

Revision of the Western Atlantic  
Clingfishes of the Genus *Tomicodon*  
(Gobiesocidae), with Descriptions  
of Five New Species

JEFFREY T. WILLIAMS  
and  
JAMES C. TYLER

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SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 621

Revision of the Western Atlantic Clingfishes  
of the Genus *Tomicodon* (Gobiesocidae),  
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Smithsonian Contributions and Studies Series

AN IMPRINT OF SMITHSONIAN BOOKS

Washington, D.C.

2003

## ABSTRACT

Williams, Jeffrey T., and James C. Tyler. Revision of the Western Atlantic Clingfishes of the Genus *Tomicodon* (Gobiesocidae), with Descriptions of Five New Species. *Smithsonian Contributions to Zoology*, number 621, 26 pages, 13 figures, 1 table, 2003.—Extensive collecting efforts involving rotenone sampling throughout the Caribbean Sea during the last four decades have vastly increased the numbers of specimens of cryptic fishes in museum collections. Among such collections containing clingfishes of the genus *Tomicodon* Brisout de Barneville taken by ourselves and others, we have discovered numerous Caribbean species of *Tomicodon* in addition to those recognized by W.F. Smith-Vaniz in 1968 (*T. fasciatus* (Peters, 1859) and *T. rhabdotus* Smith-Vaniz, 1968). We recognize herein eight more species: three for which names are available—*T. rupestris* (Poey, 1860), *T. australis* Briggs, 1955, and *T. reitzae* Briggs, 2001 (the last erroneously described as a species from the eastern Pacific Ocean); and five species described as new herein—*T. briggsi*, *T. clarkei*, *T. cryptus*, *T. lavettsmithi*, and *T. leurodiscus*.

OFFICIAL PUBLICATION DATE is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, *Annals of the Smithsonian Institution*. SERIES COVER DESIGN: The coral *Montastrea cavernosa* (Linnaeus).

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### Library of Congress Cataloging-in-Publication Data

Williams, Jeffrey T.

Revision of the western Atlantic clingfishes of the genus *Tomicodon* (Gobiesocidae), with descriptions of five new species / Jeffrey T. Williams and James C. Tyler.

p. cm. — (Smithsonian contributions to zoology ; no. 621)

Includes bibliographical references (p. ).

I. *Tomicodon*. I. Tyler, James C., 1935– II. Title. III. Series.

QL1.S54 no. 621

[QL638.G6]

590 s—dc21

[597'.62]

2003054263

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# Revision of the Western Atlantic Clingfishes of the Genus *Tomicodon* (Gobiesocidae), with Descriptions of Five New Species

*Jeffrey T. Williams and James C. Tyler*

## Introduction

Cryptic fishes, those that are hidden from view, are a major component of the shallow-water, tropical marine shorefish fauna around the world, but most are rarely seen in life. Our knowledge of cryptic fishes is based primarily upon specimens obtained through rotenone sampling. Collecting efforts by researchers using rotenone in the Caribbean Sea during the last four decades have vastly increased the numbers of specimens of cryptic fishes in museum collections. The clingfish genus *Tomicodon* Brisout de Barneville, 1846, is an example of a group for which many more preserved specimens have become available for study. Although individuals of *Tomicodon* rarely are seen in life, they are relatively common in rotenone collections from shallow, rocky surge zones. In addition to surge zones, three records of *Tomicodon* indicate they occur in other habitats as well. Szelistowski (1990) recorded a Pacific species that occurred on mangrove roots. Mejia et al. (1994) discussed the occurrence of *T. fasciatus* (Peters, 1859) associated with mixed sea grass and calcareous rubble/shell habitats from the Caribbean coast of Colombia. We report herein the occurrence of *T. clarkei*, new species, in a hole in a branch of *Acropora* coral and *T. lavettsmithi*, new species, in mangrove roots and in coral rubble, both from cays off Belize.

Peters (1859) described the first clingfish, *Arbacia fasciatus*, from the Atlantic Ocean. Prior to 1955, the generic name *Arbacia* Jordan and Evermann was used for most of the few clingfishes then known from the Pacific Ocean and for the single species then known from the Atlantic Ocean. In Briggs'

(1955) monographic revision of the Gobiesocidae, the generic name *Arbacia* was considered a junior synonym of *Tomicodon* Brisout de Barneville, 1846, which then came into common usage. Briggs (1955) also listed two species names (*A. minuta* Meek and Hildebrand, 1928, and *Gobiesox rupestris* Poey, 1860) as junior synonyms of *T. fasciatus*, and he described a new subspecies (*T. fasciatus australis*) from Brazil. In 1968, Smith-Vaniz described a new species, *T. rhabdotus*, from the Lesser Antilles. Subsequently, Briggs (2001:745) described the new species *T. reitzae*, and in so doing he gave the locality of the holotype and only known specimen as the "Pacific coast of Colombia," but the latitude and longitude he gave for the type locality, Isla Grande, places it in the Caribbean Sea off the coast of Colombia near Cartagena. Thus, based upon the literature available at that time, three species and two subspecies were recognized from the western Atlantic Ocean and 12 species were recognized from the eastern Pacific Ocean.

Our collections taken at Belize, Tobago, and Navassa Island (a territory of the United States between Haiti and Jamaica) contained specimens of *Tomicodon* that were not identifiable as any of the three recognized western Atlantic species (*T. fasciatus*, *T. rhabdotus*, *T. reitzae*) or two subspecies (*T. f. australis*, *T. f. fasciatus*). Our efforts to determine their specific identities led us to conclude that the specimens from these three localities represent four undescribed taxa. Furthermore, our examination of comparative specimens in collections from the Caribbean Sea and southwestern Atlantic Ocean revealed one additional new species and the two previously unrecognized nominal taxa among specimens previously identified as the supposedly common and widespread *T. fasciatus*.

Of the six nominal Caribbean *Tomicodon* taxa, we recognize *T. rupestris* (Poey, 1860) and *T. australis* Briggs, 1955, as valid species in addition to *T. fasciatus*, *T. reitzae*, and *T. rhabdotus*. *Arbacia minuta* is retained as a junior synonym of *T. fasciatus*.

We redescribe *T. reitzae* on the basis of numerous specimens in collections from the Bahamas, the Antilles, and the northern coast of South America. We describe five species as new (*T.*

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*Jeffrey T. Williams, Department of Systematic Biology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560-0159. James C. Tyler, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560-0106, USA.*

*Reviewers: Carole C. Baldwin and Stanley H. Weitzman, Department of Systematic Biology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, USA.*

*briggsi*, *T. clarkei*, *T. cryptus*, *T. lavettsmithi*, and *T. leurodis-*  
*cus*), bringing the total number of valid western Atlantic spe-  
cies of *Tomicodon* to 10. An analysis of the phylogenetic rela-  
tionships among the species of *Tomicodon* must await a  
comprehensive study of all 22 *Tomicodon* taxa, including the  
12 from the eastern Pacific Ocean.

#### METHODS

Methodology and terminology follow Briggs (1955), with  
the following exceptions and clarifications. All available local-  
ity data are given for specimens of the new species and for  
those used in our redescription of *T. reitzae*; abbreviated data  
are given for other taxa. All of our counts of vertical fin-ray  
elements were taken from radiographs, whereas Briggs' (1955)  
counts were taken by external examination of specimens. We  
found it difficult to obtain accurate counts by external exami-  
nation alone.

Counts of pectoral-fin rays include the rudimentary upper-  
most ray, which is often slender and inconspicuous. Pectoral-  
fin elements are difficult to discern, and it requires diligence to  
obtain accurate counts. The ventralmost rays are obscured by a  
membrane from the pelvic disk attaching to the basal region of  
the pectoral fin at about the level of the third or fourth ventral-  
most ray.

The relative positions of the dorsal- and anal-fin origins were  
taken from radiographs, as were vertebral and associated  
counts. The first element of the dorsal fin and the first of the  
anal fin are reduced and hidden by fleshy tissue; thus, they are  
not externally discernable.

Counts of caudal-fin rays from radiographs include only the  
segmented rays. We found that Briggs' (1955) method (fol-  
lowed by Smith-Vaniz, 1968) of counting only the "free tips"  
of principle caudal-fin rays yielded inconsistent values for the  
smaller-sized species. All species examined have procurrent-  
ray counts falling in the range of four to eight, both dorsally  
and ventrally. The several species for which we have large  
sample sizes have variable procurrent-ray counts within the  
range of four to eight, but all species typically exhibit a range  
of five to seven. Procurrent-ray counts are not given in the de-  
scriptions or tabulated.

Vertebral counts from radiographs are presented as a for-  
mula: precaudal + caudal = total count (Briggs (1955) did not  
provide vertebral counts). The first caudal vertebra is distin-  
guished from the posteriormost precaudal vertebra by having a  
distinct, although often short, hemal spine. Specimens some-  
times show varying degrees of fusion of the penultimate and  
antepenultimate centra, indicated by the presence of two neural  
and/or hemal spines on what appears to be one centrum. This  
complex was counted as one, unless a distinct vertical fusion  
line between the two centra could be clearly discerned.

The characterization of the series of epineural bones and ribs  
(pleural) is given as the number of the posteriormost vertebra,  
counting from the first precaudal vertebra, bearing an epineural  
or rib (both often tiny) on one or both sides. Occasionally, an

epineural may be completely lacking from the vertebra directly  
anterior to the last vertebra that bears an epineural.

The anterior and posterior margins of the pelvic disk are of-  
ten curled under; we extended the membrane to an estimated  
natural condition to measure disk length in preserved speci-  
mens. The anterior margin of the disk varies among species  
from being smooth to bearing well-developed flaps (Figure 1).  
We recognize two categories—smooth versus crenulate. The  
smooth category includes pelvic disks with anterior margins  
that vary from being smoothly rounded to having broad, low,  
weak convexities. The crenulate category includes margins  
varying from prominently crenulate to deeply lobed with pro-  
jecting flaps or papillae.

Upper- and lower-jaw tooth counts are presented separately.  
Counts of canine teeth include the combined total from the left  
and right sides (canines are positioned at each end of the cen-  
tral row of trifold incisors). Counts of trifold incisors also are pre-  
sented as the total number of incisors from both sides (previous  
publications—e.g., Briggs, 1955, 2001, and Smith-Vaniz,  
1968—gave the number of pairs of teeth). It is sometimes diffi-  
cult to classify individual teeth as canines versus incisors. The  
lateralmost tooth on each side of the central row of trifold inci-  
sors has a typical canine shape, but it may be the same size as  
the incisors. The one or two teeth adjacent to the lateralmost  
canine are sometimes intermediate in morphology between inci-  
sors and canines. We categorize teeth with a single pointed  
cusp as canines, even when they are slightly flattened. The typ-  
ical incisors of *Tomicodon* are trilobed, although the lateral-  
most incisors may be bilobed in rare cases.

The belly refers to the area between the posterior insertion of  
the pelvic disk and the anus.

We recognize three categories for position of the anus: (1)  
closer to the posterior margin of the pelvic disk than to the anal  
fin (near disk); (2) closer to the anal-fin origin than to the pel-  
vic disk (near anal fin); and (3) about midway between the pos-  
terior disk margin and the anal-fin origin (midway). The mid-  
way category includes positions slightly anterior or posterior to  
the midpoint. The relative position of the anus is the only pro-  
portional character we found to be useful in distinguishing  
these species. We recorded most of the measurements describ-  
ed by Briggs (1955) and found none useful in distinguish-  
ing the species of *Tomicodon*. We present data for only a few  
standard descriptive measurements in the species descriptions.

In most cases, specimens of *Tomicodon* must be dissected to  
determine the sex; thus, only a small sample of the specimens  
from any given locality was sexed. Counts of eggs were made  
for the right ovary. The left ovary is similar in size and shape to  
the right ovary and contains eggs of similar size and number.

Distinguishing characters for each taxon are provided in the  
identification key and are not repeated as a separate section in  
the individual species accounts.

Catalog numbers for specimens deposited in the National  
Museum of Natural History (NMNH), Smithsonian Institution  
(SI), are preceded by the acronym USNM (United States Na-  
tional Museum, whose collections are now part of the NMNH).



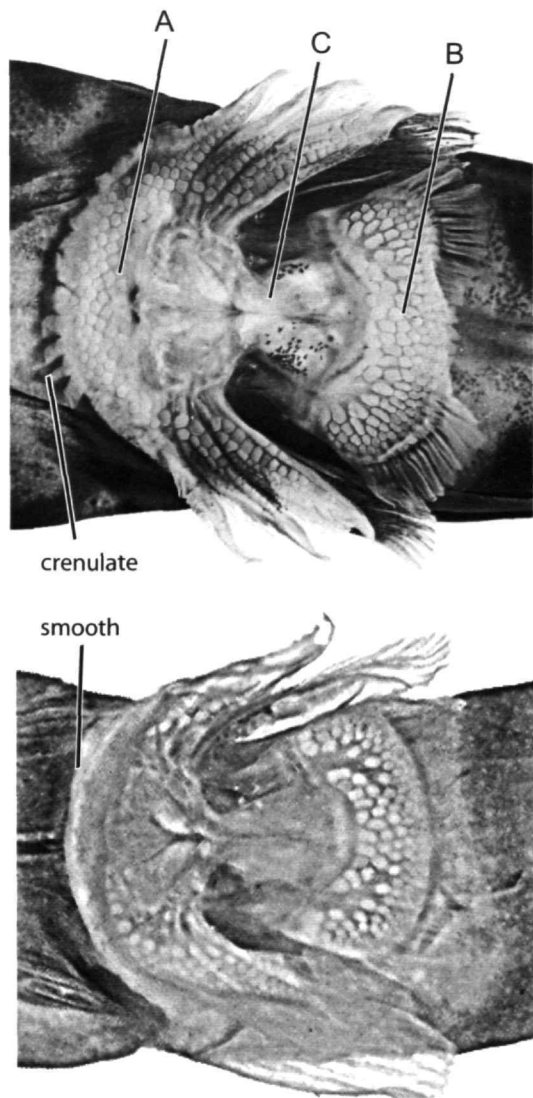


FIGURE 1.—Ventral view of pelvic disk of preserved specimens of *Tomicodon lavettsmithi* (top; USNM 365813, 26.7 mm SL) and of *T. clarkei* (bottom; USNM 358693, 14.1 mm SL). A, B, and C are regions of the disk discussed in the text; crenulate and smooth refer to condition of the anterior margin of the disk.

#### ACKNOWLEDGMENTS

We have been assisted in a variety of ways by many people. In the Division of Fishes, Department of Systematic Biology, National Museum of Natural History, Smithsonian Institution, we are especially indebted to D.G. Smith for providing keen insight into several taxonomic problems within *Tomicodon*; we particularly thank J.M. Clayton, S.J. Raredon, L.F. Palmer, S. Smith, and K.A. Murphy for specimen processing and radiography. J.H. Mounts (NMNH), S.J. Raredon, and S. Smith provided helpful suggestions on the use of image processing pro-

grams. M.H. Sabaj, E.B. Böhlke, and J.G. Lundberg of the Academy of Natural Sciences of Philadelphia (ANSP); R. Robins and S. Gardieff of the Florida Museum of Natural History (UF); and M.A. Rogers of the Field Museum of Natural History (FMNH) provided loans of specimens. O.M. Lasso-Alcala, Museo de Historia Natural La Salle (MHNLS) and Museo Oceanológico Hermano Benigno Roman, Estación de Investigaciones Marinas de Margarita (MOBR-EDIMAR), Venezuela, lent specimens and provided information. P. Bartsch and H. Landesberg, Humboldt-Universität zu Berlin, Museum für Naturkunde, searched for the type specimens of *T. fasciatus* and provided information about the publication dates of W.C.H. Peters' papers. M.L. Smith, Conservation International, provided information on the status of F. Poey's type specimens in Cuba.

