Jack Dempsey (*Rocio octofasciata*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, March 2011
Revised, July 2019
Web Version, 12/23/2019

Photo: Tomolyka. Licensed under Creative Commons Attribution-Share Alike 3.0 Unported. Available: https://commons.wikimedia.org/wiki/File:Rocio_octofasciata.jpg. (June 2019).

1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2019):

"North and Central America: Atlantic slope from southern Mexico (Papaloapán River) to Honduras (Ulua River)."

Froese and Pauly (2019) lists *Rocio octofasciata* as native to Belize, Guatemala, Honduras, and Mexico.

From Nico and Neilson (2019):

"Native Range: Tropical America. Atlantic Slope drainages in Middle America from Río Paso San Juan, Veracruz, Mexico, south to the Río Ulua basin in Honduras (Greenfield and Thomerson 1997)."

Status in the United States

From Froese and Pauly (2019):

"Accidentally released from aquaria and established populations were recorded in Florida."

According to Nico and Neilson (2019), nonindigenous occurrences of *Rocio octofasciata* have been reported in the following states, with range of years and hydrologic units in parentheses:

- California (1986-1986; Suisun Bay)
- Colorado (2010-2010; Middle South Platte-Cherry Creek)
- Connecticut (1996-1996; Housatonic; Lower Connecticut; Thames)
- Florida (1968-2019; Cape Canaveral; Choctawhatchee Bay; Florida Southeast Coast; Little Manatee; Manatee; Oklawaha; Peace-Tampa Bay; South Atlantic-Gulf Region; St. Johns; Tampa Bay; Tampa Bay; Vero Beach; Waccasassa)
- Hawaii (1991-1991; Oahu)
- South Dakota (2009-2012; Middle Cheyenne-Spring)

From Nico and Neilson (2019):

"Status: Locally established in South Dakota; established in Hawaii. In Florida, extirpated in Alachua County; unknown in other counties. Failed in California, Colorado, and Connecticut."

From CABI (2019):

"As an introduced species, *R. octofasciata* occurs in anthropogenically-modified mud and sand-bottomed canals and drainage ditches in Florida (Page and Burr, 1991; Obordo and Chapman, 1997), and also in rock quarries in the USA (Levine et al., 1979) and Australia (NSW Department of Primary Industries, 2014). *R. octofasciata* occurs in artificially heated lakes and waterbodies outside its latitudinal range, […] and in Fall River, Hot Springs, South Dakota, USA (Nico and Neilson, 2014)."

Rocio octofasciata is still in trade within the United States.
From Aquatic Arts (2019):

"Electric Blue aka Powder Blue Jack Dempsey cichlid (*Rocio octofasciata* "Electric Blue"), Tank Bred!
$17.95"

Means of Introductions in the United States

From Froese and Pauly (2019):

"Accidentally released from aquaria and established populations were recorded in Florida."

From Nico and Neilson (2019):

"Means of Introduction: Likely aquarium release in most cases, with the possibility of aquaculture escape in areas of Florida adjacent to current or former aquaculture production facilities."

From CABI (2019):

"There are three main factors likely to influence the risk of introduction of *R. octofasciata* to new environments: the popularity of the species as an ornamental fish, its rather large size and/or aggressive behaviour, and the number of naturalized introduced populations present in the wild."

Remarks

From Froese and Pauly (2019):

"The generic allocation of this species is still uncertain. It belongs to the tribe Heroini, but is maintained as an incertae sedis species of *Cichlasoma* pending a revision of heroin cichlids traditionally assigned to the cichlasomatin genus *Cich*"

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From Fricke et al. (2019):

"Current status: Valid as *Rocio octofasciata* (Regan 1903)."

From Bailly (2017):

"Biota > Animalia (Kingdom) > Chordata (Phylum) > Vertebrata (Subphylum) > Gnathostomata (Superclass) > […] Actinopterygii (Class) > Perciformes (Order) > Labroidei (Suborder) > Cichlidae (Family) > Cichlinae (Subfamily) > *Rocio* (Genus) > *Rocio octofasciata* (Species)"

Size, Weight, and Age Range

From Froese and Pauly (2019):

"Max length : 25.0 cm TL male/unsexed; [Page and Burr 1991]; common length : 7.5 cm TL male/unsexed; [Hugg 1996]"

Environment

From Froese and Pauly (2019):

"Freshwater; benthopelagic; pH range: 7.0 - 8.0; dH range: 9 - 20. […]; 22°C - 30°C [Conkel 1993]; […]"

From CABI (2019):

"Within its natural range, *R. octofasciata* occurs in wetlands (Froese and Pauly, 2014) and particularly slow moving waters of lower river valleys on the coastal plains (Conkel, 1993). In a tropical wetland in the Sian Káan Biosphere Reserve, Yucatán Peninsula, México, *R. octofasciata* occupies both temporary and permanent pool habitats, although showing a clear preference for permanent pools (Escalera-Vázquez and Zambrano, 2010). A study performed in this area concluded that macrophyte coverage was important for *R. octofasciata* due to its positive relationship to food availability, spawning sites and protection from potential predators."

