

Green Terror (*Andinoacara rivulatus*)

Ecological Risk Screening Summary

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1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2015):

“South America: Pacific slope from the Esmeraldas River in Ecuador to the Tumbes River in Peru.”

Status in the United States

No records of *Andinoacara rivulatus* introductions in the United States were found.

GBIF Secretariat (2017) reports a location in California which is sourced from iNaturalist – research grade observations; in review of the report, the author doubted the identification of the observation and there were no other indications of an established population in California.

Means of Introductions in the United States

No records of *Andinoacara rivulatus* introductions in the United States were found.

Remarks

The accepted name according to Froese and Pauly (2015) and Eschmeyer et al. (2017) is *Andinoacara rivulatus*. *Aequidens rivulatus* is the accepted name for this species according to ITIS (2015). Searches for information for this assessment were conducted using both names.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From Eschmeyer et al. (2017):

“*rivulata*, *Chromis* Günther [A.] 1860:418 [Proceedings of the Zoological Society of London 1859 (pt 3) (art. 7); [...]] Andes of western Ecuador. Lectotype: BMNH ?1860.6.15.13. Paralectotypes: BMNH 1860.6.15.14-16 (3); ZMB 28099 (2). Type catalog: Paepke & Schindler 2013:266 [...] BMNH 1860.6.16.153 (1) is not part of the syntypical series -- Schindler & Morgenstern 2010:119 [...]. The lectotype as designated by Wijkmarj 2010:124 [...]. •Valid as *Aequidens rivulatus* (Günther 1860) -- (Ortega & Vari 1986:20 [...], Castro et al. 1998:79 [...], Kullander in Reis et al. 2003:609 [...]). •Valid as *Andinoacara rivulata* (Günther 1860) -- (Musilová et al. 2009[a]:7 [...], Musilová et al. 2009[b]:131 [...], Reis et al. 2016:17 [...]). •Valid as *Adinoacara rivulatus* (Günther 1860) -- (Schindler & Morgenstern 2010:118 [...], Wijkmark et al. 2012:124 [...], Jiménez-Prado et al. 2015:327 [...], Musilová et al. 2015:339 [...]). **Current status:** Valid as *Andinoacara rivulatus* (Günther 1860). Cichlidae: Cichlinae.”

From ITIS (2015):

“Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Osteichthyes
Class Actinopterygii
Subclass Neopterygii
Infraclass Teleostei

Superorder Acanthopterygii
Order Perciformes
Suborder Labroidei
Family Cichlidae
Genus *Aequidens*
Species *Aequidens rivulatus* (Günther, 1860)”

Froese and Pauly (2015) identify the following as synonyms of *Andinoacara rivulatus*: *Chromis rivulata* Günther, 1860, *Aequidens rivulatus* (Günther, 1860), *Acara aequinoctialis* Regan, 1905, and *Aequidens azurifer* Fowler, 1911.

Size, Weight, and Age Range

From Froese and Pauly (2015):

“Max length: 20.0 cm TL male/unsexed; [Kullander 2003]”

Environment

From Froese and Pauly (2015):

“Freshwater; benthopelagic; pH range: 6.5 - 8.0; dH range: ? - 25. [...]; 20°C - 24°C [assumed to be recommended aquarium temperature range] [Riehl and Baensch 1991]; [...]”

From Trujillo-Jiménez et al. (2010):

“Third group was constituted by *C. istlanum*, *Atherinella balsana*, *Poeciliopsis gracilis*, *Poecilia reticulata*, *Aequidens rivulatus* and *O. mossambicus*, are related to sites that are characterized by high values with respect to ammonium and hardness (Fig. 5b [in source material]).”

Climate/Range

From Froese and Pauly (2015):

“Tropical; [...]; 1°S - 2°S”

Distribution Outside the United States

Native

From Froese and Pauly (2015):

“South America: Pacific slope from the Esmeraldas River in Ecuador to the Tumbes River in Peru.”

Introduced

From Froese and Pauly (2015):

“Introduced to the Philippines in 1989”

From Trujillo-Jiménez et al. (2010):

“According to the results of the IVI, *Poeciliopsis gracilis* and *Astyanax aeneus* were the most common and abundant species in the river [Río Amacuvac, Mexico], while *X. helleri*, *Aequidens rivulatus* and *Poecilia reticulata* were the less common species and with low abundance (Table 2 [in source material]).”

According to Koehn and MacKenzie (2004), *Aequidens rivulatus* has been introduced into Queensland, Australia. Corfield et al. (2008) specifies that there is an established population in the Ross River in Queensland.

