

**National Recovery Plan for the
Yarry Pygmy Perch
*Nannoperca obscura***

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Summary

The Yarra Pygmy Perch *Nannoperca obscura* is a small freshwater fish endemic to south-eastern Australia, where it occurs in South Australia and Victoria. The species is listed as Vulnerable under the Australian Government *Environment Protection and Biodiversity Conservation Act 1999*, and is also designated as Vulnerable on the IUCN Red List of Threatened Animals (IUCN 2003) and on the Australian Society for Fish Biology threatened species list (ASFB 2001). In Victoria the Yarra Pygmy Perch is listed as Threatened under the Victorian *Flora and Fauna Guarantee Act 1988*, and as Near Threatened (DSE 2003). In South Australia the species is protected under the *Fisheries Act (1982)* and has been listed as Endangered (Draft Threatened Species Schedules of the *National Parks and Wildlife Act 1972*).

The Yarra Pygmy Perch is still widely distributed, but populations are fragmented and patchy across the landscape. It is likely that the species has suffered a significant decline in abundance due to habitat changes to rivers, creeks and shallow freshwater wetlands (particularly wetland drainage). This decline appears to be continuing, with at least three populations apparently becoming extinct in recent decades. Major threats to the Yarra Pygmy Perch include wetland drainage, climate change, habitat damage through grazing and lack of regeneration, and introduced fish competitors and predators. This is the first national Recovery Plan for the Yarra Pygmy Perch, and details its distribution, habitat, conservation status, threats, and recovery objectives and actions necessary to ensure its long-term survival.

Species Information

Description

The Yarra Pygmy Perch *Nannoperca obscura* is a small perch-like member of the family Percichthyidae that attains a total length of 75 mm. It has an oblong, compressed body, a single deeply-notched dorsal fin and a lateral line that is divided into two parts. The dorsal head profile is relatively straight and the snout pointed. The eye is of moderate size and is situated high on the head near the dorsal profile. The mouth is quite small (the maxilla and supplemental bones reaching back to the anterior border of the eye), terminal and oblique. The colour is generally olive green above, greenish-brown laterally and yellowish-white underneath with several anteriorly pointing, chevron shaped markings on the posterior half of the body. The fins are normally clear to translucent fawn to orange and may have dark margins. At the onset of spawning, the male's pelvic fins become black, the leading edge of the anal fin darkens and the dorsal and anal fins intensify to a brownish-orange colour (description from McDowall 1980; Cadwallader & Backhouse 1983). Unlike other members of the genus, the Yarra Pygmy Perch has a pre-orbital bone that is not completely covered by skin, exposing its serrated lower edge (Kuitert & Allen 1986).

The Yarra Pygmy Perch is a free-swimming species whose entire life cycle is completed in freshwater (Cadwallader & Backhouse 1983). Diet consists primarily of insects, insect larvae and planktonic crustaceans (Allen 1989). Yarra Pygmy Perch spawn during spring (September to October) at water temperatures of 16–24°C (Kuitert *et al.* 1996). Very little is known of the breeding biology of this species, although it is assumed that breeding behaviour is similar to the closely related Southern Pygmy Perch *Nannoperca australis*, which lays demersal, non-adhesive eggs over aquatic vegetation and the substrate.

Distribution

The Yarra Pygmy Perch is distributed from the Bunyip River basin in West Gippsland east through southern Victoria and in south-eastern South Australia, as far west as Lake Alexandrina and the Finniss River, near the mouth of the Murray River (Figure 1). Within this total range, distribution is patchy and highly fragmented.

