Species of Concern
NOAA National Marine Fisheries Service

Mangrove rivulus
Rivulus marmoratus

Photo credit: Florida Medical Entomology Lab.

KEY INFORMATION

Areas of Concern
Western Atlantic: Florida.

Year Identified as "Species of Concern"
1997

Factors for Decline
- Habitat alteration and fragmentation
- Development
- Mosquito control

Conservation Designations
IUCN: Least Concern
American Fisheries Society: Vulnerable
Species of Greatest Conservation Need: FL

Figure 1. Mangrove rivulus in damp, terrestrial habitat. Photo credit: Scott Taylor.

Brief Species Description:
The mangrove rivulus is a small mangrove forest species. It has a long slender, dorsally flattened body and a rounded caudal fin. It is dark brown to green in coloration. The body may be mottled with small black dots and there may be a little orange coloration on the body and fins. The maximum length is 2.4 inches (60 mm), although the average is about 1 inch (25 mm). Mangrove rivulus is one of a few known self-fertilizing hermaphrodites (both the eggs and the sperm are produced by one parent, and the young are genetically identical to the parent); although there are some populations that are non-hermaphroditic in Belize. It is the only vertebrate with this form of reproduction. Eggs hatch in 2 to 4 weeks and only require dampness, not standing water (Figure 1, Taylor 1999). Males are rare and have larger anal fins; both females and hermaphroditic individuals usually have a distinct ocellus or eyespot on the caudal peduncle. The mangrove rivulus can be found from south-central Florida (where it is a species of concern, Figure 2) through the West Indies to coastal areas of South America. It can also be found throughout the waters of the Bahamas and the Yucatan Peninsula. There is large morphological variation among populations from different areas of their range.

Diet includes terrestrial and aquatic invertebrates (such as mosquito larvae, polychaete worms, and copepods), and the mangrove rivulus is known for its cannibalistic tendencies (e.g., eating its own eggs when in captivity). They forage infrequently, but usually during mangrove forest flooding. Mangrove rivulus have been collected within microhabitats within the mangal (a forest of mangrove trees) including: crab burrows, stagnant pools, sloughs or ditches (often intermittently dry) and some fossorial (burrow) niches (inside or under logs, debris, leaf litter, etc. (Figure 1)). On the east coast of Florida, the preferred micro-habitat is in the land crab (*Cardisoma sp.*) burrow. In south Florida, and on the west coast, the preference is for stagnant pools and old mosquito control ditches in mangrove forests. In mangrove ecosystems, rivulus has been collected in salinities ranging from 0 to 68 ppt, and in the laboratory juveniles remained viable at 70 to 80 ppt (Taylor 1999). The species can also be found in a large range of temperatures, from 45 to 100°F (7-38°C) and can survive in temperatures as low as 41°F (5°C). They

are known to be very tolerant to exposure to air for periods up to 30 days (Litwiller et al. 2006). Mangrove rivulus have also been reported from cave systems and solution holes adjacent to mangroves in the Bahamas.

Rationale for "Species of Concern" Listing:

Demographic and Genetic Diversity Concerns:

No direct estimates of abundance are available for mangrove rivulus, partly because of the diverse habitat use of this fish and the difficulty of sampling some of these habitats. Nevertheless, habitat loss can be seen as a proxy for abundance. The great loss of mangroves in recent decades suggests large declines for the species (Taylor 1999).

Factors for Decline:

This species is extremely vulnerable to habitat modification and fragmentation, environmental alteration, and human development and encroachment. Much of the suitable habitat has been isolated and fragmented as a result of the destruction of mangroves through removal and practices such as mangrove "trimming" and impounding of high marshes for mosquito control. Although it is obvious that this species has been dramatically reduced, it is difficult to evaluate distribution and status because of natural rarity and its cryptic tendencies. Because of its preference for land crab (*Cardisoma*) burrows, the mangrove rivulus may have decreased habitat availability with decreasing numbers of *Cardisoma*. More information needs to be gathered regarding the relationship between these two species. A natural threat to the rivulus is the formation of hydrogen sulfide (H_2S) from the decaying input from the mangroves. The formation of this gas

