## Inland Fisheries Service Report

## Recreational Fisheries Report



Fisheries Performance Assessment
Technical Report
Tooms Lake - July 2015
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## I Introduction

Tooms Lake is an artificial impoundment situated 36 km northeast of Oatlands. The lake is used as a town water supply for Campbell Town as well as providing irrigation water for downstream users. The waters of the lake inundate a natural marshland covering an area of 6.6 square kilometres, with a full supply level of 464 m above sea level. Tooms Lake is subject to annual drawdowns with the water frequently being moderately turbid. Much of the shoreline is rocky although weedy shallows exist in many of the sheltered bays.

According to early reports brown trout were well established by 1903-04 and there have been many liberations of brown trout since. Liberations of rainbow trout were first recorded around 1907-1908 and there have been regular releases of both rainbow and brown trout over the past 25 years including the transfer of adult brown trout more recently 2010-2015. Previous surveys and creel information indicate the average weight of brown trout to be I-I.5 kg with bigger fish of $2.0-2.5 \mathrm{~kg}$ occasionally captured.

## 2 FPA Survey Methodology

## 2.I In-lake Surveys

In readiness to undertake a capture-mark-recapture population estimate, during the brown trout spawning run 3-5 June 2015, 3,850 adult brown trout sourced from the Great Lake spawning traps of Liawenee Canal $(650)$ and Sandbanks Creek $(3,200)$ were marked by having their adipose fin clipped. These fish were transferred to Tooms Lake over a threeday period 3-5 June 2015 and allowed to mix with the general brown trout population before undertaking a recapture survey to estimate the population size. The average weights of these transferred fish were 800-900 grams.

During the period 14-16 July 2015, the Service undertook an intensive trapping and electrofishing survey within Tooms Lake. The purpose of the survey was to gain information on catch per unit effort, the size structure of the brown trout population and establish an estimate of the population size. A total of 96 box traps (see figure I) were set over two nights, with 88 deployed around the perimeter of the lake and eight deployed in the deep water section in the basin adjacent to the dam wall. In addition, the Smith-Root electrofishing boat was used to electrofish Groves Point and Neck Inlet where a significant number of spawning brown trout had congregated due to the low inflows and low lake level following a significant dry Spring to Autumn period.

From the 192 box trap sets and the two hours of electrofishing, a total of 654 trout were captured consisting of 570 brown trout and 84 rainbow trout. A sample of 394 brown trout and 45 rainbow trout collected by both methods were sexed, weighed and measured. All brown trout captured were examined for the presence of an adipose clip.


Figure 1: Typical box trap set showing three co-joined traps (Penstock Lagoon).

### 2.2 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 effort.

### 2.3 Stocking Database

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.

## 3 Survey Results

## 3.I In-Lake Survey 2015

## Brown trout length weight data (all methods and all brown trout)

From 192 box trap sets and the two hours of electrofishing, a total of 657 trout were captured, consisting of 573 brown trout and 84 rainbow trout. A sample of 394 brown trout and 45 rainbow trout collected by both methods were sexed, weighed and measured. There was no significant difference between the mean weight and length of those brown trout captured by either box traps or electrofishing despite a high number of large prespawning brown trout capture by electrofishing within the Neck Inlet basin (see table I). However, when length and weight were combined and condition factor calculated, there was a significant difference between condition factor for electrofishing and box traps (see figure 2 ) ( $\mathrm{P}<0.05$ ). Consequently, the results for electrofishing and box traps are reported separately, with the data collected from box traps being the primary information relied upon within the report for weight, length and CPUE data. Additionally, unless otherwise stated the results reported are for non-fin clipped (resident) brown trout only, as fin clipped fish had only been in the lake for 6 weeks. Some comments are made on these fin clipped fish within the relevant sections.


