A Fisheries Overview of the Hurunui Waiau Zone.

Resource Document

North Canterbury Fish and Game

Contents

1. Role of North Canterbury Fish and Game Council (NCF&GC)

The North Canterbury Fish & Game Council is one of 12 Regional Fish and Game Councils established under Section 26(P) of the Conservation Act for the purpose of the "…management, maintenance and enhancement of sports fish and game"… for each region defined by the Minister of Conservation, and are obliged to discharge their functions "…in the recreational interests of anglers and hunters".

The particular functions of these councils are set out in Section 26(Q) of the Conservation Act, and include "to represent the interests and aspirations of anglers and hunters in the statutory planning process" and "to advocate the interests of the Council, including its interests in habitats"

The NCF&GC manages the fish and game resources and its associated recreational use in the area between the Rakaia and Waiau catchments, and the Southern Alps.

2. Introduction

This report is prepared as a resource document for use by the Hurunui Waiau Zone. It includes a summary of the sports fishery and research that has been undertaken. It should be noted that this report was prepared at short notice and is not a total description of the resource.

There are also substantial gaps in information, especially in the Waiau, Waipara and Conway catchments. No description of the Conway is included in the report as the Conway lays outside the NCF&GC boundary.

The first sections (3-5) give background to research or findings used across the zone. The remainder of the report describes the fishing resource by catchment and river/lake where possible. When angling is discussed it can be assumed that it will be in regard to angling for Brown trout unless stated otherwise.

3. National Angler Surveys

Fishing licence databases are an important tool for Fish and Game New Zealand (F&GNZ) managers seeking to collect information on usage of the angling resource, and are particularly suited to sample surveys. Any person wishing to fish for salmon and trout in waters managed by F&GNZ must purchase a fishing licence at least annually from one of the twelve F&GNZ Regions. Licences are freely interchangeable between Regions, so that an angler may live in one Region, purchase a licence from a second Region, and fish in a third.

F&GNZ manages all freshwater fishing in New Zealand with the sole exception of the Lake Taupo catchment, which is administered by the Department of Conservation (DoC) and requires anglers to purchase a licence specifically for the Taupo region. F&GNZ licence records thus provide a complete census of anglers fishing anywhere in New Zealand except Lake Taupo and its tributaries.

A sample survey involves selecting a random sample of licence holders, representing a known percentage (e.g., 5%) of total sales, and administering a questionnaire to collect the information of interest. Questionnaires may be administered by post, telephone, or (most recently) email, depending on the target group and the type of information required. Subject to the assumption that the information so obtained is not significantly influenced either by licence holders who cannot be contacted (non-response bias), or who cannot accurately remember details such as when and where they fished (recall bias), results for the anglers in the sample can then be extrapolated to give a result applicable to the full population of licence holders.

The objective of the 1994/95 - 2007/08 surveys was to obtain consistent estimates of annual usage (during a single October to September angling season) for all waters managed by F&GNZ. This contrasts with the 1979/81 survey, which emphasised qualitative rather than quantitative aspects of each river fishery. Detailed results from all three surveys have been published in a series of reports for FGNZ (Unwin & Brown 1998, Unwin & Image 2003, Unwin 2009a), and the most recent of these is publicly available via the Fish & Game New Zealand web site[1].

In each survey, the 12 month angling season was divided into six two-monthly segments, with respondents being contacted at the end of each period. This interval was chosen based on previous FGNZ studies, which indicated that recall bias became significant only after a recall period of three months or more. Respondents were asked whether or not they had fished over the previous two months, and – if so – which rivers and lakes they had fished, and the number of days they had spent on each. Surveys were conducted simultaneously in

[1] http://www.fishandgame.org.nz/Site/Environment/Research0809.aspx

all twelve FGNZ Regions[2], and the data for all Regions pooled into a single national database.

Sample sizes for these surveys were extremely large for a random sample survey, reflecting the need to collect information on rivers which may be fished by only a few individuals out of a total survey population of up to 100 000. For example, the 2007/08 survey recorded the fishing activity of 11 803 out of 65 025 whole-season licence holders, representing 18.2% of the total.

The basic measure of angling effort provided by the surveys is the angler-day, defined as one angler fishing on one day irrespective of the number of hours spent fishing. By summing results across all Regions, over the full 12 month angling season, the survey provides usage estimates for essentially all New Zealand angling waters. Standard errors for most waters are relatively broad (typically ±20% - 50%), but are to be interpreted in the context of usage estimates which vary by a factor of more than ten thousand between the most heavily fished waters (e.g., Mataura, Rakaia) to single figures for the most remote headwater streams.

The National Angler Surveys (NAS) has become an integral tool for not only fisheries management, but also has an important role for balancing water resources. It has been used extensively in resource management process is the last ten years. The angler days are used in this report where available in a breakdown of the fishery resources.

4. Drift Dives

Drift diving is the most commonly utilised method employed by Fish and Game staff to monitor relative trout abundance in clear, medium to large size rivers.

Small (<150mm), Medium (150mm - 450mm) and Large (>450mm) Brown trout, and Chinook salmon smolt or adults, are counted by a team of divers with wetsuits, fins and snorkel gear, as they drift down each section. Divers maintain as close to a right angled line across the river as is possible, given variations in current velocities across the width of the river.

Fish that move off downstream ahead of the divers are not counted. Only fish that swim upstream beneath each diver, and/or pass upstream to a pre-designated side are counted.

[2] With the exception of the Otago Region in the 1994/96 survey, which was surveyed one year after the other eleven regions.

In order to avoid double counting, each diver is given a section of water to count and must ignore the rest. Hand signals are used to clarify who is counting each fish if any doubt exists. At regular intervals throughout the dive, the leader will call a halt and record the number of fish (small, medium and large of each species) each diver has seen.

An ideal drift dive on the Hurunui River. Enough divers to be spaced evenly and maintaining a near perfect line. (Emily Arthur).

Reliable counting of trout depends on a sufficient number of divers being positioned in order to adequately cover the width of the section, and having good visibility through the water. Visibility in metres (m) is ascertained prior to the dive taking place, by the horizontal 200mm black disc technique. Anything less than 4m visibility is generally considered to be inadequate.

Comparisons of results may be made from one year to the next to determine what changes to the population have occurred over time.

5. Significant salmon spawning sites

Environment Canterbury (ECan) notified a variation to the Proposed Natural Resources Regional Plan (PNRRP) which establishes objectives, policies and methods for managing the region’s water resources. As input to this process, ECan commissioned a desktop study to compile an inventory of salmonid habitats, based on published and unpublished sources. This was undertaken in co-operation with F&GNZ, and the results are contained in an unpublished ECan technical report and GIS database (Langlands & Elley 2000). However, this inventory did not include a regional assessment of the values of these habitats because FGNZ staff were unwilling to make a comparative assessment of individual habitats, and to rank them in terms of their regional importance.

ECan used the Langlands & Elley (2000) report to compile a Schedule of significant salmon spawning habitats (Schedule WQN 14), linked to various regional rules in the plan. However, the stream segments defined by Langlands & Elley (2000) were not necessarily selected solely for their value as salmon spawning habitat, so that in many cases the waters actually used by spawning salmon comprise only a sub-section of the entire segment. In addition, the Schedule included some water bodies which spawning salmon were likely to use only in an opportunistic manner when favourable conditions arise, and were not necessarily significant in a regional or national context. ECan therefore requested NIWA to “Critically review the list of salmon spawning sites in Schedule WQN 14, and prepare a list of significant spawning sites that are essential to maintain the salmon fishery in the Canterbury region”.

This was undertaken by Unwin (2006) who used aerial trend count data that was in its infancy in the time of Langlands & Elley (2000). Unwin recommended the significant salmon spawning sites listed in Figure 1. These recommendations were adopted by ECan staff at Hearing Stage 28 of the PNRRP. For the purposes of the Schedule, a significant salmon spawning site is one of national or regional importance to the salmon fishery. Only significant spawning sites will be included in the final draft of Schedule WQN14.

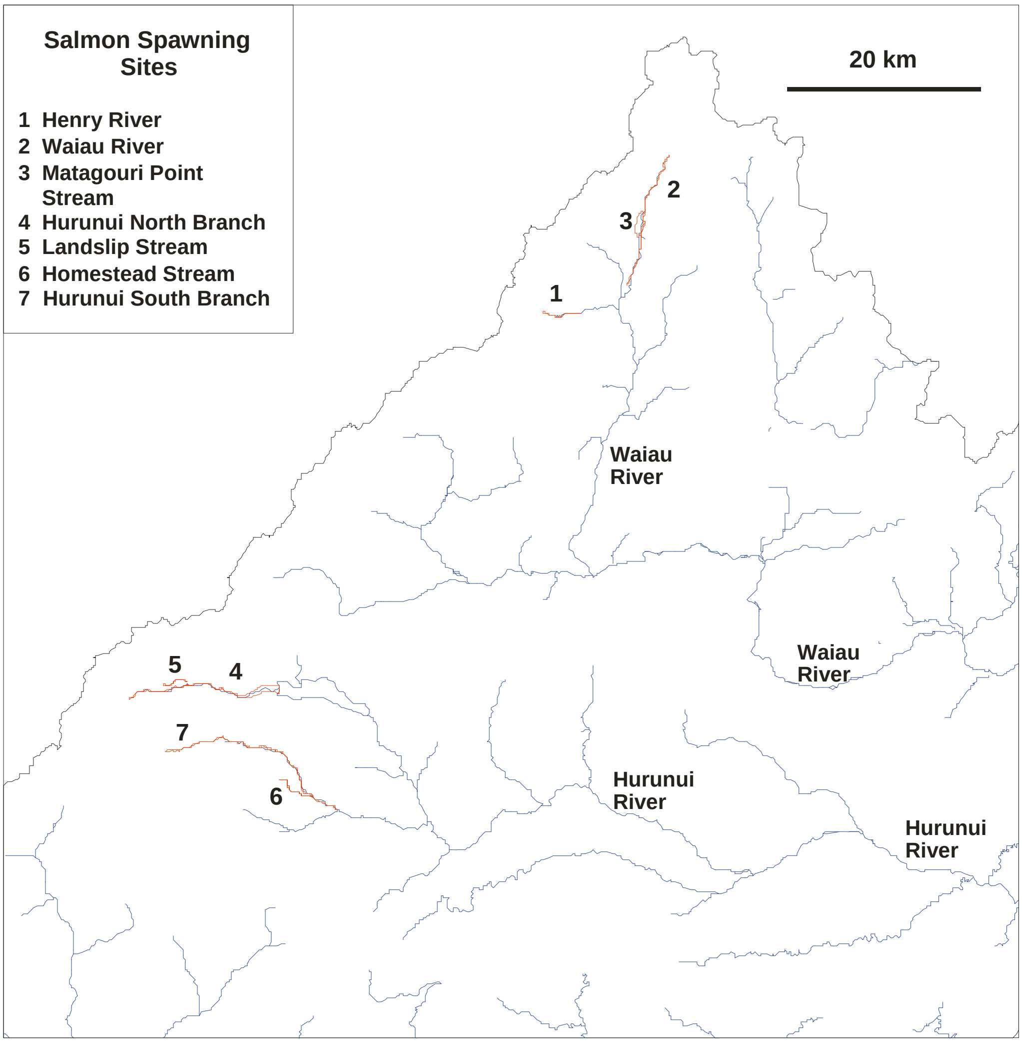


Figure 1: Significant Chinook salmon spawning sites in the upper Hurunui and Waiau catchments (source: Unwin 2006).

Summary of resources

Waiau Catchment

6. Lewis River

The Lewis River is sourced from the main divide at Lewis Pass and flows south to join with the Nina and Boyle Rivers. It flows parallel to, and is easily accessed by, State Highway 7. Its catchment is mainly beech forest and is managed by the Department of Conservation as the Lewis Pass National Reserve.

According to NAS angler use has declined with 270 angler days in 1994/94, 110 angler days in 2001/02 and just 50 angler days in 2007/08. It is suspected that anglers do not always use the correct river name when responding to the survey. The stretch of river from the Nina to Boyle confluence is very popular with anglers. It is likely that some anglers mistake this reach for the Nina River which contributes most of the water.

This photo on the cover of Fish & Game magazine shows a large fish taken on the Lewis River. (Zane Mirfin).

Upstream of the Nina confluence, the Lewis has very little holding water for trout. It is lacking in pools and falls quite steeply. Although the area receives high rainfall the bush clad catchment means that this river is reasonably stable. Very little is known about its contribution to salmonid spawning and juvenile rearing.

7. Nina River

The Nina River is sourced from the main divide and flows eat to join the Lewis River. Access is via a swingbridge over the Lewis River at State Highway 7 near Palmers Lodge (New Zealand Deer Stalkers Association Lodge).

Despite providing good habitat and some impressive pools, trout stocks are not high. Nevertheless it is popular with anglers due to its scenic locations and ease of access, with a walking track and DoC hut along the valley. NAS shows a moderate but steady angler use with 260 angler days in 1994/94, 40 angler days in 2001/02 and 200 angler days in 2007/08.

Salmon have been reported in the Nina River. However, very little is known about its contribution to either salmon or trout spawning. Like the Lewis, the heavily forested catchment means that it provides a reasonable degree of stability.

8. Boyle River

The Boyle River is sourced east of Lewis Pass near Anne Saddle and flows south for a time through beech forest. It then turns west and joins the Lewis River near the Boyle Village on State Highway 7. It then continues to flow in a southerly direction and joins the Hope River near Windy Point.

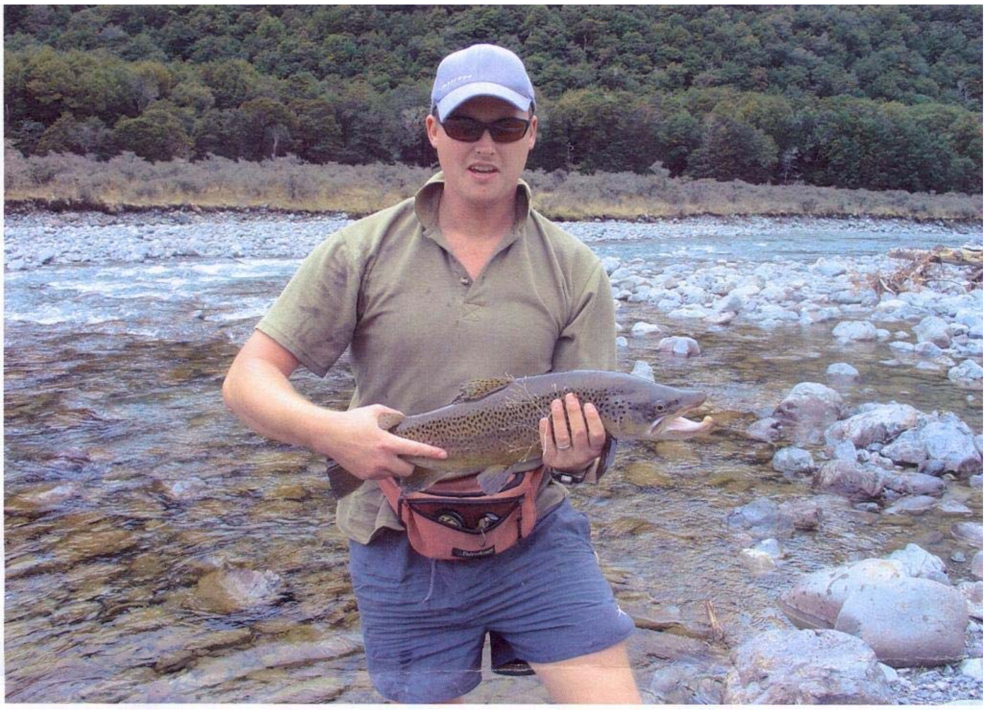
There is access to the river from State Highway 7 up until the Boyle Village. From here the St James Walkway allows access all the way to Anne Saddle. There are also serviced DoC huts in the valley.

The most productive water lies between Windy Point and the Boyle Village (Kent 2009). Here trout stocks are reasonable with trophy fish not uncommon. Upstream of the Boyle Village fish stocks are not as high but angling pressure is still significant as the proportion of trophy fish is high and the river flows through very scenic surroundings. The NAS shows 390 angler days in 1994/95, 200 angler days in 2001/02 and 400 angler days in 2007/08.

The Boyle River has never been surveyed for trout abundance, salmonid spawning or juvenile rearing habitat.

9. Doubtful River

The Doubtful River is sourced from the main divide at Amuri Pass and flows east to join the Boyle River 5km south of Boyle Village. It is accessed by crossing the Boyle River just upstream from the Engineers Camp. A walking track and two huts are maintained by DoC. Most of the catchment is contained within Lake Sumner Conservation Park and is covered in beech forest.



Good conditioned brown trout caught in on the Doubtful River. (Tony Hawker).

Despite being quite a small river, it is targeting by anglers in search of trophy fish, which it often produces. Trout stocks are never high and can be variable from year to year (Kent 2009). The best holding water is approximately one hour's walk upstream from the confluence with the Boyle.

The NAS show that this river has gained in popularity in recent years with no angler days reported in 1994/95, 50 angler days in 2001/2002 and 280 angler days in 2007/08[3].

Salmon have been seen in this river. However, very little is known about its contribution to salmonid spawning and juvenile rearing.

[3] The 2007/08 NAS had 170 angler days for the Doubtful River and 110 angler days for the Doubtless River. The Doubtless River is a small tributary of the Doubtful and is not considered to hold any trout. NCF&G believe this to be a naming mistake by anglers. Even if anglers do fish the Doubtless on its own, it is part of the Doubtful catchment and therefore seems appropriate for this document to combine the angler usage to have a total figure.

10. Hope River

The Hope River is sourced from the Hope Pass in the main divide. It then flows east to meet up with the Boyle and further down the Waiau River at Glenhope. The Upper reaches contain large grassy flats and beech forest. This area lies within Lake Sumner Conservation Park. Lower down it flows adjacent to The Poplars and Glenwye Stations.

Access is reasonable with State Highway 7 running parallel up until Windy Point. From there a DoC walking track and huts can be used for the upper reaches.

Up until now the Hope River has been the most heavily fished backcountry river in the Waiau catchment. As well as being popular with local and regional anglers, it is also very popular with fishing guides and overseas clients. The most productive reach is upstream from the Halfway Shelter; about two hours walk upstream from Windy Point. Here fish stocks are reasonable with trophy fish being caught regularly. Although the upper reaches are the most popular, there is good fishing throughout the entire river.

The NAS confirm its popularity with 510 angler days in 1994/95, 340 angler days in 2001/02 and 940 angler days in 2007/08.

Within the upper reaches draining the Hope/Kiwi flats, is the Kiwi River. This has been subject to informal[4] NCF&G aerial surveys, with observations of both trout and salmon spawning. Spawning habitat in this area has improved greatly with the Nature Heritage fund purchase of Poplars leasehold land around the Hope/Kiwi flats and the upper Hope. DoC now manages this area and stock have been excluded. Salmon have been observed by anglers in the upper reaches of the Hope River, but this has never been subject to surveys.

11. Upper Waiau

The upper Waiau is sourced from the main divide at Waiau Pass. It flows south firstly through beech forest and then the valley becomes open and wide with extensive wetlands lining the valley floor. The river then enters a gorge and joins the Hope River at Glenhope near State Highway 7.

[4] The Kiwi and Hope River are flown over as part of the Hurunui and Waiau salmon spawning surveys. Staff observations are made but only as a fly over between the Hurunui and Waiau Rivers. It is not considered cost effective to do a proper salmon spawning survey for the Hope River as the majority of the salmon spawning for the Waiau catchment occurs in the upper reaches of the Waiau River.

The upper Waiau has historically been a difficult place for anglers to access. Access has been subject to landowner permission (St James Station) and was tightly managed. Up until recently the guiding industry has had a monopoly on access and angling on this river.
The Nature Heritage Fund purchased the St James Station in 2008. This has meant that access has been opened to the public in a managed way. Vehicle access will now be permitted over the Edwards and Maling Passes to the Waiau River. From those points there is a network of walking and mountain biking tracks to access the remaining catchment.

