Talk Wild Trout 2015

Conference Proceedings

21 November 2015
Mansfield Performing Arts Centre, Mansfield Victoria

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Foreword

Fishing for wild trout is a great activity with a long and rich social history. It takes us into wild, beautiful places and provides a special opportunity for our families to spend quality time together and get away from life's hectic pace.

Trout fishing is also important to regional Victoria because it makes a strong tourism contribution to economic activity as recreational fishers travel, buy fishing gear and food and stay at local accommodation.

The State Government's **Target One Million** plan aims to get more people fishing more often. We are busy improving recreational fishing by investing in projects that will make a real difference on the ground, such as increasing fish stocking, introducing minimum size limits on trout, improved angler access, $2,000 grants to support angling clubs and many other programs.

The **Wild Trout Fisheries Management Program** has been driven by trout fishers and is a great example of government and anglers working together toward a common goal - better fisheries. Through research, monitoring and genuine engagement with recreational fishers, the three-year program will bring a special focus to our wonderful trout fisheries. This work is particularly important as we start to understand and deal with the implications of a changing climate on our fisheries.

I'm sure you will all enjoy this fantastic initiative that will lead to even better trout fishing in Victoria in the future.

Jaala Pulford, MLC

Minister for Agriculture

Conference Program — Saturday 21 November

9.30 am	Arrival & morning refreshments	Delegates
10.00 am	Welcome & foreword	Travis Dowling, Executive Director Fisheries Victoria & Mayor, Mansfield Shire Council
	Traditional owner welcome to country	Lawrence Moser, CEO Taungurung Clans Aboriginal Corporation
10.10 am	Introduction to the Wild Trout Fisheries Management Program	Anthony Forster, Fisheries Victoria

Keynote Address

10.30 am	Trout fisheries in a changing landscape	Dr Dan Dauwalter, Trout Unlimited (USA)
11.15	Morning Tea Break	

Theme 1 – Wild Trout Secrets

11.30 am	The state of trout: Survey results from key wild trout rivers	Jason Lieschke, Arthur Rylah Institute
11.45 am	Health cards for twelve of our best wild trout streams	Taylor Hunt, Fisheries Victoria
12.00 am	The heat is on: Summer trout movement in the Delatite River	Jason Lieschke, Arthur Rylah Institute
12.15 pm	Lunch	

Theme 2 – Climate & Habitat (Session chair: Jarod Lyon, Arthur Rylah Institute)

12.45 pm	Looking at riparian vegetation effects at local and landscape levels	Dr John Morrongiello, University of Melbourne
1.05 pm	How riparian vegetation supports aquatic insects and better trout fishing	Di Crowther, Arthur Rylah Institute
1.20 pm	Riparian vegetation management into the future	Mark Turner, Goulburn Broken CMA & Amber Clarke, DELWP
2.35 pm	Panel Questions & Answers	Delegates, speakers & chair
2.50 pm	Afternoon Tea Break	

Theme 3 – Fisheries Management (Session chair: Anthony Forster, Fisheries Victoria)

3.00 pm	Stocking the Howqua and Goulburn rivers: What's the catch?	John Douglas, Fisheries Victoria
3.05 pm	Smarter trout stocking & the use of chemical markers	Dr Brett Ingram, Fisheries Victoria & Fletcher Warren-Myers, University of Melbourne
3.15 pm	Taking stock: Are we overfishing our trout? Social aspects & harvest of wild trout stream anglers	Kylie Hall, Fisheries Victoria
3.30 pm	Does size matter?: The lengths we go to for trout size limits	John Douglas, Fisheries Victoria & Anthony Forster, Fisheries Victoria
3.45 pm	Building trout fisher capacity & finding common ground	Tom Camp, Trout fisher
4.00 pm	Panel Questions & Answers	Delegates, speakers & chair

Conference Wrap-up

4.15 pm	A trout fisher's thoughts	Philip Weigall, FlyStream.com
4.30 pm	Close of conference	Travis Dowling, Fisheries Victoria

Mansfield & District Fly Fishers Inc.

Presents a

Trout Fishing Film Festival

Following Fisheries Victoria's "Talk Wild Trout" State Conference.

21st November 2015
at 7.30pm

Mansfield Performing Arts Centre

Tickets available online at
www.mansfieldmtbuller.com.au/twt

Adults $20 Children $10

Light refreshments available before screening & during intermission

Sponsored by
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Overview of the Wild Trout Fisheries Management Program

The **Wild Trout Fisheries Management Program** is a collection of nine projects over three years that aims to deliver:

- A clearer understanding of the cause(s) of the decline in wild trout fisheries,
- A better understanding of priority trout populations' health and status,
- Improved engagement with fishers to share our understanding of trout fisheries management, science and factors that drive the fishery,
- More responsive management of wild trout recreational fishing in Victoria, and
- Improved fishing opportunities for wild trout in Victoria.

Development

The summer of 2013-14 was an unhappy one for many of Victoria's trout stream anglers. Widespread reports of poor fishing were received from many normally productive wild trout streams.

In response, Fisheries Victoria commissioned Arthur Rylah Institute researchers to conduct population surveys of four trout rivers in North East Victoria during February 2014. These streams were selected to broadly represent those North East rivers where anglers reported poor angling catch rates. They included the King River (above and below Lake William Hovell), the Howqua River (upstream of Mansfield-Jamieson Road), the Jamieson River (upstream of Jamieson) and the Upper Goulburn River (Jamieson to Woods Point). The results suggested that trout populations in the lower reaches of these rivers were low in abundance. Trout populations at the higher elevations seemed unaffected.

The results of the survey were presented to:

- Representatives of trout fishing organisations at meetings on 3 April and 20 June 2014 held at Fisheries Victoria's Snobs Creek Hatchery. This group of 12 agreed to act as a reference group to consider future research and development proposals.
- A public forum (attended by approximately 70 guests) held at Alzburg Resort, Mansfield on 10 April 2014.

A range of possible factors may have contributed to the trout population results observed. For example, one likely contributor to seasonally low trout abundances in the lower reaches of rivers in North East Victoria are high water temperatures associated with high ambient air temperatures and low summer river flows. Australia's mean temperature has been increasing since the 1980s and there are predictions that higher temperatures will occur more frequently in the future.

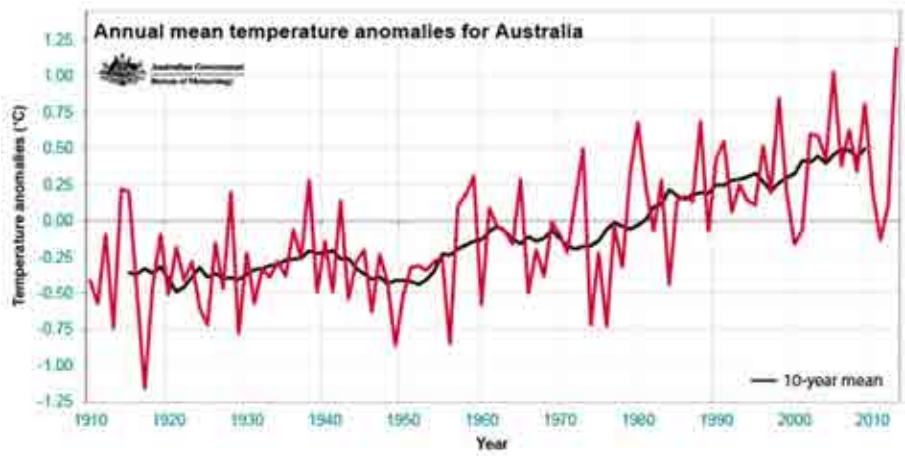


Figure 1: Annual mean temperature anomalies for Australia (compared with 1961–1990 average). Source: BOM 2014.

Trout are a cold water fish species and are physiologically vulnerable to warm water and impacts can be seen on distribution, feeding, growth, survival, reproduction and catchability by fishers.

A range of additional factors have also been suggested as contributing to low trout abundances in the lower reaches of North East Victorian rivers. These include stream habitat condition, fishing pressure, predation (e.g. cormorants) and competition with other species (e.g. carp).

At both meetings, there was considerable discussion about what, if any, fisheries management interventions could be adopted to better understand how the fishery is performing and what could be done to improve it.

The high levels of angler concern about the status of river trout fishing in North East rivers and the social and economic contribution that trout fishing makes to the regional economy warranted further attention. Fisheries Victoria initiated a research and management program to address the key questions raised at the public meetings to better understand how the trout fishery is performing and what, if any, management interventions may be appropriate. Further details about the Wild Trout Fisheries Management Plan (WTFMP) are listed over page, throughout the proceedings and can be obtained from the website: www.depi.vic.gov.au/fishing-and-hunting/recreational-fishing/wild-trout-population-survey/wild-trout-fisheries-management-plan'

The Wild Trout Fisheries Management Program will address the following key questions:

Are summer temperatures adversely impacting our river trout fisheries?
Trout are a cold water fish and high summer water temperatures can reduce feeding and increase mortality. A trout tracking study will use acoustic tags and listening stations in the Delatite River to determine how river trout respond to changes in water temperatures. If trout move when water temperatures increase, where do they go and at what temperature do they move?

Is there a decline in wild trout populations and breeding?
Wild trout populations in rivers rely on natural breeding to spawn young fish. Monitoring trout populations will help us assess annual breeding performance and predict the strength of the next year class of trout. This project will conduct annual fish population surveys in up to twelve priority rivers annually (3–4 sites in each) to provide a 'report card'. This can be compared to historical trout population information in some of these rivers given substantial prior research in many Victorian waters. This project will also consider whether predation and competition from other species is adversely affecting trout populations in rivers. During the survey work, scientists will record information about carp, their size and abundance, along with other possible predators of trout such as cormorants.

Is fishing pressure adversely impacting trout populations and the quality of the trout fishery?
Excessive angler harvest of fish can impact trout populations by decreasing the number of reproductively mature fish. In turn, this can reduce the number of young fish produced in a system. Angler surveys and a 'tag return' program in the Howqua River will help us understand more about catch and harvest levels. It is prudent to regularly test catch limits, closed seasons and equipment restrictions to confirm they are still appropriate. If the project finds evidence that fishing pressure is impacting the fishery, then there may be a need to reconsider fishing regulations including size and bag limits, the closed season or permitted equipment.

Are research results well understood by fishers?
Annual conferences with trout fishers and community groups will help everyone stay informed about the progress and key outcomes of each project from the Wild Trout Fisheries Management Plan. Interested groups can thus better understand the factors at play and consider the best options for maintaining and improving our wild trout fisheries. The conferences will also provide an opportunity for fishers to hear about the very latest trout fishing developments, from local and international trout experts.

How can we reliably track changes in the angling performance of our trout fisheries?
There are many angling clubs that record their catches with great diligence. If this information can be shared for use in fisheries management, it may be a cost-effective way to get an indication of fishery performance over time and a means of assessing the impacts from interventions such as stocking and habitat restoration. A trial program using angling club records in fisheries monitoring will be expanded to include the wild trout fisheries in Victoria.

Is reduced trout stocking into Lake Eildon impacting the trout fisheries in its inflowing rivers?
Fisheries managers are keen to better understand the contribution that trout stocking in Lake Eildon makes to the inflowing river trout populations. Similarly, to better understand the proportion of river fish which return to the lake for some period of their life stage. A study will be undertaken to determine more cost effective and accurate methods of marking stocked trout and allow a better understanding of the relationship between trout populations in Lake Eildon and its feeder rivers.

Have there been changes to bankside vegetation along our rivers? If so, have they affected water temperatures?
River water temperature is strongly influenced by the nature and extent of stream-side (riparian) shading. Major changes to bankside vegetation (e.g. bushfires and flooding, clearing and replanting) may adversely impact wild trout fisheries. This project will look at the changes to riparian shading and if warranted, the scope to rehabilitate streamside vegetation.

Does trout stocking help wild brown trout river fisheries recover?
Past research on wild trout fisheries in Victoria and worldwide suggest stocking on top of existing self-sustaining populations is an ineffective strategy to improve the quality of fishing in the long-term. However anglers have a strong affinity with stocking and it's perceived benefits. This project will trial the stocking of two-rivers (Howqua and Upper Goulburn Rivers) with tagged trout to re-assess the effectiveness of this intervention to assist recovery and enhance wild trout fisheries.

Keynote speaker

Dr Dan Dauwalter,
Trout Unlimited

Trout fisheries in a changing landscape

Trout Unlimited (TU) was founded in 1959 on the banks of the Au Sable River in Michigan, USA. The 16 fisherman that initially met at the home of George Griffith were bonded by their love for fishing and growing discontent with the management of some streams. They simply thought that Michigan's trout streams could produce far superior fish if the habitat was right.

From the beginning TU has been guided by the principle that if we "take care of the fish, the fishing will take care of itself," and TU's first policy focused on emphasizing naturally-produced (wild) trout and healthy habitat. Today, TU has over 150,000 volunteer members organized into over 400 chapters across the United States, and it has 200 full-time staff that work on everything from youth education programs and land protection to water policy and stream restoration.

This presentation will touch on the broad spectrum of TU's programs, with an emphasis on stream restoration and habitat projects and how TU's volunteers - the anglers - get involved.

Theme 1 - Wild Trout Secrets

Photo: John Douglas

How healthy are wild trout populations in Victoria's wild trout fishery?

Jason Lieschke, Andrew Pickworth, John Mahoney, Justin O'Connor
Arthur Rylah Institute, DELWP

Aim:

Determine the health of wild trout populations in 12 priority rivers across the state.

Background:

While substantial monitoring of trout populations has occurred historically, in the last 5-10 years only limited monitoring has been undertaken. Recommencing annual fish population surveys will increase our understanding of trout population trends and health indicators (e.g. breeding, recruitment, growth and condition of fish). This will help anglers decide where to fish and enable more responsive and targeted fisheries interventions — should they be needed.

Twelve priority rivers across the state were selected for monitoring in 2015 by the Victorian Trout Fisher Reference Group. These were: the Aire, Dargo, Goulburn, Howqua, Jamieson, Kiewa, King, Mitta Mitta, Ovens, Toorongo and Yarra rivers and Nariel Creek (Figure 1).

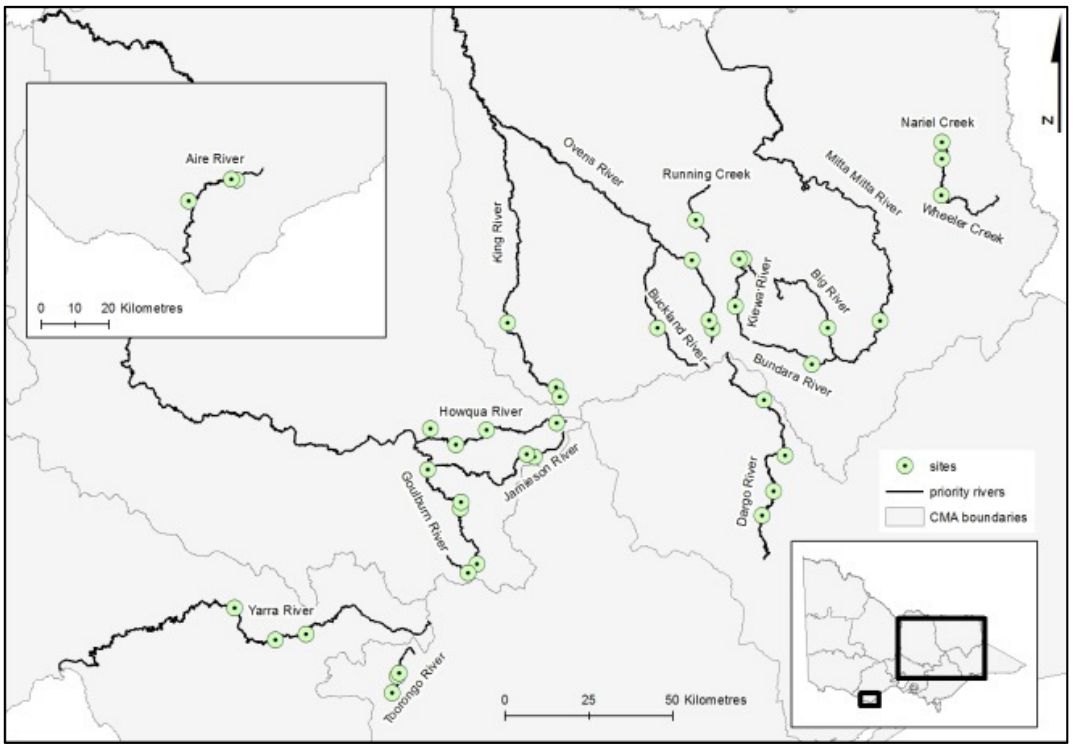


Figure 1. Location of the 12 priority rivers and the 41 sites surveyed across Victoria.

What we did:

We reviewed historical trout population surveys to identify sites in each priority river that had previously been surveyed and where survey methods could be repeated). A total of 41 sites, over the 12 priority rivers were identified and then surveyed between 19 January and 26 March 2015.

To keep sampling methods consistent with previous surveys, smaller streams were surveyed with a backpack electrofisher for approximately 90 minutes. This generally resulted in 200 metres of stream fished, depending on stream conditions (width, depth, etc.). Larger sites were fished using an electrofishing boat for approximately 60 minutes. Some sites were fished with a combination of boat and backpack electrofishing, depending on site conditions.

Figure 2. Electrofishing for trout via backpack and boat electrofishing.

What we learnt:

A total of 1279 trout were surveyed. Brown trout were the most dominant trout species , contributing 66% (838) of the trout surveyed. Brown trout were also consistently bigger (up to 55 cm) than rainbow trout (up to 32 cm) (Figure 3).

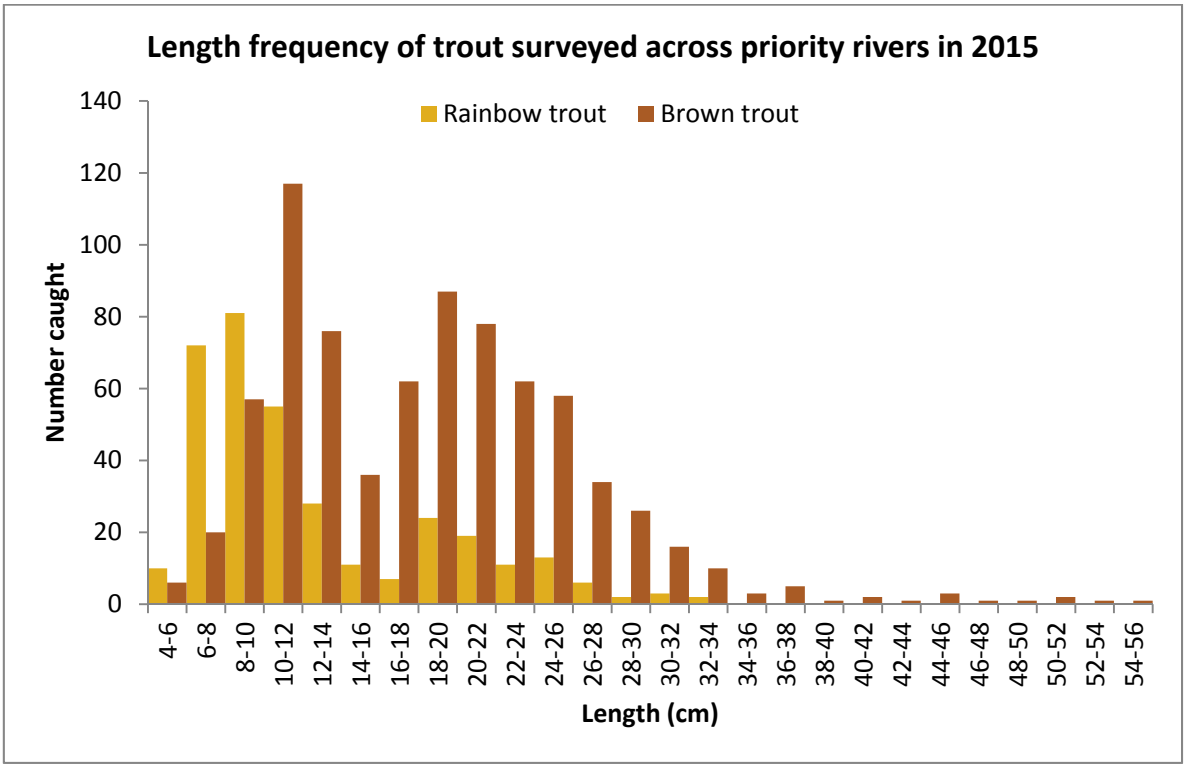


Figure 3. Length frequency of trout across Victoria.

Numbers of brown trout generally increased with altitude in Northern Victoria, especially above 555 m. (Figure 4).

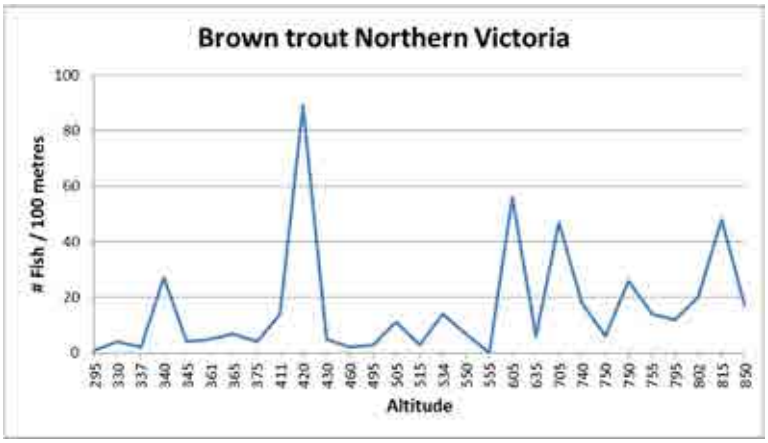


Figure 4. Brown trout abundances per site at different altitudes in northern Victoria.

Key findings:

- There was evidence of brown trout recruitment from 2014 spawning in 11 of the 12 priority rivers, with no brown trout recruitment recorded in the Jamieson River.
- There was evidence of rainbow trout recruitment from the 2014 spawning in 9 of the 12 priority rivers, including the Jamieson River.
- The Aire, Goulburn, Howqua, Kiewa, King, Ovens and Toorongo rivers all had at least one site with > 50 trout captured per 100 metres surveyed.
- The Goulburn, Howqua, Kiewa and Toorongo rivers all had at least one site with > 100 trout captured per 100 metres surveyed.
- The Ovens River showed signs of trout recovery following the 2013 fires and sediment impact.
- The survey site at Harrietville had high abundances of mature brown trout. No brown trout were collected from the Ovens River upstream of Harrietville, although rainbow trout were collected indicating the population is showing signs of recovery.
- The Dargo River had very low abundances of brown trout, except for the highest altitude site.
- The number of trout captured per 100 metres in Nariel Creek (8 trout / 100 metres) was half that of the next lowest stream (Yarra River with 16 trout / 100 metres).
- Generally, trout were in much higher abundances at the higher altitude sites. However, two of the four rivers surveyed in Coastal Victoria had higher abundances at lower altitudes (Aire and Toorongo rivers).

