

Azolla pinnata [简体中文](#) [正體中文](#)

System: Terrestrial

Kingdom	Phylum	Class	Order	Family
Plantae	Pteridophyta	Filicopsida	Hydropteridales	Azollaceae

Common name mosquito fern (English), ferny azolla (English), water velvet (English)

Synonym

Similar species *Azolla* spp.

Summary *Azolla pinnata* can spread rapidly, and has the ability to survive on moist soil in and around rivers, ditches, and ponds. It forms dense surface mats, which degrade water quality by reducing oxygen levels, and can interfere with boating, fishing and recreational activities.



[view this species on IUCN Red List](#)

Species Description

"Plants small, 1.5 - 2.5cm long, with a more or less straight main axis with pinnately arranged side **branches**, progressively longer towards the base, thus roughly triangular in shape, the basal branches themselves becoming pinnate and eventually fragmenting as the main axis decomposes to form new plants. Roots with fine lateral rootlets, having a feathery appearance in the water. **Leaves** minute, 1 -2mm long, overlapping in 2 ranks, upper lobe green, brown green or reddish, lower lobe translucent brown; minute, short, plae, +/- cylindrical unicellular hairs often present on the upper lobes. When fertile, round **sporocarps** 1 - 1.5mm wide can be seen on the under side at the bases of the side branches. The leaves often have a maroon-red tinge and the water can appear to be covered by red velvet from the distance. The upper surface of the leaves are totally water-repellant, and if completely submerged the plants quickly refloat with the right side up."

Uses

Azolla is useful as a "soybean plant in rice field", because it can assimilate atmospheric nitrogen gas owing to the nitrogen fixation by cyanobacteria (blue green alga) living in the cavities located at the lower side of upper (dorsal) lobes of leaf. (Duke)

Habitat Description

It has the ability to survive on moist soil in and around rivers, ditches, and ponds which may allow the plant to survive low water levels and periods of drought. (NC Aquatic Fact Sheet)

Reproduction

Generally it multiplies vegetatively, and by spores. In the right conditions *A. pinnata* can double its biomass in 5 to 10 days in the field. (Duke)

Nutrition

Azolla species can often grow on nitrogen poor water due to nitrogen fixing ability. However will grow very rapidly in high nitrogen habitats.



GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: *Azolla pinnata*

General Impacts

Azolla pinnata can spread very quickly forming dense vegetative masses on areas of still water. This in turn limits light available to other aquatic plants and oxygen used by other aquatic life. It forms dense mats that choke out other species. *A. pinnata* is on the US noxious weed list. In New Zealand has replaced a native floating fern, *Azolla rubra*, over most of northern New Zealand. *Azolla* lives in symbiosis with blue-green algae (cyanobacteria), taking advantage of their ability to fix nitrogen. It is sometimes introduced and used by farmers as a natural fertilizer for this reason.

Management Info

Chemical: [Fact sheet](#) on control of *Azolla* from Queensland, Australia, DNR.

Biological: There was some success in management of *A. pinnata* using weevils in South Africa although the study was aimed primarily at *Azolla filiculoides*.

Pathway

Possible introduced to New Guinea with cattle. *Azolla* lives in symbiosis with blue-green algae (cyanobacteria), taking advantage of their ability to fix nitrogen. It is sometimes introduced and used by farmers as a natural fertilizer for this reason. (PIER, 2003)

Principal source: [Pacific Islands Ecosystems at Risk, \(PIER\)](#)

Compiler: IUCN/SSC Invasive Species Specialist Group (ISSG)

Review:

Publication date: 2010-05-26

ALIEN RANGE

[1] NEW ZEALAND

[1] UNITED STATES

BIBLIOGRAPHY

32 references found for *Azolla pinnata*

Management information

Benton, N., Bell, G. and Swearingen, J. L. 1999. *Arundo donax* factsheet. Plant Conservation Alliance, Alien Plant Working Group.

Summary: Fact sheet

Champion, P., Clayton, J. and Rowe, D. 2002. *Alien Invaders Lake Managers Handbook*. Ministry for the Environment.

Summary: Available from: <http://www.mfe.govt.nz/publications/water/lm-alien-invaders-jun02.pdf> [Accessed 3 February 2005]

Champion, P.D.; Clayton, J.S. 2000. *Border control for potential aquatic weeds. Stage 1. Weed risk model. Science for Conservation 141.*

Summary: This report is the first stage in a three-stage development of a Border Control Programme for aquatic plants that have the potential to become ecological weeds in New Zealand.

