Report to the Department of Climate Change, Energy, the Environment and Water: Annual Performance Report (2022) against the Enlarged Cotter Dam Fish Management Plan Version 4

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Contents

Introduction

This report outlines Icon Water's performance against Version 4 of the Enlarged Cotter Dam (ECD) Fish Management Plan (FMP V4) as required under the Commonwealth Department of Department of Climate Change, Energy, the Environment and Water conditions of approval:

'*The person taking the action must implement the Plan. Every year the person taking the action must submit to the Minister a report covering performance against the Fish Management Plan.'*

Icon Water has completed the requirements of the ECD FMP V4 and associated sub-plans throughout the reporting period (2022 calendar year). There was, however, some monitoring components of the program that could not be achieved due to the exceedingly high river levels associated with the above average wet weather conditions.

This performance report is structured against each of the sub plans.

This Performance Report should be read in conjunction with the ECD FMP V4 available on Icon Water's website.

Background

As a condition of approval for Icon Water to construct and operate the ECD, the Commonwealth Environment Minister directed Icon Water to manage the potential environmental impacts to five threatened native aquatic species in the Cotter River system, particularly the threatened species protected under the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* (EPBC Act).

The specific fish and crayfish species to be managed are listed below.

Species	EPBC Act Listing Status
Macquarie Perch(*Macquaria australasica*)	Endangered
Trout Cod (*Maccullochella macquariensis*)	Endangered
Murray Cod (*Maccullochella peelii*)[1]	Vulnerable
Two-spined Blackfish (*Gadopsis bispinosus*)[2]	-
Murray River Crayfish (*Euastacus armatus*)	Endangered

Table 1 - EPBC Listing Status

Icon Water's approach to manage threatened aquatic species is documented through a series of ECD Fish Management Plans and projects as shown in **Figure 1**. The ECD Fish Management Plan continues to be reviewed every 5 years, in line with Icon Water's adaptive management principles.

The objective of FMP V4 is "*To ensure that operation of the Cotter Dam for the supply of community drinking water continues to support aquatic communities, particularly threatened native fish and crayfish species."*

Most of the monitoring objectives were achieved throughout the 2022 period. However above average rainfall events during the period prevented autumn sampling from being undertaken in 2022, which means that questions 2, 5 and 6 could not be addressed for this monitoring year.

Objective	Controls
Risks mitigation	Protect threatened aquatic fauna and their habitats arising from the construction and operation of the enlarged Cotter Dam
Adaptive Management	Scientifically based, using adaptive management, and use of expertise.
Stakeholder involvement	Robust peer review and public transparency
Compliance	Regularly updated on the basis specified in the approval conditions
	Developed as part of the overall requirements of the ECD

Table 2. ECD Fish Management plan version 4 (and relevant sub plans) objectives and controls

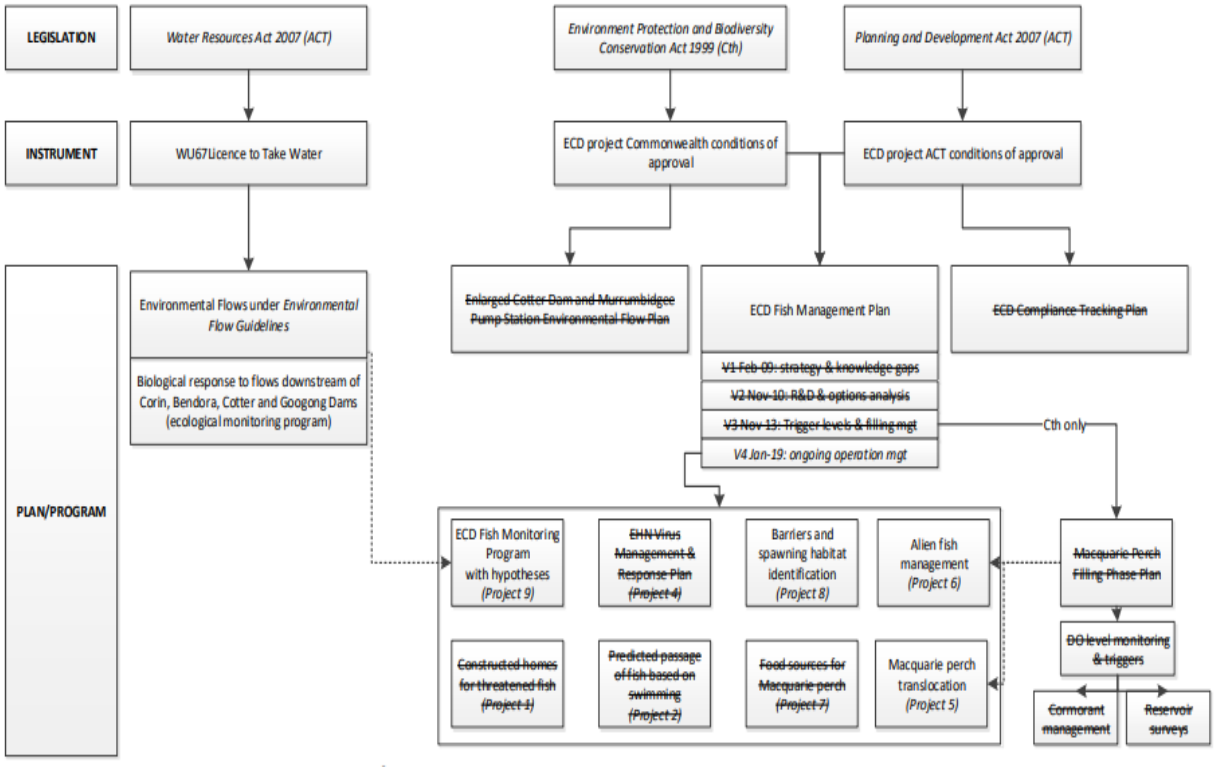
[1] Murray cod have not been detected in the Cotter River and are not included in this version of the FMP

