Inland Fisheries Service

RECREATIONAL FISHERIES REPORT

Fisheries Performance Assessment

Technical Report

Lake Leake – April 2022

Inland Fisheries Service

Contents

Title:	**Fisheries Performance Assessment, Technical Report, Lake Leake - April 2022, Inland Fisheries Service**
Prepared by:	**Rob Freeman, Senior Fisheries Management Officer**
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Approved by:	**John Diggle, Director - Inland Fisheries**

1. Introduction

Lake Leake is an artificial impoundment built during the early 1880's, situated 36 km east of Campbell Town. The lake was used as a town water supply for Campbelltown but now provides irrigation water for downstream users. Full supply level is 571 m ASL. The waters of the lake inundate a natural marsh and bushland, covering an area of approximately six square kilometres. Lake Leake is subject to annual drawdowns, but the water quality is generally good, with low turbidity typical. Much of the shoreline is lined with drowned timber and the lake supports extensive macrophyte beds.

The lake has a very large population of the invasive redfin perch and has in the past been stocked with short finned eels, rainbow trout and brown trout.

The fishery is managed as a brown trout water, with supplementation of the rainbow trout population with commercially grown fish. Until 2003, the brown trout population was supplemented by stocking 30-40,000 fry per annum. By comparison to natural recruitment, the contribution of these fish has been negligible. In 2013, the Inland Fisheries Service commenced a program to stock the water with adult brown trout collected from the spawning runs from the Central Highland (mostly Liawenee Canal). These fish appear to be contributing to the underlying population and maintaining an acceptable catch rate.

Under the *Tasmanian Inland Recreational Fishery Management Plan 2018-28*, Lake Leake is listed as an 'assisted fishery' with the fishing season managed for brown trout. Fishing methods are restricted to the use of artificial lures only. A daily bag limit of five fish exists with a minimum size limit of 300 mm that includes no more than two fish over 500 mm.

2. FPA Survey Methodology

2.1. In-Lake Population Survey

During 11-13 April 2022, 80 box traps were set each over two nights, for a total of 160 box trap sets. Traps were set along the shoreline covering all habitat (see Appendix 1). All brown and rainbow trout were weighed and measured. Brown trout were checked for the presence of a clipped adipose fin that distinguished adult transfers that were released into the lake during May 2017. In addition to the trapping of fish within the lake, the inflowing Snowy River was electrofished using a backpack electrofisher. These trout were measured for length only.

At the time of the 2022 survey, the lake level was at 4.375 m, 0.825 m below the spill level. The lake level during the previous 2017 survey was 3.925 m, 1.275 m below the spill level.

2.2. Annual postal survey

Since 1986, the Inland Fisheries Service (IFS) has conducted a postal survey seeking information about anglers' catches. The survey comprises a form sent to around 4,000 anglers of all licence categories asking set questions about their angling (catch of trout) for the past season. Information on catch per day, harvest and angling effort is collated and analysed. This provides a long-term overview of individual fishery performance, in addition to characterising fishing effort. Only records post 1999 were used.

2.3. Stocking database

The IFS keeps electronic records of fish stocking within public waters dating back to 1980. These records set out information on location, date of stocking, species, age, origin, stock type and genotype, in addition to some length/weight data and comments e.g., denoting tagged fish. This information provides an historical record of supplementary recruitment into individual waters. Only records post 2009 are used in this report.

2.4. Angler Creel Data

Each season IFS officers collected catch and fishing effort information from anglers. This information is entered directly into a dedicated 'Angler Creel' data collection app. Information on the location, date, species, number of fish caught, fish caught and released, time spent fishing, method etc. are entered and stored in an electronic database. In this report, only records from anglers that fished for three or more hours were used. Once analysed, the summary information is reported as the number of fish caught per day, irrespective if an angler had fished for three or more hours or was continuing to fish. All fish irrespective of being kept or released were used, including zero catches.

2.5. Analysis Methods

Condition factor was calculated using the basic formula of $K=10^5 \times \text{weight}/\text{length}^3$. This provides a generalised result that can be used to compare other fish and fisheries. The short comings of condition factor are acknowledged but are used for relative comparisons only. Categories are indicative and may not necessarily reflect the perception of anglers in general.

