2024/25 Annual Implementation Plan

Snowy 2.0 Threatened Fish Management Plan

NSW GOVERNMENT | snowyhydro | snowy 2.0

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Introduction

Snowy 2.0 is a pumped hydro expansion of the Snowy Mountains Scheme which will hydrologically link the existing reservoirs of Talbingo and Tantangara, via underground tunnels and an underground power station that will be owned and operated by Snowy Hydro Limited (SHL).

The transfer of water between these reservoirs and catchments brings with it the risk of transfer of pest fish and pathogens which are currently not present within the upper Murrumbidgee catchment (Baumgartner et al 2018 and Ning et al 2019), and which may impact the threatened fish species Macquarie Perch *(Macquaria australasica)* and Stocky Galaxias *(Galaxias Tantangara)* if planned controls fail, and pest species spread beyond Tantangara Reservoir.

Snowy Hydro comprehensively assessed the likelihood of these potential impacts and options to avoid transfer of pest fish through Snowy 2.0 as well as options to minimise potential impacts (EMM 2019, EMM 2020).

As a result, Snowy Hydro has committed to designing and constructing:

- A 'Galaxiid barrier' at the downstream extent of the Stocky Galaxias habitat (subsequently imposed as Condition 21(a) of the Infrastructure Approval)
- Fish screens at Tantangara Dam and the inlet to the Murrumbidgee to Eucumbene tunnel (M-E Tunnel) to prevent the transfer of all life stages of fish so far as is reasonably practicable from Tantangara Reservoir through the Dam to the mid-Murrumbidgee River and to Lake Eucumbene (subsequently imposed as Condition 21(a) of the Infrastructure Approval).

Details about these structures are provided in the Snowy 2.0 Biosecurity Risk Management Plan (BRMP).

In addition, the Snowy 2.0 Threatened Fish Management Plan (TFMP) was developed to minimise the impact of the development on threatened fish species and their habitat, particularly the Macquarie Perch, Stocky Galaxias and Murray Crayfish *(Euastacus armatus)*.

A key part of this plan is a captive breeding program for the Macquarie Perch and Stocky Galaxias involving the spending of $5 million over 5 years from the commencement of the program that provides for:

- population monitoring, surveillance and research on the Macquarie Perch and Stocky Galaxias in the Mid to Upper Murrumbidgee catchment;
- habitat surveys to identify suitable receiving sites for stocking insurance populations of Stocky Galaxias and Macquarie Perch;
- captive breeding, stocking and monitoring of Macquarie Perch and Stocky Galaxias with the aim of achieving self-sustaining populations of these species;
- habitat enhancement for the Macquarie Perch in the mid-Murrumbidgee catchment in accordance with the National Recovery Plan.

Implementation of the TFMP aims to increase the existing population's resilience to the potential biosecurity risks from the development.

The TFMP contains broad management objectives and is based on several underpinning plans and strategies developed for each species: Macquarie Perch (Lintermans et al. 2022a,b; Lyon et al. 2022; Tonkin et al. 2022); Stocky Galaxias (Raadik and Lintermans 2022a,b; Raadik et al. 2022; Stoessel and Raadik 2022). These detailed documents contain objectives, methods, and outputs for each species, and as such, along with the TFMP, provide the direction and detail for the implementation of the captive breeding program ('the program') under the TFMP.

The program is funded by Snowy Hydro and undertaken by NSW Department of Primary Industries and Regional Development (NSW DPIRD) with activities guided by an annual implementation plan (AIP) (this document) developed by NSW DPIRD to outline the activities and deliverables that will occur under the program. The AIP will be prepared by the 30th of June each year (or such date as otherwise agreed by Snowy Hydro and NSW DIPRD and submitted to the Expert Advisory Committee (EAC) for review and endorsement or otherwise by the 31st of July of each year. NSW DPIRD then provide deliverables to the EAC as they occur throughout the year, including a draft annual report to the EAC by 31 August of each year detailing activities and results.

Once finalised, the annual report is made public via the Snowy 2.0 website.

2. Program overview

Each year, the following sections are reviewed as part of the annual plan preparation to ensure they remain relevant as the program progresses.

2.1 Goal

The overall goal of the program is to build resilience in Macquarie Perch and Stocky Galaxias within the upper Murrumbidgee Catchment, should a new incursion of pest fish occur due to Snowy 2.0 activities.

2.2 Measures of success

Achievement of the goal of the program can be measured by progress against the following three key outcomes:

1. An established monitoring program that provides quantitative data about the spatial and temporal patterns of population size and structure (age, size, genetic) and distribution of Macquarie Perch and Stocky Galaxias in current known locations within the upper Murrumbidgee Catchment, to allow assessment of species status and inform success of the re-stocking/re-introduction program.
2. An established basis for a successful re-stocking/ re-introduction program of genetically diverse individuals for Macquarie Perch and Stocky Galaxias supported by; scalable hatchery protocols for captive breeding; habitat rehabilitation; and for Stocky Galaxias an established captive reproductive insurance population in “The Eucumbene Borrows”.
3. Improved knowledge on the distribution (presence/ absence) and potentially suitable habitat of Macquarie Perch and Stocky Galaxias, to inform decisions on management intervention for the long-term survival of the species.

3. Specific aims, objectives, activities and targets of the five-year plan

The following details are taken from Lintermans et al. (2022a,b), Lyon et al. (2022),Raadik and Lintermans (2022a,b), Raadik et al. (2022), Stoessel and Raadik (2022) and Tonkin et al. (2022). These documents contain additional specific detail on methods and effort.

3.1 Goal

3.1.1 Stocky Galaxias

Aim: To provide baseline, comparable data on the species, to inform decisions on management intervention for the long-term survival of the species.

Objectives are to collect data on:

- The persistence of Stocky Galaxias (presence and breeding).
- The population trajectory (is the population increasing, stable or decreasing?) and variability (significant change from normal).
- The status of the Stocky Galaxias population (incorporating measures of abundance, distribution, reproduction, fish health and demographics).
- The status of identifiable threats at Stocky Galaxias locations (e.g. riparian erosion, instream sedimentation, riparian vegetation condition with respect to ability to trap sediment).
- The persistence and establishment of any new translocations of the species into the catchment.
- Incursions of exotic fish species (Brown Trout *(Salmo trutta)*, Rainbow Trout *(Oncorhynchus mykiss)*, or invasive native species Climbing Galaxias *(Galaxias brevipinnis)* into known Stocky Galaxias populations.
- Metrics informing triggers (as part of a Trigger Action Response Plan (TARP)) for identified management interventions to mitigate potential sudden declines because of identified threats (e.g. fish incursion, fire, drought).
- Triggers for further investigations and/or identified management interventions to mitigate potential sudden declines because of identified threats (e.g. pest fish invasion, drought, fire).

Activities:

→ Undertake population monitoring at the two sites in Tantangara Creek and one site in Sallys Flat Creek as outlined in section 6.2.2 of this document.

Target:

→ Improved knowledge of baseline population, distribution, and fluctuations, and measuring the success or otherwise of restocking and translocation programs.

3.1.2 Macquarie Perch

Aim: provide baseline, comparable data on the mid-Murrumbidgee population, to inform decisions on management intervention for the long-term survival of the population.

Objectives are to collect data on:

→ The persistence of Macquarie Perch (is the species still present and breeding at sites where recorded since 1998).

→ The population trajectory (is the population increasing, stable or decreasing) and variability (significant change from normal).

→ The status of the Macquarie Perch population (incorporating measures of abundance, distribution, reproduction and demographics).

→ The persistence and establishment of any new translocations of the species into the catchment.

→ Incursions of Redfin Perch *(Perca fluviatilis)* into the mid-Murrumbidgee catchment.

→ Triggers for further investigations and/or identified management interventions to mitigate potential sudden declines because of identified threats (e.g., Redfin Perch fish invasion, drought, fire).

Activities:

→ Undertake population monitoring at the seven core sites and two fringe sites in the Murrumbidgee River and two reference sites in the Abercrombie River as outlined in section 6.1.4 of this document.

Target:

→ Improved knowledge of baseline populations, distribution and fluctuations, and measuring the success or otherwise of restocking and translocation programs.

3.2 Catchment Survey

3.2.1 Stocky Galaxias

Aim: improve knowledge on the distribution (presence/absence) and potentially suitable habitat of Stocky Galaxias, to inform decisions on management intervention for the long-term survival of the species.

Objectives:

→ Locate any additional Stocky Galaxias populations.

→ Identify potential future Stocky Galaxias translocation sites.

Activities:

→ Develop desktop prioritisation of sites and undertake prioritisation.

→ Undertake initial ‘rapid’ survey.

→ Second prioritisation.

→ Detailed survey of identified sites (habitat, barriers, predatory fish/barriers).

Output: Identify at least 3 priority reintroduction locations.

3.2.2 Macquarie Perch

Aim: Establish the geographic extent of the existing population/s of Macquarie Perch in both the Murrumbidgee River mainstem and major tributaries

Objectives:

→ Identify potential translocation sites.

→ Identify opportunities for habitat enhancement .

→ Verify the presence and distribution of target pest fish within the catchment (i.e. Redfin Perch).

Activities:

- → Determine current distribution and abundance.
- → Identify potential translocation/reintroduction sites.
- → Locate barriers to dispersal/colonisation and predator control barrier sites.

Target:

- → Identify at least three priority reintroduction locations.

3.3 Translocation

3.3.1 Stocky Galaxias

Aim: improve the conservation status of Stocky Galaxias in the wild to ensure enough viable populations with evolutionary potential exist to support long term persistence.

Objectives:

- → Increase the number of wild populations, and therefore decrease the risk of extinction of the species by establishing additional populations to the two presently known.

Activities:

- → Investigating and prioritising options to enhance the condition and resilience of the current population.
- → Establish a translocation procedure to enable the harvesting and translocation of Stocky Galaxias (wild-to-captivity, captivity-to-wild, and wild-to-wild) to act as brood stock for a captive breeding program, to establish additional wild populations, and where required, for emergency extraction.
- → Translocation site identification and suitability assessment.
- → Genetic modelling and assessment of the donor and recipient populations.
- → Collection of fish for wild-to-wild translocation.
- → Pre-release translocation site monitoring.
- → Translocate individuals to establish a captively maintained population in the short term, as insurance against the loss of the species in the wild.
- → Post-release monitoring to assess success of translocations (short- and long-term).

