Sunrise Waimakariri Mouth

2018 Salmon Management Report

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ABSTRACT

In recent years salmon returns have fallen to record low levels in almost all rivers on the east coast of the South Island. Anglers are looking to Fish & Game to restore the sea-run Chinook salmon fishery to levels seen in the mid-nineties. This prompted the Sea-Run Salmon Symposium "Turning the Tide", held in 2017. Following the symposium, keynote speaker David Willis, a biologist from the Department of Fisheries and Oceans Canada, produced a short report highlighting his observations of our fishery and provided several recommendations to help address the recent declines. Since the symposium, a National Salmon Committee has been formed which has developed terms of reference and discussed how best practices can be implemented to restore the fishery across the South Island.

In March 2018, North Canterbury Fish & Game held a strategic planning workshop for the region to develop a roadmap for the next three years. Staff subsequently prepared a report outlining various strategies staff developed alongside D. Willis's recommendations to help restore the fishery, both short and long term, highlighting some of the projects already underway, along with some of the issues the fishery faces on this journey to recovery.

The salmon fishery is at a record low level. Ocean conditions have not favoured salmon in recent years. There are many variables that have an influence on the number of salmon that return each season, with ocean conditions along the East Coast of the South Island the common denominator. Other ocean species such as Red Cod, Barracuda and Blue Warehou that commercial fishermen catch in similar areas as salmon have also been present in low numbers in recent years, with ocean temperatures off the East Coast of the South Island 2 - 3 degrees warmer than usual.

Ideally we would be able to open and close the fishery using adaptive management as they do in key North American fisheries, ensuring sufficient numbers return each season, however we do not have the resources to determine return numbers in real time, other than anecdotal reports from anglers, nor do we have the legislation to implement this adaptive approach.

There are a number of strategies we could implement to reduce harvest during these low return years, such as introducing daily bag limits, season bag limits, shortening the season length and limiting the length of river fishable. However, as with the opportunity to close the season if runs are

determined to be low, we are somewhat hamstrung by legislation in our ability to reduce harvest during the season, and instead have to react the following year.

Both CSI & NC have been working closely with ECan in recent years to ensure fish screens are operating to the NIWA guidelines and consider this to be the area we have the greatest potential to help the wild fishery. At long last, staff in both regions are pleased with the progress ECan are making around reviewing fish screens, and an on-going media strategy should also encourage non-compliant abstractors to bring their screens up to international best practice.

Cawthron Institute’s recent review of stocking practices has highlighted some areas where we can modify some of our stocking practices. North Canterbury is now looking to implement a revised release program using the best available knowledge to achieve maximum returns using the resources we have. The long-held aim of our release program has been to provide moderate supplementation of the wild run, with around 10% of returning fish being of hatchery origin. However the frustration is that hatchery-released fish also have poor survival in years when conditions do not favour wild fish survival, so while a 10% return or greater may be achieved, 10% of a poor run equates to very few fish. Paradoxically, in years with good wild runs, it is questionable whether we need an extra 10% of fish. While we could aim for a higher proportion of the run being hatchery fish, financially it is questionable whether that would be cost-effective.

INTRODUCTION

North Canterbury Fish & Game Council has been monitoring sea-run Chinook salmon returns for 26 years. Estimates of annual salmon returns consist of combining the number of salmon that reach their spawning streams, angler catch, and returns to hatchery facilities such as Silverstream and the Fish & Game managed hatcheries. All of the key primary North Canterbury salmon spawning streams were monitored and a number of secondary streams had one off spawning counts carried out at the peak of the spawning run last season. These secondary spawning streams’ contribution to the total run is usually minor and this was very apparent in last season’s observations, with the majority of salmon spawning in the primary streams. Not all spawning salmon are seen in the aerial surveys, either due to spawning in areas unknown to us, spawning outside the monitored areas or counting period, but the number of these is believed to be minor.

This report includes previously reported information, along with historic management decisions made by North Canterbury Fish & Game, to give readers a background to how salmon have been and are now currently managed.

BACKGROUND

AUC (Area Under the Curve) vs Peak Count Spawning Escapement

All population surveys are a compromise between the effort expended and cost in sampling, and the necessary precision required for the estimate. Historically, the use of the AUC methodology was considered the most appropriate, as it was thought that more surveys resulted in a more detailed and therefore a more precise estimate. Under the AUC methodology, the main spawning streams in both the Rakaia and the Waimakariri River catchments were assessed using a program of five 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 number of spawning salmon were obtained. The model works by plotting live fish counts on a curve. The area under that curve represents the total fish days for that spawning stream. An estimate of the number of fish that reached the spawning streams is obtained by dividing the total fish days by an estimate of the average residency time of an individual salmon in the spawning stream, RT (the average time a salmon spends in the aerial count reach of each spawning stream before it dies or leaves the stream).

However, there is a significant area of weakness in this methodology, in that it has to use an estimate of the average RT for salmon in each tributary. This RT is used as a guide to space the aerial counts, and as a parameter in the AUC model to account for any double counting or under-counting of fish.

The estimates of RT that have been applied to each stream are based on historic observations from trap research, where salmon entering a trap were tagged, released above the trap, and foot counts used to recover carcasses each day. This research showed that on average, the salmon spawned and died just over two weeks after entering the trap. However, observations by NCF&G staff suggest that this trap RT figure is likely to be an under-estimate of the true residency time, under normal conditions when salmon migration into a stream is not impeded by a trap.

Upper Rakaia – above irrigation takes

Observations suggest that the actual RT may be double the trap estimate, which would mean that the actual spawning escapement has been only half what has previously been estimated using the calculated two week RT. In contrast with AUC, a Peak Count only requires one survey and its primary potential error appears to be limited to missing the ‘peak’ of the run. Because there is no risk of double counting, the Peak Count method has the potential to provide data that better reflects the true spawning population, at a significantly reduced cost. See Appendix 1 for the 2018 aerial count salmon numbers in each stream.

Each spawning stream has a slightly different pattern to the timing of spawning. The Rakaia spawning streams typically experience their peak salmon numbers two weeks ahead of Waimakariri streams. Including the NIWA calculated RT on the Glenariffe Stream, there are five North Canterbury streams which were studied in an effort to calculate RT. These are the Hydra Waters with 14.67 days, Double Hill Stream 13.95 days, Glenariffe Stream 18.5 days (recalculated up from 10 days using NIWA trap data), Poulter River 21 days and Winding Creek 15.42 days. The streams which have not been trapped were given an average RT of the trapped streams of 16.7 days.

Below is an example of how different RT's affect reported salmon spawning calculations, and is typical of observations seen in a number of spawning streams. The first aerial count in the Hydra Waters is carried out in late March. There were an estimated 500 salmon congregating in a series of pools below the start of the counted spawning area and 100 in the counted area. Two weeks later in mid-April during the second count, there were 400 in the count reach and 200 in the pools below, with no sign of any dead salmon carcasses in the count reach or below. Two weeks later in late April/early May during the third count, there were 600 salmon in the counted reach, with no salmon left in the pools below and still no sign of carcasses either in the spawning reach or below. Two weeks later in mid-May during the fourth count, there were 400 salmon in the count reach and a number of carcasses both in the stream and below the counted reach. Two weeks later at the end of May or early June during the fifth and final count, there were only 100 live salmon in the count reach with many carcasses visible throughout the stream.

With a RT of 14.67 for the Hydra Waters, the AUC model calculates over 1,600 salmon entered this stream in the above scenario, as the RT used is very close to the period between aerial counts. This effectively means that the AUC model assumes that every two weeks, different salmon are being counted to those seen in the previous count, as on average, the salmon seen in the flight two weeks earlier are assumed and calculated to have all died or left the stream. Therefore it is critical that accurate RT's are calculated and used. For example, if a RT of 28 days had been found in the Hydra Waters, there would have only been around 8-900 salmon calculated, a more realistic total number of salmon likely to have spawned.

Rakaia Mouth showing very small tidal area

Double Hill Flat Stream, slowly being swallowed by the Rakaia

METHODS

The accuracy of the reporting of salmon spawning escapement and catch estimates, is affected by the methods used to interpret these counts, specifically the relationship between individual salmon aerial count data and the proportion of the run this represents, compared with angler catch.

a. Spawning Escapement

Since 2013, the key spawning streams in both the Rakaia and the Waimakariri River catchments have been assessed by helicopter around the time of the average historic peak in salmon spawning numbers observed during AUC observations (Peak Count). Salmon generally congregate in pools around the entrance to the spawning streams in reasonable numbers towards the end of March. Peak spawning occurs late April to early May, with the runs tapering off around mid-May, and by mid-June, very few live salmon are left, although isolated runs of salmon have been reported spawning as late as August.

