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Goulburn River Trout Fishery: Angler Survey 2008–2009

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Victoria
The Place To Be

Goulburn River Trout Fishery: Angler Survey 2008-2009

Paul Brown

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Executive Summary

The condition of the trout fishery along the Goulburn River between Eildon and Alexandra (including the lower reaches of the Rubicon River) was evaluated using a roving on-site creel survey to sample anglers' catch-rates randomly, and record fishing-effort. A random sub-sample of these anglers was also questioned further to survey their behaviours, attitudes and opinions. Information was collected about their awareness of a river health and angler-access enhancement program run by the Goulburn Broken Catchment Management Authority (GB CMA) and a fishery development and promotion program called *Go Fishing in Victoria* (GFIV) run by Fisheries Victoria.

The fishery resource is under a similar level of exploitation (angler effort) compared to five years previously and this may be interpreted as a similar number of anglers participating in the fishery.

Harvest estimates for rainbow trout have declined significantly from five years ago. Catch and harvest estimates for brown trout and rainbow trout from comparable sites along the Goulburn River are slightly lower although statistically similar to five years ago. Catches of brown and rainbow trout from the lower Rubicon are very similar to previous estimates made six and seven years previously. Release rates for trout remain high particularly for brown trout. Brown and rainbow trout harvested and measured at interview are significantly larger than in either previous Goulburn creel survey.

There was some evidence that angler-satisfaction levels reported in the present study may be higher than in previous creel surveys on the Goulburn or the Rubicon River although this may be influenced by slight methodological differences between surveys that may be critical in determining the actual satisfaction levels over each fishing season. Even so, the present study identifies a new benchmark in angler-satisfaction that can be used comparatively over the life of the *Go Fishing in Victoria* promotion.

Anglers who fished the mid-Goulburn River trout fishery mainly did so because they enjoyed relaxing, catching fish and being outdoors. The study showed that anglers along the Goulburn River, like anglers everywhere, are a diverse bunch when it comes to their attitudes and motivators. While some are concerned with safe vehicle parking and easy bank-access, others have expectations of aesthetic beauty and solitude. The more avid, specialist anglers are more strongly motivated by prospects of catching fish of their preferred species (predominantly brown trout), and less inspired by prospects of increasing popularity of their fishery.

While reasons for satisfaction or dissatisfaction often included catching or not catching fish, anglers often blamed themselves, their inexperience, the weather, the water-conditions, etc., before they identified "too few fish in the river" as an explanation for dissatisfaction. Even when they perceived a lack of fish as the problem, factors perceived as interfering with their expectations included overcrowding with "too many anglers" and overfishing as explanations.

Anglers preferred particular access-points for a range of reasons. Key drivers for site selection were: whether the features of the river (at that point) suited their preferred methods; the aesthetics or natural beauty of the surroundings; and ease of access to the river (including parking). We speculate that the significant increase in popularity of fly-fishing may be due to the uncharacteristic low river levels and the impact of river management practices in recent years. Consistent low flows have made more sites suitable for wade-based fishing for more of the time. In-stream and riparian management may have enabled or simplified fly-fishing access where previously bait or lure casting would have been more suitable at many sites.

Knowledge of GB CMA's river health and access enhancements program was similar to the highest levels of awareness about similar activities in other Victorian catchments. Over half the anglers responded that they had learned about the GB CMA work through observing it themselves. However, less than 1-in-4 were aware of changes at the site where they were being interviewed.

Knowledge of Fisheries Victoria's *Go Fishing in Victoria* promotion was relatively poor and many were unable to demonstrate the awareness they claimed, or confused the

program with other management activities or with the GB CMA program. The relatively low awareness level should be expected as the study was prior to the launch of the 'Premier Rivers' promotion of the Goulburn River, and considering the longer time span that anglers have been exposed to the GB CMA initiative. This study forms a benchmark for future evaluation of the GFIV promotional program of the Goulburn as a 'Premier River' that commences in 2010.

Awareness of the concepts of 'Crown Land' and 'freehold land' was high, although many were unsure about what activities were allowed on Crown Land. The present study has identified an opportunity to reduce uncertainty and increase awareness of people's rights and responsibilities for recreation on Crown Land water frontages, by providing educational material about popular activities in a package that is targeted towards the recreational angler.

The traditionally funded activities of stocking, river restoration and angler-access enhancements were the most popular themes that anglers suggested for future investment from the recreation fishing grants program. Some non-traditional areas for investment such as 'litter-management' and 'freehold riparian lands buy-back scheme' were also proposed. These new proposals for investment would link well with non-consumptive factors (i.e. not to do with catching fish), such as increasing aesthetic beauty and prevention of overcrowding, that are influencing angler satisfaction and site-choice along the Goulburn River.

Table of Contents

List of Tables

List of Figures

Introduction

The need for this research was two-fold.

Firstly, it was important for Fisheries Victoria to 'benchmark' the status of the fishery, including the attitudes and opinions of its anglers, as part of the *Go Fishing in Victoria* initiative, prior to the start of a promotion of the Goulburn River as a Premier River. Sections of three Victorian rivers (Hopkins, Goulburn and Kiewa) are being developed in partnership with local stakeholders to cater for more experienced anglers, and are being promoted as Premier Rivers. The promotion of the Upper Goulburn 'Premier River' section between Eildon and Alexandra is scheduled for May 2010.

Secondly, the study was designed to evaluate the performance of a program to upgrade angler-access, and rehabilitate riverine trout habitat. This program was undertaken in recent years by the Goulburn Broken Catchment Management Authority (GM CMA) as part of its River Health Program and with co-investment from Recreational Fishing Licence trust funds.

The present study covers the trout fishing season September 2008 to June 2009. Five years previously, comparable 'creel survey' data were collected from recreational fishers along this reach of the Goulburn during two successive trout-seasons (Brown and Gason 2007). The present study will seek to compare results with that previous study. The present study also incorporates some of the Rubicon River, a tributary of the Goulburn River, that was also sampled during 2001 to 2003 (Douglas 2005), making further comparisons with these data possible.

The most recent previous angler survey on this fishery sampled the fishery using two concurrent surveys over two successive fishing seasons. A main survey was designed to cover fishing activity from vehicle-based public access points, and a second survey to cover fishing activity from three camping and caravan-parks within the same study area (Brown and Gason 2007).

The present study uses a stratified and randomised sampling strategy to sample catch-rates, behaviours attitudes and opinions from anglers fishing only from public-access points from Eildon to Alexandra. This simplified approach was taken because previous research has shown that a majority of anglers fish and catch up to 93% of the estimated total catch, from these public access points (Brown and Gason 2007).

The objectives of the present study were:

- To evaluate the condition of the trout fishery (Alexandra to Eildon)
- To provide information on anglers behaviour, knowledge of, and attitudes-towards GB CMA's River-Health Enhancements and the *Go Fishing In Victoria* project

This report provides a detailed and comparative evaluation of catch and fishing-effort, and provides a benchmark of the awareness, motivating factors, beliefs and behaviours of anglers in 2008–09.

Project Design and Methods

Creel survey design

To estimate total catch and effort for the 2008–09 trout-fishing season, a creel survey was designed to target anglers fishing the Goulburn River between Eildon Pondage gates and Brooks Cutting Reserve, Alexandra. The survey interviewed a random sample of anglers fishing from public access-points along the Goulburn River. The survey boundaries also included the lower Rubicon River up to the roadside reserve upstream of the Tumbling Waters Bridge, and the short reach of the lower Acheron River up to the first bridge (Figure 1.)

The potential sampling frame for stratification of this creel survey included two day-types (i) 'weekdays' and (ii) 'weekends and Public Holidays'; and two time-periods of either 'early' (06:00 –14:00 h) or 'late' (14:00–22:00 h). These figures became the weighting factors (*wf*) used in subsequent calculations to weight-up the sampled data (e.g. catch rates) for each strata to represent those for the season.

Decisions on probability weighting of the strata were made with reference to previous creel surveys of Brown and Gason (2007), who used data collected from 'pedestrian-counters' at angler-access points. Weekends and public holidays were weighted so that the probability of a creel census was three times that of a weekday. Early and late sessions were weighted equally. Dates and times within each stratum were randomly chosen.

A total of eighteen vehicle-based public access points were identified. Thirteen of the fourteen public access points used in previous creel surveys were re-used (Brown and Gason 2007). One was dropped due to low observed use. Two recently developed ones were added on the lower Acheron/Goulburn river confluence and on the Back Eildon Road near Eildon Waters Caravan Park. Three additional access points along the lower Rubicon River were also surveyed.