Target:

- → Have initiated stocking at, at least one of the priority locations, with the detection of survival of released fish.

3.3.2 Macquarie Perch

Aim: Improve the conservation status of Macquarie Perch in the upper Murrumbidgee catchment by enhancing condition and resilience of the current population/s.

Objectives:

- → Extend the range and abundance of the current population or establish new populations.
- → Improve the genetic fitness and ensure the persistence of the existing population/s in the catchment.

Activities:

- → Establish a catchment specific translocation procedure to enable the harvesting, transport and release/return of Macquarie Perch for translocation, stock for a captive breeding program, and for emergency extraction if needed.
- → Establish an ex-situ population maintained in captivity in the short term, as insurance against the loss of the population (and therefore unique genetic diversity for the species more broadly) in the wild.
- → Undertake captive breeding and/or wild to wild translocation of Macquarie Perch to establish an insurance population in a new area of the catchment if a suitable area is identified, and to provide offspring to bolster the upper Murrumbidgee population if needed.

Target:

- → Detection of admix genetics along current known Macquarie Perch distribution and initiate stocking at, at least one of the priority locations, with the detection of survival of released fish.

3.4 Captive Breeding

3.4.1 Stocky Galaxias

Aim: Improve the resilience of the species by increasing the number of individuals and populations through the captive production of viable offspring with evolutionary potential.

Objectives:

- To identify existing knowledge and knowledge gaps in relation to the captive maintenance and breeding of Stocky Galaxias.
- To identify the requirements for captive breeding and rearing of Stocky Galaxias.

Activities:

- **Quarantine**
  - Development of quarantine protocol specific to hatchery facility, including fish health protocol.
  - Isolation and observation of batches of fish entering the facility, and treatment for parasites or disease, to ensure no transferal of disease or parasites, and that only healthy fish are maintained.
- **Captive maintenance**
  - Development of a captive maintenance protocol to maximise fish health and vigour, to promote reproductive progression, and to minimise mortality.
  - Undertake captive maintenance of fish.
  - Genetic analysis of individuals to provide data to the breeding program (i.e. selection of brood stock or brood-pairs) to meet genetic targets of the captive breeding plan (see further down).
- **Captive breeding**
  - Development of a captive breeding protocol that is guided by genetics and that ensures reproductive success (egg fertilisation and development, hatching, and larval growth and survival) and genetic targets for offspring are met.
  - Development of post spawning recovery guidelines to maximise brood stock recovery, and, if necessary, the replacement of all or part of the brood stock if needed before captive management continues.
  - Undertake captive breeding (spawning, fertilisation, egg development and hatch, larval survival, and development).
- **On-growing offspring**
  - Develop larval rearing protocol.
  - On-grow offspring and maintain until release.
  - Assessment of offspring genetics to monitor compliance with the genetic target of captive breeding (if required).

Targets:

- Maintain a minimum of 100 Stocky Galaxias brood stock (genetic make up to be informed by current genetic analysis).
- The potential to initially produce 1500 Stocky Galaxias annually increasing to 2500 annually.
- Increase the abundance and distribution of Stocky Galaxias.

3.4.2 Macquarie Perch

Aim: Improve the resilience of the population by increasing the number of individuals through the captive production and stocking of viable offspring with evolutionary potential.

Objectives:

- Detail the current approach for captive breeding of Macquarie Perch.
- Outline existing knowledge gaps, known limitations of existing techniques and current research.
- Set out the steps to procure and stock Macquarie Perch in the mid-Murrumbidgee River.

Activities:

- Captive breeding.
- Genetic augmentation.

Targets:

- → 100 Macquarie Perch brood stock (genetic make up to be informed by genetic management plan currently under development).
- → The potential to produce of 25,000 Macquarie Perch annually by the end of the 5 year program.
- → Increase the abundance and distribution of Macquarie Perch within the Upper Murrumbidgee Catchment.

3.5 Implementation timeframes

The initial five-year implementation of the Snowy 2.0 Threatened Fish Management Plan commenced on 1 January 2024 and will conclude on 31 December 2028, however, the planning is on a financial year basis as outlined below (Figure 1).

Consideration for the continuation of the program beyond the initial five-year will occur as the program progresses and in accordance with the trigger, action, response plan outlined in the TFMP.

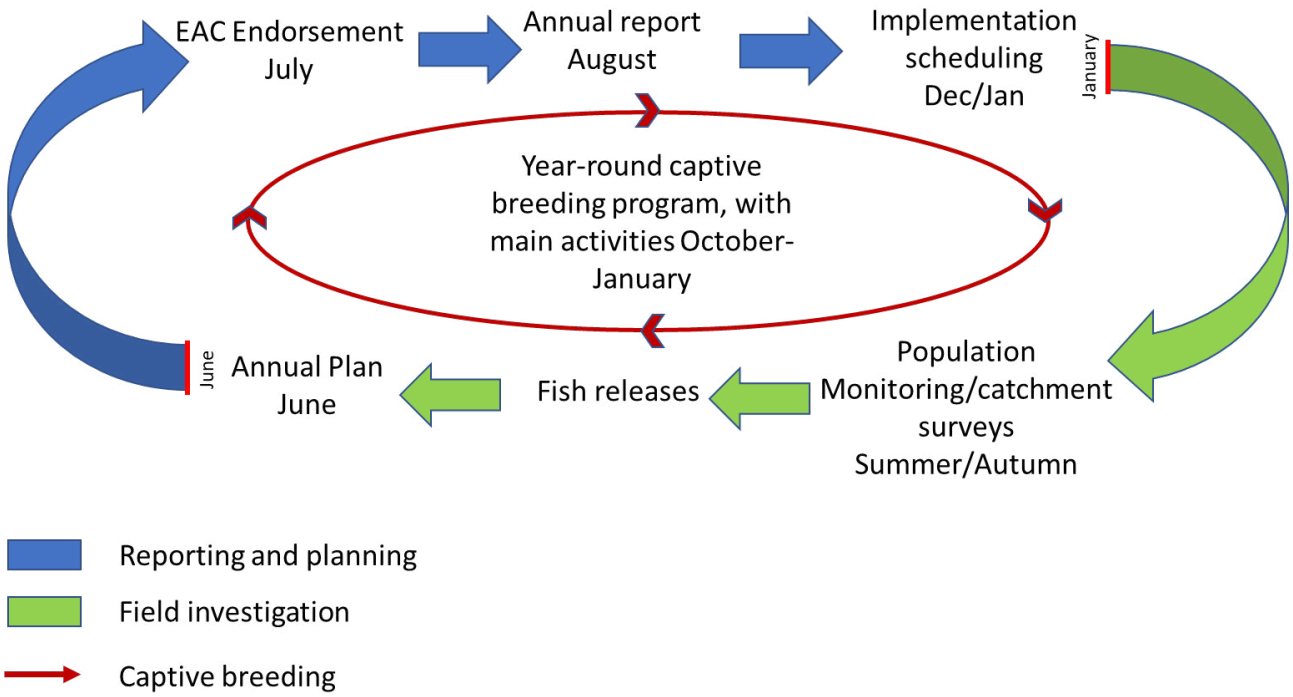


Figure 1. Indicative depiction of the implementation of the TFMP activities

4. Project management

Funding for the Program is provided by Snowy Hydro to NSW DPIRD via a funding agreement.

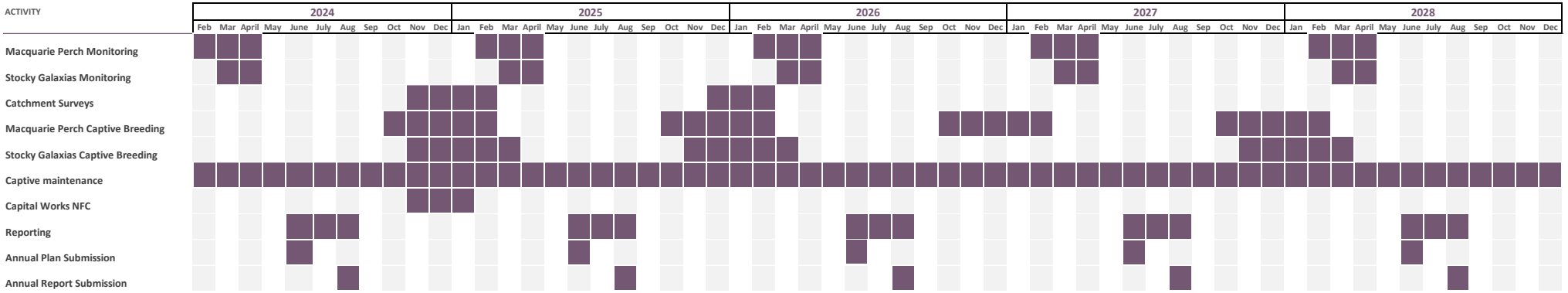
Implementation of the Program is undertaken by the NSW DPIRD Fisheries, Habitat and Threatened Species team that sits within the Freshwater Environment Branch. Project lead is Luke Pearce (Senior Fisheries Manager), who is responsible for resource allocation and the development and delivery of the Annual Implementation Plan along with other staff within the team including Simone Mabon (Project Officer) and Tim McGarry (Fisheries Manager). Oversight of the development and implementation of the program is provided by the Habitat and Threatened Species Program Leader, Samantha Davis.

Myworkzone is the administration and finance system that NSW DPIRD Fisheries uses for functions including finance, purchasing, procurement, staff time sheeting and cost centre management. All NSW DPIRD projects are allocated a unique account identifier against which all related spending project spending (salaries, procurement etc.) are made. This allows expenditure to be planned, tracked and reported easily and allows for transparent audit processes to be undertaken. Daily time sheeting (with breaks) is also allocated to relevant project accounts to provide for accountable staff resourcing and tracking.

