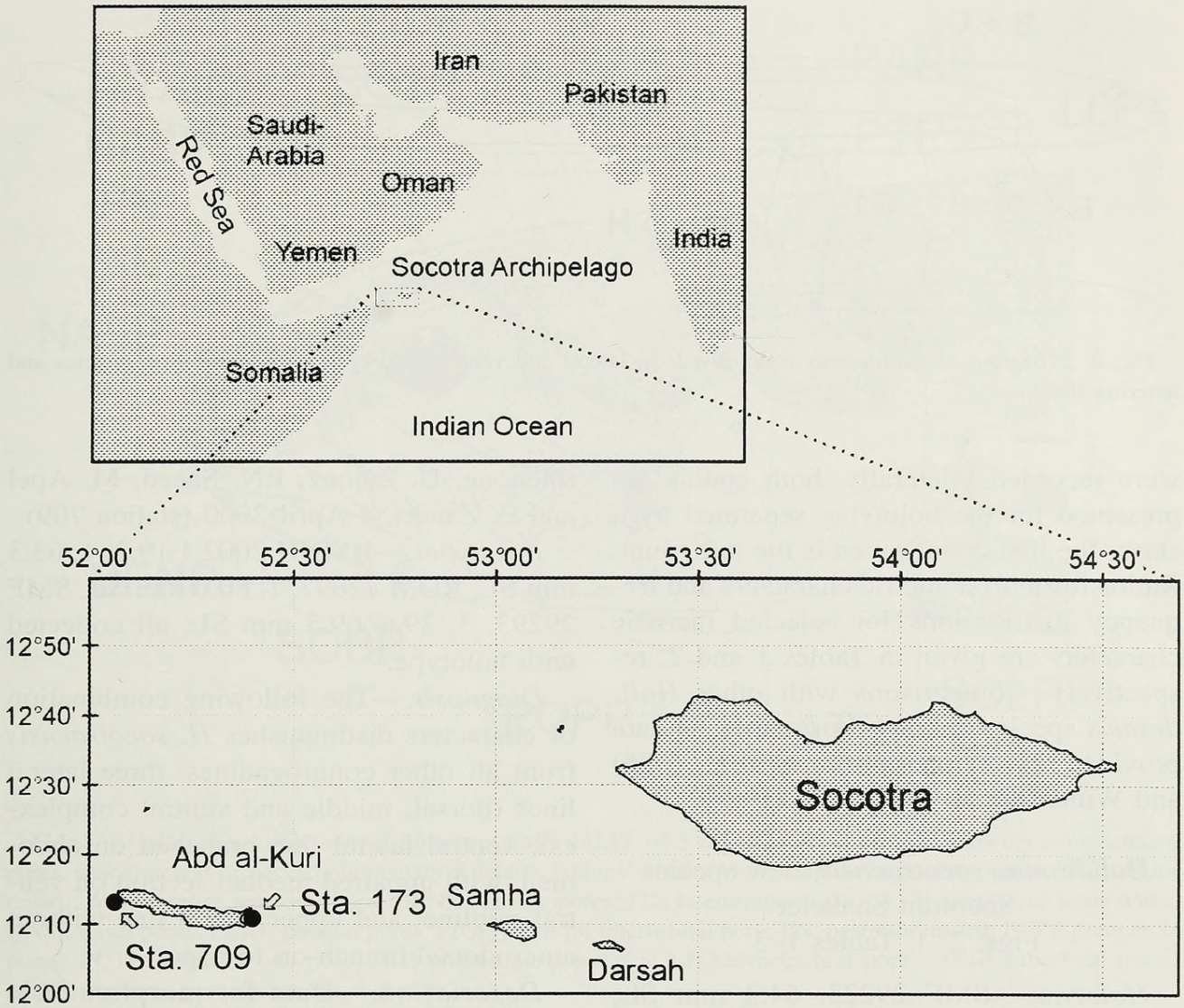

Fig. 1. Map of the Socotra Archipelago showing collection sites.

identified. The purposes of this paper are to describe the new species and to document the new record of *H. guttatus* from the Socotra Archipelago.

