

**Red Shirt Lake  
Adult Sockeye Salmon  
Data Report  
2009**

**Prepared by:  
CIAA Staff  
2012**

**The Red Shirt Lake Project was made possible through an Alaskan Sustainable Salmon Fund grant received from the Alaska Department of Fish & Game and the National Oceanic and Atmospheric Administration and a State of Alaska Designated Legislative Grant.**

*This page was intentionally left blank*

## **DISCLAIMER**

The Cook Inlet Aquaculture Association (CIAA) conducts salmon enhancement and restoration projects in Area H, Cook Inlet and associated waters. As an integral part of these projects a variety of monitoring and evaluation studies are conducted. The following data report is a synopsis of the monitoring and evaluation studies conducted for Red Shirt Lake. The Red Shirt Lake Data Report encompasses data collected from the 2009 adult sockeye escapement as it falls under the Alaskan Sustainable Salmon Fund.

The purpose of the data report is to provide a vehicle to distribute the information produced by the monitoring and evaluation studies. Data collected each year are presented with a summary of the information previously collected for comparative purposes. These reports are intended to provide a general description of project activity and are not an exhaustive evaluation of any restoration or enhancement project. The information presented in this report has not undergone an extensive review. As reviews are completed, the information may be updated and presented in other reports.

The Red Shirt Lake Data Report was prepared by CIAA under award of the Alaskan Sustainable Salmon Fund 45888 from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, administered by the Alaska Department of Fish and Game (ADF&G). The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration, the U.S. Department of Commerce, or ADF&G.

The Cook Inlet Aquaculture Association maintains a strong policy of equal employment opportunity for all employees and applicants for employment. We hire, train, promote, and compensate employees without regard for race, color, religion, sex, sexual orientation, national origin, age, marital status, disability or citizenship, as well as other classifications protected by applicable federal, state or local laws.

Our equal employment opportunity philosophy applies to all aspects of employment with CIAA including recruiting, hiring, training, transfer, promotion, job benefits, pay, dismissal, and educational assistance.

*This page was intentionally left blank*

## **ACKNOWLEDGEMENTS**

Many individuals and agencies contributed to the success of the Red Shirt Lake Project. Appreciation is extended to Cook Inlet Aquaculture Association Interns Matt Smukall, Jeffrey Williams, Tim Bembenic, Taylor Strout, and seasonal employee Eric Fluette, as well as all full time staff who aided in the field. Special thanks are also extended to the Alaska Department of Fish and Game for the support they provided during this project.

*This page was intentionally left blank*

## TABLE OF CONTENTS

DISCLAIMER .....	iii
ACKNOWLEDGEMENTS .....	v
TABLE OF CONTENTS .....	vii
LIST OF FIGURES .....	ix
LIST OF APPENDICES .....	xi
ABSTRACT .....	xiii
INTRODUCTION AND PURPOSE .....	1
PROJECT AREA .....	3
METHODS .....	5
Environmental Conditions .....	5
Weir .....	5
Adult Enumeration .....	5
RESULTS .....	7
Environmental Conditions .....	7
Adult Enumeration .....	7
RECOMMENDATIONS .....	9
LITERATURE CITED .....	11
APPENDICES .....	13

*This page was intentionally left blank*



## LIST OF FIGURES

Figure 1: Red Shirt Lake in relation to Cook Inlet and Alaska .....	3
Figure 2: Bathymetric map of Red Shirt Lake.....	4

*This page was intentionally left blank*

**LIST OF APPENDICES**

Appendix 1: Red Shirt Lake 2009 environmental conditions..... 14  
Appendix 2: Red Shirt Lake water level fluctuation ..... 15  
Appendix 3: 2009 Red Shirt Lake daily adult escapement..... 16  
Appendix 4: Red Shirt Lake 2009 hourly escapement ..... 17

*This page was intentionally left blank*

## ABSTRACT

As part of the continued evaluation of lakes in the Susitna River watershed to determine the sockeye salmon (*Onchorhynchus nerka*) abundance in key salmon producing lakes with and without northern pike (*Esox lucius*), Cook Inlet Aquaculture Association (CIAA) and the Alaska Department of Fish and Game (ADF&G) agreed to monitor adult sockeye salmon returns to Red Shirt Lake. Red Shirt Lake was known to have a population of northern pike.

