SICYOPTERUS RAPA, NEW SPECIES OF SICYDIINE Goby (Teleostei: Gobiidae), FROM RAPA, FRENCH POLYNESIA

Lynne R. Parenti and John A. Maciolek

ABSTRACT

Sicyopterus rapa, apparently endemic to one of the two southernmost islands of French Polynesia in the south central Pacific Ocean, is distinguished from congenerics by a low number of premaxillary teeth and an unscaled ventral surface of the body in largest adults. Its putative closest living relatives are in the Marquesas and Indonesia.

Sicydiine gobies comprise a group of tropical and subtropical stream fishes that exhibit a relatively high degree of island-group endemism, particularly in the Pacific (Ryan, 1991; Marquet and Galzin, 1992). We described recently five new sicydiine species in three genera from the islands of Ponape and Palau, Micronesia, in the western Pacific, bringing the total number of nominal sicydiine species to about 100 (Parenti and Maciolek, 1993). Our objectives herein are to describe Sicyopterus rapa, a new species from Rapa, one of the two southernmost islands of French Polynesia, and to comment on Indo-Pacific sicydiine biogeography.

Rapa is a subcircular, volcanic island at approximately 27°36’S, 144°20’W in the south central Pacific Ocean (Fig. 1). The atoll is relatively small, 20 km in circumference, and high, maximum altitude approximately 656 m. Two hundred and sixty-eight fish species were reported from Rapa by Randall et al. (1990), including the new sicydiine described herein which they referred to as Sicyopterus sp. The fish fauna of Rapa, like that of other volcanic Pacific islands, such as the Hawaiian Islands, comprises principally marine, estuarine, and diadromous species, the last including gobiodids and anguillid eels. Some fishes, including those in the gobiiid subfamily Sicydiinae, are more properly called anadromous: adults live and breed in freshwater; larvae are carried passively to the sea where they undergo transformation prior to ascending a stream (McDowall, 1992; Parenti and Maciolek, 1993). Populations live on islands high enough to maintain perennial freshwater stream systems, and in high-gradient, coastal streams.


Sicydiine monophyly is well-supported (Parenti and Maciolek, 1993: 950–954). Hypothesized sister genera Sicyopterus and Sicydiyum share putative synapomorphies of a short, blunt ascending/articular process of the premaxilla (Parenti and Maciolek, 1993), and an oculoscapular–canal pore pattern characterized by fusion of pores H and K to form one pore, HK (Pezold, 1993), following canal pore terminology of Akihito et al. (1984).

Characters to distinguish between Sicydiyum and Sicyopterus were discussed by Akihito and Meguro (1979: table 3). Parenti and Maciolek (1993: table 2) eval-
uated polarity of those characters and diagnosed *Sicydium* as monophyletic based on a single specialization: a large, fleshy, swelling between posterior extent of labial (horizontal) and unicusp dentary teeth. *Sicyopterus* is diagnosed as monophyletic by a distinct, medial gap between left and right premaxillary tooth rows.

*Sicydium* lives in insular and coastal streams of the tropical eastern Pacific and Atlantic oceans, including the Caribbean Sea. *Sicyopterus* is widespread throughout the tropical Indo-Pacific, including Madagascar, but absent from the eastern Pacific. Maugé et al. (1992) recognized three species of *Sicyopterus* from French Polynesia: *S. pugnans* (Ogilvie-Grant, 1884); *S. taeniurus* (Günther, 1877) under which they considered *S. marquesensis* Fowler, 1932, a probable synonym; and *S. caudimaculatus*, which they described as new from the Marquesas. Description of *Sicyopterus rapa* from the south central Pacific Ocean brings the number of recognized *Sicyopterus* species from French Polynesia to four.

**MATERIALS AND METHODS**

Representative specimens were cleared and either counterstained with alcian blue and alizarin red (Dingerkus and Uhler, 1977), or stained solely with alizarin. The species diagnosis includes those characters unique or otherwise hypothesized to be autapomorphic (sensu Hennig, 1966). Additional characters useful for identification are given in the description and comparisons.

