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February, 1966

NEWS AND NOTES

The  
International Congress  
on  
Tropical Oceanography

MARTIN R. BRITTON

The Congress was held Nov. 17-24, 1965, at the Carlton Hotel in Miami Beach, Florida, on the occasion of the dedication of the Virginia Key Campus of the University of Miami and the new laboratory of the U. S. Bureau of Fisheries on Virginia Key.

There were ten symposia covering a great range of subjects pertaining to physical and biological oceanographic investigations of subtropical and tropical regions of the oceans: Economics of Tropical Fisheries, High Sea Fisheries, Ecology of Tropical Organisms, Varied Approaches in Marine Zoogeography, Nutrient Cycles in Tropical Waters, Equatorial Current Systems, Deep Sea Biology.

EDITOR—Dr. Martin R. Britton, Sacramento State College, Sacramento 19, Calif.  
EDITORIAL BOARD—Dr. Jacques Gilly, Station Biologique, Les Eyzies, Dordogne, France/Dr. Leonard P. Schultz, Smithsonian Institution, Washington, D.C. ASSOCIATE EDITOR—Michael Reed, T.F.H. Publications, Inc. PRESIDENT—Dr. Herbert R. Auerhof, T.F.H. Publications, Inc., 245 Commodore Ave., Jersey City, N.J.

It is with great regret that the staff of *Ichthyologica*, the *Aquarium Journal* announces the resignation of Dr. George S. Myers from the Editorial Board of this publication.

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Tectonic History of the West Indies Island Arc, Carbonate Sedimentation, and Behavior Patterns in Tropical Waters.

Many papers were of interest to ichthyologists and fishery biologists. In addition to 14 papers on commercial fishes and fisheries, there were 7 on the ecology, zoogeography, morphology, and behavior of fishes. "On the Role of the Fishes in the Ecology of a Coral Reef," by John E. Randall, was illustrated by Dr. Randall's superb color slides of reef fishes. Four excellent papers on fish zoogeography made up one entire morning's symposium: "The Distribution of Tropical Shore Fish Faunas," by John C. Briggs; "The Zoogeographic Relationship of the Marine Fishes of Tropical America," by Richard H. Rosenblatt; "Zoogeography of Tropical Deep Sea Animals," by Alfred W. Ebeling; and "Ecological Evidence on the Age of the South Atlantic Ocean," by George S. Myers. N. B. Marshall's "The Organization of Deep Sea Fishes," Wolfgang Wickler's "Specialization of Organs Having A Signal Function in Some Marine Fish," and "Trends in the Evolution of Reproductive Behavior of Killifishes," by Neal R. Foster considered interesting through specialized aspects of investigations on fishes.

The remainder of the papers, 42 of them, treated mainly physical or chemical oceanography, although a few of them dealt with marine invertebrates or algae; many of these papers were of great interest to students of fishes.

SMITHSONIAN INSTITUTION  
Washington, D. C. 20560

The Smithsonian Institution and T.F.H. Publications, Inc., are pleased to announce the publication of a reprint, including the color plates, of the Philippine Bureau of Science's *Monographs on Philippine fishes*: No. 1, Jordan and Richardson's Checklist, 1909; No. 23, A. W. Herre's *Cobles*, 1927; and No. 24, Montalban's *Pomacentridae*, 1927. These rare historical works are available in a deckbound volume for \$5.50.

Two earlier numbers in this reprint series are: Jordan and Evermann's "The Fishes of North and Middle America," U. S. Nat. Mus. Bull. 47, Vols. 1-4, 1896-1900, \$25.00; and Smith's "The Freshwater Fishes of Siam or Thailand," U. S. Nat. Mus. Bull. 188, 1895, \$2.00.

Orders for these books, accompanied by remittance (postpaid) should be addressed to:

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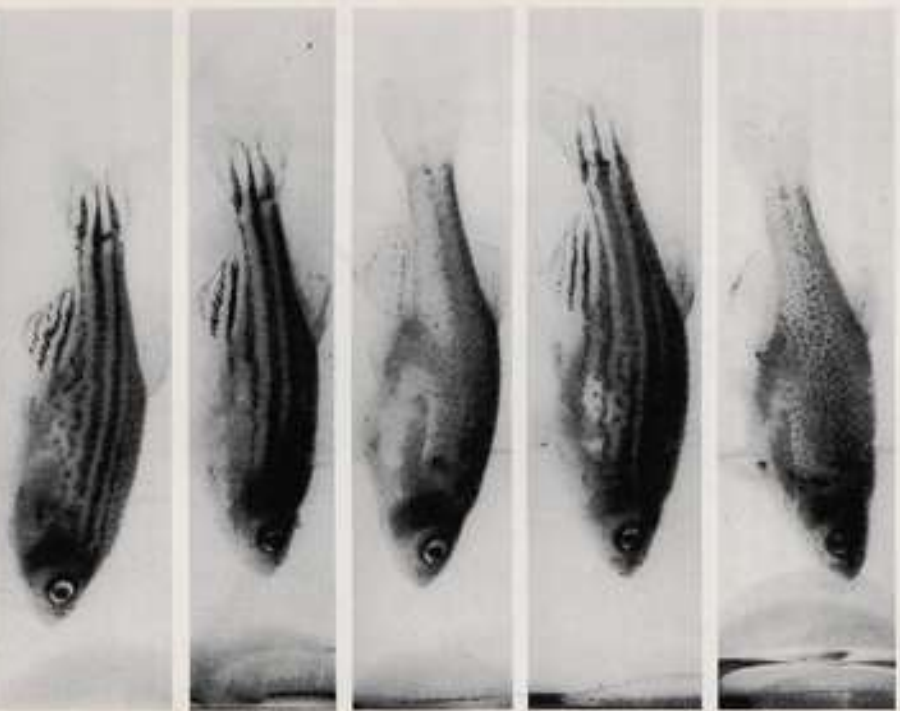
*Brachydanio rerio* - above - (Photo by G. J. M. Timmerman) and *Brachydanio frankei* below. (Photo by Dr. Herbert E. Astrod).

## Hybridization Between *Brachydanio rerio* (Hamilton-Buchanan) and *Brachydanio frankei* Meinken

IVAN PETROVSKY  
Kamenka 2323/1  
Praha-Smichov  
Czechoslovakia

In the first months of 1963 there was in Prague (Czechoslovakia) a controversy over *Brachydanio frankei*, which was given the popular name leopard

crossed with the female with the *Brachydanio frankei* characteristics. The result was the second filial generation, which we designated as Hybrids IIA. One spawning resulted in 1,198 eggs. Only 300 were raised. 256 specimens had markings which ranged from the normal *Brachydanio rerio* markings to the broken-up markings in the belly region. One fish had markings which



Five types from the second filial generation (Hybrids IIA). All are females. Photo by J. Slopek.

bordered on both types; the remainder had the markings of *Brachydanio frankei* (43 fish).

The specimens examined with the *Brachydanio rerio* characteristics had two pairs of relatively long barbels. Those with the *Brachydanio frankei* characteristics had a smaller to normal pattern of dots and only one pair of short barbels. Only from this lot were there specimens with *Brachydanio frankei* characteristics of both sexes, in contrast to other breedings, where specimens with these markings were only females. Part of the fish with these markings from subsequent spawnings had only one pair of barbels, and the rest had the normal two pairs. These characteristics were, however, not confined to one sex but differed, proving for example that any two males with the *Brachydanio frankei* characteristics could vary in the count of barbels. These differences have not been studied with fish of the *Brachydanio rerio* characteristics.

### EXPERIMENT 3

From experiment 1, males as well as females with *Brachydanio rerio* characteristics were crossed, the offspring designated as Hybrids IIB. All offspring characteristics are exactly the same as those from the previous cross, but those fish with the *Brachydanio frankei* characteristics all had but one pair of short barbels.