Next steps:

- Monitor trout populations for the following two years, including assessing levels of recruitment from the 2015 spawning event.
- The list of priority waters to be surveyed in 2016 are:
  - ✓ Barkly River
  - ✓ Dargo River
  - ✓ Goulburn River
  - ✓ Howqua River
  - ✓ Jamieson River
  - ✓ Kiewa River
  - ✓ King River
  - ✓ Mitta Mitta River
  - ✓ Morass Creek
  - ✓ Nariel Creek
  - ✓ Ovens River
  - ✓ One south-west Victorian river (to be determined)

Health cards for 12 of our best wild trout streams

Taylor Hunt[1], John Douglas[1] and Jason Lieschke[2]
[1] Fisheries Victoria, DEDJTR, [2] Arthur Rylah Institute, DELWP

Aim:

Produce health cards for each of our monitored streams to give fishers and managers a better understanding of the past and current health of our wild trout streams.

Overview:

The information in these health cards is aimed to give the reader a better understanding of the health of particular trout streams now and into the future. It is hoped the health cards will also provide some information useful for your future trout fishing adventures.

The information provided on the health cards is based on recent and past survey information collected using electrofishing. Electrofishing is an effective sampling tool for providing a snapshot of the presence and abundance of fish present in a stream. However, electrofishing is not perfect and does not catch all fish present. The numbers of fish presented in the Health Cards should therefore be considered a underestimate. ***There are likely to be many more fish in the system available to fishers, than just those recorded in the surveys!***

It is also important to remember that trout populations vary widely and trout are a resilient species. Some streams support large populations and others support small populations. Some streams have lots of small fish and others have few big fish. Streams that fished poorly last year may fish well the next season, or vice versa. Fluctuation is normal in fish populations and trout are particularly good at responding to their environment. These cards provide a snapshot insight into the current health of a variety of trout populations in Victoria.

How to read the Health cards:

The green **Key Health Indicators** box give you an easy to read overall evaluation of key health attributes of the trout population and an overall rating.

The pink **Monitoring Results** section provides a summary the fish surveys and provides information to the reader regarding the number of brown and rainbow trout caught, percentage of fish that were over 20cm in length (defined as catchable), largest brown trout, average size and density of catchable brown trout and what other fish species are in the stream.

The map provides locations of each survey site and density of catchable brown trout

The reverse of the card provides important information about the shape of the population (size structure) and the relative abundance compared with previous surveys. Finally, a simple overview summary of the health card report is provided.

Location: Aire River

Three sites surveyed 19-20 Jan 2015:

Site A: 130m stretch near Aire Crossing
Site B: 200m stretch near Hopetoun Falls.
Site C: 240m near Binns Road

Key health indicators

Recent recruitment ✓

Multiple size classes ✓

Mature fish ✓

Overall Rating: **Excellent**

Monitoring results

Total number of brown trout caught:
125 in 570m of river

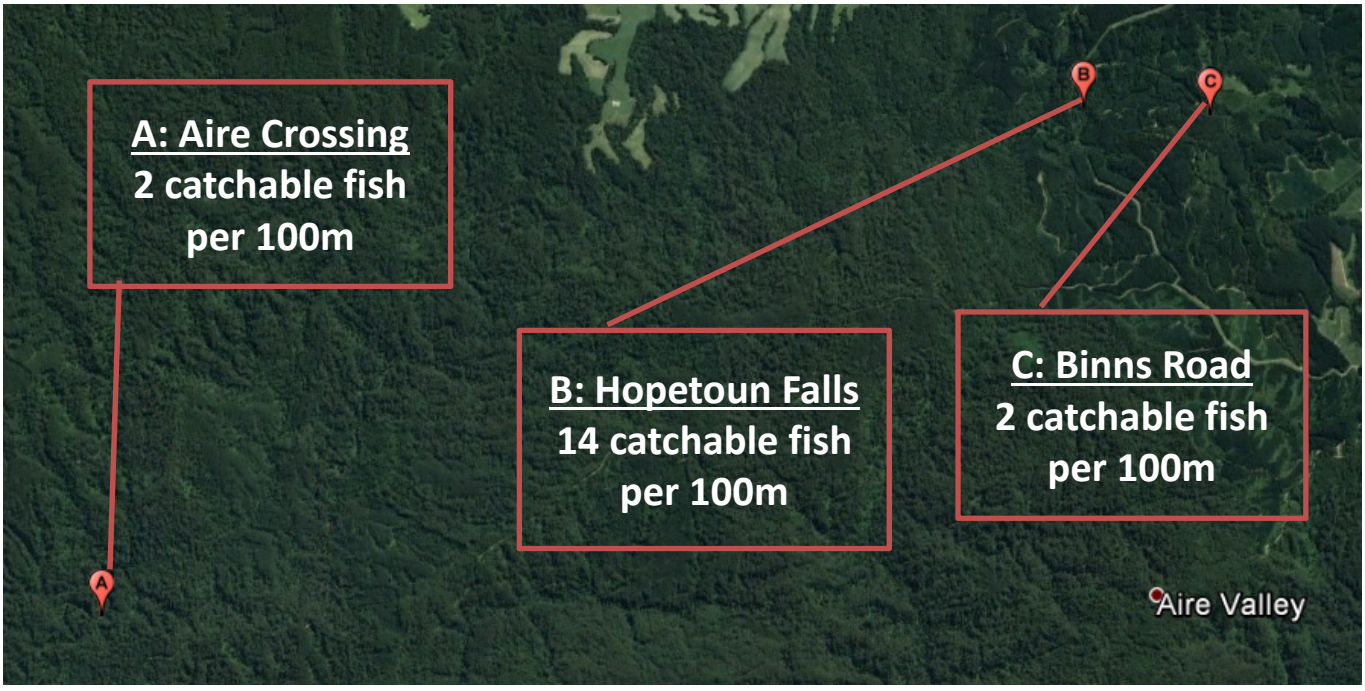
% Catchable (20cm+) brown trout: 31%

Largest fish: 28 cm (11 inch), 230 g (8oz)

Average size of catchable (20cm+) brown trout: 22cm (9 inch)

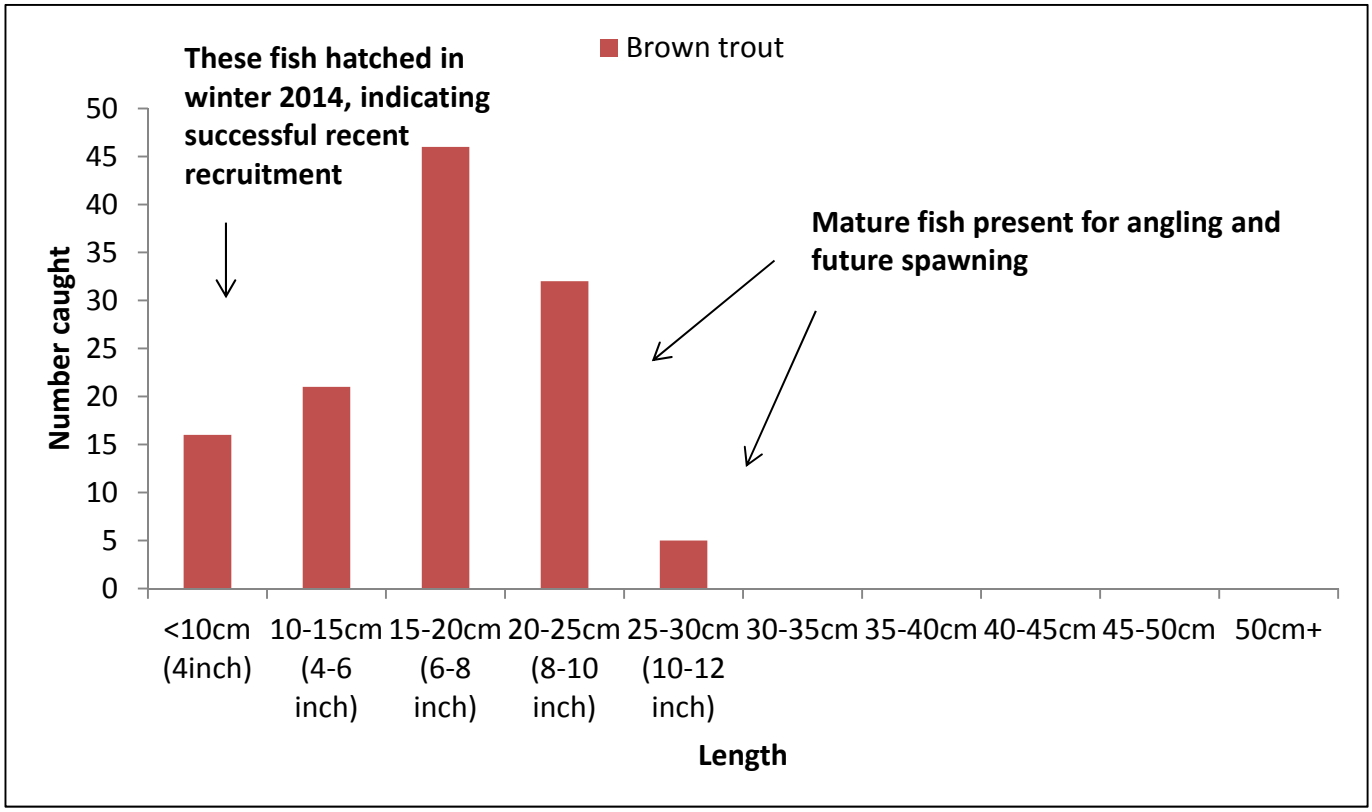
Overall catchable (20cm+) brown trout density: 6 fish per 100m

Other species present: Shortfinned eel, spiny crayfish, galaxid minnow

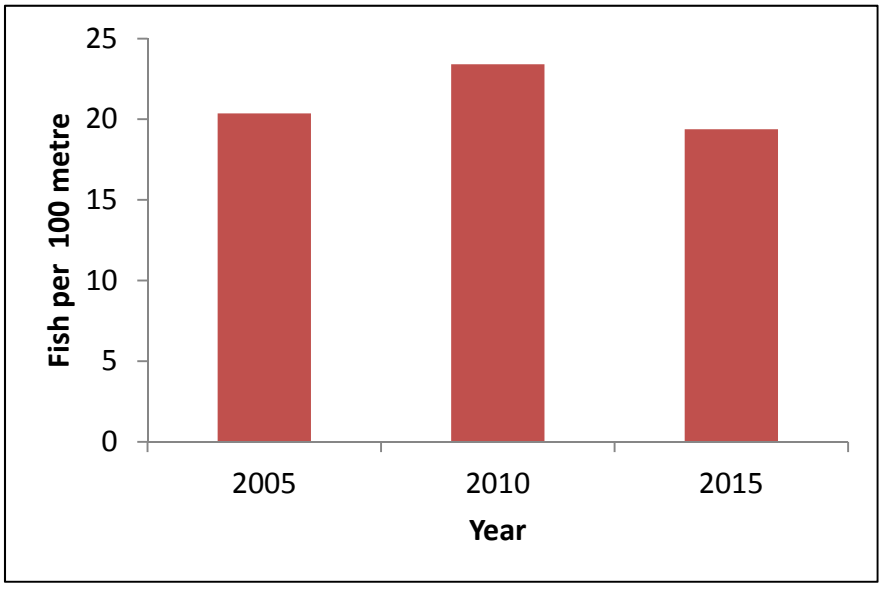


Location: Aire River

Multiple size classes of brown trout indicate a healthy population



Abundance and size structure of brown trout is similar to surveys in previous years



The 2015 survey suggests the Aire River continues to support good numbers of brown trout consistent with previous years.

Location: Dargo River

Four sites surveyed 23 Feb - 24 March 2015:

Site A: 250m stretch on King Spur Track
Site B: 200m stretch Twiggy Track
Site C: 290m stretch Upper Dargo Road
Site D: 240m stretch Two Mile Creek Junction

Key health indicators

Recent recruitment	✓
Multiple size classes	✓
Mature fish	**Few**
Overall Rating:	**Moderate**

Monitoring results

Total number of trout caught:
32 brown trout (BT) in 980m of river

% Catchable (20cm+) fish: 31% (BT)

Largest brown trout: 35cm/14in and 460g/1lb

Average size of catchable (20cm+) brown trout: 24cm/9in

Overall catchable (20cm+) brown trout density: 1 fish per 100m

Other species present: Short-finned eel, long-finned eel, river blackfish, tupong, Australian smelt and Australian grayling

A: King Spur Track
3 catchable fish per 100m

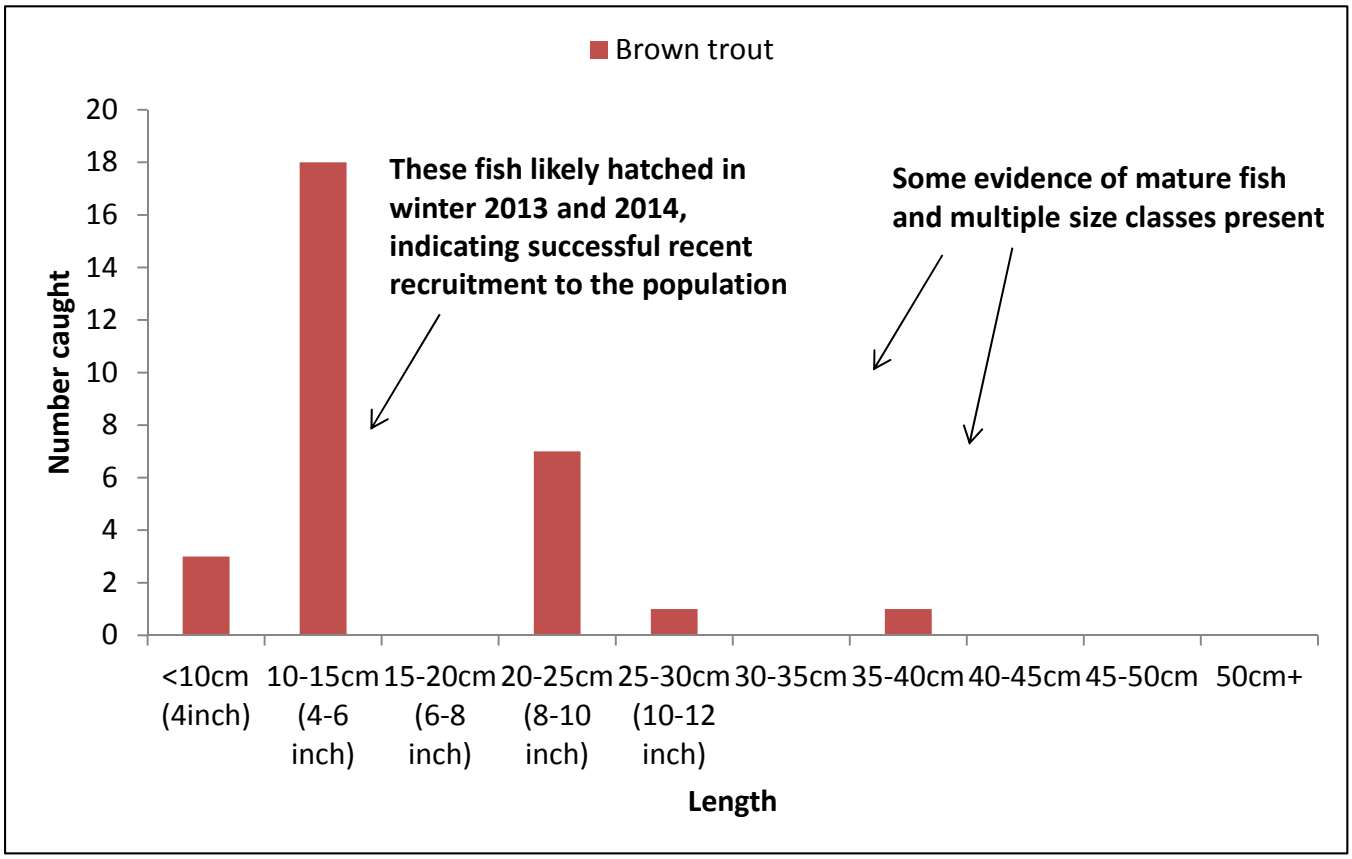
B: Twiggy Track
1 catchable fish per 100m

D: Two Mile Creek
0 catchable fish per 100m

C: Upper Dargo Road
0 catchable fish per 100m

Location: Dargo River

Multiple size classes of brown trout are currently present



Relative abundance of brown trout is compared to previous years is unknown as surveys were conducted on different sites

The 2015 survey suggests the Dargo River currently supports few mature brown trout, however strong recent recruitment and multiple size classes are present. Future surveys will assist in confirming the relative health of the population.

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Location: Upper Goulburn River

Four sites surveyed 10 Feb-10 March 2015:

Site A: 180m stretch on Johnson Hill Track
Site B: 240m stretch Clarke Spur- Abbot Link Track
Site C: 180m stretch at Picnic Point
Site D: 215m stretch Blue Hole

Key health indicators

Recent recruitment	✓
Multiple size classes	✓
Mature fish	✓
Overall Rating:	**Good**

Monitoring results

Total number of trout caught:
76 brown trout (BT) and 105 rainbow trout (RT) in 895m of river

% Catchable (20cm+) fish: 31% (BT), 8% (RT)

Largest brown trout: 32cm/13in and 350g/1lb

Average size of catchable (20cm+) brown trout: 24cm/9in

Overall catchable (20cm+) brown trout density: 3 fish per 100m

Other species present: Two-spined blackfish, galaxid minnow, redfin, carp and spiny crayfish

D: Blue Hole
2 catchable fish per 100m

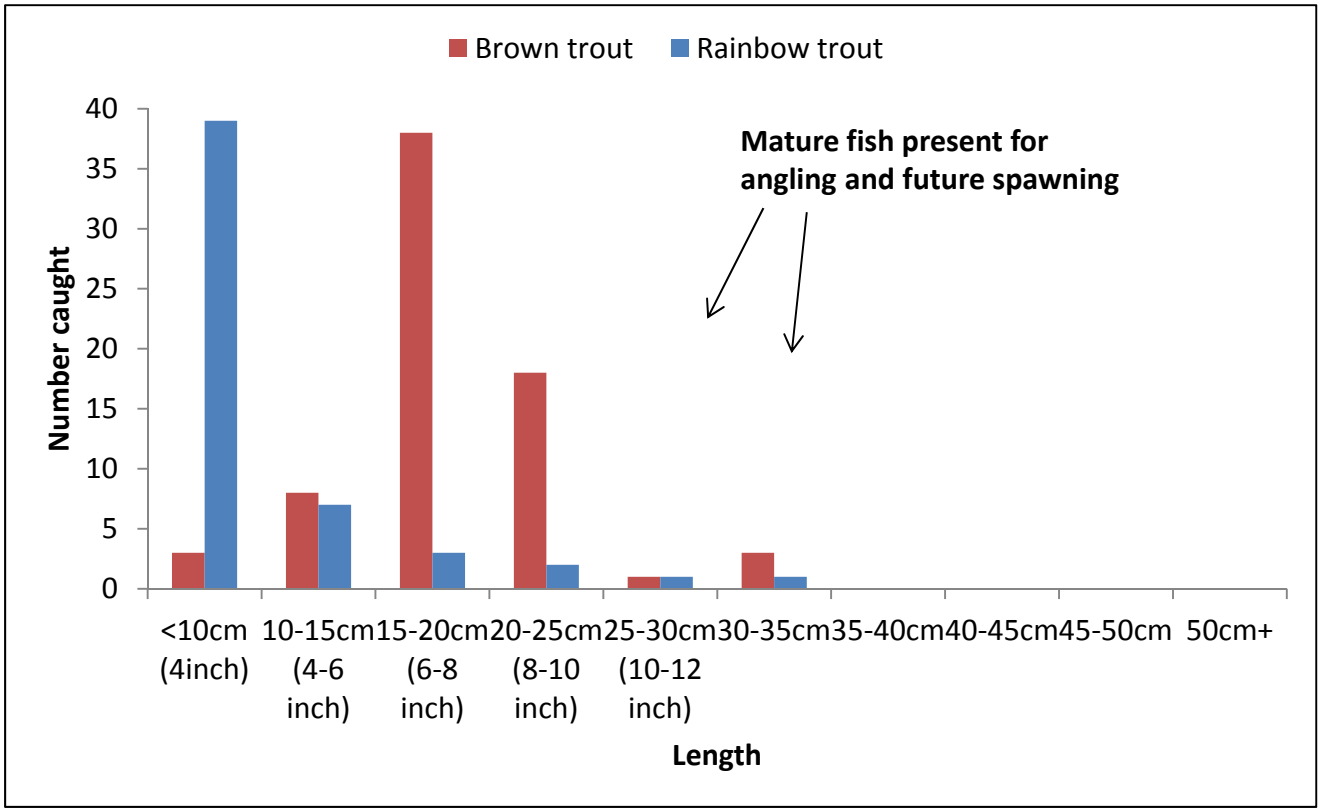
C: Picnic Point
4 catchable fish per 100m

B: Clarke Spur Abbot Link Track
1 catchable fish per 100m

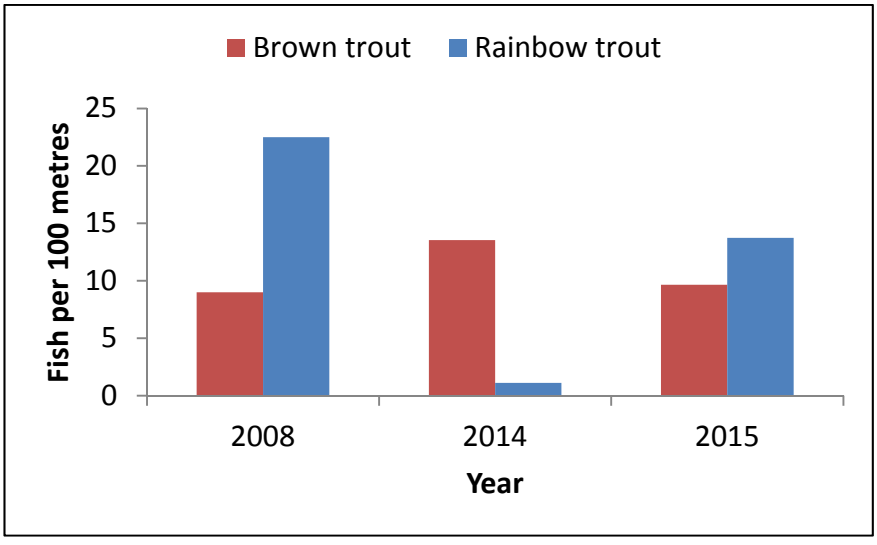
A: Johnson Hill Track
4 catchable fish per 100m

Location: Upper Goulburn River

Multiple size classes of brown and rainbow trout are currently present indicating a reasonably healthy population



Relative abundance and size structure of brown trout is consistent with surveys in previous years



The 2015 survey suggests the Goulburn River currently supports good numbers of brown and rainbow trout in similar abundance as found in previous surveys.