The NSW Government has set procurement guidelines and processes for the acquisition of goods and services, which is governed by the NSW Government Procurement Policy Framework. Procurement involves three broad stages: Plan, Source, and Manage. This provides for a structured approach to procurement, supported with a range of procurement tools to ensure business units achieve best practice procurement activity recommendations.

The Plan, Source, and Manage process provides for an accountable and transparent nine-step procedure to achieve successful procurement. NSW DPIRD maintains a Strategic Procurement Group that delivers procurement advisory and sourcing support services to optimise spend and deliver value for money for the department's sourcing activities, which will be used as needed during the project.

4.1 Table 1: Schedule of implementation of the five-year program



5. Annual implementation plan 2024/2025 Schedule

Table 2: Schedule of the AIP for 24/25

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
Mon	1											
Tue	2			1						1		
Wed	3			2			1			2		
Thur	4	1		3			2			3	1	
Fri	5	2		4	1		3			4	2	
Sat	6	3		5	2		4	1	1	5	3	
Sun	7	4	1	6	3	1	5	2	2	6	4	1
Mon	8	5	2	7 Labour Day PH	4	2	6	3 Mac Perch collection Cataract	3 Mac Perch Monitoring Bidgee	7 Stocky Gal Monitoring round 2	5	2
Tue	9	6	3	8 Hatchery preparation	5	3	7	4	4	8	6	3
Wed	10	7	4	9	6	4	8	5	5	9	7	4
Thur	11	8	5	10	7	5	9	6	6	10	8	5
Fri	12	9	6	11	8	6	10	7	7	11	9	6
Sat	13	10	7	12	9	7	11	8	8	12	10	7
Sun	14	11	8	13	10	8	12	9	9	13	11	8
Mon	15 Pond Tender Assessment	12 Reporting	9	14 Mac Perch Brood stock collection Bidgee	11	9	13	10 Stocky Gal Monitoring round 1	10 Mac Perch Monitoring Bidgee	14 Mac Perch genetic rescue	12 Stocky Gal release	9
Tue	16	13	10	15	12	10	14	11	11	15	13	10
Wed	17	14	11	16	13	11	15	12	12	16	14	11
Thur	18	15	12	17	14	12	16	13	13	17	15	12
Fri	19	16	13	18	15	13	17	14	14	18	16	13
Sat	20	17	14	19	16	14	18	15	15	19	17	14
Sun	21	18	15	20	17	15	19	16	16	20	18	15
Mon	22 Award tender	19 Reporting	16	21 Mac Perch Spawning NFC	18	16	20	17	17 Mac Perch Monitoring Abercombie	21	19	16 Reporting
Tue	23	20	17	22	19	17	21	18	18	22	20	17
Wed	24 EAC Meeting	21	18	23	20	18	22	19	19	23	21	18
Thur	25	22	19	24	21	19	23	20	20	24	22	19
Fri	26	23	20	25	22	20	24	21	21	25	23	20
Sat	27	24	21	26	23	21	25	22	22	26	24	21
Sun	28	25	22	27	24	22	26	23	23	27	25	22
Mon	29	26	23	28 Mac Perch Spawning NFC	25	23	27	24 Mac Perch Monitoring Bidgee	24	28	26	23 Reporting
Tue	30	27	24	29	26	24 Christmas Eve	28	25	25	29	27	24
Wed	31 Endorsement of AIP	28	25	30	27	25 Christmas day	29	26	26	30	28	25
Thu		29	26	31	28	26 Boxing Day	30	27	27		29	26
Fri		30 23/24 Annual report due	27		29	27	31	28	28		30	27
Sat		31	28		30	28			29		31	28
Sun			29			29			30			29
Mon			30			30			31			30

Pond construction NFC (OCT–NOV)

Pond construction NFC (NOV–DEC)

Catchment surveys (DEC–JAN)

Stocky Gal captive breeding (DEC–JAN)

Catchment surveys (JAN–FEB)

6. Planned Activities

6.1 Macquarie Perch

6.1.1 Captive Breeding Current Program

The Macquarie Perch captive breeding will continue as part of the ongoing "Cracking the Code" project at the Narrandera Fisheries Centre (NFC), which is focusing on utilising species-specific hormone technology to stimulate Macquarie perch to simultaneously spawn in captivity. This program is currently utilising F1 and F2 (Abercrombie origin) fish and Cataract Dam fish as the wild treatment. Additional broodfish have been collected for this program from Cataract Dam and the upper Murrumbidgee River, Retreat River and Winburndale Dam, however it is unlikely that they will contribute to this year's program as they are generally smaller fish that are not yet at sexual maturity and will take time to acclimate. In addition to the currently held broodfish at the NFC this year we will be attempting to collect 'running ripe' Macquarie Perch from the upper Murrumbidgee River, these fish will be collected during the spawning season then taken to the NFC where we will attempt to cross them with the captive held fish.

A major priority for captive breeding of Macquarie Perch as part of this plan is to establish capacity to house, maintain and grow additional Macquarie Perch from the Murrumbidgee and other populations in both outdoor earthen ponds and indoors in a controlled hatchery environment. One of the major limitations to holding sufficient numbers of Macquarie Perch at the NFC is a lack of dedicated pond resources, to meet the requirements for the proposed captive breeding targets. A plan to construct eight purpose-built Macquarie Perch ponds at the NFC has been developed. Once completed these additional ponds will provide sufficient capacity to hold the required number of brood stock, allow for larval rearing and provide the ability to grow out sub adult brood stock and on grow captive bred juveniles if required. It will also provide capacity to rotate and rest ponds and spread risk across multiple ponds around the site.

6.1.2 Pond Construction

One of the major components of the 24/25 program will include the construction of eight Macquarie Perch ponds at the Narrandera Fisheries Centre. These ponds will be utilised for the holding of Macquarie Perch broodfish, larval rearing, the grow out of subadults and allow for the rotation and resting of ponds and spreading of risk. Additional ponds will enable an increase in the numbers of broodfish able to be maintained on site that will ultimately support an increase in production.

Pond construction will be completed by 30 November 2024, with the ponds ready to start receiving fish by late 2024.

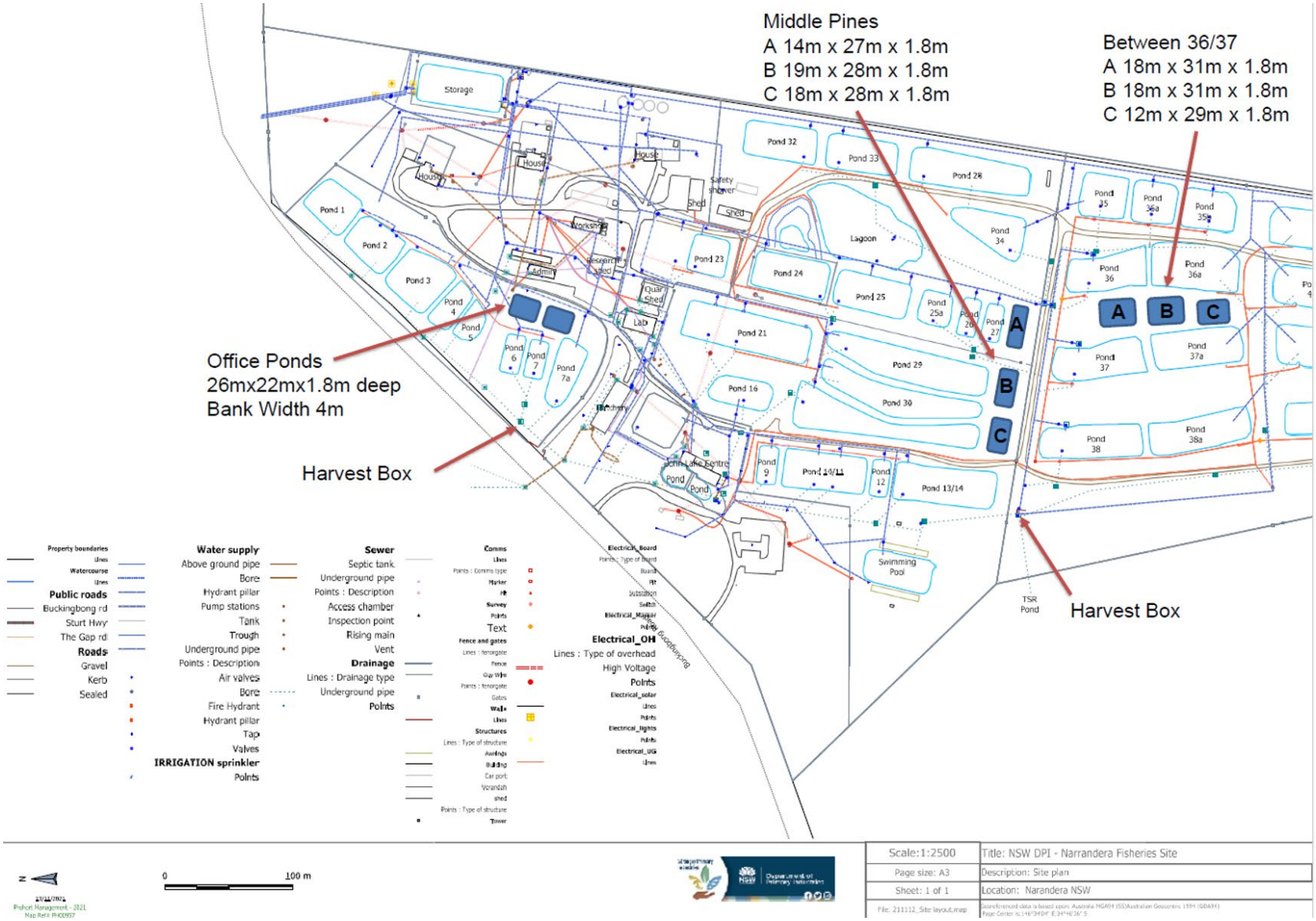


Figure 2. Plan of proposed Macquarie perch ponds at Narrandera Fisheries Centre

6.1.3 Brood Stock Collection

Under the 23/24 Annual Implementation Plan an additional 28 broodfish were collected for incorporation into the program consisting of six from Winburndale Dam, seven from Cataract Dam, six from the upper Murrumbidgee and nine from the Retreat River (Table 3). The current inventory of Macquarie Perch is provided in Table 4.

