NSW GOVERNMENT | Department of Primary Industries

Review of the River Snail Recovery Plan

December 2017

Introduction

This document reviews the NSW River Snail Recovery Plan (NSW DPI 2007). The review assesses the implementation of recovery actions in NSW and details the progress made towards meeting the stated recovery objectives. The review also considers if any changes are required to actions or priorities necessary for the recovery of the species.

The River Snail Recovery Plan was finalised and released in 2007 (DPI 2007). The overall objective of the recovery plan is to prevent the extinction and promote the recovery of River Snail populations in NSW. Specific objectives of the recovery plan are to:

- Increase awareness of the current status of the River Snail throughout its former natural range;
- Locate and protect remnant populations in natural habitats or translocated populations in artificial habitats;
- Investigate the feasibility of establishing an artificial breeding and translocation program for the River Snail in NSW;
- Increase our understanding of the threats to the River Snail and undertake management actions to ameliorate threats; and
- Establish a program to monitor the status of the River Snail populations (either natural or introduced) and assess the effectiveness of recovery actions.

The plan will be judged a long-term success in NSW if the River Snail is revised from endangered to vulnerable on the Schedules of the NSW *Fisheries Management Act 1994* (FM Act) 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 FM Act.

Changes to the River Snail Listing

In 2001 the FSC listed the River Snail (*Notopala sublineata*) as an endangered species in NSW under the FM Act. In 2016 the FSC made a final determination to change the listing of the River Snail to recognise two separate species – the Darling River Snail (*Notopala sublineata*) and Hanley's River Snail (*Notopala hanleyi*). Those final determinations also amended the listing status for both species from 'endangered' to 'critically endangered'.

This recovery plan review relates to actions undertaken over the last 10 years during which time the *N. hanleyi* and *N. sublineata* were still listed as a single species (*Notopala sublineata*). The review will therefore only refer to the River Snail collectively as it was listed during the time the recovery plan was prepared and implemented.

Review of Recovery Actions

This statutory review of the River Snail Recovery Plan has been undertaken in consultation with a range of natural resource managers and scientists and drew on several sources of information (e.g. Fisheries Scientific Committee's Annual Reviews of the threatened species lists, scientific papers, internal DPI reports) and personal communication with a range of professionals with involvement in River Snail research and management actions.

The recovery plan includes three program areas:

- Research and investigation activities;
- Compliance and regulatory activities; and
- Management activities.

The implementation details for each recovery action are summarised in Tables 1 – 3.

Table 1 Review of recovery actions - Research and Investigation Activities (RIA)

Recovery Action	Implementation Details
RIA 1: Collate data on the historical distribution of the River Snail	**Complete.** NSW DPI has compiled and collated data on the historical distribution of the River Snail into a database for distribution mapping purposes. The data has been used in a range of advisory and planning documents.
RIA 2: Conduct targeted surveys to determine the current distribution of the River Snail in natural and artificial habitats.	**Commenced, ongoing.** Three surveys of relevance to the River Snail have been undertaken since around the time the recovery plan was implemented. Mitchell (2005) examined the macroinvertebrate communities of the littoral zone from sections along the Murray, the Murrumbidgee, the Namoi, the Upper Barwon-Darling and the Lower Darling rivers. The goal of the surveys was to detail the macroinvertebrate assemblages, specifically the molluscan diversity surviving within the rivers and irrigation structures, and to determine the current distribution and conservation status of *Notopala sublineata sublineata* and *Notopala sublineata hanleyi*. The results of the study indicated a severe decline in molluscan diversity, with a total of only eight species collected, of which only three species occurred within the river channels. A living population of River Snail (*Notopala hanleyi*) was discovered in a Western Murray Irrigation pipeline off the Murray River at Dareton in NSW. In December 2005 NSW DPI organised collection of flushed snails from the irrigation pumping station at Dareton. The snails collected from the irrigation pipeline were identified as the River Snail and taken to Narrandera Fisheries Centre. The live snails collected from the pipeline bred following capture but unfortunately did not survive in captivity for very long. The snails have not been found in the pipeline environment again despite one further attempt by NSW DPI to locate them. Holmes *et al* (2013) carried out a survey of the irrigation pipelines, and the Darling River from Brewarrina to Wentworth and the irrigation pipelines in Barmera/Kingston on the Murray (South Australia) to determine the presence and size of any *Notopala sublineata* populations found. Thirty-nine sites were surveyed along a section of and adjacent to the Murray River, and for the entirety of the Darling River. No live *N. sublineata* were found in either river. Old *N. sublineata*