"It appears that *R. octofasciata* has only established viable introduced populations in highly anthropogenically-modified habitats, such as drainage canals and rock quarries, and has not been successfully introduced to less modified habitats with stable native aquatic communities. Although the species is euryhaline (Oldfield, 2004; NSW Department of Primary Industries, 2014), it does not appear to occupy saline or brackish waters, or estuarine environments, as an introduced species."

Climate/Range

From Froese and Pauly (2019):

"Tropical; […]; 21°N - 14°N"

Distribution Outside the United States

Native

From Froese and Pauly (2019):

"North and Central America: Atlantic slope from southern Mexico (Papaloapán River) to Honduras (Ulua River)."

Froese and Pauly (2019) lists *Rocio octofasciata* as native to Belize, Guatemala, Honduras, and Mexico.

From Nico and Neilson (2019):

"Native Range: Tropical America. Atlantic Slope drainages in Middle America from Río Paso San Juan, Veracruz, Mexico, south to the Río Ulua basin in Honduras (Greenfield and Thomerson 1997)."

Introduced

Froese and Pauly (2019) lists *Rocio octofasciata* as introduced in Australia, Philippines, and Thailand.

From Froese and Pauly (2019):

"Introduced [from Brazil to Thailand] in the 1950s. The jack dempsey is a popular aquarium species which breeds successfully in natural habitats in Thailand."

"Reported to be established in the cooling ponds of one power station and in the out-flow creeks in Victoria [Australia], however, it is probably now declining."

From Nico and Neilson (2019):

"*Rocio octofasciata* is also introduced in Australia (Welcomme 1988), Russia (Zworykin and Pashkov 2010), and Thailand (Nico et al. 2007)."

From CABI (2019):

"In Australia, *R. octofasciata* was collected from the cooling ponds of a power station (Hazelwood) in Victoria in the late 1970s, although the population was not self-sustaining (Cadwallader et al., 1980). A population was discovered in early 2004 at Yamba, north coast of New South Wales, Australia (NSW Department of Primary Industries, 2014). This population is confined to an isolated flooded quarry locally known as the 'green pool'. Three failed eradication attempts using explosives were carried out between September 2004 and June 2005.

R. octofasciata is well established in Lake Staraya Kuban, Krasnodar, Russia and has been present at this location since at least the 1980s (Pashkov and Zworykin, 2009; Zworykin and Pashkov, 2010). Lake Staraya Kuban is an oxbow lake of the Kuban River and is used as a cooling water body of the "Krasnodar Thermal and Electric Power Plant". The species occupies areas of the lake with water temperatures up to 26°C (Pashkov and Zworykin, 2009).

R. octofasciata has also been introduced to Asia, namely the Philippines [establishment unknown] (BFAR, 2006) and Thailand (Nico et al., 2007; Froese and Pauly, 2014)."

"*R. octofasciata* occurs in artificially heated lakes and waterbodies outside its latitudinal range, e.g. in a lake warmed by power station thermal effluents in Russia (Pashkov and Zworykin, 2009; Zworykin and Pashkov, 2010); […]"

From Pashkov and Zvorykin (2009):

"Previously we (Zvorykin and Pashkov, 2008) reported the finding of an allochtonous species—cichlasomine *Rocio octofasciata*—new for Russia. The American cichlid fish has been inhabiting Lake Staraya Kuban (the city of Krasnodar) for over 25 years and has become so numerous that it serves as an item of amateur fishery. […]. It was first mentioned in scientific literature only at

the beginning of the 21st century (Pashkov et al., 2004, 2005), and its species qualification has been estasblished only quite recently (Zvorykin and Pashkov, 2008).

Studies of the population of this species, alien for Lake Staraya Kuban, are at an initial stage; however, the data we obtained up to the present allow us to state that this species has completely naturalized in the water body: it formed a self-reproducing and rather numerous population."

Means of Introduction Outside the United States

From Froese and Pauly (2019):

"The jack dempsey is a popular aquarium species which breeds successfully in natural habitats in Thailand."

CABI (2019):

"*Rocio octofasciata* is a popular ornamental freshwater fish, native to north and central America that has been introduced to aquatic habitats of at least five countries. It has become established in these new habitats because of wide environmental tolerances, the ability to colonize disturbed habitats, trophic opportunism, fast growth rates and advanced parental care of offspring. *R. octofasciata* is euryhaline and highly tolerant of hypoxic conditions. The species is aggressive, particularly when breeding, as territories are established on the substrate and defended against intruders. Potential ecological impacts include predation and resource competition upon endemic fish fauna, and predation of aquatic invertebrate communities in general."

"There are three main factors likely to influence the risk of introduction of *R. octofasciata* to new environments: the popularity of the species as an ornamental fish, its rather large size and/or aggressive behaviour, and the number of naturalized introduced populations present in the wild.

The release of unwanted ornamental fishes is the most likely explanation for the presence of nonindigenous populations of *R. octofasciata* in Australia and elsewhere (Lintermans, 2004; Nico and Neilson, 2014). *R. octofasciata* is a moderately popular ornamental species (Corfield et al., 2007), which makes the potential for its release into the wild correlated with its popularity and abundance among fish hobbyists. In Australia, the species has been listed as a commercial aquarium fish species of medium importance, with up to 10,000 fish sold annually (Corfield et al., 2007)."

"Natural dispersal and anthropogenic translocation of introduced populations of *R. octofasciata* can also take place and is more likely to occur in areas with multiple, larger or widely dispersed populations. In these areas, there is a greater risk of the general public collecting, translocating and potentially re-releasing fishes."