[2] Listed as vulnerable in the ACT under Section 91 of the Nature Conservation Act 2014.

The following sub plans are contained in the following appendices to the FMP:

Appendix E	Cotter Reservoir EHN Virus Management Plan
Appendix F	Cotter Reservoir Destratification System Process Operating Plan
Appendix G	Enlarged Cotter Reservoir (ECR) Cormorant Management Plan
Appendix H	ECR Emergency Inspection and Translocation Plan
Appendix I	Cotter Reservoir Alien Fish Management Plan

Figure 1. ECD framework



FMP Working Group

The delivery of the FMP V4 was overseen by FMP Working Group (WG), chaired by Icon Water and comprising representatives and subject matter experts from the Commonwealth Government, ACT Government, and the University of Canberra.

Icon Water has continued to meet with and report to the WG, which met on the 14th of September 2022.

In November 2021 Icon Water prepared, and the FMP WG conducted a review, of a position paper of the Macquarie Perch Translocation Program. Stakeholder feedback was requested against preferred options going forward (report provided as attachment)

As a result of these consultations, it was decided to cease further translocations from the ECD to other locations and maintain monitoring only for the remaining required timeframe under the activity conditions of approval. Therefore, there was no translocation of Macquarie Perch from the ECD in 2022.

ECD Fish Monitoring – Technical Report July 2022

The following key results from the monitoring were reported through the 2022 FMP technical report and the spring data report.

Adult Macquarie Perch (gill netting)

- Relative abundance of adult Macquarie perch captured in 2022 in gill nets was the lowest since 2013. However adult Macquarie perch captured by boat electrofishing in 2022 was among the highest since this method was employed. This may indicate a change in the catchability of adult Macquarie perch in 2022.
- There was no difference in Catch-Per-Unit-Effort (CPUE) among monitoring phases. 2022 was a relatively low capture for the operation monitoring phase.
- No difference in the condition of adult Macquarie Perch in 2022. Condition of adult Macquarie perch captured in gill nets was significantly higher in operational phase compared to baseline.
- Relative abundance of Macquarie perch captured between years was similar across all survey periods, though was low in 2020. Relative abundance of adult Macquarie Perch captured between years was similar across all survey periods.

Young of Year (YOY) (Fyke netting & snorkeling)

- Young of year (YOY) detected for the fifth year in succession. Macquarie Perch YOY detected at every Cotter River site.
- A continuation of improvement in CPUE of YOY compared to filling phase, however 2022 revealed lower abundances of young-of-year Macquarie perch compared to that of 2021.
- Access to suitable spawning habitat was achieved even though all reservoirs on the Cotter River were full, and flows were operating as unregulated.
- Young-of-year abundance at the reference site (Kissops Flat) were at their lowest in 2022 since monitoring began. It is possible that bushfires in the catchment around Yaouk and Adaminaby over the summer of 2019 / 2020 may have impacted on recruitment of Macquarie perch in 2020.

Juveniles (1+ and older)

- Abundance of juvenile Macquarie perch in Cotter Reservoir has been relatively stable since 2018 suggests the ECR is providing suitable conditions for early survival and growth of Macquarie perch recruits
- There is a strong class of juvenile fish captured in the last 5 years (2018 – 2022), suggesting good annual recruitment conditions through to 1 – 3-year-old individuals.

