

**Enumeration of Adult Steelhead
in the
Upper Sustut River, 2002**

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Abstract

The upper Sustut River steelhead (*Oncorhynchus mykiss*) population was enumerated from July 29 to September 30, 2002, using a floating PVC fence. The first steelhead migrated past the fence on August 9 and by September 30, a total of 812 steelhead had been counted moving upstream. This value was defined as the upper Sustut River steelhead index for 2002. No count was made of steelhead remaining downstream of the fence due to poor conditions for visual enumeration. The population index for 2002 was the second highest on record and was 78% of the estimated carrying capacity (1036) for the upper Sustut system (Tautz *et al.* 1992). Between July 29 and September 30, a total of 988 chinook salmon (*O. tshawytscha*), 674 sockeye salmon (*O. nerka*), 64 coho salmon (*O. kisutch*), 22 bull trout (*Salvelinus confluentus*), 6 resident rainbow trout (*O. mykiss*) and 26 Rocky Mountain whitefish (*Prosopium williamsoni*) were counted passing by the fence.

Eight steelhead tagged at the upper Sustut River fence in 2000 were recaptured in 2002 indicating that a minimum of 2.1% of the 2000 run returned as potential repeat spawners. While the percentage of repeat spawners was above the long-term average (1.5%), the growth between spawning events (54 mm) was below average (72 mm). None of the steelhead tagged at the fence in 1999 were recaptured in 2002.

The ratio of female to male steelhead was 1.27:1. A total of 6.3% of all steelhead handled at the fence exhibited gillnet marks. This falls in the lower end of historical values, which have ranged from 2.0 to 23.0% and averaged 11.5%. Female steelhead exhibited a higher gillnet mark rate than males (8.4 and 3.6%, respectively).

With the addition of the 2002 data point, the upper Sustut steelhead population index became significantly correlated with the cumulative Tyee test fishery index to August 10.

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1.0 Introduction

The upper Sustut River steelhead (*Oncorhynchus mykiss*) stock has been used as an index population for early run summer steelhead in the Skeena Region since 1986 (Spence *et al.* 1990; Bustard 1993; Saimoto 1994; Saimoto 1995; Parken and Morten 1996; Parken *et al.* 1997; Williamson 1998, 1999a, 1999b, 2000; Diewert 2000, 2002). Early run steelhead stocks are of special concern for fisheries managers as their migration timing coincides with intense commercial fisheries for sockeye (*O. nerka*) and pink (*O. gorbuscha*) salmon where they are often captured incidentally (Ward *et al.* 1993; Cox-Rogers 1994). The resulting impact on the spawning populations can be significant and potentially detrimental to the long-term viability of these important stocks. Annual enumeration of the upper Sustut River steelhead stock provides yearly population index values and time series data that demonstrate trends in the abundance of all early run Skeena steelhead.

The objectives of the 2002 enumeration program were:

1. to index the upper Sustut River steelhead population,
2. to determine the number of previously tagged steelhead, by sex, that returned in 2002, and to calculate the growth rate for these repeat spawners,
3. to examine the sex ratio of steelhead throughout the run,
4. to examine the effect of water height and temperature on steelhead migration,
5. to examine the number of gillnet marked steelhead and the distribution of gillnet marked fish throughout the run,
6. to examine the relative run timing of male and female steelhead, and
7. to examine the effect of adding the 2002 data to the regression relationship between the upper Sustut River steelhead index and the cumulative Tyee test fishery index.

2.0 Study Area

The Sustut River is located in north central British Columbia and is a tributary to the upper Skeena River (Figure 1). Originating in the Omineca Mountains approximately 220 km north of Smithers, B.C., the Sustut River flows for 8 km northwest from Sustut and Mud lakes where it joins Johanson Creek near the main spawning area for upper Sustut steelhead (Bustard 1993). The river then flows 3 km west to its confluence with Moosevale Creek before turning southwest for approximately 100 km and flowing into the Skeena River. The Sustut River drains approximately 3,574 km² and has seven main tributaries: Birdflat Creek, Bear River, Asitka River, Red Creek, Two Lake Creek, Moosevale

Creek and Johanson Creek. Fish species known to inhabit the upper Sustut River include steelhead, chinook salmon (*O. tshawytscha*), sockeye salmon, coho salmon (*O. kisutch*), bull trout (*Salvelinus confluentus*), Dolly Varden char (*S. malma*), Rocky Mountain whitefish (*Prosopium williamsoni*), and burbot (*Lota lota*)¹ (Bustard 1993; Saimoto 1994; Saimoto 1995). The physical area that defines the upper Sustut River steelhead population is the Sustut River upstream of the Moosevale Creek confluence including Johanson Creek and Sustut and Johanson lakes (Spence *et al.* 1990, Figure 1). The physical area that defines the lower Sustut River steelhead population is the Sustut River downstream of the Bear River confluence, including Bear River and Bear Lake (Spence *et al.* 1990; Figure 1).

3.0 Methods

3.1 Steelhead Enumeration

A floating fish counting fence constructed from 3.8 cm PVC pipe was placed in the Sustut River, 500 m upstream of the confluence with Moosevale Creek and 70 km upstream of the confluence with the Bear River (Figures 2, 3). The fence was operated between July 29 and September 30. The new aluminum trap box fabricated in 2001 to replace the aging wooden structure, was used again in 2002 (Diewert 2002).

The total count of steelhead migrating past the fence has been defined as the upper Sustut River steelhead index. Fish holding between the fence and the Moosevale Creek confluence pool were not counted in 2002 due to poor visual enumeration conditions. As a result, the total escapement for the upper Sustut River steelhead population could not be estimated.

The fence was inspected daily for debris accumulation and openings passable to fish. Debris was removed and repairs made as necessary. The fence trap box was checked in the morning and evening during low levels of fish migration and was checked more frequently during heavier migration. It has been observed that activity around the fence often halts or delays migration. Therefore, periods of fish handling and the removal of debris and carcasses from the fence were limited to avoid delaying fish migration. Past fence modifications implemented to reduce stress and mortality caused by the original fence design and handling procedures were used again in 2002 (Williamson 1999b).

¹ In August, 1999 a single juvenile burbot (<10 cm fork-length) was found in a beaver impoundment by Ministry Staff on the Sustut River approximately 800 meters upstream of its confluence with Johanson Creek.

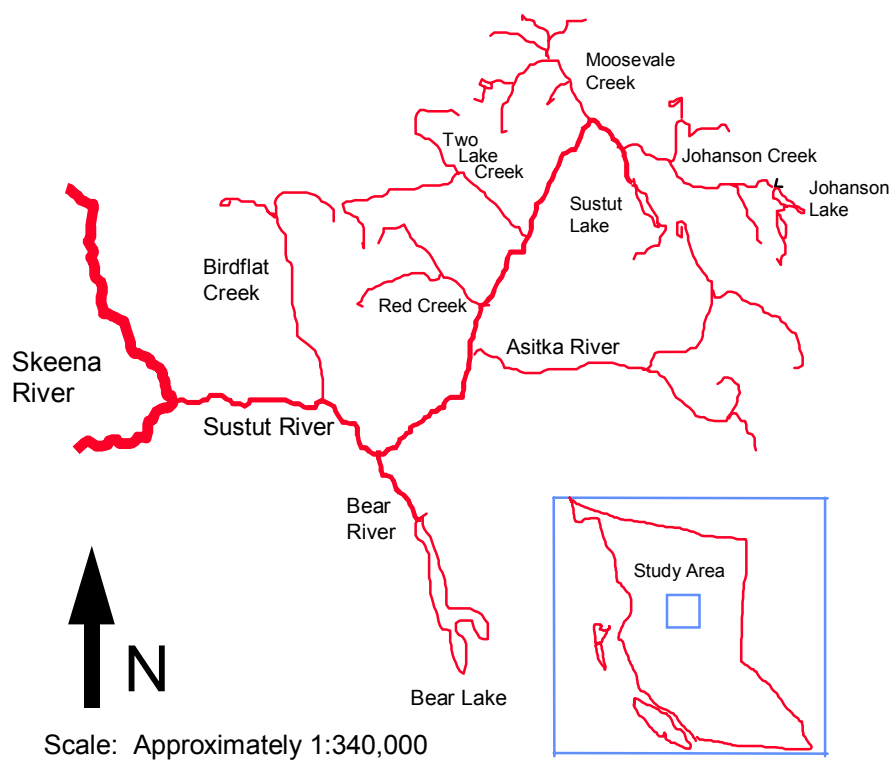


Figure 1. The Sustut River and major tributaries (from Saimoto 1995).

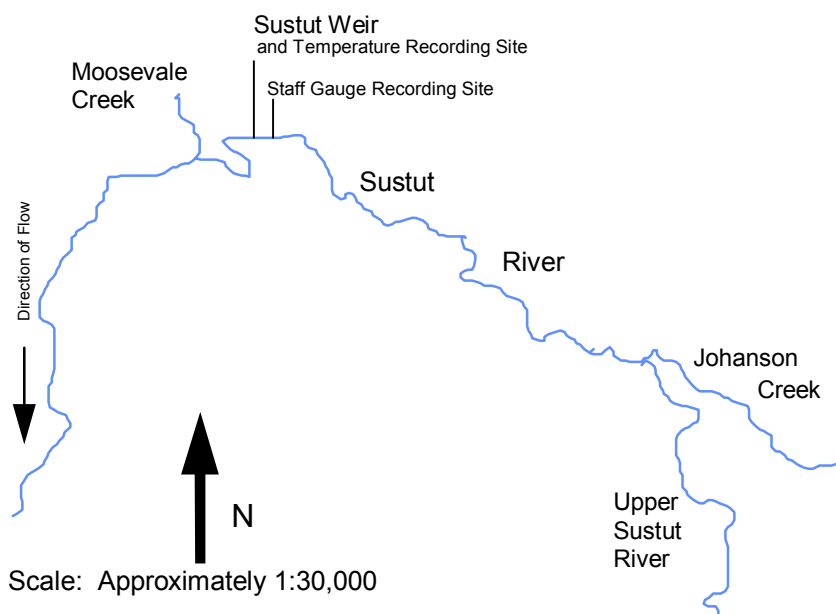


Figure 2. Detailed map of the study area (adapted from Saimoto 1995).

a



b



Figure 3. Aerial photograph of the steelhead enumeration fence looking downstream 1998 (a) and photograph of the fence from the trail on the right bank (b) of the Sustut River, 1999.

Experienced personnel, using the visual characteristics described in Scott and Crossman (1973) and McPhail and Carveth (1994), identified all fish passing the fence to species. In an attempt to reduce any stress-related mortality that may be associated with the collection of biological data, senior biologists decided to avoid handling steelhead at the fence in 2002. As a result, no steelhead were tagged or measured for nose-fork length and scales were not collected for age analysis. Instead, a plexiglass viewing box was used to identify fish by species and sex and to observe gillnet marks, scars, wounds and general condition. All data were recorded for each fish and summarized daily. Mortalities recovered from the fence were measured for nose-fork length and a sample of 5 scales, taken mid-laterally between the dorsal and anal fins, was collected for age analysis. Photographs were taken of all steelhead mortalities to further document fish condition. All other species of fish encountered at the fence were enumerated and sub-sampled for length. Tissue samples were collected for genetic stock identification and scales removed for age analysis.

3.2 Steelhead Recaptures

Sex, nose-fork length and the presence of gillnet marks or predator scars were recorded for previously tagged steelhead (identified by tag presence, or unhealed scar in the tag position). Tag colour and number were recorded and compared to the Ministry of Environment, Lands and Parks, Skeena Region, TAGS database to determine original tagging location and date. Fork lengths of recaptured fish were compared between tagging periods to determine growth rates.

3.3 Steelhead Migration and Physical Data

Stream temperatures were recorded once daily by personnel using a Brannon minimum-maximum thermometer. Also, automatic data loggers (Onset Computer Corporation, Pocasset, MA) were deployed in the stream and in the air near the fence site to record hourly temperatures. Water levels were recorded in the morning and the evening using an instream staff-gauge. Air temperature and weather conditions were also recorded daily. Maximum daily water temperature and level were examined against steelhead migration by graphical and statistical methods to determine if these physical factors influenced migration patterns.

3.4 Steelhead Gillnet Marks

The presence of gillnet marks was recorded for all steelhead. The cumulative daily percentage of steelhead with gillnet marks was compared with the cumulative total number of steelhead for the duration of the run. The mean nose-fork lengths of gillnet marked and unmarked steelhead could not be compared in 2002 as length data were not collected. Temporal trends in the

gillnet mark rate were examined by pooling and plotting the percent of gill net marked steelhead by week.

3.5 Male and Female Steelhead Run Timing

The run timing of male and female steelhead was examined by plotting cumulative percent male and female steelhead by date over the duration of fence operation. Also, time series histograms of male and female migration timing were plotted and compared using Student's t-test. Finally, the date of first arrival and mean migration date past the fence for male and female steelhead was also compared.

3.6 Upper Sustut River and Tyee Test Fishery Indices

The cumulative steelhead index at the Tyee Test Fishery has been used to indicate the relative abundance of steelhead and salmon migrating into the Skeena River (Cox-Rogers and Jantz 1993; Ward *et al.* 1993; Cox-Rogers 1994; Koski *et al.* 1995; Labelle *et al.* 1995). The cumulative steelhead index to August 10 is considered to indicate the relative abundance of early run Skeena River steelhead (upper Sustut River steelhead). This date was chosen as it was the last date that tagged upper Sustut River steelhead were observed in the Tyee test fishery (Parken *et al.* 1997).

In 1996, the relative abundance of upper Sustut River steelhead was standardized into a population index to reduce the variability resulting from the different enumeration methods (Parken *et al.* 1997). This index was defined as the total number of steelhead counted through the Sustut River fence to September 30. Parken *et al.* (1997) found that the August 10 cumulative Tyee steelhead index correlated positively with and was a significant predictor of the Upper Sustut steelhead index. The 2002 data point was added to the data set to determine if the August 10 Tyee test fishery index was a significant predictor of the upper Sustut Steelhead population index.

4.0 Results

4.1 Steelhead Enumeration

Between August 9 and September 30, 812 steelhead migrated through the upper Sustut River fence (Appendix Tables 2, 6). This value was defined as the upper Sustut River steelhead index for 2002 (Table 1). Fish holding between the fence and the Moosevale Creek confluence pool were not counted in 2002 due to poor visual enumeration conditions. As a result, the total escapement for the upper Sustut River steelhead population could not be estimated.

The first steelhead migrated through the fence on August 9 and by September 2, 50% of the run had passed (Figure 4; Table 1). In order to provide a historical context for the 2002 data, the annual dates of 50% migration along with the corresponding total index values are presented in Table 1 for the years 1994 to 2002. Information prior to 1994 was not included due to the variability in enumeration methodology that existed during this period.

Table 1. Dates when 50% of the steelhead migrated through the fence and the total index by year.

Year	Date of 50% Migration		Total Index
1994	Aug-29		584
1995	Sep-08		467
1996	Sep-07		466
1997	Sep-13		649
1998	Sep-07		1064
1999	Sep-17		731
2000	Sep-07		377
2001	Sep-16		756
2002	Sep-02		812
Earliest 50% Migration Date	Aug-29	Minimum Index	377
Latest 50% Migration Date	Sep-17	Maximum Index	1064
		Mean Index	656

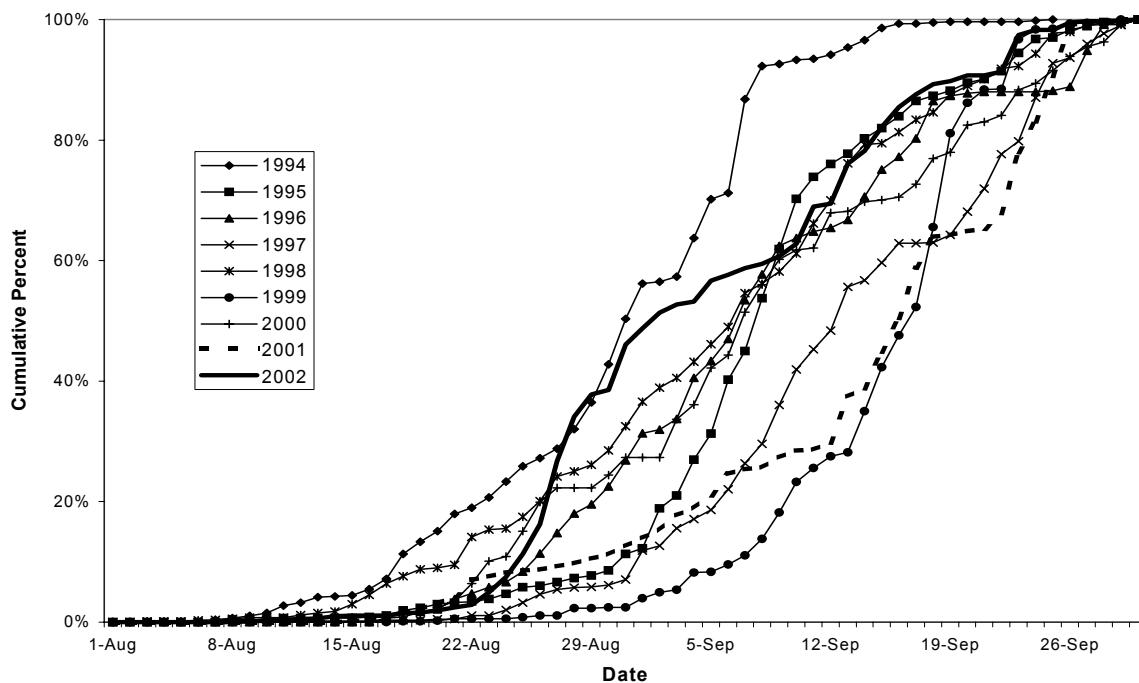


Figure 4. Daily cumulative percentage of upper Sustut steelhead migrating past the fence for the years 1994 to 2002.