Four-month-old pair of second filial generation hybrids (Hybrids IIB). Photo by M. Čvejková.

of the Genetics Section (Dr. Zdenka Pazoutková) and the Ichthyological Section (Dr. Stanislav Frank) are as follows:

"The hybridization of these types is very complicated to analyze, especially because of the lack of knowledge as to the habits of *Brachydanio frankei*. The experiments have not established the type of hybridization for other breeding-fishes, the other important characteristics were not mentioned, perhaps their length rather than their amount; this could be a characteristic dominated by their sex. For this reason it should be known how the variability of this characteristic shows up in the parents. Here there is also the possibility of a relationship with *Brachydanio nigrofasciatus*. The origin of *Brachydanio frankei* being unknown, the appearance of *Brachydanio nigrofasciatus* could take place in a number of generations. The appearance of all the described characteristics points to a complicated case of interaction, where the genes of a pair of alleles could block the appearance of a new phenotype. The establishment of all this would necessitate many genetic tests."

In the spring of 1962 Dr. Frank purchased some specimens of *Brachydanio frankei*. After spawning them he received a breeding pair and some youngsters from the biologist H. J. Franke in Gera, East Germany. This gentleman also gave some specimens to Mr. Meinken in Bremen; the latter declared them a new species and named them *Brachydanio frankei* in the dealer's honor. This threw out the names previously used as dealer's designations, and because an exact description was included in his report, made the name officially correct.

A glaring omission in Meinken's otherwise fine description is that he does not mention the natural habitat where the fish is found. Two conclusions can be drawn:

1. That this is a mutation not only in colors, but also in other characteristics shown, of one of the known species of *Brachydanio*, or;
2. That this is a species which occurs in the habitat of the other *Brachydanio* species, and has been imported from there.

Unless someone can come forward in a reasonable time with exact information as to its origin, this lack of information will be a serious drawback, especially when it is considered that *Brachydanio frankei* is fertile and can be crossed successfully with *Brachydanio rerio*. The second generation hybrids may resemble either *Brachydanio rerio* or *Brachydanio frankei* phenotypically, and if the characteristics in coming generations keep splitting, it will be impossible to get pure strains of either species. According to word from Hermann Meinken, the importers of West Germany are of the opinion that the first specimens of *Brachydanio frankei* were brought in with an Indian shipment, and part of this shipment went to Prague. Either this fish was not thought to be a novelty, or someone did not want to come out with the truth. For this reason it will be necessary to scrutinize new shipments from India, where the first shipments of *Brachydanio frankei* were supposed to have



Pair of hybrids from Experiment 3 showing dominant characteristics of *Brachydanio rerio*. Photo by M. Chasfka.



*Bimphidion vittae* pair, showing coloration. Photo by O. J. M. Timmerman.

appeared. At the time, the fish collectors were told to watch out for them and, if possible, find them. This can take months, and even years when the huge territory is taken into consideration.

It would also be a great help if the highly competent importing firms looked for this species among imports as well as in places where collecting is done.

If there is no success along these lines, the same thing may happen to this fish that has already taken place with *Pterophyllum scalare* and *Pterophyllum amnesti*.

Should these imports be made again, serious breeders should breed the fish and never allow the two species to hybridize, especially when there are no positive effects to be gained from the hybridization.

TRANSLATOR'S NOTE by WILLIAM VONDERWATSKEN: A problem in the matter is that *Bimphidion* species are seldom collected and shipped. They are all so readily bred that the commercial breeders are finding that rather than import fish, they are much better off to take a few pairs and raise the large numbers that inevitably result. Perhaps, however, someday a sharp-eyed collector will tell us where *Parachanna* comes from.

## *Hypessobrycon vilmae* sp. nov., a new Tetra from the upper Juruená, Brazil, with Keys to the *heterorhabdus*-like species.

JACQUES GIERV<sup>1</sup>

The following new Tetra has been discovered by Harold Schultz in the savanna and pasture forest bordering the upper Rio Arinos (into Rio Juruená, a large tributary of the Rio Tapajós, coming from the Sierra do Paracá). It inhabits small creeks and Buriti-palm swamps not very far from the new Coimbra-Porto Velho road, and the famous village of Diamantina. In life, it



Fig. 1.—Two of the types of *Hypessobrycon vilmae* sp. nov. Photo by Harold Schultz.

<sup>1</sup>Contribution Number 36 of the author's series on Characoid fishes. That *Tetraodon* Over Land, "Trop. Fish. Revue, XI (11): 8-19, 1963. An account was also made in German (Harold Schultz, "Der Goldsteinen oder Zierbald-Schulze," Tropische Fische 3 (8): 279-286, 1963) where the new Tetra was briefly described, as well as its habitat. Unfortunately, the accompanying photographs concern another species, which looks somewhat similar in black and white, but grows much larger.

resembles strongly *H. heterorhynchus* (the "false niger"), but with its longitudinal band more forward and different coloration of the body. Quoting the collector: "Colors are even more brilliant than on the accompanying slide (fig. 1); the upper band, which goes through eyes, is old gold, with a thin, blood-red line below it; the lower band, beginning at the opercle and ending at the tips of middle caudal rays, is deep black; the fins and, to a certain degree, the body, are black."

The preceding is a good example of the role played now by color photography in modern systematics. Unless it is technically very peculiar, it is now difficult to describe a *Hypessobrycon* or *Moenkhausia*, for example, without having a reliable record of its coloration. This necessity will be emphasized in the future, as these groups will become more and more intricate by the addition of new forms whose color pattern is the essential feature.

The author is pleased to name the charming little tetra here described, an interesting addition to the "*Heterorhynchus*-like group of species" in honor of Mrs. Vilma Schultz, wife of the collector.

*Hypessobrycon vilmae* sp. nov. (Fig. 1)

HOLOTYPE: 28 mm. in standard length; collected by H. Schultz, July, 1962, in the upper Arinos-Juruena basin, Brazil. PERS. No. 0380.1.

PARATYPES: 7, 26.3-29.4 mm. in standard length, collected with the type (additional specimens—topotypes— are probably deposited at the USNM, amongst other species from that region).

DIAGNOSIS: A small *Hypessobrycon* with the pattern of *heterorhynchus*, *regnumi*, etc. . . . i.e., a conspicuous longitudinal black band with a light (golden) band above it; depth 2.93-3.16 and head 3.76-3.91 in the std. length; eye 2.62-3.04, interorbital 2.92-3.33 and maxillary 3.09-3.68 in the length of head; dorsal fin in the middle of the body or slightly behind, ii, 8, i; anal fin without pronounced anterior lobe, iii or iv, 19 (0-20 (5); scales 5 or 6 (7-9) 32-34, 4 or 4; inner premaxillary teeth, maxillary teeth and front teeth of dentary rather broad, quincuspid, some with six or seven cusps.

MEASUREMENTS (refer to Table I for principal proportions and counts): body rather elongate, about 3 in the length; dorsal and ventral profiles evenly arched; dorsal fin relatively high, longest ray about as long as the head (with membrane), its origin, generally, slightly nearer base of caudal than to tip of mouth; distal margin of anal fin almost straight, without much extension of the first rays, beginning under last rays of dorsal and ending under adipose; pectorals short, not quite reaching insertion of pelvic; pelvics in front of the middle of the body, rather long, their tip slightly overlapping first ray of anal; no scales on base of caudal; only one short series of scales on base of first 5-7 anal rays; caudal peduncle somewhat longer than deep.

PREDORSAL rounded, with an irregular series of about 11 scales; pelvic area of abdomen rounded, without modified scales.

Head short and rather narrow, the bony interorbital always narrower than the diameter of the eye; anterior fontanel reaching to the level of the front of the pupil; great suborbital leaving a naked area, which is contained, at the angles, 2.5-3.5 times in the width of the bone. The teeth (Fig. 2) are similar to those of *H. regnumi* Gery (1961, Fig. 2 p. 9), but distinctly narrower; the largest mandibular tooth (second or third from the middle) has 6 or 7 cusps, whereas in *regnumi* the upper as well as the lower largest teeth have up to 9 cusps;

TABLE I  
PRINCIPAL PROPORTIONS AND COUNTS OF 8 EX. OF  
*HYPESOBRYCON VILMAE* SP. NOV.

