Toitu te Land whenua Information New Zealand

Crown Pastoral Land Tenure Review

Lease name : Glenariffe

Lease number : Pc 129

Fish & Game report

As part of the process of tenure review Fish & Game councils may provide advice on significant inherent values within the pastoral lease, and the information may be incorporated in the conservation resources report. The advice is part of the information gathered and assessed for the development of a preliminary consultation document.

The report attached is released under the Official Information Act 1982.

Copied May 2003

Fish and Game Resources of the Glenariffe Pastoral Lease, North Canterbury

Prepared by the North Canterbury Fish and Game Council as a Contribution to the Drafting of a Preliminary Proposal for a Tenure Review Project Plan

September 1999

Preamble
This report has been prepared under the provisions of the Crown Pastoral Lands Act (1998), Part 2, Tenure Review.

Part 1- Introduction

1.1 Glenariffe Station Pastoral Lease

Glenariffe Station Pastoral Lease (PL) consists of 4 799 ha in a long narrow property centred on the upper catchment of the North Ashburton River, leading north to the floodplain on the south bank of the Rakaia River. It occupies an area of the flood plain of the Rakaia River and a mountainous area to the south characterised by steep river catchments.

Two spring creek systems flow on the flood plain. The Glenariffe Stream Tributary and Double Hill Streams, which join to form the Glenariffe Stream. The Glenariffe Stream flows for a significant part of it's course through Glenariffe PL (Attachment 2). Small wetlands adjoin the riparian margin of the spring creeks. A second spring creek system, the Double Hill Flats Stream flows outside the northern boundary of the Glenariffe PL.

The river flats through which the spring creeks flow are open and treeless, with dense introduced grassland cover and wetlands adjoining the spring creeks.

The remainder of the Station is high relief hill sides, planar and glacially scoured slopes, intermoraine basins, moraines and alluvial fans. The vegetation on the mountainous section of the Station to the south of the flood plain is primarily a combination of fescue and tall tussock lands. The hill slopes are dissected by unstable streams.

Rainfall predominantly comes from a westerly direction with snowfall common over the winter and spring months.

Part II - Fish and Game Values on the Glenariffe Pastoral Lease

2.1 Sports Fish

Glenariffe PL has two main spring fed river systems on the flood plain adjoining the Rakaia River. The Glenariffe Stream mainstem (2.3 kilometres) and its tributaries, Double Hill Stream (2 kilometres) and the Glenariffe Tributary (2 kilometres), and a smaller unnamed tributary which flows against the terrace to the south of the Glenariffe Stream (2.3 kilometres). Refer Attachment 2.

Glenariffe PL also adjoins the mainstem Rakaia River. There are numerous smaller water ways which drain from the mountain sides into the Rakaia River and Ashburton River Catchments.

The Double Hill and Glenariffe Stream tributaries join to form the Glenariffe Stream . The Glenariffe Stream system is the second most important site for spawning Chinook salmon (*Oncorynchus tshawytscha*) in the Rakaia River Catchment (refer Attachment 1- Table 4). The Glenariffe Stream is of national significance to spawning Chinook salmon. Salmon tagged at Glenariffe have strayed into other rivers such as the Waiau, Hurunui and Waimakariri. Therefore evidencing the importance of Glenariffe Stream, not just to the Rakaia River system, but to the South Island's east coast salmon fishery. The Glenariffe Stream was the site of a salmon research station which was operated by NIWA until 1999,but has recently been sold to private interests.

Spawning surveys undertaken on Glenariffe Stream have shown that spawning activity occurs throughout the main stem Glenariffe Stream and into the three tributaries , Double Hill Stream and Glenariffe Stream Tributary, and a unnamed side channel of the Glenariffe Stream Tributary , which are inside the Glenariffe PL.

The Double Hill Stream and mainstem Glenariffe Stream is used by spawning brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*), to a lesser extent. The streams are vital spawning areas for brown trout which occupy the main Rakaia River and spend part of their life at sea and as a spawning area for brown trout, which are resident within Glenariffe Stream.

Glenariffe Stream is the second most important spawning location for brown trout within the Rakaia catchment. The Glenariffe Streams regional importance for it's resident brown trout population and for brown trout migrating within the Rakaia System is summarised by Davis (1979). Data on brown trout captured incidentally at the Glenariffe Stream Salmon trap has been kept annually between 1965 to 1993. The trap data demonstrates the high numbers of large brown trout within Glenariffe Stream (Unwin pers. comm./ N.I.W.A unpublished data).

Double Hill Stream, Glenariffe Stream Tributary, and Glenariffe Stream also have a resident population of brown trout . The brown trout fishery attracts much attention from anglers and is valued to the extent that "catch and release" regulations have been proposed by anglers to preserve the quality of the fishery. The North Canterbury Fish and Game Council recognises Glenariffe Stream and its tributaries as being a site of regional importance for it's trout fishery. Glenariffe Stream's recreational significance to anglers has also been recognised by Unwin and Davis 1983.

While the value of Glenariffe Stream Tributary, Double Hill Stream and Glenariffe Stream to brown trout and rainbow trout are secondary to the national importance of the site for spawning chinook salmon, the trout fisheries are still of regional importance and have been recognised as a "A" grade headwater fisheries in a report by Jellyman and Graynoth, 1994.

There are also numerous small streams within the Glenariffe Pastoral Lease which flow off the mountain sides. With the exception of Turtons Stream and the North Ashburton River headwaters , the other streams have no significant value to salmonids themselves. Turtons Stream has some value to brown trout smolt. The headwaters of the north branch of the Ashburton River are important for brown trout smolts. The North Branch of the Ashburton River also has a headwater trophy brown trout fishery. Despite this lesser significance, it is important that water quality from all of these mountain streams is maintained, as they form the catchments of the Ashburton and Rakaia Rivers which have high fisheries values.

2.2 Gamebirds

Canada geese, paradise shelduck, mallard and grey ducks all frequent the flood plain adjoining the Rakaia River. The wetlands adjoining Glenariffe Stream provide nesting sites for paradise shelducks and mallard and grey ducks. The nearby Rakaia riverbed is also used by both Canada geese and paradise shelduck, generally as resting areas. Neither Canada geese or paradise shelduck appear to be a significant problem on the improved pastures on Glenariffe PL. Yet the improved pastures on Glenariffe Pastoral Lease play an interim role as a site for Canada geese within the Rakaia Catchment. There are periods when there is

conflict between the farmer and the presence of Canada Geese. At such times the values of gamebird hunters would be in harmony with the desires of the landowner.

The improved pastures on the lower slopes of the Rakaia Faces and adjoining Rakaia foodplain are sites where paradise shelduck and Canada geese could pose a problem for agricultural activities.