Figure 2: Box plots for brown trout - length, weight \& condition factor separated by capture method including fin clipped and non - fin clipped fish.

|  | Mean | Std. Error | Count | Minimum | Maximum | Median | IQR |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| Length (mm), Total | 526.33 | 3.15 | 333 | 335.00 | 746.00 | 532.00 | 62.00 |
| Length (mm), Box Trap | 525.76 | 3.30 | 312 | 335.00 | 746.00 | 531.00 | 62.00 |
| Length (mm), Electrofishing Boat | 534.76 | 9.41 | 21 | 440.00 | 600.00 | 535.00 | 37.50 |
| Weight (g), Total | 2003.19 | 34.64 | 333 | 480.00 | 4930.00 | 1970.00 | 750.00 |
| Weight (g), Box Trap | 1987.92 | 36.13 | 312 | 480.00 | 4930.00 | 1955.00 | 730.00 |
| Weight (g), Electrofishing Boat | 2230.00 | 107.70 | 21 | 1000.00 | 2930.00 | 2400.00 | 622.50 |
| Condition Factor, Total | 1.34 | 0.01 | 333 | 0.63 | 2.89 | 1.31 | 0.18 |
| Condition Factor, Box Trap | 1.33 | 0.01 | 312 | 0.63 | 2.89 | 1.30 | 0.16 |
| Condition Factor, Electrofishing Boat | 1.44 | 0.04 | 21 | 1.11 | 1.82 | 1.44 | 0.23 |

Table: 1 Descriptive statistics for brown trout - length, weight \& condition factor separated by capture method includes both fin clipped and non - fin clipped fish (Total=combined).

## Brown trout length weight data (all non-fin clipped fish from box traps only)

A total of 312 non-fin clipped brown trout were captured in box traps, consisting of 175 males, 73 females and 64 unidentified sex fish. Male fish were significantly longer and heavier than either female fish or unidentified sex (see figure 3 and table 2). There was no difference in the mean condition factor between sexes or between male and female fish and unidentified sex fish.


Figure 3: Box plots for brown trout - length, weight \& condition factor separated by sex ( $\mathrm{F}=$ female, $\mathrm{M}=$ male $\& \mathrm{U}=$ undetermined).

|  | Mean | Std. Error | Count | Minimum | Maximum | Median |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: |
| Length (mm), Total | 525.76 | 3.30 | 312 | 335.00 | 746.00 | 531.00 |
| Length (mm), F | 512.12 | 6.05 | 73 | 388.00 | 620.00 | 512.00 |
| Length (mm), M | 536.57 | 4.31 | 175 | 348.00 | 746.00 | 545.00 |
| Length (mm), U | 511.77 | 7.93 | 64 | 335.00 | 676.00 | 520.00 |
| Weight (g), Total | 1987.92 | 36.13 | 312 | 480.00 | 4930.00 | 1955.00 |
| Weight (g), F | 1892.27 | 69.09 | 73 | 680.00 | 3600.00 | 1840.00 |
| Weight (g), M | 2106.78 | 48.72 | 175 | 530.00 | 4930.00 | 2100.00 |
| Weight $(\mathrm{g}), ~ U$ | 1772.03 | 75.76 | 64 | 480.00 | 3170.00 | 1810.00 |
| Condition Factor, Total | 1.33 | 0.01 | 312 | 0.63 | 2.89 | 1.30 |
| Condition Factor, F | 1.38 | 0.03 | 73 | 0.88 | 2.67 | 1.35 |
| Condition Factor, M | 1.34 | 0.02 | 175 | 0.70 | 2.89 | 1.30 |
| Condition Factor, U | 1.27 | 0.02 | 64 | 0.63 | 2.00 | 1.27 |

Table 2: Descriptive statistics for brown trout - length, weight \& condition factor separated by sex (non-fin clipped), (Total=all brown trout, $\mathrm{F}=$ female, $\mathrm{M}=$ male \& $\mathrm{U}=$ undetermined).

The average length and weight for all non-fin clipped brown trout captured in box traps was 526 mm and I,988 grams respectively, with male fish averaging 2,107 grams and female fish 1,892 grams (see table 2). Seventy eight percent of the fish weighed and measured were categorised as having good to excellent condition factor, with only 22 percent in the poor to fair range (see figure 4). The average condition factor for all non-fin clipped fish combined was 1.33 k-factor.