No.	1	2	3 (Type)	4	5	6	7	8
Std. length (mm.)	29.4	28.2	28.0	27.4	26.8	26.7	26.4	26.3
Depth in std. length	3.16	2.93	2.98	3.11	2.94	3.14	3.14	2.96
Head (without mouth) (mm.)	3.82	3.76	3.78	3.91	3.77	3.81	3.88	3.87
Eye (vertical) in head	2.66	2.88	2.74	3.04	2.79	2.69	2.72	2.82
Interorbital in head	3.08	3.26	3.08	3.33	2.86	2.92	3.09	2.96
Maxillary in head	3.21	3.41	3.22	3.33	3.23	3.68	3.09	3.4
Snout (in oblique) in head	4.54	4.69	4.94	5.0	5.07	5.0	4.54	4.86
Snout-dorsal in dorsal-caudal	1.0	1.0	1.0	1.0	0.97	0.98	1.0	1.0
Dorsal	ii, 8, i	ii, 8, i	ii, 8, i	ii, 8, i	ii, 8, i	ii, 8, i	ii, 8, i	ii, 8, i
Anal	iii, 19 (3)	iii, 19 (3)	iii, 19 (3)	iii, 20 (3)	iii, 20 (3)	iii, 19 (3)	iii, 19 (3)	iii, 19 (3)
Scales long	...	(9) 34	(7) 33	(8) 33	?	(8) ?	?	(9) 32
Scales trans.	...	5/4	5/4	6/4	6/4	5/4	?	5/4
Pearl ext. teeth	...	3	2	3	2	3	3-2	2
Pearl int. teeth	...	5	5	5	5	5	5-4	4-5
Max. teeth	...	3	2	2	2	2	2-1	2
Naked zone on cheek in suborbital	...	3	2/1	3/1	3/1	3/1	3	2/1

2 or 3 (rarely 4) quincuspid teeth in the external premaxillary series, 5 (once 4) quincuspid, slightly larger, teeth in the inner row; generally 2 quadrate or quincuspid teeth on maxillary, more rarely one or three; 4 or 5 large frontal mandibular teeth, followed on the sides by about 7 much smaller ones which are tri- or bicuspid. Gill-rakers about 7-8/11-12.

PATTERNS: Like a number of forms, *H. vilmae* sp. nov. has a black longitudinal band on the middle of the sides; unlike some, *heterorhynchus* and *robleri* among others, this band distinctly marks the opercle and postorbitals, being continuous from the eye to the caudal; there is no humeral spot, distant from the band, nor a caudal spot, the band being only very slightly enlarged on the peduncle. In preserved specimens at least (in formalin) the band is conspicuous up to the end of the middle caudal rays. The coloration when living has been described in the introduction.

REMARKS: *H. vilmae* sp. nov. is close to some well-known *Hypessobrycon* species, namely *heterorhynchus*, *robleri* and *regnumi*. It is distinguished by a combination of characters, including the color pattern, which shows no inter-

black. Also, *H. scholzei* has at least 20 or 21 branched anal rays (more, in the original description), the great suborbital almost entire, a shorter head and a shorter maxillary (these last characters do not overlap with the new species).

(b) *H. heterorhabdus* (Fig. 4), also from Belém do Para, is very colorful but the fins are not blue. The band, beginning behind the opercle, is characteristically club-shaped, and ends on the peduncle, being scarcely visible on the caudal fin. It has a more forward dorsal fin, a more elongate body, a longer maxillary, and fewer transverse scales. These characters do not overlap with the new species.

(c) *H. nigromaculatus* (Fig. 5), discovered by Harald Schultz in the lower Tocantins region, has the lateral band expanded on the peduncle, and different coloration. The teeth are different, as well as the position of the dorsal fin, slightly in advance of the middle of the body; it has only 17 or 18 branched anal rays.

(d) Finally a species described as "bluish silvery", and with a conspicuous lateral band to the end of the middle caudal rays, may also be included in this differential diagnosis; it is *H. coelestinus* Myers from the State of Goiás. Judging from its description (not figured), it differs strongly in having only 15 (16?)–16(17?) branched anal rays, a long maxillary with 4–6 narrow teeth, etc. . . .

(e) Differences with other forms may be seen in the following Keys where the species, known to me to have a distinct longitudinal band, have been included. *H. herbertaxelroldi* has also been mentioned, because it could be confused with *nigromaculatus*. *H. aquilus*, *maria*, *paranaense* and *lucorum* have been omitted; they probably belong (with *herbertaxelroldi*?) to another "group," even more difficult than the present one.

**1. KEY TO 10 HYPHESOBRYCON-SPECIES OF THE HETERORHABDUS-LIKE GROUP, BASED ON MERISTICS AND PROPORTIONS:**

- a. Teeth narrow, the broadest tricuspid; great suborbital very large or entire
- b. Maxillary with at least 4 teeth; dorsal fin more or less nearer caudal; great suborbital not quite covering cheek
- c. Depth 3.2–3.5; maxillary more than 3 in the head; anal iii, 24–26; transv. scales 6 or 7/5; only 4 internal pmx. teeth
  - ... *melanopleurus* (State of São Paulo)
  - oc. Depth 2.5–3; maxillary about 2.5 in the head; anal iii, 14 or 15 to 17 or 18; transv. scales probably 6/4; 5 internal pmx. teeth
  - ... *coelestinus* (Goiás)
- bb. One maxillary tooth; dorsal fin in the middle of the body; great suborbital covering entire cheek (depth 2.8–2.9; maxillary more than 3 in the head; anal iii, 16–21; transv. scales 5/4)
  - ... *scholzei* (Venezuela)

\* *H. nigromaculatus* was inadvertently called *nigromaculatus* in the legend of the color slide of my first description (Trop. Fish. Herb., IX (9): 7–13, 1961), and in the legend of Fig. 5 (skull); *H. nigromaculatus* is a common misnomer. In Axelrod, et al., *Exotic Tropical Fishes* (Lancaster Edition, p. F. 344.00), *nigromaculatus* is portrayed on both figures (photos by H. Schultz and by E. Schmidt, erroneously given as being those of *herbertaxelroldi*). The Black Neon Tetra, *Hypseterodon herbertaxelroldi*, is correctly figured page F. 343.00.

aa. Teeth at least quincunspid in the inner pmx. series and in front of dentary; great suborbital variable in size

- d. Dorsal fin in the middle of the body or more or less behind it; broadest teeth (on dentary) generally with 7 cusps; transv. scales 5 or 6/4 or 5
- e. Anal fewer than iii, 17; head heavy; interorbital 2.2–2.5 in head; maxillary very short; dorsal clearly nearer caudal; great suborbital almost entire
- f. Head 3.8–4 in sd. length; eye 3–3.25, interorbital 2.2 and maxillary almost 5 in head; anal iii, 12–14; maxillary without teeth (depth about 3)
  - ... *tanuiceps* (Rio Iguaçu)
  - ff. Head 3.66–3.75 in sd. length; eye 6, interorbital about 2.5 and maxillary more than 4 in head; anal iii, 14–16; one (rarely more or 2) maxillary tooth (depth 2.66–3) (rarely more or 2)
  - ... *poeciloides* (Caura, Colombia)

cc. Anal more than iii, 18; interorbital more than 2.75 in head; maxillary of moderate length; dorsal fin in the middle of the body or very slightly behind (depth about 3 in sd. length)

