U.S. Fish & Wildlife Service

African Jewelfish (*Rubricatochromis letourneuxi*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, January 2026
Revised, February 2026
Web Version, 3/31/2026

Organism Type: Fish
Overall Risk Assessment Category: High

Photo: Klaus Rudloff. Licensed under Creative-Commons-License CC BY-SA 4.0. Available: https://animalia.bio/african-jewelfish (January 2026).

1 Native Range and Status in the United States

Native Range

From Nico et al. (2026):

"Tropical Africa. Widespread in northern, central, and west Africa (Loiselle 1979, 1992; Linke and Staeck 1994) in savannah and oasis habitats."

According to Froese and Pauly (2026), *R. letourneuxi* is native to the following countries: Central African Republic, Chad, Egypt, Ethiopia, Gambia, Guinea, Ghana, Ivory Coast, Kenya, Senegal, Sierra Leone, Sudan.

In addition to countries listed by Froese and Pauly (2026), Madden (2018) reports *R. letourneuxi* as native to Algeria, Burkina Faso, Cameroon, Niger, Nigeria, and Uganda.

Status in the United States

From Nico et al. (2026):

"Established in Florida. Prior to 1972, found only in Miami Canal and canals on western side of Miami International Airport (Hogg 1976). Species is now abundant and spreading westward and northward."

Comments on an occurrence record from Nico et al. (2026) in Puerto Rico state: "Identifcation [sic] if [sic] tentative; either *H. bicmaculatus* [*sic*] or *H. letourneuxi*. Taxonomy is uncertain".

From Madden (2018):

"*H.letourneuxi* [sic] was first documented in south Florida in the Hialeah Canal-Miami River Canal System, Miami areas (Rivas, 1965) and prior to 1972 the species was only found in this localized area, i.e. only in Miami Canal and canals on western side of Miami International Airport (Hogg, 1976). In the 1970s *H. letourneuxi* became abundant in many canals in and around the Miami/Homestead area (Courtenay et al., 1974; Hogg, 1976; Loftus and Kushlan, 1987) and in the late 1990s and early 2000s the species was found in the Everglades National Park and Big Cypress National Preserve (Kline et al., 2014; Zokan et al., 2015; USGS NAS, 2016). Regular wet-season flooding (includingoccasional [sic] hurricanes) likely assisted in the expansion of *H. letourneuxi* westward through the Rocky Glades in the Everglades National Park in 2005 (Loftus et al., 2006). *H.letourneuxi*[sic] is now abundant in southern Florida and spreading westward and northward. It is present along the Gulf Coast of Florida in Charlotte Harbor and in the lower Caloosahatchee, Peace and Alafia rivers (USGS NAS, 2016). It has also been collected from the central Florida counties of Glades, Hardee, Hendry, and was first collected in the Archbold Reserve, Highlands County, in 2008 (O'Connor and Rothermel, 2013; USGS NAS 2016). Although the species has been present in Florida since the early 1960s, it was identified as *H. bimaculatus* until the 1990s (USGS NAS 2016)."

From Artigas Azas (2023):

"In the United States, *Rubricatochromis* have been kept in aquaria for more than 50 years. […] For many years, most species of jewel cichlids in the aquarium hobby were considered to be variations of *R. bimaculatus*, a species of which we know very little and don't even know how it looks alive, hence those specimens were likely misidentified, or pertain to populations of jewel cichlids that were later subsequently described."

No species-specific information was found on *R. letourneuxi* in live trade in the United States.

Regulations
No species-specific regulations on possession or trade were found within the United States.

Means of Introductions within the United States
From Nico et al. (2026):

“This species was possibly introduced into Florida through aquarium release, perhaps in combination with escapes or releases from fish farms.”

Remarks
This ERSS was previously published in July 2018 under the name *Hemichromis letourneuxi*. Revisions were completed to incorporate new information and conform to updated standards.

From Nico et al. (2026):

“Prior to the 1990s, most published references to introduced populations of this species taken in Florida were incorrectly identified or listed as *Hemichromis bimaculatus* (Smith-Vaniz, personal communication).”

The taxonomic authorities used in this Ecological Risk Screening Summary are defined in a Standard Operating Procedure (USFWS 2024). This report follows the chosen taxonomic authority for fish (Fricke et al. 2026) in treating *Rubricatochromis letourneuxi* as the accepted scientific name for the subject taxon and *Hemichromis letourneuxi* as its superseded combination. However, because this is a recent revision, many published works still refer to this species as *Hemichromis letourneuxi*. Information for this assessment was searched for using the accepted name *Rubricatochromis letourneuxi* and the synonym *Hemichromis letourneuxi*.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing
From ITIS (2026):

Kingdom Animalia
  Subkingdom Bilateria
    Infrakingdom Deuterostomia
      Phylum Chordata
        Subphylum Vertebrata
          Infraphylum Gnathostomata
            Superclass Actinopterygii
              Class Teleostei
                Superorder Acanthopterygii
                  Order Perciformes
                    Suborder Labroidei
                      Family Cichlidae

According to Fricke et al. (2026), *Rubricatochromis letourneuxi* (Sauvage 1880) is the current valid name for this species.

The following synonym of *Rubricatochromis letourneuxi* from Fricke et al. (2026) was used to search for information for this report: *Hemichromis letourneuxi*.

Size, Weight, and Age Range

From Nico et al. (2026):

"12 cm SL [standard length] (Loiselle 1979)."

From Madden (2018):

"Although the species grows to 12 cm standard length, the average size is much smaller, approximately 7 cm."

Environment

From Froese and Pauly (2026):

"Freshwater; brackish; benthopelagic; pH range: 6.0 - ? ; dH range: 5 - ?. […] 22°C - 25°C [Baensch and Riehl 1985; assumed to represent recommended aquarium water temperatures]"

From Langston et al. (2010):

"*Hemichromis letourneuxi* showed remarkable salinity tolerance with 100% survival in salinities from 10-50 ppt, and 25% survival at 60 ppt when salinity was gradually increased over time."

