GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Oreochromis mossambicus***

Oreochromis mossambicus 简体中文 正體中文

System: Freshwater

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Actinopterygii	Perciformes	Cichlidae

Common name

Mozambikskaya tilapiya (Russian, Russian Federation), nkobue (Sena, Mozambique), mojarra (Spanish, Mexico), tilapia mozámbica (Spanish, Mexico), tilapia del Mozambique (Spanish), Mozambique mouth-breeder (English), Mozambique mouthbrooder (English), Mozambique tilapia (English), tilapia mossambica (English, Dominican Republic), kawasuzume (Japanese), blou kurper (Afrikaans, South Africa), fai chau chak ue (Cantonese, Hong Kong), tilapia (English, Bangladesh), common tilapia (English, Fiji), Java tilapia (English, Fiji), kurper bream (English, Hong Kong), Mozambique cichlid (English, India), malea (Fijian), tilapia du Mozambique (French), mujair (Javanese, Indonesia), trey tilapia khmao (Khmer, Cambodia), wu-kuo yu (Mandarin, Taiwan), mphende (Nyanja, Malawi), weißkehlbarsch (German), mosambik-maulbrüter (German)

Synonym

Tilapia mossambica , (Peters, 1852)
Sarotherodon mossambicus , (Peters, 1852)
Chromis dumerilii , Steindachner, 1864
Chromis vorax , Pfeffer, 1893
Chromis natalensis , Weber, 1897
Tilapia arnoldi , Gilchrist & Thompson, 1917

Similar species

Oreochromis

Summary

Oreochromis mossambicus (Mozambique tilapia) has spread worldwide through introductions for aquaculture. Established populations of Oreochromis mossambicus in the wild are as a result of intentional release or escapes from fish farms. Oreochromis mossambicus is omnivorous and feeds on almost anything, from algae to insects.

view this species on IUCN Red List

Species Description

28-31 vertebrae; dorsal spines XV-XVII; total dorsal rays 26-29; 30-32 lateral line scales; anal spines III, lower outer gill rakers 14-20; fine pharyngeal teeth; breeding males black (not in some cultured strains) with white lower parts on head; red dorsal and caudal fin margins; remnants of striped and barred pattern often visible in females, juveniles and non-breeding makes, as a series of mid-lateral and dorsal blotches; jaws of adult males greatly enlarged, concave dorsal head profile; male genital papilla simple or slightly notched; caudal fin not densely scaled.

Notes
Mozambique tilapia (*Oreochromis mossambicus*) are easy to keep and breed in captivity.
The so-called red tilapia in aquaculture is a hybrid between *O. mossambicus* and either *O. niloticus* or *O. hornorum*. *O. mossambicus* is the research subject of many physiological and biochemical studies in Asia.
The mouthbrooding habit of this species allows it to nurture and carry its young long distances to invade habitats far from the original site of introduction (Costa-Pierce, 2003).
Outside of Asia exotic tilapia fishes were not imported directly from Africa, but arrived as transits from third or fourth party sources. Founder populations may be morphologically and meristically distinct in Africa but are still reproductively compatible due to their recent divergence (Costa-Pierce, 2003).

Lifecycle Stages
Size and age of sexual maturity varies according to environmental conditions, with spawning in ponds at 2-3 months and 6-10cm for females and 7-13cm for males at intervals of 1- 5 months. In natural conditions sexual maturity at greater age and size.

Habitat Description
Many tilapias (*Oreochromis* spp.) can live quite happily in seawater. The fact that they have not typically invaded coral reefs is perhaps due to predation by marine fishes. (Courtenay, W., pers. comm., 2004).
Mozambique tilapia (*Oreochromis mossambicus*) is very hardy and tolerates the high salinities of atoll lagoons, such as that at Fanning Atoll (Lobel, 1980). Thought to be ideal pond fish, they readily produce stunted stocks when overcrowded, as has been observed on Pagan in the Northern Mariana Islands (Eldredge, 2000).

