

Abundance and Run Timing of Adult Salmon in the Sixmile Creek Drainage on JBER, Alaska, 2011

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Introduction

In 2008, National Marine Fisheries Service (NMFS) listed the Cook Inlet beluga whale (*Delphinapterus leucas*) as endangered (NMFS 2008). Beluga whales are predatory in nature and follow eulachon (*Thaleichthys pacificus*) into the Upper Cook Inlet during the spring then switch to consuming salmon (*Oncorhynchus spp.*) as the eulachon numbers decline. (NMFS 2009). Critical habitat was established within Cook Inlet, Knik Arm, and the mouth of Sixmile Creek (NMFS 2009).

The Sixmile Creek drainage (Figure 1), located in Southcentral Alaska, consists of Upper and Lower Sixmile Lakes and Sixmile Creek on Joint Base Elmendorf-Richardson (JBER). The lakes were created in 1951 when Sixmile Creek was dammed in two locations (Abbott and Allgair) to create a floatplane base. The first records of sockeye (*Oncorhynchus nerka*) in Sixmile Creek drainage occurred in 1975 (Rothe et. al. 1983). These sockeye have been genetically linked to stocks in Big Lake and Fish Creek (Habicht et. al. 2007).

In 1988, the Conservation and Planning Element of the Environmental Flight, 3rd Civil Engineering Squadron began monitoring the returning adult salmon using a weir and continued to monitor through 2008. In 2009 and 2010 the Alaska Department of Fish and Game (ADFG) was contracted to conduct data collection and daily operations of the weir. In 2011 JBER Natural Resources Conservation section (CEANC) once again operated the weir and collected salmon escapement data.

The Sixmile weir is operable by mid-July. Releasing and counting salmon runs until mid-September. Four out of the five North American Pacific salmon can be found spawning in the Sixmile Creek drainage. Sockeye, coho (*Oncorhynchus kisutch*), and a small fraction of the pink salmon (*Oncorhynchus gorbuscha*) run can be enumerated at the weir. Chum salmon (*Oncorhynchus keta*) and pink salmon spawn primarily in the creek thus, a stream walk is necessary to enumerate their spawning numbers.

Objective

The Primary objective of this project was to enumerate the adult salmon species returning to the Sixmile Creek drainage to spawn. The second objective was to maintain the historical database that CEANC has and see if there are any trends in the fish numbers from year to year.

Study Site

The Sixmile Creek drainage covers approximately 2,033.15 acres, on JBER (Figure 1). The drainage includes Sixmile Creek, Lower Sixmile Lake, and Upper Sixmile Lake. The lakes and creek occupy a valley created by an old channel of Eagle River. The system is charged primarily by springs entering the south side of Upper Sixmile Lake. The Lakes are approximately 3.39 km in length. Sixmile Creek flows approximately 1.5 kilometers from Lower Sixmile Lake into the Knik Arm of Cook Inlet.

During 1975, when sockeye were recorded in Sixmile Creek drainage, a fish ladder was installed at the outflow of Lower Sixmile Lake (Gotthardt 2006). During the summer of 1996 a new fish friendly culvert with splash pool was placed between Upper and Lower Sixmile Lake. The culvert was then revamped in 2004 to add a beaver baffler to prevent beaver from clogging the culvert and preventing fish passage.

From 1988 until 1997 the weir was located in a meadow half way between Lower Sixmile Lake and Cook Inlet (61.29209 -149.82277). Since 1998 the weir has been located at the out flow of Lower Sixmile Lake under the Fairchild Avenue bridge.

