U.S. Fish & Wildlife Service

Convict Cichlid (*Amatitlania nigrofasciata*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, February 2025
Revised, May 2025
Web Version, 6/12/2025

Organism Type: Fish
Overall Risk Assessment Category: High

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1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2025):

"Central America: Pacific slope, from Río Sucio, El Salvador to Río Suchiate, Guatemala; Atlantic slope, from Río Patuca, Honduras to Río Jutiapa, Guatemala."

Status in the United States

From Nico et al. (2025):

"Established or locally established in Hawaii, Idaho, and Nevada; possibly established in Arizona, but current status unknown (Courtenay and Hensley 1979); established locally in California and Louisiana. Failed in Alabama, Florida, Texas, and Wyoming. One population eradicated in Florida."

Nico et al. (2025) also report introductions in Utah, with population status uncertain.

From Harper and Farag (2017):

"Recent National Park Service surveys of KWS [Kelly Warm Spring, Grand Teton National Park, Wyoming] have found multiple nonnative species, including […] Convict/Zebra Cichlid (*Cichlasoma nigrofasciatum*) […] Several of these nonnative species have specific temperature tolerances that likely limit their spread beyond the spring (e.g., […] Cichlids, […])."

From Hovey and Swift (2012):

"In June of 2007 a large population of convict cichlid (*Archocentrus nigrofasciatus*) was discovered in the Bouquet Canyon Water District outflow into the Santa Clara River, Los Angeles County, California. […] Surveys conducted after the discovery revealed abundant cichlids of all size classes (25-144 mm TL), indicating a reproducing population."

"So far the Bouquet population appears to be isolated thermally in the small tertiary-treated outflow where the temperature is consistently 27°C. No fish have been observed in the perennial portions of the Santa Clara River proper, where water temperatures range from 14.0–18.0°C."

From Maddern (2014):

"California - an established population was recorded in a thermal outfall flowing into the Santa Clara River, Los Angeles County, in 2007 (Hovey and Swift, 2012). Failed introductions observed in Machado Lake (Los Angeles County) and Montecito Creek (Santa Barbara County) (Hovey and Swift, 2012)."

"Hawaii - *A. nigrofasciata* was first reported in Hawaii in 1983 in an irrigation ditch and reservoir near Haleiwa, on the island of Oahu (Devick, 1991b). It was also found in the lower reaches of several windward streams on Oahu and Nuuanu 4 Reservoir (Devick, 1991b). The species was recently was [sic] established in Kalama and Opaek'a streams (adjacent to the North Fork of the Wailua River), on Kauai, ca. 1990 (Devick, 1991a)."

"Idaho - an established population was found in Barney Hot Spring and the upper end of Barney Creek in Little Lost River Valley, Custer County in 1985 (Courtenay et al., 1987). This species was recorded as being present in one or a few geothermal waters in the Snake River drainage below Shoshone Falls, in the south central part of the state, in a report produced by the Idaho

Game and Fish (Fisheries Management Plan, 1991-1995) however, it is believed that that report may contain "erroneous information" (USGS NAS, 2014)."

"Nevada - *A. nigrofasciata* has established in several locations along the White and Moapa rivers and the Pahranagat Valley. The earliest records of *A. nigrofasciata* in this state are from Rogers Spring, near the Overton arm of Lake Mead, Clark County, from March 1963 (Deacon et al., 1964; Bradley and Deacon 1967; Courtenay and Deacon, 1983). There are three springs along the White River in Lincoln County with established populations. These populations are located at Ash Spring (recorded in 1964), Crystal Springs since the 1970s and Hiko Spring since approximately 1984 (Hubbs and Deacon, 1964; Courtenay and Hensley, 1979; Courtenay and Deacon, 1982; Deacon and Williams, 1984; Courtenay et al., 1985)."

"*A. nigrofasciata* has also been reported from Puerto Rico. Records indicate that it was established in the Canaboncito, Yunes and Canas rivers most likely between 2000-2006 (Froese and Pauly, 2014; USGS NAS, 2014). The species has also been recorded in the Carraizo Reservoir (USGS NAS, 2014)."

Amatitlania nigrofasciata is in trade in the United States.

From Aquatics Unlimited (2025):

"CICHLID – CONVICT"

"*Amatitlania nigrofasciata*"

"$1.99 – $24.99"

Regulations

Amatitlania nigrofasciata is regulated in Hawaii (HDOA 2019; as *Cichlasoma nigrofasciatum*). Please refer to state agency regulatory documents for details on regulations, including restrictions on activities involving this species. While effort was made to find all applicable regulations, this list may not be comprehensive. Notably, it does not include regulations that do not explicitly name this species or its genus or family; for example, when omitted from a list of authorized species with blanket regulation for all unnamed species.

Means of Introductions within the United States

From Nico et al. (2025):

"As this species is popular in the aquarium trade, aquarium release is the most likely source of introduction in all instances."

From Maddern (2014):

"The use of *A. nigrofasciata* as bait by anglers is thought to be responsible for this species increasing its range in Hawaii (Englund and Eldredge, 2001)."

From Tuckett et al. (2017):

"We evaluated the scope of ornamental fish invasions in this region [Tampa Bay region, Florida] by examining (1) escape vectors and (2) the distribution of escaped fish. […] The dominant escape vector was through farm [i.e., ornamental aquaculture facility] effluents […] Ornamental fish were often found in the immediate vicinity of fish farms but were rarely captured in the surrounding environment."

"The most common non-native fishes [captured near aquaculture facilities] were […] Convict Cichlid (*Amatitlania nigrofasciata*; 122 [individuals]) […]"

Remarks

This ERSS was previously published in June 2018. Revisions were completed to incorporate new information and conform to updated standards.

From Lyons et al. (2020):

"Recently, Schmitter-Soto (2007) described three new species from *Amatitlania nigrofasciata*. However, mtDNA [mitochondrial DNA] studies revealed that there may not be enough genetic divergence to warrant this split (Bagley et al. 2016). More studies are necessary to resolve these taxonomy uncertainties."

"[…] there is considerable uncertainty with regard to the native distribution of this species because additional molecular studies are needed to clarify the taxonomy of this species (Bagley et al. 2016). While many records of this species extend southward to Panama (Pérez and MacBeath 2012, Oosterhout and Velde 2015, GBIF 2019), these probably represent the close congeners *A. siquia* and *A. kanna* (McMahan et al. 2014)."

From Froese and Pauly (2025):

"Not in slope to Panama (*Am. coatepeque*), Costa Rica or even Nicaragua (*Am. siquia*), as formerly considered."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From EDDMapS (2025):

Kingdom: Animalia
  Phylum: Chordata
    Subphylum: Vertebrata
      Class: Actinopterygii
        Subclass: Neopterygii
          Order: Perciformes
            Family: Cichlidae
              Genus: *Amatitlania*

Subject: *Amatitlania nigrofasciata* (Günther, 1867)

According to Fricke et al. (2025), *Amatitlania nigrofasciata* (Günther 1867) is the current valid name for this species.