Generally, the Rakaia salmon numbers reach their peak in the spawning streams at the beginning of May, the Hurunui and Waiau rivers the second week of May, and the Waimakariri River the third week of May. When only a single trend count is carried out at peak spawning time, as much of the river is counted as possible to ensure any salmon waiting below the traditional spawning reaches are accounted for, as well as counting all carcasses. Historically during peak counts, very few dead salmon are usually observed.

There are some salmon that are not accounted for in our surveys, either by spawning in areas unknown to us, or typically where too smaller runs occur to justify the cost of aerial counting, but the number of these is believed to be minor, with clear trends from year to year between rivers almost mirroring each other.

The timing of the Waimakariri Peak Count on the 15th May appeared to be early, with fewer than expected salmon observed both spawning and congregating below the spawning streams, with very few dead salmon also seen, and a flight for some distance downstream from each of the spawning streams showed a number of salmon heading upstream. Another Peak Count was carried out two weeks later on the 31st May where a few of the streams showed increased numbers of salmon present.

To calculate the annual total trend count for the Rakaia River, the peak aerial count data from all streams in the catchment was added to the aerial observations by Central South Island Fish & Game (CSIF&G) staff for Mellish Stream and the total salmon returning to the Montrose hatchery. To calculate the annual total trend count for the Waimakariri River, the peak aerial count data from all streams in the catchment was added to the total returns to the Silverstream hatchery. With no trap in the Otukaikino Stream flowing from the Isaacs hatchery, no trap return was recorded this year. Historical peak aerial count data for each stream cannot be used to compare the new Peak Count data. AUC count data does not give a true representation of the total numbers present at that time, as there would usually still be a significant number of salmon waiting below the spawning reaches, along with a small number of spent carcasses that were not traditionally recorded, and therefore not included in the historic data.

Observations over the last 18 years indicate that the salmon observed during the peak counts, represents the majority of the spawning salmon. There are usually very few carcasses observed at this time. Calculations indicate that the historically reported AUC spawning numbers are likely to be around 1.5 x the number seen on the recent Peak Counts. Using this multiplier for calculating comparable spawning numbers in each stream, the graphed results look very similar to the historically reported results using the AUC model.

The Waiau and Hurunui aerial Peak Count was planned for the first available day after the Rakaia count, given the historically similar timing of the spawning, and occurred on the 26th April. Data from these Peak Count flights has historically been used with similar weight for advocacy purposes, as the comprehensive data from the AUC method of five flights for the Rakaia and Waimakariri rivers. The total run is not calculated for the Hurunui or Waiau Rivers, as the angler catch phone survey does not sample enough anglers who caught salmon from each of these rivers, to provide a sufficiently precise statistical extrapolation when calculating the total number of salmon caught.

b. Angler Salmon Catch

A phone survey was carried out at the end of the salmon fishing season with 738 randomly selected North Canterbury licence holders, to determine the number of salmon that were caught from each river. An additional survey was also carried out on 421 of 471 ‘expert’ anglers, (identified as having caught one or more salmon in previous seasons) which had been removed from the random database. The survey results were then analysed and the results extrapolated to include all licence holders in the region. An estimate of the total salmon catch in each river by North Canterbury licence holders was then calculated.

In the survey, it is important that salmon kept or killed are recorded separately and all anglers who caught salmon were asked**,** “*Did you intentionally release any of the salmon you caught, and if so, how many in each river?”* Additionally, those anglers who caught salmon were asked “*Did you notice whether any of the salmon you caught were Adipose Fin-Clipped, and if so, how many from each river?”* The full questionnaire can be found in Appendix 2.

A similar survey conducted by CSIF&G provided data on the number of salmon caught by their anglers in North Canterbury rivers. This data is combined with harvest figures from the NCF&G survey to give the total angler salmon harvest in the region's main salmon rivers. The CSIF&G survey also asks the "release" and "fin-clip" questions as above, however the data for this report has been analysed using NCF&G licence holders' catch figures only.

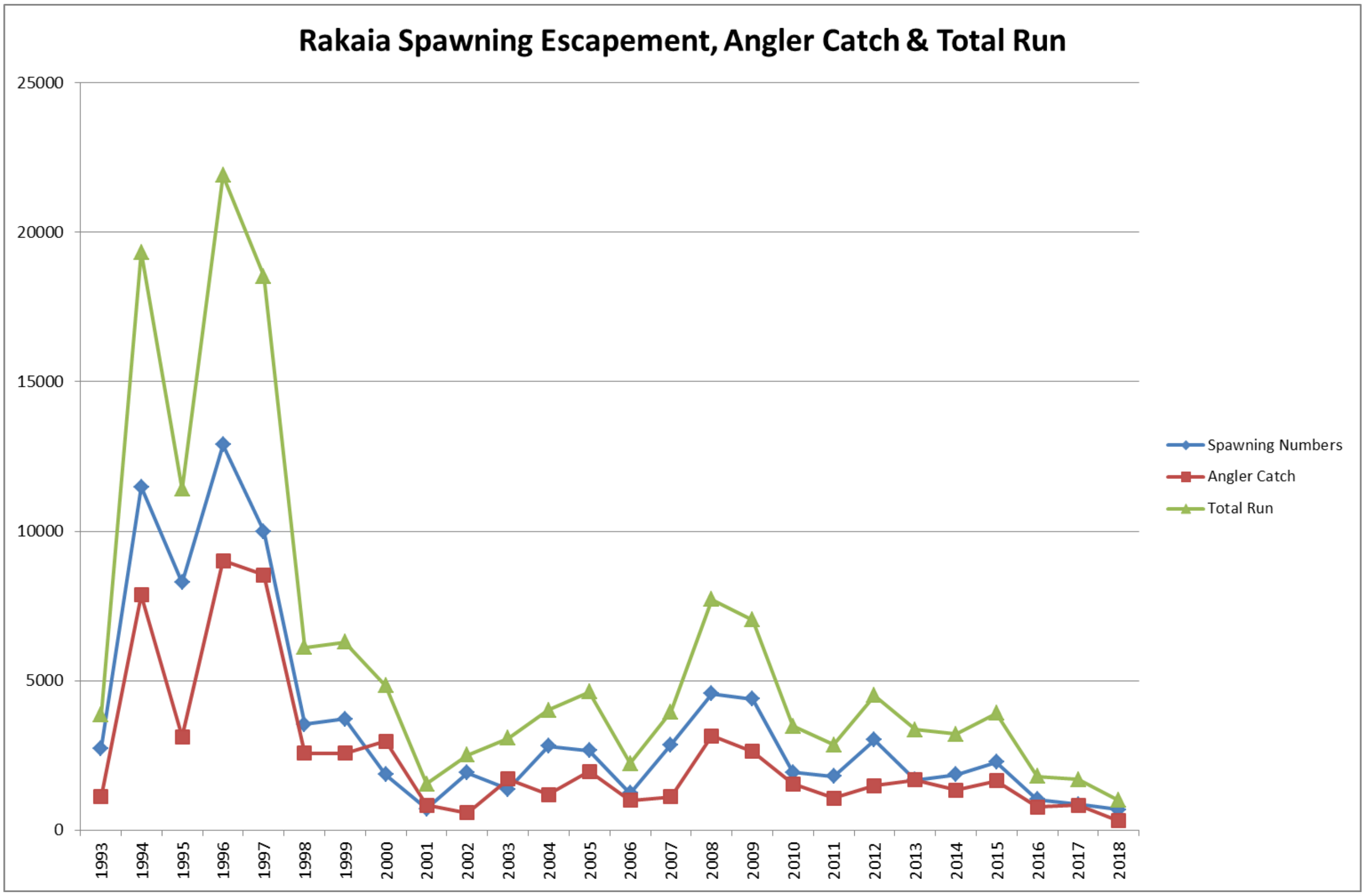
Irrigation and Development

The significantly increased sampling effort that would be required to obtain precise catch estimates for the Hurunui and Waiau cannot be justified financially. Unfortunately, this means that estimates for these rivers can be highly influenced by the harvest data of only one or two anglers in the random survey, as appears to be the case again this year for the Hurunui River angler catch. Whilst the estimate of angler catch varies from year to year, actual angler harvest and spawning numbers in these two smaller fisheries follows trends similar to the larger Waimakariri and Rakaia rivers.