Due to the increased number of access points sampled in the present survey, comparisons with previous creel survey (catches and effort) are only made with an equivalent subset of data from thirteen comparable access-points (listed in Table 1). Temporal comparisons of other statistics (i.e. angler behaviours, opinions, etc.) will compare full datasets.

For each interview session, a starting point was chosen at random with all access points having equal probability of being chosen to start a session. All access points were visited once in each shift. The creel clerk proceeded around the route in a fixed direction, and revisited access-points in the same set-order for the duration of the shift.

Creel clerks collected catch-rate data mainly from incomplete trips. Analyses from previous similar creel surveys has shown that catch rates and harvest rates are independent of time spent fishing (Brown and Gason 2007), meaning that catch-rates from incomplete trips are just as informative as those from completed trips.

Angler interviews

Interviews were based on standard survey questionnaires and data sheets (see Appendix 1).

Questionnaires and interviews were designed in consultation with recreational fishery and catchment managers commissioning the surveys. Where possible, surveys design facilitated comparisons with previous similar work on the Goulburn and related fisheries (Douglas 2005; Brown and Gason 2007; Douglas and Hall in press), and with similar work commissioned on other Victorian waters as the Merri and Hopkins Rivers and the Glenelg River (Brian Mottram, Fisheries Victoria, Pers. Comm.)

For each creel session, interviewers also recorded weather conditions, air temperature and river-flow volume, dissolved oxygen content and temperature at Eildon (from the Goulburn-Murray Water recorded message line Ph: 03 57708128).

During the 2008–09 fishing season, two types of survey questionnaire were used:

- Short-form
- Long-form

Core catch and effort data

Each angler, including multiple anglers in each group, was asked to answer questions on the short-form; this took approximately 2-4 minutes. Questions were asked about start and finish times; whether the angler had finished fishing

(and if not, their estimated finishing time); numbers of fish of each species caught; numbers of fish of each species returned; reasons for releasing any fish; and fishing methods. Anglers were asked about their avidity using a question about the frequency with which they fish the Goulburn River. Some basic demographic data were recorded (gender, age-bracket, home post-code, and whether they were exempt from holding a recreational fishing licence). Any fish retained by anglers were inspected and measured.

Detailed attitudinal survey

One angler from each group (or each 'lone'-angler) was also asked to respond to the long-form questions. These questions were more detailed, with the whole interview taking up to 20 minutes with some 'probing' of responses by the interviewer often required. In a group of anglers, the one asked to answer the long-form was randomly chosen by asking, "who has the next birthday?" This ensures that all respondents were equally unbiased[1]. In addition, to avoid biasing responses with the opinions of frequently encountered anglers through the season, once someone had been sampled with the long-form questionnaire they were exempt from being re-sampled on subsequent dates and times.

Fishing motivation
On the long-form, anglers were asked to rate the importance of a range of reasons why they go fishing, both generally and specifically on the Goulburn River. Potential general reasons (n=9) and specific reasons (n=7) were supplied and anglers asked to rate them from 'extremely important' to 'totally unimportant' on a five-point scale.

Angler Satisfaction
Anglers were asked about their satisfaction with the overall quality of the fishing they had experienced that day and more generally over the last twelve-months, along the Goulburn River. They were asked to rate satisfaction on a four-point scale from 'very satisfied', to 'not at all satisfied', and asked to indicate their perceived reason and contributing factors for their rating.

Angling related tourism
They were asked if their visit involved over-night stays, and if so, how many nights. They were asked if other tourism activities would be undertaken, and to describe those activities.

Awareness of relevant management programs
The interviewer also sought information about the level of the angler's awareness of the '*Go Fishing in Victoria*' initiative, and from where they obtained that information. A similar question was asked about the angler's awareness-level of the GB CMA's river health enhancement works, including projects to improve angler access. Without prompting, the interviewer noted if the respondent mentioned the following in particular:

- Stiles/angler-access points
- Signage
- In-stream habitat
  - Groynes
  - Boulder fields
  - LUNKERs[2]
- Rock-beaching
- Stock-exclusion fencing
- Exotic veg. (willow) control
- Revegetation works

Choice and preference of fishing location
Next, the respondent was shown a list and map of all the access-points important to the present study (n=18) and asked to nominate one as their preferred fishing access point. This question was followed by asking the angler to rate twelve statements about why they prefer that particular access point (on a four-point scale from 'strongly agree' to 'strongly disagree').

The interviewer then asked the respondent if they were aware of any changes to public access, facilities or to the local environment at the site where they were fishing, and if they were aware of any, to describe them.

[1] If we had failed to randomly choose a candidate for the long-form questionnaire we may have inadvertently biased the responses towards those given by respondents more inclined to 'volunteer.'

[2] Acronym for a type of artificially constructed bank overhang Little Underwater Neighbourhood Keepers Encompassing Rheotactic Salmonids. Hunter, C. (1991). 'Better Trout Habitat: a guide to stream restoration and management.' (Montana Land Reliance & Island Press: Washington D.C.)

The interviewer ascertained the maximum distance that the angler had travelled from their vehicle and asked the angler to recall how they first 'discovered' the present access point (e.g. 'found it on map', 'discovered it while passing', etc.).

Next, a series of questions enquired about the respondent's awareness of issues related to accessing Crown Land and freehold land, along the river; and what activities they perceived were permitted at their present location.

The final question sought suggestions as to what activities, works and services the angler wanted to see 'fishing licence money' invested in.

Creel calculation methods for catch and effort

Estimates of total catch and effort for the fishery were calculated following the methods modified from Brown and Gason (2007) and implemented within a Microsoft Access database with five main queries:

- The first query collates all the effort, numbers of each species caught and released, and a catch and harvest rate for each species for each interview for the area searched during that interview session.
- The second query calculates the sums and variance for catch and effort data for each interview session.
- The third query groups these sums and variances with the relevant numbers of interview sessions and their weighting factors for all strata in the survey-design. Weighting factors are simply the number of possible occurrences of that stratum within the season (e.g. the number of weekday mornings during the season).
- The fourth query expands the summed catch and effort data to estimate these for the whole season and reach surveyed using the number of sessions and weighting factors, and known reach dimensions.
- The fifth query calculates the standard errors of each estimate based on the variances.

Statistical analysis

The *t* test was used to compare mean fish size.

The Z-test was used to compare the proportions from two independent groups to determine if they are significantly different from one another.

Table 1 Public-access points for vehicle-based anglers along the Goulburn River and tributaries that were used to sample catch-rates, views and opinions of recreational fishers within the present study during the 2008–09 fishing season, and during two previous seasons 2002–03 and 2003–04. Direct comparisons of catch and effort are made between studies where 'ticks' are present in both columns. Other comparisons are made using both whole datasets from all access-points.

River		Access point	Used in 2002–04 creel surveys	Used in present creel survey
Goulburn	1	Brooks Cutting Reserve	✔	✔
Goulburn	2	UT Creek Mouth	✔	✔
Goulburn	3	Maroondah Highway Bridge	✔	✔
Goulburn	4	Breakaway Bridge	✔	✔
Goulburn	5	Mc Martins Road	✔	✔
Goulburn	6	Gilmore's Bridge	✔	✔
Goulburn	7	Thornton Bridge	✔	✔
Goulburn	8	Point Hill Reserve 1	✔	✔
Goulburn	9	Point Hill Reserve 2	✔	✔
Goulburn	10	Canoe Launch (Pondage gates)	✔	✔
Goulburn	11	Eildon Fish Trap (Pondage gates)	✔	✔
Goulburn	12	S-bends Reserve	✔	✔
Goulburn	13	Walnuts Reserve	✔	✔
Acheron	14	Acheron R. confluence	×	✔
Goulburn	15	Back Eildon Road	×	✔
Rubicon	16	Christies Lane	×	✔
Rubicon	17	Rubicon Road	×	✔
Rubicon	18	Tumbling Waters reserve	×	✔

Results

The fishery

During forty-six survey sessions throughout the trout fishing season 2008–09, anglers were interviewed (n=361) to collect core data on catch, effort and demographic information (i.e. the short-form). Of these anglers, many (n=194) went on to provide detailed information on their motivations preferences, attitudes and opinions (i.e. the long-form). Interview numbers from the present study were slightly lower than the 412 and 370 obtained during 2002–03 and 2003–04 at fewer sites.

During the present survey, interviewed anglers reported catching 54 brown trout (*Salmo trutta*), 95 rainbow trout (*Oncorhynchus mykiss*), 27 redfin (*Perca fluviatilis*), 1 golden perch (*Macquaria ambigua*) and 1 common carp (*Cyprinus carpio*). Compared with recent previous surveys, these actual catches of anglers interviewed during the survey are higher for all species except rainbow trout. Golden perch is a species not previously captured during surveys in this reach of the Goulburn River.

