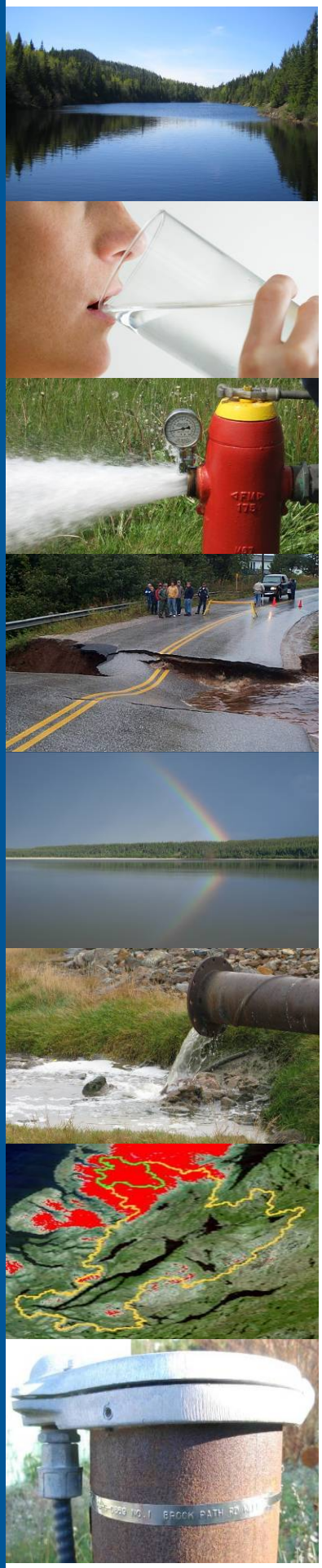


Waterford River @ Kilbride

NF02ZM0009

June to July 2011

Government of Newfoundland & Labrador
Department of Environment and Conservation
Water Resources Management Division
St. John's, NL, A1B 4J6 Canada

Real Time Water Quality Monthly Report
Waterford River - St. John's NL
June - July 2011

General

- Data from the Waterford River real-time station is monitored by the Water Resources Management Division staff regularly.

- The instrument used for this deployment period from June 15th until June 22nd was a Minisonde which continuously monitors water temperature; pH; specific conductivity; and dissolved oxygen. This particular instrument is not capable of monitoring turbidity. From June 22nd to July 21st, the original Minisonde was replaced with an YSI multiprobe which possesses the capability to measure turbidity.

Maintenance and Calibration of Instrumentation

- The following table (**Table 1**) displays the dates when the Waterford River water quality probe was installed and removed during this deployment period for routine cleaning, maintenance and calibration.

Table 1: Table of Water Quality Probe Installation and Removal

Date Installed	**Date Removed**
June 15th, 2011	July 21st, 2011

- Water quality readings were taken with a second freshly cleaned and calibrated water quality instrument at the time of installation and removal for QAQC comparison. The QAQC instrument was calibrated prior to each use.

Quality Assurance and Quality Control

- Deployment and removal comparison rankings for the Waterford River deployment from June 15th to July 21st are summarized in **Table 2**.

- Field Sonde to grab samples comparison rankings for the Waterford River deployment from June 15th to July 21st are summarized in **Table 3**.

- The absence of turbidity ranking can be attributed to the QA/QC probe lacking a turbidity sensor.

Table 2: Comparison rankings for Waterford @ Kilbride station, June 15th – July 21st, 2011

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Waterford @ Kilbride	June 15th, 2011	Deployment	Excellent	Fair	Excellent	Excellent	N/A
	July 21st, 11	Removal	Fair	Good	Excellent	Good	Excellent

