Rare and Endangered Biota of Florida

VOLUME II. FISHES

EDITED BY

CARTER R. GILBERT

Chair, Special Committee on Fishes
Florida Committee on Rare and Endangered Plants and Animals

UNIVERSITY PRESS OF FLORIDA
Gainesville, Tallahassee, Tampa, Boca Raton,
Pensacola, Orlando, Miami, Jacksonville

Coastal Habitats

Coastal Freshwater and Oligohaline Tributaries

Tidal rivers.—This habitat consists of the lower reaches of all riverine systems in Florida that flow into the Atlantic Ocean or Gulf of Mexico and associated estuaries (e.g., Tampa Bay, Pensacola Bay, Charlotte Harbor, and Indian River lagoon). The major hydrological character governing this habitat is the mixing of tidal saline water and fresh water. Tidal saline waters may extend below surface fresh water for considerable distances upstream, depending on river topography and flow rates. Water flow in the St. Johns River may become reversed; tides may extend as far as 145 miles upstream, with considerable mixing of fresh and salt waters between about 32 to 80 km (20–50 miles) upstream (McLane 1955).

Tidal riverine habitats offer various vegetative communities around the Florida peninsula, as the character of these communities changes radically with both latitude and salinity gradient. Upstream vegetation may be similar throughout much of the Florida peninsula (e.g., *Taxodium distichum, Acer* spp., *Salix* spp., *Acrostichum* spp., *Sagittaria* spp., *Pontederia lanceolata, Panicum* spp.). North of 28°00′N latitude, the mouths of these tributaries are normally associated with broad salt-marsh meadows, which typically consist of *Spartina* spp. and *Juncus roemerianus*. South of 28°00′N, mangrove swamps consisting of *Rhizophora mangle, Avicennia germinans*, and *Laguncularia racemosa* are more likely to develop around river mouths, along with an association of halophyte prairies vegetated with *Juncus roemerianus, Spartina* spp., *Salicornia virginiana, Salicornia bigelovii*, and *Batis maritima*. In the disturbed tidal streams draining the Everglades/Big Cypress Swamp complex, red mangrove (*R. mangle*) and pond apple (*Annona glabra*) form a narrow border along their courses, which penetrate freshwater habitats 30–40 km (19–25 mi) from the Gulf of Mexico. Submerged aquatic vegetation is generally absent, except in cases where the river flow is reversed by clear tidal ocean waters often and long enough for sea grasses to grow, such as at the mouths of the St. Lucie and Loxahatchee rivers. Tidal rivers with red mangrove associations are also host to epiphytic proproot algal communities.

The fish fauna of this habitat is typically diverse, with both euryhaline freshwater and marine species represented. A unique group of tropical peripheral fishes reproduce in this habitat in the Loxahatchee and St. Lucie rivers and in Sebastian Creek, along the southeastern coast of Florida (*Awaous tajasica, Gobiomorus dormitor, Gobionellus pseudofasciatus*, and

Microphis brachyurus lineatus). This represents the only persistent, tropical peripheral fish community in the state and perhaps throughout the United States, with the possible exception of the Rio Grande, in southern Texas. The community's existence depends on the fortuitous combination of moderate climate, suitable and relatively undisturbed hydrology, vegetation and channel physiography, and the proximity of the warm Gulf Stream. The Gulf Stream is undoubtedly responsible for transportation of the original fish stocks from the Caribbean area and is probably a source of continuous recruitment from there. The annual movement of millions of gobioid fish larvae into tributaries of the Indian River lagoon greatly resembles the *tismiche* and *seti* migrations of the Caribbean and the *ipon* migrations of the Philippines and is one of the most impressive predictable ichthyological displays in the state. The habitat of these fishes and their reproducing populations are considered threatened. The same southeastern Florida streams also support other rare tropical fishes, such as *Agonostomus monticola, Pomadasys crocro, Diapterus rhombeus, Centropomus ensiferus*, and *Gobionellus fasciatus*, which are sporadically captured in routine stream surveys; however, there is no documentation of breeding activity in Florida waters for these particular species.

Human impacts on this habitat vary from damming (e.g., the Miami, Loxahatchee, Caloosahatchee, St. Lucie, and Hillsborough rivers) and channelization (Miami, St. Lucie, Alafia, and Peace rivers) to gross pollution (St. Johns, Miami, Hillsborough, Alafia, and Peace rivers). Major urbanization has virtually eliminated viable fish habitat along portions of these rivers in Miami, Tampa, and Jacksonville. As the human population of coastal Florida continues to grow rapidly, it is highly likely that downstream, coastal riverine habitats will continue to lose their viability and capability of supporting fishes unique to these ecosystems, particularly in southeastern Florida.

Tidal creeks, ditches and canals.—These are small though common coastal tributaries found throughout the state. Canal and ditch habitats are most abundant along the southeastern coast of Florida, where extensive flood-control systems have been constructed to drain freshwater wetlands for human habitation or agricultural purposes. Because these tributaries typically are more shallow than riverine habitats, vertical stratification between saline and fresh waters does not always occur. Downstream reaches may become oligohaline or even mesohaline during drought periods. The same system may be completely fresh during periods of maximum rainfall, particularly in flood-control canals where large volumes of water are released rapidly, creating flow rates between 1.0 and 2.0 m/sec.

Floral and faunal associations in tidal creek, ditch, and canal habitats are identical to those of coastal riverine systems. However, these small water bodies, particularly canal and ditch tributaries, are more subject to disturbance and removal of native botanical communities. The fish communities are also similar to tidal riverine systems, with all the tropical peripheral species listed for the tidal riverine systems also occurring in the smaller southeastern tributaries.

These habitats are particularly susceptible to anthropogenic disturbances and are often dredged, drained, flooded, dammed, and treated with herbicides, in addition to acting as conduits for a variety of agricultural and urban waste products. As human populations continue to expand around the Florida coast, many of the natural and seminatural streams will undoubtedly be disturbed to the point that they will no longer support an indigenous fish community. Native ichthyofaunas are supplemented and disrupted by introduced species that are better adapted to altered aquatic habitats. There are many examples of this destruction available for study throughout southeastern Florida today.

Salt Marshes

Herbaceous salt marshes are found throughout coastal Florida. The greatest acreage occurs in estuaries north from Charlotte Harbor on the Gulf Coast and the Indian River lagoon on the Atlantic coast. Salt-marsh communities are extensive along the southern tip of the peninsula, although they are separated from direct contact with the Gulf of Mexico by a wide band of mangrove forest. The most conspicuous vegetation types are *Spartina* spp., *Juncus roemerianus, Distichlis spicata, Paspalum* spp., *Salicornia* spp. *Sesuvium* spp., *Limonium carolinianum*, and *Batis maritima*. The distribution and zonation of these plants are dictated by the topography and hydrology of the marsh, which vary significantly around the Florida peninsula. Very small tidal amplitudes in isolated portions of the Indian River lagoon and in certain estuaries of the lower Gulf Coast result in vegetative associations that differ significantly from those in higher energy systems at the mouth of the St. Johns and St. Marys rivers, along the northeast coast.

The fish fauna associated with salt marshes is typically one that can withstand a wide range of environmental conditions, because of the peripheral nature of the habitat. Despite their tolerance of considerable environmental variation, some fishes occur principally in this habitat; however, none is listed as endangered or threatened in this volume.

Mangrove Swamps

Coastal salt marshes broadly intergrade with mangrove forest communities from north to south along both coasts of Florida. South of 28°00'N latitude, mangrove forests become the dominant, marginal estuarine vegetation, although they are always in association with a subtropical marine herbaceous prairie. These mangrove forests are most extensive in southwestern Florida, forming basin communities several kilometers wide. The mangrove swamps are comprised of *Rhizophora mangle, Avicennia germinans*, and *Laguncularia racemosa*, whereas the associated marine prairies consist of *Batis maritima, Salicornia* spp., *Distichlis spicata, Juncus roemerianus* and *Spartina* spp.

Tidal amplitudes are generally low throughout the range of mangrove forests on the Florida peninsula. Net primary productivity is high, and this condition, along with high detrital production and deposition, results in a high biological oxygen demand.

Fish associated with mangrove forest communities are usually adapted to the harsh environmental conditions typically found there, particularly highly variable water levels and very low oxygen levels. A species indigenous to this habitat, *Rivulus marmoratus* (an account of which is presented in this volume), has adapted remarkably well to a very limited microhabitat and anoxic conditions within the mangrove swamp.