For extensive help with field collecting at various Caribbean localities during which we obtained the clingfishes reported herein, we thank the following colleagues (listed in alphabetical order): R. Allum (Quest Foundation), I. Augustine (Tobago Marine Fisheries Section), C.C. Baldwin (NMNH), S.D. Blum, Jr. (California Academy of Sciences), E.B. Brothers (EFS Consultants), E. Caesar (Tobago Marine Fisheries Section), R.E. Clark, Jr. (NMNH), R.D. Clarke (Sarah Lawrence College), B.B. Collette (U.S. National Marine Fisheries Service), W.P. Davis (Environmental Protection Agency (EPA)), W.N. Eschmeyer (California Academy of Sciences), C.R. Gilbert (Florida Museum of Natural History), C. Hansen (NMNH), J.D. Hardy (U.S. National Marine Fisheries Service), J.C. Howe (NMNH), G.D. Johnson (NMNH), R.S. Jones (University of Texas), P. Keener (College of Charleston), S. Love (NMNH), L. Micheletti (Quest Foundation), M. Nizinski (U.S. National Marine Fisheries Service), T. Petersen (Quest Foundation), M.J. Schotte (NMNH), C.L. Smith (American Museum of Natural History), D.G. Smith (NMNH), M.L. Smith, A. Sundberg (University of Delaware), C. Thacker (Los Angeles County Museum), C.L. Thacker (University of Florida), D.M. Tyler (Smithsonian Books), A. Wight (Quest Foundation), and the Captain and crew of the M/V *Quest*.

We thank R.E. Clark, Jr., for photographs of live specimens of *T. lavettsmithi* and T.B. Griswold (National Aeronautics and Space Administration) for photographs of preserved specimens of *T. clarkei*, *T. cryptus*, and *T. leurodiscus*. W.P. Davis provided behavioral observations of *T. lavettsmithi* maintained in aquaria in Belize and Florida. W.F. Smith-Vaniz (United States Geological Survey, Gainesville) and L.A. Rocha (University of Florida) provided preserved specimens and photographs of fresh specimens recently collected in the U.S. Virgin Islands.

K. Ruetzler and M.R. Carpenter (both of NMNH) provided support for work in Belize through the Caribbean Coral Reef Ecosystems Program, of which this paper is contribution number 621. The Discovery Channel's Animal Planet series provided funding for the Navassa Expedition.

We thank S.H. Weitzman (NMNH) and C.C. Baldwin for many helpful comments on the manuscript. We also thank Meredith Ray McQuoid (Smithsonian Books) for careful editing of the paper.

**Genus *Tomicodon* Brisout de Barneville, 1846**

*Tomicodon* Brisout de Barneville, 1846:144 [type species: *Tomicodon chilensis* Brisout de Barneville, 1846; by subsequent designation by Jordan, 1919:228 (see also Eschmeyer, 1990)].

*Arbacirosa* Jordan and Evermann in Jordan, 1896:230 [type species: *Gobiesox humeralis* Gilbert, 1890 (see also Eschmeyer, 1990); by original designation].

**DISTINGUISHING CHARACTERS.**—This genus is distinguished from other western Atlantic gobioid genera by the combination of a single row of flattened incisors (at least some trifold) on both jaws and the absence of papillae in disk region C (see Figure 1). Additional characteristics of the genus may be found in Briggs (1955).

**Key to the Atlantic Species of *Tomicodon***

1. Anterior margin of pelvic disk smooth, without fleshy tabs [Figure 1] . . . . . 2  
Anterior margin of pelvic disk crenulate, with fleshy tabs [Figure 1] . . . . . 5
2. Anus nearer to anal-fin origin than to pelvic disk . . . . . 3  
Anus nearer to pelvic disk or midway between disk and anal-fin origin . . . . . 4
3. Anal-fin origin at vertical from base of dorsal-fin ray 2 or 3; anal-fin rays 7; pectoral-fin rays 21. . . . . *T. briggsi*  
Anal-fin origin at vertical from base of dorsal-fin ray 4 or 5; anal-fin rays 6; pectoral-fin rays 20. . . . . *T. leurodiscus*
4. Head and body without dark bars; dorsal-fin rays 7 . . . . . *T. clarkei*  
Head and body with dark bars; dorsal-fin rays usually 8 . . . . . *T. cryptus*
5. Head and body with sharply defined narrow pale bars on dark background . . . . .  
. . . . . *T. rhabdotus*  
Head and body pale tan with broad dark bars or irregular blotches . . . . . 6
6. Two strongly contrasting, pupil-sized dark spots on dorsum, one on each side above pectoral-fin base. . . . . *T. fasciatus*  
Dorsum above pectoral-fin base without two distinctive dark spots. . . . . 7
7. Fleshy base of pectoral fin bicolored, with dorsal half covered by brown blotch, ventral half unpigmented . . . . . *T. rupestris*  
Fleshy base of pectoral fin with melanophores covering at least dorsal three-fourths and often all of base, frequently with two dark diagonal bars on a dusky background . . . . . 8
8. Anus usually nearer to pelvic disk than to anal-fin origin; anal-fin origin usually at vertical from base of dorsal-fin ray 1 or 2; total number of vertebrae 34–38 (usually 35 or more). . . . . *T. reitzae*  
Anus usually nearer to anal-fin origin or midway; anal-fin origin usually at vertical from base of dorsal-fin ray 3 or 4 (often of 2 for *T. lavetsmithi*); total number of vertebrae 29–32 . . . . . 9
9. Nasal flap tiny (length much less than diameter of nasal opening); dorsal-fin rays 6 or 7; caudal vertebrae usually 15 or 16 . . . . . *T. lavetsmithi*  
Nasal flap usually well developed (length about equal to diameter of nasal opening); dorsal-fin rays 8 or 9 (one with 7); caudal vertebrae usually 17 or 18 . . . *T. australis*

***Tomicodon australis* Briggs, 1955**

## FIGURE 2

*Tomicodon fasciatus australis* Briggs, 1955:67 [type locality: San Francisco do Sul, Santa Catarina, Brazil; holotype, USNM 88042].

**DESCRIPTION** (Table 1).—Dorsal-fin rays 7–9 (mode 8). Anal-fin rays 7 or 8. Pectoral-fin rays 19 or 20 (mode 20). Caudal-fin segmented rays 11 or 12. Vertebrae 13–14+17–19=30–32 (mode 14+18=32); last rib on vertebra 13 or 14 (mode 14); last epineural on vertebra 19–21 (mode 20). Anal fin origi-

nating at vertical from base of dorsal-fin ray 3–5 (usually 3 or 4). Upper jaw with 3 or 4 canines (mode 4), 8–10 incisors. Lower jaw with 3–6 canines (mode 4), 6 incisors. Anterior margin of pelvic disk crenulate, with well-developed flaps. Pelvic disk region A with 6 or 7 irregular rows of papillae; region B with 6 or 7 irregular rows (region C without papillae and not repeated in species descriptions that follow). Anus position varying from midway to near anal-fin origin, usually nearer anal-fin origin. Anterior nostril usually with well-developed dermal flap, flap sometimes tiny.

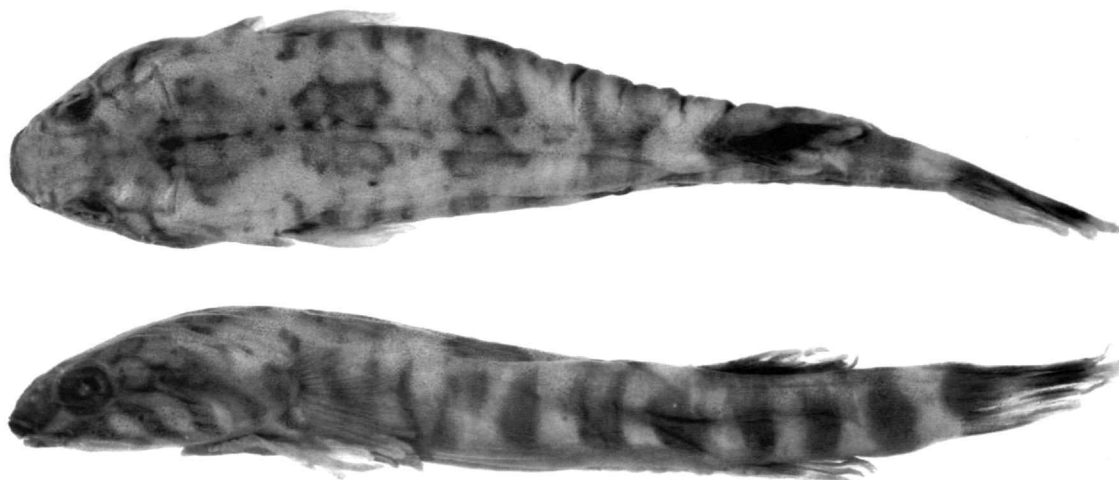


FIGURE 2.—Dorsal (top) and lateral views of a preserved specimen of *Tomicodon australis* (USNM 88042, 24.7 mm SL, holotype) from the southeastern coast of Brazil.

Body elongate, rounded in cross section. Head length 26.5%–30.1% SL ( $\bar{x}$  = 28.5%). Head width 19.8%–24.5% SL ( $\bar{x}$  = 21.8%). Pelvic disk small, length 23.3%–25.9% SL ( $\bar{x}$  = 24.4%). Longest known specimen 26.8 mm SL.

Mature ovaries large, cigar-shaped, extending most or all of length of body cavity. One 25.7 mm SL specimen (USNM 87802) with well-developed ovaries, right ovary containing more than 50 eggs. Largest eggs among examined specimens about 0.6 mm in diameter in two females, 20.1 mm SL and 25.3 mm SL (both USNM 87808). Genital papilla of females short and conical with somewhat pointed tip; male papilla a slender, elongate tube.

**ECOLOGICAL HABITAT AND DISTRIBUTION.**—No information is available on the ecological habitat of this species. It is known only from Rio de Janeiro and Santa Catarina on the coast of southeastern Brazil.

**PRESERVED COLOR PATTERN** (Figure 2).—Specimens seem to retain their pigmentation pattern after preservation.

**Males:** Head and body with dark brown bars on tan background. Head with five narrow dark bars radiating from eye: anteriormost bar from eye to middle of upper lip, extending anteriorly and meeting similar bar from other side; remaining bars extending posteroventrally from eye to just below ventrolateral curvature of head; posterodorsalmost bar extending from eye to border of opercle. Underside of head pale, with dark brown spots on each side of lower lip. Approximately six hourglass-shaped, dark saddles along dorsal profile: anteriormost saddle on top of head, posteriormost on top of caudal peduncle. Body laterally bearing approximately 9–11 narrow dark bars separated by broader pale interspaces: anteriormost bar behind pectoral-fin base, posteriormost bar on caudal pe-

duncle. Dark lateral bars from anal-fin origin to caudal-fin base reaching ventral midline. Belly and region anterior to anal-fin origin pale. Dorsal fin generally dark brown with irregular pale streak submarginally. Anal fin varying from pale to having a dark blotch over bases of anterior four or five rays. Caudal fin pale basally and distally, with two intervening broad, dark bars separated by a pale interspace. Pelvic disk pale. Pectoral fin and base with two or three slightly irregular, diagonal dark bars: first (anteriormost) bar extending from beneath dorsal attachment of gill cover posteroventrally to base of ventral pectoral rays; second bar beginning on bases of dorsalmost pectoral rays and paralleling first bar to about middle of fin; third bar, when present, beginning at midlength of dorsalmost rays and paralleling second bar in dorsal half of fin.

**Females:** Similar to males except lateral bars irregular and forming mottled pattern along sides of body; only posteriormost one or two bars with a few scattered melanophores reaching ventral midline.

**FRESH COLORATION.**—Field note in jar with holotype states “markings were jet black, transverse bands sort of double on sides.”

**ETYMOLOGY.**—The specific epithet is based upon the Latin *australis*, meaning southern, referring to the southwestern Atlantic distribution (Briggs, 1955).

**MATERIAL EXAMINED** (Abbreviated).—BRAZIL. USNM 88042 (24.7 mm SL, male, holotype of *Tomicodon fasciatus australis*); paratypes of *T. f. australis*: USNM 87799 (1: 24.3 mm SL), USNM 87800 (1: 21.5 mm SL), USNM 87801 (1: 22.0 mm SL), USNM 87802 (11: 19.0–26.8 mm SL), USNM 163663 (1: 23.8 mm SL).





*Tomicodon briggsi*, new species

FIGURE 3

DESCRIPTION (Table 1).—Dorsal-fin rays 7. Anal-fin rays 7. Pectoral-fin rays 21 or 22 (mode 21). Caudal-fin segmented rays 10 or 11 (mode 10). Vertebrae  $13-15 + 15-18 = 29-31$  (mode  $13+17=30$ ); last rib on vertebra 13 or 16 (mode 13); last epineural on vertebra 21–25. Anal-fin origin positioned at

vertical from base of dorsal-fin ray 2 or 3. Upper jaw with 2 canines, 9–12 incisors. Lower jaw with 2 canines, 6 incisors. Anterior margin of pelvic disk smooth. Pelvic disk region A with 6 or 7 irregular rows of papillae (papillae of innermost row larger than others and longitudinally elongate, best developed in larger specimens); region B with 7 irregular rows. Anus near anal-fin origin. Anterior nostril without dermal flap.

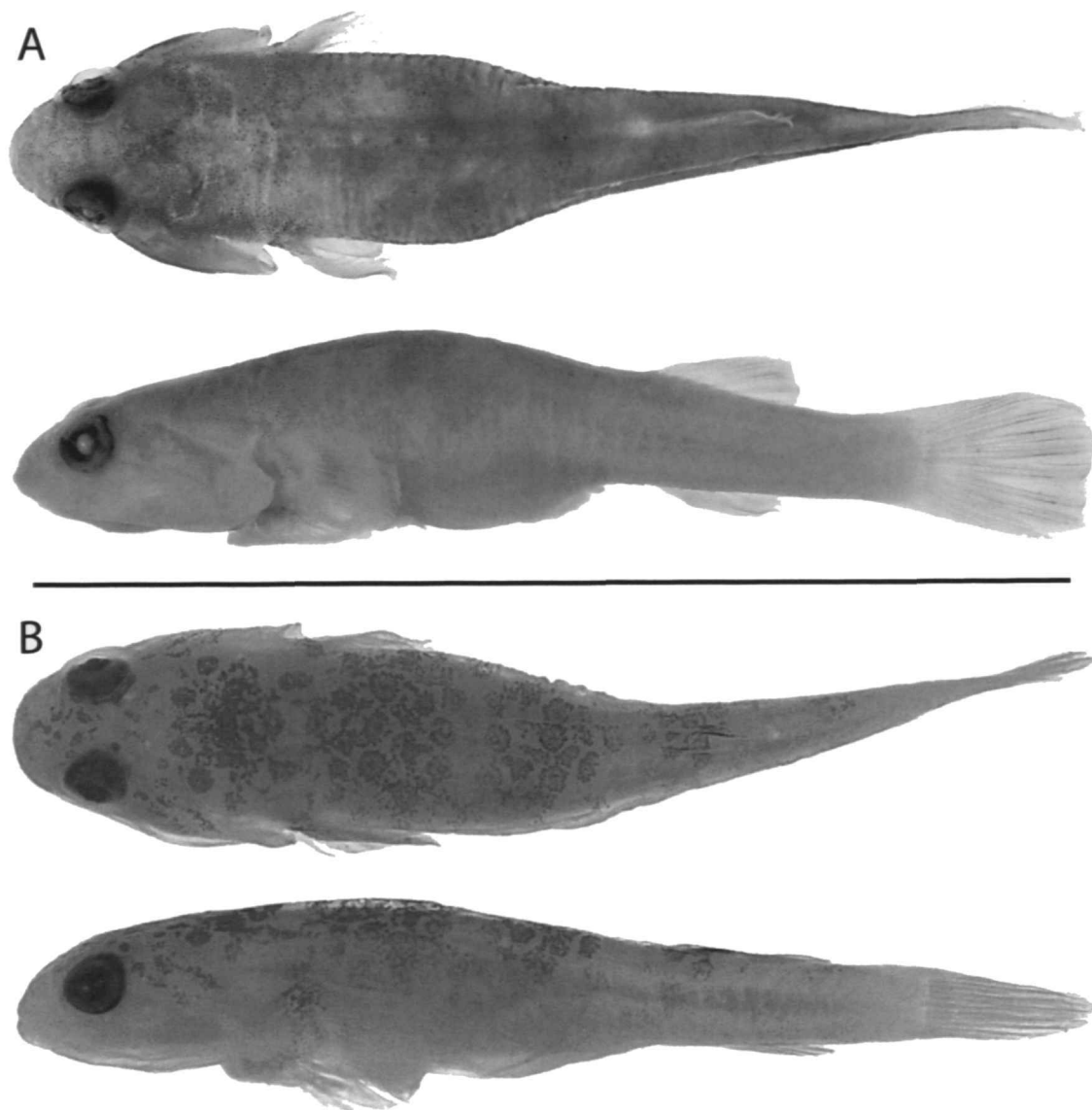


FIGURE 3.—Dorsal and lateral views of preserved specimens of *Tomicodon briggsi*: A, representative of faded pigmentation pattern (USNM 360612, 16.0 mm SL, female, holotype) from St. Croix, U.S. Virgin Islands; B, specimen with more of pigmentation pattern retained after preservation (FMNH 93758, 11.1 mm SL, female, paratype) from Carrie Bow Cay, Belize.