Summary (Macquarie Perch Cotter Reservoir)

- Likely recruitment shadow from spawning seasons of 2014 and 2015 (there were three years of recruitment failure). This resulted in low catches of adult Macquarie Perch in 2019 – 2020.

Summary (other monitoring results)

- There was no Two-spined blackfish captured in the bait traps set in the Cotter Reservoir in 2022
- The abundance and size of Rainbow trout in the ECR in 2022 was not significantly different to any other year of monitoring
- Brown trout was low in 2022, in contrast to the previous five years which had recorded very high abundances. Stomach monitoring could not take place to help reveal predator potential.
- Goldfish abundance has been low since 2017, following a boom in abundance during filling and the first year of operational phase
- Piscivorous birds have been relatively stable in their species composition and abundance in the ECR. Some shifts in their distribution within ECD driven by nesting aggregations of Little Pied Cormorants.
- For the first time since filling commenced, emergent macrophyte stands were detected along the shoreline of Cotter Reservoir

- Food resources Monitoring since 2018 suggests that decapod abundances are returning to that observed in the baseline phase

Operational Risks to native fish and mitigation actions

Management measures and controls were identified in the FMP technical report 2022 and are presented in FMP V4 with their relevant number and risk rating according to the risk assessment.

This section shows the high (H) and medium (M) level risks and status of the management actions undertaken by Icon Water in 2021 to mitigate these risks.

H1. Loss of food resources

Current Controls

- Constructed rock reef provides substrate for food.
- Inundated native hardwood and shrub habitat left in-situ provides source of nutrient loads.
- Larger area of shallow fringing habitat in reservoir provides habitat for food.

Potential Additional Controls

- Trials of reed bed establishment and riparian revegetation around selected areas of the reservoir. The enlargement of the reservoir has altered reservoir food resources (loss of reed beds).

Status

- The current controls are considered adequate as there is a healthy native fish population in the reservoir. In addition, while the reservoir is being used as a water supply source the level is fluctuating which makes the potential additional controls impractical at this stage.

H2. Cold Water Pollution

Current Controls

- Monitoring of water temperature upstream and in the reservoir and selective environmental releases (as practicable) from Bendora Reservoir in accordance with Icon Water's License to Take Water.

Potential Additional Controls

- Explore options for use of variable offtakes and release at Bendora Reservoir.

Status

- Water temperature and other water quality parameters are monitored upstream and in the Corin and Bendora Reservoirs.
- Reservoir levels were very high between 2021 – 2022 with all dams spilling and mostly natural flows.

M1. Increased abundance of Alien Fish

Current Controls

- Implement management options described in section 3.2 of the Alien Fish Management Plan (Appendix I) following approval by the FMP SC and/or WG.
- Report illegal fishing to PCS (Parks and Conservation Service) who as the land manager is the delegated authority for pursuing compliance matters.
- Implement controls described in section 3 of the EHN Virus Management Plan related to fish vectors of EHN virus (e.g., Redfin Perch).

- Implement the ECD Fish Monitoring Program to define trigger levels and inform adaptive management controls of alien fish.
- Educate Icon Water contractors who are working in the catchment and inspect work sites to reduce the risk of transfer of alien fish eggs on vehicles and equipment.

Potential Additional Controls

- Monitor for trout predation on Macquarie Perch larvae, and if trout are demonstrated to impact larvae, implement additional management options described in the Alien Fish Management Plan following approval by the FMP SC and/or WG.

Status

- Rainbow trout size and abundance remains similar between years and Brown trout were low in 2022 in Cotter Reservoir. There have been previous confirmed cases of Brown trout predation on YOY Macquarie Perch.
- Trout and other alien fish will continue to be monitored by the ECD Fish Monitoring Program. Further meetings will also take place between EPSDD and IW to assess response actions if required.

M2. EHN Virus

Current Controls

- Report illegal fishing to PCS who as the land manager is the delegated authority for pursuing compliance matters.
- Implement controls described in Section 3 of the EHN virus management plan.
- Inspect Fish Monitoring Program Reports to inform potential management actions if threatened fish are exhibiting signs of infection.
- Educate (Toolbox Talk) Icon Water staff and contractors who are working in the catchment and enforce compliance with wash-down procedures.

Potential Additional Controls

- None identified.

Status

- All Icon Water staff who work in the catchment have attended a Toolbox Talk about the vehicle and equipment wash-down procedures in accordance with the Work Instruction in Icon Water's Integrated Management System.
- The Icon Water Catchment Protection and Land Management Team communicate regularly with PCS on catchment risks and actions relating to EHN Virus and other threats.