Materials and Methods

The nomenclature of cephalic laterosensory pores follows Gill et al. (2000). Alphabetical codes for lateral lines in the new *Halidesmus* generally follow Winterbottom (1982), except that the structure of the ventral lateral line necessitates the following modifications (Fig. 2): the apparent homolog of line G in *H. scapularis* is represented in *H. socotraensis* (and *H. polytretus*) by a median anterior section (termed G1) and a bilaterally paired posterior section (termed G2). Vertebral counts are presented in the form precaudal + caudal; the latter are defined as vertebrae bearing a haemal spine, and include the terminal urostylar complex. Terminology of ribs and intermuscular bones follows Gill (1998). Other methods of counting and measuring follow Winterbottom (1982). Institutional codes follow Leviton et al. (1985), except for NHCY-F, which is for the fish section of the Natural History Collection of Yemen. Osteological details were determined from x-radiographs. In the description of the new species, counts are given as values or value ranges for all type specimens, followed, where variation was noted, by values for the holotype in parentheses. Where counts

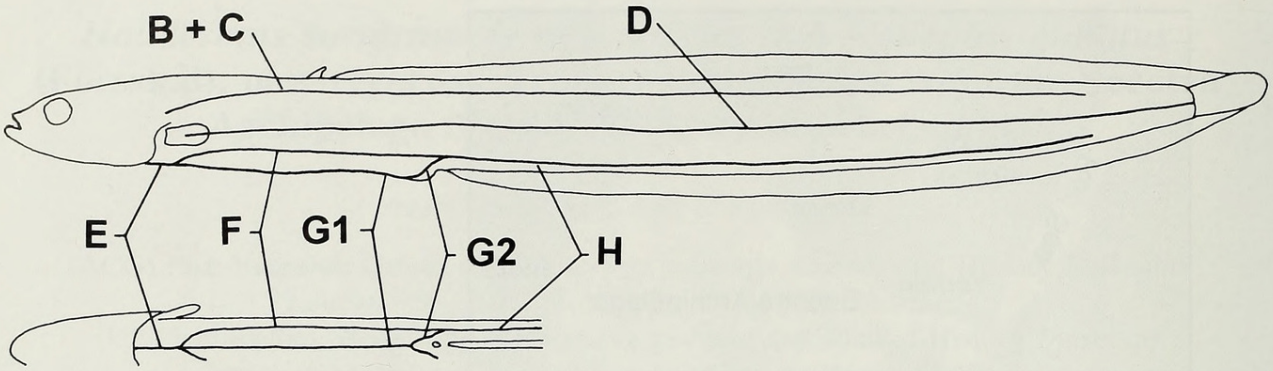

Fig. 2. Diagram of *Halidesmus socotraensis* in lateral and ventral views showing lateral-line systems and lettering scheme.

were recorded bilaterally, both counts are presented for the holotype, separated by a slash; the first count given is the left count. Ratios for morphometric characters and frequency distributions for selected meristic characters are given in Tables 1 and 2, respectively. Comparisons with other *Halidesmus* species are based primarily on data provided by Winterbottom (1982, 1986) and Winterbottom & Randall (1994).

Halidesmus socotraensis, new species
Socotran Snakelet
Figs. 2–4, Tables 1–3

Holotype.—SMF 29223, 64.3 mm SL, Socotra Archipelago, Abd al-Kuri Island, SW coast, ca. 12°13′N 52°04′E, 6–15 m, rotenone, U. Zajonz, F.N. Saeed, M. Apel and E. Zandri, 4 April 2000 (station 709).

Paratypes.—BMNH 2002.1.19.3, 1, 63.3 mm SL, ROM 72697, 1, 60.0 mm SL, SMF 29293, 3, 39.6–69.5 mm SL, all collected with holotype.

Diagnosis.—The following combination of characters distinguishes *H. socotraensis* from all other congrogadines: three lateral lines (dorsal, middle and ventral complexes); ventral lateral line branched on abdomen, with unpaired median section on ventral midline; and upper lateral line without anterodorsal branch on to nape.

Description.—Data for morphometric characters appear in Table 1.

Dorsal fin I + 58–61 (I + 61), all seg-

Table 1.—Morphometric values for *Halidesmus socotraensis* expressed as percentages of standard length (SL).