From Madden (2018):

"*H. letourneuxi* is tolerant of environmental variability and introduced populations in Florida have been found to be euryhaline, resistant to low dissolved oxygen (hypoxia) and low temperatures (Loftus et al., 2006). The species is particularly tolerant of hypoxia and it is though [sic] that this […] has assisted in its ability to exploit the seasonally inundated wetlands of south Florida (Schofield et al., 2007; Schofield et al., [2009])."

Climate

From Froese and Pauly (2026):

"Tropical; […] 35°N - 4°N"

Distribution Outside the United States

Native

From Nico et al. (2026):

"Tropical Africa. Widespread in northern, central, and west Africa (Loiselle 1979, 1992; Linke and Staeck 1994) in savannah and oasis habitats."

According to Froese and Pauly (2026), *R. letourneuxi* is native to the following countries: Central African Republic, Chad, Egypt, Ethiopia, Gambia, Guinea, Ghana, Ivory Coast, Kenya, Senegal, Sierra Leone, Sudan.

In addition to countries listed by Froese and Pauly (2026), Madden (2018) reports *R. letourneuxi* as native to Algeria, Burkina Faso, Cameroon, Niger, Nigeria, and Uganda.

Introduced

From Madden (2018):

"*H. letourneuxi* […] is reportedly found in the Philippines (Froese and Pauly, 2016) and Europe (Gherardi et al., 2009). However, no further information is available regarding populations in the Philippines or Europe. In the Philippines, it is unclear whether the document referenced by Froese and Pauly (2016), refers to established nonindigenous populations and/or the presence of the species within the country (for example, present within the ornamental fish trade). Froese and Pauly (2016) also list introduced populations of *H. bimaculatus* as present within the Philippines and provide the collection information as "Introduced in the 1970's. Collected from Limnological Station, University of the Philippines Los Banos". Considering the historical tendency to label all *Hemichromis* species as *H. bimaculatus*, it is possible that this record may refer to other species. Nonetheless, as the status of *H. letourneuxi* in the Philippines is unclear, the Froese and Pauly (2016) reference is considered unreliable. Similarly, Gherardi et al. (2009) lists *H. letourneuxi* as "present" in Europe as an introduced species with no further details. Hanel et al. (2011) state that *H. fasciatus* and *H. guttatus* were established in a hot spring near Austrian Villach around 1970. It is unknown if Gherardi et al. (2009) refers to this record and thus the presence of *H. letourneuxi* in Europe is also considered unreliable."

Yoğurtçuoğlu et al. (2025) states that *Rubricatochromis letourneuxi* is "recorded in the wild, but not established" in Turkey.

Means of Introduction Outside the United States

From Froese and Pauly (2026):

"ornamental [Philippines]"

From İnnal and Sungur (2019):

"Introduced specimens of *H. letourneuxi* in this area [Pınarbaşı Creek, Burdur, Turkey] may be the result of escapes from fish farms, intentional releases from nearby ornamental fish farms or aquariums."

Short Description

From Madden (2018):

"*H.letourneuxi* [sic] is a small fish with a fairly long, slender body with a rounded caudal fin. Background body colouration is highly variable and can be green-yellow to red-brown or even dark (almost black) depending on various factors including, sex, season, habitat and disposition of fish. While breeding, males may develop red colouration on the gills and ventral surface. The species has limited blue "spangling" (small, brilliant blue iridescent spots or flecks) on the head, body and fins that may be more pronounced in breeding adults. There is a dark black lateral spot above the lateral line on the side of the fish and smaller blotches on opercular tab and caudal peduncle. […] There are 13-15 dorsal fin spines and three anal fin spines."

"Species of *Hemichromis* available within the ornamental fish industry are prized for (i) bright red colouration covering the whole body and (ii) blue "spangling" also covering much of the body. Neither of these traits are [*sic*] apparent in wild-type *H. letourneuxi*."

Biology

From Froese and Pauly (2026):

"Savannah associated species which prospers in a range of lentic habitats [Daget and Teugels 1991; Lamboj 2004], tolerant of a wide range of water quality parameters and found in both very soft waters and highly saline ones [Lamboj 2004], including brackish water lagoons, large lakes and riverine flood plains [Daget and Teugels 1991]. Occurs near vegetation beds and fringes. Feeds on *Caridina* [freshwater shrimp] and insects. Pair-bonding [Lamboj 2004] substrate spawner [Bailyey 1994; Lamboj 2004], ripe and spent fish are common early in the flood season [Bailey 1994]."

From Madden (2018):

"As an introduced species, *H. letourneuxi* occurs in shallow vegetated or rocky areas in marshes, along river banks and on the margins of mud and sand-bottomed canals and culverts."

"Once pairs of fish have formed, they are monogamous and will remain together for life. During reproduction both sexes will intensify in colour and a spawning site will be chosen; usually a flat rock. The male will vigorously pursue the female to initiate spawning. Spawning occurs in a similar fashion to many other cichlids, with the female laying a line of eggs before the male fertilises them. Up to 600 eggs may be laid and during this period the male will defend the spawning site while the female tends to the eggs. The eggs hatch in approximately 72 hours and the brood is moved into a shallow depression in the substrate near the spawning site."

"Hogg (1976) conducted the first investigation of the diet of *H. letourneuxi* in Florida and recorded filamentous algae, juvenile introduced cichlids including *H. letourneuxi*, assorted insect parts and predominantly plant material in the stomachs of 26 fish. O'Connor and Rothermel (2013) also concluded that their diet consisted primarily of fish and macroinvertebrates. The seasonal diet of *H. letourneuxi* was investigated in the Rocky Glades area of the Everglades National Park, Florida and was found to be primarily carnivorous and included small fishes, arthropods (shrimp and other crustaceans and insects) and varied according to prey availability which was mediated by seasonal water levels (Loftus et al., 2006). The heaviest feeding occurs during seasonally dry periods, when marshes begin to dry and prey becomes concentrated. Groundwater "solution holes" provide dry-season refuge to native and introduced aquatic fauna and within these specific environments *H. letourneuxi* preyed heavily upon the [native] Eastern mosquitofish, *Gambusia holbrooki* (Loftus et al., 2006)."