Reproduction
Egg-layer. Male builds spawning bowers. Up to 1775 ripe eggs in one female. Hatching after 3-5 days; fry released 10-14 days after spawning, but mouthbrooded for about another week; more than one brood per season.
Reproductive performance of tilapias is affected by salinity, which suppresses the aggression of dominant males. *O. mossambicus* can reproduce at 35 and 49 ppt (Bhujel, 2000).

Nutrition
Mozambique tilapia (*Oreochromis mossambicus*) are opportunistic feeders; juveniles are mainly omnivorous, while adults mainly feed on detritus.

General Impacts
When introduced, Mozambique tilapia (*Oreochromis mossambicus*) may be a possible threat to native species through competition for food and nest space. Juveniles have been documented to feed on other fish (de Moor *et al*. 1986). Tilapia are now generally considered to be pests. Eradication has been suggested on Tarawa and Nauru (Eldredge, 2000).
In Hawai‘i, this species is suspected to be a threat to native species such as striped mullet (*Mugil cephalus*) (Randall 1987; Devick 1991). Tilapia also have been considered a major factor in the decline of the desert pupfish (*Cyprinodon macularius*) in the Salton Sea area (Courtenay and Robins, 1989; Swift *et al.* 1993).
Because of its presence in Dade County, Florida, Courtenay (1989) indicated that the Mozambique tilapia may eventually enter Everglades National Park.

Management Info
Mozambique tilapia (*Oreochromis mossambicus*) are hardy and can easily establish in natural waters near aquaculture ponds or cages, from which they may escape during loading-harvesting or *via* containment failures. Mozambique tilapia are particularly hardy, resistant to wide varieties of water salinity oxygen and pollution levels, and can migrate long distances. They are difficult to catch by angling. They occupy a wide range of habitats, and reproduce rapidly and successfully. Removal from natural water resources where they have established may be impossible. The most effective management is complete isolation of individuals from natural waters to prevent introductions. Established populations may require intensive fishing to prevent overpopulations from affecting native populations (Jeffrey McCrary pers.comm May 2005).
Preventative measures: The use of potentially invasive alien species for aquaculture and their accidental release/or escape can have negative impacts on native biodiversity and ecosystems. Hewitt *et al*, (2006) Alien Species in Aquaculture: Considerations for responsible use aims to first provide decision makers and managers with information on the existing international and regional regulations that address the use of alien species in aquaculture, either directly or indirectly; and three examples of national responses to this issue (Australia, New Zealand and Chile). The publication also provides recommendations for a 'simple' set of guidelines and principles for developing countries that can be applied at a regional or domestic level for the responsible management of Alien Species use in aquaculture development. These guidelines focus primarily on marine systems, however may equally be applied to freshwater.
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)).

Pathway
Mozambique tilapia (*Oreochromis mossambicus*) have been introduced to many locations mainly for aquaculture. Mozambique tilapia has been directly introduced as a fishery resource by governmental agencies and individual anglers into natural waters th

Principal source:

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Pubblication date: 2006-06-22

ALIEN RANGE

[1] ALGERIA
[1] ANTIGUA AND BARBUDA
[44] AUSTRALIA
[1] BANGLADESH
[1] BENIN
[1] BRAZIL
[1] CAMBODIA
[1] COLOMBIA
[1] COOK ISLANDS
[1] CUBA
[1] AMERICAN SAMOA
[1] ARGENTINA
[3] BAHAMAS
[1] BARBADOS
[1] BOLIVIA
[1] BURUNDI
[1] CHINA
[1] CONGO
[1] COSTA RICA
[1] CZECH REPUBLIC