	Holotype	Paratypes				
mm SL	64.3	39.6	48.7	60.0	63.3	69.5
Soft dorsal-fin base	78.2	80.0	78.2	78.3	78.2	81.7
Anal-fin base	61.6	59.8	60.6	61.7	63.0	61.2
Snout to first dorsal	17.1	20.2	19.7	17.7	18.3	17.7
Snout to soft dorsal	19.8	22.5	22.2	19.2	19.6	20.1
Snout to anal origin	37.2	39.1	39.4	38.0	35.2	37.4
Head length	13.2	15.4	14.4	13.5	13.1	12.7
Depth at parietal	7.0	8.1	7.6	8.0	7.4	7.5
Depth at anal origin	7.9	8.8	8.8	8.7	8.5	7.5
Eye diameter	2.8	4.0	3.3	3.0	3.0	2.9
Snout length	2.8	3.3	2.9	2.8	3.0	3.2
Interorbital width	1.2	1.3	1.4	1.3	1.3	1.3
Upper jaw length	4.5	4.8	4.7	4.5	4.4	4.6
Lower jaw length	6.2	7.3	6.8	6.3	6.3	6.5
Pectoral length	5.6	5.1	4.9	4.7	5.1	?*

* fin damaged.

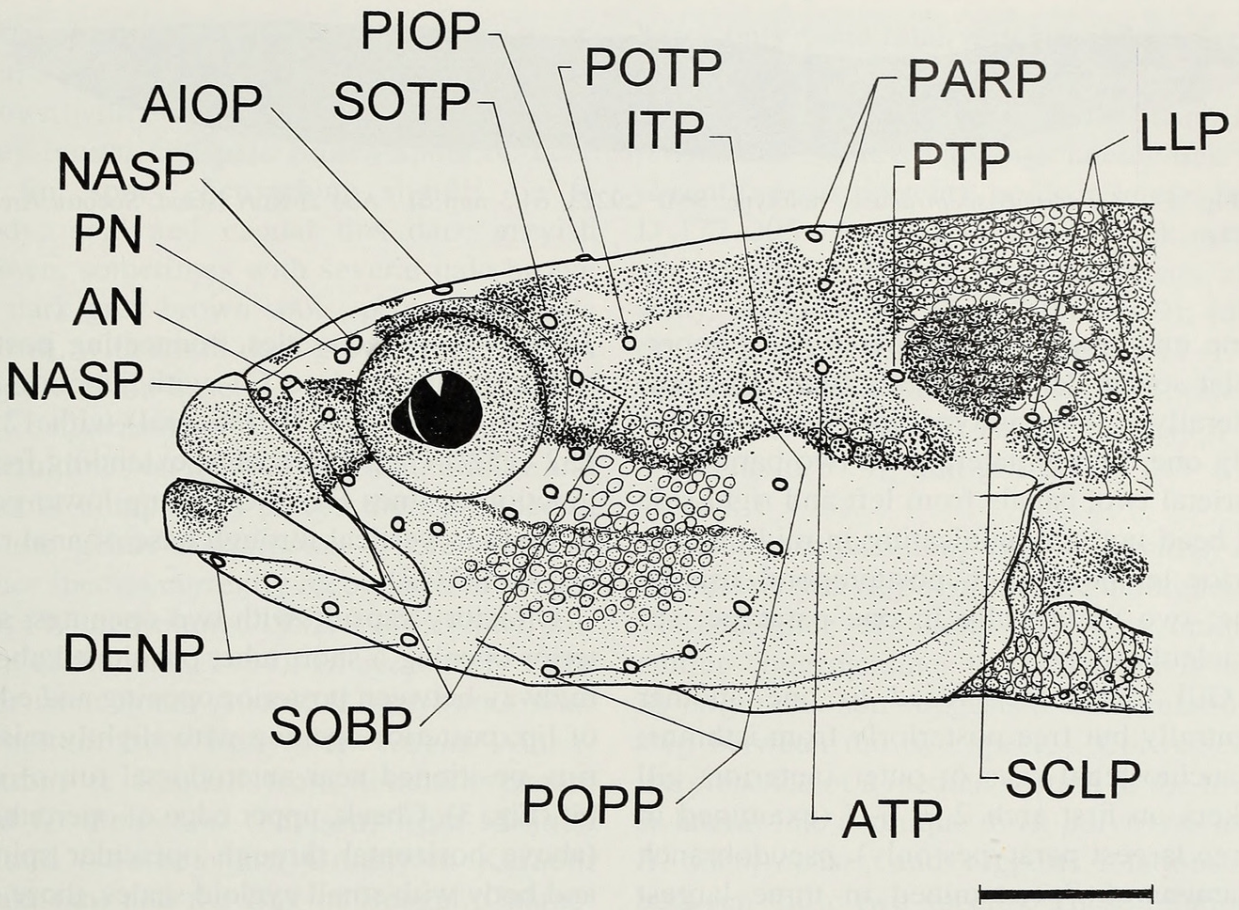

Fig. 3. *Halidesmus socotraensis,* holotype, SMF 29223, 64.3 mm SL; detail of head showing laterosensory pores, scalation and preserved pigmentation details. Abbreviations: AIOP, anterior interorbital pore; AN, anterior nostril; ATP, anterior temporal pore; DENP, dentary pores; ITP, intertemporal pore; LLP, lateral-line scale pores; NASP, nasal pores; PARP, parietal pores; PIOP, posterior interorbital pore; PN, posterior nostril; POPP, preopercle pores; POTP, posterior otic pore; PTP, posttemporal pore; SCLP, supracleithral pore; SOBP, suborbital pores; SOTP, supraotic pore. Scale bar = 2 mm.

mented rays branched; anal fin 45–48 (48), all rays branched; pectoral fins 9–10 (10/10), upper 1–2 (2/1) and lower 0–2 (1/1) rays unbranched, other rays branched; pelvic fin absent, though small rod-like pelvis present internally; caudal fin with five dorsal and five ventral principal rays, and one dorsal and one ventral procurrent rays; branched caudal fin rays 5 + 4. Caudal fin