Body elongate, rounded in cross section. Head length 29.9%–32.5% SL ( $\bar{x}$  = 31.2%). Head width 20.7%–26.6% SL ( $\bar{x}$  = 23.6%). Pelvic disk small, length 21.3%–22.7% SL ( $\bar{x}$  = 22.0%). Longest known specimen 17.3 mm SL.

Mature ovaries flattened dorsoventrally, restricted to postero-dorsal half of body cavity. Two paratypes, 15.4 and 16.0 mm SL (both USNM 365845), with well-developed ovaries, right ovary of each with about 28–30 eggs. Largest egg diameter among specimens examined about 0.15 mm. Sexually mature 11.1 mm SL paratype (FMNH 93758) with about 12 eggs in right ovary. Genital papilla of females forming a slender tube, with base of tube only slightly broader than distal portion (males similar) and with tip rounded to pointed.

**ECOLOGICAL HABITAT AND DISTRIBUTION.**—Specimens from the Grenadines and Belize were collected in areas with a mix of sand bottom and coral. Habitat data are unknown for specimens collected at St. Croix. Known depth range is 0–12 m.

**PRESERVED COLOR PATTERN** (Figure 3).—Pigmentation apparently fades after preservation.

**Males:** Head and body with faint bars composed of pale brown reticulations on straw-colored background. Head with five very faint, narrow bars radiating from eye: anteriormost bar from eye extending anteriorly almost to middle of upper lip; bar beneath middle of eye short, with slight bifurcation into short anteriorly and posteriorly directed portions; remaining bars extending from eye posteroventrally for a distance about equal to eye diameter, except posterodorsalmost bar merging with reticulate bar on top of head. Underside of head pale, without obvious melanophores. Interorbital space with scattered melanophores forming reticulate pattern extending posteriorly and merging with reticulate nape bar; nape bar extending ventrally onto dorsalmost pectoral-fin ray. Dorsum of body with approximately four faint reticulate bars with narrow, dusky interspaces posterior to nape bar; all four body bars extending ventrally to about middle of side of body; first two bars positioned between nape and dorsal-fin origin; next bar at dorsal-fin origin; last bar on caudal peduncle. Belly pale. Dorsal fin with streak of scattered melanophores along distal one-fourth of fin; basal three-fourths of fin unpigmented. Anal fin without melanophores. Caudal fin with streak of melanophores along dorsal and ventral borders from posterior end of caudal peduncle to middle of fin; upper and lower edges of each fin ray outlined with melanophores in midregion of fin; remainder of caudal fin translucent (see Figure 3A, lateral view). Pelvic disk unpigmented. Pectoral-fin base unpigmented, but one specimen with faint reticulations on base.

**Females:** Similar to males.

**FRESH COLORATION.**—Unknown.

**ETYMOLOGY.**—The species is named in honor of John C. Briggs, Georgia Museum of Natural History, in recognition of his pioneering monograph on clingfish systematics.

**MATERIAL EXAMINED.**—*Holotype:* U.S. VIRGIN ISLANDS. *St. Croix:* USNM 360612 (16.0 mm SL, female); sta 726;

A.H. Ruse; collection date unknown, cataloged at USNM in 1875.

**Paratypes:** BELIZE. *Carrie Bow Cay:* FMNH 93758 (1: 11.1 mm SL, female); coral at S end of island, bottom sand with good coral development; 0–1 m depth; G-78-4; D.W. Greenfield, T. Greenfield, C. Rakocinski; rotenone. GRENADINES. *Little St. Vincent Island:* ANSP 126691 (1: 12.8 mm SL) off NW point of Little St. Vincent (NE of Carriacou Island), white sand bottom with low coral heads, 120 m from shore; 10.5–12 m depth; TE-13; J.C. Tyler, W.N. Eschmeyer, G. Koven; 27 Jun 1965; rotenone. U.S. VIRGIN ISLANDS. *St. Croix:* USNM 365845 (4: 15.0–17.3 mm SL); collected with holotype.

### *Tomicodon clarkei*, new species

FIGURE 4

**DESCRIPTION** (Table 1).—Dorsal-fin rays 7. Anal-fin rays 7. Pectoral-fin rays 20. Caudal-fin segmented rays 11. Vertebrae 14+16=30; last rib on vertebra 15; last epineural on vertebra 23. Anal-fin origin positioned at vertical from base of dorsal-fin ray 4. Upper jaw with 2 canines, 8 incisors. Lower jaw with 2 canines, 4 incisors. Anterior margin of pelvic disk smooth (membrane thin, flexible, and only weakly and broadly crenulate). Pelvic disk region A with 5 irregular rows of papillae; region B with 5 irregular rows. Anus position midway. Anterior nostril without dermal flap.

Body elongate, rounded in cross section. Head length 30.5% SL. Head width 17.7% SL. Pelvic disk small, length 20.6% SL.

Mature ovaries elongate and cylindrical. Holotype (14.1 mm SL; USNM 358693) with well-developed ovaries, right ovary with about 8 eggs, largest egg about 0.4 mm in diameter. Genital papilla long, slender, and recessed into longitudinal groove.

**ECOLOGICAL HABITAT AND DISTRIBUTION.**—This species is known from a single specimen from Carrie Bow Cay, Belize. The specimen was collected at a depth of 5 m from a 130 cm high colony of dead *Acropora palmata* by using quinaldine. The holotype was observed underwater with its head slightly protruding from a hole surrounded by pink calcareous algae on the undersurface of a coral branch about 80 cm above the substrate. Despite years of observing and collecting with quinaldine the small, hole-dwelling fishes (by JCT, especially chaenopsid tube blennies) in the spur-and-groove formations at Carrie Bow Cay, we believe this is the first (and only) specimen of *Tomicodon* to have been observed or collected from that habitat and locality thus far. Careful and modest application of rotenone, which rarely has been used in that habitat at the Carrie Bow Cay marine laboratory, might yield additional specimens of this elusive species.

**PRESERVED COLOR PATTERN** (Figure 4).—Pigmentation faded rapidly after preservation of the only known specimen (R.D. Clarke, pers. observ., 1999).

**Female:** Head and body of holotype straw colored, without broad, dark bars; irregular cluster of melanophores on nape, a

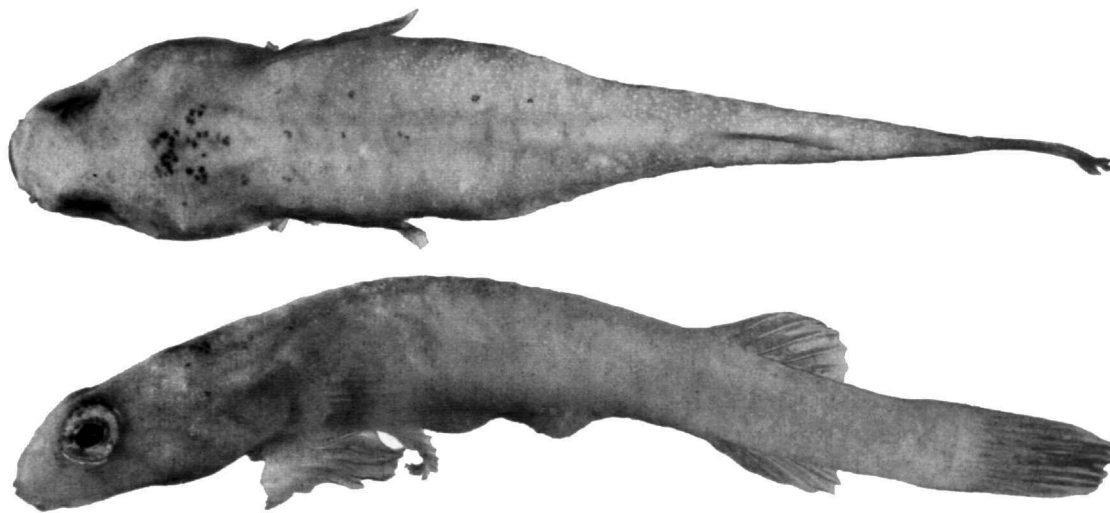


FIGURE 4.—Dorsal and lateral views of the preserved holotype of *Tomocodon clarkei* (USNM 358693, 14.1 mm SL) from Carrie Bow Cay, Belize.

few other melanophores along dorsum to about midpoint of body. Head with approximately five very faint, narrow bars radiating from eye: anteriormost bar radiating from eye to middle of upper lip, extending anteriorly and meeting similar bar from other side; posterodorsalmost bar extending from eye to border of opercle. Underside of head unpigmented. Belly, dorsal fin, anal fin, caudal fin, pelvic disk, pectoral fin, pectoral base, and remainder of body unpigmented.

**FRESH COLORATION.**—Color observations were made by R.D. Clarke at the time of collection.

Holotype tanish overall with orangish pink cast, about same color as the patch of pinkish calcareous algae surrounding the hole from which it was collected; specimen without prominent markings when examined fresh under a compound microscope.

**ETYMOLOGY.**—The species is named in honor of Raymond D. Clarke, Professor of Biology at Sarah Lawrence College, Bronxville, New York, who collected the holotype and only known specimen during his studies of the behavioral ecology of chaenopsid blennies at Carrie Bow Cay, Belize.

**MATERIAL EXAMINED.**—*Holotype*: BELIZE. *Carrie Bow Cay*: USNM 358693 (14.1 mm SL, female); spur-and-groove formation off E side of island; 16°48.15'N, 88°04.91'W; 5 m depth; R.D. Clarke; 27 Jul 1999.

#### *Tomocodon cryptus*, new species

FIGURE 5

**DESCRIPTION** (Table 1).—Dorsal-fin rays 7 or 8 (mode 8). Anal-fin rays 6–8 (mode 7). Pectoral-fin rays 20–22 (mode 20). Caudal-fin segmented rays 10–12 (mode 11). Vertebrae 13–15 + 15–18 = 29–31 (mode 14 + 16 = 30); last rib on vertebra 13–15 (usually 14 or 15); last pineural on vertebra 20–26. Anal-fin

origin positioned at vertical from base of dorsal-fin ray 3–5 (mode 4). Upper jaw with 0–2 canines (mode 0), 8–10 incisors. Lower jaw with 0–4 canines (mode 2), 4–10 incisors. Anterior margin of pelvic disk smooth. Pelvic disk region A with 6 or 7 irregular rows of papillae; region B with 6 or 7 irregular rows. Anus position varying from midway to near disk. Anterior nostril usually with small dermal flap, flap sometimes tiny or absent on one side.

Body elongate, rounded in cross section. Head length 28.3%–35.8% SL ( $\bar{x}$  = 31.5%). Head width 19.1%–27.2% SL ( $\bar{x}$  = 22.6%). Pelvic disk moderate in size, length 26.7%–31.0% SL ( $\bar{x}$  = 28.3%). Longest known specimen 19.0 mm SL.

Mature ovaries elongate and cylindrical. One 14.5 mm SL paratype (USNM 365860) with well-developed ovaries, right ovary with about 10 eggs, largest egg about 0.6 mm in diameter. Genital papilla of females forming a slender tube, with base of tube only slightly broader than distal portion (males similar), and with tip rounded to pointed.

**ECOLOGICAL HABITAT AND DISTRIBUTION.**—Specimens have been collected from depths of 0–8.5 m in high-energy surge zones of rocky shores, including tide pools at the Bahamas, Navassa Island, Grand Cayman, Puerto Rico, Mona Island (Puerto Rico), St. Barthélemy, and Tobago.

**PRESERVED COLOR PATTERN.**—Pigmentation faded rapidly in all but a few specimens after preservation (JTW, pers. observ.). The holotype is one of the few exceptional specimens that has retained much of its pigmentation pattern after preservation.

*Males* (Figure 5A): All pigmentation completely, or almost completely, faded on most specimens soon after preservation in ethanol. Some specimens (e.g., the holotype), however, in a jar with faded individuals retaining prominent dark bars and



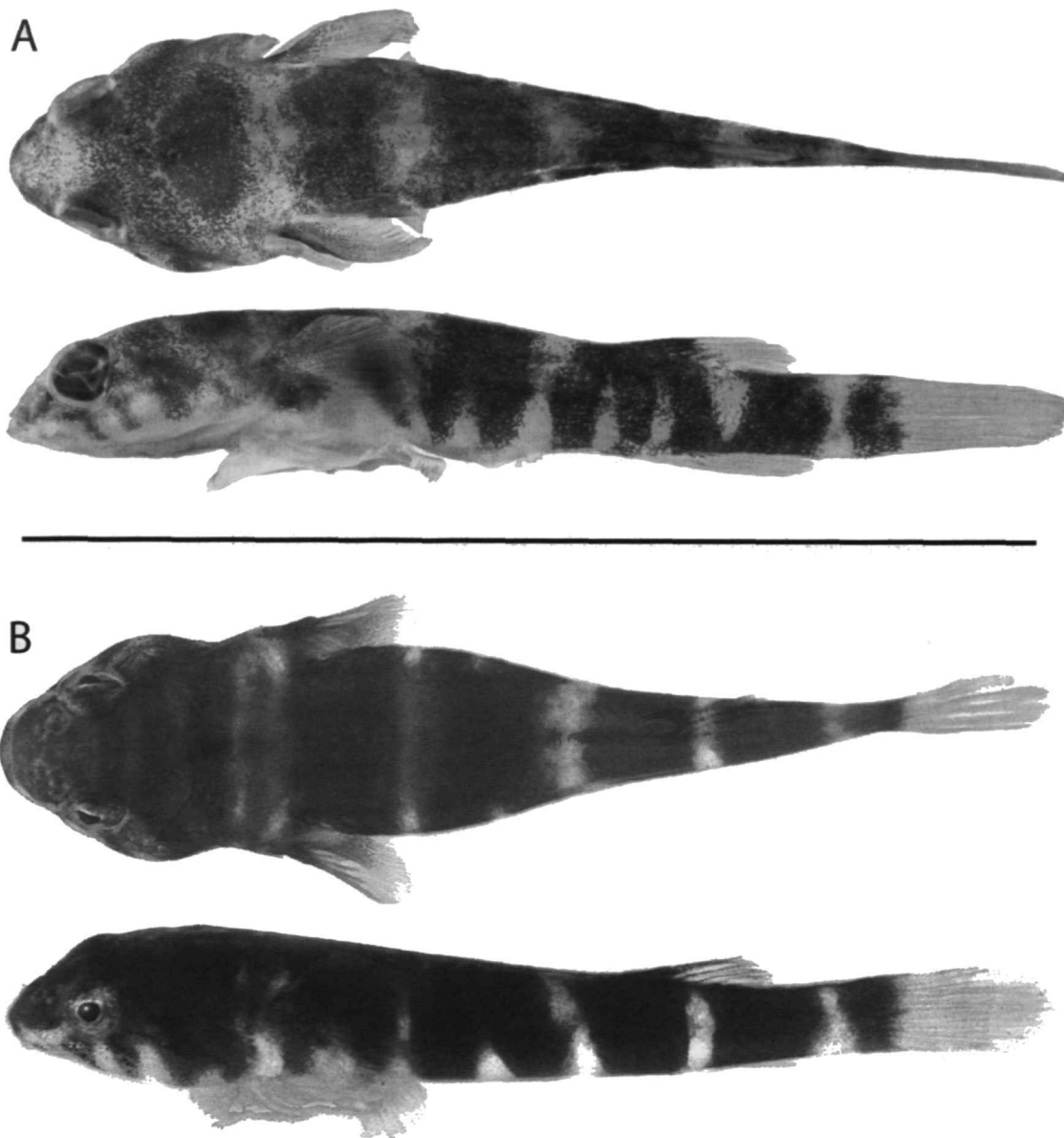


FIGURE 5.—Dorsal and lateral views of *Tomiodon cryptus*: A, preserved specimen (USNM 358700, 13.4 mm SL, holotype) from Navassa Island (between Haiti and Jamaica); B, fresh specimen (USNM 365861, 13.8 mm SL, paratype) from Navassa Island.

blotches; one jar of specimens collected in 1973 containing some specimens with prominent dark markings, others completely faded.