Human impact on the mangrove forest ecosystem has varied widely, from complete removal, filling, and burning to drowning. Between 1950 and 1970 the majority of indigenous black mangrove forest habitats on the central east coast of Florida was destroyed through flooding associated with the construction of impoundments for mosquito control. These impounded wetlands are still of considerable value since, with renewed tidal access, they have been found to perform many of the same functions as preimpoundment wetlands. The rapid growth of human populations in Florida has completely eradicated mangrove communities along a major portion of the Florida coast. Considerable mangrove habitat in Palm Beach, Broward, Dade, Collier, Pinellas, and Hillsborough counties was destroyed as a result of urban development long before the value of mangrove ecosystems was realized. Plans to lease portions of the southern coastline for offshore oil exploration open the potential for oil spills, which would result in pollution of fringing mangrove swamps, with disastrous consequences to the associated biota.

Sea-grass Meadows

Submerged, shallow-water sea grass meadows are conspicuous features of most coastal estuaries throughout Florida. There are also major sea-grass communities in the northeastern Gulf of Mexico. The most conspicuous spermatophyte species are *Thalassia testudinum, Syringodium filiforme, Halodule wrightii, Ruppia maritima, Halophyla baillonis, Halophyla engelmannii*, and *Halophyla johnsonii*. The numerically dominant sea-grass species vary from estuary to estuary and from season to season. A wide variety of marine algae is associated with the sea-grass community, as are very diverse sessile and mobile invertebrate faunas.

The great diversity and productivity of sea-grass communities attract a wide variety of fishes, and consequently sea-grass fish communities are the richest fish communities in Florida estuaries. Not only is there an indigenous resident ichthyofauna associated with sea-grass meadows, but there is also a transient fauna consisting primarily of juveniles of larger species that may depend on other habitats as adults. The principal sea-grass inhabitant listed in this volume, *Gobionellus stigmaturus*, is considered a species of special concern.

Human impact on sea-grass communities has been more insidious and less obvious than for most other aquatic habitats. Hundreds of acres of sea grasses have been eradicated by filling for coastal developments and road causeways (e.g., Biscayne Bay, Indian and Banana River lagoons, Boca Ciega Bay, and Sarasota Bay). However, water quality declines are responsible for reduction in sea grasses over a wide range of Florida estuaries. Tampa Bay has lost the majority of its historic sea-grass meadow habitat through changes in water quality. There have been reductions in sea-grass cover in nearly all major estuaries throughout Florida. With this reduction, available habitat has declined for hundreds of species that depend on sea grasses for survival.

Rock-algal Reef Formations

Exposed bedrock formations offer habitat for coastal neritic and benthic marine invertebrate and vertebrate faunas around the state. These consist primarily of surface limestone from various Cenozoic formations. Limestone origins vary from lithifications of shell fragments (Anastasia formation) to lithification of oolite (Miami oolite) or Key Largo limestone derived from tropical coral reef communities. Erosion of these rock for-

mations forms undercuts ledges and vertical holes, offering a variety of locations for faunal access and cover on otherwise featureless open sand or shell bottoms.

These rock substrates provide attachment sites for a wide variety of algal species, thus forming hash

starcki) is so far known only from one locality in the Florida Keys (Looe Key) and from one locality off the coast of Honduras.

Human impacts on coral reef habitats range from collection of corals and the associated fauna to fisheries consumption and dredge-and-fill operations. Many of the same disturbances affecting the rock-algal reef habitats also affect coral habitats. Deep reef corals are quite brittle and are very susceptible to destruction by deep-water trawls. Of considerable concern for future preservation of these habitats are human activities that may influence water quality from adjacent urban areas or from oil-drilling operations. Many substances originating from urban, agricultural, and petroleum-based activities may prove to be quite deleterious to this fragile tropical ecosystem.

Literature Cited

Beck, W. M., Jr. 1965. The streams of Florida. Bull. Fl. St. Mus. Biol. Sci. 10(3): 91–126.

Berner, L. 1950. The mayflies of Florida. Univ. Fl. Stud. Biol. Sci. Ser. 4(4): vii–xii, 1–267.

Berner, L., and M. L. Pescador. 1988. The mayflies of Florida. Rev. ed. University Presses of Florida, Gainesville.

Carr, A. F. 1940. A contribution to the herpetology of Florida. Univ. Fl. Stud. Biol. Sci. Ser. 3:1–118.

Davis, J. H., Jr. 1943. The natural features of southern Florida. Fl. Geol. Surv. Bull. 15:1–311.

Duever, M. J., J. E. Carlson, J. R. Meeder, L. C. Duever, L. H. Gunderson, L. A. Riopelle, T. R. Alexander, R. L. Myers, and D. P. Spangler. 1986. The Big Cypress National Preserve. National Audubon Society Research Report 8. New York.

Ewel, K. C., and H. T. Odum, eds. 1984. Cypress swamps. University Presses of Florida, Gainesville.

Gilmore, R. G., Jr. 1977. Fishes of the Indian River lagoon and adjacent waters. Bull. Fl. St. Mus. Biol. Sci. 22(3): 101–148.

Herring, J. L. 1951. The aquatic and semi-aquatic Hemiptera of northern Florida. Pt. 4. Classification of habitats and keys to the species. Fl. Entomol. 34: 141–146.

Hobbs, H. H., Jr. 1942. The crayfishes of Florida. Univ. Fl. Stud. Biol. Sci. Ser. 3:1–179.

Livingston, R. J. ed. 1991. The rivers of Florida. Springer-Verlag, Inc., New York. x+289 pp.

Loftus, W. F., and J. A. Kushlan. 1987. Freshwater fishes of southern Florida. Bull. Fl. St. Mus. Biol. Sci. 31(4): 137–344.

McLane, W. M. 1955. The fishes of the St. Johns River system. Ph.D. diss., University of Florida, Gainesville.

Rogers, J. S. 1933. The ecological distribution of craneflies of northern Florida. Ecol. Monogr. 3:1–74.

Rosenau, J. C., G. L. Faulkner, C. W. Hendry, Jr., and R. W. Hall. 1977. Springs of Florida. Rev. ed. Florida Department of Natural Resources Bureau of Geology, Bulletin 31. 461 pp.

Schomer, N. S., and R. D. Drew. 1982. An ecological characterization of the lower Everglades, Florida Bay, and the Florida Keys. U.S. Fish and Wildlife Service FWS/OBS-82/58.1.

Seaman, W., Jr. ed. 1985. Florida aquatic habitat and fishery resources. Florida Chapter, American Fisheries Society, Kissimmee. xiv + 543 pp.

Opossum Pipefish

Microphis brachyurus lineatus

FAMILY SYNGNATHIDAE

Order Syngnathiformes

Opossum pipefish, *Microphis brachyurus lineatus* (Valenciennes, 1856). UF 6819. Adult female, 1600 mm TL. San Carlos Creek, Duval County, Florida. 30 July 1949.

OTHER NAMES: None.

DESCRIPTION: *Microphis brachyurus lineatus* (= *Oostethus lineatus*) is a relatively large pipefish, reaching a SL of 194 mm (7.64 in). It is the only western Atlantic member of the group with the combination of confluent lateral trunk and inferior tail ridges, 17–23 pectoral-fin rays, and 9 caudal-fin rays; and it is also the only Florida species in which the male bears the brood pouch on the trunk rather than on the tail (subfamily Doryhamphinae). The snout is long (1.5–2.0 in head length), the trunk rings number 16–21, and the tail rings number 20–26. Fine serrations are present on the body ridges, these becoming slightly less prominent in adults.

The color of the opossum pipefish is distinctive, particularly in breeding adults: upper snout and posterior half of head and body are sienna brown, with a series of dark red blotches on each lateral trunk ring forming a red stripe between lateral and superior trunk ridges; silver stripe on midside between lateral and inferior trunk ridges and silver edge on inferior trunk ridge; lower half of snout is bright red, with a variable number of black vertical bars; and caudal fin is also red, with a central dark stripe. Juveniles are less colorful, as they are either nearly transparent or light brown with widely spaced dark vertical bars.

