Restoring Spanish Bank Creek to a Living Classroom: Assessment of Factors Impeding Chum Salmon Returns in Spanish Bank Creek

Summary

In 2000, Spanish Bank Creek was daylighted and restoration work began to support the reintroduction of coho and chum salmon into the creek. The Spanish Bank Streamkeepers hope to continue using the creek as an educational resource to teach local students about salmon life cycles and raise awareness in the local community regarding the threats to Pacific salmon. Despite initially strong returns, chum have not been observed returning to the creek in recent years. This project will seek to evaluate potential factors causing low returns and identify next steps or restoration actions to increase chum returns and support educational activities.

To assess the potential factors affecting salmon returns, existing data on salmon returns, in-stream conditions, and similar salmon-rearing streams in the area will be collected and evaluated for any correlation with chum returns. Additionally, where data is unavailable, future methods for data collection will be suggested.

The project is expected to be completed by March 2021 with a final report and recommendations for the Spanish Bank Streamkeepers.

Contents

Background Information

Chum returns around North America

The data regarding chum returns to North America is of poor quality, but appears to show abundance generally stable, with results highly variable around Southern BC (Ruggerone et al., 2018; Grant et al., 2019). To be more specific, Fraser River stocks are experiencing severe declines, while other streams along the South Coast are flat, or even growing, such as Kanaka Creek (Walters, 2019; conversation with Ross Davies, below). The total open-ocean population is dominated by Asian-origin fish—especially Japanese fishery salmon—which have increased in population dramatically over the past half-century. The impact of this increase on wild stocks is unclear; some research on specific areas has found a distinct negative correlation, while the higher-level overviews do not reflect such a trend (Ruggerone et al., 2018). Reflecting the generally flat North American abundance numbers, commercial catches of chum are similarly stable, exhibiting a gradual decline since the highly variable 1960s and '70s. This may be contrasted with other salmon in the area, especially

sockeye, for which commercial catches have plummeted over the past few decades (Grant et al., 2019; Walters et al., 2019).

History and Morphology of Spanish Bank Creek

Spanish Bank Creek flows north from Chancellor Boulevard for approximately one kilometer, then flows under NW Marine Drive, and terminates at a tidal estuary in the Burrard Inlet (figure 1). Logging and urbanization that occurred between the 1860s & 1940s led to ecological disturbances in the watershed of the creek, including a decrease in biodiversity of native species and an increase in water runoff (Reynolds, 2017). Historically, the greater Vancouver region consisted of many streams and creeks covering a distance of 124 km; however, by 1998, only 10km of open streams remained (Reynolds, 2017). Anecdotal evidence suggests that Spanish Bank Creek supported chum and coho salmon and cutthroat trout in the 1920s (Page & Eymann, 1994).

Restoration of the creek was initiated in 1999 and supported by the Spanish Bank Streamkeepers. A section of the culvert connecting Spanish Bank Creek and Burrard Inlet was daylighted. This culvert was chosen because it was the only location that would have allowed salmon to access the creek. Riparian vegetation was also restored around the lower reaches of the stream. An off-channel pond was created in 2004 and was connected to the creek (Reynolds, 2017). This pond serves as a refuge for fry who would have otherwise been washed out to sea by periods of flash flow—frequent in the stream due to its straight, relatively unobstructed course. It is important to note that the creek's estuary was not restored (see figure 4).