The observed steelhead handling mortality at the fence was 0.5% (4 steelhead) (Appendix Table 1). No consistent physical wounds or scars were noted for these fish.

Between July 30 and September 30, 988 chinook salmon, 674 sockeye salmon, 64 coho salmon, 22 bull trout, 6 resident rainbow trout and 26 Rocky Mountain whitefish migrated through the fence (Appendix Tables 2, 3).

4.2 Steelhead Recaptures

Eight steelhead (7 female, 1 male) tagged at the Sustut River fence in 2000 were recaptured in 2002 (Table 2). Growth from the date of initial tagging to the date of recapture ranged from 15 to 110 mm and averaged 54 mm.

Table 2. Tagged steelhead recaptured at the Sustut River fence, 2002.

Recapture Data					Tagging Data			
Date	Sex	NF Length (mm)	Tag Colour	Tag Number	Date	Location	Sex	NF Length (mm)
24-Aug-02	F	760	White	14270	17-Sep-00	Sustut Fence	F	700
27-Aug-02	F	810	White	14091	27-Aug-00	Sustut Fence	F	745
27-Aug-02	F	780	White	14152	05-Sep-00	Sustut Fence	F	720
28-Aug-02	F	750	White	14008	20-Aug-00	Sustut Fence	F	710
28-Aug-02	M	730	Yellow	37397	19-Jul-02	Tyee Test Fish.		
02-Sep-02	M	895	Orange	00942	14-Sep-00	Sustut Angle	M	785
03-Sep-02	F	785	Orange	04513	04-Sep-00	Sustut Angle	F	770
11-Sep-02	F		White					
18-Sep-02	F	730	White	14176	06-Sep-00	Sustut Fence	F	700

The timing of arrival at the fence for these fish ranged from 24 days earlier to 12 days later. The average time of arrival at the fence was earlier in 2002 than in 2000 by 4 days. None of the steelhead tagged at the Sustut River fence in 1999 were recaptured in 2002 (Table 2).

A total of 377 steelhead were tagged at the fence in 2000. The eight fish recaptured in 2002 indicate that a minimum of 2.1% of the 2000 run returned as potential repeat spawners in 2002.

One male steelhead tagged at the Tyee test fishery on the lower Skeena River was recovered at the fence on August 28. The time from initial tagging to recovery at the fence was 41 days.

4.3 Steelhead Migration and Physical Data

All environmental data along with a description of daily weather conditions are presented in Appendix Table 4. Daily minimum and maximum water temperatures are shown graphically in Appendix Figure 1.

Maximum daily water temperature and staff gauge height were plotted with steelhead migration through the fence (Figures 5, 6). While daily steelhead migration was not dependent on water temperature, regression analysis indicated

that river level influenced steelhead movement past the fence (ANOVA: $F=7.664$, $p=0.009$). When daily steelhead migration was lagged

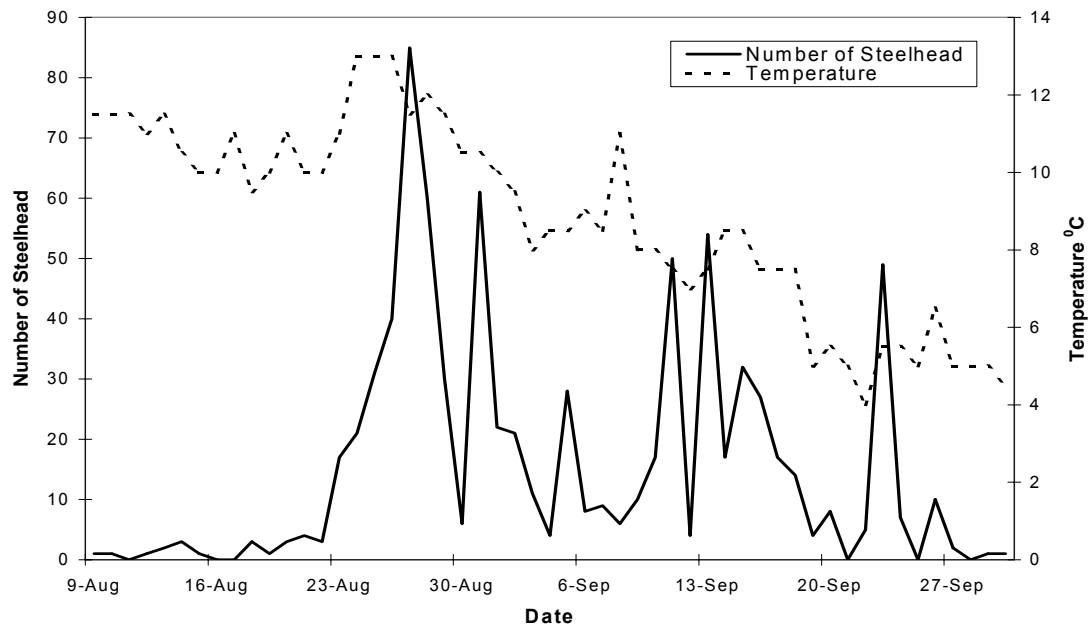


Figure 5. Daily maximum water temperatures and the number of steelhead migrating past the fence.

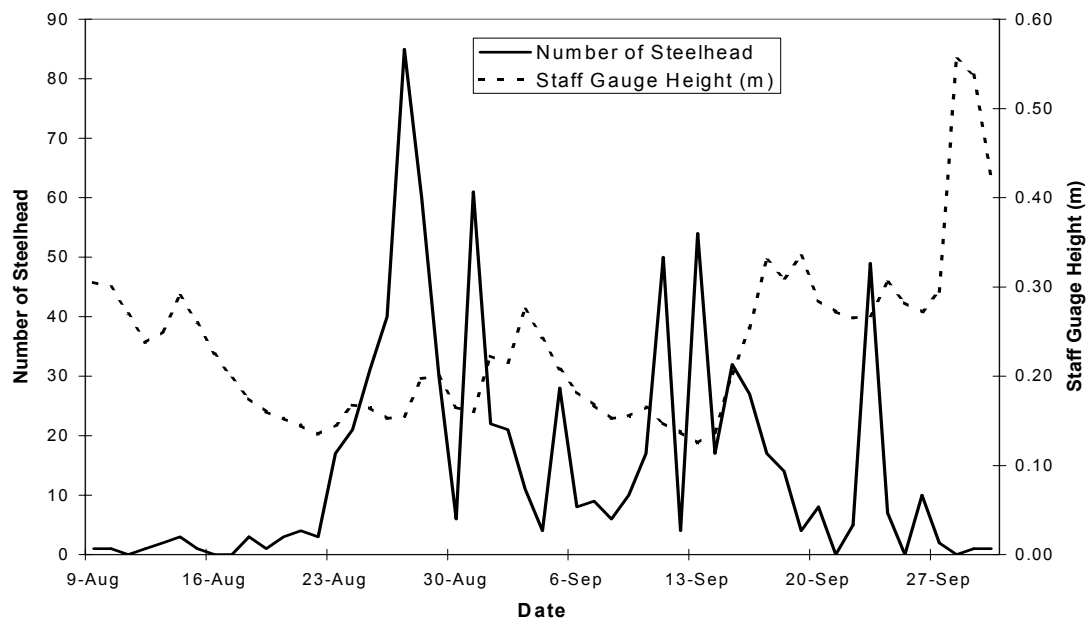


Figure 6. Daily staff gauge height and the number of steelhead migrating past the fence. by 3 days (daily steelhead migration matched with physical data from 3 days previous) regression analysis revealed that both water temperature (ANOVA:

$F=6.009$, $p=0.018$) and river depth (ANOVA: $F=14.699$, $p=0.001$) had a significant effect on migration (Appendix Figure 2, 3).

4.4 Steelhead Length Distributions by Sex

Of the 812 steelhead handled at the fence, 358 (44.1%) were male and 454 (55.9%) were female making the ratio of female to male steelhead 1.27:1. As steelhead were not handled at the fence in 2002, length comparisons could not be made between males and females.

4.5 Steelhead Gillnet Marks

Gillnet marks were present on 6.3% of all steelhead that migrated past the fence. The daily cumulative percentage of gillnet marked steelhead was plotted by date along with cumulative total steelhead (Figure 7). This figure indicates that cumulative gillnet marks remained at zero until late August and then increased and remained relatively stable until program termination. This trend became more evident when the percent of gillnet marked steelhead was pooled and plotted by statistical week (statistical week definitions are outlined in Appendix Table 5) (Figure 8). Weekly gillnet mark rates ranged from a low of 0% in statistical weeks 8-1 and 8-2 to a high of 7.8% in statistical week 9-1.

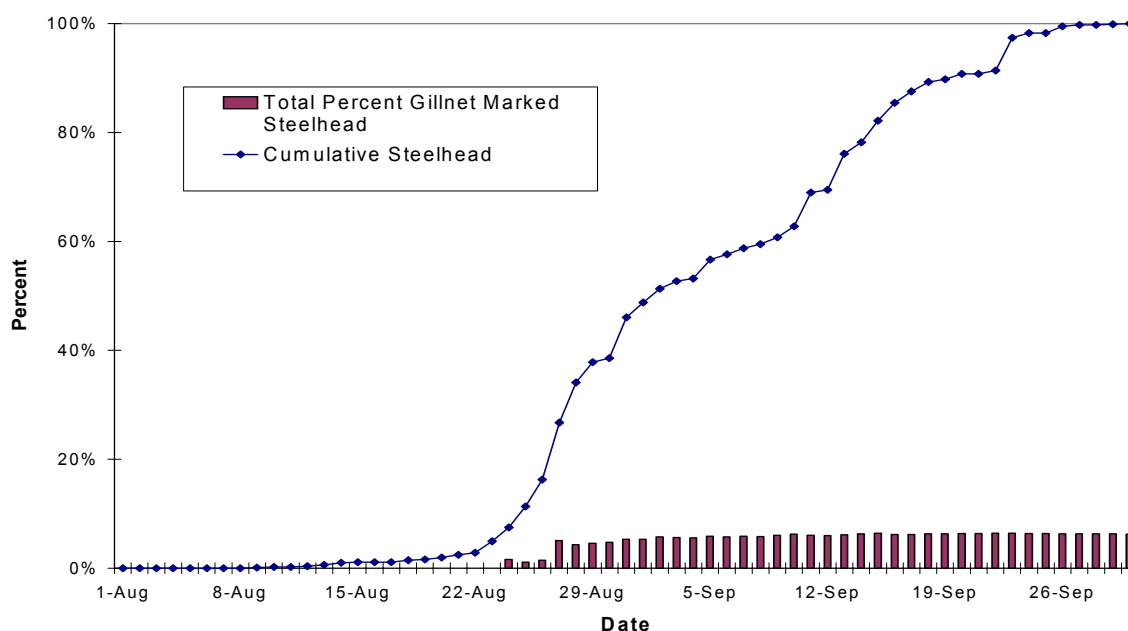


Figure 7. Daily cumulative total gillnet marked steelhead and daily cumulative total steelhead.

A total of 3.6% of male steelhead and 8.4% of female steelhead examined at the fence exhibited gillnet marks. These values are lower than those reported for males and females in 2000 (10.6 and 16.2%, for males and females, respectively; Diewert 2000) or in 2001 (10.1 and 14.5%, for males and females,

respectively; Diewert 2002). The lengths of gillnet marked and unmarked fish could not be compared, as length data were not collected in 2002.

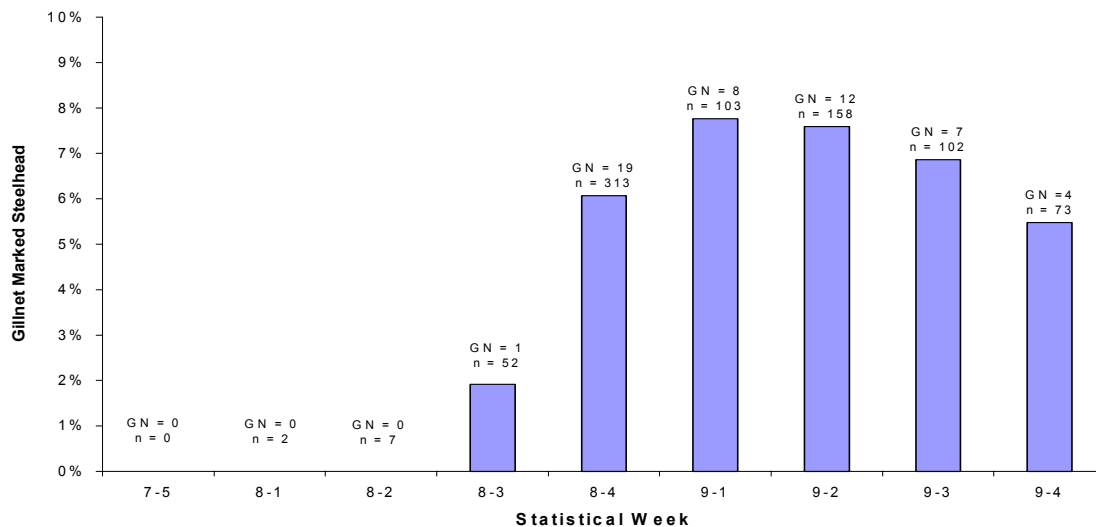


Figure 8. Percent of steelhead with gillnet marks by statistical week. GN = the number of gillnet marked steelhead and n = the total number of steelhead handled each week.

4.6 Male and Female Steelhead Run Timing

The first female steelhead passed through the fence on August 9 while the first male steelhead arrived on August 13. The median migration dates for males and females were September 3 and September 1, respectively. The plot of daily cumulative percentage of fish arriving at the fence for both sexes revealed a slightly different migration pattern for males and females (Figure 9). However, when time series histograms were compared, there was no significant difference in the timing of migration past the fence for male and female steelhead (Students t-test: $t=0.930$, $p<0.05$).

4.7 Upper Sustut River and Tyee Test Fishery Indices

The 2002 upper Sustut steelhead population index and the cumulative Tyee test fishery index to August 10 were added to the historical regression relationship between these two values (Figure 10). With the addition of the new data point, the regression relationship became statistically significant (ANOVA: $F=4.992$, $p=.0495$) indicating that the Tyee index can be used as a predictor of upper Sustut steelhead abundance.

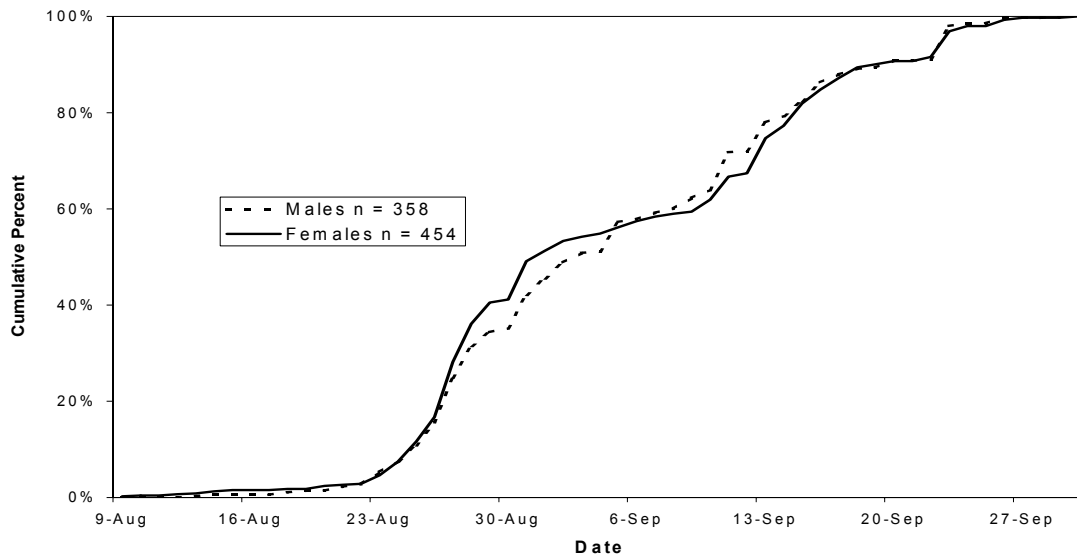


Figure 9. Daily cumulative percent of male and female steelhead.

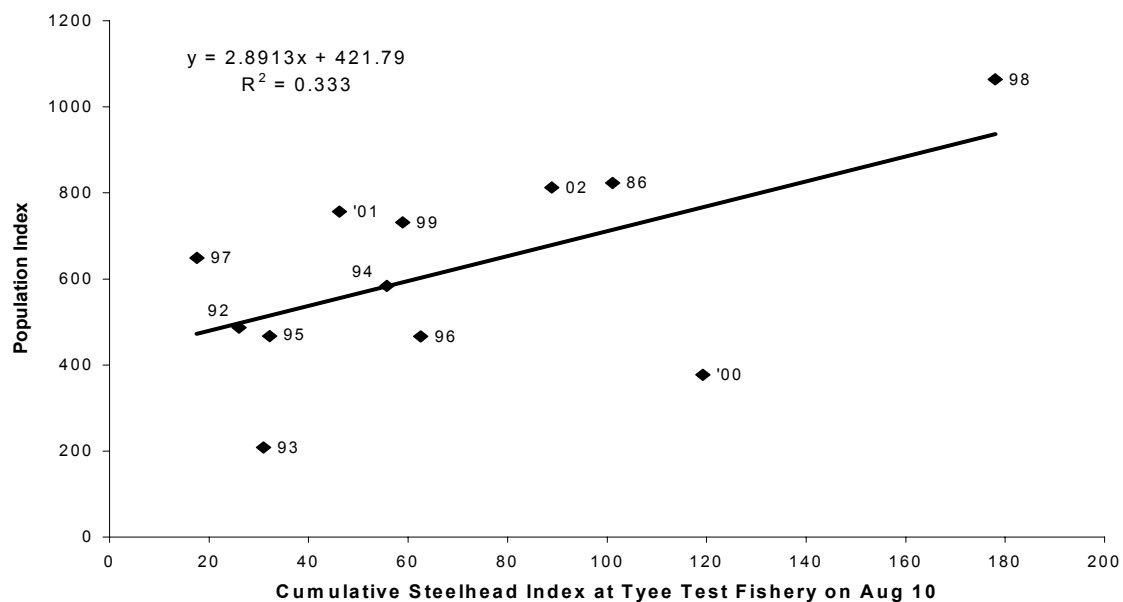


Figure 10. Linear relationship between the upper Sustut River steelhead population index and the cumulative steelhead index at the Tyee test fishery on August 10.