3. Results

3.1. In-Lake Population Survey – Brown Trout

Catch effort

In total, 228 brown trout were captured over two nights, from a total of 160 box trap sets. This equates to a CPUE of 1.43 fish per trap.

Weight and Length Information

All 228 brown trout were weighed and measured, consisting of 96 females, 85 males and 47 indeterminate fish, with lengths ranging between 177 – 635 mm (see Figure 1). The average weight and length for brown trout was 1,091 g and 472 mm respectively. The maximum length recorded for an individual fish was male of 635 mm, weighing 3.28 kg. Twenty three brown trout (13 females & 10 males) were adipose fin clipped. These are the remaining from a transfer of 2,000 adult brown trout from the Liawenee fish trap that were all adipose fin clipped during May 2017. The average weight for these recaptured fish was 1,193 g and length 528 mm.

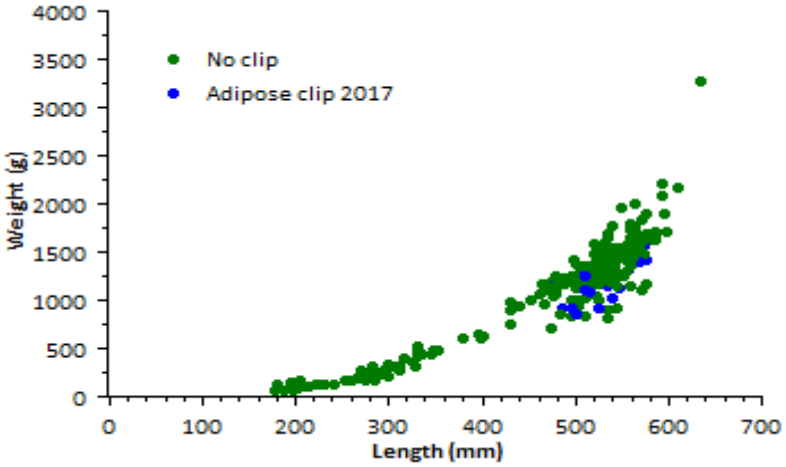


Figure 1: Length and weight of brown trout, showing recaptured adipose fin clipped fish.

The length frequency data for brown trout (see Figure 2) shows evidence of natural recruitment with peaks at 210 and 270 mm. There are very few fish in the 360 – 460 mm length range, indicating very low recruitment resulting from the 2018 spawning. Over 460 mm in length, there is a large group of fish that includes adipose fin clipped fish released during 2017 that are now, at least eight years old.

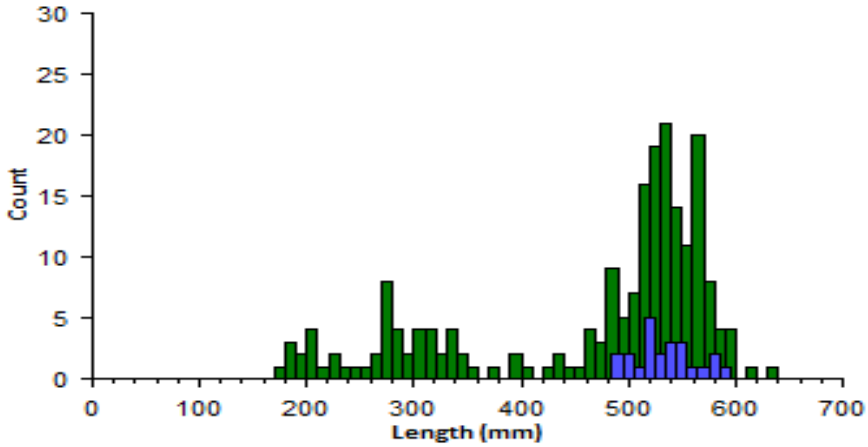


Figure 2: Number of brown trout in each length class, showing adipose fin clipped fish from 2017 release.