The following synonyms of *Amatitlania nigrofasciata* from Froese and Pauly (2025) were used to search for information for this report: *Cichlasoma nigrofasciatum, Archocentrus nigrofasciatus*.

Size, Weight, and Age Range

From Froese and Pauly (2025):

"Max length : 10.0 cm SL [standard length] male/unsexed; [Kullander 2003]; common length : 8.5 cm TL [total length] male/unsexed; [Hugg 1996]"

From Ishikawa and Tachihara (2010):

"Lengths of females at first maturity (SL) and 50% maturity (L_{50}) were estimated to be 32.2 and 37.3 mm SL, respectively [in Haebaru Reservoir, Okinawa-jima Island]. […] The maximum age of male and female cichlids was 3 years."

Environment

From Froese and Pauly (2025):

"Freshwater; benthopelagic; pH range: 7.0 - 8.0; dH range: 9 - 20. […] 20°C - 36°C [Bussing 1998]; […]"

From Harper and Farag (2017):

"Convict Cichlids prefer temperatures 24 °C to 28 °C, but can survive temperatures as low as 7.8 °C (Minckley and Marsh 2009)."

From Maddern (2014):

"Magalhães and Jacobi (2013) reported that *A. nigrofasciata* requires dissolved oxygen levels of 5.0 mg/l or above based on a reference search. In contrast, Hill and Cichra (2005) collected *A. nigrofasciata* from a very low oxygen aquatic habitat (1.4-3.7mg/l) in the University of Florida."

Climate

From Froese and Pauly (2025):

"Tropical […]"

From Radkhah and Eagderi (2020):

"[…] it is also likely for this fish to be distributed in the subtropical climate due to its high adaptability to new environmental conditions."

Distribution Outside the United States

Native

From Froese and Pauly (2025):

"Central America: Pacific slope, from Río Sucio, El Salvador to Río Suchiate, Guatemala; Atlantic slope, from Río Patuca, Honduras to Río Jutiapa, Guatemala."

Introduced

From Herrera-R et al. (2016):

"[…] it has been introduced into several countries including: […] Australia (Duffy et al. 2013), Mexico (Perez and Ramírez 2015), Iran (Esmaeili et al. 2015), […] Philippines (Kottelat 2013), Japan (Ishikawa and Tachihara 2010), Italy (Piazzini et al. 2010), Israel (Roll et al. 2007), Indonesia (Sentosa and Wijaya 2013), Réunion (Keith et al. 2006), Slovakia (Lipt[á]k et al. 2016), Germany (Jourdan et al. 2014) and Peru (Coss[í]os 2010)."

Contreras-MacBeath et al. (1998) report *Amatitlania nigrofasciata* (as *Cichlasoma nigrofasciatum*) as introduced to the state of Morelos, Mexico, in 1987, with a status of "abundant."

From Ortega et al. (2007):

"*Cichlasoma nigrofasciatum* (ciclasoma, convict cichlid; Cichlidae). This species, introduced in the late 1980s for the aquarium trade, is native to Central America. It, too, has adapted to the wetlands of Lima [Peru] (e.g., Humedales de Villa) (Castro et al., 1998)."

From Maddern (2014):

"A population of *A. nigrofasciata* was first discovered in 1983 in Kibbuzim River in Israel, and observed in the river for about 17 years. It has not been found again since 2000 and seems to be extirpated now (Roll et al., 2007; Esmaeili et al., 2013)."

"In Western Australia the species has been collected in a small, shallow urban lake (Duffy et al., 2013). In Victoria, Australia the species occurs in the cooling ponds of the Hazelwood Power Station outside of its normal latitudinal range (Allen, 1989; Corfield et al., 2008). Similarly, the species is abundant in a small stream in southern Tuscany (Fossa Calda) fed by hot springs (Piazzini et al., 2010)."

"Occurs in the rivers Sainte-Suzanne and Saint-Jean [Réunion]"

"Recorded from Lapad River, Laguna [Philippines]"

"Introduced to the Rio Balsas basin [Mexico]"

"Found in the Ross River near Townsville [Australia]"

From Herrera-R et al. (2016):

"Two specimens of *A. nigrofasciata* were collected from two small creeks draining into the Guavio River, upper Meta River in Mambita, Ubalá, Cundinamarca, Colombia in the Piedmont Orinoco ecoregion. This is the first record of *A. nigrofasciata* in natural freshwaters of Colombia and the Orinoco River basin."

"[…] there is no evidence of self-sustaining and expanding populations of *A. nigrofasciata* in freshwaters of Colombia, […]."

From Lipták et al. (2016):

"[The Opatovce site in Slovakia] is a thermal stream flowing through Opatovce and Nitrou, a small village next to the popular thermal spa town Bojnice."

"At the Opatovce site, […] Three ornamental fish species [including] the convict cichlid (*Amatitlania nigrofasciata*), were observed […]"

From Lukas et al. (2017):

"In Germany, non-native convict cichlids (*Amatitlania nigrofasciata*) […] have established populations in the Gillbach, a small stream that receives warm water discharge from a local power plant."

"*Amatitlania nigrofasciata* have successfully persisted in the Gillbach for more than 18 years now (first record by Höfer & Staas [1998]). […] So far the only other introduction sites within Europe are two thermal refugia in Italy [Piazzini et al. 2010] and Austria [Petutschnig et al. 2008], both of which are very similar to the Gillbach system in their habitat characteristics and species assemblage."

According to Radkhah and Eagderi (2020), *A. nigrofasciata* has been reported in Iran in Golabi Spring (Hormuz Basin) and Sulaymaniyah Spring (Namak Lake basin). It is not clear whether these springs have a different thermal regime than surrounding waters.

From Huang (2021):

"In Taiwan, they are found in Sun Moon Lake and the lower reaches of the Tamsui River basin."

From Parawangsa et al. (2023):

"The convict cichlid (*Amatitlania nigrofasciata*) belonging to the Cichilidae family is inhabited in Tamblingan Lake, Buyan Lake, and Beratan Lake [Bali, Indonesia]. […] There were 888 individuals of convict cichlids caught during this study, consisting of 385 fish from Tamblingan Lake, 371 fish from Buyan Lake, and 132 fish from Beratan Lake."

From Froese and Pauly (2025):

"To: Canada
From: Guatemala […]
Period: 1950-1974
Established in the wild: probably not established, […]"

"Reintroduced in 1967. Accidentally released from aquaria and presently confined to Alberta [Canada] hot springs. Species found to be not established [Crossman 1991]. Population existed for some time in hot springs of Banff National Park, Alberta but has now disappeared [Welcomme 1988]."