Figure 4: Condition factor category for all non-clipped brown trout captured by box traps.


Figure 5: Length/weight relationship for brown trout; left figure shows Tooms Lake (non-fin clipped fish and right figure shows Tooms Lake fish and the fin clipped fish transferred in June 2015.

Almost all of brown trout weighed and measured displayed very good growth across all length ranges (see figure 5). Fish over 500 mm continued to display excellent weight gains with very few longer fish displaying lower weight to length ratios (fish condition). It would appear in general, larger (older) brown trout still had significant growth potential, even at lengths beyond 550 mm and some beyond 600 mm . The length weight relationship for fin clipped brown trout that were transferred from the Highlands spawning runs during June 2016 showed a similar pattern in weight for a given length to those non-fin clipped fish at a same length. Additionally, it is apparent that fish transferred from the Highlands supplemented stocks at the smaller length range of $350-475 \mathrm{~mm}$ (see figure 7). There appears to be little evidence of any significant natural recruitment from the previous 2-3 years spawning run, or from the stocking of 30,000 hatchery-reared fry in 2013 (see figure 6). It is most probable that the non-fin clipped fish captured are from the stocking of adult fish from Great Lake, Arthurs Lake and Lake Sorell during 20I2-2014, although there were no fin clips or tags to differentiate these fish.


| From (>=) | To (<) | Count | Percent |
| ---: | ---: | ---: | ---: |
| 200.0 | 250.0 | 0 | 0.0 |
| 250.0 | 300.0 | 0 | 0.0 |
| 300.0 | 350.0 | 2 | 0.6 |
| 350.0 | 400.0 | 6 | 1.9 |
| 400.0 | 450.0 | 26 | 8.3 |
| 450.0 | 500.0 | 47 | 15.1 |
| 500.0 | 550.0 | 113 | 36.2 |
| 550.0 | 600.0 | 93 | 29.8 |
| 600.0 | 650.0 | 18 | 5.8 |
| 650.0 | 700.0 | 6 | 1.9 |
| 700.0 | 750.0 | 1 | 0.3 |
|  | Total | 312 | 100.0 |

Figure 6: Length frequency for non-fin clipped brown trout- Tooms Lake 2015.


Figure 7: Length frequency for brown trout, showing fin clipped transfers and non-fin clipped captures.

### 3.2 CPUE Information (brown trout)

## Brown trout

Generally, the capture of brown trout in box traps was moderately high with 540 brown trout capture from 96 box traps set over two nights (total 192 sets), with the nets cleared each day. This equates to a mean CPUE of 2.8 I brown trout per net (see table 3). A total of 25 brown trout were captured using the electrofishing boat for a fishing time of I20 minutes, resulting in a CPUE of 12.5 brown trout per hour. This figure is however, artificially inflated as the neck inlet basin was targeted as the area contained a high abundance of spawning brown trout trying to access the inflowing stream.

| Method | No. <br> traps/EF | No. <br> nights | Effort | No. brown <br> trout | CPUF |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Box traps | 96 deployed | 2 | I92 net <br> sets | 540 | $2.8 \mathrm{I} / \mathrm{trap}$ |
| Electrofishing | I run only | one day | 120 <br> minutes | 25 | $12.50 / \mathrm{hr}$ |

Table 3: Survey CPUE for brown trout.

## Rainbow trout

Rainbow trout represented $12.3 \%$ of the total capture from box traps with a CPUE of 0.39 fish per trap set. Electrofishing resulted in 8 rainbow trout captures at a CPUE of 4 rainbow trout per hour.

| Method | No. <br> traps/EF | No. <br> nights | Effort | No. rainbow <br> trout | CPUE |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Box traps | 96 <br> deployed | 2 | 192 net <br> sets | 76 | $0.39 /$ trap <br> set |
| Electrofishing | I run only | one day | 120 <br> minutes | 8 | $4.00 / \mathrm{hr}$ |

Table 4: Survey CPUE for rainbow trout.