Location: Howqua River

Three sites surveyed 19-20 Jan 2015:

Site A: 250m stretch near Running Creek Camp reserve
Site B: 650m stretch at Frys Hut
Site C: 1km stretch at 7 Mile Flat
Site D: 200m stretch at Bindaree

Key health indicators

Recent recruitment ✓
Multiple size classes ✓
Mature fish ✓

Overall Rating: **Very good**

Monitoring results

Total number of trout caught:
78 brown trout (BT) and 132 rainbow trout (RT) in 2.1km of river

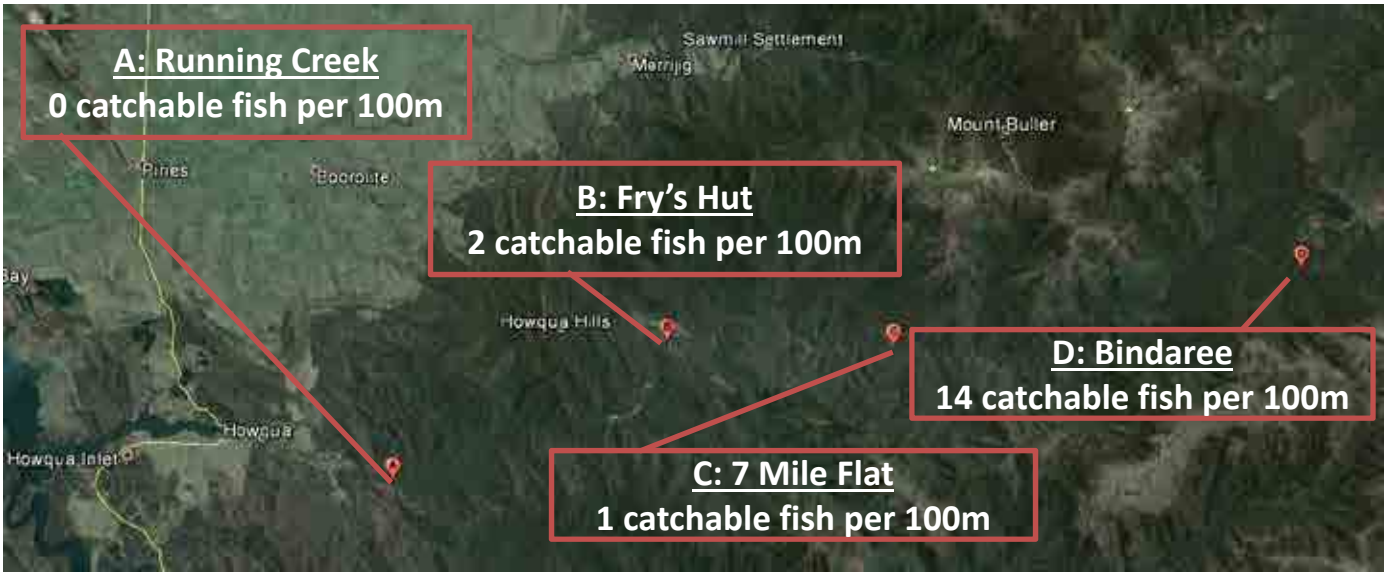
% Catchable (20cm+) fish: 63% (BT), 4% (RT)

Largest brown trout: 52cm/20in and 1.4kg/3lb

Average size of catchable (20cm+) brown trout: 27cm/11in

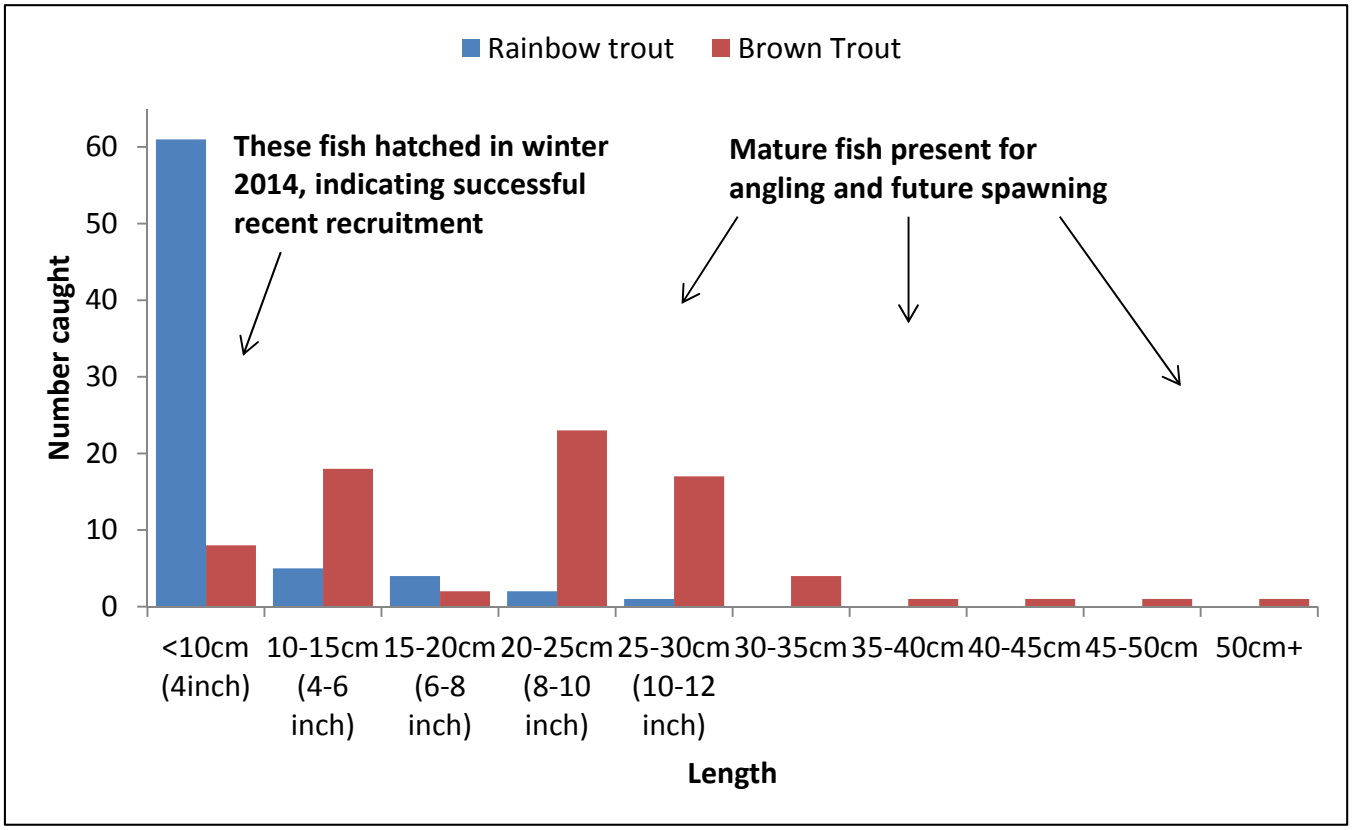
Overall catchable (20cm+) brown trout density: 2 fish per 100m

Other species present: Yabby, carp, spiny crayfish, two-spined blackfish, galaxid minnow, redfin, roach

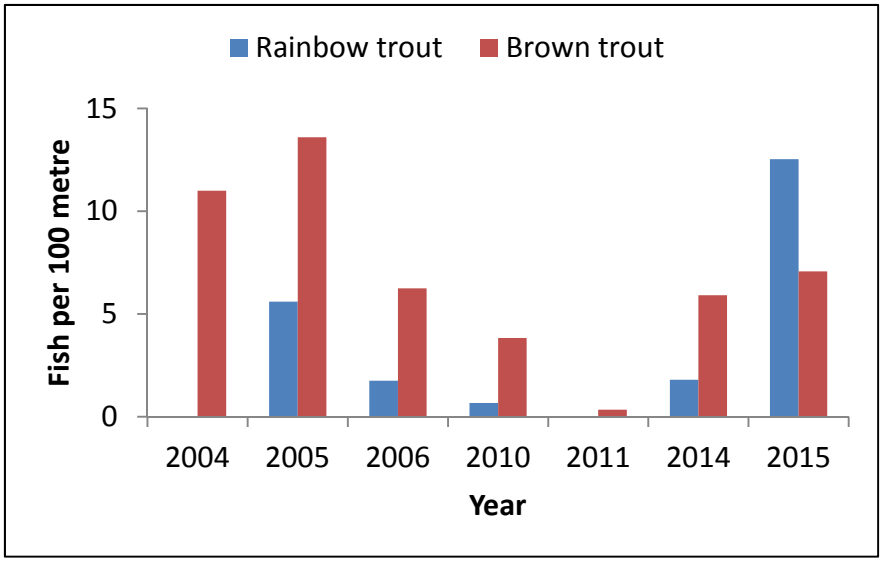


Location: Howqua River

Multiple size classes of brown and rainbow trout are currently present



Relative abundance of brown and rainbow trout is average to high compared to surveys in previous years



The 2015 survey suggests the Howqua River continues to support good numbers of brown trout and rainbow trout, including mature brown trout over 50cm

Location: Jamieson River

Four sites surveyed 9 Feb-12 March 2015:

Site A: 280m stretch at Jamieson Caravan Park

Site B: 220m stretch Saddle Road Bridge

Site C: 250m stretch at Brocks Road Bridge

Key health indicators

Recent recruitment	✗
Multiple size classes	✓
Mature fish	✓
Overall Rating:	Moderate

Monitoring results

Total number of trout caught:
27 brown trout (BT) and 17 rainbow trout (RT) in 750m of river

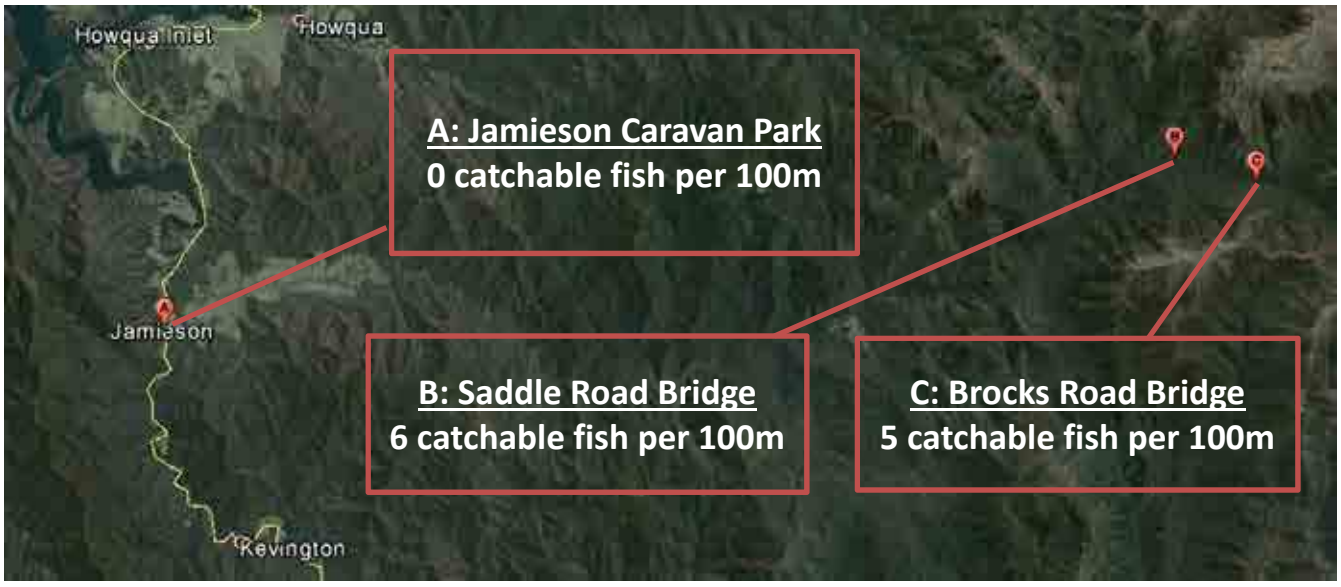
% Catchable (20cm+) fish: 96% (BT), 25% (RT)

Largest brown trout: 33cm/13in and 447g/1lb

Average size of catchable (20cm+) brown trout: 27cm/11in

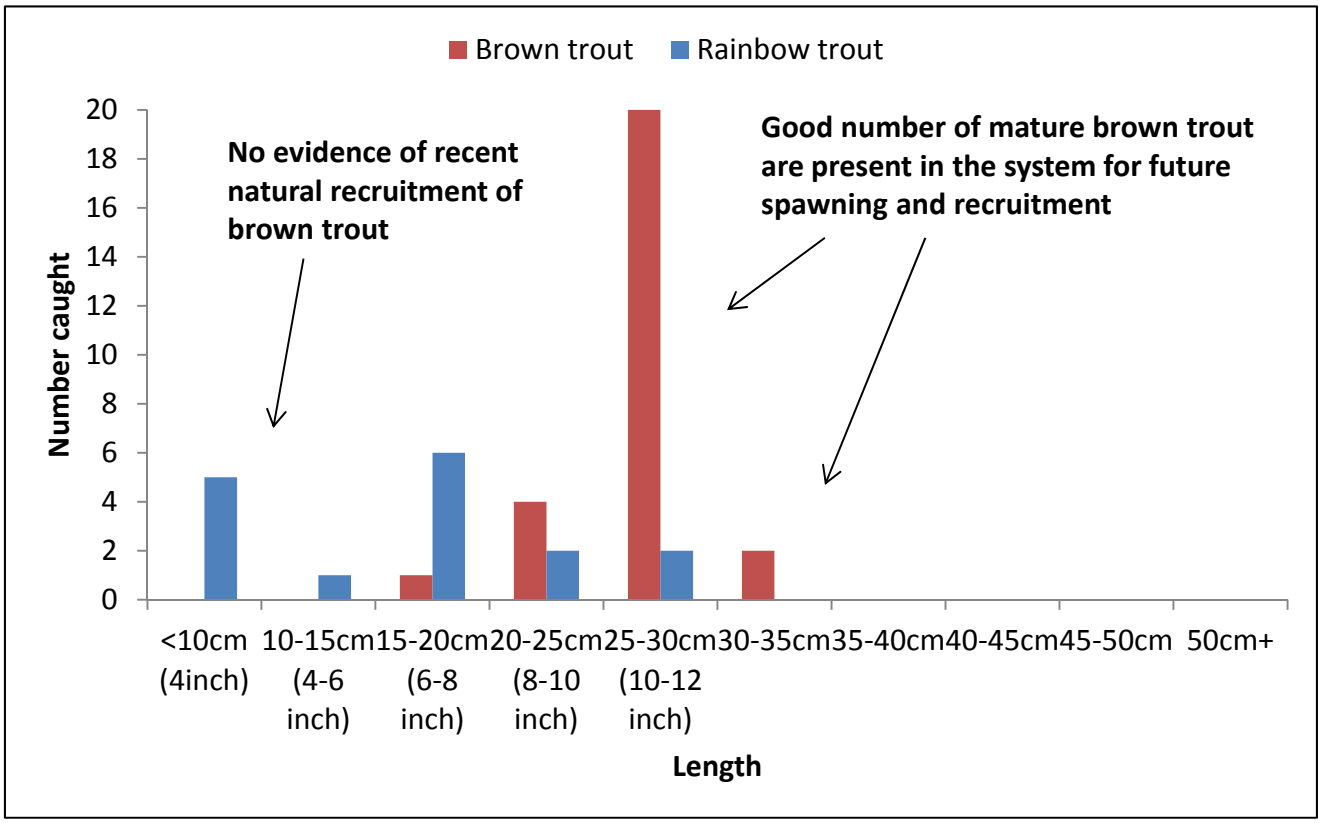
Overall catchable (20cm+) brown trout density: 4 fish per 100m

Other species present: Two-spined blackfish, roach, redfin, gudgeon, galaxid minnow, carp and yabbies

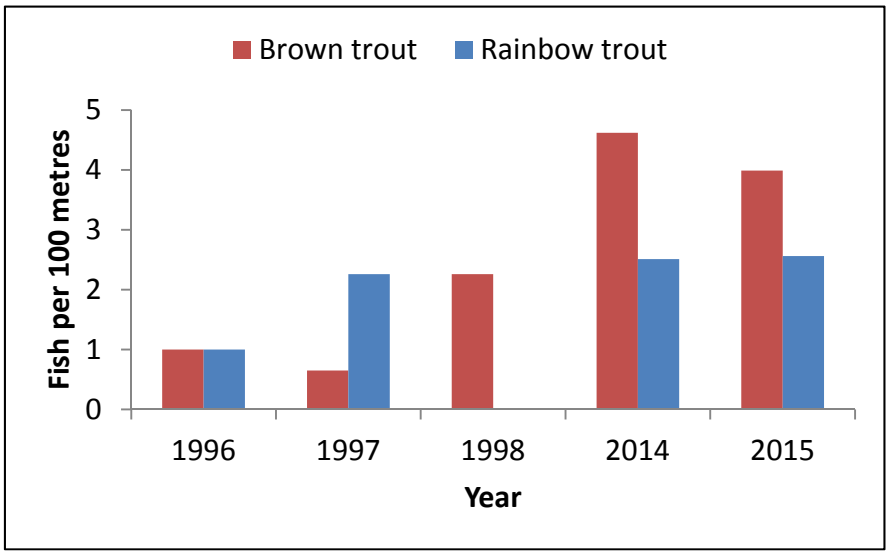


Location: Jamieson River

Although catchable fish were present in the Jamieson River, no evidence of brown trout recruitment was detected



Relative abundance and size structure of brown trout is high compared with surveys in previous years



The 2015 survey suggests the Jamieson River currently supports good numbers of mature brown and rainbow trout. Lack of recent brown trout recruitment is noted and will continue to be monitored in future surveys.

Location: Kiewa River System

Four sites surveyed 18-26 March 2015:

Site A: 170m stretch on Running Creek
Site B: 220m stretch at Mount Beauty
Site C: 210m stretch at Damms Road
Site D: 250m stretch at Dungey Track

Key health indicators

Recent recruitment	✓
Multiple size classes	✓
Mature fish	✓
Overall Rating:	**Excellent**

Monitoring results

Total number of trout caught:
152 brown trout (BT) and 71 rainbow trout (RT) in 850m of river

% Catchable (20cm+) fish: 38% (BT), 16% (RT)

Largest brown trout: 51cm/20in and 1.3kg/3lb

Average size of catchable (20cm+) brown trout: 28cm/11in

Overall catchable (20cm+) brown trout density: 5 fish per 100m

Other species present: Two-spined blackfish, galaxid minnow, redfin, mosquito fish, spiny crayfish and yabbies

A: Running Creek
5 catchable fish per 100m

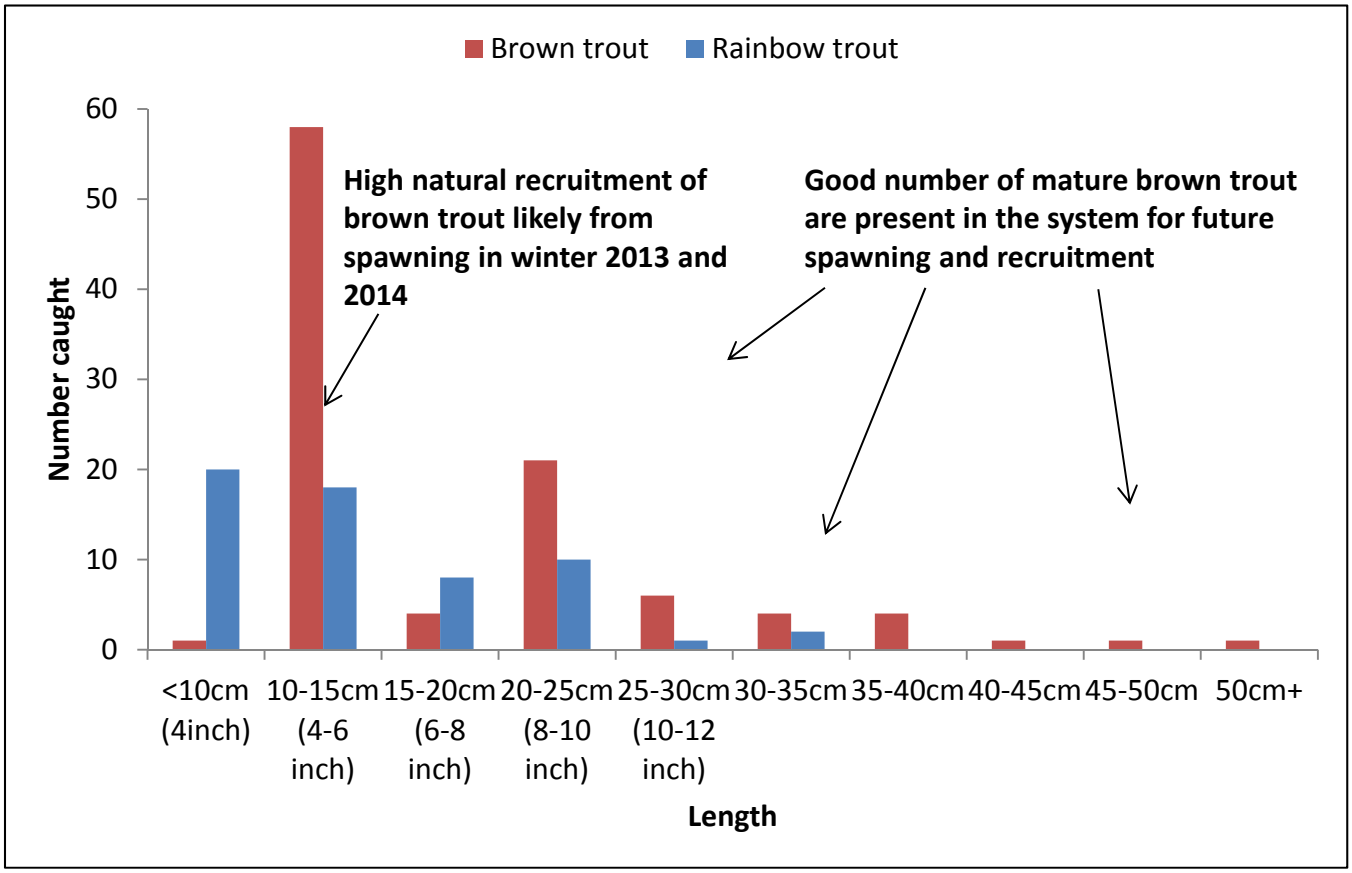
B: Mount Beauty
1 catchable fish per 100m

C: Damms Road
8 catchable fish per 100m

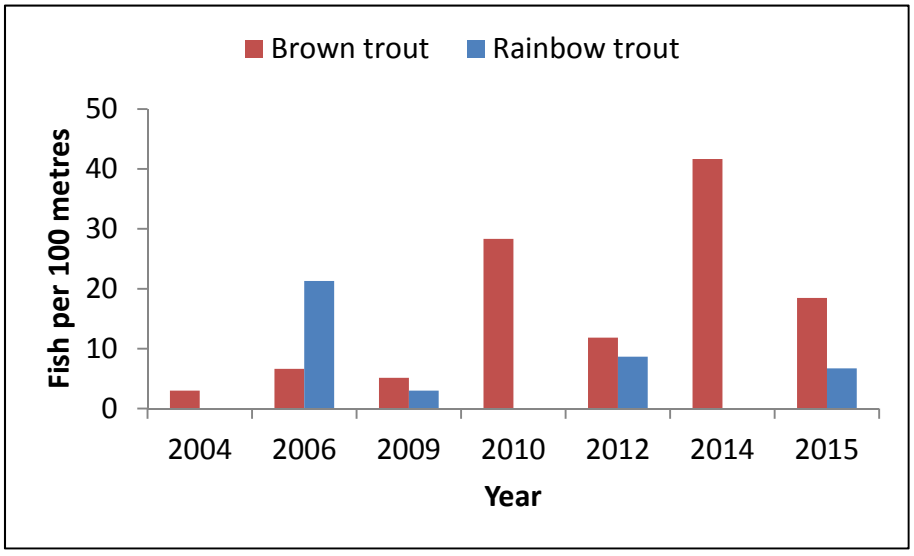
D: DungeyTrack
4 catchable fish per 100m

Location: Kiewa River System

Multiple size classes present in population of brown and rainbow trout



Relative abundance and size structure of brown and rainbow trout is consistent with surveys in previous years



The 2015 survey suggests the Kiewa River System currently supports high numbers of brown and rainbow trout with a healthy population structure, consistent with previous surveys.

