Department of Sustainability and Environment

National Recovery Plan for the Ridged Water-milfoil *Myriophyllum porcatum*

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Australian Government

Victoria The Place To Be

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Published by the Victorian Government Department of Sustainability and Environment (DSE) Melbourne, November 2006.

Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

ISBN 1 74152 293 5

This is a Recovery Plan prepared under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999, with the assistance of funding provided by the Australian Government.

This Recovery Plan has been developed with the involvement and cooperation of a range of stakeholders, but individual stakeholders have not necessarily committed to undertaking specific actions. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved. Proposed actions may be subject to modification over the life of the plan due to changes in knowledge.

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Citation: Murphy, A.H. 2006. National Recovery Plan for the Ridged Water-milfoil *Myriophyllum porcatum*. Department of Sustainability and Environment, Melbourne.

Cover photograph: Ridged Water-milfoil *Myriophyllum porcatum* by Mark Tscharke.

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Summary

The Ridged Water-milfoil *Myriophyllum porcatum* is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 and Threatened under the Victorian *Flora and Fauna Guarantee Act* 1988. The species is endemic to Victoria. Numbers fluctuate depending on availability of habitat, but current information suggests there are about 4,400 plants remaining in 15 wild populations. Major threats to populations include wetland drainage and modification, weed invasion, grazing and climate change. This national Recovery Plan for *M. porcatum* details the species' distribution and biology, conservation status, threats, and recovery objectives and actions necessary to ensure its long-term survival.

Species Information

Description

The Ridged Water-milfoil *Myriophyllum porcatum* is an annual aquatic herb growing to 40 cm in length. The stem is 1–3 mm wide, brittle, and sparsely branching, mainly at the base and towards the stem tip. Leaves are dimorphic: submerged leaves are dark green, 11–16 mm long, pectinate with 10 to 18 pinnae, and occur in whorls of 4–5; emergent leaves are glaucous, elongate, 5–6 mm long and 1.3–1.8 mm wide, have 2–6 lobes at base, and occur in whorls of 3–5. Flowers are sessile, occur in sparsely branched or simple spikes, and are located in leaf axils, with male flowers arranged higher on spike, the female flowers below. Male flowers have a perianth 4-merous, four sepals, eight stamens and four sterile styles with a slightly red tinge. Female flowers lack a perianth and sepals, while the ovary has four loculi. Fruit is cylindrical and ribbed, 1.8–2.1mm long and 0.9–1.2 mm wide (description from Orchard 1981; Walsh & Entwisle 1996). Little is known of the biology or ecology of this species. It occurs in shallow, ephemeral wetlands, and seed may be able to persist in sediment when the wetland dries out, germinating once the wetland refills.

Distribution

Myriophyllum porcatum is endemic to Victoria, where it is widely but patchily distributed across the north and north-west of the State, in the Riverina, Midlands and Murray Darling Depression IBRA Bioregions (DEH 2000). There is also an old record from the south-west.

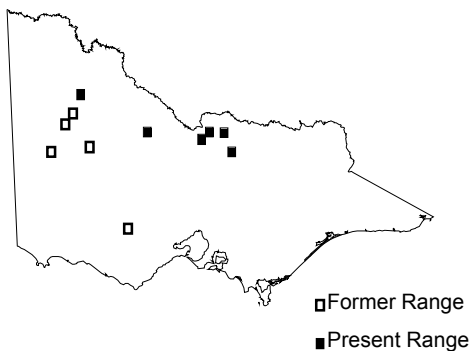

Figure 1. Former and current distribution of *Myriophyllum porcatum* in Victoria

Maps showing the detailed distribution of *M. porcatum* are available from the Department of Sustainability and Environment Flora Information System (DSE-FIS). The FIS is a state-wide repository for flora grid and site distribution data, photographs and text descriptions. This information is available on request in a variety of formats for natural resource management purposes.

Population Information

Myriophyllum porcatum is currently known from 15 small, widely separated wetlands, including farm dams, drainage lines on private land, and rock pools and waterholes in granite outcrops and claypans. Total number of plants is estimated at 4,400, although almost all plants occur in just two populations, the remaining 13 having just a few plants each. Unconfirmed anecdotal information suggests that the species may be present in the seed bank of Lake Lascelles and Lake Albacutya (both currently dry). Current populations occur in the following locations:

- Mitiamo (Terrick Terrick National Park): two populations.
- Hopetoun (Wathe Flora and Fauna Reserve): two populations.
- Nathalia (private land): five populations.
- Euroa (private land): six populations.
- Tongala (roadside): one population (possibly extinct).

