

Freshwater Fishes of Palau, Caroline Islands

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Abstract—Forty-four species of fishes have been collected in the freshwaters of Palau; of these, nine are new records. Over half belong to the families Gobiidae and Eleotridae.

Introduction

Two early checklists of fishes of the Palau Islands (Herre, 1935; Abe, 1939) contain partial records of freshwater collections, accounting for 12 species. Fehlmann (1960) reported 29 native and 3 introduced fishes as occurring in Palauan freshwaters. Among the fishes we collected in freshwater between II 1976 and IV 1979, there were 9 species not previously recorded from Palau. This paper is a comprehensive checklist of freshwater fishes of Palau, made by combining our collection data with those published earlier. A discussion of some features of the fauna is included.

The term "freshwater fish", as used in this paper, refers to any fish collected in freshwater. Thus, Myers' (1938) categories of primary, secondary, diadromous, and sporadic fishes are included. Freshwater habitats in Palau include areas of streams extending above the level of the highest tides and ponds supplied directly by rainfall or by stream flow.

Our checklist is arranged according to the systematic format of L. S. Berg as cited by Munro (1967). Records of each species are listed chronologically and qualified with locality and specimen data (n = number collected, SL = standard length, and TL = total length). Year dates before our 1976–1979 collection refer to the following literature: 1935 = Herre (1935), 1939 = Abe (1939), and 1960 = Fehlmann (1960). Locations are on Babeldaob Island unless otherwise noted. Synonyms are given for previous citations that differed from the name presently accepted. The salinity preference of most of these fishes is given by Koumans (1953), Herre (1953), or Munro (1967). Listed species are euryhaline as adults unless otherwise noted. Specimens we deposited with museums are noted by museum code (AMS = Australian National Museum, Sydney; CAS = California Academy of Sciences, San Francisco) and catalogue number. Most species are represented in a collection at the Office of the Chief Conservationist, Koror, Palau.

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CHECKLIST OF PALAU FRESHWATER FISHES

(*denotes more common species according to number and frequency of all published collections)

Poeciliidae

Poecilia reticulata (Peters)

- 1960, *Lebistes reticulatus*, a well, Koror Is.
 V 1976, a well, Tobi Is., n=8, SL=15–24 mm
 CAS 36988
 VI 1976, pond, Koror Is., n=13, SL=12–24 mm
 CAS 36987
 freshwater, introduced

Xiphophorus maculatus (Günther)

- 1960, a well, Koror Is.
 freshwater, introduced

Syngnathidae

Bombonia spicifer (Ruppell)

- 1960, Ngetuchong Cr., Koror Is.
 VI 1978, Kaod R., n=3, SL=32–87 mm
 IX 1978, Metengalakumer R., n=1, SL=88 mm

Coelonotus liapsis (Bleeker)

- 1960, Arakitaoch R.

**Doryichthys brevidorsalis* (de Beaufort)

- 1960, Arakitaoch R.
 VI 1978, Kaod R., n=1, SL=65 mm
 IV 1978, Metengalakumer R., n=4 (2 ovigerous), SL=27–73 mm
 XII 1978, Metengalakumer R., n=1 (ovigerous), SL=62 mm
 II 1979, Metengalakumer R., n=1 (ovigerous), SL=74 mm
 III 1979, Metengalakumer R., n=1 (ovigerous), SL=75 mm

Oostethus brachyurus (Bleeker)

- V 1978, Ngerbekuu R., n=1, SL=54 mm
 IX 1978, Metengalakumer R., n=1, SL=108 mm

Mugilidae

Liza melanopterus (Cuvier and Valenciennes)

- 1939, *Mugil melanopterus*, stream (Ngaraard Municipality)

Kuhliidae

**Kuhlia marginata* (Cuvier and Valenciennes)

- 1935, stream
 1939, streams
 1960, Arakitaoch R.
 III 1976, stream (Melekeok Municipality), n=1, SL=79 mm
 II 1979, Ghimel R., n=11, SL=46–79 mm

**Kuhlia rupestris* (Lacepede)

- 1935, stream
 1939, streams
 1960, Arakitaoch R.
 X 1976, Ghimel R., n=5, SL=28–86 mm
 XII 1977, Ngardok R., n=3, SL=75–127 mm
 XI 1978, Ngardok Lake, n=1, SL=250 mm

Centropomidae

Ambassis interruptus (Bleeker)

- XI 1976, Ghimel R., n=120, SL=18–32 mm
 CAS 37928
 XI 1977, Metengalakumer R., n=7, SL=7–16 mm

Scatophagidae

Scatophagus argus (Linnaeus)

- 1960, Arakitaoch R.

