Salmon research report 2009

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www.gwct.org.uk/salmonreport

Game & Wildlife
CONSERVATION TRUST

Contents

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1. Abstract

Welcome to the 2009 Salmon Research Report from the Salmon & Trout Research Centre on the River Frome, Dorset. This represents the first time the annual report of fish numbers in the river has been produced by the Game & Wildlife Conservation Trust (GWCT). In March 2009 we took over the running of the fish counter and employed the three research staff being made redundant at the nearby research facility, previously run by the Government-funded Centre for Ecology & Hydrology.

Counts of adult salmon running upstream in the 12 months between 1 February 2009 to 31 January 2010, recorded 602 fish. This is the third lowest adult count since 1985 and is lower than the 10-year average (1999-2008) of 876 fish.

In addition to adult fish we also count parr in the river throughout the catchment and we mark over 10,000 of them each year with PIT tags. This represents about 10-20% of the total parr population. Parr numbers have been estimated for seven years and 2008 saw the third highest count.

We have also been counting smolts each year in April and May. We estimate that 10,913 smolts left the river in 2009, again, the third highest count since 2002.

We again recorded the migration of parr down the river in the autumn. This seems to be an active migration but the fish are not yet physiologically adapted to go to sea. Our set up for counting on the River Frome will allow us to get to the bottom of this phenomena in future years.

Professor Nick Sotherton
Director of Research

Front cover photograph: The GWCT Salmon & Trout Research Centre's salmon counter.
Page 2: The River Frome. This page: Leaping salmon. © Laurie Campbell

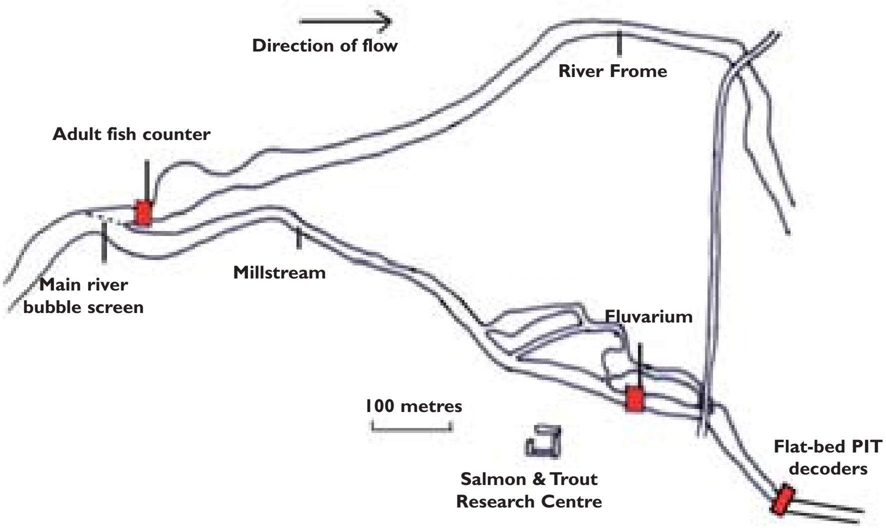
2. Introduction

In 2009 the Game & Wildlife Conservation Trust took over the responsibility for continuing to run the salmon research and adult counter at East Stoke on the River Frome. The co-operation of the Centre for Ecology & Hydrology (who previously funded the work) and the Freshwater Biological Association (who own the site) in helping this continuation of monitoring, is gratefully acknowledged.

The site at East Stoke has an unparalleled infrastructure in the river that enables us to monitor both the adult salmon migrating upstream and the juveniles going downstream. Equipment on site also allows the detection of small Passive Integrated Transponder tags (PIT tags) that we use to individually mark the juvenile salmon. Figure 1 gives a schematic plan of the East Stoke site.

Figure 1

Site plan of the counting equipment at the Salmon & Trout Research Centre at East Stoke



This report gives a brief summary of the salmon research carried out over the past year and detailed information regarding the data from the adult salmon counter. Data from this research project will allow us to identify the critical mortality phases of the salmon, enable river-site dependant factors that affect mortality and emigration to be determined, allow a better estimate of spawning targets required and enable an intelligent management of the stock.

The adult salmon count data in this report represents the 37th consecutive year of the East Stoke counter's operation recording the upstream movement of Atlantic salmon *(Salmo salar L.)* in the River Frome. As such it is one of the most comprehensive long-term records of salmon movement in England and Wales.

Data are collected by a Scottish Hydro-Electric (formerly North of Scotland Hydro-electric Board (NSHEB)) Mk Xb resistivity counter. The counter is connected to three stainless steel electrodes mounted 450mm apart on the Environment Agency venturi gauging weir at East Stoke (NGR SY 867868). Data are verified by a combination of trace waveform analysis (see Beaumont et al. 1986), video frame-grab and videotape analysis. A more full description of the history of the counter and preliminary long-term results are given in Beaumont et al. (2007).

PIT tag data are collected by detection vanes (Wyre Micro Design Ltd) mounted on the main river counter (see picture right) and (during the smolt run only) detectors housed in the fluvarium building on the Millstream (see map). Detectors are also situated at the Louds Mill fish pass at Dorchester and at the lower end of Tadnoll Brook.

PIT tag data is collected by detection vanes mounted on the main river counter.

In conjunction with data on salmon movement, information on water temperature, air temperature, rainfall and light levels are also collected at 15 minute intervals from purpose built instrumentation and an on-site weather station. Hydrological (discharge) summaries are derived from Environment Agency data (© Environment Agency). All data are collated into hourly records.

Salmon run data are presented for the period February to January inclusive. Past data and personal observations indicate that the majority of the upstream movement in January is caused by the continued migration of fish from the previous calendar year migrating to spawn, not fish migrating to spawn in 11 months time.

Numbers used in this report refer to both 'gross' and 'nett' numbers of fish ascending the counter. Gross number refers to the total number of fish moving up over the weir irrespective of whether they subsequently drop back down over the weir. Nett numbers are the gross upstream number minus the number of downstream counts. The reason for the two figures is that between 1974 and 1984 only coincident downstream counts (counts immediately preceding or following an upstream count) were subtracted from the upstream totals. These coincident counts were considered to be salmon vacillating over the counter and were subtracted from the upstream counts (reducing the total by about 12%): other downstream counts were not recorded. With the development of the computer verification system (Beaumont et al. 1986) it was discovered that about 40% of all downstream counts were caused by salmon; leading to an overestimate of about 10% in nett upstream counts. Thus, since 1985, all downstream counts have been recorded, these data are individually verified (by waveform analysis and video) and the figure for nett upstream movement determined. This more accurate measure of nett upstream number averages out at ~80% of the gross number and is positively correlated with the gross number (r^2=95%). However, for better comparability with data prior to 1985, gross data are still presented. These data, while not being as precise as nett numbers, will still show the trend of salmon numbers and will be within approximately 12% of the pre-1985 data.

During January, February and March the downstream counts are not subtracted from the upstream counts as a high percentage are caused by downstream moving kelts (post-spawning salmon). In 2009 fewer kelts exhibited vacillating behaviour over the weir (successive up and down movement by individual fish over the counting system) during February and March and so additional editing of this data (in order not to have inflated up counts at this time of year) has not been necessary.

Efficiency of the counter is assessed by viewing video tape for 24 hour periods approximately every month. Only the efficiency of the computer system is assessed as the raw counter data are rarely used (only when both the PC and video system is not working or when the PC is not working and the water is dirty).

3. Salmon research report

Gravel cleaning

The large-scale gravel cleaning programme (instigated with funding from the Environment Agency (EA) in 2003) has been continued. Poor survival of the eggs in the spawning gravel has been shown to be a key bottleneck in the recruitment of fish into chalk streams. Data from a study (Scott and Beaumont 1993) has shown that survival can be increased from 10% to 66% by cleaning the spawning areas. This work is now directly contracted out by the EA to a local fishery contractor and we hope to continue to be involved and offer advice to this programme in future years. We can also provide training and liaison with fishing groups carrying out the cleaning, as well as monitoring the effects on subsequent smolt and salmon production.

Parr tagging

In September, for the past five years, we have tagged approximately 10,000 juvenile salmon (about 10-20% of the juvenile salmon population of the whole river) with Passive Integrated Transponder (PIT) tags. These small tags (just 12mm long x 2mm wide – see below) are inserted into parr and enable us to individually identify the fish when they swim past a reader. The passage of the PIT tagged fish out to sea is recorded by equipment mounted on the East Stoke smolt counter and the main river weir. The main river reader also allows the detection of the return of the PIT tagged adult fish. There are also detectors mounted at the new Louds Mill fish pass at Dorchester and at Tadnoll Mill on the Tadnoll Brook.

Salmon parr and PIT tag (circled). Individual ID of the tag is shown on the label.

In 2009 we detected just 11 PIT tagged adult salmon (two of which were descending Kelts in spring 2009). This is far fewer than in 2008 and we will be investigating possible reasons for this. Numbers of tags reported from Louds Mill were also down on last year. We also detected ~50 emigrating and 16 ascending PIT tagged trout from our Tadnoll Brook trout studies.

The combination of the autumn tagging and the spring smolt counting also allows us to get an estimate of the total number of salmon parr in the river in the autumn (see Figure 2). These records, together with the records from the other PIT reader, are giving us unparalleled information about freshwater survival rates. The data will enable us to determine survival from individual reaches of the river and link the growth rates of the juvenile fish with the time of migration. During the 2009 parr tagging we also recorded details of the habitat characteristics of each of the 100 metre sites that we fished. We will use these data to try to understand factors that control the numbers of fish at each site as well as the influence of habitat on influencing parr to become autumn migrants. Data on freshwater survival, marine survival and life history strategy from different tributaries, will also be available.

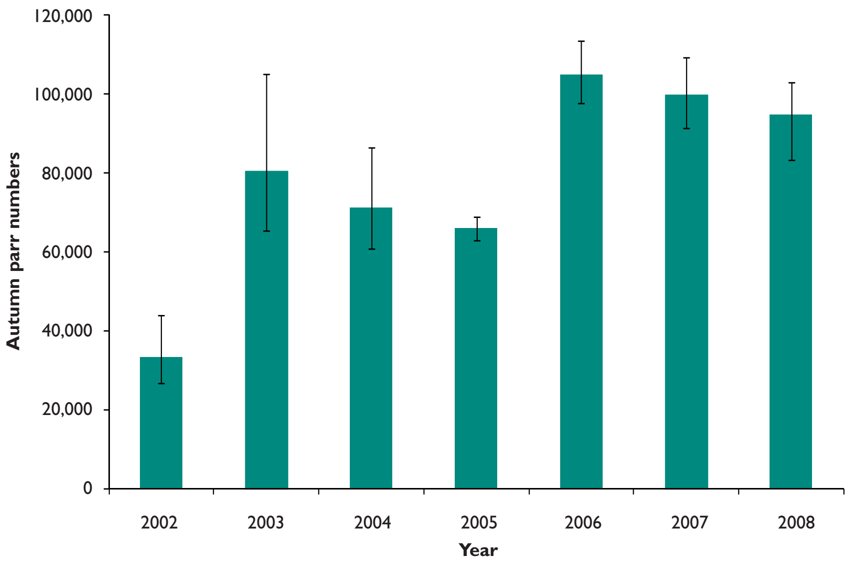


Figure 2

Estimated autumn parr numbers with confidence limits for estimate

Autumn migrants

The vanes on the main weir also allow us to monitor the 'autumn' downstream run of parr in the river. This phenomenon, although reported before, has not been studied, quantified or explained. Our studies show that the movement is an active migration ie. the fish are not just passively drifting downstream, but the fish are not able to tolerate salt water. We have found that many of these fish reside over winter in the lower river downstream of Wareham and we are working with the Centre for Environment, Fisheries & Aquatic Science (CEFAS) to study the biology and behaviour of these fish. We have recorded the first return of an adult fish that was an autumn migrant (Riley et al. 2009) and we will continue to examine returns from the adult fish to see if the survival of these early moving fish is better or worse than the fish that migrate in the spring, the 'usual' migration time for the smolts.

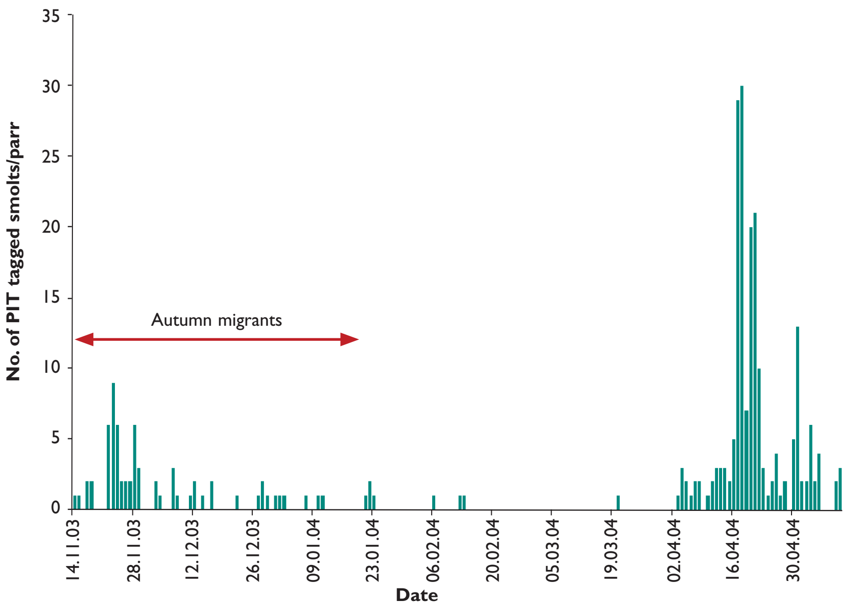


Figure 3

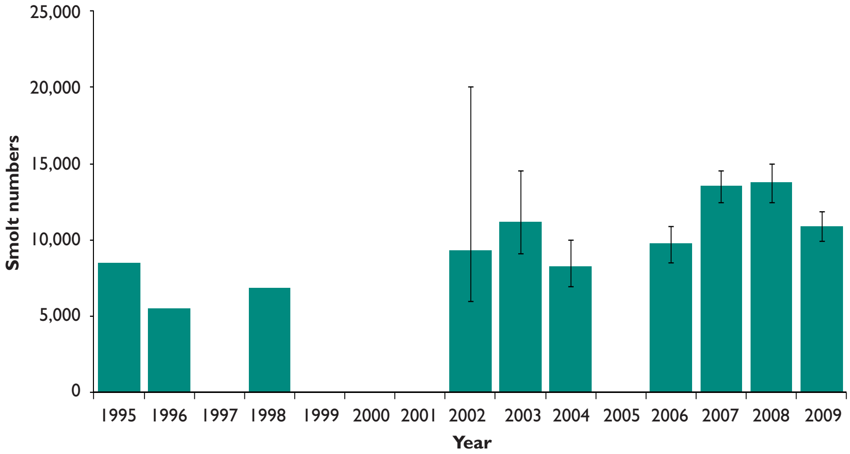
The autumn migrant run and the 'normal' spring smolt run

Smolt counting

Since 1995 we have been trying to count the number of smolt emigrating from the river. To do this we use a Bio-Acoustic Fish Fence (BAFF) Fish Guidance Systems Ltd to divert the fish into the Millstream at East Stoke. The BAFF is simply a curtain of bubbles that also has sound entrained within the bubbles, thereby using both the visual impression of a barrier (the bubbles) with the sound to divert the fish. Provision is made for adult fish to be able to negotiate the apparatus. In the Millstream the fish pass through the fluvarium tanks where (being a smaller volume of water) it is easier to count them electronically. The data from the early years are not good quality and in some years no estimate at all was possible. However, as equipment and methods have been perfected better estimates have been possible. Figure 4 shows the annual numbers (including the years with poor data). Since 2006 the precision of the estimate has been very good (as shown by the small confidence limits).

The combination of autumn parr numbers and smolt numbers has also allowed us to identify the over-winter mortality of the fish. This has been found to be very high and we are using the data that we can get from knowing the location of individual fish and the habitat data that we collected during the autumn survey, to try to understand the causes for this.

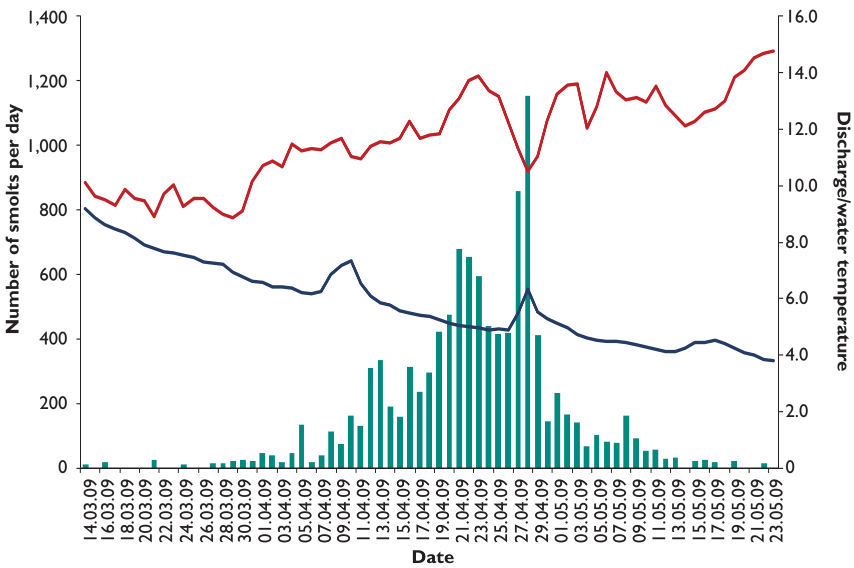
Figure 4
Annual smolt estimate and (where available) confidence limits



The daily smolt migration data from 2009 is presented in Figure 5. Data are a total of PIT records from all the various detectors at East Stoke and data from the Rotary Screw Trap. Analysis of the data, after adjusting for the numbers that were not diverted into our counting set-up, showed that a total run of 10,913 smolts emigrated from the river in spring 2009.

Figure 5
Daily count of smolts, mean discharge records and daily mean temperature

Total discharge
Water temperature



The ability to assess smolt numbers has also led to a joint study with CEFAS on the effect of Rotary Screw Traps (RSTs) on subsequent smolt survival. RSTs are widely used to trap and count migrating salmon smolts on other rivers. However, there have been concerns that the process may be detrimental to the fish. This project involves us using the information that we get from monitoring the PIT tagged fish, to assess whether fish that have been trapped in the RST have higher marine mortality than those that have not.

There are concerns that Rotary Screw Traps, used to trap and count migrating salmon smolts on rivers, may be detrimental to the fish.

