



Endangered Pedder galaxias fish



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Monitoring and Reporting System for Tasmania's National Parks and Reserves

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MONITORING AND REPORTING SYSTEM FOR TASMANIA'S NATIONAL PARKS AND RESERVES

EVALUATED CASE STUDY REPORT	
PERFORMANCE ARENA:	2. CONDITION OF RESERVES AND RESERVE VALUES
Key Performance Area:	2.4 Condition of ecosystems and natural diversity
Date last updated	29 June 2016
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Cover photo (main image): The endangered freshwater fish *Galaxias pedderensis* occurs only in Tasmania.

Photo: IFS

Evaluation report

Endangered Pedder galaxias fish

This report examines the performance of management in relation to an attempt to establish self-maintaining populations of the endangered Pedder galaxias fish in water bodies outside the species' original natural habitat of Lake Pedder, which was permanently altered following construction of the Gordon Power Scheme and subsequent invasion of the waterbody by trout and another species of galaxiid. The evaluation concludes that the program has been highly successful. Populations of Pedder galaxias are now firmly established in the ex-situ sites of Lake Oberon and the Strathgordon water supply dam. Monitoring has provided clear evidence that the populations at both sites are breeding well, while the abundance and mixed age-classes of the fish indicate that the populations are self-maintaining. This program has almost certainly saved the Pedder galaxias fish from extinction, and has dramatically increased the likelihood that this species will continue to survive and persist in the Tasmanian Wilderness World Heritage Area into the future. Note however that because the species now only survives outside its original natural habitat, it is officially recognised as being 'extinct in the wild'.

Introduction

About the threat or issue

The Pedder galaxias fish (*Galaxias pedderensis*) is endemic to Tasmania and naturally occurred only in the original (pre-dam) Lake Pedder and its inflowing streams. After dam construction and inundation of Lake Pedder in 1972-74 for the Gordon Power Scheme, the Pedder galaxias was known to be present in large numbers in the impoundment and some tributaries between 1975 and 1980. However the species then rapidly declined and could no longer be found in the impoundment after the mid 1980's or in its tributaries after 1996.

The exact cause of the decline of Pedder galaxias is unclear. However major ecological changes associated with the Gordon Power Scheme have included the loss (through inundation) of the original lake environment and meandering stream habitat; and the invasion by the exotic predatory brown trout (*Salmo trutta*) and the native climbing galaxias species (*G. brevipinnis*) of the Lake Pedder impoundment and tributaries.

What natural or cultural values are affected?

The Pedder galaxias is listed as Extinct in the wild under the *Environment Protection and Biodiversity Conservation Act 1999*, and as Endangered under the *Tasmanian Threatened Species Protection Act 1995*. Tasmania is a centre of diversity for galaxiid fishes and the present circum-southern hemisphere distribution of the galaxioid fishes suggests that the ancestors of this group of fishes were present before the break-up of the Gondwana supercontinent.



Pedder galaxias (*Galaxias pedderensis*) is a small freshwater species of fish that occurs only in Tasmania. A distinguishing feature of all galaxiids is that they only have one dorsal fin whereas most other types of fish have two dorsal fins, e.g. trout.

Photo: J. Patil

Background to management

The Pedder galaxias is listed on State and Commonwealth threatened species protection legislation. The Tasmanian *Inland Fisheries Act 1995* prohibits the collection of any freshwater fish without a permit. All fish on reserved land are protected under the *National Parks and Reserves Management Act 2002* and cannot be taken without authority under this Act.

The Pedder galaxias has been included in three recovery plans (Gaffney et al. 1992, Crook and Sanger 1997, and Department of Primary Industries and Water, 2006). Actions in the recovery plans included capture and transfer of stock to Lake Oberon, monitoring of the Bonnet Bay populations in Lake Pedder, monitoring of the Lake Oberon population and associated changes in lake fauna, captive breeding, establishment of a second translocated population in the Strathgordon water supply dam, and increasing public awareness. For a map of site locations, refer to Figure 1.

A translocated population was successfully established in Lake Oberon following the transfer of a total of 34 fish to the lake between 1991 and 1997. A second ex-situ habitat for the Pedder galaxias species was constructed by modification of the Strathgordon water supply dam in 1997. The success of population expansion in the Lake Oberon population enabled a total of 353 adult fish to be moved to Strathgordon between 2001 and 2007. Limited success was obtained with captive breeding. For example, only 11 juveniles were produced from attempts in 1990–91 (Hamr 1992). These juveniles were included in the fish placed in Lake Oberon. Subsequent attempts to establish a captive breeding program have also been unsuccessful.