Head and body with brown bars on straw-colored background. Head with five narrow, dark bars radiating from eye: anteriormost bar radiating from eye to middle of upper lip, extending anteriorly and meeting similar bar from other side; bar beneath middle of eye usually bifurcating into anteriorly and

posteriorly directed portions; remaining bars extending from eye posteroventrally to just below ventrolateral curvature of head; posterodorsalmost bar extending from eye to border of opercle. Underside of head with pale background; scattered melanophores on lip flap on each side of lower jaw. Interorbital space dusky; scattered melanophores on snout and posterior interorbital region. Approximately six dark brown broad bars with narrow, dusky interspaces along body and saddling dorsal

midline: anterior bar on nape; next two bars extending ventrally, bifurcating at about midbody and forming inverted Y, its tips terminating before reaching midventral line of belly; fourth bar also forming inverted Y, with tips reaching ventral midline, forming continuous double band (ventrally)/single band (dorsally) around body; remaining bars forming continuous broad bands around body; last bar encircling caudal-fin base. Belly pale. Dorsal fin with dark brown blotch over basal one-half of about anteriormost four or five rays, remainder pale. Anal fin with few scattered melanophores at bases of anterior two or three rays, remainder pale. Caudal fin unpigmented posterior to bar encircling bases of caudal rays. Pelvic disk unpigmented. Pigmentation on pectoral fin and base faded or absent in many specimens; in specimens with color pattern persisting in preservative, a large brown blotch covering all but ventral border of pectoral lobe and extending out about one-half length of pectoral-fin rays over upper three-fourths of pectoral fin.

**Females:** Similar to males except bars more irregular and without obvious bifurcations; pectoral blotch restricted to lobe and basal one-fourth length of pectoral-fin rays.

**FRESH COLORATION.**—The following description is based upon 35 mm Kodachrome photographs (one presented in black and white in Figure 5B) of two males (13.6 and 13.8 mm SL) and one female (12.8 mm SL) from Navassa Island (NAV 99-5).

Males with dark brown bars and bands separated by pinkish maroon interspaces dorsally, changing to bright white interspaces midlaterally and ventrally; snout and pale regions between bars under eye pinkish; all fins with pinkish cast. Females with mottled, dark brown bars anteriorly separated by olive-brown interspaces; posterior bands olive, separated by pinkish interspaces; four bright white, approximately pupil-sized spots along ventrolateral side of body between pectoral-fin base and anal-fin origin; dark bars above pectoral-fin base and on head with bluish white mottling around borders; pale areas beneath eye and on opercle pinkish; pinkish white spots on body just above pectoral-fin base; snout and interorbital region pinkish brown; all fins with pinkish cast.

**ETYMOLOGY.**—The specific epithet is from the Greek *kryptos*, meaning hidden or secret, and refers to the cryptic coloration that conceals specimens of this species in their habitat.

**GEOGRAPHIC VARIATION.**—Our data indicate only one modal shift for meristic characters—i.e., in the precaudal vertebral count from 13 at St. Barthélemy (10 of 11 specimens) and Tobago (1 of 1) to 14 at Navassa Island (16 of 18) and Grand Cayman (15 of 15).

**MATERIAL EXAMINED.**—*Holotype:* NAVASSA ISLAND. USNM 358700 (13.4 mm SL, male); tide pools and surf zone at shore just E of Northwest Point; 18°25.81'N, 75°01.57'W; 0–2 m depth; NAV 99-15; C. Thacker, M. Smith; 2 May 1999; rotenone.

*Paratypes:* CAYMAN ISLANDS. *Grand Cayman:* ANSP 105056 (16: 4.0–13.6 mm SL); SW corner of island, rocky shore in front of Seaview Lodge; 0.5–3.5 m depth; sta 1; C.R. Gilbert, J.C. Tyler; 20 Oct 1964; rotenone. ANSP 178031 (1:

12.4 mm SL); S side of island, Prospect Point, just E of South Sound; 1–2 m depth; sta 3; C.R. Gilbert, J.C. Tyler; 21 Oct 1964; rotenone. NAVASSA ISLAND. USNM 359404 (3: 7.8–14.6 mm SL); tidepools above surf zone and adjacent surf area just E of Northwest Point; 18°25.81'N, 75°01.54'W; 0–0.4 m depth; NAV 99-14; C. Thacker, M. Smith; 2 May 1999; rotenone. USNM 365858 (1: 10.3 mm SL); steep rock wall at shore just E of Northwest Point, steep rock wall with brown algae and sea fans, with sand flat beginning at a depth of 7.5 m; 18°24.84'N, 75°01.69'W; 3–8.5 m depth; NAV 99-7; J.T. Williams, B.B. Collette, L. Micheletti, R. Allum; 29 Apr 1999; rotenone. USNM 365859 (2: 10.7, 13.6 mm SL); at shore on tip of Northwest Point, undercut area with wall dropping off to a depth of about 4.5 m; 18°25.78'N, 75°01.22'W; 0–6 m depth; NAV 99-1; J.T. Williams, B.B. Collette, C. Thacker, L. Micheletti, M. Miller; 29 Apr 1999; rotenone. USNM 365860 (7: 10.0–14.5 mm SL); collected with holotype. USNM 365861 (23: 8.2–14.3 mm SL); shore at undercut of island at Northwest Point, surf zone in deeply undercut (about 3 m) cliff, encrusting bryozoa abundant; 18°25.82'N, 75°01.74'W; 0–4.5 m depth; NAV 99-5; J.T. Williams, B.B. Collette, C. Thacker, L. Micheletti, M. Smith; 30 Apr 1999; rotenone. PUERTO RICO. *Mona Island:* ANSP 178029 (2: 11.8–13.4 mm SL); near anchorage, sand and rock-covered bottom with calcareous algae and shallow caves at shore; 18°05'30"N, 67°56'30"W; 0–1 m depth; W.F. Smith-Vaniz, P.L. Colin; 6 Oct 1978; rotenone. ST. BARTHÉLEMY. *Ile Syndare*, Port Gustavia: ANSP 106115 (1: 13.6 mm SL); W edge of the smaller of the two islets that make up the Syndares, boulders and short grass in surge zone, 0–3 m from shore; 0–1.5 m depth; TE-53; J.C. Tyler, W.N. Eschmeyer; 13 Jul 1965; rotenone. ANSP 123662 (11: 9.0–15.3 mm SL); all other data same as ANSP 106115.

*Nontype Specimens:* BAHAMAS. *Exuma Cays:* UF 212746 (30: 9.0–13.5 mm SL); CRR-BW152; H.A. Feddern et al.; 23 Aug 1963. COLOMBIA. *Isla de Providencia:* UF 25717 (1: 19.0 mm SL); CRG 69-20; C.R. Gilbert, J.C. Tyler et al.; 12 Aug 1969. PUERTO RICO. *Puerto Yabucoa:* ANSP 115676 (1: 16.4 mm SL); sta 3; N. Foster, J. Loos; 14–15 Jul 1969. TOBAGO. *Mt. Irvine:* ANSP 178030 (1: 15.4 mm SL); J. and H. Randall; 3 May 1964.

### *Tomocodon fasciatus* (Peters, 1859)

FIGURE 6

*Sicyases fasciatus* Peters, 1859:412 [type locality: Puerto Cabello, Venezuela; type specimen lost; neotype, USNM 365854, Panama, designated in "Nomenclatural Discussion," below].

*Arbaciola minuta* Meek and Hildebrand, 1928:928 [type locality: Colon, Panama; holotype, USNM 81523].

**DESCRIPTION** (Table 1).—Dorsal-fin rays 7 or 8 (mode 7). Anal-fin rays 6–8 (mode 7). Pectoral-fin rays 19 or 20 (mode 20). Caudal-fin segmented rays 10–12 (usually 10 or 12). Vertebrae 13–14 + 16–20 = 30–33 (mode 14 + 17 or 18 = 31); last rib on vertebra 13–15 (mode 14); last epineural on vertebra

20–25 (mode 21). Anal fin originating at vertical from base of dorsal-fin ray 2–4 (mode 3). Upper jaw with 2 canines, 8–11 incisors. Lower jaw with 2 or 4 canines (mode 2), 6 incisors. Anterior margin of pelvic disk crenulate, with flap complexity (referring to larger size and development of lateral cup-like concavities) of flap ornamentation increasing with specimen size. Pelvic disk region A with 5 irregular rows of papillae; region B with 6 or 7 irregular rows. Anus position varying from midway to near disk. Anterior nostril usually with well-developed dermal flap.

Head and body strongly depressed, head much wider than deep (width > 2× depth; head proportionally widest in specimens greater than 22 mm SL). Head length 26.3–29.4% SL ( $\bar{x}$  = 27.7%). Head width 19.0%–25.6% SL ( $\bar{x}$  = 22.9%). Pelvic disk small, length 20.4%–25.6% SL ( $\bar{x}$  = 23.1%). Longest known specimen 31.2 mm SL.

Mature females with large, cigar-shaped ovaries extending through posterior three-fourths of body cavity. Two specimens, 16.8 and 18.0 mm SL (both USNM 365939), with well-developed ovaries, right ovary with about 20+ and 30+ eggs, respectively (number of eggs increasing with specimen length), largest eggs from these two specimens about 0.4 mm in diameter. Genital papilla of females short and conical with somewhat pointed tip; male papilla a slender, elongate tube.

**ECOLOGICAL HABITAT AND DISTRIBUTION.**—The ecological habitat is unknown for examined specimens of this species. The known distribution of *T. fasciatus* is St. Croix in the U.S. Virgin Islands, northern Venezuela, and Panama.

**PRESERVED COLOR PATTERN** (Figure 6).—Pigmentation apparently fades after preservation.

**Males:** Head and body with dark brown bars on tan background. Head with five diffuse dark bars radiating from eye: anteriormost bar radiating from eye to middle of upper lip, extending anteriorly and meeting similar bar from other side; bar beneath middle of eye bifurcating into anteriorly and posteriorly directed portions; remaining bars extending posteroventrally from eye to just below ventrolateral curvature of head. Underside of head pale, with patch of melanophores on fleshy lobes positioned laterally on each side of lower lip; Panama neotype with melanophores evenly distributed across entire lower lip; central portion of lower lip pale in St. Croix specimens. Approximately six hourglass-shaped, dark saddles along dorsal profile: anteriormost saddle on top of head, posteriormost saddle on top of caudal peduncle; anterolateral border of second saddle (above pectoral fin) forming elongate, somewhat crescent-shaped, and pupil-sized dark spot on either side of nape above pectoral-fin base. Body laterally bearing approximately six to eight diffuse dark bars: anteriormost bar behind pectoral-fin base, posteriormost bar on caudal peduncle. Dark lateral bars extending from anal-fin origin to caudal-fin base reaching ventral midline (anterior bars not reaching ventral midline). Belly and region anterior to anal-fin origin pale. Dorsal fin with small melanophores scattered over entire fin; melanophores somewhat concentrated over bases of anterior four or five rays. Anal fin unpigmented. Caudal fin with faint basal band of melanophores; Panama neotype with faint central bar of fine melanophores; this central bar absent in St. Croix specimens. Pelvic disk pale. Pectoral-fin base typically with large dark blotch covering entire base and extending posteriorly over about two-thirds length of pectoral fin.



FIGURE 6.—Dorsal and lateral views of a preserved specimen of *Tomocodon fasciatus* (USNM 15382, 31.2 mm SL) from St. Croix, U.S. Virgin Islands.

*Females:* Similar to males except only examined Venezuela female with distinctive dark brown bar over basal one-fourth of caudal fin, and with dark blotch over basal one-third length of anterior three dorsal-fin rays.

FRESH COLORATION.—Unknown.

ETYMOLOGY.—The specific epithet is apparently based upon the Latin *fascia*, meaning banded, and presumably refers to the dark brown bars on the body of specimens of this taxon.

GEOGRAPHIC VARIATION.—Our limited data indicate slight modal shifts for some meristic characters. Caudal-fin ray counts are modally higher (12) for specimens from Venezuela and Panama than for those from St. Croix (10). There is a shift in the vertebral centrum bearing the last rib from 13 at St. Croix to 14 at Venezuela and Panama. Although the terminal epineural in the series is difficult to discern, the St. Croix and Venezuela specimens appear (Table 1) to have epineurals extending farther posteriorly (23–25) than do the Panama specimens (20–22). Although the total number of vertebrae is modally the same (31) for the St. Croix and Panama specimens, those from St. Croix have 13 precaudal vertebrae (versus 14 for Panama), and 18 or 19 caudal vertebrae (versus usually 16 or 17 for Panama). The position of the anus is usually closer to the disk for St. Croix specimens, whereas for Panama specimens the disk is usually midway.

NOMENCLATURE DISCUSSION.—Briggs (1955) gave the date of publication for *Sicyases fasciatus* Peters as 1860. This date was a matter of some importance until now because *Gobiesox rupestris* Poey, 1860, has been treated as synonymous with *S. fasciatus*, and there has been some discrepancy among cited dates of publication of the Peters paper (Jordan and Evermann, 1898; Schultz, 1944; Briggs, 1955; Bauer et al., 1995). For example, Schultz (1944) gave the year 1859 for the Peters name but listed 8 May 1860 as the actual publication date, and he gave the publication date of the Poey name as July 1860.

Our personal communication (2002) with P. Bartsch and H. Landsberg, Museum für Naturkunde, Berlin, led us to an article by Bauer et al. (1995) that provided dates of publication for papers by Peters. Bauer et al. (1995) gave the year 1859 for the publication date of Peters' journal pages that contain the description of *S. fasciatus*. Dr. Bartsch informed us that the type specimen of *Sicyases fasciatus*, which had been cataloged as ZMB 4113, could not be located after a thorough search, and he believed it to be lost.