Poole Harbour netting

Under an agreement with the River Frome salmon net licence holder, the Environment Agency and the Frome & Piddle Fishing Association, we are monitoring the salmon and sea trout net catch from Poole Harbour. All salmon and sea trout caught are being released and we will be tagging the fish to see if they are caught by the rods or pass the East Stoke detecting equipment. We accompanied the netsman on 24 netting occasions; this represents in excess of 75% of the times when netting was carried out. A total of four salmon were captured, all of which were tagged with PIT tags. Most of the fish were retrieved from the net in good or moderate condition, however, two of the salmon had Red Vent Syndrome. So far none of the PIT tagged fish had been logged at the East Stoke main river PIT tag reader. The netting location means that fish destined for both the River Piddle (where there are no PIT tag detection facilities) and the River Frome are likely to be captured. It would be improbable, however, if all the fish PIT tagged this year were of Piddle stock, and therefore some fish would be expected to be detected at East Stoke if they survived the net fishing and handling.

In addition to the salmon, eight sea trout were caught. One fish was in extremely poor condition when removed from the net and was killed, the rest were tagged with Floy type tags, scale samples taken and the fish released.

A sea trout caught and released from the Poole Harbour net.

4. Adult counter data report 2009

A large part of the effort in running the East Stoke counter is focused on verifying the 'counts' from the counter. Counts are verified by either video picture (when the water is clear) or the shape of the electrical waveform produced when an object goes across the weir or (more often) both. In addition, frame grabs can be taken from the computer screen and stored, thus to some extent making it unnecessary to view the video data (apart from assessing missed fish). Only rarely are raw, unverified data used. An example of the computer verification system's display is shown in Figure 6. A salmon can be seen on the video picture and the electrical trace is shown on the bottom segment of the screen. Text boxes along the bottom of the display record: number of records; number of frame grabs; input signal value; time of day; number of records registered by computer and counter.

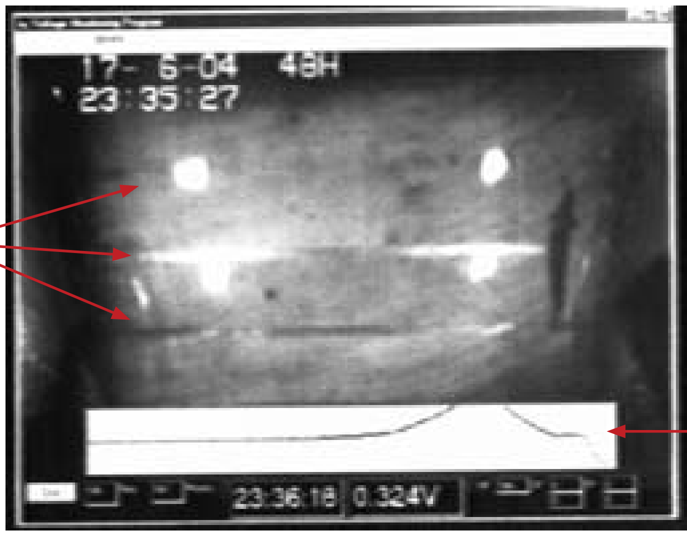
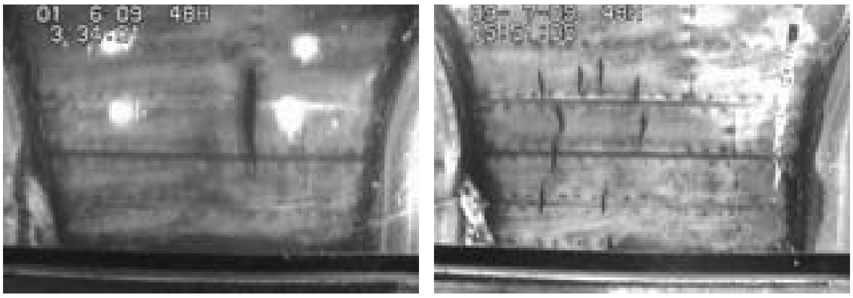


Figure 6

Screen display from the computerised counting and evaluation system. The image shows a 75cm salmon ascending the weir

As well as verifying the counts, the video also shows some intriguing pictures and below shows a 102cm salmon and a shoal of sea trout ascending the weir together. We also have footage of sea lampreys and swimmers on the weir.



Frame grabs from the computerised counting and evaluation system. (L-R) 102cm salmon and a shoal of sea trout.

This year we have also used the side-viewing camera to try and differentiate between salmon and large sea trout (see below). Cloudy water and fish out of range of the camera meant that it was still often difficult to see or identify fish, but a limited number of good images were obtained. The results showed that where a fish was initially identified as a salmon by the PC trace and overhead video picture, on 15/42 times (36%) the fish was actually a sea trout. This coming year we will modify the system to improve the coverage of the weir by adding an additional camera on the other side of the weir and try to increase the time periods when the side view cameras run.

(L-R) Images from the side-view camera showing a sea trout and a salmon on the weir.

Verification of the data entailed identifying the cause of the upstream and downstream counter records plus many thousand (due to the number of false counts recorded) computer waveform traces. For periods when the computer system was not operational, accuracy of the counter was assessed by direct examination of the video data. When the computer system was operational, accuracy of assessment was carried out by comparing identity assessed from computer traces, with identity observed from video records (both tape and video frame grabs). Data from the actual counter could vary widely in accuracy and on a day-to-day basis could equal 0% if it missed fish. Raw data from the counter are rarely used in an unverified form, and the data for the run are compiled from a combination of counter, computer and video records ie. all computer trace records and counter records are checked on the video to identify the cause of the record. Raw fish counter data are only used when computer or video data are not available. Providing adequate water clarity, video records are 100% accurate and assessment of accuracy of interpretation of the computer records is made from comparing trace identity with the video records. Where water clarity is poor just computer records are used to verify data. Accuracy of the computer records is usually checked by viewing complete time periods on video (approximately one 24-hour period every month) and comparing the numbers from the computer with the numbers of fish seen. In 2009 average accuracy of waveform interpretation was 91% for both upstream and downstream records. However, data are not corrected for verification error.

We were fortunate this year in having few mechanical and electrical problems in running the counter. Over the year the electronic counter did not operate for only two days and there was no waveform verification for 10 days. Due to turbid water there was either no video verification or images were too poor for video viewing for 98 days. There were no days where count information was not possible from either electronic or video data. Appendix I summarises the operational times and verification diary for the counter in 2009.

Figure 7 shows daily counts together with mean daily discharge data. Data from the counter are presented for both gross upstream and gross downstream counts as well as the nett upstream count (see earlier for a full description of how the data are presented). Although nett numbers equate to the estimated numbers of salmon ascending the river, gross numbers are included to allow comparison with data obtained prior to 1985 when total downstream numbers were not recorded and verified.

Gross total for the year was 756
Nett total for the year was 602

Figure 8 shows that the total nett upstream count for the year was the third lowest since 1985 and about 100 below the average of the very low runs that have been recorded since 1999. Gross run data show a similar pattern.

Figure 9 shows the cumulative nett numbers of fish migrating over the weir for each month. The graph also shows the average numbers for 1985-1990 (representing the start of the recording of nett numbers and before the 1991 crash in numbers), the years 1991 to 1998 (when the first sustained drop in numbers occurred), 1999 to 2008 (the second period of very low numbers) and the current year (2009). The figure shows that until July, the run was above that of the average for the 1999-2008 years. However, during July to September (the main grilse run period) very few fish ascended the river.

Figure 10 shows time of day of fish movement over the weir. The avoidance of daylight hours during the summer months can be clearly seen.

A total of 361 upstream migrating fish (60% of the nett run) were measured this year (see Figure 11) with the largest being two fish of 102cm, one in April and one in June. The increase in proportion of fish measured this year is due to the inclusion of approximate length data. These data were from periods where there was some turbidity in the water and only approximate (± 5cm) length data could

Salmon smolts swim down the river and are diverted by the acoustic bubble screen.

be obtained. In past years this data was not used, leading to a loss of data that still has some value in assigning sea-age to the migrating fish. Data from fish below 50cm and fish that are obviously the same fish vacillating over the weir have also been excluded from Figure 12 (and the data set).

The length data obtained from the video records can be used to calculate the proportion of grilse and multi-sea-winter (MSW) fish migrating each month. This proportion can then be used to calculate the numbers of grilse and MSW each month and for the whole year. Size limits for grilse have been calculated from the historic scale data from the River Frome that we have. However, these data may have inaccuracies due to changing sizes of the grilse (getting smaller) that have been reported since the size thresholds were calculated. There are also some inaccuracies caused by low numbers of measured fish unduly influencing the proportions. However, the data provide a starting point for examining the partition between grilse and MSW fish and its variation over the years. Figure 12a shows the estimated nett numbers of grilse and MSW fish for each month in 2009. Figure 12b shows the annual proportion of grilse and the numbers of grilse and MSW per month since 1996. Note that these data will undoubtedly change as further analysis is carried out.

Appendix II shows data from the hourly database for each month. As well as gross upstream salmon numbers in an hour, hourly averages (4 x 15 minute readings) of water discharge (East Stoke Millstream (ESMS) discharge is shown separately as dark blue on top of light blue main river (East Stoke flume) discharge – upper boundary of data therefore is total discharge) from Environment Agency data. Air temperature, water temperature, rainfall data (mm/hr) and light level are also shown. Graphs of the hourly data clearly show the clarity of detail available with the hourly time-base.

Figure 13 shows mean monthly discharge data (in cubic metres per second (cumecs)) for 2009 together with mean (1966-2008) 5, 25(Q1), 75(Q3) and 95 percentile discharge data. This data is collated and calculated from Environment Agency records. The river discharge started the year within the median range (between Q1 and Q3 level) but went above the Q3 in February, thereafter it fell steadily away until June when it went below the 5%ile level. In August it was within the interquartile range, but November and December saw a sharp increase to above the 95%ile range. Figure 14 shows that overall the mean annual discharge data for the River Frome was only just below the long-term average.

Acknowledgements

We gratefully acknowledge the support of the following organisations and people: Freshwater Biological Association; Centre for Ecology & Hydrology; Environment Agency; Centre for Environment, Fisheries & Aquaculture Science; the Valentine Trust; the Ellen Cooper Dean Charitable Foundation; the Atlantic Salmon Trust; the Salmon & Trout Association; the Garfield Weston Foundation; the Frome, Piddle & West Dorset Fisheries Association; the Wessex Salmon & Rivers Trust.

Finally, and importantly, the many landowners and fishery owners that give their permission for us to fish their areas so that we can tag the juvenile salmon.

5. References

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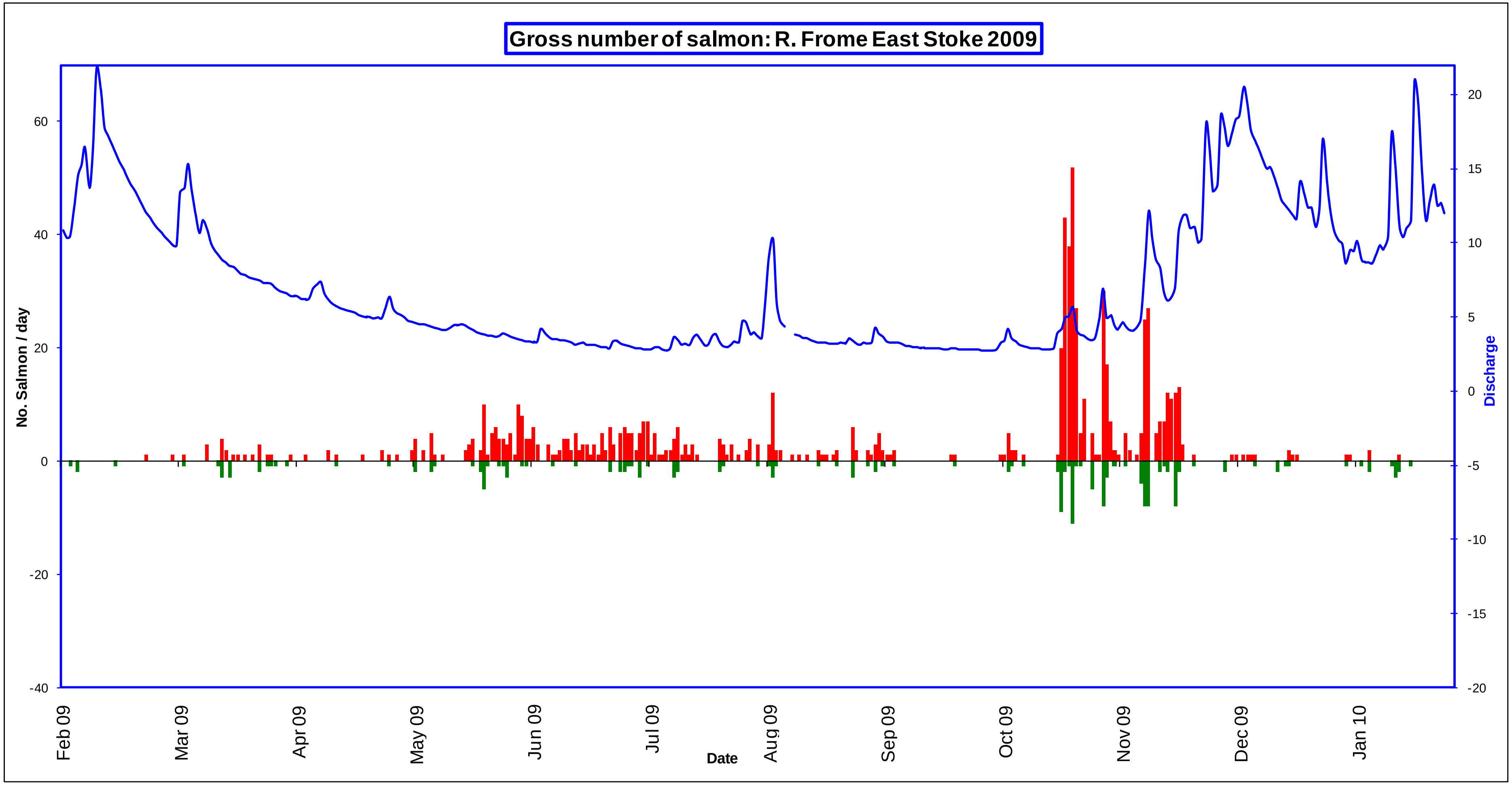
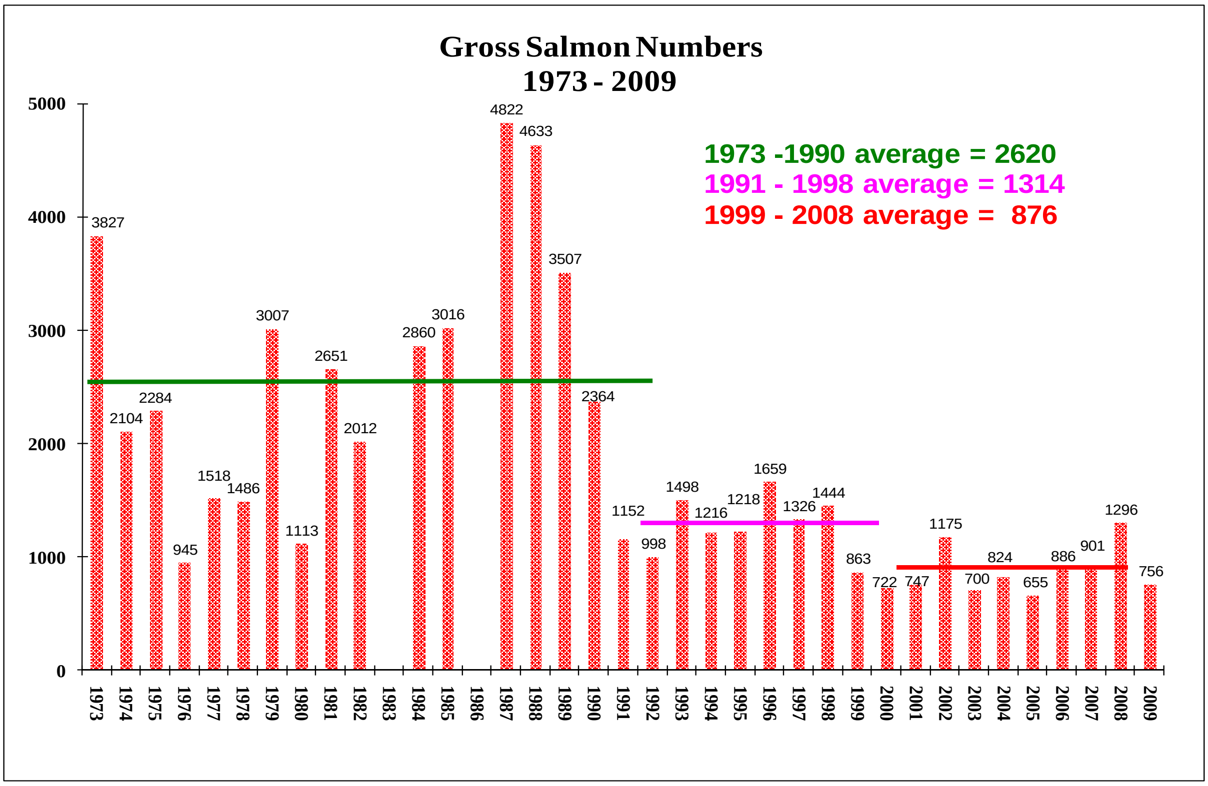
Riley W D, Ibbotson A T & Beaumont W R C (2009). Adult returns from Atlantic salmon, *Salmo salar L.*, parr autumn migrants. *Fisheries management & Ecology* 16: 75-76.

Scott A & Beaumont W R C (1994). Improving the survival rates of Atlantic salmon *(Salmo salar L.)* embryos in a chalk stream. Institute of Fisheries Management Annual Study Course, 1993, Cardiff.