Overall management goal

The overall goal of this program is:

- Establishment of self-maintaining ex-situ populations of Pedder galaxias in Lake Oberon and the Strathgordon water supply dam to ensure the survival and long-term viability of this endangered fish species.

Management actions and significant events

- The Lake Oberon population is monitored every five years to determine numbers and age structure. The last date of sampling was in 2012, with significant numbers of juvenile and adult Pedder galaxias present.
- The Strathgordon population is monitored annually. Pedder galaxias are now successfully breeding in the water supply dam, with multiple age-class cohorts detected during monitoring since 2008.
- In 2010 two climbing galaxias were caught in the Strathgordon dam. Hydro Tasmania upgraded the screens on the outflow of the dam to prevent entry by the climbing galaxias. One climbing galaxias was caught in 2011 and none in the period 2012–2016.
- Lake levels are managed by Hydro Tasmania to reduce the risk of the introduced species redfin perch invading Lake Pedder via the canal connecting it to Lake Gordon (McPartlan canal).

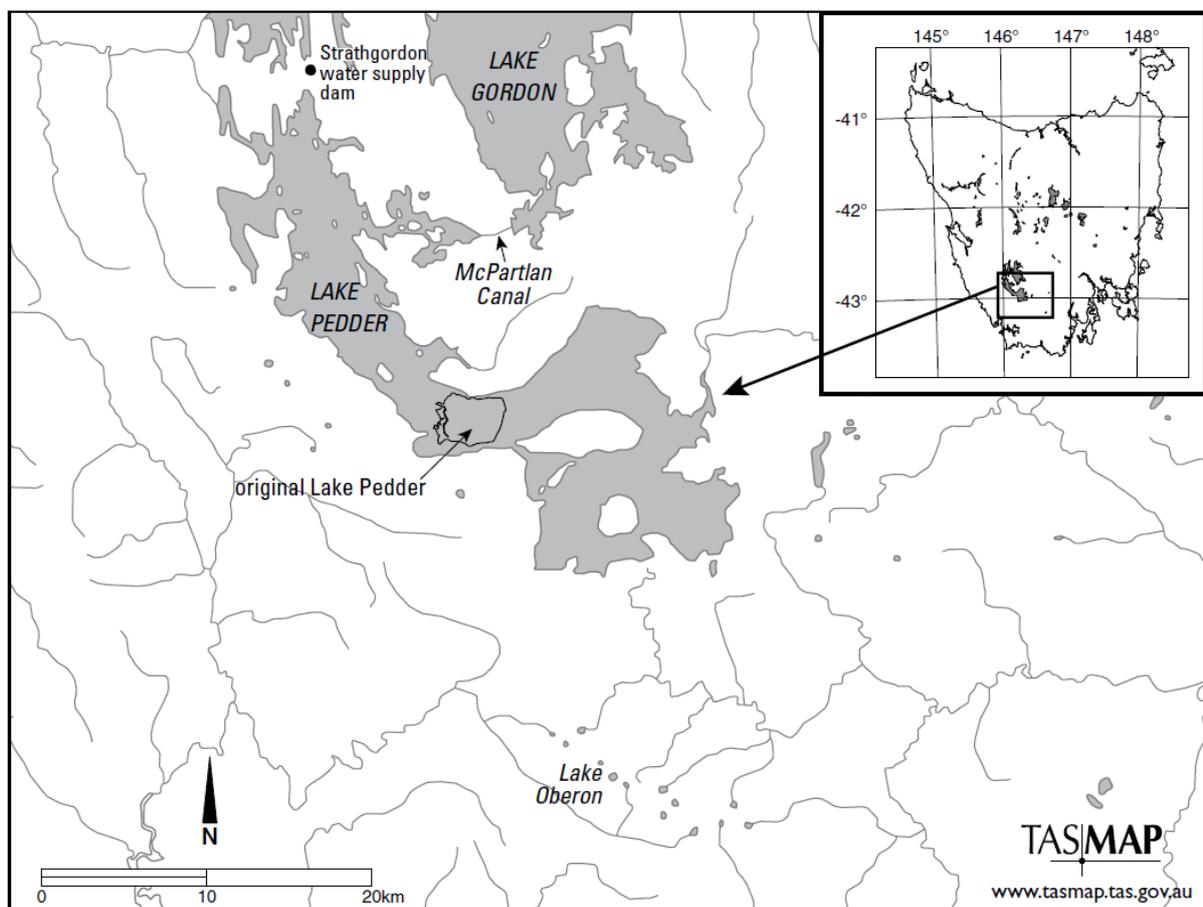


Figure 1. Location map showing Lake Pedder (the original lake and new impoundment), Lake Oberon and Strathgordon water supply dam. As part of recovery efforts to save the endangered Pedder galaxias species from extinction, fish were successfully translocated from their original habitat to new 'ex-situ' sites, initially to Lake Oberon and subsequently to the Strathgordon water supply dam.

Monitored results for performance indicators

Table I. Performance indicators and results

Performance Indicators (and how they are monitored)	Targets and/or Limits (and how performance is assessed)	Monitored Results (detected over the management period)
PRESSURE INDICATORS¹		
1. Presence of other fish species in translocated populations of Pedder galaxias		
<i>Monitoring</i>	<i>Targets</i>	<i>Results</i>
Annual monitoring of fish in Strathgordon water supply dam using fyke nets.	On-going annual recruitment of juvenile Pedder galaxias (as evidenced through monitoring).	Strathgordon water supply dam: Multiple cohorts of Pedder galaxias present since 2008.
Annual monitoring of barriers to fish migration into Strathgordon water supply dam by visual inspection and detection of Climbing galaxias or brown trout within the impoundment.	No other fish species recorded in translocated sites for populations of Pedder galaxias.	Two climbing galaxias recorded in the Strathgordon water supply dam in 2010 and one in 2011. None were recorded in the period 2012–2016 following improvements to fish barriers.