Means of Introduction Outside the United States

From Herrera-R et al. (2016):

"Introduction of *A. nigrofasciata* in natural freswaters [sic] of Colombia probably resulted from the release of ornamental fishes from aquacultures in the Mambita urban area."

From Lubos and Bucol (2021):

"We speculate that this cichlid probably arrived on Mindanao Island [Philippines] either through the aquarium pet trade or the aquaculture [sic]."

From Maddern (2014):

"It is suggested that *A. nigrofasicata* was probably released by local people, as it is an Iranian tradition to release fish into the wild at the New Year festival."

From Contreras-MacBeath et al. (1998):

"Due to the mismanagement of this exotic species within an ornamental farm located in the town of Cuautitla in the county of Tetecala [Mexico], a tank containing a stock of *C. nigrofasciatum* was spilled into the River Chalma […] (Contreras-MacBeath, [1991]).

From Lukas et al. (2017):

"Convict cichlids […] were most probably introduced into the Gillbach [Germany] by aquarium hobbyists."

Short Description

From Maddern (2014):

"It is pale blue/grey in colour with approximately seven black vertical stripes/bars on the sides that extend onto the dorsal and anal fins. The vertical stripes vary in intensity and the first and third bar may appear as blotches. The first or second bar may be Y shaped. There is a black spot on the operculum. The fins are clear or light blue/grey. Large males may have intense black bars with long fin rays at rear of dorsal and anal fins (Page and Burr, 1991). Selective breeding has produced several colour variations including pink, albino, long-finned and marbled (Page and Burr, 1991)."

"*A. nigrofasciata* has a total of 17-19 dorsal spines, 7-9 dorsal soft rays, 8-10 anal spines, 6-7 anal soft rays and 27-28 vertebrae (Schmitter-Soto, [2007])."

From Herrera-R et al. (2016):

"Schmitter-Soto ([2007]) diagnosed *A. nigrofasciata* from all of its congeners by the presence of two rows of interradial scales in the distal portion of the anal fin (vs one). However, recent synonymization of *A. coatepeque* by McMahan et al. (2014) implies that *A. nigrofasciata* may have one or two rows."

Biology

From Herrera-R et al. (2016):

"This cichlid species inhabits lentic and lotic water bodies, commonly found among rocks, roots and debris (Froese and Pauly 2016). It is an omnivorous species with a carnivore tendency that feeds on crustaceans, aquatic insects, fishes and plant material (Trujillo-Jiménez 1998). It is a monogamous species that displays parental care of eggs and young, depositing in each spawn 100–150 eggs in rocky substrates (Mendoza et al. 2015)."

From Ishikawa and Tachihara (2010):

"The present study revealed that the convict cichlid populations introduced into freshwater reservoirs on Okinawa-jima Island [Japan] exhibit rapid growth during the first year, early maturation, a long spawning period, multiple spawning, and a short life span. These attributes, combined with biparental brood care, likely contribute to the establishment success of convict cichlids on Okinawa-jima Island and in other regions."

From Moscicki et al. (2011):

"Convict cichlids are an aggressive, territorial species that does not form shoals save for a brief period as juveniles during parental dependence (Wisenden, 1994)."

Human Uses

From Herrera-R et al. (2016):

"Because it is easily bred and maintained in aquaria, it has been commonly used as model for behavioral and physiological studies (Schmitter-Soto [2007])."

"*Amatitlania nigrofasciata* is a popular ornamental fish that has been traded and cultivated for the aquarium industry around the world due to its aesthetic appearance (Trujillo-Jiménez 1998)."

From Maddern (2014):

"[…] in Australia, the volume of fish sold ranked as "low" with in excess of 10,000 fish sold annually (Corfield et al., 2008). The economic value of this is unknown."

Magalhães and Jacobi (2013) report that *A. nigrofasciata* was found for sale in 66.67% of aquarium shops surveyed in Minas Gerais State, Brazil, in 2007.

Amatitlania nigrofasciata is in trade in the United States.

From Aquatics Unlimited (2025):

"CICHLID – CONVICT"

"*Amatitlania nigrofasciata*"

"$1.99 – $24.99"

Diseases

No information was found associating *Amatitlania nigrofasciata* with any diseases listed by the World Organisation for Animal Health (2025).

According to Froese and Pauly (2025), *Amatitlania nigrofasciata* is susceptible to white spot disease and *Spiroxys* infestation.

According to Poelen et al. (2014), *Amatitlania nigrofasciata* is a host to the parasites *Sciadicleithrum meekii* and *Rhabdochona kidderi*.

Salgado-Maldonado (2013) describe the parasitic worm *Neoechinorhynchus* (*Neoechinorhynchus*) *panucensis* from *Amatitlania nigrofasciata*.

From Emde et al. (2016):

"Here, n=77 convict cichlids (*Amatitlania nigrofasciata*) were sampled by electro-fishing at two sites from a thermally altered stream in Germany and examined for parasite fauna […] The most abundant non-native parasite species was the tropical nematode *Camallanus cotti* with *P*=11.90 % and *P*=80.00 % at the inlet and further downstream, respectively. Additionally, nematode larvae of *Anguillicoloides crassus* and one specimen of the subtropical species *Bothriocephalus acheilognathi* were isolated. *A. nigrofasciata* was also highly infected with the native parasite *Acanthocephalus anguillae*, which could be linked to high numbers of the parasite's intermediate host *Asellus aquaticus*."

Threat to Humans

From Froese and Pauly (2025):

"Potential pest [Yamamoto and Tagawa 2000]"

3 Impacts of Introductions

From De La Torre Zavala et al. (2018):

"We have shown that the Mexican mojarra changes its behavior in the presence of both heterospecific (convict fish [*Amatitlania nigrofasciata*]) and conspecific presence. These changes were more acutely shown in the presence of the convict fish by using refuges more, eating less and, in general, being less active."

"Previous claims that the Mexican mojarra may be excluded by the convict fish (Contreras-MacBeath et al. 2014) seem supported by our study. However, the mechanism to understand how such exclusion occurs were unknown with the exception that at the trophic level, there was no indication of interspecific competition according to Trujillo-Jim[é]nez (1998). Some other authors have included other potential mechanisms such as a superior ability to defend nesting territories by convict fish as these can compete with a number of fish species in their natural habitat which is not the case of the Mexican mojarra (Contreras-MacBeath et al. 2014). Although this reason may apply in our study animals, the simple presence of the convict fish, [sic] negatively affects activity and feeding rate in the Mexican mojarra. Therefore, if these response variables can be taken as proxies of fitness, our results may be interpreted as negative effects of convict fish on Mexican mojarra."

From Contreras-MacBeath et al. (1998):

"From research done in 1990, which aimed at evaluating the distribution and ecological impact of *C. nigrofasciatum* in the state's [Tetecala, Mexico] rivers, this species was found to be dominant in the Rivers Amacuzac, Chalma and Tembemebe and accounted for approximately 50% of the total fish community as based upon biomass and abundance. The survey also showed a clear displacement of the native [*Cichlasoma*] *istlanum*, the almost total disappearance of [nonnative] tilapias and the complete absence of [native] [*Ictalurus*] *balsanus*."