Preserved color is that after fixation in formalin and storage in ethanol or isopropanol. Counts and
Table 1. Summary of standard length and proportional measurements of type specimens of *Sicyopterus rapa*. (Proportions expressed as percent of standard length)

<table>
<thead>
<tr>
<th></th>
<th>Males (N = 9, including holotype)</th>
<th>Females (N = 9)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Holotype</td>
<td>Range</td>
</tr>
<tr>
<td>Standard length (mm)</td>
<td>62.5</td>
<td>40.0–64.8</td>
</tr>
<tr>
<td>Head length</td>
<td>24.2</td>
<td>21.5–25.3</td>
</tr>
<tr>
<td>Eye diameter</td>
<td>3.9</td>
<td>2.3–4.2</td>
</tr>
<tr>
<td>Snout length</td>
<td>11.4</td>
<td>8.8–11.4</td>
</tr>
<tr>
<td>Interorbital width</td>
<td>10.2</td>
<td>9.4–11.0</td>
</tr>
<tr>
<td>Body depth</td>
<td>17.3</td>
<td>15.1–19.8</td>
</tr>
<tr>
<td>Predorsal length</td>
<td>35.4</td>
<td>33.0–38.1</td>
</tr>
<tr>
<td>Preanal length</td>
<td>54.4</td>
<td>53.9–57.6</td>
</tr>
<tr>
<td>First dorsal base</td>
<td>13.3</td>
<td>11.8–19.4</td>
</tr>
<tr>
<td>Second dorsal base</td>
<td>30.1</td>
<td>28.3–33.3</td>
</tr>
<tr>
<td>Interdorsal fin space</td>
<td>3.2</td>
<td>2.3–5.6</td>
</tr>
<tr>
<td>Caudal length</td>
<td>25.9</td>
<td>21.7–25.9</td>
</tr>
<tr>
<td>Pectoral length</td>
<td>23.2</td>
<td>20.0–23.2</td>
</tr>
<tr>
<td>Anal base</td>
<td>25.6</td>
<td>24.1–30.0</td>
</tr>
</tbody>
</table>

Measurements follow Parenti and Maciolek (1993). Measurements are straight-line distances recorded with metric dial calipers and are reported for males and females as a range of percent of standard length (SL; Table 1). Transverse scale rows are those along the mid-side of the body from just posterior to the dorsal extent of the gill opening to the point of caudal flexure. Anterior scales are small and irregularly placed. Scale counts are highly variable within sicydine species because of this irregular scale placement; reported values are approximate. Counts were made from radiographs and cleared and stained or alcohol specimens. Values for the holotype are given in brackets following counts or measurement ranges.

Specimens of the new species are listed in the species account. Institutional abbreviations follow the Standard Symbolic Codes for Institutional Research Collections in Herpetology and Ichthyology (Leviton et al., 1985). The generic citation follows Eschmeyer (1990). Comparative material examined includes that listed in Parenti and Maciolek (1993), and the following:

*Sicyopterus brevis*, Seram, Indonesia, ZMA 110.981, syntypes, 2 spec.
*Sicyopterus caudimaculatus*, Marquesas, French Polynesia, MNHN 1989-1777, holotype, male, 88.0 mm SL, MNHN 1992-121, 31 paratypes, 25.0–95.0 mm SL.
*Sicyopterus micrurus*, Tutuila, American Samoa, CAS 67540, 3 spec.
*Sicyopterus tenuis*, Guan, Marianas Is., CAS 67532, 3 spec.
*Sicydium plumieri*, Puerto Rico, USNM 313664, 4 spec.

*Sicyopterus* Gill, 1860

*Sicyopterus* Gill, 1860: 101, as a subgenus of *Sicydium* Valenciennes, in Cuvier and Valenciennes, 1837 [type species *Sicydium (Sicyopterus) stimpsoni* Gill 1860: 101 by original designation].

*Sicyopterus rapa*, new species

Figures 1–3, Table 1

*Sicyopterus* sp.—Randall, Smith, and Feinberg, 1990: 35, figure 46, Rapa, French Polynesia.

**Diagnosis.**—Distinguished from congeners by a low number (approximately 45 as opposed to 60 or more) of teeth on each premaxilla, and ventral body surface unscaled in largest adults.

