Chapman Creek Hatchery

The Chapman Creek Hatchery is owned and operated by the Sunshine Coast Salmonid Enhancement Society, a non-profit organization dedicated to sustaining and building salmon stocks on the Sunshine Coast. Historically, the Chapman Creek Hatchery has produced millions of salmon (Chinook, Coho, Chum, and Pink) and trout (Cutthroat and Steelhead) for release in local streams and lakes. In addition, the Hatchery has also produced Rainbow Trout as a source of revenue for the Society through the U-Fish program.

The Chapman Creek hatchery is located on Chapman Creek, a designated sensitive ecosystem (Fisheries Protection Act, 1997), approximately 1km from the mouth of the creek in Davis Bay, and currently holds a water license to remove water from Chapman Creek via an intake pipe. This water is then gravity fed from the holding pond, through the hatchery, providing water for the tanks and incubation building. The water is then fed into the settling pond, where any particles in the water can settle out, before it is returned to the creek, approximately 200m downstream of the intake, via the outflow stream. Unfortunately, during stage 4 water restrictions in Sechelt, the SCRD releases 200L/second from the dam at Chapman Lake to meet the required Environmental Flow Need (EFN), which is defined as the amount of water and timing of flow required for the aquatic ecosystem to maintain proper function (Province of British Columbia, 2016). During low flow conditions, the Hatchery is legally unable to remove water from Chapman Creek, as the 200m between the intake and outflow would not meet the EFN, resulting in the tanks running dry, and no water for the salmon and trout on site.

In addition to the Hatchery being unable to remove water from Chapman Creek when the flow is at 200L/s, the EFN set for Chapman Creek does not take into account the temperature of the water. At 16°C, fish become stressed and begin to have trouble with body regulation, feeding, and overall health, and at 24°C you begin to see large die offs (Oliver and Fidler, 2001). In July 2018, the the water in Chapman Creek measured 22°C, just 2°C shy of the temperature threshold for die offs to occur. Water temperatures in the summers of 2015, 2016, and 2017 were also similar to those seen in 2018. The Department of Fisheries and Oceans (DFO) recommends that the EFN in streams be set at 300L/s for the survival of salmon, while the biologist contracted by the SCRD recommended that 200L/s for Chapman Creek would be sufficient flow (Triton Environmental Consultants, 2006). However, the EFN set at 200L/s puts the pink salmon returning in August, and the fry of other salmon species who use this sensitive ecosystem to grow, at risk of low flow and high temperatures.

The future of the hatchery is in jeopardy due to the low flow conditions and the high temperatures experienced during the late summer months. With the low flow in Chapman Creek, the Hatchery will be unable to keep fish on site during this time period. Currently, DFO is creating a plan to remove the Coho juveniles from this site on July 1st, before returning them to the Chapman Creek Hatchery when flows are increased and temperatures drop, likely in October. Additionally, the Hatchery is required to sell off all Rainbow Trout before the creek reaches 200L/s, or will be forced to cull any trout left on site once the low flow is reached. This loss of trout and salmon from the hatchery during the summer months coincides with the busiest tourist months, resulting in the hatchery having no fish on site during the time when the Society receives the majority of our donations, effectively removing this source of funding for the Society.

The Society has considered options to support the Hatchery during low flow times, including the use of the well on the property, as well as pumping the outflow back to the intake. Unfortunately, both of these options are not entirely feasible for the Society. The well is currently under investigation, but it is likely that due to the proximity to the creek, that the well is connected to Chapman Creek, and could therefore draw it down, reducing the flow below the EFN. The Society has also considered pumping the water from the outflow back to the point of intake, effectively removing any impact of water removal from the creek. Unfortunately, pumping the water back is not financially feasible for the Society as a line would need to be dug, buried under the road and back to the intake. Additionally, pumping the water back would remove the outflow stream, and therefore would not allow fish to swim into the hatchery's trap, removing our broodstock collection and sorting ability.