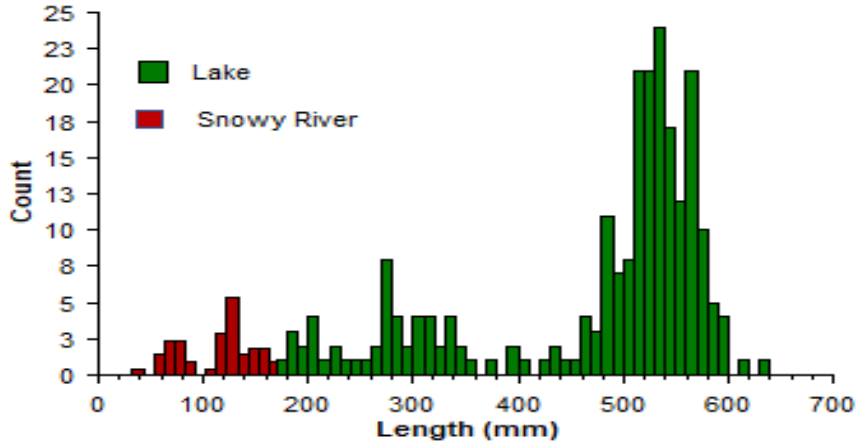
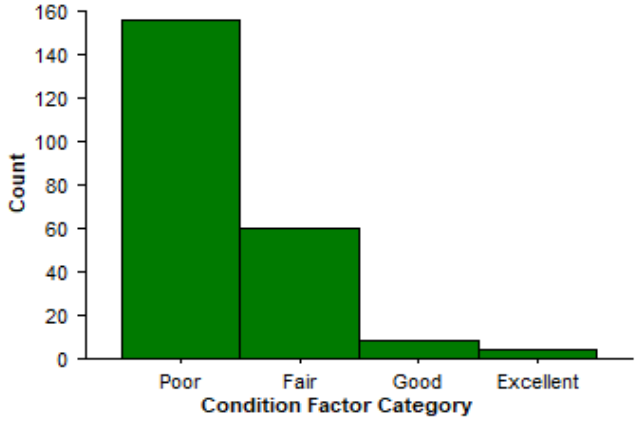


Figure 3: Number of brown trout in each length class, with juvenile brown trout electrofished from the lower section of the Snowy River.

In addition to the in-lake survey, the Snowy River was electrofished using a backpack electrofisher. A total of 47 young of the year (YOY) brown trout were captured from 1,165 seconds of electrofishing on-time. Only length data was recorded. The average length was 119 mm, with lengths ranging between 44 and 178 mm (see Figure 3). Two distinct length cohorts were evident, the reasons for these two groupings are unclear but there may be a mix of YOY from the 2021 spawning and resident stream fish. Figure 3 shows the addition of these fish in the length frequency plots and suggest that some natural recruitment into the lake fishery is likely for 2022. Very few redfin perch were present within the stream.

Condition Factor

The average condition factor for brown trout was 0.94 k. The majority (70%) were classified in poor condition, with 24 percent in fair condition (see Figure 4). Just one fish was in excellent condition, with the remainder categorised as good. Of those younger fish under 380 mm, only 30 percent were classified as being in poor condition (see Figure 5). Adipose fin clipped fish that are at least eight years old, were all in poor condition.



Condition factor range (k-factor)	Number	Percentage	Condition category
0.50 – 0.6	4	2	Poor
0.6 – 0.7	11	5	
0.7 – 0.8	32	14	
0.8 – 0.9	53	23	
0.9 – 1.0	59	25	
1.0 – 1.1	39	17	Fair
1.1 – 1.2	18	8	
1.2 – 1.3	6	3	Good
1.3 – 1.4	2	1	
1.4 – 1.5	3	1	
1.5 – 1.6	0	0	
1.6 – 1.7	1	1	Excellent
1.7 – 1.8	0	0	
Totals	***228***	***100***	

Figure 4: Condition factor for brown trout and associated table for each category.

