Inland Fisheries Service

Four Springs Lake July 2023
Fisheries Performance Assessment
Technical Report

Inland Fisheries Service

Four Springs Lake July 2023 Fisheries Performance Assessment Technical Report

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Introduction

Four Springs Lake is situated 14 km north of Westbury, on Sandy Creek. Access is via Selbourne Road north of Westbury, or east via Rosevale. Tasmap Bridgenorth 1:25,000 (88908 5417530 AGD 94).

Four Springs Lake was formed in 1997 following the construction of a 10-metre-high, 260-metre-long clay core dam on Sandy Creek. The lake was created to establish a passive aquatic recreation center at Four Springs to service residents of northern Tasmania, with special provisions for the elderly, the disabled, the youth and family.

Four Springs Lake is identified as an Assisted Fishery within the *Tasmanian Inland Recreational Fishery Management Plan 2018-28* (Plan). This means it is stocked as there is no natural recruitment. As part of the performance assessment of the Plan: the IFS will undertake at least four surveys within the 10-year period. The first two surveys are to be conducted in sequential years and examine population structure and catch per unit effort (CPUE). We will undertake a population estimate for at least one year, and measure survival of at least one stocked cohort.

Assessments of the fishery have previously been undertaken during 2012, 2013, 2015 and 2020. This assessment will be the second within the duration of the Plan. The first was a mark and recapture population estimate. For this assessment the IFS will look at CPUE and population structure as well as the survival of fish marked during the previous assessment.

FPA Survey Methodology

In-lake Survey

To assess the brown trout population structure, a trapping survey was conducted during 25 - 27 July 2023. Two teams set a total of 80 box traps each day across 29 locations as shown in Figure 1. Traps were set mostly in strings of two or three, with some sets of six traps.

The traps were set for two consecutive nights, totaling 160 sets. Most were set around the margins of the lake in a range of habitats, with 10 set in deep water.

Traps were checked and cleared of fish each day. Of the fish caught, 303 were weighed, measured, and sexed with additional fish just counted.

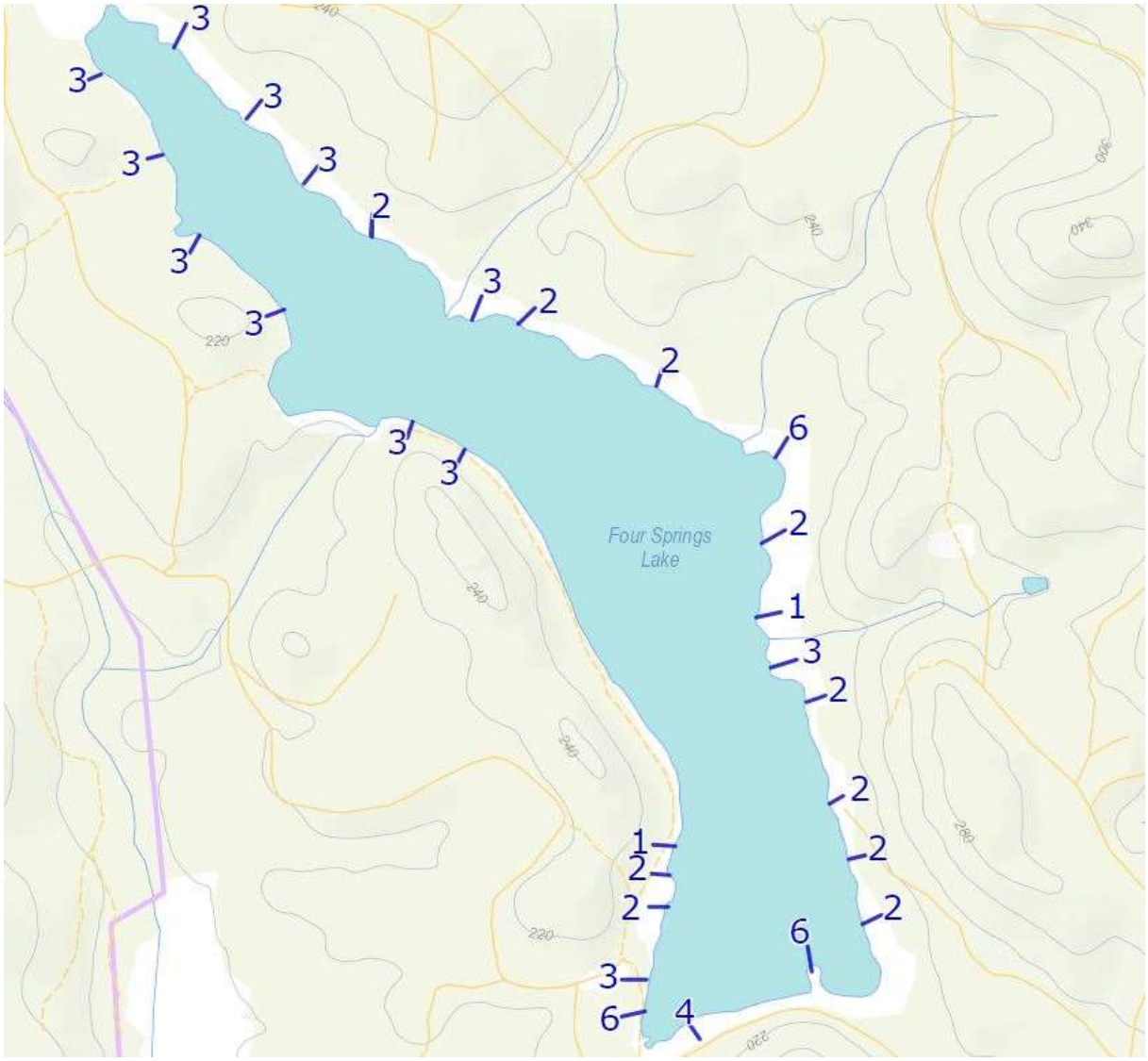


Figure 1. Map of Four Springs Lake showing the location and number of traps set at each.