Two types of upland gamebirds occur within the internal ranges of the Glenariffe PL, these being Californian quail and chukor. Both species occur in low numbers and do not attract any notable attention from hunters.

Wetland drainage has occurred on the flood plain around the Glenariffe Stream and it's tributaries. Waterfowl are likely to have suffered from such drainage.

2.3 Recreational Values

Glenariffe PL has high recreational values for a high country fishing experience. The area is easily accessible and has nationally outstanding landscape values. The Glenariffe Stream and tributaries (refer Attachment 2) attract a high level of attention from trout anglers, especially in the early part of the fishing season (between the months of October and November).

The brown trout fishery is of regional significance as a headwater trout fishery where trophy sized brown trout are regularly caught by both local and international anglers. The fishery is also of high value because of it's close location to Christchurch. Double Hill Stream itself receives less attention from trout anglers than the Glenariffe Stream. Yet Double Hill Stream offers a wilderness angling experience and allows anglers a second option for fishing when other fishers are already present on the main Glenariffe Stream.

The streams are open until the end of February, at which point North Canterbury Fish and Game Council regulations prohibit angling. While there is no public access along these streams at present the landowner allows anglers to fish along Double Hill Stream and the Glenariffe Stream Tributary and Glenariffe Stream (mainstem).

There are also two important access points used by anglers to cross Glenariffe PL to access the Rakaia River mainstem and the Hydra Waters. The first track is approximately along the eastern boundary of Double Hill PL and goes within Glenariffe PL (refer Attachment 3A). This is an important track for upriver salmon anglers and anglers accessing the Hydra waters (on the true left bank of the Rakaia) for headwater trout fishing. The track does not follow a legal road which starts inside the boundary of Double Hill and crosses the north western corner of Glenariffe Pastoral Lease leading out onto the Rakaia River.

The second track which is of comparatively lesser importance goes from the Double Hill Run Road, just west of Glenariffe salmon farm and is used to access the Double Hill Flats Stream and mainstem Rakaia River.

A third track starts just east of the Glenariffe salmon farm and lies just north of the Glenariffe PL. It is an important access point to the pool at the confluence of the Glenariffe Stream and Rakaia River. The pool is a popular location for salmon fishing during January and February, and early season trout fishing.

Technical gamebird hunting information is lacking for the Glenariffe Pastoral Lease. Glenariffe PL is not a targeted gamebird hunting area and this relates to the relatively low numbers of gamebirds on the station compared to other areas within the Rakaia Catchment. Canada Geese are an occasional problem for the farmer at which times the values of gamebird hunters would be in harmony with the desires of the farmer. Generally hunting is arranged by Glenariffe Station to use a group of established hunters when there is a gamebird problem. Yet other hunters may request access to the lease from the station holder.

There is also some shooting of paradise shelducks mallard and grey ducks along the margins of Glenariffe Stream and it's tributaries.

Part III - Recommendations

To promote the ecological management of reviewable land in a way that is ecologically sustainable (as per Sec 24 (a) (i) of the Crown Pastoral Land Act (1998)) and to enable the protection of significant inherent values on reviewable land (as per Sec 24 (b) of the Crown Pastoral Land Act (1998)), the Council forwards the following recommendations.

3.1 Sports Fish

Riparian buffers of twenty metres should be established along Double Hill and Glenariffe Streams, given the national importance of the streams for spawning chinook salmon. Suitable riparian protection (such as electric fencing) should be established to exclude cattle from entering the river bed.

Cattle disturb the river banks leading to increased siltation within the river and loss of overhanging bank cover for juvenile salmon. Cattle trampling through the stream dislodges sediments and directly destroys salmon redds. Cattle may have some positive benefit to the stream by grazing on macrophytes, which may otherwise cover available areas of spawning shingles, yet other techniques could be used to control macrophyte growth such as mechanical cutting. Cattle should therefore be excluded along a marginal strip of 20 metres of the stream bank.

Sheep grazing does not have the same impact and would be permissible within a 20 metre riparian strip to prevent rank vegetation. Sheep have not been observed to have any significant impact upon salmonid spawning streams.

The creation of a fenced off marginal strip (Esplanade Reserve) along the spring creeks on the floodplain (refer Attachment 4) would serve to provide an ecological buffer zone that could mitigate adverse affects on water quality from the adjoining land.

Willows on the unnamed tributary south of Glenariffe Stream (refer Attachment 2) should also be removed as they are likely to result in in-stream debris which may restrict upstream fish passage.

Erosion from the Rakaia Faces south of the Glenariffe Stream Tributary may also be causing discolouration in the river. Appropriate land management techniques to prevent erosion may improve water quality.

Changes in landuse (such as pine plantation forestry) may also impact upon the water quality within Glenariffe PL.

Public access for fishing and management purposes would be ensured by the creation of esplanade reserves along the Glenariffe Stream Tributary, Double Hill Stream and Glenariffe Stream (refer Attachment 4). Riparian access, along the esplanade reserve, should be fair and reasonable, and ensure that access ways are provided when the waterways are not accessible from existing legal access routes (eg. walkway provisions). It is important that public access is maintained given the high value of the Glenariffe Stream Tributary, Double Hill Stream and Glenariffe Stream fisheries to trout anglers and for management purposes for the salmon and trout fisheries.

A legal road across Turtons Saddle into the headwaters of the North Branch of the Ashburton River also needs to be recognised as having value to trout anglers as an access way to a headwater trout fishing resource (refer Attachment 3B).

Also the track along the western boundary of Glenariffe PL provides an important access point to a nationally important salmon fishery and regionally important trout fishery on the mainstem Rakaia (refer Attachment 3A).

A track which is used to access Double Hill Flats Stream starts within the Glenariffe Pastoral Lease and is an important access point for anglers to the Rakaia River and for Fish and Game staff who wish to access the area for the monitoring chinook salmon runs within Double Hill Flats Stream (Attachment 3A)

Esplanade reserves (for access purposes) should also be put in place on either side of Glenrock Stream (Which adjoins freehold land encompassed within the Glenariffe PL). The Glenrock Stream is an important informal point for anglers to access the mainstem Rakaia River from the road (Attachment 3A).

3.2 Game Birds

Riparian strips along the spring creeks on Glenariffe PL should allow habitat values for nesting waterfowl to be preserved. Glenariffe Stream has a riparian margin of Carex, bog rush and exotic grasses which provide an important habitat for waterfowl. Carex wetlands adjoining the unnamed tributary of the Glenariffe stream Tributary have been seriously degraded by cattle. Restoration work (such as fencing of the carex wetlands to exclude cattle) could improve the area for waterfowl.

Provision should also be made for shooters to use firearms and dogs along the Glenariffe Stream, Glenariffe Stream Tributary and Double Hill Streams for waterfowl hunting.