	shells were found around Bourke, Brewarrina and Walgett. Fresh shell fragments were found in a water supply tank near Brewarrina. Further survey work is required to confirm the existence of a population at this locality. The project also surveyed the Paroo River and the upper reaches of the Barwon River. Murphy and Shea (2013) undertook a survey of both terrestrial and freshwater molluscan fauna in the Pilliga forest in northern inland NSW in 2006 – 2012. Despite the sampling of 88 aquatic sites no living *N. sublineata* were found. A new population of River Snail was discovered by NSW DPI in September 2015 in rock crevices at Island Creek Weir on the Lachlan River in NSW. Preliminary identification is that the species is Hanley's River Snail (*Notopala hanleyi*). A follow-up quantitative survey of the Island Creek structure and similar weirs/irrigation infrastructure within the lower Lachlan catchment is currently being scheduled by NSW DPI. To assist with future targeted surveys for the River Snail NSW DPI has developed a sampling protocol and data recording sheets.
RIA 3: Continue to collect data on the presence/absence of the River Snail during incidental surveys.	**Commenced, ongoing.** The new population of River Snail discovered in rock crevices at Island Creek Weir on the Lachlan River was found by NSW DPI during opportunistic surveys. Since this discovery, a River Snail sighting sheet has been prepared and distributed to NSW DPI research staff with a request to keep an eye out for the species when undertaking survey work. The sighting sheet includes identification information, photos of the possible variability in shell appearance, and information on the species preferred habitat. NSW DPI continues to record data on the presence/absence of the River Snail during incidental surveys and maintains a database for sighting records of protected and threatened species that covers potential River Snail habitat. NSW DPI actively encourages community reporting sightings of the species via the DPI website.
RIA 4: Ensure that all River Snail records are confirmed by an expert and included in the Australian Museum collection.	**Commenced, ongoing.** All River Snail records have been confimed by an expert and have been included in the Malacology Collection at the Australian Museum where possible. Recent samples collected from the Lachlan River have been sent to an expert and are awaiting

	formal identification. Preliminary identification is that they are *Notopala hanleyi*.
RIA 5: Where possible, encourage scientific investigation into key aspects of the biology and ecology of the River Snail. This may include work to establish environmental tolerances, recruitment success, factors influencing population dynamics and variability, age and growth, diet etc.	**Commenced, ongoing.** Limited research has been undertaken into the biology and ecology of the River Snail during the statutory review period. Scientific investigation has been made difficult by the inablity to find the species in the natural environment and subsequently from artificial habitats following collection in Western Murray Irrigation pipelines in 2005. A primary information source on the species biology and ecology is an unpublished Honours thesis by Wishart (1994). Aspects of the biology and ecology of the River Snail investigated during the statutory review period include characterisation of the biofilm utilised by the species; age and growth of *N sublineata hanleyi*; morphology including variation in shell shape; and genetics (see Holmes *et al* 2013). Dr Sebastian Holmes provided NSW DPI with several hundred *N. sublineata* individuals sourced from Kingston on Murray in South Australia in February 2014. In the time that NSW DPI held the species in captivity several young snails were observed. Unfortunately, no formal observations relating to habitat preferences or breeding behaviour were made and all snails have since died.
RIA 6: Where possible, ensure that elements of this research are incorporated into funded survey programs. In other cases, actively encourage and support university students (honours or postgraduate) to undertake relevant projects.	**Commenced, ongoing.** NSW DPI has been supportive of research into the River Snail and has provided in-kind support where possible. In 2012/13 the FSC funded a student research project into the species culminating in the report by Holmes *et al*. 2013. River snail research has not been incorporated into a long-term funded survey program. To date, NSW DPI research staff are asked to keep a look out for the species when undertaking sampling and surveys in areas where the species may occur.