During the 2009 adult escapement, environmental conditions were monitored from 16 July through 1 September. Water levels fluctuated  $\pm 0.94$  feet during that time period. Stream temperatures averaged  $18.6^{\circ}\text{C}$  ( $\pm 0.31$  SE) and ranged from 11 to  $22^{\circ}\text{C}$ . Air temperatures averaged  $19.4^{\circ}\text{C}$  ( $\pm 0.40$  SE) and ranged from 12 to  $24^{\circ}\text{C}$ . A total of 165 mm of rain fell during that period.

The adult escapement was enumerated from 16 July through 1 September. During that time, no adult sockeye salmon returned to Red Shirt Lake.

*This page was intentionally left blank*

## **INTRODUCTION AND PURPOSE**

To better understand the recent low adult sockeye salmon (*Oncorhynchus nerka*) returns to Upper Cook Inlet, the Cook Inlet Aquaculture Association (CIAA), in cooperation with the Alaska Department of Fish and Game (ADF&G), is assessing sockeye salmon populations at several key salmon producing lakes with and without northern pike (*Esox lucius*) in the Susitna River drainage. The overall objective of this effort is to enumerate the smolt and adult returns and to assess the characteristics of these populations in terms of age composition, sex and size. Additionally, for some lake systems, CIAA and/or ADF&G are recording environmental conditions and water quality measurements as well as genetic samples, mark-recapture studies and hydroacoustic surveys. The goal is to collect sound biological data to provide the foundation on which decisions for management and rehabilitation strategies can be made. Understanding the adult to juvenile relationship will allow management biologists to analyze and evaluate the production and rearing condition of each lake.

The enumeration of adult salmon returns to Red Shirt Lake was completed in the first year of a three year effort to enumerate sockeye salmon returns to the Susitna River drainage. Red Shirt Lake was chosen for enumeration because invasive northern pike were known to be present.

*This page was intentionally left blank*



## PROJECT AREA

Red Shirt Lake is located approximately 48 km Northwest of Anchorage, Alaska (Figure 1). The lake is located in T17N, R5W, Section 4. The lake is in the Southern portion of the Susitna River Valley, and has a surface elevation of 37 m. Red Shirt Lake has a surface area of 479 ha, and total volume of  $28.8 \times 10^6 \text{ m}^3$ . Red Shirt Lake has a maximum depth of 15.2 m, and a mean depth of 5.3 m (Figure 2). Major tributaries to Red Shirt Lake include two unnamed creeks, one which is on the north side of the lake, with the other lying on the southeast side. The lake's discharge forms Fish Creek, which flows approximately 20 km to the Susitna River. Due to its proximity to Anchorage, and relatively close road access, Red Shirt Lake has many cabins and is popular for recreational boating activity.