Short Description

From Froese and Pauly (2019):

"Dorsal spines (total): 17 - 19; Dorsal soft rays (total): 8-10; Anal spines: 8-9; Anal soft rays: 7 - 9. This species has spots on sides smaller than scales, aligned in about 15 regular series (vs. not

clearly aligned); abdomen predominantly whitish or greyish in life (similar to *R. gemmata*, vs. reddish in *R. ocotal*; ventral angle of articular is acute (vs. right); the first neural spine oriented rostrad (vs. caudad); circumpeduncular scales as few as 17 (vs. always more than 19); distance from the caudal esophageal loop in gut to esophagus always greater than 24% gut length (vs. less than 16%) [Schmitter-Soto 2007]. There are no unique autapomorphies."

From Nico and Neilson (2019):

"Identification: In general, cichlids (Cichlidae) are superficially similar to North American native sunfishes and black basses (*Lepomis* and *Micropterus*; family Centrarchidae). Cichlids can be distinguished from centrarchids by a single nostril opening on each side of the head (vs. two in centrarchids) and the presence of a discontinuous or two-part lateral line (continuous in centrarchids)."

Biology

From Froese and Pauly (2019):

"Occurs in swampy areas with warm, murky water. Found in weedy, mud-bottomed and sand-bottomed canals and drainage ditches [Page and Burr 1991]. Prefers coastal plains and slow moving waters of the lower river valleys [Conkel 1993]. Feeds on worms, crustaceans, insects and fish [Mills and Vevers 1989]."

From CABI (2019):

"Reproductive Biology

R. octofasciata is a biparental substrate spawner/brooder (Lee et al., 1980; Seriously Fish, 2014), which exhibits a separation of parental roles (Zworykin, 1995; Zworykin et al., 1998). Typically, female *R. octofasciata* primarily guard the eggs until they hatch, and fry are guarded by male fish (Zworykin et al., 1998). Parental fin digging in the substrate is performed significantly more often by females than males. It has been suggested that fin digging stirs the substrate and provides small particles of food for the fry to consume. Both parents increase the frequency of fin digging significantly with an increase in fry age, particularly from 3 to 10 days (Zworykin, 1998). While *R. octofasciata* parents incubate eggs and guard young, they are likely to undertake aggressive behaviour towards con- and heterospecifics (Froese and Pauly, 2014). Fecundity is 500 to 800 eggs per spawning (Riehl and Baensch, 1991). Laboratory experiments researching reproductive behaviour of the species have been conducted at 25±1°C (Zworykin, 1998; Zworykin et al., 1998). In aquaria, eggs hatch in 3 days at 26.6°C and fry become free-swimming in 3 days (Texas Parks and Wildlife, 2012). *R. octofasciata* will reach maturity in less than a year and can undertake multiple spawning per year (Froese and Pauly, 2014). Fishes of this species with an 'equilibrium life-history strategy' exhibit parental care, prolonged breeding seasons and live in deeper and more stable habitats, such as slow-flowing ponds, river channels and lakes (Winemiller, 1989; Escalera-Vázquez and Zambrano, 2010).

Physiology and Phenology

R. octofasciata possesses physiological adaptations and behavioural traits that may facilitate its dispersal as an introduced species. It has a relatively high tolerance to hypoxic conditions and undertakes aquatic surface respiration when exposed to extremely low oxygen concentrations (<5 mm Hg) (Obordo and Chapman, 1997). Other well developed physiological mechanisms, including a low metabolic rate and large gills relative to body size, also aid the species in hypoxic conditions (Obordo and Chapman, 1997).

Longevity

In the wild, *R. octofasciata* may live for 3-4 years and, in aquaria, the species is reported to live 8-15 years (Texas Parks and Wildlife, 2012).

Nutrition

R. octofasciata is an opportunistic omnivore that consumes insects, worms, crayfish, molluscs, crustaceans, small fish and filamentous algae (Mills and Vevers, 1989; NSW Department of Primary Industries, 2014).

Hinojosa-Garro et al. (2013) determined the diet of *R. octofasciata* from permanent and semi-permanent pools in Petenes Biosphere Reserve, Yucatán Peninsula, Mexico. The species was found to be principally detritivorous in permanent pools, and omnivorous in semi-permanent pools, consuming a higher proportion of terrestrial insects and arachnids in the latter habitat. At the same time, the species can be described as predominantly predatory in a creek at the University of Florida, Alachua County, Florida (Jennings, 1986).

An introduced population of *R. octofasciata* in Russia was found to be omnivorous, mainly consuming chironomid larvae, aerial insects, aquatic invertebrates (Trichoptera, Odonata, Coleoptera and Mollusca) and vegetable matter (sunflower seeds) (Pashkov and Zworykin, 2009)."

"The potential for natural dispersal of *R. octofasciata* is increased by the environmental tolerances of the species. Euryhalinity can greatly aid the natural dispersal of *R. octofasciata*, by promoting the utilisation of saline environments as "saline bridges" to facilitate the spread of freshwater fish species (Brown et al., 2001). High hypoxia tolerance may allow this species to readily colonize and migrate within anthropogenically-modified waterways, often associated with urban areas. Obordo and Chapman (1997) suggest that physiological adaptations of *R. octofasciata* to cope with low oxygen conditions enable them to colonize wetland areas, temporary ponds and other habitats that experience large diel fluctuations in oxygen concentrations.