Because several sympatric species recognized herein had been misidentified previously as *Tomicodon fasciatus*, it was necessary to select a neotype to stabilize the nomenclature. We were unable to locate a specimen from Puerto Cabello, Venezuela (the type locality for *fasciatus*), which was an important nineteenth century port-of-call for vessels traveling between South America and Europe (P. Bartsch, pers. comm. with JTW, JCT, 2002). Dr. Bartsch stated that specimens received in Berlin from "Puerto Cabello" could have originated from almost anywhere in the southern Caribbean Sea. We herein designate

USNM 365854 (21.1 mm SL, male, Panama) as the neotype of *Sicyases fasciatus*.

Our examination of the holotype of *Arbacirosa minuta* Meek and Hildebrand, 1928, confirms its conspecificity with *Tomicodon fasciatus*, and we therefore treat it as a junior synonym of the latter.

MATERIAL EXAMINED (Abbreviated).—PANAMA. USNM 81523 (18.6 mm SL, holotype of *Arbacirosa minuta*), USNM 365854 (21.1 mm SL, male, neotype of *Sicyases fasciatus*), USNM 365939 (10: 13.3–21.6 mm SL). U.S. VIRGIN ISLANDS. St. Croix: USNM 15382 (6: 16.2–31.2 mm SL), USNM 15431 (2: 20.9, 23.4 mm SL). VENEZUELA. MOBR EDIMAR 3827 (1: 27.4 mm SL).

### *Tomicodon lavettsmithi*, new species

FIGURES 7, 8

DESCRIPTION (Table 1).—Dorsal-fin rays 6 or 7 (mode 7). Anal-fin rays 6 or 7. Pectoral-fin rays 20. Caudal-fin segmented rays 11 or 12 (mode 11). Vertebrae 14–15+15–17=29–31 (mode 14+16=30); last rib on vertebra 14 or 15 (mode 14); last epineural on vertebra 20–23. Anal fin originating at vertical from base of dorsal-fin ray 2–4 (mode 3). Upper jaw with 0–3 canines (mode 2), 9–13 incisors. Lower jaw with 2–4 canines (mode 2), 5–8 incisors. Anterior margin of pelvic disk crenulate, with prominent flaps. Based upon one specimen, pelvic disk region A with 6 irregular rows of papillae; region B with 7 irregular rows. Anus position varying from midway to near anal-fin origin. Anterior nostril usually with small or tiny dermal flap, flap sometimes absent on one side.

Body elongate, rounded in cross section. Head length 28.5%–30.0% SL ( $\bar{x}$  = 29.2%). Head width 18.1%–25.4% SL ( $\bar{x}$  = 21.3%). Pelvic disk small, length 22.5%–25.0% SL ( $\bar{x}$  = 23.9%). Longest known specimen 26.7 mm SL.

Mature ovaries elongate and cylindrical. One 18.5 mm SL paratype (USNM 365862) with well-developed ovaries, right ovary with about 40 eggs, largest egg about 0.2 mm in diameter (other females of 18.8–25.3 mm SL with egg diameters of 0.2–0.3 mm). Genital papilla of females short and conical with rounded tip; male papilla a slender, elongate tube with pointed tip.

ECOLOGICAL HABITAT AND DISTRIBUTION.—Specimens have been collected from depths of 0–1 m off the coast of Belize at Punta Gorda in the south and at the centrally located Twin Cays (northwest of Carrie Bow Cay) and Pelican Cays (southwest of Carrie Bow). The Pelican Cays are generally a quiet-water region, but the northeast corners of some of the individual cays have relatively stronger currents and wave action. The two collections from Pelican Cays were taken from an eroded coral rubble and conch shell area at the inshore northern portion of a large, white sand beach at the northeast corner of Co-Cat Cay—one of the few prominent sand beaches in the Pelicans. During the initial collection made in 2000 with rotenone, *Tomicodon* specimens were seen clinging to the insides of

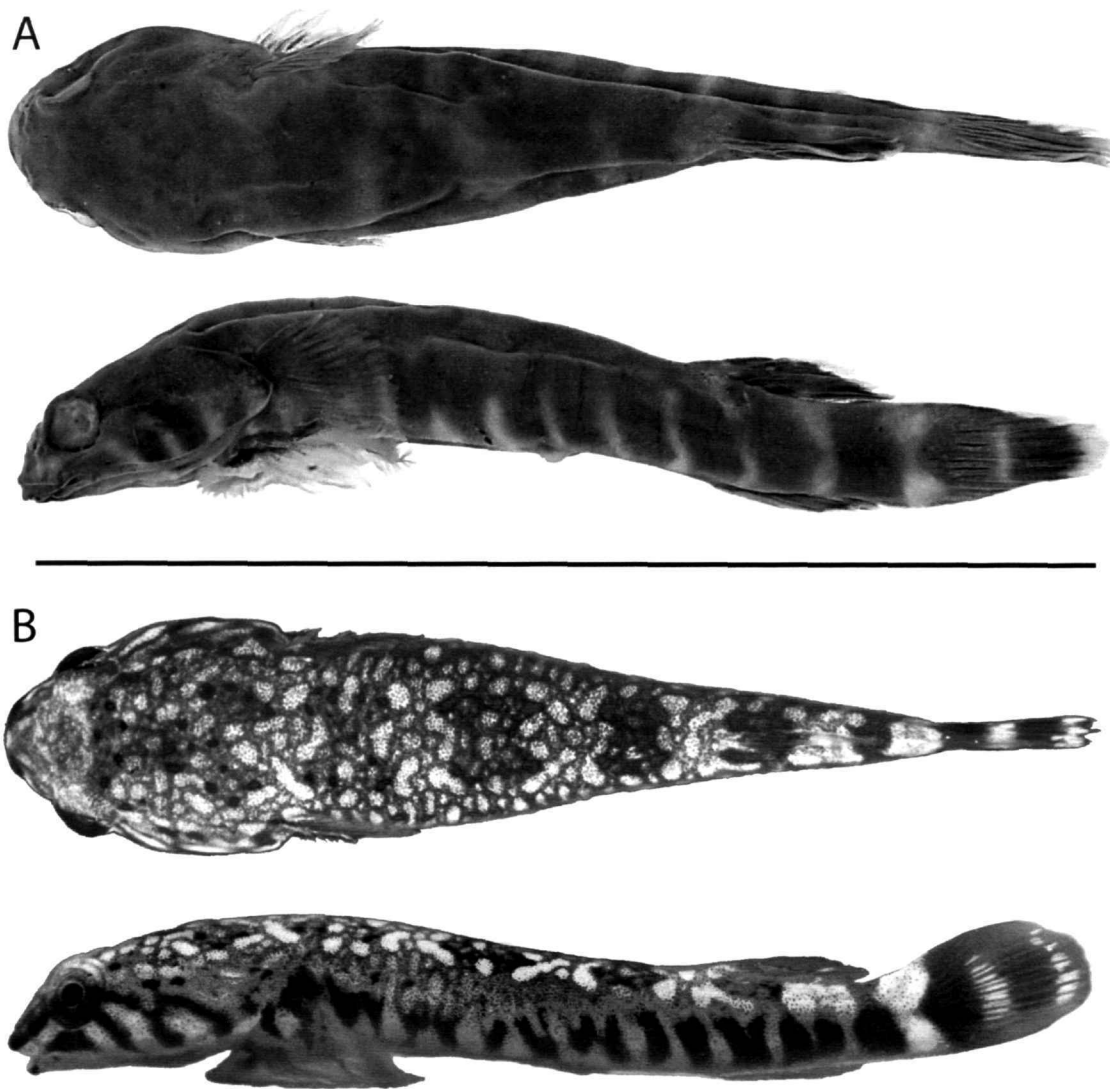


FIGURE 7.—Dorsal and lateral views of *Tomicodon lavettsmithi*: A, preserved specimen (USNM 365813, 26.7 mm SL, holotype) from Pelican Cays, Belize; B, live specimen in aquarium (USNM 364369, 18.5 mm SL, paratype) from Pelican Cays, Belize.

coral rubble (Figure 8) and conch shells, where the specimens' pale coloration made them difficult to detect. Specimens subsequently taken at Co-Cat Cay in 2001 were obtained exclusively by shaking rubble and conch shells to dislodge the specimens. Field notes for the two collections from Twin Cays—a large mangrove island in quiet lagoonal water—state that one collection was taken from flocculent mud and *Thalassia* and the other from mangrove roots.

**PRESERVED COLOR PATTERN** (Figure 7A).—Pigmentation is relatively well retained, but some subtleties of the pattern disappeared after preservation (JCT, pers. observ.).

**Males:** Head and body with dark brownish black to black bars on brown background (small males with paler brown background). Head with five narrow dark bars radiating from eye: anteriormost bar radiating from eye to middle of upper lip, extending anteriorly and meeting similar bar from other side; bar beneath middle of eye bifurcating into anteriorly and posteriorly directed portions (in some specimens, anterior and posterior parts separated dorsally); remaining bars extending posteroventrally from eye to just below ventrolateral curvature of head; posterodorsalmost bar extending from eye to border of opercle. Underside of head with pale background; lower jaw



FIGURE 8.—Aquarium photographs of living specimens of *Tomiodon lavettsmithi* on coral rubble taken immediately after capture from the type locality (specimens now preserved as paratypes, USNM 364369).

covered by a dark brown bar; several pupil-sized brown blotches scattered over underside of head. Usually six, sometimes seven, hourglass-shaped dark saddles along dorsal profile: anteriormost saddle on top of head, posteriormost saddle on top of caudal peduncle. Body laterally bearing approximately 11 or 12 dark bars (one specimen with 12 on one side and 14 on the other) separated by pale interspaces; anterior bars narrow and posterior bars becoming broader, pale interspaces varying from narrower to same width as dark bars; anteriormost bar behind pectoral-fin base, posteriormost bar on caudal peduncle. Corresponding dark lateral bars on each side from behind pectoral-fin base to genital papilla separated on ventral midline of belly by unpigmented stripe of pupil width; posterior bars from just behind genital papilla to caudal-fin base meeting on ventral midline. Belly and region anterior to anal-fin origin pale in small specimens. Dorsal fin black with nar-

row, pale distal margin. Anal fin black with narrow, pale distal margin and dusky blotch over central section of posterior two to three rays. Caudal fin pale basally and distally, with two intervening broad, dark bars meeting dorsally and ventrally and enclosing a narrow dusky interspace; small specimens with bars separate and interspace broader. Pelvic disk pale, with pupil-sized brown blotches in central section; blotches lacking in small specimens. Pectoral fin and base with two or three slightly irregular, diagonal dark bars separated by dusky interspaces: anteriormost bar extending posteroventrally from just beneath and anterior to dorsal attachment of gill cover, across pectoral-fin base, and onto pelvic disk; second bar extending posteroventrally from pectoral-fin base at attachment of gill cover, along distal part of base and bases of pectoral rays, paralleling first bar, and extending onto pelvic disk; third bar, when present, extending from midlength of dorsalmost pectoral

rays to, or just above, ventral border of pectoral fin, becoming fainter ventrally and paralleling second bar along most of length of latter. Scattered melanophores covering all but distal margin of pectoral fin.

*Females:* Similar to males except symphysis of lower jaw unpigmented and underside of head without dark blotches; lateral bars irregular, forming mottled pattern along sides of body, with dark mottling from anal-fin origin to caudal-fin base extending to ventral midline; pelvic disk without dark central blotches; dorsal fin dusky with pale distal margin; anal fin pale or dusky with pale distal margin.

**FRESH COLORATION.**—The following description is based upon color notes and 35 mm Kodachrome photographs (illustrated in black and white in Figures 7B, 8) of live specimens kept in aquaria after being collected from Co-Cat Cay in 2001.

An 18.5 mm SL female with uniformly scattered melanophores and reticulate pattern covering dorsum from snout tip to caudal peduncle. Reticulate pattern forming dark tan to brown hourglass-shaped saddles with paler interspaces. Dark saddles with concentrations of erythrophores increasing in each successive saddle, greatest concentration on caudal peduncle saddle. Reticulations of paler interspaces light tan. Reticulations coalescing ventrolaterally into dark brown V-shaped bars along side of body. Iris yellowish green along dorsal margin, becoming pinkish with narrow yellow ring around pupil, ventral half of iris dark brown. Males similar to female.

Specimens allowed to remain on or in coral rubble inside an aquarium bearing an overall coloration paler than specimens (Figure 8) forced out of rubble onto bare glass of the aquarium. Reticulate pattern of specimens in situ in field and on rubble in aquarium closely matching pattern on eroded surface of substrate.

**ETYMOLOGY.**—The species is named in honor of C. Lavett Smith, Emeritus Curator of Ichthyology at the American Museum of Natural History, in recognition of his many contributions to the systematics and behavioral ecology of Caribbean reef fishes and of his leadership of the Pelican Cays fish survey, during which most of the known specimens of this species were collected.

**REMARKS.**—W.P. Davis (EPA; pers. comm. with JCT, 2000, 2001) noted a remarkable sideways flexibility of the head and rolling of the eyes in specimens kept in aquaria, with pronounced turning of the head to either side while keeping the body stationary. After acclimation in aquaria, specimens frequently ventured out from rubble in both pale and more barred color phases and readily fed on brine shrimp.

**MATERIAL EXAMINED.**—*Holotype:* BELIZE. *Pelican Cays:* USNM 365813 (26.7 mm SL, male); Co-Cat Cay (W of Fisherman's and Manatee Cays), white sand, coral, and conch shell rubble beach at NE end of Co-Cat Cay; 16°40.29'N, 88°11.85'W; 0.5–1 m depth; JCT 2000-5; J.C. Tyler, C.L. Smith, W.P. Davis, R.S. Jones; 29 Jan 2000; rotenone.

*Paratypes:* BELIZE. *Pelican Cays:* USNM 364369 (4: 8.8–18.5 mm SL); Co-Cat Cay, white sand, coral, and conch shell rubble beach at NE end of Co-Cat Cay; 16°40.29'N,

88°11.85'W; 0–1 m depth; JCT 2001-2; J.C. Tyler, C.L. Smith, W.P. Davis, R.E. Clark; 26 Jan 2001; shaken out of pieces of coral rubble and conch shells. USNM 365862 (10: 14.1–25.3 mm SL); collected with holotype. *Twin Cays:* FMNH 93759 (3: 10.8–16.0 mm SL); NW of Carrie Bow Cay, E side of East Island, in mangrove roots; 0–0.2 m depth; AC-CBC-134; A. Cohen; 26 Apr 1977; rotenone. USNM 276185 (2: 17.7, 19.3 mm SL); flocculent mud bottom with *Thalassia* in mangrove area; 0–1 m depth; GDJ 84-7; G.D. Johnson, P. Keener; 5 Nov 1984; rotenone. *Toledo:* FMNH 93754 (1: 20.3 mm SL); near Punta Gorda on far S coast of mainland Belize, unnamed mangrove cay about 4 km WSW of Wilson's Cay, much *Thalassia*, some *Porites* and *Siderastrea*, most coral dead or overgrown by encrusting sponge; 0–1 m depth; F-79-24; R.K. Johnson, D.W. Greenfield, T. Greenfield; 18 Jun 1979.

### *Tomiodon leurodiscus*, new species

FIGURE 9

**DESCRIPTION** (Table 1).—Dorsal-fin rays 7. Anal-fin rays 6. Pectoral-fin rays 20. Caudal-fin segmented rays 10. Vertebrae 15+15=30; last rib on vertebra 16; last epineural on vertebra 19 or 20. Anal-fin originating at vertical from base of dorsal-fin ray 4 or 5. Upper jaw with 2 canines, 8 or 9 incisors. Lower jaw with 2 canines, 6 incisors. Anterior margin of pelvic disk smooth. Pelvic disk region A with 6–8 irregular rows of papillae; region B with 6 or 7 irregular rows. Anus near anal-fin origin. Anterior nostril without dermal flap.