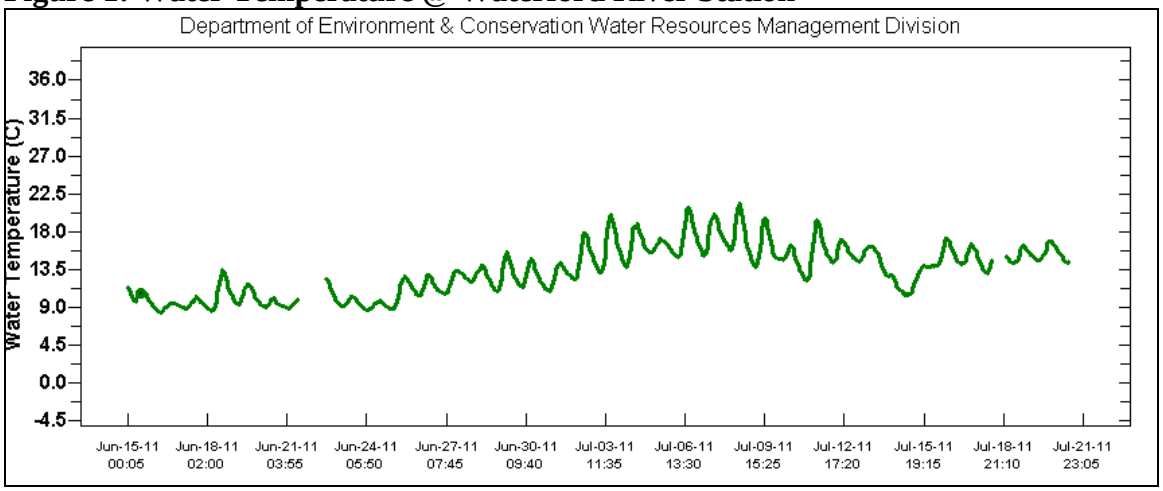
Table 3: Field Sonde to Grab Sample Comparisons for Waterford @ Kilbride station, June 15th - July 21st, 2011

Parameter	Field Sonde	Grab Sample	Difference / % Difference	Ranking
pH	6.50	6.87	0.37	Good
Specific Conductivity (µS/cm)	566.70	592.00	4.46	Poor

Data Interpretation

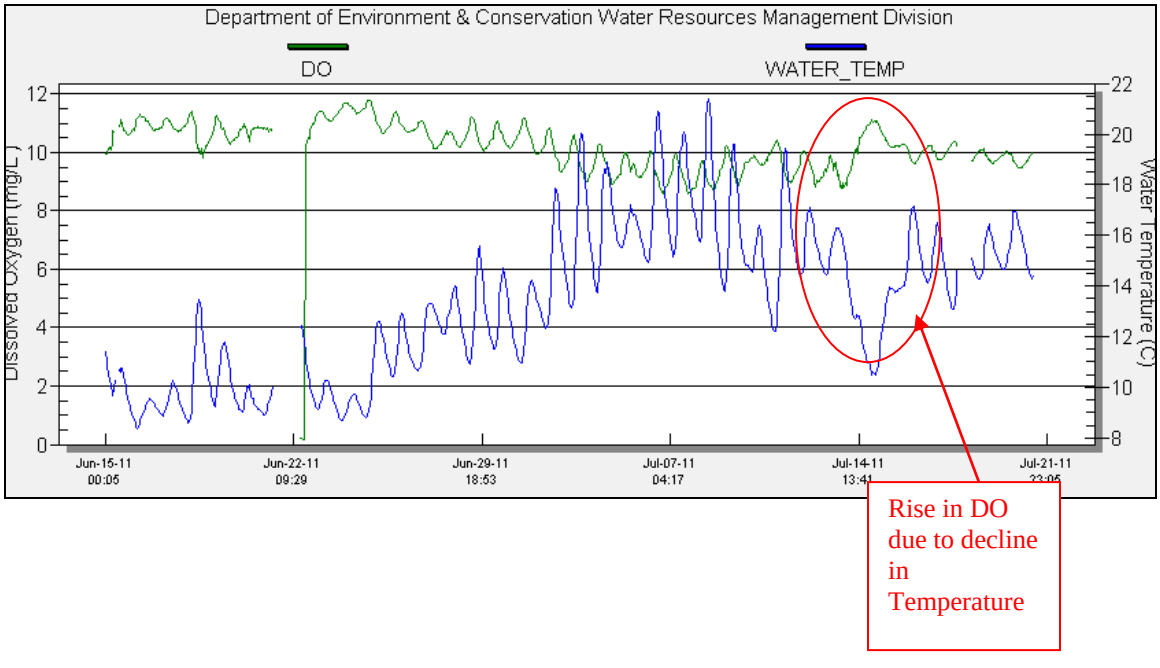
- **Water temperatures** were fairly constant and increasing slightly during this deployment, ranging between 8.39 and 21.36^{o}C, which is within the expected temperature range for this time of year. Water temperature data is shown in **Figure 1** below.