[1] DOMINICA
[1] ECUADOR
[1] EL SALVADOR
[1] FRENCH POLYNESIA
[1] GUADELOUPE
[1] GUATEMALA
[1] HAITI
[1] HONG KONG
[3] INDONESIA
[1] JAMAICA
[1] JORDAN
[2] KIRIBATI
[1] MADAGASCAR
[1] MALDIVES
[1] MARTINIQUE
[1] MICRONESIA, FEDERATED STATES OF
[1] NAURU
[1] NEW CALEDONIA
[1] NIUE
[1] PAKISTAN
[1] PANAMA
[1] PERU
[1] PUERTO RICO
[2] RUSSIAN FEDERATION
[1] SAMOA
[1] SEYCHELLES
[2] SOLOMON ISLANDS
[9] SRI LANKA
[1] TAIWAN
[1] TONGA
[1] TUNISIA
[1] UGANDA
[41] UNITED STATES
[2] VENEZUELA
[1] WALLIS AND FUTUNA
[1] DOMINICAN REPUBLIC
[1] EGYPT
[2] FIJI
[1] GRENADA
[1] GUAM
[1] GUYANA
[1] HONDURAS
[4] INDIA
[1] ISRAEL
[1] JAPAN
[1] KENYA
[1] KOREA, REPUBLIC OF
[1] MALAYSIA
[1] MALTA
[3] MEXICO
[1] NAMIBIA
[1] NEPAL
[2] NICARAGUA
[2] NORTHERN MARIANA ISLANDS
[1] PALAU
[1] PAPUA NEW GUINEA
[1] PHILIPPINES
[1] REUNION
[1] SAINT LUCIA
[1] SAUDI ARABIA
[1] SINGAPORE
[3] SOUTH AFRICA
[1] SURINAME
[1] THAILAND
[1] TRINIDAD AND TOBAGO
[1] TUVALU
[1] UNITED KINGDOM
[2] VANUATU
[2] VIET NAM

Red List assessed species 21: CR = 2; EN = 9; VU = 7; LC = 3;

Barbus andrewi **EN**
Crossocheilus periyarensis **EN**
Etroplus suratensis **LC**
Garra menoni **VU**
Horadandia atukorali **LC**
Hypselobarbus periyarensis **EN**
Mesonoemacheilus pambarensis **VU**
Nemacheilus periyarensis **VU**
Rohtee ogilbii **LC**
Tor khudree **EN**
Travancoria jonesi **EN**
Chirostoma bartoni **VU**
Devario fraseri **VU**
Garra ghorensis **CR**
Garra periyarensis **VU**
Hypselobarbus curmuca **EN**
Lepidopygopsis typus **EN**
Nemacheilus menoni **VU**
Puntius chalakkudiensis **EN**
Tilapia guinasana **CR**
Travancoria elongata **EN**

BIBLIOGRAPHY
70 references found for **Oreochromis mossambicus**

Managment information
Aguirre, W. and Poss, S. 1999. *Oreochromis mossambicus* (Peters, 1852). University of Mississippi, College of Marine Sciences, Gulf Coast Research Laboratory Museum.

Summary: Chapter on *Oreochromis mossambicus* from a list of non-indigenous species in the Gulf of Mexico ecosystem.

