

Review of the Oxleyan Pygmy Perch Recovery Plan

November 2015



Oxleyan Pygmy Perch (*Nannoperca oxleyana*). Photo: Gunther Schmida

**Prepared in accordance with the threatened species provisions of the
New South Wales *Fisheries Management Act 1994***

Introduction

This document reviews the National Oxleyan Pygmy Perch Recovery Plan (2005). The review assesses the implementation of recovery actions in NSW and progress in meeting the stated recovery objectives. The review also aims to clarify any required change in management actions or priorities in NSW necessary for the recovery of the species.

The Oxleyan Pygmy Perch Recovery Plan was approved as a final plan in 2005. The overall objectives of the recovery plan are to prevent the extinction and ensure the recovery and ongoing viability in nature of Oxleyan Pygmy Perch populations. The specific objectives of the recovery plan are to:

- Increase scientific knowledge and understanding about the distribution, habitat, life history, ecology and genetics of Pygmy Perch;
- Increase community awareness and support of Pygmy Perch recovery actions;
- Protect and restore essential habitats for Pygmy Perch;
- Minimise the impacts of introduced fish on Pygmy Perch;
- Reduce the illegal collection of Pygmy Perch by encouraging and involving aquarium enthusiasts to support recovery efforts; and
- Establish a program to monitor the status of Pygmy Perch and assess the effectiveness of recovery actions.

The plan will be judged a long-term success in NSW if the status of Oxleyan pygmy perch is revised from 'endangered' to 'vulnerable' on the schedules of the NSW *Fisheries Management Act 1994* within 15 years.

The recovery plan requires a major review within ten years of its publication. This document comprises the review and complies with section 220ZR (review of recovery and threat abatement plans) of the NSW *Fisheries Management Act 1994*.

Review of Recovery Actions

The Oxleyan Pygmy Perch Recovery Plan contains 41 actions to meet the plan objectives. The review of recovery actions was undertaken in consultation with a range of managers and scientists and drew on several different sources of information (e.g. Fisheries Scientific Committee's Annual Reviews of the threatened species lists, scientific papers, consultant reports, internal DPI reports and personal communication with a range of professionals with involvement in Oxleyan Pygmy Perch research, management and compliance operations).

The implementation details for each of the recovery action program areas are outlined in Table 1, 2 and 3.

Table 1: Review of recovery actions - Research and Investigation Activities

Recovery Action	Implementation Details
RIA 1: Evaluate sampling methodologies to determine the most effective way to sample Pygmy Perch populations while minimizing adverse impacts on the species.	Complete. Field testing of a combination of sampling techniques was undertaken culminating in the design of a non-harmful, efficient sampling protocol designed. The protocol was published in the scientific literature (Knight et al. 2007a), and has been widely used in surveys by government and environmental consultants.
RIA 2: Conduct broad-scale surveys to establish the species' limits of distribution and to identify catchments where the species might be found.	Complete. Broad-scale surveys were undertaken in 2001 to the north, west and south of the known NSW populations in Broadwater, Bundjalung and Yuraygir National Parks, with several new locations were found supporting the species. Research in 2007 revealed a new population near Red Rock, extending the range to the south of Yuraygir National Park. The Pacific Highway Upgrade studies have extended the species' known range to the west of Bundjalung National Park.
RIA 3: Conduct intensive surveys in drainage areas identified as supporting or potentially supporting new Pygmy Perch populations, to map their distribution and identify habitat associations.	Complete. Intensive surveys between 2001 and 2004 discovered numerous sites supporting populations within the Richmond and Clarence River Catchments. Distributions were mapped and habitat associated quantified. Results have been published in the scientific literature (Knight and Arthington 2008). NSW DPI monitored populations at 11 sites across the species distribution in 2008 and 2012. The result suggested declining abundance at most sites. No Oxleyan Pygmy Perch were detected at several previously occupied locations. Further sampling is planned at these sites for 2015. Further survey work has been undertaken as part of the Pacific Highway upgrade. Eighteen waterways were sampled for 3 consecutive years from 2013 – 2015 capturing 221 individual Oxleyan Pygmy Perch. Water quality, habitat description, macrophytes and all fish species were identified. A drought refuge and connectivity study was completed in April 2014 as part of the Pacific Highway Upgrade in the Broadwater area.
RIA 4: Develop a GIS-based map of the distribution of known and predicted Pygmy Perch habitat across the species range. This will be achieved by combining available mapping and remote sensing data with existing or new field data.	Complete. A GIS-based map of the known and potential distribution of Oxleyan Pygmy Perch has been developed and distributed as required.
RIA 5: Project fine scale maps for important areas (e.g. near towns) showing the distribution of water bodies: a) known, b) with the potential, and c) unlikely to support Pygmy Perch.	Complete. Fine scale maps for important areas showing the distribution of water bodies has been completed. It is updated as new information becomes available. Maps were also prepared and publicly exhibited as part of the preliminary identification of critical habitat for Pygmy Perch (see CRA3).
RIA 6: Encourage scientific investigation of key areas of the biology and ecology of Pygmy Perch to provide information valuable to the recovery of the species or its management. This may include work to establish environmental tolerances, ability to survive in disturbed habitats, factors influencing population dynamics and variability, age and growth, diet, etc.	Commenced. Research has been undertaken into the species reproductive biology, early life history, salinity tolerances, environmental associations, and age and growth, with several publications resulting (Knight et al. 2007b; Knight and Arthington 2008; Knight and Trnski 2011. Knight et al. 2012). A PhD thesis (Knight 2008) was also completed which synthesised the available biological and ecological information.
RIA 7: Initiate a project to examine genetic diversity and structure in populations of Pygmy Perch, in collaboration with a university or other research institution.	Complete. The genetic diversity of NSW populations was examined and compared to that of Queensland populations by Knight et al. (2009).
RIA 8: Support this work by collecting material (e.g. fin clips) during surveys within NSW.	Complete. Fin clips were taken during broad-scale and intensive surveys and were used in genetic analysis by Knight et al. (2009).
RIA 9: Record data on all fish species captured during the survey program and on-going monitoring program for entry	Complete. Data on all species captured was collected during broad-scale and intensive surveys. Results have been included in the Fisheries Final Report Series (publication pending). Monitoring surveys in 2008 revealed