Fish Size

Size characteristics of the measured retained catch of trout are shown in Table 2.

The average sizes of retained brown trout ($p<0.05$) and rainbow trout ($p<0.001$) were significantly larger during the present survey compared to fish retained in recent previous surveys (

Figure 1).

Table 2. Size of retained trout measured by creel clerks during the 2008–09 seasons

Fork Length, mm	Brown trout (n=10)	Rainbow trout (n=18)
Smallest	290	220
Average	390	321
Largest	440	390

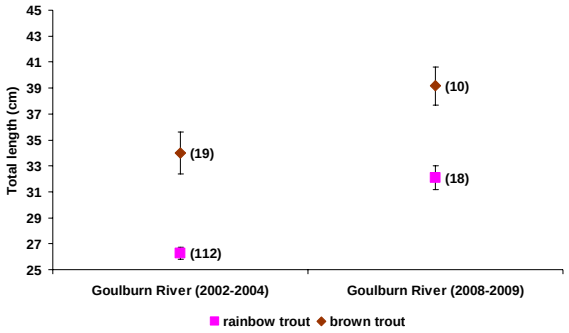

Figure 1. Average length (±s.e.) of trout retained by anglers is larger for brown trout ($p<0.05$), and rainbow trout ($p<0.001$), during the present study (2008-2009), compared to the previous creel surveys (2002-2004), on the Goulburn River. Sample size is in parenthesis.

Catch and Effort

Total Effort and Catch During 2008–09 Fishing Season (all 18 access points)

The estimate (±se) of total angling effort was 11,187 (211) angler-hours. Estimates of total angling catch and harvest (retained catch) were made for all public vehicle-based access points (Table 1) along the Goulburn and lower Rubicon and Acheron Rivers between Eildon and Alexandra (Table 3.) Average (±se) angler effort within the interview shift has not varied significantly during the present and previous two surveys, with anglers fishing for 3.2 h (±0.1 h) on average.

Table 3. Catch estimates for all 18 access-points along the Goulburn and lower Rubicon and Acheron Rivers

	2008–2009 Season	
Species	Catch (±se)	Harvest (±se)
Brown trout	780 (131)	48 (60)
Rainbow trout	1,253 (391)	179 (31)
Redfin	502 (167)	5 (7)

Comparisons of Total Catch and Harvest Estimates with Previous Creel Surveys (13 access points)
To enable comparisons with previous creel surveys during 2002–03 and 2003–04, additional estimates of catch and effort were recalculated from data collected by Brown and Gason (2007), for the thirteen comparable access points described in Table 1 that were re-surveyed in the present study during 2008–09 (Table 4).

Catch estimates for brown and rainbow trout and the harvest estimate for brown trout are lower than previously estimated but the precision of the estimates obtained means that this change is not statistically significant. Present estimates of catch have declined by 54% and 48% from the previous creel survey in 2003-04, for brown and rainbow trout respectively. Given the observed precision in estimates, the present survey intensity only had the statistical power to detect 75% and 55% declines in catches for these species (p=0.05).

The harvest estimate for rainbow trout during 2008-09 has declined since both previous creel surveys. Given the observed precision in estimates, the present survey intensity had the statistical power to detect an approximate 48% decline in harvest for rainbow trout, whereas, there was actually a 75% decline.

Comparisons of Total Effort Estimates with Previous Creel Surveys (13 access points)
For this subset of access-points, the angler effort during 2008–09 was estimated as 9,100 (±218) angler hours; this is statistically similar to the estimate of 9,477 (±115) hours for 2003–04, and a decrease from the peak estimate of 12,073 (±176) hours for 2002–03 fishing seasons.

The overall catch rates including all estimated catch and effort from all access sites in 2008–09 for brown trout, rainbow trout and redfin were 0.07, 0.11 and 0.04 fish/h.

At the set of comparable access points, the overall estimated brown trout catch rate (0.04 fish/h), was the same as that estimated for 2003–04, and slightly lower than the 2002-03 estimate (0.06 fish/h). The overall rainbow trout catch rate (0.11 fish/h) was lower than the 2002–03 and 2003–04 estimates (0.16 and 0.23 fish/h), respectively.

Release-rate and Reason for Release

Considering only the fish captured by interviewees, more brown trout (70%) than rainbow trout (33%) were reported as released ($Z=4.27$, $p<0.05$). The estimates of catch and harvest (Table 3) suggest that the actual release rate may be much higher at around 94% and 86% for brown and rainbow trout, respectively.

The brown trout release-rate from interviewees in the present survey has not changed significantly from the comparable rate from the previous survey (58%). For rainbow trout, the release-rate in the present survey has decreased significantly from the comparable rate (52%) found the previous surveys ($Z=3.38$, $p<0.05$).

For brown trout in the present survey, the most common reason (89%) for release is 'sport-fishing', whereas in the previous survey, the most popular reason (74%) given was 'undersized'. For rainbow trout, there has been a less striking shift, albeit in same direction, from most rainbow trout (70%) being released as 'undersized' in 2002-2004, to most (52%) released for 'sport-fishing' reasons during 2008-2009.

Table 4. Catch estimates for sub-set of access-points comparable with previous creel surveys (Brown and Gason 2007), along the Goulburn River during three recent fishing seasons

	2008–2009 Season		2003–2004 Season		2002–2004 Season	
Species	**Catch (±se)**	**Harvest (±se)**	**Catch (±se)**	**Harvest (±se)**	**Catch (±se)**	**Harvest (±se)**
Brown trout	366 (105)	42 (60)	759 (180)	300 (136)	371 (160)	182 (212)
Rainbow trout	1,034 (398)	174 (39)	1,985 (158)	693 (122)	2,193 (245)	884 (173)
Redfin	418 (222)	5 (8)	51 (19)	18 (28)	119 (263)	102 (279)

Angling success factors

Throughout the study, dissolved oxygen concentration at Eildon remained between 6 and 11 mg/L; river temperatures were observed between 10.7 and 20.9 °C; and flows were observed between 130 and 8600 ML/d. Measures of angling success (catch-rate and harvest rate) were not significantly correlated directly with river temperature, river flow, or dissolved oxygen content of the Goulburn River.

For both trout species, the highest catch-rates were observed around the optimal physiological temperature for growth at 13–14 °C. For brown trout on the Goulburn River, non-zero catch rates were observed during interviews when river temperature (n=152) was f 12.2 and 18.3 °C at Eildon, and river flows (n=191) were between 500 and 8600 ML/d; zero catch-rates were observed outside this range.

During the same interview sessions, non-zero catch-rates were observed for rainbow trout on the Goulburn River during interviews when flows were 500–8600 ML/d, and river temperatures were 13.1–20 °C.

The best average catch rates for rainbow trout were observed at Gilmore's Bridge (access-point 6) on the Goulburn River, and Tumbling Waters Reserve (access-point 18) on the Rubicon River. The best average catch rates for brown trout were at Thornton Bridge (access-point 7) on the Goulburn River and at Tumbling Waters Reserve on the Rubicon River (apart from a single high value for an interview at the Acheron confluence)(access-point 14).

Of the 361 anglers who identified their main method of fishing, 48% were bait fishing, 30% were fly-fishing and 22% were lure fishing. This is a significant increase in the proportion of fly fishers and decrease in the number of bait fishers compared to the 20% and 61% observed, respectively, during 2002–2004 ($Z=3.84, p<0.05$).

Catch and harvest rates were highly variable across all methods and there were no significant differences in catch rates or harvest rates between anglers using bait, flies or lures as their main method.

The fishers

Species preferences: The fish that anglers prefer to catch

Of the 188 anglers that expressed a preference, 72% preferred to catch brown trout, 21% preferred rainbow trout, and 5% preferred redfin in the mid-Goulburn River fishery. This represents a statistically significant preference for brown trout over rainbow trout using a normal approximation to a binomial test on preference for one of the two trout species (99% confidence). Of those that preferred brown or rainbow trout, 72% said that their third preference was redfin.

For the more avid anglers (n=16), 88% preferred to catch brown trout while 12% preferred rainbow trout.

Motivation of Anglers

Why Anglers Choose to Fish

Of the 192 anglers who responded to the question about their general motivation to go recreational fishing, 187 of them identified their most important motivator by rating a single one of the nine listed reasons as "extremely important" to their motivation. The top three reasons were, *to relax and unwind* (38%), *to enjoy the sport of catching fish* (18%), and *to be outdoors* (16%). These three responses were rated as extremely important to interviewee's motivation to go fishing by 67%, 66% and 70% of all the respondents, respectively (Figure 2). The motivation, *to compete in fishing competitions,* was regarded as "totally unimportant" by the majority of respondents (72%). The range of responses showed no strong motivation either way for the driver, *to catch fresh fish for food*, which was rated as "totally unimportant" and "extremely important" by similar proportions of respondents. There was a moderate trend to value companionship-drivers such as, *spend time with family*, or *spend time with others,* or *to be on my own, away from crowds.* This trend was stronger for attributes related to solitude than for attributes related to sharing time with friends or others.