Baird, R. 1976. Historical review of the SPC fisheries activities. South Pacific Commission, Noumea. 5 pp.
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]
Cossios E. Daniel, 2010. Vertebrados naturalizados en el Per&#65533;: historia y estado del conocimiento (Naturalised vertebrates in Peru: history and state of knowledge) Rev. peru. biol. 17(2): 179 - 189 (Agosto 2010)
Summary: Available from: http://sisbib.unmsm.edu.pe/BVrevistas/biologia/v17n2/pdf/a07v17n2.pdf [Accessed 23 February 2011]
Courtenay, W. R., Jr. 1989. Exotic fishes in the National Park System. Pages 237-252 in L. K. Thomas, editor. Proceedings of the 1986 Conference on science in the national parks, volume 5. Management of exotic species in natural communities. U.S. National Park Service and George Wright Society, Washington, DC.
Courtenay, W. R., Jr. and Robins, C. R. 1989. Fish introductions: good management, mismanagment, or no management? CRC Critical Reviews in Aquatic Sciences 1(1): 159-172.
De Silva, S.S; Subasinghe, R.P.; Bartley, D.M.; Lowther, A. 2004. Tilapias as alien aquatics in Asia and the Pacific: a review. FAO Fisheries Technical Paper. No. 453. Rome, FAO. 2004. 65p.
Summary: This document reviews and analyses published literature, grey literature, and personal communications on the social, economic and environmental impacts of tilapias in the Asia and the Pacific.
Available from: http://www.fao.org/docrep/007/y5728e/y5728e00.htm [Accessed 3 March 2008]
Eldredge, L. G. 2000. Non-indigenous freshwater fishes, amphibians, and crustaceans of the Pacific and Hawaiian islands. In Invasive Species in the Pacific: A Technical Review and Draft Regional Strategy. South Pacific Regional Environment Programme, Samoa: 173-190
Summary: Discusses the most invasive freshwater fish in the Pacific region and also includes a checklist of introduced fish to the Pacific.
Hewitt, C.L, Campbell, M.L. and Gollasch, S. 2006. Alien Species in Aquaculture. Considerations for responsible use. IUCN, Gland, Switzerland and Cambridge, UK. viii + 32 pp.
Summary: This publication aims to first provide decision makers and managers with information on the existing international and regional regulations that address the use of alien species in aquaculture, either directly or indirectly; and three examples of national responses to this issue (New Zealand, Australia and Chile).
Available from: http://data.iucn.org/dbtw-wpd/edocs/2006-036.pdf [Accessed 22 September 2008]
Hogan, A. and Vallance, T. (undated). An assessment of an NHT project to re-establish riparian zones as a Tilapia control measure. *Queensland Department of Primary Industries*, Walkamin QLD.
Summary: A management plan that aims to reduce tilapia numbers by improving stream habitat quality.

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].
Ranoemihardjo, B. S. 1981. Nauru: eradication of tilapia from fresh- and brackish-water lagoons and ponds with a view of promoting milkfish culture. FI:DP/NAU/78/001 Field Document 1, FAO, Rome.
Trewavas, E. 1983. Tilapiine fishes of the genera *Sarotherodon*, *Oreochromis* and *Danakilia*. British Museum (Natural History), London, UK: 292-315.
Summary: Taxonomic account and compilation of other biological data available for the mouth-brooding tilapias.

General information
Adams, T.; Bell, J. and Labrosse, P. 2000. Current status of aquaculture in the Pacific Islands. In *Aquaculture in the Third Millennium*, Subasinghe, R.P., Bueno, P., Phillips, M.J., Hough, C., McGladdery, C.E., Arthur, J.R.(eds.), Technical Proceedings of the Conference on Aquaculture in the Third Millennium. 20-25 February 2000, Bangkok, Thailand. pp. 295-305.
Summary: One record of tilapia in Nauru.
Aiken, K. A.; Morris, D.; Hanley, F. C.; and Manning, R. 2002 (July-Dec). Aquaculture in Jamaica. *Naga, Worldfish Centre Quarterly* 25(3&4): 10-15.
Summary: Information on tilapia aquaculture in Jamaica.
Alcocer, J.; Escobar, E.; and Lugo, A. 2000. Water use (and abuse) and its effects on the crater-lakes of Valle de Santiago, Mexico. *Lakes & Reservoirs: Research and Management* 5: 145-149.
Summary: Outlines the effects of tilapia in the crater-lakes of Valle de Santiago, Mexico.
Amarasinghe, U. S. and De Silva, S. S. 1999. Sri Lankan reservoir fishery: a case for introduction of a co-management strategy. *Fisheries Management and Ecology* 6: 387-399.
Summary: Information on tilapia fisheries in Sri Lanka.
Arthington, A. H. and McKenzie, F. 1997. Review of impacts of displaced/introduced fauna associated with inland waters. *Australia: State of the Environment Technical Paper Series (Inland Waters)*, Department of the Environment, Canberra.
Summary: Information on the distribution of tilapia within Australia.
Barton, M. 1999. Threatened fishes of the world: *Cyprinodon laciniatus* Hubbs & Miller, 1942 (Cyprinodontidae). *Environmental Biology of Fishes* 55: 422.
Summary: Information on the effects of tilapia on the Bahama pupfish.
Bhujel, R. C. 2000. A review of strategies for the management of Nile tilapia (*Orechromis niloticus*) broodfish in seed production systems, especially hapa-based systems. *Aquaculture* 181: 37-59.
Summary: A small amount of information on the effects of salinity on breeding in *O. mossambicus*.
Bios. 2002. R&#65533;alisation d un atlas des eaux douces de la Guadeloupe. Rapport d avancement des travaux. Septembre 2002.
Coles, S. L. and Eldredge, L. G. 2002. Nonindigenous species introductions on coral reefs: a need for information. *Pacific cience* 56(2): 191-209.
Summary: Has one record of tilapia in Hawaii.
Coles, S. L.; DeFelice, R. C.; Eldredge, L. G.; and Carlton, J. T. 1999. Historical and recent introductions of non-indigenous marine species into Pearl Harbor, Oahu, Hawaiian Islands. *Marine Biology* 135: 147-158.
Summary: A record of tilapia in Pearl Harbor.