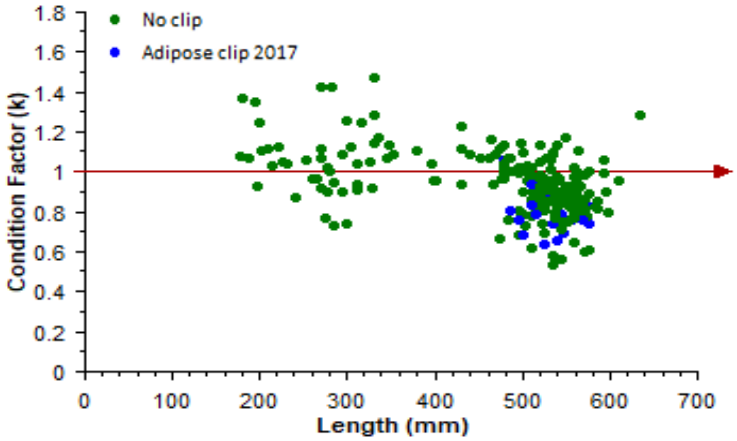


Figure 5: Condition factor for brown trout at varying fish lengths, showing adipose fin clipped fish, (below the red line indicates poor conditioned fish i.e., under 1.0 k-factor).

3.2. In-Lake Survey - Rainbow trout

A total of seventeen rainbow trout were captured, resulting in a CPUE of 0.11 fish per trap. This equates to seven percent of the total catch of all brown and rainbow trout combined. The sex of fish was unable to be determined as past stockings were all triploid stock (see Appendix 2). The average length was 449 mm and average weight 962 g, with the largest fish weighing 2.23 kg (see Figure 6).

There were two distinct length ranges (see Figure 7), with fish in the 350 - 420 mm range resulting from a stocking of 300 g fish during July 2021 and larger fish in the 460 - 580 mm range from stockings during 2019 and 2020 consisting of 500 g and 300 g fish respectively.

The average condition factor was 1.0 k, with 42 percent classified as poor and 52 percent as fair and six percent as good. The max condition factor was 1.2 k, for one individual.

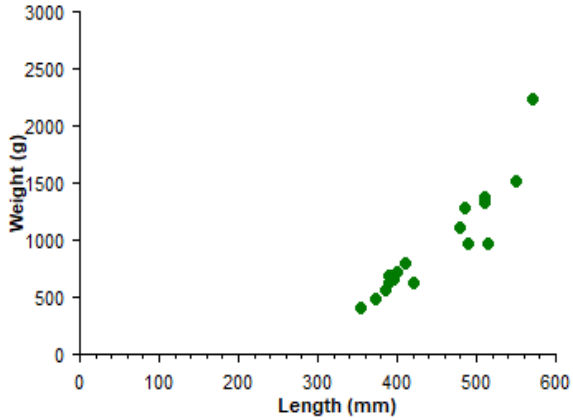


Figure 6: Length and weight of rainbow trout.

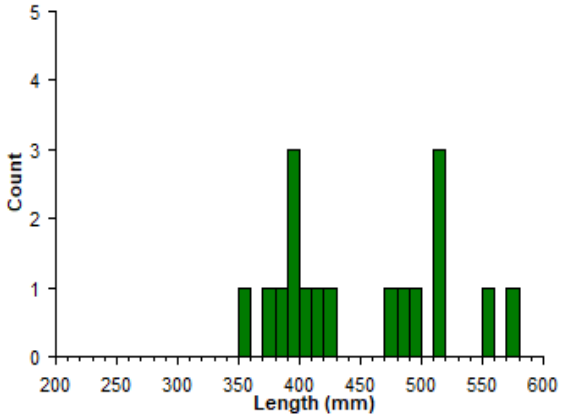


Figure 7: Number of brown trout in each length class.

4. Adipose Clipped Brown Trout 2017 & 2022 comparison

Table 1: Summary statistics for adipose fin clipped brown trout released May 2017 and recaptured April 2022.

Grouping	Measurement	Mean	Minimum	Maximum
Clipped – May 2017 (n=53) (71 captured with 53 being weighed & measured. CPUE = 0.46	Length (mm)	453	361	540
	Weight (g)	977	460	1,650
	Cond Factor (k)	1.03	0.08	1.25
Clipped – April 2022 (n=23) CPUE = 0.14	Length (mm)	528	480	583
	Weight (g)	1,193	830	1,650
	Cond Factor (k)	0.81	0.64	1.06

During the survey, 23 adipose fin clipped brown trout were captured (from a stocking of 2,000 fish during 2017 see Appendix 2), resulting in a CPUE of 0.14 fish per trap or 10.1 percent of the total catch of brown trout. This compared to 71 clipped brown trout captured during the 2017 survey, resulting in a CPUE of 0.46 fish per trap or 18.5 percent of the total catch of brown trout. In terms of CPUE, this represents a 70 percent decrease between 2017 and 2022.