**Description.**—First dorsal fin VI, depressed third spine longest, extending posteriorly well beyond second dorsal-fin insertion in males; second dorsal fin I,11; dorsal pterygiophore formula 3-12210; anal fin I,10; pectoral fin 17–19 [18]; pelvic fin I,5, interspinal membrane or frenum thick; branched caudal-fin rays 13–15 [15]; vertebræ 10 + 16 = 26; no rakers on first gill arch; branchiostegal rays 5.

Transverse scales in 44–62 [44] rows. Dorsal surface of head unscaled; oper-
Figure 2 (upper). *Sicyopterus rapa*, new species. Holotype, BPBM 12923, male, 62.5 mm SL, Rapa, French Polynesia.

Figure 3 (lower). *Sicyopterus rapa*, new species. Paratype (allotype), USNM 330077, female, 66.7 mm SL, Rapa, French Polynesia.

culum, cheeks and lateral portion of body to first dorsal fin irregularly scaled with small cycloid scales; ventral surface of body unscaled in largest adults, otherwise incompletely covered with small cycloid scales; remainder of body to caudal peduncle covered with imbricate ctenoid scales; anterior portion of caudal-fin rays with smaller ctenoid or cycloid scales in one or two discrete rows dorsal and ventral to each ray. Three preopercular canal pores (M', N, and O'); anterior and posterior oculoscapular canals united, pore pattern A', B, C, D (single), F, HK and L'. Urogenital papilla blunt in males, slightly bilobed in females.

Mouth subterminal, small, maxilla ends at or just anterior to anterior edge of eye; upper lip with small median and large lateral efts, approximately 8 to 11 weak crenulations on lip margins between medial and lateral cleft; small papilla posterior to medial cleft, row of papillae laterally on underside of lip; simple anterior naris about halfway between anterior margin of eye and posterior extent of upper lip; simple posterior naris anterior to eye. Premaxillary teeth tricuspid; approximately 45 teeth on each premaxilla. Dentary with 2–11 caniniform teeth, anterior two largest.

Head blunt and rounded in profile, head length 20.2–25.9 [24.2]; eye diameter 2.2–4.2 [3.9]; snout length 7.8–13.0 [11.4]; interorbital width 7.8–11.0 [10.2]; body depth 15.1–26.8 [17.3]; predorsal length 32.3–38.9 [35.4]; preanal length 53.9–62.2 [54.4]; first dorsal-fin base 11.8–19.4 [13.3]; second dorsal-fin base 25.1–33.5 [30.1]; interdorsal fin space 2.3–5.8 [3.2]; caudal-fin length 17.6–25.9 [25.9]; pectoral-fin length 18.0–23.2 [23.2]; anal-fin base 20.5–30.0 [25.6].

**PRESERVED COLOR.** Most specimens bleached somewhat in alcohol. Males with
head light brown dorsally, including upper lip, paler brown ventrally. Head with
dark brown to black bar from ventral rim of orbit to posterior extent of maxilla.
Body light brown dorsally to middle of caudal peduncle, light brown laterally,
body pearlish gray, translucent ventrally. Pectoral and dorsal fins light brown;
dark brown membrane between first-dorsal-fin rays 3 and 4, and posterior to
dorsal-fin ray 5. Membrane of second dorsal fin dark brown on dorsal half of
anterior portion of fin, darker brown on posterior portion. Pelvic disc pale brown.
Anal fin with dark-brown marginal band. Caudal fin medium brown on posterior
portion of middle rays, slightly paler brown on margin. Females like males except
head lighter brown dorsally and anal and second dorsal fins light brown, not
darker than body.

Sexual Dimorphism.—In addition to the dorsal-fin ray and color-pattern differ-
ences noted above, males and females have non-overlapping ranges of caudal-fin
length (the fin is longer in males) (Table 1). Some females are proportionally
deeper bodied and have a greater preanal length, measurements likely correlated
with being gravid (compare Figs. 2, 3).