The following source describes potential impacts of *Amatitlania nigrofasciata* and impacts which may be attributed to an assemblage of introduced species that includes *A. nigrofasciata.*

From Maddern (2014):

"*A. nigrofasciata*, in combination with other introduced fishes, has been implicated in the decline and demise of a population of the native speckled dace, *Rhinichthys osculus*, near the Overton arm of Lake Mead, Nevada (Deacon et al., 1964). Similarly, Deacon and Bradley (1972) implicated *A. nigrofasciata* and other introduced species as a threat to the endangered White River springfish, *Crenichthys baileyi*, in south-eastern Nevada. Supporting this proposition was experimental evidence from Tippie et al. (1991) who found that growth and recruitment of *C. baileyi* in the presence of *A. nigrofasciata* was reduced."

"Courtenay and Hensley (1979) were concerned about the aggressive nature of *A. nigrofasciata* while it was breeding and suggested that the species may compete with native sunfishes for spawning sites. Trujillo-Jim[é]nez (1998) speculated that *A. nigrofasciata* may have displaced a sympatric cichlid in Mexico. The author concluded that although there were differences in the feeding behaviour of the two species that would tend to reduce dietary overlap, it may occur when food resources were restricted. […] It [*A. nigrofasciata*] also displays a high diet overlap with the native [Mexican] species *Notropis moralesi* and *Poecilia butleri* (Medina-Nava et al., 2011). In addition to this in Hawaiian streams it has been reported that "native aquatic species are non-existent or rare" in areas where *A. nigrofasciata* is present (Englund and Eldredge, 2001)."

Amatitlania nigrofasciata is regulated in Hawaii (HDOA 2019; as *Cichlasoma nigrofasciatum*).

4 History of Invasiveness

The History of Invasiveness for *Amatitlania nigrofasciata* is classified as High. *A. nigrofasciata* is widely used in trade for ornamental purposes. It has been introduced to at least 15 countries, including the United States, and is established in many of those countries, although its distribution is often limited by its temperature tolerance. *A. nigrofasciata* has negatively altered the behavior and abundance of several native species where introduced in Mexico. It excludes native species where present in Hawaii and may have negatively affected native species in Nevada.

5 Global Distribution

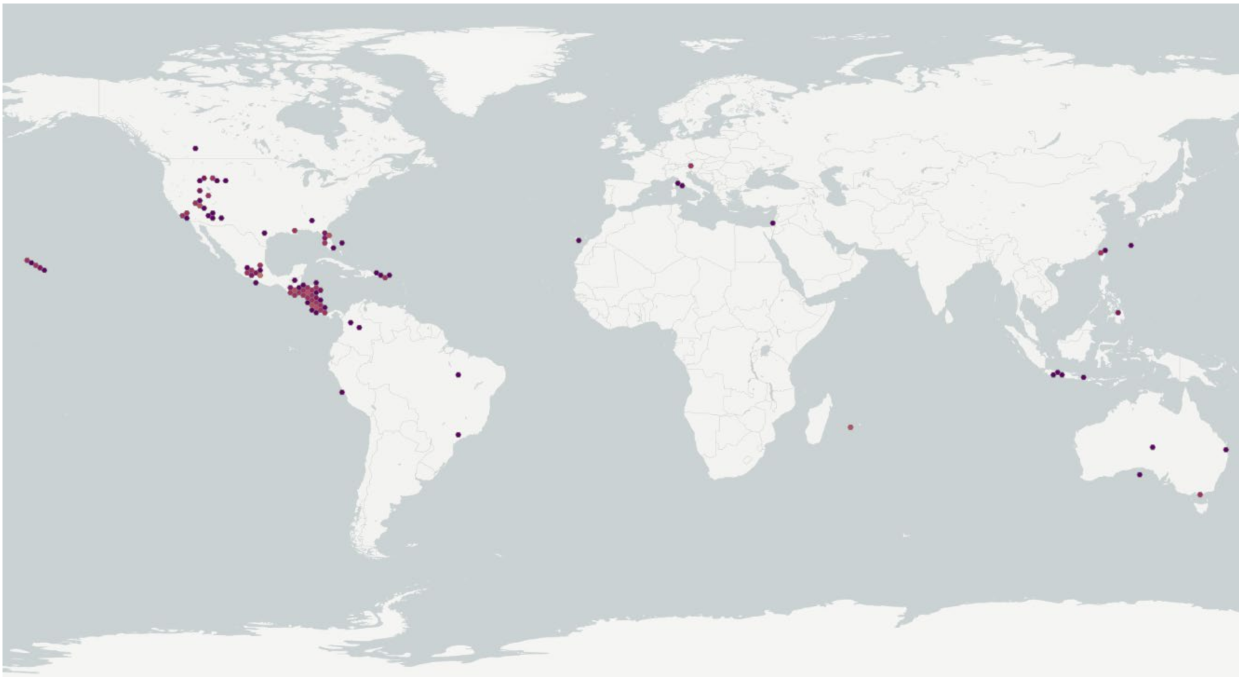

Figure 1. Reported global distribution of *Amatitlania nigrofasciata*. Map from GBIF Secretariat (2023). Observations are reported from North America, Hawaii, Puerto Rico, South America, the Canary Islands, Italy, Austria, Réunion, Israel, Palestine, Australia, Japan, Taiwan, Indonesia, and the Philippines. Some occurrences reported here were not used to select source points for the climate matching analysis for the following reasons: points in Colombia, Brazil, Israel, the Canary Islands, Java (Indonesia), northern Guatemala, and parts of the United States (see section 6) are not known to represent established populations; occurrences in Austria, Italy, Canada, and southeastern Australia occur in hot springs or thermally polluted waters; records from Panama, Nicaragua, and Costa Rica likely represent closely related congeners of *A. nigrofasciata* (see Remarks); central Australian and Palestinian records represent country centroids, not specific locations; and a point in the ocean south of Australia has incorrect coordinate data.

6 Distribution Within the United States

Figure 2. Reported distribution of *Amatitlania nigrofasciata* in the contiguous United States. Map from Nico et al. (2025). Observations are reported from Florida, Alabama, Louisiana, Texas, Arizona, California, Nevada, Utah, Idaho, and Wyoming. Yellow points represent established populations. Orange points represent state centroids, failed introductions, eradicated or extirpated populations, and populations with unknown status; these points were not used to select source points for the climate matching analysis. Established points in California, Idaho, Utah, Nevada, and Wyoming occur in geothermally or anthropogenically warmed water bodies and were not used to select source points for the climate matching analysis.

