

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/368243485>

Mistichthys luzonensis (Sinarapan). THE IUCN RED LIST OF THREATENED SPECIES™

Article · February 2023

CITATIONS

0

READS

879

6 authors, including:



Armi Gentiles Torres

Mindanao State University - Iligan Institute of Technology

82 PUBLICATIONS 102 CITATIONS

SEE PROFILE



Kathleen Kesner-Reyes

Quantitative Aquatics, Inc.

96 PUBLICATIONS 3,454 CITATIONS

SEE PROFILE



Nico Leander

National Taiwan University

58 PUBLICATIONS 91 CITATIONS

SEE PROFILE



Juan Carlos Tecson Gonzalez

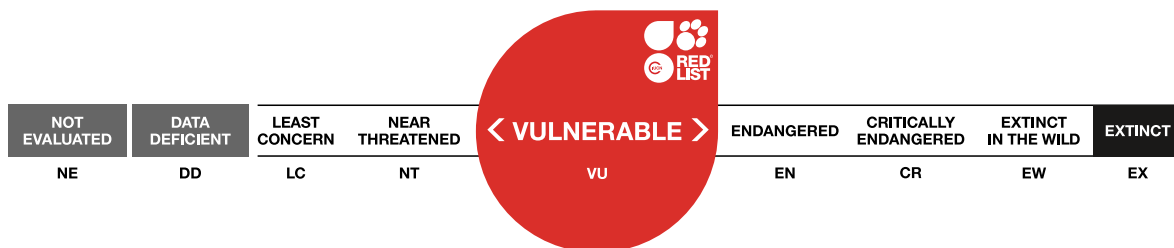
University of the Philippines Los Baños

87 PUBLICATIONS 1,655 CITATIONS

SEE PROFILE

Mistichthys luzonensis, Sinarapan

Assessment by: Soliman, V.S. *et al.*



View on www.iucnredlist.org

Short citation: Soliman, V.S. *et al.* 2021. *Mistichthys luzonensis*. The IUCN Red List of Threatened Species 2021: e.T13586A117405712. <https://dx.doi.org/10.2305/IUCN.UK.2021-2.RLTS.T13586A117405712.en> [see full citation at end]

Copyright: © 2021 International Union for Conservation of Nature and Natural Resources

Reproduction of this publication for educational or other non-commercial purposes is authorized without prior written permission from the copyright holder provided the source is fully acknowledged.

Reproduction of this publication for resale, reposting or other commercial purposes is prohibited without prior written permission from the copyright holder. For further details see [Terms of Use](#).

The IUCN Red List of Threatened Species™ is produced and managed by the [IUCN Global Species Programme](#), the [IUCN Species Survival Commission \(SSC\)](#) and [The IUCN Red List Partnership](#). The IUCN Red List Partners are: [ABQ BioPark](#); [Arizona State University](#); [BirdLife International](#); [Botanic Gardens Conservation International](#); [Conservation International](#); [Missouri Botanical Garden](#); [NatureServe](#); [Re:wild](#); [Royal Botanic Gardens, Kew](#); [Sapienza University of Rome](#); [Texas A&M University](#); and [Zoological Society of London](#).

If you see any errors or have any questions or suggestions on what is shown in this document, please provide us with [feedback](#) so that we can correct or extend the information provided.

Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Actinopterygii	Perciformes	Gobiidae

Scientific Name: *Mistichthys luzonensis* Smith, 1902

Synonym(s):

- *Gobiopterus luzonensis* (Smith, 1902)

Common Name(s):

- Philippine (Other): Sinarapan
- Bikol: Tabios
- Tagalog: Bia

Taxonomic Source(s):

Fricke, R., Eschmeyer, W. N. and Van der Laan, R. (eds). 2020. Eschmeyer's catalog of fishes: Genera, species, references. Available at: <http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>. (Accessed: 10 August 2020).