fully connected by membrane to last ray of dorsal and anal fins. Vertebrae 17–18 + 46–49 = 63–66 (17 + 49); ribs present on precaudal vertebrae 3 through 4–5 (3 through 5); epineural bones present on precaudal vertebrae 1 through 3–5? (1 through 3?; bones difficult to distinguish on x-radiographs); hypural 5 absent; hypurals 3–4 fused to one another and to urostylar complex; hypurals 1–2 fused to one another and, variably, to parhypural; epurals 1; supraneurals 2.

Cephalic sensory pore openings (Fig. 3; all pores bilateral unless otherwise indicated): nasal two, one pore just posterior to upper lip, second pore just above posterior nostril; anterior interorbital usually one, small second pore present unilaterally in one paratype, about two-thirds distance from typical anterior interorbital pore to posterior nasal pore; median (unpaired) posterior interorbital one, positioned above or slightly behind vertical through posterior edge of eye, additional posterior interorbital pore present in one paratype, displaced laterally in line with right side anterior interorbital pore; supraotic one; posterior otic usually one, two pores present unilaterally in one paratype; suborbital usually eight,

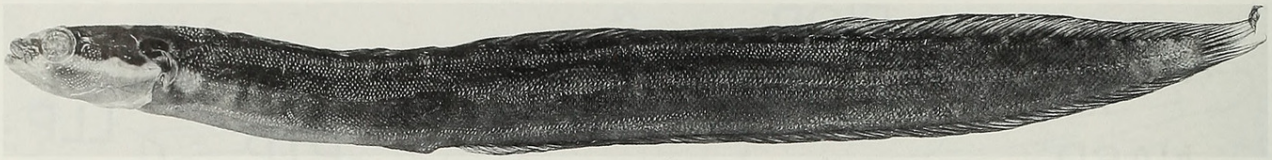

Fig. 4. *Halidesmus socotraensis,* holotype, SMF 29223, 64.3 mm SL, Abd al-Kuri Island, Socotra Archipelago.

nine unilaterally in one paratype; preopercular seven; dentary usually four, three unilaterally in one paratype; intertemporal usually one, two unilaterally in two paratypes; parietal two, canals from left and right side of head not communicating in midline; anterior temporal one; posttemporal usually one, two unilaterally in one paratype; supracleithral one.