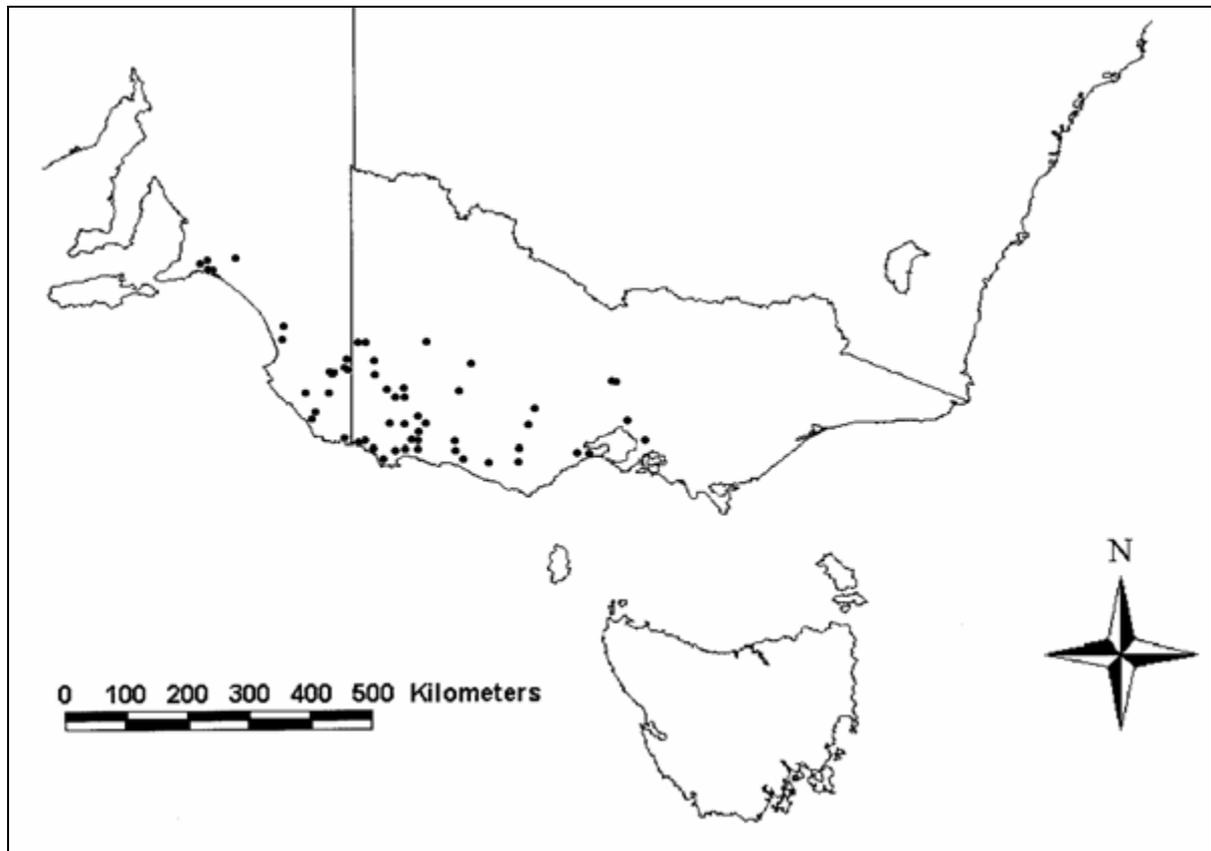


Figure 1. Distribution of the Yarra Pygmy Perch

Habitat

The Yarra Pygmy Perch typically occurs in slow-flowing or still waters which possess large amounts of aquatic vegetation (particularly emergent vegetation) such as lakes, ponds and slow-flowing rivers. Yarra Pygmy Perch are usually found in small groups, often occurring with the Southern Pygmy Perch, although the Yarra Pygmy Perch appears to prefer slightly stronger flows (Kuitert *et al* 1996).

Population Information

The Yarra Pygmy Perch has been recorded from 42 locations in Victoria and South Australia (Appendix 1). Some populations are tiny, occurring in extremely limited ephemeral habitat, while others are quite large and extensive and occur in permanent waterways. Of these 42 populations, four are thought to have become extinct since first being recorded (two in Victoria and two in South Australia). Only seven populations occur in some form of reserve: one in a national park; two in coastal parks and four in reserves (including game reserves), while three additional sites are listed in the 'Directory of Important Wetlands' (DEH 2001). Most populations (31) occur on private land or public land managed for purposes other than nature conservation

Populations have been ranked for management priority, on the basis of one or more of the following criteria:

- Populations at the extremes of the range.
- Populations are of a high density.
- Populations are isolated within their range from other populations.
- Populations are in an area of high conservation significance (eg. conservation reserve, in 'Directory of Important Wetlands').
- Populations of other threatened fish species occur at the site.

Decline and Threats

The Yarra Pygmy Perch was almost certainly once more widespread and abundant than current records suggest, but has declined in both distribution and abundance since European settlement of Australia. Its range has contracted in the east, with the disappearance of the Yarra River and Dandenong Creek populations in 1872 and 1982 respectively. It has also disappeared from Gnarkeet Creek (Vic) and Lake Bonney (SA) (Appendix 1). Remaining populations have almost certainly been substantially fragmented and depleted historically by wetland drainage and modification. The Yarra Pygmy Perch is believed to be a short-lived species and probably has poor dispersal ability. The fragmented and patchy nature of its remaining habitat across the landscape, and variability of this habitat between seasons and years, makes the species extremely vulnerable to local extinctions. Reduced flooding and loss of habitat linkages greatly reduce the ability to recolonise habitats. However, populations supporting high densities of individuals can still be found in some locations including the Glenelg River, Merri River and Bridgewater Lakes in Victoria, and Mosquito Creek in South Australia.

The major current and suspected threats are detailed as follows:

Degradation and loss of habitat

The impact of European settlement on shallow freshwater wetlands has been severe, with many wetlands lost, and much of what remains has been affected by one or more degrading processes including the loss of connectivity with associated rivers and creeks. The main process contributing to wetland loss and degradation in Victoria (which constitutes the bulk of the species' range) 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, with over 90% of this habitat type being lost in some parts of the State, with the loss being particularly severe on private land (NRE 2000). This decline is almost certainly continuing, especially on private land. Distribution of populations is now generally disjunct and patchy, due to the fragmented nature of the remaining lowland shallow freshwater wetland habitat. Draining of wetlands is a major cause of the decline and probable loss of many populations of this species (Hammer 2002).

The nature of the lowland, shallow freshwater habitat of the Yarra Pygmy Perch means it is especially susceptible to a range of practices that result in its degradation and loss, especially where this habitat occurs on private land. Considerable areas of shallow freshwater wetlands have been drained for agriculture, urban and industrial development, and wetlands are still being lost in some areas, especially on the outer urban fringe. Many sites on private property are threatened by damage from unrestricted stock access. Stock access and trampling has a major impact on these wetlands, through disturbance and removal of instream and riparian habitat. Physical damage to instream vegetation directly removes a key habitat component. A reduction in riparian vegetation quality often results in a decrease in water quality through increased nutrient run-off, sedimentation and summer water temperatures. Further effects include a reduction in bank stability, leading to increased erosion and sedimentation, and decreased organic input, required by many macroinvertebrates which in turn are a food source for the Yarra Pygmy Perch. Further physical disturbance of wetlands may occur through practices such as ploughing when wetlands are dry.

Alteration to flow regime

Appropriate hydrological conditions that regularly replenish the shallow freshwater habitats are essential for the survival of the Yarra Pygmy Perch, and the natural degree of wetland connectivity to a more permanent waterbody (such as river or creek) may also be vital to their long-term survival (particularly during extended dry conditions). Changes to natural flood and drying cycles, particularly in swamps and shallow creeks, through activities such as catchment clearing, establishing extensive plantations, construction of dams and direct abstraction of water, pose threats to Yarra Pygmy Perch habitat. These activities may alter natural seasonal water levels at critical times of the year or may result in complete loss or permanent alteration of wetland habitats. Changes in the level of local water tables may also affect the hydrology of swamps and smaller flowing waters. Populations occurring in smaller creeks on land where grazing is practiced (constituting the majority of known sites) are particularly susceptible to water abstraction for stock watering.