Location: King River

Three sites surveyed 11 Feb-11 March 2015:

Site A: 200m stretch at Gauging station, D/S Lake William Hovell

Site B: 180m stretch on King Basin Road

Site C: 180m stretch at Speculation Road bridge

Key health indicators

Recent recruitment	✓
Multiple size classes	✓
Mature fish	✓
Overall Rating:	**Good**

Monitoring results

Total number of trout caught:
32 brown trout (BT) and 79 rainbow trout (RT) in 560m of river

% Catchable (20cm+) fish: 80% (BT), 25% (RT)

Largest brown trout: 45cm/18in and 688g/1.5lb

Average size of catchable (20cm+) brown trout: 27cm/11in

Overall catchable (20cm+) brown trout density: 4 fish per 100m

Other species present: Murray cod, two-spined blackfish, galaxid minnow, redfin, carp, spiny crayfish and yabbies

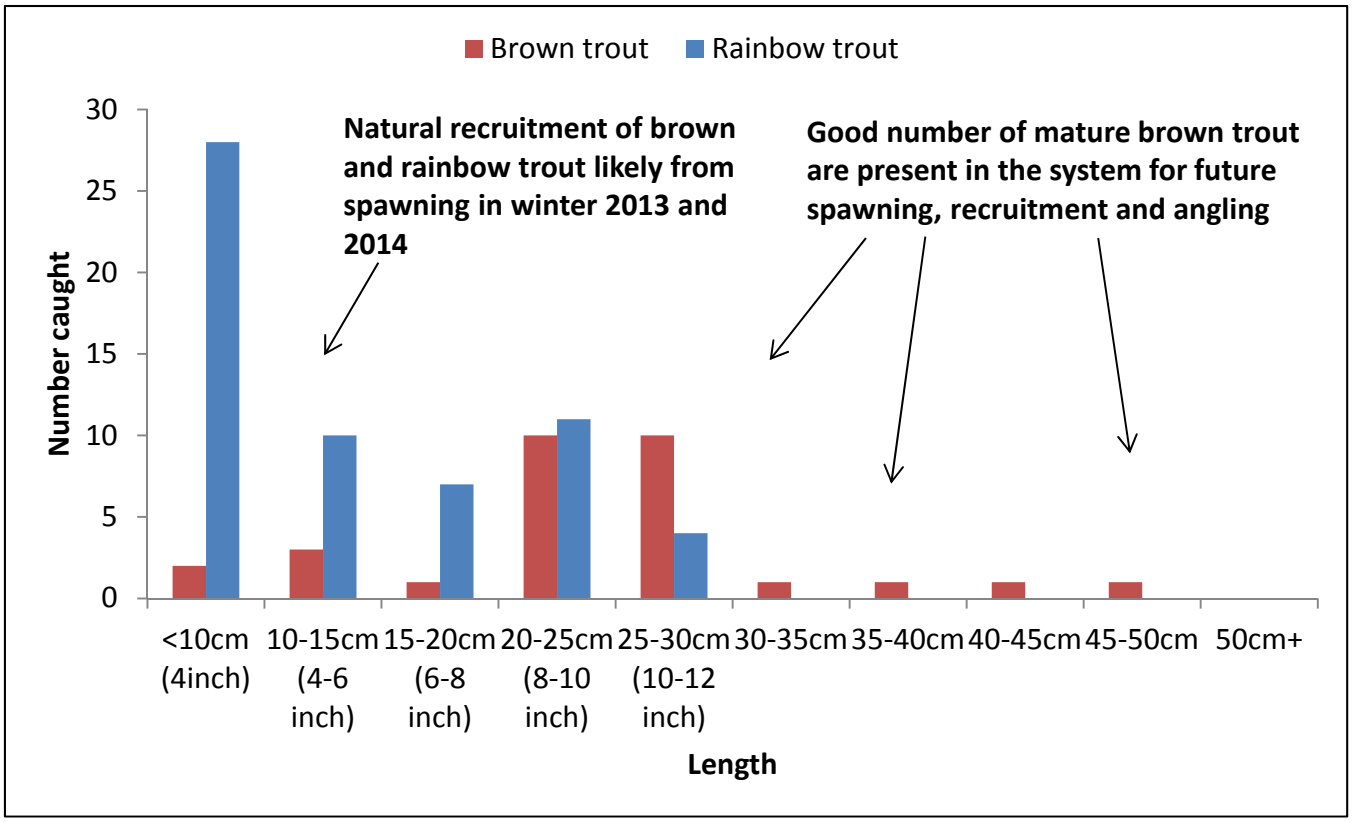
A: Gauging station
2 catchable fish per 100m

B: King Basin Road
3 catchable fish per 100m

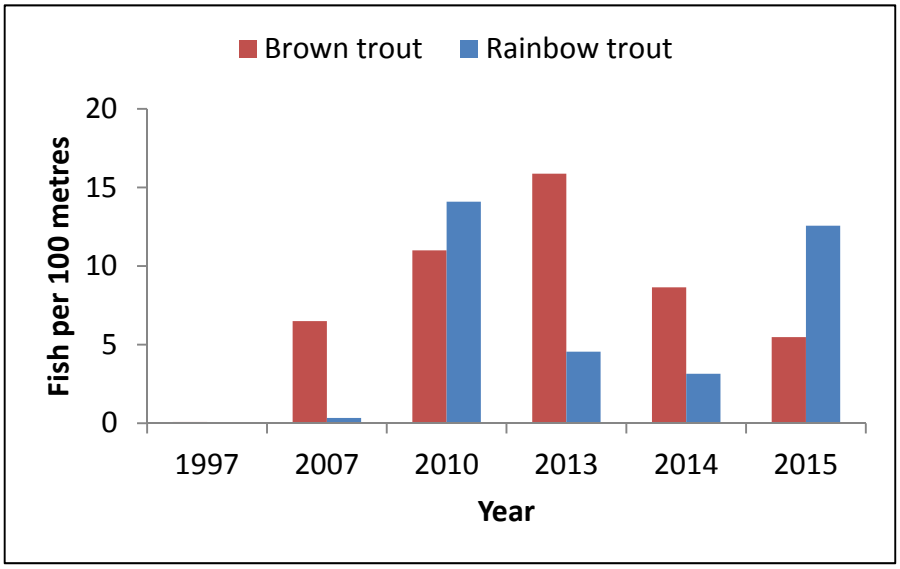
C: Speculation Road bridge
8 catchable fish per 100m

Location: King River

Multiple size classes are present in populations of both brown and rainbow trout



Relative abundance of brown and rainbow trout is low and high respectively, compared with surveys in previous years.



The 2015 survey suggests the King River currently supports good numbers of brown and rainbow trout with a healthy population structure.

Location: Mitta Mitta River system

Three sites surveyed 19-24 March 2015:

Site A: 260m stretch in Bundara River off Callaghan Road

Site B: 120m stretch in Big River

Site C: 300m stretch at campground off Kelly's Road

Key health indicators

Recent recruitment ✓

Multiple size classes ✓

Mature fish ✓

Overall Rating: **Excellent**

Monitoring results

Total number of trout caught:
92 brown trout (BT) and 1 rainbow trout (RT) in 680m of river

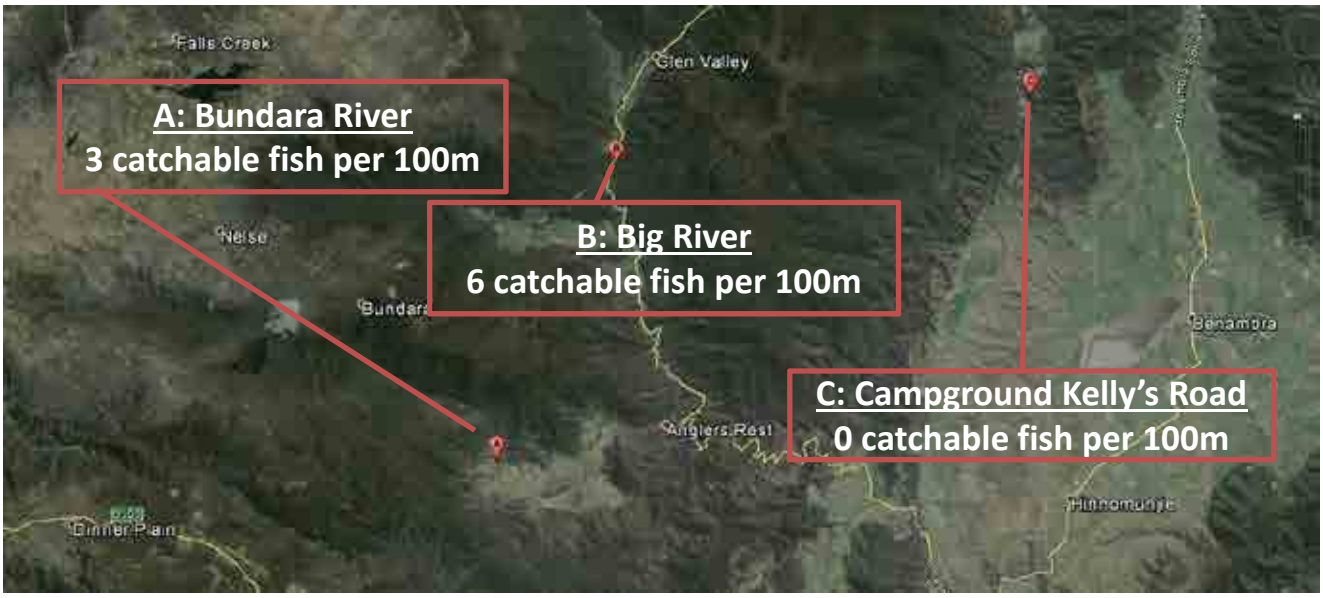
% Catchable (20cm+) fish: 19% (BT), 0% (RT)

Largest brown trout: 55cm/22in and 2.1kg/5lb

Average size of catchable (20cm+) brown trout: 28cm/11in

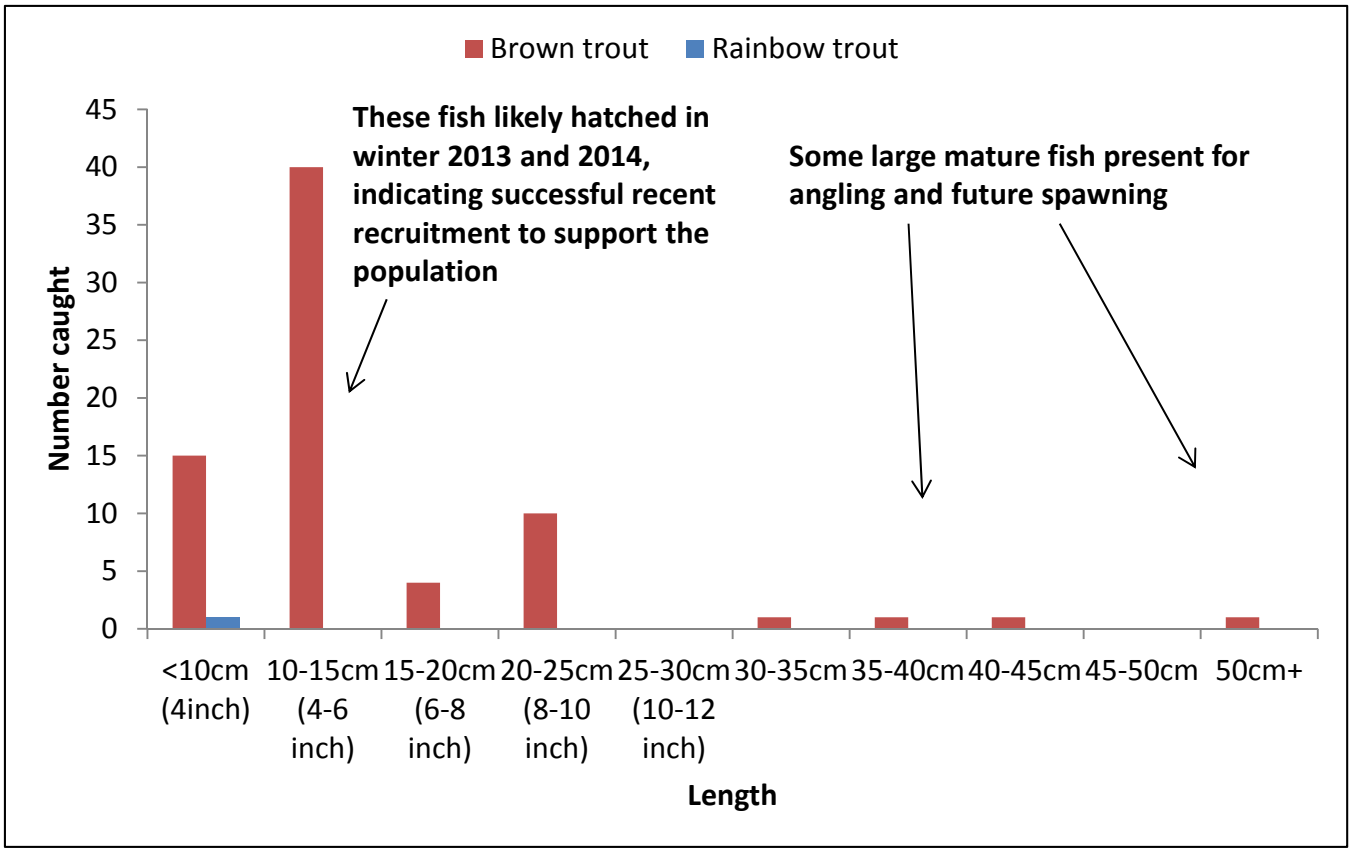
Overall catchable (20cm+) brown trout density: 2 fish per 100m

Other species present: Macquarie perch, two-spined blackfish, galaxid minnow, spiny crayfish and yabbies

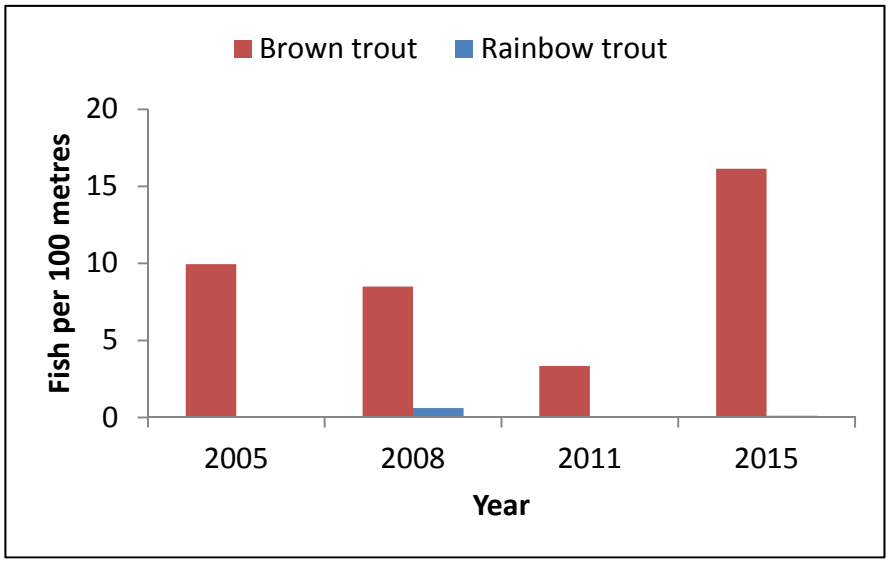


Location: Mitta Mitta River system

Multiple size classes of brown trout are currently present



Relative abundance of brown trout is high compared to surveys in previous years



The 2015 survey suggests the Mitta Mitta River system currently supports high numbers of brown trout, including large specimens over 45cm

Location: Nariel Creek System

Three sites surveyed 13 Feb-26 March 2015:

Site A: 180m stretch at Carmody's Bridge on Benambra-Corryong road

Site B: 180m stretch at Stacey's Bridge

Site C: 210m stretch at Wheeler Creek Log Track

Key health indicators

Recent recruitment	**Some**
Multiple size classes	✓
Mature fish	**Few**
Overall Rating:	**Low**

Monitoring results

Total number of trout caught:
13 brown trout (BT) and 13 rainbow trout (RT) in 590m of river

% Catchable (20cm+) fish: 45% (BT), 54% (RT)

Largest brown trout: 32cm/13in and 151g/5oz

Average size of catchable (20cm+) brown trout: 25cm/10in

Overall catchable (20cm+) brown trout density: 1 fish per 100m

Other species present: Two-spined blackfish, galaxid minnow and spiny crayfish

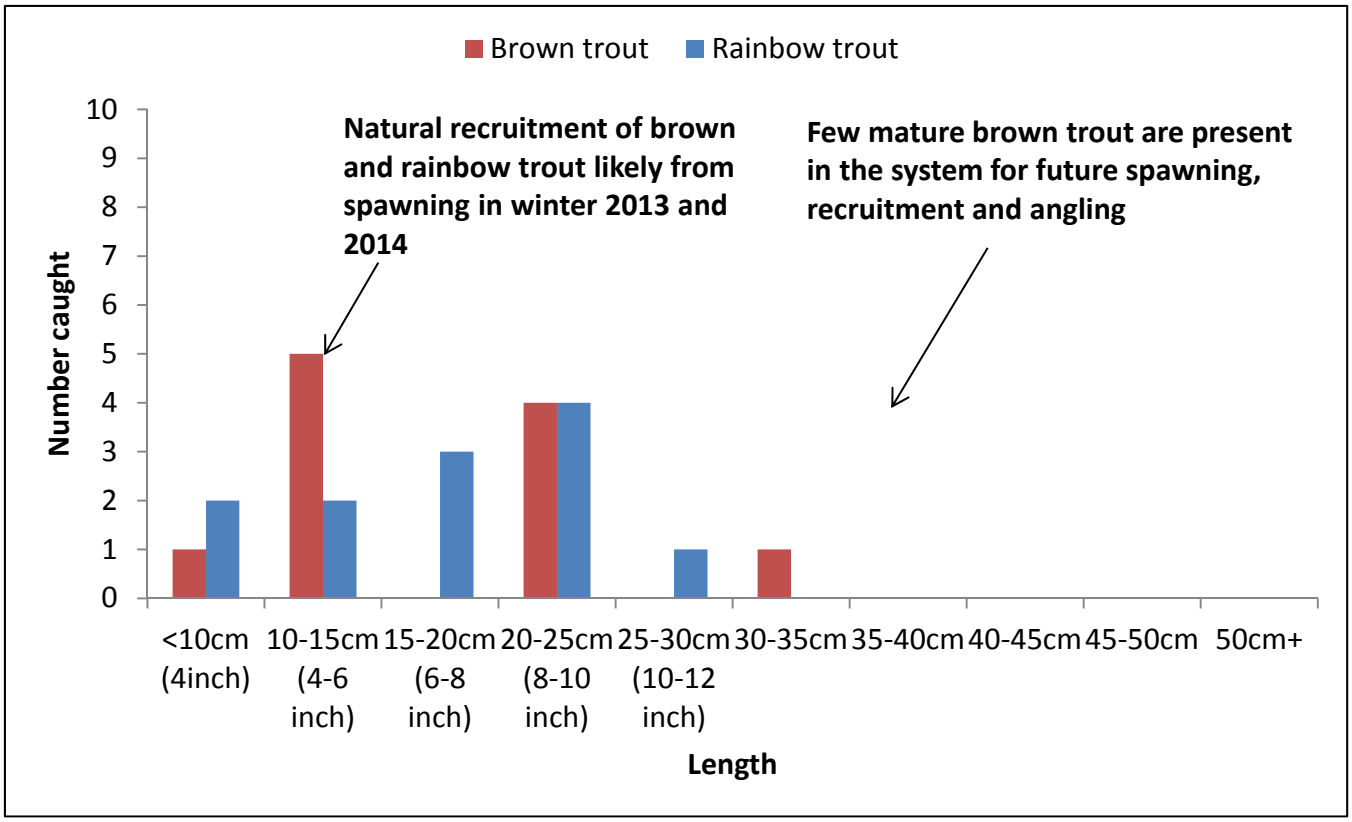
A: Carmody's Bridge
1 catchable fish per 100m

B: Stacey's Bridge
1 catchable fish per 100m

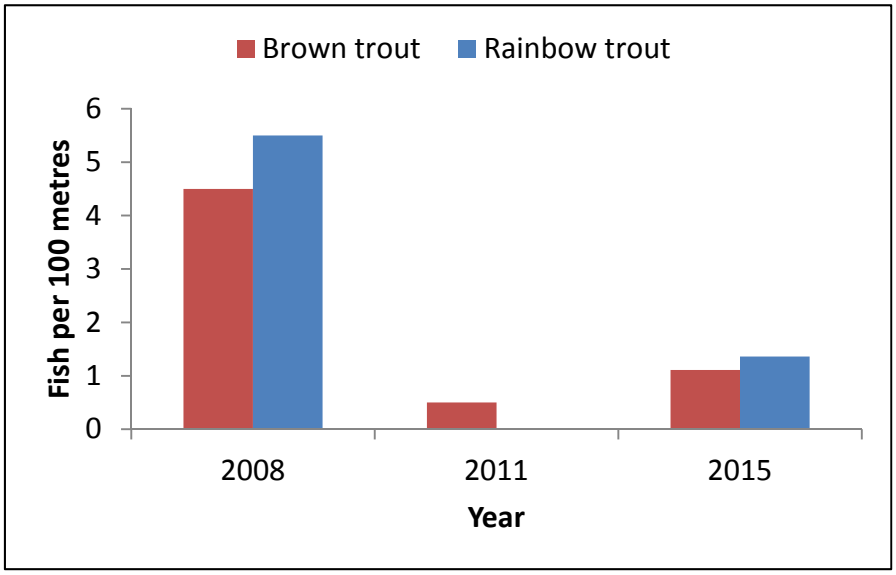
C: Wheeler Creek
1 catchable fish per 100m

Location: Nariel Creek System

Multiple size classes are present in populations of both brown and rainbow trout



Relative abundance of brown and rainbow trout is low compared with surveys in previous years, however size structure is relatively consistent.



The 2015 survey suggests the Nariel Creek system currently supports low numbers of brown and rainbow trout, however multiple size classes present and evidence of recruitment suggests the population is in a reasonable position to recover.