M3. Increased Great Cormorant Predation

Current Controls

- Constructed rock reef provides shelter/refuge habitat for Macquarie perch.
- Native submerged hardwood provides shelter/refuge habitat.
- Implement the monitoring and management actions specified in the Cormorant Management Plan.
- Operate the destratification mixers in accordance with the Destratification operation plan to reduce the impact of low dissolved oxygen in the water column.

Potential Additional Controls

- None identified.

Status

- Regular monitoring of the cormorant population is continuing. As reported in the latest ECD Fish Monitoring Technical Report, cormorant abundances are stable with some shifts in their

distribution within the ECR, driven by nesting aggregations of Little Pied Cormorants.

- Destratification mixers were offline during first half of 2020-21 and late 2022. The units are currently offline while the Log boom is being repaired. Should be back online in early 2023.

M4. Drawdown of reservoir and sedimentation of river reach

Current Controls

- Reservoir operating level and inflow management during spawning informed by ECR Fish Monitoring Program monitoring report.
- Environmental flows including riffle and pool maintenance flushes.

Potential Additional Controls

- None identified.

Status

- Environmental flows from Bendora Dam have been released in accordance with the License To Take Water (WU67) and the associated Environmental Management Plan. However most, if not all, the flows in the 2022 period have been natural flows and far more than normal controlled flows.

M5. Exposure of instream barriers during Macquarie Perch spawning season exacerbated by water level and flow

Current Controls

- Reservoir operating level and inflow management during spawning informed by ECR Fish Monitoring Program monitoring report and the Annual Spawning Management Plan developed in conjunction with subject matter experts and endorsed by the FMP WG.
- Compliance with licensed environmental flows in accordance with Icon Water's License to Take Water.

Potential Additional Controls

- Prepare guidelines that detail the target for spawning in successive years.
- Management of barriers (requires annual identification of relevant barriers) including mitigation options (e.g., flows, fishways, translocation).
- Continue to gather information and conduct research to inform the adaptive management of reservoir levels and river flows to mitigate the impact of instream barriers.

Status

- Annual spawning management plan developed and implemented.
- Compliance with licensed environmental flows in accordance with Icon Water's License to Take Water.

References

Broadhurst, B. T., Clear, R. C., Fulton, C. and Lintermans, M. (2022). *Enlarged Cotter Reservoir ecological monitoring program: technical report 2022*. Institute for Applied Ecology, University of Canberra, Canberra.

Annexure 1

The 10 management questions that underpin the Enlarged Cotter Reservoir Ecological Monitoring Program are:

1. Has there been a significant change in the abundance and body condition of Macquarie Perch in the enlarged Cotter Reservoir (Young-of-Year, juveniles and adults) because of the filling and operation of the ECD?
2. Has there been a significant change in the abundance, body condition and distribution of the Macquarie Perch in the Cotter River above and below Vanity's Crossing because of the filling and operation of the ECD?
3. Have Two-spined blackfish established a reproducing population in the enlarged Cotter Reservoir and are they persisting in the newly inundated section of the Cotter River?
4. Has there been a significant change in the abundance, distribution and size composition of adult trout in the enlarged Cotter Reservoir as a result of the filling and operation of the ECD?
5. Has there been a significant change in the abundance and size composition of trout in the Cotter River upstream of the enlarged Cotter Reservoir as a result of the filling and operation of ECD?
6. Are Two-spined blackfish and Macquarie Perch present in trout stomachs in the Cotter River?
7. Has there been a significant change in the abundance and distribution of non-native fish species in the enlarged Cotter Reservoir as a result of the filling and operation of the ECD?
8. Has there been a significant change in the abundance, distribution, and species composition of piscivorous birds in the vicinity of the enlarged Cotter Reservoir as a result of the filling and operation of the ECD?
9. Have macrophyte beds re-established in the enlarged Cotter Reservoir?
10. Are there adequate food resources (particularly decapods) for the Macquarie Perch following the filling and operation of the enlarged Cotter Reservoir?

Annexure 2

POSITION PAPER

MACQUARIE PERCH TRANSLOCATION PROGRAM

Prepared by:
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Senior Aquatic Monitoring Officer
5.7.2021

PURPOSE OF THE DOCUMENT

The purpose of this document is to assist Icon Water in assessing the effectiveness of the Macquarie perch translocation program and outlining a preferred program going forward.

INTRODUCTION

The Macquarie perch translocation program is a research program designed as an insurance program to ensure the species' continued survival in the ACT. Translocation of Macquarie perch comprises moving individual fish from the donor population, at Cotter Reservoir, to other suitable sites in the ACT. The program is a requirement of the Commonwealth Government (EPBC Act) in response to the potential impact on Macquarie perch habitat from the Enlarged Cotter Dam (ECD).