On average, adipose clipped fish captured in this survey had increase in weight by 22 percent and length by 17 percent, with the average condition factor declining 21 percent. The minimum age of these fish would be eight years old, with a number being between nine to eleven years old. Of the 23 clipped fish captured, five (22%) grew to over 550 mm in length.

At the time of the 2022 survey, the lake level was 0.825 m below the spill level. The lake level during the 2017 survey was 1.275 m below the spill level.

5. Angler Postal Survey

The long term fishing effort since 2010 has averaged 5,877 angler days per season (see Figure 8). This has remained mostly consistent from 2010 to 2015. However, during the 2015-16 season, fishing effort, catch rate and the harvest of brown trout declined dramatically (see Figures 8, 9 & 10). Since then, the catch rate for brown trout has returned to around the long term average of 0.7 fish per day. However, fishing effort during 2020-21 was three times the long term average and the annual harvest of brown trout peaked at 135 percent above the average. Angling effort and annual harvest reduced during the 2021-22 season, but both remained well above the long term average.

The catch rate for rainbow trout has through time, increased to around 0.6 – 0.8 fish per day, except for the low lake level period during 2015-16. This result has largely been driven by stockings of yearling and adult rainbow trout and fluctuations in angling effort. The increase in harvest during 2020-21 was caused by a substantial increase in angling effort.

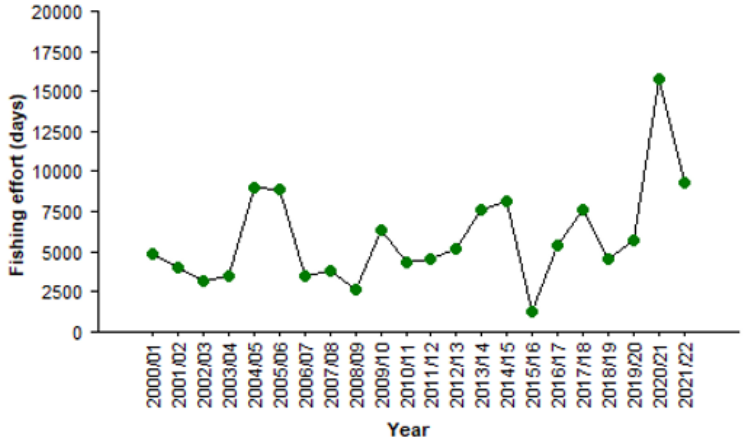


Figure 8: Fishing effort, Lake Leake, 2000 - 2022.

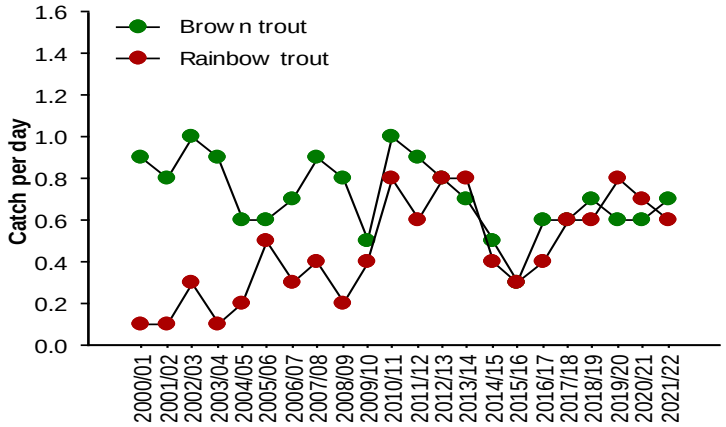


Figure 9: Catch rate for brown and rainbow trout, Lake Leake, 2000 - 2022.