Table 3: Additional broodfish collected in 2023/24

Origin	Length (mm)	Weight (g)
Winburndale	223	153
Winburndale	229	160
Winburndale	232	197
Winburndale	233	186
Winburndale	227	207
Winburndale	210	136
Cataract	232	148.2
Cataract	184	72.6
Cataract	166	47
Cataract	160	58.6
Cataract	173	55.1
Cataract	277	281.3
Cataract	154	48
Upper Bidgee	154	48
Upper Bidgee	244	189.4
Upper Bidgee	170	69.3
Upper Bidgee	285	291
Upper Bidgee	79	6
Upper Bidgee	66	3.2
Retreat	420	1400
Retreat	402	1150
Retreat	397	1050
Retreat	188	100.5
Retreat	154	50.5
Retreat	179	81.3
Retreat	173	79.1
Retreat	167	62.3
Retreat	170	77.5

Table 4: Inventory of current Macquarie perch broodfish numbers held at Narrandera Fisheries Centre (excluding fish collected in 23/24) and their origins

Cataract Dam	20
F1 (Abercrombie)	34
F2 (Abercrombie)	22
F2 (Unknown)	29
Dartmouth	3
Upper Murrumbidgee	1
Total	**109**

Brood stock targets

A genetic management strategy for Macquarie Perch is currently being prepared by the team at Monash University, this plan will inform the current and future captive breeding program for Macquarie Perch and give clear guidance on which populations should be mixed, and to what extent, to achieve the greatest level of genetic diversity and adaptation potential. The advice and recommendations from this plan will guide the ongoing genetic management of the upper Murrumbidgee Macquarie Perch population and what admixing of genetics from other populations should be included in the program.

Additional brood stock numbers will be required moving forward and as proposed in the 23/24 AIP brood stock collection will again occur as part of the 24/25 AIP, collection targets for the 24/25 AIP year are detailed in Table 5 below:

Table 5: Brood stock collection targets for 2024/25

Cataract Dam	20
Upper Murrumbidgee	10
Winburndale Dam	10
F1's Victoria (Dartmouth)	20

Long term brood stock targets will be informed by the genetic management strategy currently in preparation, however given the forecast production targets it is envisaged that at least 250 Macquarie perch brood stock will be required.

Previous attempts to incorporate large mature broodfish into the program have proven unsuccessful. Large mature Macquarie Perch from the upper Murrumbidgee River, Mongarlowe River and Dartmouth Dam that were included in the program in the past, all lost condition and did not contribute, particularly the females who either did not develop eggs or only developed eggs of very poor quality. Given this early result, the focus will be on collecting younger subadult fish to acclimate over a longer period of time and in the interim, whilst we are waiting for these fish to mature utilise mature running ripe Macquarie Perch from the upper Murrumbidgee to cross with some of the existing fish already in the program at NFC.

6.1.4 Production Targets

The current Macquarie Perch 'Cracking the Code' project is aimed at refining and improving the use of a synthetic species-specific hormone to induce female Macquarie Perch to simultaneously spawn in captivity, results to date have been very promising, however the technique requires further refinement which the current project aims to do this over the next two breeding seasons (Oct 2024 and Oct 2025). These two seasons will be used to increase the number and genetic diversity of the current brood stock held at NFC and grow them out to reach sexual maturity with increased production envisaged in the 2026 breeding season. Initial output targets will be 5,000-10,000 fingerlings/year in the first two years of increased production, increasing to 25,000 fingerlings/year by the end of this program.

Collection of Wild Ripe Macquarie Perch 2024

As part of the 2024/25 AIP, the collection of wild running ripe Macquarie Perch from the upper Murrumbidgee River will be attempted and incorporate these into the captive spawning for the 2024 season. The collection and use of running ripe Macquarie Perch for captive breeding has been undertaken since the 1960's and is still currently undertaken by the Victorian Fisheries Authority, it has however not been attempted in the upper Murrumbidgee River or previously in NSW. Recent studies by van der Meulen et al (2023) have identified spawning locations and timing within the Cooma gorge section of the Murrumbidgee River and where successful in collecting wild spawned Macquarie Perch eggs from this location in 2020.

The findings of this study can be used to guide the timing and locations attempt to collect wild Macquarie Perch brood stock prior to them spawning in the wild.

Whilst the long-term objective of the "Cracking the Code" project and the Snowy 2.0 TFMP is to have a reliable and consistent breeding program from captive held stock, this is not likely to materialise until later in the project, at earliest the 2026 program. This is an opportunity to gain some early results and boost the program by crossing mature ripe fish from the upper Murrumbidgee River with captive held stock (Abercrombie or Cataract) to produce more genetically diverse offspring. These offspring could then be utilised to boost the numbers and genetic diversity of the upper Murrumbidgee population/s and potentially start to reintroduce fish into additional locations should the catchment surveys identify suitable locations and captive breeding produce sufficient numbers.

The current proposal is to target sampling in the known spawning locations within the upper Murrumbidgee River, just prior to the spawning period currently scheduled for the 14-18th October the week prior to the proposed spawning of the captive stock at NFC which will occur 21-25th October. We will be aiming to capture between 6-12 mature Macquarie Perch of mixed sexes, once spawning has been competed these wild fish will be returned to the upper Murrumbidgee at either the site of capture or potentially other sites to increase genetic diversity within the system.

6.1.5 Population Monitoring

Monitoring aim and objectives

The overall aim of the monitoring for Macquarie Perch is:

→ To provide baseline, comparable data on the mid-Murrumbidgee population, to inform decisions on management intervention for the long-term survival of the population.

Specific monitoring objectives for Macquarie Perch in the mid-Murrumbidgee catchment to meet the overall aim are to provide baseline, comparable data on:

→ The persistence of Macquarie Perch (is the species still present and breeding at sites where recorded since 1998?).

- → The population trajectory (is the population increasing, stable or decreasing?) and variability (significant change from normal).
- → The status of the Macquarie Perch population (incorporating measures of abundance, distribution, reproduction and demographics).
- → The persistence and establishment of any new translocations of the species into the catchment.
- → Triggers for further investigations and/or identified management interventions to mitigate potential sudden declines because of identified threats (e.g. Redfin Perch fish invasion, drought, fire).

Time of sampling

Annual population sampling of sites are planned for early to mid-autumn (March–April), as this is the time of lowest flows and Young-of-Year fish will be of an advanced size, both of which improve detection probability. Sampling earlier or later than this runs the risk of lower detection probability due to higher flows, with episodic high flow events during later sampling also introducing even greater variation in catch data. One monitoring event, repeated annually at the same time of year is considered adequate, based on other threatened species monitoring programs.

Monitoring sites

The known existing distribution of the Macquarie Perch recruiting population encompasses approximately 95 km of the upper Murrumbidgee River mainstem between approximately the Numeralla River junction (~25 km downstream of Cooma) and Yaouk (Figure 1) (M. Lintermans unpublished data; D. Gilligan unpublished data, Lintermans 2016, 2020). Subadult and adult individuals are sporadically captured at sites downstream of the Numeralla junction to the ACT border, but these are largely considered likely to be dispersing or vagrant individuals (M. Lintermans unpublished data).

Monitoring sites/reaches, including two reference sites, are listed in Tables 6 and 7 and Figures 3 and 4 have been selected to give adequate spatial coverage of the core distribution and allow for detection of spatial expansion (an upstream and a downstream fringe site are included).

Reference sites are a valuable inferential component of a robust monitoring programs (Reynoldson et al. 2001; Davies et al. 2010; Lintermans et al. 2013; Broadhurst et al. 2020) but can be problematic for rare or threatened species monitoring. Threatened species often occur as small, fragmented populations (often on different population trajectories) with few populations available to act as a reference. At least one reference population and two sites are required to allow inference of whether changes in a trend of the target population is a local response, or if it represents a broader response across the species range (e.g. to climate extremes such as drought). It was the reference site data from the mid-Murrumbidgee that clearly identified that a multi-year recruitment failure of Macquarie Perch in Cotter Reservoir was a local rather than regional pattern (Broadhurst et al. 2020). No two sites or streams are directly comparable and ideally data from multiple reference populations would be used to better represent the species trajectory, however we do not have the luxury of multiple reference sites for Macquarie Perch available in NSW.

The two reference sites identified within the Abercrombie River Macquarie Perch population that have been included in this annual plan may require further review and refinement during the program and will continually be assessed for suitability as reference sites as well as other options for reference sites including populations from the ACT and Victoria.