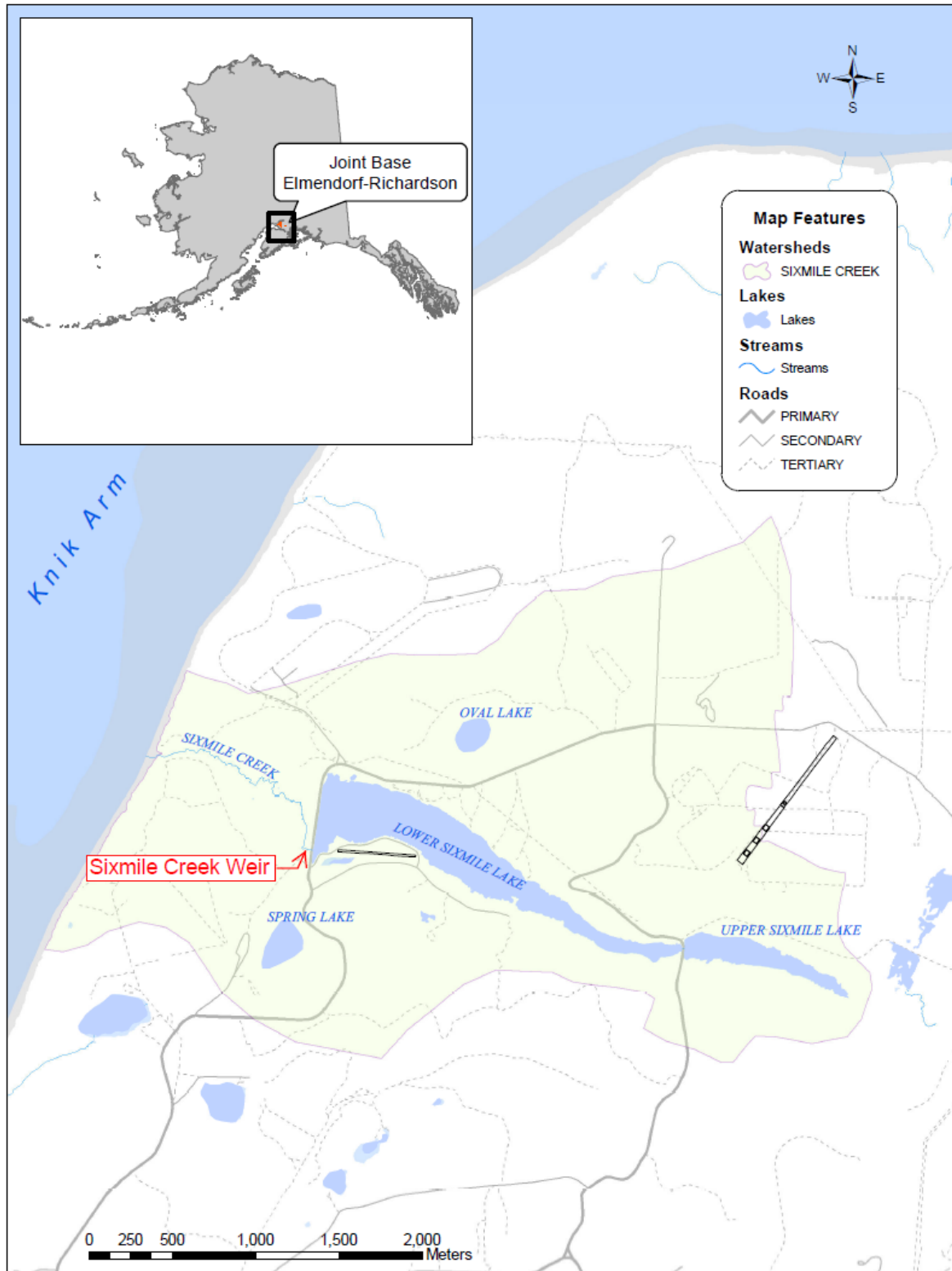


Figure 1 shows the Sixmile Creek drainage on JBER, AK.

Methods

Weir Design and Operation

The current weir consists of chain link covered gates under the Fairchild Avenue bridge. Salmon assemble behind the gates, under the bridge, and are enumerated as they are released into the lake. The weir was visually inspected daily to ensure there were no gaps that would allow salmon to pass through undetected and cleaned of debris. The weir was checked a minimum of twice daily during daylight hours, as fish gathered. During the peak of the run the weir was checked more often. Late in the run the weir was checked once a day. Before the gates were opened to pass fish the exit of the fish ladder was blocked so that fish were unable to escape down creek. A beach seine net was used to herd the fish through the open fence where they were identified and counted. Water temperature (°C) was collected at the site on a daily basis.