It is important for hunters that both of the access tracks to the Rakaia River across the Glenariffe PL are maintained (refer Attachment 3A).

Also the Glenrock swamp has suffered from cattle plugging, grazing, drainage and over-sowing. The swamp should be restored by excluding cattle

Concluding Statement

This report summaries the sports fish, game bird habitat and recreational values identified as significant on the Glenariffe Pastoral Lease. It also presents the recommendations of the North Canterbury Fish and Game Council for the protection of these values.

Attachments:

1. North Canterbury Region -1998-1999 Salmon Management Report. Table 4.
2. Map 1 showing important areas for salmon and trout spawning.
3. Map 2A and 2B showing important access points for anglers and shooters.
4. Map 3 showing sites recommended to have a 20 metre riparian strips on both sides of the water course.

References.

Davis, S.F. 1979. Fish and fishery values of the Rakaia River: a preliminary report. New Zealand Freshwater Fisheries Reports. Ministry of Agriculture and Fisheries Freshwater Division. 55p

Jellyman, D.J. and Graynoth, E. 1994. Headwater trout fisheries in New Zealand. New Zealand Freshwater Research Report No. 12. NIWA Freshwater- Christchurch. 87 p.

Unwin, M. J. Personal communication. Salmonid fisheries scientist. N.I.W.A. Riccarton- Christchurch.

Unwin, M. J. and Davis, S.F. 1983. Recreational fisheries of the Rakaia River. New Zealand Freshwater Fisheries Reports. Ministry of Agriculture and Fisheries Freshwater Division. 110 p

Peter Langlands,
consultant for
Wayne McCallum
Environment Officer
North Canterbury Fish and Game Council

14. 09. 99

Attachment 1.
North Canterbury Region -1998-1999 Salmon Management Report. Table 4.

1998-1999 Salmon Management Report
North Canterbury Region

Introduction

The North Canterbury change management priorities meeting held in 1998 identified the east coast salmon fishery as the most significant Fish and Game asset in the region. A brief look at the outcomes of other regional meetings further suggests that the salmon fishery is either the second or third most valuable fish and game asset nationally. A well-documented characteristic of the fishery is that the number of returning salmon, the key factor for anglers and fisheries managers alike, varies significantly on an annual basis.

A comprehensive salmon productivity data collection program is in place in the North Canterbury and Central South Island Fish and Game regions. Its purpose is to produce estimates of annual salmon returns to the six main fisheries in the region. The salmon database has been running in its current form since the 1992-93 season. Accompanying the data collection program is research into salmon residency times which started in 1997 with the aim of improving the accuracy of the salmon database. Every year as the duration and accuracy of the data set improves, more interesting trends come to light.

Methods

Estimates of annual salmon returns are made up of estimates of spawning escapement (the number of salmon that reach the spawning grounds), angler catch and returns to facilities such as the Glenariffe and Silverstream traps.

1. Spawning Escapement
The main spawning areas of the Rakaia, Waimakariri, Hurunui and Waiau Rivers were assessed by a program of live fish surveys conducted from a helicopter. The results from these counts were fed into a model developed by NIWA and estimates of the total spawning run (spawning escapement) were obtained. A quick summary of the way the model works is that the five live fish counts are plotted on a curve. The area under that curve represents total fish days for that spawning stream. An estimate of the spawning escapement is obtained by dividing the fish days by an estimate of the average residency time of an individual salmon in the spawning stream.

2. Angler Salmon Catch
750 adult full season licence holders (increased from 500 in previous years) were randomly selected and surveyed by telephone as to the number of salmon they caught from each river over the season. Most anglers have no problem recalling their salmon tally, even some months after the end of the season. These results are analysed and an estimate of the total salmon catch in each river is obtained. A similar survey conducted in the Central South Island Region provides data on salmon caught by their anglers in North Canterbury rivers. When angler catch survey data is combined with aerial estimates of spawning escapement, total run estimates can be obtained.

3. Salmon Residency Research
Estimates of spawning escapement from the NIWA model rely on the use of a variable known as "salmon residency time" (SRT). This is the time each salmon spends in the spawning stream where it is likely to be encountered during an aerial survey. The model estimates "salmon days"; that is the number of days spent by salmon in the Hydra Waters. For example

if 1000 salmon each spent ten days in the Hydra Waters then there were 10 000 salmon days. In order to calculate the actual spawning run, salmon days need to be divided by the SRT.

In the past the only spawning stream with a known SRT figure was the Glenariffe Stream where an estimate of ten days was derived by MAF Freshwater during the 1970's. In 1998 Fish and Game commenced a long term research program with the intention of gaining individual SRT estimates for all significant spawning waters in the region. In 1999 the research centered on Double Hill Flats Stream, a tributary of the Rakaia River. SRT was calculated by trapping salmon as they entered the spawning stream, double-tagging and releasing them over the trap to continue spawning normally. Daily walks were conducted over the entire spawning grounds aiming to identify salmon carcasses as soon as possible after the time of death. The average time span between tagging and recovery of the carcass is the SRT.

Results

1. Salmon Residency Research

The results for the salmon residency research are presented first as they affect the results for other projects that follow. The trap in a braid of Double Hill Flats Stream was manned between 30 March and 27 May, 1999. The resulting data was as follows:

Salmon Trapped	157
Salmon Recovered	142
Useable Recoveries	130
Non-Useable Recoveries	12
Mean Residency Time	13.95 days
Standard Deviation	5.38 days

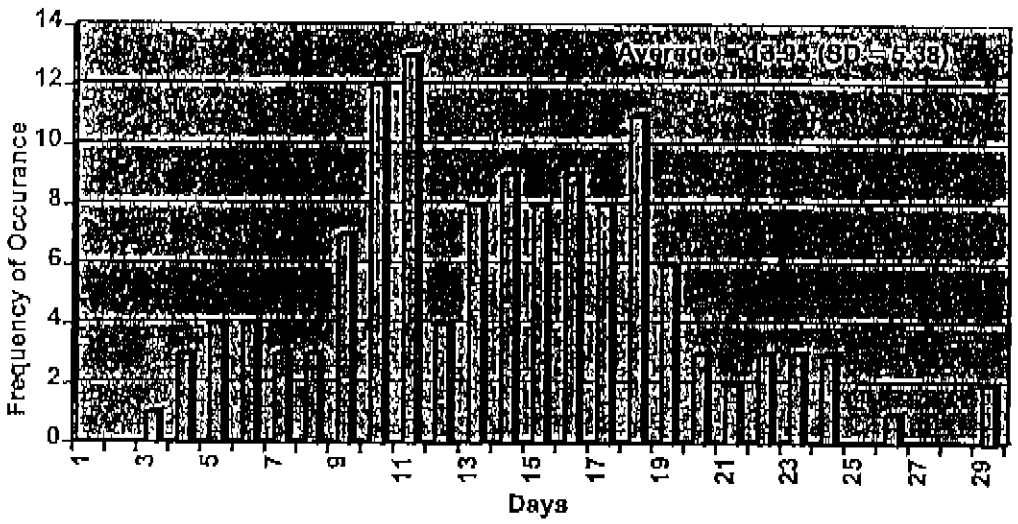


Figure 1: *Residency Times of 130 Tagged and Re-captured Spawning Salmon in Double Hill Stream, 1999.*

This represents a much better result than last year with more than double the number of useable recoveries being made. This is due to the choosing of a better trap site and working with a smaller, more manageable stream where the chance of losing salmon carcasses was lower.