TAXONOMIC REMARKS: The opossum pipefish has undergone several nomenclatural changes since appearance of the 1978 FCREPA report (Gilbert 1978). It was treated as a full species (*O. lineatus*) until 1979, at which time Dawson (1979) downgraded it to a subspecies of the widespread *Oostethus brachyurus*. Dawson (1984), in his revision of the genus *Microphis*, later expanded the taxonomic limits of that group to include *Oostethus*, which was accordingly downgraded to a subgenus.

Controversy surrounds authorship of the subspecific name *lineatus*. The original description first appeared, in a publication by Kaup (1856), as

Distribution map of *Microphis brachyurus lineatus*. Southern limit of range in western Atlantic region extends beyond limits of inset. Distribution of *M. brachyurus* (but not subspecies *lineatus*) also includes portions of tropical eastern Atlantic, eastern Pacific, and Indo-West Pacific regions.

"*Doryichthys lineatus* Valenciennes MS." Some, including Dawson (1982), feel this merely indicates that Valenciennes had earlier coined the name *lineatus* and was not responsible for the description itself, in which case authorship should be credited to Kaup. Although this may well be true, absolute proof is lacking; thus, we find it preferable to credit authorship to Valenciennes, *in* Kaup.

RANGE: *Microphus brachyurus* (with four subspecies) is a nearly cosmopolitan anadromous species that occurs throughout the tropical Indo-Pacific region, as well as the eastern and western Atlantic regions (Dawson 1979, 1985). It has also been recorded in the eastern Pacific Ocean near the terminus of the Panama Canal, which it unquestionably reached via migration through the canal (Hildebrand 1939).

The subspecies *lineatus* ranges from New Jersey south to São Paulo, Brazil, including the Gulf of Mexico and West Indies and (as indicated above) has also recently reached the eastern Pacific Ocean (Dawson 1982). Breeding adults and permanent populations are apparently limited to tropical and subtropical areas (Gilmore and Hastings 1983), with extralimital northern records (e.g., New Jersey) based on seasonal waifs carried there by ocean currents. It was first recorded from Florida by McLane (1955) on the basis of two specimens taken on 30 July 1949 in San Carlos Creek, near the mouth of the St. Johns River (UF 6819); however, it has not been collected there since. In Florida, it has consistently been collected only from the Loxahatchee River drainage (Palm Beach County), St. Lucie River (Martin and St. Lucie counties), Sebastian Creek (Indian River and Brevard counties), the St. Lucie Canal at Lake Okeechobee (Gilmore and Hastings 1983), and in relief canals associated with these tributaries and the southern half of the Indian River lagoon. It is able to negotiate its way through canal locks, as evidenced by its occurrence in Lake Okeechobee, which it could only have reached by moving through locks in the St. Lucie Canal, and by its occurrence at the Pacific terminus of the Panama Canal (Hildebrand 1939).

HABITAT: In southeastern Florida, the opossum pipefish matures, mates, and releases its progeny in fresh water, where it typically inhabits dense emergent bank vegetation usually dominated by *Panicum* spp. and *Polygonum* spp. These plants are generally well dispersed and grow rapidly in freshwater tributaries to the Indian River lagoon, but are subject to seasonal treatment by herbicides (see subsequent discussion). In Mississippi, individuals have been recorded from *Spartina* marshes (Dawson 1970). Juveniles (individuals less than 90-mm SL) occur primarily in pelagic

oceanic or estuarine waters, including pelagic rafts of *Sargassum* (Böhlke and Chaplin 1968; Hastings and Bortone 1976).

LIFE HISTORY AND ECOLOGY: Although a definitive life-history study of *M. brachyurus lineatus* has not been conducted, considerable information has been gathered in conjunction with other studies. Some of this was summarized by Gilbert (1978) in the earlier FCREPA report and was based partly on Dawson's (1970, 1972) observations in Mississippi. Information on specimens collected in the estuary at Tortuguero, Costa Rica, appears in Gilbert and Kelso (1971). The following information is based on data obtained from 235 specimens (64–176 mm SL), which were captured between 1972 and 1981 from freshwater tributaries to the southern Indian River lagoon during every month of the year (Gilmore 1977; Gilmore and Hastings 1983).

Since adults appear to breed only in fresh water (Dawson 1982; Gilmore and Hastings 1983), freshwater microhabitats are obviously critical to the reproductive success of this species. Gilmore (unpublished data) encountered pairs of adult males and females at densities of one pair per 100 m of linear stream bank. Distribution is patchy in such areas, however, and is limited principally by the occurrence and abundance of clumps of emergent vegetation, such as *Polygonum* spp. and *Panicum* spp. (Gilmore and Hastings 1983). As is true for all species of Syngnathidae, egg brooding is performed exclusively by the males, with the number of eggs carried being a function of size of the individual. Dawson (1982) found that eggs are rarely present in males smaller than 120 mm, but he did occasionally find eggs attached to individuals as small as 102 mm (number of eggs not indicated). Herald (1943) found a 147-mm individual to have 744 eggs, and Gilbert (1978) reported one of 158 mm to contain approximately 700 eggs. Gilmore (1977) found brooding males from eastern Florida during July and November, and Dawson (1982) reported them to occur from June to September in Mississippi. In other areas, they have been noted during all months of the year except January and February (Dawson 1982).

Individuals hatch at lengths of from 3 to 6 mm (Gilmore 1977). The juveniles subsequently move into offshore waters, where they become associated with pelagic rafts of *Sargassum* or other types of floating vegetation. There they remain for an indeterminate length of time. After reaching lengths of from approximately 60 to 90 mm, they move back inshore into fresh water, as reported by Gilbert and Kelso (1971) from Tortuguero lagoon, Costa Rica.

It is impossible to determine the overall population size of opossum

pipefish in Florida because of the wide dispersal of larval and juvenile stages.

BASIS OF STATUS CLASSIFICATION: The dependence of the opossum pipefish on accessible coastal freshwater habitat along the southern portion of the Indian River lagoon limits the breeding adult population to the coastal reaches of this area. Although juvenile habitat is the open ocean, the species is dependent on specific freshwater microhabitats for successful reproduction. The human population in these same coastal areas is increasing rapidly, and concurrent demands on freshwater resources have resulted in heavy impaction by a variety of anthropogenic processes. Among these is herbicide spraying of areas used for breeding by this fish. Consequently, the adult habitat of the opossum pipefish in Florida has already been destroyed in many areas, and remaining habitat is highly vulnerable to human activities.

The opossum pipefish was accorded "rare" status in the 1978 FCREPA report. Increased knowledge of the distribution, habitat, and ecology of the species in Florida indicates that it is in a more vulnerable position than earlier realized. Consequently, it is upgraded to "threatened" status, one of only two species listed in the 1978 report for which this is true.

RECOMMENDATIONS: Human population encroachment on the coastal freshwater streams where this species occurs should be limited and a buffer area implemented. Water-management agencies should attempt to "mimic" natural stream hydrologic and vegetative conditions. The remaining natural portions of the creeks and streams where the species occurs (e.g., Sebastian Creek) should be preserved. Nonpoint and point-source pollutants should be eliminated. Herbicide spraying programs should be eliminated for critical areas in the streams and canals between the water control structures and coastal estuaries. Additional research is needed to determine spatial and temporal population dynamics, microhabitat requirements, and early life history, particularly with regard to egg, larval, and juvenile stages.

Literature Cited

Published Information

Böhlke, J. E., and C. C. G. Chaplin. 1968. Fishes of the Bahamas and adjacent tropical waters. Livingston, Wynnewood, Pa. xxiii+771 pp.

Dawson, C. E. 1970. A Mississippi population of the opossum pipefish, *Oostethus lineatus* (Syngnathidae). Copeia 1970(4):772–773.

_____.1972. Nektonic pipefishes (Syngnathidae) from the Gulf of Mexico off Mississippi. Copeia 1972 (4):844–848.

_____. 1979. Review of the polytypic doryhamphine pipefish *Oostethus brachyurus* (Bleeker). Bull. Mar. Sci. 29(4):465–480.

_____. 1982. Family Syngnathidae. Pages 1–172 *in* C. E. Dawson and R. P. Vari, eds., Fishes of the western North Atlantic. Pt. 8. Mem. Sears Found. Mar. Res., New Haven, Conn. 198 pp.

_____. 1984. Revision of the genus *Microphis* Kaup (Pisces: Syngnathidae). Bull. Mar. Sci. 35(2):117–181.

_____. 1985. Indo-Pacific pipefishes (Red Sea to the Americas). Gulf Coast Research Laboratory, Ocean Springs, Mississippi. 230 pp.