2011 Foot Surveys

Two surveys of adult salmon were conducted on foot in the stream from the weir to the Knik Arm tied line. The first was conducted 18 August 2011, at the peak of the pink salmon return, and second was completed on 15 September 2011, the last day of weir operation for the season. These surveys were done in three-person teams. One person was, wearing polarized sunglasses and constantly counting fish seen in the creek channel. A second person was surveying for fish while looking for bears, and the third person was constantly looking for bears.

Data Analysis

CEANC maintains a historical database of the Sixmile drainage sockeye and coho adult escapements counts. The total number of sockeye and coho were added to this database. Graphs depicting cumulative and daily counts for 2011 were compared to previous years' mean counts.

Results and Discussion

Weir Operation

The weir was fully operational at 1040 hours on 11 July 2011, with zero salmon being counted that day. A 8.89 cm hole was found in the left fencing panel on 14 August 2011 and was repaired that day. It is assumed that no fish passed through the hole. There were three days during the season that the weir was not checked. The days can be found on Table 1 as dash lines through the daily counts. The weir was removed at 1545 hours on 15 September 2011.

Adult Foot Surveys

Both stream surveys were conducted during sunny weather condition. Surveys included both live and dead salmon "morts". The first survey was conducted 18 August 2011 from 0945-1230. Observers counted 125 pink, 12 sockeye, and 9 chum. The final survey was conducted on 15 September 2011 from 1300-1545. Observers counted 4 pink, 2 sockeye, 1 chum, and 4 coho. These numbers do not fully represent the number of fish that spawn below the weir due to missing salmon during the surveys and missing salmon in between the surveys. These surveys were done during what is thought to be the peak of the pink salmon run.

Weir Data

The average water temperature for the season was 12.9 °C. Water temperature can be a factor in whether the sockeye choose to migrate up river to spawn or not. Ideal migration temperatures range from 6.0 °C to 12.0 °C (Wilson and Kelly 1984). Water clarity was excellent for the entire season.

Adult salmon were counted at the weir from 11 July until 15 September with a total of 656 sockeyes, 5 coho, 3 pinks and zero chum passing through the weir. The first two sockeyes passed the weir on 16 July, while the last sockeye passed on 2 September (Table 1). The first coho was seen on 29 August with the last one passing the weir on 2 September (Table 1).

Table 1. Daily and cumulative (Cum) counts of sockeye and coho salmon and other fish species, at the Sixmile Creek weir, JBER 2011.

Date	Sockeye		Coho		Pink	Rainbow	Water Temp (°C)	
	Daily	Cum	Daily	Cum	Daily	Daily	AM	PM
11-Jul	0	0	0	0	0	0	14	14
12-Jul	0	0	0	0	0	0	15	15
13-Jul	0	0	0	0	0	0	13	-
14-Jul	0	0	0	0	0	0	14	-
15-Jul	0	0	0	0	0	1	14	17
16-Jul	2	2	0	0	0	0	12.5	16
17-Jul	0	2	0	0	0	0	15	16
18-Jul	0	2	0	0	0	0	14.5	16
19-Jul	0	2	0	0	0	0	14	16
20-Jul	0	2	0	0	0	0	14	-
21-Jul	1	3	0	0	0	0	15	16
22-Jul	0	3	0	0	0	0	15	-
23-Jul	0	3	0	0	0	0	15	16
24-Jul	0	3	0	0	0	0	15	15
25-Jul	198	201	0	0	0	0	14	15
26-Jul	241	442	0	0	0	0	14	15
27-Jul	18	460	0	0	0	0	14	15
28-Jul	0	460	0	0	0	0	14	15
29-Jul	2	462	0	0	0	0	14	16
30-Jul	1	463	0	0	0	0	15	16
31-Jul	0	463	0	0	0	0	15	16
1-Aug	0	463	0	0	0	0	14.5	-
2-Aug	2	465	0	0	0	0	13.5	-
3-Aug	115	580	0	0	0	0	13	14
4-Aug	57	637	0	0	1	0	13	14
5-Aug	5	642	0	0	1	0	12.5	13
6-Aug	0	642	0	0	0	0	12	13.5
7-Aug	0	642	0	0	0	0	12	13
8-Aug	0	642	0	0	0	0	12	12
9-Aug	0	642	0	0	0	0	11	13
10-Aug	0	642	0	0	0	0	11	-
11-Aug	2	644	0	0	1	0	11	12
12-Aug	0	644	0	0	0	0	13	-
13-Aug	0	644	0	0	0	0	13	-
14-Aug	0	644	0	0	0	0	13	-
15-Aug	3	647	0	0	0	0	13	-
16-Aug	-	647	-	0	-	-	-	-
17-Aug	-	647	-	0	-	-	-	-
19-Aug	3	650	0	0	0	0	12	-
20-Aug	1	651	0	0	0	0	12	-