"Loftus et al. (2006) found that *H. letourneuxi* was most active after dark."

Human Uses

From Madden (2018):

"Pet/ aquarium trade; Research model"

From Artigas Azas (2023):

"In the United States, *Rubricatochromis* have been kept in aquaria for more than 50 years. […] For many years, most species of jewel cichlids in the aquarium hobby were considered to be variations of *R. bimaculatus*, a species of which we know very little and don't even know how it looks alive, hence those specimens were likely misidentified, or pertain to populations of jewel cichlids that were later subsequently described."

Diseases

No information was found associating *Rubricatochromis letourneuxi* with any diseases listed by the World Organisation for Animal Health (2026).

Poelen et al. (2014) lists *Scutogyrus* sp. and *Cichlidogyrus* sp. as parasites of *Rubricatochromis letourneuxi*.

From Řehulková et al. (2013):

"Two new species of *Cichlidogyrus* are described from the gills of three species of African cichlids collected from the Gambia River basin in the Niokolo-Koba National Park, Senegal: *Cichlidogyrus dracolemma* n. sp. from *Hemichromis letourneuxi* and *Cichlidogyrus nageus* n. sp. from *Sarotherodon galilaeus* and *Tilapia guineensis*."

Threat to Humans

From Froese and Pauly (2018):

"Harmless"

3 Impacts of Introductions

From Pintar et al. (2023):

"The boom-and-bust of non-native jewelfish [*Rubricatochromis letourneuxi*] in Shark River Slough [Florida Everglades] was associated with lower densities of several small fishes during the boom phase. During the boom, densities of Eastern Mosquitofish, typically the most abundant fish in the ecosystem (Loftus and Kushlan 1987; Trexler et al. 2001), were as much as 50% lower than predicted by hydrologic drivers, while declines in other species were relatively smaller […]."

"After the decline of jewelfish (bust period; 2018–2019) in Shark River Slough, populations of the most-affected species appeared to have recovered (particularly Eastern Mosquitofish, Least Killifish, and, prior to 2021, Flagfish), with predicted densities more closely matching observed densities […]."

"Our 26-year dataset suggests that, perhaps thanks to the natural wet/dry seasonality of the Everglades, jewelfish have had effects lasting only the few years when they were exceptionally abundant."

"Jewelfish were at their peak ~ 50% of the fish collected at multiple long-term monitoring sites in Everglades National Park and appeared to be a major disrupter of the food-web supporting endangered wading birds and other species of concern."

From Flood et al. (2025):

"By 2018, jewelfish densities [in Everglades National Park] had declined to previous population levels observed from 2000 to 2012; however, altered community structure (relative abundance) of fishes and invertebrates seen during the jewelfish boom persisted through at least 2021 (Flood et al., 2024). The long-term ecological consequences of jewelfish-altered community structure remain unknown."

From Madden (2018):

"Dietary studies (Hogg, 1976; Loftus et al., 2006; Lopez et al., 2012; O'Connor and Rothermel, 2013), in situ mesocosm experiments (Porter-Whitaker et al., 2012; Rehage et al., 2012; Schofield et al., 2014), field surveys (Rehage et al., 2014) and ex situ laboratory behavioural and competition experiments (Dunlop-Haydon and Rehage, 2011; Porter-Whitaker et al., 2012) have inferred deleterious impacts of *H. Letourneuxi* [sic] on aquatic habitats and invertebrate, amphibian and fish communities. *H. letourneuxi* can reach high densities and numerically dominate the ichthyofauna in anthropogenically-modified habitats in Florida (O’Connor and Rothermel, 2013).”

The following sources describe impacts of *Rubricatochromis letourneuxi* on native species in mesocosm and field experiments, rather than under natural conditions:

From Nico et al. (2026):

“According to a study by Loftus et al. (2006), this species was shown to suppress the spawning of dollar sunfish [*Lepomis marginatus*] in mesocosm tanks because of strong agonistic behavior by the cichlid. Schofield et al. (2014), found this species to have detrimental impacts on snail and shrimp species in a mesocosm experiment.”

From Rehage et al. (2014):

“Our field experiment showed that African jewelfish can be an important source of mortality for small-bodied native taxa. Only 38 % of mosquitofish survived short term co-occurrence with jewelfish in experimental cages, and this mortality rate was higher than the mortality mosquitofish experienced in abiotic stress trials during any individual week (max ~30 %). Although the cages may have artificially enhanced risk for prey in our experiment, our findings at minimum show that predation by African jewelfish can be an important source of mortality, in agreement with studies that show that predation is an important mechanism by which nonnative taxa impact natives (Schlaepfer et al. 2005; Sih et al. 2010). While mosquitofish were used in this experiment are [sic] a representative of native prey due to their abundance and ubiquitous distribution, their position in the water column (surface-dwelling) relative to jewelfish (bottom-dwelling) does not make them ideal jewelfish prey throughout much of the hydrologic year (Porter-Whitaker et al. 2012), and suggests experiment predation estimates may be conservative.”

From Schofield et al. (2014):

“In an 8-month mesocosm experiment, we examined how a simulated Everglades aquatic community of small native fishes, snails, and shrimp changed with the addition of either a native predator (dollar sunfish *Lepomis marginatus*) or a non-native predator (African jewelfish *Hemichromis letourneuxi*) compared to a no-predator control. Two snail species (*Planorbella duryi*, *Physella cubensis*) and the shrimp (*Palaemonetes paludosus*) displayed the strongest predator-treatment effects, with significantly lower biomasses in tanks with *Hemichromis*. One small native fish (*Heterandria formosa*) was significantly less abundant in *Hemichromis* tanks, but there were no significant treatment effects for *Gambusia holbrooki*, *Jordanella floridae*, or *Pomacea paludosa* (applesnail). Overall, there were few treatment differences between native predator and no-predator control tanks. The results suggest that the potential of *Hemichromis* to affect basal food-web species that link primary producers with higher-level consumers in the aquatic food web, with unknown consequences for Florida waters.”