Location: Ovens River system

Four sites surveyed 17-24 March 2015:

Site A: 230m stretch on Buckland River
Site B: 270m stretch opposite Germantown Caravan Park
Site C: 245m stretch at Harrietville
Site D: 230m stretch East Ovens Track

Key health indicators

Recent recruitment	**Some** ✓
Multiple size classes	✓
Mature fish	✓
Overall Rating:	**Recovering**

Monitoring results

Total number of trout caught:
21 brown trout (BT) and 73 rainbow trout (RT) in 975m of river

% Catchable (20cm+) fish: 75% (BT), 48% (RT)

Largest brown trout: 52cm/20in and 1.4kg/3lb

Average size of catchable (20cm+) brown trout: 31cm/12in

Overall catchable (20cm+) brown trout density: 2 fish per 100m

Other species present: Two-spined blackfish, galaxid minnow and spiny crayfish

B: Germantown Caravan Park
1 catchable fish per 100m

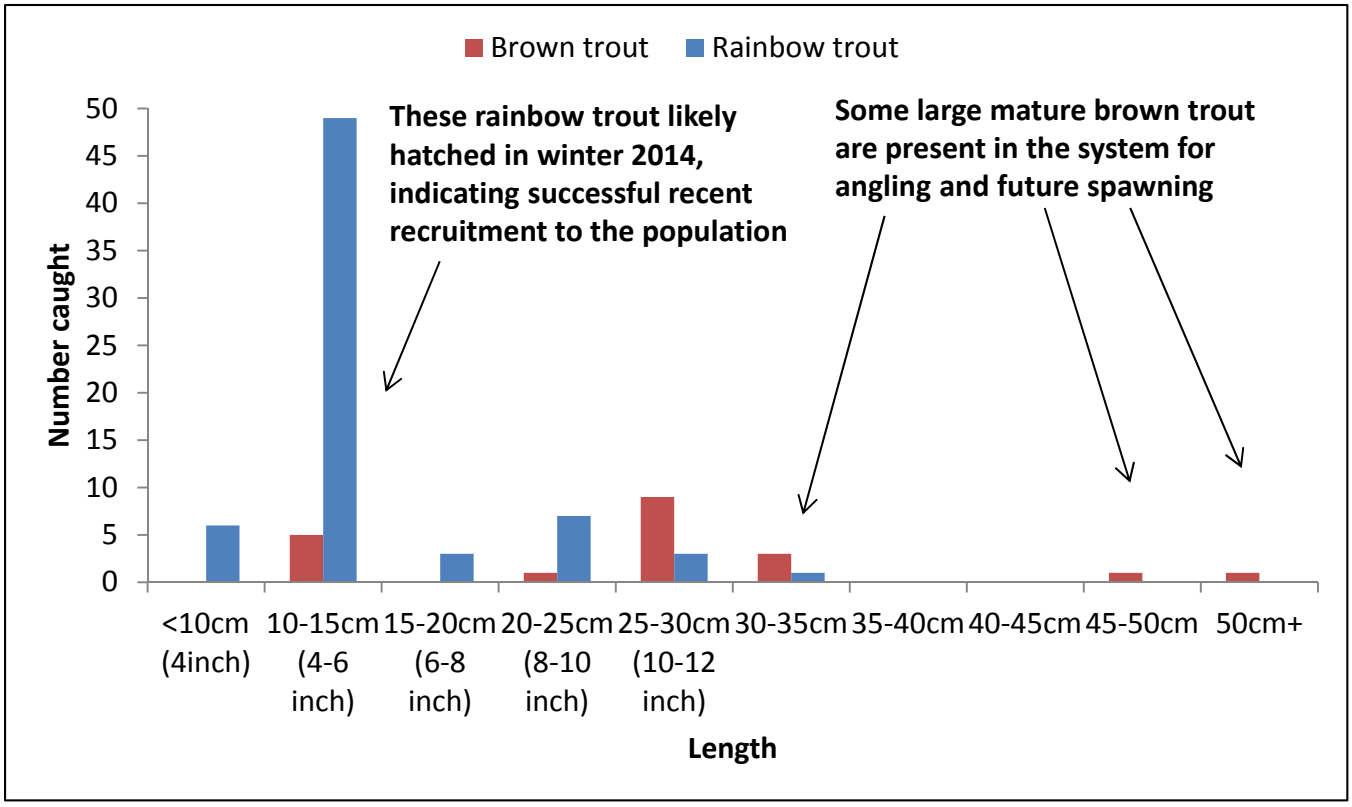
A: Buckland River
1 catchable fish per 100m

C: Harrietville
5 catchable fish per 100m

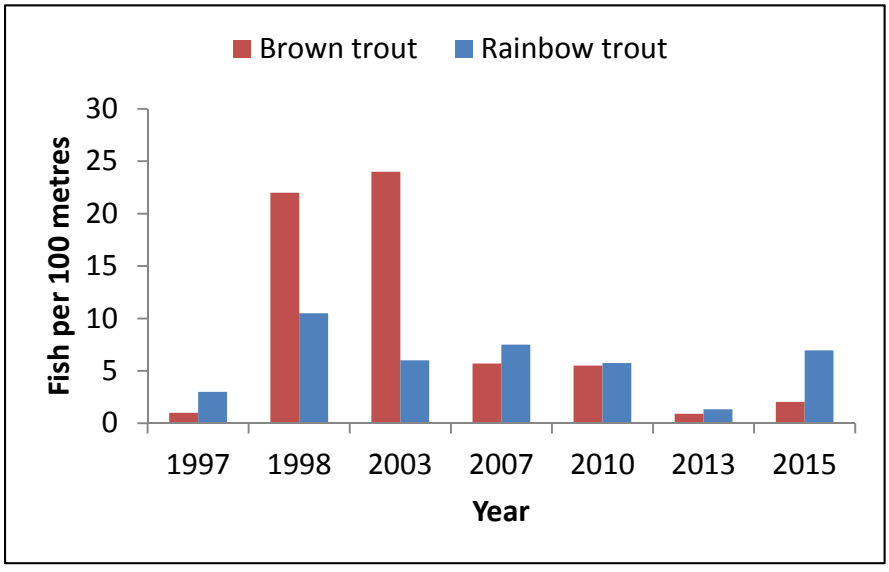
D: East Ovens Track
0 catchable fish per 100m

Location: Ovens River system

Multiple size classes of brown trout are currently present enabling further population recovery



Relative abundance of brown trout is low compared to surveys in previous years but is recovering since 2013



The 2015 survey suggests the Ovens River system currently supports good rainbow trout and some brown trout. Population recovery appears underway.

Location: Toorongo River

Three sites surveyed 23-26 Feb 2015:

Site A: 200m stretch at Toorongo Falls walking track

Site B: 220m stretch at Toorongo Falls Road Bridge

Site C: 200m at Baw Baw Road Bridge

Key health indicators

Recent recruitment ✓

Multiple size classes ✓

Mature fish ✓

Overall Rating: **Excellent**

Monitoring results

Total number of trout caught:
224 brown trout (BT) and 6 rainbow trout (RT) in 620m of river

% Catchable (20cm+) fish: 28% (BT), 67% (RT)

Largest brown trout: 32cm/13in and 356g/1lb

Average size of catchable (20cm+) brown trout: 24cm/9in

Overall catchable (20cm+) brown trout density: 9 fish per 100m

Other species present: River blackfish, Australian smelt, short-finned eel and spiny crayfish

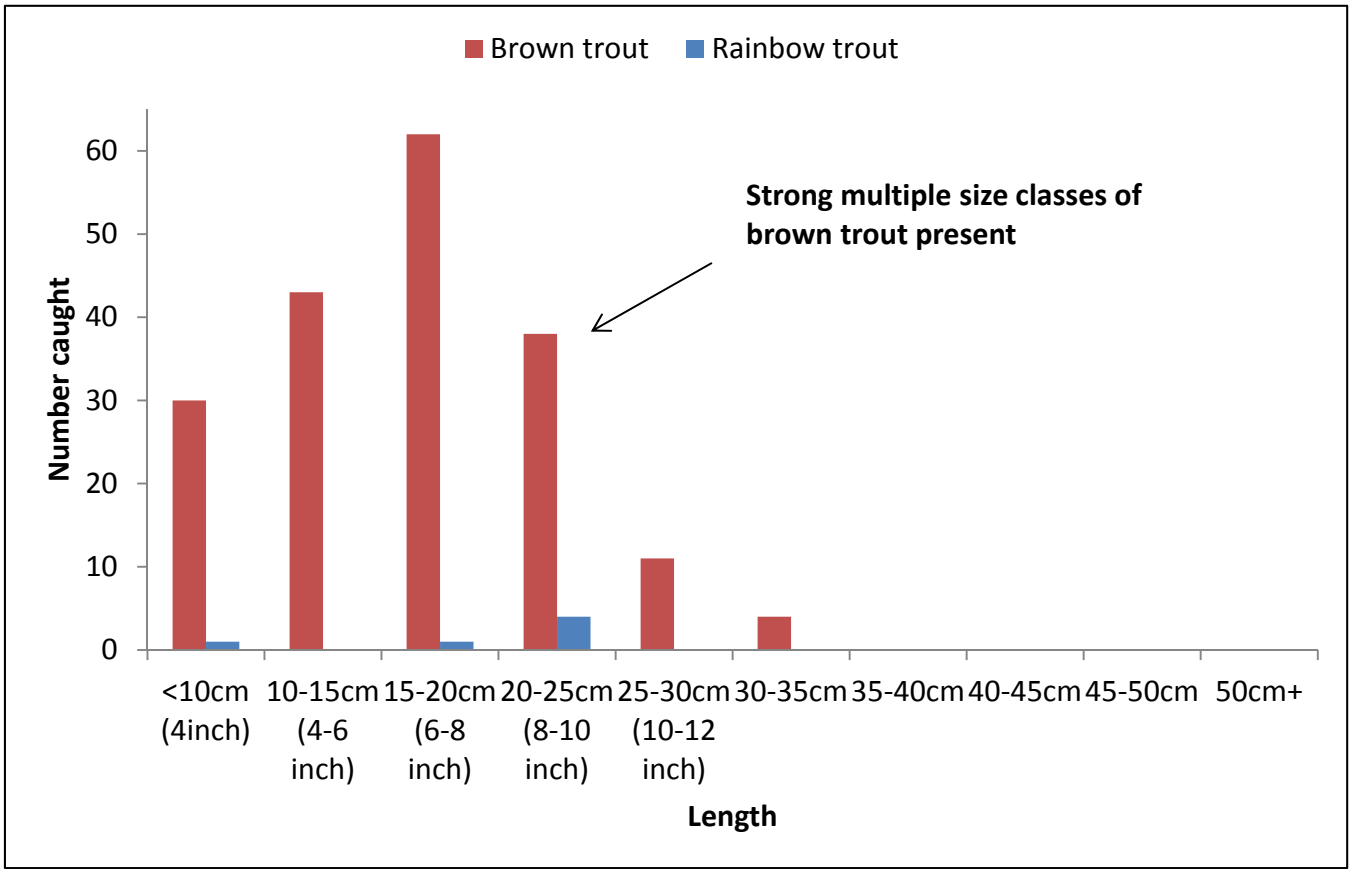
A: Toorongo Falls walking track
8 catchable fish per 100m

B: Toorongo Falls road bridge
3 catchable fish per 100m

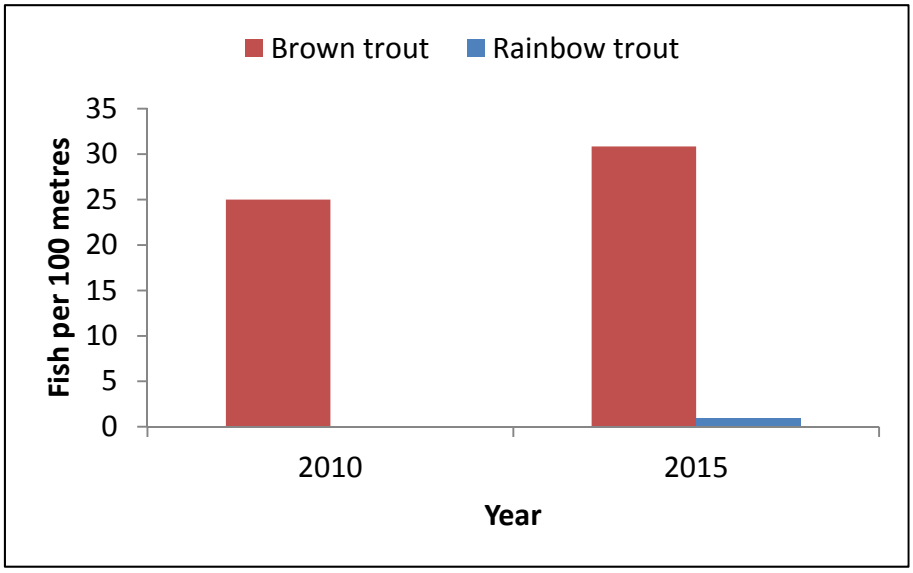
C: Baw Baw road bridge
15 catchable fish per 100m

Location: Toorongo River

Multiple size classes are present in brown trout population



Relative abundance and size structure of brown and rainbow trout is high compared with the 2010 survey



The 2015 survey suggests the Toorongo River currently supports very high numbers of brown trout and a healthy population present.

Location: Yarra River

Three sites surveyed 28 January 2015:

Site A: 350m stretch at Maroondah Highway Bridge
Site B: 360m at Station Road Bridge
Site C: 300m at bridge on Warburton-Woods Point Road

Key health indicators

Recent recruitment	✓
Multiple size classes	✓
Mature fish	✓
Overall Rating:	**Good**

Monitoring results

Total number of trout caught:
19 brown trout (BT) and 0 rainbow trout (RT) in 1.01km of river

% Catchable (20cm+) fish: 74% (BT)

Largest brown trout: 33cm/13in and 392g/1lb

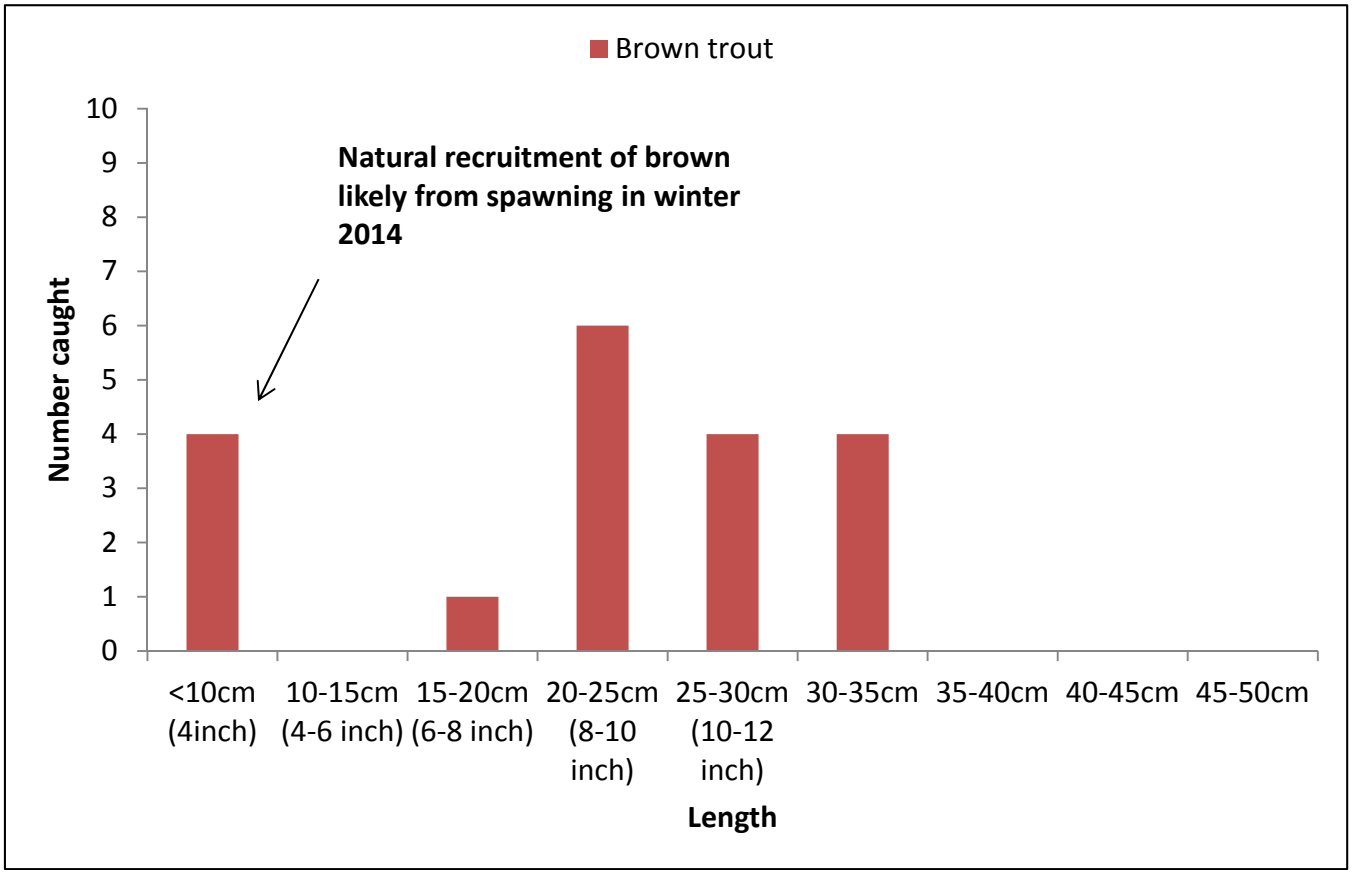
Average size of catchable (20cm+) brown trout: 27cm/11in

Overall catchable (20cm+) brown trout density: 1 fish per 100m

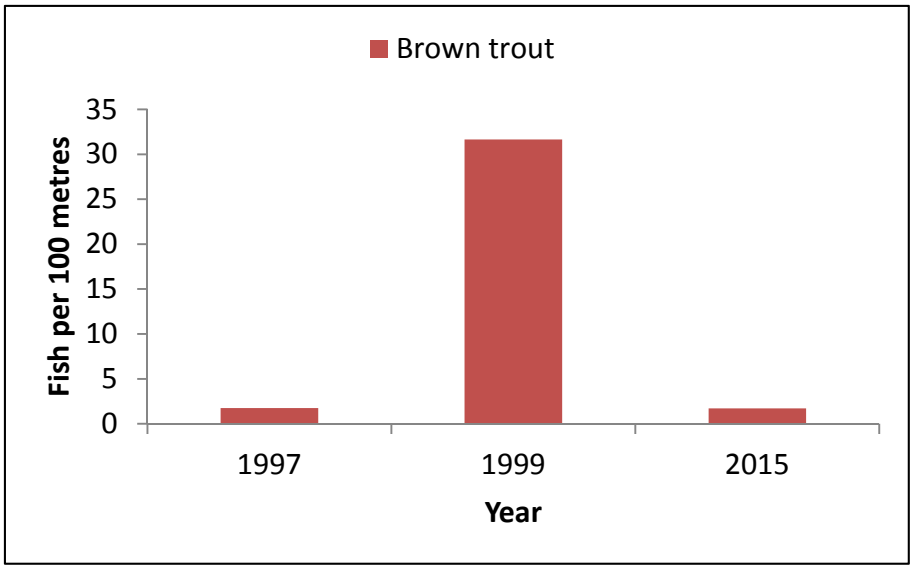
Other species present: Macquarie perch, river blackfish, Australian grayling, Australian smelt, galaxid minnow, short-finned eel, roach, redfin, carp and spiny crayfish.

Location: Yarra River

Multiple size classes are present in brown trout population



Relative abundance and size structure of brown trout is low to average compared with survey in previous years



The 2015 survey suggests the Yarra River currently supports moderate - low numbers of brown trout.

Are summer water temperatures adversely impacting river trout fisheries?

Jason Lieschke, Canran Liu, Andrew Pickworth, John Mahoney
Arthur Rylah Institute, DELWP

Aim:

To determine how river trout respond to changes in water temperatures e.g. When it gets too hot, do trout move or die? If they are moving, where do they go?

Background:

Anglers in north east Victoria have expressed concerns about the status of wild trout populations with reports of poor fishing across many streams, particularly during the summer of 2013-14.

Trout are a cold water species, when the water heats up we don't know whether they die or actively move away.

Cool water refuge is likely to be found in higher altitudes (upstream) or in deeper habitats (e.g. Lake Eildon or deep pools). An improved understanding of fish response to increased water temperatures may benefit anglers and give them a better idea where to find fish and adapt their fishing practices accordingly. Fisheries managers will also gain an understanding of how water temperatures may affect the fishery in the future.

What did we do:

We placed nine acoustic receivers in the Delatite River from Mirimbah to Lake Eildon in October 2014. The transmitters, which are implanted in the Brown trout, send out an acoustic signal into the water at regular intervals (see Figure 1 below). When they are in range of a receiver, the signal from the transmitter is picked up, and the ID of the fish is recorded, along with the date and time.

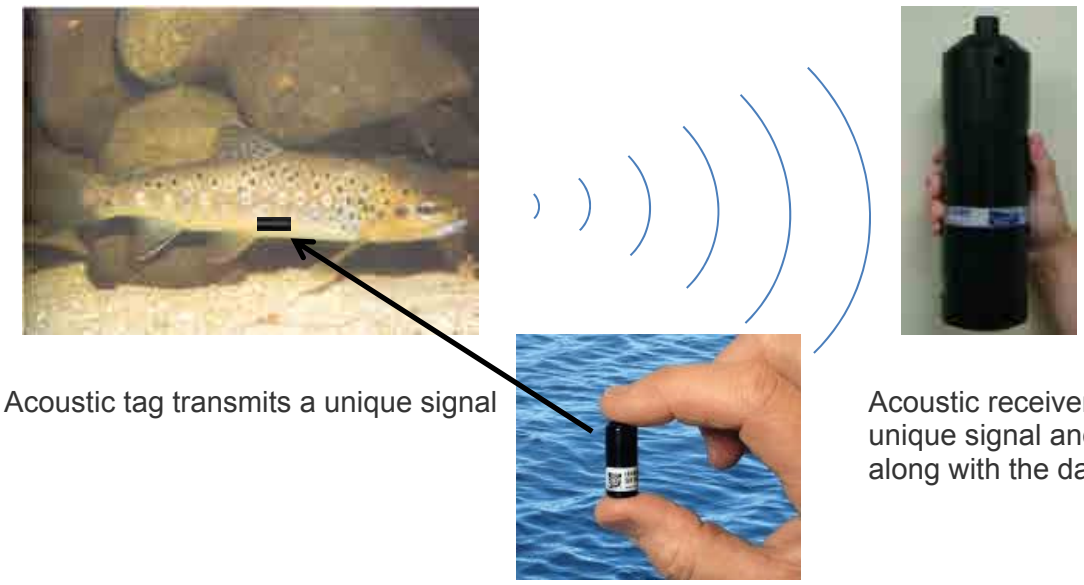


Figure 2. How a transmitter and receiver work.

Four receivers were placed above the Mansfield water supply offtake and five below, including one in Lake Eildon (Figure 2). At seven of the acoustic receivers, instream temperature data loggers were also placed, recording water temperatures every hour.

