

# Mangrove Rivulus

## *Kryptolebias marmoratus*



Photograph by Scott Taylor

### Species Overview

**Status:** Removed from Florida's Endangered and Threatened Species List.

#### Current Protections

- Chapter 379.361(2)(i)(1), Florida Statutes – Harvest limit of two fish or 100 pounds per person, per day - whichever is more.

### Biological Background

This section describes the biological background for this species and provides context for the following sections. It focuses on the habitats that support the mangrove rivulus and threats faced by the species.

The mangrove rivulus (*Kryptolebias marmoratus*) is a small, olive-colored fish reaching up to 60 mm (2.36 in) in length (Taylor et al. 2008, Taylor 2012). It has a long, slender, dorsally-flattened body with a rounded caudal fin. Similar in overall appearance to many Florida killifish, this species is the only member of the rivulus family found in North America. The most unique feature of the species is its reproductive strategy: the mangrove rivulus is a self-fertilizing hermaphrodite, producing both eggs and sperm and fertilizing eggs internally. This results in populations which are comprised almost entirely of genetically identical individuals (homozygous clones) with a small proportion of males. This unique trait has made the species desirable in genetic research (Davis et al. 1995).

The species is semi-terrestrial and able to survive exposure in intertidal environments for prolonged periods of time (Richards et al. 2011). On land the mangrove rivulus burrows under leaf litter or inside rotten logs to avoid drying. The species is well adapted to tolerate a wide range of salinities, temperatures, and oxygen levels, and can tolerate exposure to hydrogen sulfide which would be toxic to other species (Richards et al 2011).

The mangrove rivulus occurs from southeastern Brazil through Central America and north to Florida. In Florida, the mangrove rivulus has been detected on the Atlantic coast from the Keys north to Volusia County, and on the Gulf Coast from the Tampa Bay area south to the Keys. Knowledge of the Florida range of has grown with the improvement of sampling methods that have resulted in greater detection of the species (Taylor et al. 2008, Taylor 2012). The life history of the mangrove rivulus is closely tied to mangrove forests, and the species has been shown to be locally abundant red (*Rhizophore mangle*) and black (*Avicennia germinans*) mangrove forests along Florida's coasts. Within mangrove forests, mangrove rivulus utilize land crab burrows, pools of stagnant water, damp logs, leaf litter, and mosquito-control ditches as microhabitats (Richards et al 2011).

#### Threats

The mangrove rivulus was historically known from a very limited number of locations in Florida. However, recent studies employing new or modified sampling gear have shown the species to be locally abundant and present across a much larger range than was previously reported. A [Biological Status Review](#) (BSR) completed in 2011 found that the mangrove rivulus did not meet the criteria for state listing in Florida, and the species was removed from the list of Species of Special Concern (FWC 2011, 2016). However, the species is still vulnerable to decline, largely due to habitat loss. Loss of mangrove forest habitat via natural (i.e., hurricanes)

or anthropogenic causes (coastal development) is a key threat to the persistence of the mangrove rivulus in Florida. [A Species Action Plan for the Mangrove Rivulus](#) also notes that climate change and sea-level rise will likely impact mangrove rivulus populations given their impacts on mangrove forest habitats (FWC 2013). Alterations to the natural hydrology of mangrove wetlands may result in reduced water quality and quantity, further reducing available habitat for the species. The use of pesticides in coastal habitats to control mosquito populations may also pose a threat to mangrove rivulus populations, although the extent to which these practices impact the species is not known (Taylor 1999). Changes to the natural hydrology of mangrove systems which result in altered salinity regimes are known to impact mangrove fish communities, although the exact impacts of these practices on mangrove rivulus are also not well documented (Lorenz 1999)