Means of Introduction Outside the United States

From FAO (2015):

“1) ornamental”

Short Description

From Animal-World (2013):

“The Green Terror is a deep bodied fish with pointed anal and dorsal fins. They are a good sized cichlid and tend to reach just over 12 inches (31 cm) in the wild, though in the aquarium they are typically about 6–8 inches (15 - 20 cm) and have a life span of about 7 - 10 years, though there are reports of them living more than 10 years if well cared for.”

“This is a very colorful deep bodied fish marked with various striping on its body and face. The male has a green and blue metallic sheen, a blue anal fin, and a red band at the edge of its tail fin. In addition, mature males will develop a rounded hump on their heads. The female has a darker tone with a green anal fin, no red band along the edge of its tail fin, and are generally a little smaller than the male.”

Biology

From Froese and Pauly (2015):

“In small and larger coastal streams [Ortega and Vari 1986].”

“Deposit up to 600 eggs on hard substrate: the female cares for the eggs and larvae and the male defends the territory [Stawikowski and Werner 1998].”

Human Uses

From Froese and Pauly (2015):

“Fisheries: of no interest; aquaculture: commercial; aquarium: commercial”

Diseases

Information on diseases of *Aequidens rivulatus* was not found.

Threat to Humans

From Froese and Pauly (2015):

“Harmless”

3 Impacts of Introductions

No records of impacts from introductions were found.

4 Global Distribution



Figure 1. Known global distribution of *Andinoacara rivulatus*. Map from GBIF Secretariat (2017).

The location in California is sourced from iNaturalist; in review of the report, the author doubted the identification of the observation and there was no indication of an established population. This location was not used as a source point for the climate match.

The location in India is the result of a geographically tagged genetic sequence and a specimen collected from a market (GBIF Secretariat 2017). These do not indicate an established population and no other sources indicate an established population in India. This location was not used as a source point for the climate match.



Figure 2. Location of an established population of *Andinoacara rivulatus* in Australia (Corfield et al. 2008).

Trujillo-Jiménez et al. (2010) gives additional locations of *Andinoacara rivulatus* in Mexico.

Although a record for introduction to the Philippines was listed by both Froese and Pauly (2015) and FAO (2015), no location data was given and no other sources were found.

5 Distribution Within the United States

No records of *Andinoacara rivulatus* introductions in the United States were found.

GBIF Secretariat (2017) reports a location in California which is sourced from iNaturalist – research grade observations; in review of the report, the author doubted the identification of the observation and there were no other indications of an established population in California.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Andinoacara rivulatus* was medium for the west coast of California, and the very southern parts of Arizona, Florida, and Texas. The climate match was low everywhere else. The Climate 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the contiguous U.S. was 0.001, low, and no states had an individually high climate match.