Body elongate, rounded in cross section. Head length 27.3%–30.4% SL ( $\bar{x}$  = 29.2%). Head width 19.0%–20.6% SL ( $\bar{x}$  = 19.6%). Pelvic disk small, length 21.6%–25.2% SL ( $\bar{x}$  = 23.5%). Longest known specimen 19.4 mm SL.

Mature ovaries flattened dorsoventrally and restricted to posterodorsal half of body cavity. The 13.5 mm SL paratype (USNM 319752) with well-developed ovaries, right ovary with about 19 eggs, largest egg about 0.3 mm in diameter. Genital papilla in female a broad-based, short, stubby cone, much broader basally than distally; male papilla a slender, elongate tube with pointed tip.

**ECOLOGICAL HABITAT AND DISTRIBUTION.**—Specimens have been collected from depths of 5–14 m on vertical rock walls at Tobago off the northeast coast of Venezuela. Other specimens have been taken at Antigua and the U.S. Virgin Islands.

**PRESERVED COLOR PATTERN** (Figure 9).—Pigmentation fades rapidly after preservation, although some markings persist on males.

After approximately one year in preservative, male holotype exhibiting about nine faint, pale yellow, mid-lateral blotches along body; top of head pale yellow; ventral border of eye with three faint, pale yellow bars radiating ventrally or posteroventrally; dorsal fin pale, bearing black blotch basally over rays one to five or rays one to three (on male and female paratypes, respectively); other melanophore patterns as below for specimens after longer term preservation.

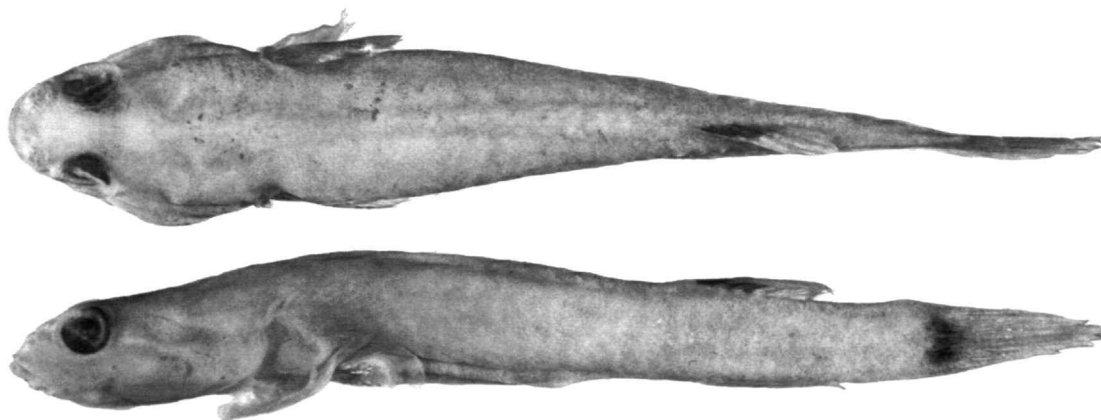


FIGURE 9.—Dorsal and lateral views of a preserved specimen of *Tomiconodon leurodiscus* (USNM 319752, 13.5 mm SL, paratype) from Tobago, Trinidad and Tobago.

**Males:** Head and body of holotype and of paratype straw colored, without discernable bars; paratype with several scattered melanophores on nape, second group of melanophores on dorsal midline at about midpoint of body. Middle of upper lip of both specimens bearing small group of melanophores on ventral margin. Lower lip of both with small patch of melanophores positioned on each side. Underside of head pale, without melanophores. Belly pale. Dorsal fin with dark brown blotch over basal one-half of about anteriormost four or five rays, remainder pale. Anal fin pale. Caudal fin with melanophores forming faint band over proximal one-fourth of length (that on paratype darker). Pelvic disk unpigmented. Pectoral fin and base unpigmented except for several scattered melanophores on body just above dorsalmost attachment of fin.

**Female:** Similar to males except no melanophores on caudal fin and generally fewer and less conspicuous melanophores elsewhere.

**FRESH COLORATION.**—Color observations were not made at time of collection.

**ETYMOLOGY.**—The specific epithet is a combination of the Greek *leuros*, meaning “plate,” and the Latin *discus*, meaning “smooth,” and it refers to the smooth anterior margin of the pelvic disk.

**MATERIAL EXAMINED.**—*Holotype:* TOBAGO. USNM 319751 (19.4 mm SL, male); about 1 mile (1.6 km) N of Speyside in Brisant Bay, vertical rock wall, with rubble, rock, and coral bottom; 11°18'52"N, 60°31'12"W; 12 m depth; JTW 90-6; J.T. Williams, J.C. Howe, M.M. Nizinski, S.D. Blum, Jr., S. Love, I. Augustine; 7 Sep 1990.

*Paratypes:* TOBAGO. USNM 319752 (2: 13.5 mm SL, female; 16.8 mm SL, male); E edge of Man-of-War Bay on E side of North Point; 11°19'08"N, 60°33'06"W; 5–12 m depth; JTW 90-9; J.T. Williams, J.C. Howe, S.D. Blum, Jr., G.D. Johnson, S. Love, M. Schotte; 8 Sep 1990.

**Nontype Specimens:** ANTIGUA. UF 11415 (2: 9.8, 12.8 mm SL); 2–3 m depth; CRG 64-12; C.R. Gilbert, B.M. Endicott; 26 Apr 1964. U.S. VIRGIN ISLANDS. *St. John:* UF 203774 (1: 17.4 mm SL); JER-V14; J.E. Randall, H. Kumpf; 6 Nov 1958.

### *Tomiconodon reitzae* Briggs, 2001

FIGURE 10

*Tomiconodon reitzi* Briggs, 2001:745 [lapsus calami: see “Etymology;” type locality: corrected herein to Caribbean coast of Colombia, Isla Grande; holotype, USNM 363264].

**DESCRIPTION** (Table 1).—Dorsal-fin rays 7–9 (mode 8). Anal-fin rays 7–10 (mode 8). Pectoral-fin rays 19–23 (mode shifts from 22 in north to 20 in south). Caudal-fin segmented rays 10–12 (mode 11). Vertebrae 13–5+20–23=34–38 (mode 14+22=36); last rib on vertebra 13–16 (mode 15); last epineural on vertebra 21–28 (bi-modal at 23 and 24). Anal fin originating at vertical from base of dorsal-fin ray 1–4 (mode 2). Upper jaw with 2–4 canines (mode 2), 8 or 10 incisors. Lower jaw with 2–6 canines (mode 4), 6–9 incisors. Anterior margin of pelvic disk crenulate, with prominent flaps. Based upon two specimens, pelvic disk region A with 5–7 irregular rows of papillae; region B with 6 or 7 irregular rows. Anus usually near disk, sometimes midway. Anterior nostril usually with tiny dermal flap, often absent on one or both sides.

Body elongate (especially in caudal peduncle region), rounded in cross section. Head length 21.6%–35.5% SL ( $\bar{x}$  = 25.9%). Head width 15.7%–21.2% SL ( $\bar{x}$  = 19.0%). Pelvic disk small, length 18.5%–25.8% SL ( $\bar{x}$  = 21.6%). Longest known specimen 35.0 mm SL.

Mature females with large, cigar-shaped ovaries extending most of length of body cavity. In three specimens (USNM 37414, 192160, 365846) with well-developed ovaries, right ovary with about 40–50+ eggs. Largest egg about 0.5 mm in di-



ameter in two specimens of 27.0 and 31.1 mm SL (USNM 192160 and 365846, respectively), other specimens with egg diameters as follows: 32.0 mm SL (USNM 37414) with eggs of 0.4 mm, 24.6 mm SL (USNM 360611) with eggs of 0.3 mm, and 26.6 mm SL (USNM 319753) with eggs of 0.2 mm. Genital papilla of females short and conical with somewhat pointed tip; male papilla a slender, elongate tube.

**ECOLOGICAL HABITAT AND DISTRIBUTION.**—Specimens examined ranged from 9.3 to 35.0 mm SL and were collected from depths of 0–3 m (field data records for some stations show a wide range of depths, such as 0–22 m for NAV 99-17, but all *Tomicodon* specimens were taken from the shallow surge zone in depths of 3 m or less). The known distribution of *T. reitzae* ranges from the Bahamas, throughout the Greater and Lesser Antilles to the coasts of Venezuela and Colombia and Isla de Providencia off the coast of Colombia. At Navassa Island, specimens were taken from porous, eroded rock and rubble in shallow, high-energy surge zones at the submerged bases of rocky cliffs. Small crustaceans were found in the gut of a 33.6 mm SL specimen.

**PRESERVED COLOR PATTERN** (Figure 10A).—Pigmentation is relatively well retained, but some subtleties of the pattern disappear after preservation.

**Males:** Head and body with dark brown bars on tan background. Head with six broad, dark bars radiating from eye: anteriormost bar radiating from eye to middle of upper lip, extending anteriorly and meeting similar bar from other side; bar beneath middle of eye bifurcating into anteriorly and posteriorly directed portions; remaining bars extending posteroventrally from eye to just below ventrolateral curvature of head; posterodorsal-most bar extending from eye to border of opercle. Underside of head pale, with dark brown spots on each side of lower lip, these being anterior extensions of anterior branch of bar beneath eye, posteriormost spots sometimes joining to form band across isthmus. About six squarish dark saddles along dorsal profile: anteriormost saddle on top of head, posteriormost saddle on top of caudal peduncle. Body laterally bearing approximately 8–13 dark bars separated by narrow pale interspaces, often restricted to ventral half of body; anteriormost bar behind pectoral-fin base, posteriormost bar on caudal peduncle. Dark lateral bars on body from anus to caudal-fin base reaching ventral midline; anterior bars not reaching ventral midline. Belly pale, with scattered melanophores usually present just anterior to anus. Dorsal fin with dark blotch covering basal one-half of fin; distal one-half of fin with melanophores extending along shaft of each ray, interradiation membranes pale. Anal fin pale. Caudal fin with broad, dark basal bar, with melanophores joining midlaterally with last caudal peduncle bar, forming intervening pale dorsal and ventral saddles; large, rounded dark spot present or absent in about middle of fin. Pelvic disk either pale or with dark blotch on dorsal surface of anterior pelvic rays. Pectoral-fin base typically with large dark blotch covering most or all of surface and extending posteriorly about one-half length of pectoral rays; posterior margin of

blotch irregularly indented with pale intrusions; ventralmost intrusion sometimes completely dividing blotch into large dorsal and smaller ventral portions, and sometimes forming pale spot within posteroventral field of dark blotch.

**Females:** Similar to males except lateral bars irregular, forming mottled pattern along sides of body; highly variable pigmentation on ventral surface of body: pigmentation varying among (1) pale, (2) slightly pigmented posteriorly from origin of anal fin, or (3) heavily pigmented from distal border of pelvic disk to caudal-fin base. One female with two parallel, longitudinally elongate clusters of melanophores in region C of pelvic disk.

**FRESH COLORATION.**—The following description is based upon a 35 mm Kodachrome photograph (presented in black and white in Figure 10B, lateral view) of a female specimen, 31.1 mm SL, from Navassa Island. Variations in the dorsal banding pattern are illustrated in Figure 10B,C.

Pale areas on sides of head and lips yellowish; iris yellowish with purplish area below pupil; background color of head pinkish tan with tiny bluish white speckling; underside of head with purplish brown mottling, dark brown bars, and yellowish spots; body with pinkish tan background, dark brown dorsal saddles and lateral bars; belly beneath disk white, densely mottled with gray posterior to disk; dorsal-, anal-, and caudal-fin rays reddish brown.

**ETYMOLOGY.**—The species was named in honor of Elizabeth J. Reitz, Georgia Museum of Natural History, but Briggs (2001) inadvertently applied the masculine ending (*T. reitzi*). We emend this lapsus calami to the feminine ending as *T. reitzae*.

**GEOGRAPHIC VARIATION.**—Our data indicate geographically associated modal shifts for several meristic characters. Dorsal-fin ray counts are modally higher (9) for Bahamian specimens than for those from more southerly localities (7 or 8). Anal-fin ray counts are modally higher (9) for Bahamian and Cuban specimens than for those from other Greater and Lesser Antilles localities (7 or 8); Barbados, Colombia, and Venezuela are represented by too few specimens to make definitive comment on modality. Pectoral-fin rays are very difficult to count accurately, but our data indicate a gradual shift from higher counts (22 or 23) in the north to lower counts in the south (19–21).

**COMMENTS.**—Briggs (2001) compared *T. reitzae* only with *Tomicodon* species treated in his 1955 monograph and in subsequent papers on *Tomicodon* of the eastern Pacific Ocean. He stated that *T. reitzae* was distinctive among all *Tomicodon* in having a combination of a proportionately smaller pelvic disk (disk length = 20% of SL compared with 22%–31% of SL in other *Tomicodon*) and a higher number of vertebrae than other *Tomicodon* species (34 in *T. reitzae* compared with 29–33 in others; we counted 13+22=35 vertebrae for the holotype of *T. reitzae*, which is one centrum more than Briggs recorded). As documented herein, the pelvic-disk length is highly variable (<20%–25% of SL) within several of the western Atlantic *Tomicodon* species, including *T. reitzae*.

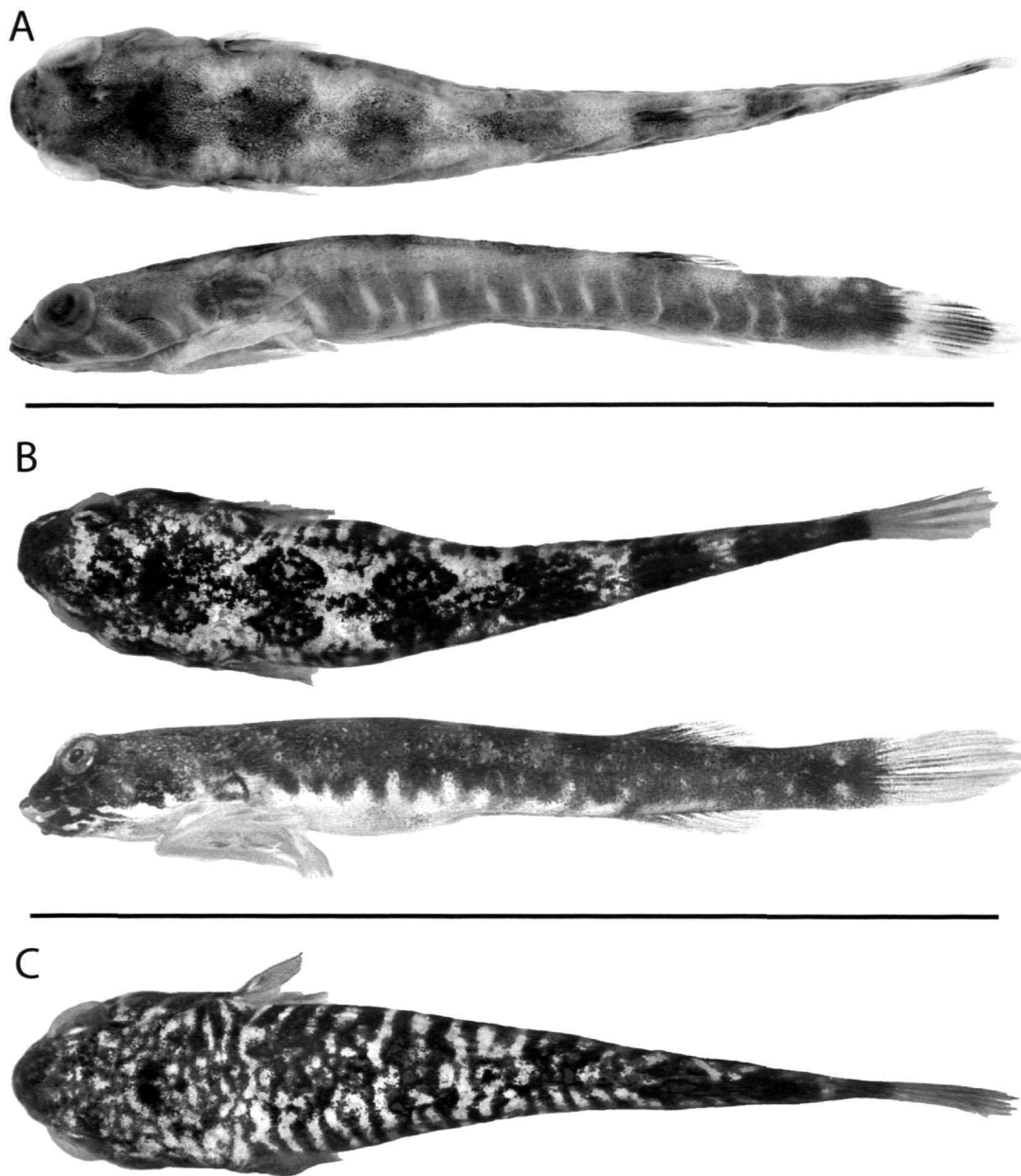


FIGURE 10.—Dorsal and lateral views of *Tomicodon reitzae*: A, preserved specimen (USNM 319753, 21.3 mm SL) from Tobago, Trinidad and Tobago; B, fresh specimens from St Croix (dorsal view, UF 118551, 23.9 mm SL), and from Navassa Island (lateral view, USNM 365846, 31.1 mm SL); C, fresh specimen (dorsal view, UF 118551, 30.2 mm SL) from St. Croix showing a prominently banded pattern with well-defined, pale bars extending onto dorsum.