Extensive plantations of eucalypts and pines in south-eastern South Australia and south-western Victoria pose a major threat to habitat through lowering ground water levels and decreasing runoff into waterways. More wide-scale clearing of catchment vegetation may lead to elevated agricultural runoff that may directly affect water quality (through increased input of sediment, pesticides/herbicides

etc) or increase the risk of algal blooms through increased water nutrient levels and sedimentation. Catchment clearing and subsequent tree plantation establishment are also likely to cause altered hydrological regimes (Vertessy *et al* 2000) resulting in reduced catchment water yield and direct aquatic habitat loss.

Climate change

Climate change poses a substantial medium to long term threat to the survival of the Yarra Pygmy Perch. A predicted major impact of climate change in south-eastern Australia will be a decline in overall rainfall, increasing temperatures, and increasing evaporation, with subsequent increasing dryness (Pittock 2003). This scenario is expected to result in a reduction in the shallow freshwater habitats favoured by the Yarra Pygmy Perch through increased drying and decreasing flooding cycles. Decreased flooding will also decrease chances of recolonisation after local extinctions, further fragmenting and isolating remaining populations.

Introduced Aquatic Species

Predation by Redfin Perch *Perca fluviatilis*, Brown Trout *Salmo trutta* and Rainbow Trout *Oncorhynchus mykiss* may be a factor in the decline of Yarra Pygmy Perch (Wager & Jackson 1993). Specimens of Southern Pygmy Perch have been found in the stomach contents of Redfin Perch (S. Saddler, pers. obs.), suggesting that Yarra Pygmy Perch may also be a target for Redfin Perch predation. Damage to aquatic vegetation by Common Carp *Cyprinus carpio* may also impact on habitat critical to the survival of this species while competition/aggressive behaviour (particularly from Eastern Gambusia *Gambusia holbrooki*) are also implicated in the decline of this species (Wager & Jackson 1993).

Illegal collection

Although there is no direct evidence of the unauthorised collection of Yarra Pygmy Perch in Victoria or South Australia, the collection of small threatened species by aquaculture enthusiasts has been flagged as a potential problem for the closely related species, the Oxleyan Pygmy Perch *Nannoperca oxleyana* (NSW DPI 2005). While no direct evidence exists for the collection of Yarra Pygmy Perch, notes on the husbandry of this species in aquaria are readily available in web based publications, suggesting that collection to some degree may be occurring. The random collection of individuals for aquariums is likely to be harmful to small, restricted populations of this species (NSW DPI 2005). Additionally, this unregulated collection and trading of individuals by aquarists has the capacity to undermine the genetic integrity of natural populations if specimens are released back into the wild into areas other than those in which they were collected from.

Populations Under Threat

Virtually all populations of Yarra Pygmy Perch are under threat to some degree. The type of threats applying to particular populations depend largely on land tenure and management, with populations on private land most at risk. Only seven populations occur in some form of reserve: one in a national park; two in coastal parks and four in reserves (including game reserves), while three additional sites are listed in the 'Directory of Important Wetlands' (DEH 2001). The majority of known populations (31) therefore occur at sites that have little or no formal protection from many of the threats listed, and those that do are exposed to broader threats affecting shallow freshwater habitats.

Recovery Information

Program Implementation

The Recovery Plan will run for five years from the time of adoption of a Final Plan, and will be managed by the Department of Sustainability and Environment (Victoria) and the Department for Environment and Heritage (South Australia). Implementation of individual actions will remain the responsibility of the relevant agencies and organisations identified in the Recovery Plan (subject to available resources), who will be responsible for obtaining resources, preparing work plans and monitoring progress toward recovery within their own jurisdiction.

Program Evaluation

This Recovery Plan will be reviewed within five years of the date of its adoption under the EPBC Act.

Recovery Objectives

The long-term objective of recovery is to minimise the probability of extinction and ensure long-term survival of Yarra Pygmy Perch 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 are to:

- Determine the distribution and abundance of the Yarra Pygmy Perch.
- Determine the genetic and taxonomic status of Yarra Pygmy Perch populations.
- Determine Yarra Pygmy Perch habitat characteristics and requirements.
- Identify and manage potentially threatening processes impacting on Yarra Pygmy Perch conservation.
- Protect key populations across the range of the Yarra Pygmy Perch.
- Determine population trends at key sites.
- Investigate key aspects of biology and ecology of the Yarra Pygmy Perch.
- Establish a captive breeding population of Yarra Pygmy Perch.
- Undertake translocations to establish new populations of Yarra Pygmy Perch.
- Undertake community education and communication to increase awareness and involvement.

Recovery Objectives, Performance Criteria and Actions

Recovery Objective	Performance Criteria	Actions
1. Determine the distribution and abundance of the Yarra Pygmy Perch.	Increases in knowledge of population numbers and distribution in all regions.	1.1 Develop targeted survey techniques. 1.2 Undertake field surveys and mapping in Victoria and South Australia.
2. Determine the genetic and taxonomic status of Yarra Pygmy Perch populations.	Understanding of population genetic and taxonomic partitioning, and information incorporated into recovery management.	2.1 Determine levels of genetic partitioning between populations and regions. 2.2 Determine taxonomic implications of population partitioning.
3. Determine Yarra Pygmy Perch habitat characteristics and requirements.	Habitat use at different life history stages and across total range determined, and information used for recovery management.	3.1 Investigate habitat requirements at different life history stages and across total range and determine habitat critical to survival. 3.2 Develop and test a predictive habitat model. 3.3 Develop management strategies to maintain, enhance or restore essential habitat requirements.
4. Identify and manage potentially threatening processes impacting on Yarra Pygmy Perch conservation.	Increasing understanding and effectiveness of threat abatement so that there is an increase in the numbers of animals and area of occupancy of target populations.	4.1 Identify current and potential threats at each population site. 4.2 Prepare threat abatement plan for all priority sites. 4.3 Prioritise protection and restoration of habitat at sites supporting Yarra Pygmy Perch populations. 4.4 Implement threat abatement plans for all known sites
5. Protect key populations across the range of the Yarra Pygmy Perch.	Key Yarra Pygmy Perch populations are identified and protected across all bioregions and incorporating the genetic/taxonomic variation of species.	5.1 Protect populations on public land/waters by negotiating Public Authority Management Agreements under the <i>FFG Act</i> (1988) and Special Protection Zones in State Forest (Vic), as well as negotiating land covenants under the S.A Sanctuary Scheme (DEH). 5.2 Liaise with statutory bodies responsible for the management of water affecting Yarra Pygmy Perch populations to ensure species requirements are considered during planning and management activities. 5.3 Protect populations on private land/waters by initiating private land management agreements in consultation with private land-owners under the <i>Victorian Conservation Trust Act</i> 1972 and Land for Wildlife program (Vic) and the Heritage Agreement Scheme and Sanctuary Scheme in South Australia. 5.4 Liaise with landholders whose land borders or lies immediately upstream of Yarra Pygmy Perch populations to encourage appropriate protection and general awareness of species requirements.