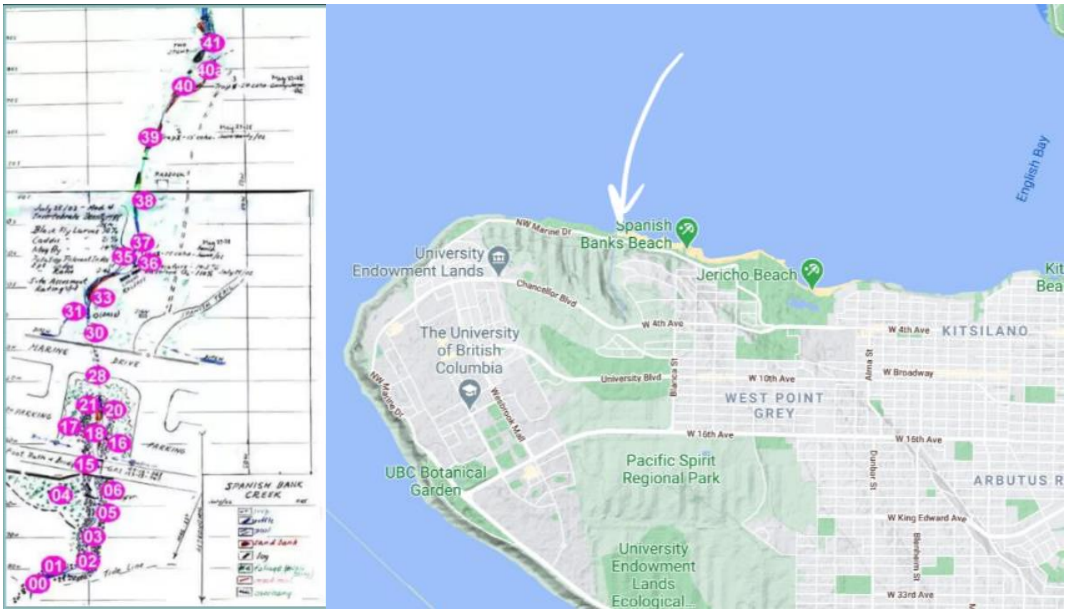

Figure 1. map of Spanish Bank Creek and location on Point Grey

Spanish Bank Streamkeepers:

The Spanish Bank Streamkeepers (SBSk) is an organization of volunteers who have partnered with government departments and agencies, including Fisheries and Oceans Canada (DFO), to renew and revive the streams of Spanish Bank—in particular, the eponymous Spanish Bank Creek. Their main objective is to safeguard salmonid species and provide educational experiences to students and local community members regarding the importance of preserving and restoring salmonid habitats. The SBSK intends to restore Spanish Bank Creek to a consistent chum & coho-bearing stream. This project will be implemented in direct collaboration with Richard and Jilian Scarth, two streamkeepers who dedicate their time and effort to this stream's success and continue to provide their expertise and advice.

Chum salmon life cycle:

Spanish Bank Creek is home to both chum and coho salmon; however, this project will focus on chum salmon and their diminishing returns to Spanish Bank Creek, as coho returns have been stable. Chum salmon leave their redds in early spring and enter the stream as alevins. They imprint upon the stream for 2-3 weeks and then begin migrating down the stream from mid-March to the

end of April, becoming fry (Beacham & Murray, 1986). Once the chum fry leave the creek proper, they stay in the stream's estuary for the summer, becoming acclimated to saltwater, and then leave the Burrard Inlet and head offshore toward the open ocean (Holt et al., 2018). At this point, the fish migrate northwards, then eastwards, arriving at the Alaska current (Debertin et al., 2017). They live, as all Pacific salmon do, in the ocean for their adult lives, until the rising water temperature in their final spring triggers their return to coastal areas (Debertin et al., 2017). Their spawning period extends from September to January, and their death follows (figure 2).

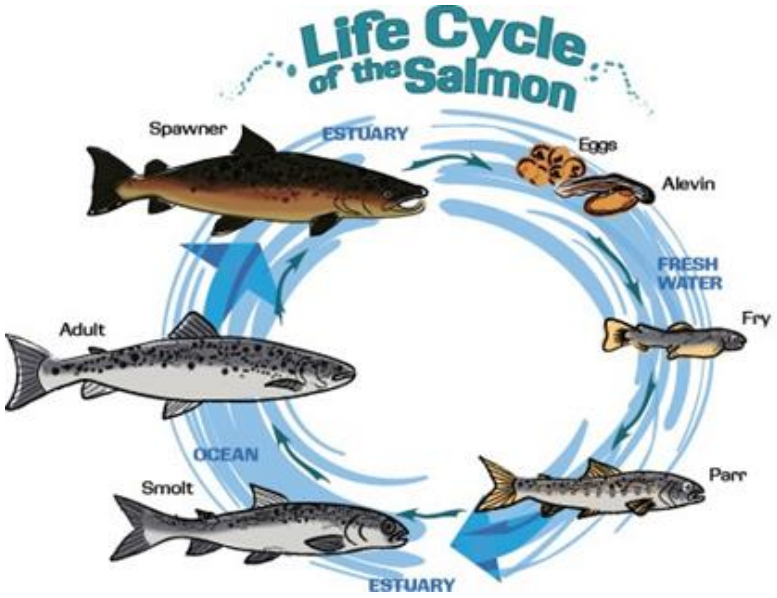

Figure 2. the life cycle of salmon (Ragan, 2015)

