

Inland Fisheries Service

RECREATIONAL FISHERIES REPORT



Fisheries Performance Assessment

Technical Report

Four Springs Lake - July 2020

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I 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 10-metre-high, 260-metre-long clay core dam on Sandy Creek. The lake was created to establish a passive aquatic recreation centre at Four Springs to service residents of northern Tasmania, with special provisions for the elderly, the disabled, the youth and family. The lake inundates Four Springs Plain that drains into Four Springs Creek via a small tributary know as Sandy Creek. The inundated area supported a small patch of virgin forest that was logged prior to flooding, with most of the area being extensive open plain covered with sedges and low scrub. It is typically shallow with an average depth of 2.5 m and a maximum depth of nine meters adjacent to the dam wall. Prior to flooding, the natural depressions in the lake were connected to facilitate draining if the need arose in the future. Key System Data Water Storage: 3 430 000m³ Full Supply Level (FSL) 197m AHD, Catchment area 1 000 Ha. Assessments of the fishery have previously been undertaken during 2012, 2013, and 2015.

2 Fishery Performance Methods

2.1 In-lake Surveys

In readiness for a capture-mark-recapture (CMR) population estimate, 2,000 adult brown trout sourced from Sandbanks Creek and Liawenee Canal fish traps, yingina / Great Lake, were transferred to Four Springs Lake (24-25 May 2020). These fish were marked by having their adipose fin clipped. The fish were allowed to mix with the general brown trout population for 8 weeks, before undertaking a recapture survey to estimate the population size. The average weight of the transferred fish was 977 grams. During the same period, a further 2,028 adult brown trout collected from both the yingina / Great Lake fish traps were released into Four Springs Lake. The reason for only 2,000 fish being adipose fin clipped was that this was the number required to gain a robust population estimate and it was the same number of fish marked as an earlier CMR population estimate undertaken during 2013.

Between 21-24 July 2020, the Service undertook an intensive trapping survey within Four Springs Lake. The purpose of the survey was to gain information on:

- catch per unit effort (CPUE) for brown trout
- the length structure of the brown trout population,
- establish an estimate of the brown trout population size,
- examine the condition of the brown trout, and
- examine the rainbow trout population.

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A total of 80 box traps were set over two nights (total 160 box trap sets), with most deployed around the perimeter of the lake and seven deployed in the deep water adjacent to the dam wall. A sample of 407 brown trout and 25 rainbow trout were sexed, weighed and measured. All brown trout captured were examined for the presence of an adipose fin clip. Traps were checked and cleared after the first night and then cleared and retrieved after the second night.

2.2 Stocking History

The Service 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 an historical record of supplementary recruitment into individual waters. Records for Four Springs Lake post 2014 were used in this assessment

2.3 Annual Postal Survey

Since 1986, the Service has conducted a postal survey seeking information about anglers' catches. The survey comprises of a form sent to ten percent 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 information on catch per day, harvest and angling effort is extrapolated. This provides a long term overview of individual fishery performance in addition to characterising fishing effort. Only records between the 1999/00 and 2019/20 angling seasons were assessed in this study.

3 Fishery Performance Results

3.1 In-Lake Survey Brown Trout

Brown trout length and weight data

From 160 box trap sets, a total of 587 brown trout were captured, with 407 weighed, measured (fork length) and sexed. As only half of the 4 000 adult brown trout transferred were adipose fin clipped, and with 34% sourced from the Sandbanks Creek trap and 66% from the Liawenee trap, it was not possible to differentiate all the 2020 fish transfers. Additionally, there were 1 052 Lake King William fish transferred into Four Springs Lake during June 2019, these fish weight an average of 500 grams when transferred, consequently they have now grown and are undistinguishable within the population. However, for completeness, table 1 (over page) shows the results for clipped, unclipped, and combined samples.

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Table 1: Descriptive statistics for brown trout - length, weight and condition factor for combined sample, non – fin clipped and fin clipped fish.