2. Salmon Return Estimates

The results from the SRT research have had significant impacts on past and present return estimates. The fact that the SRT estimates from the two streams which have been assessed are so similar to each other (13.95 and 14.67 days), but significantly longer than the historical MAF figure (10 days), creates a dilemma over which figures to use for streams which have yet to be assessed. After discussions with NIWA it was agreed that the Double Hill Flats Stream SRT estimate (13.95 days) be used for all streams which have yet to be assessed. This has resulted in 30% reductions in estimates of past spawning escapement and significant increases in estimates of past angler catch ratios (percent of returning salmon caught by anglers).

The results presented here are general in nature. The specific survey results can be found in the appendix.

A) Rakaia River

Rakaia River salmon returns showed a small improvement (8%) in the 1998-1999 season but were still at below-average levels. Angler catch levels were within the normal range experienced in the past.

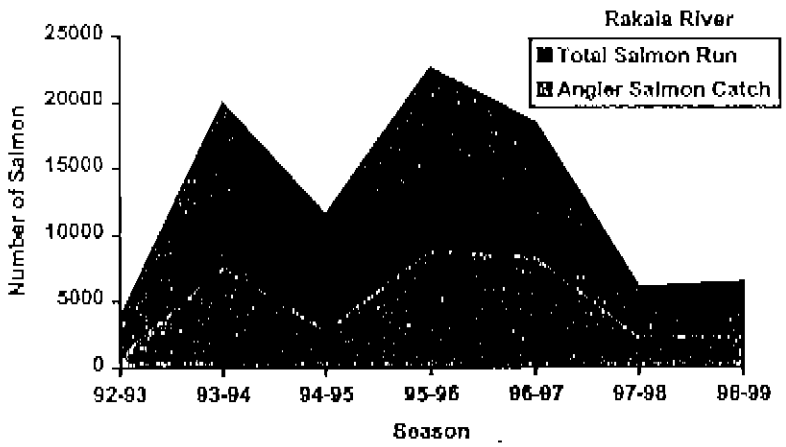


Figure 2: *Estimates of total salmon run and angler salmon catch in the Rakaia River 1992/93-1998/99.*

B) Waimakariri River

The Waimakariri River salmon run was also up (24%) in the 1998-1999 season. Of particular note is the angler catch which at 66% in well in excess of that experienced before.

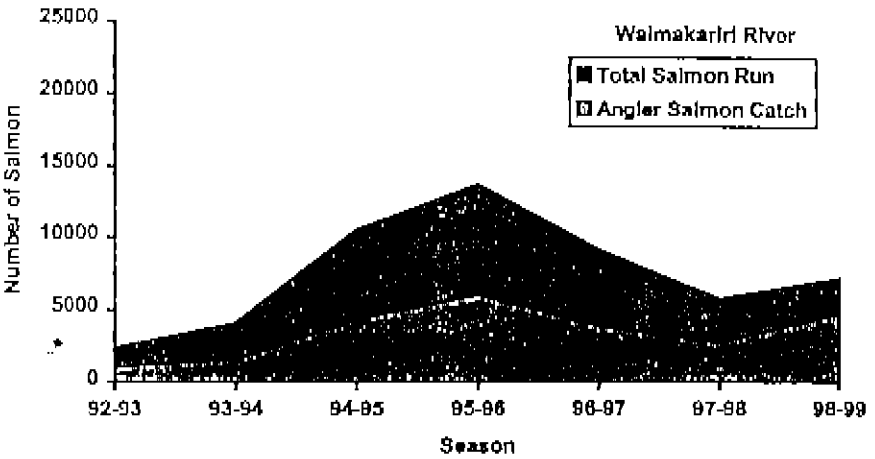


Figure 3: *Estimates of total salmon run and angler salmon catch in the Waimakariri River 1992/93-1998/99.*

C) Hurunui River

This was the first year that the full aerial program was conducted in the Hurunui River and so results are presented in table form only. Past estimates of angler catches are included to give some point of reference with the current count.

	Anglers Catch	
	1218	
	n/a	
	n/a	
	714	
	826	
	665	
1999	559	

Table 1: *Estimates of spawning escapement, angler catch and total run size of the Hurunui River, 1992/93-1998/99 (* Residency time is an estimate only).*

D) Waiau River

Once again this was the first year that the full aerial program was conducted in the Waiau River so data is in table form.

Waiau River	Spawning Escapement (RT=1.95)	Anglers Catch	Total Run
1992	n/a	108	n/a
1993	n/a	n/a	n/a
1994	n/a	60	n/a
1995	n/a	305	n/a
1996	n/a	70	n/a
1997	973	496	1469

Table 2: *Estimates of spawning escapement, angler catch and total run size of the Waiau River, 1992/93-1998/99 (* Residency time is an estimate only).*

E) Angler Catch

Data presented below estimates the *percentage* of the salmon run caught by anglers in all four rivers. Raw data on angler catch can be found in the appendix.

