

Commentary on our big day out June 11th 2016.

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

MAIN MESSAGES when compared with May 7th data.

- 1 Water temperature much cooler with a decreasing gradient up the harbour**
- 2 Chloro a concentrations much lower, less biological activity**
- 3 NNN higher than last time.**
- 4 DRP similar**
- 5 Turbidity slightly less**
- 6 Strong indications of *Enterococci* at many sites especially at Sites 88 and 89.**

What was the day like?

A very pleasant day to monitor, sunny, very light wind (9°C) with little cloud cover. Wind direction was a light E/NE in direction, 10 knots later in the day.

Tide and harbour conditions.

All observations and sample collection occurred between 0950 and 1205. All observations carried out close to high tide (at 0950) in Dunedin.. Tide starting to turn.

This has been a dry period prior to monitoring. 9 mm rainfall over the last 10 days.

Water of Leith flowing at 0.337 cumecs (low) and the water temperature 7.44°C at 15.45.

Is there anything unusual ?

Nothing significant

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 reasonably calm at most sites. There was a slight ripple or chop at most 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 7.9 °C (#810) – 10.1 °C. (#81/2) Most around 8.5°C. The water temperatures are cooler than May 7th. 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 colder than water entering the harbour mouth in winter.

[May 7th 9.8 °C (#88) – 14.3 °C.(#86)]

Salinity

Sites that are directly impacted on by the tidal flow showed a range of 25.62 (#86) -33.89 ppt (#81/2/3) The salinities are similar to May 7th. The high tide meant that any inflows are influenced strongly by the sea water. A slight salinity gradient of decreasing values the further you go up the harbour.

Some samples were tested in the lab.

[May 7th 30.7 (#89) -34.40 ppt (#87)]

Open sea salinity 34.998 ppt!!!

Salinity readings more accurate, both YSI instruments are check each time against standard sea water. YSI 2030 measured 30.6 (standard 33.67ppt). YSI 85 measured 32.2 (vs 33.67). These differences are included in our adjusted calculations for salinity and conductivity.

pH

No data.

What about buffers in the water???

[May 7th 7.62 (#89) – 8.12(#85).]

Turbidity

All sites tested. Range was 1.6 NTU (#83) – 6.72 NTU (#89).

The water was relatively clear at all open water sites. This was similar to May 7th data.

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, #81/2 had noticeably higher chloro a levels.

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.

[May 7th 1.52 NTU (#84) – 6.64 (#87) /18.2 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

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

The DO readings shows a range from sites tested 7.89 mg L⁻¹ (#85)-8.40 mg L⁻¹ (#87)

DO % saturation range 81.8% (#86) – 87.6 % (#87/8)

There is no reliable data from #81-4.

The data suggests a degree of uniformity between sites, this is not surprising as all sites tested close to high tide, the water is the “same”

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

From 2013 Coastal and estuarine water quality

Dissolved Oxygen; 99.5% C/95.9 E

Chlorophyll a.

The range of values is 0.47 µg L⁻¹ (#81)/0.57µg L⁻¹(#82) – 1.46 µg L⁻¹(#86)

Range and values are less than May7th. 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???

[May 7th 1.17 µg L⁻¹ (#84)/1.27 µg L⁻¹(#88) – 3.07 µg L⁻¹(#89)/ 2.97µg L⁻¹(#81)/3.49 µg L⁻¹(#82).]

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.

5.07 µmol L⁻¹(#810) -6.64 µmol L⁻¹(#85) Open water sites. All sites exceed 4 µmol L⁻¹ , **greater values overall than May 7th values.**

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 some are **less than May 7th values.**

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??

[May 7th 2.79 $\mu\text{mol L}^{-1}$ (#810) -10.76 $\mu\text{mol L}^{-1}$ (#87) Open water sites. Most sites around 2 $\mu\text{mol L}^{-1}$

13.97 $\mu\text{mol L}^{-1}$ (#86) – 26.67 $\mu\text{mol L}^{-1}$ (#88)/ 27.47 $\mu\text{mol L}^{-1}$ (#89) 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 $\mu\text{mol L}^{-1}$)

DRP (dissolved reactive phosphate)

Range of 0.43 $\mu\text{mol L}^{-1}$ (#89) – 1.41 $\mu\text{mol L}^{-1}$ (#86).