Stocking history

The IFS keeps electronic records of public water stockings dating back to 1980. These records set out information on location, date of stocking, species, age, origin, stock (wild or domestic strain) and genotype, in addition to some length-weight data and comments of stocked fish, e.g., denoting tagged fish. This information provides a historical record of supplementary recruitment into individual waters. Only records for Four Springs Lake after 2014 were used in this assessment.

Annual Postal Survey

Since 1986, the IFS has conducted a postal survey seeking information about anglers' catches. The survey comprises of a form sent to a subset of all categories of anglers, asking set questions about their angling (catch of trout) for the past season. This information is entered into a database and catch per day, harvest, angler visitation and angling effort are calculated for each water-fishery. This provides a long-term overview of individual fishery performance in addition to characterising effort. The Angler Postal Survey (APS) results for Four Springs Lake from 1999-00 season up to and including the 2022-23 season are shown as charts in Appendix B.

Survey Results

In-lake Survey

Trout length weight data

A total of 313 brown trout were caught and released, 303 were weighed and measured prior to release (Table 1). Of those, 204 were females and 99 were males. Seventeen of the fish caught had their adipose fin clipped, these were from the stocking of 2,000 adult brown trout from Great Lake during May 2020.

On average, the clipped fish were 61 mm longer and 409 grams heavier than unclipped fish. The average weight of these fish when stocked was 977 grams. In the 38 months the fish had been in the lake they had on average gained 602 grams.

There were 12 rainbow trout caught, the sex could not be determined as they were triploid.

Table 1: Descriptive statistics for all trout caught during the July 2023 FPA - length, weight and condition factor separated by sex.

Grouping	Measurement	Mean	Minimum	Maximum
All brown trout (n=303)	Length (mm)	473	273	601
	Weight (g)	1,170	250	2,170
	Condition Factor (k)	1.06	0.69	1.41
Female (n=204)	Length (mm)	464	326	579
	Weight (g)	1,086	370	2,170
	Condition Factor (k)	1.04	0.69	1.41
Male (n=99)	Length (mm)	491	273	601
	Weight (g)	1,343	250	2,120
	Condition Factor (k)	1.09	0.75	1.36
Clipped brown trout (n=17)	Length (mm)	534	484	572
	Weight (g)	1,579	810	2,120
	Condition Factor (k)	1.01	0.71	1.21
Rainbow trout (n=12)	Length (mm)	381	309	485
	Weight (g)	687	320	1,120
	Condition Factor (k)	1.17	0.98	1.35

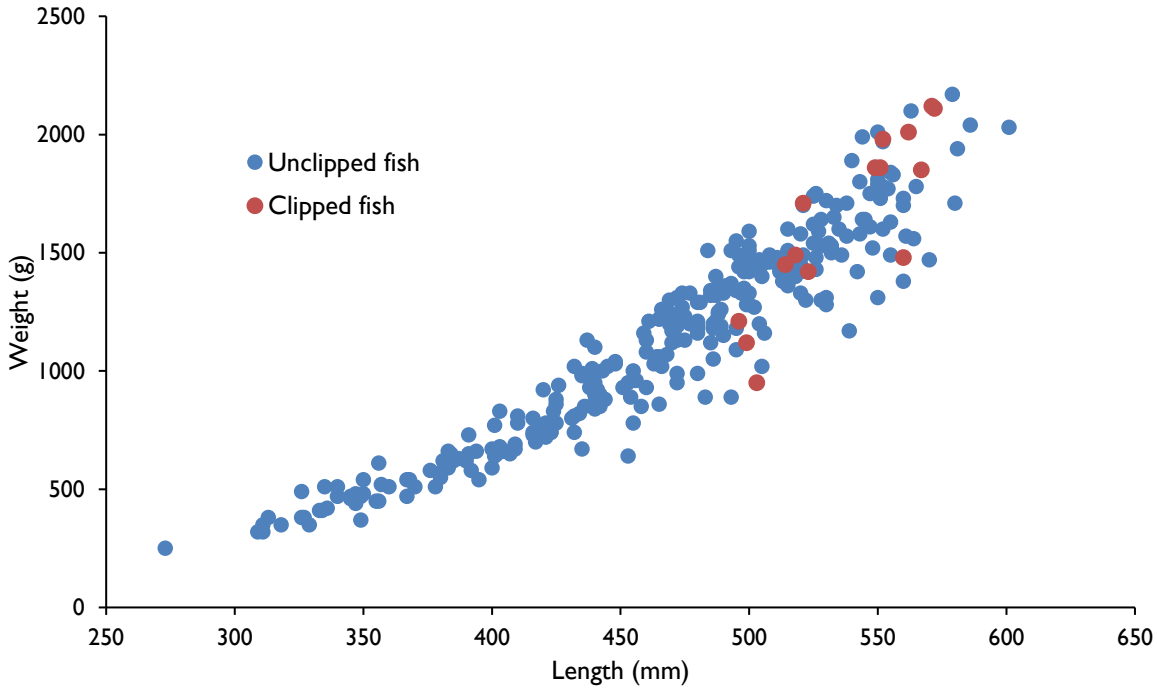


Figure 2. Length-weight relationship for brown trout showing comparison for non-fin clipped and fin clipped fish.