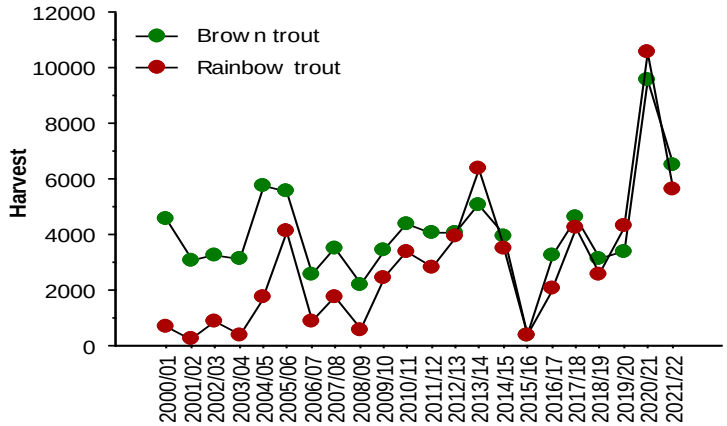


Figure 10: Estimated harvest of brown and rainbow trout, Lake Leake, 2000 - 2022.

6. Angler Creel Summary

Table 2 shows a summary of the digital creel data collected by IFS staff during the period 2020 to the commencement of the 2022-23 trout fishing season. The data is limited to only those anglers that fished for three or more hours and expressed as fish caught per day. For the 2020-21 and 2021-22 seasons, most records collected were from the opening weekend. In the case of the 2022-23 season, all fifty records were from the first day of the season. Catch rates for brown trout during 2020 to 2022 were in general, the same magnitude as the results from the postal survey. However, the catch rate for rainbow trout was much lower. The results from the opening day of the 2022-23 season were dominated by the presence adult rainbow trout released during June 2022 (see Appendix 2).

Table 2: Summary data from angler creel interviews, Lake Leake, 2020 to the angling season opening day 2022.

Season	Anglers Interviewed	Brown caught	Brown catch rate/angler/day	Rainbow caught	Rainbow catch rate/angler/day
2020-21	73	61	0.84	24	0.33
2020-22	39	41	1.05	13	0.32
2022-23	50	39	0.78	113	2.26

7. Discussion

General

Overall, the abundance of brown trout was lower than expected, with a CPUE of 1.43 fish per trap. In comparison to the 2017 FPA survey result (2.54 fish per trap), the CPUE was 44 percent lower. This is despite signs of natural recruitment, with multiple length classes present. The presence of these length classes is indicative of natural recruitment over the previous 3 years, but the magnitude of these recruitment pulses is likely to be low given the low total CPUE. Small numbers of brown trout in the 380 mm to 460 mm range indicates very poor recruitment from 2018. Lake levels during this time (June 2018) were low at 2.53 m below spill, although rainfall totals were around the 3 month running average.

The condition of brown trout under 380 mm length was in general fair to good, with longer/older fish mostly in poor condition. This is a result of the population containing a high percentage of older fish that are unable to successfully compete with younger trout and especially, the very large number of redfin perch that dominate the fish biomass within the lake. Despite these influences, some brown trout have grown to over 600 mm length, with several adult fish stocked during 2017 growing over 550 mm when captured during this survey.

By comparison to brown trout, rainbow trout were generally in better condition, with around 70 percent in the fair to good category. The CPUE was exceptionally low but similar to the 2017 survey result, at just under 7 percent of the total catch.

While there has been recruitment of brown trout into the fishery over the past three years, it appears to be at low levels. The primary reason for this is predation pressure from redfin perch. During higher

lake levels the number of redfin perch increases significantly and resulting predation becomes a limiting factor on the survival and recruitment of YOY brown trout. It is possible the only significant recruitment into the lake is from those YOY fish that seek refuge in the Snowy River during suitable flows. Once these YOY reach a size where they can overcome predation from redfin perch, they enter the lake and contribute to the fishery. The high abundance of redfin perch also results in direct competition for food resources and limits trout growth and condition in larger trout, as evident in this survey.

