

Commentary on our big day out July 2nd 2016.

YSI 85 doing well, we borrowed a YSI 2030 from Julie/Geography Dept, it also needs some attention.

MAIN MESSAGES when compared with June 11th data.

Samples collected on a flooding tide, close to low water.

1 Water temperature slightly cooler than June 11th, lowest temperature at discharge sites (4.3°C), the water was “warmest” at the mouth of the harbour (8.7°C)

2 Salinity normal as at June 11th at open water sites, with a slight decreasing gradient up the harbour

3 pH values around 8.00.

4 Dissolved oxygen typical

5 Chloro a concentrations slightly less, biological activity low.

6 NNN similar

4 DRP similar

5 Turbidity lower, water is very clear.

What was the day like?

The day was a typical mid winter day, air temperatures around 4°C., early in the day little or no wind, calm, wind building to 5-8 knots E/NE later on. Cloudy sky, 80-90% ccv.

Tide and harbour conditions.

High tide at 1400, so most sampling took place close to low water and a flooding tide. 26.2 mm of rainfall over the last 10 days, 0.385 cumecs flowing out of the Leith, close to its mean value. Water temperature in the Leith was 4.33 °C at 15.45.

Is there anything unusual ?

Filmy layer on water surface at #83/4. Geese still at Mussel bay. Litter observed at some sites.

Seaweeds.

See the data sheets

Animals

See the data sheets.

Conditions of the surface water and does the water have any real or apparent colour?

Surface conditions were calm at most sites. There was a slight ripple or chop at some sites... There was nothing unusual about the colour at the surface of the water.

WE make this observation to check for any unusual discharges, like oil on the surface. The good news is that seldom do we notice any sheens or unusual colours on the surface of the water.

Water temperature

The water temperature ranged from 5.3 °C (#810) – 8.7 °C. (#81/2) Most around 7°C. The water temperatures are cooler than June 11th. The winter pattern of temperature is establishing itself, a slight temperature gradient decreasing from the mouth to the head of the harbour.

The water temperature will have an effect on the solubility of different substances in water, solubility of ions will decrease however the solubility of oxygen and gases will increase.

Freshwater flowing in from the Leith is cooler than water entering the harbour mouth in winter.

[June 11th 7.9 °C (#810) – 10.1 °C. (#81/2)]

Salinity

Sites that are directly impacted on by the tidal flow showed a range of 31.6 (#86) -34.2 ppt (#81/2) The salinities are similar to June 11th. The low tide meant that sites are influenced strongly flooding seawater into the harbour. Salinity at discharged sites was determined by the freshwater flowing.. A salinity gradient of decreasing values the further you go up the harbour quite pronounced.

Some samples were tested in the lab.

[June 11th 25.62 (#86) -33.89 ppt (#81/2/3)]

Open sea salinity 34.998 ppt!!!

Salinity readings more accurate, both YSI instruments are check each time against standard sea water. YSI 2030 measured 33.7 (standard 33.67ppt). YSI 85 measured 32.2 (vs 33.67). These differences are included in our adjusted calculations for salinity and conductivity.

pH

7.8/7.9 (#88/9)-8.25 (#83). pH reasonably uniform 8.1-8.2.

What about buffers in the water???

[May 7th 7.62 (#89) – 8.12(#85).]

Turbidity

All sites tested. Range was 1.07 NTU (#81/3) – 11.1 NTU (#88).

The water was very clear at all open water sites.

Discharge sites higher than the open water sites

Filtering of the water samples was “easy” as the water generally was very clear.

Some turbidity could be explained by the extra phytoplankton in the water.

The samplers have to be careful collecting their samples at low tide and avoid including sediment in their samples. It was difficult to collect a sample from #89 as the water was very shallow.

[June 11th 1.6 NTU (#83) – 6.72 NTU (#89).]

**** Why is turbidity important?? .**

Light is essential for photosynthesis, increased turbidity will inhibit PS deeper in the water column. Increased surface area will increase the solubility of nutrients?especially phosphates/heavy metals.

Presence of significant amounts of fine particles in the water column will act against filter feeders!!, may block up their siphons/filters.

Guideline values 0.5-10 NTU ANZECC&ARMCANZ (2000)

All samples within these guidelines except for, #89. This a discharge sites.

New data:

From 2013 Coastal and estuarine water quality

Median WQ values 2.63 NTU C/5.3 E NTU

Open water sites lower than median values.

Dissolved oxygen (DO) mg L⁻¹ and % saturation.

6 sites measured. YSI problem.

The DO readings shows a range from sites tested 8.14 mg L⁻¹ (#85)-13.01 mg L⁻¹ (#88)

DO % saturation range 81.8% (#86) – 100.1 % (#88)

There is no reliable data from #81-4.

The data suggests a degree of uniformity between open water sites.

Similar to June 11th data.