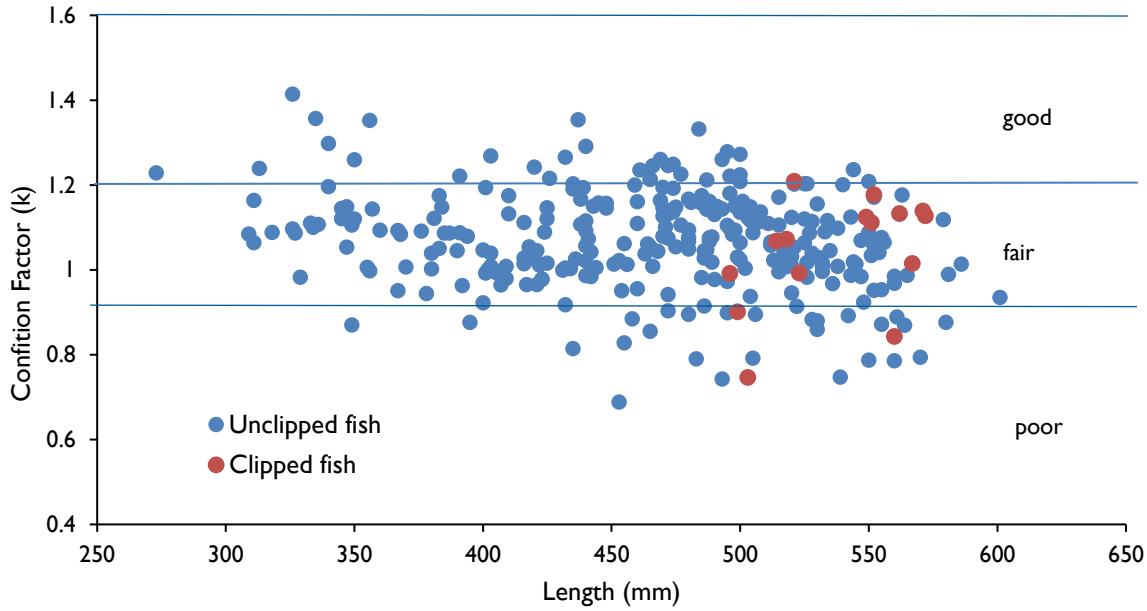


Figure 3. Condition factor at length for all brown trout caught during the 2023 survey.

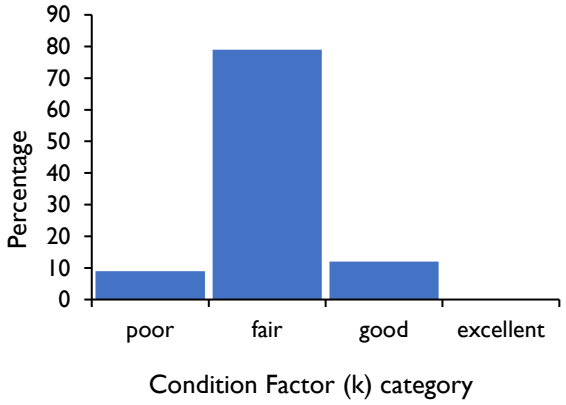


Figure 4. Condition factor category for all brown trout caught during the 2023 survey.

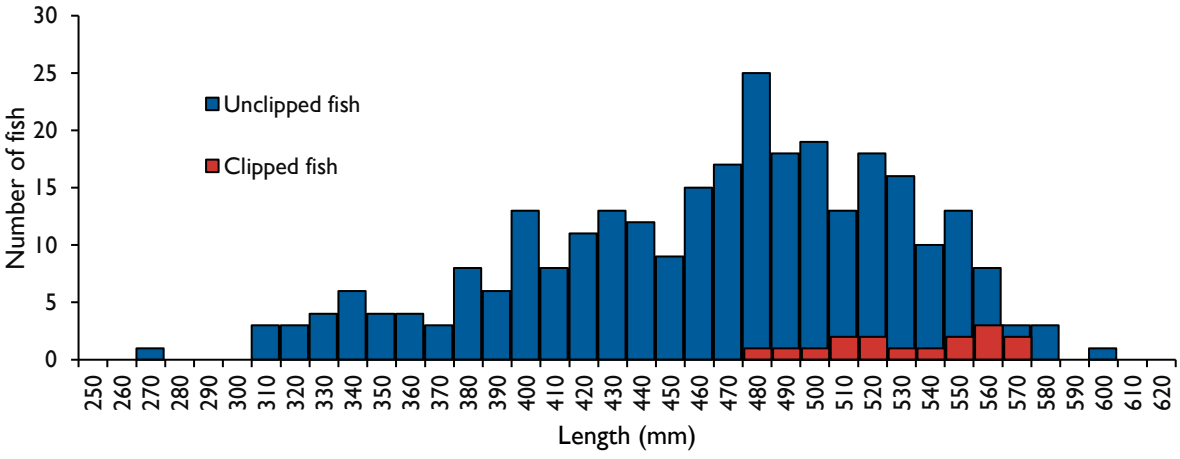


Figure 5. Length frequency plot for all brown trout caught during the July 2023 survey, n=303.

CPUE Information

During the survey (July 2023), there were 325 trout captured from 160 box trap overnight sets. This equates to a CPUE of 2.03 trout per trap per night. Catch effort information is split to show the CPUE for each species, see table 2.

Table 2: Descriptive statistics for all trout caught during the July 2023 FPA - length, weight and condition factor separated by sex.

Species	Number of traps	Number of nights	Effort (trap sets)	Number of trout	CPUE
Brown trout	80	2	160	313	1.96
Rainbow trout	80	2	160	12	0.08
For all trout					2.03

Comparison of results – CPUE information

A survey during July 2013 where 85 traps were set over two nights had a CPUE of 4.8 trout per trap per night. The CPUE for each species was not stated. The July 2013 survey estimated the population of brown trout through mark and recapture to be 14,000 to 24,000.

An FPA survey during July 2020, where 80 traps were set over two nights had CPUE values of 3.7 brown trout and 0.2 rainbow trout per trap per night. The total catch CPUE is 3.9 trout per trap per night. The July 2020 survey estimated the population of brown trout through mark and recapture to be 11,000 to 16,000.