### 3.3 Population Estimate

During 3-5 June 20I5, 3,850 adult brown trout that had been adipose fin clipped were transferred from three different highland waters to Tooms Lake to allow for a population estimate to be conducted. A six week settling in period was allowed before a recapture survey was undertaken. A total of 540 brown trout were captured in box traps over a three day period (two nights). Of these fish, I IO had adipose fin clips (20\%). Table 5 shows the parameters for the estimation with around 18,900 brown trout estimated to be within the lake. The associated estimate of bias was at acceptable levels i.e. > 4 and implies a reasonable degree of confidence of the estimate.

| Parameter | Result |
| :--- | :--- |
| Total fin clipped released (M) | 3,850 |
| Total recaptures (C) | 540 |
| Total marked recaptures (R) | 110 |
| Population estimate: MC/R = N | 18,900 |
| Standard error | 1,585 |
| Lower and Upper 95\% CI limits | 15,793 - 22,007 |
| Estimate bias level: MC/4N = | 27.5 (>4 acceptable bias) |

Table 5: Petersen population estimate for brown trout Tooms Lake 2015.


Figure 8: Capture frequencey expressed as a percentage of box traps that caught fish for day two captures only.

Figure 8 shows the percentage of box traps that caught a specified number of brown trout. Only captures from day two were used to graph this data as on the first capture day several box traps rolled over due to wind and a number of traps on the first day had catch data pooled across two traps rather than being recorded separately for each trap. Fifty four percent of the traps caught between I to 5 brown trout per trap with 40 percent capturing no brown trout. The highest number of fish (brown \& rainbow) captured in one individual net were 23 , on the first day of the survey. Box traps captured a wide range of length classes between $335-746 \mathrm{~mm}$. The lack of brown trout captured less than 380 mm indicates an absence of young fish rather than sampling bias, as box traps have captured a wide range of length class fish during surveys at other waters.

### 3.4 Rainbow trout

From 192 box trap sets and the two hours of electrofishing, a total of 84 rainbow trout were captured, 37 from box traps and 8 from the electrofishing boat, representing I2.8 percent of the total catch of all trout. A sample of 45 rainbow trout collected by both methods were sexed, weighed and measured. The results of this data are presented below in figure 9 and figure 10 .

The average length for the 45 rainbow trout captured was 436 mm and average weight 1.2 kg , with the largest fish weighing 2.2 kg (see figure 9). There were two distinct length classes with fish in the 260-320 mm range most likely resulting from a stocking of 46330 fingerlings during 2014.


Figure 9: Length frequency and descriptive statistics for rainbow trout captured in box traps and electrofishing.


Figure 10: Condition factor for rainbow trout captured in box traps and electrofishing.

Of the 45 rainbow trout weighed and measured, 93 percent were classified as being in good or excellent condition, with no fish showing poor condition (see figure 10 ).

### 3.5 Comparison of results 2003 and 2015

A comparison of the survey results from 2003 and 2015 shows there were a significant number of large well condition brown trout within the lake during the 2015 survey. While the average weight and length of brown trout during the 2003 survey was greater than most other comparable fisheries, the 2015 survey results were exceptional. The 2015 sample contained a large numbers of brown trout greater than 550 mm with weights in excess of 2 kg , with a number of fish in the $2.5-3.5 \mathrm{~kg}$ range (see figure II and table 6). An interesting point is the strong showing of three distinct length cohorts within the 2003 survey indicating successive years of significant recruitment (see figure 12). The younger (smaller) fish are absent from the survey as the capture methods biased toward larger fish with the use of larger mesh size gill nets. The 2015 survey did not have the same bias and the lack of smaller brown trout less than 360 mm is likely to be a true indication of unsuccessful recruitment from both natural and stocked recruitment over the previous three years (see figure 12 ).