6. Determine population trends at key sites.	A network of monitored populations is established and long-term monitoring of population trends undertaken to assess the impact of threats and effectiveness of recovery actions.	<p>6.1 Develop standardised population monitoring techniques.</p> <p>6.2 Establish a network of sites within each bioregion where population monitoring will occur.</p> <p>6.3 Conduct population monitoring at selected sites to investigate recruitment/mortality levels and determine population viability.</p>
7. Investigate key aspects of biology and ecology of the Yarra Pygmy Perch.	Information on key aspects of biology and ecology is gained and used in conservation management of the species.	<p>7.1 Determine the conditions for spawning and recruitment of the Yarra Pygmy Perch.</p> <p>7.2 Determine the diet of the Yarra Pygmy Perch.</p>
8. Establish a captive breeding population of Yarra Pygmy Perch.	Yarra Pygmy Perch successfully established at one or more locations in captivity, breeding and recruiting young.	8.1 Establish and maintain populations in captivity (eg. zoos, aquaria, universities, institutes) to safeguard against loss of wild populations and genetic diversity.
9. Establish new populations of Yarra Pygmy Perch.	At least one new demographically robust population established in secure habitat.	<p>9.1 Evaluate and select suitable translocation sites.</p> <p>9.2 Prepare a translocation plan and protocols to ensure appropriate genetic diversity in translocated populations.</p> <p>9.3 Prepare site(s) to achieve maximum survival of translocated individuals and implement translocation plan.</p> <p>9.4 Maintain and monitor translocated populations.</p>
10. Increase awareness and involvement.	Community and stakeholder understanding of and support for Yarra Pygmy Perch conservation is increased.	<p>10.1 Identify opportunities for community involvement in the conservation of the Yarra Pygmy Perch.</p> <p>10.2 Provide information about threats to and recovery management of the Yarra Pygmy Perch to land and water managers, other stakeholders and the general public.</p>

Cost of the Recovery Plan

The estimated cost of implementing the Recovery Plan is \$1.33 million over five years.

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Totals	\$62,000	\$167,600	\$295,425	\$422,130	\$378,515	\$1,334,670

See Appendix 2 for detailed costs by Action and by Year.

Benefits to other Species/Ecological Communities

The Recovery Plan includes a number of potential biodiversity benefits for other species and ecological communities known to co-occur with Yarra Pygmy Perch populations (Appendix 3). Of particular importance is the potential benefit to other threatened fish species such as the Variegated Pygmy Perch *Nannoperca variegata* and Dwarf Galaxias *Galaxiella pusilla* (both listed as Vulnerable under the EPBC Act). Several regionally threatened species including the Southern Pygmy Perch and Freshwater Blackfish *Gadopsis marmoratus* (both protected in South Australia under the *Fisheries Act 1982*) and the Australian Mudfish *Neochanna cleaveri* (Listed as Threatened in Victoria) will benefit from actions under this Recovery Plan. Principally, this will be through the protection and management of aquatic and riparian habitat where Yarra Pygmy Perch occur and on adjacent land. The adoption of broad-scale management techniques and collection of baseline data will also benefit other aquatic species occurring in association with Yarra Pygmy Perch, particularly those species with similar habitat requirements and life cycles. In addition, implementation of the recovery plan will increase public awareness of this and other freshwater species and their conservation requirements.

Additional fish species recorded from catchments where Yarra Pygmy Perch are found (but not listed in Appendix 3) will also benefit from conservation measures aimed at conserving Yarra Pygmy Perch populations. Many of these species are migratory, requiring access to estuaries or the marine environment to complete their life cycle. These include the Australian Grayling *Prototroctes maraena* (Listed as Vulnerable under the EPBC Act) which is known to pass through habitat occupied by the Yarra Pygmy Perch (DSE 2005).

The Recovery Plan will also provide an important public education role as threatened fish have the potential to act as 'flagship' species for highlighting broader nature conservation issues in aquatic habitats, such as habitat degradation, barriers to migration and invasive species.

Role and interests of indigenous people

Indigenous communities on whose traditional lands the Yarra Pygmy Perch occurs are being advised, through the relevant regional Indigenous facilitator, of this Recovery Plan and invited to provide comments. Indigenous communities will be invited to be involved in the implementation of the Recovery Plan.

Affected Interests

The Yarra Pygmy Perch occurs across a variety of land/water tenures and managers, including national parks, urban reserves, state forest, heritage rivers and private land. Consequently, management is the responsibility of a range of agencies, organisations and individuals (Table 1). Populations are considered reserved if they are contained within parks/reserves or other protected areas established with nature conservation (as defined under relevant state/territory legislation) as a primary or major aim of management (eg. in national and state parks, nature reserves).

This Recovery Plan has the support of State/territory government agencies, land/water managers including Catchment Management Authorities, Melbourne Water and community groups involved in nature conservation in general and native fish conservation in particular (eg. Native Fish Australia).