Recovery Action	Implementation Details
into a species database. The data will record the capture of introduced and indigenous species.	Pygmy Perch populations persisting where previously recorded. However, data collected in 2012 suggest declines in abundance at most sites and the possible absence of Oxleyan Pygmy Perch at several previously occupied locations.
RIA10: Use this data, and any other available records, to map the distribution of introduced species relative to Pygmy Perch and any expansion in their range or abundance over time.	Not commenced.
RIA 11: Implement the NSW Freshwater Fish Stocking Fishery Management Strategy to prevent significant impacts from stocking on Pygmy Perch.	Ongoing.
RIA 12: Support further studies on interaction between gambusia and Pygmy Perch (e.g. experimental trials, behavioral studies, resource partitioning studies) to determine the probable impacts of gambusia on Pygmy Perch.	Commenced. Some preliminary research into aggressive interactions was undertaken by students from Southern Cross University.

Table 2: Review of recovery actions – Compliance and Regulatory Activities

Recovery Action	Implementation Details
CRA 1: Provide GIS-based maps of known and potential Pygmy Perch sites on CD-ROM, to councils and relevant government agencies.	Complete. Hard copy habitat distribution maps and associated data has been provided to relevant stakeholders including Richmond Valley Council, State Forest NSW, NSW Office of Environment and Heritage, relevant consultants undertaking Pygmy Perch survey work (e.g. Aspect North, Geolink, Greenloaning Biostudies), Evans Head Memorial Aerodrome Committee, and the Environment Protection Authority.
CRA 2: Develop Environmental Impact Assessment Guidelines for Oxleyan Pygmy Perch and distribute these to relevant councils, LLS, State government agencies, environmental consultants and developers.	Complete. Environmental Impact Assessment Guidelines for all threatened fish species were prepared in 2008. The guidelines were made available on the NSW DPI website at: http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/226536/Threatened-Species-Guidelines.pdf Policy and Guidelines for Fish Habitat Conservation and Management were updated in 2013 and are available at: http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0009/468927/Policy-and-guidelines-for-fish-habitat.pdf This document outlines policy and guidelines aimed at maintaining and enhancing fish habitat for the benefit of native fish species, including threatened species. It also contains up-to-date legislative and policy information for planning and development assessment processes, including threatened species assessment.
CRA 3: Review regulatory and voluntary incentive based mechanisms available to enhance protection for key Pygmy Perch habitat areas and apply as required. This may include the use of critical habitat provisions, aquatic protected areas, voluntary conservation agreements etc.	Complete. Following a review of the possible regulatory and voluntary mechanisms available to enhance protection for Oxleyan Pygmy Perch habitat a decision was made to proceed with a preliminary identification of critical habitat. The preliminary identification was released for public comment from 3 February to 12 March 2010. The proposal included all public land where the species are known or are likely to occur. Following public exhibition and consideration of submissions it was decided not to proceed with the declaration of critical habitat due to the nature of potential impacts on operational matters (such as fire hazard reduction) of several public authorities. Further information is available at http://www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what-current/endangered-species/oxleyan-pygmy-perch/update-declaration-of-oxleyan-pygmy-perch-critical-habitat
CRA 4: Communicate information on the conservation and legal status of	Complete, ongoing. Several measures have been undertaken to communicate the conservation and legal status of Pygmy Perch.