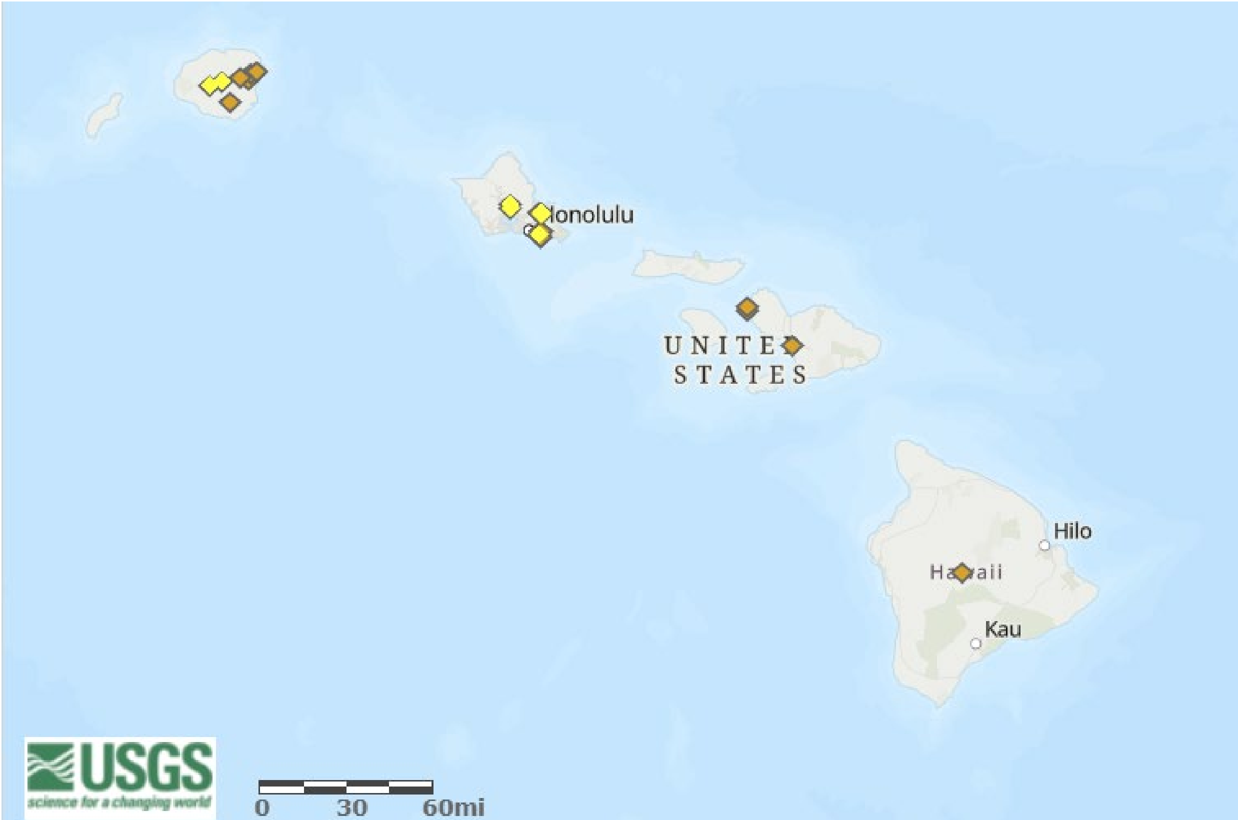

Figure 3. Reported distribution of *Amatitlania nigrofasciata* in Hawaii. Map from Nico et al. (2025). Observations are reported from the islands of Kauai, Oahu, Maui, and Hawaii. Yellow points represent established populations. Orange points represent centroids, failed introductions, eradicated or extirpated populations, and populations with unknown status; these points were not used to select source points for the climate matching analysis.

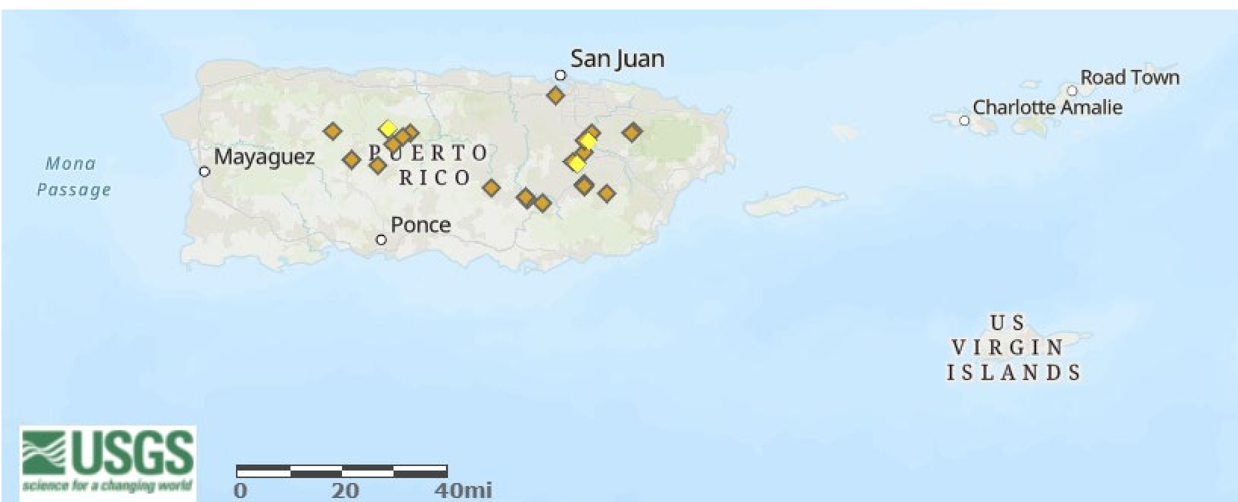

Figure 4. Reported distribution of *Amatitlania nigrofasciata* in Puerto Rico and the U.S. Virgin Islands. Map from Nico et al. (2025). Yellow points in central and eastern Puerto Rico represent established populations. Orange points represent centroids, failed introductions, eradicated or extirpated populations, and populations with unknown status; these points were not used to select source points for the climate matching analysis.

7 Climate Matching

Summary of Climate Matching Analysis

The climate matching analysis for *Amatitlania nigrofasciata* to the contiguous United States was high along the southern border and Gulf Coast of the contiguous United States and up the Atlantic coast to North Carolina, with the highest matches in Arizona and along the northern Gulf coast. Small areas of high match were also scattered through the Great Basin, along the western edge of the Appalachian Mountains, and in the vicinity of Seattle. The Southern Plains, inland Southeast, and much of California had a medium match, while the northern United States had a mostly low climate match. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.303, 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 *Amatitlania nigrofasciata* (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.