Table 1. Affected Interests

Organisation	Type
National/Regional	
WWF – Threatened Species Network	Community Group
Australia and New Guinea Fish Association	Community Group
Native Fish Australia	Community Group
South Australia	
Dept. for Environment and Heritage	State Government
South Australian Research and Development Institute	State Government
Dept. of Water, Land and Biodiversity Conservation	State Government
Conservation Council of South Australia	State Government
Department for Water Resources	State Government
South East Catchment Management Board	State Government
South Australian Environmental Protection Agency	State Government
PIRSA Fisheries	State Government
Forestry SA	State Government
SE Water Conservation and Drainage Board	Regional Authority
South Australian Recreational Fishing Advisory Council	Community group
Native Fish Australia (SA)	Community group
Landcare South Australia	Community group
Victoria	
Department of Sustainability and Environment	State Government
Department of Primary Industries	State Government
Parks Victoria	State Government
Victorian Environmental Protection Agency	State Government
Glenelg-Hopkins Catchment Management Authority	Regional Authority
Corangamite Catchment Management Authority	Regional Authority
Port Phillip & Westernport Catchment Management Authority	Regional Authority
Melbourne Water	Local Water Authority
Glenelg Shire Council	Local Government
Southern Grampians Shire Council	Local Government
Moyne Shire Council	Local Government
Colac-Otway Shire Council	Local Government
City of greater Dandenong	Local Government
Victorian Threatened Species Network Coordinator	Community group

Social and economic impacts

The implementation of this Recovery Plan is unlikely to cause significant adverse social and economic impacts, although there may be low-level impacts associated with protection of populations on private land. Because most populations are on private land, habitats potentially affected by the impacts of riparian clearing, drainage, stock access or water abstraction may require controls on their use. For this reason, potential negative on-farm impacts may include foregone grazing, and costs associated with fencing and establishing alternative watering points (LWRRDC 1999). However, affected areas are likely to be generally small. There are substantial benefits associated with improved riparian management, including improved stock control, opportunity for income diversification (farm forestry in riparian zone), improved water quality, reducing stream bank erosion, improved aesthetics, improved farm biodiversity and improved farm capital value. Protection on private land will be achieved through negotiation with land owners/managers. Incentives are available through natural resource management programs, and protection of habitat for the Yarra Pygmy Perch will be included as an objective in high priority areas.

Management Practices

The condition of the riparian zone surrounding waters where the Yarra Pygmy Perch occurs is critical to the survival of this species, as is the condition of the aquatic vegetation within the waterbody.

Appropriate hydrological conditions are also considered of vital importance, with the draining of wetlands being attributed for the loss of a number of populations of this species (Hammer, 2002). Hydrological conditions also affect the natural level of wetland connectivity (where Yarra Pygmy Perch are often found) to more permanent waterbodies such as rivers or creeks. Maintaining this connectivity is vital to the long-term survival of this species (particularly during extended dry conditions) and must therefore be considered as a critical habitat. Management practices that should be adhered to by land and water managers in order to avoid threatening processes believed to be responsible for the decline in the Yarra Pygmy Perch include:

- No direct loss of habitat through wetland drainage on either public or private land.
- No physical alteration to habitat as a consequence of incidental works on land adjoining Yarra Pygmy Perch habitat.
- Applications for water abstraction or dam construction do not compromise flow regimes for Yarra Pygmy Perch.
- Habitat and adjoining riparian habitat are fenced off to stock access.
- Off-stream watering points are provided for stock.
- No further damage to riparian vegetation.
- Damaged or depleted riparian vegetation is protected and (if necessary) supplemented by active revegetation works.
- Plans to clear vegetation lying adjacent to Yarra Pygmy Perch habitat will not impact upon water quality (no increase in sedimentation/nutrient levels/pesticides/herbicides etc).
- Plans to revegetate with plantation timber/crops will not impact upon overall water yield (and subsequently flow regime of Yarra Pygmy Perch habitat).
- Proposals to translocate aquatic species into Yarra Pygmy Perch habitat are subject to relevant risk management processes according to relevant national and State guidelines.

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References

- Allen, G.R. 1989. *Freshwater Fishes of Australia*, TFH Publications, Sydney
- ASFB 2001. *Conservation Status of Australian Fishes 2001*. Australian Society for Fish Biology, Website: www.asfb.org.au/research/tscr/tf_constat2001.htm
- Ashburner, L.D., and Ehl, A.S., 1973. *Chilodonella cyprini* (Moroff), a parasite of freshwater fish and its treatment. *Bull. Aust. Soc. Limnol.*, 5, 3-4.
- Australian and New Zealand Conservation Council and Biological Diversity Advisory Committee 2001. Biodiversity Conservation Research: Australia's Priorities. Environment Australia, Canberra.
- Beschta, R.L. (1979) Debris removal and its effects on sedimentation in an Oregon coast range stream. *Northwest Science* 53: 71-77.
- Cadwallader, P.L. (1979) Distribution of native and introduced fish in the Seven Creeks River System, Victoria. *Australian Journal of Ecology* 4: 361-85.
- Cadwallader, P.L. & Eden, (1982) Observations on the food of rainbow trout, *Salmo gairdneri* Richardson, in Lake Purrumbete, Victoria. *Bulletin of the Australian Society for Limnology* 8: 17-21.
- Cadwallader, P. L. & Backhouse, G. (1983) A Guide to the Freshwater Fish of Victoria. (Government Printer: Melbourne). 249 pp.
- Cordone, A.J. & Kelly, D.W. (1961) The Influences of inorganic sediment on the aquatic life in streams. *Calif. Fish Game* 47:189-228.