- e. Head more than 4 in sd. length; maxillary about 4 in head, with 0–2 teeth; anal iii, 20–21 (0); great sub-orbital almost entire
  - ... *scholzei* (Para)
  - gg. Head less than 4 in sd. length; maxillary about 3–3.75 in head, with 2 broad teeth (rarely 1 or 3); anal iii, 19 or 20 (0); great suborbital leaving a naked area on cheek
    - ... *vlanae* sp. nov. (Upper Jurua)
- dd. Dorsal in advance of the middle of the body; transv. sc. 5/3 or 3/1
  - h. Broadest teeth quincunspid; anal iii or iv, 19 (0) or more; great suborbital leaving a naked area on cheek
    - l. Depth 3.15–3.6 in sd. length; maxillary 2.8–3.1 in head
      - ... *heterorhabdus* (middle and lower Amazon)
      - ll. Depth 2.9–3.2; maxillary 3.4–3.5 in head
        - ... *herbertaxelroldi* (Mato Grosso)
    - hh. Broadest teeth with 9 cusps; anal iii or iv, 17–18(3); great suborbital almost covering cheek (depth 2.5–3.1; maxillary short, 3.5–4 in head)
      - ... *stegmanni* (lower Tocantins)

**2. KEY TO THE SAME SPECIES BASED ON COLOR PATTERN: SPECIES WITH A DARK, BLACK OR BLUE LATERAL STRIPE ALONG MIDAXIS, EXTENDING AT LEAST FROM BACK OF HEAD TO END OF PEDUNCLE.**

- a. A humeral spot, more or less distinct from the lateral band, which extends to the tip of middle caudal rays
  - b. Humeral spot vertically elongate
    - ... *poeciloides* and *coelestinus*
  - bb. Humeral spot horizontal (lower part of peduncle dark)
    - ... *herbertaxelroldi*



3b. The white streak along middorsal line begins in interorbital space and then continues as in 3a.

*perideraion*

2b. Dorsal spines longer than width of interorbital space; the white streak on back occurs only along base of dorsal fin.

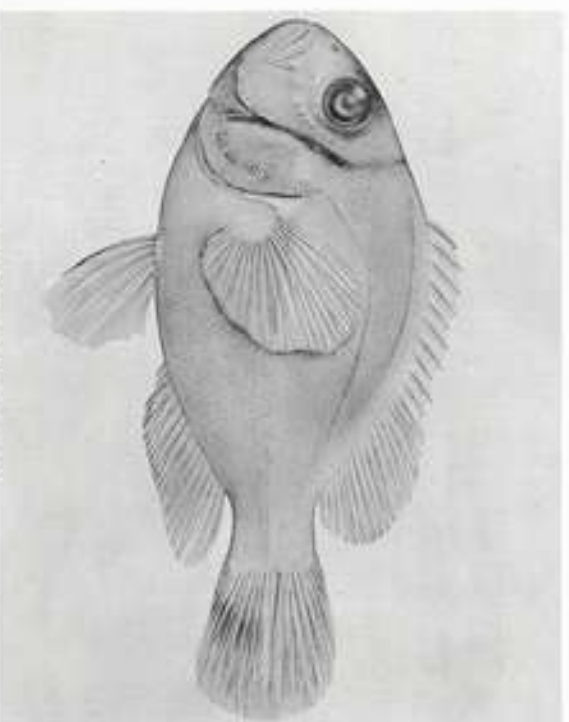
*calliops*, new species

*Amphiprion calliops*, new species

Holotype: USNM 197554, collected in the Indian Ocean (exact locality not known) by Dr. Wolfgang Klausewitz, standard length, 37 mm.

Paratypes: USNM 236481-F1, taken with holotype and bearing same data, 6 specimens, 30 to 42 mm in standard length. USNM 82781, collected by the Wilkes Expedition in the Fiji Islands, standard length, 70 mm.

Description: Counts are recorded in table 1 for the new species, and for the related species, *A. akallopis* Bleeker and *A. perideraion* Bleeker. Certain



*Amphiprion calliops*, new species.

TABLE 1. Counts recorded for three species of *Amphiprion*

	Dorsal rays			Anal rays			Pectoral rays								
	IX	X	XI	12	12	13	14	15	16	17	18	19			
<i>calliops</i> , new species	-	6	2	2	3	3	3	-	2	5	1	-	1	3	3
<i>akallopis</i>	4	2	-	1	1	4	5	4	2	-	-	-	7	4	-
<i>perideraion</i>	1	7	-	7	1	-	3	6	-	-	-	-	2	11	-

measurements expressed in thousands of the standard length are recorded in table 2. These data for length of dorsal spines are summarized in table 3 as frequency distributions, which upon examination indicates consistently longer first, second, fourth, next to last, and last dorsal spines for *calliops* than occurs in *akallopis* and *perideraion*.

Teeth in both jaws in a single row, conical basally, becoming a little inchiselike near tips; interorbital space scaled forward to a line crossing front margin of eyes; in the large specimen from Fiji the interorbital is scaled forward to middle of interorbital space; suborbital, preopercle, opercle, and subopercle strongly denticulate in the longest specimens, but in the two smallest, the edge of the preopercle is smooth, and the suborbital has only a single small spine; apparently the suborbital, preorbital, and preopercle become more spatulate with increase in size; gill rakers 5 or 6 + 9 or 10; median fins scaled out from their bases a distance of about 1 to 1.5 their length; lateral line ends opposite a few scales before rear of dorsal fin base; pores in peduncular lateral line obscure and on about every other scale row.

Color in alcohol: Prone light tan with a dark bar beginning at middorsal line almost an eye diameter in front of dorsal origin, and passing behind orbit thence ventrally along preopercular edge and on front of opercle, ending at notch between opercle and subopercle; the greatest width of this bar is about equal to the distance between front of eye and nostril; this color bar is prominent on the two smaller specimens, but indistinct on the larger ones; a pale band occurs along base of dorsal fin on the large specimens but is less distinct on the small ones; outer pelvic ray just beyond tip of spine has a fine black line; although the middle of the side is somewhat pale below the dark lateral line, this light area may be caused by preservation.

Remarks: The new species differs in regard to the broad white band (in alcohol) that begins on the snout tip of *akallopis* and continues along the middorsal line and base of dorsal fin to rear of dorsal edge of caudal peduncle, whereas in *perideraion* it begins in the interorbital space and in *calliops* at the dorsal origin. All three species have the bar across head just behind the orbit, but this is most prominent in *perideraion*.

TABLE 2. Measurements expressed in thousandths of the standard length for three species of *Amphiprion*

USNM Number	Holotype 197554	<i>sullips</i>					<i>akalops</i>					<i>pendulum</i>										
		Paratypes 236481-17					82761	147130	160664	160663	197014	147129	160298	160297	168214	168215	141032	141033	199403			
Standard length in mm.	37	39.7	35	31	42	30	38	70	64	55	44	48	35	55.5	43.5	47.5	53.5	44.5	55.3	39.5	22.5	31
Greatest depth of body...	489	517	477	500	504	460	499	490	436	478	436	458	430	467	483	498	458	453	466	454	470	451
Length of head ...	292	303	312	342	312	284	308	329	282	293	307	313	308	289	317	312	318	313	298	309	324	310
Snout ...	95	91	100	91	100	93	103	103	91	89	95	87	77	95	87	92	97	110	98	96	71	94
Eye diameter ...	86	88	94	94	90	97	97	90	67	76	82	83	100	76	92	80	92	81	81	91	107	94
Least preorbital width...	35	43	29	29	36	27	50	47	44	51	39	33	34	36	37	34	41	40	20	33	22	29
Snout tip to rear of maxillary ...	103	103	109	100	107	110	118	107	94	104	92	92	94	108	108	109	112	110	105	111	107	94
Least width of interorbital	86	93	89	91	95	83	92	90	78	80	73	75	63	86	92	99	93	102	94	91	102	97
Eye to lower preper- cular edge ...	119	131	129	126	140	117	129	144	138	145	134	137	123	132	138	128	131	132	134	127	116	110
Least depth caudal pe- duncle ...	151	146	89	161	162	147	150	153	166	173	182	183	177	179	177	154	172	155	172	165	187	181
Length of caudal peduncle	121	111	111	116	155	140	105	100	133	142	161	129	146	137	156	147	155	147	145	132	164	139
Longest fin ray of:																						
Pectoral ...	289	260	280	310	276	297	297	242	253	240	237	—	—	242	246	267	250	231	257	233	209	—
Pelvic ...	314	285	315	304	270	300	290	275	205	182	216	—	—	209	221	227	220	202	232	220	178	197
Caudal ...	354	303	317	336	264	—	300	—	—	266	300	337	—	292	322	316	286	275	298	299	284	—
Soft dorsal ...	200	194	226	219	210	193	184	181	153	164	175	—	—	150	—	175	159	158	163	139	129	—
Soft anal ...	197	181	200	184	181	177	192	184	166	151	141	—	—	123	—	143	144	121	132	129	—	132
Length of fin spine:																						
First anal ...	54	58	60	45	52	40	58	63	50	38	36	46	43	36	55	48	54	48	47	48	31	39
Second anal ...	92	123	129	103	119	120	116	129	92	75	89	90	77	74	106	95	97	90	92	81	71	—
First dorsal ...	100	101	109	113	95	100	103	97	75	49	57	69	69	47	60	69	49	67	51	73	44	26
Second dorsal ...	122	131	114	123	112	117	129	—	—	97	73	66	87	94	106	105	93	99	98	103	71	61
Fourth dorsal ...	146	156	154	135	124	133	137	131	102	96	99	108	100	94	69	97	75	124	121	111	71	84
Next to last dorsal ...	143	123	143	135	131	117	134	—	—	86	85	64	85	74	61	85	92	75	90	96	71	48
Last dorsal ...	160	126	143	135	140	127	137	126	94	80	64	87	77	67	110	133	114	78	63	81	44	58