RESULTS

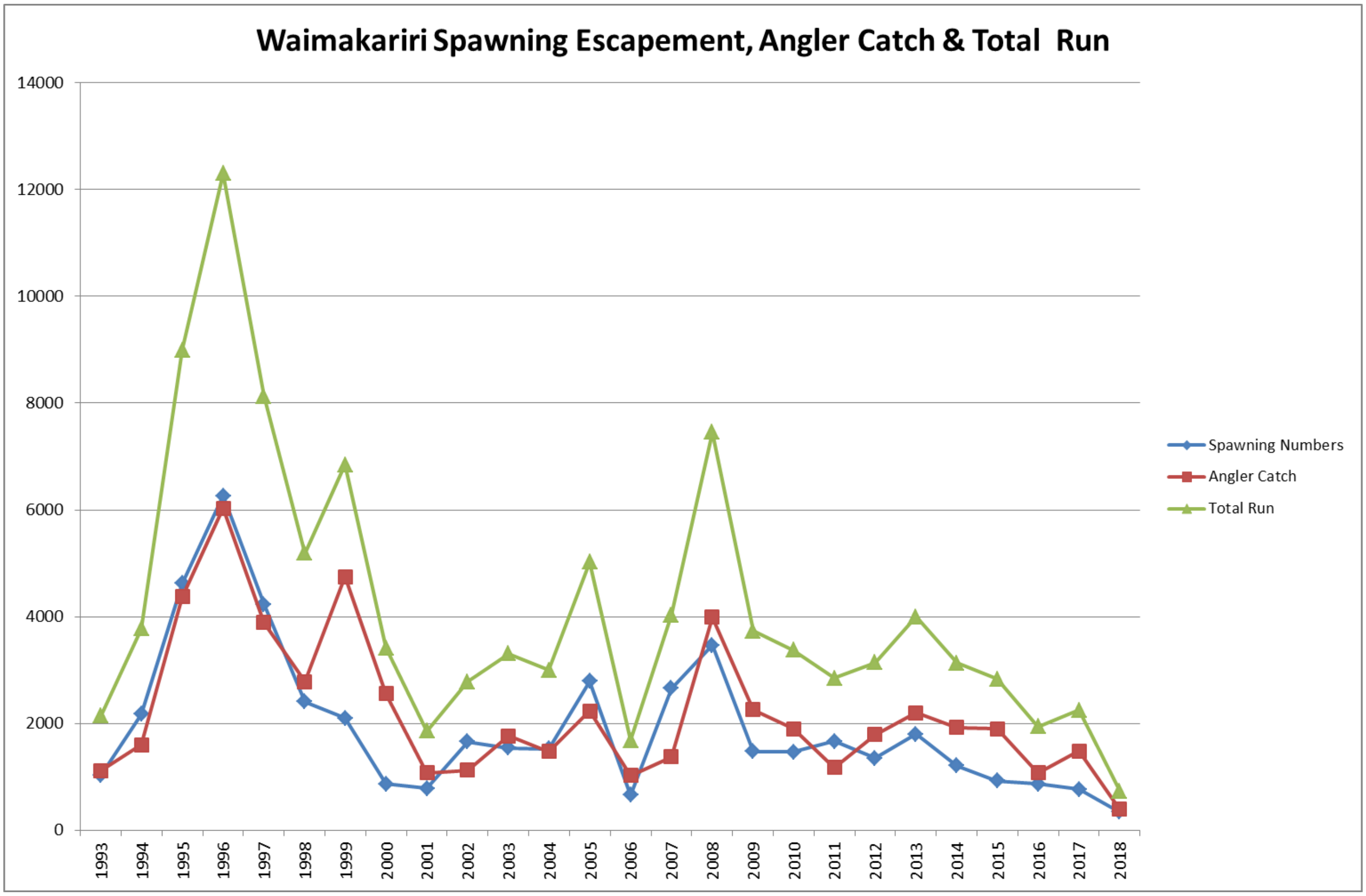
a. Rakaia River Returns

The AUC historic total run has been calculated using the 1.5 multiplier of the Peak Count from 2013, and from the graph below, the total run in the Rakaia was the lowest seen in over a decade, but similar to that seen in 2001, the lowest year on record. See Appendix 1 for counts on each spawning stream, and Appendix 3 for comparisons between methods.



b. Waimakariri River Returns

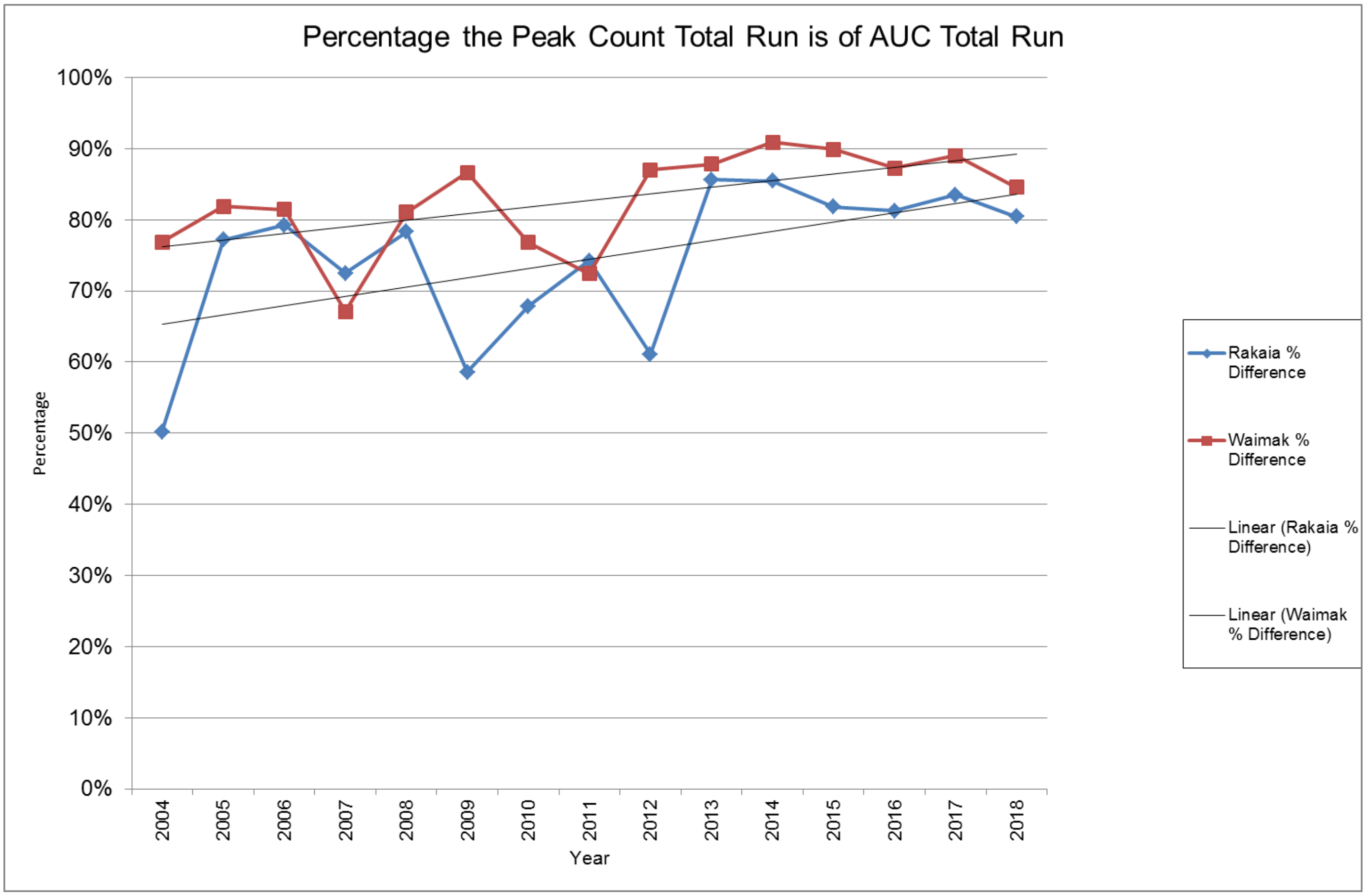
Perhaps not surprisingly many Waimakariri anglers perceived last season as a poor salmon fishing season, and it was, with the poorest run of fish since records began. A number of anglers in the phone survey did however report a very successful seasons fishing upriver. The Peak Count total run has been estimated by multiplying the Peak Count by 1.5. See Appendix 1 for counts on each spawning stream, and Appendix 3 for comparisons between methods.