Monitoring of fish at Lake Oberon every five years using electrofishing and fyke netting.	<i>Assessment of performance</i>	Lake Oberon: Significant numbers of both juvenile and adult cohorts of Pedder galaxias present since 2002.
(Note: Monitoring is less frequent at Lake Oberon due to the expense of getting personnel and equipment to this remote site. Also, the risk of other fish species colonising is very low).	Results of fish surveys using fyke nets, and electro-fishing, and visual inspection of fish migration barriers.	No other fish species recorded in Lake Oberon.
CONDITION INDICATORS²		
2. Distribution and abundance of Pedder galaxias		
<i>Monitoring</i>	<i>Target</i>	<i>Results</i>
Annual monitoring of fish in Strathgordon water supply dam using fyke nets.	A target of at least 500 adult fish in each of the populations of Pedder galaxias in Lake Oberon and Strathgordon water supply dam is considered the minimum necessary to achieve a genetically viable self-maintaining population.	Strathgordon water supply dam: Fish populations have increased during the survey period (2007–2016) as a result of successful breeding. Population size is estimated to be well in excess of 500.
Monitoring of fish at Lake Oberon every five years using electrofishing and fyke netting.	<i>Assessment of performance</i>	Lake Oberon: Fish populations are stable with an estimated population of several thousand (Chilcott et al. 2013).
(Note: Monitoring is less frequent at Lake Oberon due to the expense of getting personnel and equipment to this remote site).	Results of fish surveys using fyke nets and electro-fishing.	
OTHER INDICATORS (e.g. social or economic)		
None appropriate for this project.		

¹ Pressure indicators¹ relate to activities, processes and/or agents that are considered to pose a threat of degradation to reserves or reserve values (either directly or indirectly).

² 'Condition indicators' relate to the condition of reserves or reserve values (e.g. natural or cultural resource assets and features).

Supporting evidence

Population characteristics

Figure 2 below shows the length frequencies for those Pedder galaxias captured during monitoring at Lake Oberon in March 2012 (n = 184). This population displays multiple cohorts with fish present in the range 30–118mm length, including a significant young of the year cohort 30–45mm length class.