Assessment Information

Red List Category & Criteria: Vulnerable B1ab(iii)+2ab(iii) [ver 3.1](#)

Year Published: 2021

Date Assessed: September 7, 2020

Justification:

This species is endemic to Bicol Region in the Philippines. Its population virtually disappeared from most lakes from 1979 due to overfishing, destruction of its breeding and refuge areas, and pollution. It has undergone intense conservation management, which includes legal and institutional mechanisms, habitat restoration and protection, establishment of fish sanctuaries, restocking, assisted colonization, and community participation. In Camarines Sur, it is now found in six lakes and lakelets where four are natural populations (Lakes Manapao, Bato, Buhi, and Katugday) and two (Lake Makuao and Lake Paguiriron) have resulted from direct fish transfers. An estimate of 20,000-40,000 individuals is presently residing and reproducing in these lakes. In Albay, it is thriving in Lake Danao. Due to its small geographic range with an estimated extent of occurrence (EOO) of 844 km² and area of occupancy (AOO) of 100 km² covering seven locations only, this species is assessed as Vulnerable. Strict implementation and enforcement of laws, policies, and regulations are needed as illegal fishing and pollution from aquaculture still exist. Invasive alien species, siltation, pollution from domestic and agricultural wastes, and the growing human settlements may continue to pose threats and push this species to a higher risk of extinction, if not properly addressed.

Previously Published Red List Assessments

1996 – Lower Risk/conservation dependent (LR/CD)

<https://dx.doi.org/10.2305/IUCN.UK.1996.RLTS.T13586A4212550.en>

1994 – Vulnerable (V)

1990 – Vulnerable (V)

1988 – Vulnerable (V)

1986 – Vulnerable (V)

Geographic Range

Range Description:

This species, locally known as Sinarapan, is endemic to Bicol Region in Luzon, Philippines. It has been recorded in Lakes Buhi (Camarines Sur), Bato (Camarines Sur), and Danao (Polangui, Albay), as well as in the lakelets Manapao, Katugday, Paguiriron and Makua (Barangay San Ramon, Buhi, Camarines Sur) in the southeast of Luzon (Soliman and Sergio 2001). It has an extent of occurrence (EOO) of 844 km² and an area of occupancy (AOO) of 100 km².

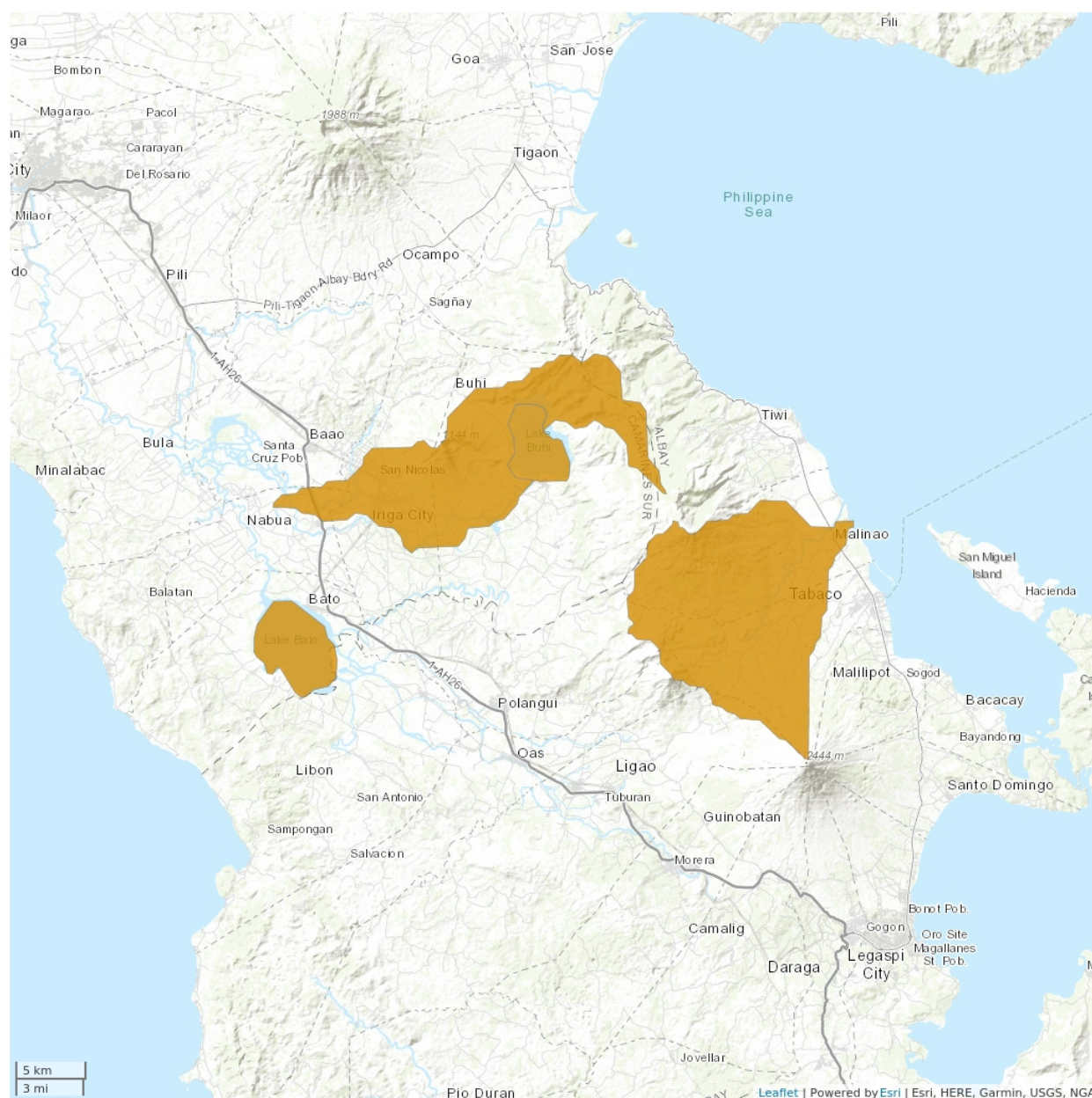
This species almost disappeared in most lakes. However, recent monitoring by the Buhi local government confirmed its presence in Lake Katugday. This can be explained by the natural transfer of Sinarapan eggs and larvae from the adjacent mountain lakes during flooding due to rains in the area. Beginning September until November, gravid female Sinarapan can be found in Lakes Paguiriron and Makua. Lakes Katugday and Makua have been target lakes where the Sinarapan population has been successfully established due to direct fish transfers. The Lake Buhi population was also thought to have crashed in the 1980s due to overfishing. There have been attempts to reintroduce this species. In 2001, it could only be found in Lakes Manapao, Buhi, and Katugday (Soliman and Sergio 2001). Sinarapan can be found now in Lakes Bato, Makua, and Paguiriron, including Manapao, Buhi, Katugday and Danao.