c. Peak Count vs Traditional AUC Methodology

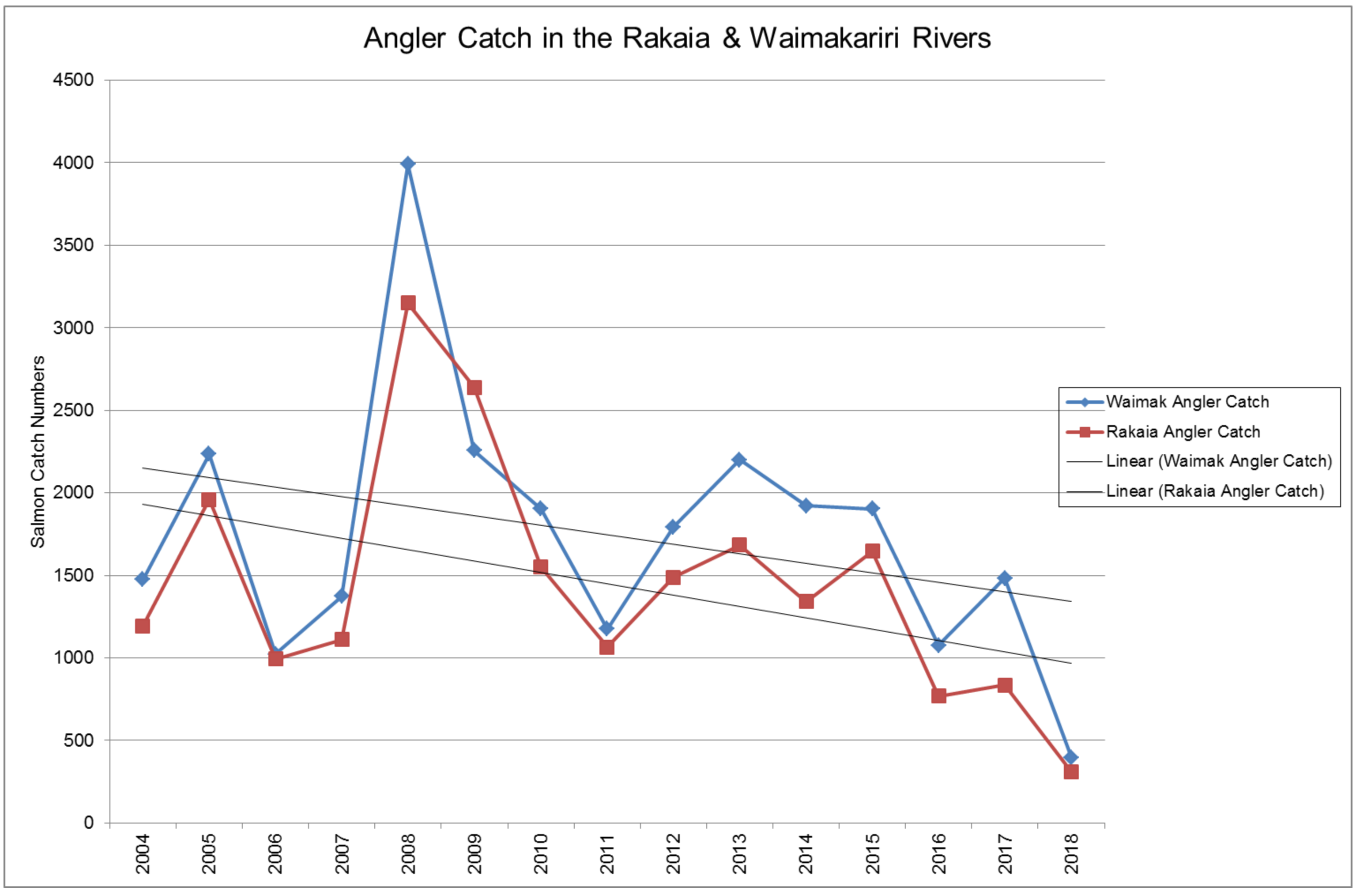
The graph below shows what percentage the Peak Count calculated total run is, of the historically calculated AUC total run for the Rakaia & Waimakariri rivers. This ranges from around 65% in the Rakaia to 90% in the Waimakariri, but is trending up as the Peak Count method is refined each year. The Peak Count method is likely to lead to a further reduction in this difference in future years, as carcasses and salmon below the spawning reaches are now also included in the Peak Count figures, which had not previously been included.

One of the main differences between the two methods is the resulting effect the Peak Count methodology has on the reported angler harvest, as a percentage of the total run, with calculations showing the Peak Count average angler harvest, 10% higher than reported using the AUC method, at well over 60% in the Waimakariri River.

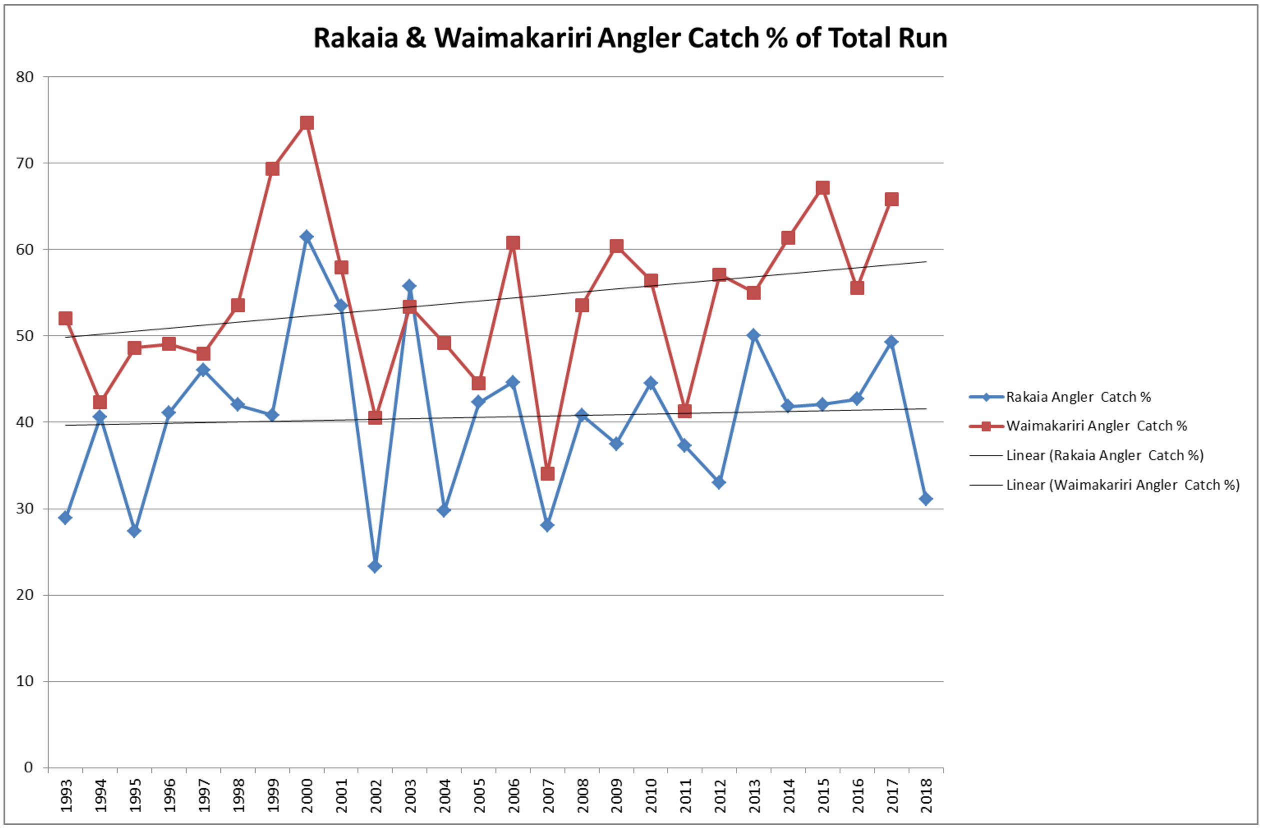


d. Angler Catch in the Rakaia & Waimakariri Rivers

The Waimakariri had the lowest number of salmon caught since records began.
Anglers Colin and Diane Eaton, along with Peter Robinson collected catch data from the lower Waimakariri River again this year, including fin-clipped salmon (see appendix 5). Of note is the low harvest of fin-clipped salmon caught when very few also arrived back to the Silverstream Hatchery. This data has not been compared with the phone harvest data as the phone survey does not break down catch into the different areas of the river, and covers all the river. Both the Rakaia & Waimakariri rivers have shown similar trends in catch numbers over the last 14 years. The angler catch in the Rakaia River was 309, and in the Waimakariri River (including the Kaiapoi River) the angler catch was 394. A full table of results can be found in Appendix 4.



The following graph shows the angler catch as a percentage of the total run in the Rakaia & Waimakariri rivers, with both these catch rates trending up over the last 15 years.