The previous two surveys used the same methodology as this survey (July 2023), so a direct comparison on CPUE can be made. Over ten years the total CPUE has decreased by 58%, from 4.8 to 2.03.

Both the brown and rainbow trout CPUE values were significantly lower for this survey than previous. The rainbow trout CPUE decreased by 60% from the 2020 survey. The brown trout CPUE decreased by 47% from the 2020 survey.

The performance criteria from the *Tasmanian Inland Recreational Fishery Management Plan 2018-28* (Plan) are shown in Table 5.

The CPUE decrease between surveys allows extrapolation of the population estimates to give an estimate of the brown trout population during 2023 as 8,000 (Figure 5). Note total CPUE has been used for comparison of results. This estimate is an average value and

assuming there is a variation of 15 percent, gives bounds of 6,800 to 9,200. This is well below the target in the Plan of 10,000 to 14,000.

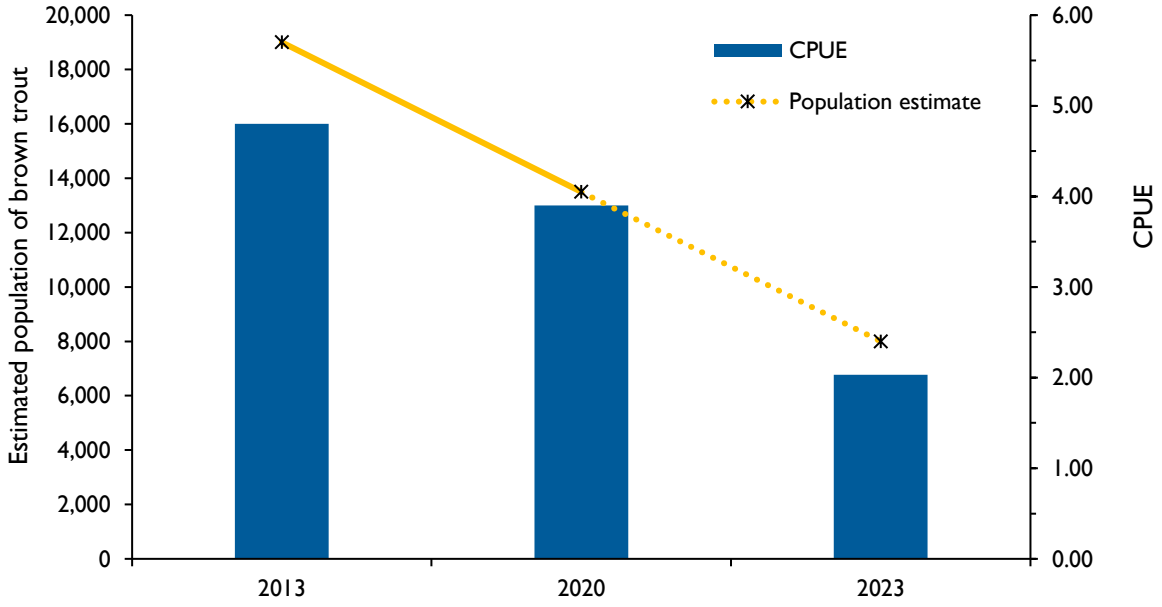


Figure 5. Comparison of CPUE of the 2013, 2020 and 2023 surveys with the 2013 and 2020 population estimates, showing the trend line of the population estimates. The trendline indicating a population estimate of 8,000. N.B. the population estimates are averages of the upper and lower limits of the mark and recapture estimate.

Comparison of results – trout length weight data

The average weight for Four Springs Lake brown trout shows variation of around 200 g over the 11 year period that these FPA surveys cover (Table 4). The 2013 FPA yielded the largest average size of the three surveys at 1,420 g, 487 mm and a Condition Factor of 1.19. The 2023 survey yielded the smallest average size at 1,170 g, 473 mm and Condition Factor of 1.06. Figures 2 – 4 shows where the adipose fin clipped cohort fits in terms of size and Condition Factor.

Assessing the 2020 and 2023 results against the fishery performance criteria outlined in Plan, shows that the brown trout are meeting the targets, average length greater than 400 mm and average weight 1.25 kg +/--0.1 (Table 5). With only one fish from 303 being greater than 600 mm, the current performance of Four Springs Lake does not meet the "large fish" criterion. That criterion states that three percent of fish should be greater than 600 mm.

Table 4. Descriptive statistics of brown trout - length, weight and condition factor for 2013, 2020, and 2023 surveys.

Grouping	Measurement	Mean	Minimum	Maximum
2013 Survey – box trap only data n=162	Length (mm)	487	301	621
	Weight (g)	1,420	320	2,740
	Condition Factor (k)	1.19	0.80	1.83
2020 Box trap survey n=351	Length (mm)	471	178	589
	Weight (g)	1,181	260	2,230
	Condition Factor (k)	1.09	0.65	1.87
2023 Box trap survey n=303	Length (mm)	473	273	601
	Weight (g)	1,170	250	2170
	Condition Factor (k)	1.06	0.69	1.41

Table 5: Fishery performance criteria for identified Assisted Fisheries requiring stocking from the Plan.

Water	Average weight (kg)	Catch rate (fish per day)	Large fish (percentage)	Population size (BT) at full lake level
Four Springs Lake				
Brown trout	>400 mm 1.25 kg +/--0.1	>1.0 +/--0.2	> 600mm 3%	10,000 – 14,000
Rainbow trout	>400 mm 1.40 kg +/--0.2	>0.5 +/--0.1	> 500mm 3%	

Low numbers of rainbow trout were caught in all the FPA surveys, four in 2013, 25 in 2020 and 12 in 2023. These results make it difficult to make any assessment against fishery performance criteria as set out in the Plan. The average weight in 2013 was 1.4 kg, in 2020 it was 420 g and for the 2023 survey it was 687 g.