Available from: <http://www.doc.govt.nz/upload/documents/science-and-technical/sfc141.pdf> [Accessed 13 June 2007]

Champion, P.D.; Clayton, J.S. 2001. *Border control for potential aquatic weeds. Stage 2. Weed risk assessment. Science for Conservation 185. 30 p.*

Summary: This report is the second stage in the development of a Border Control Programme for aquatic plants that have the potential to become ecological weeds in New Zealand. Importers and traders in aquatic plants were surveyed to identify the plant species known or likely to be present in New Zealand. The Aquatic Plant Weed Risk Assessment Model was used to help assess the level of risk posed by these species. The report presents evidence of the various entry pathways and considers the impact that new invasive aquatic weed species may have on vulnerable native aquatic species and communities.

Available from: <http://www.doc.govt.nz/upload/documents/science-and-technical/SFC185.pdf> [Accessed 13 June 2007]

Cowie, R. H. 2001. Can snails ever be effective and safe biocontrol agents?. *International Journal of Pest Management* 47: 23-40.

Summary: Discusses the use of land and freshwater snails as biological control agents against other snails and against aquatic weeds. Recommends snails not be used for biocontrol.

Daehler, C. C. and Strong, D. R. 1996. Status, predication, and prevention of introduced cordgrass *Spartina* spp. invasions in Pacific estuaries, U.S.A.. *Biological Conservation* 78: 51-58.

Summary: This paper uses *Spartina* species characteristics to predict which *Spartina* species will invade specific sites along the U.S. Pacific coast. Mean tidal ranges were then used to predict the extent of spatial spread of a *Spartina* sp. after colonization.

[European and Mediterranean Plant Protection Organization \(EPPO\), 2006. Guidelines for the management of invasive alien plants or potentially invasive alien plants which are intended for import or have been intentionally imported. EPPO Bulletin 36 \(3\), 417-418.](#)
[McConnachie A.J. ; M.P. de Wit, M.P. Hill, and M.J. Byrne., 2003. Economic evaluation of the successful biological control of *Azolla filiculoides* in South Africa Biological Control 28 25-32](#)

Summary: Available from: <http://www.wits.ac.za/apes/marcus/McConnachie%20et%20al%202003.pdf> [Accessed 11 May 2005]

[McConnachie A.J. ; M.P. Hill, and M.J. Byrne., 2004. Field assessment of a frond-feeding weevil, a successful biological control agent of red waterfern, *Azolla filiculoides*, in southern Africa Biological Control 29 326-331](#)

Summary: Available from: <http://www.wits.ac.za/apes/marcus/McConnachie%20et%20al%202004.pdf> [Accessed 11 May 2005]

[PIER \(Pacific Island Ecosystems at Risk\), 2003. *Azolla pinnata*](#)

Summary: Ecology, synonyms, common names, distributions (Pacific as well as global), management and impact information.

Available from: http://www.hear.org/pier/species/azolla_pinnata.htm [Accessed 23 October 2003]

General information

Bury, R. B. and Whelan, J. A. 1984. Ecology and management of the bullfrog. U.S. Dept. of the Interior, Fish and Wildlife Service, Resource Publication 155, Washington, D.C.

Summary: A comprehensive summary and critical review of information on the biology of the bullfrog related to its ecology, status, culture and management. Literature through 1982 is included.

[CONABIO. 2008. Sistema de informaci3n sobre especies invasoras en M3xico. Especies invasoras - Plantas. Comisi3n 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 - Plants is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Plantas [Accessed 30 July 2008]

Spanish:

La lista de especies del Sistema de informaci3n sobre especies invasoras de M3xico cuenta actualmente con informaci3n acerca de nombre cient3fico, familia, grupo y nombre com3n, as3 como h3bitat, estado de la invasi3n en M3xico, rutas de introducci3n y ligas a otros sitios especializados. Algunas de las especies de mayor riesgo ya tienen una liga directa a la p3gina de alertas. Es importante resaltar que estas listas se encuentran en constante proceso de actualizaci3n, por favor consulte la portada (<http://www.conabio.gob.mx/invasoras/index.php/Portada>), en la secci3n novedades, para conocer los cambios.

Especies invasoras - Plantas is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Plantas [Accessed 30 July 2008]

Duke, J.A. Innovative Biological Technologies for Lesser Developed Countries.

Summary: Includes section on potential use of *Azolla Pinnata* as a fertiliser.

Available from: www.wws.princeton.edu/cgi-bin/byteserv.prl/~ota/disk2/1985/8512/851214.PDF [Accessed 23 October 2003].