Recovery Action	Implementation Details
Pygmy Perch through appropriate media such as aquarium industry journals, society newsletters, conferences etc.	Conservation research staff have presented at a number of conferences (e.g. ASFB, National ANGFA conference) and published articles in journals and magazines. A consultant for the Environmental Trust Oxleyan Pygmy Perch stormwater retrofit project presented a paper to the NSW Coastal Conference. A workshop organised by Richmond Valley Council on "Saving Aquatic Habitat in Stormwater Drains" helped to raise awareness of the importance of these areas to Pygmy Perch. The factsheets developed to complement the workshop are available at: http://www.dpi.nsw.gov.au/fisheries/habitat/protecting-habitats/toolkit#Workshops

Table 3: Review of recovery actions – Management Activities

Recovery Action	Implementation Details
MA 1: Produce and distribute information brochures (e.g. Primefacts) and other advisory materials. Advisory material will be posted to stakeholders and distributed at meetings, community days and other functions. They will also be on display at local councils, relevant government offices and LLS/NRM regional offices.	Complete, ongoing. NSW DPI has prepared and updated a Primefact on Pygmy Perch (see http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0014/144311/oxleyan-pygmy-perch.pdf). The Primefact was distributed internally within DPI to relevant sections for display purposes and use at community events. The DPI Threatened Species Unit has sent the Primefact to various stakeholders when requested including primary and high school students. The Primefacts are also available to the public via the NSW DPI website and are on display at relevant DPI offices.
MA 2: Write articles for regional newspapers and/or relevant magazines to raise awareness of Pygmy Perch status and issues.	Complete, ongoing. Several articles have appeared in local newspapers about the habitat rehabilitation works that have been undertaken for Pygmy Perch near Evans Head (see MA16).
MA 3: Encourage participation of local indigenous people through direct consultation and targeted advisory activities.	Complete. Indigenous groups were consulted during the public exhibition of the Oxleyan Pygmy Perch recovery plan. Relevant indigenous groups including 20 Local Aboriginal Land Councils, as well as relevant aboriginal advisory councils were consulted on the draft plan. Submissions and feedback were invited from these groups. One submission was received from the Dirawong Reserve Trust which indicated support for the recovery plan for the species.
MA 4: Develop and distribute Pygmy Perch educational materials including information on the species habitat and role in the ecosystem.	Complete. Various advisory materials have been prepared and distributed for Oxleyan Pygmy Perch including Primefacts, factsheets, advisory signs and research papers in scientific journals.
MA 5: Install signs and/or interpretative displays at appropriate locations (e.g. access points for national parks or on council managed land).	Commenced, ongoing. Two advisory signs were prepared and installed for the Oxleyan Pygmy Perch Habitat Ecosystem Restoration Project location near Evans Head.
MA 6: Incorporate the location of Pygmy Perch sites within national parks into the information systems used to manage national park activities.	Commenced. Oxleyan Pygmy Perch distribution data has been incorporated into the Fire Management Strategy for Broadwater National Park. Specific recommendations relating to the use of fire near Pygmy Perch habitat in Broadwater National Park has been incorporated into the relevant fire management plan. NSW DPI is investigating incorporating Oxleyan Pygmy Perch distribution data into the Bushfire Risk Information Management System (BRIMS). BRIMS is accessed and used by a range of relevant government agencies (e.g. OEH, Rural Fire Service etc) when undertaking hazard reduction works within national parks.
MA 7: Incorporate the use of habitat protection mechanisms into the management plans for relevant NSW National Parks. These can include the closure of access trails that bisect key water bodies or the modification of weed and pest control activities.	Not commenced.
MA 8: Incorporate appropriate impact minimisation considerations in bushfire	Commenced. NSW DPI is investigating incorporating Oxleyan Pygmy Perch distribution data and protection provisions into the Bushfire Risk