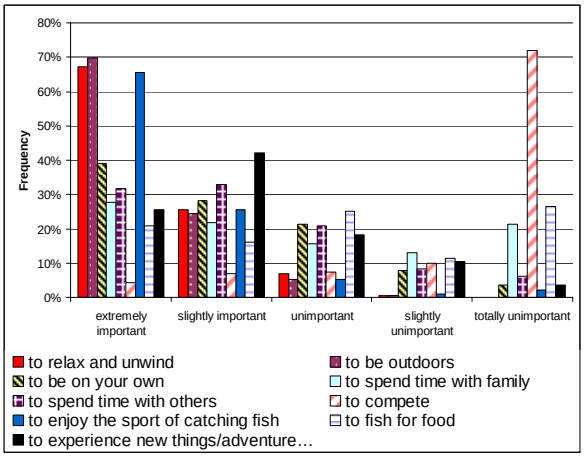

Figure 2. Frequency of responses to question about the importance of a range of 'reasons why you go fishing' (n=192).

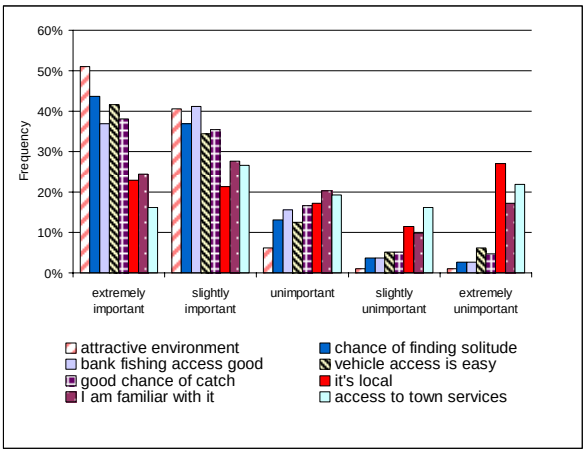

Figure 3. Frequency of responses to question about the importance of a range of 'reasons why you go fishing in the Goulburn River' (n=192).

Of the 16 respondents identified as the most avid category (i.e. 'active'), over half (58%) nominated *to enjoy the sport of catching fish*, as their most important motivator; 13% responded that *to be outdoors* and *to relax and unwind* as their primary motivations for fishing. These three responses were rated as "extremely important" by 81%, 50% and 44% of 'active' anglers respectively.

Why Anglers Choose to Fish the mid-Goulburn River

One hundred and ninety two anglers responded to a question about what is important in motivating them specifically to fish the mid-Goulburn River trout fishery. The majority regarded statements about *an attractive environment, a good chance of finding solitude, good vehicle access, good bank fishing access* and *a good chance of catching* their preferred species, as important in motivating them to fish this particular fishery. The statements about the fishery being *local*, *familiar* or having *access to town services* were not rated as strong motivational factors (Figure 3) by the respondents.

Of the 16 respondents identified as the most avid category (i.e. 'active'), *good bank fishing access* was seen as "extremely important" by only 13% (although 56% rated it as "slightly important"); 44% of these specialists rated, *I am familiar with it,* as "extremely important" and 38% thought *an attractive environment, easy vehicle access, good chance of catching fish,* and *it is local*, were "extremely important" factors in their choice to fish the Goulburn River.

Angler Satisfaction

Interviewees were asked to rate their satisfaction with "the overall quality of the fishing they had done today" on a five-point scale. Overall, 191 responses were obtained, including the response of *unsure* (23%). Just over half these respondents showed a level of satisfaction as either, *very satisfied* (30%), or *quite satisfied* (31%); and 16% reported that they were unsatisfied. Of the 16 most avid anglers interviewed, satisfaction was higher with 69% satisfied to some level, and only 6% reporting dissatisfaction. However, non-response rate was high amongst this group with 25% "unsure").

Relatively few respondents were able to supply reasons or contributing factors to support their level of satisfaction (n=35). Of these, five reported that they were satisfied because they caught a fish and/or it was a "peaceful day". Of those unsatisfied anglers (n=30), the majority cited reasons connected with not catching any/many fish. However, very few (n=3) cited insufficient fish stocks as their perceived reason for their lack of catch, and hence for their lack of satisfaction. Their perceived contributing factors ranged widely from weather related reasons, their own inexperience, the wrong tackle being used or lack of skill, the water-level being wrong, the fish "just not biting", or due to overfishing or overcrowding with fishers.

Interviewees were also asked to rate their satisfaction with their "fishing in the Goulburn River over the last 12-months" on a similar five-point scale. Of the 188 responses obtained, 22%

were *unsure*. The majority of respondents were *very satisfied* (28%) or *quite satisfied* (39%), while only 10% were unsatisfied. Again satisfaction levels amongst the group of avid anglers (n=16) were higher with 93% reporting that they were either *very satisfied* or *quite satisfied*.

For the 24 respondents who supplied reasons for their satisfaction rating, most were again connected to the ability or inability to catch fish. However, perceptions were often related to other factors other than fish abundance, such as the drought, water levels, angler inexperience, etc.. Only three respondents perceived that low fish stocks were the cause of their satisfaction, and two of these linked this to over-fishing by "too many anglers".

Where Anglers Fish on the mid-Goulburn River Trout Fishery

Anglers were presented with a list of eighteen fishing access points and asked to list which ones they had visited in the preceding 12-months. The frequency distribution of sites visited is presented in Figure 4 for 192 respondents (NB. multiple choices were allowed). The access points that most respondents had visited included three of the Goulburn River bridges (Breakaway, Thornton and Gilmores), the Rubicon River's Tumbling Waters Reserve and the Rubicon road site upstream of the Rubicon road bridge.

These choices mirrored those of the 76 anglers who nominated a 'favourite' access-point, with the Breakaway Bridge, Gilmores Bridge, Thornton Bridge and Rubicon Road rating as the preferred access-point for 53% of respondents.

The avid angler group showed similar access-point choices except that the Maroondah Highway Bridge, McMartins Road and the Back Eildon Road were visited with relatively increased frequency.

Previous on-site creel surveys did not canvas where else anglers had fished or their preferred access point, but reported the frequency distributions of interviews and rate of interviews obtained across all the access points (Brown and Gason 2007). Data from the present study shows that the preferred access point of anglers, and the access-point at which they were interviewed, are highly correlated (*c=0.85*) so reasonable comparisons can be drawn between the previous distribution of interviews from 2002–2004 and the preferred access in the present study.

Ten anglers nominated preferred access points other than those listed as options. These included, "Blue gums" (n=5), "deer farm" (n=1), "Snobs Creek" (n=2) and "Rubicon power station" (n=2).

Access-Point Preference

Interviewees were asked to classify their agreement/ disagreement with a series of twelve statements about why they preferred their nominated 'favourite' access-point. Strong reasons for preference were noted by respondents who "strongly agreed" or "agreed" that their preferred access-point was their favourite because:

1. *The river there suits my preferred fishing method* (93%)
2. *aesthetically pleasing* (88%)
3. *plenty of room for all to fish together* (88%)
4. *prospects of catching a fish are good* (85%)
5. *it was easy to get to the water (no physical barriers, etc)* (83%)
6. *lots of the river is accessible from that point* (80%)
7. they *don't have to walk far* (63%)
8. there is *plenty of safe car parking* (63%)
9. it was *away from other people* (56%)
10. *the exotic trees (willows) have been removed* (40%).

A greater or equal proportion of respondents "disagreed" or "strongly disagreed" that their favourite site was preferred because:

- they *could launch a boat there* (83%)
- of *the habitat improvement works in the river* (41%)
- *the exotic trees (willows) have been removed* (40%).

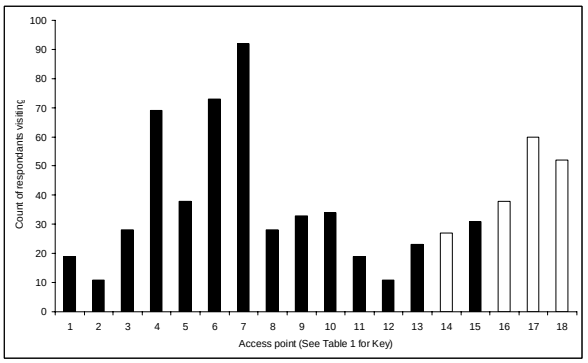

Figure 4. Frequency of visitation for each of the eighteen access points along the Goulburn (solid bars), Rubicon and Acheron rivers (open bars) within the mid-Goulburn trout fishery. (n=192 respondents). See Table 1 for access-point key.