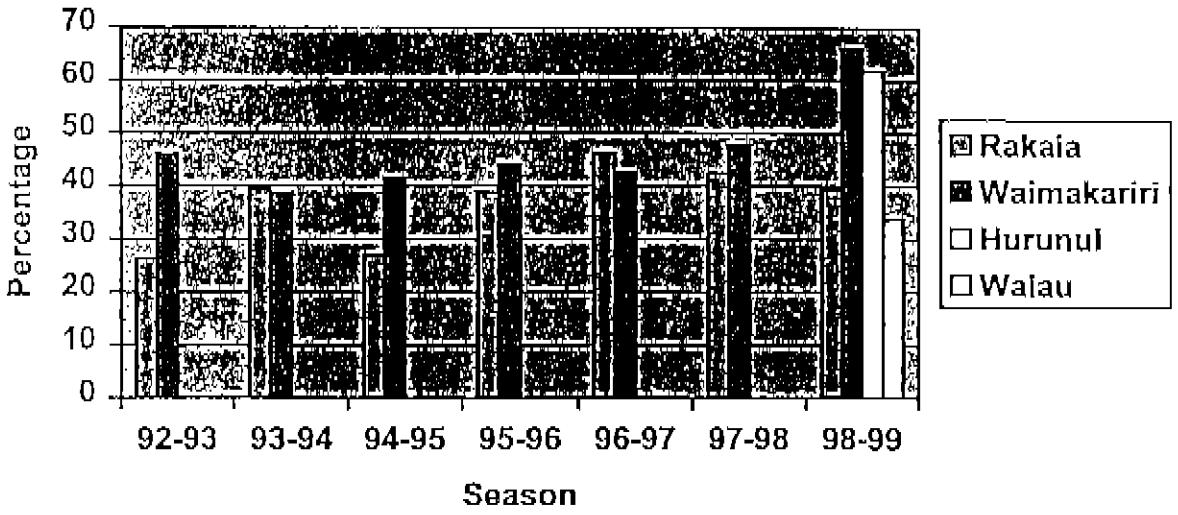


Figure 4: *Estimates of angler catch as a percentage of the total run in the Rakaia, Waimakariri, Hurunui and Waiau Rivers, 1992/93-1998/99.*

Angler catch ratios have been affected by the outcomes of SRT research which forced a re-calculation of past and present angler data. Angler catch in the Rakaia was within the range estimated in the past. The Waimakariri catch was well above average in 1998-1999 and was the highest we have ever recorded. Few observations can be made of the Waiau and Hurunui data as it is the first year it has been collected.

F) Points of Interest

i) Waimakariri/Kaiapoi River Catch Rates

During the recent Anglers Notice consultation process there was much discussion on angler catch rates in the Kaiapoi River. As a means of gaining more information on this issue

anglers were asked during the catch interviews to list their Waimakariri and Kaiapoi River catches separately. Fish said to be caught at the confluence of the Waimakariri and Kaiapoi Rivers were included in the Kaiapoi River figures. The following results were obtained:

Kaiapoi River

Angler Catch	620 (55%)
Spawning Escapement	500 (45 %)

Waimakariri River

Angler Catch	4178 (68%)
Spawning Escapement	1937 (32%)

N.B. Some fish declared as caught in the lower reaches of the Waimakariri could have been Kaiapoi River fish that had yet to reach the confluence of the two rivers.

ii) Rangitata/Waitaki Runs

The Rangitata and Waitaki salmon runs both showed reasonable improvements on the previous year but were still below average.

iii) Out of Region Anglers

North Canterbury anglers caught 1243 salmon in the Central South Island region.
Central South Island anglers caught 363 salmon in the North Canterbury region.

Discussion

Salmon Returns

Salmon returns appear to have remained at much the same levels as last year and could be described as "below-average". However they are still well within the range of return figures estimated since the salmon database began in 1993. The revision of the database as a result of SRT research has resulted in significant reductions in estimates of spawning escapement and hence the total run size. This revision process will continue until the completion of SRT research.

Angler Catch

Angler catch in two rivers, the Waimakariri (66%) and the Hurunui (62%) was much higher than has been recorded before and takes us into unknown territory in salmon management. Little can be read into the Hurunui figure because this is the first year that such data has been collected. However the Waimakariri catch ratio needs to be considered as it significantly higher than any other ratio estimated in the seven years that the database has been in operation. It is likely that the high catch ratio was caused by the extended low flows which were observed over the summer period, causing salmon to congregate in the lower reaches where they are vulnerable to anglers.

While the fact that two-thirds of returning Waimakariri salmon were caught by anglers is alarming, it should be considered in the context of what we know about the salmon fishery. Research conducted by NIWA and Fish and Game suggests that there is little link between the number of spawning fish and the size of the resulting run in three years time. For example in the seven years that the salmon database has been in operation in the Waimakariri River, the worst ever recorded spawning (92-93) produced the best ever returns (95-96). The best ever spawning (95-96) produced below average returns (98-99). However there must be a point where if the spawning population gets to a sufficiently low level that it does become limiting on the population. Although the level at which spawning becomes a limiting factor is not known, we do know that there were still 50% more fish spawning in Waimakariri tributaries this year than spawned in the 92-93 season. With the information that is currently at hand, Fish and Game has some security in sitting back and waiting to see what happens in

upcoming years. It is events such as this that prove the value of long-term population monitoring programs such as the salmon database. It is of vital importance that it continue as a high priority project into the future.

Waiau and Hurunui Aerial Survey Program

This was the first year that the full aerial survey program was conducted on the Waiau and Hurunui Rivers. The nature of the spawning waters in these catchments is sufficiently different to those in the Rakaia and Waimakariri systems to suggest that the program may not be completely appropriate. The answer to that question will only be known once both programs have run in tandem for a number of years. However the results from the angler catch surveys give a hint that the model is giving good population estimates in the Waiau and Hurunui Rivers. The Hurunui and Waimakariri salmon fisheries are similar in that most of the fish are caught at the mouth or in the tidal reaches. Both would have been similarly affected by the low flows during summer and both have similar angler catch ratios (62 and 66%). The Waiau and Rakaia are also similar to each other in that much of the fishing occurs upriver away from the rivermouth. The low flows should have had less impact on angler catch ratios as salmon do not tend to congregate in the tidal reaches to the same extent. Once again both have catch ratios similar to each other (34 and 36%).

Recommendation

That the program continue in the same format as in 1998-1999.

Acknowledgements

I thank the following for their assistance with the salmon program in 1998-1999:

1. Aerial Survey Program; -Jim Stephenson (St James Station), David Gunn (Lake Taylor Station), Ted Phipps (The Lakes Station), John Westenra (Craigieburn Station), Ross Urquart (Flock Hill Station), Peter Bryce (Manuka Point Station), Hamish and Phillipa Innes (Mt Algidus Station), Hamish Ensor (Glenaan Station), Marshall Freer (Canterbury Helicopters), DOC (Arthurs Pass and Hanmer Field Centres).

2. Salmon Residency Research; - Hamish Ensor (Glenaan Station), Martin Tawa, Dick Haydon, Trevor Keeley, Keith Ross, Peter Barnes, Ian Riach, Bob Richmond, Brent Chamberlain.

3. Salmon Angler Survey; -Shelley McMurtrie.

Ross Millichamp
Fish and Game Officer
12 July 1999.