The upper Waiau River is highly regarded by the guiding industry. The majority of the river has low to medium stocks of large brown trout. Some stretches of river have higher stocks with impressive numbers of trophy fish.

NCF&G undertook drift dive surveys in the upper Waiau for the first time in February 2010. This was in effort to gain some baseline information before the upper Waiau experiences an increase in angling pressure due to the new access regime. The first reach was by the rain gauge directly below Malings Pass.

Over a drift dive distance of 1km, two large trout were seen along with 40 juvenile salmon. This reach is not known for trout. This was confirmed by the low trout numbers seen.
The second drift dive site started at the Ada confluence to just below the outlet of Muddy Lake (Little Lake). Over a distance of 1.5km 150 juvenile salmon were seen along with 37 large trout all over an estimated 8lbs (Ross, 2010). Almost all trout seen would be considered very large or trophy size with a complete absence of medium sized fish.

Trophy water! Fishing guides call this the "Golden Mile". Upper Waiau drift dive site. (Steve Terry).

This particular stretch of river is considered to be one of the most significant trophy fishing waters in New Zealand. It has been rumoured to produce five trophy fish in one day to a lucky overseas angler (Giles 2005).

Well known fishing author and photography Les Hills caught a 17 pound trout at the exact drift dive location. It featured on the cover of Fish and Game magazine.

NAS information is of little use for the upper Waiau as respondents did not differentiate between the upper Waiau and the rest of the Waiau River.

12. Lake Guyon

Is located about 800m between the western foothills of Mt, Stanley of the St James Range, and Lake Hill to the South, with the outlet stream flowing north west into the Waiau River from the true left bank. The lake at 800 m.s.l is hemmed into a small glacial made valley and formed by enclosed moraine with tussock, grassland, matagouri and beech forest vegetation surrounding its margins and upper catchment. The lake is 67 hectares in area and 25 metres deep.


Cattle grazing at the head of Lake Guyon, May 2009. (Tony Hawker).

Water quality is mesotrophic with some nutrient enrichment from inlet streams flowing through grazed pasture. A recent purchase from the nature heritage fund has meant that the surrounding area is now managed by DoC as part of the St James Conservation Area. As a result the area has been destocked. It is expected that water quality would now be improving, although flocks of Canada geese and paradise ducks may still contribute to water enrichment.

The sports fish present are rainbow and brown trout. It has received very little angling pressure in the past with only the 2001/02 NAS registering an activity with 160 angler days. This is mainly due to limited access as a result of the farm management regimes. However, access is now being actively encouraged now that it is under DoC management. There is also a DoC hut on the shores of the lake. Angler pressure from 2010 onwards is expected to increase significantly with public 4WD access being allowed over Malings Pass, meaning that an easy walk of 45 – 60 minutes is now all that is required to reach the lake.

13. Ada River

The Ada River is sourced from the main divide and flows east to join the Upper Waiau River at the Ada Homestead. Its catchment consists of beech forest and wide grassy flats. It is managed as part of the St James Conservation Area.

It holds fish, especially in the lower reaches but not in high numbers. Like its neighbour the Waiau the fish tend to be large. It does not have as much holding water however so is somewhat limited to angling.

The NAS only shows low angling activity with 20 angler days in 1994/95, no angler days in 2001/02 and 30 angler days in 2007/08. This use may increase with increased ease of access.

Salmon have been observed spawning in the Ada River. The habitat is much improved up near the Christopher River where a small lake outlet provides stable spawning habitat.

14. Henry River

The Henry River is sourced from the main divide and flows east to join the upper Waiau River approximately 3km below the Ada confluence. Its catchment consists of beech forest and grassy river flats. It is also part of the St James Conservation Area. Access is a mixture of 4WD combined with walking.

There are some fish in the lower reaches of the river. Anglers may fish it as part of a combined trip to fish the upper Waiau but it would not be worth the effort on its own. The NAS shows 30 angler days in the 2007/08 season only. It is expected that angler pressure will increase in the Henry as access is improved.

The Henry is listed as a significant salmon spawning site.

15. Percival River

The Percival River drains the Hanmer Range and is made up of several tributaries. The catchment is a mixture of pasture, native and exotic forestry and the Hanmer Springs township. It flows south west and joins the Waiau River at the Hanmer River confluence.

This river is reasonably well stocked with smallish trout and receives some local angling pressure, mainly because it is fishable in north westerly conditions. However, it does not feature in the NAS. It is probably more significant as spawning and juvenile rearing habitat for the Waiau River.

There is an effluent discharge from the Hanmer Springs waste water treatment plant into the Chatterton which is a tributary of the Percival.

16. Hanmer River

The Hanmer River is sourced from the Hanmer Range at Hossack Saddle. It flows west to join the Waiau River at State Highway 7A.

The lower and mid reaches are very braided and unstable and does not provide good trout habitat. Despite this it does show up in the NAS with 20 angler days in 1994/95, 30 angler days in 2001/02 and 30 anglers days in 2007/08. This probably occurs in the upper reaches on the Hossack Station, where the river is more confined and may provide better habitat for trout.

No surveys have been undertaken to determine its significance for spawning and juvenile rearing.

17. Mason River

The Mason River and tributaries drain the Amuri range and flow south to join the Waiau River at the Waiau township.

The lower and upper reaches are generally unsuitable for trout as the river bed is shingly and unstable. There is a more confined gorgy area in the middle reaches that offers better trout habitat. The NAS shows some limited use with 30 angling days in 2001/02 only.

No surveys have been undertaken to determine its significance for spawning and juvenile rearing.

18. Waiau downstream of Hope confluence

Once the Hope joins the Waiau it swells to become a large river. There are plenty of good fish for the angler in the gorge both above and below Hanmer. However, these stretches can only be reached during low summer flows. Further downstream it becomes braided and unstable before entering another difficult to negotiate gorge below the Waiau township.

The mouth provides good habitat for both salmon and trout angling. But it is remote, with most anglers gaining access by jet boat. Despite this NAS shows significant angler use with

1440 angler days in 19994/95, 2130 angler days in 2001/02 and 4340 angler days in 2007/08. Some of these days would have been expended on the upper Waiau.

19. Salmon in the Waiau

The Waiau River is the northernmost river which can consistently be relied on to provide a salmon angling resource each year, and is considered to be of at least local significance (Unwin 2006).

The Waiau salmon population has been surveyed annually and a long term data set has been developed (Table 1). Counts are conducted during early May, hopefully to coincide with peak spawning activity. As such the counts are one-off trend counts rather than estimates of total spawning activity. Salmon residency time research conducted by NCF&G on the Rakaia and Waimakariri Rivers, suggests that spawning takes place over an eight to ten week period, with each individual salmon spending an average of 16 days on the spawning grounds. This means that there are a number of "turn-overs" of spawning fish each season. If the findings from the Rakaia and Waimakariri Rivers apply in the Waiau, the total spawning population should be 2-3 times greater than the peak spawning count.

Waiau		
		Trend
Year	**Date**	**Count**
1995		243
1996		420
1997		393
1998		146
1999	11-May	281
2000	10-May	111
2001	3-May	87
2002	9-May	162
2003	7-May	203
2004	10-May	121
2005	24-May	197
2006	16-May	66
2007	8-May	168
2008	15-May	614
2009	12-May	316
2010	11-May	192

Table 1. Annual spawning run trend count for the Waiau River.

Fish and Game New Zealand also conduct a salmon harvest survey throughout the Canterbury region. Around 10% of anglers are contacted by telephone at the end of the season and asked how many salmon they caught from each river. The data is more accurate for rivers such as the Rakaia and Waimakariri which are very heavily fished, with higher error applying to smaller fisheries such as the Waiau.

	Waiau
	Angler
Year	**Catch**
1996	63
1997	305
1998	70
1999	496
2000	253
2001	30
2002	40
2003	40
2004	40
2005	110
2006	18
2007	16
2008	111
2009	24
2010	0

Table 2. Estimated angler catch for the Waiau. (2010 not yet completed).

The Waiau seems to be sustaining a healthy ratio of adult annual spawning salmon compared to the catch rate, suggesting this is a very sustainable wild salmon fishery. The main spawning site is the upper Waiau from the Ada confluence upstream. Here the river has a series of spring fed streams and side channels. A significant amount of spawning also takes place in the mainstem of the river, suggesting that the upper Waiau is reasonably stable.

Salmon congregating in a pool on the mainstem of the upper Waiau. (Tony Hawker).

NCF&G have been frustrated with the degradation of this important spawning site from cattle on St James station. Some of the previously productive side channels have been lacking in spawning salmon recently as the streams have been smothered in sediment from collapsing banks and pugging from cattle.

Cattle in the upper Waiau. This is the biggest threat to salmon runs in Canterbury. Thankfully, no longer an issue at this site. (Tony Hawker).

As mentioned earlier now that this area has been de-stocked and is under DoC management, it is expected that there will be a significant improvement in habitat not only for spawning of salmon but also juvenile rearing.

Hurunui Catchment

20. North Branch above Lake Sumner

The North Branch (Hurunui) is sourced from the main divide at Harpers Pass and flows east into Lake Sumner[5]. The catchment consists of beech forest with large grassy river flats. Land tenure is a mixture of Lake Sumner Conservation Park administered by DoC, but there is also some free hold tenure on the true left immediately above the lake.

North Branch above Lake Sumner looking upstream towards head of catchment (Ross Millichamp)

Access is via public 4WD tracks with numbers managed by DoC. Alternatively there is tramping tracks accessing the North Branch from other catchments.

Although this river is flood prone it contains large and trophy sized trout in the more stable reaches. Hence its popularity with anglers targeting trophy fish. The amount of angling use is hard to quantify as the NAS surveys do not differentiate the North Branch from the rest of the river. Rather the angling effort is considered as a total package from the Mandamus confluence on the mainstem up (See 37).

[5] Often the reach of the Hurunui from Lake Sumner to the South Branch confluence is also referred to as the "North Branch". For the purposes of this document the North Branch shall only be the section of river above the lake, with the section below the lake being referred to as the "mainstem". This is consistent with terminology used in the recent Water Conservation Hearings.

Within the catchment lies Landslip stream. This stream is identified as one of the significant salmon spawning sites.

In 2009, a special tribunal appointed by the Ministry for the Environment recommended the North Branch be protected in its natural state under a Water Conservation Order for its outstanding natural character, wild and scenic values, habitat for brown trout, fishery and angling, contribution to brown trout fishery and cultural values.

21. South Branch

The South Branch drains the Crawford and Dampier Ranges and flows east between Esk Head and Lake Taylor Station. The top of the catchment is part of Lake Sumner Conservation Park.

There is access from Lake Sumner Road which crosses the South Branch just upstream from the confluence with the mainstem. From here there are marginal strips on either side of the river that allow public access along the entire length of the river, although upstream progress through the gorge is determined by river levels. Access to the upper reaches is easier through either station or the public walkway from Home Bay, Lake Sumner, where there is approximately two hours of walking to reach the river. The most popular form of access is through Lake Taylor Station where for a reasonable fee anglers can use the private hut on the shores of Lake Mason.

The South Branch above the gorge. (Ross Millichamp).

The South Branch is a highly regarded trophy fishery with reasonable numbers of fish in the gorge and in the braided section in the upper reaches. Like the North Branch, angler use is hard to quantify as recent NAS do not differentiate the South Branch from the rest of the upper Hurunui. However, the 1981/82 survey of North Canterbury anglers showed that 3% of the total annual effort on the Hurunui River (i.e., 3% of 23 700, or ~700 angler-days) was expended on the South Branch (Bonnett et al. 1991).

The South Branch is also popular with guides. It is the preferred choice out of all rivers for two well known Canterbury fishing guides (Chapman 2009), Harrison pers. com. 2010).


Success! A trophy Brown from the South Branch gorge. (Dean Harrison).

In an effort to gain an understanding of trout abundance, NCF&G along with Cawthron Institute scientist Dr Roger Young, undertook a drift dive in the upper reaches in February 2010. One stretch was drift dived just above the gorge with 9 small and 9 large trout seen over a distance of 1.2km. The site was problematic to dive with less than ideal conditions and a rough section of river making it hard for divers to stay aligned. It is suspected that many fish were missed. Before a better section could be found weather conditions made it unsuitable for diving. Unfortunately this one dive at a less than ideal site cannot provide much useful insight into trout abundance.

Challenging conditions for drift diving. Upper South Branch. (Steve Terry).

However, there have been surveys carried out on trout abundance (Hawker 2010) by aerial means while undertaking salmon spawning surveys. These surveys were undertaken in May of 2009 and 2010.

In 2009, 110 medium and large sized trout were observed over the surveyed area from the top of the gorge to Stoney Creek fan (8km). In 2010, 115 medium and large sized trout were observed over the same area. It was surprising to see the amount of trout holding in steep fast water. It is highly likely that these fish would be hard to see while drift diving fast stretches of water.

Drift diver Tony Hawker getting used to the cold waters of the South Branch. (Emily Arthur).

The mainstem of the South Branch above the gorge is the most significant salmon spawning site for the entire Hurunui catchment (see section 41). The lower reaches of Homestead Creek also provide some limited spawning.

The South Branch is considered national significant for both trout weight and length (Young 2009, Jellyman 2009) and for its contribution to the Hurunui fishery (Young 2009).

In 2009, a special tribunal appointed by the Ministry for the Environment recommended the South Branch from the Lake Mason outlet confluence up be protected in its natural state under a Water Conservation Order for its outstanding natural character.

22. Lake Mason

Lake Mason lies in the South Branch valley in a basin on the true left of the valley. It actually consists of two lakes. Big Lake Mason (53 hectares) is typical of the other lakes in the region being deep with shingle beaches. Little Lake Mason however is totally different in nature being shallow with extensive weed beds providing excellent habitat for trout. Little Lake Mason is far more productive for fly fishing.

Lake Mason with the South Branch valley in the background. (Ross Millichamp).

Access is via a public walkway from the head of Lake Sumner. This is approximately a 1.5 hour walk. The most popular access is via Lake Taylor Station where for a reasonable fee the private hut can also be used right on the shore of the lake.


Little Lake Mason with the Lake Mason Hut (Lake Taylor Station) in background. (Emily Arthur).

NAS shows a reasonable amount of use with 300 angler days in 1994/95, 20 angler days in 2001/02 and 380 angler days in 2007/08.

23. Lake Sumner

Lake Sumner/Hoka Kura covers an area of 1,390 hectares with a maximum depth of 135m. Except for the southwest side which is grazed, it is surrounded largely by forested mountains extending up to 1,900m. The lake plays a vital role in the hydrology of the Hurunui River mainstem by moderating flows. The lake also provides highly productive trout habitat at the outlet and the mainstem of the Hurunui. This is discussed further in section 28.


Lake Sumner outlet. (Ross Millichamp).

Lake Sumner can be accessed by a public 4WD track. It can also be accessed by boat by navigating through the “canal” from Loch Katrine.

Due to the size of the lake, most fishing is via boat rather than shoreline. It is very popular however, with NAS showing 390 angler days in 1994/94, 520 angler days in 2001/02 and 1910 angler days in 2001/08.

In 2009, a special tribunal appointed by the Ministry for the Environment recommended that Lake Sumner be protected in its natural state under a Water Conservation Order for its outstanding natural character, wild and scenic values, habitat for brown trout, fishery and angling, contribution to brown trout fishery and cultural values.

24. Loch Katrine

Loch Katrine (83 hectares) lies just to the south of Lake Sumner but is connected by a natural “canal”. The lake is accessed by a public 4WD track, with private fishing huts nestled on the south eastern shore.


Loch Katrine and outlet draining into Lake Sumner. (Ross Millichamp).

Like Sumner, fishing by boat is popular. There can be good shoreline fishing near the outlet at the north western end (Kent 2009). NAS shows moderate angler use with 190 angler days in 1994/95, 200 angler days in 2001/02 and 260 angler days in 2007/08.

In 2009, a special tribunal appointed by the Ministry for the Environment recommended that Loch Katrine be protected in its natural state under a Water Conservation Order for its outstanding natural character, wild and scenic values, habitat for brown trout, fishery and angling, contribution to brown trout fishery and cultural values.

25. Lake Taylor

Lake Taylor (214 hectare) lies further south of Loch Katrine. Access is via Lake Sumner Road. There is also a public campground at the south eastern end administered by DoC.

Lake Taylor is well stocked with smallish trout. It is an extremely popular location for angling with good access a plenty of scope for shoreline fishing. NAS confirms its popularity with 750 angler days in 1994/95, 970 angler days in 2001/02 and 3320 angler days in 2007/08.


Lake Sheppard on the left with Lake Taylor to the right. (Ross Millichamp).

26. Lake Sheppard

Lake Sheppard (115 hectares) lies just to the east of Lake Taylor. It is smaller but similar in nature to its neighbour. Lake Sheppard is the only one of the Hurunui lakes that does not have public access to the lake. However, access is readily given by the Lakes Station. Like most waterways in the Hurunui catchment, once anglers are on the shore they can use the marginal strips for legal access.

There is good shoreline fishing with the trout being large than those in Lake Taylor. NAS shows 230 angler days in 1994/95, 120 angler days in 2001/02 and 240 angler days in 2007/08.

27. Sisters Stream

Sister stream drains both the Sheppard and Taylor Lakes then flows east to join the Hurunui River. NAS shows 30 angler days in 2007/08. It is not well known for its angling attributes but it plays a very significant role for trout spawning and juvenile rearing.

In 2009, a special tribunal appointed by the Ministry for the Environment recommended that Sisters Stream be protected in its natural state under a Water Conservation Order for its outstanding cultural values.

28. Hurunui River (Mainstem)

The mainstem of the Hurunui River winds approximately 40 kilometres from the outlet of Lake Sumner to its confluence with the Mandamus River just above the Amuri Plain.

Between the Lake Sumner outlet and the Seaward River confluence, the bed of the Hurunui River mainstem is generally entrenched within glacial outwash terraces, with a bed of boulders, cobbles and gravel. This section is fast flowing, commonly about 30 metres wide and with frequent rapids and some short rock gorges characterized by deep pools. The lower part of this reach between the South Branch confluence and the Seaward River confluence flows for several kilometres through a steep-sided valley with native beech/hardwood forest and kanuka shrubland. The natural character throughout is very high and the aquatic habitats unmodified by abstraction or surrounding land use. The moderating influence of Lake Sumner stabilises river flows, reducing the extent and duration of low flow periods and smoothing flood peaks.

Downstream of the Seaward River confluence, the mainstem enters a gorge named Maori Gully, where the surrounding vegetation is also mainly beech forest and mature shrubland. Below Maori Gully the river widens briefly before being confined by terraces before entering the rocky Hawarden Gorge just upstream of the Glenrae River confluence. The surrounding terraces and hillsides are characterized by native forest, shrubland and broom.

Below the confluence with the Mandamus River, the mainstem of the Hurunui River becomes braided across the Amuri Plains before entering a rocky gorge through the Lowry Peaks Range. Once it leaves the Lowry Peaks Gorge at State Highway 1 the river again becomes widely braided, flanked by terraces and high hills. The Hurunui River reaches the Pacific Ocean approximately 80 kilometres north east of Christchurch and just south of Gore Bay. The mouth is contained by sandstone cliffs on the true right, with an extensive lagoon on the true left, flanked by coastal broadleaf forest.

The Hurunui River mouth is considered to be one of the most scenic East Coast river mouths. (Peter Langlands).

Flows of above 15m^3/s make it very difficult to fish the reach of river immediately above the Mandamus confluence. Anything higher than this makes the river hard to negotiate as it is quite confined in this area. Wading and negotiating the river becomes too dangerous above these flows as the crossing are too deep and swift. Flows above 15m^3/s also make it hard to negotiate the gorge upstream from SH1 for the same reasons.