Figure 11: Box plots for length and weight data comparing Tooms Lake survey results for 2003 \& 2015, brown trout.

|  | Mean | Std. Error | Count | Minimum | Maximum |
| :--- | ---: | ---: | ---: | ---: | ---: |
| Weight $(\mathrm{g})$, Total | 1751 | 33 | 452 | 310 | 4930 |
| Weight $(\mathrm{g}), 2003$ | 1179 | 49 | 58 | 400 | 1900 |
| Weight $(\mathrm{g}), 2015$ | 1836 | 36 | 394 | 310 | 4930 |
| Length $(\mathrm{mm})$, Total | 504 | 3 | 452 | 300 | 746 |
| Length $(\mathrm{mm}), 2003$ | 454 | 9 | 58 | 305 | 570 |
| Length $(\mathrm{mm}), 2015$ | 511 | 3 | 394 | 300 | 746 |

Table 6: Descriptive statistics for length and weight data comparing Tooms Lake survey results for 2003 \& 2015, brown trout.


Figure 12: Length frequency graphs for brown trout comparing Tooms Lake survey results for 2003 \& 2015 ( 2015 does not show outliers $>700$ mm and excludes fin clipped brown trout released in June 2015).


Figure 13: Length/weight regression data for brown trout, comparing Tooms Lake survey results for 2003 \& 2015 (2015 includes clipped and non-clipped fish), (2003: $Y=-1187.662+5.212 * X$; $\left.R^{2}=0.85 \& 2015: ~ Y=-3191.683+9.833 * X ; R^{2}=0.83\right)$

A simple regression plot of comparative lengths and weights of brown trout captured during the 2003 and 2015 surveys (see figure 13) shows that the growth rate of brown trout captured in 2015 was significantly greater than for 2003 captures.

## 4 Stocking History

| Species | Year | Age | Number | Origin | Stock | Type |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| brown trout | 2005 | Fry | 100000 | IFS - S. Ponds | Wild | Diploid |
| brown trout | 2010 | Fingerling | 2500 | IFS - New Norfolk | Wild | Diploid |
| brown trout | 2010 | Adult | 620 | Spawning run | Wild | Diploid |
| brown trout | 2010 | Fingerling | 20000 | IFS - New Norfolk | Wild | Diploid |
| brown trout | 2011 | Adult | 1000 | Liawenee | Wild | Diploid |
| brown trout | 2011 | Fingerling | 4000 | IFS - New Norfolk | Wild | Diploid |
| brown trout | 2012 | Adult | 600 | Spawning run | Wild | Diploid |
| brown trout | 2013 | Adult | 1080 | Spawning run | Wild | Diploid |
| brown trout | 2013 | Fry | 30000 | IFS - New Norfolk | Wild | Triploid |
| brown trout | 2014 | Adult | 2305 | Spawning run | Wild | Diploid |
| brown trout | 2015 | Adult | 3850 | Spawning run | Wild | Diploid |
| rainbow trout | 2005 | Yearling | 3000 | Commercial Hatchery | Domestic | Triploid |
| rainbow trout | 2006 | Fingerling | 22500 | Commercial Hatchery | Domestic | Diploid |
| rainbow trout | 2009 | Fingerling | 5500 | Commercial Hatchery | Domestic | Triploid |
| rainbow trout | 2009 | Yearling | 3000 | Commercial Hatchery | Domestic | Triploid |
| rainbow trout | 2010 | Fingerling | 10000 | IFS - New Norfolk | Wild | Diploid |
| rainbow trout | 2010 | Yearling | 7500 | Commercial Hatchery | Domestic | Triploid |
| rainbow trout | 2011 | Fingerling | 8000 | IFS - New Norfolk | Wild | Diploid |
| rainbow trout | 2012 | Yearling | 6000 | IFS - New Norfolk | Wild | Triploid |
| rainbow trout | 2012 | Adult | 300 | Commercial Hatchery | Domestic | Diploid |
| rainbow trout | 2012 | Fry | 10000 | IFS New Norfolk | Wild | Diploid |
| rainbow trout | 2013 | Fingerling | 6000 | Commercial Hatchery | Domestic | Triploid |
| rainbow trout | 2014 | Fingerling | 46330 | Commercial Hatchery | Domestic | Triploid |

Table 7: Stocking data Tooms Lake for brown \& rainbow trout 2005 to 2016.