The Chapman Creek Hatchery is not only important for the maintenance of the salmon runs in the Chapman Creek; it is also an important facility for education and community involvement. As a society, we have 30+ core volunteers who assist with every aspect of the operation, and 80+ others who assist in seasonal activities such as fish releases, fin clipping, and spawning. The Hatchery also acts as a meeting place for dozens of local and visiting fishermen, who come to Chapman Creek to fish salmon and trout in the fall and winter months. Additionally, the Hatchery is instrumental in the education of school children. Dianne Sanford runs her DFO funded Salmon in the Classroom program using the Hatchery as a base for field trips, as well, the Hatchery supplies adult salmon for dissections, and eggs for the classes to care for and release in the spring. In addition to school programs, the Hatchery runs summer camps, providing children a safe and fun environment to learn about the Chapman Creek Watershed. Furthermore, the Chapman Creek Hatchery provides a tourist attraction for 9000+ tourists annually, who come to learn about the watershed and the 4 salmon species who call it home.

Overall, the Chapman Creek Hatchery is instrumental in the education of the community, a tourist attraction, a meeting place, as well as for the maintenance of our local salmon stocks.

Water Problems in Sechelt

Residents in the District of Sechelt rely heavily on Chapman Lake and the seasonal snowpack in the Tetrahedron Provincial Park for their domestic water use (Cox, 2018). Unfortunately, due to climate change, fall rains being pushed farther back, warmer spring temperatures, decreasing snowpack, and increases in population, summer water shortages are becoming the norm (Cox, 2018). With Stage 4 water restrictions becoming a yearly occurrence for the District of Sechelt, long term solutions need to be explored and implemented, rather than “band-aid” solutions such as the surface siphon previously used (Sechelt, 2018). Suggestions have been made to increase the capacity of Chapman Lake by turning the area into a reservoir, as well as adding a deeper intake pipe on the dam, allowing the SCRD to draw down deeper in the lake (Grant, 2017). Currently, both of these plans have been placed on hold, as Chapman Lake is located within the Tetrahedron Provincial Park, and more work is required on the regional water plan before the Province of BC will consider adjusting the park boundaries to accommodate the expansion project (Province of British Columbia, 2019). Suggestions have also been made to install water meters within the district, pipe water from Clowhom Lake, and use a gravel pit as a reservoir for use in the summer months (Grant, 2017). Unfortunately, while the SCRD is looking at expansion projects and new sources of water, such as wells, little is being done in the way of education and enforcement of bylaws during water restrictions (Woodroofe, 2018). While the SCRD has offered 2 rebate programs, one for replacing toilets with low flow models, and the other for rainwater harvesting, this is not enough to curb our water usage, and ensure we avoid Stage 4 water restrictions in the coming summers (SCRD, 2015; SCRD, 2018). The District of Sechelt has a long way to go in managing and conserving our water resources, and can learn from other locations who have also faced water crises.

Case Studies - Water Conservation

<u>Background</u>

Southeastern Australia

Between 1995 and late 2009, Southeastern Australia experienced the worst drought on record, post-european settlement (Australian Government, 2015). Minimal rainfall in the years prior to 1994 intensified through 1995 resulting in the collapse of river systems and the declaration of a

drought for the region (Van Dijk *et al*. 2013). The drought was further exacerbated by high temperatures due to the occurrence of a strong El Nino in mid-1995. Leading up to 2006, with many regions recording the lowest winter rainfalls since the beginning of the century, capital regions faced water crises, with under 50% of water stores available (Seqwater, n.d.). In addition, higher than average temperatures increased the evaporation rates in reservoirs, further depleting water stores. In response to the decade-long drought, and the possibility of this being the new normal, cities and towns were forced to change the way they treated their water resources and develop permanent solutions. These solutions included: rebates for the installation of water tanks for industry, tougher regulations for industry, grey-water recycling, pipelines for transporting water, and the completion of numerous desalination plants (White, 2007). On an individual level, governments gave rebates to homeowners to retrofit their homes with water efficient fittings, as well as water efficient appliances, and rainwater tanks. The government also pushed water-friendly education, including the sharing of information through an online portal, where they display up-to-date information on rainfall, streamflow, dam levels, and water use (Water Corporation, n.d.). Additionally, Melbourne has implemented the 'Target 155', where they are encouraging people to curb their water use from 166L/person/day to 155L/person/day, reducing the pressure on the region's water resources (Victoria State Government, n.d.).