It is not very often that the Hurunui does flow below 15m^3/s. It is often around late summer. When it does it offers a brief opportunity to explore some gorgy reaches of the river that do not get fished over as much.

The mainstem below Lake Sumner is considered fly fishable when the river at Mandamus is less than 30m^3/s. Any more then this and the river starts to become too “heavy” for optimal fly-fishing (Hawker 2009). The water becomes too fast and too big to fish effectively with the fly. It also makes it very hard to spot fish.

Low summer flows like this provide ideal "angler habitat". Hurunui River just upstream of Sisters Stream confluence. (Peter Langlands).

Lake outlets like the Hurunui River below Lake Sumner are typically characterised by high densities of benthic invertebrates (Wotton 1979; Bronmark & Malmqvist 1984; Harding 1994) and also support the highest densities of trout in New Zealand (Tierney & Jowett 1990).

The high densities of trout and invertebrates at lake outlets probably are related to the combination of stable flows, abundant food resources, good physical habitat, good water quality, and suitable water temperatures that are typical of these locations. All information that is available indicates that the Hurunui River below Lake Sumner is typical of other lake outlets in these regards and therefore compared to other fisheries generally, has a high density of trout.

An instream habitat survey of the Hurunui River below Lake Sumner was carried out as part of the '100 Rivers' survey (Jowett 1990). The instream habitat survey involved measuring depth, water velocity and substrate composition at regular intervals across a series of river cross-sections. The water level is measured during the survey and again at several contrasting flows to determine the relationships between water level and flow on each cross section (these are commonly referred to by hydrologists as rating curves). A hydraulic model (RHYHABSIM, Jowett et al. 2008) is then used to predict how water depths and velocities will change with flow across the cross-sections. The model then uses a series of preference curves to relate changes in flow (and thus depth and velocity) with changes in habitat availability for particular species or life stages of a particular species.

The '100 Rivers' study showed that the percentage of adult trout drift feeding habitat at the mean annual low flow (MALF) and the percentage of food producing habitat at the median flow were important factors affecting trout population abundance in New Zealand rivers (Jowett 1992).

A comparison of these values among the 63 sites where data was collected placed the Hurunui River as the 6th ranking site (top 10%) in terms of food producing habitat (Figure 2a) and the 3rd (top 5%) best site in terms of adult brown trout drift feeding habitat (Figure 2b). When looking at these two measures combined together, the Hurunui was the top ranked river in the country (Figure 1c). This ranks it equivalent to or above other rivers recognised as having outstanding trout habitat and/or fisheries in existing Water Conservation Orders such as the Buller, Gowan, Oreti, Motueka, Mangles, Ahuriri, Rangitikei and Mataura.

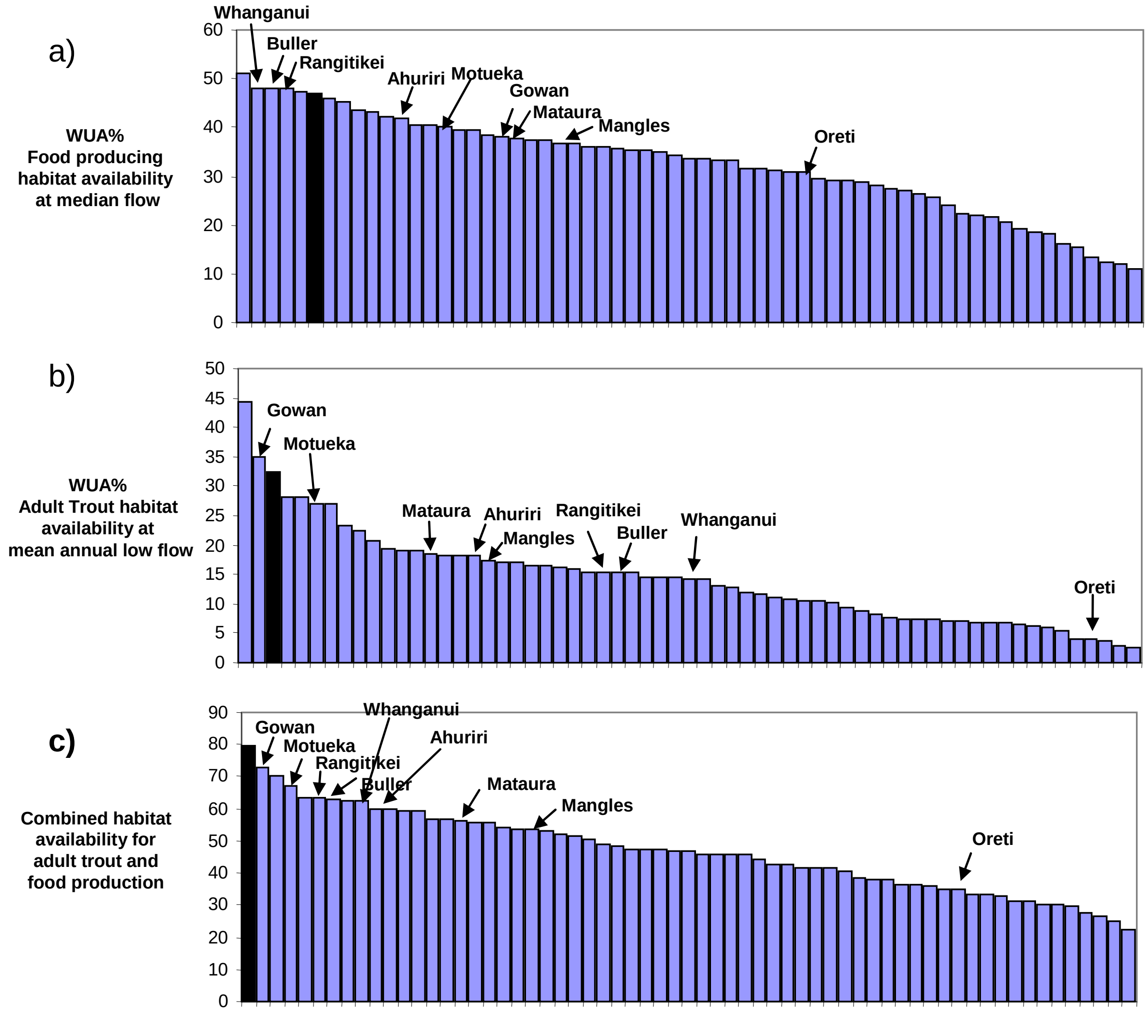


Figure 2. A comparison of habitat availability in the Hurunui River below Lake Sumner with other notable rivers around New Zealand for a) food production, b) adult trout, and c) the combination of food production and adult trout. The Hurunui River is marked as the black bars (Young 2009).

The high water clarity in the Hurunui River between Lake Sumner and the South Branch confluence will be one factor contributing to the outstanding abundance of trout in this reach. Many anglers also prefer to spot fish before fishing to them, so water clarity is also an important feature contributing to angling values. The consistently high water clarity in the Hurunui below Lake Sumner will allow angling opportunities when conditions elsewhere in the catchment and in neighbouring rivers will be unsuitable because of turbid water.

Hurunui mainstem at Jollie Brook confluence. (Peter Langlands).

Trout fisheries are normally recognised as outstanding based on the abundance of trout and/or the size of the trout available. Both of these features are apparent in the Upper Hurunui Catchment which is relatively unusual.

Trout abundance in rivers throughout New Zealand was assessed by drift diving as part of the '100 Rivers' study (Teirney & Jowett 1990). Drift dive counts are considered to be underestimates of the total trout population (Teirney & Jowett 1990; Young & Hayes 2001). The degree of underestimation varies from river to river and is probably dependent on the amount of physical cover that is available. However, the proportion of trout that are detected by divers appears to remain relatively constant over time within river reaches (Young & Hayes 2001).

A comparison of the abundance of large (> 40 cm) and medium (20 – 40 cm) brown trout among 158 dive records from the 152 river reaches surveyed during the '100 Rivers' study shows that the mainstem of the Hurunui River just downstream of Lake Sumner had a very high abundance of trout >20 cm (Figure 2). Trout densities during one dive in 1988 (329 per km) were the second highest recorded among New Zealand rivers, while an earlier dive in 1983 found 86 medium and large trout per km (18th highest recorded). This ranks it equivalent to or above other rivers recognised as having outstanding trout habitat and/or fisheries in existing Water Conservation Orders such as the Buller, Gowan, Oreti, Motueka, Mohaka, Mangles, Maruia, Ahuriri, Rangitikei and Mataura.

Two other reaches of the Hurunui River were also included in the '100 Rivers' survey. The mainstem below Jollie Brook had 22 large and medium trout per km in 1983 (70th highest recorded), while a reach of the Hurunui just below the South Branch confluence had a density of 17 large and medium trout per km in 1983 (80th highest recorded; Figure 3).

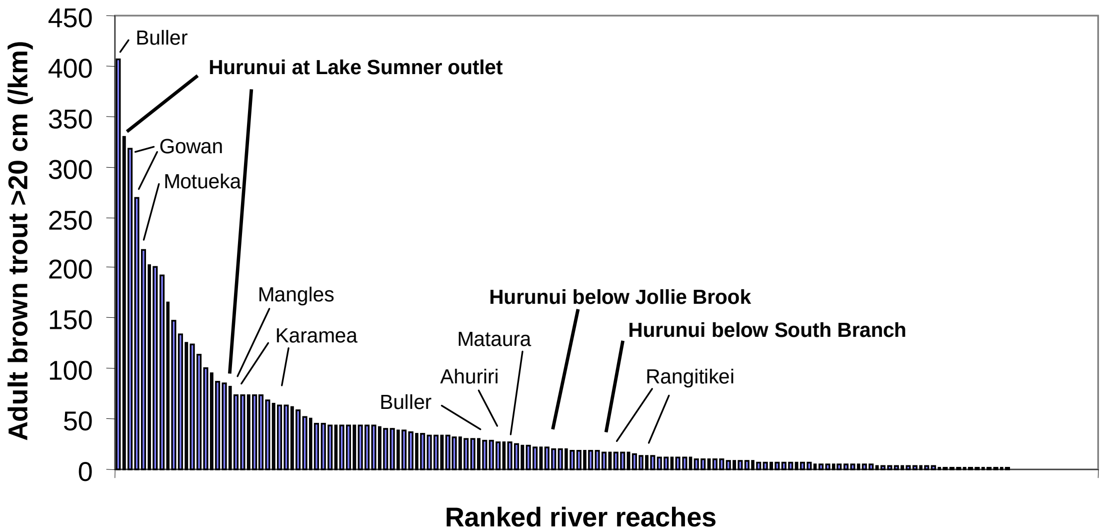


Figure 3. A comparison of the abundance of adult brown trout in 158 river reaches from throughout the country (data from Teirney & Jowett 1990).

Two sites on the Hurunui River below Lake Sumner have been monitored annually by Fish and Game using the drift diving method since 1995. Site 1 is from the Lake Sumner outlet downstream for approximately 1.2 km, while Site 2 is located a further 5 km downstream, immediately above the Sisters Stream confluence, and is 1.9 km in length (see Figure 4 below. The first section is representative of an unmodified lake outlet, and the second section is representative of the Hurunui River downstream to the Mandamus River confluence, excluding the narrow gorge sections. Results from these surveys have previously been published in our "Sportsfishing News" magazine, Fish and Game magazine supplements and Fish and Game annual reports. These dives have been conducted to gain information on population trends for our own internal management purposes.

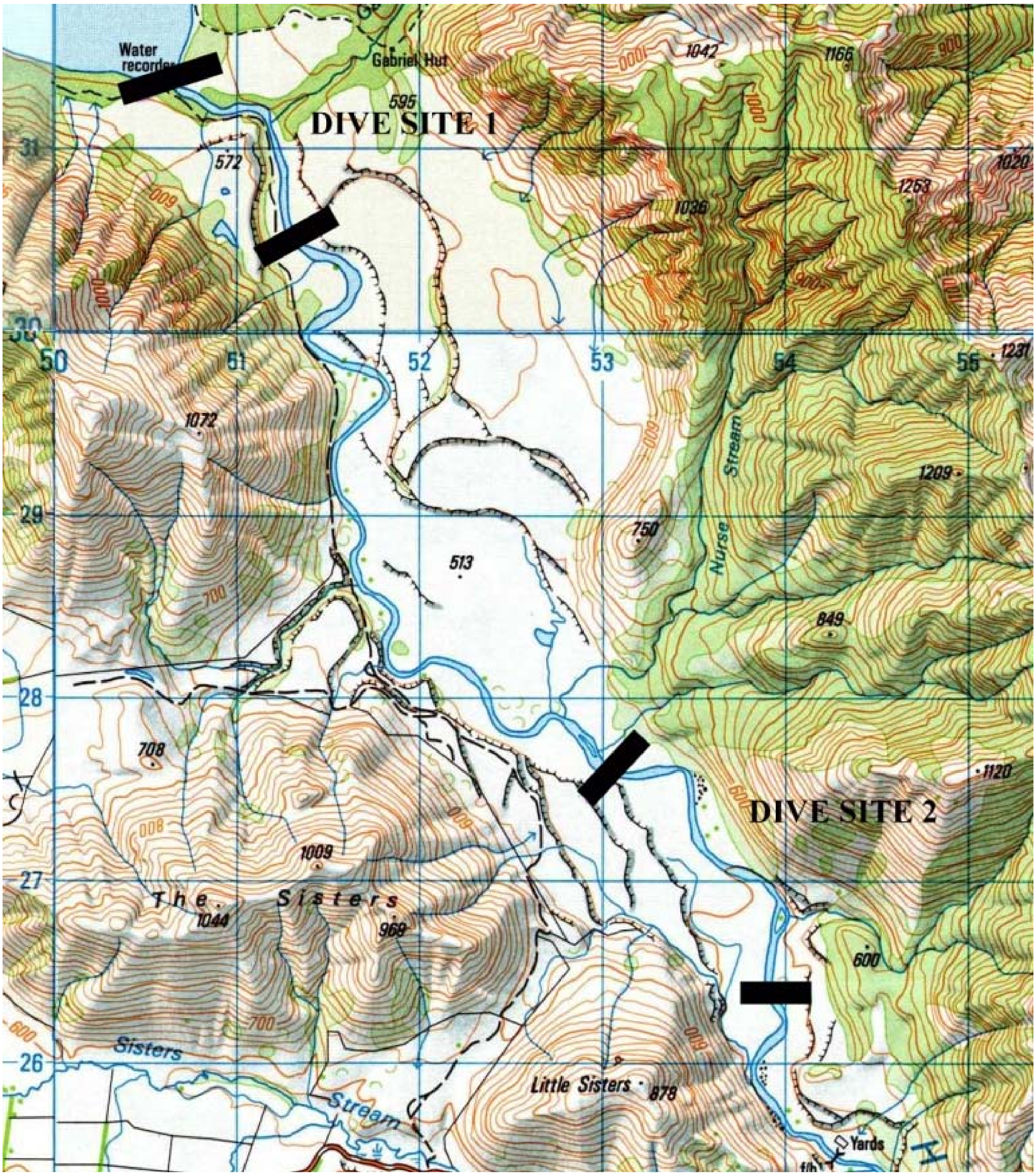


Figure 4. Hurunui drift dive sites.

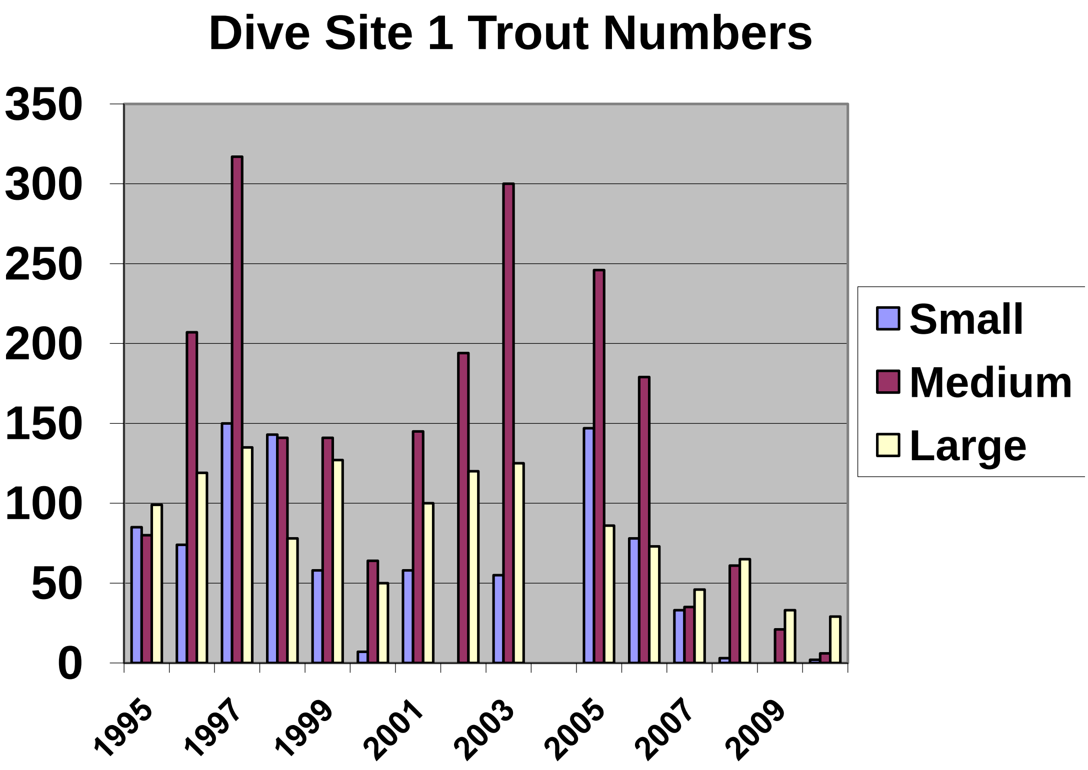


Figure 5. Numbers of trout at dive site 1.

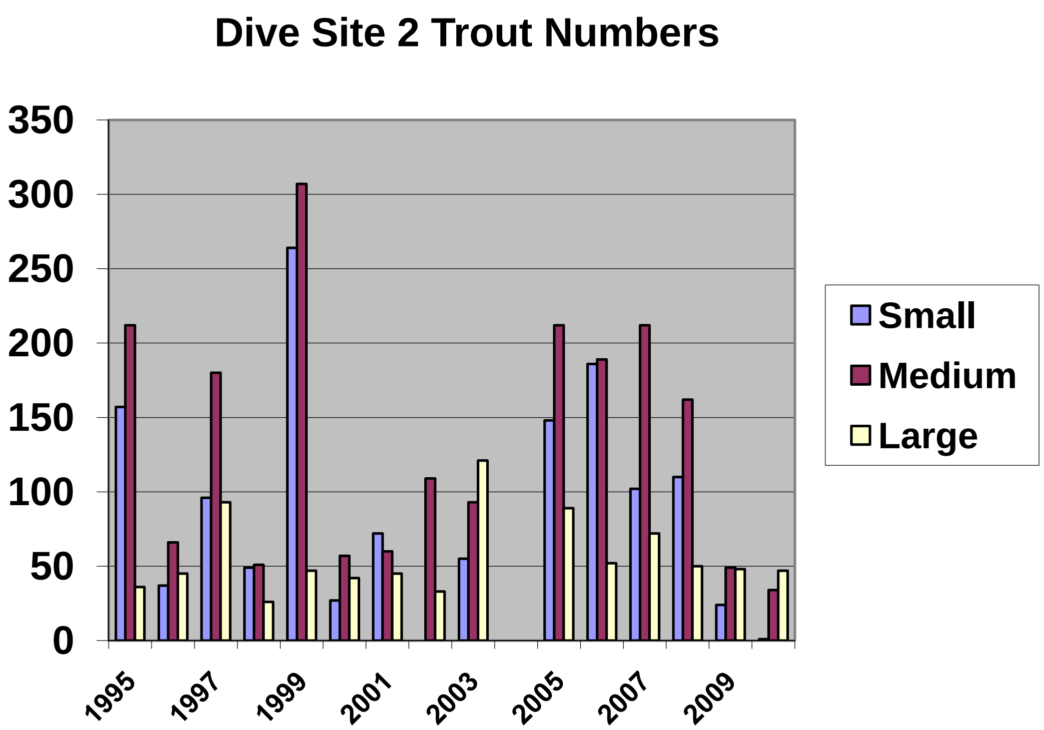


Figure 6. Numbers of Trout at dive site 2.