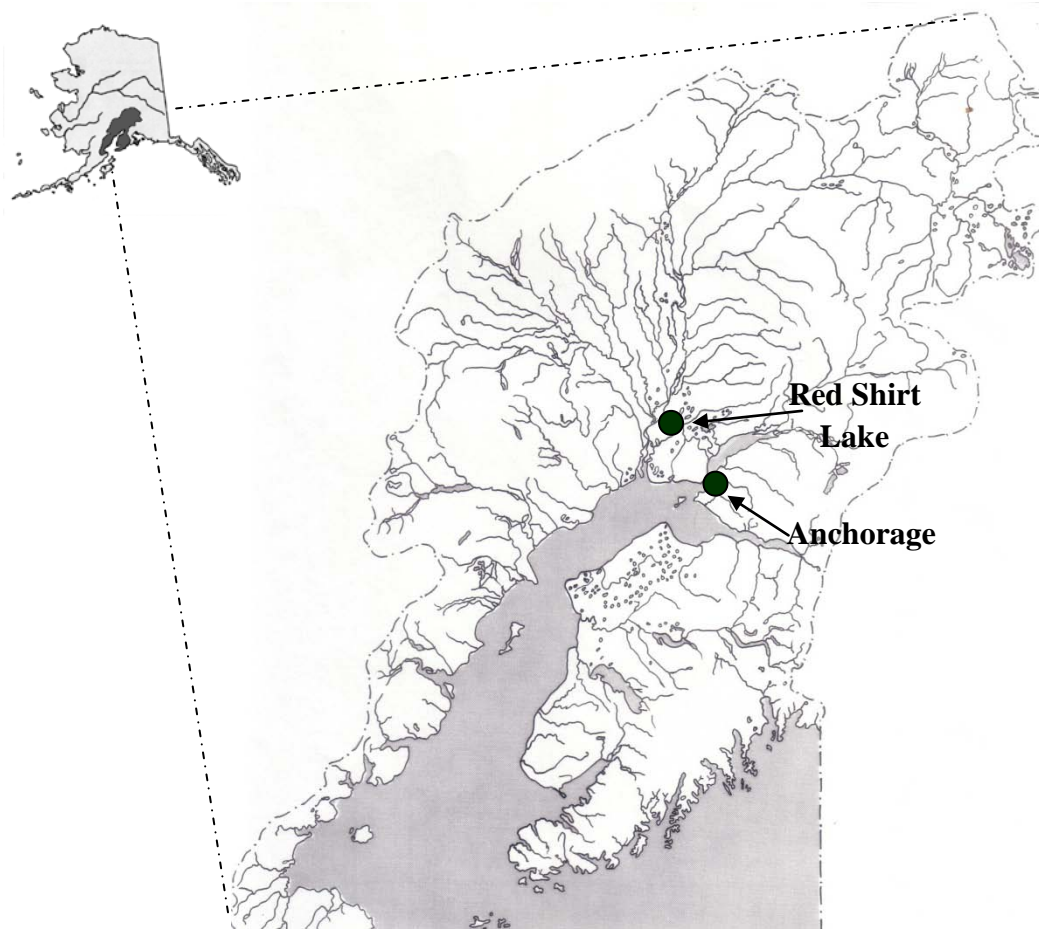
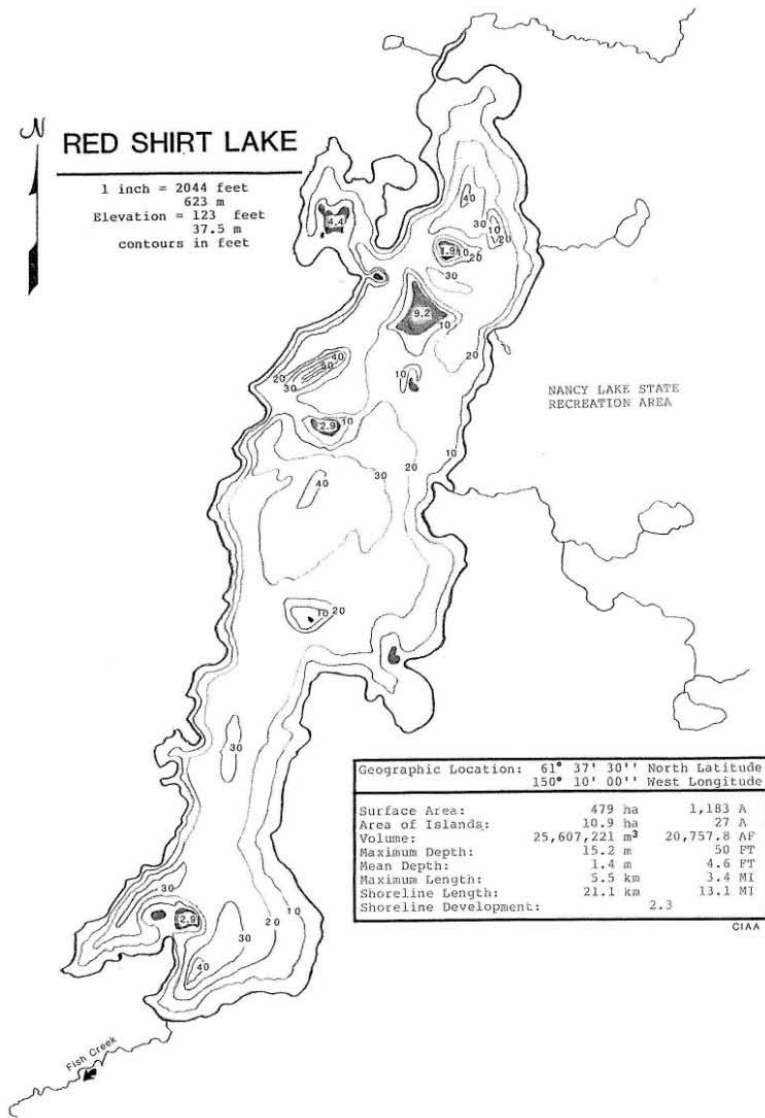


Figure 1: Red Shirt Lake in relation to Cook Inlet and Alaska



**Figure 2: Bathymetric map of Red Shirt Lake**

## METHODS

### **Environmental Conditions**

To assess the environmental conditions during the adult sockeye salmon migration to Red Shirt Lake, percent cloud cover was visually estimated, stream stage measured to the nearest tenth of a foot, and precipitation measured to the nearest millimeter, and water and air temperatures to the nearest 1°C were recorded at 5:00 PM daily. Standard CIAA procedures were followed for collecting these observations (CIAA 2009).