5.0 Discussion

The upper Sustut River steelhead population index for 2002 was 812 fish. This value is the second highest since enumeration methods were standardized in 1994 and approximately 20% above the long term average (Table 1). Since an

assessment of steelhead below the fence could not be completed in 2002, it was not possible to estimate total escapement to the system. As a result, it is difficult to determine if carrying capacity was reached; however, since 1995 the number of steelhead counted downstream of the fence has ranged from 6 to 41% of the annual index and averaged 18% (Parken and Morten 1996; Parken *et al.* 1997; Williamson 1998, 1999a, 2000; Diewert 2000, 2002). If an average percentage of the index remained below the fence in 2002 then the escapement would be approximately 958 and would still be below the estimated carrying capacity (1036) for the upper Sustut system (Tautz *et al.* 1992).

The rate of potential repeat spawners in 2002 was the second highest on record (2002 = 2.1%; long term average = 1.5%); however, the growth between spawning events was the lowest on record (2002 = 54 mm; long term average = 72 mm). This is likely due to the highly skewed sex ratio of repeat spawners as seven were female and only one was male. Size selective fisheries may have influenced this result as larger fish, and therefore repeat spawning males, were likely removed from the population en route to the spawning grounds at a higher rate than females.

The mortality rate for steelhead migrating past the fence in 2002 was 0.5%, which was the second lowest on record and well below the historical average of 1.5%. It is likely that the decision to avoid handling steelhead this year contributed to the low mortality rate; however, similar levels of mortality also occurred in years when all steelhead were tagged, measured and sampled for scales and DNA. For example, handling mortality rates were 0.8, 0.3, and 0.5% for the years 1998, 1999, and 2000, respectively (Williamson 1999a, 2000; Diewert 2000). While it is clear that handling steelhead to collect biological data adds additional stress to the fish, the relationship between this stress and mortality is less clear. It remains for project biologists to decide if the value of the data collected outweighs the potential negative impact of handling stress on such valuable fish. Gulland (1983) emphasized the value of collecting length and age data suggesting that it is important as it provides a time scale against which growth and mortality can be measured. It may be that collecting biological data from a sub sample of steelhead migrants will satisfy all data requirements while minimizing handling stress and the potential associated mortality.

Reports from previous years indicated that water temperature and river height influenced steelhead movement (Siamoto 1995; Parken and Morten 1996). Results from this year's study indicated that only river level was significantly correlated with fish movement when analyzed on a same day time frame (i.e. changes in water temperature are correlated with changes in migration on the same day). However, when the daily steelhead migration was lagged by 3 days, both environmental parameters were significant predictors of steelhead movement as river level was negatively correlated (higher levels resulted in lower migration rates) and temperature was positively correlated (higher temperatures resulted in higher migration rates) (Appendix Figures 2, 3). This result seems reasonable, as there is likely to be a delay between changes in environmental conditions and the subsequent response by fish. Figures 5 and 6 seem to support this conclusion, as there appears to be a slight delay between

fluctuations in river level and water temperature and increased migration past the fence.

In 2002, 55.9% of the steelhead migrating past the fence were female and 44.1% were male yielding a ratio of 1.27:1 females to males. The skewed sex ratio in favour of females is similar to that found in previous years (Parken *et al.* 1997; Williamson 1998, 1999a, 2000; Diewert 2000, 2002). Parken *et al.* (1997) postulated that this may have resulted from disproportionate sampling throughout the run during early studies. However, since 1995 all steelhead have been identified to sex and therefore the reported sex ratios accurately reflect those of the population. Hooton has indicated (personal communication in Parken *et al.* 1997) that past research found males dominant in the beginning of the run and females dominant near the end of the run. This has not been the case in the upper Sustut during the past several years when females dominated throughout the run. It may be that gillnet fisheries targeting other species have selectively harvested male steelhead as their larger size and in some cases, secondary sexual characteristics, make them more susceptible to this gear type. Sandercock (1991) suggests that in theory, sex ratios should be 1:1 but that a high level of differential mortality is associated with both commercial and recreational fisheries, which are selective for larger fish and therefore males. If this is the case for upper Sustut steelhead, then years of intensive fishing as reflected by high gillnet mark rates should be associated with smaller average fish size. When the historical length data were plotted against the annual gillnet mark rate, a negative trend was indeed apparent but the relationship was not statistically significant (Appendix Figure 4). It is likely that the addition of new data points in future years will continue to clarify this pattern.

A total of 6.3% of all steelhead migrating past the fence exhibited gillnet marks. This falls in the lower portion of historical values which have ranged from 2.0 to 23.0% and averaged 11.5% (Table 3). Female steelhead exhibited a higher gillnet mark rate than males (8.4 and 3.6%, respectively). Past studies have found that gillnet marked males and females were significantly smaller than unmarked fish (e.g. Diewert 2002). This suggests that smaller fish escape capture more often than larger fish due to the size selective nature of gillnets (Ricker 1975). The cumulative gillnet mark rate remained low to the end of August and then increased and remained relatively stable to the end of the program. This trend may reflect the pattern of fishery openings, including in-river IFF and ESSR fisheries, which can result in different timing components of the run encountering more or fewer gillnets.

With the addition of the 2002 data point, the upper Sustut River steelhead population index became significantly correlated with the cumulative Tyee test fishery index to August 10. As a result, the test fishery index once again functions as a predictor of upper Sustut steelhead abundance. The variability that exists in the relationship may be the result of recent adjustments made to commercial, IFF and ESSR fishing plans. Over the past several years, fisheries have been re-designed to target large Skeena sockeye returns while minimizing the impact on coho and the peak of the steelhead return. The resulting intensified effort during the early portion of the fishery coincides with the return

migration of early summer run steelhead including the upper Sustut stock. These change in the intensity and timing of fisheries has likely introduced additional variability into the regression relationship.

5.1 Historical Review

The assessment of steelhead in the upper Sustut River has been ongoing since 1986. Since enumeration methods varied considerably up to 1994 when the fence was installed at the current site, inter-annual comparisons of the population index prior to this date are more difficult to make. Parken *et al.* (1997) reviewed the early escapement data and concluded that the total population estimates fluctuated little between 1992 and 1996 and that all escapements up to 1996 were substantially below the carrying capacity ($k = 1036$; Tautz *et al.* 1992). Since the methods for establishing the annual population index were standardized in 1994, this value has ranged from a high of 1064 in 1998 to a low of 377 in 2000 (Table 3, Figure 11). This dramatic variability witnessed over such a short period indicates the vulnerability of the upper Sustut steelhead stock to fluctuations in natural and fishery related influences. While environmental variables can demonstrate annual fluctuations that may effect survival rates it is the ever changing pattern of the various fisheries that intercept upper Sustut steelhead which are most likely to effect the annual index and determine the level of subsequent production.

Since 1994, migration timing has also exhibited extensive variability with the date of 50% migration ranging from August 29 to September 17 (Table 3, Figure 11). Since analysis has shown that the pattern of movement past the fence is related to local environmental conditions including water temperature and river level it may not follow that relative timing at the fence site reflects the general pattern of arrival in other parts of the river. In 2001, 5 steelhead tagged at the Tyee test fishery in the lower Skeena River arrived at the upper Sustut fence. Migration time between these 2 sites ranged from 37 to 62 days and averaged 52 days. This additional variability in migration timing suggests that there are many factors that determine when various portions of the run arrive in different sections of the river. The difficulty in predicting migration timing reveals the inherent risks that managers face when attempting to schedule in-river fisheries without impacting steelhead stocks. It seems that steelhead will always be vulnerable to interception in these fisheries and caution should be exercised when contemplating any opening.

Between 1992 and 2001 the average length of male steelhead migrating past the fence has ranged from 777 to 864 mm and averaged 828 mm. Over the same period, female steelhead length has ranged from 721 to 771 mm and averaged 743 mm (Table 3, Figure 12). As has been discussed above, the greatest influence on the size of fish that reach the spawning grounds is associated with commercial fisheries, which are strongly selective for larger fish. It follows that in years where more steelhead are intercepted in the various

Table 3. Historical upper Sustut River steelhead data for the years 1992 to 2002.

Year	Date of First Steelhead	Date of 50% Migration	Index	Average Length (mm)		Repeat Spawner Growth	% Repeat Spawner	% Handling Morts	% Gillnet Marked		
				M	F				M	F	Total
1992				777	721						23.0
1993				848	740						11.0
1994	Aug-08	29-Aug	584	824	737						2.0
1995	Aug-08	8-Sep	467	826	746		1.2	4.0			6.0
1996	Aug-17	7-Sep	466	829	739	67	1.3	2.8			14.0
1997	Aug-09	13-Sep	649	814	733	98	0.6	1.5	9.2	17.8	15.4
1998	Aug-03	7-Sep	1064	827	749	74		0.8	13.4	13.8	13.7
1999	Aug-17	17-Sep	731	848	756	81	2.5	0.3	6.1	9.9	8.5
2000	Aug-08	7-Sep	377	827	741	63	0.4	0.5	10.6	16.2	14.1
2001	Aug-15	16-Sep	756	864	771	65	2.5	1.9	10.1	14.5	12.8
2002	Aug-09	2-Sep	812			54	1.9	0.5	3.6	8.4	6.3
Minimum			377	777	721	54	0.4	0.3	3.6	8.4	2.0
Maximum			1064	864	771	98	2.5	4.0	13.4	17.8	23.0
Average			656	828	743	72	1.5	1.5	8.8	13.4	11.5

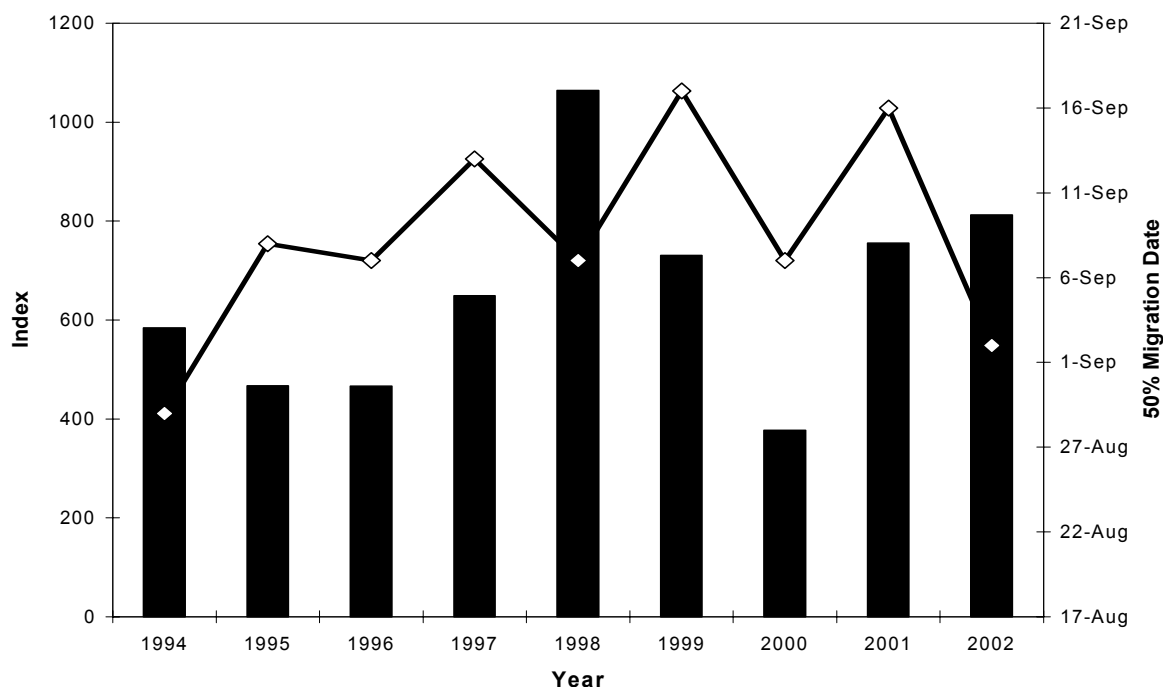


Figure 11. Annual upper Sustut steelhead index (bars) and date of 50% migration past the fence (line) for the years 1994 to 2002.

fisheries the average size of fish that survive to spawning will be reduced. Since length and fecundity are positively correlated (Sandercock 1991) the negative impact of fisheries on steelhead stocks cannot be measured strictly in terms of the number of fish removed by the fishery. As larger females produce more eggs

the selective removal of these fish from the spawning population results in reduced overall productivity.

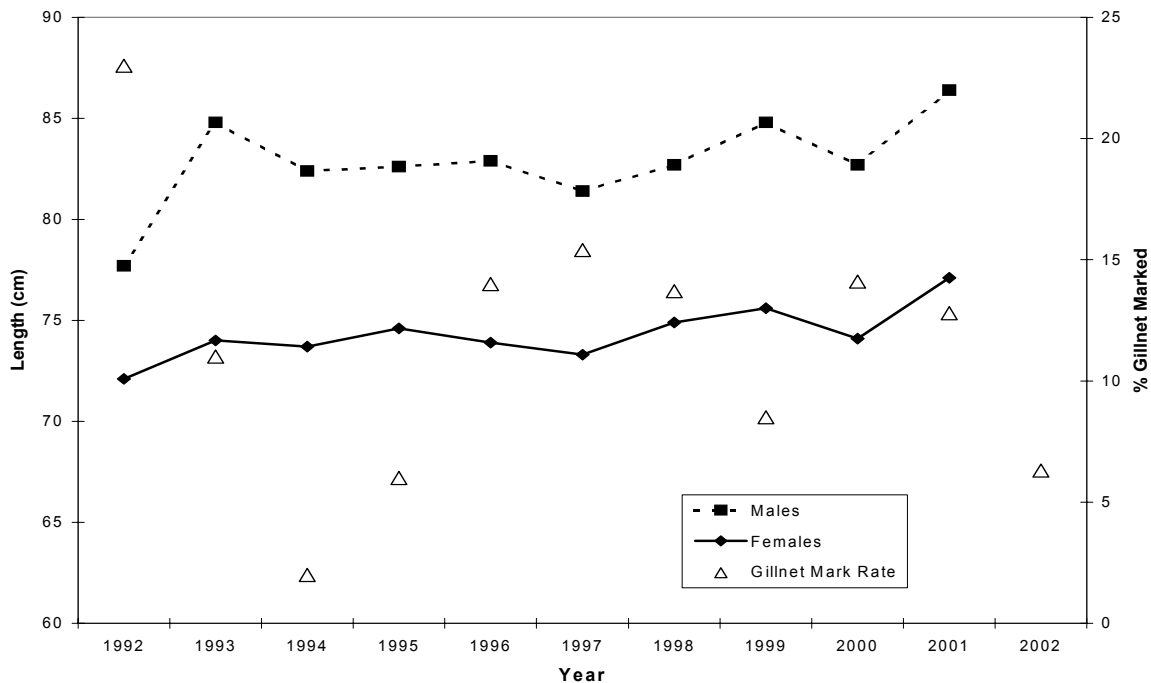


Figure 12. Annual average length of male and female upper Sustut River steelhead and the gillnet mark rate for the years 1992 to 2002.

Since 1992, the percentage of steelhead migrating past the Sustut fence exhibiting gillnet marks has ranged from 2.0 to 23.0% and averaged 11.5% (Table 3, Figure 11). Females have consistently higher annual gillnet mark rates than males. The implications of gillnet selectivity on the size and sex ratio of steelhead reaching the spawning grounds has been discussed above.

Between 1995 and 2002, the minimum percent repeat spawners based on tag recoveries has ranged from 0.4 to 2.5% and averaged 1.5%. Average growth rate between spawning events has ranged from 54 to 98 mm and averaged 72 mm (Table 3). While the proportion of repeat spawners determined by tag recaptures is a minimum value due to unassessed tag loss and other factors, it does provide valuable insight into this unique salmonid behaviour. The analysis of scale samples taken from a representative sample of the population can also provide information on repeat spawning rates and may be a more reliable method to determine this important population parameter.

5.2 The Importance of Continued Monitoring.

Commercial and recreational fisheries provide a vital contribution to food supplies, employment and culture. Without accurate stock assessments and their proper use in management, exploited fish populations can collapse, creating

severe economic, social and ecological problems. Therefore, ensuring that stock assessment research progresses and that operational stock assessments use the best techniques for a given stock are fundamental for ensuring the sustainability of commercial and recreational fisheries (U.S. National Academy of Sciences 1998).

The validity of any stock assessment project depends on long term monitoring, which allows for the evaluation of decadal trends in population parameters. The study of the effects of fishing on stocks is essentially a concern with long term effects. In intense fisheries, accurate estimates of stock parameters (stock size, age and size structure of the population etc.) are necessary to ensure proper regulation of the fishery (Gulland 1969). Feedback on the effects of management strategies is vital to determine if fishing plans were effective in protecting important stocks from interception. Since the upper Sustut steelhead stock is representative of all upper Skeena stocks, it is imperative that a rigorous and defensible assessment occur annually to present feedback to managers on the impact of interception fisheries on Skeena steelhead. This can only be done if consistent stock assessment data are collected using established, widely accepted methodologies. Following such methods ensures that the scientific advice given is based on figures about which there can be little dispute (Gulland 1983).