Albulidae

unidentified larva

- 1960, Ngeritang Cr., Arakabesang Is, adults strictly marine

Megalopidae

Megalops cyprinoides (Broussonet)

- 1935, stream
 1939, ponds (Ngaraard Municipality)

Anguillidae

Anguilla bicolor pacifica (Schmidt)

- 1960, Arakitaoch R.
 XII 1977, Ngardok R., n=1, TL=914 mm
 II 1979, Ghimel R., n=3, TL=109–123 mm
 catadromous

- Anguilla marmorata* (Quoy and Gaimard)
1939, *A. mauritiana*, streams
1960, Arakitaoch R.
catadromous
- Muraenidae
- Gymnothorax polyuranodon* (Bleeker)
1960, *Polyuranodon polyuranodon*, Arakitaoch R.
- Cyprinidae
- Puntius sealei* (Herre)
1960, *Barbus elongatus*, Ngardok Lake
freshwater, introduced
- Cobitidae
- Misgurnus anguillicaudatus* (Cantor)
IX 1977, Ngerekall Pond, n=2, SL =
48-51 mm
freshwater, introduced
- Moringuidae
- Moringua* sp.
1960, Arakitaoch R.
- Symbranchidae
- Symbranchus bengalensis* (McClelland)
1939, taro swamp, Koror Is.
1960, Arakitaoch R.
- Gobiidae
- Awaous grammepomus* (Bleeker)
1960, *A. ocellaris*, Arakitaoch R.
- Glossogobius celebius* (Cuvier and Valenciennes)
1960, *G. giuris*, Arakitaoch R.
XI 1976, Ghimel R., n=1, SL=55 mm, AMS
I. 1956-002
- Mugilogobius* sp.
VII 1977, taro swamp, Koror Is., n=14,
SL=15-29 mm
- Pandaka* sp.
I 1978, Merab ra Chol Cr., n=4, SL =
8-11 mm
- Pseudogobius javanicus* (Bleeker)
1960, *Stigmatogobius javanicus*, Arakitaoch R.
I 1978, Merab ra Chol Cr., n=2, SL =
- 18-21 mm
III 1978, Metengalakumer R., n=4, SL =
20-26 mm
- Redigobius bikolanus* (Herre)
XI 1976, Ghimel R., n=14, SL=15-29 mm.
AMS I. 19656-007
- **Redigobius horiae* (Herre)
1935, *Vaimosa horiae*, stream
1960, *Stigmatogobius romeri*, Arakitaoch R.
I 1979, Ngerikiil R., n=2, SL=27-28 mm
endemic species
- Redigobius sapangus* (Herre)
IX 1977, Ngerksong reservoir, Arakabesang Is.,
n=3, SL=27-32 mm
- Sicyopterus micrurus* (Bleeker)
1960, Arakitaoch R.
III 1978, Metengalakumer R., n=1, SL =
25 mm
freshwater
- **Sicyopus* sp.
1960, *S. vanderbilti*, Arakitaoch R.
III 1978, Metengalakumer R., n=1, SL =
38 mm
endemic species
collected only in freshwater
- **Sicyopus zosterophorum* (Bleeker)
1960, Arakitaoch R.
VI 1978, Kaod R., n=1, SL=36 mm
freshwater
- Stenogobius genivittatus* (Cuvier and Valenciennes)
XI 1976, Ghimel R., n=5, SL=58-61 mm.
AMS I. 19656-004
- **Stiphodon elegans* (Steindachner)
1935, *S. pelewensis*, stream
1960, Arakitaoch R.
XI 1976, Ghimel R., n=1, SL=28 mm, AMS
I. 19656-003
II 1978, Metengalakumer R., n=8, SL =
19-26 mm
- Kraemeriidae
- Kraemia cunicularia* (Rofen)
1960, Behes Cr.