South Africa

Cape Town, South Africa experienced an El Nino-triggered drought in 2016, with unusually high temperatures and low rainfall (Van Dam, 2017). Following the El Nino, Cape Town received very little rain, leading to low dam levels, furthering the water shortage (Van Dam, 2017). In addition to the low rainfall and high temperatures, South Africa has high urban water use, with high inefficiency due to water loss (IRN, EMG, GEM, 2000). The agricultural sector is also highly inefficient, with less than 50% efficiency, and accounts for 69% of the total consumption for South Africa (IRN, EMG, GEM, 2000). In a push to decrease water usage in the face of the severe drought, and as a part of their education program, the government in Cape Town published a countdown to "Day Zero", the date where the taps would run dry. Through education and rebates for retrofitting homes, people in Cape Town were able to decrease their water use from 124L/person/day to 50L/person/day over a two year period (Thompson, 2018). This decrease in individual water usage pushed Day Zero back from summer of 2018 to 2019, and potentially further, depending on the amount of winter rain (Thompson, 2018).

California

As with the majority of the west coast of North America, the State of California relies heavily on snowpack to replenish surface water reservoirs. In the four years leading up to 2015, higher than average temperatures, coupled with a lack of winter storms, resulted in an all-time low in snowpack (Dimick, 2015). This lack of snowpack, coupled with higher than average summer temperatures forced the State of California to implement the first ever water restrictions in the history of the state, in response to the record-breaking drought (Dimick, 2015). California is now planning on increasing and replenishing underground water storage through canals and aqueducts, as well as recycling water, and linking the state to larger water sources via pipelines (Hanak and Mount, 2018). At the individual level, the government is offering rebate programs for consumers, educating on the benefits of drought-tolerant landscaping, and pushing to limit individual indoor water use to 55 gallons/day (208L) in 2020 and to 50 gallons/day (180L) in 2030 (Weiser, 2018). Unfortunately, these restrictions and methods are not yet applied to the agricultural sector, which currently uses up to 80% of California's water supply (Dimick, 2015). Methods such as drip irrigation systems and water reporting have been suggested to curb the water use in agriculture.

Solutions

Education and Sharing Information

Education is the single most important factor in starting change in a community. People will not understand how to make changes, or why they need to make those changes, without first understanding that there is a problem and what that problem is. Both South Africa and Australia ran, and continue to run, educational campaigns during and after the drought, resulting in a dramatically reduced daily individual water use. For example, Australia has programs where school children can get involved individually, or as an entire school, to monitor and reduce their water use. Australia and Cape Town also have a program for educating the general public through an online portal, where you are able to select an area of your home and learn easy ways to save water and money in your home.

Through these education programs, Australian and South African governments have both created websites, where you can not only monitor your household use, but the use of the entire community, or city, therefore holding people accountable for their usage. These websites also

display the up-to-date dam levels, streamflows, and rainfalls, allowing the general public access to the information the government is basing the current water restrictions on, and allowing individuals to adjust their usage accordingly.
The Australian website can be accessed at: https://www.watercorporation.com.au/water-supply/rainfall-and-dams/dam-levels
The South African website can be accessed at: http://coct.co/water-dashboard/?ca_source=Website&ca_medium=affiliate&ca_campaign=Home%20page%20trends%20-%20Day%20Zero%20Dashboard&ca_term=Day%20Zero%20Dashboard&ca_content=Day%20Zero%20Dashboard