### **Weir**

To enumerate returning adult salmon and facilitate data collection, a fixed picket weir approximately 5 meters wide was temporarily installed across Fish Creek, approximately 90 meters downstream from the outlet of Red Shirt Lake. The weir was constructed of 1.9 cm galvanized pipe and 7.6 cm aluminum channel. The galvanized pipe was picketed through 1.9 cm holes in the aluminum channel spaced 2.54 cm apart.

### **Adult Enumeration**

Passage counts were conducted several times daily. CIAA adult salmon enumeration normally includes assessment of the sex, age (scales), and mideye fork length (MEF)<sup>1</sup> of up to 40 randomly selected adult sockeye daily (CIAA 2009). Due to no returns, no sampling occurred.

---

<sup>1</sup> MEF length is defined as the measurement to the nearest millimeter from the middle of the eye to the fork of the tail.

*This page was intentionally left blank*

## **RESULTS**

### **Environmental Conditions**

During the 2009 adult escapement, environmental conditions were monitored from 16 July through 1 September. Water levels fluctuated  $\pm 0.94$  feet during that time period. On 24 July, the water level was extremely low due to overnight beaver activity on the dam directly upstream from the staff gauge. Stream temperatures averaged  $18.6^{\circ}\text{C}$  ( $\pm 0.31$  SE) and ranged from 11 to  $22^{\circ}\text{C}$ . Air temperatures averaged  $19.4^{\circ}\text{C}$  ( $\pm 0.40$  SE) and ranged from 12 to  $24^{\circ}\text{C}$ . A total of 165 mm of rain fell during that period.

### **Adult Enumeration**

The adult escapement was enumerated from 16 July through 1 September. During that time, no adult sockeye salmon returned to Red Shirt Lake.

Throughout the month of August, CIAA personnel made four trips by canoe to the two dams downstream from the weir to ensure fish passage was unhindered. No fish were observed below the dams.

On August 11<sup>th</sup>, CIAA personnel flew Fish Creek by helicopter to survey beaver dams. No fish were observed below the dams and no modification to the beaver dams was necessary.

*This page was intentionally left blank*

## **RECOMMENDATIONS**

No adult sockeye salmon returned to Red Shirt Lake in 2009 and additional salmon monitoring is not warranted. However, Red Shirt Lake should be evaluated for control and/or removal of northern pike and habitat conditions (limnology) in order to assess the success of reintroducing salmon to the lake.

*This page was intentionally left blank*



## **LITERATURE CITED**

CIAA 2009. Red Shirt Lake Adult Procedures Manual. Cook Inlet Aquaculture Association.