Less than the median DO values for coastal waters. Less photosynthetic activity and calm waters, less agitation of the air-water interface.

The sites with supersaturated concentrations of DO generally had elevated concentrations of chlorophyll a

[June 11th 7.89 mg L⁻¹ (#85)-8.40 mg L⁻¹ (#87) and 81.8% (#86) – 87.6 % (#87/8)]

From 2013 Coastal and estuarine water quality

Dissolved Oxygen; 99.5% C/95.9 E

Chlorophyll a.

The range of values is 0.71 µg L⁻¹ (#83)/0.57µg L⁻¹(#84) – 1.22 µg L⁻¹(#86)

Range and values are less than June 11th . This suggests less biological activity than last time of monitoring.

Values above 5.0 are classified in estuaries as a matter for concern, possible algal blooms???

[June 11th 0.47 µg L⁻¹ (#81)/0.57µg L⁻¹(#82) – 1.46 µg L⁻¹(#86)]

All sites had low values.

Low ENVIRONMENTAL HEALTH CATEGORY for open water

0-2 (µg L⁻¹) low

>2-5 medium

>5-10 high
>10 very high

NNN (total dissolved nitrates and nitrites)

Variable readings from different sites.

3.93 $\mu\text{mol L}^{-1}$ (#85) -5.65 $\mu\text{mol L}^{-1}$ (#87) Open water sites. All sites close to 4 $\mu\text{mol L}^{-1}$, **similar values overall than June 11th values.**

7.91 $\mu\text{mol L}^{-1}$ (#86) – 55.69 $\mu\text{mol L}^{-1}$ (#89)/ 55.69 $\mu\text{mol L}^{-1}$ (#88) Storm water /discharge sites some are **greater than June 11th values.**

The tide was starting to flood , so discharge sites like #88 and 9 were draining water off the land and there had been some rain falling over the last 2/3 days.

Winter values are higher and this story is being told here, less uptake by phytoplankton??

Assume that more NNN being utilised by the phytoplankton. Chloro a levels are **higher** reflecting the **lower** concentration of nutrients. ?? From our last day, both the chloro a and NNN are higher.

Hypothesis.

A Brief algal bloom!!!!

The phytoplankton will draw down the NNN in the water, is there biological activity developing in the harbour??

[June 11th 5.07 $\mu\text{mol L}^{-1}$ (#810) -6.64 $\mu\text{mol L}^{-1}$ (#85) Open water sites. All sites around 4 $\mu\text{mol L}^{-1}$

.
2.94 $\mu\text{mol L}^{-1}$ (#89) – 32.63 $\mu\text{mol L}^{-1}$ (#86)/ 10.16 $\mu\text{mol L}^{-1}$ (#88) Storm water /discharge sites]

ALL sites exceed guidelines.

GUIDELINE value 1.79 $\mu\text{mol L}^{-1}$ (=0.025 mg N-NO₃⁻¹ L⁻¹)

Medium ENVIRONMENTAL HEALTH CATEGORY !!!!!!!

From 2013 Coastal and estuarine water quality

NNN: median values 0.01mg/L, (0.714 $\mu\text{mol L}^{-1}$) C/ 0.02 mg/L (1.43 $\mu\text{mol L}^{-1}$)

1) All values exceed the median value.

DRP (dissolved reactive phosphate)

Range of 0.53 $\mu\text{mol L}^{-1}$ (#82) – 1.57 $\mu\text{mol L}^{-1}$ (#86).

The range of and the values is similar to June 11th

[June 11th 0.43 $\mu\text{mol L}^{-1}$ (#89) – 1.41 $\mu\text{mol L}^{-1}$ (#86).].

All sites exceed the Guidelines.

GUIDELINE value 0.0322 $\mu\text{ mol L}^{-1}$ (= 0.010 mg P- $\text{PO}_4^{3-} \text{ L}^{-1}$)
HIGH ENVIRONMENTAL HEALTH CATEGORY

Enterococci

No data

Guideline value 140 cells per 100mL of sample indicated

***Enterococci* bacteria**

SUMMARY OF DATA.

DATE: 02/07/2016

<p>What is the weather like?</p> <ul style="list-style-type: none"> • <i>Air temperature</i> • <i>Wind speed and direction</i> • <i>Cloud cover</i> 	<p>#81and 2 3oC,Slight SE,78%ccv</p> <p>#82</p> <p>#83 4oC, no wind, 80% cloud cover</p> <p>#84 4oC, no wind,95%ccv</p> <p>#85 8-9oC,N,5k/h,85-90%ccv</p> <p>#86 8-9oC,Northerly,5k/h, 85-90%ccv</p> <p>#87 4.8oC,calm,70%ccv</p> <p>#88 4.4oC,calm,70%ccv</p> <p>#89 3.8oC, sl westerly,90%ccv</p> <p>#810 4oC,slight wind,, 90% ccv</p>
<p>What is the time, and what stage is the tide?</p> <p><i>What is the condition of the Leith ?</i></p> <p><i>Check websites (Met service and Port otago)</i></p>	<p>#81and 2 1004, tide coming in</p> <p>#82</p> <p>#83 1038, tide coming in</p> <p>#84 1055, coming in</p> <p>#85 1130,tide coming in</p> <p>#86 1151,ht, flooding</p> <p>#87 0930, low tide</p> <p>#88 1000, low tide</p> <p>#89 1020,low tide/water is clear</p> <p>#810 1045, low tide, flooding</p>