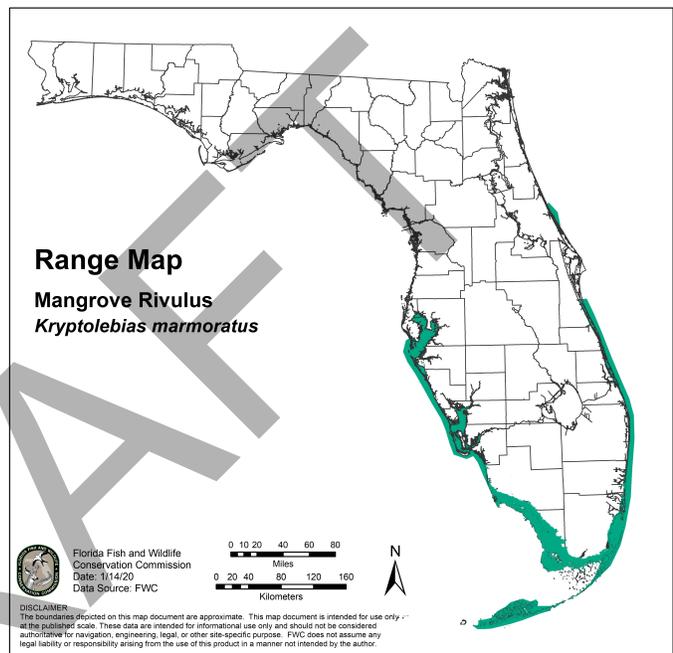
## Distribution and Survey Methodology

The range map represents the principle geographic range of the mangrove rivulus, including intervening areas of unoccupied habitat. This map is for informational purposes only and not for regulatory use.

**Counties:** Pinellas, Hillsborough, Manatee, Sarasota, Charlotte, Lee, Collier, Monroe, Miami-Dade, Broward, Palm Beach, Martin, Saint Lucie, Indian River, Brevard, Volusia.

### Recommended Survey Methodology

Surveys for determining the presence of mangrove rivulus are not required, however improvement to sampling methods have made the species easier to detect in appropriate habitats. Mangrove rivulus are most likely to be detected using a modified bottomless lift net in tidal mangrove forests within the species range (McIvor 2010). Surveys using these methods do not require a license or permit, provided they do not result in harvest of mangrove rivulus exceeding two fish or 100 lbs, per person, per day.



## Recommended Conservation Practices

Recommended conservation practices are general measures that could benefit the species but are not required. No FWC license or permit is required to conduct these activities, but FWC will review and provide comment on permit applications made to other state and federal agencies for potential impacts to this species. Further assistance on recommended conservation practices may be provided by the [FWC Landowner Assistance Program](#).

- Design projects within the range of the mangrove rivulus to minimize loss of mangroves and avoid impacts to water quality within suitable habitats.
- Avoid trimming or alteration of mangroves on uninhabited islands or lands set aside for conservation, preservation, or mitigation, and follow appropriate practices for mangrove trimming and mangrove forest restoration, per Florida's [Mangrove Trimming and Preservation Act](#).
- Restore natural vegetative structure and hydrology of altered mangrove forests within the known range of the mangrove rivulus to increase the availability of suitable habitat for the species.
- Avoid or minimize the application of pesticides and fertilizers and the loading of heavy metals and other contaminants to maintain water quality.

## Prohibitions and Permitting

Recreational harvest of mangrove rivulus requires a recreational saltwater fishing license (unless recreational licensing exceptions apply). Commercial harvest requires a commercial Saltwater Products License (SPL). There is no documented importance of mangrove rivulus to recreational or commercial harvesters, although they may be taken as incidental catch during bait-collection activities. Currently, there are no known commercial fishing operations that take significant numbers of mangrove rivulus. There are no known recreational or commercial uses of the mangrove rivulus.

### Other Permits

- The Marine Special Activity License Program issues licenses for activities that require a waiver of marine fisheries regulations such as harvesting in areas closed to fishing and provides for the use of harvesting gear that would otherwise not be allowed. Activities that may be licensed include (but are not limited to): scientific research, education, exhibition, aquaculture, the use of non-conforming gear (for research purposes only), the testing of innovative gear, and the release of marine organisms. Applications are available online at <https://myfwc.com/license/saltwater/special-activity-licenses/>.

## Additional Information

Information on Economic Assessment of this guideline can be found at: <http://myfwc.com/wildlifehabitats/imperiled/management-plans/>

## Contact

For more species-specific information contact FWC at [Imperiled@MyFWC.com](mailto:Imperiled@MyFWC.com).

Recreational and commercial licensing information can be found at <https://myfwc.com/license/>. For Special Activity License questions, visit <https://myfwc.com/license/saltwater/special-activity-licenses/>, or contact [SAL@MyFWC.com](mailto:SAL@MyFWC.com).

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