Appendix

1. Rakaia System

Table 1: *Raw data of aerial live fish spawning surveys conducted in the Hydra Waters, 1993-99.*

Hydra [illegible]	1		2 [illegible]		3		4 [illegible]		5	
Year	Date	Count	Date	Count	Date	Count	Date	Count	Date	Count
1993	29/3	166	14/4	417	29/4	270	14/5	80	30/5	132
1994	31/3	584	15/4	[illegible]	27/4	1243	14/5	[illegible]	30/5	[illegible]
1995	3/4	790	21/4	1009	6/5	[illegible]	18/5	[illegible]	1/6	[illegible]
1996	25/3	881	17/4	1737	1/5	905	13/5	671	24/5	497
1997	25/3	298	9/4	905	24/4	899	6/5	557	28/5	251
1998	26/3	136	8/4	346	24/4	454	10/5	362	25/5	199
1999	25/3	101	9/4	310	22/4	453	8/5	387	20/5	344

Table 2: *Raw data of aerial live fish spawning surveys conducted in Double Hill Stream, 1993-99.*

Double Hill [illegible]	1		2 [illegible]		3		4 [illegible]		5	
Year	Date	Count	Date	Count	Date	Count	Date	Count	Date	Count
[illegible]	29/3	69	14/4	[illegible]	29/4	[illegible]	14/5	[illegible]	30/5	[illegible]
[illegible]	31/3	[illegible]	15/4	[illegible]	27/4	[illegible]	14/5	[illegible]	30/5	[illegible]
[illegible]	3/4	291	21/4	[illegible]	6/5	[illegible]	18/5	[illegible]	1/6	[illegible]
[illegible]	25/3	[illegible]	17/4	[illegible]	1/5	[illegible]	13/5	[illegible]	24/5	[illegible]
[illegible]	25/3	[illegible]	9/4	[illegible]	24/4	[illegible]	6/5	[illegible]	28/5	[illegible]
[illegible]	26/3	[illegible]	8/4	[illegible]	24/4	[illegible]	10/5	220	25/5	[illegible]
1999	25/3	[illegible]	9/4	[illegible]	22/4	[illegible]	8/5	[illegible]	20/5	[illegible]

Table 3: *Raw data of aerial live fish spawning surveys conducted at Manuka Point, 1993-1999.*

Manuka Pt [illegible]	1		2 [illegible]		3		4 [illegible]		5	
Year	Date	Count	Date	Count	Date	Count	Date	Count	Date	Count
1993	29/3	[illegible]	14/4	[illegible]	29/4	[illegible]	14/5	[illegible]	30/5	[illegible]
1994	31/3	[illegible]	15/4	[illegible]	27/4	[illegible]	14/5	[illegible]	30/5	[illegible]
1995	3/4	[illegible]	21/4	[illegible]	6/5	[illegible]	18/5	[illegible]	1/6	[illegible]
1996	25/3	[illegible]	17/4	[illegible]	1/5	[illegible]	13/5	[illegible]	24/5	[illegible]
1997	25/3	[illegible]	9/4	[illegible]	24/4	[illegible]	6/5	[illegible]	28/5	[illegible]
1998	26/3	[illegible]	8/4	[illegible]	24/4	[illegible]	10/5	[illegible]	25/5	[illegible]
1999	25/3	[illegible]	9/4	[illegible]	22/4	[illegible]	8/5	[illegible]	20/5	[illegible]

Table 4: *Estimates of spawning escapement, angler catch and total run size of the Rakaia River, 1993-99.*

Rakaia [illegible]	Glenariffe (Trap Census)	Double Hill [illegible]	Hydra (RT=14.67)	Manuka Pt [illegible]	Rakaia Total	[illegible]	Total Run
[illegible]	713	[illegible]	1106	[illegible]	2742	[illegible]	3858
[illegible]	4497	[illegible]	4240	[illegible]	12038	[illegible]	19899
[illegible]	3026	[illegible]	3763	[illegible]	8452	[illegible]	11572
[illegible]	5442	[illegible]	5049	[illegible]	13572	[illegible]	22580
[illegible]	3630	[illegible]	3013	[illegible]	9921	[illegible]	18452
[illegible]	912	[illegible]	1585	[illegible]	3482	[illegible]	6049
1999	1528	[illegible]	1687	[illegible]	3952	[illegible]	6519

* Residency time is an estimate only.

2. Waimakariri System

Table 5: *Raw data of aerial live fish spawning surveys conducted at Winding Creek, 1993-1999.*

Winding Ck	1		2		3		4		5		6	
Year	Date	Count	Date	Count	Date	Count	Date	Count	Date	Count	Date	Count
1993	-	[illegible]	14/4	[illegible]	29/4	88	14/5	[illegible]	30/5	78	15/6	60
1994	31/3	[illegible]	15/4	36	27/4	61	14/5	67	30/5	47	14/6	27
1995	3/4	16	21/4	[illegible]	6/5	321	18/5	[illegible]	1/6	233	-	
1996	25/3	34	21/4	[illegible]	1/5	530	13/5	[illegible]	27/5	326	9/6	307
1997	-		9/4	51	24/4	132	6/5	[illegible]	28/5	221	11/6	[illegible]
1998	-		8/4	[illegible]	24/4	70	10/5	[illegible]	25/5	[illegible]	4/6	[illegible]
1999	-	[illegible]	9/4	30	22/4	[illegible]	8/5	141	20/5	139	3/6	122

Table 6: *Raw data of aerial live fish spawning surveys conducted at Cass Hill Stream, 1993-1999.*

Cass Hill St	1		2		3		4		5		6	
Year	Date	Count	Date	Count	Date	Count	Date	Count	Date	Count	Date	Count
1993		[illegible]	14/4	109	29/4	[illegible]	14/5	[illegible]	30/5	[illegible]	15/6	[illegible]
1994	31/3	[illegible]	15/4	[illegible]	27/4	119	14/5	104	30/5	[illegible]	14/6	[illegible]
1995	3/4	195	21/4	[illegible]	6/5	143	18/5	[illegible]	1/6	[illegible]	-	
1996	25/3	176	17/4	[illegible]	1/5	[illegible]	13/5	[illegible]	27/5	[illegible]	-	
1997	25/3	[illegible]	9/4	[illegible]	24/4	[illegible]	6/5	[illegible]	28/5	[illegible]	11/6	[illegible]
1998	26/3	[illegible]	8/4	[illegible]	24/4	[illegible]	10/5	[illegible]	25/5	[illegible]	4/6	[illegible]
1999	25/3	[illegible]	9/4	[illegible]	22/4	[illegible]	8/5	[illegible]	20/5	[illegible]	-	[illegible]

Table 7: *Raw data of aerial live fish spawning surveys conducted at Cora Lynn Stream, 1993-1999.*

