GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Gambusia holbrooki***

Gambusia holbrooki 正體中文 **System:** Freshwater

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Actinopterygii	Cyprinodontiformes	Poeciliidae

Common name topminnow (English, USA), plague minnow (English, Australia), eastern gambusia (English, Australia), mosquitofish (English, USA), gambusia (English)

Synonym *Gambusia affinis holbrooki*

Similar species *Gambusia affinis, Craterocephalus marjoriae, Poecilia reticulata*

Summary Eastern mosquito fish, Gambusia holbrooki is a small, aggressive live-bearing fish that originates from the southern United States. It has been introduced worldwide as a mosquito-control agent. G. holbrooki have been implicated in damage to native fish, amphibian and invertebrate populations.

view this species on IUCN Red List

Species Description
Greenish olive to brown on the back, the sides are grey with a bluish sheen with a belly silvery-white. Females have a distinct black blotch surrounded by a golden patch occurring just above the vent. Males have a highly modified anal fin, the third, fourth and fifth rays of which are elongated and thickened to form a 'gonopodium' which is used to inseminate the female. Females are also larger than males with maximum standard lenghts of 60mm and 35mm respectively.

Notes
Gambusia holbrooki is the only species of *Gambusia* in Australia. *G. affinis* is similar to the closely related *G. holbrooki*, and until relatively recently they were classed as sub-species rather than distinct species. As such, their impacts and behaviour are virtually identical, and the same management techniques will work for both species. Although hybrids between *G. holbrooki* and *G. affinis* can occur, they are unusual in natural populations (Wooten and Lydeard, 1990).

Lifecycle Stages
Individuals become sexually mature in under two months (McDowall 1996). Gestation period is between 21 and 28 days (Cadwallader and Backhouse 1983; McDowall 1996). Female gambusia have the capacity to store sperm from breeding season to breeding season (Howe 1995). Females can live for up to 15 months.

Uses
Used as a feeder fish for aquarium species. Formerly used to control mosquitoes, but has since been shown to be generally ineffective. Since 1982 the World Health Organisation has no longer recommended the use of gambusia for malaria control purposes and indicates it should not be introduced into new areas.

Habitat Description
Gambusia holbrooki prefer warm, slow flowing or still waters, and occur amongst aquatic vegetation at the edge of waterbodies in water depths of 10cm or less (Merrick and Schmida 1984; McDowall 1996; Arthington *et al.* 1999). Although gambusia can tolerate a broad range of environmental conditions, they tend to avoid rapid discharge, naturally variable creeks and rivers and areas of dense surface vegetation, that can obstruct access for feeding on the surface (Meffe 1984; Arthington *et al.* 1990; Galat and Robinson, 1992).

Reproduction
Sexual. Internal fertilisation with embryos developing within the female. Livebearer. The reproductive cycle is primarily governed by photoperiod (Pen and Potter, 1991). 50-100 young per brood per female adult. Females have two to three broods per season (Howe 1995).

Nutrition
Gambusia is an opportunistic omnivore that feeds on a diverse range of terrestrial insects such as ants and flies that fall on the waters surface as well as aquatic invertebrates including bugs, beetles, fly larvae, zooplankton, filamentous algae and fragments of fruit and other plant tissues. *Gambusia* select their prey according to size, colour, movement and position in water column (Bence and Murdoch 1986; Lloyd 1984; Arthington and Marshall 1999)

General Impacts
Gambusia holbrooki predate on amphibian eggs; and predate and compete with tadpoles, resulting in injury or death to individuals. They may have a negative influence on some frog species' choice of breeding habitat. *G. holbrooki* have been shown to predate upon the eggs and tadpoles of the 'Critically Endangered (CR)' yellow-spotted tree frog (see *Litoria castanea* in IUCN Red List of Threatened Species); the 'Endangered (EN)' green and gold frog (see *Litoria raniformis* in IUCN Red List of Threatened Species); and the 'Vulnerable (VU)' golden bell frog (see *Litoria aurea* in IUCN Red List of Threatened Species) in Australia (NSW National Parks & Wildlife Service, 2004). *Gambusia* spp. have been implicated in the decline in the range and abundance of native fish species worldwide (Lloyd 1990) through predation and interference competition (McKay 1984; Howe 1995; Ivanstoff and Aarn 1999; Knight 1999). The species is purported to impact on macro-invertebrates such as rotifers, mayflies, beetles, dragonflies and molluscs (Anstis, 2002).