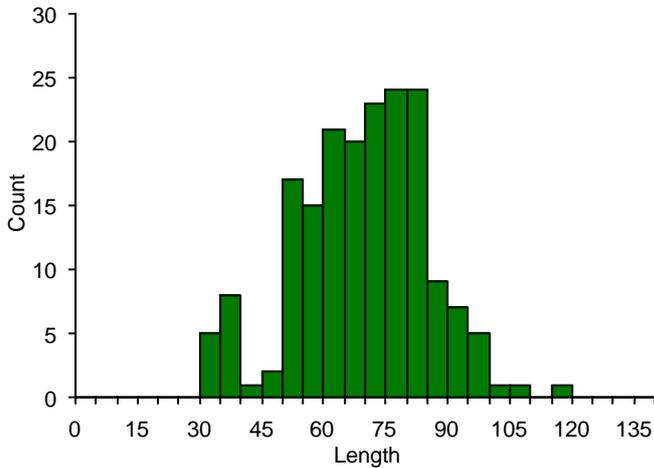


Figure 2: Length frequency for Pedder galaxias, Lake Oberon - March 2012

Figure 3 below shows the length frequencies for those Pedder galaxias captured and measured during monitoring at the Strathgordon water supply dam in March 2016 (n=111). This population displays multiple cohorts with fish present in the range 39–122mm length, including a significant young of the year cohort 35–55mm length class.

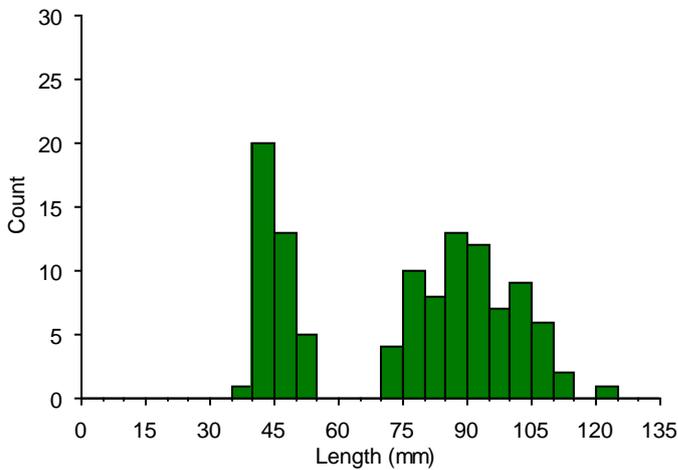


Figure 3: Length frequency for Pedder galaxias, Strathgordon - March 2016

Figure 4 below shows the increase in the catch per unit effort (CPUE) for Pedder galaxias during fyke net surveys undertaken at the Strathgordon water supply dam 2007 to 2016. A marked increase in CPUE occurred between 2007 and 2009 with the installation of suitable spawning habitat in late 2007, resulting in an increase in young of the year fish as detected during 2008 monitoring. A highly significant increase in CPUE also occurred between the 2012 and 2016 monitoring periods, highlighting a large and sustained increase in total population abundance.

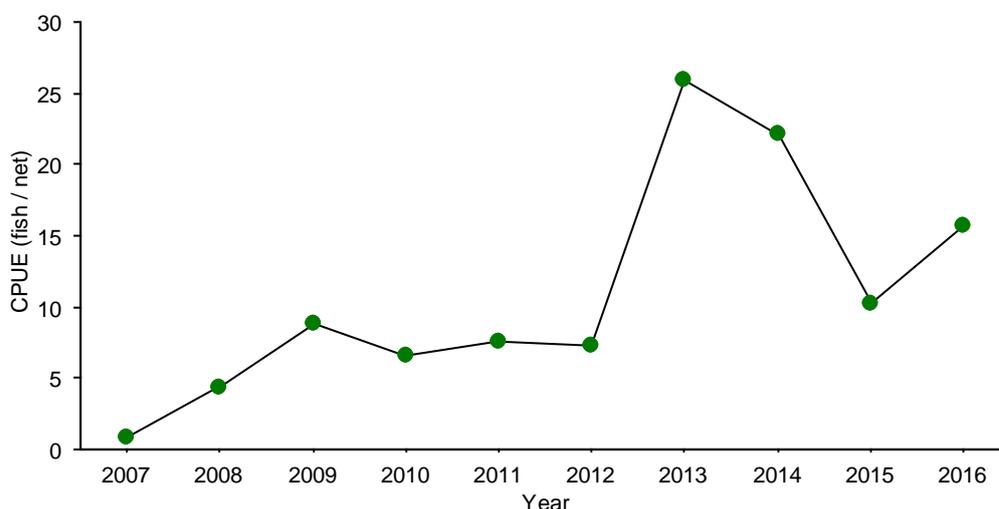


Figure 4: Catch per unit effort for Pedder galaxias from fyke netting surveys, Strathgordon 2007-2016

On-going monitoring over a number of years at both Lake Oberon and the Strathgordon water supply dam shows clear evidence that both populations of Pedder galaxias are well established and self-sustaining. These positive results give hope for the long-term future of the species.