4 History of Invasiveness

Introductions of *Rubricatochromis letourneuxi* have resulted in established populations in Florida. Nonnative populations have reached high densities, leading to altered community structure and declines in native fish species and other fauna. Therefore, the History of Invasiveness for *Rubricatochromis letourneuxi* is classified as High.

5 Global Distribution

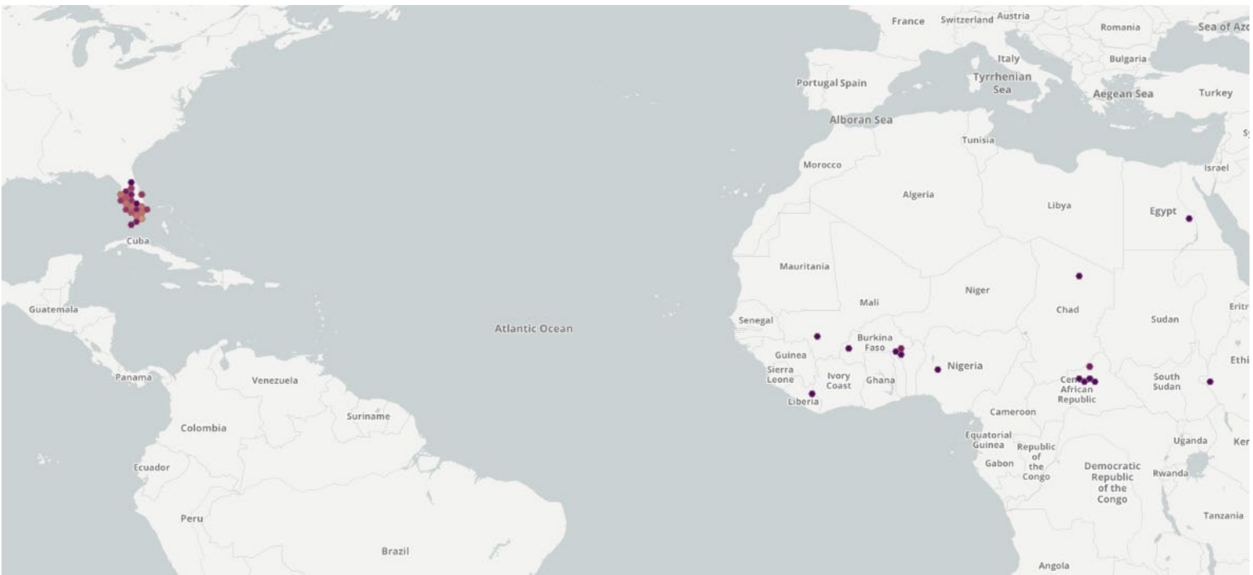

Figure 1. Reported global distribution of *Rubricatochromis letourneuxi*. Map from GBIF Secretariat (2023). Observations are reported from the United States (Florida), Ivory Coast, Mali, Burkina Faso, Benin, Nigeria, Central African Republic, Chad, Ethiopia, and Egypt.

6 Distribution Within the United States

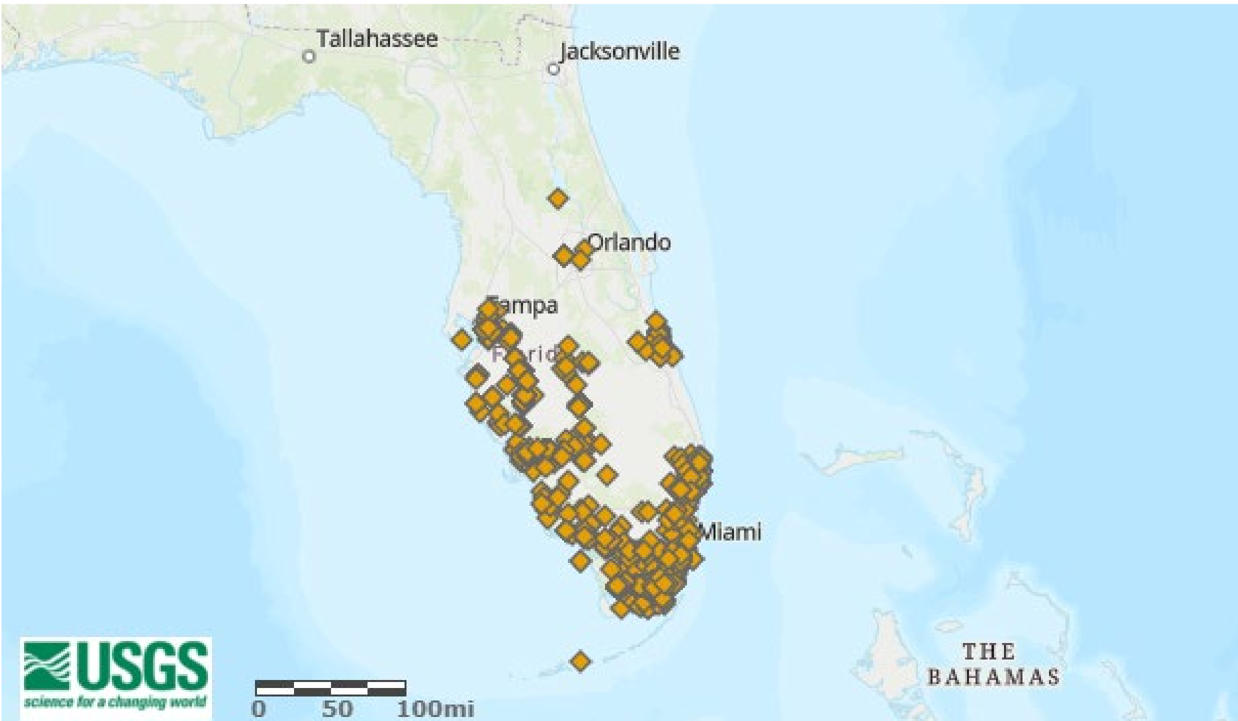

Figure 2. Reported distribution of *Rubricatochromis letourneuxi* in the contiguous United States. Map from Nico et al. (2026). Observations are reported from Central and Southern Florida.