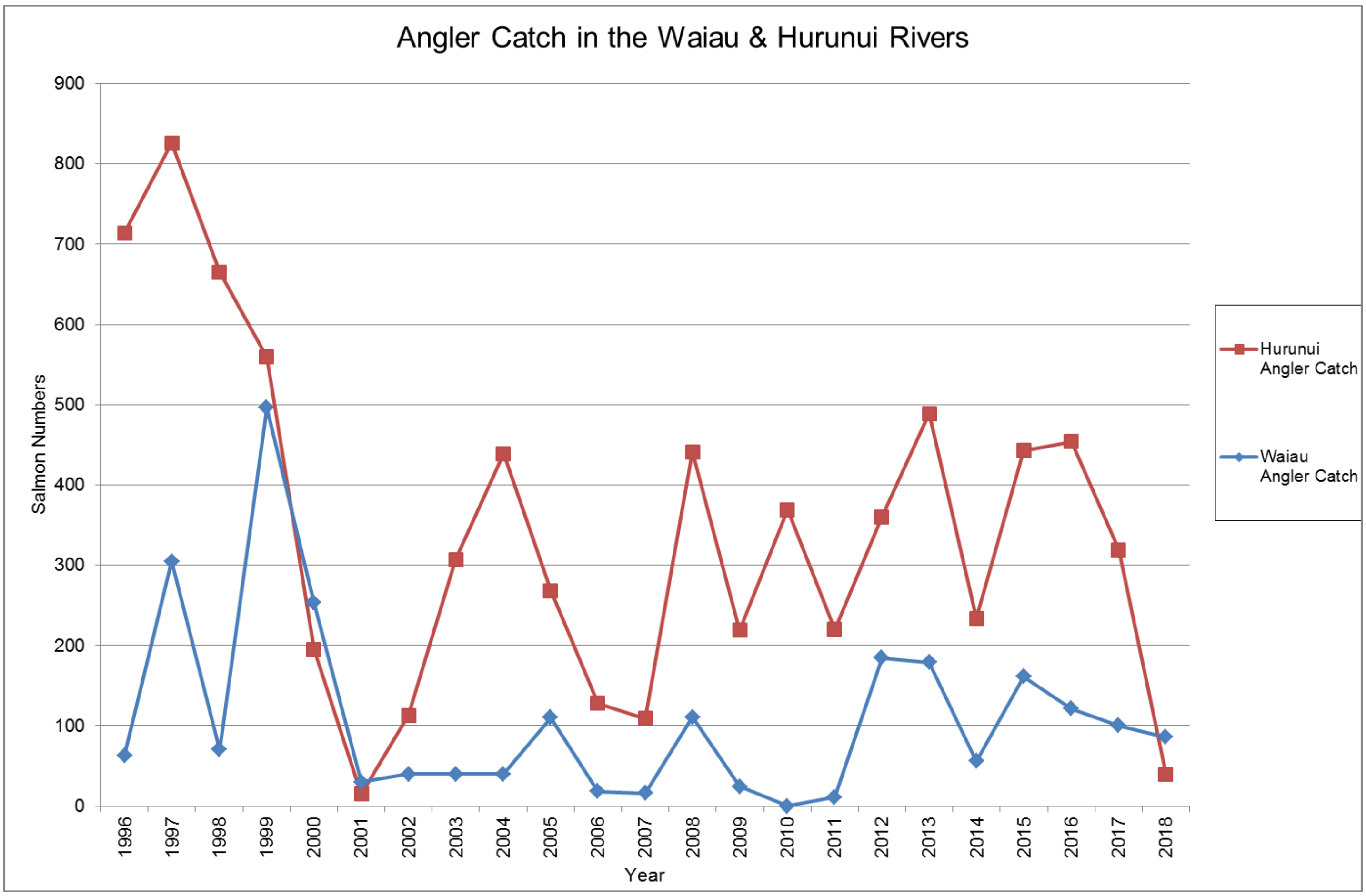



Historic photo of salmon congregating in the Poulter River before heading upriver into the spawning streams

e. Hurunui / Waiau River Salmon Returns

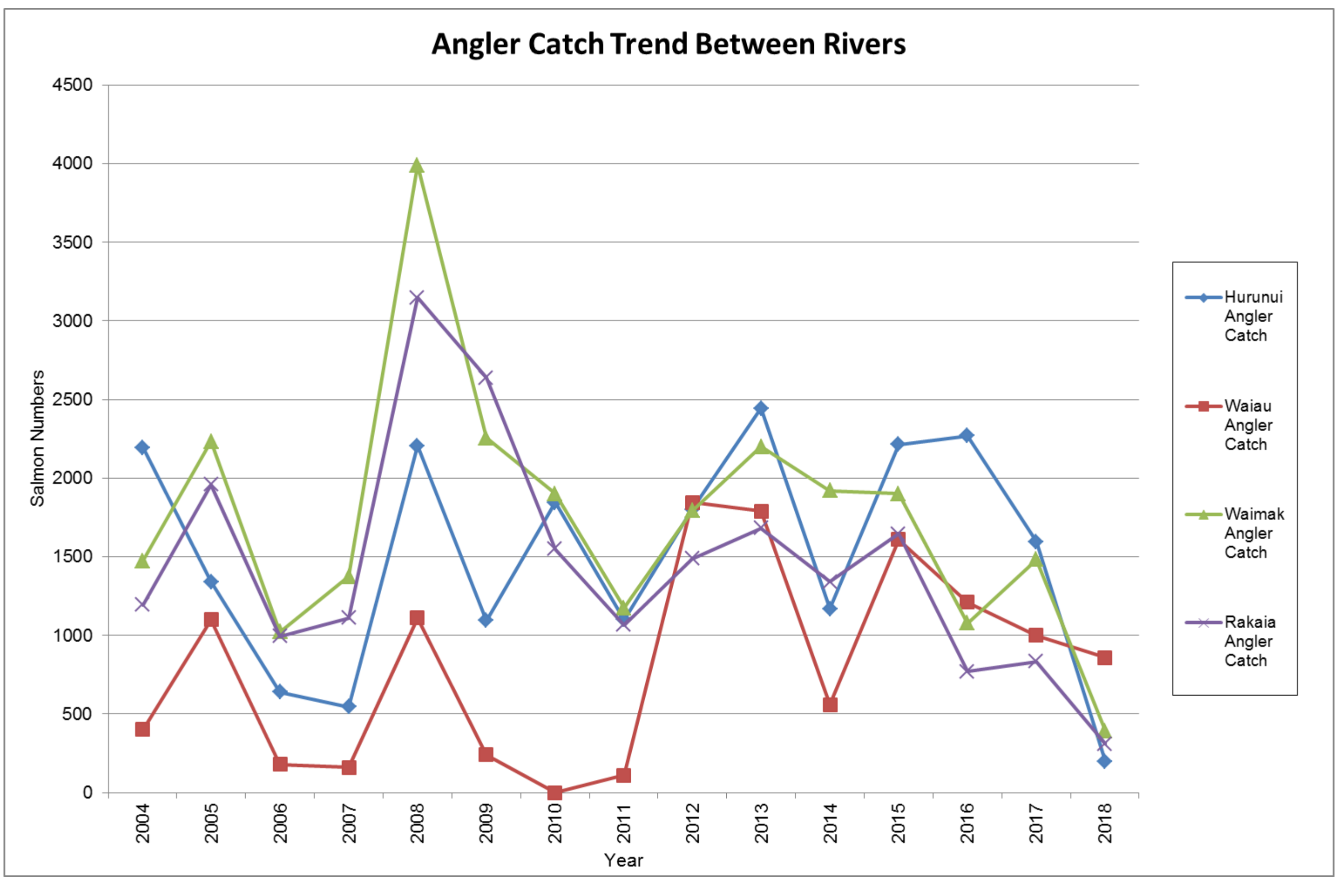
The annual aerial Peak Count of the Hurunui and Waiau rivers was carried out on the 26th April. The angler catch survey shows 40 salmon were caught in the Hurunui River and 86 in the Waiau River. Given the low number of anglers that caught salmon last season, there is likely to be a greater error shown with data from these two rivers.