Grey Water Recycling

Grey water is the water that has been used in showers, sinks, and washing machines, and is safe to be used in the yard and garden, or to flush toilets. Grey water recycling can easily be accomplished by placing a bucket under the shower to catch water as it warms up, or collecting the water used for washing vegetables. This water can be used to water gardens and yards, or can be used to manually flush the toilet, reducing the amount of water required for each flush. Washing machines can also be piped into drip irrigation systems and used to water gardens and yards as well. Not only does recycling grey water drastically reduce the amount of water used daily by each person, it also saves money.

Drought Tolerant Landscaping

Drought tolerant landscaping is a great way to reduce outdoor water use. By planting native plants, as well as plants and grasses that are drought tolerant, you can reduce the frequency and amount of water needed for your lawn and garden. Additionally, using methods such as drip irrigation provides water directly to the base of the plant, reducing water waste through spray and evaporation. Grouping plants by the amount of water required is also a great way to save water. Additionally, using rain barrels to catch water allows you to store water during the rainy season for your gardens and lawn.

Rebate Programs

Rebate programs are a great incentive for homeowners to retrofit their homes with water saving appliances and technologies, and increase the water use efficiency in their own homes. Australia offered a rebate program to change taps and leaking pipes at a reduced cost or free labour through certified technicians. They also offered rebate programs for anyone who purchased low-flow toilets, or certified water and energy saving appliances. Additionally, the Australian government required all appliances and fittings installed in new builds or renovations be water and energy saving. Cape Town offered a similar rebate program in order to increase the efficiency of their water system.

Solutions for Sechelt

As Canadians we are extremely lucky to have over 20% of the world's freshwater resources, as well as 7% of the world's renewable water flow (Statistics Canada, 2018). However, Canadians also have one of the highest individual water consumption rates, at 251L/person/day (Government of Canada, 2017). Sechelt is in a unique position with our water resources and currently small population, to become not only leaders in water conservation in Canada, but in the world. Sechelt has the potential to reduce the frequency and duration of stage 4 water restrictions through the implementation of these solutions used elsewhere around the world. The implementation of the education program should be the first thing to occur in order to inform people on the issues their community is facing and the potential solutions at the individual, community, and government levels. The education programs should include school programs to teach the young generation how to save water, and community outreach programs to teach the general public what they can do. Additionally, online resources such as those used by Australia and Cape Town, should be used to increase the transparency of the information the government has, and to allow individuals to adjust their water consumption rates accordingly. Secondly, rebate programs for homeowners to increase their efficiency and reduce water consumption rates need to be implemented in order give individuals incentive to change their current water use habits. Furthermore, setting goals for individual water use limits, such as Target 155, and imposing harsher penalties will be required to ensure everyone complies with new regulations. If we were to implement these solutions as a community, Sechelt has the potential to drastically reduce our individual daily water use rates, and to become leaders in the conservation of water resources.

Not only would conserving water as a community take the pressure off our water resources and limit the duration, or prevent the implementation, of stage 4 water restrictions, it would take the pressure off sensitive habitats like Chapman Creek and the salmon and other creatures who live in this ecosystem. By reducing our water usage in the community, we are ensuring that there is enough water flowing through the ecosystem to maintain required water flows and temperatures, ensuring the survival of our important salmon stocks. Reducing water usage will also allow the continued function of the community based Chapman Creek Hatchery, allowing the hatchery to continue the enhancement of the Sunshine Coast's salmon stocks. Not only would maintaining water flows protect our salmon stocks, both wild and hatchery, it will also protect their predators, as well as the rich and diverse riparian ecosystem they live in. Implementing good water conservation practices will ensure future generations have water resources available to them, as well as giving them the ability to experience the diverse and rich ecosystems.

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