<p>Is there anything unusual to report (dead crabs, nasty smell, coloured sheen on the water)?</p> <ul style="list-style-type: none"> • Discharge pipes • Any star fish/other animals ?? • Rubbish or litter. 	<p>#81and 2 –</p> <p>#82 –</p> <p>#83 filmy layer on surface, cloudy</p> <p>#84 filmy layer on surface, geese, broken glass</p> <p>#85 –</p> <p>#86 lot of dead leaves trapped in the rocks small organic bits cans on the bottom, green substance in the water</p> <p>#87 –</p> <p>#88 some white foam, bubbles</p> <p>#89 –</p> <p>#810 –</p>
<ul style="list-style-type: none"> • Special seaweeds <p>f=few</p> <p>s=some</p> <p>m=many</p>	<p>See data sheets</p>
<p>Animals</p>	<p>See data sheets</p>
<p>What condition is the surface of the water?</p>	<p>#81and 2 small ripples</p> <p>#82 –</p> <p>#83 flat/still</p> <p>#84 murly, still</p> <p>#85 SI scummy, little bits of stuff</p> <p>#86 surface flow up the L.</p> <p>#87 calm</p> <p>#88 flowing stream</p> <p>#89 clear</p> <p>#810 clear</p>
<p>Does the water have any real, or apparent colour?</p>	<p>#81and 2 clear/colourless</p> <p>#82 –</p> <p>#83 teal-green/blue</p> <p>#84 brown/green</p>

	#85	Murky grey-brown
	#86	blue grey-murky
	#87	Grey/Green
	#88	grey-brown
	#89	No
	#810	No

Understanding Estuarine Processes

<p>What is the water temperature ?</p>	<table> <tr> <td>#81and</td> <td></td> </tr> <tr> <td>2</td> <td>8.7</td> </tr> <tr> <td>#82</td> <td></td> </tr> <tr> <td>#83</td> <td>8.1</td> </tr> <tr> <td>#84</td> <td>6.6</td> </tr> <tr> <td>#85</td> <td>7.4</td> </tr> <tr> <td>#86</td> <td>7.5</td> </tr> <tr> <td>#87</td> <td>7.1</td> </tr> <tr> <td>#88</td> <td>4.3</td> </tr> <tr> <td>#89</td> <td>4.5</td> </tr> <tr> <td>#810</td> <td>5.3</td> </tr> </table> <p style="text-align: right;">°C</p>	#81and		2	8.7	#82		#83	8.1	#84	6.6	#85	7.4	#86	7.5	#87	7.1	#88	4.3	#89	4.5	#810	5.3
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<p>What is the electrical conductivity of the sample ?</p> <p>NOTE: record the first conductivity, this is the actual conductivity at this temperature, the next reading is the specific conductance, the conductivity adjusted by the instrument to 25 °C</p>	<table> <tbody> <tr><td>#81and</td><td></td><td></td></tr> <tr><td>2</td><td></td><td>52.4</td></tr> <tr><td>#82</td><td>-</td><td></td></tr> <tr><td>#83</td><td></td><td>51.8</td></tr> <tr><td>#84</td><td></td><td>51.8</td></tr> <tr><td>#85</td><td>34.17</td><td>51.47746</td></tr> <tr><td>#86</td><td>33.46</td><td>50.19</td></tr> <tr><td>#87</td><td>33.83</td><td>51.27</td></tr> <tr><td>#88</td><td>0.17</td><td>0.28</td></tr> <tr><td>#89</td><td>3.44</td><td>5.64</td></tr> <tr><td>#810</td><td>31.21</td><td>50.63</td></tr> </tbody> </table> <p style="text-align: right;">mS/cm</p>	#81and			2		52.4	#82	-		#83		51.8	#84		51.8	#85	34.17	51.47746	#86	33.46	50.19	#87	33.83	51.27	#88	0.17	0.28	#89	3.44	5.64	#810	31.21	50.63
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	#89 55.69 #810 4.59 <div style="text-align: right;">μmol/L</div>
****DRP	#81and 2 0.54 #82 0.53 #83 0.63 #84 0.62 #85 1.08 #86 1.57 #87 0.66 #88 0.63 #89 0.54 #810 0.57 <div style="text-align: right;">μmol/L</div>
What is the enterococci count in the sample ?	No data <div style="text-align: right;">colonies indicated /100mL</div>