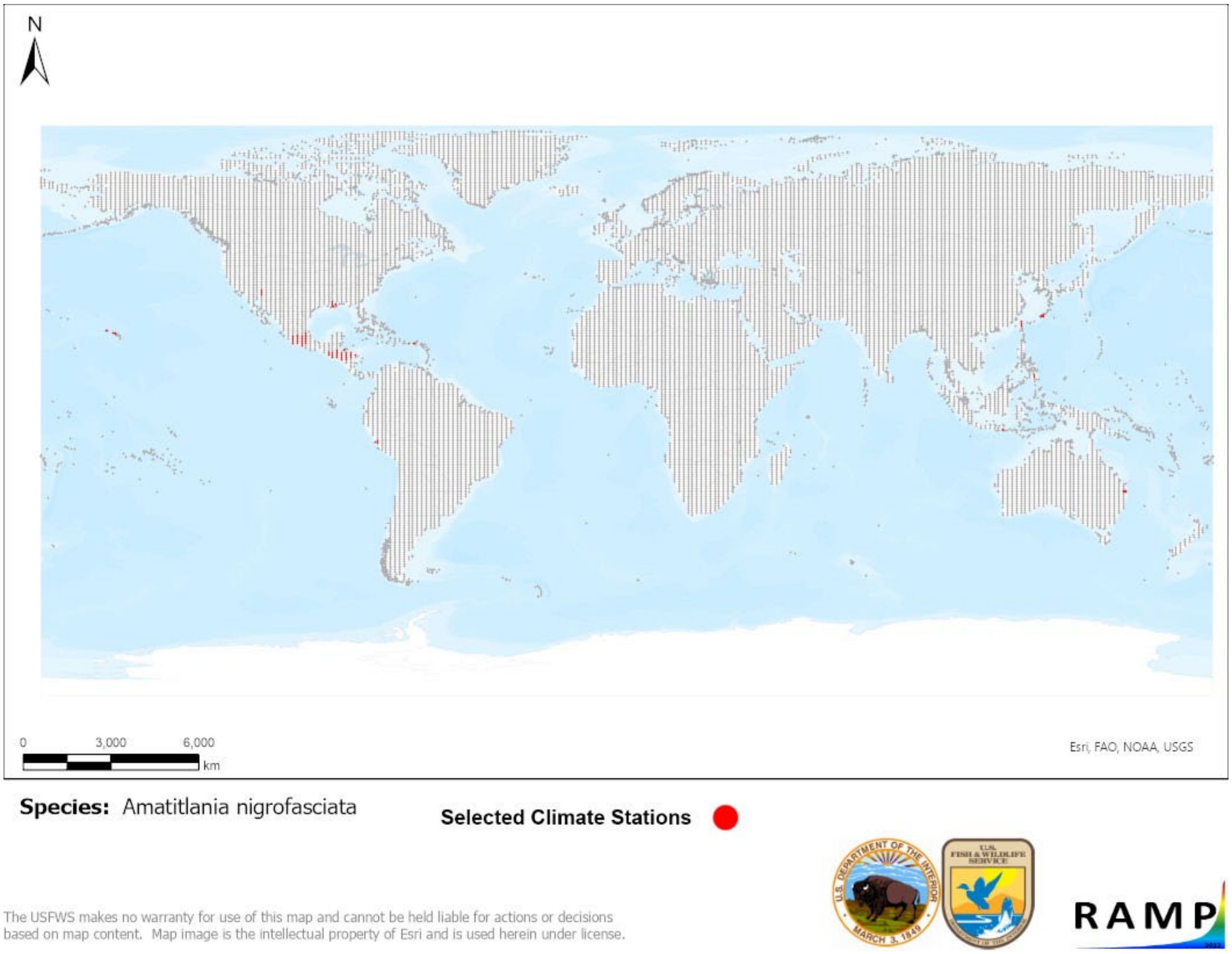

Figure 5. RAMP (Sanders et al. 2023) source map showing global weather stations selected as source locations (red; United States, Mexico, El Salvador, Guatemala, Honduras, Nicaragua, Peru, Japan, Taiwan, Indonesia, Philippines, Australia) and non-source locations (gray) for *Amatitlania nigrofasciata* 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.