Recovery Action	Implementation Details
hazard reduction plans.	Information Management System (BRIMS). BRIMS is accessed and used by a range of relevant government agencies (e.g. OEH, Rural Fire Service etc.) when undertaking hazard reduction works.
MA 9: Negotiate with councils in regard to local environmental plans, development control plans and other planning documents, regarding the type and scale of development near Pygmy Perch populations and habitat.	Commenced, ongoing. NSW DPI has negotiated with Richmond Valley Council on numerous projects since the adoption of the Oxleyan Pygmy Perch Recovery Plan. Examples include the Development Control Plan for Water Sensitive Urban Design, Local Environment Plan, Drain Management Plan and Stormwater Management Plan. Conditional permits with requirements to avoid impacts on Oxleyan Pygmy Perch have been issued for the Evans-Woodburn pipeline, Evans-Broadwater pipeline, Woodburn-Evans bike path.
MA 10: Provide appropriate knowledge and expertise to assist councils to develop drain management plans which avoid or minimise the impacts of drain construction and maintenance on Pygmy Perch populations and habitats.	Complete. Richmond Valley Council has developed a drain management plan for Oxleyan Pygmy Perch. The drain management plan has resulted in Council recognising that much of its historic drainage work; involving modifying natural waterways are no longer required.
MA 11: Identify Pygmy Perch habitat sites affected by sedimentation, pollution or barriers to fish movement such as roads and trails. Encourage land holders or relevant agencies (e.g. councils, OEH) to install sediment and pollution controls and provide adequate fish passage.	Commenced, ongoing. As part of the Pacific Highway Upgrade permanent water quality basins will be installed adjacent to all waterways where Oxleyan Pygmy Perch occur. The basins will treat road runoff and improve water quality and can capture polluting spill events. Fish passage will also be enhanced by the replacement of culverts with bridges. Compliance investigations were undertaken into two matters for their potential impacts on Oxleyan Pygmy Perch habitat. Further work is required to proactively identify issues on private or public lands and assist with rehabilitation activities.
MA 12: Incorporate information and strategies to reduce the impacts of bush fire hazard reduction works, fire fighting operations and fire trial construction on Pygmy Perch populations and habitats when reviewing local bush fire management plans and other reserve or community fire plans.	Commenced. Pygmy Perch distribution data has been incorporated into the Fire Management Strategy for Broadwater National Park. Specific recommendations relating to the use of fire near Pygmy Perch habitat in Broadwater National Park has been incorporated into the relevant fire management plan. NSW DPI is investigating incorporating Pygmy Perch distribution data and protection provisions into the Bushfire Risk Information Management System (BRIMS). BRIMS is accessed and used by a range of relevant government agencies (e.g. OEH, Rural Fire Service etc) when undertaking hazard reduction works.
MA 13: Encourage the identification, assessment and modification of natural resource management plans and policies (including catchment action plans, water management plan, vegetation management plans, and other land management plans) which may impact on Pygmy Perch habitat to minimise impacts on stream flows, connectivity of habitats, riparian vegetation or soils in wallum heath areas.	Not commenced.
MA 14: Identify degraded habitats known or likely to have supported Pygmy Perch, where there is a potential for the species to re-establish viable populations.	Commenced, ongoing. Degraded habitats for Pygmy Perch have been identified as part of the habitat rehabilitation projects undertaken in the Evans Head Area and as part of the Pacific Highway Upgrade (see MA10, MA16).
MA 15: Develop guidelines for rehabilitation work which includes advice on appropriate native species for replanting, effective sediment controls etc.	Commenced. A Threatened Fish Management Plan for Oxleyan Pygmy Perch has been prepared as part of the Pacific Highway Upgrade. This includes advice on habitat requirements include aquatic vegetation that they occur in and detailed erosion and sediment control plans.
MA 16: Work with relevant stakeholders to prioritise and commence the rehabilitation of key Pygmy Perch	Commenced, ongoing. Richmond Valley Council was successful in obtaining \$78,000 from the NSW Environmental Trust to retrofit two stormwater systems to minimize impacts on Oxleyan Pygmy Perch