Outcomes

Table 2. Expected and actual outcomes

Expected outcomes	Actual outcomes/outputs
A. GOAL AND KEY DESIRED OUTCOMES	
<i>Overall management goal:</i>	
<ul style="list-style-type: none"> Establishment of self-maintaining ex-situ populations of Pedder galaxias at Lake Oberon and the Strathgordon water supply dam to ensure the survival and long-term viability of this endangered fish species. 	<ul style="list-style-type: none"> Ex-situ populations of Pedder galaxias are now firmly established in Lake Oberon and the Strathgordon water supply dam. Monitoring has provided clear evidence that the populations at both sites are breeding well, and the abundance and mixed age-classes of the fish indicate that the populations are self-maintaining. This program has almost certainly saved the Pedder galaxias fish from extinction, and has dramatically increased the likelihood that this species will continue to survive and persist in the Tasmanian Wilderness World Heritage Area into the future.

Expected outcomes	Actual outcomes/outputs
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B. OTHER ANTICIPATED OUTCOMES/IMPACTS

- Potential establishment of a third translocated population of Pedder galaxias at a new site.
- Low priority outcome yet to be addressed.

C. UNANTICIPATED OUTCOMES AND/OR LEGACY

Three individuals of the climbing galaxias (a competitive species to Pedder galaxias) were detected in the period 2010 – 2011 within the Strathgordon water supply dam. Following mitigation measures (installation of a fish barrier on the outflow of the water supply dam) in late 2011 to prevent access to climbing galaxias, there has been no further detection of this species during monitoring in the period 2012–2016.

Overall, the expected legacy of this project is that the Pedder galaxias fish species will continue to survive and persist into the future.

Assessment and commentary on management performance

Table 3: Assessment of management performance

LEVEL OF PERFORMANCE	EFFECTIVENESS <i>To what extent did the project achieve its objectives?</i>	EFFICIENCY <i>To what extent was the project delivered on time and on budget? Were resources, including time and effort, used wisely and without wastage?</i>
Great result		
Satisfactory/Acceptable result		
Unsatisfactory/Unacceptable result		

Comments on management performance

Summary statement on performance

This project has been highly successful in meeting its objectives.

If management intervention not been undertaken in the very early stages of this species’ population demise, the Pedder galaxias species would now almost certainly be extinct. Establishment of the translocated population within Lake Oberon saved this species from extinction. However, because the species now only survives outside its original (pre-dam) natural habitat, it is officially recognised as being ‘extinct in the wild’.

Establishment of the second insurance population of Pedder galaxias in the Strathgordon water supply dam has increased the probability of ensuring the long term viability of this species.

Key factors contributing positively to management performance

- Commitment from the Inland Fisheries Service and their collaborators, Hydro Tasmania and DPIPWVE, to implementing the species recovery program.
- The use of an adaptive management approach, led by a professional and informed recovery team, was a major contributing factor to the success of this project.

Key factors limiting or threatening management performance

- Re-establishment of Pedder galaxias in the present Lake Pedder is very unlikely to be possible given that the factors that led to the species' extinction from the lake cannot be reversed or mitigated. Even in the event that attempts were made to restore the original Lake Pedder, it is considered highly unlikely that trout or climbing galaxias could be completely removed.
- Limited number of acceptably suitable new habitat locations for successful translocation of Pedder galaxias.
- Difficulty of maintaining Pedder galaxias in captivity.

Suggestions for improving management performance

- Establish a third translocation site for Pedder galaxias—with preference being for a site located outside the Tasmanian Wilderness World Heritage Area in order to protect the remaining pristine lakes within the TWWHA from human intervention.

Lessons learnt and/or additional comments

- Careful, considered and timely use of translocation as a management tool for conservation purposes can achieve significant positive outcomes for critically endangered species.
- Implementing a single-species recovery plan can sometimes prove more operationally tractable and deliver clearer outcomes than taking a multispecies approach (Chilcott et al, 2013).
- To understand the impacts of projects that have the potential to alter natural freshwater ecosystems, there is a need to closely monitor native fish populations pre- and post- the project construction phase.
- Building knowledge and understanding of the ecology and reproductive biology of all endemic Tasmanian galaxiids is important to help guide informed decision-making so as to avert serious impacts on native fish species in future.
- The outstanding results demonstrated by this project are a testament to what can be achieved when cross-agency teams collaborate in undertaking good research, which in turn informs evidence-based adaptive management responses, with the results and lessons captured and shared through an active monitoring, evaluation and reporting program.