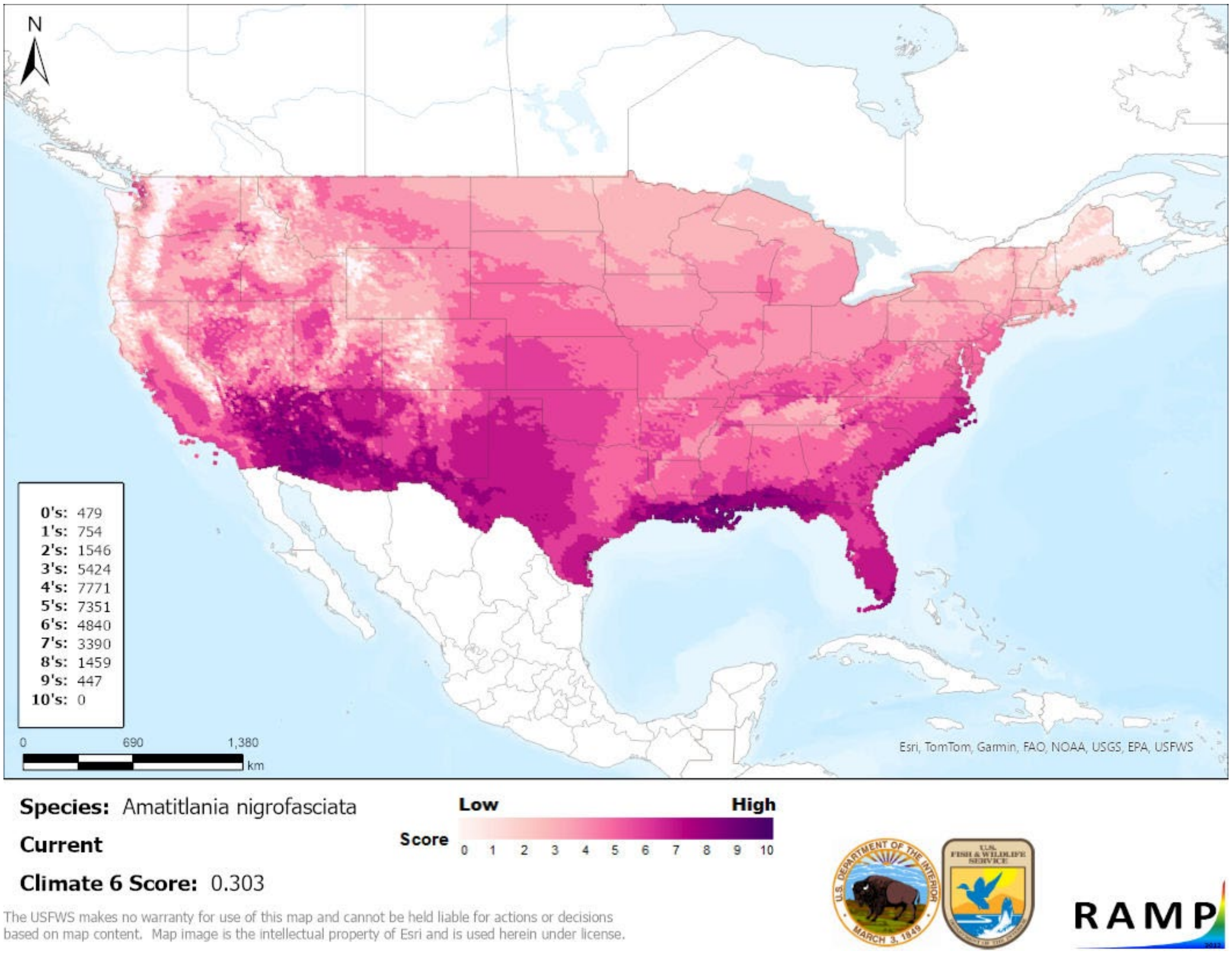

Figure 6. Map of RAMP (Sanders et al. 2023) climate matches for *Amatitlania nigrofasciata* in the contiguous United States based on source locations reported by GBIF Secretariat (2023). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Amatitlania nigrofasciata* is classified as Medium. Information on the species biology and history of invasiveness of *A. nigrofasciata* is readily available. Although multiple established nonnative populations of *A. nigrofasciata* have been documented, many of these are restricted to geothermally or anthropogenically warmed waters, suggesting the populations would likely not otherwise be able to persist in those locations. Additionally, there is uncertainty concerning the native range of *A. nigrofasctiata*. Genetic study is needed to determine whether other closely related lineages are genetically distinct enough to warrant a taxonomic split from *A. nigrofasciata*.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Amatitlania nigrofasciata, Convict Cichlid, is a freshwater fish that is native to Guatemala, Honduras, and El Salvador. This species is popular in the aquarium trade, which has contributed to its introduction in multiple countries worldwide. In the United States, it is established in California, Arizona, Louisiana, Idaho, Wyoming, Nevada, Hawaii, and Puerto Rico, although in many of these locations, populations are restricted to thermal waters. The History of Invasiveness for *Amatitlania nigrofasciata* is classified as High due to its documented ability to displace and negatively alter the behavior of native species where introduced. The climate matching analysis for the contiguous United States indicated establishment concern for this species. Its climate match with the contiguous United States was highest along the southern border and Gulf Coast of the contiguous United States, particularly in Louisiana and Arizona. The Certainty of Assessment for this ERSS is classified as Medium because of taxonomic uncertainty in the *Amatitlania* genus and because many established populations of *A. nigrofasciata* occur in hot springs or other atypical environments and therefore may be unlikely to spread. The Overall Risk Assessment Category for *Amatitlania nigrofasciata* in the contiguous United States is 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: None**
- **Overall Risk Assessment Category: High**

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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 *Amatitlania nigrofasciata* was projected to occur in Southern Florida and the Southwest regions of the contiguous United States. There were also areas of high match along the Gulf Coast and Southern Atlantic Coast under most scenarios, and scattered pockets of high match in the Great Basin and Western Mountains increased in frequency from 2055 to 2085. Areas of low climate match were projected to occur in the Northern Pacific Coast region under all scenarios, and in the Northeast in the 2055 time step. Patches of low match were also found in the Western Mountains under most scenarios. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.328 (model: GFDL-ESM4, SSP3, 2055) to a high of 0.481 (model: MRI-ESM2-0, SSP5, 2085). 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 (0.303, figure 6) falls below 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. At the 2085 time step, particularly under SSP5, areas within the Appalachian Range, Colorado Plateau, Great Basin, Northeast, and Northern Plains saw a large increase in the climate match relative to current conditions. Additionally, under one or more time step and climate scenarios, areas within the Great Lakes, Mid-Atlantic, Northern Pacific Coast, Southeast, Southwest, and Western Mountains saw a moderate increase in the climate match relative to current conditions. Under all time step and climate scenarios, areas within the Gulf Coast saw a large decrease in the climate match relative to current conditions. Additionally, areas within the Appalachian Range, Southeast, and Southwest saw a moderate decrease in the climate match relative to current conditions, particularly at the 2085 time step. Additional, very small areas of large or moderate change may be visible on the maps (figure A3).