Management Info
Preventative measures: Copp *et al*, (2005) Risk identification and assessment of non-native freshwater fishes presents a conceptual risk assessment approach for freshwater fish species that addresses the first two elements (hazard identification, hazard assessment) of the UK environmental risk strategy. The paper presents a few worked examples of assessments on species to facilitate discussion. The electronic Decision-support tools-Invasive-species identification tool kits that includes a freshwater and marine fish invasives scoring kit are made available on the Cefas (Centre for Environment, Fisheries & Aquaculture Science) page for free download (subject to Crown Copyright (2007-2008)).
Chemical: Chemical control measures such as the application of Rotenone may be appropriate for small confined waterbodies, where impacts to non-target species can be minimised. Rotenone is indiscriminate, so non-target species ideally need to be removed prior to its application. Fish affected by Rotenone come to the surface to seek oxygen, so any remaining non-target species may be removed at this stage (Willis & Ling, 2000).
Physical: Physical control measures such as draining of a pond may be appropriate for small confined waterbodies, where impacts to non-target species can be minimised.

Pathway
Obtained as feeder fish from aquariums

Principal source: FishBase, 2004. Species profile *Gambusia holbrooki* Eastern mosquito fish

Compiler: IUCN SSC Invasive Species Specialist Group
Updates with support from the Overseas Territories Environmental Programme (OTEP) project XOT603, a joint project with the Cayman Islands Government - Department of Environment

Review:

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[1] RUSSIAN FEDERATION
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[1] TURKEY

BIBLIOGRAPHY

37 references found for **Gambusia holbrooki**

Managment information
Arthington, A.H., Mckay, R.J., and Milton, D. 1981. Ecology and interactions of exotic and endemic freshwater fishes in south eatern Queensland streams. Report Number. 1. Australian National parks and Wildlife Service, Canberra.
Centre for Environment, Fisheries & Aquaculture Science (CEFAS)., 2008. Decision support tools-Identifying potentially invasive non-native marine and freshwater species: fish, invertebrates, amphibians.
Summary: The electronic tool kits made available on the Cefas page for free download are Crown Copyright (2007-2008). As such, these are freeware and may be freely distributed provided this notice is retained. No warranty, expressed or implied, is made and users should satisfy themselves as to the applicability of the results in any given circumstance. Toolkits available include 1) FISK- Freshwater Fish Invasiveness Scoring Kit (English and Spanish language version); 2) MFISK- Marine Fish Invasiveness Scoring Kit; 3) MI-ISK- Marine invertebrate Invasiveness Scoring Kit; 4) FI-ISK- Freshwater Invertebrate Invasiveness Scoring Kit and AmphISK- Amphibian Invasiveness Scoring Kit. These tool kits were developed by Cefas, with new VisualBasic and computational programming by Lorenzo Vilizzi, David Cooper, Andy South and Gordon H. Copp, based on VisualBasic code in the original Weed Risk Assessment (WRA) tool kit of P.C. Pheloung, P.A. Williams & S.R. Halloy (1999).
The decision support tools are available from:
http://cefas.defra.gov.uk/our-science/ecosystems-and-biodiversity/non-native-species/decision-support-tools.aspx [Accessed 13 October 2011]
The guidance document is available from http://www.cefas.co.uk/media/118009/fisk_guide_v2.pdf [Accessed 13 January 2009].
Clearwater, Susan J.; Chris W. Hickey and Michael L. Martin. 2008. Overview of potential piscicides and molluscicides for controlling aquatic pest species in New Zealand. Science for conservation 283. March 2008, New Zealand Department of Conservation
Summary: Available from: http://www.doc.govt.nz/upload/documents/science-and-technical/sfc283entire.pdf [Accessed 20 March 2008]
Copp, G.H., Garthwaite, R. and Gozlan, R.E., 2005. Risk identification and assessment of non-native freshwater fishes: concepts and perspectives on protocols for the UK. Sci. Ser. Tech Rep., Cefas Lowestoft, 129: 32pp.
Summary: The discussion paper presents a conceptual risk assessment approach for freshwater fish species that addresses the first two elements (hazard identification, hazard assessment) of the UK environmental risk strategy The paper presents a few worked examples of assessments on species to facilitate discussion.
Available from: http://www.cefas.co.uk/publications/techrep/tech129.pdf [Accessed 1 September 2005]
IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4.
Summary: The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on taxa that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those taxa that are facing a higher risk of global extinction (i.e. those listed as Critically Endangered, Endangered and Vulnerable). The IUCN Red List also includes information on taxa that are categorized as Extinct or Extinct in the Wild; on taxa that cannot be evaluated because of insufficient information (i.e. are Data Deficient); and on taxa that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme (i.e. are Near Threatened).
Available from: http://www.iucnredlist.org/ [Accessed 25 May 2011]