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*Amphiprion pendulum*. Photo by Dr. Herbert E. Auerbach.

February, 1966

TABLE 3. Frequency distributions of dorsal spine lengths of data taken from Table 2

From dorsal spine	Thousandths of the standard length																			
	21	21	41	41	61	61	81	81	101	101	121	121	141	141	161	161	181	181	201	201
<i>sullips</i> ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>akalops</i> ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>pendulum</i> ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Second dorsal spine	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Fourth dorsal spine	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Next to last dorsal spine	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Last dorsal spine	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

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The best character for distinguishing *calliops* from *abdolipis* and *peridrom*, its closest relatives, is the longer dorsal spines in the new species (table 3); the dorsal spines are so much longer than in the other two species that no overlap occurs in the frequency distributions. Consistently the dorsal spines of *calliops* are longer than the width of the interorbital space, whereas in *abdolipis* and *peridrom* those spines are shorter than the interorbital space.

This new species is named *calliops* in reference to the beautiful appearance of the various species of the genus *Ampelisca* of which this is a member.

## Useful New Publication On Fish Anaesthesia\*

J. W. AIR  
American Museum of Natural History  
Central Park West and 77th Street  
New York City, N. Y.

An extremely handy pamphlet on substances that anestheticize fish has recently been made available by the Fisheries Research Board of Canada. It was written by Gordon R. Bell of the Biological Station at Nanaimo and is entitled "A Guide to the Properties, Characteristics, and Uses of Some General Anesthetics for Fish." It was published as the Board's BULLETIN NO. 148 with the date of 1964. In one great table, 24 by 16 inches, it lists the properties, dosage, special precautions, source of supply, cost, and toxicity (to both man and fish) of eleven chemicals, including M.S. 222, quinaldine, and tertiary amyl alcohol. The four-page pamphlet can be purchased from Canadian Government Bookshops, which are located in the Daily Building, Corner Macdennie and Rideau, Ottawa, in the Macdennie Building, 36 Adelaide Street East, Toronto, and in the Aeterna-Vie Building, 1182 St. Catherine Street West, Montreal. The cost is fifty cents and remittance should accompany your order.

\* This notice appeared originally in *The Drom and Croaker*, Vol. LXV, No. 2.

## The West African Rivulin, *Epiplatys dageti* Poll, 1953

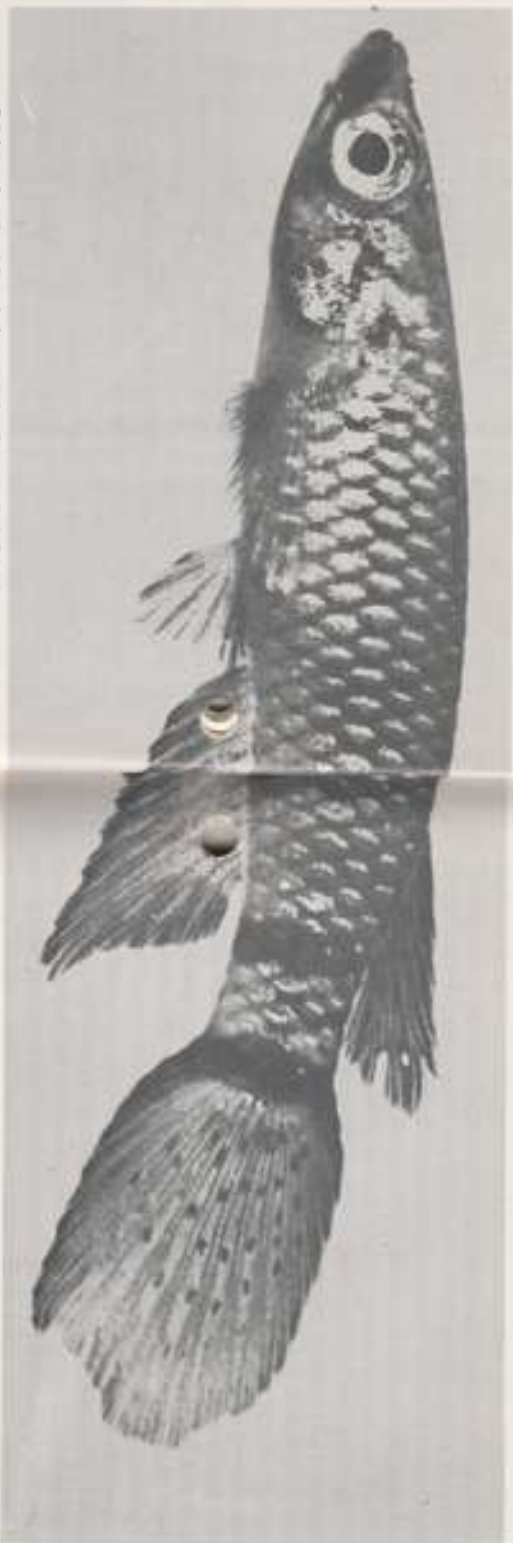
H. STENHOFT CLAUSEN, J. J. SCHERL  
Ahrhøjen 95 - Virum  
Denmark

*Epiplatys dageti* has been known to aquarists since 1908, almost 50 years before it received its present name. Up to 1964, this aquarium fish was considered *Epiplatys chaperti* (Sauvage), a rather similar species which has been kept as an aquarium fish under the name *Epiplatys shufeldti* Poll since 1953. At the present time, *Epiplatys dageti* is divided into two subspecies, inhabiting different areas of the Guinean coast: *E. dageti mwaniorae* Daget and Arnould (1964) comes from southwest Liberia and is the subspecies we have kept in our tanks since 1908. *Epiplatys dageti dageti* Poll comes from southeast Ghana. The two subspecies differ in color pattern only.

*E. dageti dageti* was first discovered in a small pool near Port Bouet by Siedlitzko in 1952. This locality is situated on a long and narrow island which extends along the coast and is covered by a subtropical forest. The biotope where the species was discovered probably differs from most other forest biotopes on the mainland. Siedlitzko considered his findings as juveniles of *E. dageti*, which were well known to him, and considered the individuals too small for shipment to Werner of Munich. He searched for the species on the mainland but did not find it in other localities. E. Roloff of Karlsruhe received some of the Port Bouet specimens which were sold as aquarium fishes. As an expert on rivulins, he soon discovered that this species was not identical with "*E. chaperti*" and sent live and preserved individuals to Poll of the Congo Museum for identification. Poll found himself in agreement with Roloff and described the Port Bouet *Epiplatys* as *E. dageti*. As this new fish was not at all a beauty, it soon disappeared from the aquarium trade even though it was not difficult to keep and breed.