Figure 1: Water Temperature @ Waterford River Station



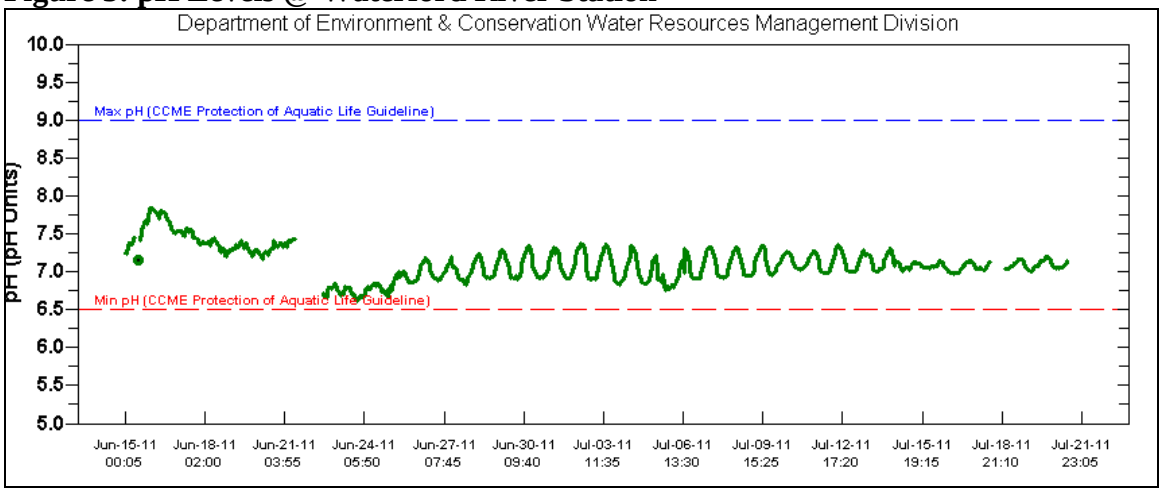
- **Dissolved oxygen (DO)** has an inverse relationship with water temperature whereby DO levels decrease as water temperature increases. Dissolved oxygen is shown in green and water temperature is shown in blue in **Figure 2**, below. The graph indicates that dissolved oxygen levels peaked at 11.79 mg/L on June 25, the same day that water temperature reached its lowest level of 9.07^{o}C. DO plummeted to its lowest level of 8.95mg/L on July 8, corresponding to the day the highest water temperatures during the deployment period were reached at 21.36^{o}C. The sudden drop in DO on June 22 can be attributed to necessary servicing of the instrument on that date.