IUCN/SSC Invasive Species Specialist Group (ISSG)., 2010. A Compilation of Information Sources for Conservation Managers.
Summary: This compilation of information sources can be sorted on keywords for example: Baits & Lures, Non Target Species, Eradication, Monitoring, Risk Assessment, Weeds, Herbicides etc. This compilation is at present in Excel format, this will be web-enabled as a searchable database shortly. This version of the database has been developed by the IUCN SSC ISSG as part of an Overseas Territories Environmental Programme funded project XOT603 in partnership with the Cayman Islands Government - Department of Environment. The compilation is a work under progress, the ISSG will manage, maintain and enhance the database with current and newly published information, reports, journal articles etc.
Krumholz, L.A. 1948. Reproduction in the western mosquitofish, *Gambusia affinis*, and its use in mosquito control. Ecological Monographs, 18(1): 1-43.
McKay, R.J. 1984. Introductions of exotic fishes in Australia. In: W.R. Courtenay, J.R. Stauffer (eds), Distribution, Biology and Management of Exotic Fishes, John Hopkins University Press, Baltimore.
McKay, S.; Clunie, P.; Gillespie, G.; Raadik, T.; Saddlier, S.; O Brien, T.; Ryan, T.; and Aland, G. 2001. Predation by *Gambusia holbrooki*: a review of the literature. *New South Wales National Parks and Wildlife Service*.
Summary: A literature review that looks at both the effects of *G. holbrooki* on a range of different organisms and control options available. This document formed the background information for NSW NPWS (2003).
Mendoza, R.E.; Cudmore, B.; Orr, R.; Balderas, S.C.; Courtenay, W.R.; Osorio, P.K.; Mandrak, N.; Torres, P.A.; Damian, M.A.; Gallardo, C.E.; Sanguines, A.G.; Greene, G.; Lee, D.; Orbe-Mendoza, A.; Martinez, C.R.; and Arana, O.S. 2009. Trinational Risk Assessment Guidelines for Aquatic Alien Invasive Species. Commission for Environmental Cooperation. 393, rue St-Jacques Ouest, Bureau 200, Montr&#65533;al (Qu&#65533;bec), Canada. ISBN 978-2-923358-48-1.
Summary: In 1993, Canada, Mexico and the United States signed the North American Agreement on Environmental Cooperation (NAAEC) as a side agreement to the North American Free Trade Agreement (NAFTA). The NAAEC established the Commission for Environmental Cooperation (CEC) to help the Parties ensure that improved economic efficiency occurred simultaneously with trinational environmental cooperation. The NAAEC highlighted biodiversity as a key area for trinational cooperation. In 2001, the CEC adopted a resolution (Council Resolution 01-03), which created the Biodiversity Conservation Working Group (BCWG), a working group of high-level policy makers from Canada, Mexico and the United States. In 2003, the BCWG produced the &#65533;Strategic Plan for North American Cooperation in the Conservation of Biodiversity.&#65533; This strategy identified responding to threats, such as invasive species, as a priority action area. In 2004, the BCWG, recognizing the importance of prevention in addressing invasive species, agreed to work together to develop the draft CEC Risk Assessment Guidelines for Aquatic Alien Invasive Species (hereafter referred to as the Guidelines). These Guidelines will serve as a tool to North American resource managers who are evaluating whether or not to introduce a non-native species into a new ecosystem. Through this collaborative process, the BCWG has begun to implement its strategy as well as address an important trade and environment issue. With increased trade comes an increase in the potential for economic growth as well as biological invasion, by working to minimize the potential adverse impacts from trade, the CEC Parties are working to maximize the gains from trade while minimizing the environmental costs.
Available from: English version: http://www.cec.org/Storage/62/5516_07-64-CEC%20invasives%20risk%20guidelines-full-report_en.pdf [Accessed 15 June 2010]
French version: http://www.cec.org/Storage/62/5517_07-64-CEC%20invasives%20risk%20guidelines-full-report_fr.pdf [Accessed 15 June 2010]
Spanish version: http://www.cec.org/Storage/62/5518_07-64-CEC%20invasives%20risk%20guidelines-full-report_es.pdf [Accessed 15 June 2010].
Merrick, J. R. and Schmida, G. E. 1984. Australian freshwater fishes: Biology and Management. Griffen Press Limited, Adelaide.
New South Wales (NSW) National Parks and Wildlife Service 2003. NSW Threat Abatement Plan. Predation by *Gambusia holbrooki* &#65533; The Plague Minnow. NPWS. Hurstville, NSW.
Summary: This management plan has been prepared in accordance with NSW legislative obligations for listed key threatening processes. It contains a review of the literature in regard to the biology, ecology, impacts and control of the species and includes proposed research and management actions. The plan also contains a model to predict the possible impact of Gambusia on NSW frog species.
Available from: http://www.nationalparks.nsw.gov.au/npws.nsf/Content/threat_abatement_plan_plague_minnow
Varnham, K. 2006. Non-native species in UK Overseas Territories: a review. JNCC Report 372. Peterborough: United Kingdom.
Summary: This database compiles information on alien species from British Overseas Territories.
Available from: http://www.jncc.gov.uk/page-3660 [Accessed 10 November 2009]
Willis, K. and Ling, N. 2000. Sensitivites of mosquitofish and black mudfish to a piscicide: could rotenone be used to control mosquitofish in New Zealand waters? *New Zealand Journal of Zoology* 27: 85-91.
Summary: Has information on the possible use of the poison rotenone to control mosquitofish.