The fish with adipose clips are those that were stocked during May 2020 for a mark and recapture population estimate in July of that year. The changes in size and therefore the growth of this cohort of fish is shown in Table 6. The average growth was 102 mm in length and 760 g in weight. The Condition Factor change was negligible.

Table 6: Changes in length, weight and Condition Factor of clipped fish from previous survey to July 2023 survey.

Grouping	Measurement	Mean	Minimum	Maximum
2020 clipped fish recapture n=86	Length (mm)	432	301	544
	Weight (g)	819	270	1580
	Condition Factor (k)	0.98	0.53	1.21
2023 clipped fish recapture n=17	Length (mm)	534	484	572
	Weight (g)	1579	810	2,120
	Condition Factor (k)	1.01	0.71	1.21
Change in size: growth	Length (mm)	+102	+183	+28
	Weight (g)	+760	+740	+540
	Condition Factor (k)	+0.03	+0.18	0

The proportion of clipped fish in the 2023 survey was significantly reduced, as would be expected three years after the initial recapture period. During the 2020 recapture survey there were 86 clipped fish caught, representing 15% of the catch. During the 2023 survey there were 17 caught, this represented 8% of the catch. Overall, there was a 47% decrease in the proportion of clipped fish caught.

When looking at the CPUE of clipped fish the 2020 survey had 0.54 clipped fish per box trap, this dropped to 0.11 for the 2023 survey. This was an 80% decrease in CPUE.

Stocking History

Since 2015, only wild adult brown trout collected from spawning runs on the Central Plateau have been transferred to Four Springs Lake (see Appendix A). The average transferred being 4,000 fish per annum to 2020. These transfers have resulted in higher and more stable catch rates of brown trout. During 2016 a significant flood event limited the number of fish available to 2,400. Subsequently, the balance of fish was made up during 2017, with 6,450 fish transferred. For 2021, 2022 and 2023 the number of brown trout transferred each year has been approximately 3,000.

The stocking of rainbow trout prior to 2018 had been opportunistic and dependent on fish donated by the major aquaculture farms. However, Four Springs Lake is now stocked with 2,000 yearling-adult (300 to 500 g) fish grown specifically to meet fishery management needs.

Angler Postal Survey

The charts showing the Angler Postal Survey (APS) results for each season from 1999-00 to 2022-23 are shown in Appendix B. The primary results of the APS for each year for any

water (in this case Four Springs Lake) are four attributes calculated from the questionnaires. These attributes are catch rate (fish per day), harvest (estimated number of fish caught), the number of anglers fishing there and total effort (days fished x anglers). The starting point for the results relevant to this report is May 2015. This is when the stocking regime of 4,000 wild adult brown trout commenced. Noting that it dropped to 3,000 brown trout from 2021 to present. The results of the APS for 2014-15 to 2022-23 are discussed below.

Summary of Angler Postal Survey results at Four Springs Lake

- With the commencement of the "new" stocking regime during 2015 the harvest of brown trout has consistently been above the long-term APS average of 6,625 fish. The peak harvest occurred during the 2018-19 season when 14,767 brown trout were caught. It is likely that most of these fish were removed from the lake, as is the nature of this fishery. The harvest for 2022-23 fell to just over 7,700 fish and corresponds with a sharp reduction in anglers and the overall fishing effort to 7,268 angler days, which is below the long term average of 8,998. Since 2015, catch rates have ranged from 0.67 to 1.35. The target catch rate in the TRIFMP 2018-28 (Plan) of greater than 1.0 fish per day (+/-0.2) has been achieved from 2017-18 to present.
- After 2018 the annual stocking of rainbow trout was set at 2,000 yearling-adults. This stocking rate has resulted in a catch rate of 0.17 to 0.47 fish per day. Apart from 2021-22 the catch rate has been significantly lower than the Plan target of greater than 0.5 fish per day (+/-0.1).
- Four Springs Lake is a popular fishery and is always in the top 15 most visited lakes and commonly in the top 10 of the APS. Since 2015 over 2,092 anglers, which is the long term average, have fished there each season.
- Angler effort has mostly been above the long term average of 8,998 angler since 2015. days with five of the eight seasons having above 10,000 angler days. Substantial drops in angler effort occurred in 2017-18 and 2022-23. The pattern in angler effort does not correlate with angler visitation. Above average angler effort for the 2019-20, 2020-21 and 2021-22 seasons could be due milder summer weather supressing weed growth. The growth of weed (macrophyte plants) during summer can greatly reduce the access to fishable water at Four Springs Lake, this will result in reduced effort. With 2020 to 2022 being cooler summers the reduced plant growth allowed anglers to expend more effort at the fishery.
- The harvest numbers from the APS do not appear to match the actual numbers of fish taken from the fishery at Four Springs Lake. In part this could be due to catch and release. It seems unlikely that 14,700 brown trout were caught during 2018-19. This is further backed by the fact that only 3,000 to 4,000 are stocked each year.

Discussion

The average weight and length for the rainbow trout caught is well below the criteria set out in the Plan, reflecting the size of the fish stocked in 2023. With only 12 fish caught this makes analysis of the population statistically weak. Box trap surveys have not been effective in catching rainbow trout in FPAs.

The size of brown trout caught in this survey is similar to those caught in the 2020 survey. The primary stocking source has remained yingina-Great Lake where the transferred fish average between 800 and 900 grams. From examination of the fin clipped fish there has been an average growth rate of 100 mm and 750 g over three years. This growth rate, 33 mm and 250 g per year indicates that Four Springs Lake is a productive environment suitable for the current stocking regime.