MONTH													
Month	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Total
Gross U/S	1	20	10	75	97	70	42	17	216	193	10	5	756
Gross D/S	4	14	2	19	12	12	12	5	36	49	7	11	183
Nett U/S	1	20	8	56	85	58	30	12	180	144	3	5	602





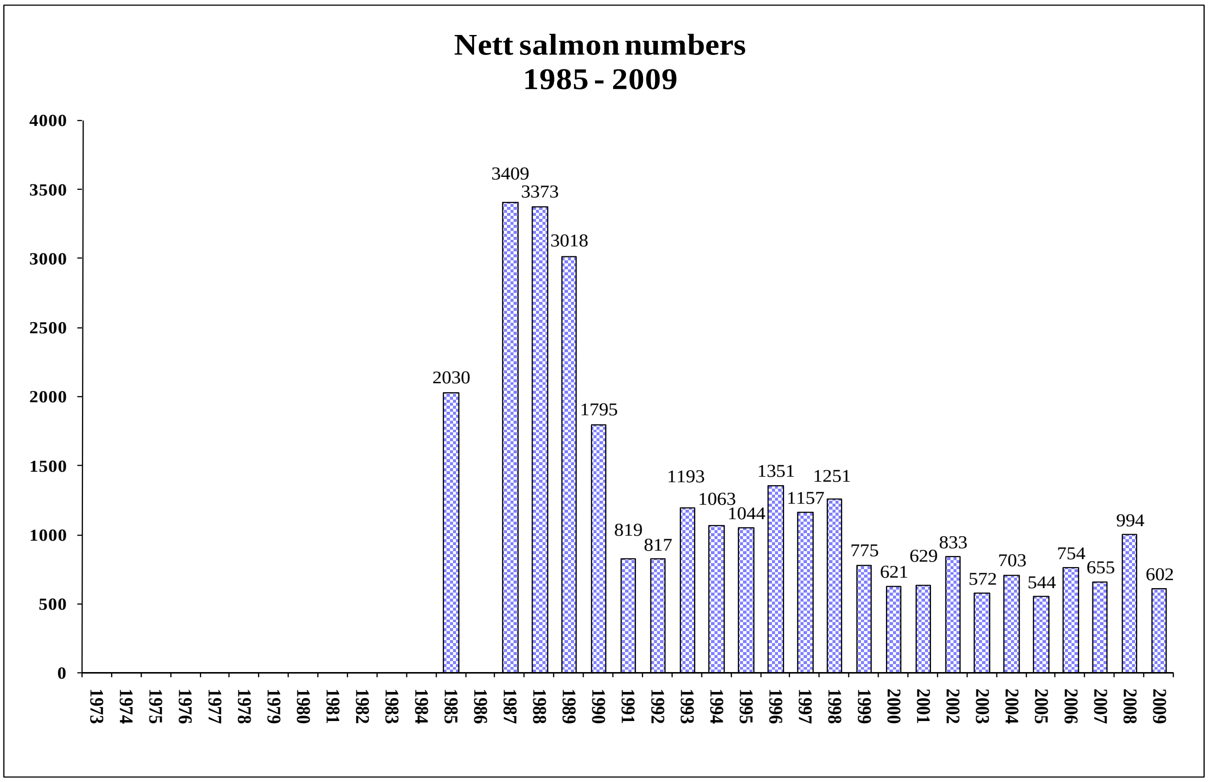


Figure 8 Annual numbers of salmon ascending the East Stoke weir

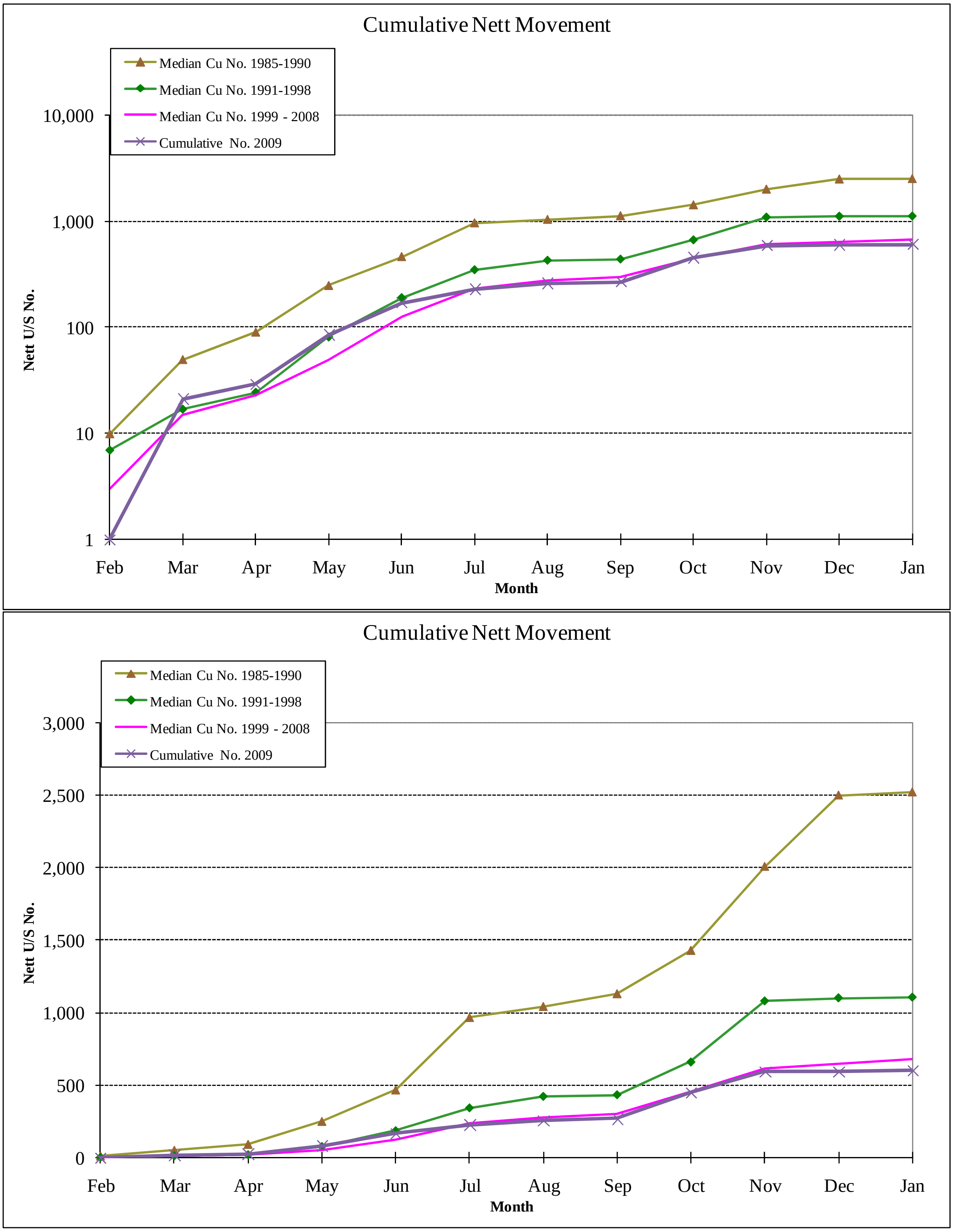


Figure 9 Comparison of Nett 2009 data with previous years. Note: On top graph y-axis (Nett No.) is on a logarithmic scale to better show the early months when low numbers of fish are present.

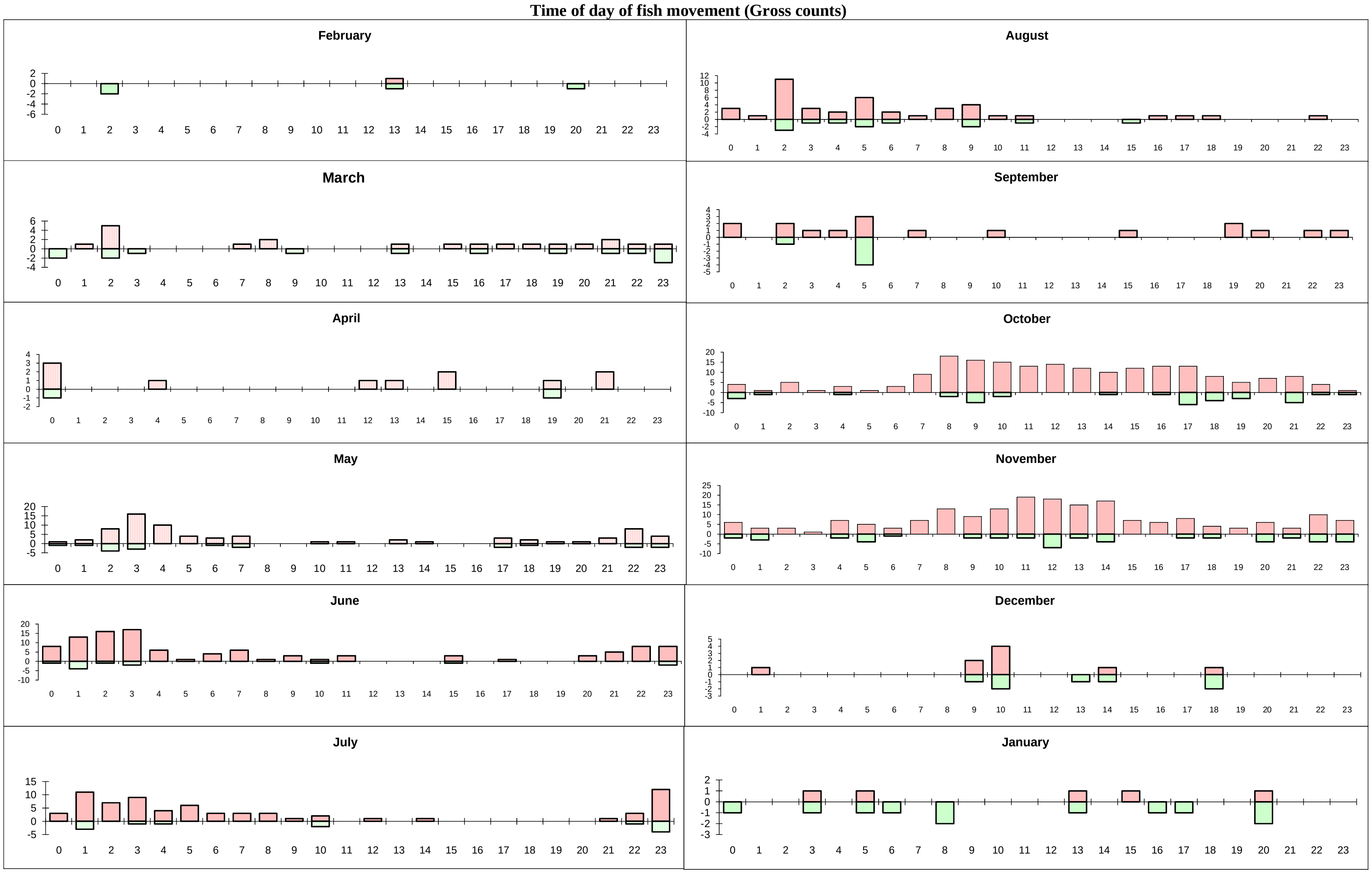


Figure 10 Time of day of movement (Gross upstream and downstream count data)

Observed Salmon Lengths 2009:

Upstream migrating fish >50 cm only

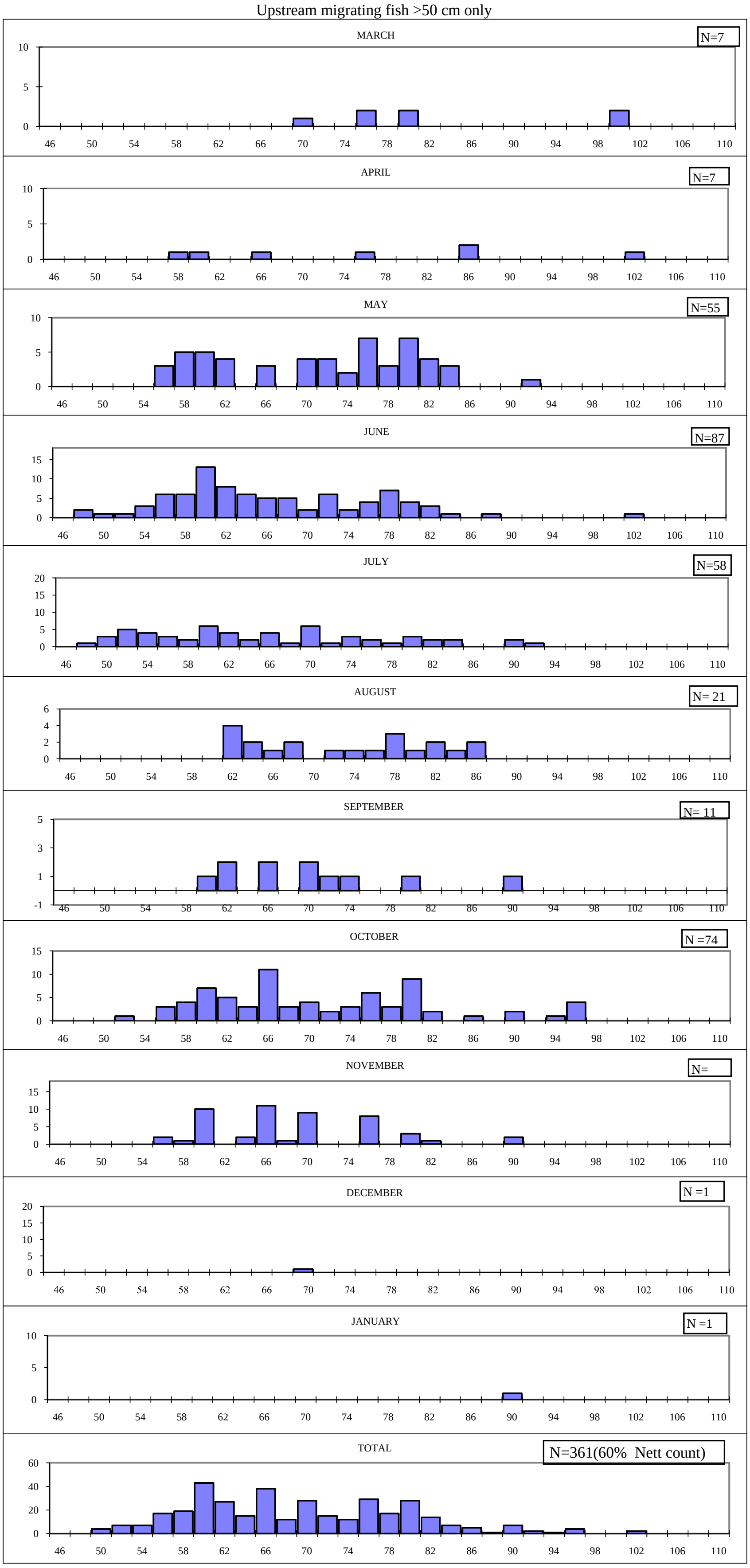
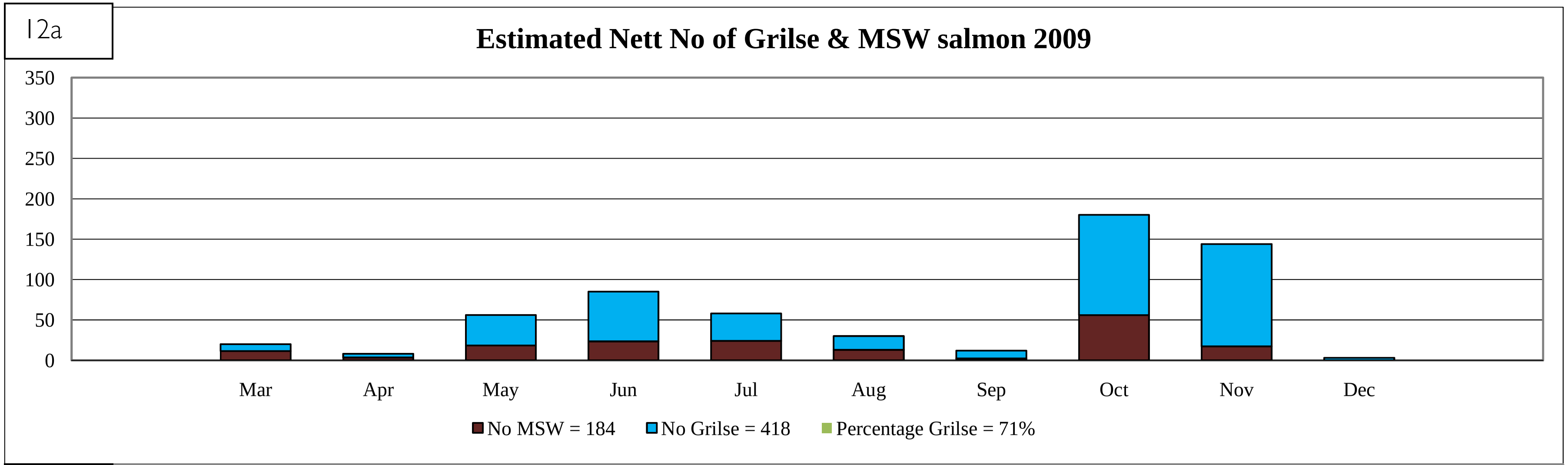


Figure 11 Length of upstream migrating fish each month (Length in cm)



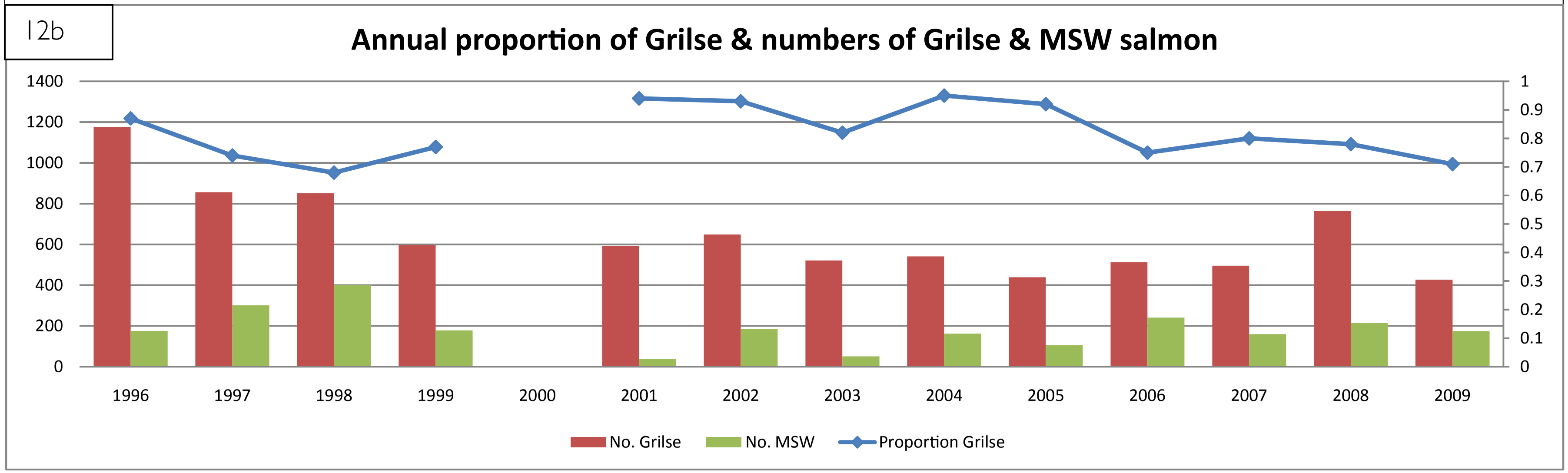


Figure 12a Estimated monthly number of Grilse and MSW fish 2009
Figure 12b Annual proportion and number of Grilse and MSW