The following graph show the similar trend observed between the Waiau & Hurunui in angler catch.



f. Trends in Angler Catch Between the Four Main Rivers in North Canterbury

The following graph shows the trend in angler catch between the four main North Canterbury rivers each season. To show catch figures in this graph on a similar scale, Hurunui catch figures have been multiplied by five and Waiau figures by ten. This shows that the catch trend largely mirrors itself across all North Canterbury rivers each year. The accuracy of angler catch figures for the Waiau and Hurunui rivers has increased over the last four years following the change in the angler catch monitoring method, to include surveying all anglers each year that had caught a salmon in the previous five years. Over time, this new survey method of classifying anglers previously surveyed with high harvest levels as "experts" and removing them from the random survey, will reduce the chance of anglers who have caught significant numbers of salmon showing up in the random survey, increasing the accuracy of the data. Note; the 2010 angler catch was calculated as 0 in the Waiau, but likely followed a similar trend as other rivers with an estimated catch of around 100.



g. Central South Island Region Salmon Returns

Salmon returns to the Rangitata and Waitaki rivers showed very similar characteristics to the North Canterbury rivers, with below average returns last season. The NCF&G angler catch survey calculated that North Canterbury anglers caught an estimated 24 salmon in the Rangitata River and 2 in the Waitaki River.

h. Angler Catch in North Canterbury Rivers by Central South Island Licence Holders

Angler catch records from CSIF&G phone surveys show their anglers caught 76 salmon in the Rakaia River, 12 in the Waimakariri River and 41 in the Waiau River (it should be noted that this was the result of extrapolating the data from one CSI angler who caught 5 salmon in the Waiau). Previous phone surveys indicate that very few salmon are caught in all but the two main North Canterbury rivers by CSIF&G anglers and this is also true of this year’s surveys.

DISCUSSION

North Canterbury salmon anglers experienced one of their poorest salmon fishing seasons ever during the 2017/18 season. Not only were returning numbers low, the main salmon rivers were fishable for less than 50% of the main season, with anglers hearing few success stories to keep them enthusiastic. The recent downturn in salmon productivity and abundance along the East Coast of the South Island is frustrating for anglers. Most of the salmon life cycle occurs in the Pacific Ocean and similarly to North American concerns over low Chinook salmon returns, is largely due to the many variable ocean influences.

There are many variables that effect salmon survival and even more theories amongst anglers as to the reason the fishery has not been performing. There are essentially two areas the salmon spend their life; freshwater and the ocean. Almost all the ocean variables that influence salmon survival are beyond our control, however many of the freshwater variables that influence their survival can be improved to minimise mortality during this stage in their lifecycle.

Preserving the pristine state of our spawning streams is critical to the ongoing sustainability of our nationally significant salmon fisheries and is one of the key areas where Fish & Game can influence survival of salmon during their time in freshwater. Considerable staff time is spent each year to advocate for improved environmental requirements in local and regional plans. Unfortunately many of the factors and variables that are likely to influence juvenile salmon survival in fresh water are beyond our direct or immediate control. However it is hoped that ongoing advocacy can influence issues such as water abstraction, ineffective fish screens and the long term cumulative degradation of habitat and water quality.

ECan has recently completed a pilot study on fish screen compliance. Fish & Game is pleased with progress on this, and both CSI and NCF&G have provided ECan with a list of priority screens to be included in a more comprehensive study during the 2018/19 irrigation season. In essence, this is the pathway staff have been advocating for over the last decade and it is great to see ECan finally addressing this issue. The outcome from this project will likely mean a number of screens will require significant upgrades at minimum, with a high percentage of them also likely needing to be replaced. The outcome is to ensure that more salmon and trout remain in, or are returned to our rivers.

In recent years, staff have placed more emphasis on the overall ecological health of the high-country salmon spawning streams, including the wetlands and riparian zones surrounding them. A gradual decline in in-stream and riparian habitat on some of the streams is likely to have reduced the spawning and rearing habitat quality. This is likely to have resulted in reduced spawning success (lower % of fry hatch/emergence) and the premature migration of many juvenile fry from the streams, due to reduced food abundance, into the flood-prone main stems (S. Terry, pers. obs, D. Willis, pers. comm.).

When premature migration occurs, fry are not strong enough to swim against flood currents, and the majority are forced downstream and out to sea before they smoltify at around seven grams. If they are forced from the river prior to smoltifying, they are unable to make the transition to salt water and die. During most years, major spring floods are common, and therefore most of the salmon that are forced to migrate out of the spring creeks earlier than desirable are likely to suffer this fate.

Due to their concerning observations, F&G staff approached ECan in 2013 and began a three-year monitoring program on the health of some of the key spawning streams throughout Canterbury. A report was released in August 2018 by ECan, which clearly shows detrimental effects on some of the stream invertebrate and periphyton communities, with relatively small elevations in nutrients due to farming intensification. Build-up of fine sediment on stream beds also has a negative impact on stream invertebrates. Once fine sediment is deposited in a spring fed stream, it is likely to take a long time, if ever, to flush out due to stable flows. While many of the streams studied show near pristine habitats, some also showed impacts from farming, and this data provides an essential baseline for reference in future years. Staff will use this to work with landowners to ensure improved protection of the key spawning streams.

Staff have found that monitoring provides a valuable opportunity to involve the landowners when gathering data, enabling long-term data sets to be collected for greater understanding of issues, and ensuring that local changes can be suggested when required. The relationships that have been developed with these landowners are critical to achieving changes in land management practice that are required around sensitive spring streams.

Following discussions with both ECan & Cawthron biologists, staff would like Council to consider proactive monitoring for the potential long-term detrimental downstream effects of intensification, in the headwaters of the salmon catchments. The cumulative impact this is likely to have on downstream water quality is unknown, but discussions with biologists indicate we are likely to see negative long-term effects from this intensification.

Current research shows that even relatively small increases in nitrogen causes changes to periphyton communities, reducing abundance and diversity of invertebrates relied upon by juvenile salmon as they migrate to sea. This is further compounded by the continued reduction in the number of side braids in the lower reaches, due to abstraction. We must be able to strongly advocate for conservation of these critical habitats as the resulting salmon are valued by thousands of anglers.

At the 2017 Salmon Symposium there was discussion around reducing salmon harvest, to ensure a greater proportion of returning salmon reached their natal spawning grounds. The Waimakariri River for example frequently has 60% harvest of the returning salmon. Long-term datasets of harvest and spawning numbers in the Rakaia and Waimakariri rivers have been analysed by Alaskan statistician Dr. Steve Fleischman, along with D. Willis and they both believe that we are likely harvesting our salmon above the maximum sustainable yield and that the current harvest levels are likely to be delaying the rebuild of the fishery, or even accelerating the decline. There is considerable effort and money being spent in Alaska and Canada, gathering essential information necessary to understand recent declines in their Chinook returns. Willis recommended introducing several regulations that could be implemented to achieve a reduction in harvest. He noted that each incremental reduction in harvest was likely to have the compounding effect of increasing spawning numbers, which would help rebuild the fishery. Management decisions require an adaptive approach, which over time, has the greatest chance of achieving long term sustainability of the salmon fishery.

Rakaia River in flood November 2017 – a common sight last season.

When looking at spawning data, it is apparent that some years with very low salmon returns still generate favourable returns three years later and vice versa. This suggests that while low spawning numbers are likely to produce fewer juveniles, the salmon may benefit from reduced densities and therefore greater food availability, remain in the headwaters longer and therefore reach the ocean at a larger size and have a greater chance of survival. Conversely, high spawning densities may oversaturate the freshwater habitat, reducing food supply and causing an early migration to the ocean, thereby reducing survival chances.

Many anglers continue to blame commercial trawlers for catching too many salmon. In the 1980's this was a significant factor, but the "Salmon at Sea Agreement", which has been in place since the early 1990's, takes the profit out of specifically targeting salmon, with 80% of the money from the sale of salmon caught at sea taken as a levy by MPI, and commercial operators now regard salmon as an unwanted by-catch. Salmon caught by trawlers has now become insignificant and is a minor concern for both NCF&G & CSIF&G.

From past records, we know that most salmon are caught commercially in an area around Banks Peninsula between December and February. Trawlers that intend to fish in this area during this period have historically been required to have an observer, or verifier on board, however meetings with the commercial operators has led to an agreement that this option is now at the request of Fish & Game, and not compulsory. Trawlers are now required to GPS plot each trawl they make with records supplied to MPI. In years when salmon are more abundant, trawlers catch greater numbers, however in both good and bad years, this catch is now considered insignificant.
Contrary to popular belief, boats seen trawling past river mouths rarely catch salmon, as they are trawling too slowly, and are targeting other species such as elephant fish and flatfish. It is only the larger boats trawling at greater speeds that have a real chance of catching salmon and even then, usually only in specific areas at certain times of the year. People often also assume that foreign trawlers are coming in at night and catching the salmon. There were reports of this occurring many years ago, but modern technology now allows accurate monitoring of who is fishing in the New Zealand economic fishing zone.