Figure 2: Dissolved Oxygen and Water Temperature @ Waterford River Station



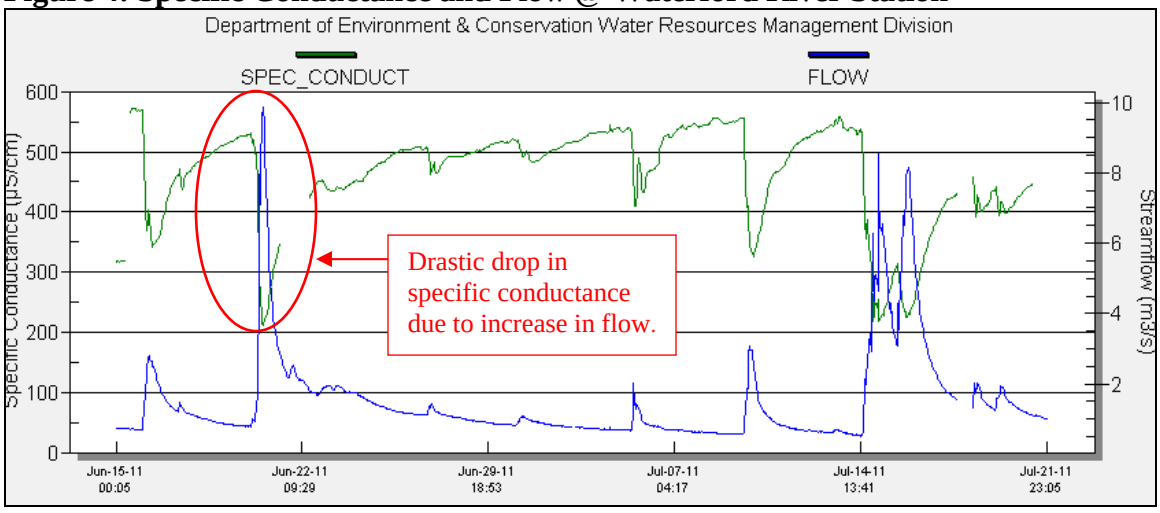
- **pH** levels were fairly constant and within the expected range for this station, with pH values ranging from of 6.61 – 7.83. There was no sudden surges or drops in pH during the specified time frame, except during servicing of the instrument which caused a slight decrease in pH on June 22. pH data is shown in **Figure 3** below.

Figure 3: pH Levels @ Waterford River Station



- **Specific conductivity** levels were within the expected range for Waterford River during this deployment. Specific conductivity levels ranged between 211.0-572.0 µS/cm and showed sudden increases, generally in response to the aftermath of significant precipitation events. The specific conductivity data for the month of July is shown in **Figure 4** below. The Environment Canada Daily Climate Data for June, for the St. John's region, shown below in **Appendix 1,** indicates that there were numerous precipitation events during the latter end of the month of June. This caused a significant increase in flow, which in turn caused a rapid decline in specific conductance. The Environment Canada Daily Climate Data for July, for the St. John's region, shown below in **Appendix 2,** indicates that there was significant precipitation events during July 14th to 16th, which resulted in an increased runoff, which in turn caused the specific conductivity to spike, producing values high in magnitude. Specific Conductance data is shown in Figure 4 below.

Figure 4: Specific Conductance and Flow @ Waterford River Station



- **Turbidity** levels were fairly constant upon installation of the YSI datasonde. It can be seen in **Figure 5** below that there was significant malfunction of the turbidity sensor in the form of very large turbidity spikes on July 6th and 10th. It was deduced upon further investigation that these turbidity spikes was the consequence of massive accumulations of muddy water/sediment inside the protective housing pipe. Action will be taken to improve the deployment techniques to minimize the impacts of turbidity.

- It should be noted that after the installation of the YSI on June 22nd, the protective pipe that houses the instrument had accumulated a significant amount of sediment. This accumulation was causing a malfunctioning of the turbidity sensor, and subsequently caused the turbidity values to spike well above the background turbidity levels commonly recorded for this site.

- The investigation that took place on July 6th, 2011 into this turbidity malfunction at the Waterford River @ Kilbride is summarized below:

  i. Inspection of the water visually. The water was slightly turbid.

  ii. Deployment of a QA/QC sonde into the river showed turbidity values varying between 2-3 NTU.

  iii. Removal of the deployed YSI sonde from the steel casing. Noticed lots of mud coming out of the steel casing when the sonde was removed.