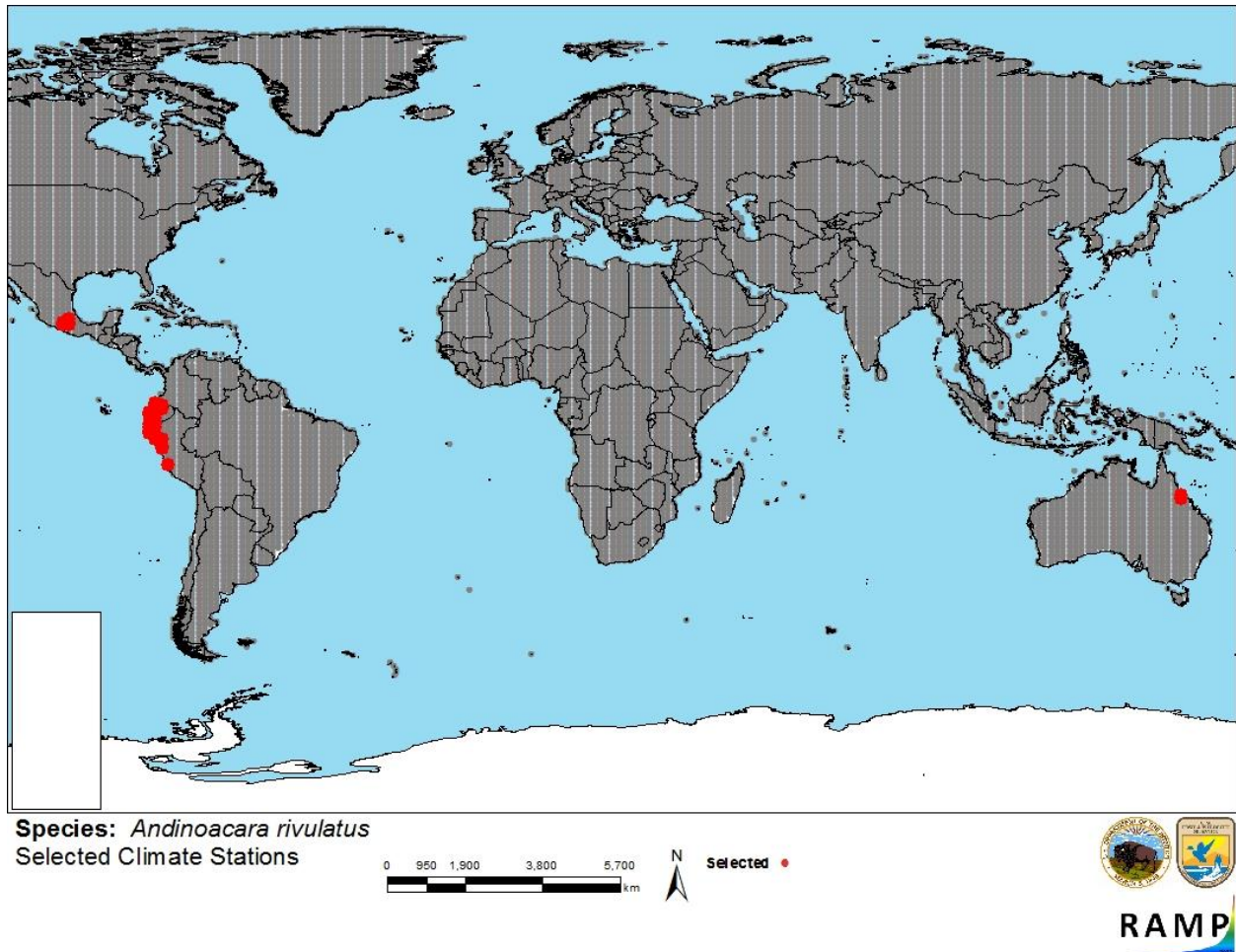


Figure 3. RAMP (Sanders et al. 2014) source map showing weather stations in Australia and Central and South America selected as source locations (red) and non-source locations (grey) for *Andinoacara rivulatus* climate matching. Source locations from Corfield et al. (2008), Trujillo-Jiménez et al. (2010) and GBIF Secretariat (2017).