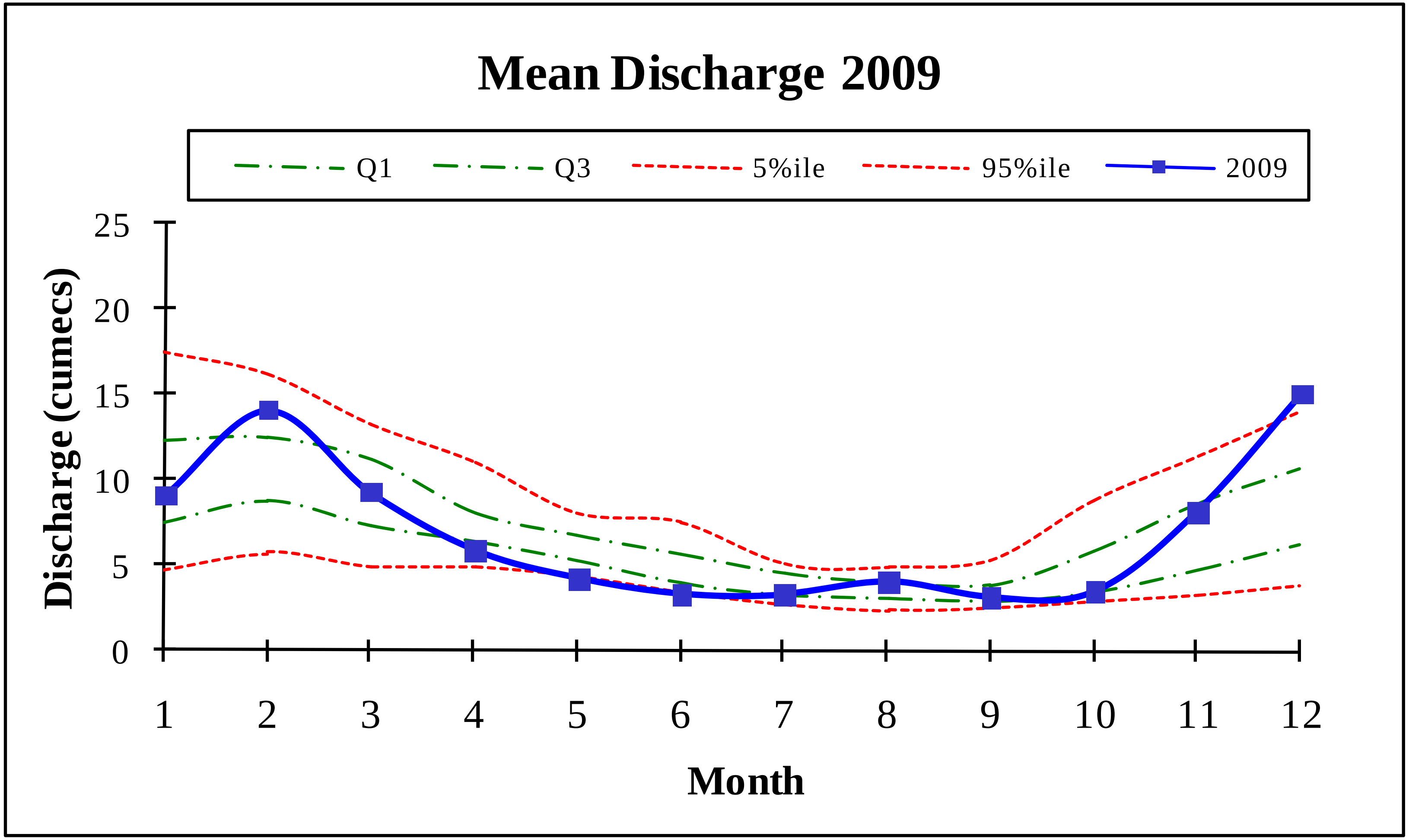


Figure 13 Monthly mean discharge and long-term percentile data (Jan – Dec data)

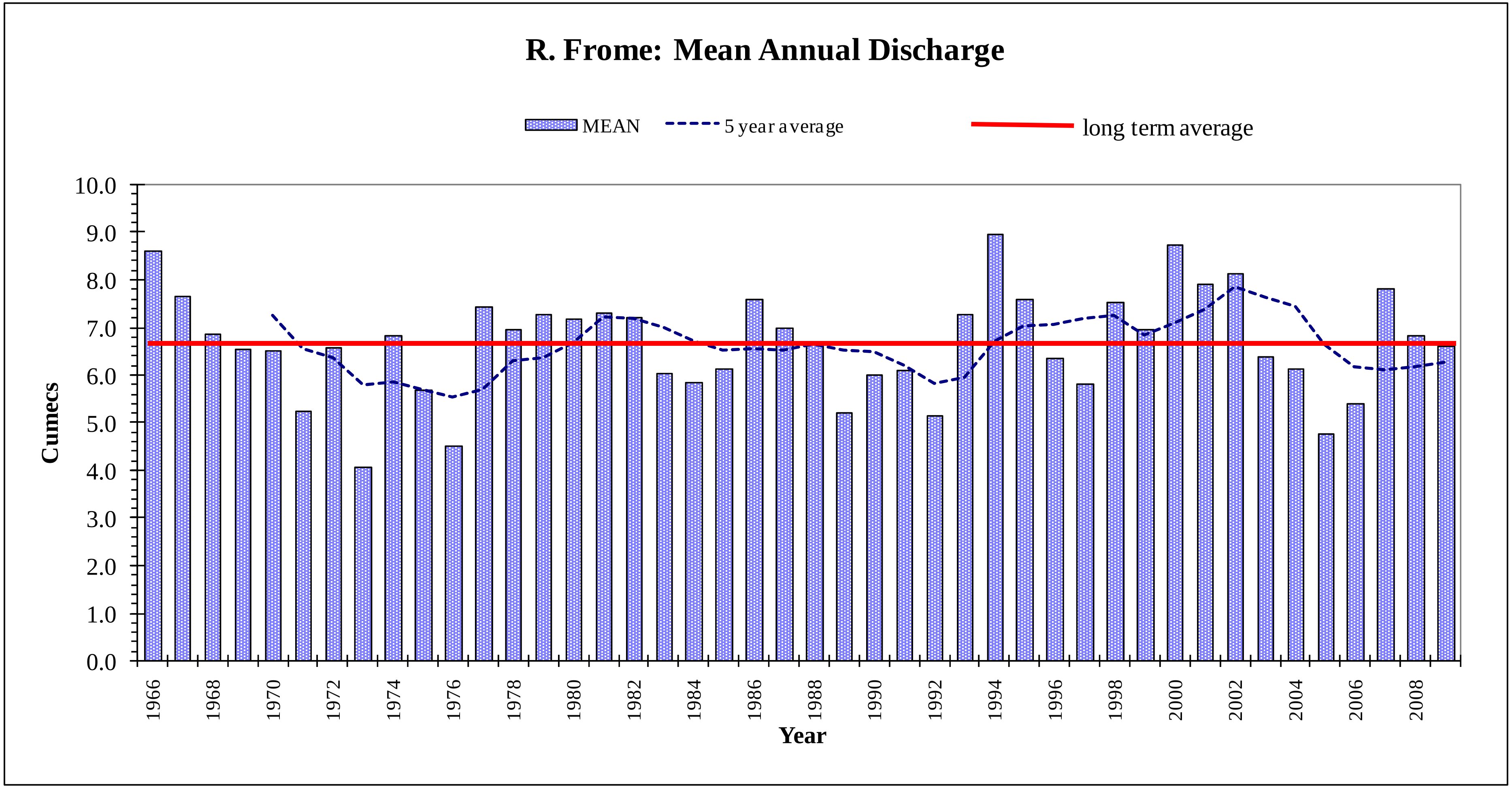
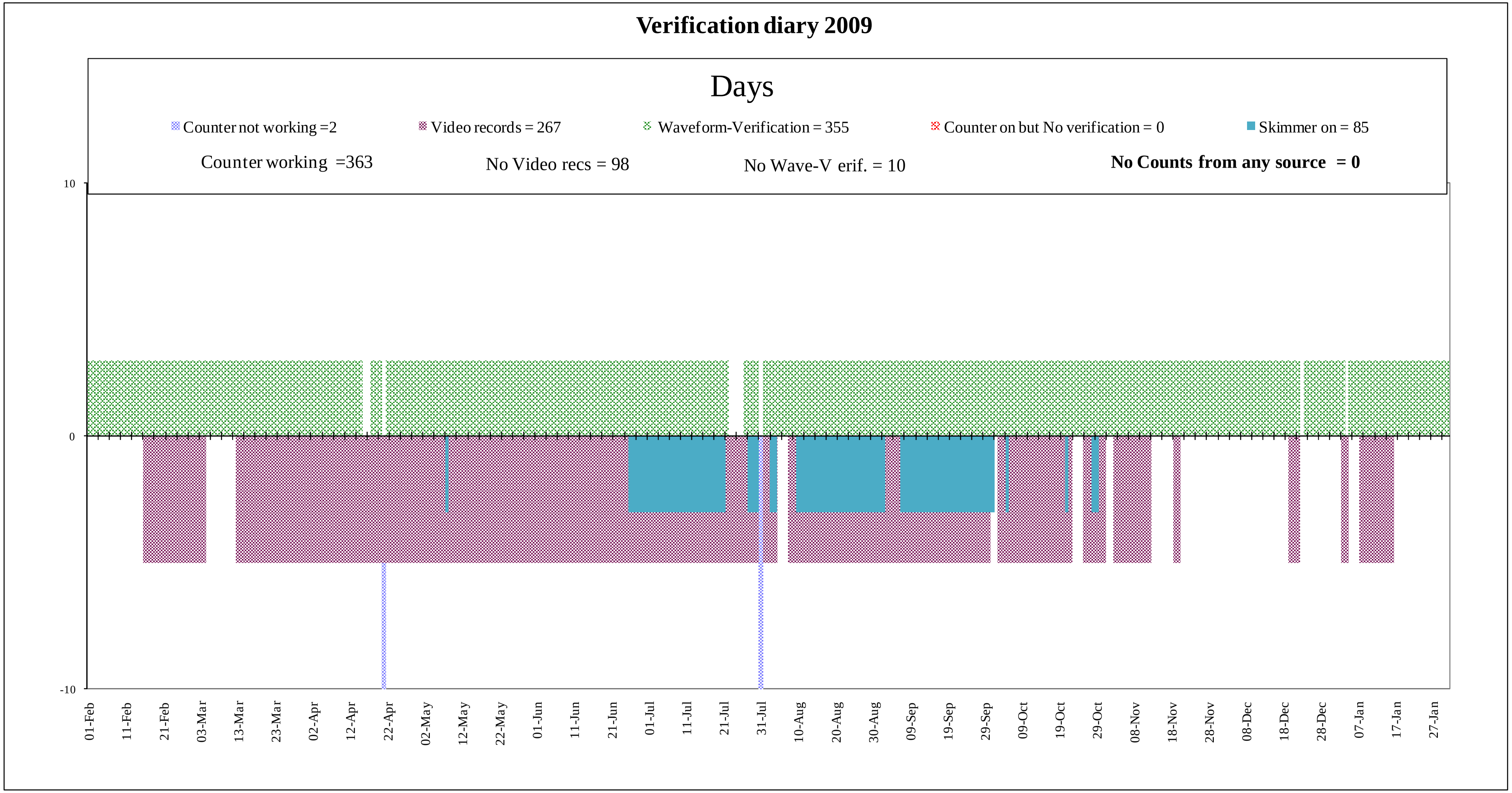
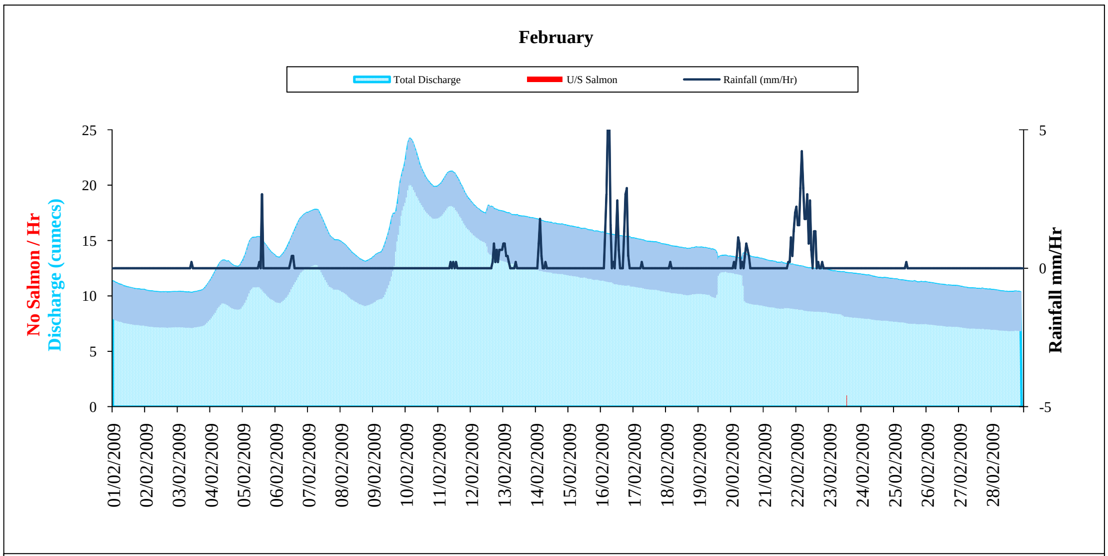
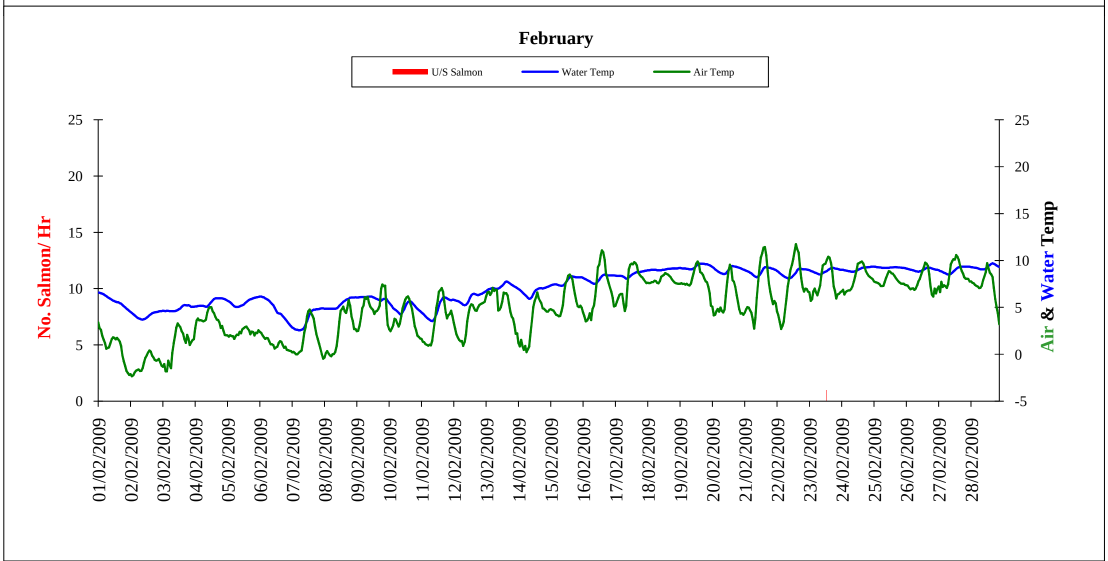


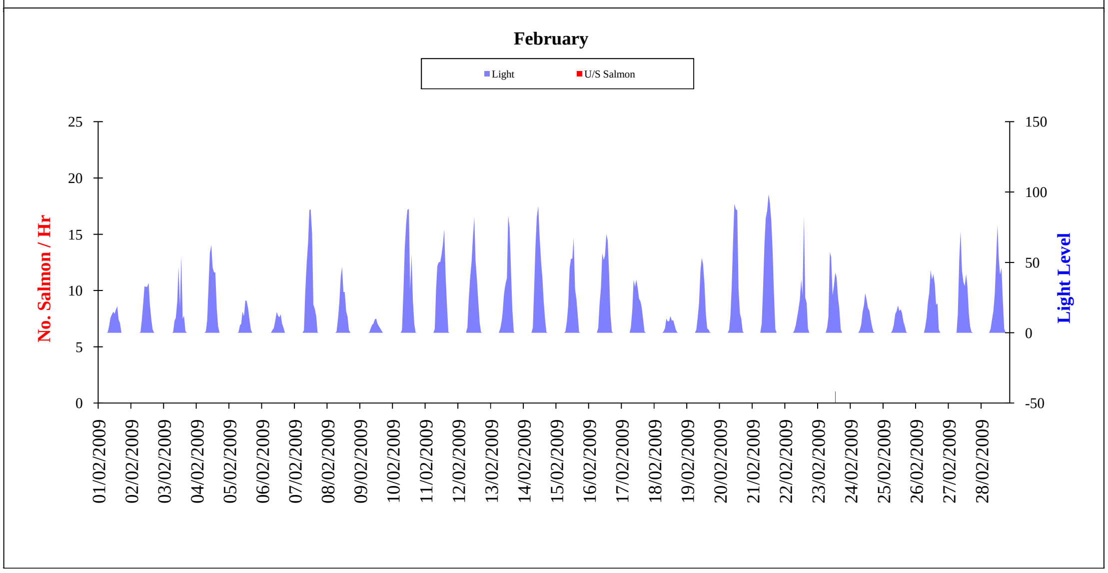
Figure 14 River Frome long-term annual discharge