Table 2 Review of recovery actions - Compliance and Regulatory Activities (CRA)

Recovery Action	Implementation Details
CRA 1: Review regulatory and voluntary incentive based mechansims available to enhance protection for key habitat areas and apply as required. This may include the use of critical habitat provisions, aquatic reserves, voluntary conservation agreements etc.	**Not commenced.**
CRA 2: Actively encourage the reporting and protection of River Snail populations found in artifical environments such as irrigation pipelines.	**Commenced, ongoing.** In 2005 the River Snail was found in a Western Murray Irrigation pipeline at Dareton. Following the find NSW DPI prepared advisory materials and liaised directly with the company regarding the logistics of collecting the species from the pipelines. NSW DPI staff communicated with the company on two occasions to facilitate collection of the snails following flushing events. The small number of live River Snail found in the pipelines in 2005 were retained and housed in aquaria at the Narrandera Fisheries Centre. Despite the birth of a small number of individuals whilst in captivity, all of the snails died within 12 months of collection.

Table 3 Review of recovery actions - Management Activities (MA)

Recovery Action	Implementation Details
MA 1: Ensure that councils, government agencies and other relevant organisations are aware of the location of important areas for the River Snail by providing maps and advisory materials of known and/or potential habitat.	**Commenced, ongoing.** Information on threatened aquatic species distribution in NSW has been distributed since 2006 using Primefacts and other web based advisory materials. Advisory materials and distribution maps for the River Snail were updated following their status revision by the FSC in 2016. All publications are made available via the NSW DPI website and are distributed to relevant DPI Fisheries Offices for display.
MA 2: Provide other relevant information to support appropriate planning and impact assessment (e.g. Environmental Impact Assessment Guidelines).	**Commenced, ongoing.** NSW DPI has put in place measures to ensure that the risk of degradation of aquatic habitat including threatened species habitat, is minimised. The NSW DPI Policy and Guidelines for Fish Habitat Conservation and Management (2013) outlines the 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. In accordance with the FM Act the definition of 'fish' for the purpose of the policy and guidelines includes not only fin fish but also crustaceans, molluscs, worms, insects and other invertebrates that spend all or part of their life cycle in aquatic habitats. Environmental Impact Assessment Guidelines for aquatic threatened fish species were prepared in 2008 and are available to stakeholders via the DPI website.
MA 3: Negotiate with local councils and industry groups regarding the type and scale of development near key areas either known to support remnant populations of the River Snail or suitable habitat.	**Not Commenced.**
MA 4: Encourage the identification, assessment and modification of natural resource management plans and policies (including Catchment Action Plans, water management plans, vegetation management plans and other land management plans) which may impact on River Snail habitats to minimise impacts on stream flow, water quality and riparian vegetation etc.	**Not Commenced.**
MA 5: Conduct targeted surveys to locate remnant river snail populations from either natural or artifical habitats.	**Commenced, ongoing.** In June 2015 NSW DPI undertook a single follow up survey of the Western Murray Irrigation pipeline where the species was found in 2005. No *Notopala* spp. were observed on this occasion. A follow-up quantitative survey of the Island Creek weir structure where the River Snail was discovered by NSW DPI in September 2015 and similar weirs/irrigation infrastructure within the lower Lachlan catchment is currently being scheduled by NSW DPI.
MA 6: Using information obtained from Objective 1 and 6 investigate the feasibility of	**Commenced, ongoing.** River Snails discovered from the irrigation pipelines in Dareton were collected in 2005 and taken to the Narrandera Fisheries Centre. The small number of live snails collected bred in captivity

establishing a breeding and translocation program in NSW.	producing several offspring. Unfortunately, all of the snails died within 12 months of capture. A single attempt to collect the River Snail from the same irrigation pipeline was undertaken in June 2015. No *Notopala* were observed on this occasion. Dr Sebastian Holmes provided DPI with several hundred *N. sublineata* individuals sourced from Kingston on Murray in South Australia in February 2014. In the time that DPI held the species in captivity several young snails were observed. Unfortunately, no formal observations relating to habitat preferences or breeding behaviour were made and all snails have since died.
MA 7: Develop and distribute guidelines regarding flow requirements of the River Snail and distribute this information to relevant natural resource management agencies.	**Not commenced.**
MA 8: Advocate appropriate allocation and improved management of environmental flows, particularly in areas known to support, or that could potentially support remnant River Snail populations.	**Not commenced.**
MA 9: Provide technical support to community groups, natural resource management authorities, local councils and landholders to protect and rehabilitate riparian vegetation and in-stream habitats along key river stretches where remnant River Snail populations are known or may potentially occur.	**Not commenced.** NSW DPI has undertaken extensive works to protect and rehabiltiate riparian vegetation and in-stream habitats along numerous river stretches thoughout NSW. As the River Snail has not been found in the natural environment until very recently, specific habitat rehabilitation and protection works aimed at improving the species habitat has not been possible. It is likely however that the habitat rehabilitation works undertaken generally throughout the Murray Darling Basin has been beneficial in improving the suitability of habitat for the River Snail, and the possibility that the species may re-establish viable populations in these areas.
MA 10: Continue to implement the NSW Weirs Policy to remove, or reduce/mitigate the impacts of weirs throughout the Murray-Darling Basin.	**Commenced, ongoing.** NSW DPI supports the goal of the NSW Weirs Policy to "halt and where possible reduce and remediate the environmental impact of weirs". This involves supporting several management principles such as discouraging the construction of new weirs or