Date	Sockeye		Coho		Pink	Rainbow	Water Temp (°C)	
	Daily	Cum	Daily	Cum	Daily	Daily	AM	PM
21-Aug	0	651	1	1	0	0	13	-
22-Aug	0	651	0	1	0	0	-	-
23-Aug	0	651	0	1	0	0	12	-
24-Aug	2	653	2	3	0	0	11	-
25-Aug	0	653	0	3	0	0	12	-
26-Aug	-	653	-	3	-	-	-	-
27-Aug	0	653	0	3	0	0	-	12
28-Aug	0	653	0	3	0	0	-	12
29-Aug	1	654	1	4	0	0	-	12
30-Aug	0	654	0	4	0	0	-	12
31-Aug	0	654	0	4	0	0	10	-
1-Sep	0	654	0	4	0	0	10	-
2-Sep	2	656	1	5	0	0	10	-
3-Sep	0	656	0	5	0	0	10	-
4-Sep	0	656	0	5	0	0	11.5	-
5-Sep	0	656	0	5	0	0	11	-
6-Sep	0	656	0	5	0	0	8	-
7-Sep	0	656	0	5	0	0	9	-
8-Sep	0	656	0	5	0	0	8	-
9-Sep	0	656	0	5	0	0	9	-
10-Sep	0	656	0	5	0	0	8	-
11-Sep	0	656	0	5	0	0	8	-
12-Sep	0	656	0	5	0	1	9	-
13-Sep	0	656	0	5	0	1	9	-
14-Sep	0	656	0	5	0	0	9	-
15-Sep	0	656	0	5	0	0	9	-
Total	656		5		3	3		

The 2011 sockeye total was the lowest to pass through the weir in 20 years (Table 1) and well below the 12 year average of 1,974 fish (Figure 2). Sockeye escapement peaked on 26 July (Figure 3). The peak escapement occurred one day later than the 12 year average. Also on 26 July, fifty percent of the seasons count had passed the weir (Figure 2). The 26 July date of 50% is four days earlier than the 12 year average.

The objective of this project was to enumerate the adult salmon species returning to the Sixmile Creek drainage to spawn and to see if there were any trends in the data from year to year. Throughout the Upper Cook Inlet the 2011 peak for sockeye tended to be a few days after the historic average peak (Eggers and Carroll 2012). One interesting point that the data shows is an almost zero return of fish during the last week in July. This possibly correlates with Alaska Department of Fish and Game Commercial Fisheries in-season assessment on 22 July, to increase the maximum number of hours the gillnet fishery could fish and the removal of the Tuesday 24- hour no-fishing window (Eggers and Carroll 2012).

The largest run of sockeye in the Sixmile Creek drainage occurred in 2001 with a total of 4,043 fish being counted (Appendix 1). The rest of the sockeye runs have been much smaller than what occurred in 2001. There is a small sport fishery for sockeye below the tide line on Sixmile Cree. If the gillnet fishery continues to harvest the same number of fish in the years to come as in 2011, the Sixmile Creek escapement and sport fishery could possibly be suffer.