Grouping	Measurement	Mean	Minimum	Maximum
All brown trout combined (n=407)	Length (mm)	466	276	589
	Weight (g)	1 131	260	2 230
	Cond Factor (k)	1.07	0.53	1.87
Non – clipped (n=351) i.e. 2,028 non-clipped transfers plus all other 'resident' fish.	Length (mm)	471	276	589
	Weight (g)	1 181	260	2 230
	Cond Factor (k)	1.09	0.65	1.87
Clipped (n=56) i.e. from 2,000 clipped transfers.	Length (mm)	432	301	544
	Weight (g)	819	270	1 580
	Cond Factor (k)	0.98	0.53	1.21

The average weight for non-fin clipped brown trout was 1,181 g at an average length of 471 mm. This result includes 2,028 non-fin clipped transfers from this year and last seasons Lake King William transfers, consequently it is lower than what would be expected for the general 'resident' population.

In total, 351 non-fin clipped brown trout were captured in box traps, consisting of 146 males and 205 females, no immature fish were identified. Male fish were significantly longer and heavier compared to female fish ($P < 0.05$) (see table 2). There was however, no significant difference in the mean condition factor between sexes.

Table 2: Descriptive statistics for non-fin clipped brown trout - length, weight and condition factor for combined sample and for separate sex.

Grouping	Measurement	Mean	Minimum	Maximum
All brown trout (n=351)	Length (mm)	471	276	589
	Weight (g)	1 181	260	2,230
	Cond Factor (k)	1.09	0.65	1.87
Female (n=205)	Length (mm)	461	324	589
	Weight (g)	1 091	320	2 120
	Cond Factor (k)	1.07	0.65	1.87
Male (n=146)	Length (mm)	485	276	582
	Weight (g)	1 316	260	2 230
	Cond Factor (k)	1.11	0.74	1.42

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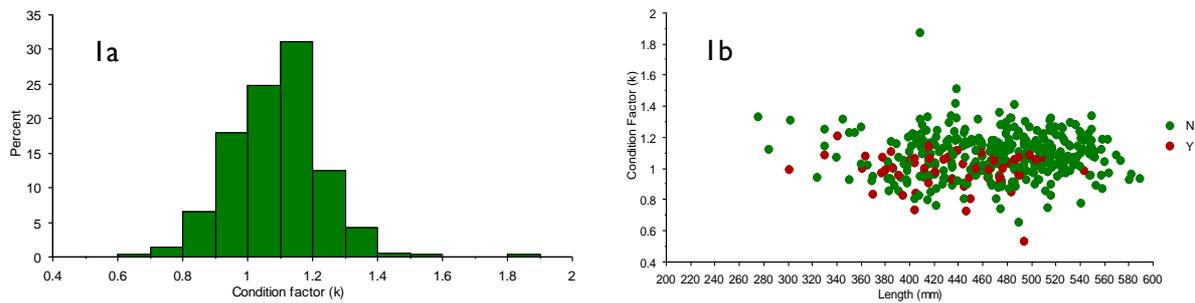


Figure 1: a) Condition factor for non-clipped brown trout, b) relationship for condition factor and length separated by (N) non-fin clipped and (Y) fin clipped fish.

In general, the overall condition of brown trout was fair to good, with an average k-factor of 1.09, with 70% of fish having a k-factor greater than 1.0 (see figure 1a), there was just one fish in excellent condition (e.g. >1.6). Most fish did not appear lose condition with increasing length as normally occurs with increasing length/age (see figure 1b).

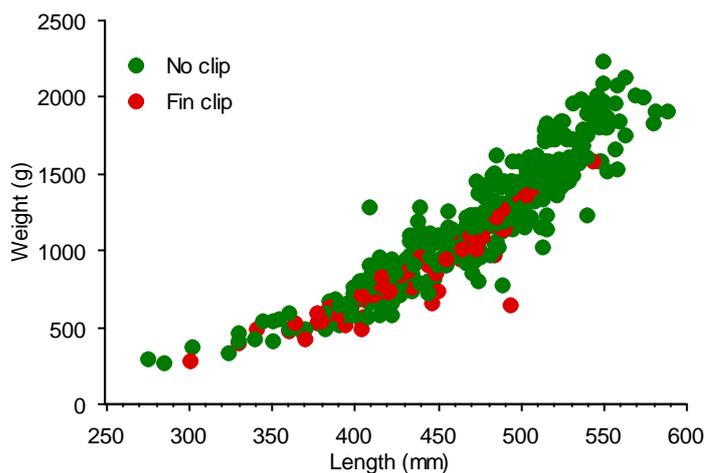


Figure 2: Length/weight relationship for brown trout showing comparison for non-fin clipped and fin clipped fish.