The program commenced in 2006 planning to identify suitable recipient translocation sites in the ACT and implement a translocation strategy from 2008 - 2021. Associate Professor Mark Lintermans has carried out the program from the University of Canberra. Since 2017 the program has focussed exclusively on a translocation reach in the upper Cotter River (upstream of Corin reservoir).

On a population level, the program to date has shown limited success. Post translocation detections before 2019 were low but increased in 2019 after the number of fish translocated increased in 2018/19. There have been no signs of recruitment detected at any of the sites. In early January 2020, the Orroral bushfire and subsequent rainfall events significantly impacted the upper Cotter River. As a result, translocation did not occur in 2020.

This review summarises the results and considers the program's recent setbacks (due to the 2020 fires). The evaluation has received input from key stakeholders, and the best strategies for the Macquarie perch translocation program going forward are outlined.

BACKGROUND AND DESCRIPTION OF THE PROGRAM

Project Background

The translocation program is an ongoing requirement of Commonwealth Conditions of Approval (EPBC Act) for the construction of the ECD. The construction period posed several risks to threatened fish species in the Lower Cotter Catchment. The Dam inundated the original spawning locations of Macquarie perch and presented new risks regarding the EHN virus entering the Dam and various hydrologic changes impacting the habitat. The translocation program aimed to help secure the Cotter population of Macquarie perch.
The Commonwealth Government approval for the ECD under the EPBC Act has the following requirements:

1. Identification of suitable recipient sites in the ACT region.
2. Development and implementation of suitable methods to translocate Macquarie Perch.
3. A monitoring program for translocated populations lasting a minimum of 20 years.

The Macquarie perch translocation project commenced in 2006, before identifying the Enlarged Cotter Dam (ECD) as Canberra's preferred future water supply option. In 2008, as part of the suite of fish projects associated with the ECD, formal planning and design of the Translocation project commenced. Translocation of fish occurred from 2008–2019, with a total of 1,519 Macquarie perch captured from the donor population (Cotter reservoir) and moved to either the Molonglo River (429 individuals) and the Upper Cotter River (1,090 individuals) (Lintermans 2017, 2019). Translocation to the Molonglo River formally ceased in 2017, with insufficient fish of the appropriate age class translocated after 2013 (Lintermans 2017).

Fish were collected from the ECD across 31 sampling events from 2008-2019 (Lintermans 2013, 2017, 2020 unpublished data). During this period, the catch-per-unit effort in the ECD varied, with a 3-year recruitment failure apparent in 2014-16 (Broadhurst et al. 2018). There was no evidence that the donor population was impacted by the amount of fish (primarily juveniles) removed. However, the adult population size in Cotter Reservoir was (and still is) unknown.

Low numbers of Macquarie Perch were captured or observed from the upper Cotter between 2008 and 2013 (Lintermans 2013) and none between 2014-17 when the number of fish available for translocation was severely impacted by recruitment failure in Cotter reservoir (Lintermans 2017). Following a translocation population model development and the recommencement of successful recruitment in Cotter reservoir, translocated fish increased in 2018 and 2019. Monitoring captured two individuals in 2019 (Lintermans 2019) and, during a separate project, the ACT Government captured a single sub-adult in 2019. Upstream of Molonglo Gorge, adult Macquarie perch have been regularly recaptured since monitoring began in 2011 (Lintermans 2013). Recaptures at this site have occurred in 2011, 2015, 2016, 2017, and 2019, with 11 adults ranging from 262–382 mm total length. There was no evidence of recruitment (i.e., Young-of-Year fish) in any monitoring in either translocation reach.

Figure 1. Location of source (Cotter Reservoir) and existing release reaches for Macquarie perch in the ACT.