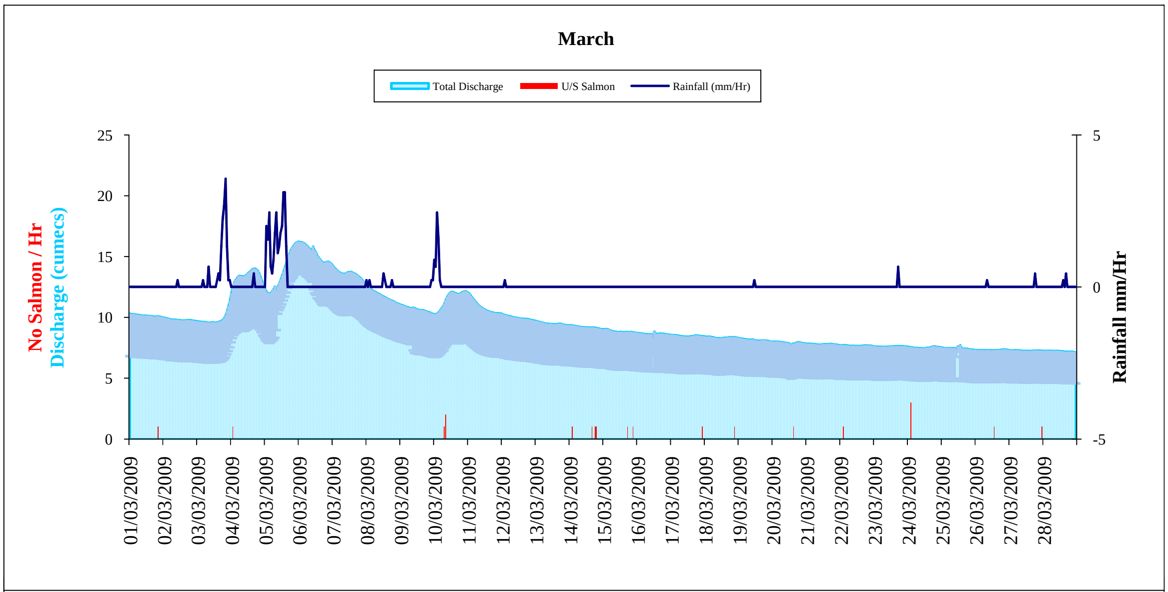


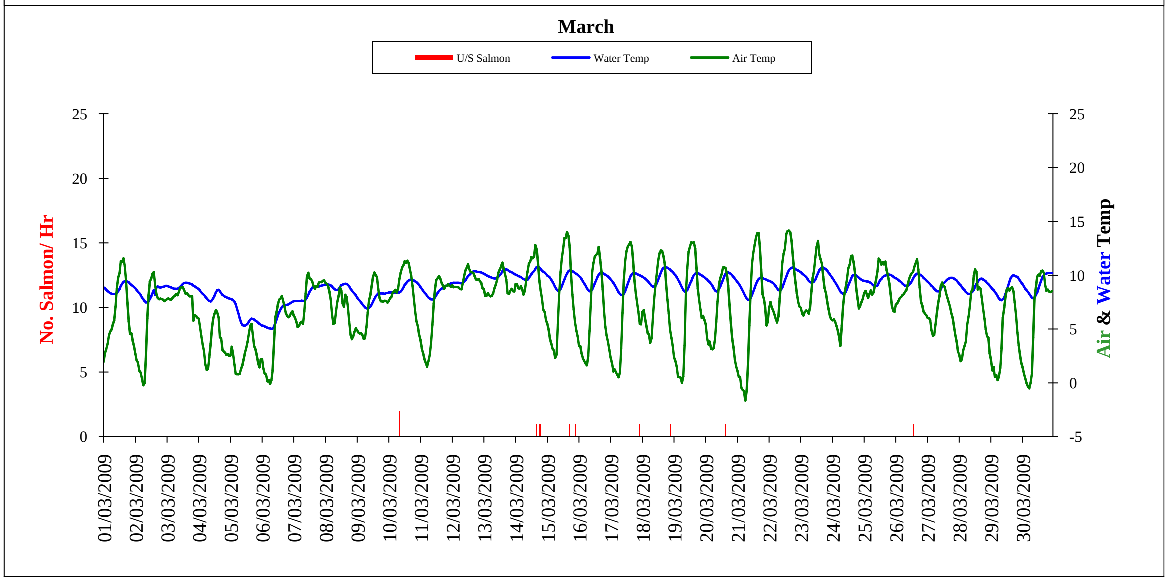
Appendix I Operational times and verification diary 2009

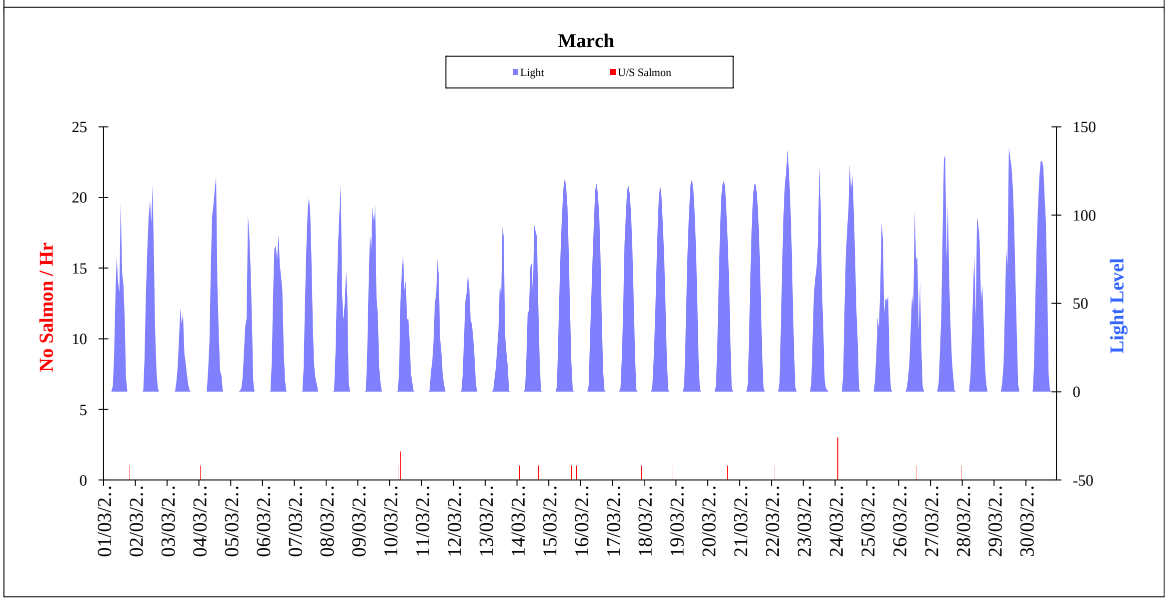

February
Total Discharge
U/S Salmon
Rainfall (mm/Hr)
No Salmon / Hr
Discharge (cumecs)
Rainfall mm/Hr
01/02/2009 – 28/02/2009


February
U/S Salmon
Water Temp
Air Temp
No. Salmon/ Hr
Air & Water Temp
01/02/2009 – 28/02/2009

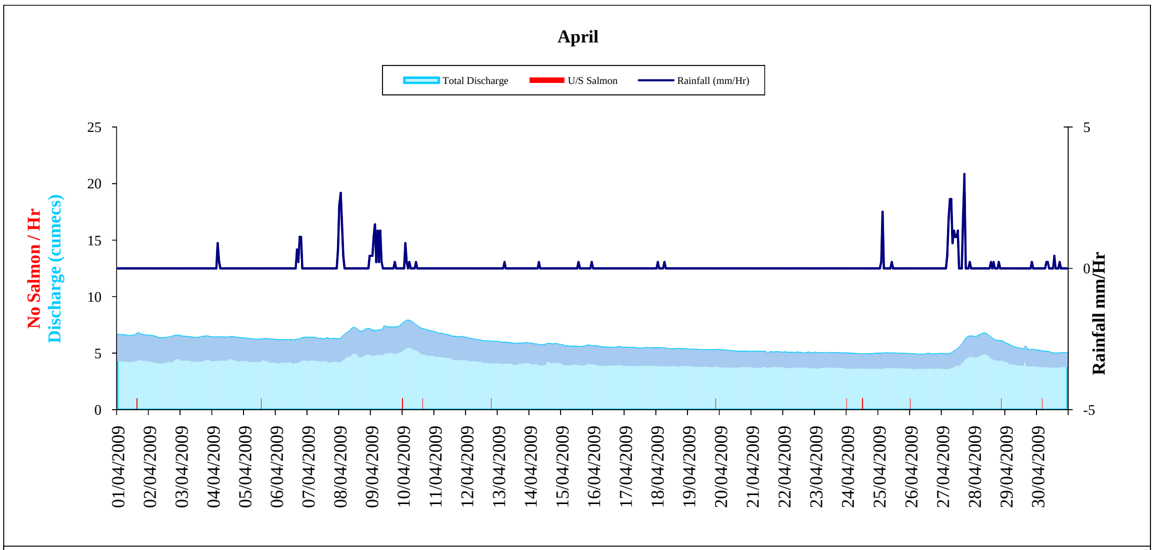

February
Light
U/S Salmon
No. Salmon / Hr
Light Level
01/02/2009 – 28/02/2009

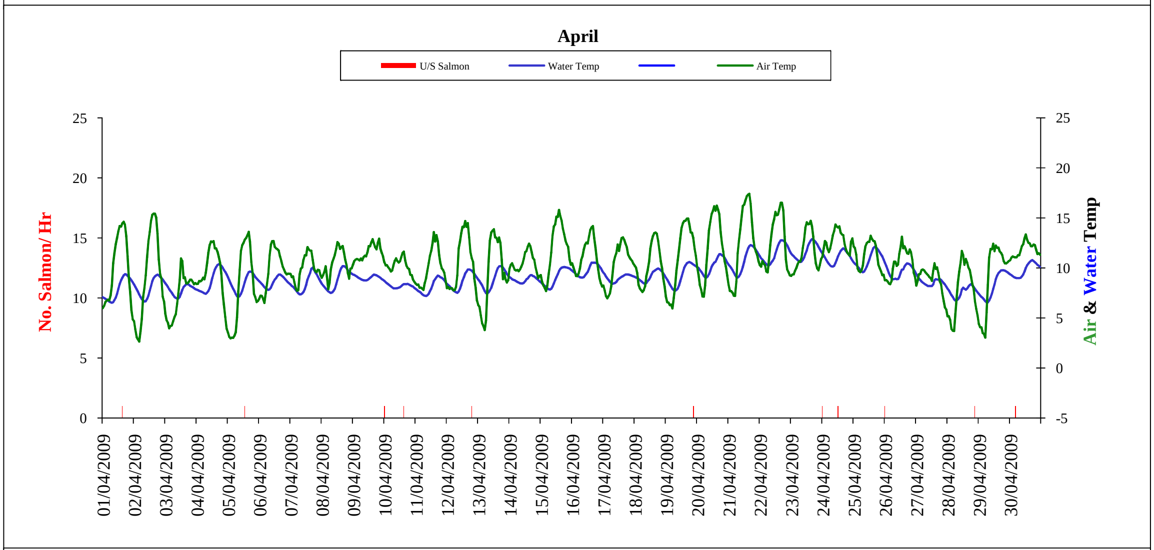






Appendix II Hourly data


April
Total Discharge
U/S Salmon
Rainfall (mm/Hr)
No Salmon / Hr
Discharge (cumecs)
Rainfall mm/Hr
25
20
15
10
5
0
-5
01/04/2009
02/04/2009
03/04/2009
04/04/2009
05/04/2009
06/04/2009
07/04/2009
08/04/2009
09/04/2009
10/04/2009
11/04/2009
12/04/2009
13/04/2009
14/04/2009
15/04/2009
16/04/2009
17/04/2009
18/04/2009
19/04/2009
20/04/2009
21/04/2009
22/04/2009
23/04/2009
24/04/2009
25/04/2009
26/04/2009
27/04/2009
28/04/2009
29/04/2009
30/04/2009


April
U/S Salmon
Water Temp
Air Temp
No. Salmon/ Hr
Air & Water Temp
25
20
15
10
5
0
-5
01/04/2009
02/04/2009
03/04/2009
04/04/2009
05/04/2009
06/04/2009
07/04/2009
08/04/2009
09/04/2009
10/04/2009
11/04/2009
12/04/2009
13/04/2009
14/04/2009
15/04/2009
16/04/2009
17/04/2009
18/04/2009
19/04/2009
20/04/2009
21/04/2009
22/04/2009
23/04/2009
24/04/2009
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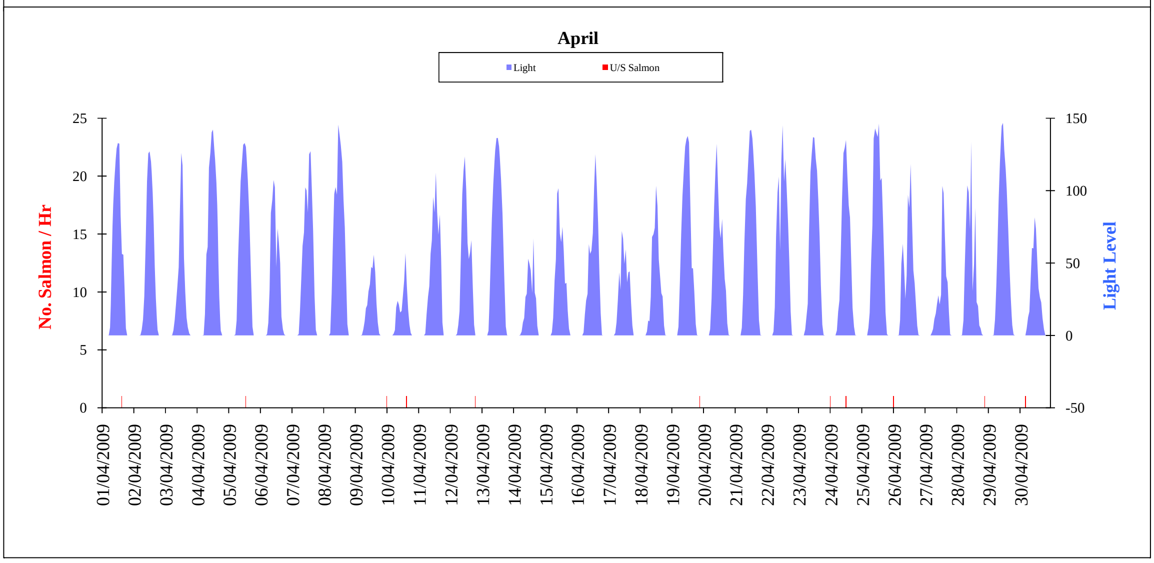
26/04/2009
27/04/2009
28/04/2009
29/04/2009
30/04/2009