General information

Anstis, M. 2002. *Tadpoles of South-eastern Australia: a guide with keys.* New Holland Publishers, Sydney.
Arthington, A.H. and Marshall, C.J. 1999. Diet of the exotic mosquitofish, *Gambusia holbrooki*, in an Australian lake and potential for competition with indigenous fish species. *Asian Fisheries Science* 12: 1-16.
Arthington, A.H., Hamlet, S., and Bluhdorn, D.R. 1990. The role of habitat disturbance in the establishment of introduced warm-water fishes in Australia., pp. 61-66. In: D.A. Pollard (ed.), *Introduced and translocated fishes and their ecological effect*. Australian Government Publishing Service, Canberra.
Bence, J.R. and Murdoch, W.W. 1986. Prey selection by the mosquitofish: relation to optimal diet theory. *Ecology* 67(2): 324-336.
Cadwallader, P.L. and Backhouse, G.N. 1983. *A guide to the freshwater fish of Victoria*. Ministry for Conservation, Melbourne.
Environment Australia, 1999. Declines and Disappearances of Australian frogs. (Ed) Alastair Campbell Biodiversity Group Environment Australia GPO Box 787 Canberra ACT 2601
Summary: Available from: http://www.environment.gov.au/biodiversity/threatened/publications/pubs/frogs.pdf [Accessed 5 March 2008]