Among the group of avid anglers, the pattern was similar. There was stronger agreement that their choice of preferred access point was influenced by *prospects of catching a fish*, *safe car parking,* and *the removal of exotic trees* (i.e. willows); there was stronger disagreement with the statement about it being *away from other people*, and *plenty of room for all to fish together*.

Responses obtained from 191 anglers show that 60% of anglers had walked up to 100 m and 30% had walked up to 500 m from their vehicle access point to fish (Figure 5). No anglers had walked

more than 5 km when interviewed. Responses obtained from 16 avid anglers showed willingness to walk further, 70% had walked up to 100 m while 50% had walked up to 500 m from their vehicle access point to fish.

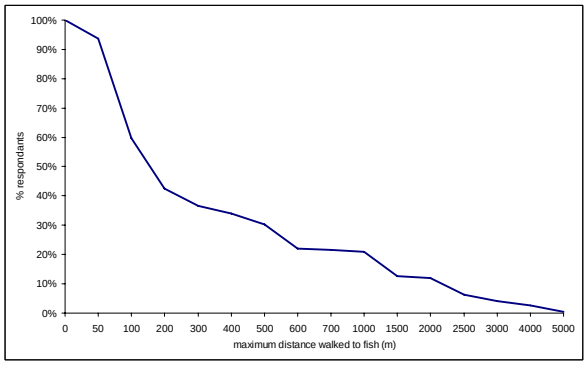

Figure 5. Cumulative proportion of maximum distance walked to fish (n=191)

Most respondents (n=191), initially fished the access-point at which they were interviewed after being *told about it or shown it by others* (45%), or *reading about it or hearing about it in the media* (48%). Few had *located it on a map* (3%), or had *seen it while passing* (4%).

Reasons for Visiting the mid-Goulburn Fishery: More than just fishing…

From the 188 respondents asked in the long interview "if their visit involved an overnight stay", 48% (n=81) reported that it did. Fishing was the primary reason to visit for many of these overnight visitors as 40% of them (n=32) reported not taking part in any other tourism based activities during the visit. Overall, 25% of respondents did report taking part in a range of other tourism related activities during their visit. These included:

- sight seeing (n=15)
- walking (11)
- cafes, drinking and dining (9)
- shopping (6)
- swimming (4)
- hunting and shooting (2)
- 4x4 driving (2)
- art show (2)
- boating (2)
- horse riding (2)
- markets (2)
- motor bike riding (2)
- water-skiing (2)
- snobs creek (DPI -FWDC)(2)
- canoeing, wineries, golf, motorbike show, nature, photography, running, fly-fishing centre, tourist drive, tractor-pull, tramway museum, visit Eildon pondage, trout farm, and wineries (1 each).

Awareness of Fisheries and Catchment Management Programs

A random sample of anglers was asked about their awareness of two programs run by Fisheries Victoria and the Goulburn-Broken Catchment Management Authority.

'Go Fishing in Victoria'

From 192 respondents, 26% (n=50), claimed to be "very aware" or "quite aware" of the *Go Fishing in Victoria* initiative (GFIV); while 71% were "not very aware," or "not at all aware" of the program; 3 % were "unsure".

Those anglers who reported some awareness of the GFIV initiative were asked to comment upon *what they knew about it*. Responses were obtained from 47 of these 50 anglers and were categorised into responses linked to three key components of the GFIV initiative, as described on the program's website; i.e., Family Fishing Lakes (including Premier Lakes), Premier Rivers and Family Fishing Events, or into an 'other' category. Responses were hard to categorise precisely and there seemed to be some mixing of awareness of 'Family Fishing Lakes' and 'Family Fishing Events'. If these categories are combined, there are indications that 51% of GFIV aware-respondents knew that the program was about Family Fishing-Lakes and/or Family Fishing Events. Many of these respondents cited "kids fishing" within their explanation. Only 5% of respondents indicated any awareness of the Premier Rivers program. A variety of other issues were described by 44% of the respondents as connected with the GFIV program. These ranged from compliance issues such as checking for RFL ownership, to funding facilities at access points and putting up signage and paying for advertising. While around half of the respondents who claimed to be aware of the GFIV initiative demonstrated this awareness, there was some evidence that respondents were confused between the GFIV initiative, the related RFL-funded access improvements program run

by the GB CMA, and general Fisheries Victoria programs and activities.

There were 68 responses to the question about 'where did you get your information about the GFIV program'. Of the options given, most respondents (20%) nominated *the internet*, then *friends/family & colleagues* (13%), with 10% naming *radio* and *newspapers*, followed by 7% naming *TV* as a source of their information. Almost 40% chose the 'other' category without naming an alternative.

'GB CMA River Health Enhancement Works'

From 183 respondents, 39% (n=71) claimed to be "very aware" or "quite aware" or the Goulburn-Broken Catchment Management Authority's river health enhancement and angler access program (RHEAA). The remainder were "not very aware" (23%), or "not at all aware" (37%), with 1% "unsure".

Those respondents who claimed some awareness (n=71) were asked to describe *what they knew, or had seen and observed*. Verbal responses were categorised by the interviewer on-site by checking boxes against the categories in Table 5. "Other" activities perceived by three individuals as part of this program included production of the 'fishing guide (book, *sic*)', fishing-platforms, and 'surveys'.

Table 5. Proportions of the respondents who were aware of GB CMA RHEAA programs (n=71) citing knowledge of the range of activities within that program.

Activities	% 'true' responses
Exotic vegetation (willow) control	75%
Stiles/access-points	48%
In-stream habitat (e.g. groynes, boulder fields, LUNKERs, etc)	46%
Revegetation	28%
Rock-beaching	25%
Stock exclusion fencing	23%
Signage	14%

The majority of respondents claiming some awareness of the program had gained their information from *observing and fishing at sites* (52%). Hearing about the program from *friends, family and colleagues* (13%) and the internet (10%) were also important information sources. The site signage reported as less important in raising awareness (6%), as was traditional media such as TV, newspapers and radio (6%). Two percent of respondents were "unsure" and 11% reported "other" information sources (unrecorded).

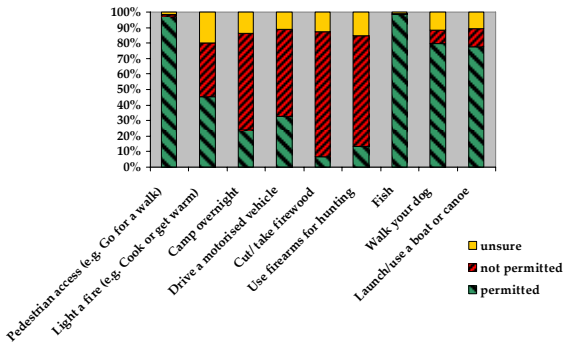

Figure 6. Respondents perceptions about what activities are "permitted" or "not permitted" on Crown land along the mid-Goulburn River trout fishery (n=186)

Awareness of Anglers about Site Management Activities

Out of 188 respondents to the long-form, only 24% (n=45) were *aware of any changes to public access, facilities or the local environment* at the site at which they were fishing. A quarter of the comments related to access improvements such as gates, stiles and walking tracks (25%), 16% related to willow management activity, 11% referred to revegetation, 11% to additional signage, 5% to improved car-parking, 4% to stock fencing, in-stream boulder fields and habitat restoration, and 2% referred to rock-groynes in the river.

A minority of comments (17% in total) related to reduced access (McMartins Lane), overgrown vegetation, and issues such as reduced flows, increased litter and changes to playground equipment (i.e. at Tumbling Waters Reserve). The angler access-points where the five highest proportion of respondents had noticed changes were: Back Eildon Road (50%); McMartins Lane (44%); Rubicon Road (43%); Thornton Bridge (41%); and Breakaway Bridge (29%). At Brookes cutting reserve, Point Hill-2, downstream of Eildon Pondage (both sides of river) and at the S-bends Reserve, none of the anglers interviewed (n=27) were aware of any changes despite extensive works at all of these sites (NB: full GB CMA signage was not erected until mid-way through this survey at most sites).

Awareness of Anglers About Crown-Lands
From 186 respondents who were not the owner or leaseholders of the land they were interviewed on, 75% were aware that *not all land along the river banks is Crown Land (public land) and that some is freehold (private) land*.

Additionally, 84% knew that *they had to seek the landowner's permission before accessing this freehold land*.