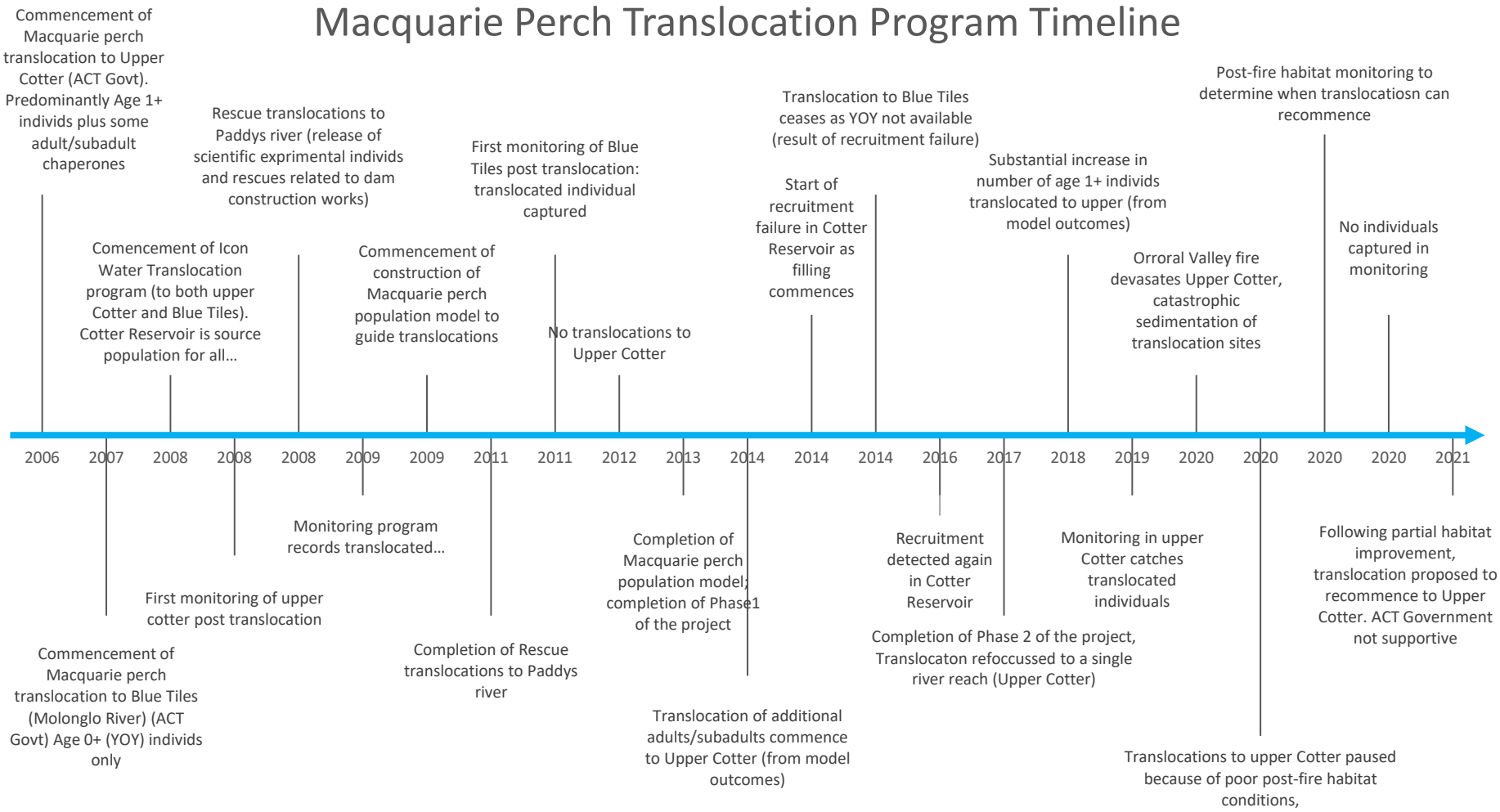

Figure 2. Macquarie Perch Translocation program timeline showing all major events throughout the program

STAKEHOLDER ASSESSMENT AND ENGAGEMENT

Stakeholder	Role	Engagement
University of Canberra	An Associate Professor and principal investigator of the translocation program, Mark Linterman's (from the University of Canberra), is a leading Macquarie perch and Australian fish specialist. Mark also plays the role of fish advisor to the business, providing ongoing specialist expertise relating to threatened aquatic species for the planning, construction, filling, and operational phases of the Cotter Dam.	Provides annual reports and updates
EPSDD	Acts on issues that affect conservation matters of the Cotter Dam, embodied in the Nature Conservation Act 2014 (ACT) and the Fisheries Act 2000.	When required
Conservation Research	Conservation Research conducts the research, monitoring, and management of threatened aquatic and terrestrial species in the Cotter River, Cotter Reservoir, and associated lands (with the University of Canberra providing the majority of the Macquarie perch monitoring under the Translocation and ECD monitoring projects). In addition, the Conservation Research department meets with Icon Water regularly to discuss translocation and various other programs.	Ongoing communication
ACT Parks and Conservation	They manage land consistent with objectives for protection of water quality, conservation, and recreation and are guided by the Statutory Reserve Management Plan for the Lower Cotter Catchment (LCC) and Namadgi National Park (NNP).	Ongoing communication
Commonwealth Department of the Environment and Energy	Approve and set the conditions for the construction and operation of the enlarged Cotter Dam under sections 130 (1) and 133 of the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth).	When required
Icon Water	Water extraction for community drinking water supply and managing environmental flow releases from Corin, Bendora, and Cotter Dam per the conditions of approval and Licence to Take Water (WU67) under the Water Resources Act 2007 (ACT). Monitoring and operation to support the maintenance of threatened fish in the Cotter Reservoir and Cotter River	