The stocking of brown trout into Tooms Lake has prior to 2005 mainly consisted of fry raised at the Salmon Ponds hatchery, it was assumed that these stockings supplemented natural recruitment and maintained the fishery. There is some evidence for this success from a survey conducted in 2003 (see figure 12), although the contribution of natural
recruitment in comparison to supplementary stocking cannot be separated. Since 2008, the New Norfolk Hatchery produced the vast majority of fry and fingerlings for stocking however, the frequency of stocking at Tooms Lake was intermittent and the success of these releases was not assessed. With the cessation of the New Norfolk Hatchery in December 2014 and the construction of three additional spawning traps at Great Lake and Arthurs Lake during 2013-2015, combined with the proven success of adult stockings at Four Springs Lake and Penstock Lagoon, a shift to stocking of adult brown trout was implemented for Tooms Lake (see table 7).

## 5 Angler Postal Survey



Figure 14: Angler Postal Survey results for angling effort, angler numbers, and daily catch rate for brown and rainbow trout Tooms Lake, 1995-2015.


Figure 15: Angler Postal Survey results for estimated harvest of brown and rainbow trout, 19862015, Tooms Lake, red dotted line indicates the long term average harvest of brown trout .

The estimated catch per day for brown trout and angling effort was consistently high at around 1.3 fish per day and $10,000-14,000$ angler days per season for the period 20022006 (see figure 14). Consequently, the harvest of brown trout was above the long term 30 year average of 5,384 brown trout (see figure 15). Angling effort fell during the period 2006 - 2009 largely driven by the effects of a prolonged and severe drought. Angling effort and the estimated daily catch rate for brown trout has steadily increased since 2010 with the lake filling and replenishment of trout stocks mainly with adult brown trout transfers. However, the lake level fell to very low levels during 2015-2016 but has since increased to moderate levels with high inflows during June 2016.

The results of the survey suggest that Tooms Lake could sustain a much larger brown trout population as there does not appear to be at present any density dependent influences regulating the population. The importance of stocking juvenile brown trout during unfavorable spawning years has merit as the lake and the associated fishery can improve quickly. Accordingly, to capitalise on this improvement, a solid population base is necessary. This can be achieved by either stocking significant numbers of fry or fingerlings or alternately adult brown trout. The later may be a more responsive action as these fish are readily available to anglers immediately after release and there is no lag time of 2-3 years between liberation and availability to anglers.

## 6 Discussion

The results of the 2015 survey indicate that Tooms Lake at the time of the survey contained a moderate population ( 18,900 brown trout) of large to very large brown trout with an average weight of around 2 kg , with a significant number of fish in the $2.5-3.5 \mathrm{~kg}$ range. The vast majority of the brown trout captured were in good to excellent condition. The relatively high numbers of large brown trout between $500-600 \mathrm{~mm}$ that dominated the catch were most likely from the stocking of fingerlings and adult transfers, in combination with significant natural recruitment during 2010 to 2013 , a period of consistently above average rainfall during favorable La Nina climate conditions. These conditions however, did not prevail during the 2014-15 spawning and fry emergence period and will most likely impact on recruitment of young brown trout into the fishery during 2016-17. Fortuitously, this void in recruitment was filled with the transfer of additional adult fish during 2015. Based on the 2015 survey results, these fish should make up approximately 20 percent of the brown trout available for anglers to catch during 2015-16 and into 2016-17 season. There is good evidence to indicate a previous stocking with 30,000 triploid brown trout fry during 2013 was unsuccessful, with very few non-fin clipped ('resident') fish below 360 mm length captured.