Escalera-Vázquez and Zambrano (2010) documented *R. octofasciata* moving between permanent and ephemeral water bodies. During the wet season, the species migrated from deeper permanent ponds to shallow ephemeral pools, only to return to the permanent refugia during the dry season. This behaviour of moving between permanent and ephemeral water bodies, and the

abovementioned physiological traits, could allow *R. octofasciata* to readily extend its range (Corfield et al., 2007).

While *R. octofasciata* possesses traits of successful introduced species and has a high adaptive potential (Pashkov and Zworykin, 2009), it has not widely dispersed in habitats where it has been introduced. For example, in Florida, it has been introduced in at least 11 counties in the 1970s-1980s (Courtenay et al., 1974; Hogg, 1976a,b; Courtenay and Hensley, 1979; Levine et al., 1979; Dial and Wainright, 1983; Gilmore et al., 1983; Jennings, 1986; Shafland et al., 2008; Nico and Neilson, 2014), with high ecological impacts predicted (Courtenay et al., 1974). However, the species did not readily disperse and populations were observed to reach comparatively small sizes or disappear altogether (Jennings, 1986)."

Human Uses

From Froese and Pauly (2019):

"Fisheries: of no interest; aquarium: highly commercial"

From CABI (2019):

"Although *R. octofasciata* is a popular ornamental fish species, it is not ideal for many hobbyists due to its large size (up to 25 cm) and aggressive nature. The species will also opportunistically consume smaller fishes. Thus, it is not ideal to keep it in the standard "community" aquarium with many different, and often small, fish species. It may outgrow small aquaria, attack and/or consume other smaller aquarium fish species, which promotes its disposal."

"Economic Value

R. octofasciata is a popular ornamental fish worldwide (Lintermans, 2004; Corfield et al., 2007). In Australia, Corfield et al. (2007) listed this species as of "medium" importance as an ornamental fish, with a volume of up to 10,000 fish sold annually.

Social Benefit

R. octofasciata is used as a biological research model in many disciplines, e.g. behavioural research (e.g. Zworykin et al., 1998)."

Diseases

No records of OIE-reportable diseases (OIE 2019) were found for *Rocio octofasciata.*

From Froese and Pauly (2019):

"White spot Disease, Parasitic infestations (protozoa, worms, etc.)
Spiroxys Infestation, Parasitic infestations (protozoa, worms, etc.)
Yellow Grub, Parasitic infestations (protozoa, worms, etc.)
Posthodiplostomum Infestation 2, Parasitic infestations (protozoa, worms, etc.)
Spiroxys Infestation, Parasitic infestations (protozoa, worms, etc.)

Campechetrema Infection, Parasitic infestations (protozoa, worms, etc.)
Crassicutis Infection, Parasitic infestations (protozoa, worms, etc.)
Genarchella Infection, Parasitic infestations (protozoa, worms, etc.)
Homalometron Infection, Parasitic infestations (protozoa, worms, etc.)
Oligogonotylus Infection, Parasitic infestations (protozoa, worms, etc.)
Oligogonotylus Infection, Parasitic infestations (protozoa, worms, etc.)
Contracaecum Disease (larvae), Parasitic infestations (protozoa, worms, etc.)
Ascocotyle Infestation 1, Parasitic infestations (protozoa, worms, etc.)
Ascocotyle Infestation 2, Parasitic infestations (protozoa, worms, etc.)
Cladocystis Infection, Parasitic infestations (protozoa, worms, etc.)
Ascocotyle Infestation 3, Parasitic infestations (protozoa, worms, etc.)
Crocodilicola Infestation, Parasitic infestations (protozoa, worms, etc.)
Diplostomum Infection, Parasitic infestations (protozoa, worms, etc.)
Pelaezia Infection, Parasitic infestations (protozoa, worms, etc.)
Perezitrema Infection, Parasitic infestations (protozoa, worms, etc.)
Ribeiroia Infection, Parasitic infestations (protozoa, worms, etc.)
Tetarcotyla Infection, Parasitic infestations (protozoa, worms, etc.)
Uvulifer Infection, Parasitic infestations (protozoa, worms, etc.)
Sciadicleithrum Infection 3, Parasitic infestations (protozoa, worms, etc.)
Falcaustra Infection (Falcaustra sp.), Parasitic infestations (protozoa, worms, etc.)
Capillaria Infestation 4, Parasitic infestations (protozoa, worms, etc.)"

Poelen et al. (2019) lists *Riberoia ondatrae, Atrophecaeum astorquii, Neoechinorhynchus golvani, Sciadicleithrum bravohollisae, Sciadicleithrum mexicanum, Homalometron pallidum, Campechetrema herrerai, Oligogonotylus manteri, Ascocotyle tenuicollis, Pelaezia, Perezitrema bychowskyi, Posthodiplostomum minimum, Genarchella isabellae, Ascocotyle nana, Ascocotyle nunezae, Crocodilicola pseudostoma, Neocapillaria pterophylli,* and *Crassicutis cichlasomae* as parasites of *Rocio octofasciata.* Poelen et al. (2019) lists *Neocapillaria pterophylli* as an endoparasite of *Rocio octofasciata.*

From Mendoza-Palmero et al. (2017):

"Based on an integrative taxonomic approach, combining morphological characters and partial sequences of the 28S rRNA gene, a new genus and species, *Parasciadicleithrum octofasciatum*, is proposed to accommodate dactylogyrids infecting the gills of *Rocio octofasciata* (Cichlidae) from a tributary of the Lacantún River basin, Chiapas State, southern Mexico."