Brown trout displayed strong growth across all lengths (see figure 2), this is despite all brown trout post 2014 being exclusively adult brown trout transfers. Twenty percent of fish were more than 1.5 kg. Most fin clipped fish despite being recently transferred into Four Springs Lake showed good growth, with several fish observed to be putting on condition. All fish except two individuals were greater than the 300 mm minimum length limit.

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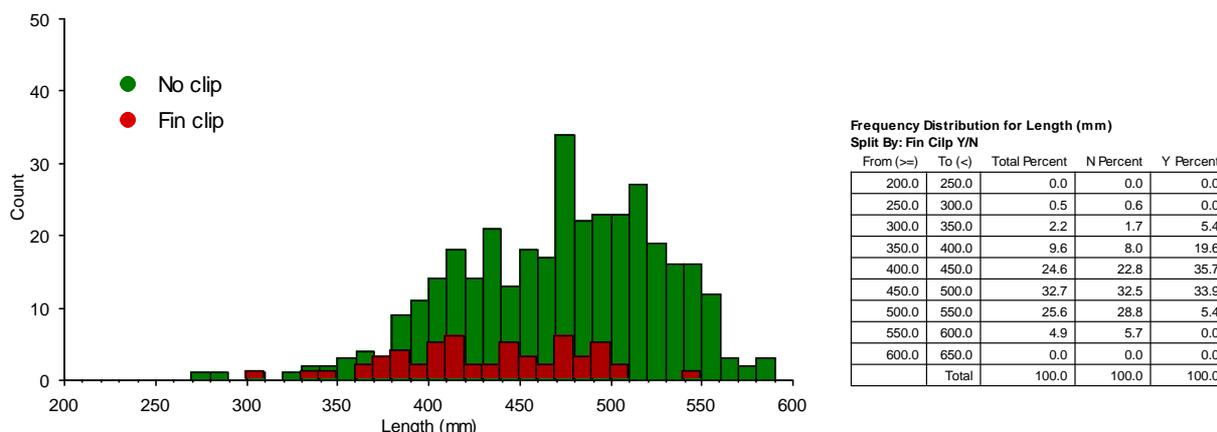


Figure 3: Length frequency plot and associated length data for all brown trout.

The length frequency plot (see figure 3) shows a wide range of lengths occurring within the fishery. Fin clipped fish ranged in size from 300 – 550 mm, while non-fin clipped fish that included 2020 transfers, ranged from 270-580 mm. There were no clearly defined length cohorts within the population, this relates to using adult brown trout from various trap sources. Over one third of the non-fin clipped fish were greater than 500 mm, there were no fish over 600 mm and only two fish under 300 mm.

3.2 CPUE Information

Brown trout

The capture of brown trout in box traps was moderately high with 587 brown trout capture from 80 box traps set over two nights, with the nets cleared each day (total 160 sets). This equates to a mean CPUE of 3.7 brown trout per trap (see table 3).

Rainbow trout

Twenty-five rainbow trout were captured representing 4.3% of the total capture of all fish from box traps, with a CPUE of 0.2 fish per trap (see table 3).

Table 3: Survey CPUE for brown and rainbow trout.