Due to the extended drought conditions in south-eastern Australia, several of these wetlands are currently dry and population persistence cannot be verified.

Habitat

Myriophyllum porcatum is an aquatic species that occurs in shallow, ephemeral wetlands including lakes, swamps, rock pools in granite outcrops, waterholes in claypans, and highly modified habitats including farm dams and drainage lines on private land. Some wetlands, such as Lake Lascelles, are dry for extended periods and only fill intermittently. Recovery actions include survey and mapping of habitat that will lead to the identification of habitat critical to the survival of the species.

Decline and Threats

Myriophyllum porcatum was almost certainly more widespread and abundant, but populations have probably been substantially fragmented and depleted historically by wetland drainage and modification. The impact of European settlement on Victoria's wetlands has been severe. Some wetlands have been totally lost and many that remain have been affected by one or more degrading processes. The main process contributing to wetland loss and degradation in Victoria has been total or partial drainage, and 37% of the State's natural wetland area has been lost in this way. This decline has been especially severe in shallow wetlands, the preferred habitat for of *M. porcatum*, with over 90% of this habitat type being lost in some parts of the State such as the northern irrigation regions, and the loss has been especially severe on private land (NRE 2000). This decline is almost certainly continuing, especially on private land. The main threats to the species are summarised as follows:

Wetland modification: The habitat of *M. porcatum* is easily modified given its shallow and ephemeral nature. Altered water regimes, through causes including wetland drainage, channelisation, lowered or raised water tables and construction of levee banks have greatly altered natural flooding and drying regimes, especially through reduced flooding and longer dry periods between flooding. Reduced water supply such as through proposals to pipe irrigation water, will need careful appraisal for its impact on this species. The population at the type locality at Wathe especially could be disadvantaged as a result of water pipelining. The Nathalia populations could be threatened by farm practices related to irrigation and drainage. The populations at Nathalia include sites that are constructed drains that need periodic maintenance to remove growth restricting water flow and repair banks that have eroded or are damaged by livestock (R. Weber pers comm.). Runoff with an increased nutrient load from rural and urban catchments may result in algal blooms and eutrophication in wetlands. Other issues affecting wetlands include pollution, sedimentation, increasing salinity and the introduction of pest species such as European Carp. Wetland communities in the Murray-Darling Basin have been significantly depleted as a result of drainage, with currently only 11 percent remaining (Bunn *et al.* 1997).

Biological and ecological functioning of *M. porcatum* and its habitat have been significantly compromised as a result of hydrological alteration and the introduction of exotic species. Today

this habitat is isolated both spatially and temporally. Due to environmental factors such as weather and drainage, some communities will be dry when others are wet, further reducing the ability for genetic exchange to take place. All *M. porcatum* populations are found at a significant distance from each other, often within highly disturbed environments such as pastures and cropped areas.

Climate change: The effects of climate change potentially threaten all sites where *M. porcatum* occurs. Increased temperatures and decreased rainfall expected with global warming will probably lead to further loss of habitat, as shallow ephemeral wetlands will be especially at risk through reduced rainfall, plus higher temperatures leading to higher evaporation rates. Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases is listed as a Key Threatening Process under the EPBC Act.

Weed invasion: Both terrestrial and aquatic weed species threaten *M. porcatum* habitat at most sites, where the habitat fills and later dries. Major weeds include the introduced species Common Starwort *Callitriche stagnalis* and Patterson's Curse *Echium plantagineum*, with the latter a significant problem at Terrick Terrick NP, where it begins to out-compete aquatic plants as the wetlands dry out. Although weed species pose a threat to these populations, their removal may also cause impacts, where damage could result from herbicide drift or chemical accumulation within wetlands. Note that the threatened native species Western Water-starwort *Callitriche cyclocarpa* can co-occur with *M. porcatum*. Any weed control activities will need to include distinguishing between the introduced invasive *C. stagnalis* and the native *C. cyclocarpa*.

Vehicle movement: Trail bike riding threatens *M. porcatum* populations at Terrick Terrick NP whilst 4WD driving potentially threatens populations at Wathe FFR.