Comparisons and Relationships.—The low number (approximately 45) of teeth
on each premaxilla and unscaled ventral adult-body surface distinguishes Sicyop-
terus rapa from congeners. Sicyopterus rapa is like certain other Sicyopterus,
such as S. stimpsoni (Hawaii), S. cynocephalus (Philippines, New Guinea), S.
eudentatus (Ponape), and S. caudimaculatus (Marquesas) in having median and
lateral clefts in an upper lip that may be only weakly crenulate, rather than dis-
tinctly crenulate, nearly “fringed,” as in S. lividus (Ponape), S. pugnans (Samoa,
Moorea, Tahiti, and Fiji), and S. panayensis (Philippines). Sicyopterus rapa also
shares with S. caudimaculatus tricuspid premaxillary teeth and a dark-brown to
black bar from the ventral rim of the orbit to the posterior extent of the maxilla.

Sicyopterus rapa differs further from S. caudimaculatus in having a relatively
low number (44–62 versus 66–70) of transverse scale rows, and in lacking the
latter species’ diagnostic markings: black, oval blotch on dorsal portion of base
of caudal-fin rays and caudal peduncle, and blackish, subtriangular, midlateral
band from base of pectoral fin to about middle of second dorsal fin in males. In
both species, a dark bar extends vertically from the eye, as in certain other Si-
cyopterus, notably seven species from Papua New Guinea which have a variety
of upper lip morphologies (Allen, 1991: 193–196, fig. 39), as well as in other
gobioids, notably the Indo-Pacific freshwater and marine genus, Stenogobius (see

Phylogenetic relationships of sicydine species have not been hypothesized rig-
gerously, yet S. rapa may be considered a member of a monophyletic group of
Sicyopterus that also includes S. caudimaculatus (Marquesas), and S. brevis (Ser-
am, Indonesia). The group is diagnosed by three putative synapomorphies: upper
lip weakly crenulate; premaxillary teeth tricuspid; and adult body and fin color-
ation generally drab. A weakly crenulate upper lip may be intermediate between
a smooth lip or a lip with just median and lateral clefts and a deeply crenulate
upper lip; polarity of this character is unclear. Distinct saddle bars or reticulations
on the body that often extend onto the caudal fin characterize most sicydines and
putative close relatives, such as Awaoanus. We view absence of these color patterns,
or presence of only an isolated caudal or subpectoral blotch (as in S. caudima-
culatus), as derived.

Distribution.—Known only from tributaries of Haurei Bay, Rapa, French Poly-
nesia, and an unspecified locality in Rapa collected by the 1934 T. Crocker Eastern
Pacific “Zaca” Expedition.
Eymology.—The species epithet *rapa*, to connote occurrence of this species on Rapa, French Polynesia, used as a noun in apposition.

Material Examined.—28 specimens, 37.4–74.7 mm SL.

Holotype. BPBM 12923, male, 62.5 mm SL, coll. A. Sinoto and D. Bryant, 5 Feb 1971, shallow water in Pania River at head of Haurei Bay, Rapa, French Polynesia.

Paratypes, Same Data as Holotype. USNM 330077 (ex. BPBM 12923), female (allotype), 66.7 mm SL; BPBM 35782 (ex. BPBM 12923), 6: 3 males, 40.0–64.8 mm SL, 3 females, 44.5–64.1 mm SL; MNHN 1994-501 (ex. BPBM 12923), male, 45.5 mm SL, MNHN 1994-502 (ex. BPBM 12923) female 47.1 mm SL; CAS 81599 (ex. BPBM 12923), male, 64.2 mm SL, female, 74.7 mm SL. Unspecified locality, Rapa, coll. 8 Dec 1934, T. Crocker Eastern Pacific “Zaca” Expedition (sta. 047): AMNH 19941, 6: 47.9–65.9 mm SL.

Nontype Material.—Same locality as holotype: BPBM 35783 (ex. BPBM 12923), 3 females, 44–55 mm SL; BPBM 35784 (ex. BPBM 12923), male, 37.4 mm SL, female, 47.9 mm SL, both cleared and stained solely with alizarin. Rapa, 200 yards from mouth of stream into Haurei Bay, about 0.5 mi. S of Tapui L., 27°36'S, 144°18'W [approximate coordinates], AMNH 72762, 4, 43.4–67.4 mm SL, coll. 16 Apr 1970. R. Mathews, P. Goodrich, and C. L. Smith (field no. CLS 70-039). Unspecified locality, Rapa, coll. 8 Dec 1934, T. Crocker Eastern Pacific “Zaca” Expedition (sta. 047): AMNH 97491 (ex. AMNH 19941), 1 cleared and stained solely with alizarin.