Cora Lynn	1		2		3		4		5		6	
Year	Date	Count	Date	Count	Date	Count	Date	Count	Date	Count	Date	Count
1993		[illegible]	14/4	[illegible]	29/4	[illegible]	14/5	[illegible]	30/5	[illegible]	15/6	[illegible]
1994	31/3	[illegible]	15/4	[illegible]	27/4	[illegible]	14/5	100	30/5	[illegible]	14/6	[illegible]
1995	3/4	[illegible]	21/4	[illegible]	6/5	117	18/5	[illegible]	1/6	[illegible]	-	
1996	25/3	[illegible]	17/4	[illegible]	1/5	[illegible]	13/5	[illegible]	27/5	[illegible]	9/6	100
1997	-	[illegible]	9/4	[illegible]	24/4	[illegible]	6/5	[illegible]	28/5	[illegible]	11/6	[illegible]
1998	-	[illegible]	8/4	[illegible]	24/4	[illegible]	10/5	[illegible]	25/5	[illegible]	4/6	[illegible]
1999	-	[illegible]	9/4	[illegible]	22/4	139	8/5	[illegible]	20/5	90	3/6	[illegible]

Table 8: *Raw data of aerial live fish spawning surveys conducted in the Poulter River, 1993-1999.*

Poulter	1		2		3		4		5		6	
Year	Date	Count	Date	Count	Date	Count	Date	Count	Date	Count	Date	Count
1993	-	[illegible]	14/4	[illegible]	29/4	[illegible]	14/5	[illegible]	30/5	[illegible]	15/6	[illegible]
1994	31/3	[illegible]	15/4	[illegible]	27/4	[illegible]	14/5	[illegible]	30/5	[illegible]	14/6	[illegible]
1995	3/4	[illegible]	21/4	[illegible]	6/5	[illegible]	18/5	[illegible]	1/6	[illegible]	-	
1996	-	[illegible]	17/4	[illegible]	1/5	[illegible]	13/5	[illegible]	27/5	[illegible]	9/6	[illegible]
1997	-	[illegible]	9/4	[illegible]	24/4	[illegible]	6/5	[illegible]	28/5	[illegible]	11/6	[illegible]
1998	-	[illegible]	8/4	[illegible]	24/4	[illegible]	10/5	[illegible]	25/4	[illegible]	4/6	[illegible]
1999	-	[illegible]	10/4	[illegible]	22/4	[illegible]	8/5	[illegible]	20/5	[illegible]	3/6	[illegible]

Table 9: *Estimates of spawning escapement, angler catch and total run size of the Waimakariri River, 1993-99.*

Waimakariri River	Winding Creek (RT=13.95*)	Cora Lynn (RT=13.95*)	Silverstream (Trap Census)	Anglers Catch
1993	358	222	-	1116
1994	260	341	855	1597
1995	1290	486	1230	4372
1996	2588	611	818	6033
1997	943	633	830	3893
1998	461	537	260	2778
1999	456	236	500	4748

* Residency time is an estimate only.

3. Hurunui River

Table 10: *Raw data of ground and aerial live fish spawning surveys conducted in the Hurunui River, 1995-1999.*

Hurunui River	1		2		3		4	
Year	Date	Count	Date	Count	Date	Count	Date	Count
1995	-	-	-	-	-	-	-	-
1996	-	-	-	-	-	-	-	-
1997	-	-	-	-	-	-	-	-
1998	-	-	-	-	-	-	-	-
1999	10/4	515	25/4	1113	11/5	1220	21/5	1005

Table 11: *Estimates of spawning escapement, angler catch and total run size of the Hurunui River, 1993-99.*

Hurunui River	Spawning (RT=13.95*)	Anglers Catch	Total Run
1993	n/a	1218	n/a
1994	n/a	n/a	n/a
1995	n/a	n/a	n/a
1996	n/a	714	n/a
1997	n/a	826	n/a
1998	n/a	665	n/a
1999	546	559	3905

* Residency time is an estimate only.

4. Waiau River

Table 12: *Raw data of ground and aerial live fish spawning surveys conducted in the Waiau River, 1995-1999.*

Waiau River	1		2		3		4	
Year	Date	Count	Date	Count	Date	Count	Date	Count
1995	-	-	-	-	-	-	-	-
1996	-	-	-	-	-	-	-	-
1997	-	-	-	-	-	-	-	-
1998	-	-	-	-	-	-	-	-
1999	10/4	197	25/4	330	11/5	381	21/5	310

Table 13: *Estimates of spawning escapement, angler catch and total run size of the Waiau River, 1993-99.*

Waiau River	Spawning [illegible]	Anglers Catch	Total Run
1993	[illegible]	108	[illegible]
1994	[illegible]	n/a	[illegible]
[illegible]	[illegible]	n/a	[illegible]
[illegible]	[illegible]	60	[illegible]
1997	[illegible]	305	[illegible]
1998	[illegible]	70	[illegible]
1999	[illegible]	496	[illegible]

* Residency time is an estimate only.