Interviewees were questioned on their perceptions of what other activities were legally allowed on Crown Lands, such as the site they were interviewed on, without first seeking further permission (Figure 6). Almost all respondents thought that pedestrian access (97%) and fishing (98%) was permitted. Most thought that they could walk a dog (80%), or launch and use a boat (77%). Most thought that using firearms for hunting was not-allowed (72%) and that they could not legally cut or take firewood (81%). There was less consensus among respondents on whether they were *permitted to drive a motorised vehicle* on Crown Land, permitted to *camp overnight,* or *light a fire to cook or keep warm*. Apart from the statements about pedestrian access or fishing, all other options instigated an 'unsure' response ranging from 11–20% of interviewees suggesting a reasonable level of uncertainty from a significant portion of the resource users (*Z=14 to 11, p<0.01)*.

Preferences of Recreational Fishers for Investment from Recreational Fishing Licence Trust Fund

All those interviewed with the long-form were asked to comment on *what they would like to see their fishing licence monies spent.*

Many respondents gave several answers; 353 ideas were provided by these 186 randomly sampled individual anglers. The list of ideas was analysed for commonalities amongst responses and grouped into the following eight categories as a result: stocking, river restoration, angler-access improvements, facilities, fisheries management (including enforcement), information, fisheries research and fisheries promotion (Appendix 1). Each of these categories was also subdivided according to the main themes provided. A frequency table of all of these responses is provided in Appendix 1. In summary, stocking was the most popular response (29%). Although it was mainly unspecified as to what species to stock or where to put them, a reasonable interpretation would be that the unspecified 'stocking' related to stocking trout (the preferred target species) into the Goulburn River fishery. Other respondents within this category did specify that they meant 'trout in rivers', or 'native fish' etc. and this detail is supplied in Appendix 1.

The next most common response was 'river restoration' (21%) with sub-categories for various forms of invasive species management (e.g. carp, willows, blackberries), and in-stream and riparian rehabilitation works.

'Angling-access improvements,' was the next major category (17%). Again, detail was often unspecified; however, some specific sub-categories were defined including access-information (e.g. maps, pamphlets, online maps etc), disabled access, and 'buying back private riparian lands'.

Suggestions for improvements to 'facilities' of various kinds were relatively common (11% of responses). A major subcategory included here was a request for provision of litterbins and a collection service at angling access-points. Improvements to boat ramps and provision of toilet facilities were also popular suggestions within this category.

Provision of information, education and advice (including in LOTE[3]) along with improvements to signage were requested although less popular (6%). Fisheries research was mentioned by a minority of respondents (3%) along with Fisheries and Tourism promotional activities (1%).

[3] LOTE=languages other than English

Discussion

The State of the Fishery:

Angler Effort

The estimate of the amount of fishing effort on the Goulburn River in 2008/09 is comparable to previous creel survey in 2003-04 although lower than 2002-03. Such surveys do not truly identify whether participation rate has changed (for instance, similar estimates of total fishing-effort could be attained by more anglers making fewer trips; or fewer anglers making more frequent trips). However, the similarity in avidity data (i.e. frequency of use) suggests that the visitation profile and therefore the participation-rate, has probably changed little over the three creel surveys to-date (i.e. 2008-09, 2003-04 and 2002-03).

Fish size

The quality of harvested fish continues to improve as the mean size of a random sample of brown and rainbow trout kept by anglers was larger in the present study than in 2003-04 which was in-turn an increase from 2002-03 (Brown and Gason 2007). For brown trout, this is consistent with the trend for an increasing proportion of trout at quality size (i.e. >350 mm, TL) in winter electrofishing samples of the population up to 2004 (Brown 2008).

Without consistent population samples from the intervening five-year period, we can only speculate that such shift in size structure could be due to biological or anthropogenic[4] reasons. Biological reasons could be better growth (Brown 2004), or a dominant year-class of fish surviving and progressing though the population (Brown 2008). Anthropogenic reasons could be accidental releases of larger rainbow trout from commercial hatcheries or maybe downstream 'leakage' from stock-enhancement activities with larger brown and/or rainbow trout from the Eildon Pondage.

The Catch and Harvest

Catch and harvest estimates for brown trout and rainbow trout are lower than previous ones made for two consecutive fishing seasons five years ago. However, given the breadth of the confidence intervals around these estimates, and the survey-intensity applied during these creel surveys, only the harvest of rainbow trout could be said to have declined with some statistical certainty.

While catch estimates have not been made in this study for the Rubicon River sites in isolation, the catch from the 'new' sites examined during the present study must have been substantial, as is shown by the differences between Table 3 and Table 4. Most of this catch probably came from the Rubicon River sites. In 2001 and 2002, Douglas (2005) estimated brown trout catches of over 1800 and 500 fish, along with catches of 73 and 232 rainbow trout, respectively, from a comparable (if slightly larger) reach of this productive tributary stream. This study's figures for both species look similar to previous estimates.

The release rates for both trout species and redfin remain very high. The reason given for release is now more often for ethical or 'sportfishing' reasons than because of size, as was reported in previous surveys (Brown and Gason 2007). There is no legal minimum size limit regulation for trout in Victoria. Few anglers (<2%) reported reaching the legal daily bag limit of five trout in this fishery. It is impossible to quantify the incidence of ethical release standards in this fishery by separating out the 'voluntary release' (i.e. release of fish that are a legally harvestable size) from the 'regulated release'. While such a change in reasoning behind releasing trout in the Goulburn River could be interpreted as a shift in ethical standards towards 'catch-and-release' over the intervening 5 years it also may simply reflect the (also) reported increase in size of more of the catch. Anglers who have predetermined to release all of their catch can logically justify releasing relatively large fish on 'sportfishing' grounds; whereas, anglers catching relatively small fish, are more likely to use size to justify the fishes release. So while the true ethical justification of releasing caught fish remains unknown amongst Goulburn River anglers its popularity is likely to be an important aspect of the fisheries sustainability.

Anglers caught trout throughout the season across a wide range of flows and river temperatures. On average, anglers caught trout at similar rates unrelated to their main fishing method (i.e. bait, fly or lure). Not surprisingly,

[4] Anthropogenic = caused by humans

there was some evidence for catch rates to be linked to physiological conditions for feeding in trout. High catch rates were observed at optimal feeding temperatures and zero catch-rates when river temperature exceeded the reported maximum feeding temperature for trout (19-20 °C) (McMichael and Kaya 1991; Ojanguren *et al.* 2001). While anglers would be wise to use river temperature as a guide (perhaps prioritising their fishing activities during periods when the river runs at 13-14 °C), they should also realise that catches were reported throughout a broad range of conditions and that these observations are simply a sample broadly representing the strong trends in fishery.

Golden perch are recorded for the first time in a creel survey of the mid-Goulburn River, by the capture of a single specimen at Point Hill Reserve, although the identification was unconfirmed as the fish was released prior to interview. Golden perch are a frequent capture further downstream on the Goulburn River and upstream of the survey reach within Lake Eildon.

The Human Dimension

Angler Satisfaction: Its not only about catching fish

Angler satisfaction levels reported in the present study may be higher than in previous creel surveys on the Goulburn (Brown and Gason 2007), or the Rubicon River (Douglas 2005). However, this interpretation is clouded by slight methodological differences in each survey. The question varied little in construction across all studies. Interviewers tried to focus the participants clearly on the quality of the fishing (Douglas 2005; Brown and Gason 2007). However, the present study uses a four-point scale, reduced from a five-point scale; the optional answers to the question in the earlier studies were phrased differently in terms about the 'intensity of fishing' (i.e. best-ever, fast, ok, slow or dead). The current methodology, specified in project development by Fisheries Victoria to match other projects commissioned around the state, simply asks them to rate satisfaction across a scale from 'very satisfied' to 'not-at-all satisfied' and may have encouraged broader evaluations of satisfaction, other than the fishing *per se*. This is supported by the answers to the follow up question about what were the factors contributing to this satisfaction level, and the perceived causes of those factors.

Natural resource managers (NRM) are increasingly being asked to manage for satisfaction of the resource-users as well as for resource security and sustainability. NRM decisions about the Goulburn River fishery should therefore be partly based on information about these current satisfaction levels within the community of fishers and factors that influence these satisfaction levels within the NRM sphere of influence.