At Site 1 (Figure 5.), large trout numbers have been observed to range from 29 in 2010 to 135 in 1997. Medium sized trout have ranged in number from 6 in 2010 to 317 in 1997. For Site 2 (Figure 6), numbers of large trout have ranged from 26 in 1998, to 121 in 2003. Medium trout have ranged in number from 34 in 2010 to 307 in 1999.

While there will be natural changes in the Brown trout population from year to year, It is considered the results are also sometimes affected by physical conditions that affect both the numbers of trout present and the drift dive technique in counting them (Ross 2009). Conditions such as diver visibility being reduced by discoloured water in Lake Sumner, which is often caused by floodwater entering the lake, Nor-West wave action stirring up silt at the outlet end or suspended phyto plankton/algae from the lake. While it is generally regarded that less than 4m visibility is less than ideal, the difference in counting effectiveness between 4m and 6m in reality is not always that obvious. Other conditions such as a high lake level and thus high river flows affecting effective diver coverage of the river width and the available cover and location of the trout; conversely the effects of low river levels on available habitat area and the effects on the habitat caused by flood events all add to the variability from one year to the next (Ross 2009).

NCF&G staff prepare for the drift dive in “snug” wetsuits. Lake Sumner outlet. (Emily Arthur).

The level of annual variability in trout numbers since 1995 is consistent with that reported elsewhere (Platts & Nelson 1988; Zorn & Nuhfer 2007; Dauwalter et al. 2009). Trout numbers have been relatively low at both of these sites over the last 3 years. However, at this stage it is impossible to say if this represents the beginning of a long-term trend or just represents the natural variation that is typical of trout populations. Detecting trends in trout populations is difficult because of the large natural variability. For example, Dauwalter et al. (2009) have calculated that detecting a 5% annual decline at a single monitoring site with good statistical power would require about 20 years of data.

Long-term drift dive records for brown trout populations with more than 6 records over a period of >10 years up to 2010 are available for 24 river reaches in New Zealand, including the Hurunui River at the Lake Sumner Outlet and the Hurunui River below Jollie Brook (Figure 7). The Hurunui River at the Lake Sumner Outlet has consistently had the highest trout abundance of any of these rivers. The Hurunui River below Jollie Brook also has consistently high trout abundance compared to the other rivers (5th highest average, Figure 7).

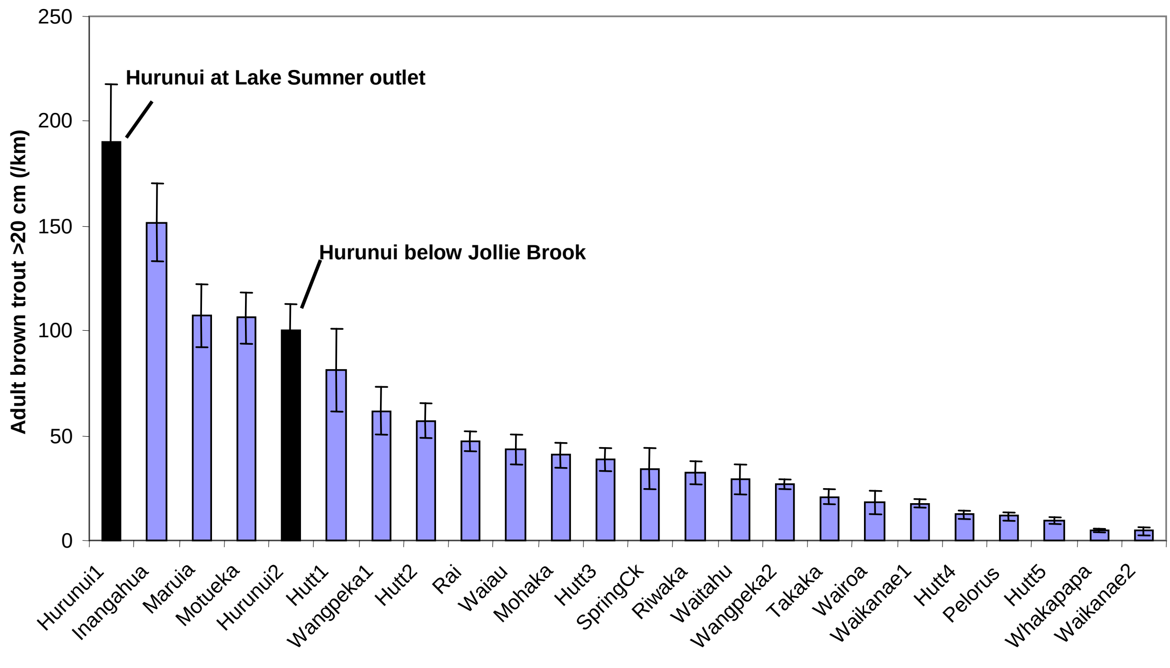


Figure 7. Average drift dive records over a 10 year period for rivers with 6 or more years of drift dive data. (Young 2009).

In 2002 a more intensive drift dive programme (Terry 2002) was initiated to produce more defendable data and also to verify the results of previous surveys. Determining what percentage of the trout population was being counted and also determining if fish were being counted twice producing an overestimate were the objectives of the study. Consultation with independent fisheries scientists suggested that a mark-resight experiment was the best way of verifying the drift dive survey method.

NCF&G staff dragged nets downstream through sections of the river at the two drift dive sites and captured and Floy tagged a total of 73 large (>450mm) Brown trout. 40 fish were tagged and released at Site 1, and 33 fish at Site 2. These were released as near to wherever they were caught as possible.

A week later NCF&G staff returned and drift dived the two sites. For the elimination of confusion, small trout (<150mm) were not counted during the dives.

At Site 1 divers counted 77 large Brown trout, of which 25 were observed to be tagged. A repeat dive 3 hours later revealed 41 large trout of which 14 were tagged, a similar ratio of tagged to untagged as the first dive. At Site 2, 33 large Brown trout were seen, with 12 of them seen to be tagged. Unfortunately time constraints did not allow a repeat dive at Site 2, thus not allowing for the reliable estimate of drift diving effectiveness at Site 2.

From the ratio of a known number of tagged fish released, to the number of tagged trout observed by the drift dive technique, this study confirmed for NCF&G that the drift dive technique is an underestimate of the true number of fish present at the two Hurunui sites that are dived. In essence, the tagged trout make up a percentage of the total trout numbers that are present at each site. If the divers' observations accounted for 100% of all the trout in the reach, they would have also seen all of the tagged ones. This was not the case. Therefore the percentage of tagged ones observed, is representative of the percentage of all trout observed in that reach. It would seem that when drift diving the Hurunui staff only see approximately 60% of the large Brown trout present at Site1 in this study, which is in line with findings of other similar studies (Teirney & Jowett 1990; Young & Hayes 2001).

29. Lower River

While the upper Hurunui River is the recognised headwater trout fishery, the lower river has some value as a recreational trout fishery in its own right. Of particular significance though will be its contribution of adult trout to the headwater fishery of the upper river. Thus, maintaining the quality of habitat in the lower river is of considerable importance to the continued well-being of the headwater fishery (Jellyman 2009).

Angling on the lower Hurunui River. (Peter Langlands).

To assess anglers' perceptions of the status of lowland rivers, a postal questionnaire was carried out of anglers with at least 20 years experience (Jellyman et al. 2003). These anglers were asked to rate any change in angling quality, and the number and size of fish, for rivers that they fished regularly. Scores were ranked from -2 (marked decline) to +2 (marked improvement). While the focus was on lowland rivers, anglers also provided information of the lowland portions of rivers sourced further inland like the Hurunui. With few exceptions, results were negative i.e. anglers perceived that the status of rivers had declined over their fishing experience.

Results (Table 3) indicated that the (lower) Hurunui River was perceived as the least impacted lowland river in the North Canterbury Fish and Game region. While this is commendable, the lower river is subject to water abstraction, river protection works, and much of the catchment is developed for pastoral farming and forestry. Given the presumed important contribution the lower river makes to trout stocks in the upper river, it is of obvious importance to maintain the water quality and quantity of the lower river.

River (number of replies)	Angling quality	Number of fish	Size of fish
Hurunui (6)	- 0.33	- 0.5	- 0.33
Ashley (9)	- 1.44	- 1.56	- 1.11
Cam (7)	- 1.86	- 1.29	- 1.14
South Branch (7)	- 1.14	- 1.29	- 0.14
Halswell (9)	- 1.89	- 1.89-	- 1.50
Harts Creek (9)	- 1.11	- 1.56	- 0.56
Irwell (9)	- 1.56	- 1.78	- 1.50
L II (14)	- 0.86	- 1.00	- 0.64
Selwyn (21)	- 1.52	- 1.67	- 0.95
Average	-1.30	- 1.39	- 0.87

Table 3. Anglers perceptions of quality of angling, number of fish, and size of fish for lowland rivers in the North Canterbury Fish and Game region (values are means for rivers where > 5 replies were received).

In 2009, a special tribunal appointed by the Ministry for the Environment recommended that the lower Hurunui be protected with a no damming provision under a Water Conservation Order for its contribution to the brown trout fishery.

30. Hurunui Catchment wide studies

Due to the Hurunui's significance as a fishery it has been subject to studies both at a national and regional level. These have been carried out by various organisations such as NIWA, ECan, Cawthron Institute and Ministry for the Environment. The analysis of these studies provides us with some useful information and enables us to make national comparisons between the Hurunui and other significant fisheries throughout New Zealand. The following sections (31-38) offer a summary of the findings and those comparisons.

31. Studies of trout size in the Hurunui catchment

Anglers generally consider trout greater than 2.7 kg (6 lb) to be 'large' while trout in excess of 4.5 kg (10 lb) are considered to be 'trophy' fish. A well-conditioned fish of 600 mm is likely to weigh more than 2.7 kg (6 lb).

Information on trout size in the Hurunui Catchment is available from samples collected by anglers for the growth modelling (45 trout, mentioned further below), otolith microchemistry study (120 trout; also mentioned below), a study of headwater trout fisheries throughout NZ (7 trout, Jellyman & Graynoth 1994), catch records of Tony Hawker for 2009/10 (29 trout), and an expert angler (127 trout, Chappie Chapman). In most cases the capture location was available along with fish length and/or weight.

The largest recorded trout caught in the Upper Hurunui Catchment was 813 mm long with a weight of 8.2 kg (18 lbs) and caught in February 1992. This record is from the headwater trout study (Jellyman & Graynoth 1994) and was recorded as being caught in the Upper Catchment of the Hurunui River. However, not surprisingly the exact capture location was not provided.

Within the Hurunui Catchment, the largest fish were generally captured in the North Branch above Lake Sumner (mean length 649 mm, mean weight 2.6kg; Figures 8 & 9), followed closely by the South Branch (mean length 625 mm, mean weight 2.5kg; Figures 8 & 9). Trout from the Hurunui River below Lake Sumner covered a broader size distribution and on average were somewhat smaller than in the North Branch and South Branch (mean length 571 mm, mean weight 1.7kg; Figures 8 & 9). Nevertheless, there were still large numbers of large trout caught in the mainstem below Lake Sumner (Figures 8 & 9). Trout caught in the Hurunui between the South Branch confluence and Mandamus (mean length of 459 mm and mean weight 1.3 kg; Figures 8 & 9) were generally smaller than those caught further upstream, but similar to that caught in the middle (Balmoral) and lower reaches (SH1) of the river (mean length 502 mm, mean weight 1.5 kg; Figures 8 & 9). Trout captured from the Hurunui Lakes were generally smaller than from the rivers (Figures 8 & 9).

The proportion of large (>2.7 kg) trout in the anglers catch from the North Branch above Lake Sumner (33%) and the South Branch (30%) is very high compared to other parts of the catchment (all <7%). The South Branch is also notable for the presence of trophy trout (>4.5 kg). One trophy trout was also captured in the lower reaches near the river mouth.

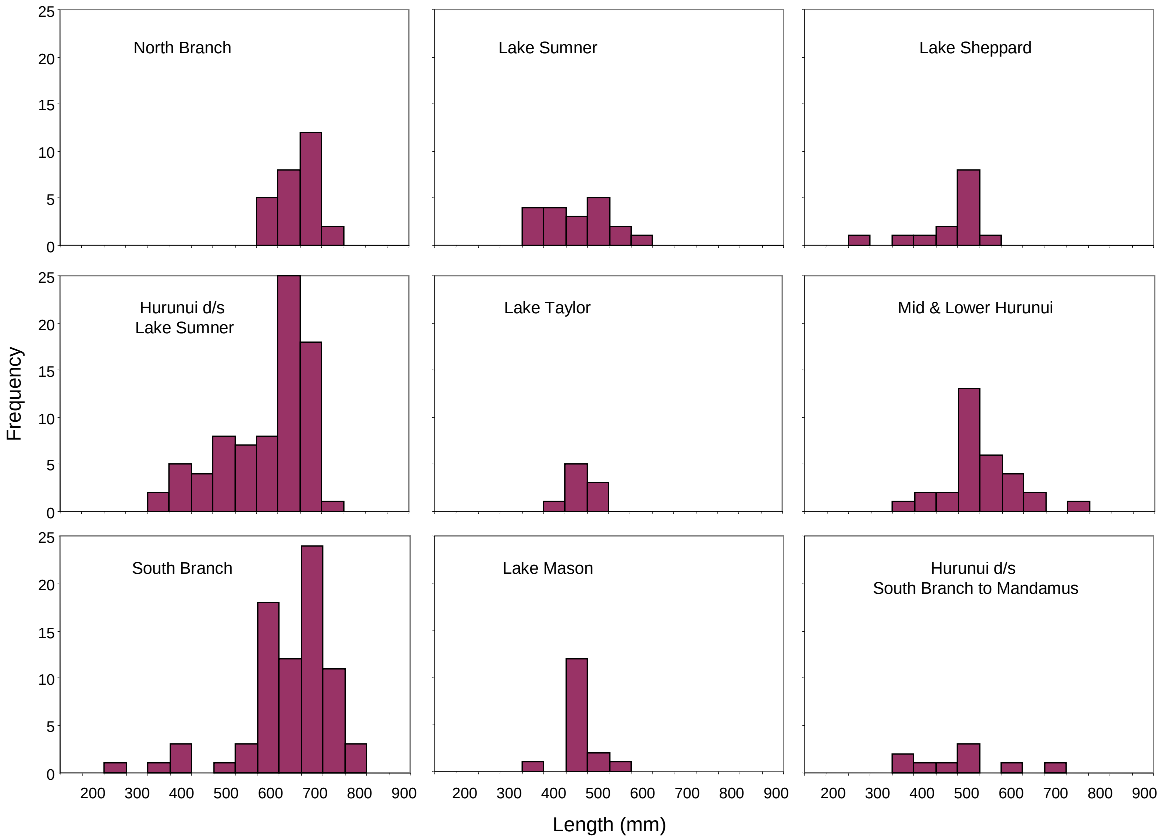


Figure 8. Length distribution of trout caught in different parts of the Hurunui Catchment (Young 2009)

A typical South Branch fish of around 5 & 1/2lbs. (Malcolm Bell).

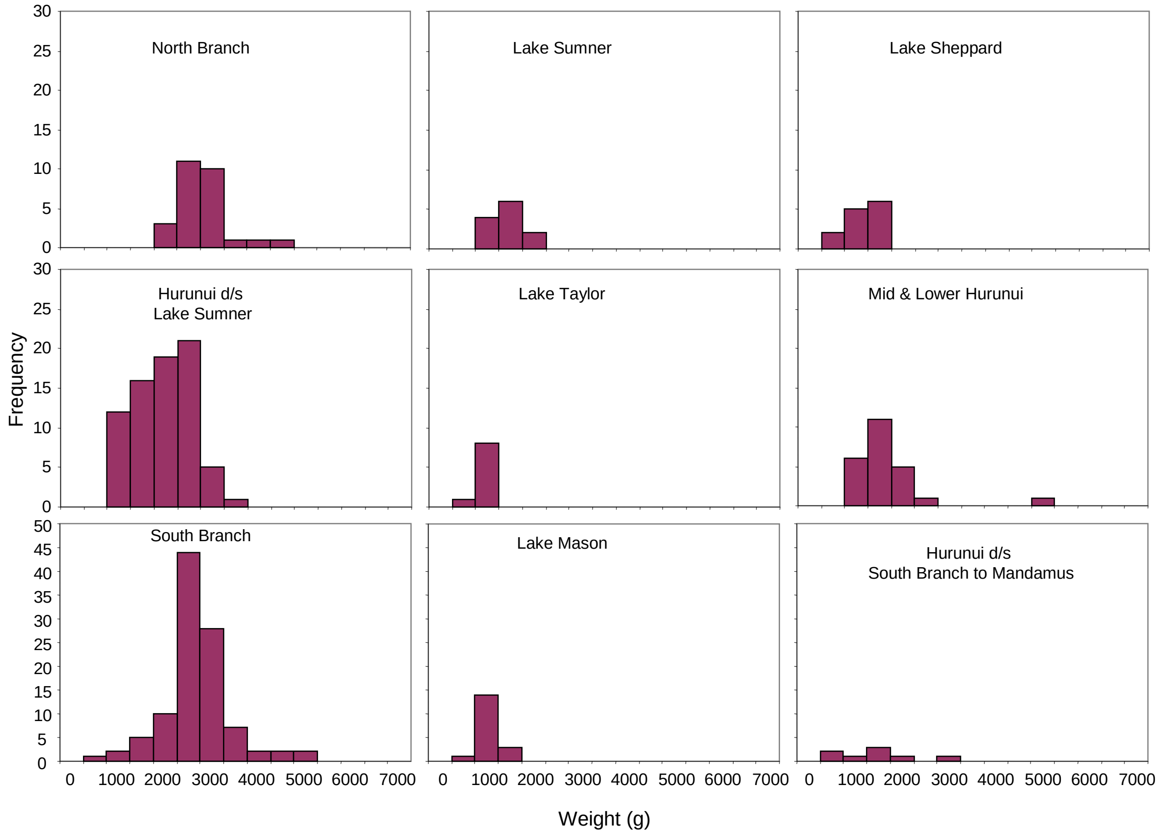


Figure 9. Weight distribution of trout caught in different parts of the Hurunui Catchment (Young 2009).

The average size of trout from different parts of the Hurunui Catchment can be compared with trout size data collated by Jellyman & Graynoth (1994) in their New Zealand headwater trout fisheries study. The mean length of brown trout recorded in this study was 556 mm with a mean weight of 2.2 kg (Jellyman & Graynoth 1994).


A 10lber caught from the North Branch. (Adrian Bell).

The average length of trout from the North and South Branches of the Hurunui River was higher than in any of the other rivers with 10 or more records included in the headwater trout study (Figure 10). Average length of trout from the mainstem downstream of Lake Sumner was comparable to many of the other headwater fisheries while the mean length of trout from the lower reaches of the Hurunui was smaller than most headwater fisheries (Figure 10). As mentioned earlier, fish from the Hurunui Lakes are generally smaller than from the rivers.