Threat to Humans

From Froese and Pauly (2019):

"Harmless"

3 Impacts of Introductions

From Nico and Neilson (2019):

"Impact of Introduction: The omnivorous, opportunistic feeding behavior of the Jack Dempsey should enhance its survival in areas where it is introduced (Jennings 1986)."

From CABI (2019):

"Little information is available on the impacts of introduced populations of *R. octofasciata*, although generalisations can be made regarding the diet and behaviour of the species. *R. octofasciata* may compete with indigenous fishes for food and will opportunistically consume smaller fishes. The aggressive behaviour of *R. octofasciata* may displace indigenous fishes.

Texas Parks and Wildlife (2012) identified North American native sunfishes (Centrarchidae) as potential competitors of *R. octofasciata*. The introduced cichlid occupies a similar ecological niche as sunfishes, having similar reproduction habits (sunfishes are substrate spawners and nest builders, with males guarding the nest), trophic position (adults eat insects, larvae and small fish) and habitat (slow waters, muddy bottoms, high vegetation cover)."

4 Global Distribution

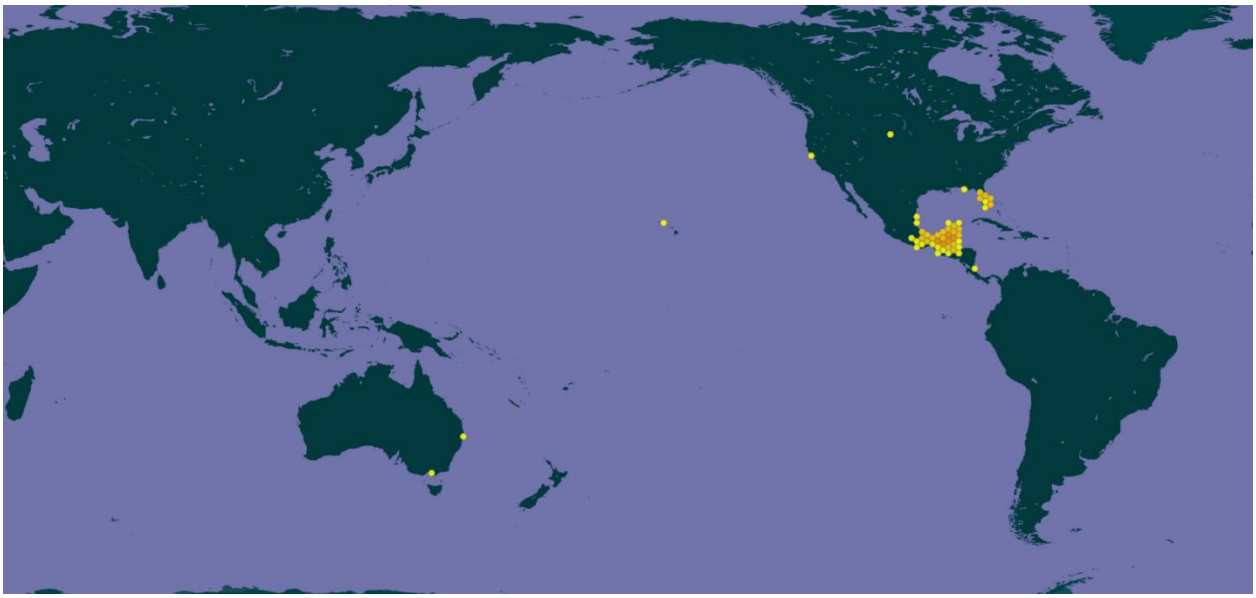

Figure 1. Known global distribution of *Rocio octofasciata*. Map from GBIF Secretariat (2019). Locations are in Central and North America, Hawaii, and Australia. The population of *Rocio octofasciata* in California was not used as a source point because Nico and Neilson (2019) states that these populations failed.