Species	No. traps	No. nights	Effort	No. brown trout	CPUE
Brown trout	80 deployed	2	160 traps set	587	3.7/trap
Rainbow trout	80 deployed	2	160 traps set	25	0.2/trap

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3.3 In-Lake Survey Rainbow Trout

From 160 box trap sets, 25 rainbow trout were captured. A sample of 15 rainbow trout were weighed and measured. All fish were assessed as being triploid (see appendix a). The average length for the 15-rainbow trout sampled was 303 mm with an average weight of 420 g, with the largest fish weighing 1.3 kg. There were two distinct length classes (see figure 4), with fish in the 220 - 340 mm range (resulting from a stocking of yearling triploid fish in June 2020) and two larger fish at 441 and 476 mm respectively. The majority of rainbow trout were in good to excellent condition.

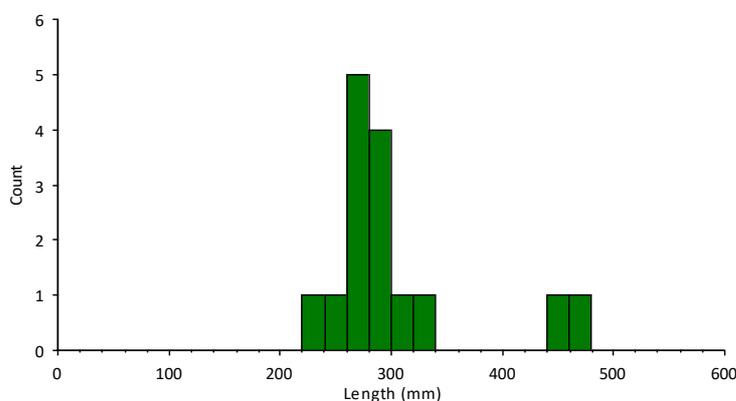


Figure 4: Length frequency for rainbow trout.

3.4 Population Estimate

During April - May 2020, to allow for a capture-mark-recapture (CMR) population estimate, 2 000 adult brown trout sourced from the yingina / Great Lake spawning runs had their adipose fin clipped. These fish were transferred to Four Springs Lake and allowed a settling in period of 8 weeks before a recapture survey was commenced. During the recapture phase, 587 brown trout were captured in box traps over a three-day period (two nights trapping). Of these fish, 86 had adipose fin clips (15.3%). Table 4 shows the parameters of the Petersen estimate, with 13,113 brown trout (+/- 2,607) estimated to be in the lake. The associated estimate of bias was at acceptable levels i.e. > 4 and implies a reasonable degree of confidence of the estimate.

Table 4: Petersen population estimate for brown trout, Four Springs Lake, July 2020.

Parameter	Result
Total fin clipped released (M)	2 000
Total recaptures (C)	587
Total marked recaptures (R)	86
Population estimate: $MC/R = N$	13 651
Standard error	1 330
Lower and Upper 95% CI limits	11 044 – 16 259
Estimate bias level: $MC/4N =$	21.5 (>4 acceptable bias)

4 Stocking History

Since 2015, only adult brown trout collected from spawning runs on the Central Plateau have been transferred to Four Springs Lake (see appendix a). These transfers have resulted in higher and more stable catch rates of brown trout. The number of adult fish transferred has during this time averaged around 4 000, apart from 2016 and 2017. During 2016 a significant flood event limited the number of fish available to 2 400 fish. Subsequently, the balance of fish was made up during 2017, with 6 450 fish transferred. The stocking of rainbow trout has prior to 2018 has been opportunistic and dependent on fish donated by the major aquaculture farms. However, Four Springs Lake is now stocked with 2 000 yearling fish grown specifically to meet fishery management needs.