CONABIO. 2008. Sistema de informaci□n sobre especies invasoras en M□xico. Especies invasoras - Peces. Comisi□n Nacional para el Conocimiento y Uso de la Biodiversidad. Fecha de acceso.
Summary: English:
The species list sheet for the Mexican information system on invasive species currently provides information related to Scientific names, family, group and common names, as well as habitat, status of invasion in Mexico, pathways of introduction and links to other specialised websites. Some of the higher risk species already have a direct link to the alert page. It is important to notice that these lists are constantly being updated, please refer to the main page (http://www.conabio.gob.mx/invasoras/index.php/Portada), under the section Novedades for information on updates.
Invasive species - fish is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Peces [Accessed 30 July 2008]
Spanish:
La lista de especies del Sistema de informaci□n sobre especies invasoras de m□xico cuenta actualmente con informaci□n aceca de nombre cient□fico, familia, grupo y nombre com□n, as□ como h□bitat, estado de la invasi□n en M□xico, rutas de introducci□n y ligas a otros sitios especializados. Algunas de las especies de mayor riesgo ya tienen una liga directa a la p□gina de alertas. Es importante resaltar que estas listas se encuentran en constante proceso de actualizaci□n, por favor consulte la portada (http://www.conabio.gob.mx/invasoras/index.php/Portada), en la secci□n novedades, para conocer los cambios.
Especies invasoras - Peces is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Peces [Accessed 30 July 2008]
Contreras-MacBeath, T.; Mojica, H .M.; and Wilson, R. C. 1998. Negative impact on the aquatic ecosystems of the state of Morelos, Mexico from introduced aquarium and other commercial fish. *Aquarium Sciences and Conservation* 2: 67-78.
Summary: A small amount of information on the stocking of tilapia in the state of Morelos, Mexico.
Costa-Pierce, B. A. 2003. Rapid evolution of an established feral tilapia (*Oreochromis* spp.): the need to incorporate invasion science into regulatory structures. *Biological Invasions* 5: 71-84.
Summary: Contains information about the native range and introduced distribution of tilapia.
de Moor, F. C., Wilkinson, R. C. & Herbst, H. M. 1986. Food and feeding habits of *Oreochromis mossambicus* (Peters) in hypertrophic Hartbeespoort Dam, South Africa. South African Journal of Zoology 21, 170□176.
Department of Primary Industries and Fisheries (DPIS), 2005. Tilapia (Mozambique mouthbrooder). The State of Queensland, Department of Primary Industries and Fisheries.
Summary: Good information on tilapia distribution in Queensland.
Available from: http://www2.dpi.qld.gov.au/fishweb/1406.html [Accessed 3 March 2008]
Devick, W. S. 1991. Patterns of introductions of aquatic organisms to Hawaiian freshwater habitats. Pages 189-213 In: *New directions in research, management and conservation of Hawaiian freshwater stream ecosystems.* Proceedings of the 1990 Symposium on Freshwater Stream Biology and Fisheries Management, Division of Aquatic Resources, Hawaii Department of Land and Natural Resources.
Edwards, R. J. 2001. New additions and persistence of the introduced fishes of the upper San Antonio River, Bexar County , Texas. *The Texas Journal of Science* 53(3).
Summary: Information on the effects of tilapia in the upper San Antonio River.
Available from: http://www.findarticles.com/p/articles/mi_hb321/is_200102/ai_n6404955 [Accessed 2 February 2005]
Eldredge, L. G. 2000. Non-indigenous freshwater fishes, amphibians, and crustaceans of the Pacific and Hawaiian islands. In: *Invasive species in the Pacific: a technical review and draft regional strategy*. Sherley, G (ed). South Pacific Regional Environmental Programme (SPREP). Apia, Samoa.
Summary: Lists locations where tilapia have been established and their impacts.
FishBase, 2005. Species profile *Oreochromis mossambicus* Mozambique tilapia
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=3 [Accessed 21 March, 2005]
Food and Agriculture Organisation of the United Nations (FAO), 1998. Aquatic Species Introductions Database (DIAS).
Summary: The database includes records of aquatice species introduced or transferred from one country to another and does not consider movements of species inside the same country. Coverage of accidental introductions of organisms (e.g., through ship ballast waters) is not complete and records on this topic have been generally entered only when important impacts on fisheries or on the environment have been caused.
Food and Agriculture Organisation of the United Nations (FAO), 2004. Database on Introductions of Aquatic Species. Food and Agriculture Organization of the United Nations.
Summary: Available from:http://www.fao.org/fishery/introsp/search [Accessed 2 February 2005]
Fuselier, L. 2001. Impacts of *Oreochromis mossambicus* (Perciformes: Cichlidae) upon habitat segregation among cyprinodontids (Cyprinodontiformes) of a species flock in Mexico. *Revista de Biolog□a Tropical* 49(2): 647-656.
Summary: Impacts of tilapia upon native fish in Mexico.
Available from: [Accessed 2 February 2005]
Gargominy, O., Bouchet, P., Pascal, M., Jaffre, T. and Tourneu, J. C. 1996. Consequences des introductions d'especes animals et vegetales sur la biodiversite en Nouvelle-Caledonie. Rev. Ecol. (Terre Vie) 51: 375-401.
Summary: Consequences to the biodiversity of New Caledonia of the introduction of plant and animal species.
Impson, N. D.; Bills, I. R.; and Cambray, J. A. 2000. State of Biodiversity: Western Cape Province, South Africa Freshwater Fishes. *Western Cape State of Biodiversity 2000.*
Summary: Information on tilapia in South Africa s Western Cape Province.