Recovery Action	Implementation Details
<p>habitat. This may include the establishment of a 'demonstration site' where various rehabilitation techniques are trialed and water quality monitoring undertaken.</p>	<p>receiving waters as part of a \$158,000 project. The works were successful and selected as an Environmental Trust Demonstration project. The Environmental Trust provided Council with an additional \$8,000 to hold a workshop and detail the project and broadly applicable lessons in a series of factsheets (see CRA4). The project won a Local Government Environmental Award in 2006 and Council's project manager received an award from the Institute of Public Works Engineers Australia NSW division. A number of sites will be rehabilitated as part of the Pacific Highway Upgrade. Wetland habitats are planned to provide drought refuges as part of the construction process.</p>
<p>MA 17: Seek funds to expand rehabilitation work through grant schemes or other sources.</p>	<p>Commenced, ongoing. Funds for rehabilitation works were received from the NSW Environmental Trust.</p>
<p>MA 18: Investigate the feasibility of eradicating gambusia from enclosed water bodies in close proximity to Pygmy Perch habitat that are high-risk in terms of the spread of gambusia.</p>	<p>Not commenced.</p>
<p>MA 19: Develop and implement a gambusia threat abatement plan (including the development of controls that could be used in waterways containing Pygmy Perch).</p>	<p>Commenced, ongoing. A gambusia threat abatement plan was prepared in 2003 by the Office of Environment and Heritage with input and assistance from NSW DPI. An action in the threat abatement plan is to "Propose gambusia for declaration as a noxious fish in NSW". NSW DPI listed gambusia as Class 1 noxious species outside the greater Sydney area. This means it is illegal to sell or possess it live, even in aquaria outside the greater Sydney area.</p>
<p>MA 20: Ensure that the Protected, Threatened and Pest Species Sighting Program cover the NSW north coast area where the Pygmy Perch occurs. Ensure materials are available to assist the public in identifying gambusia, and encourage reporting of gambusia sightings in or near Pygmy Perch habitat.</p>	<p>Complete. The Protected, Threatened and Pest Species Sighting Program covers the NSW north coast where Pygmy Perch occurs and encourages reporting sightings of the species. Various information materials are available to stakeholders via the NSW DPI website to assist with identifying gambusia and to encourage reporting of this pest species.</p>
<p>MA 21: Incorporate any information obtained from the public into the species database, available via the web, and use it to assist in mapping the distribution of gambusia.</p>	<p>Not commenced.</p>
<p>MA 22: Incorporate gambusia and its impacts on Pygmy Perch in general pest species literature and communication programs on pest species.</p>	<p>Not commenced.</p>
<p>MA 23: Facilitate the involvement of ANGFA volunteers, wherever possible, in survey work undertaken as part of the sampling and monitoring program.</p>	<p>Commenced, ongoing. ANGFA volunteers assisted with the broadscale surveys that were undertaken in 2001.</p>
<p>MA 24: Encourage the inclusion of sampling for Pygmy Perch into any ANGFA fieldtrips in parts of the State where the species may potentially occur, and ensure additional records are provided to NSW DPI.</p>	<p>Not commenced.</p>
<p>MA 25: Evaluate the results of the initial survey program in terms of techniques, timing and site selection to develop and implement a long-term program to assess the ongoing conservation status of the species and the success of recovery actions.</p>	<p>Complete, ongoing. A subset of 10 sites spanning the NSW distribution of the species have been adopted as long-term monitoring sites. Monitoring is undertaken using a standardised electrofishing and bait trap protocol consistent with Knight et al. 2007a. Samples have been collected in 2008 and in 2012. Resampling is planned for 2015 and at three yearly intervals thereafter.</p>

Assessment of Action Implementation

Overall, there has been a sustained and successful effort to implement recovery actions for Oxleyan Pygmy Perch in NSW and this is reflected in the large number of recovery actions complete or commenced. Of the twelve Research and Investigation actions eight are complete and three have commenced. Only one Research and Investigation action has not commenced to date. This action (RIA10) relates to mapping the distribution of introduced species relative to Pygmy Perch and any expansion in their range or abundance over time. All of the Compliance and Regulatory actions are complete, with one action ongoing. Of the twenty-five Management actions, seven are complete and eleven are commenced or ongoing. Only six Management Actions have not commenced to date. Of those six, three relate to biosecurity management issues concerning the impacts of introduced species on Oxleyan Pygmy Perch.