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5 Angler Postal Survey

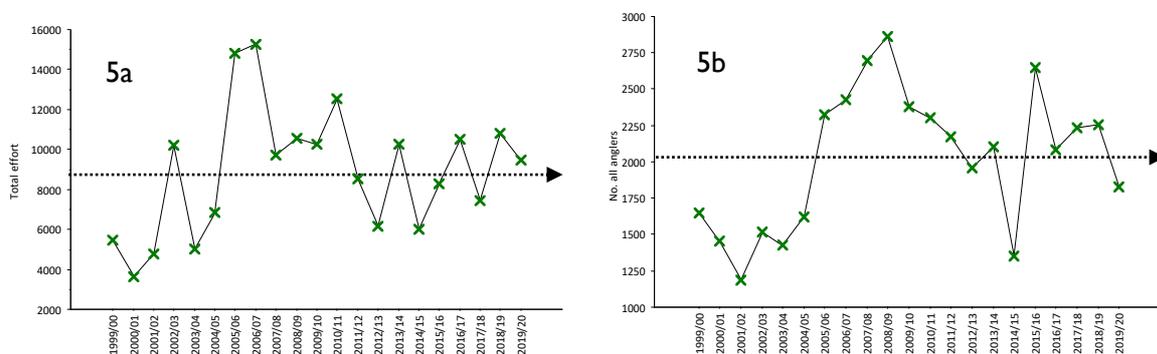


Figure 5: Results from the Angler Postal Survey for; a) fishing effort, b) angler numbers, Four Springs Lake, 1999 - 2020. Dotted line indicates the long-term average (mean).

Since the creation of the fishery during 1997, the total fishing effort increased to a high of over 15 000 days per season during 2006-07 (see figure 5a). This figure has fluctuated over the last nine years around the long-term average of 8 900 days. As expected, the number of all anglers fishing at Four Springs Lake trended in line with fishing effort, except for a significant decline in angler numbers for the 2014-15 season (see figure 5b). At present (2019-20), an estimated 9 500 days are fished by approximately 1 830 anglers at around 5 days per angler throughout the season.

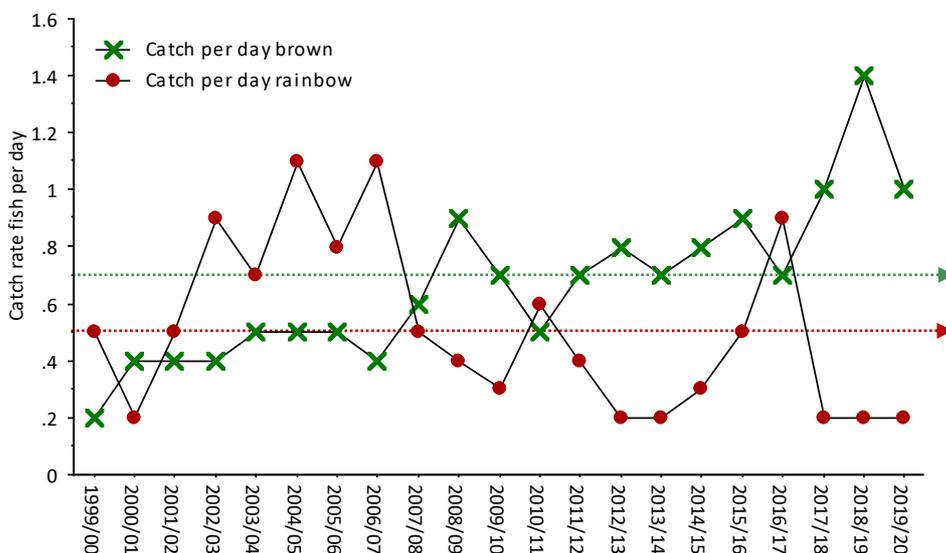


Figure 6: Results from the Angler Postal Survey for daily catch rate of brown and rainbow trout, Four Springs Lake, 1999 - 2020. Dotted line indicates the long-term average (mean).

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The long term catch rate since 1999 is 0.7 brown trout per day and 0.5 rainbow trout (see figure 6). The catch rate for brown trout has trended up since 1999 until present and it is now fluctuating around one fish per day. The reduction in catch rate for 2016-17 is likely to relate to the lower number of adult transfers for that season (see note in stocking section above) The daily catch for rainbow trout has fallen below the long term average of 0.5 to 0.2 fish per day since 2017-18. Of interest is the shift in the fishery from a higher catch rate for rainbow trout during the first seven years of the fishery, to a dominance of brown trout in the catch since 2011-12 (except for 2016-17).