There was only one brown trout that was greater than 600 mm caught during this survey. The current regulations for Assisted Fisheries like Four Springs Lake are that only two fish are permitted to be taken over 500 mm. In this survey 37 % of the brown trout were over 500 mm in length and 10 percent were greater than 550 mm. The condition of brown trout in the catch does not show any apparent decline in these larger fish, indicating that there is potential for fish to grow to more than 600 mm. The caveat to this potential is that growth will be slower for the larger fish. It seems likely that anglers are taking too many fish over 500 mm for there to be enough fish growing to 600 mm for one of the criteria in the Plan to be met. Reducing the bag and size limits could help meet the criterion of the Plan where three percent of the population is greater than 600 mm in length.

There was a reduction in the stocking of brown trout from 4,000 per annum from 2015 to 2020 to 3,000 from 2021 to present. This hasn't caused a decrease in angler catch rate nor harvest as indicated by the APS.

The most obvious difference in this survey in comparison to the 2020 and 2013 surveys, is the reduction in CPUE. Over ten years the total CPUE has decreased by 58%, from 4.8 to 2.03. The largest decrease occurred between 2020 and 2023 where brown trout CPUE decreased by 47%. By that measure and correlating it with mark and recapture population estimates in 2013 and 2020, an estimate of 8,000 is calculated. This is fewer than the population size criterion for performance from the Plan, which is 10,000 to 14,000. The variability in CPUE for each survey is difficult to reconcile in relation to other measures.

One of the performance criteria in the Plan is that anglers' daily catch rate for brown trout at Four Springs Lake is greater than 1.0 fish per day +/-0.2. This measure cannot be taken from the box trap survey. The APS has catch rate measured for the entire history of the Four Springs Lake fishery. The long term average is 0.72 fish per day. From the 2016-17

season the catch rate has been above 0.98 fish per day, thus meeting the performance criterion for catch rate from the Plan.

Angler catch rates as calculated from the APS, do not correlate with the CPUE of the box trap surveys. The survey CPUEs declined from 4.8 (2013) to 3.9 (2020) and then further to 2.03 for this survey. By contrast the APS shows increasing catch rates for these corresponding years. While the APS results need to be treated with caution, there does appear to be a large discrepancy between what the box trap surveys are indicating and what anglers are catching. There was no examination of Compliance Creel or Angler Diary results for this FPA, but they could help to further assess the apparent discrepancy, particularly as these new systems of assessment develop.

Anecdotally, there has not been a significant downturn in catch rate at Four Springs Lake. With this being the case, the results of this survey are questionable in relation to previous ones.

While the methodology of sampling using box traps is assumed to be sound, there is a high degree of variability in the catch efficiency depending on how they are set. Most traps are set in groups of two or three. With traps set in shallow water they can be aligned so that they crossover and therefore create a continuous wall of netting for fish to intercept and therefor get caught as they move in the shallows. The water needs to be shallow enough for there to be air pockets in the cod ends of the traps, to prevent the death of captured platypus. Alternatively, traps can be set with their cod ends out of the water on a stake. This ensures any captured platypus will survive but there will not be a continuous wall of netting. The gaps in the set of two or three traps set with cod ends out potentially result in lower catch rates.

One of the key objectives of the Fisheries Performance Assessments (FPA) is to measure results against performance criteria set out in the Plan. The results of this FPA do show a fishery where brown trout average greater than 400 mm and 1.25 kg +/- 0.1 with good growth rate and fair Condition Factor. The catch rate as measured by APS is greater than 1 fish per day +/- 0.1. These attributes of the fishery are within the target parameters of the Plan. The surveys in 2020 and 2023 do not show that 3% of brown trout in the population are greater than 600 mm in length, thereby not meeting that performance criterion of the Plan.

It is difficult to determine the current size of the brown trout population even using comparisons of CPUEs from different surveys. A 47% reduction in CPUE from the 2020 to 2023 survey could indicate a drop in brown trout population to approximately 8,000 +/- 1,200. Alternatively, the variation in CPUE could be due to a change in catch efficiency between surveys. Whichever the reason this FPA cannot conclude that the brown trout population is within the bounds of the criterion 10,000 to 14,000 fish as outlined in the Plan.

Recommendations

- The source of brown trout for stocking should remain as adults transferred from Central Highland spawning traps. The stocking rate should range from 3,000 to 4,000 fish per annum.
- To increase the proportion of fish growing to greater than 600 mm in length consideration should be given to changing the bag limit of two fish over 500 mm to one.
- Standardise the protocols for setting box traps to ensure a consistent survey methodology.
- Consider an assessment technique based around boat based electrofishing.

Appendices

A) Stocking table (2015-2023)