Chum salmon at Spanish Bank Creek were released for the first time in the year 2000. That year, and in every year since, DFO and the Streamkeepers have released 30 thousand chum fry into the stream between April and May, half of which are hatched in Kanaka Creek. Their first chum returns, a total of 65 fish, were witnessed in 2004. However, subsequent years were less successful, with some recording zero chum returns (figure 3). This decrease led to questions regarding the marine and in-stream factors responsible.

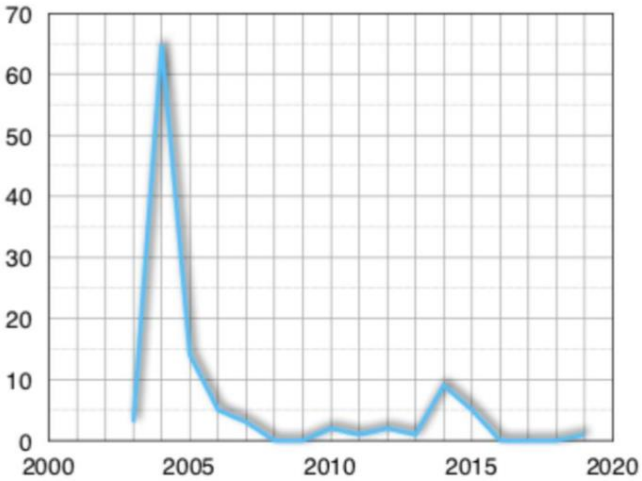

Figure 3. chum returns to Spanish Bank Creek since it was daylighted in 2000.

Research Objectives

This project aims to evaluate several marine and in-stream factors that could be impacting chum salmon returns in Spanish Bank Creek in order to determine if and how the stream environment and fry release process can be modified to improve returns. The factors include estuary conditions (or lack thereof), stream water quality, stream morphology, canopy cover, insufficient imprintation, and environmental conditions, and will be selected based on literature review, availability of data, and expert opinion. Secondary objectives include creating a more comprehensive and digitized database that can be used for future research, as well as presenting the work in a format that is accessible to the public and conducive to education.

The primary stakeholders in this project are the Spanish Bank Streamkeepers, who include local community members, along with representatives of DFO who have been providing the chum fry being released into the creek. The SBSK's motivation for this project is rooted in the educational opportunities it presents, and in the desire for students involved in raising and releasing chum fry to see their fish return 3 or 4 years later. Therefore, those students would be impacted by this work as well.

Questions:

1. Why are chum returns in Spanish Bank Creek low, despite initially being successful?
    a. Is the lack of nutrients, food and shelter normally provided by an estuary causing the fish to die shortly after leaving the creek?
    b. Are the temperature, pH or oxygen level in the creek preventing the chum from growing and reproducing sufficiently to survive in the ocean?
    c. Is the low and flashy streamflow or sedimentation preventing chum from re-entering the stream as adults?
    d. Is there insufficient canopy cover to provide a suitable habitat for chum?
    e. Are chum failing to imprint on Spanish Bank Creek after being born in the Kanaka Creek hatchery?
2. How can we best communicate and take action on our results while upholding the SBSK's role as childhood and public educators in the community?

Context

Imprintation:

Chum salmon imprint as juveniles in their natal stream. The fish use olfaction to imprint and, as adults, can identify their natal streams when their spawning time approaches. SNAP 25 is a protein responsible for pre-synaptic functions, imprinting, and memory in the brain of chum salmon, and amino acids constitute many of the odorants used in the imprinting-homing process (Abe et al., 2018; Yamamoto et al., 2013). The development of olfactory receptor neurons in the chum lifecycle controls the process of imprinting. Research shows that chum only develop 5 of their 18 olfactory membranes as fry before they imprint on the stream and begin migrating seaward—a factor that may be relevant in the case of diminished imprinting effectiveness (Kudo et al., 2009).