FishBase, 2005. Species profile *Gambusia holbrooki* Eastern mosquitofish
Summary: FishBase is a global information system with all you ever wanted to know about fishes . FishBase on the web contains practically all fish species known to science. FishBase was developed at the WorldFish Center in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and many other partners, and with support from the European Commission (EC). Since 2001 FishBase is supported by a consortium of seven research institutions. You can search on Search FishBase
This species profile is available from:
http://www.fishbase.org/Summary/SpeciesSummary.cfm?ID=4521&genusname=Gambusia&speciesname=holbrooki [Accessed 21 March, 2005]
Galat, D.L. and Robertson, B. 1992. Response of endangered *Poeciliopsis occidentalis sonoriensis* in the Rio Yaqui drainage, Arizona, to introduced *Gambusia affinis*. *Environmental Biology of Fishes* 33: 249-264.
Gillespie, Graeme and Jean-Marc Hero, 1999. Potential Impacts of Introduced Fish and Fish Translocations on Australian Amphibians. In: Declines and Dissapearances of Australian Frogs. Alastair Campbell (editor). Biodiversity Group, Environment Australia, GPO Box 787, Canberra, ACT, 2601.
Girard, C. 1859. Ichthyological notices. *Proceeedings of the Academy of Natural Science, Philadelphia* 11: 56-68
Summary: This document first describes the species
Haas, R. C.; Thomas, M. V.; and Towns, G. L. 2003. *An Assessment of the Potential Use of Gambusia for Mosquito Control in Michigan.*Fisheries Technical Report 2003-2, Michigan Department of Natural Resources Fisheries Division.
Summary: A report recommending that *Gambusia* spp. Not be introduced to Michigan for mosquito control due to their negative effects on native biota.
Available from:http://www.michigandnr.com/PUBLICATIONS/PDFS/ifr/ifrlibra/technical/abstracts/2003-2abstract.pdf
Howe, E.H.I. 1995. Studies in the biology and reproductive characteristics of *Pseudomugil signifer*. PhD thesis, University of Technology, Sydney, NSW.
ITIS (Integrated Taxonomic Information System), 2005. Online Database *Gambusia holbrooki*
Summary: An online database that provides taxonomic information, common names, synonyms and geographical jurisdiction of a species. In addition links are provided to retrieve biological records and collection information from the Global Biodiversity Information Facility (GBIF) Data Portal and bioscience articles from BioOne journals.
Available from:
http://www.cbif.gc.ca/pls/itisca/taxastep?king=every&p_action=containing&taxa=Gambusia+holbrooki&p_format=&p_ifx=plglt&p_lang= [Accessed March 2005]
Ivantsoff, W. and Aarn. 1999. Detection of predation on Australian native fishes by *Gambusia holbrooki*. *Marine and Freshwater Research* 50: 467-8.
Keith, P. 2002. Freshwater fish and decapod crustacean populations on Reunion island, with an assessment of species introductions. bull. Fr. P&#xfffd;che Piscic,, 364, 97-107.
Summary: Cet article propose un bilan de la connaissance des esp&#xfffd;ces de poissons et des crustac&#xfffd;s d&#xfffd;capodes pr&#xfffd;sents dans les eaux douces de La R&#xfffd;union avec une synth&#xfffd;se des esp&#xfffd;ces introduites.
Knight, J.T. 1999. Density dependent interference competition between the Australian native fish *Pseudomugil signifer* (Kner, 1865) and the introduced Poeciliid *Gambusia holbrooki* (Girard, 1859). Southern Cross University, Integrated project prepared as partial fulfilment of the requirements of the B. App. Sc. (Fisheries and Aquaculture Management).
Lloyd, L. 1984. Exotic Fish: Useful Additions or Animal Weeds ? Journal of the Australian New Guinea Fishes Association, 1(3): 31-42.
Lloyd, L.N. 1990. Ecological interactions of *Gambusia holbrooki* with Australian native fishes, pp. 94-97. In: D.A. Pollard (ed.), Introduced and translocated fishes and their ecological effect. Australian Government Publishing Service, Canberra.
McDowall, R.M. 1996. Family Poeciliidae: Livebearers., p.247. In: R.M. McDowall (ed) Freshwater fishes of south-eastern Australia, Reed Books, Chatswood, NSW.
Meffe, G.K. 1984. Effects of abiotic disturbance on coexistence of predator-prey fish species. Ecology, 65: 1525-1534.
New South Wales (NSW) National Parks & Wildlife Service. 2004. *Predation by the plague minnow (Gambusia holbrooki) - key threatening process declaration.*
Summary: Outlines the final determination by the NSW Scientific Committee that *G. holbrooki* is a threat to a number of endangered native Australian frog species.
Available from:
http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Predation+by+the+plague+minnow+Gambusia+holbrooki+key+threatening+process+declaration. [Accessed 18 January, 2005].
Pen, L.J. and Potter, I.C. 1991. Reproduction, growth and diet of <1>Gambusia holbrooki (Girard) in a temperate Australian river. Aquatic Conservation: Marine and Freshwater Ecosystems, 1: 159-172.
Speczi&#xfffd;r, A. 2004. Life history pattern and feeding ecology of the introduced eastern mosquitofish, *Gambusia holbrooki*, in a thermal spa under temperate climate, of Lake H&#xfffd;v&#xfffd;z, Hungary.
Summary: A study of *G. holbrooki* population dynamics in an extreme environment.