(i) Brown trout stockings at Four Springs Lake 2015 to 2023

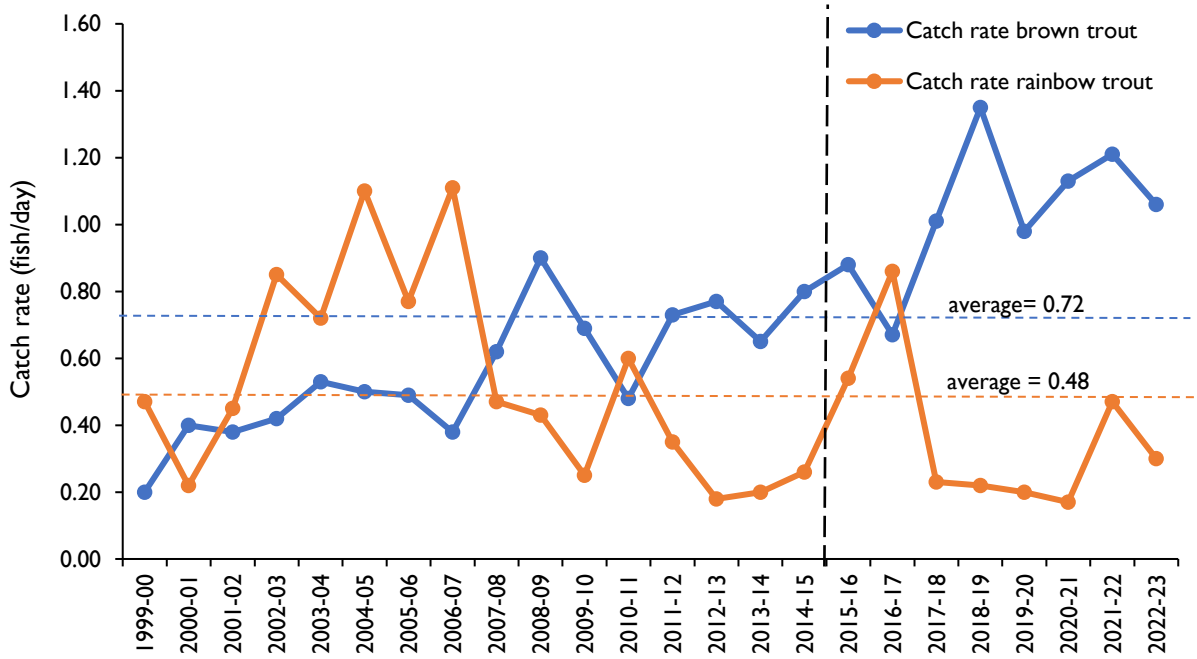
Date	Age	Number	Origin	Weight (g)
Jun-15	Adult	3,630	yingina-Great Lake	800
Jun-15	Adult	600	Tumbledown Creek, Arthurs Lake	500
Jun-16	Adult	2,400	yingina-Great Lake	1,000
Jun-17	Adult	5,540	yingina-Great Lake	1,000
Jun-17	Adult	1,000	Tumbledown Creek, Arthurs Lake	700
Jun-18	Adult	4,039	yingina-Great Lake	900
Jun-19	Adult	1,052	River Derwent, Lake King William	550
Jun-19	Adult	2,988	yingina-Great Lake	900
Jun-20	Adult	4,028	yingina-Great Lake	800
May-21	Adult	2,869	yingina-Great Lake	900
May-22	Adult	3,071	yingina-Great Lake	800
Apr-23	Adult	2,945	yingina-Great Lake	900

(ii) Rainbow trout stockings at Four Springs Lake 2015 to 2023

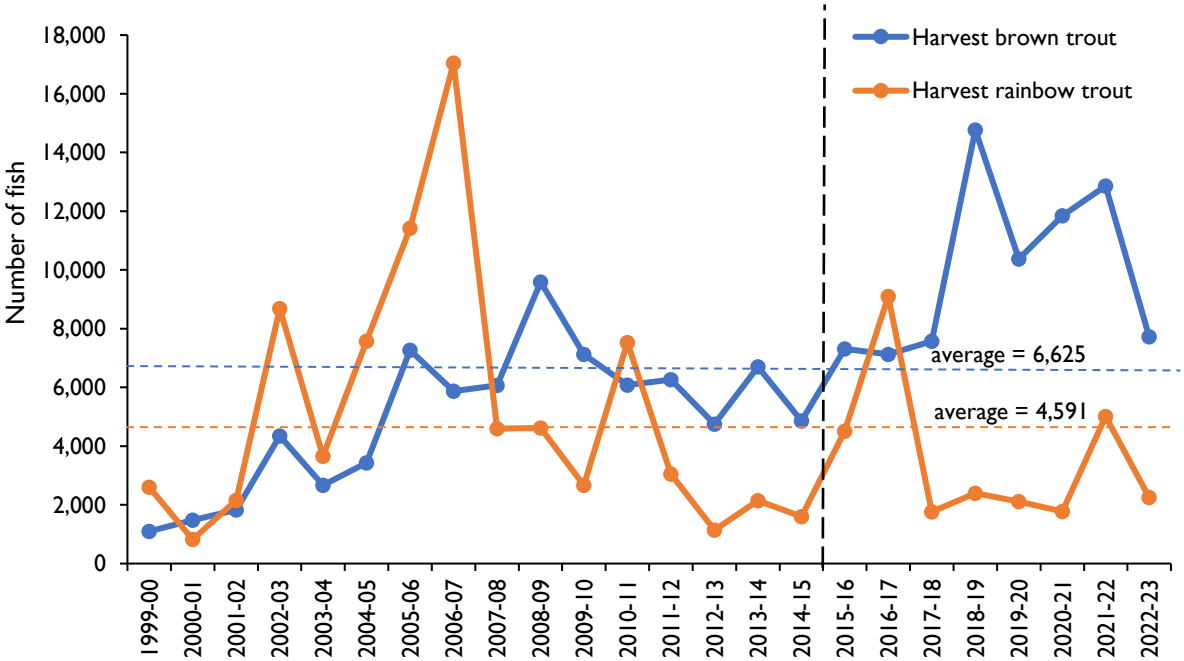
Date	Age	Number	Origin	Weight (g)
Oct-15	Yearling	6,000	FF#04 - Springfield (Huon Aquaculture Group)	138
Oct-15	Fingerling	20,000	FF#04 - Springfield (Huon Aquaculture Group)	10
Dec-16	Adult	1,200	FF#04 - Springfield (Huon Aquaculture Group)	750
Feb-17	Yearling	4,538	FF#52 - Targa (TI & AP Malahoff)	220
Jul-18	Adult	2,100	FF#65 - Millybrook (Huon Aquaculture Group)	385
May-19	Adult	1,500	FF#65 - Millybrook (Huon Aquaculture Group)	500
Jun-20	Yearling	1,817	FF#65 - Millybrook (Huon Aquaculture Group)	300
Jun-20	Yearling	200	FF#65 - Millybrook (Huon Aquaculture Group)	300
Jul-21	Adult	2,500	FF#65 - Millybrook (Huon Aquaculture Group)	380
May-22	Adult	2,107	FF#65 - Millybrook (Huon Aquaculture Group)	400
May-23	Adult	2,000	FF#65 - Millybrook (Huon Aquaculture Group)	487