Gilbert, C. R. 1978. Opossum pipefish, *Oostethus lineatus* (Valenciennes). Pages 38–39 *in* Carter R. Gilbert, ed., Rare and endangered biota of Florida. Vol. 4. Fishes. University Presses of Florida, Gainesville. 58 pp.

Gilbert, C. R., and D. P. Kelso. 1971. Fishes of the Tortuguero area, Caribbean Costa Rica. Bull. Fla. St. Mus. Biol. Sci. 16(1):1–54.

Gilmore, R. G. 1977. Notes on the opossum pipefish *Oostethus lineatus*, from the Indian River lagoon and vicinity, Florida. Copeia 1977(4):781–783.

Gilmore, R. G., and P. A. Hastings. 1983. Observations on the ecology and distribution of certain tropical peripheral fishes in Florida. Fla. Sci. 46(1):31–51.

Hastings, P. A., and S. A. Bortone. 1976. Additional notes on tropical marine fishes in the northern Gulf of Mexico. Fla. Sci. 39(2):123–125.

Hildebrand, S. F. 1939. The Panama Canal as a passageway for fishes, with lists and remarks on the fishes and invertebrates observed. Zoologica 24:15–45.

Kaup, J. J. 1856. Catalogue of Lophobranchiate fish in the collection of the British Museum, London. i–iv+80 pp.

Unpublished Information

Herald, E. S. 1943. Studies on the classification and interrelationships of the American pipefishes. Ph.D. diss., Stanford University, Palo Alto, Calif.

McLane, W. M. 1955. The fishes of the St. Johns River system. Ph.D. diss., University of Florida, Gainesville.

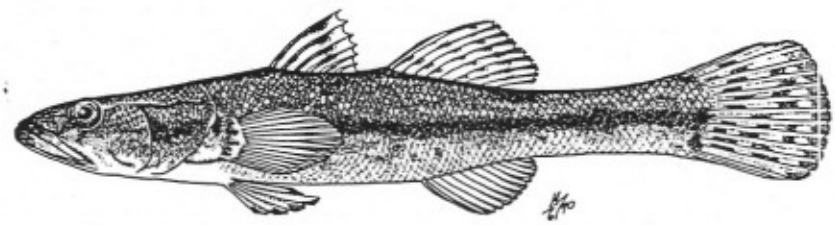
Prepared by: R. Grant Gilmore, *Harbor Branch Oceanographic Institution, Ft. Pierce, Florida 33450*; and Carter R. Gilbert, *Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611*

Bigmouth Sleeper

Gobiomorus dormitor

FAMILY ELEOTRIDIDAE

Order Perciformes



Bigmouth sleeper, *Gobiomorus dormitor* Lacepède, 1798. UF 40065. Adult, 212 mm SL. North Relief Canal, Brevard County, Florida. 23 December 1983.

OTHER NAMES: *Guavina.*

DESCRIPTION: *Gobiomorus dormitor* is the largest species of eleotridid in the Western Hemisphere, reaching a length of 317-mm SL (12.5 in) in Florida waters and reputedly as much as 610 mm (24 in) in Central America (Jordan and Evermann 1898). Body is fusiform; head wide and flattened, averaging 36% of SL; mouth wide, the maxillary reaching to middle of pupil, with lower jaw projecting in front of upper; teeth very small, slender, and depressible; dorsal-fin rays VI–I,9; anal-fin rays I,9; pectoral-fin rays 16; lateral scales 55–65; ventral fins not fused; caudal fin rounded; color dark brown or olive, with a dark stripe of pigment along side of body extending from base of pectoral fin to caudal fin, the stripe very dark and continuous in juveniles but becoming progressively lighter and more broken in adults; body with dark spots and mottling; anal and ventral fins unpigmented or mottled, the remainder of the fins dusky and with series of dark lines and spots; dorsal fin with prominent dark bar extending from tip of first spine to base of sixth spine, the bar particularly prominent in juveniles.

RANGE: *Gobiomorus dormitor* ranges from eastern Florida south to Cuba, Puerto Rico, Jamaica, Martinique, Nicaragua, Costa Rica, Panama, and Surinam (Gilmore and Hastings 1983), with its center of abundance in the Caribbean region. It also occurs in the Rio Grande and is common in the Rio Tamesi drainage, Mexico, and in other tributaries to the southern Gulf of Mexico (Darnell 1955; Treviño-Robinson 1959; Pezold and Edwards 1983). It has not been recorded from tributaries to the eastern and northern Gulf of Mexico. *Gobiomorus dormitor* apparently also occurs in the western Bahamas, Breder (1932) having listed two specimens from Lake Forsyth on Andros Island. It is surprising that Böhlke and Chaplin (1968) did not include this species in their book on Bahaman fishes and

Distribution map of *Gobiomorus dormitor*.

also made no indication that the Lake Forsyth record might have been based on a misidentification. Although the specimens on which Breder's record is based (presumably housed in the American Museum of Natural History) have not been examined, it seems unlikely that such a distinctive species as *G. dormitor* would have been misidentified. Assuming that this record was simply overlooked by Böhlke and Chaplin, the western Bahamas are included in the range of this species.

The bigmouth sleeper was first recorded from Florida by Briggs (1958), although no specific locality information was given. It has consistently been collected only in the Loxahatchee River drainage (Palm Beach County) (Christensen 1965), the St. Lucie River (Martin and St. Lucie counties), Sebastian Creek (Indian River and Brevard counties), and in relief canals associated with these streams. It also occurs in Lake Okeechobee (Lindquist 1980), in an artificial freshwater stream in Parrot Jungle (Miami) (Loftus et al. 1984), and in other freshwater tributaries to Biscayne Bay (Loftus and Kushlan 1987). Several specimens have been captured in canals inland from migratory barriers such as salinity dams and flood-control locks (W. F. Loftus and C. R. Robins, personal communication), which indicates ability of the species to move around these structures. A 330-mm-SL specimen, supposedly collected in the lower St. Johns River by William McLane, is present in the Florida Museum of Natural History collection (UF 31431). Since no specific locality data accompanies this specimen and since McLane (1955) made no mention of *G. dormitor* in his study on St. Johns River drainage fishes, this locality undoubtedly is in error.

Routine monthly and exploratory ichthyological collections from 1978 through 1982, using a variety of techniques, resulted in the capture of around 100 individuals (ranging from 16.0 to 317 mm SL) in freshwater tributaries to the southern Indian River. Christensen (1965) observed 15–20 individuals in one location below a floodgate in the Loxahatchee River. The species is considered to be a year-round freshwater resident, although it is rather infrequently encountered. This may result in part because the species appears to be less susceptible to conventional seining techniques than are most species and is more readily collected by gear types that are difficult to quantify, such as electroshockers, hook and line, cast nets, and gill nets.

HABITAT: Although a euryhaline fish, *G. dormitor* is typically found in flowing fresh water. In tributaries to the Indian River lagoon, *G. dormitor* occurs principally over an open-sand substrate along undercut banks, but it may also be found in heavy vegetation or around rock or wood

structures (Nordlie 1979). Gilmore and Hastings (1983) found juveniles ranging from 16 to 23.5 mm SL in fresh to brackish water (0.0–13.0 ppt) on the downstream side of salinity barriers. Temperatures at which juveniles have been taken range from 10.5°–29.5° C.

LIFE HISTORY AND ECOLOGY: The bigmouth sleeper is a large predator that is primarily nocturnal or crepuscular in its feeding habits (Darnell 1955, 1962; Koenig et al. 1976). Analysis of a small number of adults from Tortuguero, Costa Rica, indicates that, in frequency of occurrence, shrimp and fish comprise approximately 80 percent of the species' diet (Nordlie 1981).

Darnell (1962) reported *G. dormitor* as spawning in brackish water, a situation that receives confirmation from Nordlie (1981), who reported both large, sexually mature adults and small juveniles (down to 21-mm SL) from the lower part of Tortuguero estuary. As indicated above, Gilmore and Hastings (1983) found juveniles of 16–23.5 mm in both fresh and brackish water on the downstream side of salinity barriers in tributaries to Indian River lagoon, in Florida. However, juveniles were not present in the sample taken from the *tismiche* moving into Tortuguero estuary in August 1964 (Gilbert and Kelso 1971), although juveniles of two other species of eleotridids were included. Observations of reproduction in Lago de Yojoa, Honduras (Darnell 1962), and Lago Jiloa, Nicaragua (Lim et al. 1976; McKaye et al. 1979), both of which are entirely freshwater lakes, indicate that estuarine migrations are not necessary for effective reproduction in this species. Insufficient numbers of specimens have been collected in Florida to allow isolation of specific spawning locations; however, the simultaneous capture of young-of-the-year individuals as well as of a ripe female of *G. dormitor* in Sebastian Creek indicates apparent spawning in this particular stream.