*This page was intentionally left blank*

## **APPENDICES**

## Appendix 1: Red Shirt Lake 2009 environmental conditions

Adult Migration					
Date	Sky	Precip. (mm)	Stage* (ft)	Water Temp. (°C)	Air Temp. (°C)
16-Jul	3	0.0	0.00	22	22
17-Jul	3	0.0	0.05	20	22
18-Jul	3	0.0	0.05	21	20
19-Jul	5	9.0	0.07	20	18
20-Jul	4	15.0	0.08	21	20
21-Jul	4	12.0	0.09	21	19
22-Jul	5	12.0	0.10	20	19
23-Jul	4	0.0	0.10	21	20
24-Jul	3	5.0	-0.25	19	21
25-Jul	4	0.0	0.20	11	16
26-Jul	5	1.0	0.15	18	13
27-Jul	5	8.0	0.20	18	19
28-Jul	4	12.0	0.20	20	21
29-Jul	3	18.0	0.23	21	24
30-Jul	5	0.0	0.25	19	19
31-Jul	4	5.0	0.23	19	17
1-Aug	2	0.0	0.23	20	22
2-Aug	2	0.0	0.10	19	23
3-Aug	2	0.0	0.11	20	23
4-Aug	4	0.0	0.09	19	22
5-Aug	3	0.0	0.10	19	20
6-Aug	5	15.0	0.14	18	19
7-Aug	2	0.0	0.15	19	22
8-Aug	2	0.0	0.16	19	21
9-Aug	3	0.0	0.17	20	22
10-Aug	2	0.0	0.18	20	21
11-Aug	2	0.0	0.16	21	22
12-Aug	3	0.0	0.17	19	20
13-Aug	5	6.0	0.18	18	19
14-Aug	4	0.0	0.17	19	20
15-Aug	5	15.0	0.19	19	21
16-Aug	5	9.0	0.18	18	20
17-Aug	4	0.0	0.17	20	21
18-Aug	3	0.0	0.17	19	20
19-Aug	2	0.0	0.15	17	19
20-Aug	2	0.0	0.14	19	20
21-Aug	1	0.0	0.12	20	22
22-Aug	2	0.0	0.51	18	22
23-Aug	5	5.1	0.57	15	16
24-Aug	4	0.0	0.58	17	15
25-Aug	4	2.0	0.60	16	16
26-Aug	2	0.0	0.59	18	19
27-Aug	4	0.0	0.58	17	17
28-Aug	5	1.2	0.63	17	15
29-Aug	2	8.0	0.66	18	21
30-Aug	4	0.0	0.67	15	14
31-Aug	4	0.0	0.69	14	16
1-Sep	5	6.5	0.69	14	12
Total		165			
Avg.		3.4	0.24	19	19
Min.		0.0	-0.25	11	12
Max.		18.0	0.69	22	24

\* - Does not reflect actual water depth, only water level fluctuation

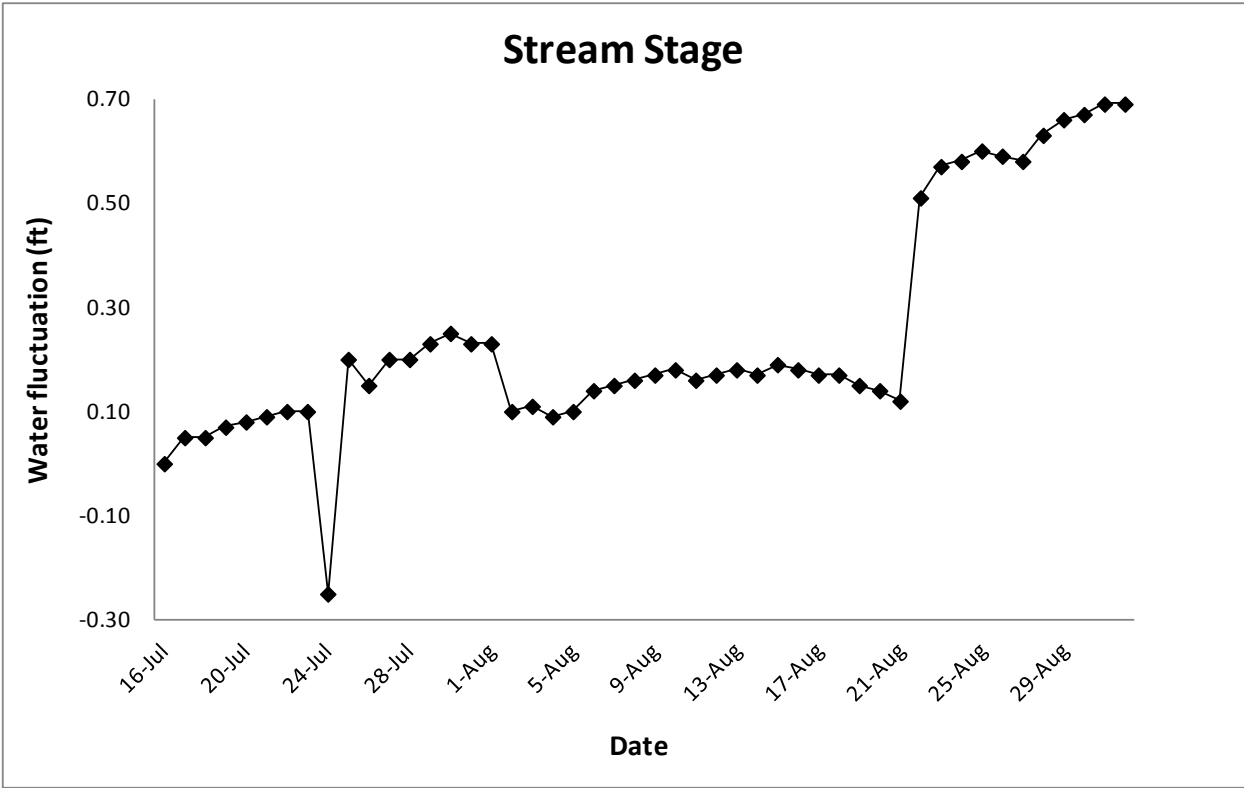
### Summary of Cloud Cover - Percent of Days