B) Angler Postal Survey (2000-2023)

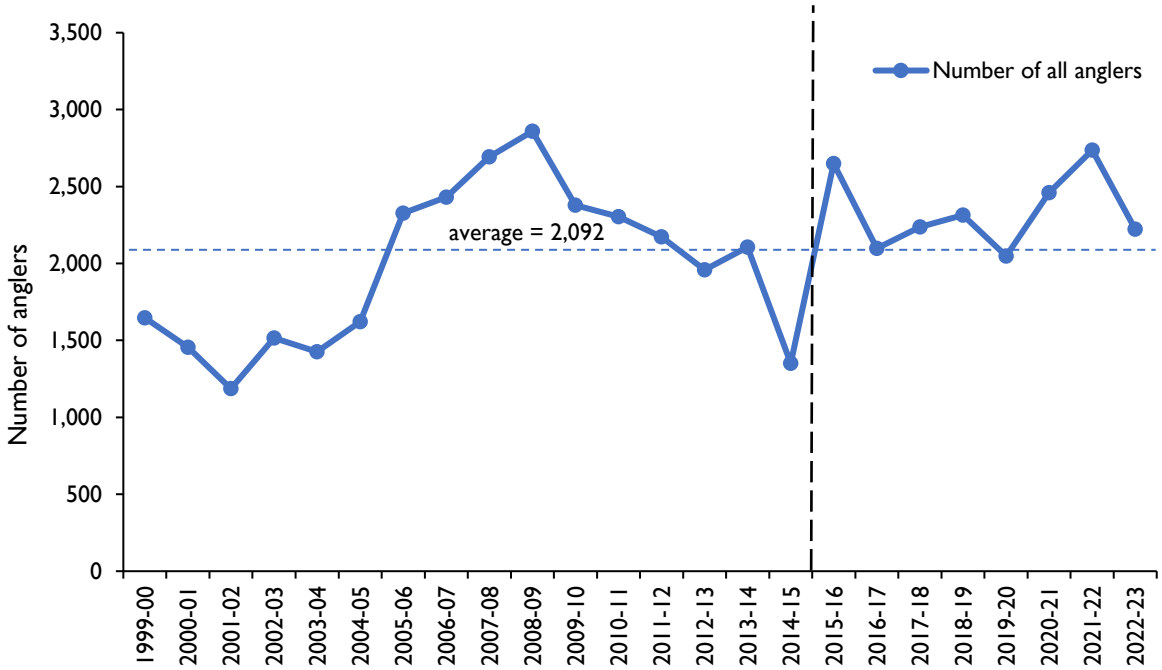
N.B. Black dashed vertical line indicates the start of the period that this FPA report is referencing i.e., 2015 to 2023.



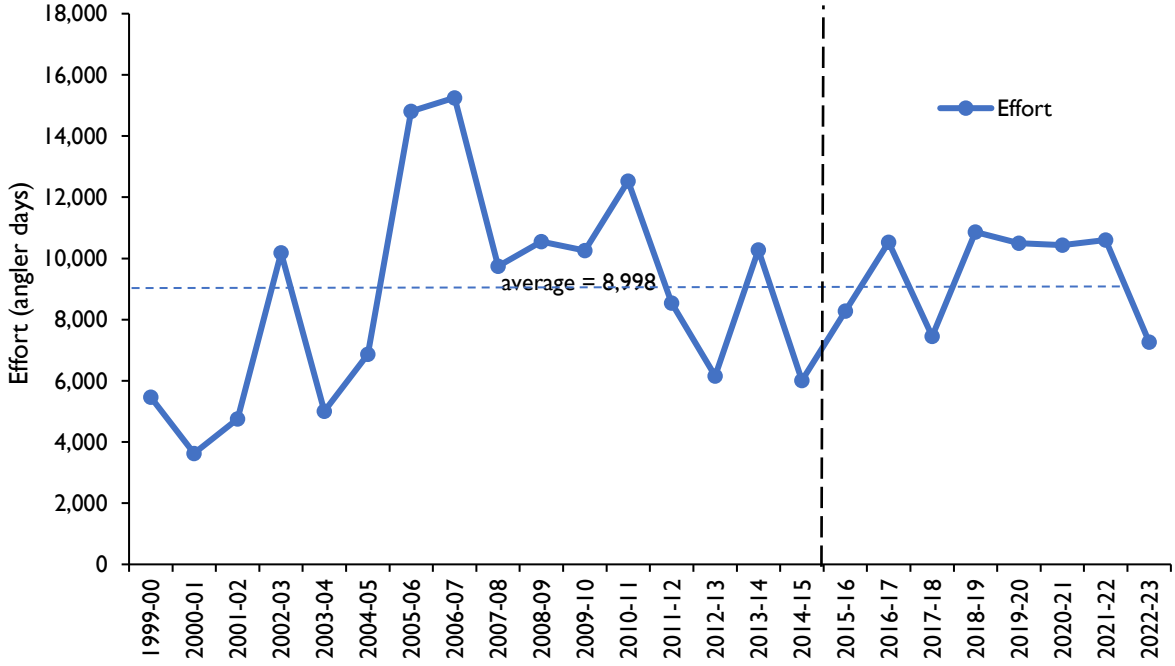
i) Estimated catch rate (fish per day) at Four Springs Lake from 1999-00 to 2022-23 season.



ii) Estimated harvest (number of fish caught) at Four Springs Lake from 1999-00 to 2022-23 season.



iii) Estimated number of anglers fishing at Four Springs Lake from 1999-00 to 2022-23 season.



iv) Estimated angling effort (angler days) at Four Springs Lake from 1999-00 to 2022-23 season.

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