Water Quality Levels for Coho Salmon in Bowker Creek

Like many other fish, the Coho salmon requires many specific water quality levels for it to thrive. Temperature and oxygen levels are some of the most important, especially in the alevin stage. This document will go deeper into the different requirements for these fish, and the changes needed to be made to Bowker Creek to accommodate for these preferences.

The first water quality preference relates to temperature; a crucial part on the spawning stages of these fish as well as their juvenile stages.

Table 6: Effects of Temperature in Considering Coho Incubation and Emergence

<table>
<tr><th>°C</th><th colspan="4">Incubation and Emergence</th></tr>
<tr><td>14</td><td colspan="4">14 Upper limit for normal embryo development (5)</td></tr>
<tr><td>13</td><td colspan="2">13 MWMT should not exceed this value to be protective of spawning, egg incubation, and fry emergence (1)</td><td colspan="2">13 Daily maximum temperature should not exceed this value to be protective (6)</td></tr>
<tr><td>12</td><td colspan="2" rowspan="2"></td><td colspan="2" rowspan="2">9-12 MWMT should not exceed this range to be fully protective (4)</td></tr>
<tr><td>11</td></tr>
<tr><td>10</td><td rowspan="6">6-10 Optimum temperature for salmonid eggs survival to hatching (4)</td><td rowspan="3">8-10 Ave. daily temp. during incubation should be at or below this to be supportive (2)</td><td>10 MWAT should not exceed this to be protective (6)</td><td rowspan="6">4.5-13.3 Preferred emergence temperature range (3)</td></tr>
<tr><td>9</td><td></td></tr>
<tr><td>8</td><td colspan="2"></td></tr>
<tr><td>7</td><td colspan="3"></td></tr>
<tr><td>6</td><td colspan="3"></td></tr>
<tr><td>5</td><td colspan="3"></td></tr>
<tr><td>4</td><td colspan="3"></td></tr>
</table>

Starting with their egg stage, Coho salmon prefer low temperatures around ten degrees Celsius. Bowker Creek's average temperature is around thirteen degrees Celsius, slightly too warm to support salmon eggs in their development. The temperature range goes up as the salmon get older, but around 10 degrees is preferable for spawning and juvenile growth. Too high temperatures can result in no embryo development, and many other health issues for salmon.

The high temperatures could be a result of the lack of shade in many areas, as large trees that once lived there were cut down. Planting more of these trees could eventually result in more shade, and thus lower temperatures. Temperatures could also be a result of warm pollutants flowing into the river, such as traces of sewage, which we plan to eliminate.

The next main aspect of water quality is dissolved oxygen – the amount of gaseous oxygen dissolved in the water.

Level of Effect	Water Column DO (mg/L)
No Production Impairment	8
Slight Production Impairment	6
Moderate Production Impairment	5
Severe Production Impairment	4
Limit to Avoid Acute Mortality	3

As seen in this table, 8mg/L is the preferable level for Coho salmon – the same levels of dissolved oxygen seen in Bowker Creek this November. While Bowker Creek may have this under control, the dissolved oxygen levels should not drop below eight, as it could harm the salmon in their embryo and larva stages. Low dissolved oxygen slows growth, and makes it incredibly hard for adult salmon to make it upstream to spawn (as it affects their swimming abilities).

Water Quality Levels for Coho Salmon in Bowker Creek

pH is another major factor into a salmon's survival (pH expressing the acidic levels of the water).

pH	Alkalinity/acidity of water (expressed in pH) that fish can tolerate.	Under laboratory conditions, coho salmon were reportedly observed to tolerate a pH range of 6.1 to 8.2 (Dahlberg et al. 1968).

Simply put, Bowker Creek's pH levels are within the parameters of Coho salmon – about 7.6– 8. These levels are on the higher end, but are tolerable for salmon life. High pH means more basic water levels, which can be caused by excess algae blooms (takes more carbon dioxide out of the water). This can be a problem for Bowker Creek (because of its susceptibility for algae blooms), but it should be controlled with stable water quality levels (especially dissolved oxygen and nitrogen).

That brings me into nitrogen levels – something that needs to be improved in Bowker Creek. Generally, Coho salmon prefer nitrogen levels around .10-20 – their maximum levels (before death after around 96 hours) is .88. Bowker creek's levels ranged from .20 to 1.5 – which in general is too high for salmon to live. This could possibly be a result of sewage leaking into the creek over many years, as sewage has high levels of nitrogen.

The same goes for phosphorous – a mineral also found in nature, but also in sewage. The recommended maximum levels for freshwater streams is around 1 ppm (parts per million), with sensitive organisms (such as fish) needing phosphates at around .20. Bowker Creek's phosphorous levels are around .75, which can cause increased algae blooms, leading to decreased oxygen for the fish.

Finally, the major issue with Bowker Creek's water quality is its high ammonia levels – most likely caused by a link with the sewer system. Ammonia is found in many fertilizers (runoff affects this), but is also found I the decomposition of organic and animal waste.

"Ammonia is toxic to fish and aquatic organisms, even in very low concentrations. When levels reach 0.06 mg/L, fish can suffer gill damage. When levels reach 0.2 mg/L, sensitive fish like trout and salmon begin to die."

This excerpt from The Department of Fisheries and Oceans report on water quality for salmonid hatching sums up Bowker Creek's problem with Ammonia. Damage to fish can occur with ammonia levels being at around .06 mg/L, and death to salmon at .2 mg/L. Bowker Creek's Ammonia levels stay at about .15 to .2 mg/L, which is not suitable for sustainable salmon life.

This could be fixed through changing the watershed (runoff), and altering sewage passes, but ultimately, if the ammonia levels in Bowker Creek do not change, salmon life will not be feasible.