A comparison of the 2003 and 2015 survey results indicates the size and growth of brown trout as evident from 2015 survey, was at the upper level of expectation. The results of the 2003 survey may likely reflect the normal state of the fishery during favorable climatic conditions, with good numbers of brown trout from multiple year classes present, with average weights around 1.2 kg . Consequently, it's unlikely the current situation (significant numbers of very large fish) will prevail unless recruitment and catch rates remain relatively low. The result for 2015 indicates there are no density dependent affects apparent that are limiting overall growth rates.

Angling effort at Tooms Lake appears to be highly influenced by climatic conditions, lake level and the affects these factors have on the brown trout population and access for boating anglers. Peak angling effort and high catch rates were dominate during 2001-2006, a time when ideal climatic conditions prevailed in the preceding years and favored high natural recruitment. Additionally, lake levels were more conducive, allowing easy access for both shore-based and boating anglers. Succeeding this period, a marked decline in angling effort and catch rate were apparent, these were driven primarily by a prolonged dry period with well below average rainfall until mid-2009. Since 2009 , there has been a rebound effect in both angling effort and the daily catch rate for brown trout, returning to near long-term average levels. The daily catch rate and harvest of rainbow trout is largely driven by similar influences, with consistent stocking crucial for the maintenance of the rainbow trout fishery.

The importance of stocking juvenile brown trout during unfavorable spawning years also has merit as the lake and the associated fishery can improve quickly therefore a solid population base is necessary to capitalise promptly on any improvement. This can be achieved by either stocking significant numbers of fry or fingerlings or alternately adult brown trout. The later may be a more responsive action as these fish are readily available to anglers immediately after release and there is no lag time of 2-3 years between liberation and availability to anglers.

The large average size of brown trout at Tooms Lake is explicitly linked to the presence of the population of the common galaxias (Galaxias maculatus or jollytail) that provides a high energy prey item for trout. Conditions that favor the growth in this population would certainly influence the size of trout. The first reported occurrence of common galaxias from Tooms Lake was around 2001 - 2002, there is likelihood the initial increase in catch rate and harvest of brown trout during 2002-2006 is related to the introduction of this prey species, with the early boom bust cycle influencing the trout population.

## 7 Recommendations

I. Provision is made to maintain a good base population of brown trout with the stocking of fry or fingerlings on a more consistent annual basis.
II. Consideration is given to using adult brown trout to stock the lake so there is no lag time between a return to a favorable environmental conditions and maintenance of acceptable catch rates.
III. 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.
IV. The present regime of stocking rainbow trout on a consistent basis is maintained.

## 8 Appendix

| From (>=) | To $(<)$ | Count | Percent |  | From (>=) | To ( $(<)$ | Count | Percent |
| ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| 0.0 | 500.0 | 1 | 0.3 |  | 0.0 | 500.0 | 3 | 0.8 |
| 500.0 | 1000.0 | 19 | 6.1 |  | 500.0 | 1000.0 | 56 | 15.2 |
| 1000.0 | 1500.0 | 40 | 12.8 |  | 1000.0 | 1500.0 | 56 | 15.2 |
| 1500.0 | 2000.0 | 105 | 33.7 |  | 1500.0 | 2000.0 | 106 | 28.7 |
| 2000.0 | 2500.0 | 94 | 30.1 |  | 2000.0 | 2500.0 | 95 | 25.7 |
| 2500.0 | 3000.0 | 34 | 10.9 |  | 2500.0 | 3000.0 | 34 | 9.2 |
| 3000.0 | 3500.0 | 12 | 3.8 |  | 3000.0 | 3500.0 | 12 | 3.3 |
| 3500.0 | 4000.0 | 6 | 1.9 |  | 3500.0 | 4000.0 | 6 | 1.6 |
| 4000.0 | 4500.0 | 0 | 0.0 |  | 4000.0 | 4500.0 | 0 | 0.0 |
| 4500.0 | 5000.0 | 1 | 0.3 |  | 4500.0 | 5000.0 | 1 | 0.3 |
|  | Total | 312 | 100.0 |  |  | Total | 369 | 100.0 |