Occurrences above stream barriers and the observation of nocturnal semiterrestrial behavior in *G. dormitor* (Darnell 1955) indicate that this species is capable of migrating overland for short distances. This was verified when a large (300-mm SL) specimen was collected and left in a bucket in a stationary truck. It was found on the ground about four hours later and had moved approximately 10 feet. It was relatively dry and covered by loose soil but was still alive and, when placed in water, appeared to have suffered no ill effects (Gilmore, personal observation).

SPECIALIZED OR UNIQUE CHARACTERISTICS: *Gobiomorus dormitor* is one of a small number of euryhaline Florida freshwater fish species of basically Caribbean affinities, whose distribution in the state is limited to

a small area around the lower Indian River lagoon. It most likely reached this area via transportation by the Gulf Stream.

BASIS OF STATUS CLASSIFICATION: The dependence of the bigmouth sleeper on accessible freshwater habitat along the lower east Florida coast, from the southern portion of the Indian River lagoon to Biscayne Bay, results in the species being almost entirely limited to coastal reaches of small tributary streams. These localized populations in turn are surrounded by the most rapidly growing human populations on the east-central coast of Florida (Miami–West Palm Beach, Port St. Lucie, Sebastian Highlands, and Palm Bay). As a consequence, all freshwater tributaries in which the bigmouth sleeper is found in southeastern Florida are under the control of regional water-management districts. These freshwater habitats have experienced major declines in water quality, natural vegetative cover, and natural freshwater hydrodynamics with the increase in regional human populations. Floodgates and salinity dams placed upstream 2–25 km from tributary mouths may inhibit but appear not to totally block inland migration of this species; however, these barriers may limit most of the usable habitat for this species to downstream areas.

A portion of the range of this species (the North Fork of the St. Lucie River) is a state wildlife preserve. The Loxahatchee River is a National Wild and Scenic River, and part of the North Fork of the Loxahatchee River is within Jonathan Dickinson State Park. The artificial stream in Parrot Jungle (Miami) presumably will continue to be maintained in its present condition. Although the species thus receives some degree of protection, much of its range is still in an area subject to heavy human population encroachment. This situation, together with the limited distribution of *G. dormitor* in Florida, justifies our according this species "threatened" status, as we have for several other fish species whose distribution is largely or entirely limited to this part of the state.

RECOMMENDATIONS: Human population encroachment on freshwater tributaries to both Indian River lagoon and Biscayne Bay should be limited and a buffer zone established. The artificial stream in Parrot Jungle should be maintained in its present condition. Water-management practices should result in duplication, insofar as possible, of natural hydrologic and vegetative conditions. The remaining "natural" portions of various creeks and streams (e.g., Sebastian Creek) should be preserved. Nonpoint and point-source pollutants should be eliminated. Herbicide-spraying programs should be eliminated along portions of tributaries (streams and canals) between water-control structures and coastal estuar-

ies. Additional research is needed to determine spatial and temporal population dynamics, microhabitat requirements, and aspects of early life history, particularly for egg, larval, and juvenile stages.

Literature Cited

Published Information

Böhlke, J. E., and C. C. G. Chaplin. 1968. Fishes of the Bahamas and adjacent tropical waters. Livingston, Wynnewood, Pa. xxiii+771 pp.

Breder, C. M., Jr. 1932. An annotated list of fishes from Lake Forsyth, Andros Island, Bahamas, with the descriptions of three new forms. Amer. Mus. Novit. 551:1–8.

Briggs, J. C. 1958. A list of Florida fishes and their distribution. Bull. Fla. St. Mus. Biol. Sci. 2(8):223–318.

Darnell, R. M. 1955. Nocturnal terrestrial habits of the tropical gobioid fish *Gobiomorus dormitor*, with remarks on its ecology. Copeia 1955(3):237–238.

———. 1962. Fishes of the Rio Tamesi and related coastal lagoons in east-central Mexico. Publ. Inst. Mar. Sci. 8:299–365.

Gilbert, C. R., and D. P. Kelso. 1971. Fishes of the Tortuguero area, Caribbean Costa Rica. Bull. Fla. St. Mus. Biol. Sci. 16(1):1–54.

Gilmore, R. G., and P. A. Hastings. 1983. Observations on the ecology and distribution of certain tropical peripheral fishes in Florida. Fla. Sci. 46(1):31–51.

Jordan, D. S., and B. W. Evermann. 1898. Fishes of North and Middle America. Bull. U.S. Nat. Mus. 47(3):2188–2236.

Koenig, K. W., R. J. Beatty, and S. Martinez. 1976. Species diversity and distribution of fish in Lake Nicaragua. Pages 321–325 *in* T. B. Thorson, ed., Investigations of the ichthyofauna of Nicaraguan lakes. School of Life Sciences, University of Nebraska, Lincoln. iv–x+663 pp.

Lim, T. M., K. R. McKaye, and D. J. Weiland. 1976. An investigation into the use of artificial habitats as a means of increasing the fishery productivity of the great lakes complex of Nicaragua. Pages 311–320 *in* T. B. Thorson, ed., Investigations of the ichthyofauna of Nicaraguan lakes. School of Life Sciences, University of Nebraska, Lincoln. iv–x+663 pp.

Lindquist, D. G. 1980. *Gobiomorus dormitor* Lacepède, Bigmouth sleeper. Page 784 *in* D. S. Lee et al., eds., Atlas of North American freshwater fishes. North Carolina State Museum of Natural History, Raleigh. i–x+854 pp.

Loftus, W. F., and J. A. Kushlan. 1987. Freshwater fishes of southern Florida. Bull. Fla. St. Mus. Biol. Sci. 31(4):147–344.

Loftus, W. F., J. A. Kushlan, and S. A. Voorhees. 1984. Status of the mountain mullet in southern Florida. Fla. Sci. 47(4):256–263.

McKaye, K. R., D. J. Weiland, and T. M. Lim. 1979. Comments on the breeding

biology of *Gobiomorus dormitor* (Osteichthyes: Eleotridae) and the advantage of school behavior to its fry. Copeia 1979(3):542–544.

Nordlie, F. G. 1979. Niche specificities of eleotrid fishes in a tropical estuary. Rev. Biol. Trop. 27(1):35–50.

_____. 1981. Feeding and reproductive biology of eleotrid fishes in a tropical estuary. J. Fish Biol. 18:97–110.

Pezold, F. L., and R. J. Edwards. 1983. Additions to the Texas marine ichthyofauna, with notes on the Rio Grande estuary. Southwest. Nat. 28(1):102–105.

Treviño-Robinson, D. 1959. The ichthyofauna of the lower Rio Grande, Texas and Mexico. Copeia 1959(3):253–256.

Unpublished Information

Christensen, R. F. 1965. An ichthyological survey of Jupiter Inlet and Loxahatchee River, Florida. M.Sc. thesis, Florida State University, Tallahassee.

McLane, W. M. 1955. The fishes of the St. Johns River system. Ph.D. diss., University of Florida, Gainesville.

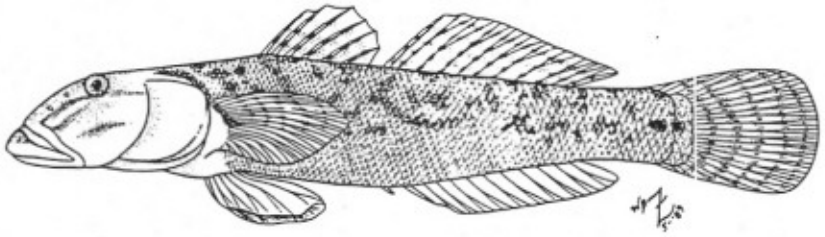
Prepared by: R. Grant Gilmore, *Harbor Branch Oceanographic Institution, Ft. Pierce, Florida 33450.*

River Goby

Awaous tajasica

FAMILY GOBIIDAE

Order Perciformes



River goby, *Awaous tajasica* (Lichtenstein, 1822). UF 44708. Adult male, 109 mm SL. Sebastian Creek, Indian River County, Florida. 21 July 1955.