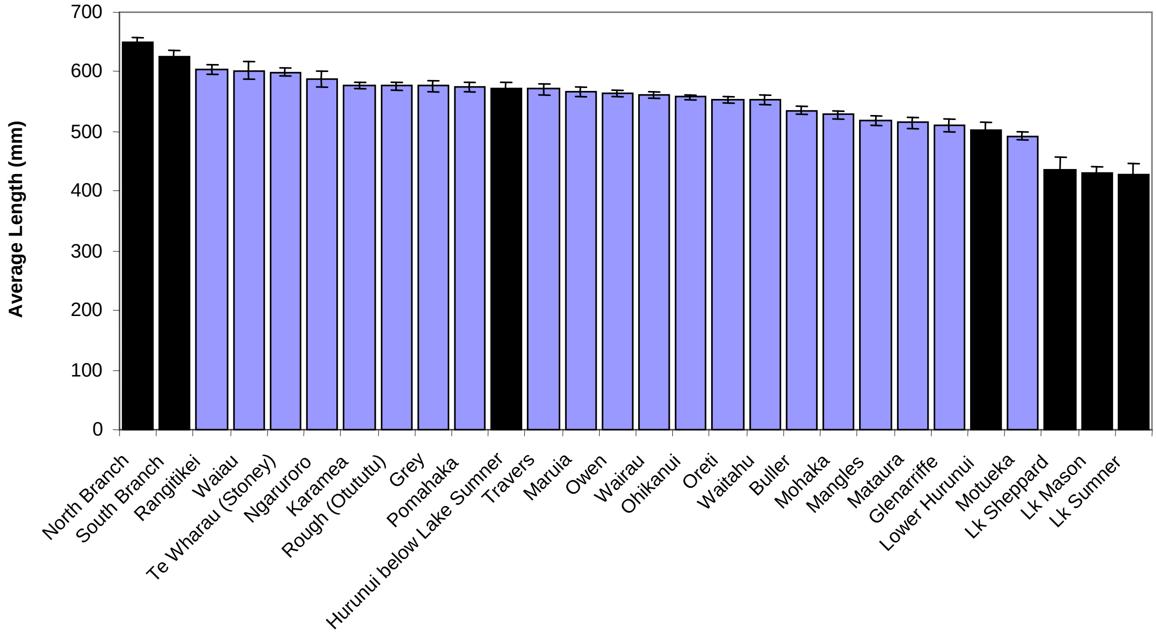


Figure 10. Average length of trout from different parts of the Hurunui Catchment (black bars) compared with data collected from other rivers in the headwater trout fisheries study (data from Dr Don Jellyman).

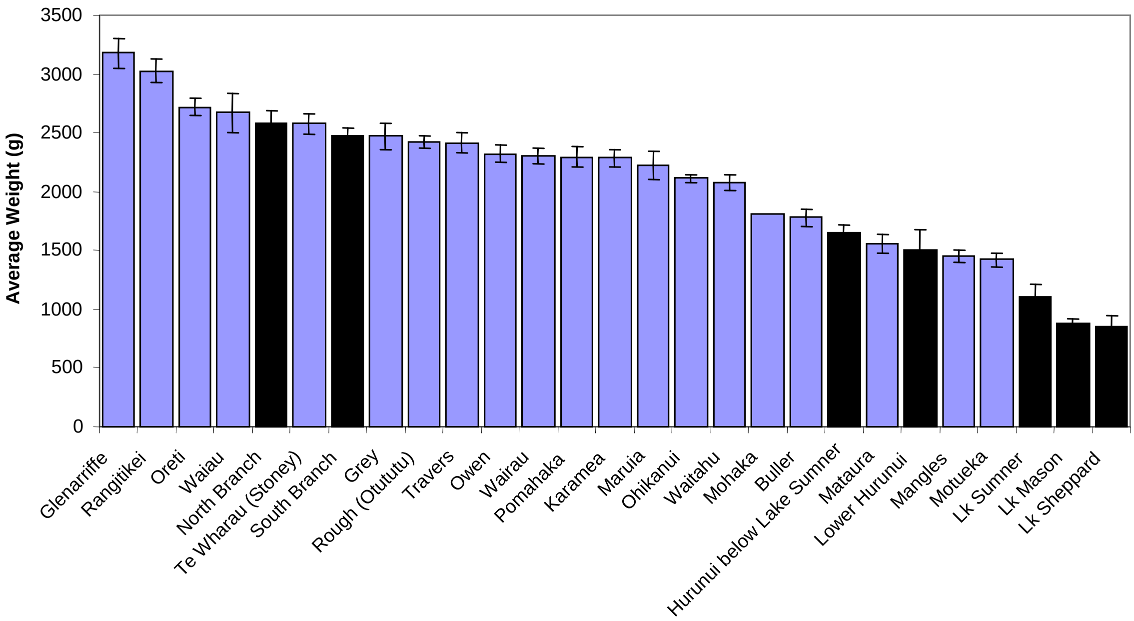


Figure 11. Average weight of trout from different parts of the Hurunui Catchment (black bars) compared with data collected from other rivers in the headwater trout fisheries study (data from Dr Don Jellyman).

The average weight of trout from the North Branch above Lake Sumner and the South Branch of the Hurunui River was also high compared to many other headwater fisheries, while the weight of trout in other parts of the Hurunui Catchment are less remarkable (Figure 11).

32. Trout movements in the Hurunui catchment

No direct measurements of trout movement have been conducted in the Hurunui Catchment. While not as definitive, cost effective alternatives are now available that use indirect evidence from which movement is inferred (Young 2009). These are trout growth modelling (Hayes & Quarterman 2003) and trout otolith microchemistry (Bickel & Olley 2009). These two approaches complement each other well with the otolith microchemistry providing information on broad scale movement patterns of trout, while the growth modelling provides information on whether trout need to migrate in order to grow to the size that anglers are used to catching (Young 2009).

33. INFERRING TROUT MOVEMENTS FROM GROWTH PREDICTIONS

Trout are cold blooded so water temperature influences their metabolism and growth. Hayes (2000) constructed growth models for brown trout based on energetics equations developed by Elliott & Hurley (1999, 2000). These models are driven by water temperature, or by both temperature and food when data on food availability and foraging behaviour of trout are available. Brown trout predominantly eat aquatic invertebrates in rivers, but larger trout will supplement their diet with fish – even switching entirely to fish prey in some circumstances. The growth models allow prediction of growth of brown trout on invertebrate and fish diets. Growth is about three times faster on a fish diet.

Brown trout have an optimal temperature for growth of 13.9°C when feeding at maximum consumption rates on invertebrates, increasing to 17°C on a fish diet (Elliott & Hurley 1999, 2000). Where trout occur in habitats that are colder or warmer than these temperatures they grow more slowly. Trout grow slowly in cold water headwaters and tributaries, or at high latitude, even when invertebrate food is abundant because the rate at which they can digest their food is severely limited by cold conditions. In these situations migration to warmer habitats downstream, and even to the ocean, at an early age allows trout to escape these temperature limitations to growth. By migrating to the lower reaches of rivers, or to the ocean, trout also have access to abundant fish prey. The abundance of native forage fish, such as bullies, smelt and whitebait, declines with distance upstream because many of these species are diadromous (sea migratory) and most only penetrate a short distance upstream in most rivers (Young 2009).

The trout growth models are useful for predicting and monitoring environmental impacts to rivers – or the effects of longitudinal temperature gradients down rivers. They can show how growth is affected by change in water temperature and by changes in aquatic invertebrate communities. Inferences can be made about whether trout need to migrate in order to grow to the sizes observed in the anglers catch (Young & Hayes 1999). Such information can be useful for assessing whether disruption to trout migration by dams might result in an isolated upstream population having reduced growth and maximum size.

The Cawthron Institute have used this modelling approach in the Hurunui River to determine the influence of the longitudinal water temperature gradient down the river on trout growth potential (Hayes & Quarterman 2003). Brown trout growth on invertebrate and fish diets was modelled for the Hurunui River using the bioenergetics growth model "Trout_Energetics 2" developed by Hayes (2000 - with recent updates). The model was based on Elliott & Hurley's (1999, 2000) bioenergetics equations for brown trout. Data input to the model was in the form of mean daily water temperature calculated from 15 minute continuously logged data recorded at seven sites in the catchment over the period 7 September 2001 – 14 January 2003 (Figure 12). An annual mean daily temperature record was predicted from sine curve models for each logger site and this was used for growth modelling.

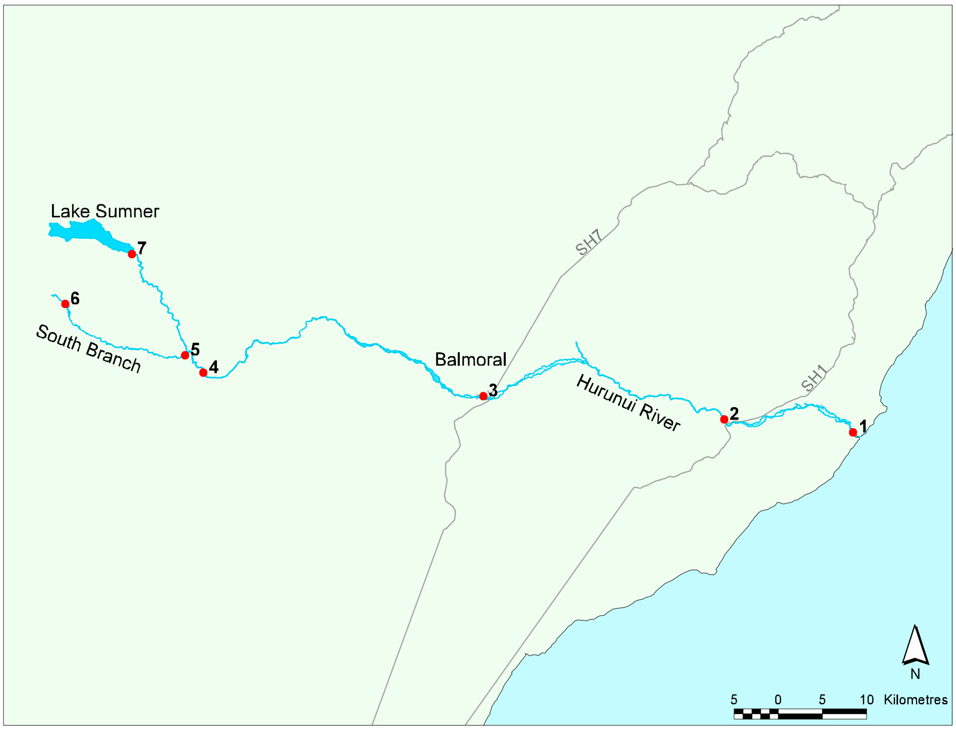


Figure 12. Map of the Hurunui River showing location of the seven water temperature loggers.

Predicted growth was compared with observed growth, the latter based on size at age data collected from 56 angler-caught fish and from 27 juvenile trout collected by electrofishing. Some of these trout have been collected subsequent to Hayes & Quarterman's initial 2003 analysis. Age was estimated from thin-sectioned otoliths and scales.

Annual water temperature regimes for the various sites showed the expected pattern of increasing water temperature with distance downstream (Figure 13). The one anomaly was Site 7 at the Lake Sumner outlet. Here the average annual temperature was higher than at Site 5, in the lower South Branch, and average winter temperature was higher than Sites 4 – 6. This was presumably due to the buffering effect of Lake Sumner.

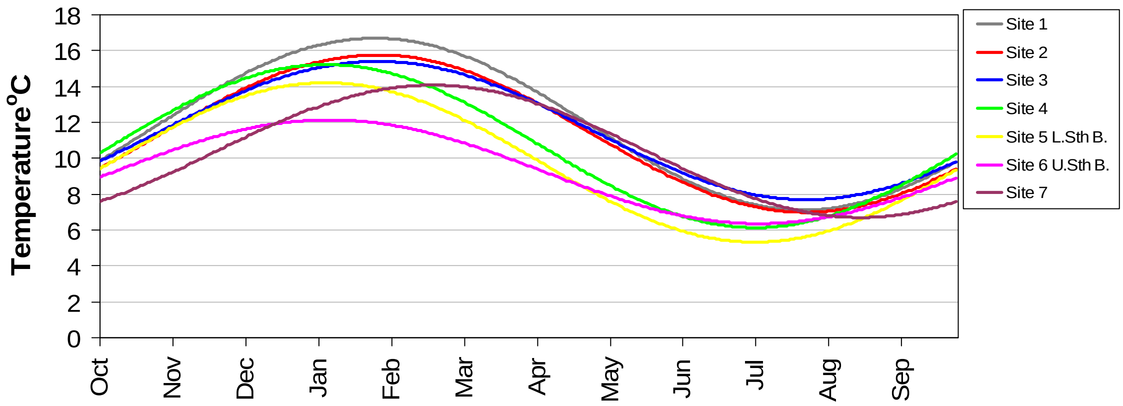


Figure 13. Modelled mean daily temperature records for the seven logger sites (site 5 = lower South Branch, site 6 = upper South Branch).

Observed size at age data indicated that the majority of trout grow rapidly in the Hurunui River until about age 4 – 5 at which point they cease growing and size levels off at about a mean of 2250 g (640 mm) (Figure 14). The asymptotic growth pattern results largely from energy being diverted into reproduction after maturity (Hayes *et al*. 2000; Hayes 2002a). This typically commences at between ages 3 – 5 in New Zealand rivers (Hayes *et al*. 2000; Fox *et al*. 2003; Hayes 2002a). Increasing costs of foraging on invertebrate drift with increasing size also contributes, but to a lesser extent, to the reduction in growth rate and asymptotic growth pattern after maturity (Hayes *et al*. 2000).

The majority of mature trout (> 4 years old) in the anglers' sample ranged between 1500 g and 2900 g (520 – 655 mm) with ages between 4 and 11. The remainder followed a faster growth trajectory, being larger (2900 - 5000 g), and young (5 - 8 years old). Three of these fish were caught in the South Branch, 3 in the mainstem, and two in the North Branch (Figure 14). The 5 kg trout was caught at the river mouth. There was no evidence of older very large fish.

This mix of a fast and slower growth trajectory pattern has also been recorded from other large rivers which have free access for trout through their length and to the ocean including: the Pomahaka, Wairau, and Motueka rivers (Hayes 2002a). The fast growing trout from these rivers are thought to be either sea-running or have grown large in warmer downstream river reaches (Young & Hayes 1999; Hayes 2002a).

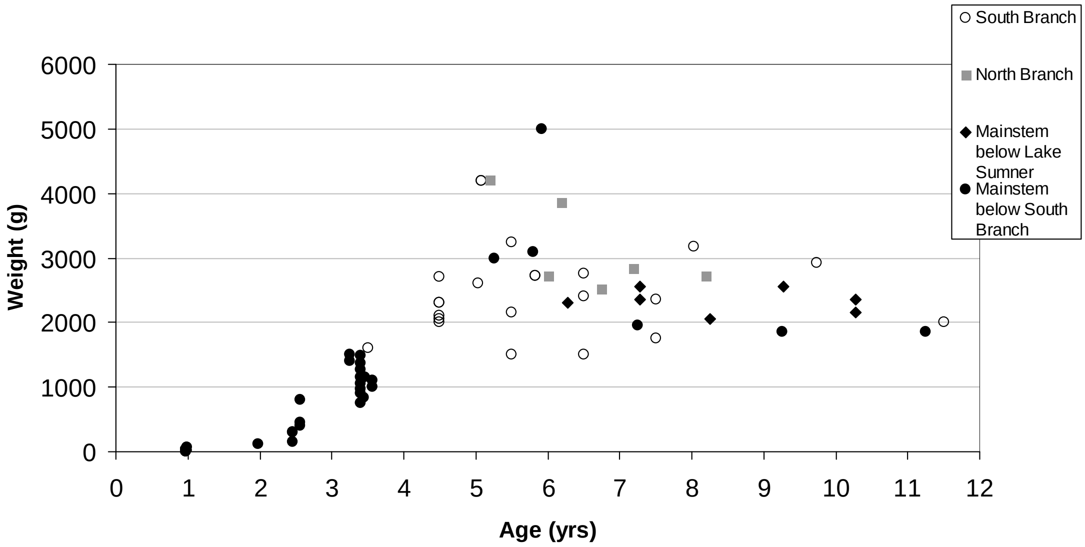


Figure 14. Observed weight at age for trout from different locations within the Hurunui River. Note that this figure contains more data than that presented originally in Hayes & Quarterman (2003).

The growth predictions from the model based on water temperature for the seven sites are shown in Figures 15 & 16. If observed growth substantially exceeds predicted maximum growth (based on temperature) then this suggests trout have grown larger than expected elsewhere (i.e., under better temperature conditions for growth). The type of food (invertebrates versus fish) can also have a role to play but this will be addressed later. Modelling for Figure 15 assumed unlimited invertebrate food and no spawning or foraging costs. The results suggest that water temperatures are sufficient for trout to match or exceed the sizes observed at every site. Predicted growth rate is highest for Site 3 (Balmoral). Growth potential does not continue increasing with distance downstream below Site 3 because summer water temperature more often exceeds the optimum for growth (13.9^{o}C) (Figure 15).

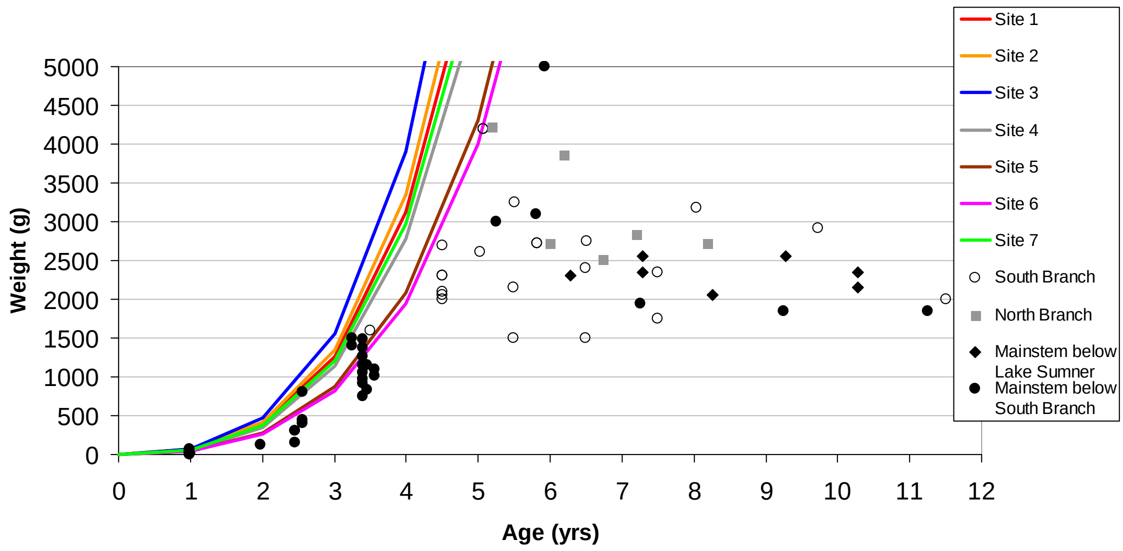


Figure 15. Observed weight at age versus predicted weight at age from growth modelling for trout on an unlimited invertebrate diet and with no reproduction or foraging costs for the seven water temperature logger sites (Site 5 = lower South Branch, Site 6 = upper South Branch). Note that this figure contains more data than that presented originally in Hayes & Quarterman (2003).

The predictions shown in Figure 15 are unrealistic since reproduction and foraging costs are not included. Foraging and reproduction costs substantially reduce predicted growth rate. Figure 16 shows predicted growth on an unlimited diet where foraging costs and reproduction costs are applied.