The upper Sustut steelhead assessment project began in 1986 and has been carried out using a consistent methodology since 1994. The project consists of a fishery independent survey, which offers the best opportunity for controlling sampling conditions over time and is considered by stock assessment experts to be the best choice for achieving a reliable index (U.S. National Academy of Sciences 1998). Continuing implementation of such a vital monitoring study is the only way to ensure that the interest of upper Skeena steelhead are not pushed aside as user groups pressure managers to increase fishing effort. Accurate and precise information on steelhead stock status must be readily available to determine the impact that expanded commercial fisheries designed to maximize the catch of other species will have on intercepted steelhead stocks. It is the responsibility of stock assessment and management biologists, and the agencies that fund this important work, to make certain that high quality monitoring projects such as the upper Sustut steelhead program, continue to be carried out annually.

6.0 Recommendations

1. Enumeration of the upper Sustut River steelhead population should continue to be carried out annually. The valuable time series of data that results from this project provides fisheries managers with information on abundance trends for all early run Skeena steelhead populations and provides feedback on the impact of fisheries on these important stocks. Sampling methods should

continue as recommended by Parken and Morten (1996), thus maintaining the reliability of comparisons across years.

2. Efforts to visually enumerate steelhead below the fence prior to fence removal should continue. These counts provide the basis for estimating total escapement to the upper Sustut River. Surveys should take place throughout the latter portion of the project to ensure that a count of steelhead below the fence is always available. A final count should be carried out as close to the date of fence removal as possible.
3. The relationship between the upper Sustut River steelhead population index and the Tyee test fishery index should continue to be investigated. With the addition of recent data the relationship is once again statistically significant and therefore the cumulative Tyee test fishery index to August 10 can be used to predict upper Sustut steelhead abundance. However, since the degree of variability in the relationship differs considerably year to year, it is recommended that the data be re-examined to determine if additional factors could be included to produce a new predictive model.
4. Fence modifications implemented in 1998 and described in Williamson (1999b), should continue to be utilized.
5. In some years, significant bank erosion at the fence site has occurred. The planting of willow branches in the streamside soil has encouraged the growth of riparian vegetation but further steps may need to be taken to stabilize the riverbanks ensuring that the present fence location is not compromised.
6. It is recommended that a portion of the steelhead migrating past the fence site be sub sampled for age and length. This compromise should ensure that the valuable time series of biological data will continue while with minimal handling mortality. Samples should be taken in a representative manner throughout the run. Since tagging will not be necessary under this new protocol, stress on biosampled fish will be further reduced.

7.0 Acknowledgments

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Matt Jessop and Mark Beere assisted with the installation of the enumeration weir.

Mark Beere directed this study and provided editorial reviews and valuable comments for the final draft.

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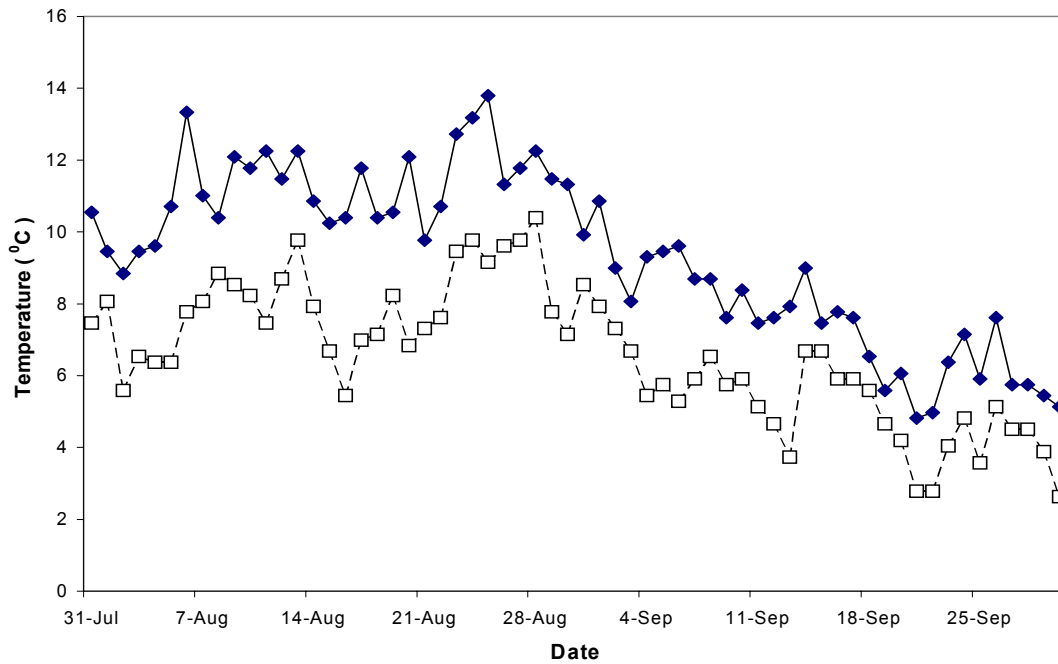
8.0 Literature Cited

- Bustard, D. 1993. Adult steelhead studies in the upper Sustut River 1992. Unpublished manuscript prepared for British Columbia Ministry of Environment, Lands and Parks, Smithers, B.C.
- Cox-Rogers, S. 1994. Description of daily simulation model for the Area 4 (Skeena) commercial gillnet fishery. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2256.
- Cox-Rogers, S. and L. Jantz. 1993. Recent trends in the catchability of sockeye salmon in the Skeena River gillnet test fishery and impacts on escapement estimation. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2219.
- Diewert, R.E. 2000. Enumeration of adult steelhead in the upper Sustut River 2000. British Columbia Ministry of Environment, Lands and Parks. Fisheries Branch. Skeena Fisheries Report SK#128.
- Diewert, R.E. 2002. Enumeration of adult steelhead in the upper Sustut River 2001. British Columbia Ministry of Water, Land and Air Protection. Fisheries Branch. Skeena Fisheries Report SK#130.
- Gulland, J.A. 1969. Manual of methods for fish stock assessment. Part 1. Fish population analysis. FAO Fisheries Series No. 3. FAO Manuals in Fisheries Science No. 4. 154p.
- Gulland, J.A. 1983. Fish stock assessment. A manual of basic methods. FAO/Wiley Series on Food and Agriculture. Volume 1. 223p.
- Koski, W.R., R.F. Alexander, and K.K. English. 1995. Distribution, timing, fate and numbers of coho salmon and steelhead returning to the Skeena watershed in 1994. Report by LGL Limited, Sidney, B.C., for Fisheries Branch, British Columbia Ministry of Environment, Lands and Parks, Victoria, B.C.
- Labelle, M., S. Pollard, R. Frith and K. English. 1995. Skeena River steelhead stock-assessment program: 1994 catch and escapement monitoring plan. British Columbia Ministry of Environment, Lands and Parks. Fisheries Branch. Fisheries Progress Report No. 44.
- McPhail, J.D. and R. Carveth. 1994. Field key the freshwater fishes of British Columbia. British Columbia Resource Inventory Committee Publication #44.

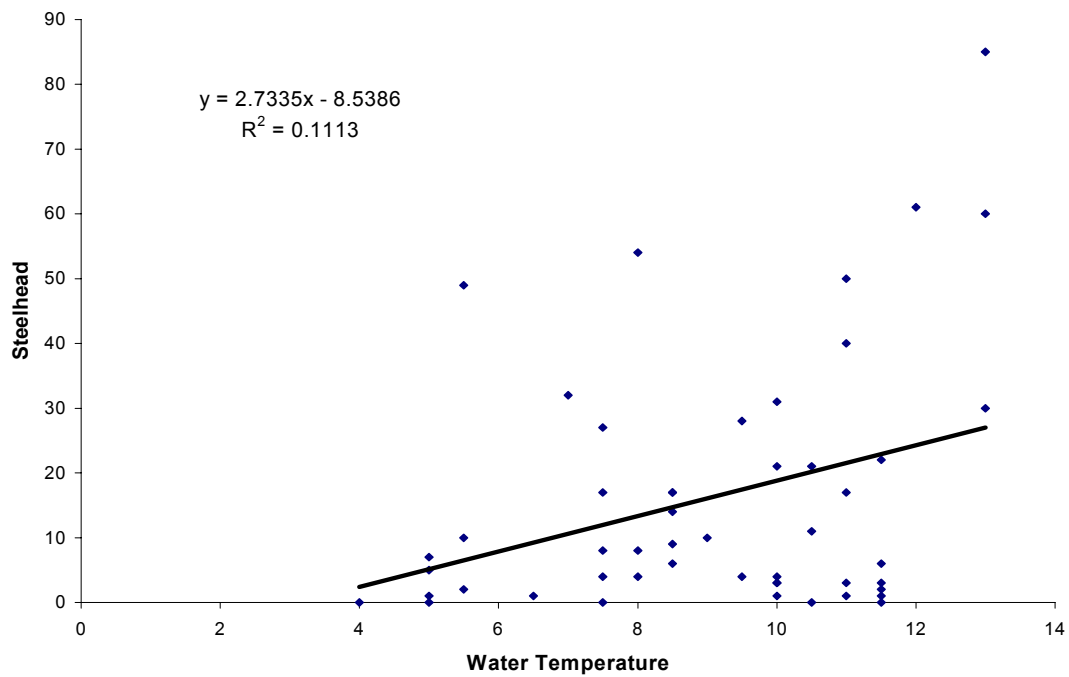
- Parken, C.K. and K.L. Morten. 1996. Enumeration of adult steelhead in the upper Sustut River 1995. British Columbia Ministry of Environment, Lands and Parks. Fisheries Branch. Skeena Fisheries Report SK#95.
- Parken, C.K., K.L. Morten, and D.Y. Atagi. 1997. Review of the escapement of adult steelhead to the upper Sustut River 1986, 1992-1996. British Columbia Ministry of Environment, Lands and Parks. Fisheries Branch. Skeena Fisheries Report SK#107.
- Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Board. Can. 191: 382p.
- Saimoto, R.S. 1994. Enumeration of adult steelhead in the upper Sustut River 1993. British Columbia Ministry of Environment, Lands and Parks. Smithers, B.C., Skeena Fisheries Report SK#87.
- Saimoto, R.K. 1995. Enumeration of adult steelhead in the upper Sustut River 1994. Unpublished Manuscript prepared for British Columbia Ministry of Environment, Lands and Parks. Smithers, B.C.
- Sandercock, F.K. 1991. Life history of chinook salmon. *In*: Pacific salmon life histories. Edited by C.Groot and L. Margolis. University of British Columbia Press, Vancouver, B.C. pp 395-446.
- Spence, C.R., M.C. Beere and M.J. Lough. 1990. Sustut River steelhead investigations 1986. British Columbia Ministry of Environment, Lands and Parks. Smithers, B.C., Skeena Fisheries Report SK#64.
- Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada, Bulletin No. 184, Ottawa, Ontario.
- Tautz, A.F., B.R. Ward and R.A. Ptolemy. 1992. Steelhead trout productivity and stream carrying capacity for rivers of the Skeena drainage. PSARC Working Papers S92 – 6 and 8.
- U.S. National Academy of Sciences. 1998. Improving fish stock assessments. Committee on Fish Stock Assessment Methods. Ocean Studies Board. National Academy Press, Washington, D.C.
- Ward, B.R., A.F. Tautz, S. Cox-Rogers and R.S. Hooton. 1993. Migration timing and harvest rates of the steelhead trout populations of the Skeena River system. PSARC Working Paper S93-06.
- Williamson, C.J. 1998. Enumeration of Adult Steelhead in the Upper Sustut River 1997. British Columbia Ministry of Environment, Lands and Parks. Fisheries Branch. Skeena Fisheries Report SK #112.
- Williamson, C.J. 1999a. Enumeration of Adult Steelhead in the Upper Sustut River 1998. British Columbia Ministry of Environment, Lands and Parks. Fisheries Branch. Skeena Fisheries Report SK #120.

- Williamson, C.J. 1999b. Enumeration of Adult Steelhead in the Upper Sustut River 1998. Appendix Report 1: Fence Modifications. British Columbia Ministry of Environment, Lands and Parks. Fisheries Branch. Skeena Fisheries Report SK #121.
- Williamson, C.J. 2000. Enumeration of Adult Steelhead in the Upper Sustut River 1999. British Columbia Ministry of Environment, Lands and Parks. Fisheries Branch. Skeena Fisheries Report SK #126

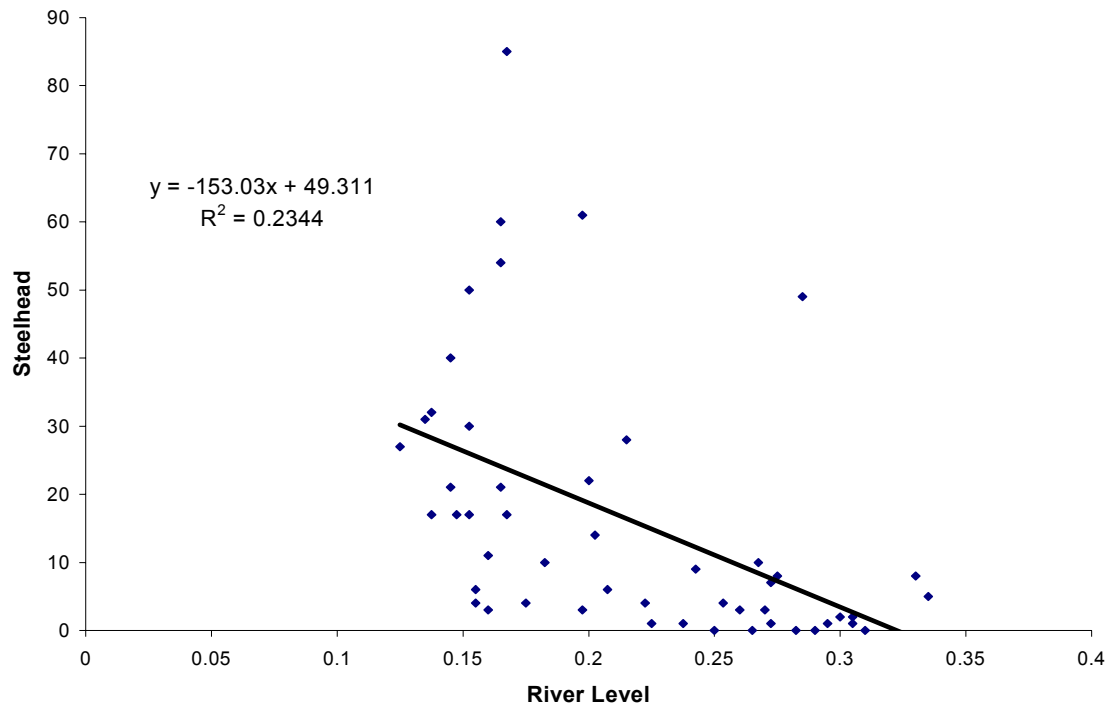
Appendix Figures



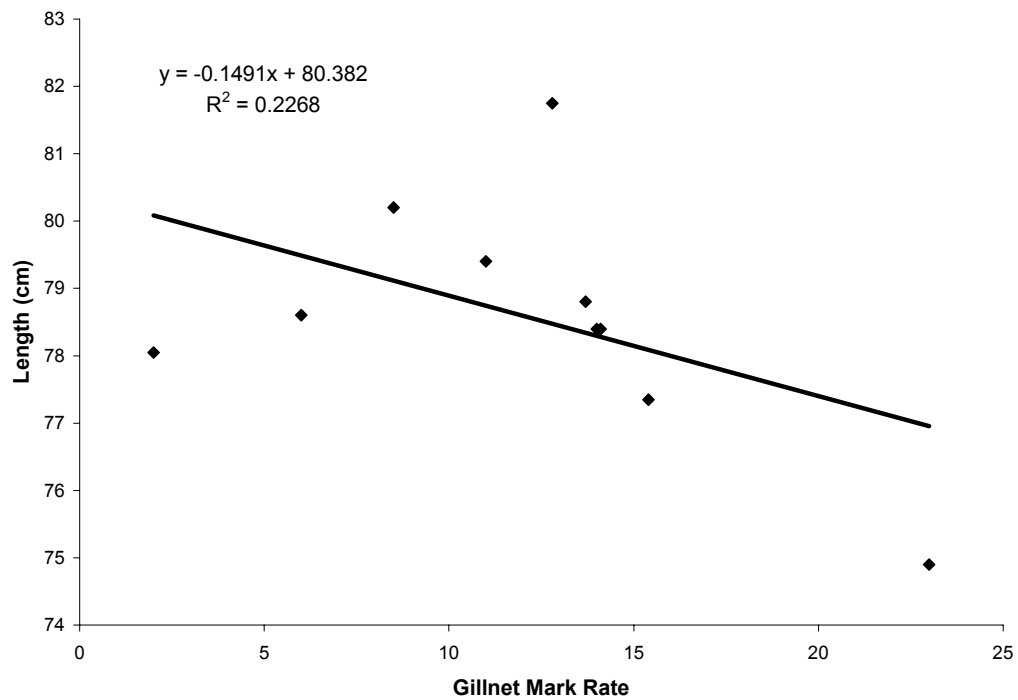
Appendix Figure 1. Daily minimum and maximum temperatures at the Sustut River fence, July 31 to September 30, 2002.



Appendix Figure 2. Linear relationship between water temperature and steelhead migration past the fence. Steelhead migration is lagged by 3 days.



Appendix Figure 3. Linear relationship between river level and steelhead migration past the fence. Steelhead migration is lagged by 3 days.