Grazing: Grazing livestock in wetlands contributes to degradation through such effects as soil compaction, pugging, increased nutrient input, changes in turbidity, spread of weeds, grazing and trampling of indigenous wetland vegetation, and erosion. Grazing and trampling by stock seriously threatens some populations on private land.

Recovery Information

Overall Objective

The **overall objective** of recovery is to minimise the probability of extinction of *Myriophyllum porcatum* in the wild and to increase the probability of important populations becoming self-sustaining in the long term.

Within the life span of this Recovery Plan, the **specific objectives** of recovery for *Myriophyllum porcatum* are to:

- Acquire accurate information for conservation status assessments.
- Identify habitat that is critical, common or potential.
- Ensure that all populations and their habitat are protected and managed appropriately.
- Manage threats to populations.
- Identify key biological functions.
- Determine the growth rates and viability of populations.
- Establish populations in cultivation.
- Build community support for conservation.

Program Implementation

The Recovery Plan will run for five years from the time of implementation and will be managed by the Department of Sustainability and Environment. A Threatened Flora Recovery Team, consisting of scientists, land managers and field naturalists will be established to oversee threatened flora recovery in Victoria in general. Technical, scientific, habitat management or

education components of the Recovery Plan will be referred to specialist sub-committees on research, *in situ* management, community education and cultivation. Regional Recovery Teams will be responsible for preparing work plans and monitoring progress toward recovery.

Program Evaluation

The Recovery Team will be responsible for annual assessments of progress towards recovery. This Recovery Plan will be reviewed within five years of the date of adoption.

Recovery Actions and Performance Criteria

Action	Description	Performance Criteria
Specific objective 1		
Acquire accurate information for conservation status assessments		
1.1	Acquire baseline population data by conducting detailed field and desk top surveys including (a) identification of the area and extent of populations; (b) estimates of the number, size and structure of populations and (c) estimation of population change. **Responsibility: DSE**	• Determination or update of conservation status for inclusion on state and national threatened species lists. • Identify target populations
Specific objective 2		
Identify habitat that is critical, common or potential		
2.1	Accurately survey known habitat and collect floristic and environmental information relevant to community ecology and condition. **Responsibility: DSE**	• Completion of requirements for essential life history stages, recruitment and dispersal identified at known sites. • Habitat critical to the survival of the species is mapped.
2.2	Identify and survey potential habitat, using ecological, historical and anecdotal information that may indicate habitat preference. **Responsibility: DSE**	• Sites of potential habitat identified and surveyed.
Specific objective 3		
Ensure that all populations and their habitat are legally protected		
3.1	Negotiate for roadside conservation and protect with Victorian Planning Provisions and municipal initiatives. **Responsibility: DSE**	• Establish a public land protected area network for threatened taxa at Tongala.
3.2	Initiate private land management agreements in consultation with private land owners under the *Victorian Conservation Trust Act* 1972, *The Conservation, Forests and Lands Act* 1987 and the *Wildlife Act* 1975 at Nathalia if appropriate. **Responsibility: DSE**	• Establish a private land protected area network for threatened taxa at Nathalia.
Specific objective 4		
Manage threats to populations		
4.1	Control threats from pest plants and animals and recreational trail bike riding at Terrick Terrick NP by placing mesh over water holes and using biological control and the sensitive application of herbicide. Control threats from recreational vehicle driving at Wathe FFR by preventing access and re-routing tracks if appropriate. **Responsibility: PV**	• Stable seedling recruitment/vegetative regeneration at Terrick Terrick NP and Wathe FFR.