- Cummins, K.W. (1986) Riparian influence on stream ecosystems. In *Stream Protection. The Management of Rivers for Instream Uses*. (Ed. I.C. Campbell.) pp: 45-56. (Chisholm Institute of Technology: Caulfield East, Australia.).
- DEH 2000. Revision of the Interim Biogeographic Regionalisation of Australia (IBRA) and the Development of Version 5.1. - Summary Report. Department of Environment and Heritage, Canberra.
- DEH 2001. *A Directory of Important Wetlands in Australia, 3rd ed.* Department for Environment and Heritage, Canberra.
- DSE 2003. Victorian Department of Sustainability and Environment (2003) Advisory List of Threatened Vertebrate. Fauna in Victoria - 2003.
- DSE 2005. Department of Sustainability and Environment, Aquatic Fauna Database.
- Ellis, M.M. (1937) Detection & measurement of stream pollution. *U.S. Dept. of Commerce, Bur. Fisheries, Bull. 22* (48): 365-437.
- Hammer M. 2002. The South East fish inventory: distribution and conservation of freshwater fishes of south east South Australia. Native Fish Australia (SA) Inc., Adelaide.
- IUCN 2003,) IUCN Red List Categories Version 3.1. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland.
- Klunzinger, C.B., 1872. Zur Fische-fauna von Sud Australien. *Arch. Naturg.*, 38 (1):17-47.
- Kuiter, R.H. & Allen, G.R. (1986) A synopsis of the Australian pygmy perches (Percichthidae), with the description of a new species. *Revue fr. Aquariol.* 12: 109-16.
- Kuiter, R.H, Humphries, P.A., Arthington, A.H., 1996. Family Nannoperidae – Pygmy Perches. Pp 168-175. In McDowall, R. (ed.) *Freshwater Fishes of South-Eastern Australia* (Revised edition). Reed Books, Sydney, 1996
- Langlois, T.H. (1941) Two processes operating for the reduction in abundance or elimination of fish species from certain types of water areas. *Trans. North Amer. Wildl. Conf.* 6:189-201.
- Lloyd, L. Lloyd Environmental Pty Ltd. P.O. Box 3014 Syndal, Vic, 3149
- LWRRDC (1999) Riparian Vegetation Management Demonstration Sites Far South Coast NSW, Land and Water Resources Research and Development Corporation report no. BVS1, December 1999.
- McDowall, R.M. (1980) *Freshwater Fishes in South-Eastern Australia*. Reed : Sydney. 208 pp.
- Muncey, R.J., Atchinson, R.V., Bulkley, R.V., Menzel, L.G., Perry, L.G. & Summerfelt, R.C. (1979) Effects of suspended solids and sediment set on reproduction and early life of warm water fishes: a review. EPA-600/3-79-0, *Corvallis Environmental research Laboratory, Corvallis*. 100pp.
- NRE (1997) *Victoria's biodiversity : directions in management*. Dept. of Natural Resources and Environment, East Melbourne, 149pp
- NRE 2000. *Victoria's Biodiversity: Directions in Management*. Department of Natural Resources and Environment, Victoria.
- NSW DPI 2005. Oxleyan Pygmy Perch: Recovery Plan and Background Paper, New South Wales Department of Primary Industry, 2005
- Olive, L.J. & Walker, P.H. (1982) Processes in overland flow-erosion and production of suspended material. In *Prediction in water quality*. Proceeding of a symposium by the Australian Academy of Science and the Institute of Engineers Australia'. pp: 87-119.
- O'Shaughnessy, P.J. & Jayasuriya, M.D.A. (1991) Water Supply Catchment Hydrology Research.
- Pittock, B. (editor) 2003. Climate change: An Australian Guide to the Science and Potential Impacts. Australian Greenhouse Office, Canberra.
- Saddler, S. Arthur Rylah Institute for Environmental Research, Department of Sustainability and Environment, Heidelberg, Victoria
- Sanger, A.C. (1978) Aspects of the ecology and evolution of the Pigmy perches (Teleostei : Kuhlidae). Honours Thesis, Department of Zoology, Melbourne University, Parkville. 98pp.
- Vertessy, R., Rahman, J., Bessard, Y. and Zhang, L. (2000) Predicting the impacts of afforestation on water yield. *Water*, 27(6): 16-19.
- Wager, R. and Jackson, P. 1993. The Action Plan for Australian Freshwater Fishes. Australian Nature Conservation Agency, Endangered Species Program. Project No. 147. Canberra

Appendix 1. Population location information for the Yarra Pygmy Perch

Sources: DSE 2004; Hammer 2002

State	Location	Catchment	Bioregion*	Abundance (N fish/ 100m) V. Low <6 Low 6-10 Med 11-20 High 21-30 V. High >30	Surveyed Year methods D Dip net S Seine net B Bait trap L Light trap E Electrofishing R Rotenone	Comments/(Land tenure-Land Manager) DIW = included in Directory of Important wetlands	Mgt Priority	Zone	Easting-Northing
VIC	Yarra River	Yarra River	SCP	Unknown ¹	1870/72	EXTINCT	N/A	55H	0322300-5811300 to 0325500-5810800
VIC	Dandenong Creek	Bunyip River	SCP	V. Low (5)	1878/1982 (D)	EXTINCT	2/3	55H	0340500-5788900 to 0343600-5799000
VIC	Deep Creek	Maribyrnong R.	VM	V. low (4-5)	1978/84/86/89/94/ 96(E/D/S)	Private	1	55H	0202900-5870900 to 0297100-5874000
VIC	Barwon River	Barwon River	SCP	Unknown ¹	2000 (E)	Private	2	55 H to 54H	0253400-5774100 to 0756700-5756700
VIC	Pennyroyal Creek	Barwon River	SCP	Unknown ¹	1999 (E)	Private	2	54H	0749600-5744500
VIC	Waurm Ponds Creek	Barwon River	SCP	Unknown ¹	1989/91	Private	1	55H	0765500-5768300 to 0763900-5767900
VIC	Woody Yaloak River	Corangamite Lake	VVP	V. Low (2)	1990 (E)	Private	2	54H	0727500-5814200
VIC	Lake Corangamite	Corangamite Lake	VVP	V. Low (2)	1982	Reserve (DIW)	3	54H	0711000-5871200
VIC	Floating Islands Lagoon	Corangamite Lake	VVP	Unknown ¹	1990 (E)	Reserve (Game)	3	54H	0709500-5752800
VIC	Gnarkeet Creek	Corangamite Lake	VVP	V. Low (1)	1974	Private Extinct?	2/3	54H	0716000-5789100
VIC	Curdies River	Otway Coast	VVP	Unknown ¹	1999 (E)	Private	1	54H	0670900-5742700
VIC	Thompsons Creek	Otway Coast	SCP	Unknown ¹	1999 (D)	Private	1/2	55H	0268100-5760600
VIC	Spring Creek	Hopkins River	VVP	Unknown ¹	1974/90/96 (E/R)	Private	1	54H	0632000-5764800 to 0628100-5781100
VIC	Merri River	Hopkins River	VVP	High (30)	1990 (R)	Private	2	54H	0633500-5762700 to 0629900-5768000