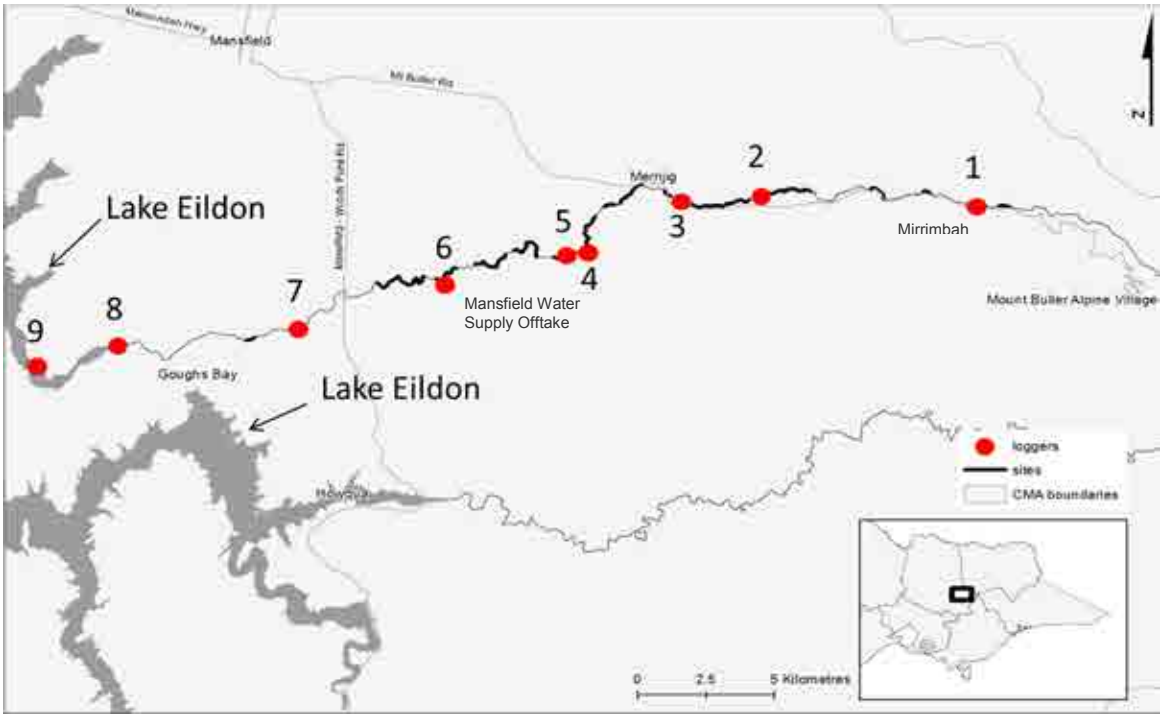


Figure 1. Location of receivers in the Delatite river.
Note darker sections of the river represent areas where brown trout were tagged.

One hundred brown trout were captured via electrofishing between Lake Eildon and Mirimbah between October and November 2014. Captured fish were anaesthetised, measured for length, weighed and tagged (acoustic transmitter and externally tagged with a t-bar tag). Fish ranged from 19.5 cm to 57 cm fork length and 100 to 1860 grams (4lb). Fish were tagged throughout the whole river, with over 22 river kilometres fished. All fish were released back into the river.

Photos of capturing trout via backpack and boat electrofishing
and a brown trout following implantation of a transmitter.

Key findings and implications to date:

Water temperature

The water temperature of the river increased as soon as it was out of the forested area (see Figure 3). The peak temperature at Receiver 1 (Mirrimbah) was 23.1 °C with a daily variation of 7.2 °C. The peak temperature at Receiver 2 was 27.8 °C with a maximum daily variation of 9.8 °C. The peak temperature at receiver 7 was the highest at 29.0 °C, however its daily variation was only 5.6 °C, not as much as the upstream sites.

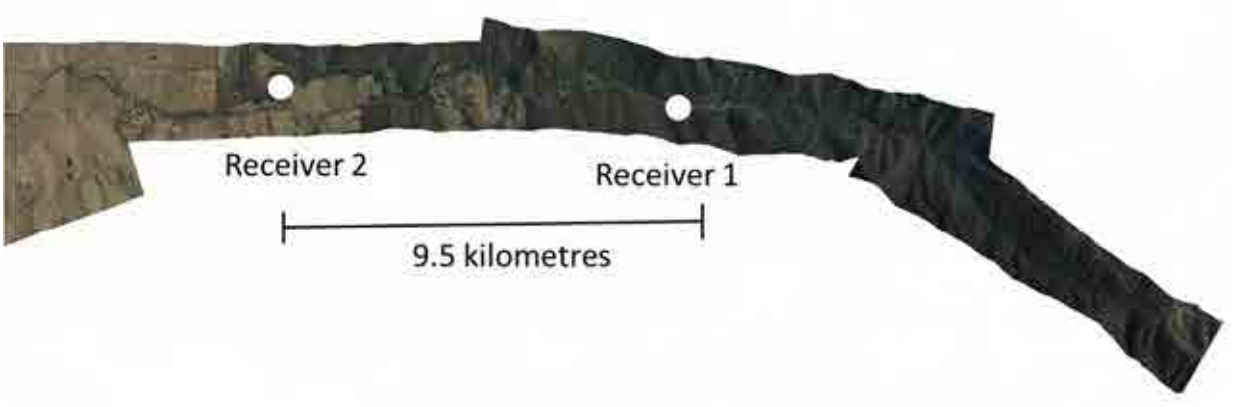


Figure 3 Aerial imagery of receiver locations one and two showing differences in tree cover

The Summer of 2014/15 was mild compared to previous years. For example, during the millennium drought and in the summer of 2013-14 the number of hot days was greater compared to the summer of 2014-15. As we have no previous instream water temperature data, the maximum daily temperature from Mount Buller was used as a surrogate for instream water temperature (Figure 4.). These "hot" days would have also caused water temperatures to increase.

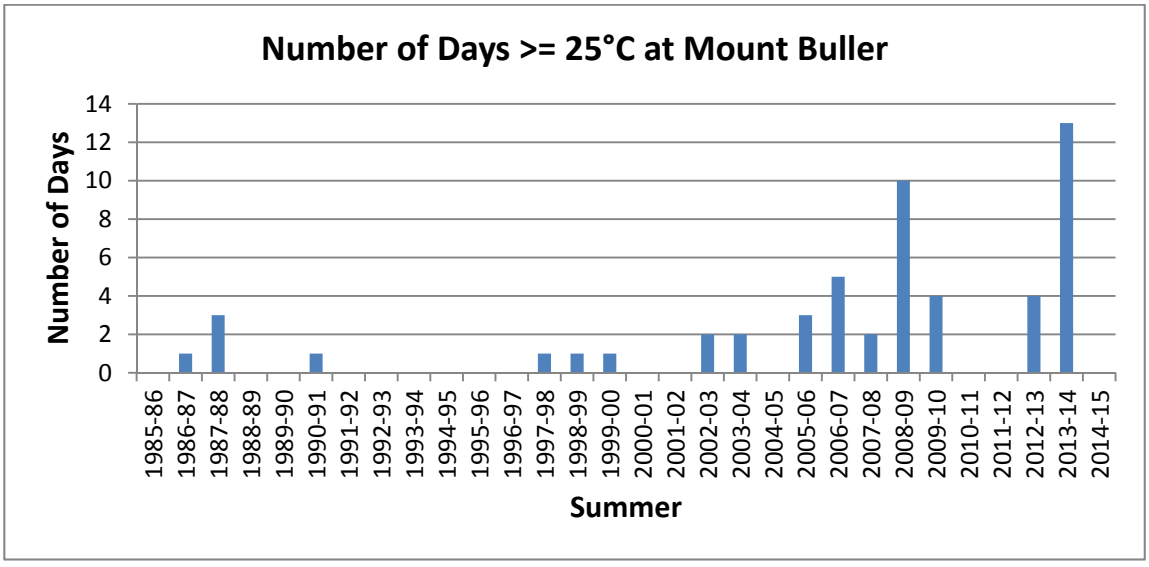


Figure 4. Number of days temperature is 25°C or above at Mount Buller.
Used as a surrogate for water temperature where instream water temperature data is not available.
Note there were no days 25°C or above in summer of 2014-15.

Trout movement and temperature

We investigated the relationship between fish movement, fish length, water level and water temperature and found that:

- Larger fish were more active;
- Fish movement increased as water level increased;
- Fish movement increased slightly as temperature increased, however, movement increased abruptly when temperature was above 22 °C (Figure 5);
- Long distance movements (between Receivers) increased as temperature increased (Figure 5).

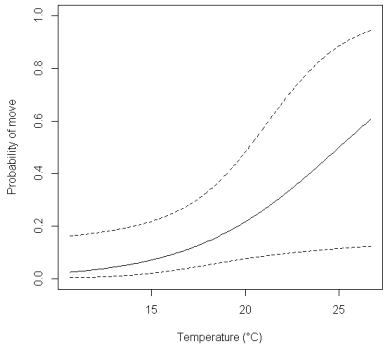


Figure 5. The probability of a fish moving and water temperature.

Where did the trout move?

- Ninety three fish did not move large distances (typically they moved < 2.5 km);
- Seven of the 100 fish were recorded on multiple receivers, i.e. from 3 to 7.5 km apart;
- One fish moved upstream from receiver 6 to receiver 7 (i.e. 3.5 km);
- Six fish moved upstream from receivers 2 and 3 (i.e. 7 km);
- No fish moved downstream;
- The fish that moved from receiver 2 to receiver 3 all moved with the peak in temperature and most returned back to their original location one week after initial upstream movement, which correlated with a decrease in temperature following a large rain event.

Summary of movement

- Larger fish were more likely to move than smaller fish;
- An increase in temperature was more likely to trigger a long distance movement (between receivers) and this movement was always upstream. However, most fish didn't move;
- No fish moved as far upstream as Receiver 1 (Mirrimbah), where temperature did not go above 23°C, suggesting that fish found a place where they were not temperature stressed before reaching this area.
- The summer of 2014/15 was a mild year (as evidenced by Mount Buller maximum daily temperature);
- Temperature increased dramatically and had a high daily variation once the river flowed out of the forested area.

Next steps:

- There are still 70 fish with transmitters that will be active over the summer of 2015/16;
- As a bonus, we will also get spawning movement (if any) for these fish for the 2015 spawning period (yet to be analysed).

Theme 2 – Climate & Habitat

Photo: Marc Ainsworth

Streamside vegetation change, water temperature and trout

John Morrongiello
School of BioSciences, University of Melbourne Victoria

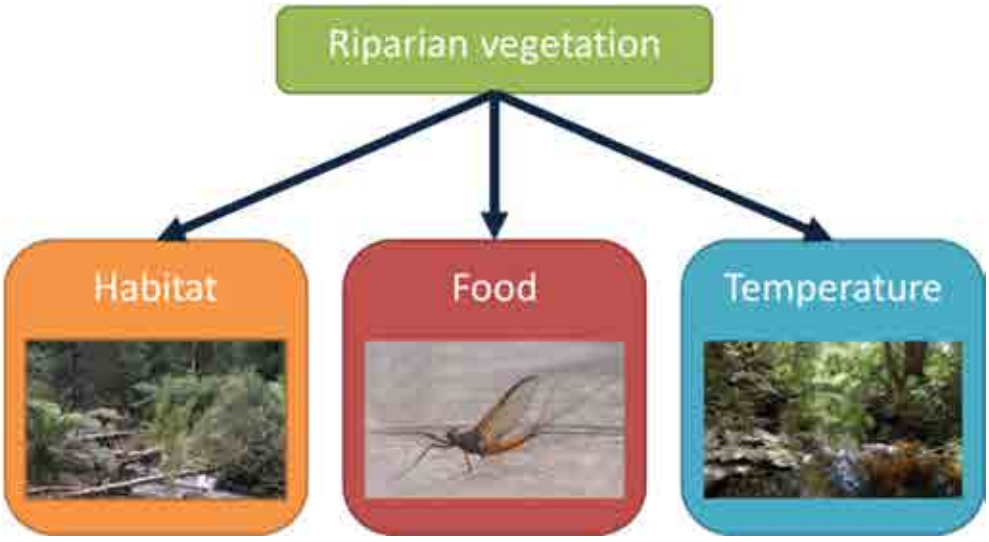
Aim:

Understand how changes to streamside (riparian) vegetation can affect water temperature, and how local events such as willow removal compare to broader, regional-scale, processes.

Background:

Riparian zones are the narrow strips of land along the banks of streams. Trees and shrubs in this zone are called riparian vegetation and these plants play a very important role in determining water temperature and water quality, the amount of in-stream habitat (e.g. snags, undercut banks), and also provide leaves and other organic material that can underpin freshwater food-webs (e.g. food for insect nymphs). All these factors affect the health of fish populations, including trout.

Brown and rainbow trout are cool-water species, meaning that they struggle to survive when water temperatures pass critical limits. For example, scientists have shown that brown trout stop growing if water temperatures get hotter than 19^{o}C, and they are at great risk of dying if the water gets hotter than 24-25^{o}C. This means that processes that cause water temperatures to increase may cause a decline in trout populations.

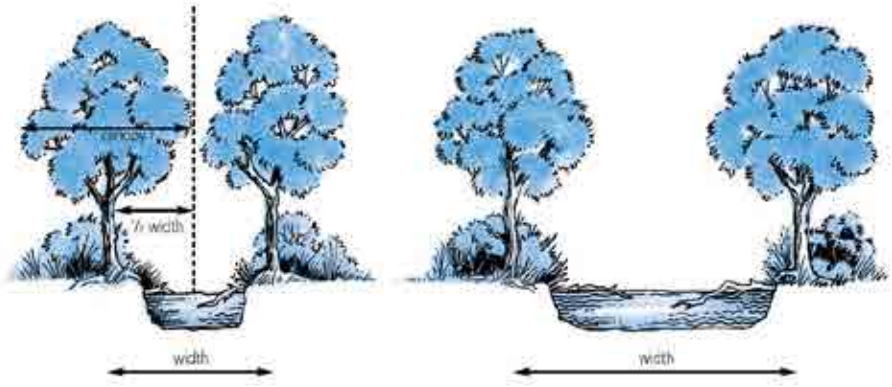


Riparian vegetation affects fish by influencing instream habitat (e.g. snags), food supply (e.g. leaves for aquatic insects to eat), and temperature (via shading).

All else being equal, a shaded pool will be cooler than an unshaded pool. However, in reality water temperature is not just dependent on the size and number of trees at a particular spot. The flowing nature of streams mean that things happening upstream and across the catchment (area of land a stream drains) can often be more important than local processes in determining water temperature.

Some larger scale drivers of stream temperature include:

- **Season and air temperature** (it is hotter in summer)
- **Landscape** (topography- do nearby hills or steep banks shade the stream?)
- **Stream flow and depth** (like in a kettle, smaller streams [less water] warm faster than bigger streams [more water])
- **Channel width and orientation** (vegetation is less effective at shading wider streams, and east-west flowing streams get hotter than north-south flowing streams because they get no afternoon shade; similar to westerly facing windows in a house letting in more heat)
- **Large scale changes in riparian vegetation** (cleared farmland verus forest, bushfire)



Completely shaded small stream Partially shaded bigger stream

Example of how channel width can influence riparian vegetation shade. Shading is dependent on canopy size and channel width. A given tree canopy may shade all of a small stream, but this shading effect becomes less effective as channel width increases (modified from Bunn etal 2004).

What we did:

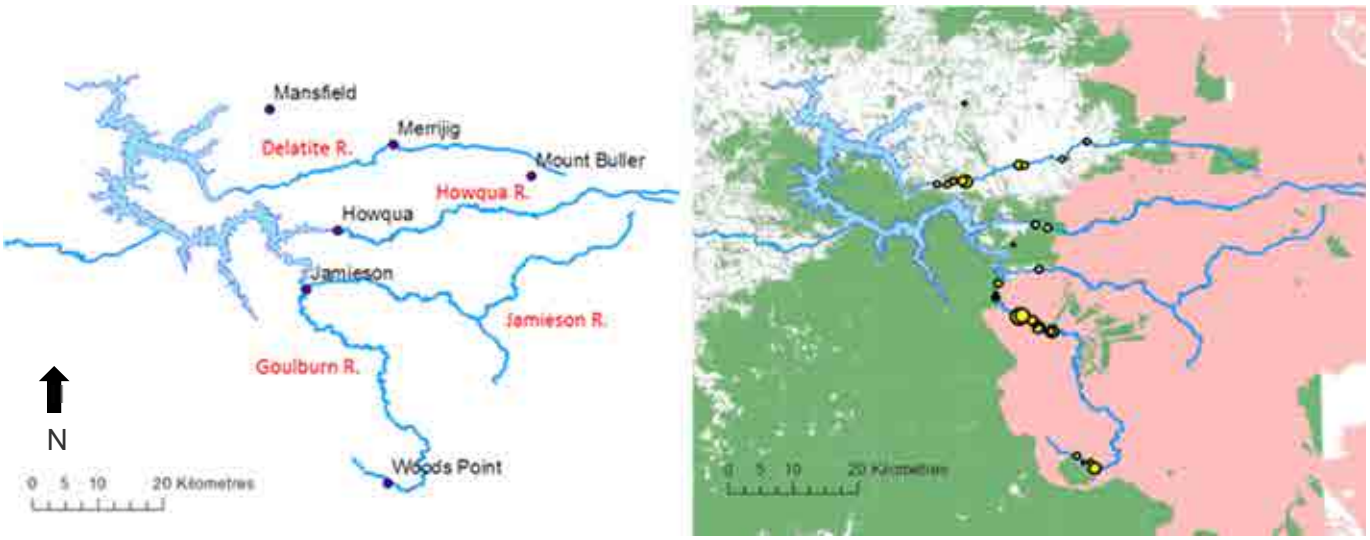
Anglers are concerned that the removal of willows along streams has caused a decline in Victoria's trout fishery. Willows are removed by managers because they are a major environmental weed, but this removal causes a very obvious change to the local stream amenity for trout anglers. It is acknowledged that willows can provide shade, habitat and food for trout at a local scale.

Does willow removal, like that seen here on the Broken River, affect stream temperature enough make conditions unfavourable for trout?
Note significant revegetation after willow removal (credit: M. Turner & J. Morrongiello)

This good sized brown trout took a Royal Wulff in a north-east Victorian stream. Conducting fish surveys after the 2007 bushfires. Note the lost canopy cover (credit: J. Morrongiello)

We explored concerns about willow removal in the upper Goulburn River catchment above Lake Eildon by putting it action in the broader context of riparian change, recent climate and river flows.

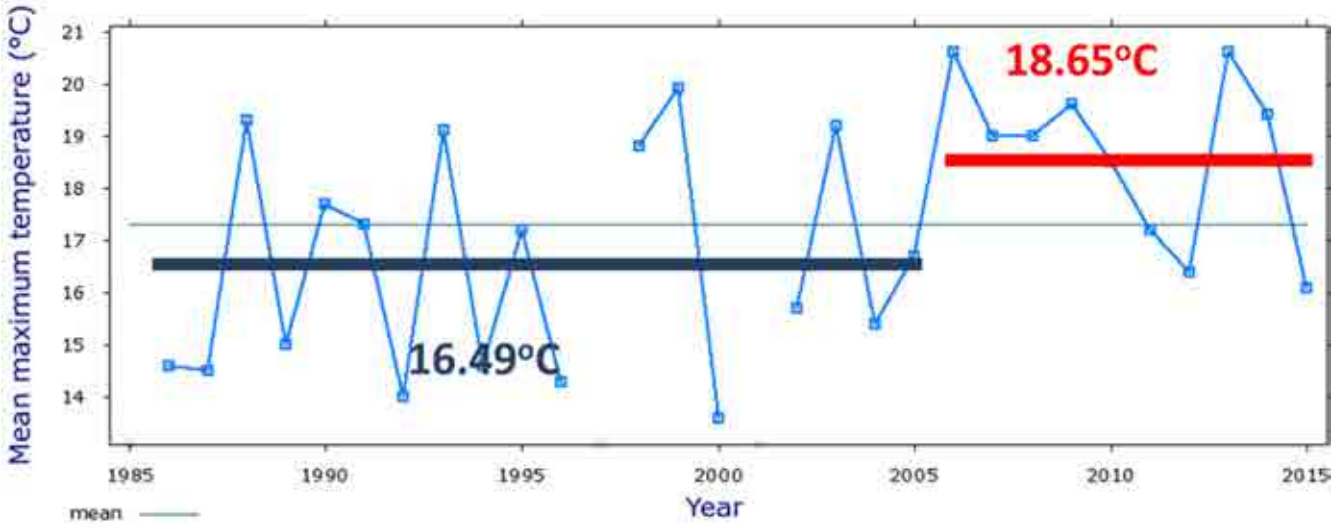
1. The Delatite, Howqua and Jamieson Rivers all flow east-west, meaning that during summer their waters are exposed to the sun all day long and are vulnerable to warming.
2. Much of the lower Delatite flows through farmland with limited riparian vegetation. The other rivers flow through forested catchments. Areas of willow removal across the four rivers are very small compared to total channel length and is concentrated in downstream reaches.



The upper Goulburn River showing river orientation. The Yellow circles on the right indicate areas of willow removal, green is existing vegetation and pink is area burnt by the 2006-07 bushfires.

3. Vast areas of the catchment were severely burnt in the 2006-07 bushfires. These fires removed most of the canopy along riparian zones and even today it has still not recovered fully.

4. The last decade has been very warm and very dry. Summer air temperatures at Mt Buller are two degrees warmer than the longer-term average. Delatite River flows are dramatically lower than they have been in recorded history. During the Millennium Drought (1997-2009) flows were 40% lower than average. Despite the drought breaking in 2009, flows are still 30% below average.



Mean maximum air temperature for January over the last 30 years at Mt Buller (Source: BoM)

Key findings and implications to date:

- Vegetation plays an important role in shading streams and keeping waters cool.
- Massive bushfires in 2006-07 dramatically reduced native riparian vegetation cover across much of the upper Goulburn catchment, especially in small headwater streams. This likely caused big increases in stream temperature due to a lack of shading.
- The last 10 years have been particularly hot and dry, further amplifying the impacts of the bushfire. 2013 and 2014 were some of the hottest summers on record. These conditions are likely to become more common in the future.
- The east-west orientation of rivers makes many upper Goulburn trout streams naturally exposed to the hot summer sun and thus vulnerable to increased warming.
- Willow removal is unlikely to have caused the observed declines in trout because it has neither been extensive enough, nor occurring in the upper parts of the catchment where the majority of stream shading should occur.
- Willow removal can affect local scale shade, habitat and food for trout, but on a river scale the impact from willow removal on trout pales in significance against broader catchment issues like climate, drought, bushfire and topography.

Next steps:

Work with the Goulburn-Broken Catchment Management Authority to prioritise areas for revegetation in the upper Goulburn catchment to maximise stream shading at a local and catchment scale.

How riparian vegetation supports aquatic insects resulting in better trout fishing

Diane Crowther and Phil Papas
Arthur Rylah Institute, DELWP

Aim:

To understand how riparian vegetation supports aquatic insect communities which results in better trout fishing.

Background:

Fly fishing is an historic and popular form of recreational fishing based on imitating the variety of insects, mainly aquatic, that are a food source for trout. Trout anglers have expressed concern over the apparent long term decline of aquatic insect communities in the upper Goulburn catchment area. One reason for the observed decline in aquatic insects may be due to changes over time in the type of riparian vegetation along river reaches.

As an important food source for trout, aquatic insect health is integral to support a healthy recreational trout fishery and any declines in health are of concern.

