Climate Change and Salmon

David Ewart
April 2024
Retired DFO Watershed Enhancement Manager
Salmon Enhancement Program
with an introduction by Max Thaysen
Cortes Island Streamkeeper,
Friends of Cortes Island Society

Introduction
Max Thaysen

The Streamkeepers of the Friends of Cortes Island has been an active program of salmon enhancement, habitat restoration and salmon reverence for many years now. It has been our honour to support the Klahoose Nation hatchery and work alongside Klahoose members in supporting salmon.

In recent years, climate change has become a major threat to salmon survival in our region and it has undermined many of our efforts and eroded our hopes and dreams of a full fish recovery.

We've had gravel and eggs washed out to sea. We've had to watch fish waiting endlessly for fall rain that never came while predators circle. We've managed to get hundreds of thousands of taxpayer dollars spent on restoring road infrastructure to support fish passage and then see those passageways sit empty.

It is time to speak out and share our experience. We've asked Dave Ewart to recount our recent experience and connect it with his deeper observations through 40 years of supporting salmon in the region.

It is time to act – salmon around the Salish Sea struggle, at times desperately, with today's level of climate disruption, and they cannot tolerate the levels of warming and hydrological chaos that are predicted under our current foot-dragging climate response. The world has already warmed too much for these sacred fish. We must do better. Please join us and others who are demanding an end to the unsanctioned experiment of endlessly adding greenhouse gases to the atmosphere – you are needed. We owe it to future generations, to First Nations, to the fish, and to all who depend on them.

Please read and digest Dave's experience and wisdom.

Dave Ewart, April 2024

I have been asked by the Cortes Island Streamkeepers to outline my experiences with climate change and how it has affected salmon. The following is my independent, personal recollections and opinions on the state of affairs in the environment, based on 40+ years of work and life experience on the coast of BC.

I grew up in Campbell River in the early 60s and started working with Fisheries and Oceans Canada in 1979 after graduating from the Renewable Resource Management 2-year technical program at Lethbridge College in Alberta.

My work experience initially began as a seasonal Fisheries Guardian, which included enforcing fishing regulations, collecting biological data, and walking streams in the fall to estimate salmon spawning abundance. In those early days, no one I worked with considered that there were any issues with stream flows or ocean productivity. We all assumed that things would stay the same. The main issues of the time were logging and mining impacts, along with overfishing and illegal fishing. Weather was fairly consistent through the seasons, and salmon returned as they always did, at the same timing.

In 1980, I started work as a Fisheries Technician at the new Quinsam River Salmon Hatchery in Campbell River. This facility was built in 1974 as part of the Salmon Enhancement Program which was begun to try and halt the drastic decline of salmon on the BC coast. In Campbell River, the many years of BC Hydro operation in the watershed, combined with mining, intense log handling in the estuary, and overfishing, had created severe negative impacts to salmon. In particular, the famous Chinook had declined from thousands to only a few hundred. This focussed attention by the Salmon Enhancement Program on the area, and research was done to look at building a hatchery to try and mitigate the habitat loss and rebuild the population. Promoting this was the discovery of an excellent source of ground water near the Quinsam River, a major tributary of the Campbell. For these reasons, Quinsam Hatchery was built and continues to support salmon in the watershed to this day.

As I soon discovered, when you work at a hatchery, you learn every detail of the life cycle of salmon. From egg to smolt to adult, salmon taught me a lot about the differences between the species and their unique needs (we raised all species of salmon (excluding Sockeye), and Cutthroat and Steelhead trout). The hatchery and its staff are the eyes and ears of the river, and we collected large amounts of environmental data ranging from river levels, water quality, temperature, wild salmon migration, and weather. We recorded everything related to salmon in the hatchery and rivers and linked it all to temperature, weather, and the environment.

During the 1980s, salmon survival rates (from entry to the ocean until return to the river) were considered good at a range of approximately 5% to 20%. There were extremely large returns of most species, commercial and sport fishing catches in BC were among the largest in the world, and I did not think that it would change. The seasons were relatively similar year to year, water

was cold in the winter and warm in the summer but well within standards for sustaining salmon. Snow pack was good in the mountains, which maintained the river levels into September when fall rains normally began and the main adult migration started.

However, by the early 90s, ocean survival rates declined drastically. Most species in BC dropped down to approximately 1% to 5% with Chinook below 1%. This was not just regional, it was a similar trend in Washington, Oregon, and California to the south. Strict fishing measures began in BC, which has virtually eliminated the commercial fishing for salmon in southern BC and put significant restrictions on the recreational fishery. At that time, our DFO scientists did not have any conclusive reason for why this had happened, but suspected that ocean productivity had changed. To that end, the Pacific Biological Station began focussing its research on the ocean. Under the direction of Dr. Richard Beamish, scientists began monitoring water quality, plankton abundance, bloom timing, and survival of juvenile salmon after entry into the ocean. This has focussed the various countries producing salmon along the Pacific coast to do the same. It has changed how we look at predicting salmon survival, and continues to this day.