PROGRAM DEVELOPMENT

Project phases	Actions	Time
Initiation	Commencement of translocation program to upper Cotter (2006) and Molonglo River (2007) by ACT Government	Pre 2008
Planning	This project is funded by Icon Water (previously ACTEW Water) as part of the fish management program for the Enlarged Cotter Dam project.	2008 20021 ???
Site locations ID	Suitable recipient sites in the ACT region were identified, including the upper Cotter catchment, Molonglo River, and Paddys River sites.	2006 to 2008
Translocation	Development and implementation of suitable methods to translocate Macquarie Perch. A total of 1,057 Macquarie perch was translocated to Cotter and Molonglo rivers between 2008-2012. A total of only 82 Macquarie perch were translocated between 2014 and 2017. All individuals were translocated to the Upstream of Corin Reservoir reach. Translocation did not occur to the Blue Tiles site on the Molonglo River above Molonglo Gorge between 2014–2017 (recruitment failure in Cotter Reservoir), with translocation to this site formally ceasing in 2017. In 2018-19 a total of 392 fish translocated to upper Cotter. Paddys River, a 'rescue' site location only utilised in 2008-2011.	2014-2019
Monitoring	Monitoring of both ongoing translocation sites has occurred since 2008. No Macquarie perch were captured in the upper Cotter River upstream of Corin Reservoir between 2014 and 2017, although ACT Government captured a single sub-adult during another project.	2008 - 2021

Table 1. Project phases from initiation of the project to translocation of fish and monitoring

INDICATORS OF SUCCESS

The Macquarie Perch recovery plan is deemed successful if, within ten years, most of the following have been achieved (measures taken from National Macquarie Perch Management Plan 2018).

	Descriptions of measures	Traffic lights
1	Populations of translocated Macquarie perch have increased in size and distribution at each known location.	

2	Self-sustaining population(s) of Macquarie perch have been established at locations in its natural range where it once historically occurred but no longer occurs	
3	A long-term population monitoring strategy has been implemented and is ongoing for the Macquarie perch in the Australian Capital Territory	
4	There is improvement in understanding of what threat mitigation is required to recover the Macquarie perch	
5	There is the implementation of threat mitigation measures to protect known Macquarie perch populations.	
6	Macquarie perch can be reliably bred in closed-life cycle hatcheries, supplemented with broodstock from the wild, as appropriate, to maintain genetic diversity.	

Table 2. Measures of success as described in the National Macquarie Perch Management Plan 2018. The traffic lights are indicative of program results against the standards (Green = success, Yellow = moderate, Red = failure)

CURRENT STATUS OF PROGRAM

No translocations took place in 2020 due to habitat devastation in the Upper Cotter translocation sites and from rainfall and catastrophic sedimentation following the 2020 bushfires. However, monitoring habitat conditions during 2021 have demonstrated that the area has recovered sufficiently to allow the translocation of fish to recommence in 2021. The Molonglo River translocation site failed to return adult fish in 2020, with this being the first year since 2014 that no Macquarie perch were captured at this site. Modelling indicates that translocating ~5 adult female fish (>150 mm TL) will improve the chance of establishing a self-sustaining population in a five-year timeframe. However, the translocation of too many adult fish from the Cotter Reservoir may threaten the viability of this population, and in recent years the apparent abundance of adult fish has declined (thought to be a result of the 3-year recruitment failure). Consequently, the license to translocate adult fish has not (and will not) been approved until assurances for the donor population can be made. EPSDD is (Conservation Research) responsible for managing the license to translocate fish, is also querying the program's lack of successful indicators, as shown so far. If the establishment of a Macquarie Perch population at new sites largely relies on juvenile fish, then the amount of fish released annually needs to increase significantly.

Icon Water has 90% of the program commitments, with the remaining milestone (as required by the Commonwealth) related to continuous monitoring until 2028. Recent monitoring from 2017 – 2021 has shown successful spawning and recruitment to YOY, with captures of this size class higher than some of the baseline monitoring years before the commencement of filling.

Icon Water will continue to explore the population dynamics of the Cotter Reservoir Macquarie perch. This information may assist in providing stock to successful captive breeding programs and continue the trial release of captive-bred Macquarie perch. NSW DPI (Fisheries) has trailed a new hormone treatment for captive Macquarie perch breeding: results in 2020 at Narrandera were very positive, but similar trials with Victorian fish were no more successful than standard breeding approaches. In addition, NSW Fisheries collected wild-spawned Macquarie perch eggs from around Cooma to grow out in the hatchery at Narrandera, but this project was not successful. Snowy 2.0 also has some significant potential long-term impacts for Macquarie perch population in the Upper Murrumbidgee via the introduction of Redfin perch and EHN virus (as a result of not installing screens at pump intakes in Talbingo Reservoir). Conditions of approval (state and Commonwealth) mean that Snowy 2.0 has to devote $5M over five years to captive breeding, survey, and monitoring Macquarie perch (and *Galaxias tantangara*). Plans for both these species are currently being prepared.