Sampling in February 2020 for aging study successfully resulted in capture of genuine specimens of Sinarapan. There have been collections of alleged Sinarapan or Sinarapan-looking fish for genetic analysis but this led to multi-species genetic results. A study done in 2015 on DNA profiling has found that some specimens of supposed Sinarapan collected from Lake Buhi and Bato belonged to *Leiopotherapon plumbeus* and *Rhinogobius giurinus*. This indicates that reported Sinarapan sightings could potentially be misidentifications (Sanchez et al. 2015). A little experience is needed to identify Sinarapan from other similar-looking species. A less likely possibility is the occurrence of natural hybridization among gobiids in the lakes.

Country Occurrence:

Native, Extant (resident): Philippines

Distribution Map

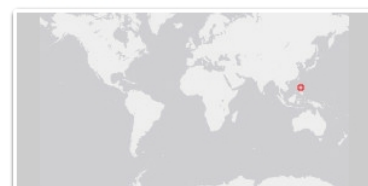


Legend

EXTANT (RESIDENT)

Compiled by:

Quantitative Aquatics, Inc. (Q-aquatics) 2020



The boundaries and names shown and the designations used on this map do not imply any official endorsement, acceptance or opinion by IUCN.

Population

The population was very abundant in the 1930s and 1960s but almost disappeared in most lakes from 1979 due to overfishing and other threats such as destruction of their breeding and refuge areas, as well as pollution (Soliman and Sergio 2001). Conservation projects such as the Bicol Biodiversity Fish Program of Bicol University funded by the Department of Science and Technology and the Sinarapan Repopulation Initiative funded by the Ford Motors Company, Phils. have been implemented to restore its habitat and restock the populations to boost its numbers (Soliman et al. 1998), with the population in Lake Buhi thought to be making a recovery (NACA 2005). Sinarapan can be found in six lakes and lakelets in Camarines Sur where four are natural populations (Lakes Manapao, Bato, Buhi, and Katugday) and the remaining two (Lake Makuao and Lake Paguiriron) are the result of direct fish transfer strategy or translocations (Soliman et al. 1998). Some 20,000 to 40,000 Sinarapan individuals are estimated to be residing and reproducing in these lakes. There is also natural population in Lake Danao in Polangui, Albay where restocking program is in place.