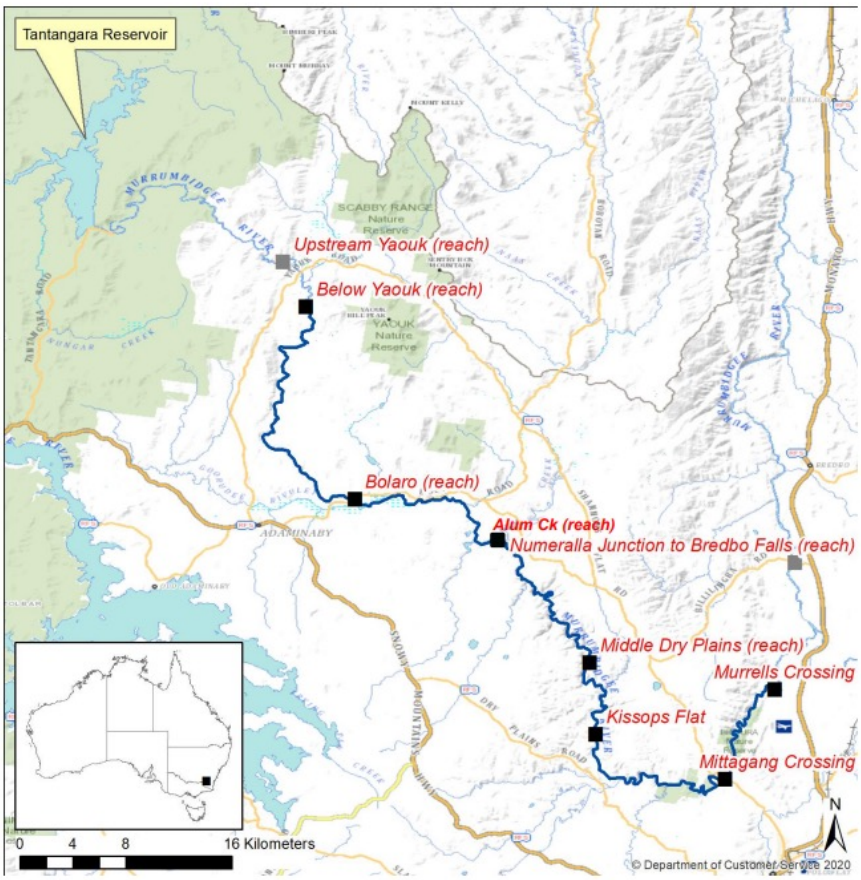


Figure 3. Map of project area and proposed monitoring sites on the Murrumbidgee River
Dark blue line – core reach for Macquarie Perch; Black squares – Core sites; Grey squares – Fringe sites.

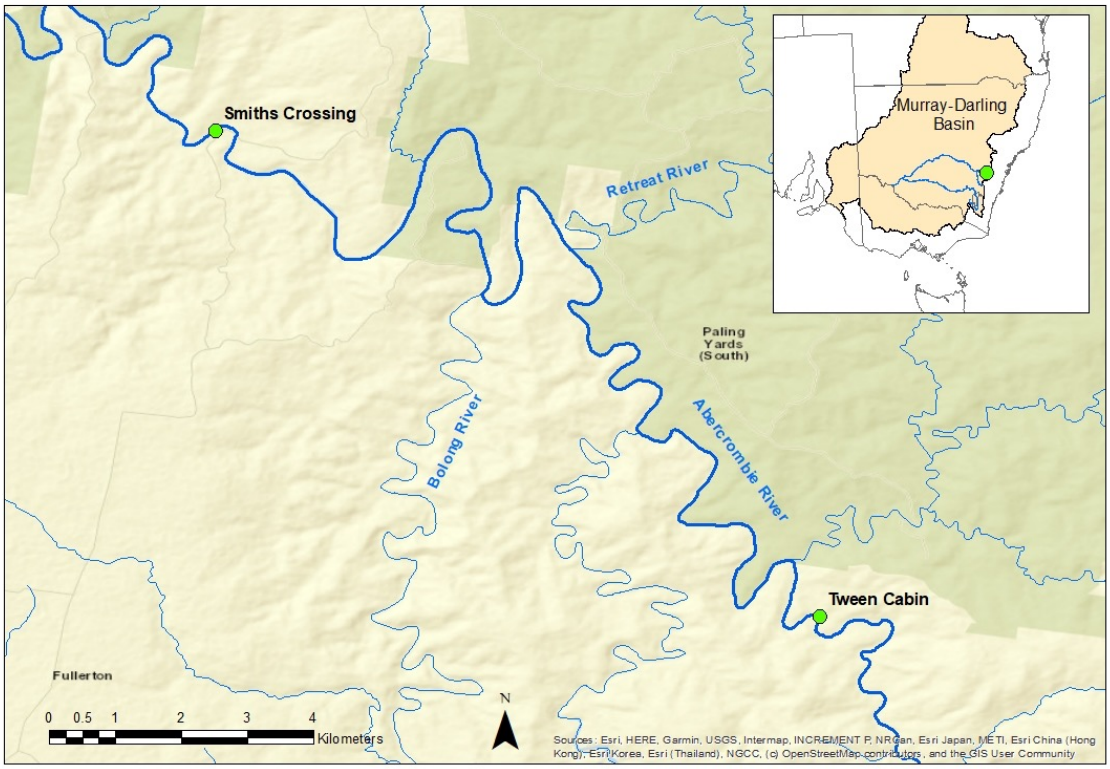


Figure 4. Map of reference sites in the Abercrombie River

Monitoring methods and level of effort

Population monitoring

Previous studies in the upper Murrumbidgee catchment have determined that fyke netting and gill netting were the most effective at detecting the presence of Macquarie Perch at a suite of survey sites, with fyke nets being particularly effective at detecting recruitment (i.e. Young of Year or age 1+ individuals) and gill nets effectively capturing subadults and adults (Lintermans 2013a, 2016). In a multi-method survey across multiple sites and years, fyke nets captured Macquarie Perch at 100% of sites where the species was detected, and gill nets captured the species at 86%. Boat electrofishing captured Macquarie Perch at 43% of sites where the species was detected but captured few Young of Year or juveniles (Lintermans 2015). It was recommended that future sampling for this species should employ fyke and gill nets to adequately characterise population structure (adults, juveniles, YOY), minimise false negatives and detect successful breeding from the previous year (Lintermans 2015).

While fyke and gill nets are most suited to sample pool, or slow-run habitats, sampling of faster flowing habitats using backpack electrofishing, which can cover larger spatial areas, increases the area that can be sampled (Lintermans et al. 2013, Tonkin et al. 2019, Broadhurst et al. 2020).

Methods

Macquarie Perch monitoring for 2024/25 will be undertaken by gill netting and fyke netting.

Fyke nets. Twelve single-winged fyke nets (12 mm stretch-mesh) are to be set at each site. Nets are to be attached to the bank at the cod-end and then set at an angle to the bank facing downstream with a weight attached to the wing to hold the net securely. The single wing is attached to the centre of the front 'D' of the fyke net. Each fyke net is to have a 150 mm diameter polystyrene float inserted in the cod end to provide an airspace to prevent mortality of non-target animals such as Platypus. Nets are to be set between 15:30 and 16:30 hrs and left overnight until retrieved between 07:30 and 08:30 hrs the following morning, giving a ~16-hour soak time.

Gill nets. Two braided monofilament gillnets, 50 meshes deep, stretch mesh size of 75 and 100 mm, 33 m length when strung on a float line are to be set across the streams during the afternoon and early evening. Nets are set between 15:30 and 16:00 hrs and retrieved between 21:30 and 22:00 hrs, giving a 6-hour soak time (Lintermans 2013a, 2016, 2020, Lintermans et al. 2013b, Broadhurst et al. 2020). Gill nets must be floating, multifilament and essentially unweighted (light weights may be used to ensure the net is not being streamed out by higher flows).

Previous research has demonstrated that the 6-hr soak time captured 79% of the number of Macquarie Perch captured using a 16-hr soak time, and that mortality of both target and non-target species was reduced (Lintermans 2013a). One end of each gill net is to be attached to the bank and the other end is to be attached to an anchor mid-stream.

The limited soak time of gill nets also reduces stress or possible mortality of threatened fish species or non-target species such as Platypus and Eastern Long-necked Turtle . Gill nets will also be patrolled at approximately hourly intervals after dusk with any captured animals (fish or platypus) removed from the nets. Platypuses should be retained in plastic 60 liter bins (rubbish bins) overnight to prevent recapture, with the bins containing a quantity of leaf litter/grass 'nesting' material to allow animals to dry off and minimize stress. Platypuses should then be released at the point of capture after removing fyke nets the following morning.

Water Quality Monitoring

Standard water quality parameters are water temperature (°C), electrical conductivity (µS/cm), dissolved oxygen levels (mg/L and % saturation), pH, and turbidity (NTU). Water quality will be taken at each sampling site on each sampling event.

In addition to standard water quality monitoring, water temperature and flow data will be sourced from existing programs and gauging stations within the catchment.

Fish processing

All fish species captured will be identified and measured for length (nearest mm; Caudal Fork Length or Total Length, as appropriate). Weight of each Macquarie Perch captured will also be recorded (nearest gram). All subadults and adult Macquarie Perch should be scanned for a PIT tag, and if a PIT tag is recorded, the code should be recorded in full. All fish should be visually inspected for deformities, injuries (e.g. cormorant strike) and external parasites (e.g. *Lernaea cyprinacea*).

Data collected in the field will be manually recorded then entered electronically and maintained (curated and backed up) during data analysis ensuring appropriate review and quality assurance procedures.

Genetic Sampling

Genetic samples will be collected at all monitoring sites with samples collected every year during population monitoring activities, with samples processed every third year. A small sample of fin tissue will be collected from all fish ≥40 mm, clipping all fish up to a maximum of 90 individuals per site into 100% ethanol. If insufficient samples collected in routine monitoring, additional sampling may be required. Collected tissue will be sent for population genetic analysis including effective population size, genetic diversity, parentage level analysis (using single nucleotide polymorphisms (SNPs) (as per Lutz et al. 2021).

6.1.6 Genetic Rescue

Recent genetic analysis of the upper Murrumbidgee Macquarie Perch population (Pavlova et al. in press) has shown that the population remains genetically depauperate and that the upstream reaches of the population are genetically isolated from the downstream reaches i.e. there is no upstream movement of genetic material from the lower sections.

There have been four separate genetic rescues undertaken in 2020, 2022, 2023 and 2024 with Macquarie Perch collected from Cataract Dam. The recent genetic analysis has demonstrated that there has been some admixture between the resident population and the newly introduced fish from Cataract Dam, with one recapture of a pure Cataract fish and three fish of mixed genetics from two cohorts captured in 2023 (Pavlova et al. in press).

It is planned to continue the genetic rescue work in the Murrumbidgee with the focus on translocation of fish from Cataract Dam into the upper sections of the Murrumbidgee that have either not yet received translocated fish or have only received a single translocation (Bolaro) and are above barriers that preclude the current upstream movement of Cataract fish that have been released elsewhere in the system. Proposed genetic rescue sites for 2024/25:

→ Site 2 (Killarney)

→ Site 3 (Bolaro)

→ Site 4 (Koomulla)

The plan is to collect 102 Macquarie Perch from Cataract Dam and Loddon Creek for release in equal numbers at the three sites above in the upper Murrumbidgee River. These fish will be quarantined at the Narrandera Fisheries Centre and given a health check prior to release.