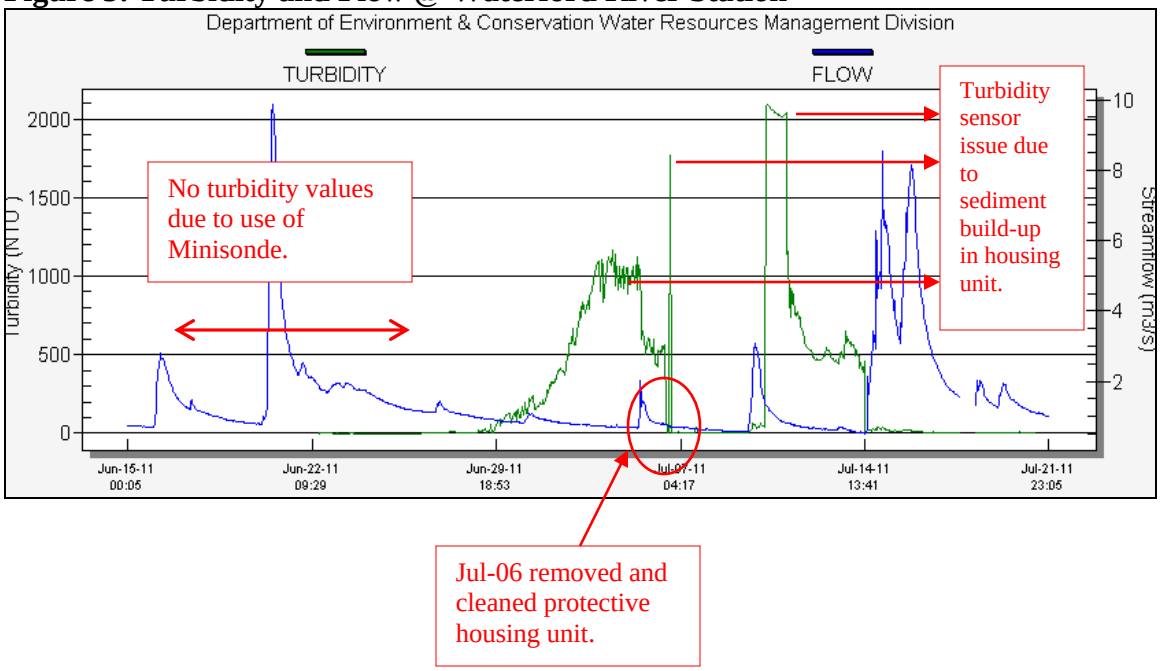
  iv. Rinsed the sensors using the river water and connected the sensor with YSI handheld unit. The turbidity value of the YSI sonde agreed with the QA/QC sonde.

  v. The YSI sonde was then put back into the steel casing and the turbidity spiked again.

  vi. Removal of the YSI sonde again from the steel casing; gave the casing a good rinse into the water and put back the sonde. At this point the turbidity value dropped back while inside the casing and agreed with the QA/QC sonde.

  - Thus it was the accumulation of muddy water inside the steel pipe that resulted in the turbidity peaks that can be seen later in this report.

Figure 5: Turbidity and Flow @ Waterford River Station



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APPENDIX 1: Weather information for St. John's, NL provided by Environment Canada for June 2011:

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's deg	Spd of Max Gust km/h
Sum				270.2	0.0	100.0	0.0	100.0			
Avg	11.7	6.2	9.0								
Xtrm											
01†	9.5	1.6	5.6	12.4	0.0	0.2	0.0	0.2		21	33
02†	9.7	4.0	6.9	11.1	0.0	6.8	0.0	6.8		20	61
03†	16.9	8.1	12.5	5.5	0.0	T	0.0	T		20	69