*Tomicodon reitzae*, as diagnosed herein, has more vertebrae (34–38) than other western Atlantic species (28–33). Smith-Vaniz (1968) included five specimens with vertebral counts of 36–38 under the name of *T. f. fasciatus* (whereas 43 of his 48

specimens had 31–33 vertebrae); thus, we believe that Smith-Vaniz's high-vertebral-count specimens are *T. reitzae*.

MATERIAL EXAMINED.—BAHAMAS. *Andros Island*: USNM 365852 (1: 34.3 mm SL); Fresh Creek, S side, rocky area 1.2

km, mid intertidal under rocks; 23°43.2'N, 77°46.7'W; sta 33; M.L. Jones; 2 Mar 1966. *Cay Sal Bank*: ANSP 178032 (1: 25.3 mm SL); Cay Sal, at and around point forming NW tip, eroded limestone and rock rock bottom with crevices and holes at point, flat sand bottom and patches of *Thalassia* off to sides of point; 0–3 m depth; sta 524; J.E. Böhlke, H.R. Roberts et al.; 2 May 1960. *Exuma Cays*: ANSP 81290 (15: 11.6–35.0 mm SL); rock-sided, sandy-beach baylet on SE edge of Warderick Wells Cay, bottom sandy with scattered boulders, rocks along either side; 0–2 m depth; sta 410; J.E. Böhlke, C.C.G. and G. Chaplin, H.R. and R.B. Roberts; 17 Jul 1957. **BARBADOS**. USNM 86752 (1: 20.8 mm SL); pools and shallows at Bethsheba; G.S. Miller; Feb 1924. **CAYMAN ISLANDS**. *Grand Cayman*: ANSP 102298 (1: 28.3 mm SL); S side of island, Prospect Point, just E of South Sound; 1–2 m depth; sta 3; C.R. Gilbert, J.C. Tyler; 21 Oct 1964; rotenone. **COLOMBIA**. USNM 363264 (33.5 mm SL, holotype of *Tomocodon reitzae*); tiny coral islet at Isla Grande (Caribbean Sea); 10°11.4'N, 75°44.9'W; 0–1 m depth; LK 69-37; L.K. Knapp; 29 Sep 1969; rotenone. *Isla de Providencia*: UF 19048 (1: 25.9 mm SL); TT 69-8; J.C. Tyler, H.K. Tyler; 7 Aug 1969; rotenone. **CUBA**. *Havana*: USNM 192160 (6: 25.2–27.0 mm SL); Biltmore Yacht and Country Club in Rep Jaimantas; BBC 119; B.B. Collette; 23 Dec 1955. *Havana Province*: USNM 360611 (1: 24.6 mm SL); Marianao, near Blanquita Building; BBC 292; B.B. Collette; 28 Dec 1956. USNM 37414 (5: 22.0–33.6 mm SL); F. Poey. **DOMINICA**. ANSP 126709 (2: 13.4, 15.0 mm SL); Prince Ruppert Bay, Portsmouth, S side of Prince Ruppert Bluff, boulders and some sand, no vegetation, in surge zone, 0–5 m from shore; 0–1 m depth; TE-43; J.C. Tyler, W.N. Eschmeyer; 7 Jul 1965, rotenone. **GUADALOUPE**. *Basse-Terre*: USNM 365853 (1: 17.5 mm SL); near Pointe-a-Pitre, beach and foreshore near Bas-de-Fort Hotel, Gosier; Gua-1; D. Kirtley; 18 Jul 1967. **NAVASSA ISLAND**. USNM 365846 (1: 31.1 mm SL); shore at undercut of island at Northwest Point, surf zone in deeply (about 3 m) undercut cliff, encrusting bryozoa abundant; 18°25.82'N, 75°01.74'W; 0–6 m depth; NAV 99-5; J.T. Williams, B.B. Collette, C. Thacker, L. Micheletti, M. Smith; 30 Apr 1999; rotenone. USNM 365847 (1: 14.0 mm SL); just E of Northwest Point, tide pools and surf zone at shore; 18°25.81'N, 75°01.57'W; 0–2 m depth; NAV 99-15; C. Thacker, M. Smith; 2 May 1999; rotenone. USNM 365848 (1: 16.5 mm SL); W of Northeast Point, undercut vertical wall with rubble and large boulders at base, extending up to flat rock shelf near surface, shell rubble, numerous large sponges; 18°24.69'N, 75°00.64'W; 0–22 m depth; NAV 99-17; J.T. Williams, B.B. Collette, C. Thacker, M. Smith, T. Peterson; 3 May 1999; rotenone. USNM 365849 (2: 23.2, 26.3 mm SL); W of Northeast Point on rocky shelf at about 2.5 m depth with abundant bryozoans and sponges; 18°24.68'N, 75°00.64'W; 0–4.5 m depth; NAV 99-19; J.T. Williams, B.B. Collette, C. Thacker; 4 May 1999; rotenone. **PUERTO RICO**. *Mona Island*: ANSP 145896 (4: 14.7–17.5 mm SL); near anchorage, sand and rock covered with calcareous algae, shallow caves at shore; 18°05.5'N, 67°56.5'W; 0–1 m depth; MON-7; W.F.

Smith-Vaniz, P.L. Colin; 6 Oct 1978. *Puerto Yabucoa*: ANSP 115605 (1: 18.7 mm SL); 2.8 km SSW of Playa de Guyanes, Municipio de Yabucoa; sta 1; N.R. Foster, J.J. Loos; 12–13 Jul 1969. ANSP 115635 (1: 30.0 mm SL); 0.4 km SW of Playa de Guyanes, Municipio de Yabucoa; sta 2; N.R. Foster, J.J. Loos; 10–12 Jul 1969. ANSP 118640 (2: 23.0, 25.5 mm SL); 2.8 km SSW of Playa de Guyanes, Municipio de Yabucoa; sta 1; N.R. Foster, J.J. Loos; 21 Jan 1971. ANSP 120015 (3: 19.6–28.0 mm SL); Sun Oil Refinery Jetty, 0.4 km SW of Playa de Guyanes, Municipio de Yabucoa; sta 2; J.J. Loos; 26 Jul 1973; rotenone. *San Juan*: USNM 365850 (1: 18.6 mm SL); 1.6 km E of Boca de Cangrejo; E.M. Nelson; 29 Jul 1961. USNM 365851 (1: 32.4 mm SL); E of San Juan, Boca de Cangrejo, on both sides of Laguna de la Torriecilla; 18°28'N 65°59.83'W; Pue-7; D. Kirtley; 16 Jul 1967. **ST. BARTHÉLEMY**. *Fourche Island*: ANSP 117906 (3: 17.5–25.4 mm SL); NW of St. Barthélemy Bay on SW side of island at head (N end) of bay, black and white sand in surge zone with many boulders and no vegetation, 0–6 m from shore; 0–1.5 m depth; TE-47; J.C. Tyler, W.N. Eschmeyer, G. Koven; 11 Jul 1965; rotenone. *Ile Syndare*: ANSP 178034 (9: 13.9–20.0 mm SL); Port Gustavia; W edge of the smaller of the two islets that make up the Syndares, boulders and short grass in surge zone, 0–3 m from shore; 0–1.5 m depth; TE-53; J.C. Tyler, W.N. Eschmeyer; 13 Jul 1965; rotenone. **ST. LUCIA**. ANSP 106116 (1: 9.3 mm SL); Port Castries at Vigie Point, rocky cliffs, rocks, boulders, no vegetation except grass on surface of rocks, surge zone at shore; 0–3 m depth; TE-28; J.C. Tyler, W.N. Eschmeyer; 3 Jul 1965; rotenone. **TOBAGO**. ANSP 144464 (1: 20.5 mm SL); Mt. Irvine, rocky shore; J. and H. Randall; 3 May 1964. USNM 318651 (1: 27.5 mm SL); Pirates Bay, just N of Charlotteville in Man-of-War Bay; rocky shore, some coral; sand beach; 11°19.53'N 60°32.97'W; 0–4.5 m; JTW 90-2; J.T. Williams, J. Howe., M. Nizinski, S.D. Blum, Jr., T. Munroe; 5 Sep 1990; rotenone. USNM 319753 (10: 18.5–26.2 mm SL); same locality data as USNM 318651. **TRINIDAD**. UF 228587 (1: 17.6 mm SL); R/V *Pillsbury* PIL 701; 18 Jul 1968. **U.S. VIRGIN ISLANDS**. *St. Croix*: UF 118551 (9, examined only 8: 19.4–30.1 mm SL); Buck Island Reef National Monument; sta BUIS 2001-8; W.F. Smith-Vaniz, L.A. Rocha. **VENEZUELA**. MHNSL 3932 (1: 27.3 mm SL); Punta Tarma, Estado Vargas; M. Ameruoso; 12 Jul 1981. *Isla La Blanquilla*: MOBR EDI-MAR 2341 (1: 25.8 mm SL); F. Cervigon; 1 Mar 1967.

### *Tomocodon rhabdotus* Smith-Vaniz, 1968

#### FIGURE 11

*Tomocodon rhabdotus* Smith-Vaniz, 1968:473 [type locality: Dominica; holotype. USNM 201804].

**DESCRIPTION** (Table 1).—Dorsal-fin rays 8 or 9. Anal-fin rays 6–8 (usually 6). Pectoral-fin rays 20 or 21. Caudal-fin segmented rays 10 or 11. Vertebrae 11–14+14–17=28–29 (bimodal at 14+14=28 and 14+15=29); last rib on vertebra 12 or 14 (mode 14); last epineural on vertebra 21 or 22 (mode 21).



FIGURE 11.—Dorsal and lateral views of a preserved specimen of *Tomicodon rhabdotus* (ANSP 123695, 24.1 mm SL) from Dominica.

Anal fin originating at vertical from base of dorsal-fin ray 4 or 5 (usually 5). Upper jaw without canines, 12 incisors. Lower jaw with 2 canines, 8 incisors. Anterior margin of pelvic disk crenulate, with well-developed flaps. Pelvic disk region A with 6 or 7 irregular rows of papillae; region B with 9 or 10 irregular rows. Anus position midway. Anterior nostril with well-developed dermal flap.

Head and body strongly depressed. Head length 31.6%–32.8% SL ( $\bar{x}$  = 32.4%). Head width 29.7%–31.8% SL ( $\bar{x}$  = 30.9%). Pelvic disk moderate in size, length 28.9%–30.1% SL ( $\bar{x}$  = 29.2%). Longest known specimen 38.4 mm SL.

Mature females with large, cigar-shaped ovaries extending length of body cavity. In one specimen (24.1 mm SL; ANSP 123695) with well-developed ovaries, right ovary with about 50+ eggs, largest eggs about 0.4 mm in diameter. Genital papilla of females short and conical, with somewhat pointed tip; male papilla a slender, elongate tube.

ECOLOGICAL HABITAT AND DISTRIBUTION.—Specimens have been taken from rocky shallow surge zones in depths of 1 m or less. Based upon material examined in this study, the known distribution of *T. rhabdotus* is expanded from Dominica northward to St. Barthélemy and southward to St. Lucia.

PRESERVED COLOR PATTERN (Figure 11).—Pigmentation apparently is retained after preservation.

*Males:* The distinctive color pattern with the head and body covered with narrow pale bars on dark brown background is figured in Smith-Vaniz (1968, fig. 1). We comment on a few features of particular interest below.

Pelvic disk with pale suctorial surface, exposed lateral surfaces dusky. Pectoral fin and base with two narrow, diagonal pale bars on dark background: first (anteriormost) bar extend-

ing from beneath dorsal attachment of gill cover posteroventrally to base of ventral pectoral rays; second bar beginning on dorsalmost pectoral ray bases and paralleling first bar to about middle of fin; remainder of pectoral fin dusky.

*Females:* Similar to males.

FRESH COLORATION.—Unknown.

ETYMOLOGY.—The specific epithet is based upon the Greek *rhabdotus*, meaning striped, and refers to the striped color pattern (Smith-Vaniz, 1968).

MATERIAL EXAMINED (Abbreviated).—DOMINICA. ANSP 123695 (4: 16.9–24.1 mm SL), USNM 199560 (1: 15.9 mm SL, paratype), USNM 199561 (1: 18.7 mm SL, paratype), USNM 201804 (38.4 mm SL, male, holotype). ST. BARTHÉLEMY. ANSP 178033 (1: 7.0 mm SL), ANSP 178035 (1: 8.9 mm SL). ST. LUCIA. ANSP 123661 (1: 23.4 mm SL).

### *Tomicodon rupestris* (Poey, 1860)

FIGURE 12

*Gobiesox rupestris* Poey, 1860:283 [type locality: Cuba; type specimen lost; neotype, USNM 365864, a Poey specimen from Cuba, designated in "Nomenclatural Discussion," below].

DESCRIPTION (Table 1).—Dorsal-fin rays 7–10 (usually 8 or 9). Anal-fin rays 6–9 (usually 7 or 8). Pectoral-fin rays 20–22 (mode 21). Caudal-fin segmented rays 10–12 (mode 11). Vertebrae 13–15+17–19=30–33 (mode 14+18=32); last rib on vertebra 13–16 (usually 14 or 15); last epineural on vertebra 20–25 (mode 22). Anal fin originating at vertical from base of dorsal-fin ray 2–5 (usually 3 or 4). Upper jaw with 2 canines, 10 incisors. Lower jaw with 2 canines, 6 or 8 incisors. Anterior

margin of pelvic disk crenulate, with flap complexity increasing with specimen size. Pelvic disk region A with 6 or 7 irregular rows of papillae; region B with 6 or 7 irregular rows. Anus position varying from midway to near anal-fin origin, usually midway. Anterior nostril usually with tiny dermal flap, flap sometimes absent or moderately developed.

Body elongate, rounded in cross section. Head width  $\leq 2 \times$  head depth for all specimen sizes. Head length 26.3%–31.7% SL ( $\bar{x} = 28.5\%$ ). Head width 15.0%–24.6% SL ( $\bar{x} = 21.1$ ). Pel-

vic disk small, length 18.0%–27.2% SL ( $\bar{x} = 24.1\%$ ). Longest known specimen 27.3 mm SL.