Figure 3. Reported distribution of *Rubricatochromis letourneuxi* in Puerto Rico. Map from Nico et al. (2026). This reported occurrence was excluded from the climate matching analysis due to uncertainty in the species identification (Nico et al. 2026). The status of this species remains unknown in Puerto Rico.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Rubricatochromis letourneuxi* was high in the southeastern United States along the Gulf Coast spanning from Texas to Florida and along the Atlantic Coast to Virginia. High climate match was also found in the southwestern United States along the U.S.-Mexico border and into the Central Valley of California. The climate match was medium in the Lower Mississippi River Basin, Ohio River Basin, and Mid-Atlantic region, shifting to low match in the Northeast, Upper Midwest, Northern Plains, Great Basin, and Pacific Northwest. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.094, indicating that Yes, there is establishment concern for this species. The Climate 6 score is calculated as: (count of target points with scores ≥ 6)/(count of all target points). Establishment concern is warranted for Climate 6 scores greater than or equal to 0.002 based on an analysis of the establishment success of 356 nonnative aquatic species introduced to the United States (USFWS 2024).

Projected climate matches in the contiguous United States under future climate scenarios are available for *Rubricatochromis letourneuxi* (see Appendix). These projected climate matches are provided as additional context for the reader; future climate scenarios are not factored into the Overall Risk Assessment Category.

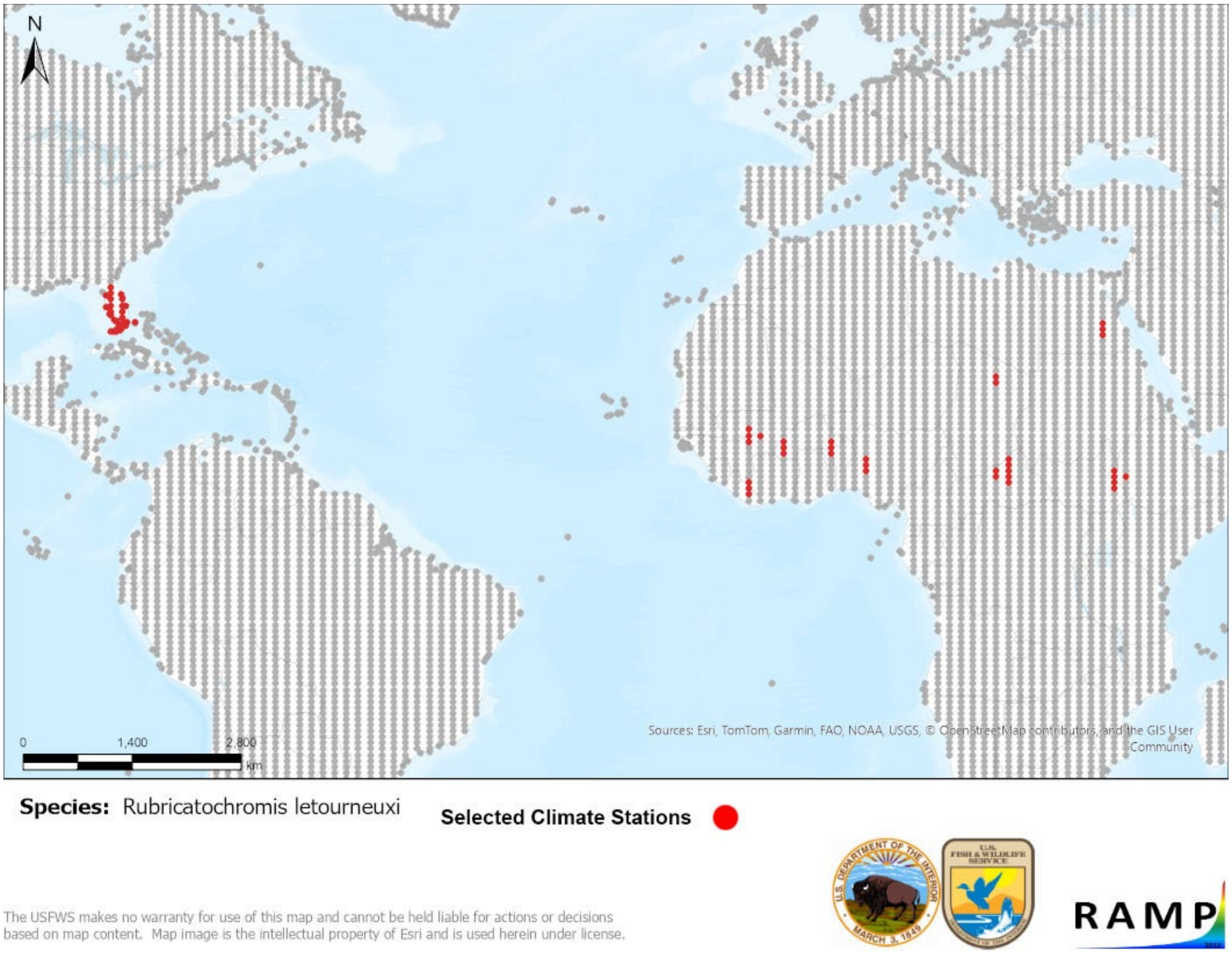

Figure 4. RAMP (Sanders et al. 2023) source map showing weather stations in the United States and Africa selected as source locations (red; United States, Chad, Central African Republic, Sudan, Ethiopia, Liberia, Benin, Burkina Faso, Nigeria, Egypt) and non-source locations (gray) for *Rubricatochromis letourneuxi* climate matching. Source locations from GBIF Secretariat (2023). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