Action	Description	Performance Criteria
Specific objective 5		
Identify key biological functions		
5.1	Evaluate current reproductive, seed bank status and longevity, fecundity and recruitment levels by conducting field based experimental trials. **Responsibility: DSE**	• Regenerative potential quantified for all known sites. • Seed bank / regenerative potential quantified for Lake Albacutya, Lake Lascelles and other target populations.
5.2	Determine seed germination requirements by conducting laboratory and field trials aimed to identify key stimuli. **Responsibility: DSE**	• Stimuli for recruitment identified. • Management strategies identified to maintain, enhance or restore processes fundamental to reproduction and survival.
Specific objective 6		
Determine the growth rates and viability of populations		
6.1	Measure population trends and responses against recovery actions by collecting demographic information including recruitment and mortality, timing of life history stages and morphological data. **Responsibility: DSE**	• Techniques for monitoring developed and implemented. • Annual census data for target populations
6.2	Collate, analyse and report on census data and compare with management histories. **Responsibility: DSE**	• Population growth rates determined and Population Viability Analysis completed for target populations. • Determination of requirements for *ex situ* conservation.
Specific objective 7		
Establish populations in cultivation		
7.1	Establish cultivated plants *ex situ* for inclusion in living collections to safeguard against any unforeseen destruction of wild populations. **Responsibility: DSE/PV**	• Development of effective propagation and cultivation techniques. • At least 250 mature plants in cultivation.
Specific objective 8		
Build community support for conservation		
8.1	Identify opportunities for community involvement in the conservation of *M. porcatum*. **Responsibility: DSE**	• Community nature conservation groups aware of the species and support its conservation.

Abbreviations

DSE Department of Sustainability and Environment, Victoria
PV Parks Victoria

Management Practices

The philosophy of the strategy for recovery is habitat conservation, restoration and management combined with an understanding of the ecological and biological requirements of *Myriophyllum porcatum*. The emphasis is on using knowledge to better implement *in situ* management techniques that protect populations and promote regeneration and recruitment. To achieve this, recovery actions are primarily structured to (i) acquire baseline data, (ii) assess habitat condition including ecological and biological function, and (iii) protection to maintain or improve population growth.

On-ground site management will aim to mitigate threatening processes and thereby ensure against extinction. Major threats requiring management include accidental destruction, competition from pest plants, inappropriate fire regimes and grazing by pest animals. A range of strategies will be necessary to alleviate these threats including integrated weed control and control of visitor impacts.

Broadscale protection measures applicable to all populations include liaison with land managers with a particular focus on private landholders. In addition, searches of known and potential habitat should continue to better define the distributions and size of populations.

The Recovery Plan also advocates strategies to fill some of the major gaps in our knowledge to date. These include an understanding of the mechanisms underlying recruitment and regeneration. Successful *in situ* population management will be founded on understanding the response of *Myriophyllum porcatum* to environmental processes. These are directly linked to biological function and are thus vital to recovery. Demographic censusing will be necessary to gather life history information and to monitor the success of particular management actions.

In addition to the above, *ex situ* conservation measures will be required and will include plant cultivation and long-term seed storage to represent each of the known major populations. Cultivating *ex situ* populations will also aim to protect the species from deleterious stochastic events *in situ*.

To reduce the likelihood of unforseen development activities negatively impacting upon *Myriophyllum porcatum*, the threatened flora team should seek relevant information on it's distribution, ecology and/or habitat to relevant land managers. Such increased awareness should allow new populations to be found if they exist, and improve the likelihood of adequate searches. Parks Victoria will investigate methods of protecting populations at Terrick Terrick NP without compromising the cultural significance of the sites (Action 4.1).

Changes to hydrology resulting from the proposed Wimmera-Mallee pipeline project may threaten populations upstream such as the type locality at Wathe Flora and Fauna Reserve. Some minor advantages for the species could occur downstream if viable seed is still present in the substrates of these waterbodies. It is likely, however that the species has become extinct downstream so these benefits are unlikely to occur. Provision will need to be made in the project so it does not threaten existing *Myriophyllum porcatum* habitat.

Affected Interests

There is a range of stakeholders in this recovery program. The Department of Sustainability and Environment is responsible for maintaining relationships with private landholders. Parks Victoria manages national parks and nature reserves on which the species occurs. Victoria's Open Range Zoo (Werribee) and Melbourne Zoo (Zoos Victoria) are involved in cultivation of the species. The Wimmera Mallee Water Authority is managing the Wimmera-Mallee pipeline project. Other populations fall under the jurisdiction of the Campaspe Shire and private landholders. Management agencies have been contacted and have approved the actions as outlined in this Recovery Plan.

Role and interests of indigenous people

Indigenous communities on whose traditional lands *Myriophyllum porcatum* occurs will be advised, through the relevant DSE Regional Indigenous Facilitator, of the preparation of this Recovery Plan and invited to provide comments if so desired. Indigenous communities will be invited to be involved in the implementation of the Recovery Plan.