OTHER NAMES: Guavina hoyera; Aboma de rio.

DESCRIPTION: *Awaous tajasica* is a large goby, with Florida specimens reaching a SL of 280 mm (11 in). Distinguishing features include the pelvic fins fused to form a sucking disk and lateral line absent from body; caudal fin rounded; snout long (42%–46% of head length); head depressed in mature males; mouth large and lips thick, with upper lip extending well beyond the lower; inner edge of shoulder girdle with two or more conspicuous dermal flaps; dorsal-fin rays usually VI–I,10 (occasionally VI–I,9); anal-fin rays usually I,10 (occasionally I,9); scales ctenoid over most of body but cycloid on head, belly, predorsal midline of back, and in region beyond hypural base; 61–69 scales in lateral series, the scales more crowded anteriorly. Body olivaceous or yellowish tan; head, back, and sides spotted and mottled with dark brown markings; dorsal, caudal, and pectoral fins with parallel rows of spots, forming crossbars.

TAXONOMIC REMARKS: An apparently unique character of the genus *Awaous* involves the respiratory surfaces of the gills, which are much re-

duced in area and have the outer surface covered by a complex array of sensory papillae.

Although treated here under the specific name *tajasica*, Ronald Watson indicates that the proper name for this species should be *Awaous banana* (Valenciennes, 1837). Watson, who is currently involved in a taxonomic revision of the genus *Awaous*, states that there are three species in the western Atlantic region: *A. tajasica* and *Awaous badius*, which have restricted ranges along the coast of South America; and the more widely ranging *A. banana*, which is the species found throughout the West Indies and adjacent areas (including Florida) to the north (R. Watson, per-

Distribution map of *Awaous tajasica*.

sonal communication). The name *tajasica* will continue to be used in this account until such time as Watson's study is formally published.

RANGE: The following range statement takes into account the new information concerning the taxonomy of *Awaous* in the western Atlantic region, as discussed in the preceding paragraph.

Awaous tajasica ranges from South Carolina south to northern South America. Within this area it has been recorded from the Savannah River (South Carolina), eastern and western Florida, and from larger islands and continental land areas around the Caribbean: Cuba, Puerto Rico, Jamaica, Belize, Guatemala, Honduras (Bonacca Island), Nicaragua, Costa Rica, Panama, mainland and insular Colombia (Providencia Island), Venezuela, Tobago, St. Vincent, Dominica, Martinique, and Barbados (R. Watson, personal communication). It has not been recorded from the Bahama Islands or from areas bordering the western Gulf of Mexico.

One might suspect that the more northerly records do not represent permanent populations. This would appear to be substantiated by a recent record from the Santa Fe River (a tributary of the Suwannee River), at the U.S. Highway 27 bridge, which is based on an underwater photograph (on file in the Florida Museum of Natural History) of a large adult individual, taken by William Streever on 7 October 1990. Fish sampling using various gears and methods has been carried out on both the Santa Fe and Suwannee rivers throughout the years, and were the species regularly present it should have been seen or collected before now. Conversely, collections of *A. tajasica* from Garnier's Creek (a tributary to Choctawhatchee Bay near Ft. Walton Beach), in the Florida panhandle, suggest either temporary or permanent establishment, since specimens were taken over an eight-year period (1959–1966, UF 55161, UF 56052, UF 63772, UF 64786), and there are unpublished reports of its having been taken there still later during the 1960s (James D. Williams, personal communication). It would be instructive to see if the species is still present there today.

In addition to the Gulf drainage localities, the species has occasionally (1949–1950 and an unspecified year recently) been collected in the St. Johns River (three records, of which one is based on material in our collection [UF 31432]) (McLane 1955). In Florida, the species has consistently been collected only from the St. Lucie River in Martin and St. Lucie counties; various freshwater relief canals constructed to drain fresh water into the adjacent estuary for flood control in Martin, Indian River, and Brevard counties; and Sebastian Creek in Indian River and Brevard counties (Gilmore and Hastings 1983).

HABITAT: *Awaous tajasica* characteristically inhabits lotic waters of streams and rivers of the Greater and Lesser Antilles, Central America, and northern South America. It is closely restricted to fast-flowing, well-oxygenated waters and apparently does not adapt well to lentic conditions, even though the water may be well oxygenated (R. Watson, personal communication). Watson believes the close dependence of the species on flowing water is a direct result of the peculiar modification of the gills (in which the outer surfaces are covered with sensory papillae), which apparently results in attendant loss of respiratory function. In view of this, the absence of the species from the Bahamas and from other low islands with streams of base-level gradient is understandable. Although present in Florida, the preponderance of low-gradient streams is obviously a factor limiting the distribution of the species throughout much of the state. Along the southeast coast, its upstream distribution is restricted by water-control structures. Gilmore and Hastings (1983), during their work in Indian River lagoon, never found any individuals at tributary mouths or in the lagoon itself. They collected specimens in tributary streams, with most being found over a sand substrate at salinities of 0.0–4.0 ppt and at temperatures of 20°–28° C. Most were found below bridges, which Gilmore and Hastings (1983) theorized was an indication of preference for shaded areas of the stream and/or sediment deposited around bridge pilings. It has been suggested that adult and subadult *A. tajasica* are probably intolerant of salinities higher than those indicated above (R. Watson, personal communication), as indicated both by experimental observations and analysis of ecological data accompanying collections of the species.

LIFE HISTORY AND ECOLOGY: Little has been published on the life history of this species, as was also true at the time of the 1978 FCREPA report (Yerger 1978). Much of the following has again been communicated to us by Watson.

Young and adult *A. tajasica* inhabit freshwater streams, and there is no evidence that they ever leave there and move into estuaries or the ocean to spawn. Spawning occurs in fresh water with the small eggs (numbering from 2,400 to 3,000 in large females) presumably drifting downstream, where they either hatch in brackish or salt water or do so before reaching there. Larval development takes place in brackish or salt waters at the mouths of tributaries, as has been documented for *Awaous stamineus* in Hawaiian waters (Ford and Kinzie 1982). Most larvae probably reenter the parental stream, but some may be dispersed via ocean currents before returning to fresh water. Evidence for this is seen from the

distribution of *A. tajasica* on many West Indian islands, as well as from the collection of small juveniles (all about 12.5 mm long) in an aggregation of juvenile fish that were entering Tortuguero lagoon, Costa Rica, on 7 August 1964 (Gilbert and Kelso 1971). The life history of this species probably parallels that of the mountain mullet (*Agonostomus monticola*), another euryhaline species whose distribution is similar to that of *A. tajasica* and the individuals of which, once transformed from the larval stage, apparently spend their entire lives in fresh water (Loftus and Gilbert, this volume).

SPECIALIZED OR UNIQUE CHARACTERISTICS: As may also be true for *A. monticola*, the river goby may be one of the few euryhaline fishes in North America in which only the larval stages occur in salt water.

BASIS OF STATUS CLASSIFICATION: With the possible exception of the St. Johns and Santa Fe rivers and Garnier's Creek in the Florida panhandle (the latter of which has not been surveyed for over 20 yr), the tributaries of Indian River lagoon are the only places in Florida where *A. tajasica* is presently known to occur. Within this area, deterioration in quality and quantity of habitat has increased in recent years and represents a serious threat to Florida river goby populations. Water-flow manipulation, degradation of water quality, and sedimentation may influence life-history patterns of this species to the point that successful reproduction and egg and larval survival are threatened. Floodgates and salinity dams commonly placed upstream, from 2 to 25 km above the tributary mouths in the Indian River lagoon, apparently block the inland migration of this species, as no specimens have been captured upstream from these barriers. This results in the habitat of the species being limited to that portion of stream situated between the barriers and the lagoon. Since this also is the area where most human habitation is concentrated, it makes the habitat highly vulnerable to human disturbance. The situation outlined above has caused us to recommend this species for "threatened" status, as we have done for several other species whose distribution in Florida is limited, or nearly limited, to the Indian River lagoon area. This also represents one of only two situations in which a fish has been listed in a "higher" category than in the 1978 FCREPA publication, in which it was only listed as "rare."