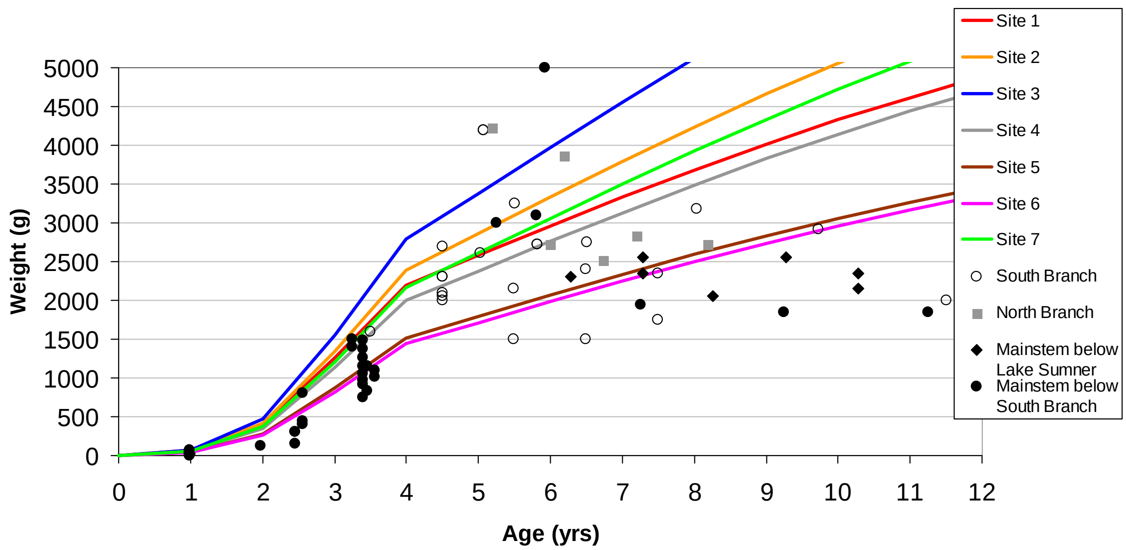


Figure 16. Observed versus predicted weight at age for trout on an unlimited invertebrate diet, and applying reproduction and drift foraging costs in consecutive years after maturity at age 4 (Site 5 = lower South Branch, Site 6 = upper South Branch). Note that this figure contains more data than that presented originally in Hayes & Quarterman (2003).

Predicted growth for all sites except the South Branch equalled or exceeded observed growth for most fish is evidence that many trout caught in the upper Hurunui mainstem would not have needed to migrate downstream to grow to the size observed (Figure 16). The buffering effect of Lake Sumner on water temperature regime enhances trout growth potential, reducing the need for fish to migrate to achieve observed size.

Predicted growth for the South Branch was substantially lower than the observed size of fish between 4 and 8 years of age caught in the South Branch and North Branch above Lake Sumner (Figure 16). The conclusion from this result is that these fish must have migrated from the Hurunui mainstem below Lake Sumner. Three trout exceeded the fastest predicted growth trajectory possible in freshwater suggesting that they may have been to the ocean and/or supplemented their diet by feeding on fish prey. One of these trout (the 5 kg one) was caught at the river mouth.

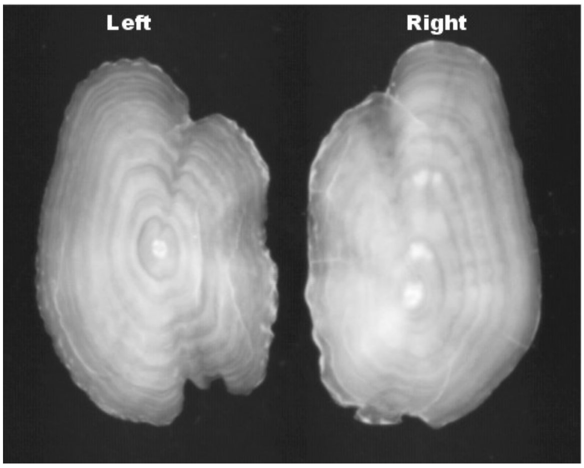
Large trout like this one caught in the South Branch would have migrated from elsewhere in the catchment to obtain this size. (Dean Harrison).

The upper South Branch (site 6) had the coldest summer water temperature regime and this may make it attractive to large trout. When trout are food limited (i.e. not attaining maximum rations) their optimum temperature for food energy conversion and growth declines. Food limitation is more likely in large, than in small, trout because they outgrow their optimal prey size. Large migratory trout, therefore, are most likely to be found in the coldest tributaries or headwaters over summer where they can minimise their metabolic costs.

In summary, the modelling analysis indicates that only the larger trout (> 3kg) are likely to have migrated from the ocean or lower river, although these fish are highly prized by anglers. Only three trout (5% of the sample of angler caught fish) would have required a period of growth in the ocean, or would have needed to have fed significantly on fish, to have attained the size-at-age observed. However, approximately 70% of the angler-caught fish from the South Branch would have had to migrate elsewhere within the freshwater part of the catchment or fed significantly on fish, to have attained the size observed. The results do not preclude other, smaller, Hurunui trout also making substantial movements within the catchment. Maintaining unimpeded passage throughout the catchment appears critical for sustaining the trophy trout in the entire Upper Hurunui and most of the large trout in the South Branch and probably the North Branch too, although there was no temperature record from there (Young 2009).

Hayes & Quarterman's (2003) analysis indicated that trout which migrate to the ocean are probably uncommon in the upper Hurunui (5% of angler-caught fish). Nevertheless these fish grow to trophy size (> 3 kg) and are highly sought after by anglers. Other large trout from the South Branch (and probably North Branch too) appear to require access to the mainstem downstream of Lake Sumner to grow to observed sizes. Free passage to downstream reaches and the ocean is necessary to sustain opportunities to catch these large fish. It is unlikely that these large trout are resident and grow large by preying on other fish (Young 2009).

34. INFERRING TROUT MOVEMENTS FROM OTOLITH MICROCHEMISTRY



Trout Otoliths

Another approach to inferring the importance of migration for trout is to analyse the microchemistry of their otoliths. Otoliths are small calcium carbonate structures found within the inner ear of bony fishes that grow continuously throughout the entire life of the fish. Once material is deposited in the otolith it is not remobilised (Campana and Thorrold, 2001). Material at the core of the otolith is formed when the fish begins to grow in the egg, and the outermost layer is material that has been deposited most recently. Although primarily made up of calcium carbonate, some trace elements are incorporated into the crystal lattice of the otolith as a substitute for calcium. Different environments have different levels of trace elements as a result of varying basement geology or land use. If a fish moves between these different chemical environments, the trace element composition of respective layers within the otolith will change accordingly, thus reflecting movement between environments. Therefore, by analyzing levels of trace elements across layers in the matrix of the otolith, we can infer patterns of movement if the trace element signature of the different habitats in which a fish may have been resident can be identified (Campana and Thorrold, 2001; Wells et al., 2003).

A study of the microchemistry of otoliths from trout collected in the Hurunui Catchment has recently been completed (Bickel & Olley 2009). This study involved three main approaches – firstly trace element signatures from the edge to the core of adult trout otoliths were analysed to determine if any trout collected from the Hurunui River had spent time in the ocean. Secondly, variability in trace element signatures across individual otoliths was used to determine the likely amount of movement within the river system by individual trout. An additional analysis compared the trace element signatures near the core of otoliths from adult trout, which would have been deposited when they were juveniles, with trace element signatures from juvenile trout collected from various potential rearing areas. This final analysis gives an indication of the likely importance of different rearing areas within the catchment.

Trout were collected from the locations shown in Figure 17. The elemental signature of brown trout otoliths was measured using a spectrometry technique known as laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS). Here, the otolith is cleaned, and mounted onto a slide which is placed in a sealed, purged chamber. A laser beam is then fired at the otolith. As the otolith material is ablated off, the ejecta are transferred via a carrier gas into a mass spectrometer which then determines the trace elemental composition of the ablated material.

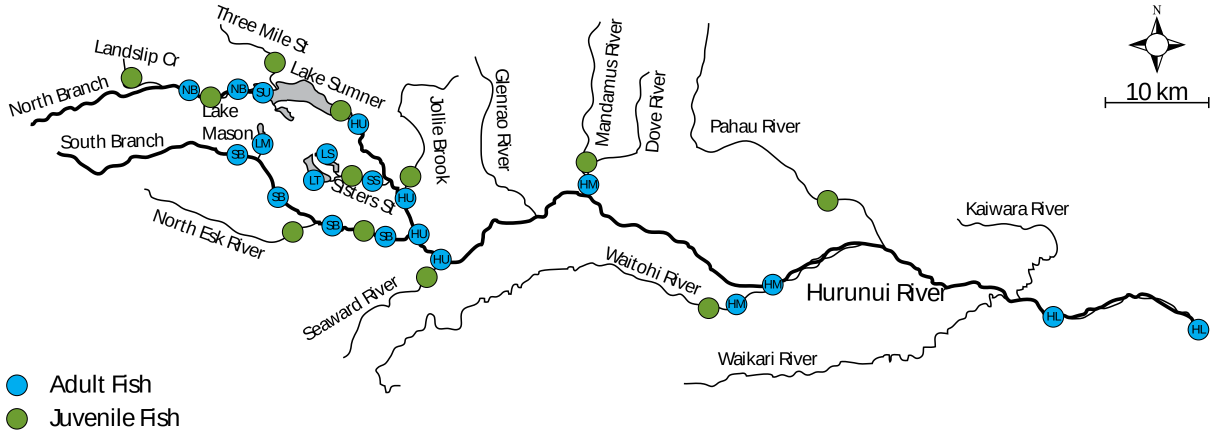


Figure 17. Map showing the Hurunui River and locations (blue circles) where adult brown trout were sampled. The major tributaries where juvenile brown trout were collected are shown with green circles.

The majority of fish collected from the Hurunui Catchment show life history transects that indicate migratory behaviour within the freshwater part of the catchment. Many of these trout move multiple times during their life. Fish collected from the North Branch were predominantly resident, while fish from the South Branch had more variable life history transects (Table 4). A large number of the fish sampled from the Hurunui Lakes also showed signs of migratory behaviour. Brown trout reproduce mainly in running waters, therefore, fish resident in lakes must recruit from elsewhere in the system. Analysis of the Sr/Ba (Strontium/Barium) transects from lake fish generally supports this with a single habitat shift presumably from recruitment/juvenile rearing habitat to the adult (lake) habitat (Bickel & Olley 2009).

Habitat	N	Resident	Migratory	Indeterminate
Lower Hurunui	15	2 (13%)	10 (63%)	3 (19%)
Mid Hurunui (Balmoral)	8	2 (25%)	5 (63%)	1 (13%)
Hurunui above Seaward	13	1 (8%)	10 (77%)	2 (15%)
North Branch	6	4 (67%)	2 (33%)	
South Branch	21	7 (33%)	13 (62%)	1 (5%)
Lake Sumner	11	1 (9%)	9 (82%)	1 (9%)
Lake Mason	7		4 (57%)	3 (43%)
Lake Sheppard	17	1 (6%)	15 (88%)	1 (6%)
Lake Taylor	11	6 (55%)	5 (45%)	
Sisters Stream (SS)	3		2 (67%)	1 (33%)
Total	113	24 (21%)	75 (66%)	13 (12%)

Table 4. Overview of the sample effort of adult fish analysed from different sections of the Hurunui catchment and the classification of fish into resident, migratory or indeterminate groups.

Trace element signatures from juvenile trout otoliths collected from potential rearing habitats showed relatively good separation among habitats. Overall, 65% of the fish were classified correctly into the area where they were sampled (Bickel & Olley 2009). The most likely origin for trout caught in the river was determined and included, in order of importance, the Hurunui mainstem, Lake Sheppard, South Branch, Waitohi River, Sisters Stream, Mandamus River, Lake Sumner, Lake Mason, Pahau River, and Landslip Creek (Bickel & Olley 2009). Trout caught in the South and North Branches (and the Hurunui Lakes) appear to depend on recruitment from elsewhere in the system, particularly the Hurunui main stem. This shows that the trout populations in the entire Hurunui catchment are linked by movement of adult fish within the freshwater part and by recruitment of juveniles from often distant parts within the catchment (Bickel & Olley 2009).

In summary, the otolith microchemistry study provided strong evidence that a substantial proportion of the trout population in the Hurunui River move throughout the river during their lifetime. Trout caught in the river appear to originate from a variety of rearing areas emphasising the interconnections between the different waterbodies of the catchment. The otolith microchemistry study provided no evidence of trout migration to and from the ocean, although it appears that at least some fish take advantage of the abundant food resources at the river mouth without incorporating high levels of strontium in their otoliths (Young 2009).

How do they get this big! If otoliths were collected on this monster, they may well shown a sea run signature. South Branch, Hurunui. (Dean Harrison).

35. THE NATIONAL HEADWATER TROUT STUDY

New Zealand possesses a type of trout fishery that appears to be unique worldwide - the opportunity to catch large wild trout in the clear upper reaches of scenic and often remote, back country rivers. For convenience, such rivers are collectively termed “headwater fisheries”. Such rivers are targeted by both New Zealand and overseas anglers, and are gaining increased international recognition.

One of the main challenges facing fishery managers is managing angler pressure (sometimes through restricting angler use) as well as managing fish stocks. These factors, together with increasing concern about possible impacts by hydro power schemes and changed landuse patterns (e.g. forestry), led to the first nation-wide study to determine the location and characteristics of such rivers (Jellyman and Graynoth 1994).

This survey used questionnaires of Fish and Game staff to compile a comprehensive list of headwater rivers throughout New Zealand, and classified them as either “all-season” or “early season” fisheries, according to whether they could sustain angling throughout the whole fishing season or not. . Another criterion used was whether a river was regarded as a “trophy’ fish river, defined as being the opportunity to catch a trout > 10 lbs (4.5 kg). A separate questionnaire sent to experienced anglers and fishing guides, asked questions about the behaviour of fish, any perceived changes to sizes and catch rates of trout and to the numbers of anglers using nominated rivers. In addition, anglers were requested to record the species and size of fish caught, and also to take scale samples for determination of ages and growth rates.

The Hurunui South Branch was listed as an “all-season” trophy and headwater fishery for brown trout throughout all reaches (upper, middle and lower), while the North Branch was listed as an “early season” trophy and headwater fishery for brown trout (with occasional rainbow trout) for its middle reach. Note that as this survey did not attempt to define reaches geographically, the “middle reach” of the North Branch is presumed to be the Mainstem reach below Lake Sumner.

The national totals of headwater rivers were:

- All season: North Island: 20 rivers, South Island 74 rivers (15 in the North Canterbury Fish and Game region)
- Early season: North Island: 3, South Island 40 (4 in the North Canterbury Fish and Game region)

Some subjective characteristics of the fisheries were provided, with the South Branch listed as having trout of “large size”, that were “challenging” to catch, and the North Branch as having “large size” of fish.

From the database of 2712 scale samples (and fish sizes) received during the National Headwater Trout Survey, a total of 7 samples were received for the Hurunui catchment. While this was a small sample, it did include records of 4 very large brown trout (4.9, 6.4, 4.0, 8.2 kg), although, understandably, the exact location of where these fish were caught was not disclosed.

36. The 1978/79 and1982 angling surveys

The 1978/79 National Angling Survey was developed in response to the requirements of the Amendment to the Water and Soil Conservation Act. This Amendment provided a new legislative mechanism for recognising and protecting rivers of national importance, and created a need for consistent and objective data on angler usage of New Zealand river fisheries (National Water and Soil Conservation Organisation 1982, Teirney et al. 1982).

The survey conducted by Fisheries Research Division (FRD) of the Ministry of Agriculture and Fisheries was implemented via questionnaires issued to a random sample of fishing licence holders throughout New Zealand. Respondents were asked to identify which rivers they had fished, to rate the importance of each river on a 1-5 scale, and to provide similar 1-5 ratings for qualitative attributes such as ease of access, area of fishable water, and size of fish. A total of 4 692 replies were received, providing 20 800 assessments of 817 river fisheries (Teirney & Richardson 1992, Teirney et al. 1982).

River fisheries were assessed as nationally, regionally, or locally important, based on their mean importance rating, the total number of respondents who had fished (as a surrogate for total usage), and the extent to which anglers were attracted from elsewhere in New Zealand. Rivers identified as nationally important fell on a spectrum representing a balance between usage and importance, with less heavily fished rivers being assessed as outstanding only if their importance ratings were exceptionally high.

The Hurunui River featured prominently in the 1978/79 survey, and was discussed extensively in two reports. These were a 1982 report prepared as a submission on the former National Water and Soil Conservation Authority's draft inventory of wild and scenic rivers of national importance (Teirney et al. 1982), and a 1987 report focussing on the North Canterbury region (Teirney et al. 1987). Key findings were:

- North Canterbury anglers expended between 15 800 and 23 700 angler-days per year on the Hurunui River;
- The Hurunui River was highly valued for both trout and salmon fishing, with respondents dividing their effort more or less evenly between the two fisheries;
- The trout fishery was primarily confined to the middle and upper reaches of the river, corresponding to the sections from SH 7 to Mandamus, and Mandamus to the headwaters, respectively;
- The upper reaches were highly rated for "scenic beauty" and "feelings of peace and solitude", both of which were considered exceptional by over 80% of respondents (Table 5).

- Other notable characteristics of the Hurunui trout fishery were the diversity of angling methods it sustained (dry fly, wet fly, spinner, nymph), and the extent to which angling was associated with other recreational activities such as camping, picnicking, swimming, tramping, and shooting (Table 5).

	Rating (1 = low, 5 = high)					Total
Fishery attribute	**1**	**2**	**3**	**4**	**5**	**replies**
Close to home (5 = close)	28	14	7	3	3	55
Ease of access	11	16	11	6	12	56
Area of fishable water	1	6	13	17	21	58
Scenic beauty	1	4	6	14	33	58
Peace and solitude	2	2	3	11	39	57
Catch rate	6	7	20	13	10	56
Size of fish	3	13	15	13	6	50
Overall importance	1	1	13	11	31	57

Fishing method(s) used	Dry fly	Wet fly	Spinner	Nymph	Bait
	31	19	27	23	2

Other activities

Camping	Picnicing	Shooting	Tramping	Swimming	Canoeing	Rafting
28	17	17	16	13	5	3

Table 5. Attributes of the Hurunui River trout fishery as characterised by the 1978/79 National Angling Survey. For the eight fishery attributes, each entry shows the number of respondents who assigned ratings of 1, 2, 3, 4, or 5. For fishing methods and other activities associated with angling, the table shows the number of respondents, out of a maximum of 59, specifying each listed item.

On the basis of these characteristics, the 1982 report considered that "… the upper Hurunui has all the attributes of a nationally important river fishery" (Teirney et al. 1982). In particular, it was noted that its usage [approximately 5000 visits annually from trout anglers] was high given its remote location and limited vehicle access. The salmon fishery in the lower reaches also contributed to the high importance attached to the river as a whole, but was secondary to the headwater trout fishery.

These conclusions were reinforced in the 1987 report (Teirney et al. 1987), which focussed specifically on the North Canterbury region and included additional data which were unavailable when the 1982 report was published. These data, based on the 1982 survey (Bonnett et al. 1991), included a more detailed analysis of the longitudinal distribution of angling effort along the Hurunui River than was possible with the 1978/79 national angling survey.

Respondents to the 1982 survey were asked to identify which of seven marked reaches they fished, four of which were above the Mandamus confluence. Analysis of these responses showed that:

- The reach from Mandamus to the South Branch received relatively little effort (less than ~5%, including both salmon and trout angling), but accounted for about 10% of the trout caught;
- The South Branch was the least fished of all seven reaches on the river, accounting for less than 5% of total effort;
- The North Branch, including Lake Sumner and the headwaters above the lake, accounted for ~25% of the total effort and about 60% of the trout catch. Effort and catch were evenly divided between the reach below the lake, and the lake and its headwaters.

37. 1994/95, 2001/02 and 2007/08 angling surveys

This section discusses not only the results of the NAS but also a comparison between the Hurunui and other popular backcountry rivers. In 2009, Unwin (Unwin 2009b) provided a useful analysis for making such a comparison. Table 6 shows the angling use for the whole Hurunui catchment.