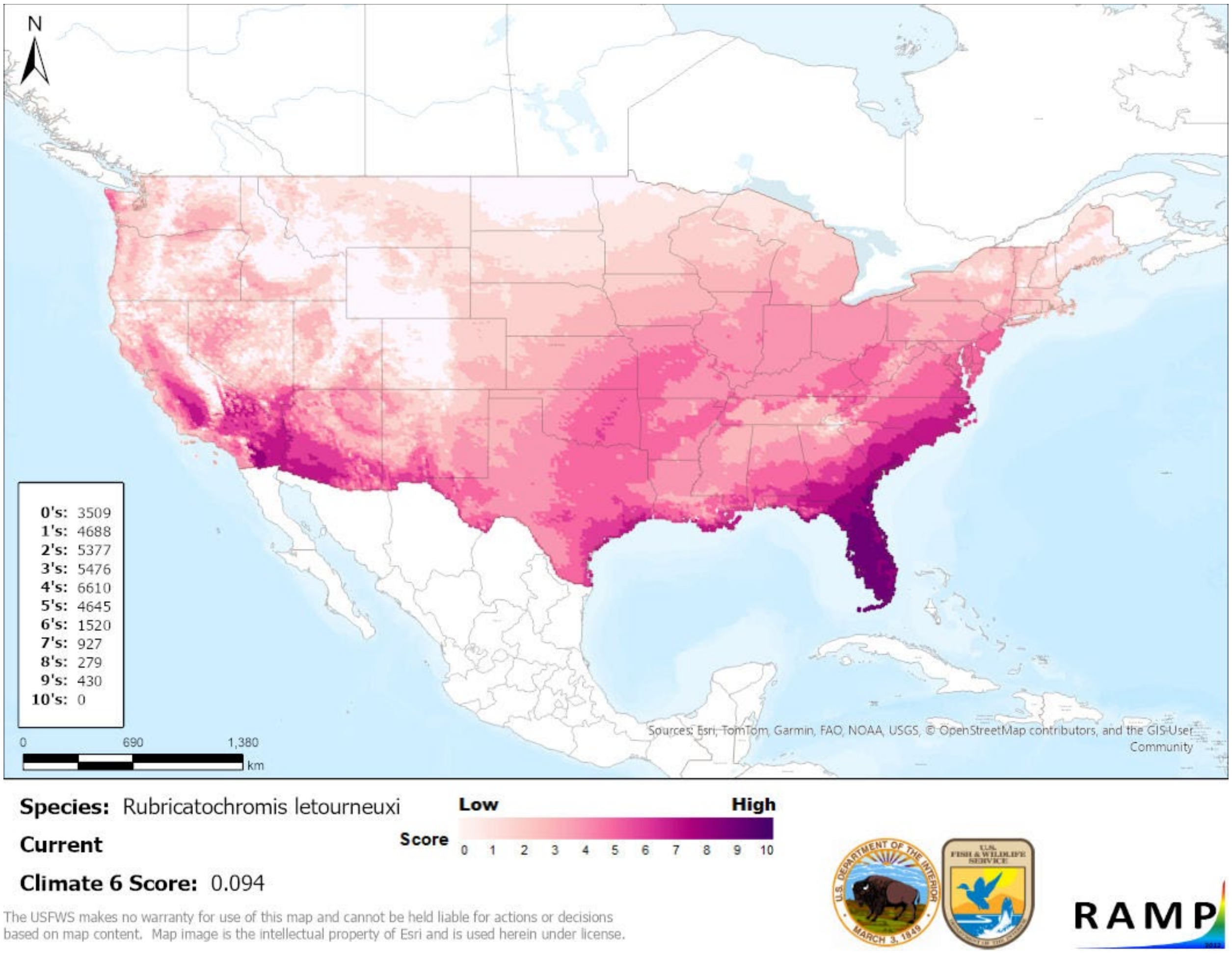

Figure 5. Map of RAMP (Sanders et al. 2023) climate matches for *Rubricatochromis letourneuxi* in the contiguous United States based on source locations reported by GBIF Secretariat (2023). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment is Medium. Information on the biology, ecology, and distribution of *Rubricatochromis letourneuxi* is available for review. It has a well-documented established presence and there is clear, convincing, and reliable evidence of negative impacts of introduction in Florida. However, species within this genus have a history of misidentification, potentially leading to misunderstanding of the native or introduced range of *R. letourneuxi*.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Rubricatochromis letourneuxi, African Jewelfish, is a freshwater fish native to northern, central and western Africa. It is a highly resilient species that thrives in both freshwater and brackish environments and can tolerate elevated salinity and low dissolved oxygen conditions. The species is common in the aquarium trade, which likely facilitated its introduction and establishment in Florida during the 1960s. Since then, *R. letourneuxi* has expanded its distribution and is now found throughout the southern half of the Florida peninsula. No other established nonnative populations are known with certainty, although introductions have been reported for Turkey and the Philippines. *R. letourneuxi* has been shown to reduce abundance of native fish communities in the Everglades of Florida, especially in years when *R. letourneuxi* is more abundant. Native fish populations are slow to recover even in years when *R. letourneuxi* is less abundant. Based on this species' documented negative impacts where introduced in Florida, the History of Invasiveness for *R. letourneuxi* is classified as High. The climate matching analysis for the contiguous United States indicating establishment concern for this species, with the highest climate matches being found in the southeastern and southwestern United States. The Certainty of Assessment for this ERSS is Medium due to the ample information available on impacts of introduction but a history of misidentification of species within the genus. The Overall Risk Assessment Category for *R. letourneuxi* in the contiguous United States is classified as High.