Gill membranes fused to one another ventrally but free posteriorly from isthmus; branchiostegal rays 6; outer (anterior) gill rakers on first arch 2 + 6–7 (examined in three largest paratypes only); pseudobranch filaments 6–7 (examined in three largest paratypes only). Lateral-line system complex (Fig. 2), with pores on either dorsal or ventral margins of lateral-line scales (or in the case of median lateral lines, on either left or right margins of lateral-lines scales): line A absent; line B + C (bilateral) with 186–210 (210/206) pored scales, extending from shoulder to beneath vertical through base of segmented dorsal ray 49–54 (51/51); line D (bilateral) with 177–205 (202/197) pored scales, extending from just behind upper edge of pectoral-fin base along midside to or almost to caudal-fin base, not connecting anteriorly with line B + C; line E (median) with 6–12 (9) pored scales, extending from just beneath branchiostegal membranes to vertical beneath pectoral-fin base; line F (bilateral) with 78–90 (90/89) pored scales, extending posterodorsally from junction of lines E and G1 almost to pectoral fin, then along lower part of abdomen to junction with line G2; line G1 (median) with 59–63 (62) pored scales, extending from junction with lines E and F along ventral edge of abdomen to just in front of anus; line G2 (bilateral) with 10–14 (11/14) pored scales, connecting posterior terminus of line G1 with junction of lines F and H; line H (bilateral) with 125–152 (152/147) pored scales, extending from junction of lines F and G2 along lower part of body to vertical through base of anal ray 36–42 (41/42).

Olfactory capsule with two openings; anterior opening a short tube, positioned about midway between posterior opening and edge of lip; posterior opening with slightly raised rim, positioned near anterodorsal rim of orbit (Fig. 3). Cheek, upper edge of operculum (above horizontal through opercular spine) and body with small cycloid scales, those on upper part of operculum imbedded and inconspicuous; predorsal scales extending anteriorly to parietal commissure (Fig. 3).

Teeth in outer row of premaxilla and dentary conical, recurved anteriorly, decreasing in size and becoming laterally compressed posteriorly, numbering 11–12 in the premaxilla and 13–15 in the dentary; single row of small conical teeth present anteriorly on premaxilla and dentary immediately behind outer row teeth; vomer edentate; palatine edentate.

Live coloration: Not recorded.

Preserved coloration (Figs. 3, 4): Head and body dark brown, with indistinct to distinct paler mottling, which may align to form diffuse bars or reticulations; lower part of head and abdomen pale brown; dark grey-brown stripe extending from midside of lower lip through midside of upper lip to mid-anterior edge of eye, then behind mid-posterior edge of eye to upper edge of operculum; dark grey-brown stripe edged ventrally with creamy white stripe; large pale-edged, dark grey-brown spot on shoulder; creamy white median stripe or series of

spots extending from tip of upper lip to origin of dorsal fin; dorsal fin dark greyish brown with series of alternating small dark grey-brown and pale brown spots on base of fin, spots encroaching slightly on to body; anal and caudal fins dark greyish brown, sometimes with several pale brown or dark grey-brown spots; pectoral fin pale brown, with small dark grey-brown spot on middle of fin base.

Comparisons.—The presence of three lateral lines on the body (dorsal, middle and ventral complexes) places the new species in the genus *Halidesmus.* There are four other species currently recognised in the genus (Winterbottom, 1982, 1986; Winterbottom & Randall, 1994): *H. scapularis* Günther from South Africa; *H. polytretus* Winterbottom from Kenya; *H. coccus* Winterbottom & Randall from southern Oman; and *H. thomaseni* (Nielsen) from Masirah Island (southeastern Oman) to Karachi (Pakistan) and the Bay of Bengal. Characters distinguishing the four species are summarized in Table 3.

Halidesmus is divisible into two apparent monophyletic groups, which are diagnosed by characters that are uniquely derived among pseudochromids. The first, which consists of *H. coccus* and *H. thomaseni,* is diagnosed by a single synapomorphy (fleshy crest on the snout and interorbital area). The other, which consists of *H. socotraensis, H. scapularis* and *H. polytretus,* is diagnosed by two synapomorphies (ventral lateral line with complex branching on abdomen; lateral-line pores opening to either ventral or dorsal margins of scales).

Halidesmus socotraensis differs from *H. scapularis* in the following features: pelvic fins absent (versus pelvic-fin rays usually I,2–3, fins rarely absent); lateral line A absent (versus present); lateral line D with 177–205 pores, not joining C (versus with 157–179 pores, joining C); lateral lines E and G median (versus bilateral); medial parietal pores bilaterally paired (versus single median pore); caudal, anal and dorsal fins fully confluent (versus united near fin-ray bases only); and total vertebrae 63–66 (versus 66–69).