Current Population Trend: Stable

Habitat and Ecology (see Appendix for additional information)

This is a freshwater species found in the Bicol Region, Luzon, Philippines. It has been recorded from the shoreline to a depth of 10-12 m, although there is no evidence to suggest that it cannot be found in deeper areas (Te Winkel 1935). Its diet consists of 92% zooplankton and 8% phytoplankton (Soliman and Sergio 2001). It also seems to have a diurnal swimming pattern that local fishermen utilize to maximize catches (Te Winkel 1935). It breeds throughout the year with a bi-modal recruitment pattern that peaks in July and November, coinciding with periods of heavy rainfall (Soliman and Sergio 2001). It does not guard its eggs. Its eggs are planktonic and are attached to the roots of vegetation (Soliman and Sergio 2001). Despite high natural mortality, the high fecundity, and adaptation for egg protection while developing in the lake environment compensate for recruitment success and species perpetuation (Soliman 1989).

Systems: Freshwater (=Inland waters)

Use and Trade

This species was once the cheapest and most readily available source of protein for the majority of fisherfolks in the area. In Lake Buhi, it was commercially harvested using hand-operated scissor nets made of finely woven abaca cloth. This type of fishing gear could catch several kilograms of fish in an hour. The introduction of motorized 'sakag', a collapsible Y-shaped push net, caused yields to rise considerably but resulted to the destruction of breeding, feeding, and refuge areas of this species (Soliman and Sergio 2001).

Threats (see Appendix for additional information)

In 1975, the use of motorized pushnets in catching Sinarapan further increased potential catch sizes. By 1976, there were 34 motorized pushnets and about 490 manually operated scissor nets, all with very fine mesh nets. The motorized pushnets also destroyed aquatic vegetation used by Sinarapan for breeding, feeding, and refuge. Harvesting has also been blamed for the species disappearance from Lake Bato in the 1970s (Gindelberger 1981) and threatens the populations in Lakes Katugday and Manapao. By 1978, the collection of Sinarapan was banned by Bureau of Fisheries and Aquatic Resources (BFAR) (Gindelberger 1981). Another major threat to this species is the introduction of exotic fishes, such as common carp and tilapia. Tilapia are farmed in great numbers in cages. It has been recorded that tilapia fingerlings are voracious predators of Sinarapan (Gindelberger 1981). Also, wastes from cage fish farming pollute the lakes. Sinarapan can have very high mortality rates of 90% per year due to stocked tilapia in fish cages (Soliman and Sergio 2001). The introduced freshwater prawn *Macrobrachium* was also blamed for the decline, but it was found that Sinarapan predated their planktonic larvae.

Pollution has also heavily impacted this species in Lake Katugday, where the stock was virtually depleted due to a chemical pesticide dumped into the lake by a local fisherman to improve yields of carps and tilapias. Studies in 1988 reported only two individuals caught after almost three hours of fishing operation (Soliman 1993). A dam was also constructed that is thought to have contributed to sulphur upwelling in Lake Buhi. There is also increased erosion in the watershed due to deforestation and agriculture that causes siltation, and pollution from domestic wastes (Guerrero 1999, Corpuz *et al.* 2015, Legaspi *et al.* 2015). Increasing human settlements near the lakes is an additional threat to this species.

Conservation Actions (see Appendix for additional information)

There are conservation measures specific for this species. Catching, gathering, or taking of Sinarapan/Tabios using motorized push nets (sarap/sacag) in Lake Buhi and Lake Bato is prohibited by Fishery Administrative Order No. 127, Series of 1980, although illegal fishing still occurs. Buhi Municipal Council passed Resolution No. 80-022, Series 1981 declaring Lakes Katugday and Manapao as 'Sinarapan' sanctuaries (Soliman and Sergio 2001). Buhi Municipal Ordinance No. 3, Series 1981 was also passed banning the fishing of Sinarapan in Lakes Katugday and Manapao. In 1998, the Buhi Sinarapan Conservation and Management Ordinance has been passed and the Sinarapan Conservation and Management Council has been organized. All mountain lakes around Mt. Asog, Buhi, Camarines Sur have been declared Sinarapan sanctuaries. Key to the successful protection of these mountain lakes is the involvement of the Aetas or aboriginal Filipinos residing along the lakeshore areas. There are still pending legislations for the protection and management of this species. The local government of Buhi has employed a regular overseer, although more monitoring and regulation is needed with additional resources to effectively manage and protect the lakes (Soliman and Sergio 2001). In the last 10 years, the efforts for Sinarapan conservation and management have been strengthened by the Buhi Lake Conservation and Management Office that has employed a regular lake development officer and a staff to assist in lake development initiatives.

Sinarapan can be found in Katugday due to the repopulation initiative for the fish in the lake as well as the strong network of protection by the Buhi local government. BFAR Region 5 is currently running a habitat restoration, breeding, and restocking project for this species in Lake Katugday, Manapao, and

Danao.