6.2 Stocky Galaxias

6.2.1 Captive Breeding Current Program

Further infrastructure works are required at the Eucumbene Borrows to improve both water flow and water security, this includes earthworks to repair a breached dam wall, to increase onsite storage, and divert overland flows, increased battery capacity and replacement of pumps. These works are currently underway and being funded via a federal Threatened Species Grant.

Primary captive breeding of Stocky Galaxias will continue to be undertaken by the team at Charles Sturt University (CSU) Albury. The team at CSU has a proven track record for not only maintaining a captive population, but also successfully breeding them in captivity. CSU has a purpose-built facility to house Stocky Galaxias, with a current captive population on site.

Given the uncertainty regarding the suitability of the Eucumbene Borrows as an ongoing ex-situ location to maintain an insurance population of Stocky Galaxias, due to high water temperatures during the 2023/24 summer, the current objectives of the captive breeding program were re-evaluated for the upcoming 2024 season, with the options listed and evaluated below.

Stocky Galaxias Captive Breeding Options 24/25 Season

1. Continue captive breeding program as planned with the collection of additional broodfish (10 females and 25 males).
2. Continue captive breeding program with the current broodfish, progeny released into Eucumbene Borrows or other sites identified during catchment surveys.
3. Continue captive breeding program with the current broodfish, progeny utilised for temperature tolerance experiments to gain a better understanding of the upper thermal tolerances of the species.
4. Continue captive breeding program with current broodfish, progeny to be held at CSU to be grown out for 12 months.
5. Hold current broodfish but don't undertake any breeding.
6. Pause the program and release current held broodfish.

Option 1. Further information is required regarding the capacity of the wild populations to sustain the required level of harvest before additional animals are collected from the wild. Population surveys and a population estimate of the Tantangara Creek population that are planned for this season will inform us as to whether the Tantangara Creek population can maintain a level of removal. Further clarification is also required regarding the genetics of the populations and how this is best managed moving forward i.e. are the populations mixed via the captive program, and, do the wild populations require mixing or be maintained as separate genetic management units. **Not Recommended**

Option 2. Given the uncertainty regarding the high temperatures at Eucumbene Borrows it is not recommended that any further reintroductions occur there until such time as there is evidence of current released fish persisting over summer and further temperature data is collected. Release of captive bred fish into suitable sites identified via the catchment surveys may be an option but cannot be relied upon at this stage. **Not Recommended**

Option 3. This option will improve our knowledge and understanding regarding the upper thermal tolerances of Stocky Galaxias, which along with additional data collected from Eucumbene Borrows, will inform whether to continue to use the site as a release and refuge location. It will also provide insight into the lower elevational limits of the species which will inform the geographic extent of where reintroduction may be successful. Following the experiments, juveniles will be either maintained in captivity or released at Eucumbene Borrows or at an alternative site. **Recommended Option**

Option 4. There would be additional costs associated with this option due to increased husbandry/feeding and monitoring of any on grown Stocky Galaxias. Depending on the number produced there may also be a requirement for additional facilities. **Not Recommended**

Option 5. This option is not recommended as it will not further our knowledge and understanding of the species. **Not Recommended**

Option 6. This option is not recommended as there will potentially be additional impacts on the wild population due to increased broodfish collection in the future to restart the program, potential budget implications due to restarting the program, loss of continuity of staff and knowledge and missed opportunity to continue to learn and refine captive breeding and husbandry techniques. **Not Recommended**

Stocky Galaxias Thermal Tolerance Trials Background

In accordance with the TFMP, a key management action is to establish additional populations to mitigate the risk of extinction. Understanding the thermal tolerance of the species is considered necessary to help identify suitable translocation sites.

Currently, there is no information regarding the thermal tolerances of Stocky Galaxias (or in fact any other Australian galaxiid species that are restricted to upland areas). The two known populations occur at high elevation sites (>1300m) where water temperatures are relatively low, however the species historical range is likely to have been much broader and may have included lower elevation sites where water temperatures are warmer.

If the Stocky Galaxias has a wide thermal tolerance, suitable translocation sites may be found across a relatively wide range of elevations and the Eucumbene Borrows site may be suitable as a release site for captively bred individuals. However, this site is at a much lower elevation than the species is currently found (>1300m) and temperature data from the site indicated that water temperatures exceeded 30°C during summer. Fish monitoring undertaken in May 2024 only detected two individuals suggesting that survival rates at Eucumbene Borrows may be low.

However, given that the historical range of the species is unknown, and currently there is no information regarding the thermal tolerances of this species, the elevation-based requirements of translocation sites is completely unknown. In addition, given that climate change suitability modelling predicts that 59-63 percent of 145 species of Australian freshwater fish will experience a range contraction and that Galaxiids are one of two families that are projected to have the largest declines in habitat suitability (Tims & Saupe, 2023), climate change is another consideration with respect to thermal habitat suitability of sites for this species.

Proposed work 2024/25 breeding season

It is proposed to undertake laboratory experiments to determine the critical thermal maxima and optimal temperature for growth of adults and captively bred larvae and juveniles. The critical thermal maximum (CTmax) is a parameter that is widely used to assess thermal sensitivity in fish and other cold blooded aquatic organisms. It represents the upper temperature limit at which physiological signs of heat stress become evident. When fish are subjected to thermal stress for a short period of time it is non-lethal but is biologically relevant as prolonged exposure to CTmax in the wild is lethal. CTmax is commonly used to evaluate the thermal tolerance and potential impact of climate change on organisms.

Temperature-based optimal growth experiments in fish involve measuring the growth rates of fish at different temperatures to determine the temperature range that supports the highest growth rates. Growth rates are positively related to recruitment and survival in fish and are strongly temperature dependent. Consequently, determining the optimal temperature for growth is an important method for evaluating thermal requirements.

Proposed method

Captive breeding will be undertaken in mid Nov – early Dec 2024 and eggs will be incubated based on current protocols (10-13°C). Larvae will continue to be kept at 10-13°C until first feeding has commenced.

The CTmax experiments will be undertaken in December-January 2024 for larval fish, February 2025 for adult fish and March 2025 for juvenile fish. The timing is based around the fish already being acclimated to higher summer temperatures and on the availability of larvae and juveniles. During each experiment, an individual fish will be placed in a mesh-sided plastic container within an aerated and mixed water bath. The fish will be acclimated to the holding container and the temperature of the water within the bath will then be increased at a rate of 1 °C every 3 minutes. This rate is commonly used for fish as it is slow enough to prevent thermal shock but fast enough to ensure that thermal acclimation does not occur. Fish will be video recorded and the temperature at which both thermal agitation and loss of equilibrium (CTmax) will be recorded. Thermal agitation occurs when fish begin to swim rapidly around the tank (the fish is attempting to seek cooler temperatures). At first sign of loss of equilibrium, the fish will immediately be removed and acclimated down to its original holding temperature.

For the growth experiments, up to 300 larvae will be randomly selected and allocated to one of 5 temperature treatments ranging between 12-32 °C (noting that this may be adjusted based on the results of the CTmax experiments for early-stage larvae). These temperatures cover the lower range that may be experienced during the breeding season through to the upper temperatures recorded at Eucumbene Borrows. Fish will be measured and weighed at the beginning of the experimental period and growth will be compared after 60 days. Any fish showing signs of temperature stress during the experimental period will be immediately removed and reacclimated down to standard holding conditions.

Following both the growth and the CTmax experiments, all fish will return to normal holding conditions and the juveniles will be able to be either maintained in captivity or released at Eucumbene Borrows or at an alternative site.

6.2.2 Population Monitoring

Population monitoring undertaken for Stocky Galaxias in 2024 found relatively low abundances within Tantangara Creek, particularly at the Bottom Flat site (Lintermans and Allan 2024). It is not known whether the apparent lower abundances reflect a seasonal change in abundance or sampling efficiency or are evidence of population declines (Lintermans and Allan 2024). It is therefore recommended that two sampling events be undertaken in 2025 one in summer (February) and one in Autumn (April) in order to gain greater understanding of the current status of the population in this location and the influence of potential seasonal changes in abundance and/or sampling efficiency, providing further guidance on the most appropriate time for sampling.

Monitoring methods and level of effort

Monitoring for the 2024/25 season will follow the methods established in Lintermans and Allan (2024) and Raadik and Lintermans (2022), consisting of replicate 30m backpack electrofishing shots, with three shots at each site in Sallys Flat Creek (Lower and Upper) and three shots at Top Flat and five shots at Bottom Flat, Tantangara Creek.