ITIS (Integrated Taxonomic Information System), 2005. Online Database *Oreochromis mossambicus*
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=Oreochromis+mossambicus&p_format=&p_ifx=plglt&p_lang= [Accessed March 2005]
Jang, M.; Kim, J.; Park, S.; Jeong, K.; Cho, G.; and Joo, G. 2002. The current status of the distribution of introduced fish in large river systems of South Korea. *International Review of Hydrobiology*. 87(2-3): 319-328.
Summary: Information on tilapia in South Korea.
Jory, D.; Cabrera, T.; Polanco, B.; S�nchez, R.; Mill�n, J.; Rosas, J.; Alceste, C.; Garcia, E.; Useche, M.; and Agudo, R. 1999. Aquaculture in Venezuela: perspectives. *Aquaculture Magazine* 25(5).
Summary: Information on the commercial production of tilapia in Venezuela.
Keith, P. 2002. Freshwater fish and decapod crustacean populations on Reunion island, with an assessment of species introductions. Bull. Fr. P�che Piscic., 364, 97-107.
Summary: Cet article propose un bilan de la connaissance des esp�ces de poissons et des crustac�s d�capodes pr�sents dans les eaux douces de La R�union avec une synth�se des esp�ces introduites.
Keith, P. 2002. Revue des introductions de poissons et de crustac�s d�capodes d eau douce en Polyn�sie fran�aise. Bull. Fr. P�che Piscic, 364, 147-160.
Summary: Cet article fait le bilan des introductions d esp�ces dul�aquicoles en Polyn�sie fran�aise.
Keith, P. 2002. Threatened fishes of the world: *Galaxias neocaledonicus* Weber & de Beaufort, 1913 (Galaxidae). *Environmental Biology of Fishes* 63: 26.
Summary: Information on the effects of tilapia on an endangered New Caledonian fish.
Keith, P., Marquet, G., Valade, P., Bosc, P. & Vigneux, E. 2006. Atlas des poissons et crustac�s d�eau douce des Comores, Mascareignes et Seychelles. MNHN, Patrimoines naturels, vol. 67, Paris, 158p.
Keith, P., Vigeux, E. & P. Bosc. 1999. Atlas des poissons et crustac�s d�eau douce de la R�union. Patrimoines Naturels (M.N.H.N./S.P.N.), 39 : 136pp.
Keith P., Vigneux E. and G. Marquet. 2002. Atlas des poissons et crustac�s d�eau douce de la Polyn�sie fran�aise. Patrimoines naturels, (MNHN), 55 :1-175.
Lim, P., Meunier, F., Keith, P., & No�l, P. 2002. Atlas des poissons et des crustac�s d eau douce de la Martinique (ed P. Naturels), Vol. 51, 120 p. MNHN.
Lobel, P. S. 1980. Invasion by the Mozambique tilapia (*Sarotherodon mossambicus*; Pisces; Cichlidae) of a Pacific atoll marine ecosystem. Micronesica 16(2): 349�355.
Marquet, G., Keith, P., Vigneux, E. 2003. Atlas des poissons et des crustac�s d eau douce de Nouvelle-Cal�donie. Paris, Mus�um national d�histoire naturelle, Collection Patrimoines Naturels 58, 282 p
Mather, P. B. and Nandlal, S. 2000 (Oct-Dec). Progress towards providing Fijian farmers with a better tilapia strain: evaluation of the GIFT fish in Fiji. *Naga, The ICLARM Quarterly* 23(4): 46-49.