Credits

Assessor(s):	Soliman, V.S., Torres, A.G., Kesner-Reyes, K., Leander, N.J.S., Gonzalez, J.C.T., Andayog, A.S., Ballad, E.L., Ame, E.C., Palla, H.P., Guino-o, R.S. II, Gaerlan, R.S.P., Angeles, I.J.P., Reyes, A.T., Cecilio, M.A.F., Garcia, M.P.C. & Mamalangkap, M.D.
Reviewer(s):	Capuli, E.
Facilitator(s) and Compiler(s):	Palmer-Newton, A.

Bibliography

- Corpuz, M.N.C., Paller, V.G.V. and Ocampo, P.P. 2015. Ichthyofaunal Survey in Selected Freshwater Habitats in Camarines Sur, Philippines. *Asian Journal of Biodiversity* 6(1): 80-99.
- Gindelberger, B. 1981. Fishery management in Camarines Sure, Philippines. Why sinarapan almost disappeared from Lake Buhi. *ICLARM Newsletter* 4(3): 3-5.
- Groombridge, B. (ed.). 1994. *1994 IUCN Red List of Threatened Animals*. IUCN, Gland, Switzerland and Cambridge, UK.
- Guerrero, R.D. III. 1999. Philippine lakes: status and strategies for sustainable development. *Trans. Nat. Acad. Sci. Tech. Philippines* 21: 278-286.
- Herre, A.W.C.T. 1924. Distribution of the true freshwater fishes in the Philippines. I. The Philippine Cyprinidae. *Philippine Journal of Science* 24(3): 249-307.
- IUCN. 1990. *IUCN Red List of Threatened Animals*. IUCN, Gland, Switzerland and Cambridge, UK.
- IUCN. 2021. The IUCN Red List of Threatened Species. Version 2021-2. Available at: www.iucnredlist.org. (Accessed: 04 September 2021).
- IUCN Conservation Monitoring Centre. 1986. *1986 IUCN Red List of Threatened Animals*. IUCN, Gland, Switzerland and Cambridge, UK.
- IUCN Conservation Monitoring Centre. 1988. *IUCN Red List of Threatened Animals*. IUCN, Gland, Switzerland and Cambridge, UK.
- Legaspi, K., Lau, A.A.Y., Jordan, P., Mackay, A., McGowan, S., McGlynn, G., Baldia, S., Papa, R.D. and Taylor, D. 2015. Establishing the impacts of freshwater aquaculture in tropical Asia: the potential role of palaeolimnology. *Geo: Geography and Environment* 2(2): 148-163.
- NACA. 2005. The Way Forward: Building capacity to combat impacts of aquatic invasive alien species and associated transboundary pathogens in ASEAN countries. Final report of the regional workshop, hosted by the Department of Fisheries, Government of Malaysia, on 12th-16th July 2004. Network of Aquaculture Centres in Asia-Pacific, Bangkok.
- Sanchez, J.A.C., Buraga, V.B., Mapanao, C.P., Maningas, M.B.B., Santos, M.D. 2015. Species Identification of a Commonly Believed Sinarapan Fish *Mystichthys luzonensis* (Smith, 1902) in Lakes Buhi and Bato of Bicol Region. *Journal of Agricultural Science and Technology B* 5: 691-700.
- Soliman, V.S. 1989. Population dynamics of Sinarapan (*Mistichthys luzonensis* Smith) in Lake Manapao, Buhi, Camarines Sur, Philippines. Central Luzon State University.
- Soliman, V.S. 1993. Status of Lake Manapao, Buhi, Camarines Sur: sanctuary of the only viable stock of sinarapan, the world's smallest commercial fish". *Outreach* 6(1): 5, 8-9.
- Soliman, V.S., Mendoza, A.B. and Sergio, M.F.H.A. 1998. Management and successful repopulation of sinarapan (*Mistichthys luzonensis* Smith), the "world's smallest commercial fish". *Bicol University R & D Journal* 11: 14-25.
- Soliman, V.S., Sergio, M.F.H.A. 2001. Managing 'sinarapan' *Mistichthys luzonensis* Smith in Lake Buhi, Camarines Sur: Insights from its biology and population dynamic. In: Santiago, C.B., Cuvin-Aralar, M.L., Basiao, Z.U. (ed.), *Conservation and Ecological Management of Philippine Lakes in Relation to Fisheries and Aquaculture*, pp. 113-122. Southeast Asian Fisheries Development Center, Aquaculture Department, Philippine Council for Aquatic and Marine Research and Development, Bureau of Fisheries

and Aquatic Resources, Iloilo , Los Banos, Quezon City.