Motivations and Expectations of Anglers

Most anglers that fished the mid-Goulburn River did so because they enjoyed relaxing, catching fish and being outdoors. The satisfaction achieved by anglers has been described as being driven by several 'motivational dimensions', including catching fish, relaxation, excitement, socializing and experiencing nature (Sutton 2007). Individual anglers can be influenced by any, or all, of these dimensions to varying degrees. The attitudes and behaviours of anglers clearly show that there is segmentation into specialization sub-groups (Hahn 1991); some driven by resource related goals such as catch rate and fish quality; some driven by environmental, socializing and aesthetic goals. Frequency of fishing, or angler avidity, is shown to be a factor that discriminates strongly amongst specialisation groups of anglers (Chipman and Helfrich 1988; Hahn 1991). Hahn (1991), recommends the following strategy for NRM,

> *"When confronted with conflicting user expectations, they should provide the limited experiences specialists require and direct less specialized participants to alternative resources that will meet their more general expectations. The result will be greater aggregate user satisfaction and less user conflict."*

It is apparent that competing factors are present in Goulburn River anglers surveyed within the present study. While some are driven by expectations of solitude and aesthetic beauty, others are more concerned with safe vehicle parking and easy bank-access. The more avid, specialist anglers are more strongly motivated by prospects of catching fish of their preferred species (predominantly brown trout), and less inspired by prospects of increasing popularity of their fishery.

Across all levels of avidity and specialisation, Goulburn River anglers motivated by resource related satisfaction /dissatisfaction blame low catches on a range of reasons – although surprisingly, not often on low fish numbers. This is an important consideration for managing the expectations for these anglers. For such anglers, increasing stocks either by stock-enhancement or by management of natural stocks, may not lead to increased angler-satisfaction. If their own perceptions of why their catch rates are low are true, the obstacles to increased catch rate are often unrelated to fish abundance, and often include resource-sharing issues.

Angler-Access Issues

Management strategies based on popularising the fishery and enabling easier access to already popular sites are unlikely to increase the satisfaction of anglers seeking peaceful solitude, or those concerned about resource sharing. To meet the expectation of these anglers NRM should strive to maximise the chance of catching the main preferred species, brown trout, while minimising factors that erode the aesthetic beauty and social-solitude aspects of the fishing experience.

Perceptions of overfishing are already prevalent amongst some Goulburn River anglers; "too many anglers" and "overcrowding" were cited as reasons for dissatisfaction. The levels of public access to this resource that are judged (by users or by NRM) as 'optimal' for social reasons (e.g. recreational satisfaction) are different and somewhat contradictory to those for 'economic' reasons (e.g. local economy). The challenge for NRM is to manage resource access to achieve a maximum net benefit that also allows for biological sustainability in the fishery.

The popularity of sites on the Rubicon River, a much smaller stream, rivals that of some of the Goulburn River's most frequented locations. This suggests that the potential for dissatisfaction due to perceptions of crowding may be relatively higher on this tributary.

The access point at Mc Martins Lane has become relatively less popular for all except the most avid anglers since 2002-04 (Brown and Gason 2007). The shift away from this site is perhaps to be expected since the removal of vehicle access from along the riverbank. The data shows that the majority of anglers will not walk far from their vehicle, and that avid anglers are prepared to walk further.

The similar shift away from Maroondah Highway Bridge is harder to rationalise. This site has the same vehicle access, boat ramp and similar pedestrian access as during the previous survey. Increased ease of access at a range of other Goulburn River sites may have played a part along with changes in behaviour of boating anglers such as increased participation in other nearby fisheries (e.g. Lake Eildon).

One strategy to improve access and positively influence satisfaction should be to increase the number of access points. Adding new access points every few hundred metres along the length of the river, could spread out the effort creating less crowded conditions and increasing satisfaction for those anglers dependant upon solitude.

Motivations for choice of fishing-site

The reasons why people like to fish generally were a good match with reasons why people choose to fish the Goulburn River. When it comes to deciding where on the Goulburn River to fish, anglers chose an access point based on whether it will suit their chosen method (not the other way around). Therefore, sites with a range of characteristics will be important. The increase in popularity of fly-fishing may be due to the uncharacteristic low river levels in recent seasons, making more sites suitable for wade-based fishing for more of the time. In addition, recent riparian and in-stream management may have altered the characteristics of a range of access points to increase their suitability for fly-fishing. River management practices such as removing willow thickets, seeding tail-outs of pools with boulder fields and creating back-water-eddies behind rock flow-deflectors, all impact on trout habitat. While these changes increase the accessibility of trout habitat to all fishing methods, they can enable or simplify fly-fishing access where previously the habitat better suited bait or lure fishing.

Aesthetics and ease of access are an important consideration for many in site choice. Willow removal is not seen as a strong driver of site choice, perhaps because few anglers were aware that such activities had occurred at many sites. Anglers' understanding of the role willow removal plays in opening up bank-fishing access may be poor. In the present study, anglers who were unaware of willow-removal activity where they fished often cited ease of access to the water, and amount of river accessible as reasons why sites were preferred.

Anglers' impacts on local tourism

One in four anglers reported taking part in other local tourism related activities while visiting during 2008–09. This suggests that the river fishery still played a significant part in local economic activity, despite a likely impact on this by the bush-fire emergency mid-way through this study period.

A previous creel survey estimated that Goulburn River anglers required the equivalent of 3000 nights of accommodation[5] and that fishing related activities had a direct expenditure of over $400,000 during the 2003–04 season (Brown and Gason 2008). Unfortunately, we have no information about whether this has changed since the 2009 bushfires.

Angler Awareness of Natural Resource Management Programs

Unprompted awareness of the two management programs seemed low although more were aware of the GB CMA's river health/enhancement works, than the GFIV initiative. This level of awareness of the GB CMA's river health /enhancement works program is similar to awareness in an East Gippsland survey of recent river a management activity at 40%, and of weed control activities at 41% that were among the highest across a Victoria wide survey cited in EGCMA (2005).

Perhaps the contrast in awareness levels is to be expected prior to the launch of the GFIV Premier Rivers promotion of the Goulburn River and considering the longer time span that anglers have been exposed to the GB CMA initiative. Nevertheless, this study forms a benchmark for future evaluation after the GFIV promotional program of the Goulburn River as a 'Premier River' commences in 2010.

Of those that claimed unprompted awareness of GFIV, only half were clearly able to demonstrate it. Confusion between programs highlights the need for clear 'branding' if FV and GB CMA respectively are to gain full benefit of future promotion. Alternatively, increased clarity amongst stakeholders may be more easily achieved by combining the programs and their promotion.

The internet, word-of-mouth and traditional media were seen as the most important info source for GFIV information. The 'other' category may have been sources of information such as local traders (e.g. tackle shops and fishing guides who did not fit into the 'friends and colleagues' category.

Over half the anglers responded that they had learned about the GB CMA work through observing it themselves. However, less than 25% were aware of any changes at the site they were being interviewed. This may be interpreted as some sites being more obviously modified and thus creating a general awareness level; whereas, other sites, where many anglers were interviewed, modifications may be less obvious. Bias in responses to questions about their awareness of any changes at their present location may also have resulted from the order of questions, inflating the stated awareness level. With hindsight, this question should have perhaps preceded the one asking about the range of activities within the GB CMA program.

Angler Awareness of Recreational Rights and Responsibilities on Water Frontages

Awareness of the concepts of 'Crown Land' and 'freehold land' was high, although many were unsure about what activities were allowed on Crown Land. Most were clear about pedestrian access, or fishing; however, uncertainty was widespread about permission for fires to cook or keep warm, firewood collection, driving a motorised vehicle or walking a dog. Most people were unaware of their right to hunt on Crown Land river frontage (i.e. duck hunting when permitted[6]), although this question may not have been specific enough to elicit a true response (i.e. specific about 'duck hunting').

The present study has identified an opportunity to reduce uncertainty and increase awareness of people's rights and responsibilities for recreation on Crown Land water frontages, by providing educational material about popular activities such as using campfires, camping, collecting firewood, dog-walking and hunting in a package that is targeted towards the recreational angler.

[5] For example, 300 rooms for 10 nights, or 30 rooms for 100 nights, etc.

[6] Game duck (only during the open season) may be hunted, but only with the permission of the lessee on leased crown land, or the licensee if the land is licensed under the Land Act 1958 (www.dse.vic.gov.au)

Anglers Investment Preferences for Recreational Fishing Licence Funds

Angler preferences for the investment of recreational fishing licence (RFL) funds are listed in Appendix 1 under broad heading themes.

Certain themes for funding have traditionally been popular to date and these are still represented in the anglers 'wish-list' for investment of revenue generated by his or her RFL fee. However, it was 'stocking' in its various forms that headed the list. While stock-enhancement has rarely been funded directly in recent years directly from RFL –$212k in 2006–07, (DPI 2006), it has been an integral part of a range of research projects funded by RFL. Anglers may be unaware of the role that such 'research stocking' has played in RFL funded fisheries management (e.g. Kerang Lakes, Coliban water storages)(DPI 2007; 2008).