Halidesmus socotraensis differs from *H. polytretus* in the following: lateral line A absent (versus present); pores in lateral line D 177–205 (versus 204–216); cheek, nape and opercular scales present (versus absent); preopercular pores 7 (versus 9); suborbital pores 8–9, usually 8 (versus 11–13); posterior interorbital pores usually 1, rarely 2 (versus 2); principal caudal fin rays 5 + 5 (versus 6 + 5); and gill rakers 2 + 6–7 (versus 1 + 5).

Relationships among *H. socotraensis, H. scapularis* and *H. polytretus* are ambiguous. The presence of lateral-line A is unique among congrogadines to *H. scapularis* and *H. polytretus* and suggests a sister relationship between the two species. Conversely, the presence of a median section of the lower lateral line is unique to *H. polytretus* and *H. socotraensis,* and suggests relationship between those two species. These relationships will be tested in a forthcoming study of the phylogeny and historical biogeography of *Halidesmus* by the second author.

Habitat and distribution.—All known specimens were collected at a single station in a small enclosed bay on the SW coast of Abd al-Kuri (Fig. 1, Sta. 709). The site is characterised by highly diverse assemblages of large massive and encrusting corals, and an associated diverse fish community.

Etymology.—The specific epithet refers to the known distribution of the species.

Haliophis guttatus (Forsskål)
Barred Snakelet
Fig. 5, Table 2

Haliophis guttatus is known from throughout the Red Sea to the northern Gulf of Aden, southern Oman, the east coast of Africa between Kenya and Mozambique, and the west coast of Madagascar (Winterbottom 1984, Winterbottom & Randall 1994). Fifteen specimens were collected by the second author and associates in the Socotra Archipelago. The morphology of

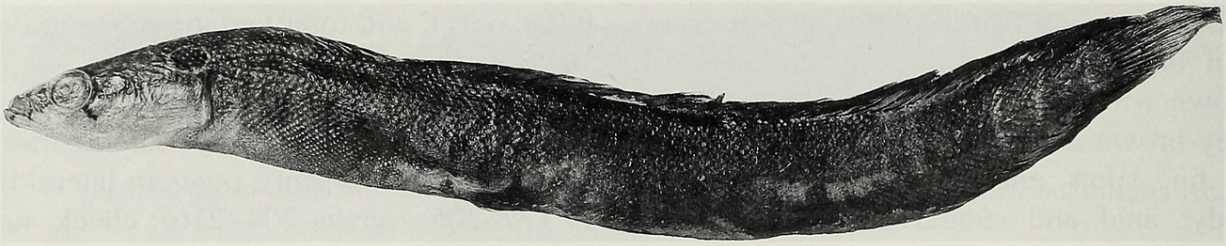

Fig. 5. *Haliophis guttatus*, SMF 29198, 59.5 mm SL, Abd al-Kuri Island, Socotra Archipelago.

these specimens agrees well with published descriptions of the species (e.g., Winterbottom, 1984, 1986; Randall, 1995). Winterbottom (1984) noted that the species exhibits geographic variation in several meristic and morphometric characters, which he interpreted as a step cline, with the step occurring between about 27°N and 20°N in the northern Red Sea. Frequency distributions of counts relevant to this phenomenon are provided for the Socotran specimens in Table 2. Unfortunately, the specimens are somewhat distorted and difficult to measure accurately; therefore, we do not provide relevant morphometric details. Generally, meristic values agree well with data presented by Winterbottom for specimens from the southern Arabian area (central and southern Red Sea and Gulf of Aden), except for counts of precaudal vertebrae, which more closely approached values for specimens from Mozambique and Madagascar. However, sample sizes for many of the localities reported by Winterbottom are small (often five or fewer specimens).

Material.—SMF 29224, 1: 64.8 mm SL, Socotra Archipelago, Abd al-Kuri Island, SW coast, ca. 12°13′N 52°04′E, 6–15 m, rotenone, U. Zajonz, F.N. Saeed, M. Apel and E. Zandri, 4 April 2000 (station 709); SMF 29198, 7: 38.0–79.5 mm SL, NHCY-F uncataloged, 7: 43.2–66.0 SL, Socotra Archipelago, Abd al-Kuri Island, E coast, Ras Anjara bay, ca. 12°10′N 52°22′E, 3–9 m, rotenone, U. Zajonz and M. Apel, 8 April 1999 (station 173).