Although a significant proportion of recovery actions have been implemented since the adoption of the recovery plan, many of the actions require ongoing work into the future to make a difference to the overall recovery status of the species. For example, MA16 relates to working with stakeholders to prioritise and commence the rehabilitation of key Oxleyan Pygmy Perch habitat. This may include the establishment of a 'demonstration site' where various rehabilitation techniques are trialled and water quality monitoring undertaken. This action requires repeated implementation at numerous sites to make a significant difference to the conservation status of the species. It also relies on the implementation of a range of other recovery actions.

Achievement of recovery plan objectives

Much has been achieved over the 10 years since the adoption of the Oxleyan Pygmy Perch Recovery Plan. Significant progress has been made to improve scientific knowledge and understanding about the distribution, habitat, life history, ecology and genetics of Oxleyan Pygmy Perch, and some work has also been undertaken to protect and restore essential habitats for the species. In their 2015 annual review of the threatened species lists, the NSW Fisheries Scientific Committee identified a need for further targeted surveys of Oxleyan Pygmy Perch. The development and implementation of an ongoing program to monitor the status of Oxleyan Pygmy Perch and to assess the effectiveness of recovery actions into the future is essential. This information needs to be used to prioritise future recovery efforts.

This review has highlighted two areas in particular where more work is required to assist with the recovery of Oxleyan Pygmy Perch. This includes work to minimise the impacts of introduced fish (gambusia) on Oxleyan Pygmy Perch; and improve community awareness and support for recovery actions. Little to no work has been undertaken in these areas and this hampers the recovery of the species. Further work is also required to investigate the extent of illegal collection of Oxleyan Pygmy Perch as no further anecdotal reports have been received by NSW DPI on this potential threatening process.

The recovery plan states that it will be judged a long-term success if the status of Oxleyan Pygmy Perch is revised from 'endangered' to 'vulnerable' on listings under the NSW *Fisheries Management Act 1994*, and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* within 15 years. Based on the information available and the recent review of the status of Oxleyan Pygmy Perch by the Fisheries Scientific Committee, it appears that populations have not increased to the point of downgrading or delisting the species. Further work is required within the next 5 years to achieve this goal.

Since the adoption of the Oxleyan Pygmy Perch Recovery Plan legislative changes to the NSW *Fisheries Management Act 1994* have required the development of a Priorities Action Statement (PAS). The PAS sets out all of the actions required to recover threatened species, populations, ecological communities and address key threatening processes listed under the *Fisheries Management Act 1994*. The recovery actions outlined in the Oxleyan Pygmy Perch Recovery Plan have been prioritised and included in the PAS. The PAS is available on the NSW DPI website at www.dpi.nsw.gov.au. Any future actions required to recover Oxleyan Pygmy Perch will be outlined and included in future reviews of the PAS.

References

- Knight, J. T. and Arthington, A. H. 2008. Distribution and habitat associations of the endangered Oxleyan pygmy perch, *Nannoperca oxleyana* Whitley, in eastern Australia. *Aquatic Conservation: Marine and Freshwater Ecosystems* **18**, 1240-1254.
- Knight, J. T., Arthington, A. H., Holder, G. H. and Talbot, R. B. 2012. Conservation biology and management of the endangered Oxleyan pygmy perch *Nannoperca oxleyana* in Australia. *Endangered Species Research* **17**, 169-178.
- Knight, J. T., Glasby, T. M. and Brooks, L. O. 2007a. A sampling protocol for the endangered freshwater fish, Oxleyan pygmy perch *Nannoperca oxleyana* Whitley. *Australian Zoologist*. **34**: 148-157.
- Knight, J. T., Butler, G. L., Smith P. S. and Wager, R. N. 2007b. Reproductive biology of the endangered Oxleyan pygmy perch *Nannoperca oxleyana* Whitley. *Journal of Fish Biology* **71**, 1494-1511.
- Knight, J. T., Nock, C. J., Elphinstone, M. S. and Baverstock, P. R. 2009. Conservation implications of distinct genetic structuring in the endangered freshwater fish *Nannoperca oxleyana* (Percichthyidae). *Marine and Freshwater Research* **60**, 34-44.
- Knight JT (in press). Distribution and conservation status of the endangered Oxleyan pygmy perch *Nannoperca oxleyana* Whitley in New South Wales. Fisheries Final Report Series. NSW Department of Primary Industries, Taylors Beach.
- NSW DPI. 2005. Oxleyan Pygmy Perch Recovery Plan and Background Paper. NSW Department of Primary Industries. Port Stephens Fisheries Institute.

More information

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