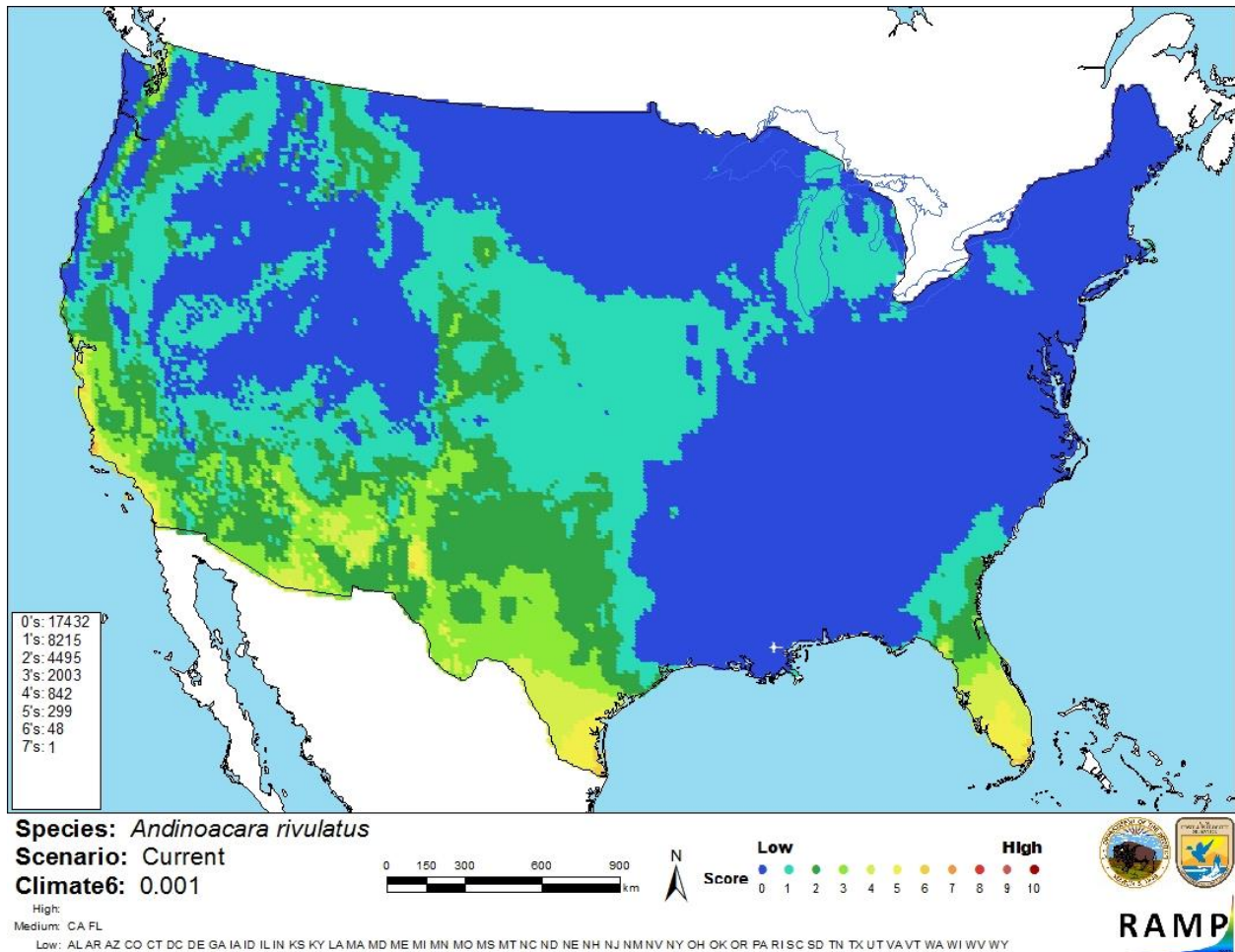


Figure 4. Map from RAMP (Sanders et al. 2014) of a current climate match for *Andinoacara rivulatus* in the contiguous United States based on source locations reported by Corfield et al. (2008), Trujillo-Jiménez et al. (2010) and GBIF Secretariat (2017). 0 = Lowest match, 10 = Highest match.

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
$0.000 \leq X < 0.005$	Low
$0.005 < X < 0.103$	Medium
≥ 0.103	High

7 Certainty of Assessment

The certainty of this assessment is medium. Adequate information was available for *Andinoacara rivulatus*. Information on the ecology and biology was found. Detailed information on the current distribution of the species and introduced populations was available. No information on any impacts of introduction was found.

8 Risk Assessment

Summary of Risk to the Contiguous United States

The history of invasiveness is not documented. Many records of introduction were found but there were not records of impacts available. The climate match is low, 0.001. There were small areas of medium match in Arizona, California, Florida, and Texas. Certainty of assessment is medium. No information on impacts of introduction was found. Overall risk assessment category is uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 3): None Documented**
- **Climate Match (Sec. 6): Low**
- **Certainty of Assessment (Sec. 7): Medium**
- **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.

- Animal-World. 2013. Green terror. Available: <http://animal-world.com/encyclo/fresh/cichlid/GreenTerror.php>. (February 2015).
- Corfield, J., B. Diggles, C. Jubb, R. M. McDowall, A. Moore, A. Richards, and D. K. Rowe. 2008. Review of the impacts of introduced ornamental fish species that have established wild populations in Australia. Final Report. Department of the Environment, Water, Heritage and the Arts, Australia.
- Eschmeyer, W. N., R. Fricke, and R. van der Laan, editors. 2017. Catalog of fishes: genera, species, references. Available: <http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>. (August 2017).
- FAO (Fisheries and Agriculture Organization of the United Nations). 2015. Database on introductions of aquatic species. Available: <http://www.fao.org/fishery/introsp/search/en>. (February 2015).
- Froese, R., and D. Pauly, editors. 2015. *Andinoacara rivulatus* (Günther, 1860). FishBase. Available: <http://www.fishbase.org/summary/Andinoacara-rivulatus.html>. (February 2015).

- GBIF Secretariat. 2017. GBIF backbone taxonomy: *Andinoacara rivulatus* (Günther, 1860). Global Biodiversity Information Facility, Copenhagen. Available: <https://demo.gbif.org/species/7570042>. (August 2017).
- ITIS (Integrated Taxonomic Information System). 2015. *Aequidens rivulatus* (Günther, 1860). Integrated Taxonomic Information System, Reston, Virginia. Available: http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=169839. (February 2015).
- Koehn, J. D., and R. F. MacKenzie. 2004. Priority management actions for alien freshwater fish species in Australia. *New Zealand Journal of Marine and Freshwater Research* 38(3):457–472.
- Trujillo-Jimenez, P., E. Lopez-Lopez, E. Diaz-Pardo, and J. A. Camargo. 2010. Patterns in the distribution of fish assemblages in Rio Amacuzac, Mexico: influence of abiotic factors and biotic factors. *Reviews in Fish Biology and Fisheries* 20:457–469.
- Sanders, S., C. Castiglione, and M. Hoff. 2014. Risk assessment mapping program: RAMP. U.S. Fish and Wildlife Service.