Mature females with large, cigar-shaped ovaries extending length of body cavity. In one specimen (23.7 mm SL; USNM 365863) with well-developed ovaries, right ovary with about 50+ eggs. Largest egg diameters about 0.4 mm in 23.7 mm SL specimen and 0.5 mm in 25.3 mm SL specimen (both USNM 365863). Genital papilla of females short and conical with somewhat pointed tip; male papilla a slender, elongate tube.

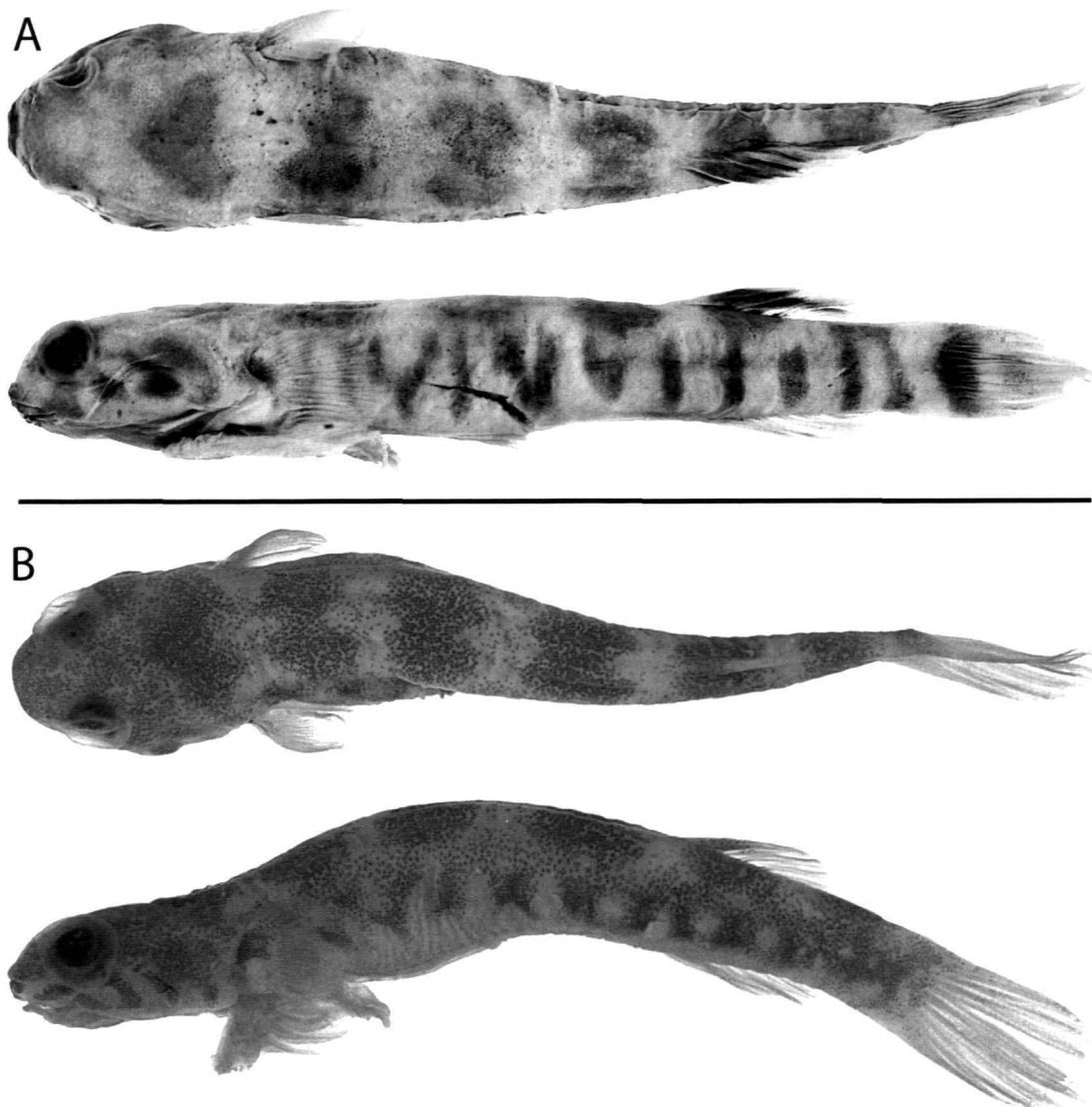


FIGURE 12.—Dorsal and lateral views of preserved specimens of *Tomicodon rupestris* showing variation in pigmentation pattern: A, male (USNM 365855, 24.5 mm SL; abdominal mark in lateral view is an incision) from Puerto Rico; B, female (FMNH 94187, 21.9 mm SL) from Ambergris Cay, Belize.

**ECOLOGICAL HABITAT AND DISTRIBUTION.**—Specimens have been taken from rocky shallow surge zones in depths of 3 m or less. The known distribution of *T. rupestris* is Bahamas, Cuba, Jamaica, Puerto Rico, U.S. Virgin Islands, Grand Cayman, Belize, Honduras, and San Andrés Island, Colombia (in western Caribbean, east of Nicaragua).

**PRESERVED COLOR PATTERN** (Figure 12).—Pigmentation apparently is retained after preservation.

**Males:** Head and body with dark brown bars on tan background. Head with five narrow dark bars radiating from eye: anteriormost bar radiating from eye to middle of upper lip, extending anteriorly and meeting similar bar from other side; bar beneath middle of eye broadening ventrally into a somewhat triangular shape; remaining bars extending posteroventrally from eye to just below ventrolateral curvature of head; posterodorsalmost bar extending from eye to ventrolateral border of opercle. Underside of head pale, with dark brown spots on each side of lower lip, these being anterior extensions of the triangular bar beneath the eye. Usually six hourglass-shaped, dark saddles along dorsal profile: anteriormost saddle on top of head, posteriormost saddle on top of caudal peduncle. Body laterally bearing approximately 8–13 narrow, dark bars separated by broader pale interspaces; anteriormost bar behind pectoral-fin base, posteriormost bar on caudal peduncle. Dark lateral bars on body from anal-fin origin to caudal-fin base reaching ventral midline. Belly and region anterior to anal-fin origin pale. Dorsal fin with dark blotch covering basal one-half of first four or five rays, and scattered melanophores extending as dusky streak along central portion of fin. Anal fin varying from pale to having a few melanophores associated in an irregular streak at about midlength of anterior four or five rays. Caudal fin pale basally and distally, with two intervening broad, dark bars separated by a pale interspace, the anterior dark bar somewhat crescent shaped and cradling a reduced, more rounded, and centrally positioned second bar. Pelvic disk pale. Pectoral-fin base typically with large dark blotch covering dorsal half and extending onto bases of dorsalmost 8–12 pectoral-fin rays, remainder of pectoral fin and base without noticeable pigmentation.

**Females:** Similar to males except lateral bars irregular and forming mottled pattern along sides of body, posteriormost one or two bars sometimes bearing a few scattered melanophores reaching ventral midline.

**FRESH COLORATION.**—Unknown.

**ETYMOLOGY.**—The specific epithet apparently is based upon the Latin *rupestris*, meaning rocky or of rocks and presumably refers to the rocky surge-zone habitat in which specimens of this species are found.

**GEOGRAPHIC VARIATION.**—Our data do not indicate any significant modal shifts for meristic characters among the several geographic regions for which we have sufficient sample sizes (i.e., Bahamas, Cuba, and Puerto Rico).

**NOMENCLATURE DISCUSSION.**—*Gobiesox rupestris* Poey, 1860, is the oldest available name for any *Tomicodon* species in the Greater Antilles. Previous authors (Schultz 1944; Briggs

1955) placed *Gobiesox rupestris* in the synonymy of *Tomicodon fasciatus* (restricted herein to the southern Caribbean Sea and St. Croix), and this synonymy has been widely accepted. We have been unable to locate the holotype (Poey specimen number 456) and presume that it is lost; it is not among Poey type specimens housed at the Museum of Comparative Zoology, Harvard University, or at the National Museum of Natural History, Smithsonian Institution. According to Michael L. Smith (Conservation International; pers. comm. with JTW, JCT, 2002), the Poey type specimens left in Havana have not been cared for and are either desiccated or lost. We believe the type specimen of *G. rupestris* is lost.

During our study, we found that almost every jar of Cuban *Tomicodon* with numerous individuals contained specimens of two species. One of these taxa is identified herein as *T. reitzae*, and the other is distinct from the taxon we recognize as *T. fasciatus*, which apparently does not occur in Cuba. Poey's original description of *Gobiesox rupestris* does not include most of the features useful in distinguishing species of *Tomicodon*, and it does not include vertebral counts, which would definitively identify it as *T. reitzae*. However, Poey stated that the head is contained four times and the depth six times in the total length, proportions atypical of the relatively elongate *T. reitzae* but in agreement with the characteristics of the other Cuban *Tomicodon* species represented in our material. Because the name *Gobiesox rupestris* Poey is available and Poey's description applies to this taxon, we recognize *Tomicodon rupestris* as a valid species and designate USNM 365864 (22.2 mm SL, male, a Poey specimen from Cuba) as the neotype.

**MATERIAL EXAMINED** (Abbreviated).—BAHAMAS. ANSP 94746 (18: 13.0–19.6 mm SL), ANSP 178036 (19: 8.3–21.2 mm SL). BELIZE. FMNH 93755 (1: 19.2 mm SL), FMNH 94187 (1: 21.9 mm SL), UF 211460 (1: 13.6 mm SL). CAYMAN ISLANDS. *Grand Cayman*: ANSP 104960 (2: 12.2, 16.4 mm SL). COLOMBIA. *San Andrés Island*: ANSP 72671 (3: 12.8–21.5 mm SL). CUBA. USNM 37421 (3: 18.8–24.0 mm SL), USNM 133010 (7: 16.0–24.0 mm SL), USNM 192157 (36: 17.9–23.0 mm SL), USNM 365863 (5: 23.3–29.9 mm SL), USNM 365864 (22.2 mm SL, male, neotype of *Gobiesox rupestris*). HONDURAS. UF 88560 (1: 17.8 mm SL). JAMAICA. UF 16303 (2: 18.3, 20.8 mm SL). PUERTO RICO. ANSP 145071 (1: 18.4 mm SL), ANSP 145832 (8: 14.5–20.1 mm SL), ANSP 178028 (2: 14.3, 14.5 mm SL), USNM 123270 (1: 19.4 mm SL), USNM 365855 (2: 13.7, 24.5 mm SL). U.S. VIRGIN ISLANDS. *St. John*: UF 205157 (3: 18.5–25.9 mm SL).

### Distribution

Distributions of the western Atlantic species of *Tomicodon* are presented in Figure 13. Although some taxa are known from only one or a few locations, and a phylogeny of *Tomicodon* species has yet to be hypothesized, several distributional patterns are suggested by these data. A pattern that appears to be related to specimen size is that species with a maximum size

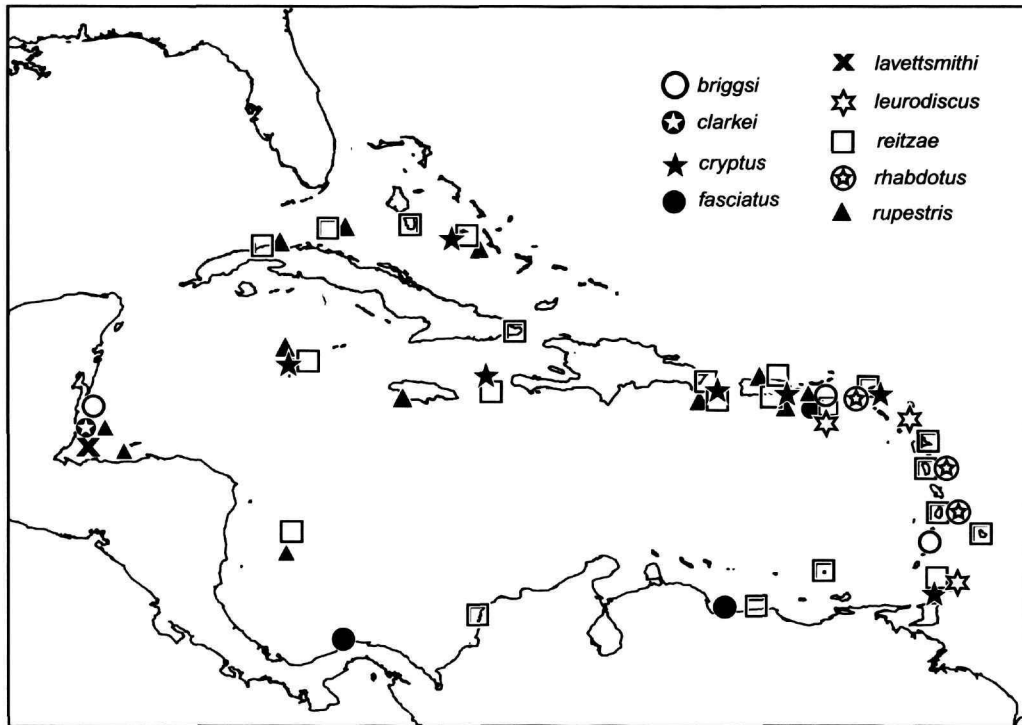


FIGURE 13.—Geographic distribution of examined specimens of the nine species of genus *Tomicodon* known from the Caribbean Sea. The distribution of *T. australis*, known only from the southeastern coast of Brazil, is not shown.

of 25 mm SL or greater (*T. fasciatus*, *T. reitzae*, *T. rhabdotus*, *T. rupestris*) tend to be geographically widespread, whereas species with a maximum size less than 20 mm SL (*T. clarkei*, *T. leurodiscus*) tend to have more narrowly restricted geographic distributions. The exceptions among species of larger size are *T. lavettsmithi*, which is known only from Belize, and *T. australis*, which is known only from southeastern Brazil. The exception among species of smaller size are *T. briggsi*, which has a wide but disjunct distribution, and *T. cryptus*, which has a relatively widespread distribution from Tobago, through the Antilles, to the Cayman Islands.

As a result of the widespread distributions discussed above, there are numerous instances of sympatry between two or sometimes three species at certain localities. *Tomicodon reitzae* occurs sympatrically at one or more localities with *T. fasciatus*, *T. rhabdotus*, *T. briggsi*, *T. leurodiscus*, *T. cryptus*, and *T. rupestris*. *Tomicodon reitzae* is absent from Central American coastal areas and Belize, where *T. clarkei* and *T. lavettsmithi* occur. *Tomicodon reitzae* also is absent from southeastern Brazil where *T. australis* occurs. We have found three localities where three *Tomicodon* species have been taken in the same

collecting station. At St. Barthélemy, *T. rhabdotus*, *T. cryptus*, and *T. reitzae* occur together. At Mona Island, a single station contained specimens of *T. rupestris*, *T. cryptus*, and *T. reitzae*. At Tobago, *T. cryptus* and *T. reitzae* were taken in the same collecting station near Mt. Irvine, and *T. leurodiscus* was taken at the southeastern end of the island.

Although *T. clarkei* and *T. lavettsmithi* occur sympatrically off the coast of Belize, they are allotopically distributed in different habitats that may be separated by only a few kilometers. The *T. clarkei* specimen was found in the high-energy spur-and-groove habitat of the fore reef, whereas *T. lavettsmithi* is known only from the quieter waters of lagoonal islands.

Of potential biogeographic interest are the distribution patterns of *T. rupestris* and *T. fasciatus*. *Tomicodon rupestris* is endemic to the northern Caribbean, occurring from San Andrés Island, Belize, Honduras, Cuba, and the Bahamas through the Greater Antilles to Mona Island, Puerto Rico. By contrast, *T. fasciatus* occurs from St. Croix and Venezuela westward to Panama. The significance of these patterns will remain unknown until a phylogeny of these taxa is hypothesized.

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