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's deg	Spd of Max Gust km/h
04†	14.9	6.7	10.8	7.2	0.0	T	0.0	T		17	39
05†	9.8	6.7	8.3	9.7	0.0	4.0	0.0	4.0			<31
06†	10.9	6.9	8.9	9.1	0.0	1.4	0.0	1.4			<31
07†	8.4	6.6	7.5	10.5	0.0	8.4	0.0	8.4			<31
08†	13.9	7.6	10.8	7.2	0.0	1.6	0.0	1.6			<31
09†	14.6	8.3	11.5	6.5	0.0	0.2	0.0	0.2			<31
10†	18.3	12.4	15.4	2.6	0.0	0.2	0.0	0.2			<31
11†	12.8	3.6	8.2	9.8	0.0	11.2	0.0	11.2		31	44
12†	7.6	3.5	5.6	12.4	0.0	1.6	0.0	1.6		35	56
13†	11.4	5.3	8.4	9.6	0.0	T	0.0	T			<31
14†	11.9	5.5	8.7	9.3	0.0	0.0	0.0	0.0			<31
15†	9.1	5.8	7.5	10.5	0.0	1.6	0.0	1.6		10	50
16†	7.4	5.8	6.6	11.4	0.0	13.6	0.0	13.6		12	46
17†	8.5	5.4	7.0	11.0	0.0	3.2	0.0	3.2			<31
18†	9.7	5.2	7.5	10.5	0.0	0.0	0.0	0.0			<31
19†	8.8	5.0	6.9	11.1	0.0	T	0.0	T		16	50
20†	8.5	6.5	7.5	10.5	0.0	24.8	0.0	24.8		15	69
21†	13.7	7.0	10.4	7.6	0.0	4.0	0.0	4.0		28	37
22†	11.1	5.5	8.3	9.7	0.0	3.0	0.0	3.0		34	33
23†	8.2	5.4	6.8	11.2	0.0	4.2	0.0	4.2		35	46
24†	7.3	5.2	6.3	11.7	0.0	1.2	0.0	1.2		36	46
25†	12.5	5.7	9.1	8.9	0.0	0.0	0.0	0.0			<31
26†	11.6	7.2	9.4	8.6	0.0	2.0	0.0	2.0		17	46
27†	19.4	9.8	14.6	3.4	0.0	1.6	0.0	1.6		26	32
28†	15.0	6.9	11.0	7.0	0.0	0.2	0.0	0.2		28	33
29†	12.2	6.7	9.5	8.5	0.0	0.0	0.0	0.0			<31
30†	17.1	7.4	12.3	5.7	0.0	5.0	0.0	5.0		13	35

APPENDIX 2: Weather information for St. John's, NL provided by Environment Canada for July 2011:

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's deg	Spd of Max Gust km/h
Sum				51.1*	5.6*	120.6*	0.0*	120.6*			
Avg	20.8*	11.4*	16.1*								
Xtrm	25.1*	6.3*								24*	93*
01†	18.4	7.6	13.0	5.0	0.0	0.6	0.0	0.6		13	32
02†	21.1	10.6	15.9	2.1	0.0	T	0.0	T		27	44
03†	21.9	11.6	16.8	1.2	0.0	0.0	0.0	0.0		29	48
04†	23.8	12.9	18.4	0.0	0.4	0.0	0.0	0.0			<31
05†	22.2	15.3	18.8	0.0	0.8	7.2	0.0	7.2		27	37
06†	25.1	13.9	19.5	0.0	1.5	0.0	0.0	0.0		27	41
07†	25.0	12.9	19.0	0.0	1.0	T	0.0	T		26	48
08†	22.8	10.6	16.7	1.3	0.0	0.0	0.0	0.0		27	48
09†	20.4	9.8	15.1	2.9	0.0	15.8	0.0	15.8		20	50

10†	17.8	10.4	14.1	3.9	0.0	2.4	0.0	2.4	24	93
11†	23.1	10.6	16.9	1.1	0.0	0.0	0.0	0.0	26	50
12†	22.3	15.0	18.7	0.0	0.7	T	0.0	T	24	52
13†	18.4	6.8	12.6	5.4	0.0	5.6	0.0	5.6	24	50
14†	8.0	6.3	7.2	10.8	0.0	31.4	0.0	31.4	7	37
15†	20.2	7.1	13.7	4.3	0.0	23.0	0.0	23.0	19	70
16†	23.8	13.8	18.8	0.0	0.8	12.4	0.0	12.4	19	46
17†	18.8	11.4	15.1	2.9	0.0	0.6	0.0	0.6	26	52
18†	23.0	11.4	17.2	0.8	0.0	6.6	0.0	6.6	25	57
19†	20.2	13.6	16.9	1.1	0.0	6.6	0.0	6.6	19	44
20†	21.5	15.2	18.4	0.0	0.4	0.2	0.0	0.2	23	35
21†	19.3	14.2	16.8	1.2	0.0	0.2	0.0	0.2	26	48
22†	20.0	12.7	16.4	1.6	0.0	7.2	0.0	7.2	25	63
23†	19.0	9.0	14.0	4.0	0.0	0.8	0.0	0.8		<31
24										
25†	23.1	9.8	16.5	1.5	0.0	0.0	0.0	0.0	27	32