Appendix Figure 4. Linear relationship between the annual gillnet mark rate and average length for upper Sustut steelhead from 1992 to 2001.

Appendix Tables

Appendix Table 1. Steelhead handling mortalities, 2002.

Date	Sex	Nose-Fork		Picture #	Comments
		Length (mm)	Weight (kg)		
27-Aug	F	700	3.5		Stressed and may have been stepped on in box; floated onto fence.
10-Sep	F	740	4.75		Stressed in box.
15-Sep	F		3.3	R2: 1-4	Fungus on nose, hook in mouth; length recorded on pictures.
24-Sep	F	739	3.95	R2: 5-6	Pictures recorded as 6 and 7 on the board.

Appendix Table 2. Daily and cumulative totals of steelhead, rainbow trout, bull trout and Rocky Mountain whitefish migrating past the Sustut River fence, 2002.

Date	Steelhead		Rainbow Trout		Bull Trout		Whitefish	
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
29-Jul	0	0	0	0	0	0	0	0
30-Jul	0	0	0	0	0	0	0	0
31-Jul	0	0	0	0	0	0	0	0
1-Aug	0	0	0	0	0	0	0	0
2-Aug	0	0	0	0	0	0	0	0
3-Aug	0	0	0	0	0	0	0	0
4-Aug	0	0	0	0	0	0	0	0
5-Aug	0	0	0	0	1	1	0	0
6-Aug	0	0	0	0	1	2	0	0
7-Aug	0	0	2	2	0	2	0	0
8-Aug	0	0	0	2	0	2	0	0
9-Aug	1	1	0	2	0	2	1	1
10-Aug	1	2	0	2	0	2	0	1
11-Aug	0	2	1	3	0	2	0	1
12-Aug	1	3	0	3	0	2	2	3
13-Aug	2	5	0	3	0	2	1	4
14-Aug	3	8	0	3	0	2	0	4
15-Aug	1	9	2	5	0	2	0	4
16-Aug	0	9	0	5	0	2	1	5
17-Aug	0	9	0	5	0	2	1	6
18-Aug	3	12	0	5	0	2	0	6
19-Aug	1	13	0	5	0	2	2	8
20-Aug	3	16	0	5	0	2	1	9
21-Aug	4	20	0	5	0	2	0	9
22-Aug	3	23	0	5	0	2	2	11
23-Aug	17	40	0	5	0	2	3	14

Appendix Table 2. (Continued)

Date	Steelhead		Rainbow Trout		Bull Trout		Whitefish	
	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.
24-Aug	21	61	0	5	2	4	0	14
25-Aug	31	92	0	5	0	4	0	14
26-Aug	40	132	0	5	0	4	0	14
27-Aug	85	217	0	5	1	5	1	15
28-Aug	60	277	0	5	0	5	4	19
29-Aug	30	307	0	5	0	5	0	19
30-Aug	6	313	0	5	0	5	1	20
31-Aug	61	374	1	6	0	5	0	20
1-Sep	22	396	0	6	0	5	0	20
2-Sep	21	417	0	6	1	6	1	21
3-Sep	11	428	0	6	0	6	3	24
4-Sep	4	432	0	6	0	6	0	24
5-Sep	28	460	0	6	0	6	0	24
6-Sep	8	468	0	6	0	6	0	24
7-Sep	9	477	0	6	0	6	0	24
8-Sep	6	483	0	6	0	6	0	24
9-Sep	10	493	0	6	0	6	0	24
10-Sep	17	510	0	6	0	6	0	24
11-Sep	50	560	0	6	2	8	1	25
12-Sep	4	564	0	6	1	9	0	25
13-Sep	54	618	0	6	2	11	0	25
14-Sep	17	635	0	6	3	14	0	25
15-Sep	32	667	0	6	3	17	0	25
16-Sep	27	694	0	6	1	18	0	25
17-Sep	17	711	0	6	1	19	0	25
18-Sep	14	725	0	6	0	19	1	26
19-Sep	4	729	0	6	1	20	0	26
20-Sep	8	737	0	6	0	20	0	26
21-Sep	0	737	0	6	1	21	0	26
22-Sep	5	742	0	6	0	21	0	26
23-Sep	49	791	0	6	0	21	0	26
24-Sep	7	798	0	6	0	21	0	26
25-Sep	0	798	0	6	0	21	0	26
26-Sep	10	808	0	6	0	21	0	26
27-Sep	2	810	0	6	0	21	0	26
28-Sep	0	810	0	6	0	21	0	26
29-Sep	1	811	0	6	0	21	0	26
30-Sep	1	812	0	6	1	22	0	26

Appendix Table 3. Daily and cumulative totals of chinook, sockeye and coho salmon migrating past the Sustut River fence, 2002.

Date	Chinook		Sockeye		Coho	
	Daily	Cum.	Daily	Cum.	Daily	Cum.
29-Jul	3	3	0	0	0	0
30-Jul	4	7	0	0	0	0
31-Jul	13	20	0	0	0	0
1-Aug	1	21	0	0	0	0
2-Aug	48	69	0	0	0	0
3-Aug	71	140	0	0	0	0
4-Aug	107	247	0	0	0	0
5-Aug	46	293	0	0	0	0
6-Aug	26	319	0	0	0	0
7-Aug	98	417	1	1	0	0
8-Aug	134	551	9	10	0	0
9-Aug	159	710	8	18	0	0
10-Aug	67	777	4	22	0	0
11-Aug	41	818	11	33	0	0
12-Aug	32	850	7	40	0	0
13-Aug	32	882	17	57	0	0
14-Aug	21	903	19	76	0	0
15-Aug	19	922	10	86	0	0
16-Aug	10	932	6	92	0	0
17-Aug	9	941	33	125	0	0
18-Aug	5	946	30	155	0	0
19-Aug	17	963	32	187	0	0
20-Aug	4	967	65	252	0	0
21-Aug	5	972	57	309	0	0
22-Aug	2	974	63	372	0	0
23-Aug	3	977	85	457	0	0
24-Aug	6	983	29	486	2	2
25-Aug	4	987	34	520	5	7
26-Aug	0	987	9	529	1	8
27-Aug	0	987	36	565	0	8
28-Aug	1	988	19	584	3	11
29-Aug	0	988	32	616	4	15
30-Aug	0	988	17	633	1	16
31-Aug	0	988	5	638	2	18
1-Sep	0	988	12	650	9	27
2-Sep	0	988	0	650	0	27
3-Sep	0	988	1	651	0	27
4-Sep	0	988	0	651	1	28
5-Sep	0	988	1	652	0	28
6-Sep	0	988	0	652	2	30
7-Sep	0	988	0	652	0	30
8-Sep	0	988	0	652	1	31
9-Sep	0	988	0	652	0	31
10-Sep	0	988	0	652	1	32
11-Sep	0	988	0	652	3	35
12-Sep	0	988	0	652	0	35
13-Sep	0	988	3	655	2	37

Appendix Table 3. (Continued)

Date	Chinook		Sockeye		Coho	
	Daily	Cum.	Daily	Cum.	Daily	Cum.
14-Sep	0	988	1	656	1	38
15-Sep	0	988	3	659	3	41
16-Sep	0	988	8	667	7	48
17-Sep	0	988	2	669	1	49
18-Sep	0	988	2	671	2	51
19-Sep	0	988	0	671	2	53
20-Sep	0	988	1	672	1	54
21-Sep	0	988	0	672	1	55
22-Sep	0	988	0	672	2	57
23-Sep	0	988	0	672	2	59
24-Sep	0	988	0	672	2	61
25-Sep	0	988	0	672	1	62
26-Sep	0	988	0	672	1	63
27-Sep	0	988	1	673	0	63
28-Sep	0	988	0	673	0	63
29-Sep	0	988	0	673	1	64
30-Sep	0	988	1	674	0	64

Appendix Table 4. Daily staff gauge height, air and water temperature and weather conditions for the upper Sustut River, 2002.

the upper Coastal Area, 2002.							
Date	Time	Staff Gauge (m)	Temperature (°C)				Weather
			Water		Air		
			Max	Min	Max	Min	
30-Jul	10:00	0.26					overcast,slight mist
	20:30	0.25	9	7.5	10	5	overcast,slight mist
31-Jul	8:50	0.24					high overcast
	21:00	0.225	9.5	8	14.5	3	high overcast
1-Aug	9:00	0.21					overcast and raining
	20:00	0.22	9	8	13.5	3.5	overcast and still raining
2-Aug	9:00	0.305					overcast and light drizzle, snow overnight
	20:00	0.315	8.5	6	10	-0.5	high broken clouds, still all day
3-Aug	8:30	0.31					high cloud cover
	20:00	0.28	9	7	13.5	1.5	mostly cloudy, some clearing
4-Aug	8:00	0.265					mostly clear and sunny
	20:00	0.245	9	6.5	14.5	-2.5	high clouds with clear patches
5-Aug	8:30	0.235					mostly clear with a few clouds
	20:00	0.225	10	6.5	19	-1.5	clear with some clouds
6-Aug	8:30	0.215					mostly sunny, windy
	20:00	0.21	12.5	9	23	5.5	mostly sunny but clouding over
7-Aug	8:30	0.21					sunny with heavy clouds moving in
	20:00	0.21	12.5	10	16	-1.5	high overcast
8-Aug	8:30	0.21					mostly cloudy,some blue patches
	21:00	0.22	11	9	15	7.5	overcast and raining

Appendix Table 4. (Continued)

Date	Time	Staff Gauge (m)	Temperature (°C)				Weather
			Water		Air		
			Max	Min	Max	Min	
9-Aug	8:30	0.29					high clouds,some patches of blue
	20:00	0.32	11.5	10	17.5	5.5	partly cloudy
10-Aug	8:15	0.31					unsettled, partly sunny, some wind
	20:00	0.29	11.5	10	16	3	some rain in afternoon, clearing at night
11-Aug	8:45	0.275					cloudy and cool
	20:00	0.265	11.5	10	18.5	-1.5	sunny and windy in afternoon
12-Aug	8:30	0.245					fairly high clouds
	20:00	0.23	11	10	19.5	7.5	cloudy, slight drizzle
13-Aug	8:30	0.235					cloudy, slight drizzle
	20:00	0.265	11.5	10	19	8	some clearing, after a rainshower
14-Aug	8:30	0.295					partly sunny
	20:00	0.285	10.5	9	18.5	0	partly cloudy
15-Aug	8:30	0.27					cloudy
	20:00	0.25	10	7	13.5	-4	mostly clear
16-Aug	8:30	0.235					clear with a few thin clouds
	20:00	0.215	10	6	18	-6.5	mostly cloudy
17-Aug	8:00	0.205					clear
	20:00	0.19	11	7.5	20	-3	mostly clear
18-Aug	8:00	0.18					mostly cloudy , some sun
	20:00	0.17	9.5	9	16	-2.5	mostly cloudy
19-Aug	8:00	0.165					mostly cloudy
	20:00	0.155	10	9.5	14.5	4	clear patches
20-Aug	8:30	0.155					clear and sunny
	20:00	0.15	11	7	20	-3	clear
21-Aug	8:30	0.145					
	20:00	0.145	10	9	13	-2	overcast all day
22-Aug	8:30	0.135					overcast,drizzly
	20:00	0.135	10	9.5	18.5	5.5	drizzling rain
23-Aug	8:30	0.14					mostly cloudy,few patches of blue
	20:00	0.15	11	10	20	11	mostly cloudy
24-Aug	8:30	0.17					mostly cloudy
	20:00	0.165	13	10	25	9	mostly cloudy
25-Aug	8:30	0.17					mostly sunny, only a few clouds
	20:00	0.16	13	10	23	3	partly cloudy
26-Aug	8:30	0.155					overcast
	20:00	0.15	13	10	17	3.5	overcast
27-Aug	8:30	0.15					overcast
	20:00	0.16	11.5	10	16	10	overcast and raining
28-Aug	8:30	0.185					overcast with drizzle, rained all night
	20:00	0.21	12	10.5	18	10.5	partly sunny
29-Aug	8:30	0.21					clear and sunny
	20:00	0.19	11.5	8	20	-2	cloudy
30-Aug	8:30	0.17					thin clouds
	20:00	0.16	10.5	9	17.5	-3.5	clouds
31-Aug	8:30	0.155					overcast,raining
	20:00	0.165	10.5	10	12.5	5	overcast,raining
1-Sep	8:30	0.22					cloudy with sunny breaks
	20:00	0.225	10	9	14	3.5	some rain

Appendix Table 4. (Continued)

Appendix Table 1 (continued)							
Date	Time	Staff Gauge (m)	Temperature (°C)				Weather
			Water		Air		
			Max	Min	Max	Min	
2-Sep	8:30	0.21					overcast,light rain
	20:00	0.22	9.5	8	8.5	1	drizzling rain
3-Sep	8:30	0.275					overcast light drizzle
	20:00	0.275	8	7.5	9	2.5	mostly cloudy
4-Sep	8:30	0.255					clear
	20:00	0.23	8.5	5	18.5	-3.5	partly cloudy
5-Sep	8:30	0.215					mix of sun and clouds
	20:00	0.2	8.5	6	20	-3.5	mostly clear
6-Sep	8:30	0.185					clear and sunny
	19:45	0.18	9	6	19.5	-4.5	partly cloudy in afternoon
7-Sep	8:30	0.17					mostly clear
	19:45	0.165	8.5	6.5	13	-4	cloudy
8-Sep	8:30	0.155					some rain
	19:00	0.15	11	6.5	10.5	3	mostly cloudy
9-Sep	8:30	0.15					high overcast
	20:00	0.16	8	6.5	7	-2	mostly cloudy and light rain
10-Sep	8:30	0.17					cloudy with sunny breaks
	20:00	0.16	8	6.5	13	4	partly cloudy
11-Sep	9:00	0.15					partly clear
	20:00	0.145	7.5	5.5	11.5	-2.5	high thin cloud cover
12-Sep	8:30	0.135					mostly clear with some thin clouds
	20:00	0.14	7	5.5	13	-3.5	mostly clear
13-Sep	9:00	0.125					clear
	20:00	0.125	7.5	4.5	15	-8	cloudy,overcast
14-Sep	9:00	0.125					overcast,raining
	20:00	0.15	8.5	6.5	13.5	5	high clouds some clear patches
15-Sep	8:30	0.175					overcast,light rain
	19:30	0.23	8.5	7	9	4.5	overcast,raining
16-Sep	8:45	0.142					partly cloudy
	19:30	0.365	7.5	7	8	1	mostly cloudy
17-Sep	8:30	0.335					cloudy with clear patches
	19:30	0.325	7.5	5.5	9.5	2.5	mostly cloudy
18-Sep	8:30	0.3					low overcast,raining
	19:30	0.32	7.5	5.5	5	1.5	low overcast,rained all day
19-Sep	8:30	0.345					mostly cloudy
	19:30	0.325	5	5	9	0	mostly cloudy
20-Sep	8:00	0.295					mostly cloudy
	20:05	0.275	5.5	5	10.5	-1	mostly clear
21-Sep	8:00	0.26					overcast,snowing
	19:30	0.285	5	4.5	2	-3	overcast,snowing
22-Sep	8:20	0.265					mostly cloudy
	19:30	0.265	4	2.5	4	-2.5	cloudy and raining
23-Sep	9:00	0.26					cloudy with fog
	19:30	0.275	5.5	4.5	13	0.5	mostly cloudy
24-Sep	8:15	0.305					partly cloudy
	19:30	0.305	5.5	4.5	13	0.5	mostly clear
25-Sep	8:00	0.29					mostly clear
	19:15	0.275	5	4	11	-5	overcast light rain

Appendix Table 4. (Continued)

Date	Time	Staff Gauge (m)	Temperature (°C)				Weather
			Water		Air		
			Max	Min	Max	Min	
26-Sep	8:30	0.275					mostly cloudy
	19:30	0.27	6.5	5	15.5	1	partly cloudy
27-Sep	8:30	0.27					overcast and raining
	19:00	0.32	5	5	6.5	-4	overcast and raining
28-Sep	8:20	0.5					overcast, rained all night
	19:00	0.61	5	4.5	7	0	partly clear
29-Sep	8:15	0.565					overcast,light snow
	19:00	0.51	5	5	8.5	-1.5	mostly clear,a few clouds
30-Sep	8:30	0.455					clear and sunny
	18:45	0.395	4.5	1.5	12.5	-7	clear a few clouds in south

Appendix Table 5. Statistical week definitions for 2002.

Statistical Week	Calendar Week
7-5	July 28 to August 3
8-1	August 4 to 10
8-2	August 11 to 17
8-3	August 18 to 24
8-4	August 25 to 31
9-1	September 1 to 7
9-2	September 8 to 14
9-3	September 15 to 21
9-4	September 22 to 28

Appendix Table 6. Steelhead sampling data from the Sustut River fence, 2002.