In terms of angling effort and catch rates, low rainfall and associated low lake levels are significant driving factors, with low participation and catch rates resulting. Since the low lake level period of 2015-16, there has been a steady increase in the daily catch rate for rainbow trout comparable to that for brown trout. There have also been improvements for brown trout, with catches returning to the long term average. However, the high harvest numbers of both brown and rainbow trout that occurred during 2020-21 and 2021-22, caused by high angling effort, will need to be monitored, especially if poor recruitment occurs.

Management Criteria (TIRFMP)

The average weight of brown trout over 400 mm was 1.34 kg and above the criteria of 1.2 kg as set in the Tasmanian Inland Recreational Fisheries Management Plan 2018-28 (TIRFMP) (see Appendix 3). The percentage of brown trout over 500 mm (64%) was also above the prescribed criteria of 30 percent, although the majority were in poor condition. Despite these results, there is evidence to show brown trout can grown to a larger size when conditions are favourable. The daily catch rate for brown trout was 0.71 and is below the target level of 1.0 $^{+/-}$ 0.2 fish per day.

The average weight of rainbow trout over 400 mm was 1.29 kg and is within the criteria of 1.2 kg $^{+/-}$ 0.1. The percentage of rainbow trout over 500 mm was above the criteria of 15 percent, being 30 percent. The catch rate was 0.6 and within target level of 0.5 $^{+/-}$ 0.1 fish per day.

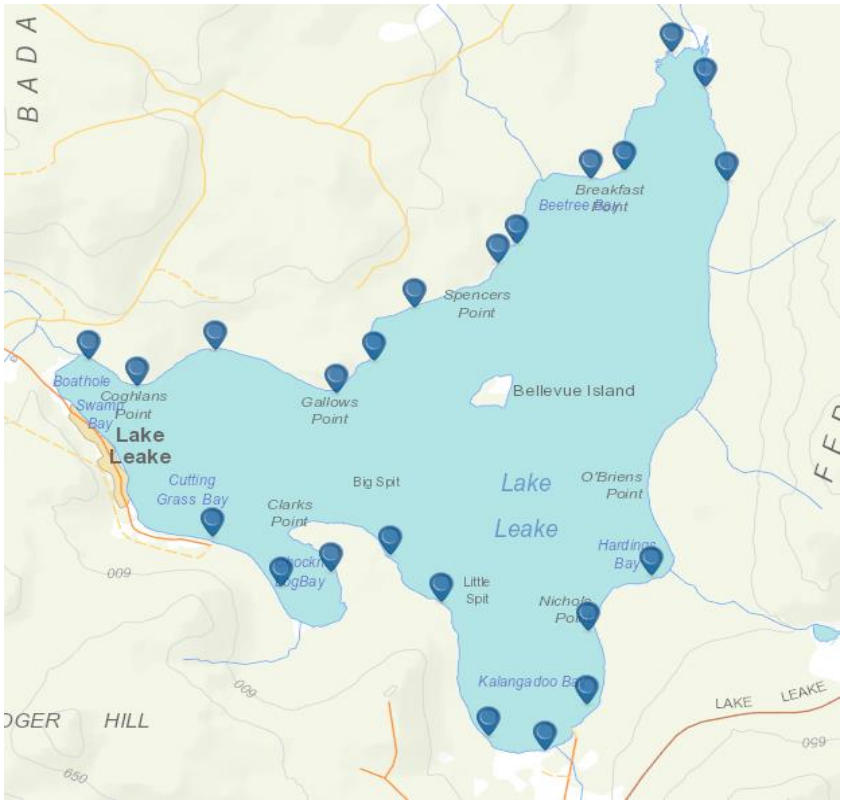
Summary

In summary, despite evidence of natural recruitment, Lake Leake presently holds a low abundance of brown trout that is 30 – 40 percent lower compared to the 2017 survey result. The reasons for this are the impacts that redfin perch and high angling effort have had on the population, by limiting natural recruitment and reducing adult fish numbers. The poor condition of brown trout, especially older fish, is linked to direct competition with redfin perch for food. Since the low lake level event of 2015-16, the catch rate for brown has improved but remains below the criteria for the fishery. Rainbow trout met all the criteria set for the fishery.