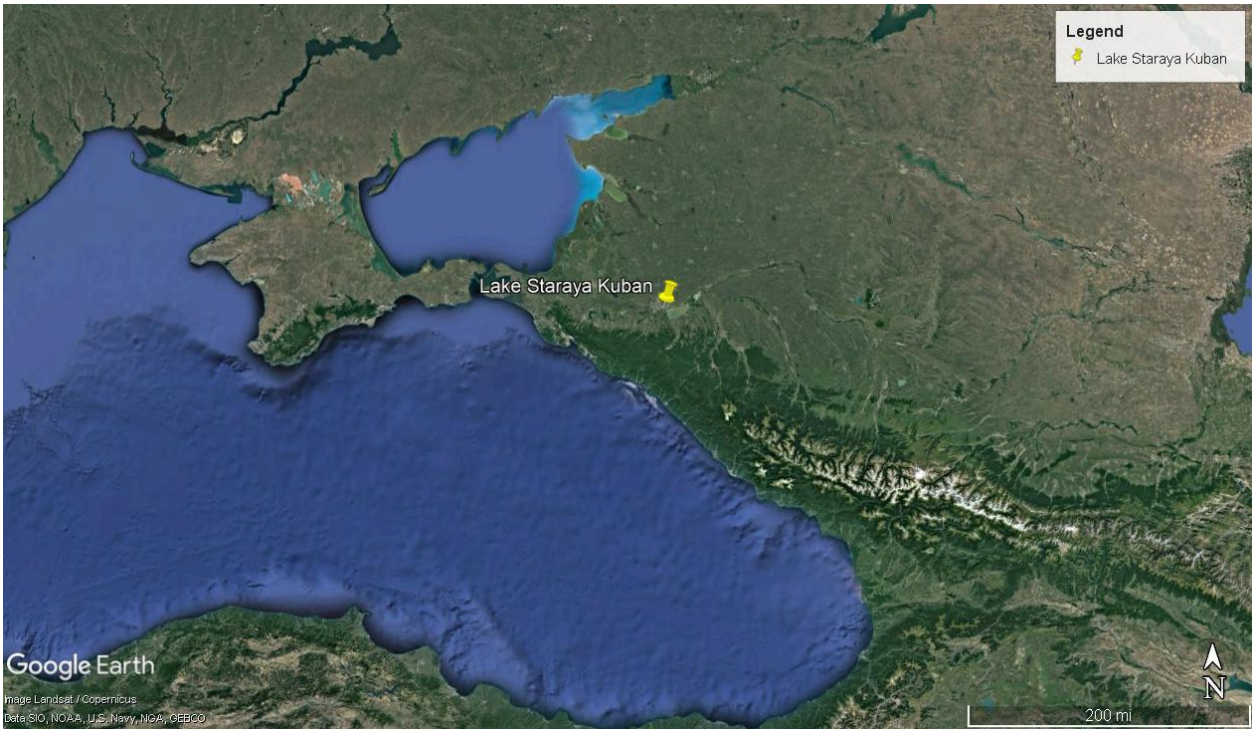

Figure 2. Known additional population of *Rocio octofasciata* in Krasnodar, Russia (Pashkov and Zcorykin 2009; CABI 2019). Map from Google Inc. (2019). This population was not used to select source points for the climate match as it is located within the thermal outflow of a power plant and the climate matching model cannot account for those thermal discrepancies (Sanders et al. 2018).

No georeferenced observations of *Rocio octofasciata* in Thailand were found.

5 Distribution Within the United States

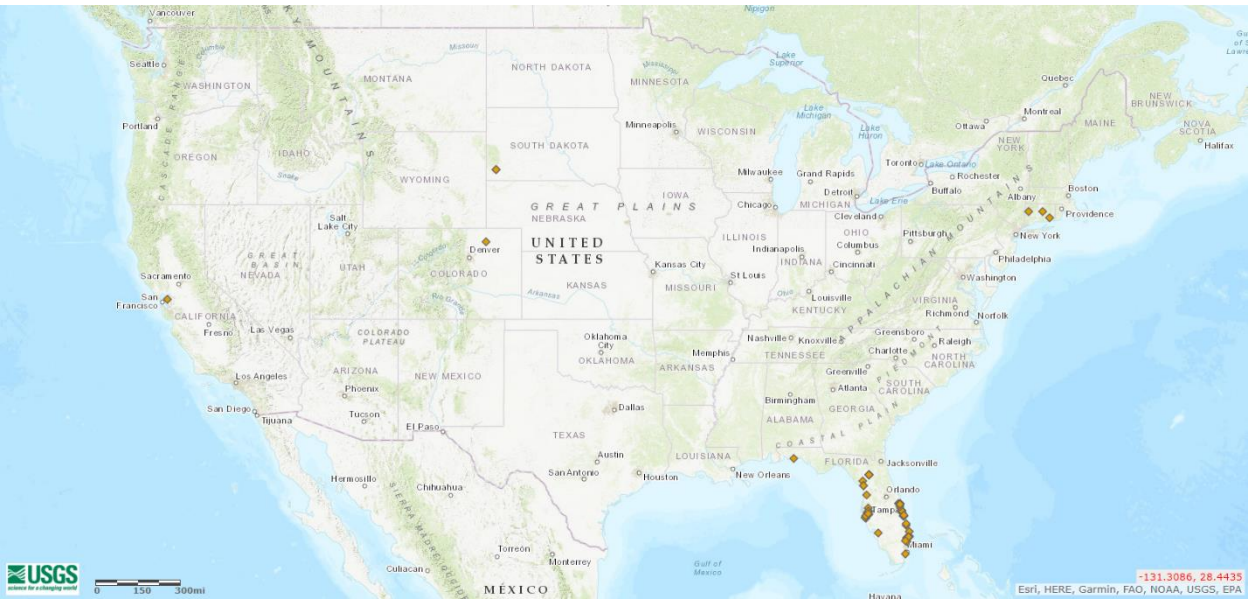

Figure 3. Map of the United States showing known locations where *Rocio octofasciata* has been reported. Map from Nico and Neilson (2019). The locations in California, Colorado, and Connecticut were not used to select source points for the climate match because Nico and Neilson (2019) state that these introductions failed. The location in South Dakota was not used to select source points, it is an established population but the location is a hot spring and the climate matching model cannot account for thermal discrepancies such as hot springs (Sanders et al. 2018).