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
9-Aug	15:00	F		no		small wound on belly
10-Aug	8:15	F		no		
12-Aug	8:30	F		no		
13-Aug	16:40	F		no		
13-Aug	18:40	M		no		
14-Aug	20:00	F		?		
14-Aug	20:00	F		?		
14-Aug	20:00	M		no		very clean, no marks
15-Aug	16:15	F		no		no marks
18-Aug	15:00	M		no		
18-Aug	18:00	M		no		
18-Aug	18:00	F		no		
19-Aug	19:00	M		no		
20-Aug	15:10	F		no		small spot of fungus on nose and head
20-Aug	16:30	F		no		some scratches on back
20-Aug	20:00	F		no		
21-Aug	15:00	F		no		
21-Aug	15:00	M		no		
21-Aug	15:00	M		no		
21-Aug	19:00	M		no		small mark on top of head
22-Aug	18:00	M		no		
22-Aug	18:00	F		no		
22-Aug	19:00	M		no		
23-Aug	11:45	M		no		
23-Aug	12:15	F		no		
23-Aug	12:15	M		no		couple blemishes on head
23-Aug	15:40	?		no		
23-Aug	15:40	M		no		
23-Aug	15:40	?		no		
23-Aug	15:40	M		no		
23-Aug	15:40	M		no		
23-Aug	15:40	F		no		
23-Aug	15:40	F		no		
23-Aug	15:40	M		no		
23-Aug	15:40	?		no		
23-Aug	15:40	?		no		
23-Aug	16:00	F		no		eroded operculum
23-Aug	16:00	F		no		
23-Aug	16:00	M		no		spot of fungus on nose
23-Aug	16:00	F		no		
24-Aug	8:30	M		no		
24-Aug	8:30	F		no		
24-Aug	12:30	F		no		
24-Aug	14:45	F		no		
24-Aug	14:45	F		no		
24-Aug	14:45	F		no		
24-Aug	14:45	M		no		
24-Aug	14:45	M		no		

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
24-Aug	16:00	M		no		
24-Aug	16:00	M		no		
24-Aug	16:00	F		no		
24-Aug	16:00	F		no		
24-Aug	17:00	M		no		
24-Aug	17:00	F		no		Hook mark near lip
24-Aug	18:00	M		no		
24-Aug	18:00	F	760	no	yes	White tag 14270
24-Aug	20:00	M		no		
24-Aug	20:00	F		no		
24-Aug	20:00	F		no		
24-Aug	20:00	F		yes		
24-Aug	20:00	F		no		
25-Aug	14:30	M		no		
25-Aug	14:30	M		no		
25-Aug	14:30	F		no		
25-Aug	14:30	M		no		
25-Aug	14:30	F		no		
25-Aug	14:30	F		no		
25-Aug	14:30	F		no		
25-Aug	14:30	M		no		
25-Aug	14:30	F		no		
25-Aug	14:30	F		no		
25-Aug	14:30	M		no		
25-Aug	14:30	M		no		
25-Aug	15:00	F		no		
25-Aug	15:00	F		no		
25-Aug	15:30	M		no		
25-Aug	15:30	F		no		
25-Aug	16:00	F		no		
25-Aug	16:00	F		no		
25-Aug	16:30	F		no		
25-Aug	16:30	M		no		
25-Aug	17:00	F		no		
25-Aug	17:00	F		no		
25-Aug	17:30	M		no		
25-Aug	17:30	M		no		
25-Aug	18:00	F		no		
25-Aug	18:00	F		no		
25-Aug	18:30	F		no		
25-Aug	18:30	M		no		
25-Aug	19:00	F		no		
25-Aug	19:00	M		no		
25-Aug	20:00	F		no		
26-Aug	8:30	F		no		
26-Aug	8:30	F		no		
26-Aug	8:30	F		no		
26-Aug	8:30	M		no		
26-Aug	8:30	F		no		

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
26-Aug	8:30	M		no		
26-Aug	8:30	F		no		
26-Aug	14:00	M		no		
26-Aug	14:00	M		no		chunk torn off upper lip
26-Aug	14:00	F		no		
26-Aug	15:00	M		no		
26-Aug	15:00	M		no		
26-Aug	15:00	F		no		
26-Aug	15:00	F		no		
26-Aug	15:30	M		no		
26-Aug	15:30	F		no		
26-Aug	15:30	F		no		
26-Aug	15:30	F		no		
26-Aug	16:45	M		no		wounded on nose and lip
26-Aug	16:45	M		no		
26-Aug	16:45	F		no		
26-Aug	17:00	M		no		
26-Aug	17:00	M		no		slight tear on nose
26-Aug	17:00	F		no		
26-Aug	17:00	F		no		
26-Aug	18:00	F		no		
26-Aug	18:00	M		no		
26-Aug	18:00	F		no		
26-Aug	19:00	F		yes		
26-Aug	19:00	F		no		
26-Aug	19:00	M		no		
26-Aug	19:00	F		no		
26-Aug	19:00	F		no		
26-Aug	19:00	F		no		
26-Aug	19:00	M		no		
26-Aug	19:00	F		no		
26-Aug	19:00	M		no		
26-Aug	19:00	F		no		
26-Aug	19:00	M		no		
26-Aug	20:00	M		no		
27-Aug	9:30	M		no		
27-Aug	11:00	M		no		
27-Aug	11:00	F		no		
27-Aug	11:00	F		no		
27-Aug	11:00	F		no		
27-Aug	11:30	M		no		mark on head
27-Aug	11:30	M		no		scar on head
27-Aug	11:30	M		no		
27-Aug	11:30	F		yes		
27-Aug	11:30	F		no		
27-Aug	11:30	F		no		
27-Aug	11:30	F		no		
27-Aug	12:00	F		no		scar on head
27-Aug	12:00	F		no		

Appendix Table 6 (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
27-Aug	12:00	F		yes		
27-Aug	12:00	M		yes		
27-Aug	12:00	M		no	very big	
27-Aug	12:00	F		yes		
27-Aug	13:00	M		no		
27-Aug	13:00	M		no		
27-Aug	13:00	M		no		
27-Aug	13:00	M		no		
27-Aug	13:00	M		no		
27-Aug	13:00	M		no		
27-Aug	13:00	M		no		
27-Aug	13:00	M		no		
27-Aug	13:00	M		no		
27-Aug	13:00	F		no		silver spot on head and snagged lower lip
27-Aug	13:00	F		yes		
27-Aug	13:00	F	810	no	yes	white tag 14091
27-Aug	13:00	F		no		
27-Aug	13:00	F		no		
27-Aug	13:00	F		no		
27-Aug	13:00	F		no		
27-Aug	13:00	F		no		
27-Aug	14:00	F		no		scar on head
27-Aug	14:00	F		no		abrasion on head
27-Aug	14:00	F		no		
27-Aug	14:00	F		no		
27-Aug	14:00	F		no		
27-Aug	14:00	F		no		
27-Aug	14:00	M		yes		
27-Aug	14:00	M		no		
27-Aug	14:00	M		no		
27-Aug	14:00	M		no		
27-Aug	14:00	M		no		
27-Aug	14:00	F		no		
27-Aug	14:00	F		no		
27-Aug	14:00	F		no		
27-Aug	14:00	F		no		
27-Aug	14:00	F		no		
27-Aug	14:00	F		no		
27-Aug	15:30	M		no		
27-Aug	15:30	M		no		
27-Aug	15:30	M		no		
27-Aug	15:30	M		no		
27-Aug	15:30	M		no		
27-Aug	15:30	F		no		
27-Aug	15:30	F		no		

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
27-Aug	15:30	F		no		
27-Aug	15:30	F		no		
27-Aug	15:30	F		no		
27-Aug	16:30	M		no		huge male with split pectoral fin
27-Aug	16:30	M		no		
27-Aug	16:30	M		no		
27-Aug	16:30	M		no		
27-Aug	16:30	M		no		
27-Aug	16:30	M		no		
27-Aug	16:30	F		yes		fungus on GN mark
27-Aug	16:30	F		no		
27-Aug	16:30	F		no		head wound
27-Aug	16:30	F		no		
27-Aug	16:30	F		no		
27-Aug	17:00	F		no		
27-Aug	17:00	F		no		
27-Aug	17:00	F		yes		
27-Aug	17:00	F		no		
27-Aug	17:00	F		no		
27-Aug	17:30	F	780	no	yes	white tag 14152
27-Aug	17:30	F		no		
27-Aug	18:30	F		yes		
27-Aug	19:00	F		no		
28-Aug	10:30	M		no		
28-Aug	10:30	F		no		
28-Aug	10:30	M		no		
28-Aug	14:00	M		no		
28-Aug	14:00	F		yes		
28-Aug	14:00	F		no		
28-Aug	14:00	F		no		
28-Aug	14:00	F		no		
28-Aug	14:00	F		no		
28-Aug	14:00	F		no		
28-Aug	14:00	F	750	no	yes	white tag 14008
28-Aug	15:00	M		no		
28-Aug	15:00	M		no		head abrasion
28-Aug	15:00	F		no		
28-Aug	15:00	F		no		head abrasion
28-Aug	15:00	F		no		
28-Aug	15:00	F		no		
28-Aug	16:30	M		no		
28-Aug	16:30	M		no		
28-Aug	16:30	M		no		
28-Aug	16:30	M		no		
28-Aug	16:30	M		no		lip severely ripped by hook?
28-Aug	16:30	M		no		
28-Aug	16:30	M		no		
28-Aug	16:30	F		no		

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
28-Aug	16:30	F		no		
28-Aug	16:30	F		no		
28-Aug	16:30	F		no		
28-Aug	16:30	F		no		
28-Aug	16:30	F		no		
28-Aug	16:30	F		no		
28-Aug	16:30	F		no		
28-Aug	17:30	M		no		
28-Aug	17:30	M		no		
28-Aug	17:30	M		no		
28-Aug	17:30	M		no		
28-Aug	17:30	M		no		
28-Aug	17:30	M		no		
28-Aug	17:30	M		no		
28-Aug	17:30	M		no		
28-Aug	17:30	M		no		
28-Aug	17:30	M		no		
28-Aug	17:30	M		no		
28-Aug	17:30	F		no		
28-Aug	17:30	F		no		
28-Aug	17:30	F		no		scratches across back
28-Aug	17:30	F		no		
28-Aug	17:30	F		no		
28-Aug	17:30	F		no		
28-Aug	17:30	F		no		head wound
28-Aug	17:30	F		no		
28-Aug	17:30	F		no		
28-Aug	17:30	F		no		scratches across back
28-Aug	17:30	F		no		
28-Aug	18:30	M	730	no	yes	yellow tag 37397
28-Aug	18:30	F		no		
28-Aug	20:00	F		no		
29-Aug	8:30	M		no		
29-Aug	8:30	F		no		
29-Aug	15:00	M		no		
29-Aug	16:00	F		no		
29-Aug	16:00	F		no		
29-Aug	17:30	M		no		scars on back
29-Aug	17:30	F		no		
29-Aug	17:30	F		no		
29-Aug	17:30	F		no		
29-Aug	17:30	F		no		
29-Aug	17:30	F		yes		
29-Aug	18:00	M		no		
29-Aug	18:00	M		no		
29-Aug	18:00	M		no		
29-Aug	18:00	M		no		

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
29-Aug	18:00	M		no		
29-Aug	18:00	M		no		
29-Aug	18:00	F		no		scars on head
29-Aug	18:00	F		no		
29-Aug	18:00	F		no		
29-Aug	18:00	F		yes		
29-Aug	18:00	F		no		
29-Aug	18:00	F		no		
29-Aug	19:00	F		no		scars on back
29-Aug	19:00	F		no		
29-Aug	19:00	F		no		
29-Aug	19:00	F		no		
29-Aug	19:00	M		no		head abrasion
29-Aug	19:30	F		no		
30-Aug	8:30	M		no		
30-Aug	8:30	M		no		head abrasion
30-Aug	8:30	F		no		
30-Aug	15:15	M		yes		small fungus spot on nose
30-Aug	15:15	F		no		
30-Aug	18:00	F		no		
31-Aug	8:30	M		no		
31-Aug	8:30	M		no		
31-Aug	8:30	M		no		
31-Aug	8:30	M		no		
31-Aug	8:30	M		no		
31-Aug	8:30	M		no		
31-Aug	8:30	F		yes		
31-Aug	8:30	F		yes		
31-Aug	8:30	F		no		
31-Aug	8:30	F		no		
31-Aug	8:30	F		no		
31-Aug	8:30	F		no		
31-Aug	8:30	F		no		
31-Aug	8:30	F		no		
31-Aug	8:30	F		no		
31-Aug	8:30	F		no		
31-Aug	11:30	F		no		
31-Aug	13:30	M		no		
31-Aug	13:30	M		no		
31-Aug	13:30	M		no		
31-Aug	13:30	M		no		
31-Aug	13:30	M		no		head abrasion
31-Aug	13:30	M		no		head abrasion
31-Aug	13:30	M		no		
31-Aug	13:30	M		no		

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
31-Aug	13:30	M		no		
31-Aug	13:30	M		no		
31-Aug	13:30	M		no		lip snagged by angler?
31-Aug	13:30	M		no		
31-Aug	13:30	M		no		
31-Aug	13:30	M		no		
31-Aug	13:30	M		no		
31-Aug	13:30	M		no		
31-Aug	13:30	M		no		
31-Aug	13:30	M		no		
31-Aug	13:30	F		yes		
31-Aug	13:30	F		no		scrape on nose
31-Aug	13:30	F		no		
31-Aug	13:30	F		no		
31-Aug	13:30	F		no		
31-Aug	13:30	F		no		
31-Aug	13:30	F		no		
31-Aug	13:30	F		no		
31-Aug	13:30	F		no		
31-Aug	13:30	F		no		
31-Aug	13:30	F		no		
31-Aug	13:30	F		no		
31-Aug	14:00	F		no		
31-Aug	14:00	F		no		
31-Aug	17:00	M		no		
31-Aug	17:00	F		no		
31-Aug	17:00	F		no		
31-Aug	17:00	F		no		
31-Aug	17:00	F		no		
31-Aug	17:00	F		no		
31-Aug	17:00	F		no		head abrasion
31-Aug	18:00	F		yes		
31-Aug	20:00	F		yes		
1-Sep	8:30	F		no		
1-Sep	8:30	F		no		
1-Sep	8:30	M		no		
1-Sep	8:30	M		no		
1-Sep	11:00	M		no		
1-Sep	11:00	F		no		
1-Sep	11:00	F		no		
1-Sep	15:30	M		no		
1-Sep	15:30	M		no		
1-Sep	15:30	M		no		
1-Sep	15:30	M		no		
1-Sep	15:30	M		no		
1-Sep	15:30	M		no		
1-Sep	15:30	M		no		
1-Sep	15:30	F		no		
1-Sep	15:30	F		no		

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
1-Sep	15:30	F		no		
1-Sep	15:30	F		no		
1-Sep	15:30	F		yes		
1-Sep	18:00	M		no		
1-Sep	18:00	F		no		
1-Sep	20:00	M		no		
2-Sep	8:30	M		no		
2-Sep	8:30	M		no		
2-Sep	8:30	M		no		
2-Sep	8:30	M		no		
2-Sep	8:30	M	895	no	yes	orange tag 00942
2-Sep	8:30	F		yes		
2-Sep	8:30	F		no		
2-Sep	16:15	M		no		
2-Sep	16:15	M		no		
2-Sep	16:15	M		no		
2-Sep	16:15	M		no		
2-Sep	16:15	F		no		
2-Sep	16:15	F		no		
2-Sep	16:15	F		no		
2-Sep	16:15	F		yes		
2-Sep	16:15	F		yes		
2-Sep	17:15	M		no		
2-Sep	17:15	F		no		
2-Sep	18:15	M		no		
2-Sep	18:15	M		no		
2-Sep	18:15	F		no		
3-Sep	8:30	M		no		cut on pectoral fin
3-Sep	8:30	M		no		
3-Sep	8:30	M		no		Spot on nose
3-Sep	17:15	F		no		
3-Sep	17:15	M		no		
3-Sep	18:00	M		no		
3-Sep	19:00	M		no		
3-Sep	19:00	F		no		
3-Sep	19:00	F		no		
3-Sep	19:00	F	785	no	yes	orange tag 04513
4-Sep	10:45	F		no		
4-Sep	15:15	F		no		
4-Sep	15:15	M		no		
4-Sep	19:00	F		no		
5-Sep	8:30	M		no		
5-Sep	8:30	M		no		
5-Sep	8:30	M		no		
5-Sep	8:30	M		no		
5-Sep	14:30	M		no		
5-Sep	16:45	M		yes		
5-Sep	16:45	M		yes		

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
5-Sep	16:45	M		no		spot on nose
5-Sep	16:45	M		no		
5-Sep	16:45	M		no		
5-Sep	16:45	M		no		
5-Sep	16:45	M		no		
5-Sep	16:45	F		no		
5-Sep	16:45	F		no		spot on nose
5-Sep	16:45	F		no		
5-Sep	16:45	F		no		
5-Sep	18:00	M		no		spot on head
5-Sep	18:00	M		no		scratches on head
5-Sep	18:00	M		no		
5-Sep	18:00	M		no		
5-Sep	18:00	M		no		
5-Sep	18:00	M		no		
5-Sep	18:00	F		no		
5-Sep	18:00	F		no		
5-Sep	18:20	M		no		
5-Sep	18:20	M		no		
5-Sep	18:20	M		no		
5-Sep	19:00	M		yes		
6-Sep	8:30	M		no		
6-Sep	8:30	M		no		
6-Sep	8:30	F		no		
6-Sep	8:30	F		no		
6-Sep	17:30	F		no		
6-Sep	17:30	F		no		
6-Sep	17:30	F		no		
6-Sep	19:45	F		no		
7-Sep	15:30	M		no		
7-Sep	16:00	F		yes		
7-Sep	16:45	M		no		
7-Sep	16:45	M		no		
7-Sep	16:45	M		no		
7-Sep	16:45	M		no		
7-Sep	16:45	F		no		3 inch scar on left side
7-Sep	16:45	F		no		
7-Sep	16:45	F		no		hook mark
8-Sep	8:45	M		no		
8-Sep	17:20	M		no		
8-Sep	17:20	M		no		
8-Sep	17:20	F		no		
8-Sep	17:20	F		no		
8-Sep	17:20	F		no		
9-Sep	8:30	M		yes		large wound at base of head
9-Sep	8:30	M		yes		
9-Sep	8:30	M		no		scratches on head
9-Sep	8:30	M		no		top half of tail worn
9-Sep	8:30	M		no		large fresh cut on pectoral fin