In 1962, Stenhoft Clausen discovered this subspecies at Awiecho in southwest Ghana. He sent home live individuals from which we raised a new aquarium strain of this subspecies. The Awiecho population was found in a swamp close to the coast and apparently this biotope does not differ much from that at Port Bouet. Only a few *E. chaperti mwaniorae* were found in the swamp at Awiecho.

*E. dageti mwaniorae* arrived in a shipment of aquarium fish from West Africa on January 13, 1908. Amateur zoologist J. P. Arnold inspected the collection



*Epiplatys dagarti*, adult male from Amazon. Photo by J. J. Schoel.

soon after arrival and found that it contained two different species of tetras. He considered most to be "*zebrinus*-like," but among these he discovered three very small individuals which belonged to a species which was unknown to him. He purchased these three and a pair of the cross-banded species and

the remainder were sold to a breeder who soon lost them all. The three small individuals were raised in Arnold's tanks and matured as females. One soon died and another was preserved and sent to Boulenger of London for identification. On May 23, 1908, Boulenger informed Arnold that these two fish



In foreground, adult Amazon tetra; in background, adult male of *Matozonia strabus*.

Inset position to show relative size. Photo by J. J. Schoel.

belonged to a new species which he was about to describe as *Hoplocheilichthys liberensis*. We will reconsider this species later in this article.

Because Arnold was not able to identify the cross-banded species, he sent one preserved individual to Boulenger for identification. These were identified as *Hoplocheilichthys chepseri* Sauvage. Arnold was not satisfied with the identification, as he did not find agreement between the color pattern in his fish and that of Sauvage's description. After some protest Arnold suppressed his doubt and distributed his aquarium strain as *H. chepseri*. There were numerous offspring from Arnold's fish, and the new species soon established itself among German aquarists as a popular aquarium fish. Probably all individuals of *E. dagerei monroviae* kept by aquarists up to 1963 originated from Arnold's pair.

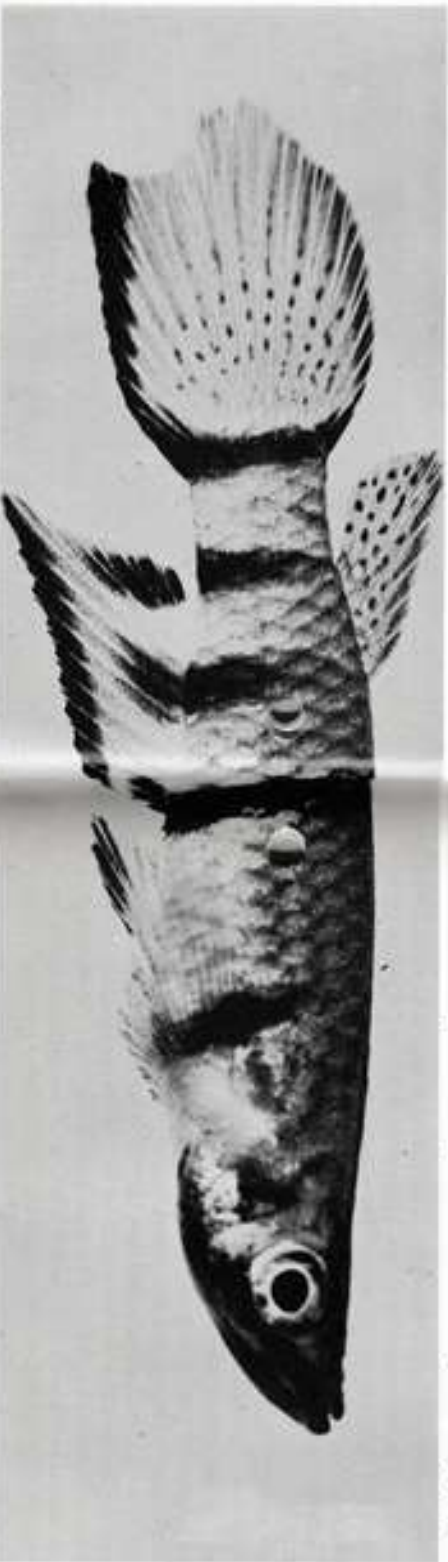
Because of Boulenger's identification of Arnold's cross-banded *Egyphtilys* as *E. chepseri*, the characteristics of the latter species became a mixture of traits from both species in zoological and aquarium literature. For this reason it is impossible to know to which species zoological reports pertain after that time. Both species are sympatric in southwest Ghana and the southeast Ivory Coast at least. The collections in the British Museum up to 1915, contained no individuals of *E. dagerei* from Ghana. There are numerous individuals belonging to *E. chepseri* of different forms in the Museum, but these individuals were all identified as belonging to *E. seiffersiana*. We have not seen the various collections of "*E. chepseri*" in the Paris Museum, but probably these fish are also not *E. dagerei*.

According to Arnold, the collection from which he bought his pair of *E. dagerei monroviae* originated from Monrovia in Liberia. In his catalogue of

1915, however, Boulenger wrote that these fishes came from Sierra Leone. As Boulenger, on the other hand, gave "Monrovia" as the type locality for his *H. calliana*, whereas Arnold with much doubt said that this shipment came from "fresh water pools of Sierra Leone," Boulenger's localities of these two species are probably wrong, because he had all his information and material concerning these species from Arnold.

"*Egyphtilys chepseri*" was reported by Schultz in 1942, from Monrovia, the port of Liberia, and by Osset in 1928, from Gran Bassa of Liberia. In order to clear up the true origin of the old aquarium strain, Steinhilf Clausen collected freshwater fish around Monrovia in 1965. He found *E. dagerei monroviae* to be very common in this area and sent home individuals which proved to be exactly like the old aquarium strain, except for size. It is known, however, that Arnold's original fish were small. According to Daget and Arnold, the two fish which Arnold originally bought measured 30 and 33 mm without caudal, whereas the largest of their offspring in the British Museum measures 38 mm without caudal. Adult individuals of the present aquarium strain grow bigger than that. We found no difference in the color patterns.

Clausen found that *E. dagerei monroviae* was the most common rivulin in the so-called "coastal savanna" north of Monrovia. This area is not a true savanna and indeed the reason for the poor vegetation, of rain forest type, may be found in the poor drainage of this very wet area. This together with the influence of man and the very poor soil has produced a "savanna-like" landscape. Clausen also found *E. annulatus*, a derivative of *E. seiffersiana*, and a derivative of *E. mysicinus*. Together with these four species of *Egyphtilys*, he



*Epyphtilys dagerei monroviae* male from Monrovia. Photo by J. J. Schell.

found only a single species of *Aphyosemion*, the form known under *A. calabaricum* Ahl since 1935-36. As these individuals were living in the same biotope as *E. dageti monroviae*, we may say that the individuals on which Boulenger based his *H. liberiensis* were similar to those which Clausen caught in 1965. The data which Boulenger published for *H. liberiensis* corresponds sufficiently to that for *A. calabaricum*, which then should be considered a synonym of *A. liberiensis* (Boulenger).

For the Awiebo strain, Clausen noted: Small brook in rain-forest area, water lilies and *Utricularia*, on tertiary sediments, conductivity is 27 reciprocal megohms, very acid water of low salinity.

In 1963, Bruce Turner sent us some live so-called "wild *chapters*" which had been imported from Africa. This form belongs to *E. dageti monroviae* Arnold and Daget, but it also differs from that form in the development of the black bars on the body sides. In our strain of Turner's form, it was found that one-third developed no black bar above the root of the ventral fins (V-bar) as in *Monrovia* strains, one-third developed such a bar on one side of the body, and one-third developed it on both sides. In this strain, many, particularly females, developed additional dark bars between the ordinary black bars. These additional bars develop high on the sides and are often only oblong dark spots. From a *Monrovia* male crossed with a Turner female 20 fish were raised and preserved: 16 with no V-bar, 4 with it on either side, and none with the bar on both sides. From the F<sub>1</sub> generation 13 F<sub>2</sub> individuals were raised: 12 with no V-bar and 1 with the bar on both sides. A Turner male crossed with a *Monrovia* female resulted in only one fish, a male with bars on both sides. No decrease in viability or fertility was noticed in the hybrids.