10 References Quoted But Not Accessed

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

- Australian Society for Fish Biology. 2003b. Newsletter 33(1), July 2003.
- Castro, E., O. Huamán, and H. Ortega. 1998. Ictiofauna de los Pantanos de Villa: composición, abundancia y aspectos ecológicos. Pages 78-83 in A. Cano, and K. Young, editors. *Los Pantanos de Villa biología y conservación*. Museo de Historia natural, UNMSM. Serie de Divulgación 11.
- Günther, A. 1860. Second list of cold-blooded vertebrata collected by Mr. Fraser in the Andes of western Ecuador. *Proceedings of the Zoological Society of London* 1859(3(7)):402–420.
- Jiménez-Prado, P., W. Aguirre, E. Laaz-Moncayo, R. Navarrete-Amaya, F. Nugra-Salazar, E. Rebolledo-Monsalve, E. Zárate-Hugo, A. Torres-Noboa, and J. Valdiviezo-Rivera. 2015. *Guía de peces para aguas continentales en la vertiente occidental del Ecuador*. Pontificia Universidad Católica del Ecuador Sede Esmeraldas; Universidad del Azuay y Museo Ecuatoriano de Ciencias Naturales del Instituto Nacional de Biodiversidad, Esmeraldas, Ecuador.
- Kullander, S. O. 2003. Cichlidae (Cichlids). Pages 605–654 in R. E. Reis, S. O. Kullander, and C. J. Ferraris, Jr., editors. *Checklist of the freshwater fishes of South and Central America*. EDIPUCRS, Porto Alegre, Brazil.

- Musilová, Z., O. Říčan, and J. Novák. 2009a. Phylogeny of the Neotropical cichlid fish tribe Cichlasomatini (Teleostei: Cichlidae) based on morphological and molecular data, with the description of a new genus. *Journal of Zoological Systematics and Evolutionary Research* 47(3):234–247.
- Musilová, Z., O. Říčan, S. Říčanová, P. Janišta, O. Gahura, and J. Novák. 2015. Phylogeny and historical biogeography of trans-Andean cichlid fishes (Teleostei: Cichlidae). *Vertebrate Zoology* 65(3):333–350.
- Musilová, Z., I. Schindler, and W. Staeck. 2009b. Description of *Andinoacara stalsbergi* sp. n. (Teleostei: Cichlidae: Cichlasomatini) from Pacific coastal rivers in Peru, and annotations on the phylogeny of the genus. *Vertebrate Zoology* 59(2):131–141.
- Ortega, H., and R. P. Vari. 1986. Annotated checklist of the freshwater fishes of Peru. *Smithsonian Contributions to Zoology* 437.
- Paepke, H.-J., and I. Schindler. 2013. The type specimens of Neotropical Cichlidae (Teleostei: Perciformes) in the Museum für Naturkunde Berlin. *Zoosystematics and Evolution* 89(2):259–274.
- Reis, R. E., J. S. Albert, F. Di Dario, M. M. Mincarone, P. Petry, and L. A. Rocha. 2016. Fish biodiversity and conservation in South America. *Journal of Fish Biology, South American Freshwater Basins* 1-36.
- Reis, R. E., S. O. Kullander, and C. J. Ferraris, Jr., editors. 2003. Check list of the freshwater fishes of South and Central America. CLOFFSCA. EDIPUCRS, Porto Alegre, Brazil.
- Riehl, R., and H. A. Baensch. 1991. *Aquarien atlas*. Band. 1. Melle: Mergus, Verlag für Natur- und Heimtierkunde, Germany.
- Schindler, I., and R. Morgenstern. 2010. Anmerkungen zur Taxonomie der *Andinoacara*-Arten. *DCG-Informationen (Deutsche Cichliden-Gesellschaft)* 41(5):114–124.
- Stawikowski, R., and U. Werner. 1998. *Die Buntbarsche Amerikas*, Band 1. Verlag Eugen Ulmer, Stuttgart, Germany.
- Wijkmark, N., S. O. Kullander, and R. E. Barriga Salazar. 2012. *Andinoacara blombergi*, a new species from the río Esmeraldas basin in Ecuador and a review of *A. rivulatus* (Teleostei: Cichlidae). *Ichthyological Exploration of Freshwaters* 23(2):117–137.