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
9-Sep	8:30	M		no		
9-Sep	8:30	M		no		
9-Sep	18:00	M		no		
9-Sep	18:00	F		no		
9-Sep	18:45	F		no		
10-Sep	8:30	F		no		abrasions on head
10-Sep	8:30	F		no		abrasions on head
10-Sep	8:30	F		no		abrasions on head
10-Sep	8:30	F		no		
10-Sep	8:30	F		yes		
10-Sep	16:00	M		no		
10-Sep	16:00	M		no		
10-Sep	16:00	M		no		
10-Sep	16:00	M		no		
10-Sep	16:00	M		no		
10-Sep	16:00	M		no		head abrasions
10-Sep	16:00	F		no		head abrasions
10-Sep	16:00	F		yes		
10-Sep	16:00	F		no		
10-Sep	16:00	F		no		
10-Sep	16:00	F		no		
10-Sep	16:00	F		no		
11-Sep	9:00	M		no		
11-Sep	9:00	F		yes		
11-Sep	9:00	F		no		
11-Sep	15:00	M		no		
11-Sep	15:00	M		no		
11-Sep	15:00	M		no		
11-Sep	15:00	F		no		
11-Sep	16:30	M		no		
11-Sep	16:30	F		no		
11-Sep	17:00	M		no		
11-Sep	17:00	F		no		
11-Sep	17:30	M		no		
11-Sep	17:30	M		yes		
11-Sep	17:30	M		no		
11-Sep	17:30	M		no		
11-Sep	17:30	F		no	yes	white tag didn't get number
11-Sep	17:30	F		no		
11-Sep	17:30	F		no		
11-Sep	18:00	M		no		split nose
11-Sep	18:00	M		no		something bright orange dragging from mouth
11-Sep	18:00	M		no		
11-Sep	18:00	M		no		
11-Sep	18:00	F		no		piece of nose missing
11-Sep	18:00	F		no		
11-Sep	18:00	F		no		
11-Sep	18:00	F		no		

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
11-Sep	18:00	F		no		
11-Sep	19:00	M		no		
11-Sep	19:00	M		no		
11-Sep	19:00	M		no		
11-Sep	19:00	M		no		
11-Sep	19:00	M		no		
11-Sep	19:00	F		no		
11-Sep	19:00	F		no		
11-Sep	19:00	F		no		
11-Sep	19:00	F		no		
11-Sep	19:30	M		no		
11-Sep	19:30	M		no		
11-Sep	19:30	M		no		
11-Sep	19:30	M		no		
11-Sep	19:30	M		no		
11-Sep	19:30	F		no		
11-Sep	19:30	F		no		
11-Sep	19:30	F		no		
11-Sep	20:00	M		no		
11-Sep	20:00	M		no		
11-Sep	20:00	M		no		
11-Sep	20:00	M		no		
11-Sep	20:00	F		no		
12-Sep	8:30	M		no		
12-Sep	8:30	F		no		
12-Sep	8:30	F		no		
12-Sep	8:30	F		no		
13-Sep	9:00	M		no		
13-Sep	9:00	M		yes		
13-Sep	9:00	M		no		
13-Sep	9:00	M		no		
13-Sep	9:00	F		no		head abrasion
13-Sep	9:00	F		no		scraped sides
13-Sep	9:00	F		no		
13-Sep	9:00	F		no		head abrasion
13-Sep	15:30	M		no		
13-Sep	15:30	M		no		growth on jaw
13-Sep	15:30	F		no		
13-Sep	16:00	F		no		
13-Sep	16:00	F		no		
13-Sep	17:00	M		no		
13-Sep	17:00	F		no		
13-Sep	17:00	F		no		
13-Sep	17:00	F		no		
13-Sep	18:00	M		no		
13-Sep	18:00	M		no		
13-Sep	18:00	M		no		
13-Sep	18:00	M		no		

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
13-Sep	18:00	F		no		
13-Sep	18:00	F		no		
13-Sep	18:00	F		no		
13-Sep	18:00	F		no		
13-Sep	18:00	F		no		
13-Sep	19:00	M		no		head abrasion
13-Sep	19:00	M		no		
13-Sep	19:00	M		no		
13-Sep	19:00	M		yes		
13-Sep	19:00	M		no		
13-Sep	19:00	M		no		
13-Sep	19:00	M		no		
13-Sep	19:00	M		no		
13-Sep	19:00	M		no		
13-Sep	19:00	F		no		
13-Sep	19:00	F		no		
13-Sep	19:00	F		no		
13-Sep	19:00	F		no		
13-Sep	19:00	F		no		
13-Sep	19:00	F		no		
13-Sep	19:00	F		no		
13-Sep	19:00	F		no		
13-Sep	19:00	F		no		
13-Sep	19:00	F		yes		
13-Sep	19:00	F		no		
13-Sep	19:00	F		yes		head abrasion
13-Sep	19:45	F		no		
13-Sep	19:45	F		no		snag under jaw
13-Sep	19:45	F		no		
13-Sep	19:45	F		no		nose abrasion
13-Sep	19:45	F		no		
14-Sep	9:00	F		no		
14-Sep	16:30	F		no		
14-Sep	18:00	M		no		slight nose abrasion
14-Sep	18:00	F		no		
14-Sep	18:30	M		no		
14-Sep	18:30	M		no		
14-Sep	18:30	M		no		
14-Sep	18:30	M		no		
14-Sep	18:30	F		no		
14-Sep	18:30	F		no		
14-Sep	18:30	F		yes		
14-Sep	18:30	F		no		
14-Sep	18:30	F		no		
14-Sep	18:30	F		no		
14-Sep	18:30	F		no		
14-Sep	18:30	F		yes		

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
14-Sep	18:30	F		no		
15-Sep	8:30	M		no		
15-Sep	8:30	M		yes		
15-Sep	8:30	F		no		
15-Sep	8:30	F		no		
15-Sep	8:30	F		no		
15-Sep	8:30	F		no		
15-Sep	8:30	F		yes		
15-Sep	15:30	F		yes		
15-Sep	16:00	M		no		
15-Sep	16:00	M		no		
15-Sep	16:00	F		no		
15-Sep	16:00	F		no		
15-Sep	16:00	F		no		
15-Sep	16:00	F		no		
15-Sep	16:00	F		no		
15-Sep	16:30	M		no		
15-Sep	16:30	F		no		
15-Sep	16:30	F		no		
15-Sep	16:30	F		no		
15-Sep	17:00	M		no		
15-Sep	17:00	F		no		
15-Sep	17:00	F		no		
15-Sep	17:00	F		no		
15-Sep	17:00	F		no		
15-Sep	17:30	M		no		
15-Sep	17:30	M		no		
15-Sep	17:30	M		no		head abrasion
15-Sep	17:30	F		no		
15-Sep	17:30	F		no		
15-Sep	17:30	F		no		puncture wound on side
15-Sep	18:00	M		no		
15-Sep	18:00	M		no		
16-Sep	8:45	M		no		
16-Sep	8:45	M		no		
16-Sep	8:45	M		no		fairly fresh hole in the bottom of mouth
16-Sep	8:45	M		no		
16-Sep	8:45	M		no		
16-Sep	8:45	M		no		
16-Sep	8:45	M		no		
16-Sep	8:45	F		no		
16-Sep	8:45	F		no		
16-Sep	8:45	F		no		
16-Sep	10:00	M		no		fresh scrapes on end of nose
16-Sep	16:30	F		no		
16-Sep	17:00	F		no		
16-Sep	17:00	F		no		
16-Sep	17:00	F		no		
16-Sep	17:00	F		no		

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
16-Sep	17:00	F		no		
16-Sep	17:00	M		no		
16-Sep	18:00	F		no		
16-Sep	18:00	F		no		
16-Sep	18:00	M		no		
16-Sep	18:00	M		no		
16-Sep	19:00	M		no		
16-Sep	19:00	F		no		
16-Sep	19:00	F		no		
16-Sep	19:00	M		no		
16-Sep	19:00	M		no		
17-Sep	8:30	F		no		minor abrasion on back
17-Sep	9:30	M		no		
17-Sep	9:30	M		no		
17-Sep	9:30	F		no		
17-Sep	9:30	F		no		
17-Sep	14:00	M		no		
17-Sep	14:00	F		no		
17-Sep	16:00	M		no		
17-Sep	16:00	M		no		
17-Sep	16:00	F		no		
17-Sep	16:00	F		no		
17-Sep	16:00	F		no		
17-Sep	16:00	F		no		
17-Sep	16:00	F		no		
17-Sep	17:00	F		yes		
17-Sep	17:00	F		no		
17-Sep	18:30	M		no		
18-Sep	8:30	F	730	no	yes	white,14176
18-Sep	8:30	F		no		
18-Sep	8:30	F		no		
18-Sep	8:30	F		no		
18-Sep	14:45	M		no		
18-Sep	14:45	M		no		
18-Sep	14:45	M		no		
18-Sep	14:45	M		no		
18-Sep	14:45	F		yes		
18-Sep	14:45	F		no		
18-Sep	14:45	F		no		
18-Sep	14:45	F		no		
18-Sep	14:45	F		no		
18-Sep	19:00	F		yes		
19-Sep	11:00	F		no		
19-Sep	14:30	F		no		
19-Sep	18:00	F		no		
19-Sep	19:00	M		no		
20-Sep	7:45	M		no		small spots of fungus on head
20-Sep	14:45	F		no		
20-Sep	14:45	M		no		

[illegible]

Appendix Table 6. (continued)

Date	Time	Sex	NF Length (mm)	Gillnet Marks	Tag	Comments
23-Sep	17:30	F		yes		
23-Sep	17:30	F		no		
23-Sep	17:30	F		no		
23-Sep	17:30	F		no		
23-Sep	17:30	F		no		
23-Sep	17:45	M		no		
23-Sep	17:45	M		no		
23-Sep	17:45	F		no		
23-Sep	17:45	F		no		
23-Sep	17:45	F		no		
23-Sep	17:45	F		no		passed it downstream because too weak to swim upstream
24-Sep	8:20	M		no		
24-Sep	8:20	F		no		
24-Sep	15:15	M		no		
24-Sep	15:15	F		no		
24-Sep	15:15	F		no		
24-Sep	15:15	F		no		
24-Sep	15:15	F		no		
26-Sep	8:45	M		no		
26-Sep	8:45	F		no		
26-Sep	17:00	F		no		
26-Sep	17:40	M		no		
26-Sep	17:40	F		no		
26-Sep	18:30	M		no		
26-Sep	18:30	F		no		
26-Sep	18:30	F		no		
26-Sep	19:00	M		no		
26-Sep	19:00	F		no		
27-Sep	18:20	F		no		
27-Sep	19:00	F		no		
29-Sep	18:15	M		no		
30-Sep	17:00	F		no		

Appendix Table 7. Sampling data from all chinook carcasses recovered from the Sustut River fence, 2002.

Date	Time	Sex	Length (mm)		Operc. Punch	Comments
			Nose-Fork	P.O.H.		
5-Aug	15:00	F	980	790	yes	100% unspawned
6-Aug	20:00	M	1000	800	no	
6-Aug	20:00	M	700	570	yes	puncture wound in belly
7-Aug	10:00	M	1060	850	no	gaff wound by tail
7-Aug	19:00	M	1030	830	no	
8-Aug	12:00	M	955	745	no	spent
8-Aug	12:00	M	1070	845	no	unspawned
8-Aug	12:00	M	1120	870	no	partial
9-Aug	17:00	M	1100	870	no	
9-Aug	17:00	M	1110	870	no	
10-Aug	20:00	M	955	770	no	
10-Aug	20:00	M	860	695	no	
10-Aug	20:00	M	1055	850	no	
10-Aug	20:00	M	685	555	no	
10-Aug	20:00	M	945	765	no	
11-Aug	20:00	F	890	740	no	
11-Aug	20:00	M	1090	870	no	
11-Aug	20:00	M	1030	810	no	
11-Aug	20:00	M	940	760	yes	
11-Aug	20:00	M	890	720	no	
12-Aug	8:30	M	900	730	yes	
12-Aug	8:30	F	850	670	no	
12-Aug	11:00	M	1140	900	no	
12-Aug	15:00	M	1110	960	no	
12-Aug	15:00	M			no	
12-Aug	18:00	M	960	760	no	
12-Aug	18:00	M	860	670	yes	
12-Aug	18:00	M	880	710	no	
13-Aug	9:00	M	940	750	no	
13-Aug	9:00	M	960	790	no	
13-Aug	9:00	M	1010	800	no	
13-Aug	9:00	M	880	690	yes	
13-Aug	9:00	M	990	780	no	
13-Aug	15:30	M	880	700	no	
13-Aug	19:45	M	770	590	yes	
13-Aug	19:45	M	850	670	no	
13-Aug	19:45	M	945	740	no	
13-Aug	19:45	M	890	720	no	
14-Aug	11:45	M	890	670	no	
14-Aug	11:45	M	890	660	no	
14-Aug	20:30	M	990	760	yes	
14-Aug	20:30	M	1010	800	no	
14-Aug	20:30	M	850	640	no	
14-Aug	20:30	M	890	680	no	
14-Aug	20:30	F	920	750	no	
15-Aug	9:30	F	910	720	no	
15-Aug	9:30	F	830	660	no	

Appendix Table 7. (continued)

Date	Time	Sex	Length (mm)		Operc. Punch	Comments
			Nose-Fork	P.O.H.		
15-Aug	9:30	M	1180	900	no	
15-Aug	9:30	M	960	730	no	
15-Aug	9:30	M	870	680	no	
15-Aug	9:30	M	1020	780	no	
15-Aug	9:30	M	1020	800	no	
15-Aug	9:30	M	960	750	no	
15-Aug	9:30	M	1110	850	no	
15-Aug	9:30	M	740	580	no	
15-Aug	20:30	M	1110	850	no	
15-Aug	20:30	M	870	680	no	
15-Aug	20:30	M	1050	810	no	
15-Aug	20:30	M	1130	890	no	
15-Aug	20:30	M	1010	890	no	
15-Aug	20:30	M	890	700	no	
15-Aug	20:30	M	1050	830	no	
15-Aug	20:30	M	1060	840	no	
16-Aug	9:00	F	880	720	no	very rotten
16-Aug	9:00	M	920	710	no	
16-Aug	9:00	M	740	590	no	
16-Aug	9:00	M	1110	870	no	
16-Aug	9:00	M	1050	820	no	
16-Aug	9:00	M	1110	850	no	
16-Aug	9:00	M	870	680	no	
16-Aug	9:00	M	830	680	no	
16-Aug	9:00	F	950	760	no	
16-Aug	9:00	M	930	730	no	
16-Aug	18:00	M	810	610	yes	
16-Aug	18:00	M	680	540	no	
16-Aug	18:00	M	790	620	no	
16-Aug	18:00	M	840	650	no	
16-Aug	18:00	M	1040	810	no	
16-Aug	18:00	M	880	700	no	
16-Aug	18:00	M	860	660	no	
16-Aug	18:00	M	800	640	no	
16-Aug	18:00	M	1000	790	no	
16-Aug	18:00	M	980	780	yes	
16-Aug	18:00	M	900	710	no	
16-Aug	18:00	M	950	750	no	
16-Aug	18:00	M	900	720	no	
17-Aug	8:30	M	990	785	no	
17-Aug	8:30	M	840	650	no	
17-Aug	8:30	M	1030	825	yes	
17-Aug	8:30	M	1040	815	no	
17-Aug	8:30	M	1050	820	no	
17-Aug	8:30	F	810	665	no	
17-Aug	8:30	M	950	750	no	
17-Aug	8:30	M	950	735	no	
17-Aug	8:30	M	1130	900	no	
17-Aug	8:30	M	820	660	yes	

Appendix Table 7. (continued)

Date	Time	Sex	Length (mm)		Operc. Punch	Comments
			Nose-Fork	P.O.H.		
17-Aug	20:00	M	930	725	no	
17-Aug	20:00	M	730	570	no	
17-Aug	20:00	M	810	640	no	
17-Aug	20:00	M	875	700	no	
17-Aug	20:00	M	740	600	no	
17-Aug	20:00	M	790	625	no	
17-Aug	20:00	M	660	530	no	
17-Aug	20:00	M	1060	825	no	
17-Aug	20:00	M	810	640	no	
17-Aug	20:00	F	880	710	no	
17-Aug	20:00	M	860	685	no	
17-Aug	20:00	M	1050	825	no	
18-Aug	9:00	M	890	700	no	
18-Aug	9:00	M	660	530	no	
18-Aug	9:00	M	860	690	no	
18-Aug	9:00	M	660	515	no	
18-Aug	9:00	M	880	700	no	
18-Aug	9:00	M	1180	900	no	
18-Aug	9:00	M	1100	855	no	
18-Aug	9:00	M	675	540	no	
18-Aug	9:00	M	830	650	no	
18-Aug	9:00	M	940	745	no	
18-Aug	9:00	M	740	560	no	
18-Aug	20:00	M	710	575	no	
18-Aug	20:00	M	820	645	no	
18-Aug	20:00	F	1000	815	no	
18-Aug	20:00	M	670	535	no	
18-Aug	20:00	M	870	690	no	
18-Aug	20:00	M	800	635	no	
18-Aug	20:00	M	860	670	no	
18-Aug	20:00	M	800	650	no	
18-Aug	20:00	M	710	570	no	
18-Aug	20:00	M	910	720	yes	
18-Aug	20:00	M	945	755	no	
18-Aug	20:00	F	860	695	no	
18-Aug	20:00	M	670	530	no	
18-Aug	20:00	M	670	540	no	
19-Aug	11:00	M	840	660	no	
19-Aug	11:00	M	1090	845	no	
19-Aug	11:00	M	860	690	no	
19-Aug	11:00	M	855	680	no	
19-Aug	11:00	M	990	775	no	
19-Aug	11:00	M	770	625	no	
19-Aug	11:00	M	900	710	no	
19-Aug	20:00	M	960	740	no	
19-Aug	20:00	M	700	550	no	
19-Aug	20:00	M	940	730	no	
19-Aug	20:00	M	690	540	no	
19-Aug	20:00	M	600	475	no	