The two populations that fall within reserved sites at Wathe Flora and Fauna Reserve and Terrick Terrick National Park both occur on areas that have very high cultural heritage values for the Koori community. No damage will occur to these sites as a result of recovery actions.

Benefits to other species/ecological communities

Given that many ephemeral wetlands in the north of the state are threatened by human activity, the restoration of *Myriophyllum porcatum* habitat will have direct benefits for other associated species. The collection of baseline data and subsequent adoption of localised, informed management techniques and will also benefit other aquatic plant species growing in association with *Myriophyllum porcatum*. The establishment and maintenance of populations *ex situ* may also enhance current knowledge regarding the cultivation of threatened aquatic species. The implementation of this plan will also raise the profile of other wetland species and their habitat, particularly those of the more threatened ephemeral wetlands.

Social and economic impacts

The implementation of this Recovery Plan is unlikely to cause significant adverse social and economic impacts. The Department of Sustainability and Environment is responsible for maintaining relationships with private landholders, and conservation of populations on private land will be achieved through negotiation with and assistance to landowners, and raising general awareness of the conservation requirements of this species. Several populations occur on national parks and conservation reserves, where nature conservation is already a high priority. If water savings measures result in some wetlands receiving less water and thereby placing populations at higher risk, some provision of water to may need to be considered.

Acknowledgments

The author would like to thank the following people who contributed to the preparation of this Recovery Plan: Geoffrey Allen, Fiona Coates, Tobi Edmonds, Rolf Weber, Deanna Marshall and Gary Backhouse (DSE); Ben Churchill, Peter Phelan, Kym Shramm and Mark Tscharke (Parks Victoria); Keith Ward (North East Catchment Management Authority); Nigel Binney (Wimmera Mallee Water); Brendan Condon and Damien Cook (Wetland Ecosystems); Doug Frood (Pathways Bushland and Environment) and Eris O'Brien (landholder).

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Priority, Feasibility and Estimated Costs of Recovery Actions

Action	*Description*	*Priority*	*Feasibility*	*Responsibility*	*Cost estimate*					
					Year 1	Year 2	Year 3	Year 4	Year 5	Total
1	**Conservation status**									
1.1	Collect baseline data	1	100%	DSE	**$4,500**	**$4,500**	**$4,500**	**$4,500**	**$4,500**	**$22,500**
2	**Habitat requirements**									
2.1	Survey known habitat	1	100%	DSE	**$4,500**	**$4,500**	**$4,500**	**$4,500**	**$4,500**	**$22,500**
2.2	Identify, survey potential habitat	1	50%	DSE	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$25,000**
3	**Legal protection of habitat**									
3.1	Protect public land habitat	3	75%	PV	**$1,500**	**$1,500**	**$1,500**	**$1,500**	**$1,500**	**$7,500**
3.2	Protect private land habitat	1	50%	DSE	**$6,000**	**$6,000**	**$6,000**	**$6,000**	**$6,000**	**$30,000**
4	**Manage threats**									
4.1	Control threats	1	75%	DSE / PV	**$2,000**	**$2,000**	**$2,000**	**$2,000**	**$2,000**	**$10,000**
5	**Identify key biol.l functions**									
5.1	Evaluate reproductive status	2	75%	DSE	**$4,500**	**$4,500**	**$4,500**	**$4,500**	**$4,500**	**$22,500**
5.2	Seed germination	2	75%	DSE	**$4,500**	**$4,500**	**$4,500**	**$4,500**	**$4,500**	**$22,500**
6	**Growth rates, pop. viability**									
6.1	Conduct censusing	1	100%	DSE	**$4,500**	**$4,500**	**$4,500**	**$4,500**	**$4,500**	**$22,500**
6.2	Collate, analyse and report	3	100%	DSE	**$700**	**$700**	**$700**	**$700**	**$2,000**	**$4,800**
7	**Establish pops. in cultivation**									
7.1	Establish cultivated plants	1	75%	DSE / PV	**$4,000**	**$4,000**	**$4,000**	**$4,000**	**$4,000**	**$20,000**
8	**Education, communication**									
8.1	Community extension	3	75%	DSE	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$1,000**	**$5,000**
	TOTAL				**$42,700**	**$42,700**	**$42,700**	**$42,700**	**$42,700**	**$214,800**