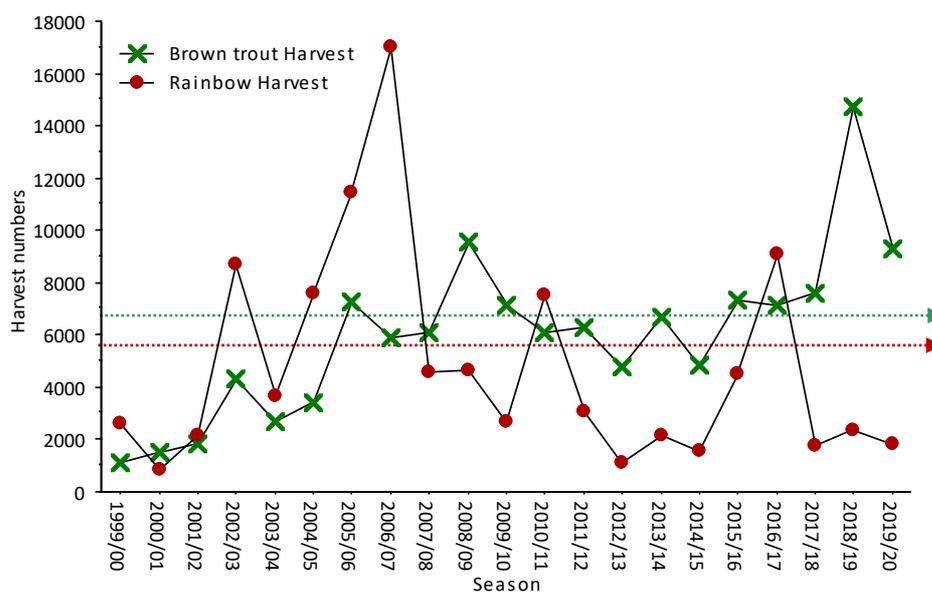


Figure 7: Results from the Angler Postal Survey for estimated harvest of brown and rainbow trout, Four Springs Lake, 1999 – 2020. Dotted line indicates the long-term average (mean).

The long-term annual harvest since 1999 is an estimated 6 000 brown trout and 4 800 rainbow trout (see figure 7). The annual harvest for brown trout, like the daily catch rate, has trended up since 1999-00 until 2018-19 with an estimated 14,500 fish harvest in that season. At present, the harvest of brown trout is approaching 9,300 fish. The harvest of rainbow trout has been highly variable and is generally influenced by the number and size of fish stocked during any one season. The harvest figures for rainbow trout at present is 1 800 fish, representing 16 percent of the total harvest of all trout.

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6 Discussion

The results of the in-lake survey at Four Springs Lake suggest the brown trout population is moderately large with an estimated 11 000 – 16 000 fish. This estimate is down on a similar capture-mark-recapture population estimate completed during 2013, where the population was estimated between 14 000 – 24 000 fish. The 2020 estimate is within the goal as set in the Tasmanian Inland Recreational Fishery Management Plan 2018-28 (TIRFMP) at 14,000 – 18,000 fish. The point estimate for the CMR for 2020 was 13 651 while the 2013 estimate was 19 167, representing a 33 percent difference. Comparably, the CPUE for 2020 at 3.7 fish per trap was 26 percent less than the 2013 result of 4.8 fish per trap. Given these results and providing the timing and condition associated with surveys are similar, it is reasonable to use CPUE to assess the relative change in population size for this water.

The average weight and length from the sample of fish captured was influenced strongly by the presence of the 2020 adult transfers from yingina / Great Lake. A total of 4 028 adult brown trout were released into the lake, with only half being adipose fin clipped. Consequently, it was impractical to exclude the non-fin clipped fish from the weigh and measure results to provide a true average length and weight for the existing 'resident' population. Furthermore, the 2019 stocking program saw the transfer of 1 052, smaller brown trout from the Lake King William spawning trap. These fish further confounded the calculation for the average length and weight of 'resident' fish. Nonetheless for reporting purposes and to assess the fishery against the goals as prescribed in the TIRFMP, the average weight for fish over 400 mm (that were not fin clipped) was 1.26 kg. This result is below the 1.5 kg (+/- 0.1) as set in the TIRFMP, although by the end of the 2020-21 this goal will be achieved.