VIC	Brucknell Creek	Hopkins River	VVP	V. Low (5)	1990 (E)	Private	2/3	54H	0644200-5754500
VIC	Bridgewater Lakes	Portland Coast	NCP	Low-Med (2-36)	1978/90/91 (E)	Discovery Bay Coastal Park	3	54H	0535000-5759400
VIC	Darlot Creek	Portland Coast	NCP	Med (14)	1990 (E)	Private (& some small public land parcels)	2/3	54H	0568300-5780600 to 0572300-5788600
VIC	Eumeralla River	Portland Coast	VVP	V. Low (1-4)	1960/66/90 (E)	Private	2	54H	0584300-5762700 to 0591000-5758500
VIC	Surry River	Portland Coast	VVP	Unknown ¹	1994/99 (E)	Private	2	54H	0547000-5772000 to 0547200-5771700
VIC	Sunday Creek	Portland Coast	VVP	Unknown ¹	1999 (E)	State forest	1	54H	0557300-5788300
VIC	Fitzroy River	Portland Coast	VVP	Low (10)	1978/88/90/01 (E/D)	Private	2/3	54H	0566700-5768700 to 0566800-5769500
VIC	Weerangourt Creek	Portland Coast	VVP	V. Low (2)	1994 (E)	Private	2/3	54H	0576700-5800300
VIC	Glenelg River	Glenelg River	NCP/VM	Unknown ¹	1980/99 (R/E)	Private (DIW)	3	54H	0537600-5836200 to 0575200-5887700
VIC	Wannon River	Glenelg River	VVP	V.High (40)	1981/94 (E/R)	Private	1/2	54H	0558300-5831100
VIC	Freshwater Lake (Unnamed Swamp)	Glenelg River	VVP	Unknown ¹	1979	Reserve	1/2	54 H	0616200-5838900
VIC	Lake Monibeong	Glenelg River	NCP	Low - Med (7-13)	1976/80/90 (E)	Discovery Bay Coastal Park	3	54H	0515500-5779500
VIC	McRae Creek	Glenelg River	VVP	V. Low (4)	1994 (E)	Private	1	54H	0552300-5822800
VIC	Merino Creek	Glenelg River	VVP	Med (17)	1994 (E)	Private	1	54H	0548000-5825400
VIC	Miakite Creek	Glenelg River	VVP	Low (10)	1994 (E)	Private	1	54H	0552300-5822800
VIC	Swamp on Dwyer Creek	Glenelg River	VM	Unknown ¹	1979 (D)	Grampians National Park	2	54 H	0628500-5863200
VIC	Crawford River	Glenelg River	NCP	V. Low (2)	1988/90/94 (E)	Private	2	54H	0541200-5797300 to 0569200-5811000
VIC	Mosquito Creek	Millicent Coast	MDD	V. Low (4)	1985/94 (E/D)	Private	1	54H	0503200-5893500 to 0514200-5890200
SA	Drain M	Mosquito Ck	MDD	V. Low (1)	2001-2	Private (grazing)	1	54H	0432350-5865419
SA	Stuntlies Station waterhole	Mosquito Ck	NCP	Unknown ³	1970-79	Private (grazing)	1	54H	0493173-5909894
SA	Mosquito Ck	Mosquito Ck	MDD	Mod-V-high (28-200)	2001-2	Private (grazing)	1	54H	0495126-5895489 to 0488128-5901182
SA	Bool Lagoon	Mosquito Ck	MDD	Low(10)	1990-95	Game reserve (DIW)	1	54H	0472494-5891687

SA	Little Bool Lagoon	Mosquito Ck	NCP	Unknown ³	1990-95	Private (grazing)	1	54H	0471200-5894500
SA	Pick's Swamp Sinkhole	Piccaninnie system	NCP		2001-2	Private (grazing)	1	54H	0491199-5789908
SA	Lake Bonney floodplain	Lake Bonney	NCP	Unknown ³	1913	Recreation Reserve Extinct?	1	54H	0439500-5829700
SA	Bakers Range Drain	Bakers Range watercourse	NCP	Unknown ¹	1980-89	Roadside drain	1	54H	0460400-5864700
SA	Mandina Marsh	Bakers Range watercourse	NCP	Unknown ²	1990-95	Private (fenced)	1	54H	0402847-5983279
SA	Henry Creek	Bald Hill watercourse	NCP	Low(8-10)	2001-2	Private (fenced)	1	54H	0400687-5963746

* IBRA Bioregion (DEH 2000; version 5.1): NCP = Naracoorte Coastal Plain; VVP = Victorian Volcanic Plain; VM = Victorian Midlands; SCP = South East Coastal Plain; MDD = Murray Darling Depression.

Note:

Unknown¹ - refers to rivers/creeks which have not been surveyed within the last 5 years

Unknown² - refers to wetlands (which are more vulnerable to critical changes in flow regimes during the current drought conditions) which have not been surveyed within the last 2 years

Unknown³ - refers to sites where *N. obscura* populations have been recorded but for which more recent surveys have not recorded this species