In our opinion, V-bars never occur in the *Monrovia* population of *E. dageti*. Our 12 individuals caught in nature do not show this bar, nor have we seen any report or picture of "E. *chapters*" showing this marking. Arnold pictured his breeding pair in 1908, with no V-bar. In both the Turner and *Monrovia* strain there is always a black bar behind the pectoral fins (P-bar) and four such bars rather evenly distributed between the first anal fin ray and the root of the caudal fin. In *E. dageti dageti* Poll, V-bars occur frequently in both sexes and additional black bars are often seen on females. These additional bars do not differ from the ordinary bars seen on Turner's strain and this means that in development of black bars on body sides the Turner strain comes closest to *E. dageti dageti*. The black pattern in the male's fins is similar in all forms. In the eastern populations, the black edging in the anal and lower caudal is reduced, and the development of the short sword in the caudal is less pronounced or even absent. The black pattern in females differs; in the eastern strain there is a very marked black line in the anal fin and a short distance from its root. In the western strains this marking is not easily seen or absent.

Daget and Arnold separated the two subspecies of *E. dageti* Poll by differ-

ences in color pattern only. In *E. d. monroviae*, the male develops a red or orange throat marking, and the black bars on the body sides are broader and more marked. In *E. d. dageti*, there is no orange marking on the throat. In our opinion, the differences in size and saturation of the black bars is not very conspicuous when the two subspecies are compared, and the red pattern is probably more important. If the area of red pigmentation is studied under the microscope, no normal cells for red pigment are found. Instead of chromatophores, the tissue appears to be stained with red or orange pigment in a very even manner. After preservation this color soon disappears, whereas the red pigments on the body sides remain unchanged in alcohol. If males of the Awiebo strain of *E. d. dageti* are preserved in alcohol a very conspicuous lemon color appears on the throat, covering just the area which is orange or red in the *Monrovia* male. This lemon color is also evenly distributed and not stored in chromatophores. It disappears completely after some time. In our opinion, the orange-red pigmentation seen in the *Monrovia* strain corresponds to the lemon color seen in the preserved males of the Awiebo strain. The conspicuous color in the preserved Awiebo strain is not at all unique to *E. dageti*; it frequently occurs in males of *Aphyosemion*, *Epilabus*, and even *Aphochelichthys* when preserved. The marking is seen mostly on the males, but occurs in some females less conspicuously. In *E. dageti* and *E. chaptali* the preserved males also develop a characteristic red-violet pigmentation of the same type as the throat marking, which soon disappears.

A Turner male was crossed to an Awiebo female, and the resulting males did not develop a red-orange throat marking in life, and the few F<sub>2</sub> males also did not develop any red-orange marking. The Turner male was backcrossed to one of the F<sub>1</sub> females, but the offspring were all females. The color pattern on the males' throats in the *Monrovia* and Turner strains is probably used by the fish for the identification of the species and to sex the approaching individuals. For this reason the black throat pattern on both the males and females does not need to differ, however, a few females of the *Monrovia* strain (nature caught) develop a small black marking in the central part of the throat and in the line between the corners of the mouth. Most females of the *Monrovia* strain do not develop this marking. In the Awiebo strain the lack of a red-orange pigmentation in the throat requires that identification within this species should be produced in a different way. In the male a very weak pinkish color may be visible in life, but the black throat pattern corresponds to the dark pattern described for a few females of the *Monrovia* strain. There is a black marking in the center of the throat and a line between the corners of the mouth. This marking is not present on a single male of the Port Hout strain which we had from the Congo Museum. In the Awiebo female the central black marking differs from that of the male in that there is a more or less complete dark band between the corners of the mouth and a less marked lateral line in the center of the throat. The difference in the throat patterns



Throat patterns of *Epipeltys dageti* Foll. Both male (above) and female (below) from Port Bouet of Ivory Coast. Photos by J. J. Scheel.

of the males and females is conspicuous.

The basic dark pattern of the throat in *E. dageti* is composed of two distinct black lateral lines which may or may not join in or behind the lower lip. This pattern is unique in *Epipeltys* and separates this species from all other members of this group of rivulines. The crossbar found in the Awiebo female belongs to the general type of dark pattern found in *Epipeltys*. The distinct differences in the throat pattern of the two sexes found in all natural strains decomposes in the Turner/Awiebo hybrids. Indeed it is still possible to

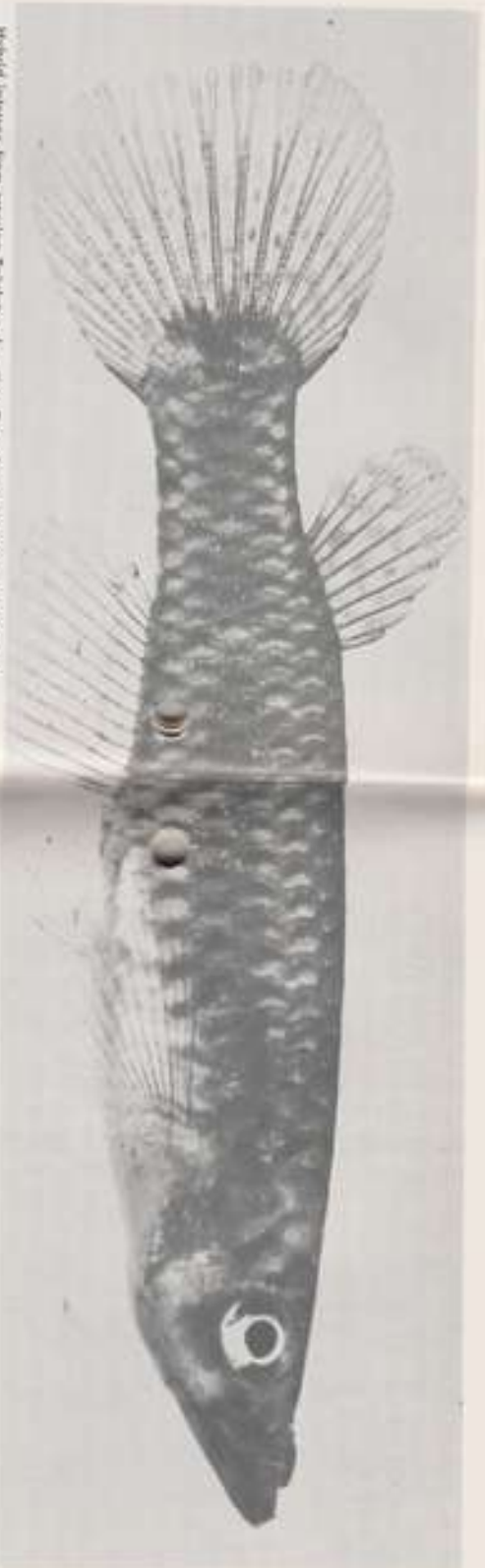
distinguish between the males and females, but the differences in the black patterns are less marked. In all strains the pattern of red on the males' body sides is a rather regular reticulation, and no tendency for the development of rounded red spots is seen.

From information on the choice of biotope, it appears that *E. dageti* is a swamp living species which corresponds to *E. grahami* of Nigeria. In the southeast Ivory Coast and southwest Ghana, *E. dageti* is sympatric with *E. chaperti* *obé* and *E. grahami* in its area is sympatric with *E. seyfasciatus*. Apparently *E. chaperti* and *E. seyfasciatus* are close relatives as are *E. dageti* and *E. grahami*. The western strains of *E. dageti* share their biotope with *A. fiberianus* and the eastern strains with *A. petersi*, whereas *E. grahami* is found with *A. collinum* and other aphyosemonids. Eleven different crossings between individuals of *E. dageti* have been studied with results that are surprising and different from other crossings within Old-World rivulines. Generally crossings between apparently closely related species in Rivulinae produce viable hybrids that are in most cases sterile. Crossings between apparently not closely related species are not viable and die in eggs or soon after hatching.