The range of and the values is similar to May7th.

[May 7th 0.63 $\mu\text{mol L}^{-1}$ (#81) – 1.31 $\mu\text{mol L}^{-1}$ (#89)].

All sites exceed the Guidelines.

GUIDELINE value 0.0322 $\mu\text{mol L}^{-1}$ (= 0.010 mg P- PO₄³⁻ L⁻¹)

HIGH ENVIRONMENTAL HEALTH CATEGORY

Enterococci

All sites showed some indications. Strong indications from #86 (Waters of Leith) and #88 (Macbay storm water) and #89 (Somervilles Creek) which exceeded the Alert or guideline value.

#89 exceeded the guideline value.

Guideline value 140 cells per 100mL of sample indicated

***Enterococci* bacteria**

SUMMARY OF DATA.

DATE: **11/06/2016**

| | |
|--|--|
| <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 Sunny,almost still,9oC,very sl wind,<12%ccv</p> <p>#82</p> <p>#83 9oC, almost still,zero ccv</p> <p>#84 9oC, almost still,zero ccv</p> <p>#85 `15oC(without wind),NE 15-20kn)70% ccv</p> <p>#86 15oC, v sl breeze,NE,70%ccv</p> <p>#87 8.3oC,gentle to moderate from W, >1%</p> <p>#88 8.3oC,gentle to moderate from W, >1%</p> <p>#89 warm,suny,SE, 0% ccv</p> <p>#810 Approx10oC,Light wind,0%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 0950 High tide</p> <p>#82</p> <p>#83 1015, High tide</p> <p>#84 1035,high</p> <p>#85 1140, just after HT</p> <p>#86 1205, just after HT</p> <p>#87 0950,HT</p> <p>#88 1010,HT</p> <p>#89 1020,HT</p> <p>#810 1040,HT</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 plastic bags and bottles at water level</p> <p>#82</p> <p>#83 –</p> <p>#84 plastic bags on top of sea wall</p> <p>#85 some leaf litter</p> <p>#86 lttle bit of leaf litter,sl outflow, wash from jet boat</p> <p>#87 –</p> <p>#88 Litter on the bottom</p> <p>#89 Rubbish and gloves</p> <p>#810 –</p> |

| | |
|---|---|
| <ul style="list-style-type: none"> Special seaweeds | See data sheets |
| f=few | |
| s=some | |
| m=many | |
| Animals | See data sheets |
| What condition is the surface of the water? | #81and 2 small ripples #82 #83 slight ripple #84 v sl ripple, calm at rock wall #85 small waves, slight foam #86 #87 ripply, quite cean #88 Ripples #89 Light ripple #810 Light chops |
| Does the water have any real, or apparent colour? | #81and 2 Dark grey/green #82 #83 blue/grey #84 blue/grey #85 greeny -blue #86 – #87 Grey/Green #88 Grey/green #89 Murky, greeny grey #810 No |

Understanding Estuarine Processes

SITE: _____ DATE: _____

| | | |
|--|--------|------|
| What is the water temperature ? | #81and | |
| | 2 | 10.1 |
| | #82 | |
| | #83 | 10 |