Fish & Game often receives anecdotal reports that large quantities of wild salmon have been caught off the Canterbury coast by commercial trawlers, with last season no exception, with reports of tonnes of salmon landed by the commercial sector. Investigations showed a large number of salmon had escaped from a commercial salmon farm in Akaroa Harbour early last season and these were the salmon being landed. There are only a limited a number of boats allowed to fish for salmon in the exclusion zone off Banks Peninsula, where there is a maximum of 5,000kg by-catch permitted each year amongst the parties who originally signed the Salmon at Sea Agreement. The owner of Pegasus Fisheries based in Lyttelton (Tony Threadwell), indicated this season had also been a very poor season for Red Cod, Barracuda and Blue Warehou, their three main quota species which tend to have similar abundance periods as salmon and he pointed to ocean temperatures as a strong indicator, which had been 2 – 3 degrees warmer than usual last season.

NCFGC is tasked with setting regulations with the intent of maintaining sustainable fisheries. This is difficult to achieve for a number of reasons, notably our inability to regulate adaptively, as we are required to set regulations well in advance of the season ahead. Sustainability requires sufficient returns to spawning streams, while trying to satisfy angler harvest expectations at the same time, almost a contradiction in objectives. However, with an increasing trend in the proportion of returning salmon harvested, particularly in the Waimakariri fishery, that the Council must take greater steps to reduce angler harvest, which international experience shows is best achieved with a number of incremental changes. Passionate anglers must recognise that sacrifices are necessary to preserve the fishery, and accept that the reduction in opportunity to harvest salmon each season is reasonable in the current environment.

The salmon monitoring program is continuing to add knowledge of the salmon fishery, however with the many environmental variables involved, and our limited understanding of the processes driving the highly varied fluctuations in salmon survival at sea, the ability to predict future returns still appears to be some way off.

Rock Bund Fish Screen – Irrigation industry now agree these are ineffective and difficult/expensive to monitor

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Lake Stream flowing from Lake Heron – still unfenced but low intensity farming…for now

APPENDIX 1

<u>Aerial Count Dates & Hatchery Returns</u>

2018	Rakaia	Hydra	Double	Glenariffe	Manuka	Goat Hill	Wilberforce					
	22/04/2018	62	21	47	81	6	1					
	Hur/Wai	Sth Hur	Nth Hur	Hope/Kiwi	Waiau							
	26/04/2017	22	6	1	41							
	Rakaia	Hydra	Double	Glenariffe	Manuka	Goat Hill	Wilberforce	Mellish				
	3/05/2018	123	14	54	81	14	1	95				
	Waimak	Winding	Cass	Poulter	Thompso	One Tree	Cora Lynn					
	15/05/2017	32	33	106	8	6	4					
	Waimak	Winding	Cass	Poulter	Thompso	One Tree	Cora Lynn	Railway	Bealey	Turkey		
	31/05/2017	18	34	94	5	6	30	4	4	5		

APPENDIX 2

<u>2018 Salmon Angler Survey</u>

1. The Purpose

This survey is aimed at estimating the number of salmon caught by anglers during the recent season. The people you will contact are all anglers who Fish & Game have categorised as either "EXPERTS" on the attached database or "RANDOMLY SELECTED" from our fishing licence database.

2. Who to Ring

The names and phone numbers of the anglers you are to ring are included on the attached databases.

3. When to Ring

Phone calls should be made in the evenings between 7.00pm and 9.00pm, Monday to Friday only.

4. The Survey

Introduce yourself and ask to speak to the person on the list.

"Hello, my name is _____ _____, and I am ringing on behalf of North Canterbury Fish and Game, can I please speak with Mr. John Smith" etc.

If the person you are after is the person that answers the phone, continue with, "C**an you please participate in a short survey about salmon fishing?"**

Or, once you are talking to the correct person, introduce yourself again and ask if they would be prepared to participate in a short survey.

“Hello, my name is _____ _____, and I am ringing on behalf of North Canterbury Fish and Game, can you please participate in a short survey about salmon fishing?”

If they say **“No”,** reply “**Thank you for your time, goodbye**”, and mark in the appropriate box in the survey sheet that they (**Decline)** to be involved.

If they reply **“Yes”,** carry on and complete the survey as follows;

Ask those anglers who agree to participate,
“**Did you go fishing for sea-run salmon during the recent 2017/18 season?”**

If they answer “**No**”, mark the appropriate box in the survey sheet (**Did Not Fish For Sea-Run Salmon**), reply “**Thank you for your time, goodbye**”, and finish the survey.

If they replied **“Yes”,** ask them,
“How many sea-run salmon did you catch and keep from each river during the last season?” Many anglers will answer “**None**”, if so, mark the appropriate box in the survey sheet, (**Fished for, But Didn’t Catch Sea-Run Salmon),** and reply, “**Thank you for your time, goodbye**”, and finish the survey.

For those anglers that answered **“Yes”,** they had caught and kept sea-run salmon, mark the appropriate box in the spreadsheet **(Fished For & Caught Sea-Run Salmon = Yes),** and also enter the number caught and kept in the (**Appropriate Yellow Highlighted River Column**).

Anglers may also reply that they “released” or “let salmon go”. It is important that you separate salmon kept or killed, from salmon released on the survey form. To do this, ask all anglers that caught salmon, “**Did you intentionally release any of the salmon you caught, and if so, how many in each river?”** Mark the total number intentionally released back into each river in the appropriate column, **(Number of Intentionally Released Salmon From Each River).**

Finally, for those anglers that caught salmon, ask them,
“Did you notice whether any of the salmon you caught were Adipose Fin-Clipped, and if so, how many from each river?”
Mark their response in the column marked (Number of Fin-Clipped Salmon Caught From Each River), and reply, “**Thank you for your time, goodbye**”, and finish the survey.

5. What to do if you cannot get hold of the person on the list.

If the phone is not answered, or the person is not home, put a cross in the “**Callback**” boxes after their number on the phone list. Contact them again a few nights later and if the phone is not answered or the person is not home once again, try another angler on the list.

If the phone is answered and you are told that you have the wrong number, the person has moved or that the person is away for some time, mark the appropriate box on the survey form **(Moved, Wrong Number etc),** and do not attempt to contact them again.

Thank you for your help with this survey.

For further information contact:

Steve Terry

sterry@fishandgame.org.nz

(03) 324 3836 (home)
(021) 221 8327 (mobile)

Fish & Game Officer Tony Hawker using a bathyscope to monitor substrate and periphyton

APPENDIX 3

Rakaia Tributaries											Rakaia
	Hydra Waters	Manuka Pt	Double Hill	Glenariffe	Mellish, Goat	Montrose	Nat Spawning	Spawning	Angler	Total	Angler
	RT=14.67	RT=16.7*	RT=13.95	RT=18.5	Wilberforce Strm	Trap Census	(Exc. Montrose)	Numbers	Catch	Run	Catch %
1993	1113	209	704	713			2739	2739	1116	3855	29
1994	4021	467	2491	4497			11476	11476	7861	19337	41
1995	3689	386	1185	3026			8286	8286	3120	11406	27
1996	4653	811	1985	5442			12891	12891	9008	21899	41
1997	2998	966	2401	3630			9995	9995	8531	18526	46
1998	1559	216	857	912			3544	3544	2567	6111	42
1999	1510	302	377	1528			3717	3717	2567	6284	41
2000	812	175	604	271			1862	1862	2975	4837	62
2001	476	43	103	100			722	722	829	1551	53
2002	1382	193	258	93			1926	1926	585	2511	23
2003	674	196	284	89		120	1243	1363	1714	3077	56
2004	1456	298	303	649		110	2706	2816	1195	4011	30
2005	898	289	306	325		850	1818	2668	1958	4626	42
2006	357	87	132	147	400	110	1123	1233	994	2227	45
2007	1471	286	243	583	90	180	2673	2853	1110	3963	28
2008	1499	990	463	811	550	250	4313	4563	3149	7712	41
2009	1372	618	647	958	350	450	3945	4395	2639	7034	38
2010	497	377	289	504	150	112	1817	1929	1550	3479	45
2011	748	169	98	173	350	257	1538	1795	1066	2861	37
2012	798	758	129	628	500	210	2813	3023	1488	4511	33
2013	516	198	98	234	384	250	1430	1680	1683	3363	50
2014	183	533	111	198	341	500	1366	1866	1341	3207	42
2015	503	602	173	599	263	130	2140	2270	1647	3917	42
2016	153	368	101	165	228	17	1015	1032	769	1801	43
2017	288	227	30	47	245	20	837	857	834	1691	49
2018	**185**	**122**	**32**	**81**	**117**	**101**	**537**	638	**309**	947	33