In crossings of *E. dageti* to individuals in species of *Epipeltys*, *Aphyosemon*, and *Aplocheilichthys*, we had rather similar results. The hybrids were not viable. The results of *Epipeltys* crossings were not markedly different from those of *Aphyosemon* and *Aplocheilichthys*, or, in other words, the results of crossing within *Epipeltys* were below what was expected, and the results of crossing to the two other genera were above the expected viability. Only the crossing between the Monrovia male and *E. grahami* female gave the expected results: hybrids rather viable and raisable. They were intercrosses with female behavior and male-like appearance. As the two species differ markedly in the development of the red pattern on the body sides, we expected that the combination of genes for red reticulation and those for perfectly rounded red spots would produce crescent shaped red spots, and they did along with intermediate throat patterns.

Dark lateral bands do not develop on females of *dageti* or *grahami* during normal display, but traces might be visible sometimes on *grahami*. When females of *E. dageti* are used for crossings and the male will not spawn with that female, she may develop a very irregular dark lateral band. Within *Epipeltys* this conspicuous band is used by females to invite spawning or when scared; the hybrids developed a broad and very conspicuous lateral band during display, but they never spawned and probably were unable to produce eggs.

All other crossings gave hybrids which were not viable. Two crossings of *E. seyfasciatus* resulted in but two hybrids which were raised to adult size: one from *E. dageti* male to *E. seyfasciatus* female, and the other from the reciprocal cross. In both we had numerous eggs which were unable to produce



Hybrid larvae from crossing *Epiplatys dogaki* to *E. gabekli*. Photo by L. J. Schaal.

a viable embryo, and the embryos died in the eggs from various abnormalities. Both hybrid fish were very difficult to raise to adult size and grew very slowly. They suffered from various diseases. Both appeared to be males in the development of color and behavior and were sterile in a backcross. There was no black pattern of bars on the central part of the body; instead a very broad

and diffuse dark lateral band was visible during display. Hybrids developed in eggs from *dogeri* male to *E. macrogona* female but died after hatching. *E. dogeri* was crossed to *E. chapevi chapevi*, *Aphichthys dimorpha*, *Aphichthys dimorpha*, *A. cognatum*, and *A. petrosi* with similar results. Embryos developed rather promisingly during the first week, and a working blood system could



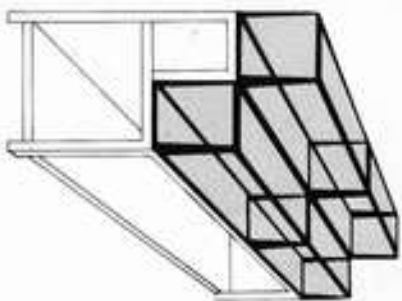
Hybrid male from crossing *Epiplatys macrogona* to *E. dogaki*. Photo by L. J. Schaal.



be seen, but all hybrids died in the eggs before they could reach full development. The cause of the breakdown in the hybrids was found in the blood systems, but deformations in the body with *A. ogunnon* were also noticed. *E. dageri* were also crossed to *E. myfasciatus* and *E. fasciatus*, and here the hybrids died early in development with no blood system development. With *A. auratus* the fertile eggs were not even able to develop a corda.

The results of the crossings indicate that *E. grahami* of Nigeria is the closest relative to *E. dageri*, differing only in color pattern. If the shape of the head, the egg type, the hemoglobin pattern, and the choice of biotope are considered, these two species come very close to each other. Apparently *E. amulianus* will prove to be another close relative. The affinities to other species in *Epplatys* are obscure. Probably *E. dageri* is related to *E. scyfaianus* through *E. chapeiri*, but this relationship is not very close. Apparently *E. dageri* has complexes of genes which are able to cooperate with gene systems in *Aphlocheilichthys*, *Aphyosemion*, and *Epipolans* in a better way than usual in crossings between members of different genera. This may indicate that *E. dageri* still contains important genes of the ancient gene combination in Old-World rivulins. The red reticulation on the body sides of the male is an ancient pattern less specialized than the various patterns of red dots found in most species of the Old-World rivulins. The throat pattern, on the other hand, is highly specialized when compared with other rivulins. The egg is small (1.0 to 1.1 mm), transparent and colorless. The membrane pattern has no trace of reticulation. Its characteristics correspond to the egg from *E. amulianus* (0.95 mm), *E. grahami*, and, as we have seen, the differences in the two subspecies of *E. dageri* can be based on the differences in the red pigmentation of the throat patterns only. The individuals from the two crossings did not show a decrease in viability nor in fertility. The separation of the two subspecies then should be based on the geographical separation. However, it is likely that populations of *E. dageri* exist all along the coast between Monrovia and Awitcho and, as we have seen in the black pattern of Turner's form, intermediate forms do occur. Until these populations have been studied in detail, the division between the two subspecies should be maintained.

It is worth some consideration that *E. dageri* is more easily kept and bred in the aquarium than such species as *E. chapeiri* and *E. scyfaianus*. *E. dageri* breeds successfully under very different conditions in the aquarium and in different types of water. *E. chapeiri* is much more specialized in these respects. However, in nature *E. dageri* is probably restricted to certain types of swamps while *E. chapeiri* is found in all biotopes of the rain forest and the derived savanna. This indicates that it is not the needs for reproduction which restrict *E. dageri* to live in the swamp, but probably this species has been forced into this biotope by the larger *E. chapeiri*, which, because of its more specialized needs for reproduction, has not been able to eliminate *E. dageri* from the swamps. The same might be true for *E. grahami* versus *E. scyfaianus*.



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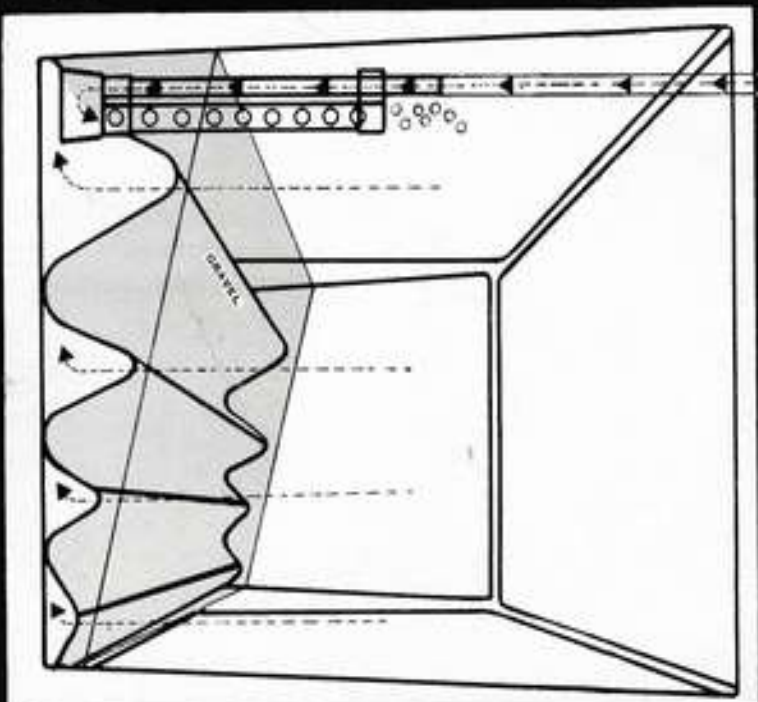
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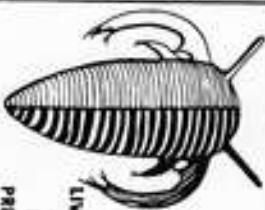
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