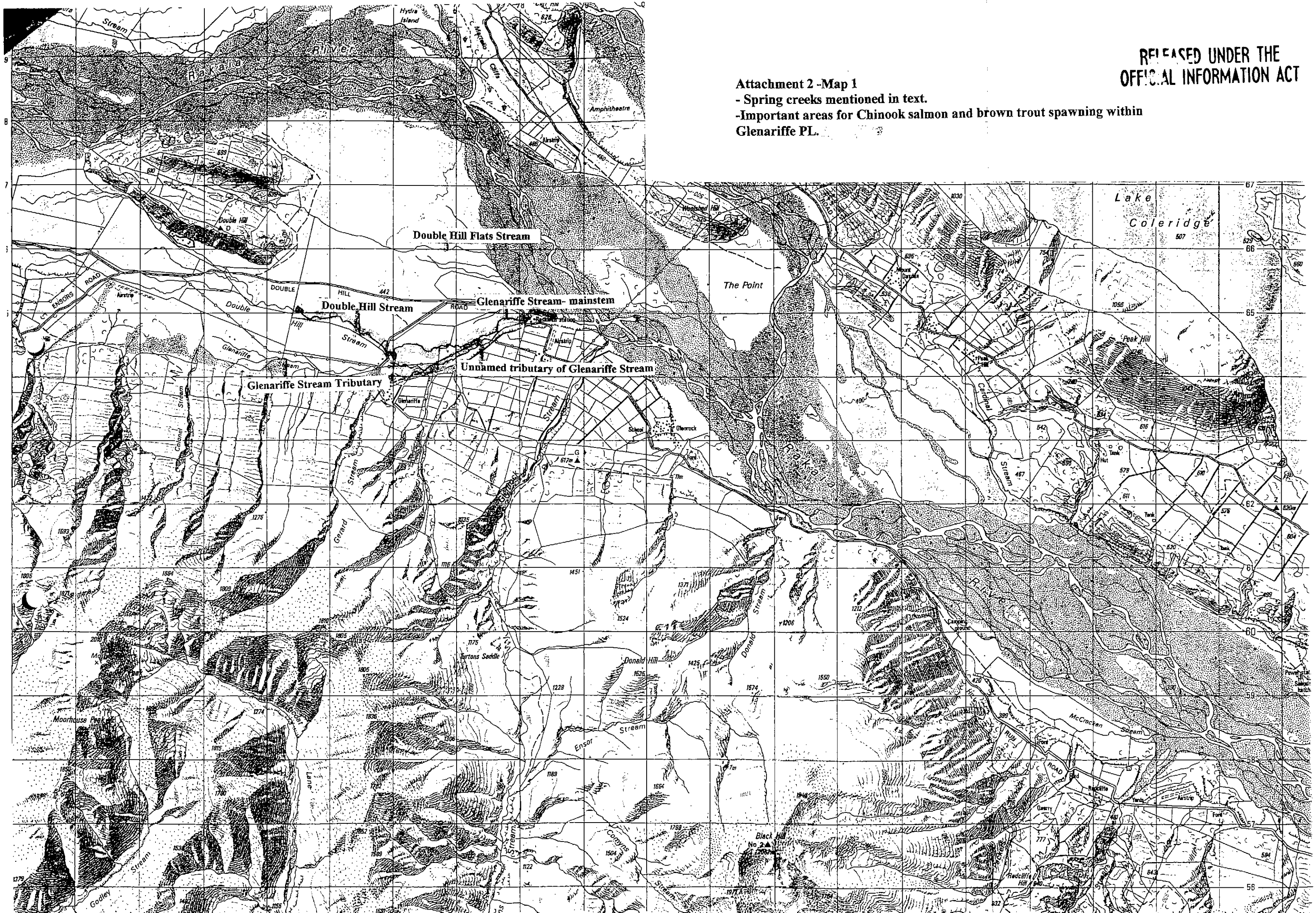
5. Angler Catch

Table 14: *Angler catch as a percentage of the total run in the Rakaia and Hurunui Rivers, 1993 –99*

	92-93	93-94	94-95	95-96	96-97	97-98	98-99
Rakaia	26.4	39.50	26.96	39.89	46.23	42.44	39.37
Waimakariri	45.96	38.72	41.39	44.01	42.44	47.80	66.08
Hurunui							*61.76*
Waiau							*33.76*

Attachment 2.
Map 1 showing important areas for salmon and trout spawning.

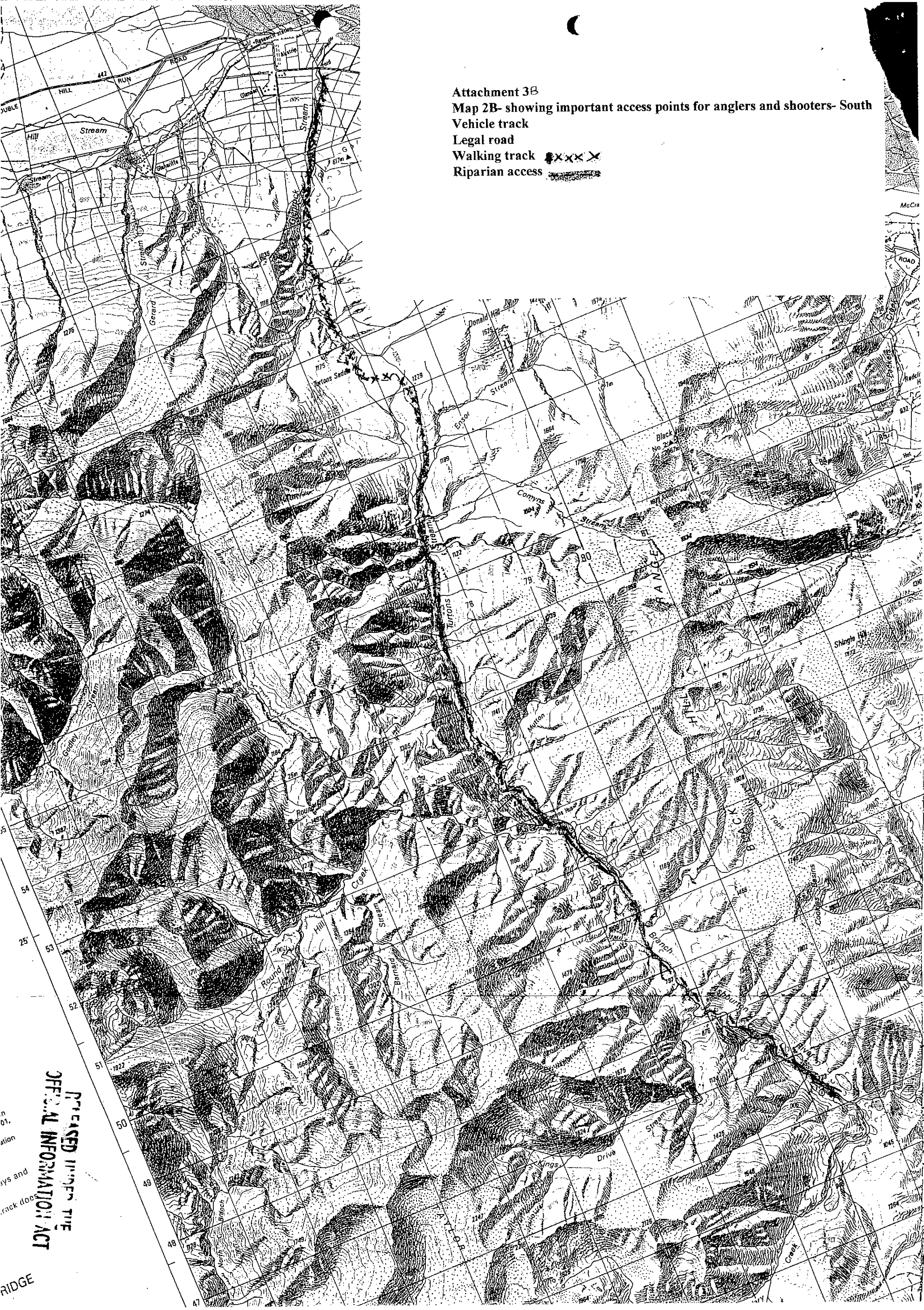
Attachment 2 -Map 1
- Spring creeks mentioned in text.
-Important areas for Chinook salmon and brown trout spawning within Glenariffe PL.



Attachment 3.
Map 2 showing important access points for anglers and shooters.

Attachment 3A
Map 2A- showing important access points for anglers and shooters- North
Vehicle Track
Legal road
Walking track
Riparian access

Attachment 3B
Map 2B- showing important access points for anglers and shooters- South
Vehicle track
Legal road
Walking track
Riparian access



Attachment 4.
Map 3 showing sites recommended to have a 20 metre riparian strips on both sides of the water course.

Attachment 4
Map 3 showing sites recommended to have 20m riparian strips on both sides of the water course.