In the ocean, the bottom line is that the water is warming, which has a major effect on the quality and types of feed available for salmon.

Working on the river day to day, I began to see that the climate really was changing. Flood events began to happen more frequently, with the worst being rain-on-snow events in the fall. It would get cold, the higher elevations would receive a big dump of snow, and then a warm front from the tropics (known as a pineapple express) would cause huge rain events and warming. This caused massive flooding, which has changed river courses, and destroyed salmon eggs in the gravel. Instead of a big flood every ten or more years, the late 90s brought 2 or 3 big floods almost every year.

Salmon were now being hit at most parts of their life history. On one end, too much water in the late fall and winter. On the other, not enough in the late summer and early fall period as rivers began to stay warm and dry. The early fall rains are essential to raise river levels so that adult salmon can migrate up to the spawning grounds. Increasingly, this is not happening. As evidence, on the Quinsam River, historic areas that salmon normally swam through to get to spawning areas began to dry up. This caused large numbers of early-entry Pink salmon to become trapped in the lower river. During the fall of 2000, it reached a crisis when thousands of Pink salmon began dying before spawning. They were blocked at a series of pinch points on the upper river, which, at higher water, was passable. In the upper watershed, the main supply lakes were going dry and risking stopping flow to the river. BC Hydro was responsible for operating a series of water diversions in the area, and had misjudged the available water, and the rains never came to replenish the reservoirs. In response, we worked with them to install large pumps to maintain flow to the river from the lakes. This had never been done before. It is happening more and more (last year, the Cowichan river was close to doing the same thing).

This event created a project in 2005 to carve fishways through these bottlenecks in the river so that if there were future low-flow events, salmon would still migrate upriver. Fall river flows have now consistently been dry and made the project highly successful and essential. This was another significant signal that the climate was changing radically.

Another example of changes to the environment from climate change is the survival of Pink salmon along the Pacific coast. Pinks are among the first to return to Vancouver Island Rivers. They enter freshwater as early as July, then hold for up to 2 months before spawning in late September. That means they need cold water with sufficient flow to hold while they wait to mature. Puntledge River near Courtenay is a river that comes from Comox Lake and is used at Puntledge Hatchery for their water supply. The Puntledge and its tributary, Tsolum, used to have large numbers of Pink salmon. The hatchery produced a few million fry every year, but by the 2000s, the river had warmed up so much in the summer that Pink salmon adults did not mature properly. It was found that their eggs and sperm had very poor quality, and egg survival in incubation was very low. Adult mortality and disease increased in the river and at the hatchery due to the fact that the river was warming up to over the threshold of 15 degrees Celsius. It became such a problem that by mid-2000, the Puntledge hatchery had to stop rearing Coho through the summer and had to change to releasing them as fry in the spring because the water got too warm. They also began getting their Pink salmon eggs from Quinsam Hatchery because the Quinsam facility operates on an excellent cold groundwater source.

An interesting fact for Quinsam Pinks is that they have survived so well through climate change because the Campbell River is unnaturally cold. The Campbell watershed is dammed, and the lower river benefits from cold water being drawn off the lower lake's thermocline. This keeps salmon holding in the river, in excellent cold conditions. When the Quinsam River cools down in late September, the Pinks migrate from the Campbell into the Quinsam where they spawn. As a note, Pink salmon are in low abundance and may have gone extinct in some areas of their historical range from California to Alaska, and that can be attributed to climate change and waters warming above the threshold for Pinks.

On Vancouver Island, the Quinsam Pinks are the only robust stock left on the eastern side, and they have been used to stock Island rivers that used to have Pinks from Campbell River to Nanaimo. Eyed eggs that have been incubated in cold water at Quinsam are transferred in the late fall to the receiving river when it has cooled down.

Other very significant changes related to climate are stream and river levels and discharge. In the 90s, I became the Quinsam River hatchery manager, with the title of Watershed Enhancement Manager. My job was to manage salmon enhancement activities in the Campbell/Quinsam watersheds. This included habitat restoration projects, assessment, research, and working with stakeholders in my area.

A big part of the job during the late 90s, and continuing now, was working on a water use plan with BC Hydro. Up until the mid-90s, BC Hydro operated the dams and generators in BC with

minimal input from agencies related to fish. However, climate change combined with some BC Hydro activities ("unplanned flow events") began to cause fish losses. BC Hydro was ordered to start a process to better plan their use of watersheds. I was part of the initial committee that formed the Campbell River Water Use Plan. This was an important but difficult task that tried to meet the needs of the local water users, BC Hydro production, and, most importantly, fish.

I worked with some excellent biologists and hydrologists who created models using historical data to chart and predict river flows under different scenarios. A lot of it was based on the needs of fish at all life stages, weather patterns and snow/rain amounts for storage. During the planning process, we found that what the experts charted was not holding true. We started having flood and drought events at the time which the models were not able to accurately predict. One year was a severe winter drought that saw lake levels drop lower than had ever been seen. Other years saw huge inflow events that necessitated large spills of water down the Campbell River, washing away newly placed spawning gravel.

The weather had become much more unpredictable and erratic.