Appendix Table 7. (continued)

Date	Time	Sex	Length (mm)		Operc. Punch	Comments
			Nose-Fork	P.O.H.		
19-Aug	20:00	M	840	640	no	
19-Aug	20:00	M	910	710	no	
19-Aug	20:00	M	850	660	no	
19-Aug	20:00	M	730	560	no	
19-Aug	20:00	M	940	760	no	
20-Aug	20:00	M	1030	820	no	
20-Aug	20:00	M	945	760	no	
20-Aug	20:00	M	1140	890	no	
20-Aug	20:00	M	885	700	no	
20-Aug	20:00	M	855	690	no	
20-Aug	20:00	M	560	455	no	
20-Aug	20:00	F	900	750	no	
20-Aug	20:00	M	995	795	no	
20-Aug	20:00	F	935	770	no	
20-Aug	20:00	M	645	520	no	
20-Aug	20:00	M	710	570	no	
20-Aug	20:00	M	1070	850	no	
20-Aug	20:00	M	995	800	no	
20-Aug	20:00	M	610	475	no	
20-Aug	20:00	M	675	530	no	
20-Aug	20:00	M	750	610	no	
20-Aug	20:00	M	790	640	no	
20-Aug	20:00	M	670	530	no	
20-Aug	20:00	M	680	540	no	
20-Aug	20:00	M	680	535	no	
20-Aug	20:00	M	720	580	no	
20-Aug	20:00	M	1140	885	no	
20-Aug	20:00	M	1130	890	no	
20-Aug	20:00	M	740	585	no	
20-Aug	20:00	M	1110	870	no	
20-Aug	20:00	M	740	605	no	
20-Aug	20:00	M	670	550	no	
20-Aug	20:00	M	890	700	no	
21-Aug	8:30	M	840	660	no	
21-Aug	8:30	M	950	745	no	
21-Aug	8:30	M	755	590	no	
21-Aug	8:30	M	900	705	no	
21-Aug	8:30	M	870	680	no	
21-Aug	8:30	M	700	565	no	
21-Aug	8:30	M	890	700	yes	
21-Aug	8:30	M	665	540	no	
21-Aug	20:00	M	880	700	no	
21-Aug	20:00	M	780	610	no	
21-Aug	20:00	M	950	745	no	
21-Aug	20:00	M	685	540	no	
21-Aug	20:00	M	770	610	no	
21-Aug	20:00	M	720	565	no	
21-Aug	20:00	M	1050	795	no	
21-Aug	20:00	M	740	580	no	

Appendix Table 7. (continued)

Date	Time	Sex	Length (mm)		Operc. Punch	Comments
			Nose-Fork	P.O.H.		
21-Aug	20:00	M	970	745	no	
21-Aug	20:00	M	870	690	no	
22-Aug	12:00	M	680	530	no	
22-Aug	12:00	M	650	500	no	
22-Aug	12:00	M	560	445	no	
22-Aug	12:00	M	700	550	no	
22-Aug	12:00	M	730	570	no	
22-Aug	12:00	M	1040	820	no	
22-Aug	12:00	M	870	680	no	
22-Aug	12:00	F	875	710	no	
22-Aug	20:00	M	630	500	no	
22-Aug	20:00	M	995	770	no	
22-Aug	20:00	M	620	480	yes	
22-Aug	20:00	M	800	630	yes	
22-Aug	20:00	M	900	710	no	
22-Aug	20:00	M	650	505	no	
22-Aug	20:00	M	900	710	no	
22-Aug	20:00	M	985	755	no	
22-Aug	20:00	M	840	650	no	
22-Aug	20:00	F	900	740	no	
23-Aug	10:00	M	700	570	no	
23-Aug	10:00	M	1060	820	no	
23-Aug	10:00	M	720	580	no	
23-Aug	10:00	M	735	590	no	
23-Aug	10:00	M	770	610	no	fresh,bear killed
23-Aug	10:00	M	815	640	no	
23-Aug	10:00	M	750	595	no	
23-Aug	10:00	M	680	540	no	
23-Aug	20:00	F	995	805	no	spawned
23-Aug	20:00	M	685	545	no	
23-Aug	20:00	M	785	620	no	
23-Aug	20:00	M	700	550	no	
23-Aug	20:00	M	1030	800	no	
23-Aug	20:00	F	885	720	no	spawned
23-Aug	20:00	M	730	580	no	
24-Aug	9:00	M	1030	800	no	
24-Aug	9:00	M	690	550	no	
24-Aug	9:00	M	890	710	no	
24-Aug	9:00	M	610	480	no	
24-Aug	9:00	M	870	700	no	
24-Aug	9:00	M	750	600	no	
24-Aug	9:00	M	720	580	no	
24-Aug	9:00	M	660	520	no	
24-Aug	9:00	M	840	660	no	
24-Aug	9:00	M	750	610	yes	
24-Aug	20:00	M	690	550	no	
24-Aug	20:00	M	680	530	no	
24-Aug	20:00	M	880	670	no	
24-Aug	20:00	M	970	740	no	

Appendix Table 7. (continued)

Date	Time	Sex	Length (mm)		Operc. Punch	Comments
			Nose-Fork	P.O.H.		
24-Aug	20:00	M	760	580	no	
24-Aug	20:00	M	750	590	no	
25-Aug	10:00	M	610	480	no	
25-Aug	10:00	M	630	490	no	
25-Aug	10:00	M	670	530	no	
25-Aug	10:00	M	680	550	no	
25-Aug	10:00	M	1050	830	no	
25-Aug	10:00	M	1110	890	no	
25-Aug	10:00	M	680	540	no	
25-Aug	10:00	F	870	700	no	
25-Aug	10:00	M	700	560	no	
25-Aug	20:00	M	770	610	no	
25-Aug	20:00	M	980	760	no	
25-Aug	20:00	M	860	680	no	
25-Aug	20:00	M	630	510	no	
25-Aug	20:00	M	660	540	no	
25-Aug	20:00	M	800	630	no	
26-Aug	9:00	M	715	565	no	
26-Aug	9:00	M	680	550	no	
26-Aug	20:00	M	895	710	no	
26-Aug	20:00	M	765	695	no	
26-Aug	20:00	M	660	520	no	
26-Aug	20:00	M	990	760	no	
27-Aug	20:00	M	840	670	no	
28-Aug	8:30	M	760	590	no	
29-Aug	9:00	M	680	540	no	
29-Aug	9:00	M	930	740	no	
29-Aug	9:00	M	670	530	no	
29-Aug	9:00	M	920	710	no	
29-Aug	9:00	M	660	530	no	
29-Aug	9:00	M	660	530	yes	
29-Aug	9:00	M	730	580	no	
30-Aug	20:00	M	710	570	no	
30-Aug	20:00	M	730	590	no	
31-Aug	20:00	M	720	560	no	
31-Aug	20:00	M	670	540	no	
31-Aug	20:00	M	860	670	no	
31-Aug	20:00	M	940	740	no	
1-Sep	11:30	F	900	730	no	
3-Sep	11:15	M	630	500	no	

Appendix Table 8. Sockeye salmon sampling data from the Sustut fence, 2002.

Date	Time	Sex	Nose-Fork Length (mm)	Scale Bk Position	Scale Book #	Comments
9-Aug	1200	M	715	1 - 41	95550	
11-Aug	1740	M	730	2 - 42	95550	
11-Aug	1900	M	720	3 - 43	95550	
11-Aug	1900	F	715	4 - 44	95550	
12-Aug	1500	M	620	5 - 45	95550	
13-Aug	1945	M	680	6 - 46	95550	
14-Aug	1530	M	730	7 - 47	95550	
15-Aug	2030	M	750	8 - 48	95550	
17-Aug	1900	F	670	1 - 41	95551	
17-Aug	1900	M	760	2 - 42	95551	
17-Aug	2030	M	725	3 - 43	95551	
17-Aug	2030	M	615	4 - 44	95551	
18-Aug	1130	M	705	5 - 45	95551	
18-Aug	1500	M	695	6 - 46	95551	
18-Aug	1500	M	735	7 - 47	95551	
18-Aug	1500	F	525	8 - 48	95551	
19-Aug	1900	M	650	9 - 49	95551	
19-Aug	1900	F	660	10 - 50	95551	
20-Aug	1645	F	645	1 - 41	95552	
20-Aug	1730	M	670	2 - 42	95552	
20-Aug	1730	M	675	3 - 43	95552	
20-Aug	1730	M	705	4 - 44	95552	
20-Aug	1800	F	680	5 - 45	95552	
20-Aug	1800	M	675	6 - 46	95552	
20-Aug	1830	M	695	7 - 47	95552	
20-Aug	1830	M	720	8 - 48	95552	
21-Aug	1500	M	660	9 - 49	95552	
21-Aug	1500	M	705	10 - 50	95552	
21-Aug	1500	M	640	1 - 41	95553	
21-Aug	1500	M	680	2 - 42	95553	
21-Aug	1500	F	610	3 - 43	95553	
21-Aug	1900	M	710	4 - 44	95553	
22-Aug	1950	F	660	5 - 45	95553	
22-Aug	1950	M	660	6 - 46	95553	
22-Aug	1950	M	710	7 - 47	95553	
22-Aug	1950	F	640	8 - 48	95553	
22-Aug	1950	M	600	9 - 49	95553	
22-Aug	1950	F	605	10 - 50	95553	
23-Aug	1930	M	735	1 - 41	95554	
24-Aug	0830	M	715	2 - 42	95554	
24-Aug	0830	F	580	3 - 43	95554	
24-Aug	1600	M	630	4 - 44	95554	
24-Aug	1600	F	590	5 - 45	95554	
24-Aug	1700	M	680	6 - 46	95554	
24-Aug	1700	F	675	7 - 47	95554	
24-Aug	1700	F	580	8 - 48	95554	
24-Aug	1700	F	600	9 - 49	95554	
24-Aug	2000	M	680	10 - 50	95554	

Appendix Table 8. (continued)

Date	Time	Sex	Nose-Fork Length (mm)	Scale Bk Position	Scale Book #	Comments
24-Aug	2000	M	760	1 - 41	95555	
24-Aug	2000	M	690	2 - 42	95555	
25-Aug	0930	M	680	3 - 43	95555	
25-Aug	0930	M	720	4 - 44	95555	
25-Aug	0930	F	680	5 - 45	95555	
27-Aug	1715	M	705	6 - 46	95555	A few minor head abrasions
28-Aug	1200	F	650	7 - 47	95555	Missing a piece of flesh on side near adipose
28-Aug	1200	F	690	8 - 48	95555	
29-Aug	0830	M	720	9 - 49	95555	
29-Aug	1600	M	700	10 - 50	95555	
29-Aug	1600	M	700	1 - 41	95556	
29-Aug	1830	F	660	2 - 42	95556	
29-Aug	1930	M	670	3 - 43	95556	
30-Aug	1800	F	600	4 - 44	95556	
30-Aug	1800	M	730	5 - 45	95556	
1-Sep	1800	M	720	6 - 46	95556	
5-Sep	1430	M	505	7 - 47	95556	
18-Sep	1600	M	650	8 - 48	95556	Chunk missing on end of nose; eroded dorsal

Appendix Table 9. Sampling data for all sockeye carcasses recovered from the Sustut River fence, 2002.

Date	Time	Sex	Length (mm)		Comments
			Nose-Fork	P.O.H.	
21-Aug	1500	F	600		Unspawned, in perfect shape, cause of death unknown
24-Aug	2000	F	600	500	Unspawned, wound in belly (gaff?)
3-Sep	1115	F	645	520	Unspawned, fungus on head
3-Sep	1115	F	580	460	Stuck between pipes trying to get upstream
3-Sep	2000	F	600	490	
4-Sep	1930	F	580	460	Unspawned, handprint of fungus on tail
6-Sep	2000	F			Unspawned, fungus all over head
8-Sep	1730	F	640	515	Partially spent, loose eggs
9-Sep	1930	M	725	570	Unspawned
11-Sep	2000	F	615	500	Unspawned
11-Sep	2000	M	630	510	Unspawned
12-Sep	1400	F	630	570	Unspawned
14-Sep	0900	F	640	510	Unspawned
14-Sep	0900	F	670	540	Unspawned, fresh puncture wound in side and belly
16-Sep	0845	F	650	530	Fungus on head and near dorsal fin, eggs loose
16-Sep	1930	M	570	460	Fungus on head, gill plate and back
17-Sep	0830	F	640	510	Spent, fungus on head and body, eroded fins
20-Sep	1830	F	580	460	Fungus on head and back, appeared mostly spawned
21-Sep	1930	M	640	490	Lots of fungus on head
24-Sep	1600	F	590	480	Unspawned
25-Sep	1915	F	570	455	Unspawned

Appendix Table 10. Sampling data from all coho migrating past the Sustut River fence, 2002.

Date	Time	Sex	Nose-Fork Length (mm)	Scale Bk. Position	Scale Bk. Number	DNA	Comments
24-Aug	1600	F	630	1 - 41	95540	Yes	
24-Aug	2000	F	650	2 - 42	95540	Yes	
25-Aug	1400	M	580	3 - 43	95540	Yes	
25-Aug	1500	M	670	4 - 44	95540	Yes	
25-Aug	1700	M	650	5 - 45	95540	Yes	Some possible gillnet scars
25-Aug	1800	F	640	6 - 46	95540	Yes	
25-Aug	2000	F	630	7 - 47	95540	Yes	
26-Aug	1530	M	745	8 - 48	95540	Yes	
28-Aug	830	M	530	9 - 49	95540	Yes	Gillnet marks
28-Aug	1200	F	645	10 - 50	95540	Yes	
28-Aug	1900	M	660	1 - 41	95541	Yes	Lots of marks; possible gillnet
29-Aug	1700	M	530	2 - 42	95541	Yes	
29-Aug	1730	M	480	3 - 43	95541	Yes	Scars on back and side
29-Aug	1800	M	720	4 - 44	95541	Yes	
29-Aug	1930	M	580	5 - 45	95541	Yes	
30-Aug	1800	M	535	6 - 46	95541	Yes	
31-Aug	1600	F	630	7 - 47	95541	Yes	Removed fish hook from side
31-Aug	1700	M	535	8 - 48	95541	Yes	
1-Sep	1100	M	530	9 - 49	95541	Yes	
1-Sep	1600	F	700	10 - 50	95541	Yes	
1-Sep	1600	M	620	1 - 41	95542	Yes	
1-Sep	1600	F	640	2 - 42	95542	Yes	
1-Sep	1600	M	510	3 - 43	95542	Yes	
1-Sep	1600	F	640	4 - 44	95542	No	
1-Sep	1600	M	680	5 - 45	95542	Yes	
1-Sep	1600	M	690	6 - 46	95542	Yes	
1-Sep	1800	M	560			Yes	Escaped before scale sampling
4-Sep	1815	F	650	7 - 47	95542	Yes	
6-Sep	1800	M	690	8 - 48	95542	Yes	
6-Sep	1830	F	685	9 - 49	95542	Yes	
8-Sep	845	M	470	10 - 50	95542	Lost	No marks
10-Sep	1600	M	540	1 - 41	95543	Yes	Nose abrasions
11-Sep	1800	M	590	2 - 42	95543	Yes	
11-Sep	1800	M	705	3 - 43	95543	Yes	several facial scars
13-Sep	1530	F	495	4 - 44	95543	Yes	Wound by eye
13-Sep	1730	F	570	5 - 45	95543	Yes	
14-Sep	1830	M	590	6 - 46	95543	Yes	Scrapes on side
15-Sep	1600	M	560	7 - 47	95543	Yes	
15-Sep	1800	F	590	8 - 48	95543	Yes	
15-Sep	1830	M	650	9 - 49	95543	Yes	
16-Sep	845	F		10 - 50	95543	Yes	Scratches on caudal peduncle
16-Sep	845	M	530	1 - 41	95544	Yes	
16-Sep	1400	F	650	2 - 42	95544	Yes	Caudal peduncle ripped
16-Sep	1400	M	510	3 - 43	95544	Yes	Bruise on back

Appendix Table 10. (continued)

Date	Time	Sex	Nose-Fork Length (mm)	Scale Bk. Position	Scale Bk. Number	DNA	Comments
16-Sep	1400	M	560	4 - 44	95544	Yes	
16-Sep	1600	M	650	5 - 45	95544	Yes	Warts, raised spots on back and side
16-Sep	1600	F	600	6 - 46	95544	Yes	Scars on caudal peduncle
17-Sep	830	F	690	7 - 47	95544	Yes	Old marks all over face and body
18-Sep	1445	M	630	8 - 48	95544	Yes	Scratch across belly
18-Sep	1445	M	480	9 - 49	95544	Yes	Gillnet marks mid body
19-Sep	830	M	470	10 - 50	95544	Yes	Lots of fungus on head
19-Sep	1930	M	705	1 - 41	95545	Yes	Abrasion on head
20-Sep	1600	M	705	2 - 42	95545	Yes	
21-Sep	800	M	670	3 - 43	95545	Yes	
22-Sep	1500	M	530	4 - 44	95545	Yes	
22-Sep	1500	M	550	5 - 45	95545	Yes	
23-Sep	1600	M	600	6 - 46	95545	Yes	Fungus on top of head
23-Sep	1745	F	610	7 - 47	95545	Yes	
24-Sep	820	F	600	8 - 48	95545	Yes	
24-Sep	1515	M	720	9 - 49	95545	Yes	
25-Sep	1900	M	660	10 - 50	95545	Yes	
26-Sep	845	M	675	1 - 41	95546	Yes	
29-Sep	1815	M	730	2 - 42	95546	Yes	Spot of fungus by eye