April
Light
U/S Salmon
No. Salmon / Hr
Light Level
25
20
15
10
5
0
150
100
50
0
-50
01/04/2009
02/04/2009
03/04/2009
04/04/2009
05/04/2009
06/04/2009
07/04/2009
08/04/2009
09/04/2009
10/04/2009
11/04/2009
12/04/2009
13/04/2009
14/04/2009
15/04/2009
16/04/2009
17/04/2009
18/04/2009
19/04/2009
20/04/2009
21/04/2009
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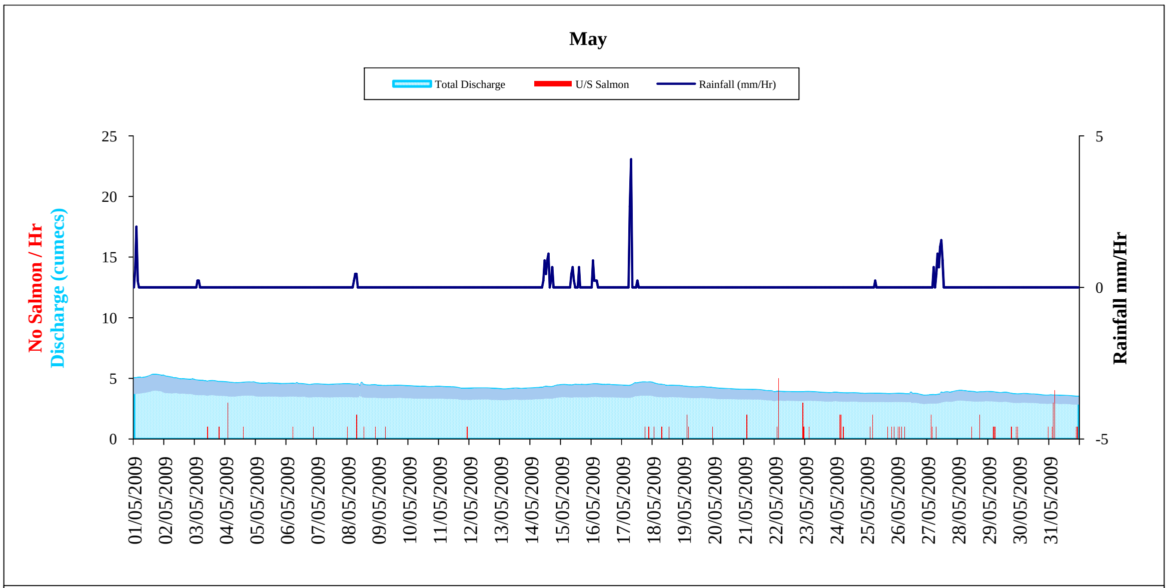
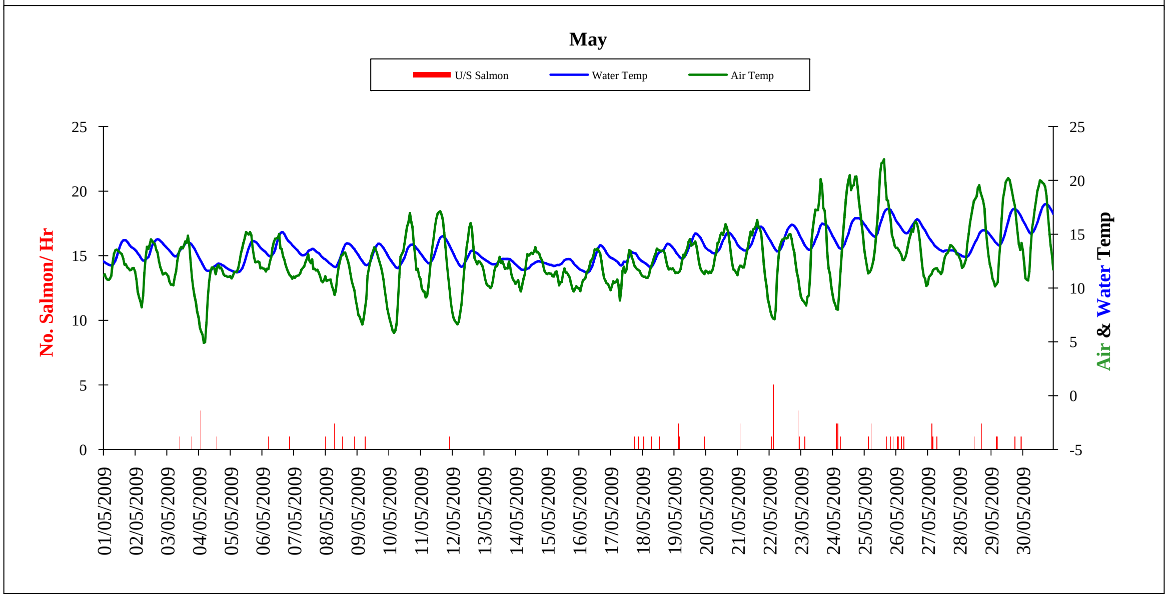
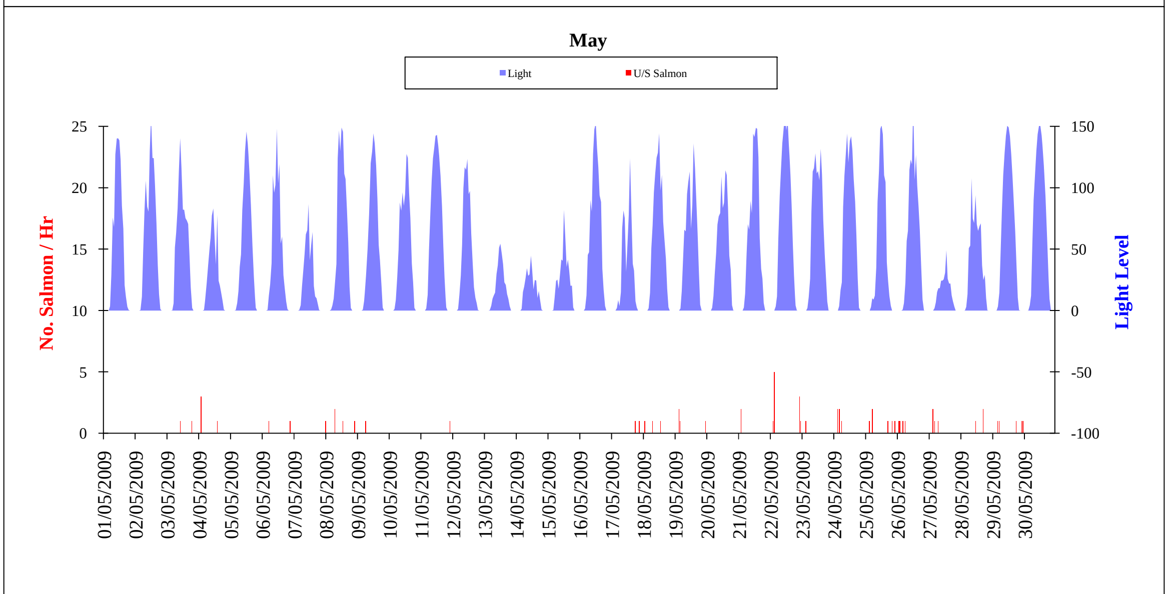
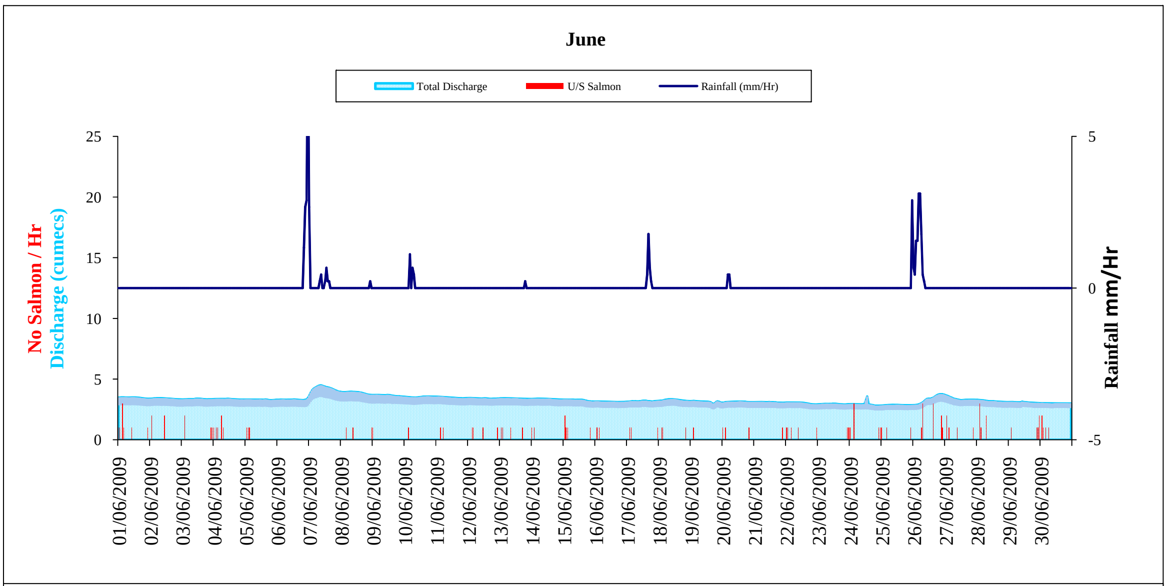
29/04/2009
30/04/2009