Figure 4. Known distribution of *Rocio octofasciata* in Hawaii. Map from Nico and Neilson (2019).

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Rocio octofasciata* was low for the majority of the northern and western United States. There were areas of high match in the Pacific Northwest, near Puget Sound in Washington, and along the Gulf and Southern Atlantic coasts. There were areas of medium match along the southern California coast, along the border with Mexico, and in the southeast. The Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.063, medium (scores greater than 0.005, but less than 0.103, are classified as medium). Most States had low individual Climate 6 scores, except for Florida, Georgia, Louisiana, North Carolina, South Carolina, and Texas, which had high individual scores, and Alabama, Mississippi, Virginia, and Washington, which had medium scores.

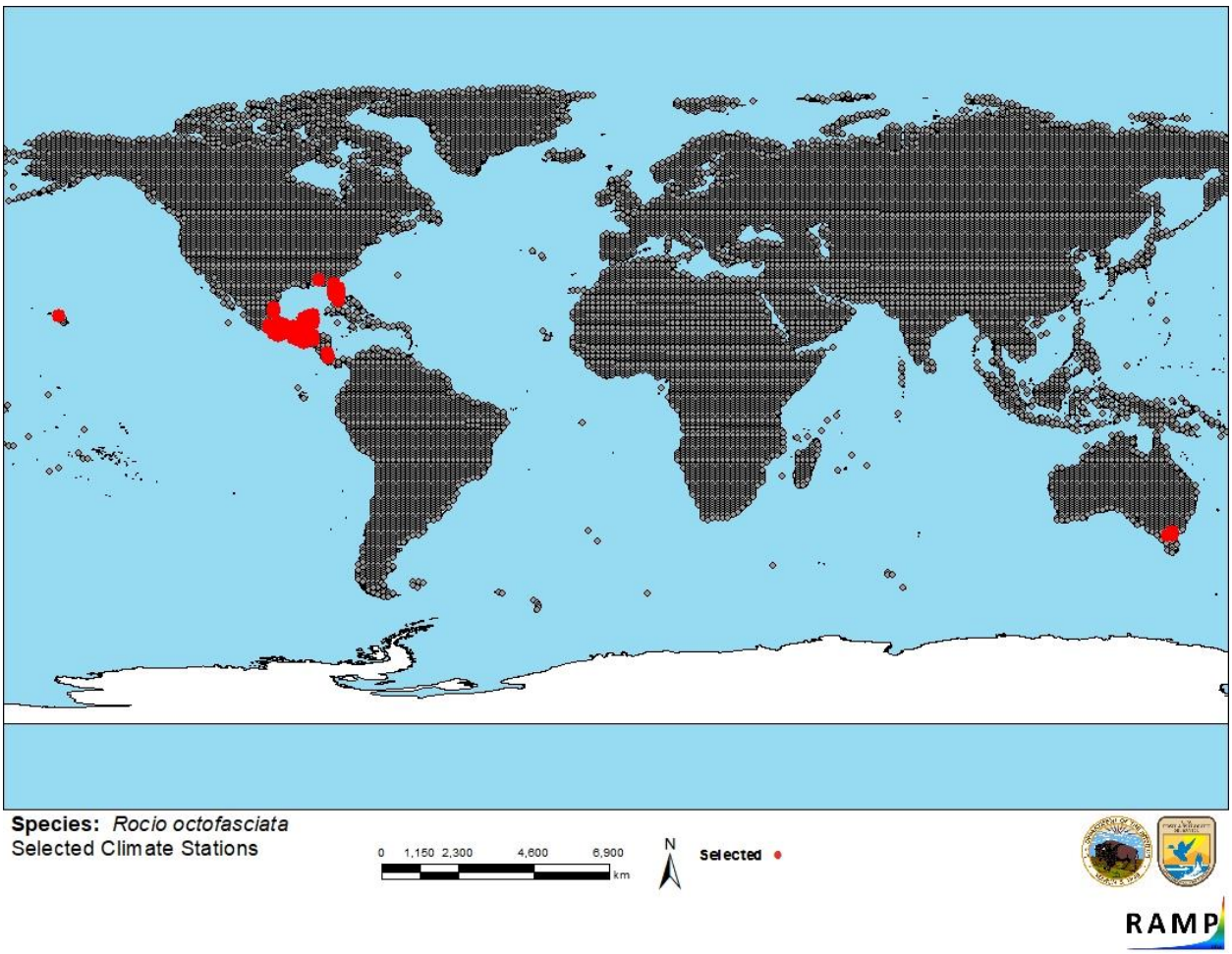

Figure 5. RAMP (Sanders et al. 2018) source map of the world showing weather stations selected as source locations (red; Central and North America, and Australia) and non-source locations (gray) for *Rocio octofasciata* climate matching. Source locations from Pashkov and Zvorykin (2009), CABI (2019), GBIF Secretariat (2019), and Nico and Nielson (2019). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