After I retired from DFO in 2014, I continued to help with small projects in the North Island area. This included working with the Friends of Cortes Island (FOCI) Stream Keepers and Klahoose First Nation on Cortes Island.

For many years, Klahoose hatchery would receive 25,000 Coho eyed eggs from Quinsam Hatchery. The locals would incubate the eggs, pond the fry, and feed them for a few weeks until they were ready to release to local creeks in May/June. At that time, there was still adequate water at the hatchery and in the creeks in April and May to do this. However, over time it became evident that the early spring period was getting drier, and the water was not there when we needed to rear and then move Coho fry.

Working with the team on Cortes, we decided in 2016 that Coho could not be raised any longer, so we switched to Chum. Chum don't stay in fresh water for more than a week or two after emergence in March, so they should be out of the system by May, when creeks dry up.
It was a difficult decision, and it probably means that Coho are no longer a viable salmon species on Cortes Island. Focussing on Chums was the only alternative. This was a stark reminder of what climate change was doing to salmon in the area.

So, we began rebuilding Chums at Basil and Whaletown Creeks. This was done under transfer approval from DFO, receiving eyed eggs from Tla'amin First Nation in Qathet (Powell River). Chums are now the only species that can adequately survive on Cortes. The Klahoose First Nation and the FOCI Streamkeepers have been diligently operating the small hatchery and in-stream incubators to ensure the best survival for the fry that are released in the spring.

Unfortunately, like the Quinsam River and so many others on the coast, salmon are being impacted at the other end of their life cycle. In 2022, the summer seemed to never end, and it continued to be dry right through November. Chum adults in the hundreds gathered at the

mouth of Basil Creek, waiting to spawn in mid-October. Predation by otters, seals, sea lions and a black bear ensued, and virtually nothing made it into the creek to spawn. To try and mitigate this, the Stream Keepers installed an incubator in Basil Creek with 20,000 eyed chum eggs in December. On Christmas Day, a huge rain-on-snow event happened, and the creek flooded, causing landslides in the upper slopes, sediment shift downstream, and movement of the incubator out of the creek. Luckily, the eggs survived the event and were taken to the hatchery, where they were reared to hatch.

This was another example of how erratic the weather has become and how it affects salmon. In 2023, another drought occurred, creating similar fall conditions on Cortes. Whether this is cyclical or the new norm, no one really knows. I suspect that it is the new norm, and we need to plan for it.

In summary, in my experience, it comes down to:

1. **Water Temperature**: Warming throughout the seasons but critically too warm in summer and fall. It affects water quality (oxygen levels), and the disease becomes more prevalent, with more pre-spawn mortality and poor egg fertilization. Warmer river temperatures can accelerate egg development and produce fry too early in the spring when feed (plankton) is not available. Some years, there are now mis-matches of migration out of rivers into the ocean that is not ready to receive the salmon juveniles.

2. **Water Discharge:** For surface-water watersheds with no storage (no ponds, lakes, reservoirs), the situation is critical. It is dry earlier than it used to be due to less spring rain and low snowpack, and it is dry in summer into mid-fall when adults need cool water in sufficient amounts to migrate and mature. Additionally, warmer winters create large storm events with sudden intense rain/snow that causes large floods. This can destroy salmon eggs in the gravel and change river courses and damage infrastructure. Low water in the fall causes adult migration blockages and increased predation. Also, squeezing too many spawners into a limited area actually decreases egg-to-fry survival (less water lowers the spawning gravel accessible).

3. **Ocean Productivity:** I (and many others) now believe that ocean productivity is by far the main limiting factor to salmon survival. Fisheries & Oceans scientists are now focussed on the ocean, which, in my career, was considered stable and limitless. We now know that this is not so, and much of salmon survival depends on this “pasture” that is the Pacific Ocean. It has become variable and unstable, and predicting salmon survival involves very complex data collection and analysis.

   All of this is related to climate change.

What can be done?

My background is in salmon enhancement (hatcheries, spawning channels, and habitat restoration). I may be considered biased, but many are now acknowledging that hatcheries have a role in mitigating effects of climate change on salmon.

This includes:

- Providing cool water during critical life stages for stocks in need (incubation, early rearing),
- Increasing egg to fry survival during critical periods,
- Manipulating development to ensure fry and smolts are released at the proper time and into adequate conditions,
- Increasing water storage and accessing groundwater sources to ensure creek and river flows through the summer and fall,
- Restoring habitat, if and when needed (dependent on surveys). In particular spawning gravel, holding pools, estuary planting, bank stabilisation,
- Data collection related to stream discharges, temperature, and salmon abundance,
- In the bigger picture, we need to monitor and stop climate change.

…….

The Friends of Cortes Island is one of many organizations that are beginning to wake up to the terminal consequences of a society that is failing to act on climate change in time. Please join us in orienting ourselves and organizing for real, deep, and fast habitat protection, including greenhouse gas emissions cuts in line with our fair share of the responsibility to limit warming to the safest levels that are now possible.

www.friendsofcortes.org
friendsofcortes@gmail.com