Waimakariri Tributaries											
	Poulter	Winding Crk	Cass Hill	Cora Lynn	Bealey/Rail/Turk	Silverstream	Nat.Spawning	Spawning	Angler	Total	Angler
	RT=21*	RT=15.42	RT=16.7	RT=28	One Tree Swamp	TrapCensus	excl.Silverstrm	Numbers	Catch	Run	Catch %
1993	304	327	213	186	Not Counted^		1030	1030	1116	2146	52
1994	363	236	438	285	Not Counted^	855	1322	2177	1597	3774	42
1995	1225	1011	817	337	Not Counted^	1230	3390	4620	4372	8992	49
1996	1559	2336	1045	508	Not Counted^	818	5448	6266	6033	12299	49
1997	726	824	1362	491	Not Counted^	830	3403	4233	3893	8126	48
1998	505	417	840	389	Not Counted^	260	2151	2411	2778	5189	54
1999	593	417	302	289	Not Counted^	500	1601	2101	4748	6849	69
2000	166	86	185	80	Not Counted^	347	517	864	2553	3417	75
2001	63	27	117	28	Not Counted^	547	235	782	1075	1857	58
2002	878	313	148	69	Not Counted^	250	1408	1658	1128	2786	40
2003	414	183	342	Not Counted^	Not Counted^	600	939	1539	1764	3303	53
2004	480	278	251	312	Not Counted^	205	1321	1526	1475	3001	49
2005	960	689	320	381	138	300	2350	2788	2234	5022	44
2006	89	88	131	101	80	170	489	659	1022	1681	61
2007	521	433	532	788	110	275	2384	2659	1373	4032	34
2008	1601	443	386	355	320	360	3105	3465	3991	7456	54
2009	537	109	244	127	100	360	1117	1477	2256	3733	60
2010	468	318	473	109	40	60	1408	1468	1902	3370	56
2011	577	354	281	333	65	60	1610	1670	1175	2845	41
2012	400	297	148	192	70	240	1107	1347	1793	3140	57
2013	723	140	162	408	24	340	1457	1797	2199	3996	55
2014	362	173	129	108	86	350	858	1208	1921	3129	61
2015	495	77	83	126	78	70	859	929	1902	2831	67
2016	386	41	107	86	123	120	743	863	1077	1940	56
2017	405	35	107	93	101	27	741	768	1482	2250	66
2018	**171**	**48**	**51**	**45**	**29**	**8**	**344**	**352**	**394**	**746**	**53**

Waiau and Hurunui Trend Counts					
Year	**Date**	**Hurunui Peak Count**	**Hurunui Angler Catch**	**Waiau Peak Count**	**Waiau Angler Catch**
1995		89		243	
1996		47	714	420	63
1997		329	826	393	305
1998		114	665	146	70
1999	11-May	129	559	281	496
2000	10-May	64	195	111	253
2001	3-May	20	15	87	30
2002	9-May	132	113	162	40
2003	7-May	151	307	203	40
2004	10-May	106	439	121	40
2005	24-May	93	268	197	110
2006	16-May	37	128	66	18
2007	8-May	80	109	168	16
2008	15-May	138	441	614	111
2009	12-May	109	219	316	24
2010	11-May	58	369	192	0
2011			220		11
2012	19-May	309	360	663	185
2013	15-May	155	489	569	179
2014	16-May	108	234	184	56
2015			443		161
2016	21-Apr	90	454	292	121
2017	12-May	154	319	172	100
2018	**26-Apr**	**28**	**40**	**42**	**86**

APPRENDIX 4

Experts			
	Surveyed Harvested	**Extrapolated Harvested**	
Waimak	65	**73**	1.12
Kaiapoi	9	**10**	
Rakaia	119	**133**	
Rangitata	17	**19**	
Hurunui	25	**28**	
Waiau	7	**8**	
Waitaki	8	**9**	
	Experts	471	
	Surveyed	421	
Extrapolation Multiplier = 471 experts / 421 experts surveyed = 1.12			
Random			
	Surveyed Harvested	**Extrapolated Harvested**	
Waimak	19	**237**	12.472
Kaiapoi	5	**62**	
Rakaia	8	**100**	
Rangitata	10	**125**	
Hurunui	1	**12**	
Waiau	3	**37**	
Waitaki	0	**0**	
	Licences	9675	
	Random	738	
	Experts	471	
Multiplier = (9675 licences - 471 experts) = 9204 / 738 surveyed = 12.472			
Total Harvest Inc CSI			
	Harvested	Plus CSI Harvest	**Total Harvested**
Waimak	310	12	**322**
Kaiapoi	72	0	**72**
Rakaia	233	76	**309**
Rangitata	144	0	**144**
Hurunui	40	0	**40**
Waiau	45	41	**86**
Waitaki	9	0	**9**

APPRENDIX 5

Email from Karl French, Manager of Silverstream Hatchery (4 Oct 2018).

Last year was 3 in the trap and 5 in the stream.

From: **Peter Robinson <perobbo@gmail.com>**

Date: **2 May 2018 at 1:13:20 PM NZST**

To: **Colin and Dia Eaton <colinanddiaeaton@xtra.co.nz>**

Subject: Re: Salmon caught at Mackintosh's area 2017/18 season.

Hi Colin

Thanks for the info

This is what I had for the mouth

Both sides

Nov 1 Dec 3 jan 4 feb 0 March 18 April 0

Brooklands side 5

Kairaki 21

26 total for season

Peter

From: **Colin and Dia Eaton**

Sent: **Wednesday, May 2, 2018 10:04 AM**

To: **Terry steve ; Barr Dirk**

Cc: **Eaton Colin**

Subject: **Salmon caught at Mackintosh's area 2017/18 season.**

A very interesting season count this year.

Due to the number of days that the river was unfishable,74 days out of 120 from 1st January till 30 April no wonder the count is down.

December 2017 =15

January 2018 = 4

February 2018 = 8

March 2018 =16

April 2018 = 1

Total = 44

Of the total only 6 were fin clipped 13.6%

My observation this year was the numbers of fishermen was down compared with other years, many days only a handful sitting on the rocks and boats.

It was also more difficult to get reliable information so this years count could have a greater degree of error.

Never mind the season will go down in history as a poor year.

I trust this information is of use to your organisation and I am only to happy to submit it.

Regards Colin Eaton

Committee member NZSAA

Angler Catch Waimak Mouth	Total	Nth Side	Sth Side	Fin-clipped	Angler Catch Waimak Mcintosh's	Fin-clipped
2013/4	263	164	97	23 - N	497	85
2014/15	336	256	80	13 - N	253	46
2015/16	195	24	171	5 - S	273	37
2016/17	358	233	125	9 - N	225	102
2017/18	**26**				**44**	**6**

APPRENDIX 6

2018 Spawn	Jacks	Hens	Fin Clip	Tagged	Total
18th March	1 Jack		Yes		1
21st March		2 Hens	Yes		2
29th March	1 Jack	2 Hens	1 Yes		3
30th March	1 Jack	1 Hen	Yes		2
31st March	1 Jack	4 Hens	3 Yes		5
3rd April		2 Hens	Yes		2
4th April	1 Jack	1 Hen	Yes		2
5th April		1 Hen	Yes		1
6th April	1 Jack	1 Hen	Yes		2
7th April		1 Hen	Yes		1
8th April	1 Jack	1 Hen	?		2
9th April	1	1 Hen	Yes		2

	Jack				
10th April	1 Jack		Yes		1
11th April	1 Jack		Yes		1
12th April	1 Jack		Yes		1
13th April	1 Jack		No		1
14th April	1 Jack		No		1
15th April	1 Jack		Yes		1
16th April	2 Jacks	3 Hens	3 Yes		5
17th April	7 Jacks	5 Hens	7 Yes	Hen Home	12
18th April	4 Jacks	2 Hens	3 Yes		6
19th April	2 Jacks		Yes		2
20th April	1 Jack		Yes		1
21st April	2 Jacks	2 Hens	2 Yes		4
22nd April	1 Jack	2 Hens	1 Yes		3
23rd April	5 Jacks	2 Hens	4 Yes		7
24th April	1 Jack	2 Hens	1 Yes		3
25th April		3 Hens	2 Yes		3
26th April	1 Jack	1 Hen	1 Yes		2
27th April		1 Hen	No		1
28th April	2 Jacks	2 Hens	3 Yes		4
30th April	2	2	2 Yes		4

	Jacks	Hens			
1st May	2 Jacks	2 Hens	2 Yes		4
2nd May		1 Hen	No		1
3rd May	2 Jacks	1 Hen	Yes		3
6th May	2 Jacks	2 Jacks	2 Yes		4
20th June	2 Jacks		1 Yes	Last Home	2
Total 101					