Assessment Elements

- **History of Invasiveness (see Section 4): High**
- **Establishment Concern (see Section 7): Yes**
- **Certainty of Assessment (see Section 8): Medium**
- **Remarks, Important additional information: For several decades, populations in Florida were misidentified as *Hemichromis bimaculatus*.**
- **Overall Risk Assessment Category: High**

10 Literature Cited

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in section 11.

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Appendix

Summary of Future Climate Matching Analysis

Future climate projections represent two Shared Socioeconomic Pathways (SSP) developed by the Intergovernmental Panel on Climate Change (IPCC 2021): SSP5, in which emissions triple by the end of the century; and SSP3, in which emissions double by the end of the century. Future climate matches were based on source locations reported by GBIF Secretariat (2023).

Under the future climate scenarios (figure A1), on average, high climate match for *Rubricatochromis letourneuxi* was projected to occur in the Southern Atlantic Coast and Southern Florida regions of the contiguous United States. Areas of low climate match were projected to occur in the Colorado Plateau, Great Basin, Northeast, Northern Plains, and Western Mountains regions. All four future scenarios showed similar patterns of high and low climate match areas. The SSP3, 2085 models projected a slightly larger area of medium climate match in the central United States. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.075 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.203 (model: MRI-ESM2-0, SSP3, 2055). All future scenario Climate 6 scores were above the Establishment Concern threshold, indicating that Yes, there is establishment concern for this species under future scenarios. The Climate 6 score for the current climate match (0.094, figure 5) falls within the range of scores for future projections. The time step and climate scenario with the most change relative to current conditions was SSP5, 2085, the most extreme climate change scenario. Under one or more time step and climate scenarios, areas within the Great Lakes and Northeast saw a large increase in the climate match relative to current conditions. Additionally, areas within the Appalachian Range, California, Colorado Plateau, Great Basin, Northern Pacific Coast, Northern Plains, Southern Plains, Southwest, and Western Mountains saw a moderate increase in the climate match relative to current conditions. Under one or more time step and climate scenarios, areas within the Gulf Coast, Southeast, Southern Atlantic Coast, and Southern Florida saw a moderate decrease in the climate match relative to current conditions. No large decreases were observed regardless of time step and climate scenarios. Additional very small areas of large or moderate change may be visible on the maps (figure A3). Large areas of increased climate match were predicted to occur under both 2085 scenarios in the Great Lakes region, with the greatest change relative to current conditions under the SSP5, 2085 scenario.

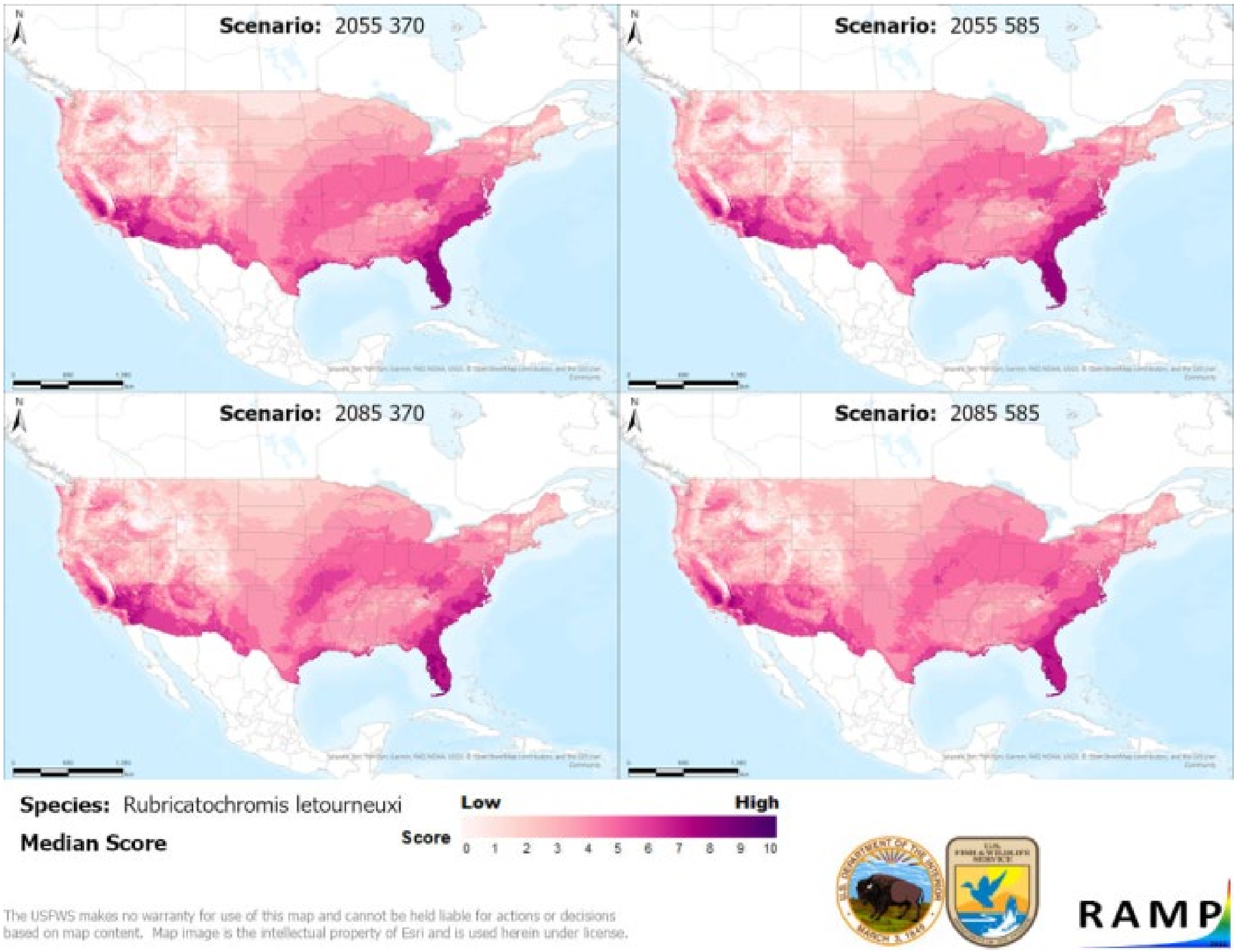

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Rubricatochromis letourneuxi* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