Investment in this project

Funding to implement the Pedder galaxias species recovery plan has mostly been provided through Australian Government programs including the Endangered Species Program and the Tasmanian Wilderness World Heritage Area baseline funding program. The Inland Fisheries Service has been a major contributor to this conservation project since 2009. Resources have included the provision of a Project Manager and supporting staff, and general on-going project costs of approximately \$30,000 per annum. Hydro Tasmania assists in maintaining the Strathgordon water supply dam asset with an estimated annual expenditure of \$8,000 directly relating to the project. DPIPWVE's TWWHA Fauna program provided funding for research, planning, translocations of Pedder galaxias, and fish surveys in the early years of this program.

Sources and acknowledgements

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Rob Freeman has been involved in the conservation efforts for the Pedder galaxias over more than 20 years, and as Native Fish Conservation Project Officer with the Inland Fisheries Service for the last 8 years.

Photo: Inland Fisheries Service

Acknowledgements

Many people and organisations have contributed to the success of this project. The Project Manager wishes to acknowledge the numerous people who helped with obtaining funding, serving on recovery teams and conducting field operations. Special appreciation is extended to funding agencies and other contributing organisations who provided support during various stages of the project including: Commonwealth Government, Inland Fisheries Service, Australian Geographic, Hydro Tasmania; and following persons: Premek Hamr, Jean Jackson, Stuart Chilcott, Brett Mawbey, Andrew Sanger, Peter Davies, Wayne Fulton, David Crook, Sally Bryant, Paul Humphries, David Jarvis, Michael Driessen, Phil Bell, Steven Smith, Andrew Scanlon, and David Rounsevell, and the numerous support staff who worked diligently under difficult conditions in the Lake Pedder scrub to ensure the long-term viability of the Pedder galaxias.

Glenys Jones (PWS Planning and Evaluation) coordinated and guided preparation of this report. Dixie Makro (PWS Interpretation Officer – Publications) assisted with graphic design.

References and further information

For more information, click on the links below for more information on the following topics from the DPIPWWE website:

- [Threatened Species Strategy for Tasmania](#)
- [Threatened Species of Tasmania booklet](#)
- [Threatened Tasmanian Galaxiidae Recovery Plan 2006-2010](#)
- [Tasmanian Wilderness World Heritage Area](#)
- [Performance monitoring, evaluation and reporting for Tasmania's national parks and reserves](#)

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Photo gallery



Lake Oberon in the highlands of the Tasmanian Wilderness World Heritage Area is one of two sites where new populations of the endangered Pedder galaxias fish species have been successfully introduced and established. Features that made this lake potentially suitable as habitat for Pedder galaxias included: the lake was largely undisturbed by human influence and had good clean water with similar characteristics to the original habitat of the species; there were no other species of fish present in the lake; the lake supported a suitable food source of invertebrates; the geographic isolation of the lake meant it was unlikely that other fish species would be able to migrate into the lake.

Photo: IFS



Pedder galaxias are small fish and adults grow to a maximum length of about 100mm. They have marbled markings and an iridescent golden colour, often displayed especially on the head. Pedder galaxias eat aquatic invertebrates such as the larvae of stone flies and caddis flies.

Photo: IFS



Project Officer Rob Freeman undertaking electro-fishing to detect the presence of fish. Electro-fishing only temporarily stuns the fish so they can be returned unharmed following monitoring.

Photo: IFS



A set Fyke net at Lake Oberon

Photo: IFS



Dr Premek Hamr returns 25 years after his initial and critically important conservation efforts that helped save the Pedder galaxias species.

Photo: IFS



This sample of Pedder galaxias shows there are many fish of different sizes present. Populations of mixed age groups indicate that the population is successfully breeding with juveniles being recruited into the population

Photo: IFS



Night snorkelling surveys were another technique used to detect the presence and abundance of Pedder galaxias in Lake Oberon following their introduction.

Photo: IFS



Strathgordon water supply dam was the second 'ex-situ' site where a Pedder galaxias population was successfully established.

Photo: IFS



Installing rock debris at Strathgordon water supply dam to provide suitable habitat for spawning. Monitoring detected a marked increase in the number of fish in the following year.

Photo: IFS



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