OPTIONS

Would you please review the actions in Table 3 and provide comment(s) for supporting or opposing a motion? There is also a section below to provide general comments.

Actions	Considerations	Please provide comments
Continue current program	• Translocation to include ` 5 adult or subadult females per year (10-15 fish total, of unknown sex) plus up to 200 juveniles • Adult population catches in Cotter Reservoir have increased in 2021, indicating recruitment shadow is disappearing	
Cease direct translocation	• ECD population is showing promising signs of persisting. • No EHN virus is transmitted via construction or via ongoing management. • Additional measures to restrict public access • Limited success to date for fish translocated from the donor population	
Translocate juveniles and sub-adults when permitted	• As recommended by the 2020 translocation update report. • Amounts of juveniles should remain at the levels established in 2018 and 2019 (up to 200 per annum).	
Standard Monitoring	• Monitoring is a requirement as per the Cwlth conditions of approval until 2028. Alterations to this requirement will require permission from Cth.	Monitoring a requirement by Commonwealth.
eDNA monitoring	• Presence absence analysis only • Ability to rapidly monitor a greater distribution of sites. Possibly more rapid (depends on lab processing time) and perhaps cheaper • Ability to detect lower abundances of Macquarie perch (i.e. confirm survival after the fire)	
Additional monitoring	• Monitoring of the recovery of instream habitats from bushfire impacts should continue in 2021 • Monitoring in Corin Reservoir to investigate the status of Macquarie perch in that water body.	
Use of NSW DPI Narrandera Fisheries Centre to breed Cotter stock	• No significant impacts to donor population (will require 10-12 adult individuals) • Costs and feasibility unknown • Emphasis of NSW DPI is on genetic rescue so that any progeny will be of mixed genetic origin (not just Cotter)	

	• May be able to team up with other stakeholders (Snowy 2.0) • Provide an avenue for substantially increasing the number of individuals available for translocation.	
Please provide any other comments:		

Table 3. Lists possible program actions as we advance and relevant considerations against each activity.

Monitoring over the 2020 -21 period has also indicated favourable results for Macquarie perch in the ECD and Cotter River. Notably, a strong class of 1+ year old (juvenile) fish captured in the last four years (2018 – 2021) suggests good annual recruitment conditions for 1 – 3-year-old individuals. The 2021 monitoring also indicated an increasing abundance of young adults. This increase is highly favourable for this population's persistence over the long term and capacity to deal with the new reservoir hydraulics. However, the reliance in the ACT on a single Macquarie perch population in the event of a catastrophe in the LCC(e.g., bushfire) is still problematic, and establishing a spatially separate population is highly desirable.
Caution regarding introducing the EHN virus is still applicable as it can have devastating impacts on the entire ECD population. Therefore, the LCC land managers (PCS) have provided larger buffers from vehicle access to the Dam and improved hygiene standards for government vehicles accessing the ECD.

Icon Water Mid-term objectives

- Monitoring of translocated fish is to continue using current monitoring methods.
- Monitor the recovery of instream habitats from bushfire impacts
- No translocation of adult or sub-adult fish in 2021
- Discussion re further translocation of adult or sub-adult fish before Cotter dam population dynamics are better understood by ACT Government and key sites and size classes agreed
- Research into the cost and adequacy of eDNA monitoring techniques for translocated sites.
- Participate as appropriate in programs associated with management of key threatening processes (in particular brown trout) in the Cotter river
- Keep abreast of results from state fisheries centers on progress re Macquarie perch breeding in captivity.
- Meet with Snowy 2.0 to open the dialogue on efforts to protect Macquarie perch and related conservation requirements. May also include sharing data.

Icon Water Long-term objectives

- Cessation of Translocation. Program requirements (monitoring) to be undertaken through the ECD monitoring program or similar aquatic program.
- Produce a final glossy report to capture program efforts.

RESOURCE INPUTS

Resources for the program remain ongoing. However, the translocation components costs for the next 18 months are pending.
At this stage, the Translocation of ECD fish has stopped until assurances can be made and accepted regarding impacts to the donor population. It is recommended that some funds be put aside to participate in the breeding programs, using the Narrandera Fisheries Centre or similar, to provide broodstock for translocations. The use of fisheries Centres would lessen ongoing impacts to the Cotter Dam's donor population and enable much larger fish of various cohorts to be translocated.

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