Fabres, G. and Brown, W. L. Jr. 1978. The recent introduction of the pest ant *Wasmannia auropunctata* into New Caledonia. Journal of the Australian Entomological Society 17: 139-142.

[ITIS \(Integrated Taxonomic Information System\), 2004. Online Database *Azolla pinnata*](#)

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.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=181820 [Accessed December 31 2004]

Kay, S. and Hoyle, S. 2000. Aquatic Weed Fact Sheet - *Azolla pinnata*. NC State University

Kupferberg, S. J. 1997. Bullfrog (*Rana catesbeiana*) invasion of a California river: the role of larval competition. Ecology 78(6): 1736-1751.

Summary: Native yellow-legged frogs, *Rana boylei*, were almost an order of magnitude less abundant in reaches where bullfrogs were well established. Competition from large overwintering bullfrog larvae significantly decreased survivorship and growth of native tadpoles.

Lafferty, K. D. and Page, C. J. 1997. Predation on the endangered tidewater goby, *Eucyclogobius newberryi*, by the introduced African clawed frog, *Xenopus laevis*, with notes on the frog's parasites. Copeia 1997: 589-592.

[Lake, 2000. Restoration of Lakes and Wetlands. India Institute of Science.](#)

Summary: A paper on the productivity of *A. pinnata* and of the effects of different environmental factors on its productivity.

Available from: http://ces.iisc.ernet.in/energy/water/proceed/proceedings_text/section2/paper3/section2paper3.htm [Accessed 23 October 2003]

MacIsaac, H. J. 1996. Potential abiotic and biotic impacts of zebra mussels on the inland waters of North America. Amer. Zool. 36: 287-299.

Mackie, G. L., Gibbons, W. N., Muncaster, B. W. and Gray, I. M. 1989. The zebra mussel, *Dreissena polymorpha*: a synthesis of European experiences and a preview for North America. Water Resources Branch, Great Lakes Section, Ontario Ministry of the Environment

Summary: Bibliographic review of biology, taxonomy, life history, anatomy, distribution, and impacts of zebra mussels, drawing from European literature. An annotated bibliography of European literature is included.

McCoid, M. J. 1985. An observation of reproductive behavior in a wild population of African clawed frogs, *Xenopus laevis*, in California. Calif. Fish Game 71: 245-246.

McCoid, M. J. and Fritts, T. H. 1980. Notes on the diet of a feral population of *Xenopus laevis* (Pipidae) in California. SWest. Nat. 25: 272-275.

McCoid, M. J. and Fritts, T. H. 1980. Observations of feral populations of *Xenopus laevis* (Pipidae) in Southern California. Bull. Sth. Calif. Acad. Sci. 79: 82-86.

McCoid, M. J. and Fritts, T. H. 1989. Growth and fatbody cycles in feral populations of the African clawed frog, *Xenopus laevis* (Pipidae), in California with comments on reproduction. SWest. Nat. 34: 499-505.



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McCoid, M. J. and Fritts, T. H. 1993. Speculations on colonizing success of the African clawed frog, *Xenopus laevis* (Pipidae). California. S. Afr. J. Zool. 28: 59-61.

McCoid, M. J., Pregill, G. K. and Sullivan, R. M. 1993. Possible decline of *Xenopus* populations in southern California. Herpet. Rev. 24: 29-30.

McMahon, R. F. 1996. The physiological ecology of the zebra mussel, *Dreissena polymorpha*, in North America and Europe. Amer. Zool. 36: 339-363.

Nalepa, T. F. and Schloesser, D. (eds.) 1993. Zebra mussels: biology, impacts, and control. Lewis Publishers, Boca Raton, FL.

Summary: Series of chapters on the biology, ecology, and genetics of zebra mussels in North America, case histories of their impacts on public facilities, and methods developed for control.

Ricciardi, A., Neves, R. J. and Rasmussen, J. B. 1998. Impending extinctions of North American freshwater mussels (Unionoida) following the zebra mussel (*Dreissena polymorpha*) invasion. J. Anim. Ecol. 67: 613-619.

Willner, G. R., Chapman, J. A. and Pursley, D. 1979. Reproduction, physiological responses, food habits, and abundance of nutria on Maryland marshes. Wildlife Monograph 65: 43.

Summary: Study on feeding strategies, population dynamics and adaption of coypus.

[Zurek, S. E. Giant Reed \(*Arundo donax*\) factsheet. Invasive Alien Plant Species of Virginia, Virginia Native Plant Society.](#)

Summary: Factsheet.