	enlarging existing weirs and removing redundant weirs (Fairfull 2013). As part of the Weirs Policy NSW DPI undertook a Detailed Weir Review program assessing a total of 109 weir structures within 13 CMA areas. Each weir review examined operational details, system hydrology, ecological considerations and remediation options at each structure (NSW DPI 2006).
MA 11: Identify priority barriers to the River Snail based on the location of remnant populations in natural or articial (pipeline) environments and/or areas identified as potentially suitable, and seek funding for capital works to removal or other remediation works.	**Not commenced.**
MA 12: Work with councils and relevant government agencies to mitigate the effects of barriers on remnant River Snail populations and/or habitats.	**Not commenced.**
MA 13: Identify priority areas for targeting of carp eradication and control programs, based on areas where remnant River Snail populations occur or where suitable habitats exist.	**Not commenced.** Several new technologies as potential carp-control methods are currently under investigation. The National Carp Control Plan, based on cyprinid herpesvirus -3 as a species specific biocontrol agent shows some promise, but is still several years from implementation. If successful it is likely that this virus will improve the suitability of the habitat for, and reduced predation on any extant populations present within the rivers thoughout the species range.
MA 14: Review and report on the status and effectiveness of recovery actions in achieving the plans objectives against the performance criteria, and report this information in recovery statements on a three yearly basis.	**Commenced, ongoing.** This statutory review will form the partial completion of this recovery action. The outcomes of this review will be used to further progress the recovery of the species by prioritising implementation of recovey actions.
MA 15: Ensure that the Threatened, Protected and Pest Species Sighting Program is widely promoted throughout the	**Complete.** Various information materials are available to stakeholders via the NSW DPI website to assist with identiying and reporting sightings of the River Snail. NSW DPI maintains a database for sighting records of

Murray-Darling Basin, and report this information in recovery statements on a three yearly basis.	protected and threatened species including the River Snail. NSW DPI encourages community reporting of sightings of the species via the DPI website.
MA 16: Develop and distribute an education kit for use in schools.	**Not commenced.**
MA 17: Where possible, actively encourage community involvement in aspects of River Snail recovery including for example, establishment of a breeding and translocaiton program.	**Commenced, ongoing.** The involvement of the community in River Snail recovery actions has been made difficult due to the apparent absence of the species in the natural environment. There is however now some scope to greatly enhance community engagement in recovery actions in the near future given the recent finding of the species from the Lachlan catchment. NSW DPI undertook community consultation during the development of the recovery plan. Community comments were considered prior to finalising the recovery plan in 2007 and the Final Determination for listing the Darling River Snail and Hanley's River Snail.
MA 18: Design and implement a targeted monitoring program for River Snail populations in natural and artificial habitats to enable the effectiveness of recovery actions to be evaluated.	**Not commenced.**

Assessment of Action Implementation

Within the last ten years there has been limited success in implementing the recovery actions under the three program areas of the River Snail Recovery Plan. This is reflected by the completion of two and the commencement of thirteen out of a total of twenty six actions. All of the recovery actions relating to 'Research and Investigation Activities' are either 'complete' or 'commenced, ongoing'. Only one of the two 'Compliance and Regulatory Activities' has commenced and is ongoing, and just eight out of the eighteen 'Management Activities' are 'complete' or 'commenced, ongoing'.

The limited success is, at least in part, attributed to the now apparent rarity of the species, and the interdependency of numerous recovery actions. The inability to locate the River Snail from the natural environment (until recently) and subsequently from artificial habitats following their collection from the irrigation pipeline at Dareton in 2005, is a major factor hampering the direct implementation of a number of recovery actions and therefore indirectly affects other recovery actions. Targeted and incidental surveys have been undertaken, however the rarity of the snails is such that targeted surveys are still required in both natural and artificial habitats (i.e. irrigation pipelines, water tanks etc.).