Discussion

The fish surveys of 1999 and 2000 comprised 18 large sampling stations scattered all around the Socotra Archipelago. Samples of congrogadine species were obtained only at Abd al-Kuri, whereas pseudochromids of the subfamilies Pseudochrominae (six species of *Pseudochromis* Rüppell) and

Table 2.—Frequency distributions for selected meristic characters of *Halidesmus socotraensis* and *Haliophis guttatus* from the Socotra Archipelago. Bilateral counts of pectoral rays are included.

	Segmented dorsal rays								Anal rays							
	42	43	44	//	58	59	60	61	34	35	36	//	45	46	47	48
socotraensis	—	—	—		1	1	3	1	—	—	—		1	—	1	4
guttatus	2	9	4		—	—	—	—	5	7	3		—	—	—	—
	Pectoral rays				Total caudal rays				Precaudal vertebrae							
	9	10	11		12	13	14	15	13	14	//		17		18	
socotraensis	4	8	—		6	—	—	—	—	—			5		1	
guttatus	1	2	27		—	—	4	11	13	2			—		—	
	Caudal vertebrae							Total vertebrae								
	36	37	//	46	47	48	49	49	50	51	//	63	64	65	66	
socotraensis	—	—		1	—	3	2	—	—	—		1	—	2	3	
guttatus	4	11		—	—	—	—	3	11	1		—	—	—	—	

Table 3.—Summary of characters distinguishing *Halidesmus* species.

Character	*socotraensis*	*polytretus*	*scapularis*	*coccus*	*thomaseni*
Pores in lateral lines	open to ventral or dorsal scale margins	open to ventral or dorsal scale margins	open to ventral or dorsal scale margins	open to posterior scale margins	open to posterior scale margins
Ventral lateral line	branched	branched	branched	unbranched	unbranched
Line A	absent	present	present	absent	absent
Line D	with 177–205 pores; doesn't join C	with 204–216 pores; doesn't join C	with 157–179 pores; joins C	with 173–194 pores; doesn't join C	with 160–198 pores; doesn't join C
Lines "E" and "G"	median	median	bilaterally paired	N/A	N/A
Cheek scales	present	absent	present	absent	present
Nape scales	present	absent	present	absent	present
Opercular scales	present	absent	absent	absent	present
Preopercular pores	7	9	7–8, usually 8	7	7
Suborbital pores	8–9, usually 8	11–13	7–8, usually 8	8	8
Medial parietal pores	bilaterally paired	bilaterally paired	median, singular	bilaterally paired	bilaterally paired
Posterior interorbital pores	1–2, usually 1	2	1	1	1
Fleshy crest	weak or absent	weak or absent	weak or absent	well-developed, convex	well-developed, concave
Dorsal fin	I + 58–61	I + 57–58	I + 60–63	I + 64–68	I + 58–64
Anal fin	45–48, usually 48	45–46	48–51	52–55	45–50
Pectoral fin	9–10	9–10	8–10, usually 9	9–12	7–9
Pelvic fin	absent	absent	usually I,2–3, rarely absent	absent	absent
Caudal fin	1, 5, 5, 1	0–1, 6, 5, 0–1	Usually 2, 5, 5, 2	2, 5, 6, 2	1, 5, 5, 1
Caudal, anal and dorsal fins	fully confluent	fully confluent	membranes united basally only	fully confluent	fully confluent
Vertebrae	17–18 + 46–49 = 63–66	16 + 47–48 = 63–64	16–18 + 49–53 = 66–69	17–18 + 51–55 = 69–73	16–18 + 46–50 = 64–68
Gill rakers	2 + 6–7	1 + 5	2–3 + 6	2–3 + 5–6	1–2 + 7–8

Pseudoplesiopinae (two species of *Chlidichthys* Smith) were collected from other islands as well. It seems possible that Abd al-Kuri receives a higher influx of pelagic eggs and larvae from East Africa through the Somali current compared to the other islands, enriching the fish communities. In particular along the south and east coasts there are isolated biodiversity "hotspots," which may act like traps for recruits by providing shelter and suitable habitats (U. Zajonz, unpubl. data). Both sites where congrogadines were collected host particularly rich fish and coral assemblages as compared to other areas visited at Socotra. The fish species compositions were exceptionally rich, suggesting that there is limited faunal exchange between these patches and the wider archipelago, at least of closely reef-associated species.

Acknowledgments

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