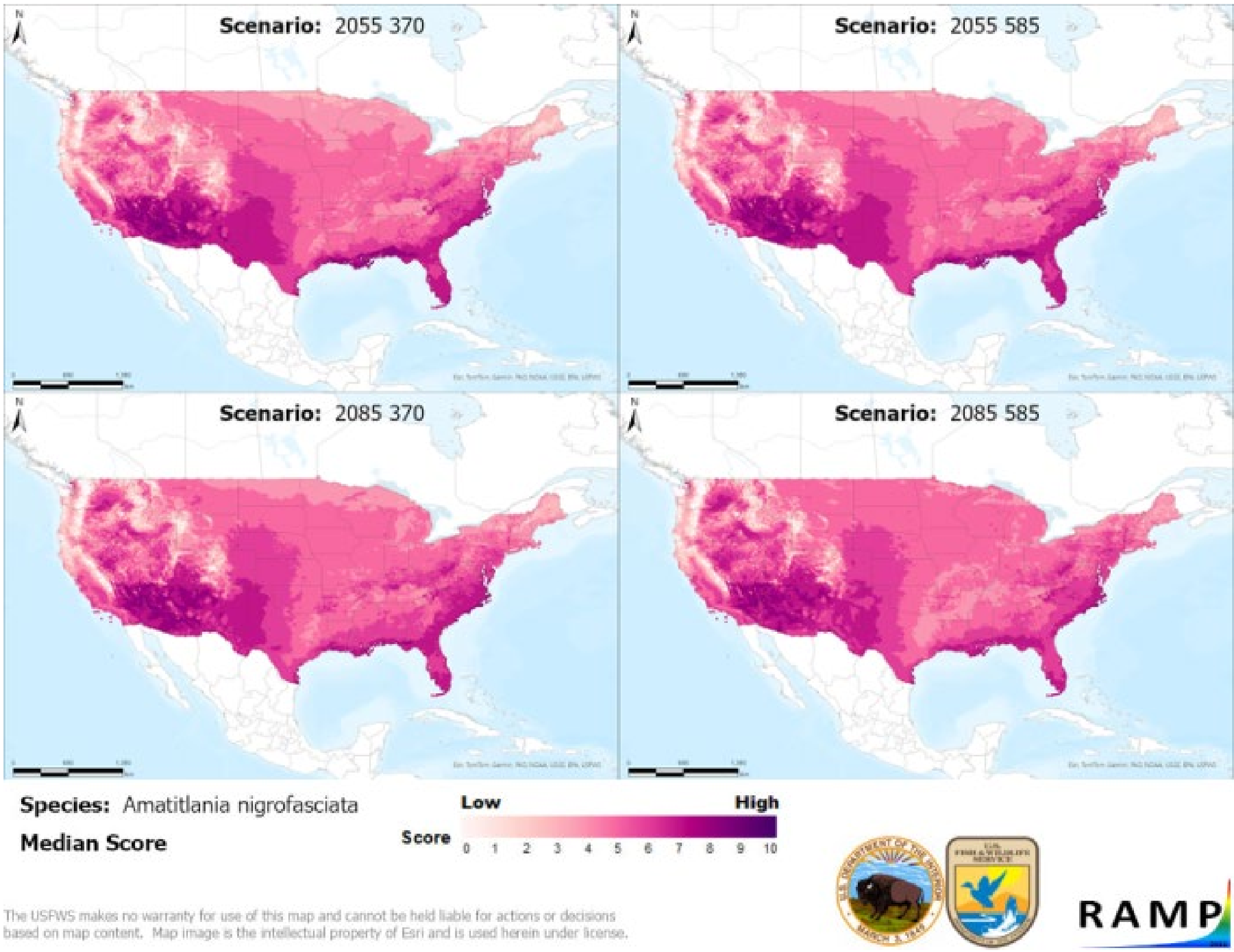

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Amatitlania nigrofasciata* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023). 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.

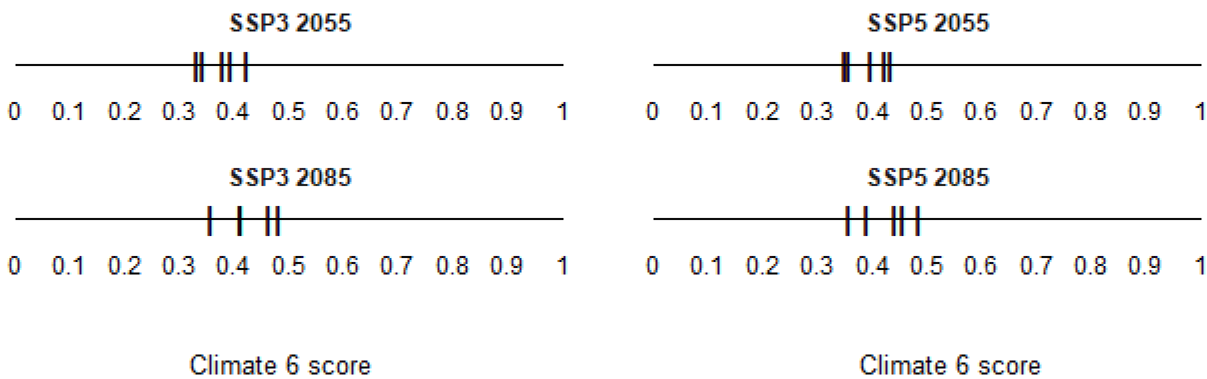

Figure A2. Comparison of projected future Climate 6 scores for *Amatitlania nigrofasciata* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 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.

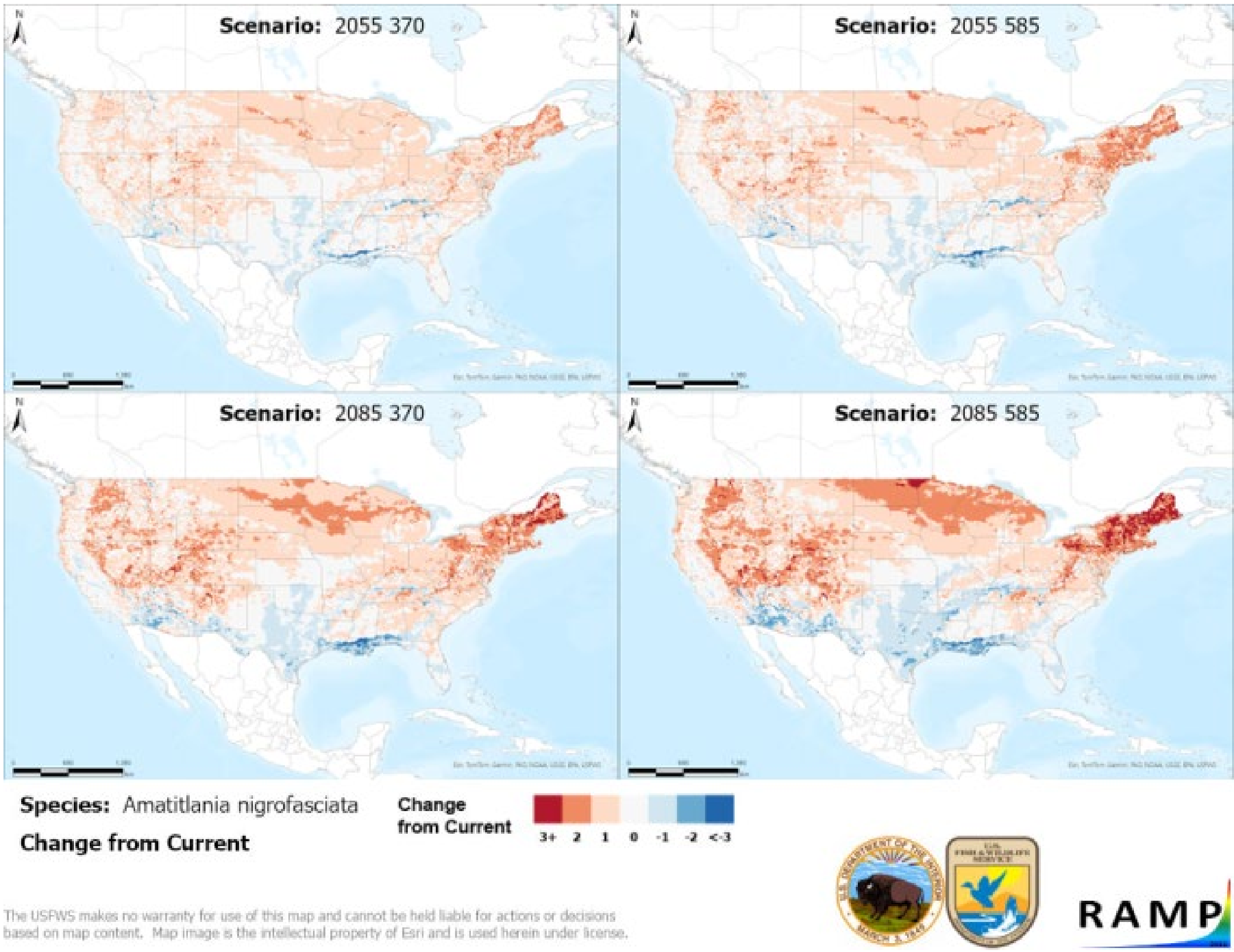

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 6) and the median target point score for future climate scenarios (figure A1) for *Amatitlania nigrofasciata* based on source locations reported 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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