Eleotridae

****Bunaka gyrinoides*** (Bleeker)

- 1935, *Lizettea pelewensis*, stream
 1960, Arakitaoch R.
 XI 1976, Ghimel R., n=2, SL=162-238 mm,
 AMS I. 19656-001
 IV 1978, Kaod R., n=3, SL=23-55 mm

Butis amboinensis (Bleeker)

- 1960, Arakitaoch R.
 XI 1976, Ghimel R., n=8, SL=28-56 mm
 I 1979, Metengalakumer R., n=1, SL=44 mm

****Eleotris fuscus*** (Bloch and Schneider)

- 1960, *E. fusca*, Arakitaoch R.
 II 1979, Ghimel R., n=20, SL=28-137 mm

Eleotris melanosoma (Bleeker)

- XI 1976, Ghimel R., n=15, SL=31-68 mm,
 AMS I. 19656-006
 VI 1978, Kaod R., n=2, SL=33-37 mm

Hypseleotris cyprinoides (Cuvier and Valenciennes)

- 1960, *H. bipartita*, Ngerksong Cr.,
 Arakabesang Is.
 XI 1976, Ghimel R., n=3, SL=21-25 mm
 AMS I. 19656-005
 freshwater

Hypseleotris güntheri (Bleeker)

- 1960, Arakitaoch R.
 II 1979, Ghimel R., n=2, SL=46-49 mm
 freshwater

****Ophieleotris aporos*** (Bleeker)

- 1935, *Ophiocara aporos*, stream
 1939, *Ophiocara macrolepidotus*, stream
 (Ngaraard Municipality)
 1960, *Ophiocara aporos*, Arakitaoch R.
 XI 1976, Ghimel R., n=2, SL=85-119 mm
 XI 1977, Metengalakumer R., n=1, SL=55 mm

Ophiocara porocephala (Cuvier and Valenciennes)

- 1935, stream
 1960, Arakitaoch R.

Xenisthmus sp.

- 1960, *Platycephalops* sp., Arakitaoch R.
 marine

Antennariidae

Antennarius nummifer (Cuvier)

- 1939, stream (Ngeremlengui Municipality)
 marine

Discussion

The streams of Babeldaob, of which 15 are at least 5 kilometers long, provide the major habitat for the freshwater fishes of Palau. The island also has many shorter coastal streams. In addition, the smaller islands Koror and Arakabesang each have small, intermittent streamlets from which fish have been collected. Fehlmann (1960) has described the distribution of fishes among stream ecological zones and noted various types of stream drainages in Palau.

This checklist contains 44 species in 18 families. The native freshwater fish fauna of Palau shows close affinities to those of the Philippines and New Guinea. Two species (gobies *Sicyopus* sp. and *Redigobius horiae*) are endemic. Fehlmann (pers. comm.) is currently preparing a description of *Sicyopus*. The largest fish in Palau streams is the freshwater eel *Anguilla marmorata*. It reportedly reaches a total length of 200 cm (Herre, 1923), though the largest Palau specimen measured only 113 cm (Fehlmann, 1960). The smallest fishes are the gobies *Stiphodon elegans* and *Redigobius horiae*, whose maximum adult total lengths are about 4.5 cm (Koumans, 1953).

Four fishes (*Poecilia reticulata*, *Xiphophorus maculatus*, *Puntius sealei*, and *Misgurnus anguillicaudatus*) were introduced during the Japanese administration of

Palau between 1914 and 1944. These are all primary freshwater fishes. The native freshwater fishes belong to primarily marine families, and most live indifferently in fresh or salt water. Individuals entering streams may be either diadromous (migrating between fresh and salt water at some stage of the life cycle) or sporadic (primarily marine but occasionally or sporadically entering freshwater). Herre (1958) noted that *Anguilla* lives exclusively in freshwater but returns to the sea to breed. *Sicyopterus micrurus* and the two species of *Hypseleotris* and *Sicyopus* may have similar life cycles, since adults are almost always found only in streams and rivers (Koumans, 1953). Other marine species probably enter the lower reaches of Palau's streams but have not yet been recorded because of the small number of collections.

Gobies and eleotrids dominate the freshwater fish fauna of Palau, accounting for 22 of the 40 native species collected to date. This situation is common in areas deficient in primarily freshwater fishes (Herre, 1958; Inger and Kong 1962).

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