The focus of this project is to look for links between aquatic insect communities and riparian vegetation. The project findings will highlight connections between aquatic insects and plants and could be used to inform Catchment Management Authority (CMA) riparian planting programs. Healthy riparian vegetation will promote a healthy aquatic insect community and in turn will support a better trout fishery.

Riparian revegetation – how does it support the aquatic insect community?
(mayfly photo used with permission from J. Gooderham and E. Tsyrlin – The Waterbug Book 2002).

What we did:

- Focused the study on aquatic insect groups that are commonly reported in the diet of trout and occur in the upper Goulburn, Acheron and Rubicon rivers.
- Reviewed scientific literature and consulted aquatic insect experts and local anglers to identify associations of specific aquatic insects with riparian plants.
- This initial review revealed no specific associations and the study was re-focussed to identify and describe the role of riparian vegetation in supporting aquatic insect communities. This was done by a further literature review and consultation with aquatic insect experts.
- Visited revegetation/rehabilitation sites (Scorah and Tumbling Waters on the Rubicon River and Thornton's Beach, Goulburn River) to gain an insight into the type of riparian plantings recently undertaken by the GBCMA.

An example of endemic riparian revegetation and instream rehabilitation (instream alignment posts to trap sediment and stabilise banks) on the Rubicon River at Tumbling Waters.

Key findings and implications to date:

- Associations between specific aquatic insects and riparian plants were not found in the initial review. This is likely because most adult aquatic insects are not dependent on bankside vegetation for many of their requirements such as feeding and egg laying. This is in contrast to many terrestrial insects such as butterflies and the willow sawfly grub which use particular riparian plants for their lifecycle requirements.
- Additionally, associations between instream detritus from specific riparian plants and the larval stages of aquatic insects were not found in the review. This represents a knowledge gap.

- The review therefore re-focused on identifying how riparian vegetation in general supports aquatic insect communities. These included:
    - inputs of leaves and woody debris into the waterway which is used by many larval insects for food and shelter
    - shading of the waterway to minimise the risk of temperature extremes which can be detrimental to aquatic insects
    - bank stabilization to minimise the risk of sediment inputs which can harm aquatic insect eggs and larvae
    - a food source for the minority of aquatic insect adults that feed on terrestrial vegetation.
- The review also identified that riparian vegetation composition, structure and density can influence the aquatic insect community. There is a change in these relationships over time, as the riparian vegetation matures. New plantings will get better with age and support more diverse aquatic insect communities.
- The origin of the riparian vegetation will also influence aquatic insect communities. For example:
    - Exotic riparian vegetation provides a higher initial instream food source but can decompose quickly and/or can be seasonally limited e.g. willows shed leaves in autumn. In contrast, native riparian vegetation provides year-round stream inputs which are generally slow to breakdown. This provides a longer-lasting food source for aquatic insects, in terms of both the biofilm which grows on it and the leaves themselves.
    - Native vegetation provides better case material for caddisflies as it is available all year round, is durable and less likely to be consumed by other animals. Caddisflies are a major component of trout diet.

Next steps:

- Communicate project knowledge, in the form of a fact sheet, to fishers and the broader community.
- Consider linking aquatic insects in existing community demonstration reaches to highlight the requirements and importance of these animals.
- Further investigations could be done to identify:
    - associations between instream detritus from specific riparian plants and the larval stages of aquatic insects
    - other habitat enhancements that can increase the abundance of aquatic insects, for example addition of instream woody habitat and boulder seeding
    - the role of riparian zones in supporting terrestrial insects which are an important food source for trout.

Overview of Waterway Management in Victoria

Mark Turner[1], Amber Clarke[2]
[1] Goulburn Broken Catchment Management Authority, [2] Waterway Health, DELWP

1. The Victorian Waterway Management Strategy

The Victorian Waterway Management Strategy provides the Victorian Government's policy direction for managing Victoria's waterways over an eight-year period.

The strategy aims to maintain or improve the condition of our waterways so they can support environmental, social, cultural and economic values that are important to communities. It provides direction for regional decision-making, investment and management issues for waterways, as well as the roles and responsibilities of management agencies.

Targets are included in the strategy for long-term resource condition outcomes (to be achieved in 8+ years) and management outcomes (to be achieved in 1–8 years). Progress against these targets will be publicly reported by the Department Environment, Land Water and Planning.

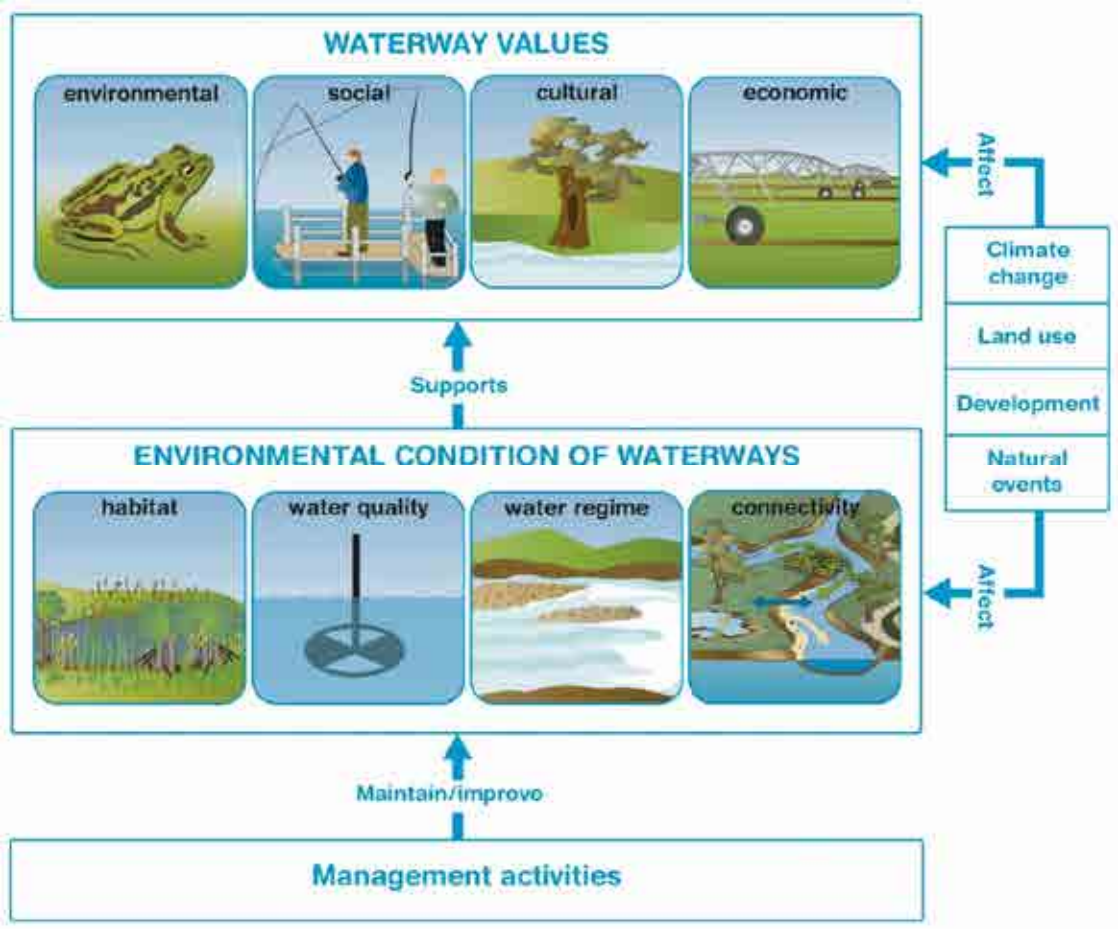


Figure 1. The environmental condition drivers that support the values of waterways (source Victorian Waterway Management Strategy).

2. Regional Waterway Management

In Victoria, there are 10 catchment management regions and each has a catchment management authority to co-ordinate integrated management of land, water and biodiversity. Catchment management authorities also have specific responsibilities for waterway management (under the Water Act 1989), except in the Port Phillip and Westernport region where Melbourne Water have the waterway management responsibilities. Collectively, the nine catchment management authorities and Melbourne Water are referred to as the 'waterway managers'.

Figure 2: CMA regions in Victoria.

The waterway managers have the lead role in developing and delivering regional programs for waterway management. The range of functions that waterway managers undertake includes:

- developing a Regional Waterway Strategy and associated action plans
- developing and implementing work programs
- authorising works on waterways, acting as a referral body for planning applications, licences to take and use water and construct dams, for water use and other waterway health issues
- identifying regional priorities for environmental water management and facilitating delivery of environmental water
- providing input to water allocation processes
- developing and co-ordinating regional floodplain management plans
- managing regional drainage in specified areas
- responding to natural disasters and incidents affecting waterways such as bushfires, floods and algal blooms
- undertaking community participation and awareness programs.

The Regional Waterway Strategies are a single planning document for river, estuary and wetland management in each region and drive implementation of the Victorian Waterway Management Strategy. Goulburn Broken CMA's Regional Waterway Strategy is available on our website: www.gbcma.vic.gov.au

The Regional Waterway Strategy outlines regional goals for waterway management. High value waterways are identified and for the eight-year planning period a work program of management activities for priority waterways is included. The regional work program provides clear direction to guide investment by the Victorian Government in waterway management.

The Regional Waterway Strategy also identifies regional priorities for environmental water management over the eight-year planning period, together with the complementary management activities required at those sites. This information will is used as a key input to environmental water planning arrangements

High value waterways are not just those with environmental values, they also include waterways that are important for their high social, cultural or economic values.

Waterways will be considered high value if they have one, or more, of the following characteristics:

- formally recognised significance
- presence of highly threatened or rare species and ecological communities
- high naturalness values (for example, aquatic invertebrate communities or riparian vegetation)
- or special waterway features (for example, drought refuges or important bird habitat)
- high social, cultural or economic values (for example, recreational fishing, Aboriginal cultural heritage and urban or rural water sources).

3. Victorian Traditional Owner involvement in waterway management

Victorian Traditional Owners have strong cultural obligations to manage waterways on their Country. Their aspirations regarding waterway management span the full range of environmental, social, cultural and economic values that waterways provide. Given this connection to Country, Traditional Owners are considered critical partners in the development and delivery of the Regional Waterway Strategies.

The Victorian Government is progressively strengthening partnerships with Traditional Owners through the likes of joint and co-operative management agreements over public land.

4. Management issues

Typical management issues covered in the state and regional strategies include:

- Recreational use of waterways
- Environmental water management
- Riparian management
- Water quality
- The river channel
- Wetlands
- Waterways in urban areas
- Extreme events of flood and bushfire
- Invasive species management

5. Making a difference

Before *During*

After

Figure 3. Typical riparian management on the Acheron River, including stock exclusion, willow management, and revegetation.

6. Additional information

Victorian Waterway Management Strategy: http://www.depi.vic.gov.au/water/rivers-estuaries-and-wetlands/strategy-and-planning

Goulburn Broken Regional Waterway Strategy: http://www.gbcma.vic.gov.au/publications/published_documents/waterway_and_floodplain

Theme 3 – Fisheries Management

Photo: Marc Ainsworth

How does trout stocking contribute to wild trout fisheries?

John Douglas[1] and Jason Lieschke[2]
[1] Fisheries Victoria, DEDJTR, [2] Arthur Rylah Institute, DELWP

Aim:

To understand whether trout stocking helps the wild brown trout river fisheries recover.

Background:

Fish stocking is an important tool in fisheries management and has been used for centuries in various applications.

One of the most important questions regarding stocking is “Do the stocked fish increase the overall number of fish in the population?”. Stocking results can vary depending on the environment and scenario, therefore we can’t assume it work’s everytime. For example, stocking can be very effective when recruitment is lacking—like the trout fisheries in many of Victoria’s lakes—however, it has found to be less effective when there is natural recruitment occurring.

Past fisheries research in Victoria on wild trout fisheries, and on fisheries worldwide, suggest that stocking on top of existing self-sustaining (breeding) populations is generally an ineffective long-term strategy to enhance wild stocks because it often provides a very low-return to anglers at considerable expense. In many instances, it is the other environmental conditions that constrain the size of the fish population, not recruitment levels.

However, anglers have a strong affinity with fish stocking as it seems to be logical that if you put fish in then there will be more fish in the river. Under this context stocking can often be seen as a fisheries management panacea or cure all, but the issue is much more complex and revolves about what is the limiting factor(s) of the population, and then, what is the best approach for intervention. If it is recruitment issues then stocking may be an effective option.

There is a case to reassess the effectiveness of fish stocking to enhance the wild trout fisheries in Victoria and to better communicate findings, educate stakeholders and re-examine the cost-effectiveness of this management option.

Fish stocking is an important fisheries management tool for improving fishing in key places and this project assessed whether it can assist wild trout fisheries recover.

What we did:

Undertake two stocking trials, one in the upper Goulburn River above Lake Eildon and another in the Howqua River. To date there have been two stocking events in each river, and one assessment in each river. Each river has received 5,000 one-year-old brown trout in 2014 and again in 2015. Stocking will continue in 2016. To identify the stocked fish from the wild fish, the stocked fish have been fin clipped. All stocked fish have been clipped by the volunteers from the Mansfield and District Flyfishing Club who also assisted in the release. The proportions of stocked fish and changes to overall fish abundance in the trout fishery and population will then be assessed as part of the monitoring of trout population and angler creel survey.

Volunteer Mansfield fishers assisted finclipping (adipose fin in 2015) and stocking the fish for the trial.

Key findings and implications to date:

The survey confirmed stocked fish survival in both rivers, which is a great start. However we need to collect more information on how those stocked fish move through the fishery, before we can interpret the success of the trial stockings.

Next steps:

- The third and final stocking of 5000 fish into each water is planned for winter 2016.
- Follow up surveys will provide information on the proportion of the population made up by the stocked fish

Smarter trout stocking through marking hatchery fish

Brett A. Ingram[1] and Fletcher Warren-Myers[2]
[1] Fisheries Victoria, DEDJTR, [2] University of Melbourne

Aim:

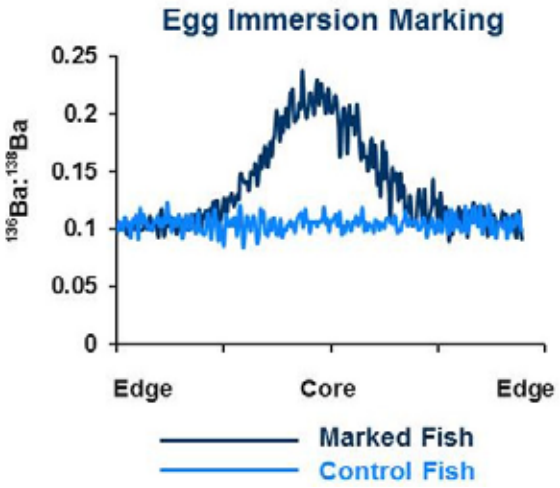
(a) To determine if brown trout stocked into Lake Eildon contribute to river trout fisheries.
(b) To improve management of trout stocking programs by implementing a cost effective method of mass-marking hatchery-bred trout to distinguish them from wild-born fish.

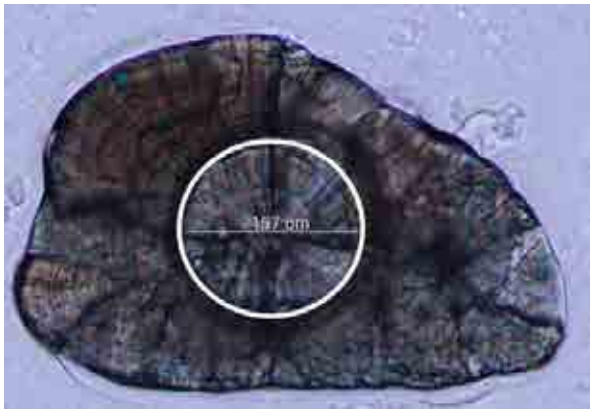
Background:

Fisheries Victoria periodically releases brown and rainbow trout into Lake Eildon to support the lake fishery. However, it is not clear if these fish also move into the steams above the lake and thus enhance the stream fisheries in these areas. Understanding the contribution of lake fish to the river fishery, and river fish to the lake fishery, will inform fisheries management practices about the effectiveness of fish stocking in Lake Eildon and closed seasons in rivers.

To answer this question, we need to distinguish the stocked fish from wild fish, as well as distinguish fish stocked into different locations. To achieve this, hatchery-bred trout will require marking before they are released, which can be costly and time consuming to undertake. Although there is a wide range of methods currently available for marking fish, this project will develop and implement a cost-effective method to tag all trout produced at the Snobs Creek hatchery that is quick and simple to apply. In the long-term, being able to distinguish between stocked and wild fish will have broader implications for the future assessment and improved management of Victorian trout stocking program.

Trout eggs transferred into a solution of barium for marking





A Mass Spectrometry scan of an otolith marked with Ba137 via egg immersion (left). Picture is of a fish otolith analysed using LA-ICP-MS, circle indicates the size of the laser spot used for detecting the Ba137 mark (right)

What we did:

An initial review was undertaken to identify trout marking methods to mass-mark fish produced at Snobs Creek. Marking with Barium (Ba) isotopes was selected because the method is simple, cost effective, safe to use, does not affect the welfare of fish, and large numbers of fish can be quickly marked with different Ba isotopes. In this method, eggs, yolk-sac larvae, or juvenile fish can be immersed in a water bath containing a small amount of enriched Ba which then becomes incorporated into the calcified structures (i.e. otoliths) of the fish as it grows in the month following immersion. This alters the chemical composition of the otolith, which can be detected by analysis with a laser.

During the 2015 breeding season, marking trials were conducted at the Snobs Creek hatchery. Two marking methods were tested on brown trout, which involved bathing either eggs or yolk-sac larvae. Brown trout were also treated with either Ba135 or Ba137 so that fish stocked into different locations can be distinguished. All rainbow trout produced during the breeding season were also marked with Ba137.

Next steps:

Samples of marked fish will be tested to confirm uptake of Ba.

Fish marked during the 2015 breeding season will be reared at Snobs Creek. In 2016, brown trout yearlings marked with Ba137 will be released into Lake Eildon while fish marked with Ba135 will be released into the Howqua and upper Goulburn Rivers. The latter fish will also be fin-clipped with the help of Volunteers from Mansfield and District Flyfishing Club as an external 'flag' that can be seen by fisheries researchers and by anglers.

During 2017 samples of brown trout will be collected from Lake Eildon and connecting rivers by volunteer anglers and ARI survey teams undertaking research for other projects. The otoliths (ear bones) from these fish will be removed and analysed for the presence of Ba marks.

Is fishing pressure adversely impacting wild trout populations and the quality of the trout fishery?

Kylie Hall and Khageswor Giri
Fisheries Victoria, DEDJTR, Agriculture Research, DEDJTR

Aim:

Determine usage patterns of anglers to assess the fishing pressure on 'wild' trout river fisheries in the Upper Goulburn basin.

Background:

Many of the waters upstream of Lake Eildon in the north-eastern region of Victoria (Goulburn River basin, Mansfield Shire) are important nursery streams for Lake Eildon and support 'wild' self-sustaining recreational fishing for trout.

Determining the usage of these streams by anglers will enable an assessment of the impact of angler pressure and exploitation on these wild trout fisheries to assist in the management of these waters.

Howqua River, north eastern Victoria.

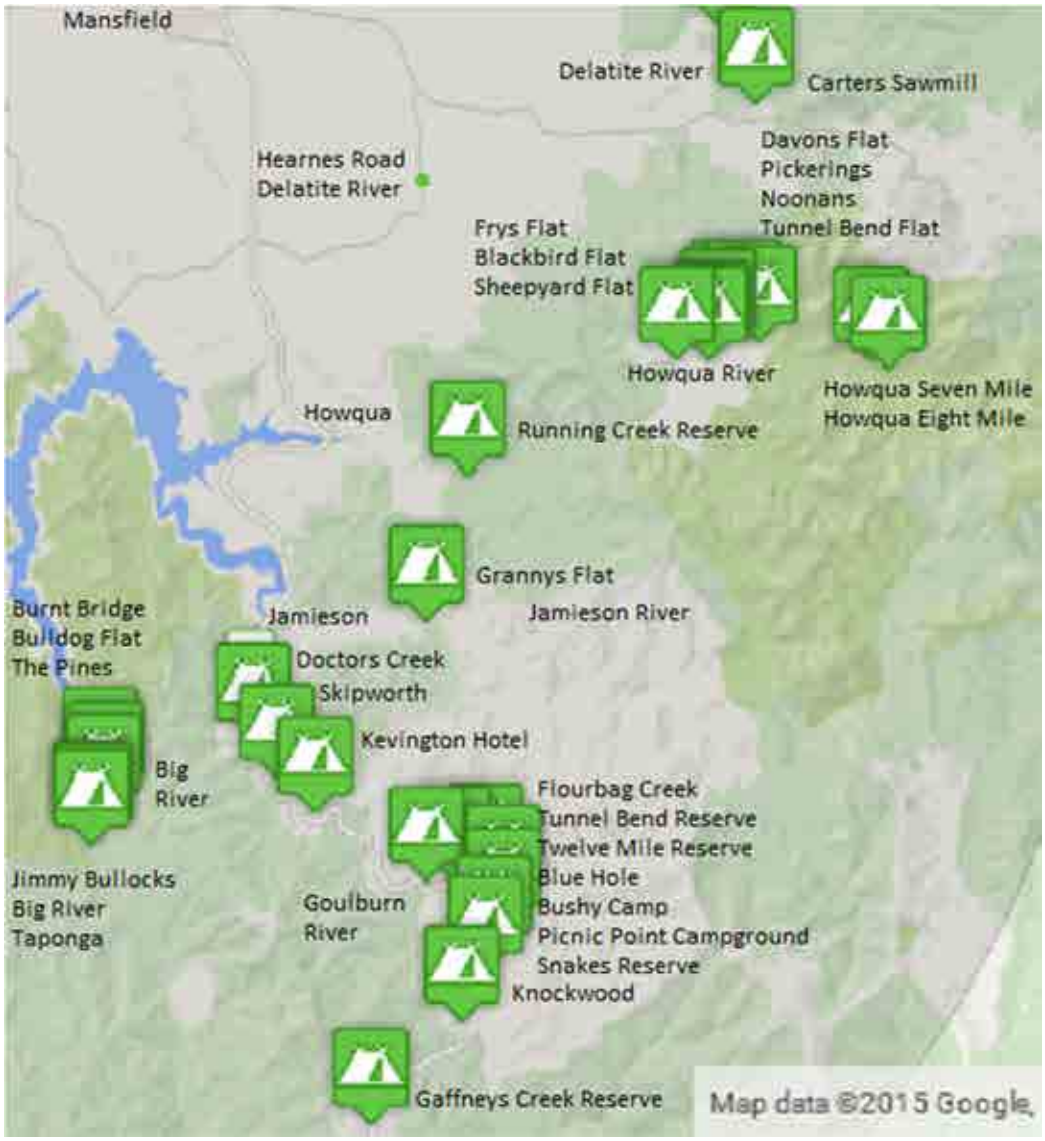
What we did:

Targeted surveys were conducted on-site at Upper Goulburn basin rivers over the 2014–2015 trout season with questions on visitor demographics, preferences, avidity, catch and effort. The creel clerk completed 13 days of driving to popular wild trout stream locations, including the townships of Jamieson, Woods Point and Mansfield, and campsites adjacent to the Goulburn, Howqua, Jamieson, Delatite and Big rivers and Running Creek. Interviews were conducted with visitors and individuals engaging in possible fishing activity to provide indications of fishing pressure, fisher behaviour, fisher avidity and visitor preferences.