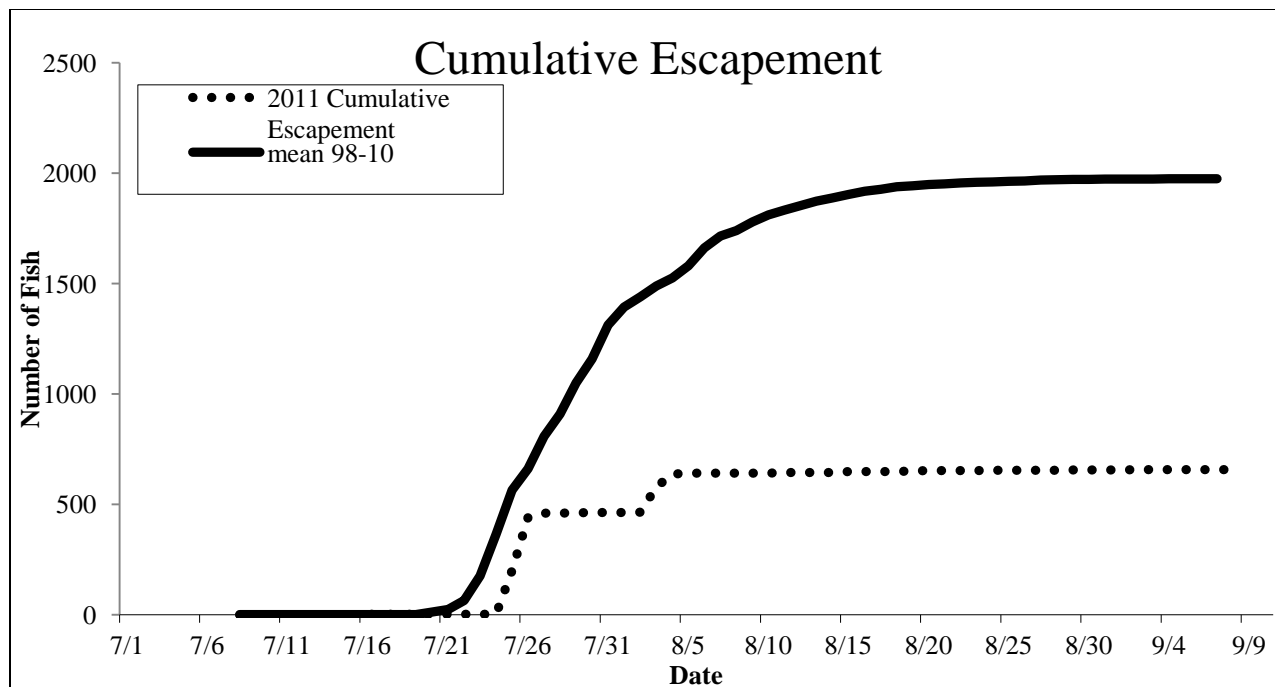


Figure 2 is a comparison of the total sockeye run from 2011 and the previous 12 year average.