RECOMMENDATIONS: Human population encroachment on freshwater tributaries to the Indian River lagoon should be limited and buffer zones established. Water managers should consider modifying their policies in

order to "mimic" natural stream hydrologic and vegetative conditions. The remaining natural portions of various creeks and streams (e.g., Sebastian Creek) should be preserved. Nonpoint and point-source pollutants should be eliminated. Additional research should be done on the life history of this species, which is essentially unknown, to determine spatial and temporal population dynamics, microhabitat requirements and early life history, particulary with regard to egg, larval, and juvenile stages.

Literature Cited

Published Information

Ford, J. I., and R. A. Kinzie III. 1982. Life crawls upstream. Nat. Hist. 91:61--66.

Gilbert, C. R., and D. P. Kelso. 1971. Fishes of the Tortuguero area, Caribbean Costa Rica. Bull. Fla. St. Mus. Biol. Sci. 16(1):1–54.

Gilmore, R. G., and P. A. Hastings. 1983. Observations on the ecology and distribution of certain tropical peripheral fishes in Florida. Fla. Sci. 46(1): 31–51.

Yerger, R. W. 1978. River goby, *Awaous tajasica* (Lichtenstein). Pages 46–47 *in* Carter R. Gilbert, ed., Rare and endangered biota of Florida. Vol. 4. Fishes. University Presses of Florida, Gainesville. 58 pp.

Unpublished information

McLane, W. M. 1955. The fishes of the St. Johns River system. Ph.D. diss., University of Florida, Gainesville.

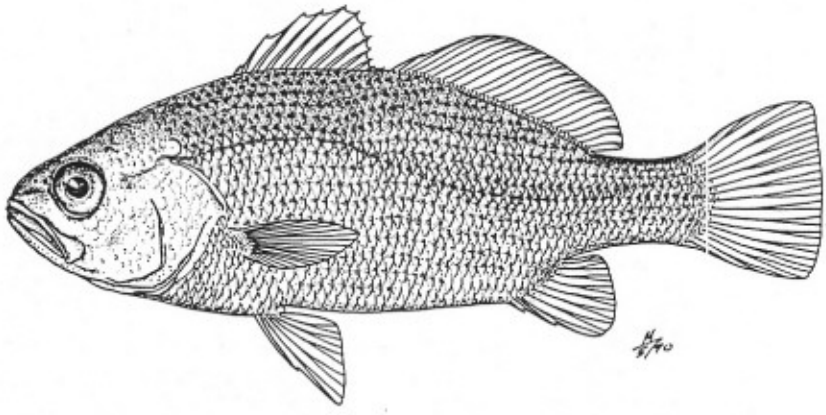
Prepared by: R. Grant Gilmore, *Harbor Branch Oceanographic Institution, Ft. Pierce, Florida 33450*; and Ralph W. Yerger (retired), *Department of Biological Sciences, Florida State University, Tallahassee, Florida 32306*

Striped Croaker

Bairdiella sanctaeluciae

FAMILY SCIAENIDAE

Order Perciformes



Striped croaker, *Bairdiella sanctaeluciae* (Jordan, 1890). UF 12031. Adult, 134 mm SL. Atlantic Ocean S of Sebastian Inlet, Indian River County, Florida. 12–13 June 1964.

OTHER NAMES: Caimuire

DESCRIPTION: *Bairdiella sanctaeluciae* is distinguished from its closest relatives in Florida waters by the following characteristics: from *Bairdiella chrysoura* (silver perch) by lack of serrations on preopercular margin, second anal spine less than two-thirds the length of first anal-soft ray, and gold to rusty stripes on body in life; from *Bairdiella batabana* (blue croaker) by greater body depth (31.5% SL vs. 28.6% SL), higher total gill-raker count (23–26 vs. 18–22), and lower dorsal-fin ray count (XI–I, 23 [range 22–24] vs. XI–I,26 [range 25–29]); from *Odontoscion dentex* (reef croaker) by absence of canine teeth (particularly in lower jaw) and in lacking a black spot at base of pectoral fin; and from *Larimus fasciatus* (banded drum) in having neither an oblique mouth nor projecting lower

jaw and in having a higher anal-fin ray count (II,8 vs. II,5–6). The maximum body size is 260 mm SL (10.2 in).

RANGE: ***Bairdiella sanctaeluciae*** is a tropical species whose range is centered primarily in the Caribbean Sea, including the Central American coast and the Greater and Lesser Antilles south to Guyana; to the north it occurs disjunctly in the Gulf of Campeche and east-central Florida (Jordan and Evermann 1898; Evermann and Marsh 1900; Meek and Hildebrand 1925; Cervigon 1966; Gilbert and Kelso 1971; Gilmore 1977; Chao 1978). It was first recorded from Florida waters by C. R. Gilbert from collections made in the Atlantic Ocean south of Sebastian

Distribution map of *Bairdiella sanctaeluciae*.

Inlet, adjacent to the Indian River lagoon (Bailey et al. 1970; Gilbert 1973).

During fish surveys conducted from 1972 to 1988, striped croakers were consistently observed on near-shore rock-algal reef formations (depth 10 m or less) from Sebastian Inlet south to Jupiter Inlet but not north of 28°00′N or south of 26°58′N (R. G. Gilmore, personal observation). Adults have been captured on reef formations at depths to 30 m within the same latitudinal range (R. G. Gilmore, personal observation). The species has never been found during intensive studies of reef-fish populations elsewhere around the Florida peninsula. The very limited distribution on the east coast of Florida parallels that of several other fish species and may be attributed to the occurrence of the proper habitat under optimal hydrological conditions, undoubtedly promoted by the near-shore occurrence of the warm Florida current (Gilmore 1977).

HABITAT: Very little has been published on the habitat of *B. sanctaeluciae* in the Caribbean region, other than general statements that it occurs over mud and sand bottoms or around rocks (Cervigon 1966; Chao 1978). However, there is considerably more information on the habitat preference of Florida populations, based on surveys conducted between 1972 and 1988 using submersible vehicles for 70 dives and scuba gear for 82 dives (R. G. Gilmore, personal observation). Striped croakers prefer rock-reef habitats, which typically support luxuriant growths of attached algae. Juveniles (15–50 mm SL) have consistently been observed hovering over mats of accumulated algae, into which they retreat when disturbed. Juveniles are most abundant on near-shore reef formations at depths less than 10 m. Adults may occur on these same shallow reefs but prefer deeper formations to depths of 30 m.

Despite intensive quantitative sampling over the years, only one small juvenile striped croaker has ever been recorded from the adjacent Indian River lagoon, where it was captured adjacent to an ocean inlet (Gilmore 1977). Absence from the estuary precludes syntopy (cooccurrence at the same specific location or microhabitat) with its congener, *B. chrysoura*, which is an estuarine species. Striped croakers and reef croakers (*O. dentex*) are syntopic and are commonly observed under the same rock formation; however, the former species is usually represented by gregarious juveniles, whereas the reef croaker is restricted to solitary adults.

It is doubtful that Florida populations of *B. sanctaeluciae* occur over open mud or sand bottoms very often or for any length of time since this species has never been captured during a wide variety of trawling surveys made on the east Florida shelf over the past 40 years.

LIFE HISTORY AND ECOLOGY: Nothing is known regarding the life history and ecology of this species other than the information appearing above. Most observations have been of juveniles occurring in groups of 10 to 50 individuals. However, no quantitative studies have been conducted to determine population sizes. The algal community with which this species is closely associated likely harbors a unique group of invertebrates (e.g., shrimp; Chao 1978) on which this species presumably feeds.

SPECIALIZED OR UNIQUE CHARACTERISTICS: *Bairdiella sanctaeluciae* is one of a group of species of basically Caribbean affinities that maintains an isolated population along the east-central coast of Florida and that is presumed to have reached this area via transportation by the Gulf Stream. The striped croaker also is unusual with regard to the very specific habitat to which it is restricted.

BASIS OF STATUS CLASSIFICATION: The highly specific habitat occupied by the striped croaker is vulnerable to beachfront activities, especially beach-renourishment projects and dredge-and-fill operations, which serve to increase sedimentation and water turbidity and often cover rock formations directly. The algal community, which supports not only juvenile striped croakers but also a specific group of invertebrates, has received little study. The impact on this floral community and the unique species that it supports should be considered when evaluating all beach-renourishment projects, particularly those contemplated within the range of Florida populations of the striped croaker.

Although the habitat in which this species occurs is vulnerable to certain human activities and the length of Florida coast occupied by the species is not extensive, it nevertheless seems that assignment of "threatened" status is inappropriate at this time. Likewise, the species is common within the area to which it is confined. Considering these factors, we feel that the species is most properly placed in the category "of special concern."