8. RECOMMENDATIONS

- A base population of brown trout is maintained by the stocking of adult brown trout. This is to be done only when there is evidence of on-going poor natural recruitment of brown trout and at a time when lake levels and the long term climate outlook are favourable. This action will ensure there is minimal lag time between a return to favourable environmental conditions and maintenance of acceptable catch rates.
- To aid natural recruitment during the year of the transfer, adult transfers should consist of 60% gravid females and 40% ripe males. As a priority, transfers should be carried out early in the spawning period, to optimise potential natural recruitment.
- The stocking of rainbow trout is reduced, considering climatic conditions. With yearling fish preferred.
- Monitoring of natural recruitment is achieved by carrying out an annual electrofishing survey of the Snowy River during autumn.
- Surveying of the Lake Leake trout population is undertaken during the 2026-27 period. CPUE and length/weight data is collected for redfin perch. The inflowing stream is electrofished to assess trout recruitment.
- Monitoring of lake level, turbidity and water temperature are established and maintained. These actions are to support management of the trout fishery and examine the influence of environmental conditions on redfin perch recruitment.
- Monitoring of future angling effort and harvest is achieved by angler feedback, the angler postal survey, collection of angler creel data and the electronic diary system.
- Retain the present regulatory management regime of a five fish bag limit of which only two fish greater than 500 mm is permitted to be taken.

9. Appendix



Appendix 1: Box trap sets, Lake Leake FPA survey April 2022.

Appendix 2: Stocking records for Lake Leake 2010-2022
(denotes three fish tagged for promotion and # adipose fin clipped fish).*

Stocking Date	Species	Number	Weight (g)	Age
July 2022	Brown Trout	3 *	926	Adult
August 2021	Brown Trout	1203 *	852	Adult
May 2020	Brown Trout	1200	800	Adult
3April 2019	Brown Trout	1050	900	Adult
May 2018	Brown Trout	1100	850	Adult
May 2017	Brown Trout	2000 #	977	Adult
June 2014	Brown Trout	205	800	Adult
May 2014	Brown Trout	1000	600	Adult
May 2014	Brown Trout	650	750	Adult
October 2013	Brown Trout	35000	1.2	Fry
July 2013	Brown Trout	986	900	Adult

June 2022	Rainbow Trout	2100	400	Adult
July 2021	Rainbow Trout	2000	380	Adult
June 2020	Rainbow Trout	2000	300	Yearling
May 2019	Rainbow Trout	2013	500	Adult
July 2018	Rainbow Trout	2100	385	Adult
January 2017	Rainbow Trout	8000	60	Fingerling
June 2017	Rainbow Trout	3000	310	Adult
October 2017	Rainbow Trout	1291	725	Adult
December 2016	Rainbow Trout	10000	20	Fingerling
October 2015	Rainbow Trout	120	500	Adult
December 2014	Rainbow Trout	5600	150	Yearling
November 2014	Rainbow Trout	19000	10	Fingerling
May 2014	Rainbow Trout	3330	150	Yearling
April 2014	Rainbow Trout	110	800	Adult
April 2014	Rainbow Trout	5000	60	Fingerling
September 2013	Rainbow Trout	10000	70	Fingerling
July 2013	Rainbow Trout	900	1000	Adult
January 2013	Rainbow Trout	50000	0.35	Fry
October 2012	Rainbow Trout	300	2500	Adult

October 2012	Rainbow Trout	1000	200	Yearling
March 2012	Rainbow Trout	8000	400	Adult
March 2011	Rainbow Trout	1100	240	Yearling
January 2011	Rainbow Trout	10000	20	Fingerling
November 2010	Rainbow Trout	1500	100	Fingerling
January 2010	Rainbow Trout	15000	20	Fingerling

Appendix 3: Performance criteria for Lake Leake, as listed in the Tasmania Inland Recreational Fishery Management Plan 2018 – 2028 (TIRFMP).

Species	Average weight (g)	Catch rate	Percent of Large fish (%)	Population size
Brown trout	> 400mm 1.2 kg +/- 0.1	1.0 +/- 0.2	> 500mm 30%	15,000 – 22,000
Rainbow trout	> 400mm 1.2 kg +/-0.2	0.5 +/- 0.1	> 500mm 15%	