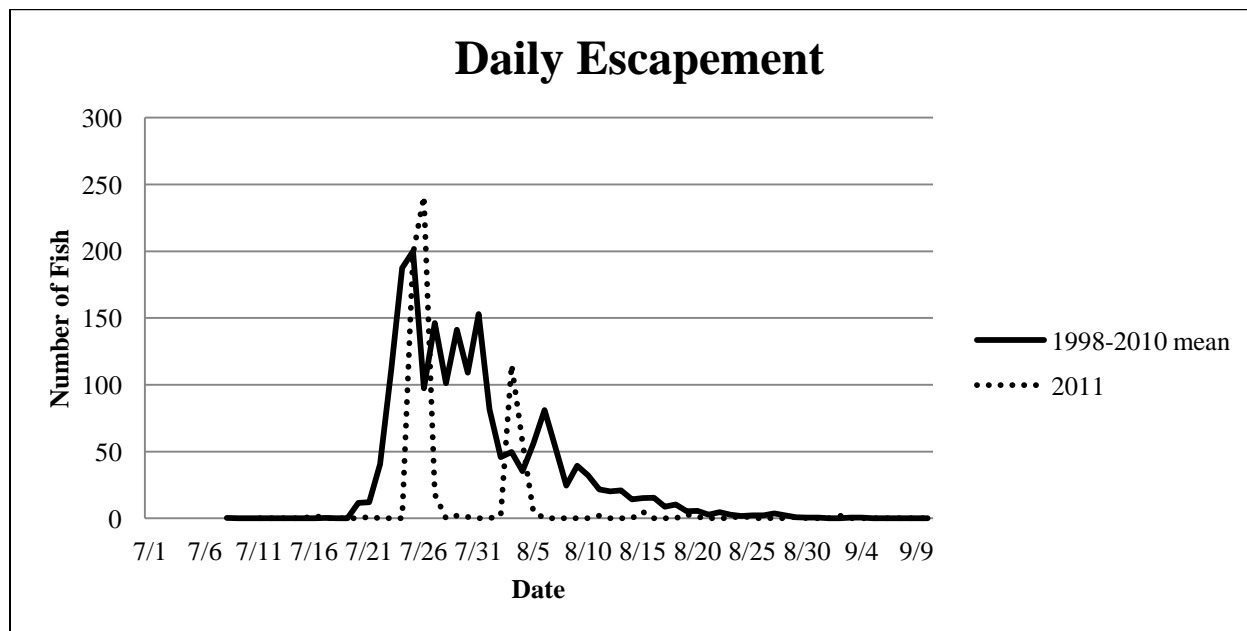


Figure 3 is a comparison of the daily totals for 2011 and the previous 12 year average.

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Appendices

Appendix 1 – Adult sockeye salmon escapement counts by date, Sixmile Creek Drainage, 1988-2011

	Year																							Average
Date	1988	1989	1990	1991	1992	1993	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	1988-2010
1-Jul																				0				0
2-Jul																				0				0
3-Jul																				0				0
4-Jul																								0
5-Jul																								0
6-Jul																								0
7-Jul																								0
8-Jul													4							1				3
9-Jul																				0				0
10-Jul													1							0				1
11-Jul																				0			0	0
12-Jul																				0			0	0
13-Jul																				0		0	0	0
14-Jul																1				0	0	0	0	0
15-Jul																				0	0	0	0	0
16-Jul										2										0	0	0	2	1
17-Jul										3										0	0	0	0	1
18-Jul										1				0						0	0	0	0	0
19-Jul														0						1	0	0	0	0
20-Jul					28					3			149	0						0	0	0	0	26
21-Jul					26					17			133	0		5				1	0	0	1	23
22-Jul		11				114				17			285	0		107			1	0	0	119	0	65
23-Jul	20		2		15	286				43		518	300	0		100			1	0	0	487	0	136
24-Jul	0	14	42		1	12			94	487		178	1,188	0		18			1	8	358	200	0	173
25-Jul	105	13	25	12	1	337			183	184		78	405	328	158	0	276		4	516	582	67	198	182
26-Jul	112		14		11	211		40		56		21	26	173	251	2	124			344	268	0	241	110
27-Jul	110	50		48	178	207	111	87		48		3	130	476	364	2	22		219	100	537	0	18	150
28-Jul	100	180		17	18	204	180	71	176	4			286	300	394	13	2		14	32	264	7	0	126
29-Jul	125	180		88		492	80	128	87	154		200	297	363	279	24	2		1	9	260	247	2	168
30-Jul	112	112	15	84		20	230		70	20		180	91	162	132	321	31	205	3	67	86	119	1	108
31-Jul				37		107	175		73	20		133	305	59	176	301	160	359	80	112	181	103	0	149
1-Aug	60		83	37		101	230	120	198	21		44	151	91	95	43	92	50	171	46	70	187	0	99
2-Aug	154	151	134	23		53	301		16	0		38	59	40	44	26	72	2	34	31	100	151	2	75
3-Aug	234	86	234		45		453			138		24	45	86	88	41	40	3	13	17	12	140	115	100
4-Aug	215	124	235	198	32	33	243	45	84	48		5	70	76	86	59	35	3	7	21	14	34	57	79