Summary: Information on tilapia aquaculture in Fiji.
Morgan, D. L.; Gill, H. S.; Maddern, M. G.; and Beatty, S. J. 2004. Distribution and impacts of introduced freshwater fishes in Western Australia. *New Zealand Journal of Marine and Freshwater Research* 38: 511-523.
Summary: Useful information on the distribution of tilapia in Western Australia.
Mus�um national d Histoire naturelle [Ed]. 2003-2006 . *Oreochromis mossambicus*. Inventaire national du Patrimoine naturel, site Web : http://inpn.mnhn.fr. Document t�l�charg� le 28 mars 2008 .
Summary: Available from:http://inpn.mnhn.fr/isb/servlet/ISBServlet?action=Espece&typeAction=10&pageReturn=ficheEspeceDescription.jsp&numero_taxon=419269 [Accessed March 2008]
Neira, I and Engle, C. 2003. Potential for restaurant markets for tilapia in Nicaragua. *Aquaculture CRSP Research Report 03-192*, August 2003.
Summary: A small amount of information on tilapia in Nicaragua.
Available from: http://pdacrsp.oregonstate.edu/pubs/nops/pdfs/03-192.pdf [Accessed 2 February 2005]
Nico, L. 2005, *Oreochromis mossambicus*. Nonindigenous Aquatic Species Database, Gainesville, Florida. Revision Date: 12/8/2004
Summary: A substantial database record of *O. mossambicus* within the US.
Available from: http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=466 [Accessed 3 March 2008]
Pascal, M., Barr�, N., De Garine-Wichatitsky, Lorvelec, O., Fr�tey, T., Brescia, F., Jourdan, H. 2006. Les peuplements n�o-cal�doniens de vert�b�br�s : invasions, disparitions. Pp 111-162, in M.-L. Beauvais *et al*., : Les esp�ces envahissantes dans l�archipel n�o-cal�donien, Paris, IRD �ditions, 260 p.+ c�d�rom
Summary: Synth�se des introductions d esp�ces de vert�br�s en Nouvelle-Cal�donie et �valuation de leurs impacts.
Powell, J. H. and Powell, R. E. 1999. The freshwater icthyofauna of Bougainville Island, Papua New Guinea. *Pacific Science* 53(4): 346-356.
Summary: Information on tilapia in Papua New Guniea.
Available from: [Accessed 2 February 2005]
Randall, J. E. 1987. Introductions of marine fishes to the Hawaiian Islands. Bulletin of Marine Science 41(2): 490-502.
Riedel, R.; Caskey, L.; and Costa-Pierce, B. A. 2002. Fish biology and fisheries ecology of the Salton Sea, California. *Hydrobiologia* 473: 229-244.
Summary: Information on tilapia in the Salton Sea and information on the location itself.
Riedel, R.; Helvenston, L.; and Costa-Pierce, B. A. 2002. Final Report: Fish biology and fisheries ecology of the Salton Sea.
Summary: Information on the presence of tilapia in the Salton Sea, California.
Available from: http://www.waterrights.ca.gov/IID/IIDHearingData/LocalPublish/DOW13.pdf [Accessed 2 February 2005]