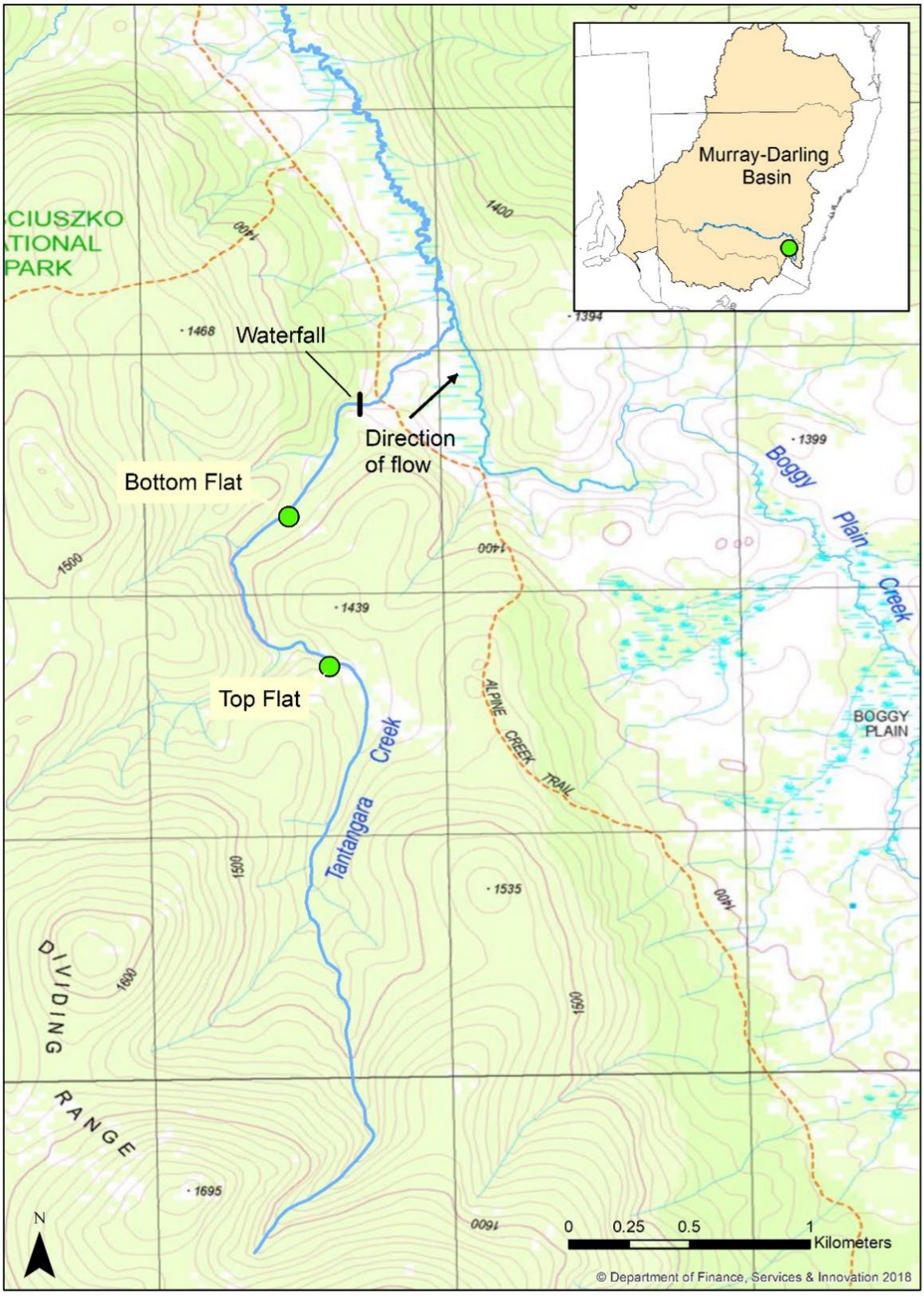


Figure 5. Map of monitoring sites on Tantangara Creek

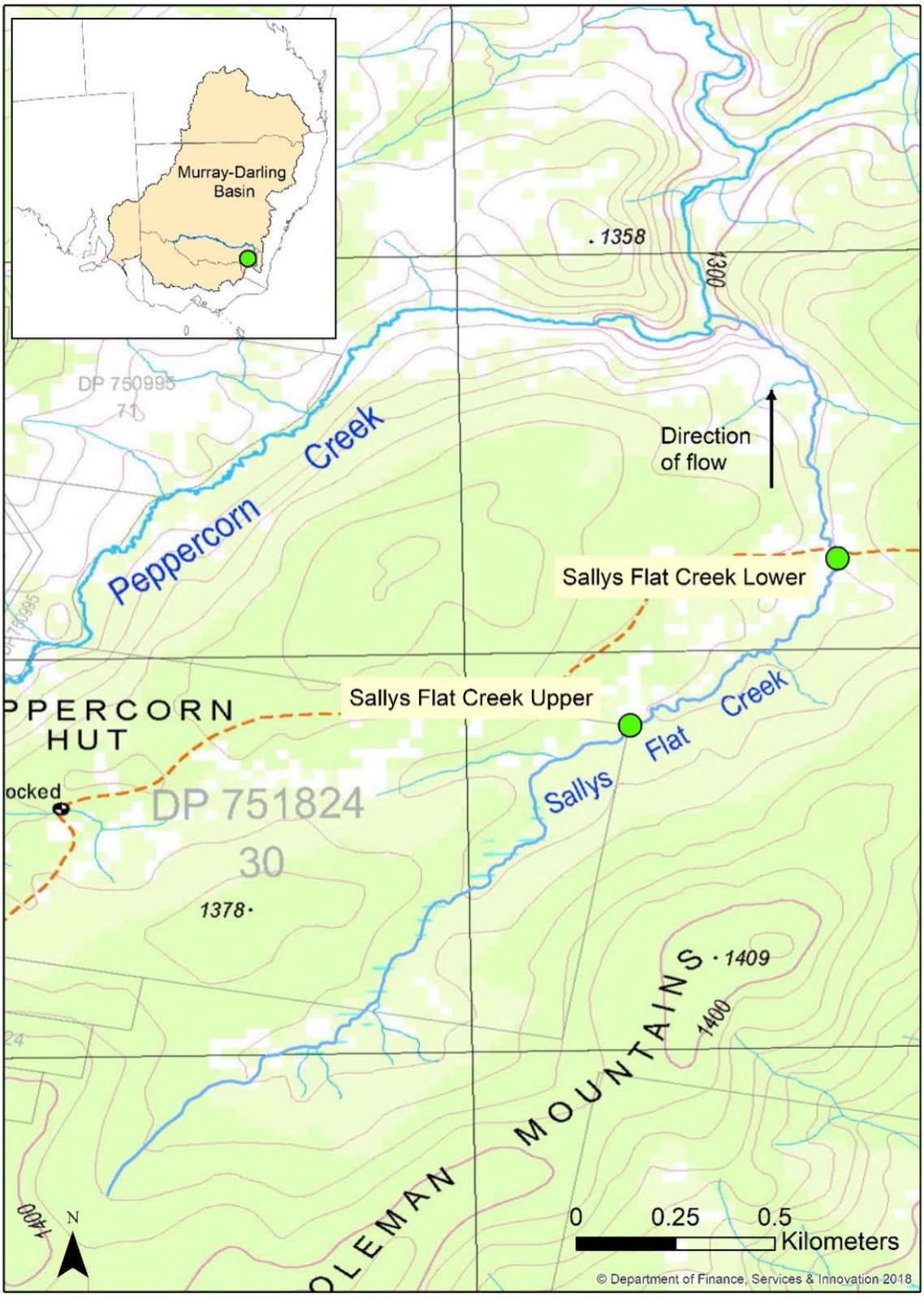


Figure 6. Map of monitoring sites on Sallys Flat Creek

Genetics

In order to monitor the level of population genetic variation and effective population size, genetic material will be collected as part of the population monitoring. A small sample of caudal fin tissue will be collected from all fish > 50 mm in length, clipping all fish up to a maximum of 45 individuals per reach (up to 90 individuals total) into 100% ethanol. Collected tissue will be sent for population genetic analysis using SNPs (effective population size, genetic diversity, parentage level analysis) at an appropriate facility. The number of tissue clips required for each successive event may be able to be reduced following analysis of initial collection.

Fish processing and data management

When captured, fish will be placed into a bucket of water carried by the dip netter. At the end of sampling, all fish captured will be placed into a larger, aerated, container whilst being processed. Fish are to be picked up using a soft, fine-mesh aquarium dip net for transfer to a wetted measuring board and then a wetted weighing dish, followed by release to the site of collection, or to another water-filled, aerated container before final release. Handling of fish must be done with wet hands. All fish species captured will be identified and measured for length (nearest mm; Caudal Fork Length or Total Length, as appropriate). Weight of each Stocky Galaxias captured will be recorded (0.1 g), and fish will be visually examined for deformities, injuries (e.g. cormorant strike) and external parasites (e.g. *Lernaea cyprinacea*).

Parasites are recorded on one side of fish (left side) and any abnormalities (wounds, lesions etc). A photo will be taken of the whole fish and zoomed in on the section of abnormality.

Data collected in the field will be manually recorded then entered electronically and maintained (curated and backed up) during data analysis ensuring appropriate review and quality assurance procedures.

Water Quality Monitoring

Standard water quality parameters are water temperature (°C), electrical conductivity (µS/cm), dissolved oxygen levels (mg/L and % saturation), pH, and turbidity (NTU). Water quality should be taken at each sampling site on each sampling event.

Water Temperature Monitoring

Temperature loggers will be installed in summer 2024/25 at Bottom Flat and Top Flat in Tantangara Creek, Sallys Flat Creek and at the Eucumbene Borrows.

Habitat Monitoring

A rapid visual assessment to identify any potential threats is to be undertaken and a photo upstream and downstream at the beginning of each sampled section or reach.

6.3 Catchment Surveys

6.3.1 Macquarie Perch

Macquarie Perch catchment surveys will commence in Spring/Summer 2024/25 following the recommendations by Lintermans et al (2022b).

Surveys for the 2024/25 will focus on the tributary sites and the mainstem sites upstream of the Yaouk Road and will not include the sites Goat Shooters, Downstream Bredbo, Baroona Rd, Lawler Road or Chakola as these sites are considered a lower priority and some have either recently been sampled under other programs or had surveys in close proximity. Surveys for 2024/25 will also not include the Queanbeyan River sites as these are located outside the catchment andtherefore a lower priority.

Depending on the findings of the 2024/25 surveys it will be assessed if the Queanbeyan River sites and other potential sites outside the catchment of the upper Murrumbidgee should be assessed along with the mainstem sites mentioned above.