	Year																							Average
Date	1988	1989	1990	1991	1992	1993	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	1988-2010
5-Aug	134		124	22			227	0	104	0		33	26	65	128	30	50	154	36	20	44	141	5	74
6-Aug	117	86	117	47	25	17	320			115	386		11	49	70	9	21	84	125	2	76	107	0	94
7-Aug	74	43	74	223	15	44	730	101	105	56	206	48	16	67	83	17	51	39	37	9	21	40	0	95
8-Aug	54		54	58	51		42			0	1	17			34	62	14	41	1	14	37	98	0	36
9-Aug	51		91	43		34	564	340		56	7	3	13	62	58	39	28	18	5	15	74	135	0	86
10-Aug	53	35	53	187	23		45	204		40		30		28	18	147	37	12	9	5	32	61	0	57
11-Aug	0			52	40	230	13		171	29			9	30	11	38	14	33	22	22	64	11	2	46
12-Aug	0			33	190	40	48	10		25	4	4	2		82	22	16	15	48	9	31	4	0	32
13-Aug	25		28	78		40	39		282	24	14	3		42	22	31	16	70	6	21	13	9	0	42
14-Aug	0	30	1	142	15		28	328		17	3	1			40	12	65	7	10	18	13		0	43
15-Aug	25		25	76					187	13	3			36	41	21	18	5	11	3	37	9	5	34
16-Aug	0			71		223	45			9	3		23		44	9	18	16	5	3	61	10	0	36
17-Aug	0		15	85	21	218	36			12		3			32	14	7	8	4	0	17	17	0	31
18-Aug	0		12			126	31		149	0	3	5	4	11	15	6	41	11	10	9	16	4	0	25
19-Aug	0			10		166				0			5		9	1	17	16		2	14	6	3	21
20-Aug	0		34		20	12			135	0				19	3	7	9	9	4	1	15	5	1	18
21-Aug	0		20	51	8		20			0	1					7	7	6	2	1	8	3	0	10
22-Aug	0		18					25	72	0	2	1		15	2	0	9	10	8	2	9	2	0	11
23-Aug	227			31	5		11			0	4	1				1	12	3	8	0	4	2	0	22
24-Aug	0			21		63								1		7	3	1	1	0	5	5	2	10
25-Aug	0					25			36						10	0	10	3		0	5	0	0	9
26-Aug	0			0		16				7						13	6	1		0	1	0	0	4
27-Aug	0					11			18		2				9	28	5	1		1	1	0	0	7
28-Aug	0							15			6			1		15	0	4	2	0	0		0	4
29-Aug	0			200				79								3	4	0		0	4	0	1	32
30-Aug	0						80									4	2	3		0	0	0	0	11
31-Aug	0															0	5	0		0	0	2	0	1
1-Sep																1		0		0		0	0	0
2-Sep																0		0		0		0	2	0
3-Sep									3							3		0		0		0	0	1
4-Sep									7							1		0		0		0	0	2
5-Sep																0		0		0		0	0	0
6-Sep										1						0		0		0		0	0	0
7-Sep																0		0		0		0	0	0

Date	Year																							Average
	1988	1989	1990	1991	1992	1993	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	1988-2010
8-Sep																0		0		0		0	0	0
9-Sep																						0	0	0
10-Sep																						1	0	1
11-Sep																							0	0
12-Sep																							0	0
13-Sep																							0	0
14-Sep																							0	0
15-Sep																							0	0
Totals	2107	1115	1450	1974	768	3442	4282	1593	2240	1662	663	1571	4034	2580	2778	1611	1341	1192	903	1463	3334	2533	658	2671
Totals	2107	1115	1450	1974	768	3442	4282	1593	2240	1662	663	1571	4034	2580	2778	1611	1341	1192	903	1463	3334	2533	658	2029