More traditionally funded themes such as river restoration were almost as popular incorporating willow management and in-stream and riparian habitat works. Angler-access improvements were less commonly suggested, but still put forward by almost 1-in-6 participants. This included a strong sub-theme about information requirements in various forms

Revenue allocation ideas also incorporated themes not traditionally seen as funding targets such as, improvements to litter-management facilities and programs, improvements to boat-ramps and a riparian-lands buy-back scheme. Litter, was seen as a problem by many respondents. Litter management is outside the jurisdiction of Fisheries Victoria and catchment management agencies. However, there is a clear link between litter management and the satisfaction of many anglers motivated by the aesthetic qualities of the outdoor experience. Natural resource managers promoting increased access and resource use should consider how this problem is to be tackled. The present study suggests that a significant proportion of anglers on the Goulburn River would like to see their RFL revenue used to address this issue.

Summary and Conclusions

The present study describes the state of the Goulburn River trout fishery, during the 2008/09 trout fishing season and comparisons are drawn with previous research where possible.

The amount of fishing effort on the Goulburn River in 2008/09 is similar to previous creel survey in 2003-04 although lower than 2002-03. The fishing effort and participation-rate, has probably changed little over the three comparable surveys to-date (i.e. 2008-09, 2003-04 and 2002-03). The quality (i.e. size) of harvested trout continues a trend of improvement. Catch and harvest estimates for brown trout and rainbow trout are lower than previous ones made for two consecutive fishing seasons five years ago.

The present research provides information on factors that motivate anglers to fish the Goulburn River trout fishery and what drives their satisfaction.

Angler satisfaction levels reported in the present study have improved since previous estimates on the Goulburn River (Brown and Gason 2007), or the Rubicon River (Douglas 2005).

A range of factors acts as motivational drivers amongst Goulburn River anglers. Most anglers that fished the mid-Goulburn River did so because they enjoyed relaxing, catching fish and being outdoors. While some are driven by expectations of solitude and aesthetic beauty, others are more concerned with parking and easy bank-access and some are motivated by resource related issues (e.g. catch-rates). The more avid, specialist anglers are more strongly motivated by prospects of catching fish of their preferred species (predominantly brown trout), and less inspired by prospects of increasing the popularity of their fishery.

For those anglers whose satisfaction is related to their catch, low-catches are blamed on a range of reasons – although surprisingly, not often on low fish numbers. This is an important consideration for managing the expectations for these anglers. For such anglers, increasing stocks either by stock-enhancement or by management of natural stocks, may not lead to increased angler-satisfaction. Such anglers often perceived that obstacles to increasing their catch rate were unrelated to fish abundance, and often include resource-sharing issues, poor knowledge of the fishery or their own skill-level.

Management strategies based on popularising the fishery and enabling easier access to already popular sites are unlikely to increase the satisfaction of a significant proportion of anglers seeking satisfaction through peaceful solitude, or of those concerned about resource sharing. Perceptions of overfishing are already prevalent amongst some Goulburn River anglers, "too many anglers" and "overcrowding" were cited as reasons for dissatisfaction.

The challenge for natural resource managers is to manage access to the fishery to achieve a maximum net satisfaction-benefit that also allows for biological sustainability in the fishery.

Results suggest that one strategy to improve access and positively influence satisfaction should be to increase the number of access points. Adding new access points every few hundred metres along the length of the river, could spread out the effort creating less crowded conditions and increasing satisfaction for those anglers dependant upon solitude. However, over-promotion of this increasing access to encourage greater participation should be avoided to prevent a amplifying of the 'overcrowding' issue identified by anglers in this study.

The current study investigated the motivations of anglers for choosing a fishing-site to evaluate the effectiveness of a recent program of improvements to fishing access and river habitat and inform the process of optimising the design of any similar works in the future.

Anglers are motivated to choose an access point (i.e. fishing site) based on whether it will suit their chosen method (not the other way around). Therefore, to cater for the range of preferred fishing methods sites at locations with a range of physical (riverine) characteristics will be important. To cater for a range of non catch-related or aesthetic-motivated fishers, sites are required with a range of access developments– from formal (e.g. car-park, fishing platform, defined gates, paths and signage etc), to informal (e.g. simple fence-crossing point and riparian vegetation management).

Awareness of DPI's relatively newly established *Go Fishing In Victoria* (GFIV) initiative was low during the 2008/09 fishing season on the Goulburn River. However, the well-established program of river health enhancement work implemented by the Goulburn Broken Catchment Management Authority (GB CMA) was widely known amongst the anglers interviewed.

Confusion amongst anglers between the two programs highlights the need for clear 'branding' if DPI and GB CMA respectively are to gain full benefit of future promotion. Alternatively, increased clarity amongst stakeholders may be more easily achieved by combining the programs and their promotion.

Although the GB CMA program has been strongly focussed on willow-management and this activity has contributed to major landscape-scale change along the river, anglers have a poor understanding of the role willow removal plays in opening up bank-fishing access.

Amongst the trout fishers of the Goulburn River, awareness of the concepts of 'Crown Land' and 'freehold land' was high, although many were unsure about what activities were allowed on Crown Land.

The present study identifies an opportunity to reduce this uncertainty and increase awareness of people's rights and responsibilities for recreation on Crown Land water frontages, by providing educational material about popular activities such as using campfires, camping, collecting firewood, dog-walking and hunting in a package that is targeted towards the recreational angler.

The present study canvassed a representative sample of Goulburn River trout fishers as to what activities they would like to see recreational fishing licence revenue invested.

It was 'stocking' in its various forms that headed the list. More traditionally funded themes such as river restoration were almost as popular. Angler-access improvements were less commonly suggested, but still put forward by almost 1-in-6 participants.

Revenue allocation ideas also incorporated themes not traditionally seen as funding targets such as, improvements to litter-management facilities and programs, improvements to boat-ramps and a riparian-lands buy-back scheme. A clear link emerged between litter-management and the satisfaction of many anglers motivated by the aesthetic qualities of the outdoor experience. Natural resource managers promoting increased access and resource use need to consider how this challenge is to be met. The present study suggests that a significant proportion of anglers on the Goulburn would like to see their RFL revenue used to address this issue.

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Appendix 1 – Preferences of Respondents for Investment of RFL Revenues

Categories	No. of Responses	sub-totals	% of respondents
stocking (unspecified)	85		
stocking trout in rivers	6		
stocking native fish in rivers	2		
stocking trout	2		
stock crayfish	1		
stocking in rivers	1		
stocking native fish in Goulburn	1		
marine stocking	1		
stocking trout in Eildon pondage	1		
stocking trout in rivers and lakes	1		
Stocking (sub total)		101	29%
River restoration (unspecified)	38		
carp control	9		
willow management	5		
revegetation	5		
improve water quality	4		
blackberry control	3		
Gambusia control	2		
remove dead trees	1		
Re-snagging	1		
fence out cattle	1		
more boulder fields	1		
More flows	1		
stabilise flows	1		
weed control	1		
estuarine habitat improvements	1		
fence out cattle	1		
River restoration (sub-total)		75	21%

Categories	No. of Responses	sub-totals	% of respondents
Angling-access improvements (unspecified)	49		
fishing access maps	3		
disabled access	2		
buy back private riparian lands	2		
fishing access information	2		
fishing access maps online	1		
clear dead trees along banks	1		
Fishing Access (sub-total)		60	17%
Facilities			
litter prevention	23		
improve facilities	7		
boat ramps	6		
toilet facilities	5		
more camping areas	4		
parking facilities	4		
fish-cleaning facilities	2		
picnic facilities	2		
marine boat ramps	2		
fireplace facilities	1		
public telephone facilities	1		
restore Lang Lang pier	1		
upgrade Snobs Creek DPI facility	1		
BBQ facilities	1		
fishing pontoons	1		
Facilities (sub total)		38	11%
Fisheries management			
Fisheries enforcement	19		
more fish	14		
catch and release fishing areas	2		
fishery improvement	2		
flyfishing only areas	2		
junior fishing days	1		
more wild trout	1		
stop netting	1		

Categories	No. of Responses	sub-totals	% of respondents
Fisheries management (sub-total)		42	12%
Information (unspecified)	1		
signage	9		
education (unspecified)	5		
information in LOTE	2		
angling advice	1		
education on littering	1		
information on how and where to fish	1		
Information (sub-total)		20	6%
Fisheries research (unspecified)	6		
fisheries research (trout)	2		
Keep research staff at Snobs Creek	1		
marine fisheries research	1		
fisheries scientists giving talks at fishing clubs etc	1		
estuarine fisheries research	1		
Fisheries research (sub total)		12	3%
Fishing promotions (unspecified)	1		
free fishing rods	1		
free lures	1		
raffles	1		
tourism promotion (unspecified)	1		
Fishing & Tourism promotion (sub-total)		5	1%