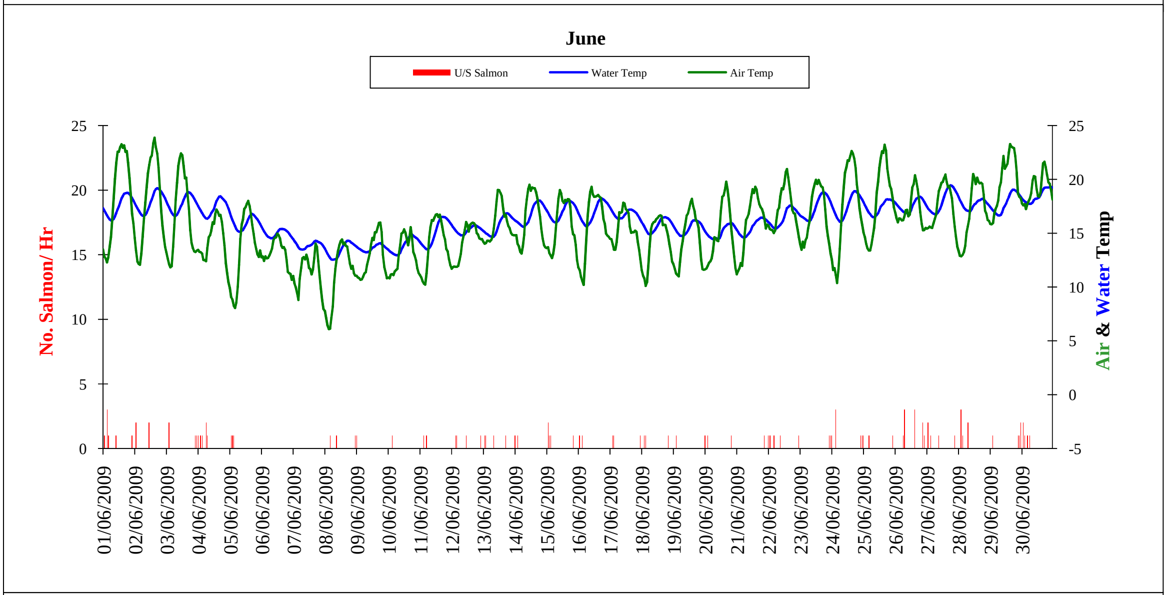


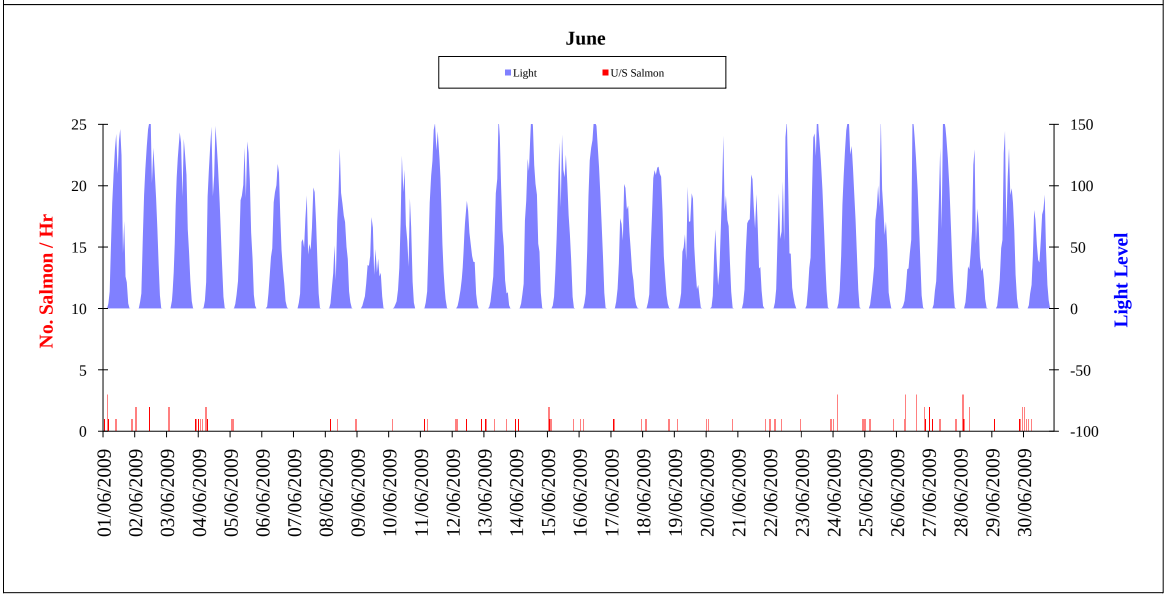




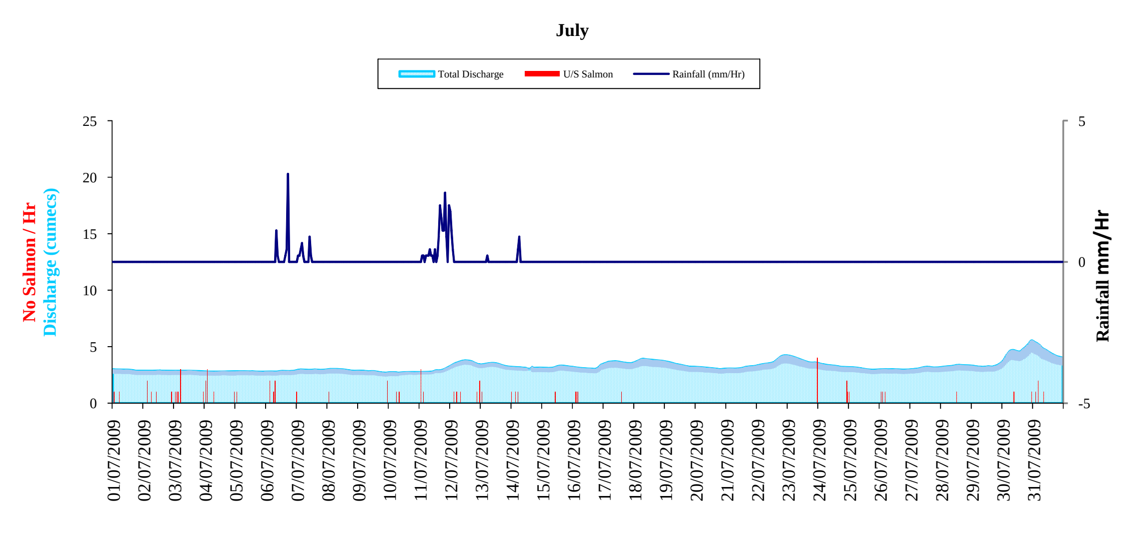
Appendix II Hourly data

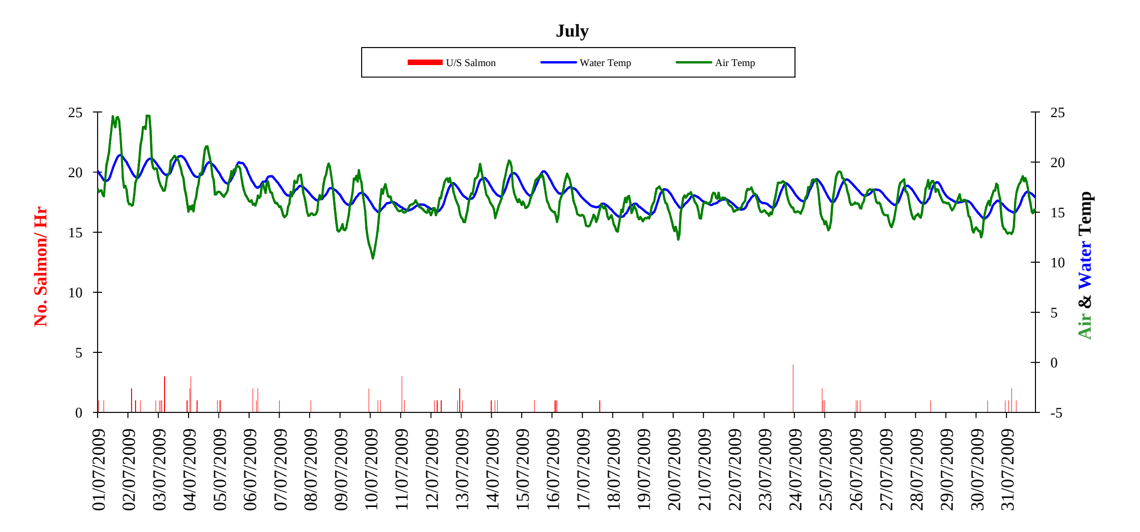


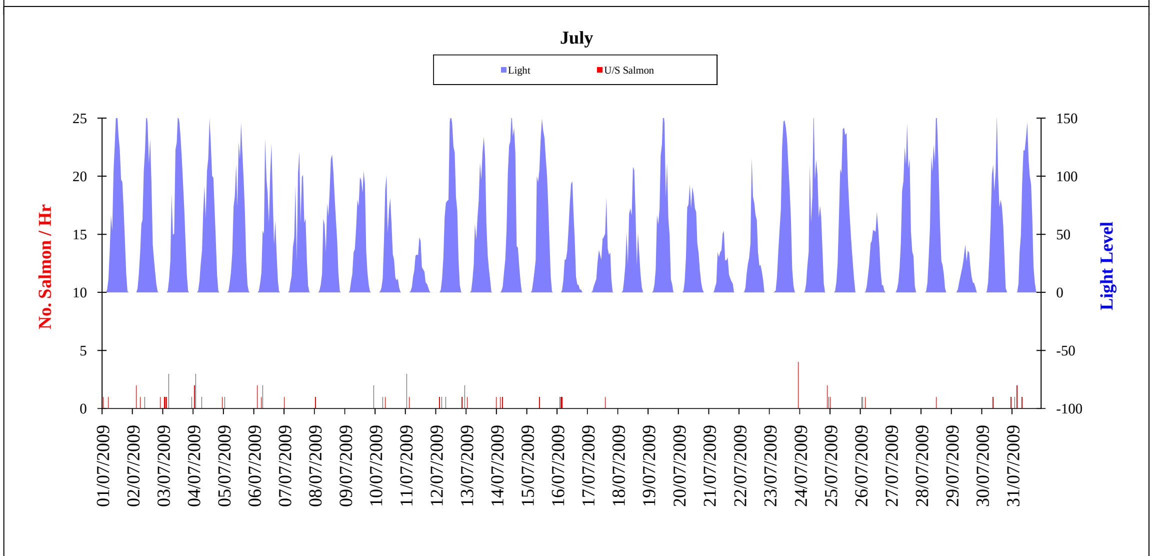


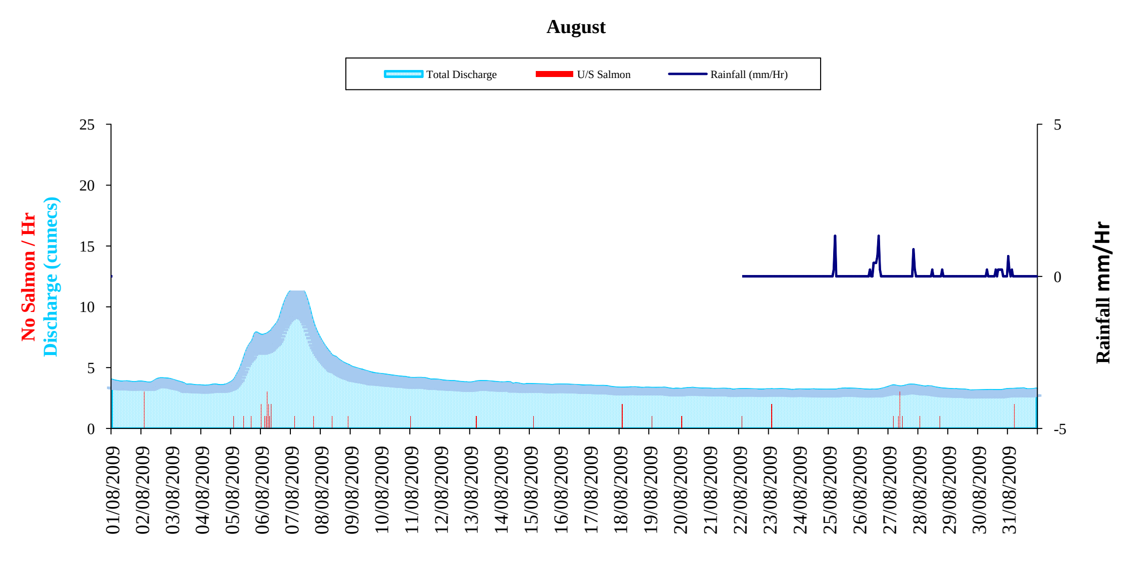


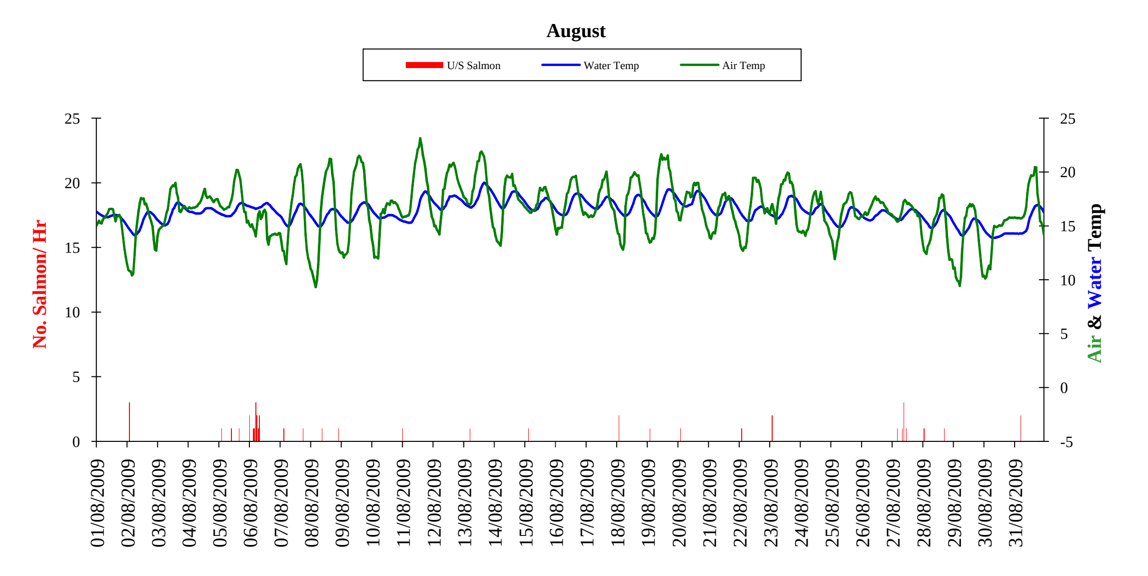
Appendix II Hourly data

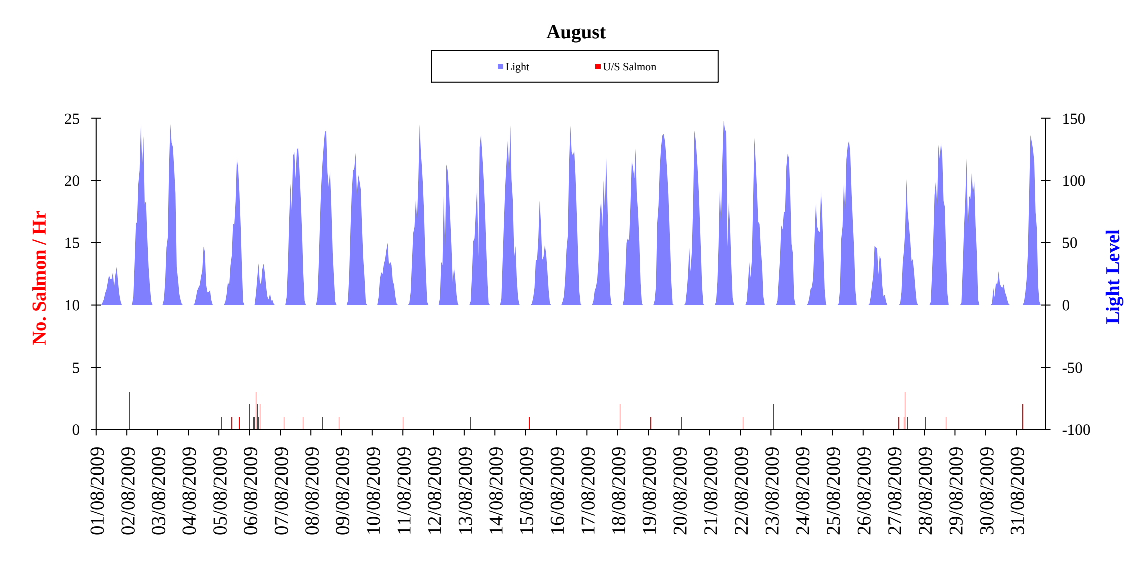

July
Total Discharge
U/S Salmon
Rainfall (mm/Hr)
No Salmon / Hr
Discharge (cumecs)
Rainfall mm/Hr


July
U/S Salmon
Water Temp
Air Temp
No. Salmon/ Hr
Air & Water Temp

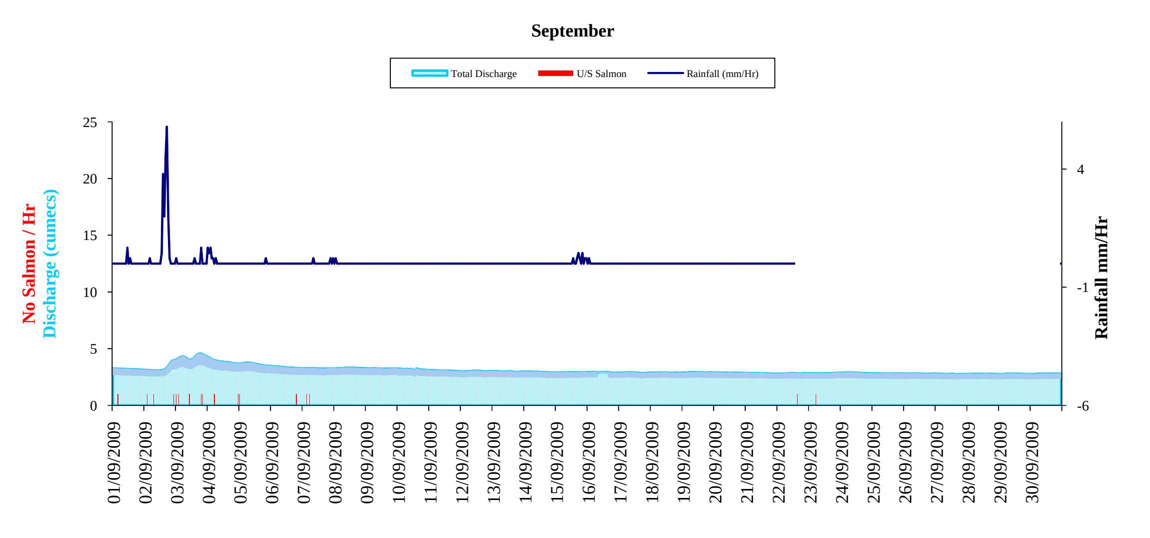

July
Light
U/S Salmon
No. Salmon / Hr
Light Level

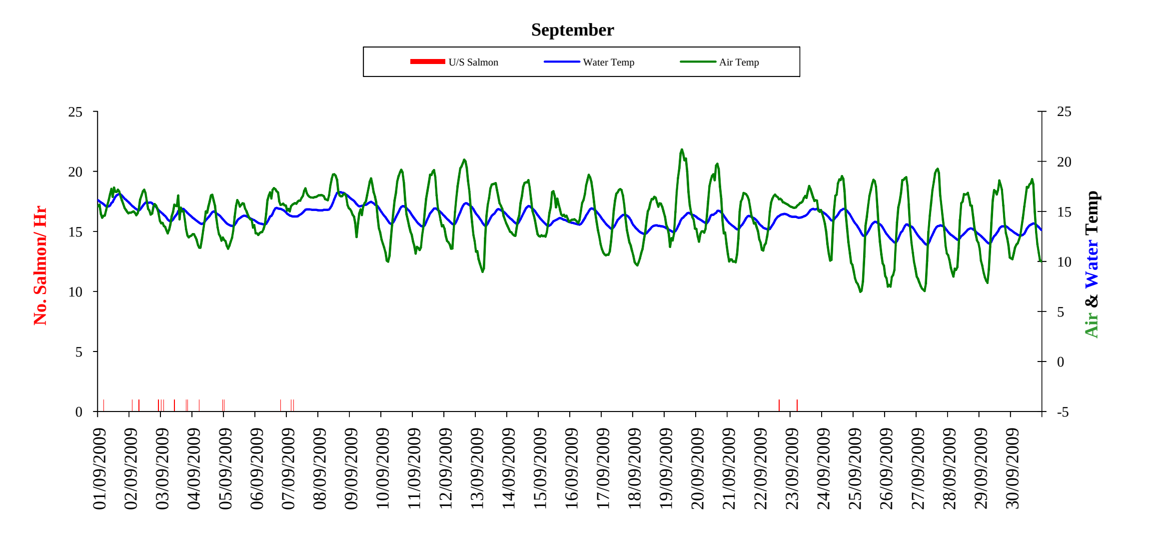


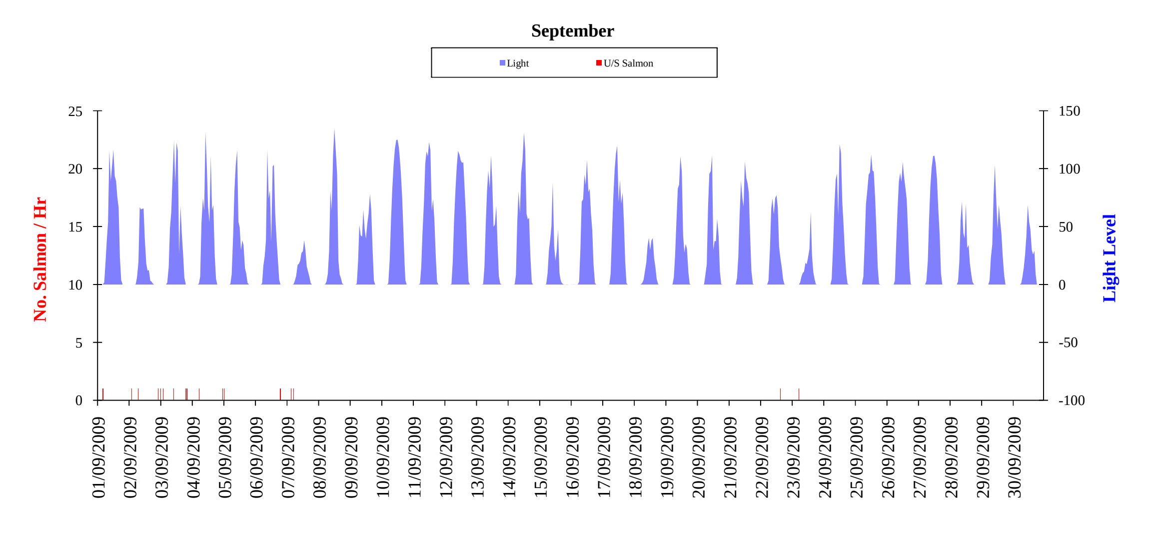


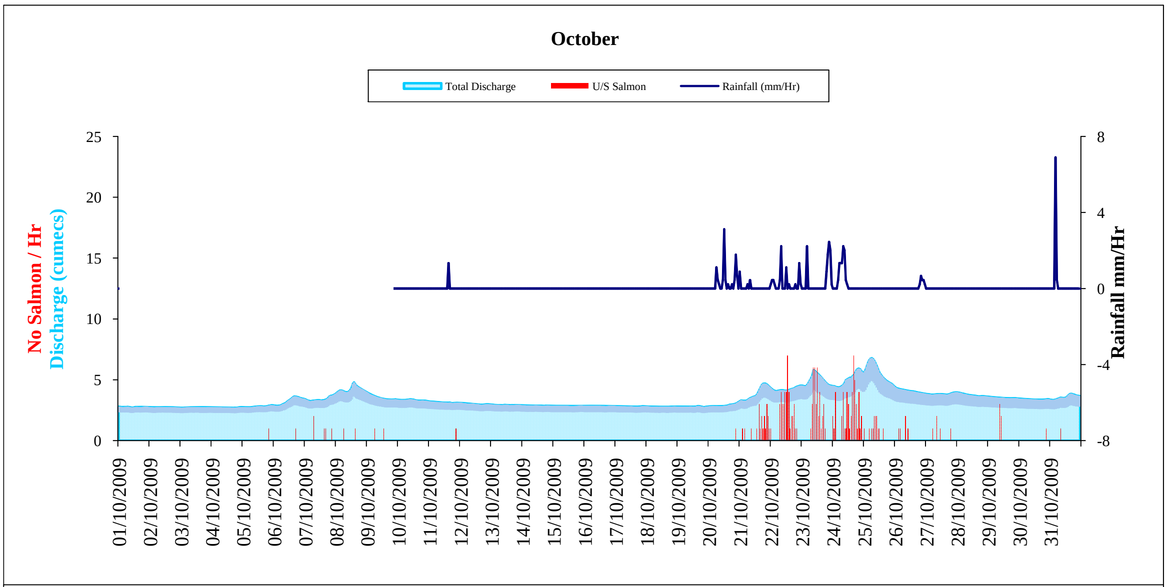


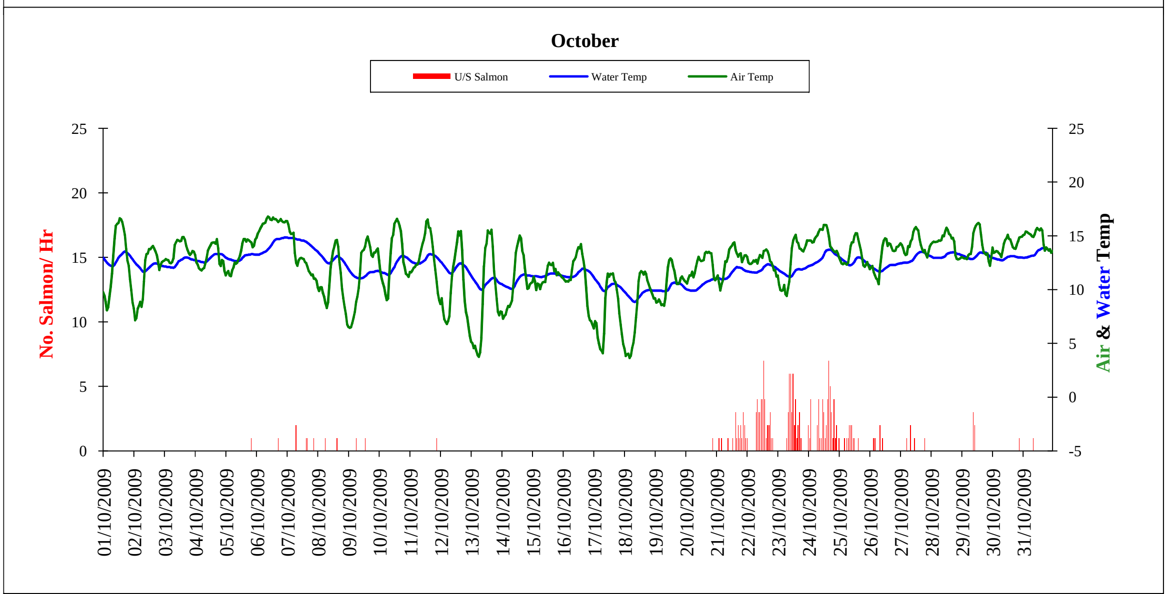
Appendix II Hourly data

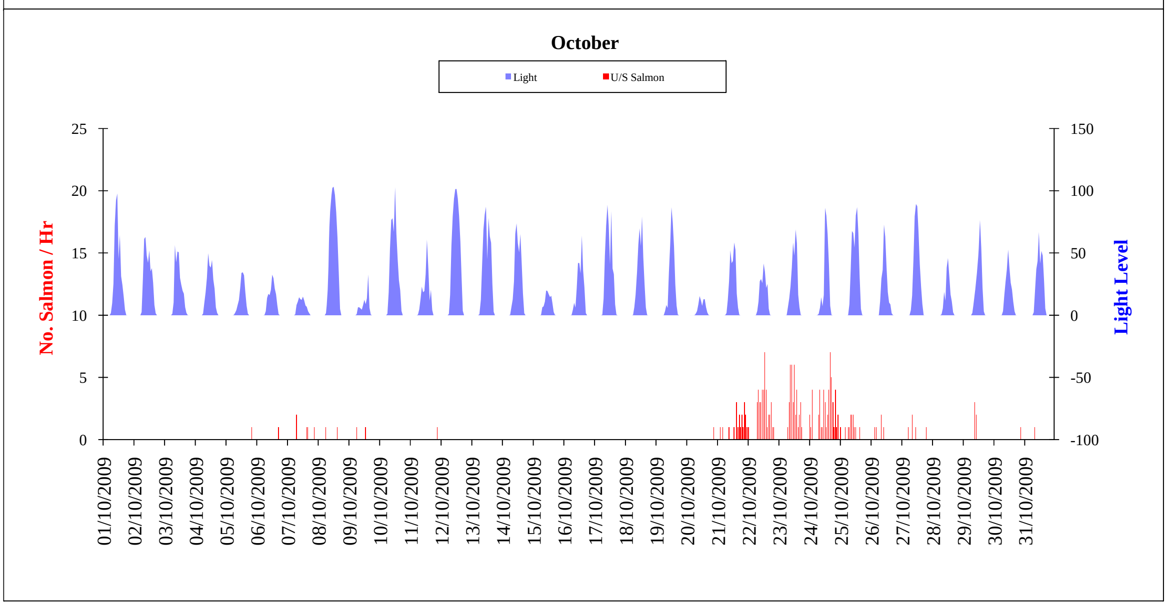

September
Total Discharge
U/S Salmon
Rainfall (mm/Hr)
No Salmon / Hr
Discharge (cumecs)
Rainfall mm/Hr