River/Lake	Reach	1994/95	2001/02	2007/08
Hurunui River	Above Mandamus	no data	2 910 ± 350	4 400 ± 800
	Below Mandamus	no data	4 370 ± 850	5 660 ± 950
	Undefined	17 100 ± 3 330	1 100 ± 370	2 530 ± 730
Hurunui River Total		*17 100 ± 3 330*	*8 380 ± 990*	*12 600 ± 1 440*
Lake Taylor		750 ± 250	970 ± 220	3 320 ± 1 280
Lake Sumner		390 ± 170	520 ± 210	1 910 ± 520
Lake Mason		300 ± 300	20 ± 20	380 ± 150
Loch Katrine		190 ± 130	200 ± 70	260 ± 140
Lake Sheppard		230 ± 120	120 ± 50	240 ± 100
Waitohi River		0	0	220 ± 190
Mandamus River		0	0	30 ± 30
Sisters Stream		0	0	30 ± 30
Total, Hurunui catchment		**18 960 ± 3 360**	**10 210 ± 1 040**	**18 970 ± 2 020**

Table 6. Estimated annual usage (angler-days ± 1 standard error), 1994/95 to 2007/08, for all river and lake fisheries within the Hurunui River catchment.

The absence of any records for the Hurunui South Branch in Table 4 contrasts with results from the 1981/82 survey of North Canterbury anglers, which indicated that 3% of the total annual effort on the Hurunui River (i.e., 3% of 23 700, or ~700 angler-days) was expended on the South Branch (Bonnett et al. 1991). A possible reason for this discrepancy is that upper Hurunui anglers who responded to the 2001/02 and 2007/08 surveys did not differentiate between the two branches of the Hurunui River during their telephone interview. Neither the North Branch nor the South Branch was nominated by any of the 63 respondents who fished above Mandamus, even though much of this activity must have occurred on the North Branch either above or below Lake Sumner. For this reason, the 2001/02 and 2007/08 usage estimates should be construed only as measures for the upper Hurunui River as a whole, rather than indicating the distribution of effort between the North and South Branch.

The upper Hurunui River is one of 263 recognised back country fisheries under F&GNZ's jurisdiction. Such fisheries, are typically in upland regions characterised by extensive rather than intensive land use, and are remote from major population centres although still accessible by road. The most highly valued back country fisheries typically attract around 5 000 angler-days per year, in contrast to mainstem and lowland fisheries (some of which attract well over 10 000 angler-days), and headwater fisheries (which rarely attract more than 1 000 angler-days).

A total of six back country river fisheries attracted more than 4 000 angler-days in 2007/08: the upper Oreti, upper Hurunui, upper Taieri, Ahuriri, Tekapo, and Waikaia (Table 7). Two of these rivers (the Ahuriri and upper Oreti) are subject to WCOs. Also included are estimates for the upper Buller River. Estimated usage of the Buller River by New Zealand resident anglers in 2007/08 (2640 angler days) was low compared to previous seasons (5060 and 4310 angler-days in 1994/95 and 2001/02, respectively), but as a back country fishery covered by a WCO the upper Buller River provides a further basis for comparison.

As with the upper Hurunui, usage estimates for the upper Oreti, upper Taieri, and upper Buller are conservative because they do not allow for respondents who are known to have fished each river, but did not specify which reach. By contrast, figures for the Ahuriri, Tekapo, and Waikaia apply to the entire river, and are thus directly comparable. To place the upper Hurunui in a national context, therefore, it is necessary to adjust the raw usage estimates for the upper reaches of the four subdivided rivers so as to allow for these anglers. Table 5 sets out the relevant data so as to document the procedure used to perform these adjustments.

The key step is to apportion the effort for "undefined" reaches in proportion to the known usage for each reach, performing separate calculations for New Zealand residents and overseas visitors. In the case of the Hurunui River, for example, It was assumed that the 2230 angler days expended by New Zealand residents on an undefined reach was distributed between the two named reaches in the proportion 4240:5660, corresponding to the known usage of each reach. This yields an adjusted estimate of 5670 angler days for the upper reaches in 2007/08, of which 470 angler days (8.3%) were contributed by overseas visitors (Unwin 2009b).

River	Reach	All anglers	NZ resident	Overseas	% overseas
Ahuriri River		**4 890 ± 720**	**2 730 ± 600**	**2 160 ± 410**	**44.2%**
Waikaia River		**4 460 ± 790**	**3 540 ± 760**	**920 ± 240**	**20.6%**
Tekapo River		**4 460 ± 590**	**2 800 ± 430**	**1 660 ± 400**	**37.2%**
Hurunui River	Upper	4 400 ± 800	4 240 ± 800	160 ± 100	3.6%
	Middle/lower	5 660 ± 950	5 660 ± 950		0.0%
	Undefined	*2 530 ± 730*	*2 230 ± 720*	*310 ± 140*	*12.3%*
	Upper (adjusted)	**5 670 ± 1 090**	**5 200 ± 1 080**	**470 ± 170**	**8.3%**
Oreti River	Upper	5 230 ± 1 090	3 800 ± 850	1 430 ± 680	27.3%
	Middle/lower	13 330 ± 1 600	13 280 ± 1 600	50 ± 40	0.4%
	Undefined	*3 290 ± 650*	*2 180 ± 590*	*1 110 ± 280*	*33.7%*
	Upper (adjusted)	**6 790 ± 1 270**	**4 290 ± 1 030**	**2 500 ± 740**	**36.8%**
Taieri River	Upper	4 050 ± 1 130	3 600 ± 1 080	460 ± 310	11.4%
	Middle/lower	10 340 ± 2 680	10 340 ± 2 680		0.0%
	Undefined	*1 970 ± 700*	*1 940 ± 700*	*30 ± 30*	*1.5%*
	Upper (adjusted)	**4 590 ± 1 320**	**4 100 ± 1 290**	**490 ± 310**	**10.7%**
Buller River	Upper	910 ± 210	520 ± 120	390 ± 170	42.8%
	Middle/lower	1 750 ± 360	1 750 ± 360		0.0%
	Undefined	*840 ± 240*	*370 ± 110*	*470 ± 210*	*56.2%*
	Upper (adjusted)	**1 470 ± 300**	**608 ± 130**	**860 ± 270**	**58.6%**

Table 7. Estimated annual usage (angler-days ± 1 standard error) in 2007/08, by angler origin (New Zealand resident vs. overseas visitor) for the six most heavily used back country river fisheries in New Zealand, and the upper Buller River.

Final 2007/08 usage estimates for the top six rivers listed in Table 7 range from 6790 angler days for the upper Oreti River to 4460 for the Tekapo River. All of these estimates have broad standard errors, typically at least ±20%, so that differences as large as 1000 angler days between rivers are unlikely to be significant. A prudent but credible interpretation of Table 5 is that the upper Oreti is the most heavily fished back country river in New Zealand (approximately 6800 angler days), followed by the upper Hurunui (5700 angler days), followed by the four remaining rivers (Ahuriri, upper Taieri, Waikaia, and Tekapo, all between 4500 and 5000 angler-days). However, the upper Hurunui could equally well be grouped with these four rivers, with only the upper Oreti likely to be clearly ahead of the field. By comparison, usage of the upper Buller River (1470 angler days) was well below the top six.

38. Other studies and findings of note for the Hurunui

The Hurunui River is characterised by the varied and geologically diverse landscape. A number of other studies came with a very similar assessment of the landscape values and qualities. Landscape values of the Hurunui catchment were assessed as outstanding for the Lake Sumner and upper river reaches and as a significant landscape for the whole catchment (summary of several reports in Mosley, 2002).

Ministry for the Environment and Ministry of Agriculture and Forestry co-ordinated The Water Programme of Action, the project to examine how to fairly use, protect and preserve the freshwater resource. One of the major components of the programme was to identify water bodies of national importance for a range of values and secure nationally important natural, economic, social and cultural values of water bodies. The Hurunui River was included as one of the 105 water bodies of national importance for its recreation value, as well as aquatic biodiversity value. The Hurunui Lakes were included in the list of Nationally Important Waters for recreation by the Ministry for the Environment (Anon., 2004).

The recreational study was completed as a joint undertaking by Fish & Game and ECan (Greenway, 2001). The study of 903 recreational visitors to the Hurunui surveyed over the summer of 2000/01 identified a number of features that distinguish it from other rivers in Canterbury and nationally: the relatively reliable water flow (being a lake fed river), the wide range of recreational opportunities that the Hurunui catchment offers, the quality of the whitewater experience and the quality of the surrounding landscape in all sections of the river. The upper river (Lake Sumner outlet to Pahau River confluence) and the Hurunui lakes received two thirds of all use (Greenway, 2001). The river offered enjoyment for a wide range or recreational pursuits and an almost total lack of conflict between different users which was an uncommon situation elsewhere. More than 10,000 visitors enjoyed the Hurunui River catchment in the summer of 2000-01 according to the results of this study. Around 6% of the total use was by overseas visitors. The authors concluded that the Hurunui offers a significant recreational resource at a national level.

The Recreation Strategy for Canterbury Conservancy (Anon., 1994) refers to the area of the Hurunui River above the Mandamus River confluence as of national and international significance. The survey showed that 8% of trout anglers and 13% of kayakers were of international origin.

The Hurunui Lakes – Sumner, Sheppard, Taylor, Katrine and Mason were included in the Waters of National Importance for Tourism by Ministry for the Environment (Anon., 2004) based on significant interest by overseas visitors.

In 2009, a special tribunal appointed by the Ministry for the Environment recommended that the mainstem from the outlet of Lake Sumner to just below Maori Gully be protected in its natural state under a Water Conservation Order for its outstanding natural character, wild and scenic values, habitat for brown trout, fishery and angling, contribution to brown trout fishery, white water recreation and cultural values.

39. Didymo in the Hurunui

Didymo (*Didymosphenia geminata*) is an exotic benthic diatom which can cover riverbeds in dense mats up to 20 cm thick. Didymo was first discovered in the Mararoa and Waiau rivers in Southland in 2004 and spread to the Hurunui River by 2007.

There is concern that proliferations of this alga have the potential to alter the aquatic invertebrate food base for trout with negative consequences for growth and carrying capacity, and affect angling success and satisfaction by fouling anglers' lures and reducing aesthetic value. Didymo could also affect water quality parameters such as pH and dissolved oxygen concentrations to a degree that could be harmful for trout (Bickel & Closs 2008).

Didymo forms substantial mats in the mainstem downstream of Lake Sumner due to the lack of bed moving floods. Therefore any impacts will be most apparent there. The more flashy flow regimes elsewhere in the catchment will mean that didymo will only become a potential problem after prolonged periods of low flow. NCF&G observations of sites downstream of Lake Sumner indicate that didymo is at times nonexistent downstream of the South Branch confluence. Even after periods of extended low flows didymo is patchy compared to the reach between Lake Sumner and the South Branch confluence.

It is likely that the uninterrupted sediment flow produced by the South Branch is a limiting factor for didymo establishment in that part of the river

As far as NCF&G are aware, no studies that have investigated the sediment load of the South Branch of the Hurunui River. However, Murray Hicks from NIWA has produced a map of predicted sediment delivery rates for all the New Zealand using information on climate, geology and slope information (Figure 18, available at http://www.niwa.co.nz/ncwr/tools#SSY).

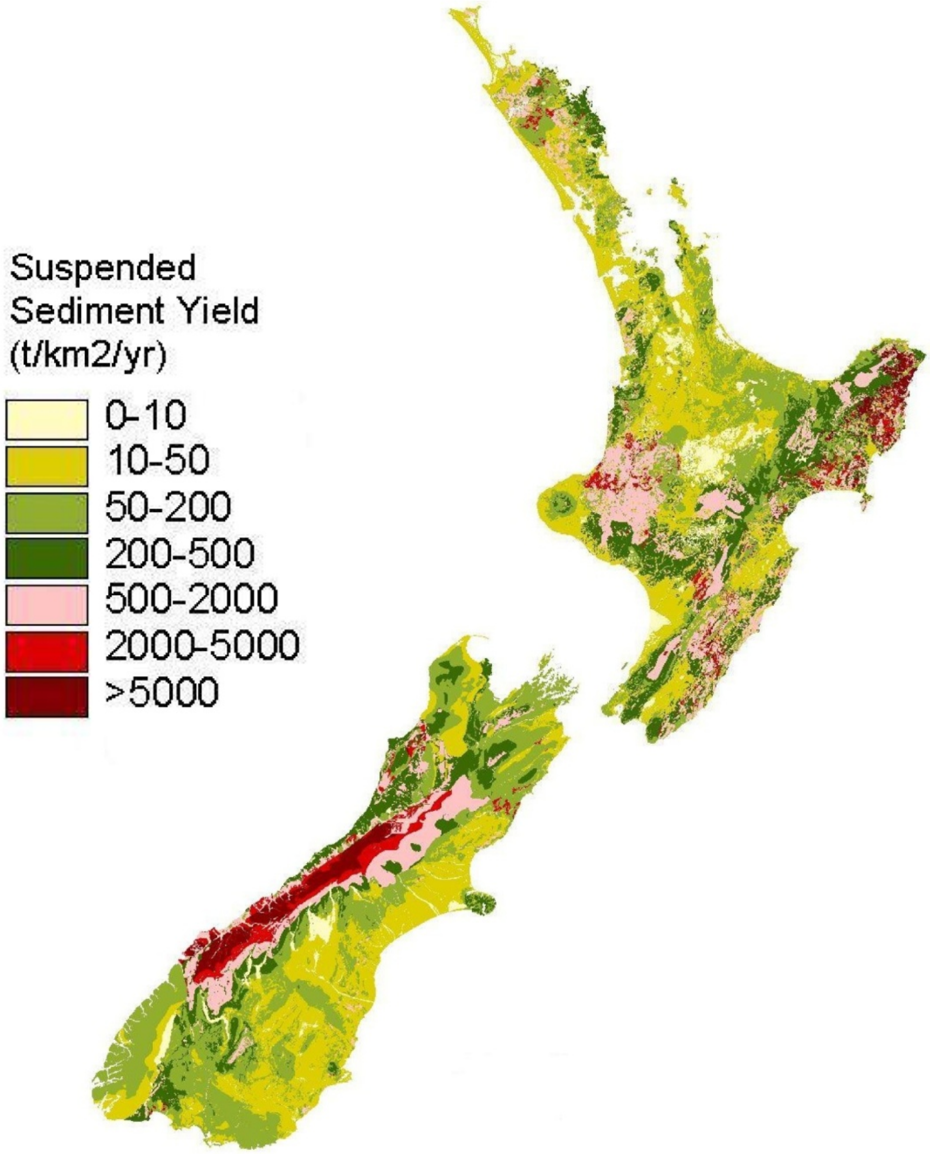


Figure 18. Map of New Zealand showing predicted sediment yield.

Using this map and a geographic information system (GIS) it is possible to predict the sediment load for any river system in New Zealand. Using this approach the South Branch of the Hurunui River is predicted to have a sediment load of 237 kT/y, which is 46% of the total load from the Hurunui River to the ocean (Table 8). The North Branch of the Hurunui River above Lake Sumner, and other tributaries to Lake Sumner export 512 kt/y, but this material is assumed to be trapped within Lake Sumner. Other tributaries to the mainstem of the river provide a relatively small load to the river (Table 8). So in summary, the South Branch makes the largest single contribution to the Hurunui River's sediment load to the sea.

Sub Catchment	Sediment Load (kT/y)
Mandamus	25
North Branch	67
South Branch	237
Dry Stream	5
Pahau	27
Waitohi	24
Waikari	11
Entire Catchment	**515**
Lake Sumner tributaries	512

Table 8. Sediment load from parts of the Hurunui Catchment. Note that sediment load from the tributaries of Lake Sumner is assumed to be trapped within Lake Sumner and thus does not contribute to the sediment load to the ocean.

The South Branch (right) confluence with the mainstem (left) of the Hurunui. Note the difference in sediment load. (Peter Langlands).

Didymo proliferations have the potential to impair drift-foraging energetics and reduce trout growth rate and maximum size of trout by reducing the abundance of large drift-prone invertebrates which promote a fast growth rate of trout in New Zealand rivers.

The Cawthron Institute conducted research for Biosecurity New Zealand focusing on the impacts of didymo on invertebrate drift and trout growth in two Southland rivers (Shearer et al. 2007). The results of the study showed no noticeable negative effect attributable to didymo on invertebrate drift density and biomass, or predicted trout growth potential. However, the study did not include spring and summer, the most critical seasons for trout growth. Therefore, the results must be considered provisional. More research is needed before we can ascertain the effects of didymo on trout growth with any certainty.

40. Flow issues

Currently there are two different flow regimes operating for two irrigation schemes on the Hurunui River. ECan contracted a study on the in-stream values and the flow regime (Mosley 2002). In recommending minimum flows and flow regime for the Hurunui River, Mosley took into account jet-boating, kayaking and in-stream requirements of aquatic organisms.

The minimum flows that meet in-stream needs were assessed as $20m^3/s$ for the period from September to March and $15m^3/s$ for the period April to August. Due to the lowest 7-day minimum flow of $12.6m^3/s$ recorded in Feb 1999, Mosley recommends that the flow for February be set at $12m^3/s$ against his own recommendation on the preferred minimum flow.

Mosley argues that the flow sharing rule that featured in the management of flows in the Hurunui River in 1980s has no benefit if minimum flows are set at the reasonable level. In his review, Mosley recommended an IFIM study that would test his assumptions. The recommendations by Mosley (2002) were accepted and an IFIM study was undertaken on a typical braided profile of the river (Duncan and Shankar, 2004).

Although recommended flows by Mosley were below optimal values for the in-stream values of a number of species and salmon passage even over the typical rather than critical reach were marginal, the authors concluded that a higher minimum flow regime or flow sharing would not provide benefits significant enough to be justified.

In the proposed flow and allocation management regime for the Hurunui River, ECan have accepted Mosley's recommendations. An increase in the A allocation was recommended with no cap on abstraction. The supposed lack of irrigable area and low reliability of potential run of river scheme were used as a justification for this decision (In NCF&Gs opinion, a short sighted recommendation).

Docherty (1979) recommended a minimum flow of $22m^3/s$. At lower flows Docherty observed, among other negative impacts, increased water temperature followed by the increased incidence of bacterial and fungal infestation of the fish observed. Salmon were observed experiencing problems with passing shallow reaches at flows of $12.4m^3/s$. Some of the critical river reaches were less than 15 cm deep and more than 30 m long precluding safe passage. At flows lower than $16m^3/s$ salmon were reluctant to enter the mouth and move upstream resulting in the delayed migration. At flows lower than $12m^3/s$ the river mouth showed signs of constricting and shallow bars prevented fish from entering.

In the Hurunui River Recreation Study (Greenway, 2001) authors queried users on the flow optimal for their chosen pursuits and $20m^3/s$ was the most commonly agreed minimum flow for recreation on the river.

NCF&G contracted an independent review (Hayes 2006) of the proposed minimum flow and allocation regime for the Hurunui River. The review is critical of the IFIM reach chosen as adverse effects would be more obvious at the critical reach. Minimum flows are seen as insufficient for salmon passage based on observations of Docherty (1979) and other authors (Davis 1980). A number of other adverse effects of continuing low flows were identified including limited recruitment of aquatic benthic invertebrates due to insufficient wetted habitat. Further IFIM modelling is required to assess the optimal flow regime for the Hurunui River.

41. Salmon in the Hurunui

The Hurunui River salmon fishery is described in the Draft Salmon Management Plan as being of "regional significance", with an annual run of between 100 and 5000 salmon. This places it 5th in terms of run size of the known 24 salmon fisheries in New Zealand. To put the fishery into wider context, the fact that almost all of the Southern Hemisphere's salmon fisheries are found in New Zealand, probably places the Hurunui in the top ten south of the equator (Millichamp 2010).