The transfer of adult brown trout since 2015 has averaged 4 000 fish. This number is presently sustaining a catch rate around the goal as set in the TIRFMP of 1.0 (+/- 0.2) fish per day. The condition of 'resident' brown trout is however, slightly less than expected, with most being fair to good with only one fish in excellent condition. The timing of the survey would be influencing the result, as many fish were in post spawning condition. Given this outcome, the number of fish transferred should not exceed the current number of 4 000 adult brown trout, with scope to slightly reduce this total by 500 fish if required.

The goal from the TIRFMP for the percentage of fish over 600 mm is five percent, however there were no brown trout over this size. This indicates larger fish are either being captured and removed from the fishery by anglers, and/or the growth potential of fish is limited. The high total harvest figures for brown trout and the above average fishing effort, indicate anglers are impacting the population, although there are a significant number of fish (around one-third) still growing through to the 500 – 580 mm length range. Subsequently, both harvest and limitation to growth (i.e. time for fish to grow to over 600 mm) are restricting the number of fish over 600 mm length. The only feasible method to realise the goal from the TIRFMP is to prevent or limit the harvest of larger fish. This could be achieved

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by further limiting the take of fish over 500 mm to one fish per day or require all fish over 550 mm to be returned. Alternately, the goal as set with in the TIRFMP is reviewed and set at a more realistic figure allowing for the harvest of larger fish and maintenance of the present catch rate.

Only 25 rainbow trout were captured, of which 15 were weighed and measured. Of these fish most were from the recent stocking of 2 017, 300 g fish, with only two being 'resident' fish. The weight of these two fish were 1.11 and 1.34 kg and therefore notionally within the 1.4 kg (+/- 0.2) weight range as set in the TIRFMP. The catch rate for rainbow trout was 0.2 and less than the prescribed range (0.5 +/- 0.1). The largest rainbow trout weighed and measured was 476 mm with the plan setting a goal of 3 percent of fish over 500 mm. It would therefore appear that like brown trout, most rainbow trout are being harvest before they can grow larger than the 500 mm prescribed goal.

7 Recommendations

- The goals for average weight, length and percentage of large trout as prescribed in the TIRFMP 2018-28 for Four Springs Lake are reviewed.
- The bag limit associated with the maximum size limit of 500 mm is reviewed.
- The transfer of adult brown trout remains the primary method for stocking Four Springs Lake and numbers are limited to 3 500 – 4 000 fish.
- The stocking numbers for rainbow trout yearlings is increased to 2 500 to increase the daily catch rate for rainbow trout.

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8 Appendix

Appendix a): Stocking list for brown trout, Four Springs Lake 2015-2020.

Date	Age	Number	Origin	Weight (g)
15 May 2015	Adult	1500	Sandbanks Creek, yingina / Great Lake	800
19 May 2015	Adult	1250	Sandbanks Creek, yingina / Great Lake	800
11 June 2015	Adult	880	Sandbanks Creek, yingina / Great Lake	800
11 June 2015	Adult	600	Tumbledown Creek, Arthurs Lake	500
9 May 2016	Adult	1200	Sandbanks Creek, yingina / Great Lake	1000
12 May 2016	Adult	1200	Sandbanks Creek, yingina / Great Lake	1000
11 May 2017	Adult	460	Sandbanks Creek, yingina / Great Lake	1000
22 May 2017	Adult	1500	Liawenee Canal, yingina / Great Lake	1000
23 May 2017	Adult	400	Liawenee Canal, yingina / Great Lake	1000
23 May 2017	Adult	630	Sandbanks Creek, yingina / Great Lake	1000
26 May 2017	Adult	1000	Tumbledown Creek, Arthurs Lake	700
29 May 2017	Adult	1300	Liawenee Canal, yingina / Great Lake	1000
30 May 2017	Adult	550	Liawenee Canal, yingina / Great Lake	1000
30 May 2017	Adult	400	Sandbanks Creek, yingina / Great Lake	1000
6 June 2017	Adult	300	Liawenee Canal, yingina / Great Lake	1000
1 May 2018	Adult	1150	Liawenee Canal, yingina / Great Lake	850
10 May 2018	Adult	1100	Liawenee Canal, yingina / Great Lake	850
15 May 2018	Adult	500	Liawenee Canal, yingina / Great Lake	850
15 May 2018	Adult	700	Sandbanks Creek, yingina / Great Lake	850
1 June 2018	Adult	239	Sandbanks Creek, yingina / Great Lake	900
6 June 2018	Adult	235	Liawenee Canal, yingina / Great Lake	850
15 June 2018	Adult	115	Sandbanks Creek, yingina / Great Lake	900
13 May 2019	Adult	250	Sandbanks Creek, yingina / Great Lake	850
15 May 2019	Adult	250	Sandbanks Creek, yingina / Great Lake	850
17 May 2019	Adult	250	Sandbanks Creek, yingina / Great Lake	850
20 May 2019	Adult	170	Sandbanks Creek, yingina / Great Lake	800
20 May 2019	Adult	888	Liawenee Canal, yingina / Great Lake	800
3 June 2019	Adult	629	Liawenee Canal, yingina / Great Lake	800
3 June 2019	Adult	200	Sandbanks Creek, yingina / Great Lake	700