Remarks.—Randall et al. (1990: fig. 46) published a photograph of the female allotype of *S. rapa*, USNM 330077 (ex. BPBM 12923).

Biogeography.—All but one (*Sicydium*) of the currently recognized sicydine genera live in the central Pacific: *Sicyopus*, *Lentipes*, *Stiphodon*, and *Sicyopterus*, plus *Parasicydium* if one follows Harrison (1993) who places *Lentipes rubrofasciatus* Maugé et al., 1992 in that genus. *Sicyopus*, the most plesiomorphic sicydine, and *Sicyopterus*, one of the two most derived genera, also live in the Indian Ocean (Parenti, 1991). Within sicydines and other central Pacific fish taxa, generic sympatry is common. For example, five sicydine species in three genera are known from Ponape, a volcanic island in the Eastern Caroline Islands, Micronesia: *Sicyopus nigrolineatus* Parenti and Maciolek, 1993, *Sicyopterus lindus* Parenti and Maciolek, 1993, *Sicyopterus eudentatus* Parenti and Maciolek, 1993, *Stiphodon caeruleus* Parenti and Maciolek, 1993, and *Stiphodon cf. elegans*. The first four of these species are endemic to Ponape, as far as known, the last was compared with a widespread western Pacific species, *Stiphodon elegans* (Steindachner, 1879). Similarly, Maugé et al. (1992) recognized seven sicydine species in four genera from French Polynesia: *Sicyopterus pugnans*, *Sicyopterus taeniurus*, *Stiphodon elegans*, *Stiphodon stevensoni* (Jordan and Seale, 1906), *Sicyopterus caudimaculatus* (Ua Huka, Ua Poa, Nuku Hiva and Hiva Oa, Marquesas), *Sicyopus bilaeniatus* Maugé et al., 1992 (Ua Pou and Hiva Oa, Marquesas), and *Lentipes rubrofasciatus* (Ua Huka, Marquesas). The last three species are endemic to the Marquesas, as far as known, the other four widespread throughout the western Pacific.

Clearly, island-group endemism is relatively high in the Pacific. Yet, islands, or island groups, do not necessarily have monophyletic groups of sicydine species, let alone genera. The Marquesas *Sicyopterus*, *S. caudimaculatus*, has putative close relatives in Rapa (*S. rapa*) and Indonesia (*S. brevis*). In addition, if Harrison’s (1993) reclassification is corroborated, then the Marquesas *Lentipes*, referred
to by him as *Parasicyclium rubrofasciatum*, has its closest relatives in the Ryukyus (*P. armatum*) and off the coast of West Africa (*P. bandama*). Springer (1982) viewed vicariance of widespread ancestral taxa to explain Marquesas endemism as preferable to postulating independent colonizations, and we agree. Furthermore, the ancestral taxa were widespread prior not only to specific, but to generic differentiation, reinforcing complexity of relationships of Pacific Plate endemics and the great age of their lineages.

**ACKNOWLEDGMENTS**

This research was supported initially by NSF grant BSR 89-06649 to the senior author while at CAS and completed in the Division of Fishes, USNM. T. Britt Griswold photographed the holotype and paratype (allotypes). J. Clayton (USNM) and D. Catania (CAS) provided technical assistance. J. E. Randall and A. Suzumoto (BPBM), M. L. J. Stiassny and M. N. Feinberg (AMNH), and G. Duhamel (MNHN) provided loans of, and other information on, specimens in their care. A. C. Gill (BMNH) and J. J. Harrison (MRAC) kindly read and commented on a draft of the manuscript. Two reviewers provided additional suggestions for revision. R. E. Watson kindly pointed out to us our previous error in family-group name authorship, and provided other information on sicydines; we thank him for his time and interest.

**LITERATURE CITED**


ADDRESSES: (L.R.P.) Division of Fishes, Department of Vertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560; (J.A.M.) P.O. Box 7117, Mammoth Lakes, California 93546.