RECOMMENDATIONS: Discourage dredge-and-fill operations in areas adjacent to near-shore rock and reef formations. Designate known reef croaker habitat as a wildlife preserve.

Literature Cited

Bailey, R. M., J. E. Fitch, E. S. Herald, E. A. Lachner, C. C. Lindsey, C. R. Robins,

and W. B. Scott. 1970. A list of common and scientific names of fishes from the United States and Canada. Am. Fish. Soc. Spec. Publ. 6. 77 pp.

Chao, L. N. 1978. Sciaenidae. *In* W. Fischer, ed., FAO species identification sheets for fishery purposes: Western Central Atlantic (fishing area 31). Vol. 4.

Cervigon, F. M. 1966. Los peces marinos de Venezuela. Vol. 2. Fundacion La Salle de Ciencias Naturales, Caracas, pp. 449–951.

Evermann, B. W., and M. C. Marsh. 1900. The fishes of Porto Rico. *In* Investigations of the aquatic resources and fisheries of Porto Rico. Bull. U.S. Fish Comm. (1900) 20(1):51–350, pls. 1–46.

Gilbert, C. R. 1973. Characteristics of the western Atlantic reef-fish fauna. Q. J. Fla. Acad. Sci. (1972) 35(2–3):130–144.

Gilbert, C. R., and D. P. Kelso. 1971. Fishes of the Tortuguero area, Caribbean Costa Rica. Bull. Fla. St. Mus. Biol. Sci. 16(1):1–54.

Gilmore, R. G. 1977. Fishes of the Indian River lagoon and adjacent waters, Florida. Bull. Fla. St. Mus. Biol. Sci. 22(3):101–147.

Jordan, D. S., and B. W. Evermann. 1898. Fishes of North and Middle America. Bull. U.S. Nat. Mus. 47(2):v–xxx, 1241–2183.

Meek, S. E., and S. F. Hildebrand. 1925. The marine fishes of Panama. Field Mus. Nat. Hist. Publ. 226 (Zool. Ser.) 15:xv–xix, 331–707.

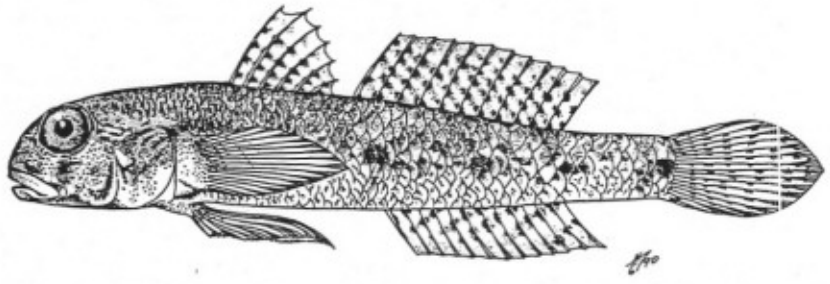
Prepared by: R. Grant Gilmore, *Harbor Branch Oceanographic Institution, Ft. Pierce, Florida 33450*; and Franklin F. Snelson, Jr., *Department of Biological Sciences, University of Central Florida, Orlando, Florida 32816.*

Spottail Goby

Gobionellus stigmaturus

FAMILY GOBIIDAE

Order Perciformes



Spottail goby, *Gobionellus stigmaturus* (Goode and Bean, 1882). UF 37133. Adult male, 29.0 mm SL. Intercoastal waterway, N of Jupiter Inlet, Palm Beach County, Florida. 13 June 1983.

OTHER NAMES: None

DESCRIPTION: The spottail goby is a "coarse-scaled" species of *Gobionellus*, having 29–33 scales in the longitudinal series along the midside of the body, dorsal rays VI–12 (I,11), anal rays 13 (I,12), and pectoral-fin rays usually 16 (range 15–17). Other distinguishing characters include a completely scaled predorsal area, 10–12 scales anterior to dorsal-fin origin, except specimens from southern Florida, which have 4–7 predorsal scales in this area (this area largely or completely naked in all other coarse-scaled members of the genus except *Gobionellus smaragdus*); a narrow band of pigment paralleling posterior margin of cheek; a diffuse blotch of pigment on cheek under eye, extending from eye to upper lip; third dorsal spine in adult males not excessively long, not reaching origin of second dorsal fin; body and head marbled with pearly white and brown in life; five more-or-less diffuse spots along midside of body, the most posterior one situated at base of tail; diffuse narrow bars extending

downward and slightly forward from anterior three or four spots described above; dorsal and caudal fins with streaks of pigment comprised of rows of spots.

RANGE: *Gobionellus stigmaturus* is known from Bermuda, Florida, Cuba, Belize, and Panama (Pezold 1984), with Florida populations being limited to the southeast coast from Brevard to Monroe counties.

HABITAT: The spottail goby has been consistently collected in sea-grass meadows during the cool-dry season (December to May) in Ft. Pierce Inlet (Springer and McErlean 1962; Christensen 1965; Gilmore 1988).

Distribution map of *Gobionellus stigmaturus*.

The only detailed habitat-microhabitat observations for the species were made in Ft. Pierce Inlet during recent sea-grass fish-community studies (Gilmore 1988; R. G. Gilmore, personal observation). Spottail gobies have been observed primarily in vegetated areas with sand bottom in sea-grass meadows of *Syringodium filiforme* and *Halodule wrightii*. Some individuals have been observed in burrows on sandbars in very shallow water (<0.5 m depth), in areas situated between a steep inlet channel dropoff and a sea-grass meadow.

LIFE HISTORY AND ECOLOGY: *Gobionellus stigmaturus* appears to undergo seasonal migrations between sea-grass meadows and burrow areas. The species is more common in the former areas during winter and spring, in places where the water is typically deeper (ca. 1.0 m). Spottail gobies have not been seen at locations away from the Ft. Pierce Inlet and are gradually replaced by *Gobionellus boleosoma* and *G. smaragdus* as one approaches the mangrove-lined shore 100 m away. The principal microhabitat for this species thus appears to be a strictly marine environment at the outer edges of ocean inlet sea-grass meadows.

Sea-grass beds are subject to ecological changes from both natural and anthropogenic processes. Sediment movement through ocean inlets can be dramatic, particularly when associated with storm events, and sea-grass meadows may be periodically covered and uncovered at such times.

BASIS OF STATUS CLASSIFICATION: As indicated above, sea-grass beds are sensitive to direct and indirect disturbances. Dredge-and-fill operations, boat traffic, and "clamming" activities all have occurred throughout Florida historically. The indirect impact of poor water quality is more difficult to assess and is typically more insidious, but may be dramatic over a short period of time. Industrial, agricultural, and urban wastes enter estuarine waters at Ft. Pierce, the principal habitat study site for the spottail goby. The same likely holds true for certain other areas where the species occurs. Since gobies are highly dependent on appropriate microhabitat, any disturbance of the sediments and sea-grass meadows where this species is found could result in its extirpation. On the other hand, since its range encompasses a fairly long stretch of the southeastern Florida coastline (including part of the Florida Keys), localized extirpation should not seriously threaten the species throughout its entire range in the state. Under these circumstances, neither a "threatened" nor a "rare" classification would appear appropriate, and it consequently is placed in the category "of special concern."

RECOMMENDATIONS: Preserve inlet sea-grass ecosystems. Protect water quality in shallow estuaries, particularly near ocean inlets.

Literature Cited

Published Information

Springer, V. G., and A. J. McErlean. 1962. Seasonality of fishes on a south Florida shore. Bull. Mar. Sci. Gulf Carib. 12:39–60.

Unpublished Information

Christensen, R. F. 1965. An ichthyological survey of Jupiter Inlet and Loxahatchee River, Florida. M.Sc. thesis, Florida State University, Tallahassee.

Gilmore, R. G. 1988. Subtropical seagrass fish communities: population dynamics, species guilds and microhabitat associations in the Indian River lagoon, Florida. Ph.D. diss., Florida Institute of Technology, Melbourne.

Pezold, F. L., III. 1984. A revision of the gobioid fish genus *Gobionellus*. Ph.D. diss., University of Texas, Austin.

Prepared by: R. Grant Gilmore, *Harbor Branch Oceanographic Institution, Ft. Pierce, Florida 33450*; and Carter R. Gilbert, *Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611.*