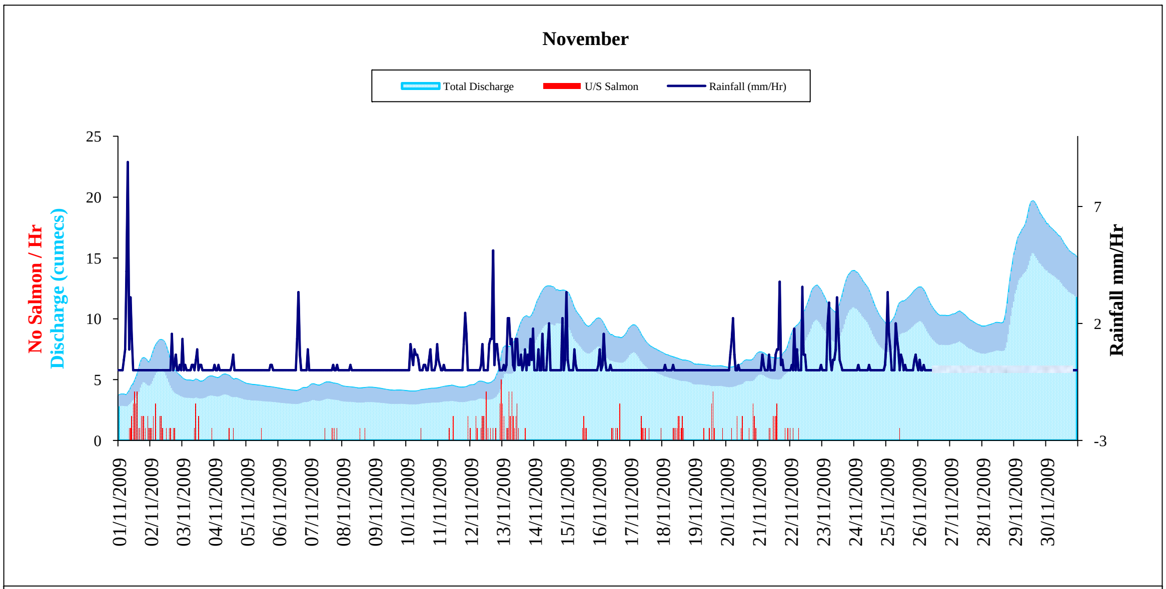

September
U/S Salmon
Water Temp
Air Temp
No. Salmon/ Hr
Air & Water Temp

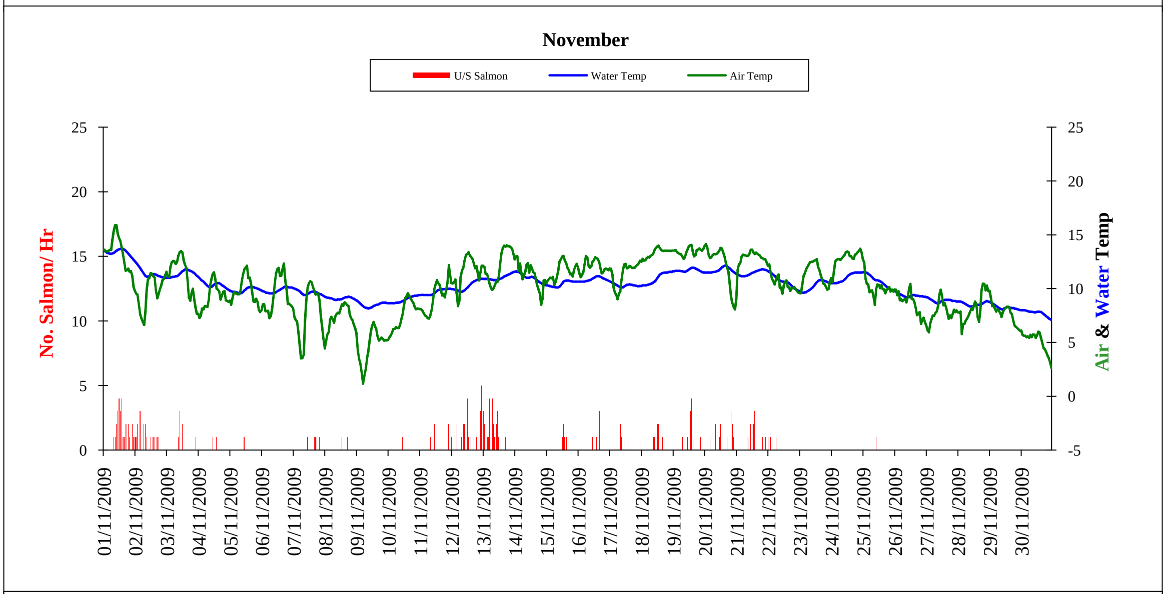

September
Light
U/S Salmon
No. Salmon / Hr
Light Level

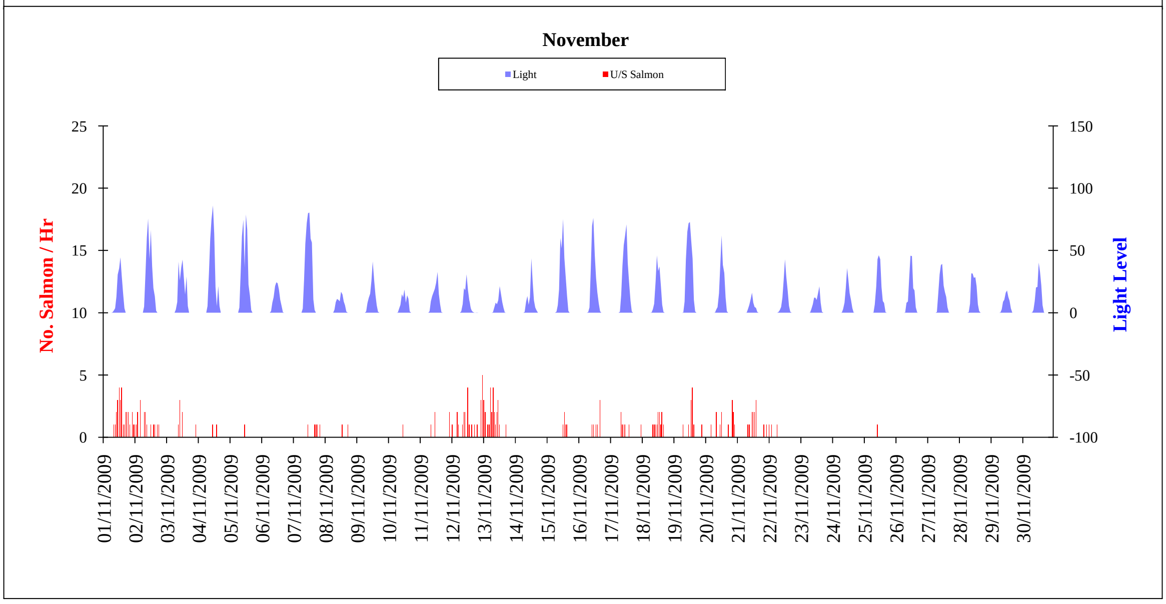

October
Total Discharge
U/S Salmon
Rainfall (mm/Hr)
No Salmon / Hr
Discharge (cumecs)
Rainfall mm/Hr


October
U/S Salmon
Water Temp
Air Temp
No. Salmon/ Hr
Air & Water Temp

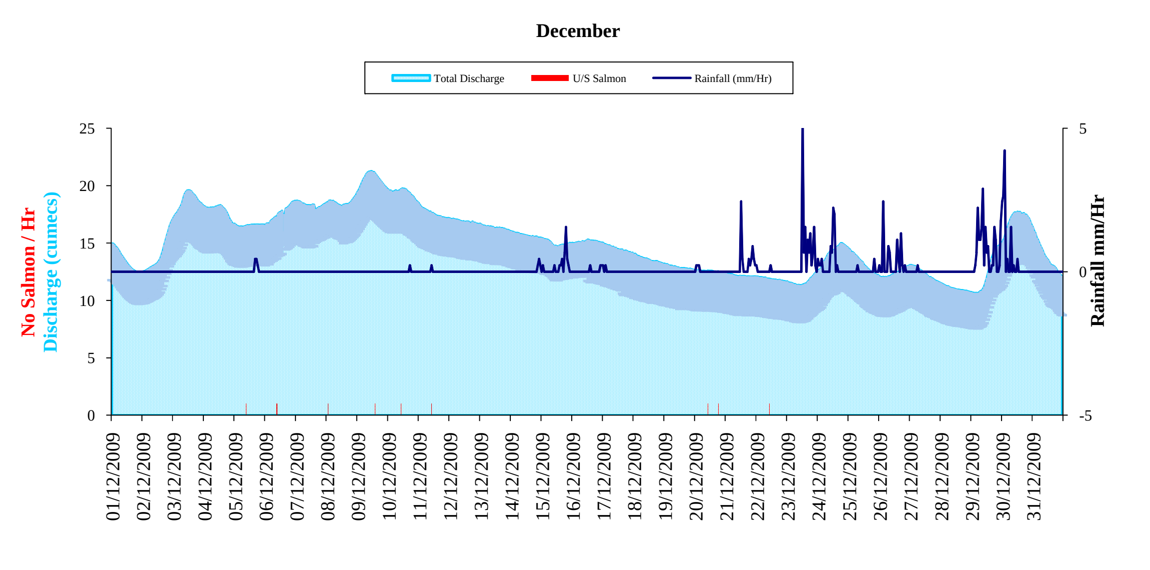

October
Light
U/S Salmon
No. Salmon/ Hr
Light Level

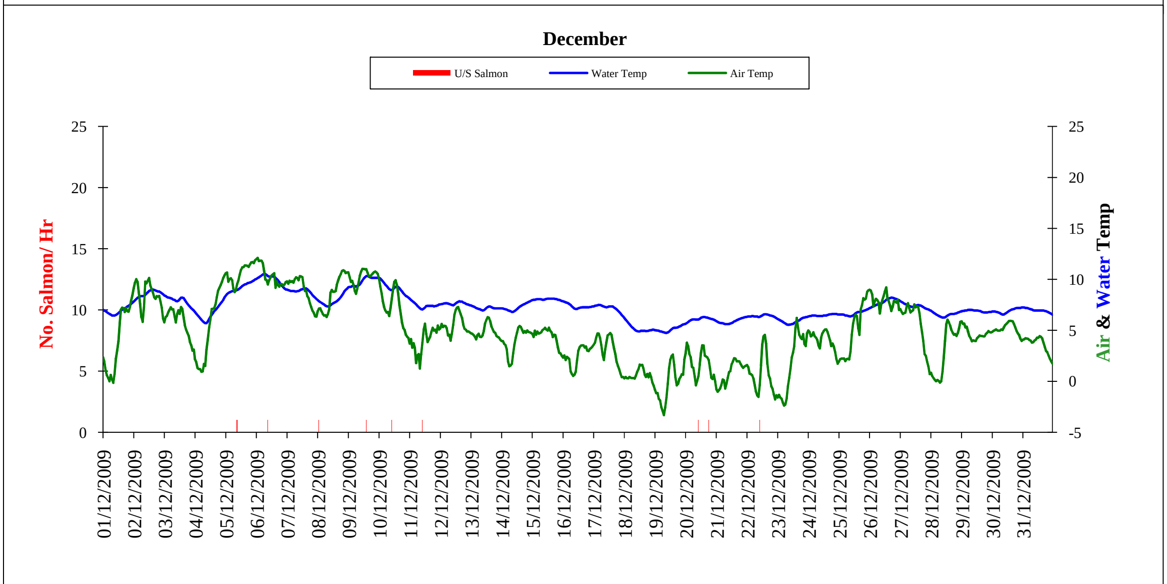


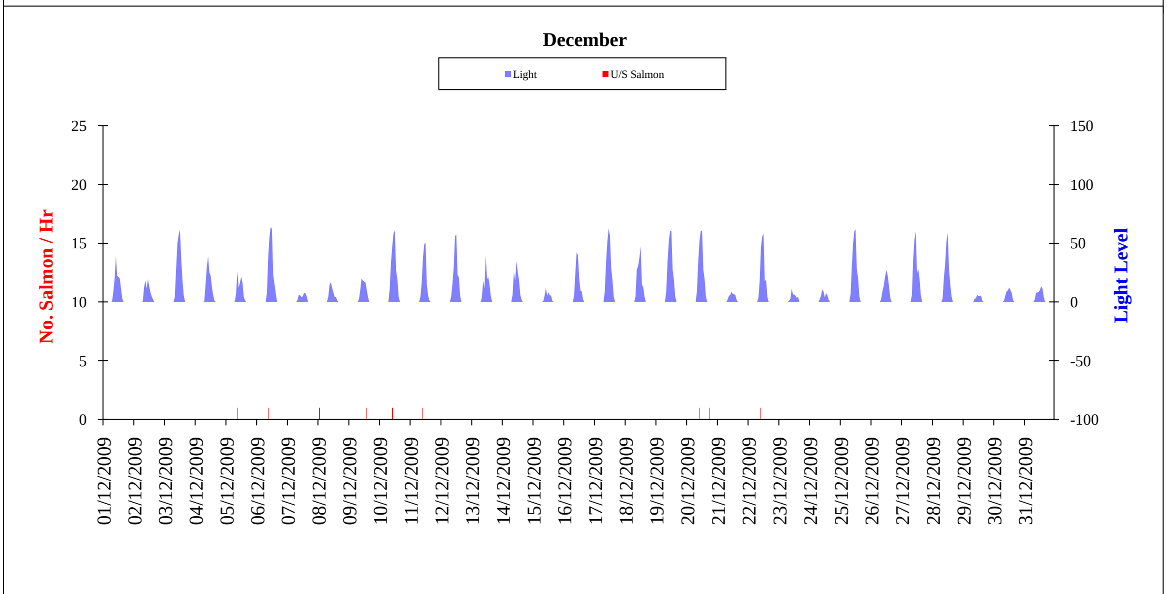




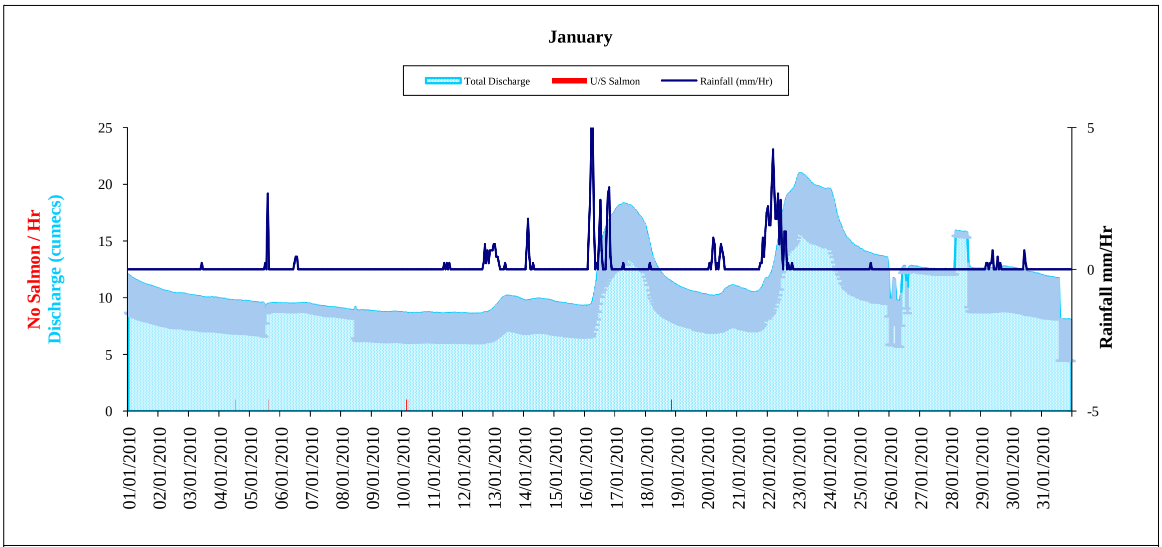
Appendix II Hourly data

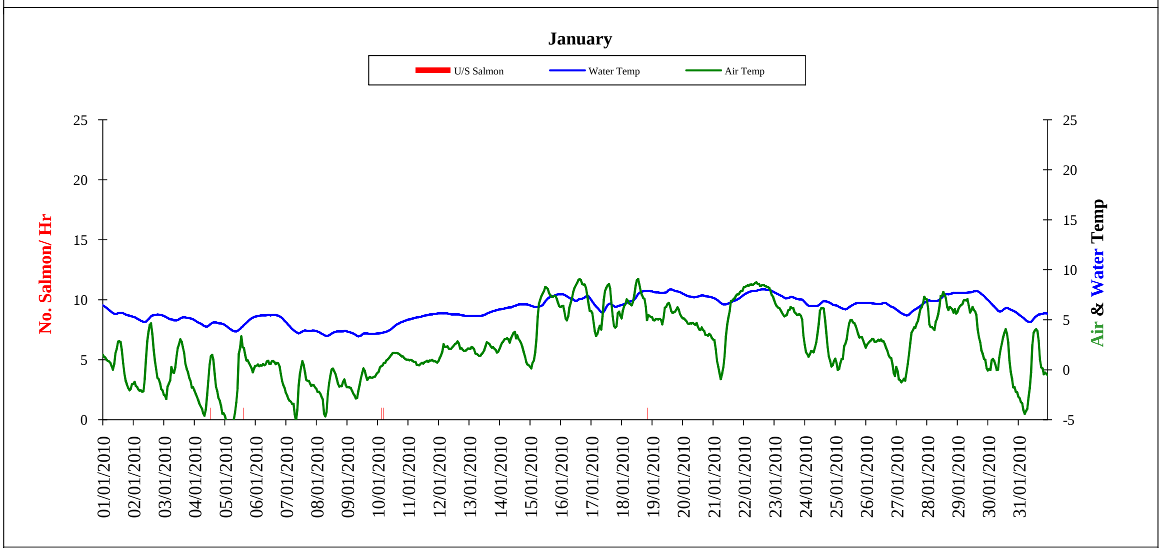


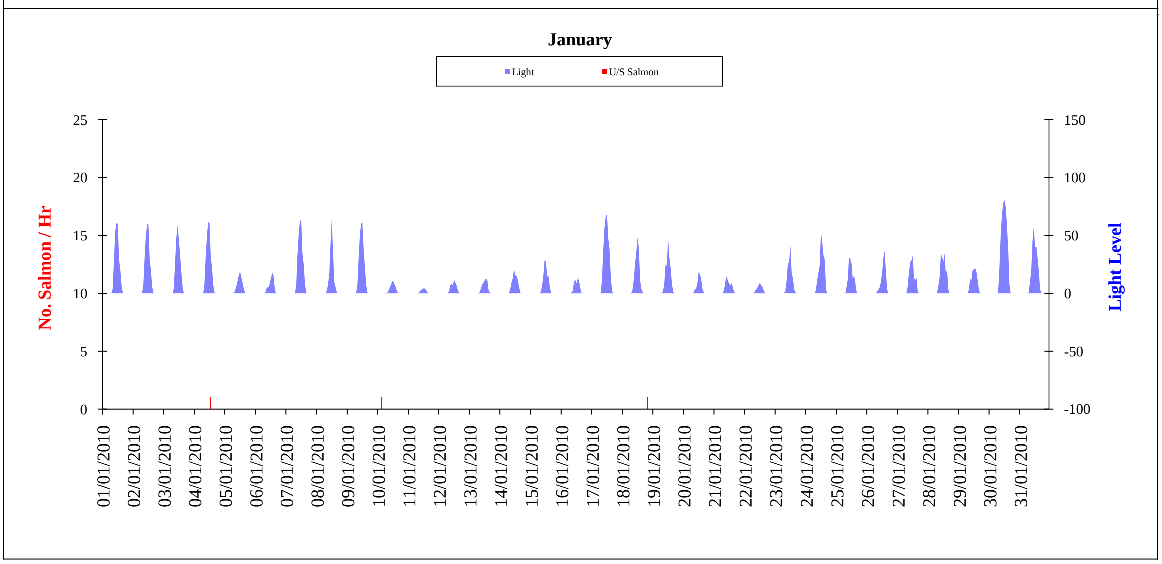




Appendix II Hourly data







Appendix II Hourly data

The Game & Wildlife Conservation Trust

For over 75 years our scientists have been researching why species like the grey partridge, water vole, corn bunting and black grouse have declined. We are continually developing practical measures to reverse these declines.

Our aim is simple – a thriving countryside rich in game and other wildlife.

We are an independent charity reliant on voluntary donations and the support of people who care about the survival of our natural heritage.

Our science is funded by our members. Be the first to know about our new research and call 01425 651010 to join us today.

Game & Wildlife
CONSERVATION TRUST

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