	No. Days	Overcast	Partly Cloudy	Clear
	Adults	48	54%	44%

ND = No Data

1.0 = Clear  
 2.0 = Cloud Cover <50%  
 3.0 = Cloud Cover >50%  
 4.0 = Overcast  
 5.0 = Rain

**Appendix 2: Red Shirt Lake water level fluctuation**



### Appendix 3: 2009 Red Shirt Lake daily adult escapement

Date	Sockeye		Coho	King	Pink	Chum	Rainbow	D.V.
	Daily Escapement	Total Return	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement	Daily Escapement
16-Jul	0	0	0	0	0	0	0	0
17-Jul	0	0	0	0	0	0	0	0
18-Jul	0	0	0	0	0	0	0	0
19-Jul	0	0	0	0	0	0	0	0
20-Jul	0	0	0	0	0	0	0	0
21-Jul	0	0	0	0	0	0	0	0
22-Jul	0	0	0	0	0	0	0	0
23-Jul	0	0	0	0	0	0	0	0
24-Jul	0	0	0	0	0	0	0	0
25-Jul	0	0	0	0	0	0	0	0
26-Jul	0	0	0	0	0	0	0	0
27-Jul	0	0	0	0	0	0	0	0
28-Jul	0	0	0	0	0	0	0	0
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	0	0	0	0
6-Aug	0	0	0	0	0	0	0	0
7-Aug	0	0	0	0	0	0	0	0
8-Aug	0	0	0	0	0	0	0	0
9-Aug	0	0	0	0	0	0	0	0
10-Aug	0	0	0	0	0	0	0	0
11-Aug	0	0	0	0	0	0	0	0
12-Aug	0	0	0	0	0	0	0	0
13-Aug	0	0	0	0	0	0	0	0
14-Aug	0	0	0	0	0	0	0	0
15-Aug	0	0	0	0	0	0	0	0
16-Aug	0	0	0	0	0	0	0	0
17-Aug	0	0	0	0	0	0	0	0
18-Aug	0	0	0	0	0	0	0	0
19-Aug	0	0	0	0	0	0	0	0
20-Aug	0	0	0	0	0	0	0	0
21-Aug	0	0	0	0	0	0	0	0
22-Aug	0	0	0	0	0	0	0	0
23-Aug	0	0	0	0	0	0	0	0
24-Aug	0	0	0	0	0	0	0	0
25-Aug	0	0	0	0	0	0	0	0
26-Aug	0	0	0	0	0	0	0	0
27-Aug	0	0	0	0	0	0	0	0
28-Aug	0	0	0	0	0	0	0	0
29-Aug	0	0	0	0	0	0	0	0
30-Aug	0	0	0	0	0	0	0	0
31-Aug	0	0	0	0	0	0	0	0
1-Sep	0	0	0	0	0	0	0	0
<b>Total</b>	0		0	0	0	0	0	0

### Appendix 4: Red Shirt Lake 2009 hourly escapement

	AM						PM												AM					
	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00	1:00	2:00	3:00	4:00	5:00
16-Jul										0														
17-Jul											0													
18-Jul					0							0											0	
19-Jul												0											0	
20-Jul												0												
21-Jul					0																		0	
22-Jul								0																
23-Jul								0																
24-Jul								0										0						
25-Jul					0													0						
26-Jul								0										0						
27-Jul					0													0						
28-Jul								0										0						
29-Jul								0										0						
30-Jul								0										0						
31-Jul								0										0						
1-Aug					0													0						
2-Aug									0															
3-Aug					0											0								
4-Aug								0																
5-Aug						0							0											
6-Aug				0																				
7-Aug								0					0											
8-Aug								0																
9-Aug								0																
10-Aug								0																
11-Aug					0																			
12-Aug						0								0										0
13-Aug								0						0										
14-Aug									0															0
15-Aug									0								0							
16-Aug						0								0										
17-Aug										0														

*This page was intentionally left blank*