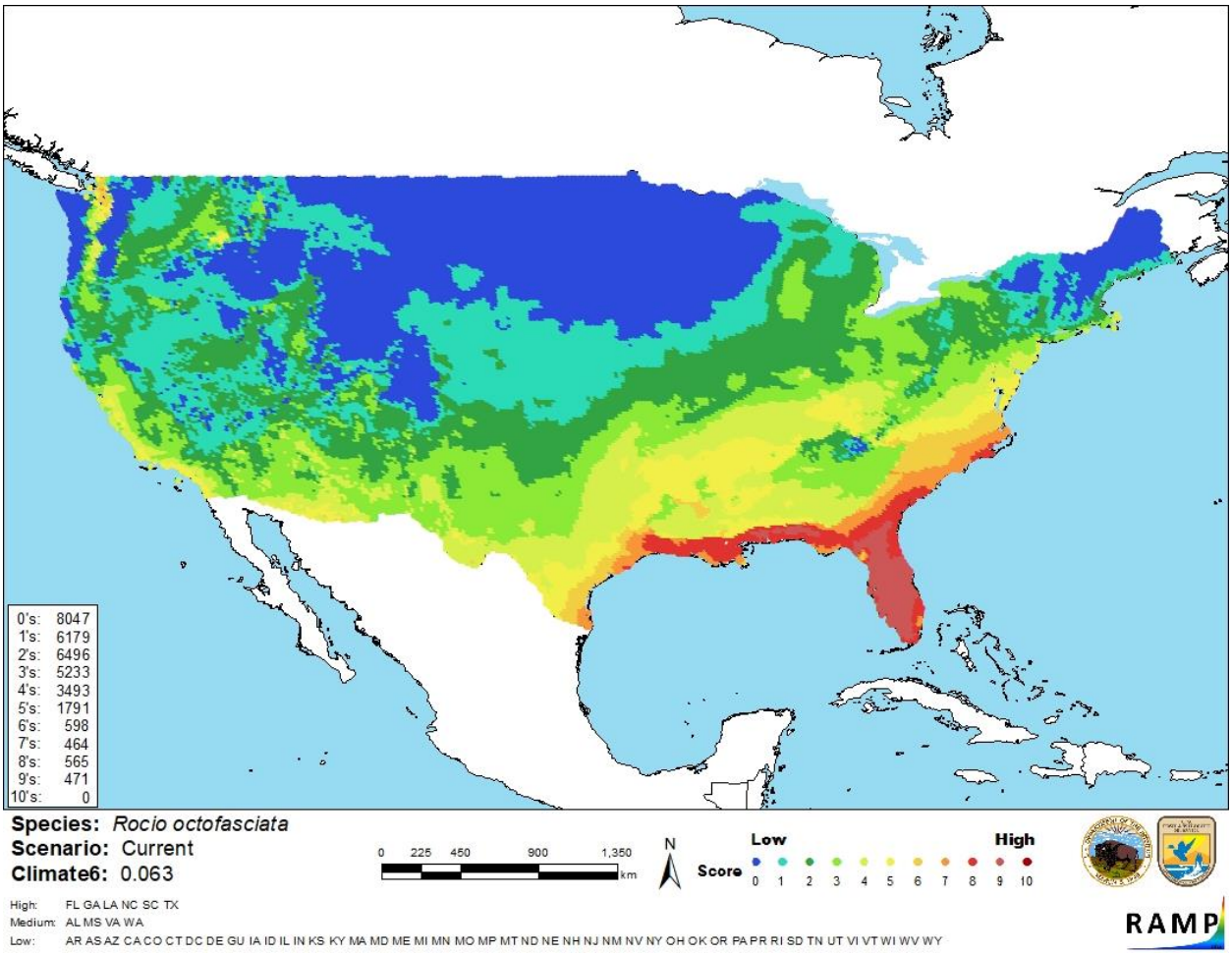

Figure 6. Map of RAMP (Sanders et al. 2018) climate matches for *Rocio octofasciata* in the contiguous United States based on source locations reported by Pashkov and Zvorykin (2009), CABI (2019), GBIF Secretariat (2019), and Nico and Nielson (2019). 0 = Lowest match, 10 = Highest match.

The High, Medium, and Low Climate match Categories are based on the following table:

Climate 6: Proportion of (Sum of Climate Scores 6-10) / (Sum of total Climate Scores)	Climate Match Category
0.000≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

7 Certainty of Assessment

The certainty of assessment for *Rocio octofasciata* is low. There is a lot of information on biology and distribution. Information on introductions was found for *Rocio octofasciata*; however, little scientific literature was found on the direct impacts of those introductions.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Jack Dempsey, *Rocio octofasciata,* is a popular ornamental freshwater fish that is native to Mexico and Central America. It is also used in research. The history of invasiveness is none documented. Jack Dempsey has been introduced outside of its native range to at least five new countries and has become established in four (United States, Russia, Thailand, and Australia). Although it has been introduced, little information has been found on direct impacts from the introductions. The climate match for the contiguous United States was medium, with a majority of the States having low individual climate scores. Areas of high match were found near the Puget Sound in Washington and along the Gulf and Southern Atlantic coasts. The certainty of assessment is low due to lack of information on impacts. The overall risk assessment category for *Rocio octofasciata* is uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 3): None Documented**
- **Climate Match (Sec. 6): Medium**
- **Certainty of Assessment (Sec. 7): Low**
- **Remarks/Important additional information:** No additional remarks.
- **Overall Risk Assessment Category: Uncertain**

9 References

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

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