| | | |
|--|---|-------|
| | #84 9 #85 8.6 #86 8.3 #87 8.4 #88 8.6 #89 8.1 #810 7.9 | °C |
| What is the salinity of the sample ? | #81and 2 33.89 #82 #83 33.89 #84 33.23 #85 32.73 #86 25.62 #87 32.62 #88 32.83 #89 31.79 #810 31.79 | ppt |
| What is the electrical conductivity of the sample ? <i>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</i> | #81and 2 37.29 — #82 — #83 37.29 — #84 36.56 — #85 34.79 — #86 30.43 41.73 #87 34.53 50.47 #88 34.92 50.85 #89 33.26 49.37 #810 33.23 49.48 | mS/cm |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|--------|--|---|------|-----|------|-----|-----|-----|------|-----|------|-----|------|-----|------|-----|------|-----|------|------|------|--------|--|---|--|-----|--|-----|--|-----|--|-----|------|-----|------|-----|------|
| <p>What is the pH of the sample ?</p> | <p>No data</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>What is the water turbidity?</p> | <table> <tr><td>#81and</td><td></td></tr> <tr><td>2</td><td>1.62</td></tr> <tr><td>#82</td><td>1.64</td></tr> <tr><td>#83</td><td>1.6</td></tr> <tr><td>#84</td><td>3.03</td></tr> <tr><td>#85</td><td>3.42</td></tr> <tr><td>#86</td><td>3.95</td></tr> <tr><td>#87</td><td>1.87</td></tr> <tr><td>#88</td><td>5.22</td></tr> <tr><td>#89</td><td>6.72</td></tr> <tr><td>#810</td><td>3.45</td></tr> </table> <p style="text-align: right;">NTU</p> | #81and | | 2 | 1.62 | #82 | 1.64 | #83 | 1.6 | #84 | 3.03 | #85 | 3.42 | #86 | 3.95 | #87 | 1.87 | #88 | 5.22 | #89 | 6.72 | #810 | 3.45 | | | | | | | | | | | | | | | | |
| #81and | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 1.62 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #82 | 1.64 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #83 | 1.6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #84 | 3.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #85 | 3.42 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #86 | 3.95 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #87 | 1.87 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #88 | 5.22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #89 | 6.72 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #810 | 3.45 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>What is the oxygen concentration of your sample ? <i>Measure both methods mg/L and % saturation</i></p> | <table> <tr><td>#81and</td><td></td></tr> <tr><td>2</td><td>—</td></tr> <tr><td>#82</td><td></td></tr> <tr><td>#83</td><td>—</td></tr> <tr><td>#84</td><td>—</td></tr> <tr><td>#85</td><td>7.89</td></tr> <tr><td>#86</td><td>8.14</td></tr> <tr><td>#87</td><td>8.4</td></tr> <tr><td>#88</td><td>8.27</td></tr> <tr><td>#89</td><td>8.26</td></tr> <tr><td>#810</td><td>8.15</td></tr> </table> <p style="text-align: right;">mg/L</p> <table> <tr><td>#81and</td><td></td></tr> <tr><td>2</td><td></td></tr> <tr><td>#82</td><td></td></tr> <tr><td>#83</td><td></td></tr> <tr><td>#84</td><td></td></tr> <tr><td>#85</td><td>82.7</td></tr> <tr><td>#86</td><td>81.8</td></tr> <tr><td>#87</td><td>87.6</td></tr> </table> | #81and | | 2 | — | #82 | | #83 | — | #84 | — | #85 | 7.89 | #86 | 8.14 | #87 | 8.4 | #88 | 8.27 | #89 | 8.26 | #810 | 8.15 | #81and | | 2 | | #82 | | #83 | | #84 | | #85 | 82.7 | #86 | 81.8 | #87 | 87.6 |
| #81and | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #82 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #83 | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #84 | — | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #85 | 7.89 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #86 | 8.14 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #87 | 8.4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #88 | 8.27 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #89 | 8.26 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #810 | 8.15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #81and | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #82 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #83 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #84 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #85 | 82.7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #86 | 81.8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| #87 | 87.6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | |
|--|---|--------------|
| | #88 87.6 #89 86.8 #810 83.8 | % saturation |
| What is the chlorophyll a concentration of the sample ? <ul style="list-style-type: none"> <i>Record the volume of water filtered</i> | #81and 2 0.47 #82 0.57 #83 0.82 #84 1.11 #85 1.04 #86 1.46 #87 0.68 #88 0.86 #89 1.12 #810 1.31 | µg/L |
| ****NNN | #81and 2 5.88 #82 5.95 #83 6.32 #84 6.27 #85 6.64 #86 32.63 #87 7.31 #88 10.16 #89 2.94 #810 5.07 | µmol/L |
| ****DRP | #81and 2 0.54 #82 0.52 #83 0.51 #84 0.50 #85 0.94 #86 1.41 #87 0.54 #88 0.51 | |

| | | |
|--|---|---------------------------|
| | #89 0.43 #810 0.46 | |
| | | μmol/L |
| What is the enterococci count in the sample ? | #81and 2 2 #82 2 #83 - #84 20 #85 17 #86 80 #87 7 #88 120 #89 650 #810 47 | colonies indicated /100mL |