Many of the recovery actions that have commenced require ongoing work into the future to make a difference to the overall recovery status of the species. For example, the recovery action 'Provide technical support to community groups, natural resource management authorities, local councils and landholders to protect and rehabilitate riparian vegetation and instream habitats along key river stretches where remnant River Snail populations are known or may potentially occur' is not a 'one off' recovery action. It requires ongoing and sustained effort across a large geographic area over time and in response to a wide range of varying issues. It is also dependent on locating those remnant populations. It is likely that new issues will emerge for the River Snail over time and as new information comes to hand. These issues will need to be addressed in order to assist with meeting the objectives of the recovery plan in the long-term. The outstanding actions should be implemented via the NSW DPI Priorities Action Statement (PAS).

Achievement of Recovery Plan Objectives

Given the decline of the River Snail and the amended listing as two species, more work is required to achieve the specific objectives of the recovery plan. One objective of the recovery plan is to increase awareness of the current status of the River Snail throughout its former natural range. The profile of the River Snail and the possible threats impacting on the species is low. This is the situation generally for invertebrates and in particular molluscs that have had more documented extinctions than any other group of organism (Ponder 1992). Further work is also required to increase understanding of the specific threats to the River Snail and the causes of the species continued decline.

Some progress has been made over the last ten years to improve the understanding of the ecological requirements, genetic status and morphology of the River Snail. This work assisted in clarifying that the River Snail (*Notopala sublineata*) as it was originally listed under the *Fisheries Management Act 1994* is in fact two separate species – The Darling River Snail (*Notopala sublineata*) and Hanley's River Snail (*Notopala hanleyi*). Holmes *et al*. (2013) morphological analysis showed that the shells of the taxa can be distinguished conchologically, supporting their status as distinct species.

Similarly, artificial breeding has been met with mixed results. NSW DPI has held a captive population of the River Snail on two occasions, and on both occasions the snails bred in captivity producing several offspring. However, neither population lasted longer than 18 months.

NSW DPI has established some positive relationships with stakeholders including Murray Irrigation Ltd who has been cooperative in allowing DPI staff to survey species flushed from the irrigation pipelines. Further work is required to investigate other irrigation pipelines within the potential distribution of the species.

NSW DPI has collected some River Snail data incidentally during survey work undertaken as part of other fish community surveys. The success of sporadic searching for the species has been low resulting in locating only one new population at Island Creek Weir in the last ten years. Regardless, this finding provides fresh hope that the species still persists in the natural environment and points to the need to undertake a distribution survey in a coordinated manner employing targeted species-specific sampling methods. The results from such a survey would provide fundamental information for recovery planning regardless of whether populations are found or not. For example, the inability to find populations would strengthen

concerns regarding the demise of the species and would inform decisions regarding the priority of implementing particular recovery actions (such as establishing / expanding a breeding and translocation program). Conversely, the discovery of extant populations would aid in initiating certain recovery actions such as rehabilitating river reaches known to support the species, and ultimately help reduce the risk of the species extinction.

The recovery plan states that success will be measured against the criterion that the status of the River Snail is revised from 'endangered' to 'vulnerable' on the schedules of the *Fisheries Management Act 1994* within 15 years. In 2016 the FSC amended the listing of the River Snail to recognise two separate species, not subspecies, and at the same time changed the status of each of those species to 'critically endangered' given that recent surveys indicate that the species has undergone extremely large reductions in population size and geographic distribution (FSC 2016a and b). Recovery action implementation is still required to halt the decline and possible extinction of this species.

One of the aims of this statutory review was to clarify if any changes were required to River Snail recovery actions or priorities. This review identified limited success in implementing the existing recovery actions. Many priorities and actions are still appropriate, but the rarity of the snail and interdependency of many recovery actions means that continued effort rather than changes is required to achieve the objectives of the recovery plan.

Since the adoption of the River Snail Recovery Plan legislative changes to the *Fisheries Management Act 1994* have required the development of a Priorities Action Statement (PAS). The PAS sets out all the actions required to recover threatened species, populations, and ecological communities and address key threatening processes listed in in the *Fisheries Management Act 1994*. The actions outlined in the 2007 River Snail Recovery Plan have been prioritised and included in the PAS. Any future actions required to recover the River Snail will be outlined and included in future reviews of the PAS.

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