Steffens, W. and Hilge, V. 1999. The importance of tilapias (Cichlidae) for tropical aquaculture. *Deutscher Tropentag 1999*, Berlin, Germany.
Summary: Information on worldwide commercial production of tilpia.
Sugunan, V. V. 2000. Ecology and fishery management of reservoirs in India. *Hydrobiologia* 430: 121-147.
Summary: Information on tilapia in Indian reservoirs.
Swift, C. C., Haglund, T. R., Ruiz, M. and Fisher R. N. 1993. The status and distribution of the freshwater fishes of southern California. *Bulletin of the Southern California Academy of Science* 92(3): 101-167.
Teroroko, T. 1982. Tilapia considered as a predator in milkfish ponds in Kiribati. Unpubl. report, Temaiku Fish Farm, Tarawa.
Thys van den Audenaerde, D. F. E. 1988. Natural distribution of tilapias and its consequences for the possible protection of genetic resources. In Pullin, R. S. V. (ed.) Tilapia genetic resources for aquaculture. ICLARM, Manila: 1-12.
Summary: Overview of the natural distributions and introductions of the tilapias important for aquaculture.
Vasil eva, E. D. 2003. Main alterations in ichthyofauna of the largest rivers of the northern coast of the Black Sea in the last 50 years: a review. *Folia Zoologica* 52(4): 337-358.
Summary: Has records of tilapia in the region of the Black Sea.
Wager, R. and Jackson, P. 1993. The Action Plan for Australian Freshwater Fishes. *Department of the Environment and Heritage*.
Summary: Outlines the distribution of tilapia in Australia.
Available from: http://www.environment.gov.au/biodiversity/threatened/publications/action/fish/index.html [Accessed 3 March 2008]
Watson, L. H. and Lang, A. J. 2003. Diet of Cape clawless otters in Groenvlei Lake, South Africa. *South African Journal of Wildlife Research* 33(2): 135-137.
Summary: Mentions that tilapia make up part of the diet of the Cape clawless otter in Groenvlei Lake.
Whitfield, A. K. 1999. Icthyofaunal assemblages in estuaries: a South African case study. *Reviews in Fish Biology and Fisheries* 9: 151-186.
Summary: Information on the habitat prefernces of tilapia in South Africa.