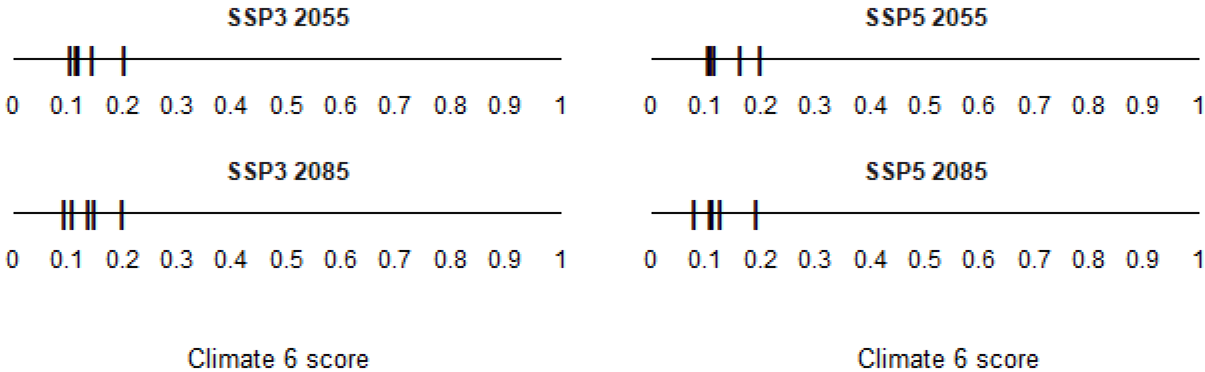

Figure A2. Comparison of projected future Climate 6 scores for *Rubricatochromis letourneuxi* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0.

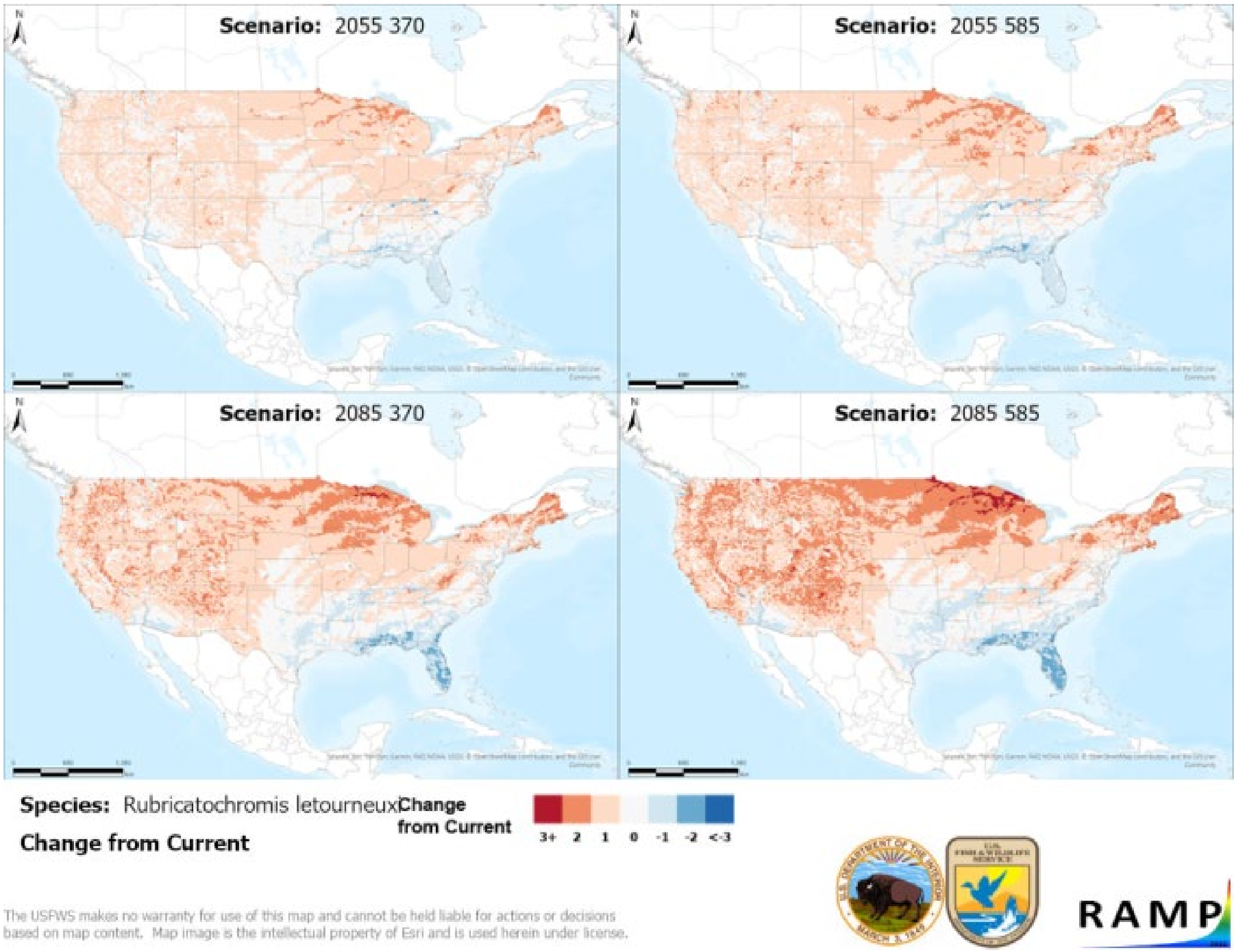

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Rubricatochromis letourneuxi* based on source locations reported by GBIF Secretariat (2023). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. Shades of blue indicate a lower target point score under future scenarios than under current conditions. Shades of red indicate a higher target point score under future scenarios than under current conditions. Darker shades indicate greater change.

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