Te Winkel, L.E. 1935. A study of *Mistichthys luzonensis* with special reference to conditions correlated with reduced size. *Journal of Morphology* 58(2): 463-535.

Citation

Soliman, V.S., Torres, A.G., Kesner-Reyes, K., Leander, N.J.S., Gonzalez, J.C.T., Andayog, A.S., Ballad, E.L., Ame, E.C., Palla, H.P., Guino-o, R.S. II, Gaerlan, R.S.P., Angeles, I.J.P., Reyes, A.T., Cecilio, M.A.F., Garcia, M.P.C. & Mamalangkap, M.D. 2021. *Mistichthys luzonensis*. *The IUCN Red List of Threatened Species* 2021: e.T13586A117405712. <https://dx.doi.org/10.2305/IUCN.UK.2021-2.RLTS.T13586A117405712.en>

Disclaimer

To make use of this information, please check the [Terms of Use](#).

External Resources

For [Supplementary Material](#), and for [Images and External Links to Additional Information](#), please see the Red List website.

Appendix

Habitats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Habitat	Season	Suitability	Major Importance?
5. Wetlands (inland) -> 5.5. Wetlands (inland) - Permanent Freshwater Lakes (over 8ha)	-	Suitable	-
5. Wetlands (inland) -> 5.7. Wetlands (inland) - Permanent Freshwater Marshes/Pools (under 8ha)	-	Suitable	-

Use and Trade

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

End Use	Local	National	International
Food - human	Yes	No	No

Threats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Threat	Timing	Scope	Severity	Impact Score
1. Residential & commercial development -> 1.1. Housing & urban areas	Ongoing	-	-	Low impact: 3
2. Agriculture & aquaculture -> 2.4. Marine & freshwater aquaculture -> 2.4.1. Subsistence/artisinal aquaculture	Ongoing	-	-	Low impact: 3
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.1. Intentional use: (subsistence/small scale) [harvest]	Ongoing	-	-	Low impact: 3
8. Invasive and other problematic species, genes & diseases -> 8.1. Invasive non-native/alien species/diseases -> 8.1.2. Named species (Cyprinus carpio)	Ongoing	-	-	Low impact: 3
8. Invasive and other problematic species, genes & diseases -> 8.1. Invasive non-native/alien species/diseases -> 8.1.2. Named species (Oreochromis niloticus)	Ongoing	-	-	Low impact: 3
9. Pollution -> 9.3. Agricultural & forestry effluents -> 9.3.1. Nutrient loads	Ongoing	-	-	Low impact: 3
9. Pollution -> 9.3. Agricultural & forestry effluents -> 9.3.2. Soil erosion, sedimentation	Ongoing	-	-	Low impact: 3

Conservation Actions in Place

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Action in Place
In-place research and monitoring
Action Recovery Plan: Yes
Systematic monitoring scheme: Yes
In-place land/water protection
Conservation sites identified: Yes, over entire range
Occurs in at least one protected area: Yes
Invasive species control or prevention: Yes
In-place species management
Harvest management plan: Yes
Successfully reintroduced or introduced benignly: Yes

Conservation Actions Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Action Needed
5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.3. Sub-national level

Research Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Research Needed
3. Monitoring -> 3.1. Population trends

Additional Data Fields

Distribution
Estimated area of occupancy (AOO) (km ²): 100
Estimated extent of occurrence (EOO) (km ²): 844
Number of Locations: 7
Population
Number of mature individuals: 20,000-40,000

Habitats and Ecology
Continuing decline in area, extent and/or quality of habitat: Yes
Movement patterns: Not a Migrant

The IUCN Red List Partnership



The IUCN Red List of Threatened Species™ is produced and managed by the [IUCN Global Species Programme](#), the [IUCN Species Survival Commission \(SSC\)](#) and [The IUCN Red List Partnership](#).

The IUCN Red List Partners are: [ABQ BioPark](#); [Arizona State University](#); [BirdLife International](#); [Botanic Gardens Conservation International](#); [Conservation International](#); [Missouri Botanical Garden](#); [NatureServe](#); [Re:wild](#); [Royal Botanic Gardens, Kew](#); [Sapienza University of Rome](#); [Texas A&M University](#); and [Zoological Society of London](#).