Appendix 2: Priority, feasibility and estimated costs of recovery actions

Action	Description	Priority	Feasibility	Responsibility	Cost estimate					Total
					Year 1	Year 2	Year 3	Year 4	Year 5	
1	Distribution & abundance									
1.1	Survey techniques	1	100%	DSE, DEH	\$10,000	\$0	\$0	\$0	\$0	\$10,000
1.2	Field surveys	1	100%	DSE, DEH	\$30,000	\$31,500	\$33,075	\$34,730	\$0	\$129,305
2	Genetic & taxonomic status									
2.1	Genetic partitioning	2	100%	DSE, SA Museum	\$0	\$10,000	\$10,000	\$15,000	\$0	\$35,000
2.2	Taxonomic implications	1	100%	DSE, DEH	\$0	\$0	\$0	\$0	\$10,000	\$10,000
3	Habitat requirements									
3.1	Habitat investigation	1	100%	DSE, DEH	\$10,000	\$10,500	\$11,000	\$11,500		\$43,000
3.2	Predictive habitat model	2	90%	DSE, DEH	\$0	\$0	\$0	\$10,000	\$10,000	\$20,000
3.3	Habitat management strategies	2	75%	DSE, DEH	\$0	\$0	\$0	\$22,000	\$22,000	\$44,000
4	Manage threats									
4.1	Threat identification	1	75%	DSE, DEH	\$2,000	\$2,100	\$2,200	\$2,300	\$0	\$8,600
4.2	Threat abatement plan	1	100%	DSE, DEH	\$0	\$0	\$0	\$0	\$7,500	\$7,500
4.3	Protection and restoration	1	100%	DSE, DEH	\$0	\$0	\$0	\$0	\$5,000	\$5,000
4.4	Control threats	1	75%	DSE, DEH, PV, CMAs	\$0	\$75,000	\$78,750	\$82,690	\$86,825	\$323,265
5	Population protection									
5.1	Public land protection	3	100%	DSE, DEH	\$0	\$0	\$10,000	\$10,500	\$0	\$20,500
5.2	Agency liaison	2	75%	DSE, DEH	\$0	\$3,000	\$3,150	\$3,300	\$3,450	\$12,900
5.3	Private land protection	1	50%	DSE, DEH	\$0	\$20,000	\$21,000	\$22,000	\$23,000	\$86,000
5.4	Landholder liaison	1	75%	DSE, DEH, PV, CMAs	\$0	\$5,000	\$5,250	\$5,510	\$5,790	\$21,550
6	Population trends									
6.1	Standardised monitoring techniques	2	100%	DSE, DEH	\$0	\$0	\$0	\$8,000	\$8,500	\$16,500
6.2	Population monitoring sites	2	100%	DSE, DEH	\$0	\$0	\$0	\$10,000	\$10,500	\$20,500
6.3	Population monitoring	2	100%	DSE, DEH	\$0	\$0	\$45,000		\$70,000	\$115,000

7	Biology and ecology										
7.1	Spawning and recruitment	2	75%	DSE, DEH	\$0	\$0	\$60,000	\$63,000	\$0	\$123,000	
7.2	Diet	3	75%	DSE, DEH	\$0	\$0	\$0	\$10,000	\$10,000	\$20,000	
8	Captive population										
8.1	Establish captive population	3	75	DSE, DEH	\$0	\$0	\$0	\$30,000	\$30,000	\$60,000	
9	New populations										
9.1	Select sites	2	100%	DSE, DEH	\$0	\$0	\$0	\$10,000	\$10,000	\$20,000	
9.2	Translocation plan	2	50%	DSE, DEH	\$0	\$0	\$5,000	\$0	\$0	\$5,000	
9.3	Prepare site(s) and implement plan	2	50%	DSE, DEH	\$0	\$0	\$0	\$45,000	\$47,000	\$92,000	
9.4	Maintain and monitor	2	50%	DSE, DEH	\$0	\$0	\$0	\$15,000	\$15,750	\$30,750	
10	Information, education										
10.1	Community involvement	2	100%	DSE, DEH	\$5,000	\$5,250	\$5,500	\$5,800	\$6,100	\$27,650	
10.2	Information, extension	2	100%	DSE, DEH	\$5,000	\$5,250	\$5,500	\$5,800	\$6,100	\$27,650	
					Totals	\$62,000	\$167,600	\$295,425	\$422,130	\$378,515	\$1,334,670

Abbreviations: CMA – Catchment Management Authority; DEH – Department for Environment and Heritage; DSE – Department of Sustainability and Environment (Vic); PV – Parks Victoria

Appendix 3: Native freshwater fish co-occurring with the Yarra Pygmy Perch

Victorian sites: DSE 2005; South Australian sites: Hammer 2002

Scientific name	Common name	No. sampling events	
		Vic	SA
<i>Nannoperca australis</i>	Southern Pygmy Perch	44	13 (P)
<i>Nannoperca variegata</i> (EPBC)	Variegated pygmy Perch	4 (E, FFG)	-
<i>Anguilla australis</i>	Short-finned Eel	28	-
<i>Galaxias maculatus</i>	Common Galaxias	31	1
<i>Neochanna cleaveri</i>	Mud Galaxias	-	1 (C)
<i>Galaxias olidus</i>	Mountain Galaxias	15	1 (C)
¹ <i>Hypseleotris</i> spp.	Carp gudgeon complex	1	9
<i>Galaxiella pusilla</i> (EPBC)	Dwarf Galaxias	7 (V, FFG)	3 (C)
<i>Gadopsis marmoratus</i>	River Blackfish	22	1 (P)
<i>Galaxias truttaceus</i>	Spotted Galaxias	2	-
<i>Philypnodon grandiceps</i>	Flat-headed Gudgeon	18	6
<i>Galaxias brevipinnis</i>	Broad-finned Galaxias	1	-
<i>Pseudogobius olorum</i>	Blue-spot Goby	1	-
<i>Geotria australis</i>	Pouched Lamprey	1	-
<i>Retropinna semoni</i>	Australian Smelt	15	-
<i>Atherinosoma microstoma</i>	Small mouthed Hardyhead	5	6
<i>Mordacia mordax</i>	Short-headed Lamprey	3	-
<i>Pseudaphritis urvillii</i>	Tupong	14	-
<i>Tasmanogobius lastii</i>	Lagoon Goby	2	1

(EPBC) denotes species listed under the federal Environment Protection and Biodiversity Conservation Act (1999)

¹ denotes species translocated to (and not naturally occurring in) the South East Coast Drainage Division

(P) denotes species that are Protected under the S.A Fisheries Act 1982.

(C) denotes species that are of Conservation concern (S.A).