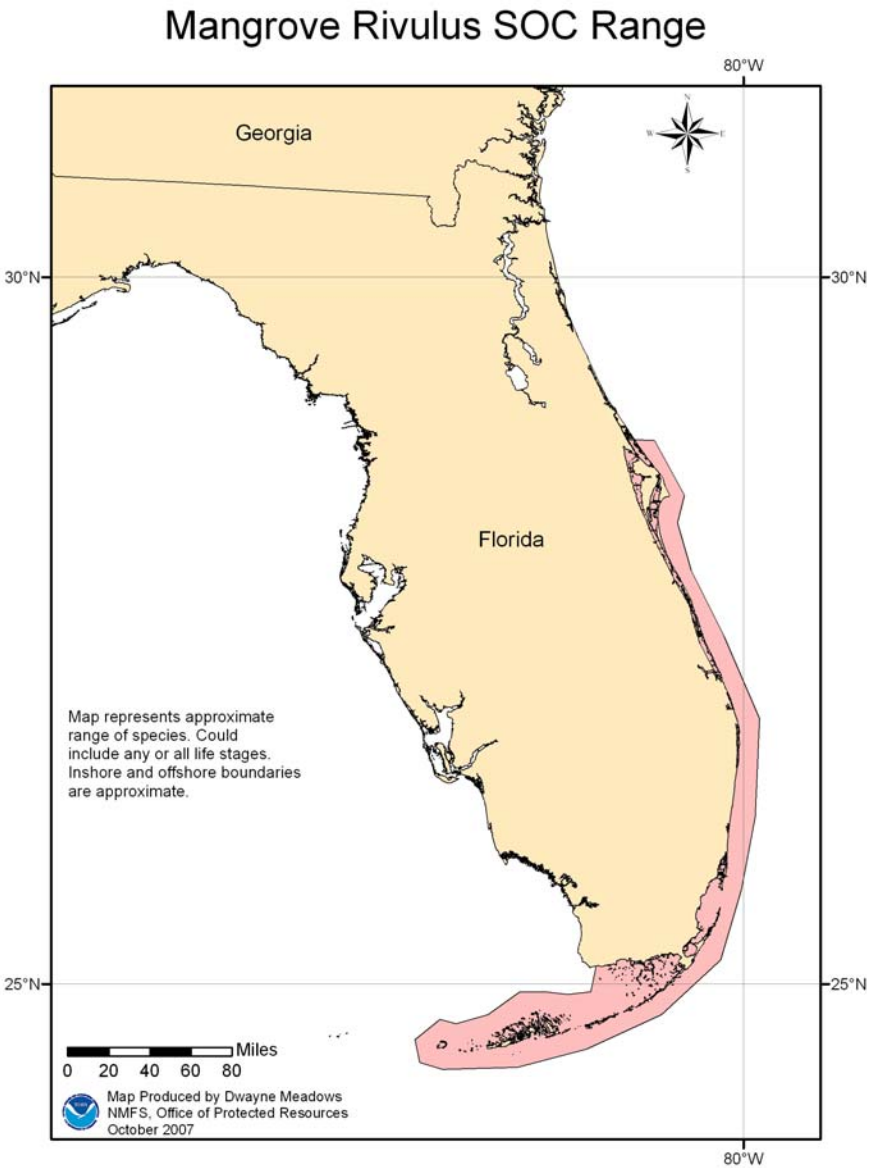

Figure 2. Range of the mangrove rivulus species of concern population.

depletes the oxygen in the water. However, mangrove rivulus has a natural mechanism for coping with normal levels of H_2S toxicity by emerging from the water and being able to survive to survive up to 66 days in damp areas (Taylor 1999).

Status Reviews/Research Underway: Taylor (1999) is the last status review for the species.

Data Deficiencies: More information is needed on the relationship between mangrove rivulus and the *Cardisoma* land crabs whose burrows the rivulus uses.

Existing Protections and Conservation Actions:
The protective listings for this species in Florida provide protections against take, possession, or transport and attention to the species declining status.

References:

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Point(s) of contact for questions or further information:
For further information on this Species of Concern, or on the Species of Concern Program in general, please contact NMFS, Office of Protected Resources, 1315 East West Highway, Silver Spring, MD 20910, (301) 713-1401, soc.list@noaa.gov; http://www.nmfs.noaa.gov/pr/species/concern/, or Dr. Stephania Bolden, NMFS, Southeast Region, Protected Resources Division, 263 13th Avenue South, St. Petersburg, FL 33701, (727) 824-5312, Stephania.Bolden@noaa.gov.