Wild trout fishery anglers were interviewed to assist in determining whether fishing pressure is adversely impacting on wild trout populations in the Upper Goulburn basin.

A tag reward program was established in a case-study river in the north-east of Victoria to understand the trout fishing rate of exploitation (tag returns). In the Howqua River, 100 trout caught during fish population surveys (27 brown trout in Dec 2014; 5 at Tobacco Flat; 4 at Pickerings Hut; 1 at Tunnel Bend; 1 at Eight Mile Flat; 4 at Cornhill Logging Track; 1 at Upper Howqua Road Crossing; 11 at Bindaree; 32 brown trout in March 2015; 4 at Frys Hut; 8 at Seven Mile Flat; 20 at Bindaree; April 2015; 23 brown trout in April 2015; 6 at Tobacco Flat; 4 at Frys Hut; 3 at Sheepyard Flat; 2 at Noonans Flat; 6 at Six Mile Flat; 2 at Seven Mile Flat) and were tagged with a high reward ($100) dart tag. Angler reported catches over one year will provide a measure of fishing catch, with the accumulated catch data used to provide an exploitation rate for the fishery. The tag reward program also engaged anglers in the research and encouraged participation in the north-east trout fishery.

Data recorded by Fisheries Officers based at Fisheries Victoria's Alexandra Station was analysed for compliance trends in the observation of regulations by anglers. Fisheries Officers travel in excess of 45,000 kms per annum; predominantly patrolling salmonid fisheries within the Murrindindi and Mansfield Shires, and annual records are kept (financial year) of inspections of individuals actively engaged in recreational fishing. Fisheries Officers are rostered for patrols Monday–Friday, 15 weekends and 5 public holidays each year, and 60 shifts including hours outside of the typical 9–5 work hours (rostering must also allow for leave and training and education activities). Also note that Fisheries Officers often work in plain clothes and do undercover surveillance — so anglers should not assume that because they haven't seen Fisheries Officers, that they haven't been observed!



On-site angler survey locations, Upper Goulburn basin, north eastern Victoria.

Key findings and implications to date:

3 lines of inquiry:

Angler Interviews

- In the 2014–2015 trout open season, over the months of January to April 2015, 172 parties were interviewed adjacent to streams in the Upper Goulburn River Basin in the Mansfield Shire (Not all groups or camps observed were interviewed – the intent was to focus on likely fishers).
- The total number of people this represented was 1,401, of which one person was interviewed twice. On average, each party had 8 members.
- Almost 41% of those interviewed were less than 30 years of age. The median age group of those interviewed was 30 to 39 years. About 6% of those interviewed were 70+ years old (Figure 4).

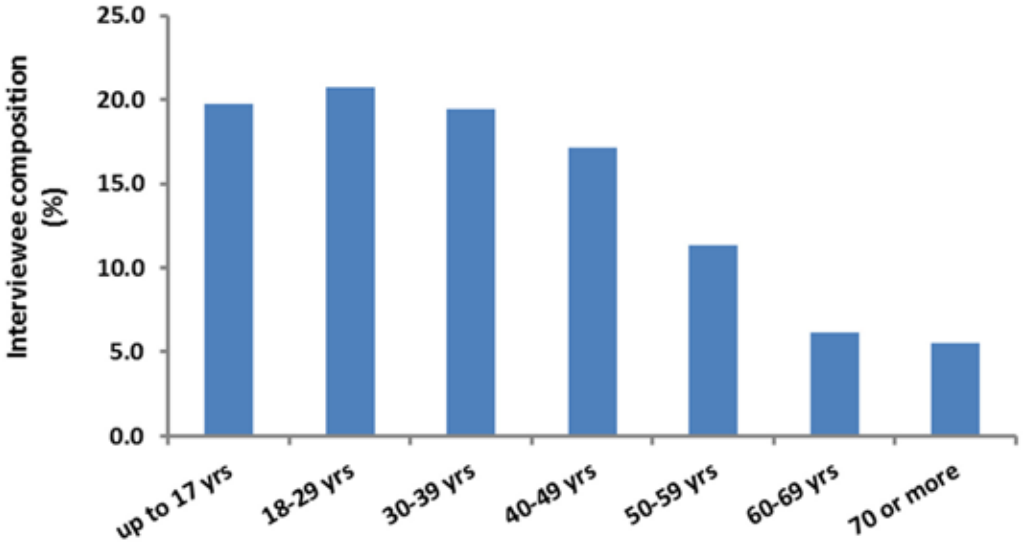


Figure 4: Age composition of interviewees.

- There were 4 local residents among those interviewed, the remainder were all visiting on holiday and more than 90% of the parties were staying for 2–7 days.
- 45% of the interviews were conducted near Howqua River (8 adjacent campsites) and 34% were adjacent to Goulburn River (12 adjacent campsites). Lesser numbers of interviews were conducted adjacent to Big River (4 campsites), Jamieson River (1 campsite) and Delatite River (2 campsites).
- Among the parties interviewed; 113 were fishing parties, whereby either the interviewee, or someone within their party had either been fishing, was fishing, or intended to fish, and 59 were non-fishing parties (Figure 5).

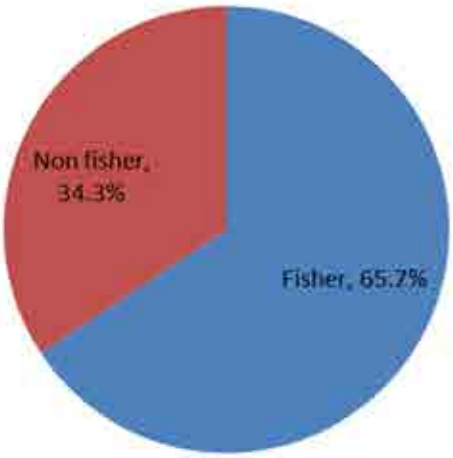


Figure 5: 'Fisher' or 'Non fisher' composition of parties.

- Each party was asked to rate the 'importance of fishing' in their choice of destination (on a 1–5 scale where 1 is very important and 5 is not relevant). For 'fishing' parties, the average score for the importance of fishing in destination choice was 3, indicating fishing was of average importance.
- When asked "How would you rate the most experienced fisher in your group, (or yourself if solo), as a trout angler?" with categories of 'committed', 'advanced', 'active' or 'casual' (definitions were provided if required, Table 1); most (70) of the fishing parties were categorised as 'casual' fishers (Figure 6).

Table 1. Angler type categorisation.

Angler type	Fishing as a leisure activity	Fishing focus	Fishing frequency	Fishing location	Fishing tackle use	Fishing target	Fishing persistence
Committed	Central focus of life	Social life revolves around fishing	Fishes as often as possible. Devotes most time to fishing related activities	Based on premium quality even if they are distant	High-quality, species-specific tackle and applies latest techniques.	Always targets a particular species and tends to release any fish that are caught	Typically continues to fish even when the fish do not appear to be biting
Advanced	The most important leisure activity	Circle of friends includes many anglers	Fishes often, devotes a substantial fraction of leisure time to fishing	Usually based on good quality and may travel long distances	Prefers high quality tackle and is aware of latest innovations in fishing	Usually targets a particular species and often releases fish	Rarely loses interest even when the fish are not biting
Active	Fishing is one leisure activity among many	Occasionally goes fishing with a few friends	Fishes regularly but also invests considerable time in other leisure activities	Usually relatively easy to access often close to home	Prefers common techniques and proven fishing tackle, some knowledge of latest innovations in fishing	Often targets a particular species and usually takes any legal fish caught home	Occasionally loses interest when the fish do not appear to be biting
Casual	Fishing is not an important leisure activity	Social life rarely involves fishing.	Fishes only occasionally and spends much leisure time pursuing other activities	Always based on convenience and easy access	Prefers common techniques and proven fishing tackle, not aware of latest innovations in fishing	Primarily targets whatever species is biting on a given trip and harvest all fish that are legal to keep	Often loses interest when the fish are not biting well

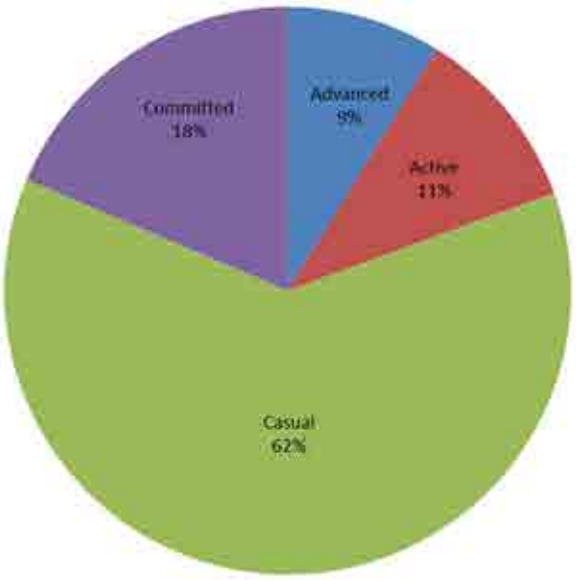


Figure 6: Most experienced angler 'angler type' composition of parties.

- 'Committed' and 'advanced' fishers were the ones who fished longest (Figure 7) with 'casual' fishers fishing for the least amount of time.

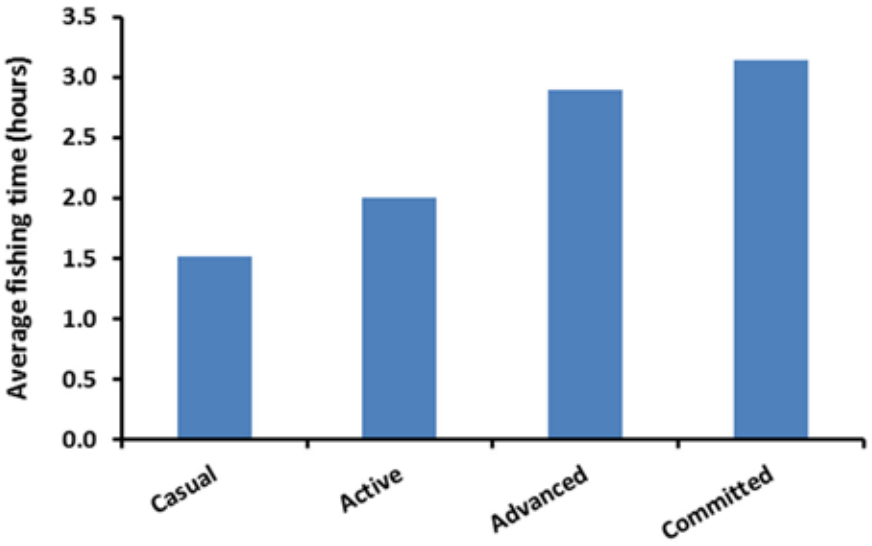


Figure 7: Average time spent fishing per day by 'angler type'.

- A similar proportion of each of the fisher types (most experienced fisher in the group) stated that they would usually release all or most of the trout caught, with active anglers proportionally releasing more fish caught (Figure 8).

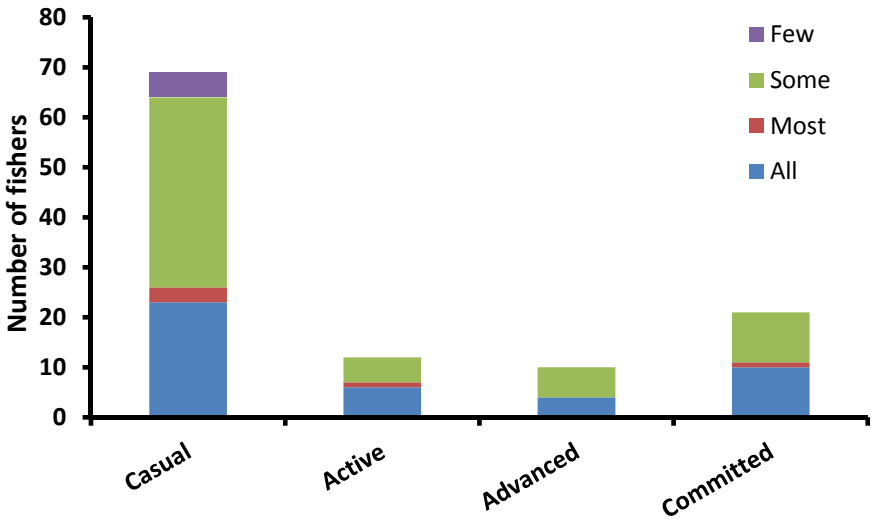


Figure 8. Proportional breakdown of harvest v release patterns of angler types.

- Postcodes of group members provide an indication of visitation to the Upper Goulburn region, and distances travelled. The majority of anglers were Victorian (90%), with 4% of postcodes indicating 'local' visitors from Mansfield and district.
- Of all interviewees, 176 individuals had been or were fishing.
- 368 hours were fished by 173 non-residents.

- Fishing parties who identified that they'd fished in the region more than 5 times in the past 2 years were asked to compare catch rates: 3 n/a, 2 unsure, 4 same, 14 lower (inc. 3 residents), 2 higher.
- Fishing parties who'd caught fish were asked if they were satisfied with their fishing: 12 unsatisfied, 10 satisfied, 3 unsure.
- 27% of fishing parties were using baited lines only, 19% were using lures only and 8% were fly fishing only. 30% of fishing parties were using both baited lines and lures and 9% of fishing parties were using both lures and flies.
- Reasons for dissatisfaction: 'lack of fish', 'increased numbers of carp', 'blackberries'
- Reasons for satisfaction: 'nice fish seen, good size', 'quality camp sites, love the area'
- Excluding the catches of residents, 25 brown and rainbow trout were caught by the visitors interviewed, ranging in size from 75 to 350 mm; all angler types released some fish, with only 8 fish retained; 5% of anglers retained fish.
- Resident fishers (3) (advanced and committed) reported catching upwards of 20 trout (averaging 200–300 mm) over the season to Feb/March, releasing all or most (all were dissatisfied with their angling — reporting 'decreases in sizes and numbers of trout, increases in carp numbers')
- Most anglers appeared to self-regulate with regards to 'keep-able' sized fish, and more avid anglers appeared to catch larger fish than casual anglers (thus, when more avid anglers did retain trout, they were generally of a larger size than those retained by casual anglers).
- General comments from fishers related to increased carp presence; cormorants; decreased flows and low water levels; increased water temperatures especially in lower reaches; increases in number of people/fishing pressure; blackberries along river edges and tracks; removal of willows in lower reaches; European wasps; rubbish.

Tag Recaptures

- As of July 2015 (and correct as of end October 2015), only 3 brown trout had been reported caught out of the 100 tagged; a low exploitation rate.

Compliance Data

- Data from the Alexandra Station are provided for financial years 2012–2015 with the number of contacts, and the number of offenders.
- Offences are additionally categorised by type, relating to the severity of penalty, ranging from verbal warnings, to official warnings, infringements (with financial penalties) and prosecutions (legal proceedings with court ordered outcomes).
- Prosecutions are initiated and charges are laid dependent upon the gravity of the offence(s). Matters are generally referred for prosecution where it is in the public interest for a matter to be dealt with by way of the Court; where behavioural recidivism is apparent, (repeat offenders), where there are multiple offences, or in instances where an offence is not infringeable.

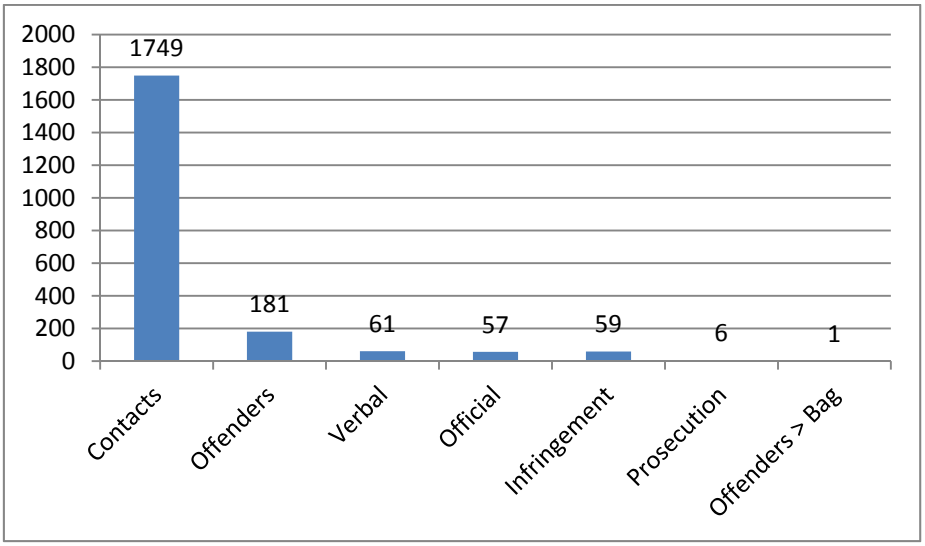


Figure 1: Compliance Data Summary 2012–2013

Four out of the six prosecutions in 2012–2013 were related to salmonids, with three of five offenders 'known' to Fisheries Officers (ie. repeat offenders or recidivists). This 'strike rate' in the detection of recidivists is indicative of/and helps demonstrate that Fisheries Officers are vigorous in maintaining compliance and committed to the protection of Victorian salmonid resources.

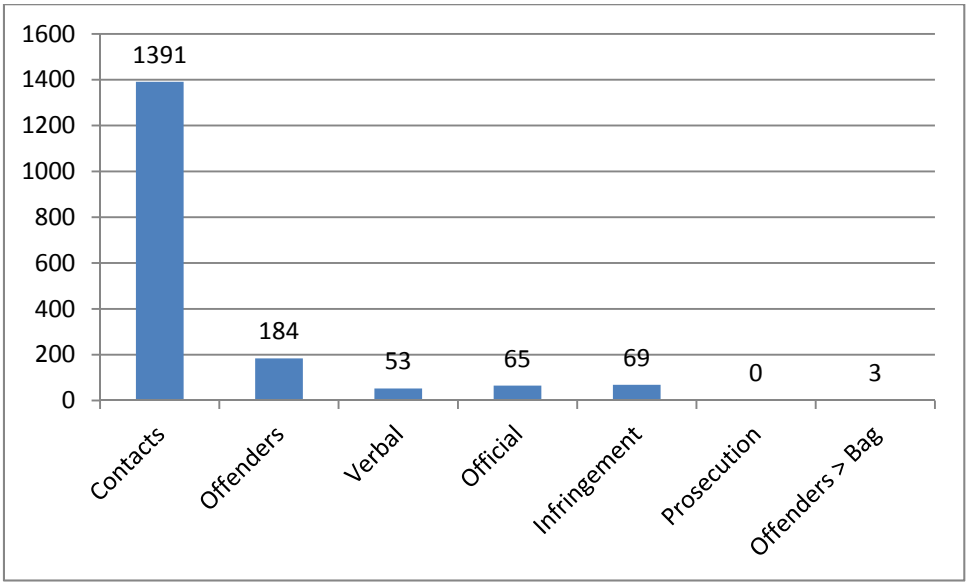


Figure 2: Compliance Data Summary 2013–2014

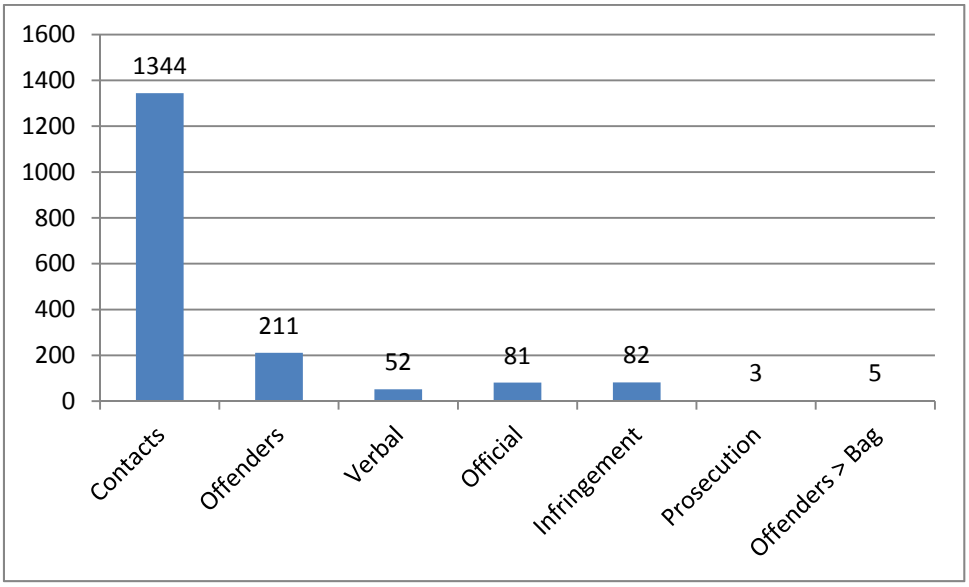


Figure 3: Compliance Data Summary 2014–2015

One of the three prosecutions during the 2014–2015 period related to salmonids (in this instance not an Upper Goulburn stream, but relating to brook trout in the Rubicon River).

- Statistics have been consolidated for both 'on land' and 'on water' inspections, however no exceeded bag limits for salmonids 'on water' have been observed locally.
- Five out of nine prosecutions during this three year period were related to salmonid offences and in each instance related directly to offenders exceeding bag limits and were subject of multiple associated ancillary charges.
- Infringeable offenders exceeding bag limits may include species other than trout (eg Murray cod) which would reduce the incidence of salmonid-related offences.

Key findings:

1. Many visitors, few fishers; even casual anglers release; only 5% of fishers are taking fish caught.

2. Low exploitation

3. Good compliance; few over bag prosecutions.

This snapshot suggests that harvest rates appear low, we're not overfishing our wild trout rivers.

Next steps:

The targeted angler surveys will again be conducted over the trout season in 2016–2017.

'Working together to build community awareness, understanding and action that will enrich our fisheries into the future.'

Anthony Forster

Victorian Trout Fisher Reference Group

Graham Godber	Mansfield & District Fly Fishing Club
Steven Relf	VRFish
Mick Hall	Australian Trout Foundation
Doug Braham	Council of Victorian Fly Fishing Clubs
Philip Weigall	Fishing Guide, Journalist
Tom Camp	State-wide roundtable forum
Merv McGuire	State-wide roundtable forum
Matt Byrne	Australian Trout Foundation
Dallas D'Silva	VRFish
Pat Sheridan	Northern Suburbs Fly Fishing Club
Daryl Horwood	Upper Goulburn Community Association
Bob Bartel	Independent trout fisher
Michael Nolan	Fly Fish Australia
Rod Barford	Australian Trout Foundation
Christopher Collins	Council of Victorian Fly Fishing Clubs
Anthony Forster (Chair)	Fisheries Victoria
John Douglas	Fisheries Victoria
Taylor Hunt	Fisheries Victoria

Fisheries Victoria

VICTORIA State Government

Your fishing licence fees at work

Arthur Rylah Institute for environmental research

Representing Victorian Recreational Fishers

VRFish

Australian Trout Foundation

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