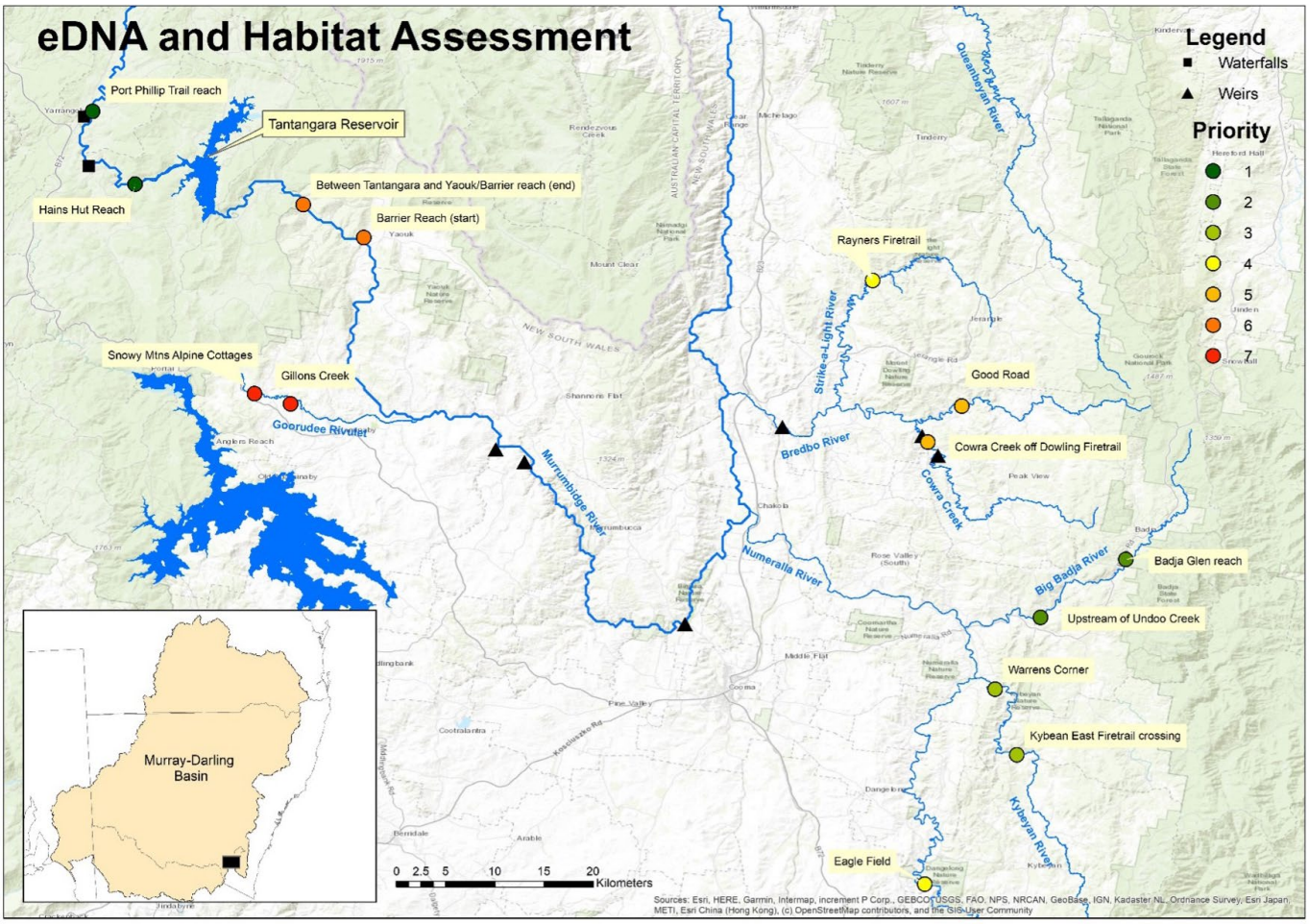


Figure 7. Map of sites to be assessed in the Macquarie Perch catchment surveys 24/25

Methods

eDNA Sampling

Eight replicate eDNA samples will be collected per site and collected with a Smith Root eDNA Sampling Backpack and 5 µm self-preserving filters. Water is to be filtered in situ using eight filters targeting a volume of 2.0 L per filter. Eight filters are used given this had previously resulted in high detectability of Redfin Perch in a different river system when the species had also been detected by concurrent conventional monitoring (Bylemans et al., 2016). An equipment control containing 1 L of sterile water is to be filtered at the beginning of each site to check for contaminating DNA at the time of sample filtration. At the completion of sampling, filters will be refrigerated at 4°C before sending to the NFC for processing where they are stored at 4°C until eDNA extraction.

Filters will be analysed for the presence of both Redfin Perch and Macquarie Perch using highly sensitive species-specific assays.

Rapid Site Assessment

During the eDNA surveys, a rapid site assessment will be undertaken to assess each locations suitability as a future reintroduction or translocation site. The site assessments will be a rapid, objective and qualitative appraisal of the following site attributes, adapted from Lintermans et al 2022b:

Instream and riparian habitat suitability.

Assess and record riparian vegetation, shading, substrate, instream structure (boulders, logs instream aquatic vegetation) and mesohabitat characteristics (presence of pool/riffle sequence).

Stream size and water permanency.

Assess and record, water depth, flow, and connectivity across the sampled reach, depth and substrate of pools, presence of instream aquatic vegetation which may indicate permanency if known.

Predator barriers.

An initial rapid qualitative site assessment will determine the potential presence of any effective, or partially effective, instream barriers possibly capable of preventing upstream movement of Redfin Perch. Further assessment can then be undertaken at a later stage, if required.

6.3.2 Stocky Galaxias

Stocky Galaxias catchment surveys will commence summer 2024/25 following the recommendations provided in Raadik and Lintermans (2022).

A detailed dataset and desktop analysis undertaken by Raadik (unpubl. Data) has been provided to NSW DPIRD for review and further assessment. This dataset contained 257 potential locations for ground truthing and potential assessment (Figure 8). Desktop analysis by Raadik and NSW DPIRD staff has prioritised these sites and excluded those at which trout is already known to exist, this has brought the number of potential sites down to 171, of these 171, there are 30 priority 1 sites and 14 priority 2 sites, catchment surveys for the 2024/25 AIP will focus on these 44, priority 1 and 2 sites.

Initial rapid fish surveys will be undertaken as outlined in Raadik and Lintermans (2022).

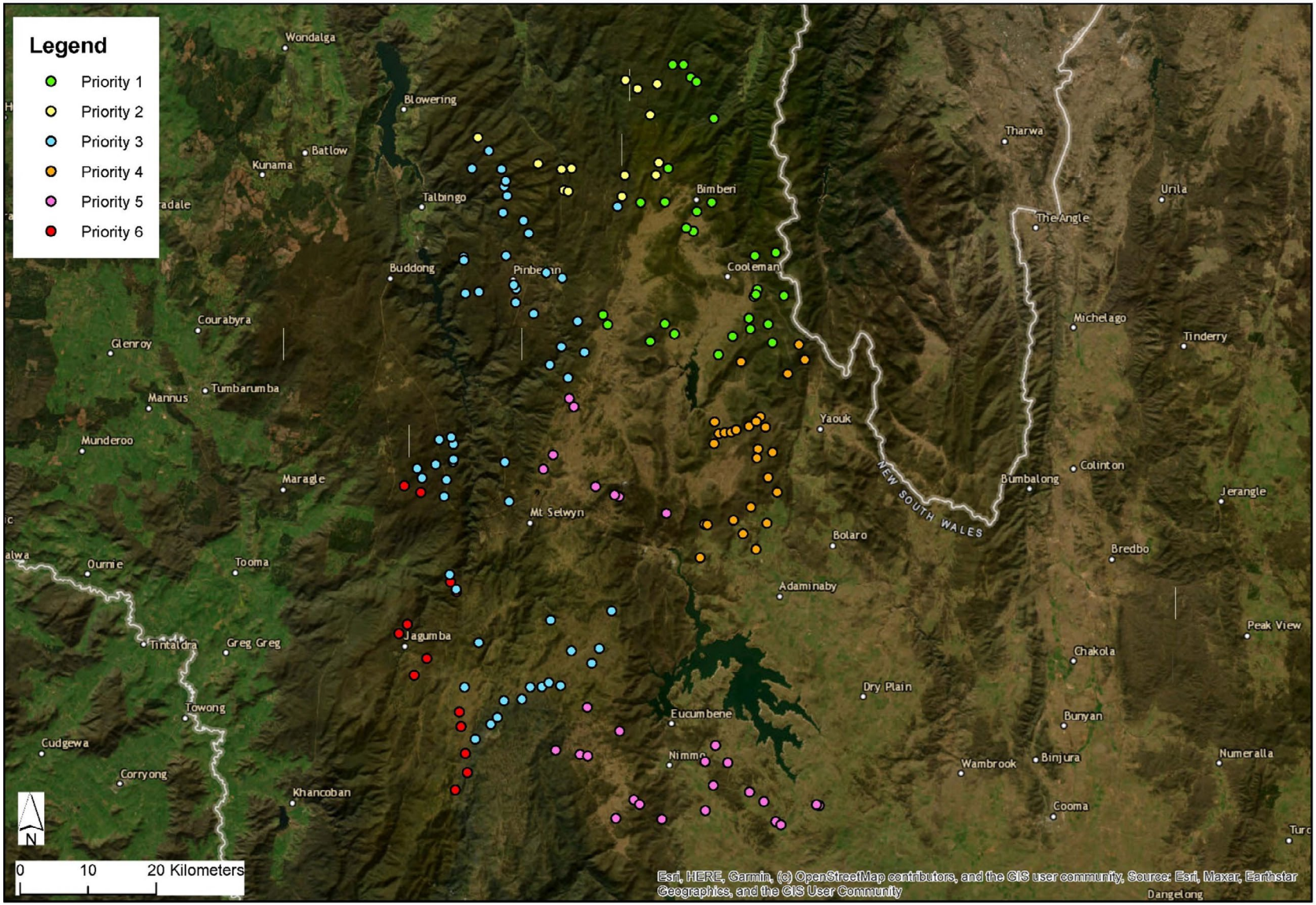


Figure 8. Map of potential sites for Stocky Galaxias catchment survey.

6.4 Budget Break Down

Activity	Funding Allocated 24/25
Macquarie Perch	
Captive Breeding	$601,256
Monitoring	$79,316
Translocation	$71,368
Catchment Survey	$82,264
Habitat Enhancement	0
Stocky Galaxias	
Captive Breeding	$119,639
Monitoring	$72,430
Translocation	$26,836
Catchment Survey	$161,144
Total	**1,218,276**

7. References

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