The Hurunui is considered by anglers to be a “small river salmon fishery”, in that river flows cause salmon to behave differently than in larger volume rivers such as the Waitaki and Rakaia. Small river fisheries are characterised by the fact that salmon congregate at the rivermouth during normal flows, waiting for fresh or flood flows before running the river. Much of their upstream movement takes place during the short periods when the river is running at higher than average flow, presumably because water temperatures are cooler and water depth over critical riffles is more favourable.

Although the Hurunui is one of the smaller salmon rivers in terms of flow, it is also relatively un-braided which facilitates the upstream migration of adult fish. However when the river reaches its minimum flow in mid- summer, there are a number of reaches where migration is difficult. Duncan (2004) did a critical reach analysis on the Hurunui and found that the area where the pylons crossed the river at map reference M33:840183 had the shallowest riffles. The survey was conducted when the river was flowing at 13 cumecs and found that in one place, water depth was at the level which is thought to prevent salmon passage (250mm).

The Hurunui River has relatively little of the spring fed tributary spawning habitat which is present in other salmon fisheries. When Fish & Game New Zealand undertook the trial aerial survey which pre-dated the current salmon monitoring program, the NIWA scientists who designed the survey were unsure about where to look. A survey of the section downstream of the Lake Sumer outlet found only 22 salmon, most of which appeared to be on their way to the spawning grounds rather than actually spawning (Unwin 1993). Subsequent foot surveys conducted by Fish and Game found that salmon spawned in Landslip Creek, a small spring-fed tributary of the North Branch of the Hurunui above Lake Sumner, and in the main braid of the South Branch of the Hurunui, in the section upstream of the Gorge.


Landslip stream in the North Branch of the Hurunui. (Ross Millichamp).

The finding that most Hurunui salmon spawn in the main braid of the South Branch was surprising because this reach is subject to occasional flooding which could wash out salmon redds before the fish have the chance to hatch. Observations have been made by NCF&G staff of this section of river in flood during the salmon spawning and incubation season and although flows lift and the water discolours, the floods do not appear to be of the same magnitude as those which affect more braided rivers such as the Rakaia and Waimakariri (Millichamp 2010).

This is likely to be due to upper reaches of the river running underground for a distance of approximately 6km. This in turn stabilises the river not unlike the effects of a spring fed stream (Hawker 2009).

Salmon redd in the South Branch of the Hurunui River, just below the Mason Stream confluence. Note the presence of grasses growing on the banks indicating a relatively stable bed in this section.

Since 2001, the Hurunui salmon population has been surveyed annually and a long term data set has been developed. Counts are conducted during early May, hopefully to coincide with peak spawning activity. As such the counts are one-off trend counts rather than estimates of total spawning activity. Salmon residency time research conducted by NCF&G on the Rakaia and Waimakariri Rivers, suggests that spawning takes place over an eight to ten week period, with each individual salmon spending an average of 16 days on the spawning grounds. This means that there are a number of “turn-overs” of spawning fish each season. If the findings from the Rakaia and Waimakariri Rivers apply in the Hurunui, the total spawning population should be 2-3 times greater than the peak spawning count.

Year	Date	Landslip/ North Branch	South Branch	Trend count Total	Estimated Spawning Escapement*
2001	3/05/2001	0	20	20	50
2002	8/05/2002			132	330
2003	7/05/2003	32	119	151	53
2004	10/05/2004	62	44	106	145
2005	24/05/2005	75	18	93	203
2006	16/05/2006	9	28	37	60
2007	8/05/2007	14	66	80	45
2008	15/05/2008	32	106	138	58
2009	12/05/2009	34	75	109	78

Table 9. Salmon trend count and spawning escapement estimates for the Hurunui River, Fish and game New Zealand Aerial Survey Program 2001-2009. Please note that in 2002, the split between North and South Branch spawning was not recorded. *Estimated spawning escapement was calculated by multiplying trend count figure by 2.5.

When the surveys conducted between 2001 and 2009 are averaged, they indicate that 68% of Hurunui River salmon spawn in the South Branch and 32% in the North Branch and Landslip Creek. All of the South Branch fish spawn above the top end of the gorge.

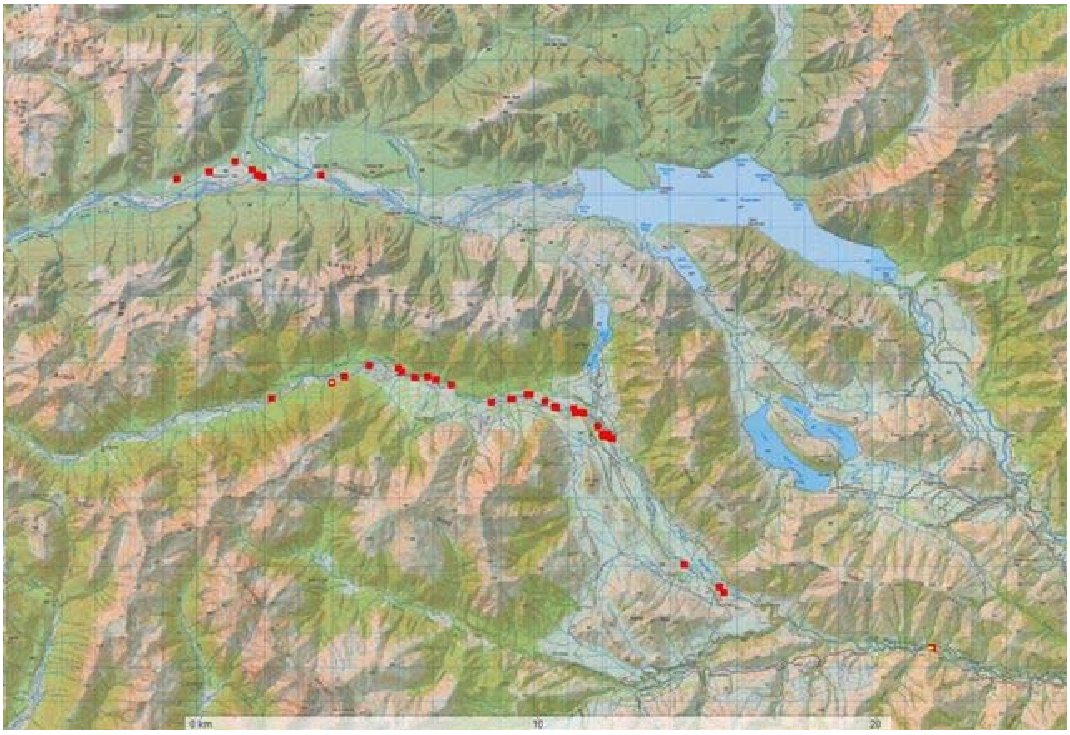


Figure 19. Map showing 2010 spawning run in upper Hurunui. The South Branch above the gorge contains most of the spawning

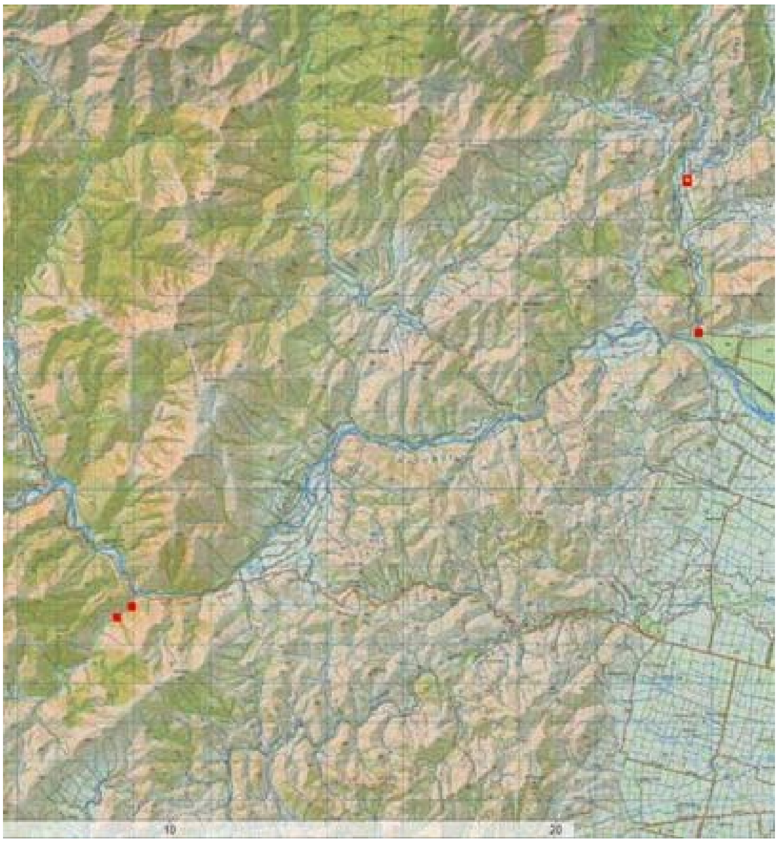


Figure 20. Map showing limited salmon spawning in the seaward and Mandamus for 2010. Floods in these streams this winter would have wiped out any redds.

The South Branch of the Hurunui. The most significant salmon spawning site in the catchment.

Estimates of angler catch are mentioned below, and although they contain high margins of error, suggest that the spawning population is low compared to the size of the fishery. This indicates that the Hurunui fishery is fragile, and relies on a comparatively small spawning population for continued existence. This could be a factor of a higher than normal rate of angler catch, the effect of occasional flooding on the South Branch spawning population, or the lack of quality spawning habitat in the catchment. The lack of quality spawning habitat is the principle driver of the fragility of the fishery (Millichamp 2010). One mitigating factor for the low spawning numbers could be a potentially high survival rate amongst the fish that do hatch. By comparison with other Canterbury braided salmon rivers, the Hurunui is less flood prone and should offer a better environment for the survival and growth of young salmon (Millichamp 2010).

The majority of salmon fishing activity in the Hurunui takes place at the rivermouth, both in the "gut" where the river narrows prior to running into the sea, and in the surf adjacent to the rivermouth. This is due in part to the way that salmon congregate at the mouth prior to fresh events, and in part due to the highly scenic landscapes which are present. Unlike most

Canterbury rivers which flow out to sea from a flat plain, the Hurunui mouth is located amongst bush- clad hills. The Hurunui rivermouth also tends to be a less crowded and less competitive environment than is present at other rivermouths. It appeals to anglers who want a relaxed and scenic experience rather than one focussed principally on harvest.

Three happy anglers at the Hurunui mouth, 2009. (Peter Robinson).

There is also significant salmon fishing in the lower and middle reaches of the Hurunui River, in particular downstream of the Mandamus confluence. The gorgy nature of the river means that access is more difficult than at the mouth which may limit participation. Many of the successful upriver anglers on the Hurunui access the river through private land. The Hurunui River is closed to salmon fishing upstream of the South Branch confluence in an attempt to preserve the fragile spawning population.

Teirney (1982) found that up to 75% of Hurunui anglers fished either solely for salmon or for salmon and trout. Greenaway (2001) estimated that 57% of angling activity was focussed on salmon. The difference between the two results probably reflects the fact that the 2000-01 salmon season was poor, causing more anglers to focus on trout. Later studies (Fish & Game National Angler Surveys) did not differentiate between salmon and trout anglers, but it is likely that salmon anglers dominate the fishery, because that is what is observed in most other Canterbury fisheries where salmon are present.

Fish and Game New Zealand also conduct a salmon harvest survey throughout the Canterbury region. Around 10% of anglers are contacted by telephone at the end of the season and asked how many salmon they caught from each river. The data is more accurate for rivers such as the Rakaia and Waimakariri which are very heavily fished, with higher error applying to smaller fisheries such as the Hurunui.

Season	**Estimated Salmon Harvest**
1995-1996	714
1996-1997	826
1997-1998	665
1998-1999	559
1999-2000	195
2000-2001	15
2001-2002	113
2002-2003	307
2003-2004	439
2004-2005	268
2005-2006	128
2006-2007	109
2007-2008	441
2008-2009	219

Table 10. Estimated season angler catch from the Hurunui River, Fish and Game New Zealand Phone Surveys, 1995-9\1996 to 2008-2009.

42. Mandamus

The Mandamus River is sourced from the Organ Range and flows south and enters the Hurunui River just west of Balmoral Forest. The headwaters of the stream flow through beech forest, while the middle and lower reaches flow through pastoral land.

Access to the river can be gained from the Glens of Tekoa Road. This small stream offers pleasant fishing through well defined pools and easily negotiated gorges. Trout can be found as far up as the Silver Brook confluence. Surprisingly NAS only shows 30 angler days in 2007/08.

An angler searching for trout on the Mandamus River. (Peter Langlands).

Salmon have been known to spawn in the river. Probably as a result of ova planting carried out by volunteers. NCF&G undertook an aerial survey of the Mandamus in 2010 and observed two salmon only. During the same survey there were good numbers of juvenile trout observed. Therefore it must have a significant role in spawning and/or juvenile raring for trout.

43. Waitohi River

The Waitohi River is sourced from the Puketeraki Range and flows east to join the Hurunui River at the State Highway 7 bridge. It can be accessed from several roads.

Historically this used to be a much more productive fishery and even used to support limited salmon spawning. There can still be some trout early in the season either in the gorge of the very lower reaches. However, it now tends to dry in the middle reaches during summer, which has meant a lack of recruitment and a decline in trout numbers. NAS shows 220 angler days in 2007/08 only.

44. Pahau River

The Pahau River is sourced from the Organ Range and flows south east to join the Hurunui just before it enters the second gorge. The Pahau River has never been a productive fishery in its own right but it does have some significance as a spawning stream in the lower reaches where the flow is increased with the addition of other spring fed streams. This section probably holds trout as well but it is difficult for anglers to access. No surveys have ever been carried out in the upper reaches.

45. Waikari River

The Waikari River drains the land surrounding the Waikari township. It flows east to join the Hurunui River approximately 5km above the State Highway One bridge.

Although it has never featured in the NAS it was highly regarded, if not rather secretly, by some anglers. It offered some very good fishing in the lower reaches.

The Waikari River in the 1990s. (Martin Clements).


The same stretch of river today. (Martin Clements).

Unfortunately the last 10 years has seen this river go repeatedly dry with virtually no trout population left at all.

Waipara Catchment

46. Waipara River

The Waipara River catchment flows from the eastern foothills in North Canterbury to its outlet into Pegasus Bay. The Waipara catchment consists of 740km^2 and includes foothills, plains, downlands and some coastal ranges. There are a number of tributaries of the Waipara including Weka Creek and Omihi Stream which contribute to flows in the lower reaches.

Trout were released in the Waipara between 1868 and 1881 and it now supports a locally significant brown trout population. The population in the lower reaches mostly consist of sea run brown trout, which enter the river when mouth openings allow. More permanent water upstream of Stringers Bridge provides better trout habitat and more consistent angling opportunities.

There is access available at several locations where formed roads met the Waipara River. In some places there has never been legal public access along the river for anglers. Despite this we have never received any complaints regarding lack of access or problems with landowners.

Sign specifying that although the river is private land, walking access is welcome. Waipara River. (Tony Hawker).

The NAS shows a modest amount of angling with no angler days recorded in 1994/95, 80 angler days in 2001/02 and 930 angler days in 2007/08. This last figure is considered to be a naming error and should read 90 angler days for 2007/08[6].

These figures confirm that the Waipara is now a fishery of local importance. Anecdotal evidence suggests that the Waipara River was once a fishery of regional significance, and NCF&G consider that the application of a more ecologically based flow regime could restore the fishery and increase its significance.

[6] Further investigation found that the 850 angler days listed for the Waipara in February/March 2008 was in fact from a respondent who resided and fished in the Auckland region. There were no other South Island rivers mentioned by the respondent. It is highly unlikely that someone from Auckland would travel to the South Island to specifically fish the Waipara only. Therefore it is considered a naming error and is not a reliable figure to use.

A nice brown taken at the start of the Waipara Gorge. Adrian Bell).

NCF&G have in recent years received submissions from concerned anglers seeking to have a trout release programme initiated on the Waipara River. Up until now we have been unable to produce a ready supply of hatchery raised Brown trout available to accommodate their concerns (Ross, 2009).

47. Flow issues

NCF&G believe it is this continual interruption of the river flow to the sea, and the sea run trout that used to run upstream to spawn that has lead to a depletion of the trout stocks (Ross 2009). Anadromous or sea run trout are thought to assist the survival of trout in rivers like the Waipara (Klemetsen *et al*). Middle and upper reach populations cannot exist in isolation and require regular re-stocking from sea-run fish. Continuous flow in the river and to the mouth is therefore critical for access to the sea for anadromous fish. Trout migrate to sea for various reasons. It is thought that trout in small streams migrate to sea to avoid adverse environmental conditions such as low flows (Klemetsen *et al*). If low flows occur quickly, or for prolonged periods, movement may be restricted or cease altogether and stranding occurs. Downstream migration can occur in spring for feeding and autumn or winter where an estuarine environment exists (Klemetsen *et al*).

During the past 20 years the catchment has witnessed an increasing demand for water with the expansion of horticulture and viticulture. The flow regime for most of the sites on the Waipara River was set in 1978 and is currently under review.

The Canterbury Strategic Water Study (CSWS) (Lincoln Environmental, 2002) notes that the Waipara is one of the many lowland rivers experiencing pressure from abstraction. This report stated that 1282% of MALF had been allocated from the Waipara River. Environment Court decision (W100/95) also indicates that the river was heavily allocated. Since that decision, additional ground and surface water permits have been issued and allocation of surface water now stands at around 260l/s (Mosley, 2003). Unfortunately for F&G most research has also been targeted at native fish, which have lower flow requirements than salmonids.

There have been numerous reports completed on the Waipara River and a number of suggested flow regimes; however, there has been little consistency in findings other than an obvious need to improve on the current regime of 50l/s at White Gorge; 60l/s at Stringers Bridge and 80l/s at Teviotdale Bridge. Successive reports on the Waipara have suggested the following flow regimes as illustrated in **Error! Reference source not found.**, below.

	White Gorge	**Teviotdale**	**Other**
CRC flow regime	50l/s (1978)	60l/s (1978)	Stringers Road -80l/s (1994)
Richardson and Jowett (1994)	No recommendation		
Jowett (1994)	50% of MALF	120l/s	Habitat reduces sharply at flows below 120l/s
Lloyd (2002)	90l/s s	140l/s	50% sharing of takes above 100l/s
Richardson, Jowett and Bonnett (2003)	Concluded that floods flows; riffles are important during low flows.		
Mosley (2003)	110l/s	Up to 370 l/s	Uses “A” and “B” permit system
Suren et al (2003)	Above 135l/s		Higher minimum flow required to maintain stream health

Table 11. A summary of different recommendations for the Waipara minimum flow.

Water quality at low flows is a further factor. This is illustrated in the work by Suren et al (2003) on nutrient enrichment in the catchment. Their research found that significant degradation of the river occurred even when the river was above the 7-day 10-year low flow of 135l/s. Degradation was exemplified by extensive growth of filamentous algae and reduced insect biodiversity.

The Waipara River at 50L/s. In 2009, ECan councillors voted against staff recommendations and kept the same minimum flow. (Tony Hawker).

Research on flow requirements has tended to focus on habitat suitability curves applied to different life stages and species. However, the research on benthic communities by Suren et al (2003a, 2003b) concludes that nutrient enrichment is also a critical factor in habitat function. This is largely due to the growth of filamentous algae which impacts on benthic communities and reduces oxygen availability. This in turn affects the entire food chain. Nutrient enriched streams exhibit a decline in mayfly, stonefly and caddis fly which are key food sources for trout. Suren et al (2003a, 2003b) found that filamentous growth developed in the Waipara River under low flow conditions and may be exacerbated by nutrient enrichment. Their argument in relation to setting flow regimes is that the nutrient status of rivers should also be considered. For the Waipara this would require setting a base flow regime above 135l/s.

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