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Date	Age	Number	Origin	Weight (g)
26 June 2019	Adult	100	Liawenee Canal, yingina / Great Lake	800
26 June 2019	Adult	1 052	River Derwent, Lake King William	550
26 June 2019	Adult	250	Sandbanks Creek, yingina / Great Lake	660
11 June 2020	Adult	120	Liawenee Canal, yingina / Great Lake	800
5 June 2020	Adult	118	Sandbanks Creek, yingina / Great Lake	800
29 May 2020	Adult	170	Sandbanks Creek, yingina / Great Lake	800
29 May 2020	Adult	78	Liawenee Canal, yingina / Great Lake	800
22 May 2020	Adult	480	Liawenee Canal, yingina / Great Lake	800
19 May 2020	Adult	220	Liawenee Canal, yingina / Great Lake	800
12 May 2020	Adult	200	Liawenee Canal, yingina / Great Lake	800
8 May 2020	Adult	360	Liawenee Canal, yingina / Great Lake	800
2 May 2020	Adult	1340	Liawenee Canal, yingina / Great Lake	800
30 April 2020	Adult	720	Liawenee Canal, yingina / Great Lake	800
24 April 2020	Adult	220	Liawenee Canal, yingina / Great Lake	800

Appendix b): Stocking list for rainbow trout, Four Springs Lake 2015-2020.

Date	Age	Number	Origin	Weight (g)
6 Oct 2015	Yearling	6 000	FF#4 Springfield (Huon Aquaculture Group)	138
29 Oct 2015	Fingerling	20 000	FF#4 Springfield (Huon Aquaculture Group)	10
8 Dec 2016	Adult	1 200	FF#4 Springfield (Huon Aquaculture Group)	750
10 Feb 2017	Yearling	4 538	FF#52 - Mountain Stream Fisheries	220
9 July 2018	Adult	2 100	FF#65 – Millybrook (Huon Aquaculture Group)	385
27 May 2019	Adult	1 500	FF#65 – Millybrook (Huon Aquaculture Group)	500
24 June 2020	Yearling	200	FF#65 – Millybrook (Huon Aquaculture Group)	300
30 June 2020	Yearling	1 817	FF#65 – Millybrook (Huon Aquaculture Group)	300

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Appendix b): Performance criteria for Four Springs Lake as prescribed in the Tasmanian Inland Recreational Fisheries Management Plan 2018-28.

Brown trout

- Average weight for Brown trout greater than 400 mm 1.5kg +/-0.1
- Daily catch rate for brown trout 1.0 +/-0.2
- Percentage of brown trout over 600 mm 3%
- Population estimate for brown trout at full supply level 14 000 – 18 000 fish.

Rainbow trout

- Average weight for rainbow trout greater than 400 mm 1.4kg +/-0.2
- Daily catch rate for rainbow trout 0.5 +/-0.1
- Percentage of rainbow trout over 600 mm 3%