Half of the chum released yearly at the Spanish Bank Creeks arrive from a hatchery located at Kanaka Creek. This leaves the chum with 2-3 days to imprint on Spanish Bank Creek, a short

timeframe, which may be insufficient for this process. The imprinting of fry on the creek is an essential process, as it guides the homing responsible for the fish's return to the stream. This raises questions about whether the chum are returning to Kanaka Creek, where they were hatched, instead of Spanish Bank Creek.

Estuary Conditions:

The second part of the salmon's life cycle takes place in the estuary. Chum salmon spend 3-4 months in their estuary after leaving their natal stream, so the conditions they experience in the estuary are significant. One study conducted in various estuaries along the coast of British Columbia found that food abundance is an indicator of salmon population abundance in estuaries (Healey, 1982). The study adds that the estuary's carrying capacity for juvenile salmon is influenced by the estuary's morphology, food availability, secondary river channels, and streamflow. For the estuary to retain high carrying capacities of juvenile chum salmon, optimal conditions in the estuary must be maintained (Healey, 1982). The estuary of Spanish Bank Creek has not been restored or monitored (Figure 4). This raises questions concerning the estuary's condition: food availability, temperature, morphology, pH, dissolved oxygen, etc., and those factors' impacts on juvenile chum.

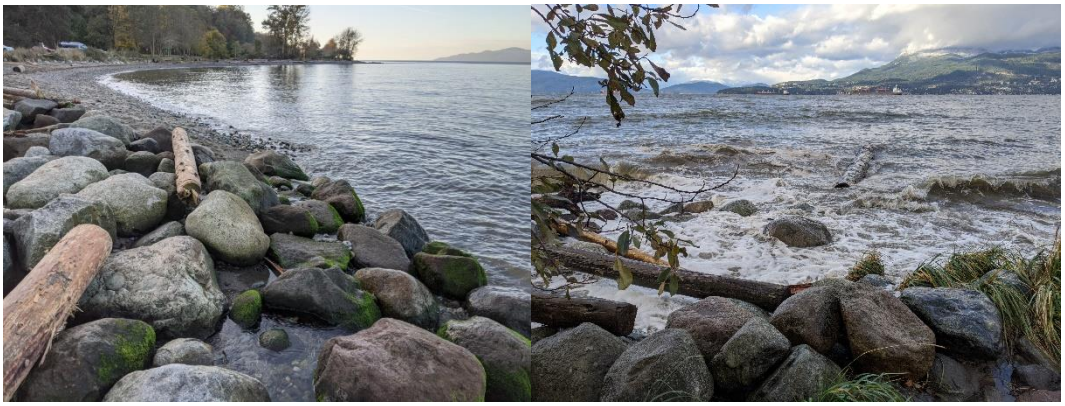

Figure 4. the unrestored estuary at mid-tide + low flow; and perigean spring tide + high flow

Stream Water quality:

High-quality water is essential for the development of juvenile chum salmon, habitat homing, and spawning of adult chum. Temperature, dissolved oxygen, and pH are three water quality indicators that can affect chum salmon mortality. In one study in the Fraser River, the emergence and survival of chum alevins ranged from 90-99% when the water temperature was 8°. Survival decreased to a low of 60% once the temperature rose to 12° (Beacham & Murray, 1986). Another study on various salmonids revealed that temperatures over 12-17° (depending on species) inhibit gill ATPase necessary for osmoregulation in seawater. This inhibition is associated with the loss of migratory behaviour in juvenile salmonids (Richter & Kolmes, 2005).

Further studies in southern British Columbia have shown that increases in ocean temperature affect the growth of chum salmon by decreasing their size and delaying their maturity (Debertin et al., 2017). This is concerning, as numerous studies & expert opinions indicate that larger females are more fecund and better at finding spawning locations and protecting their eggs (by digging deeper egg pockets) than smaller females are. Moreover, increased mortality in salmon is associated with a reduction in size-at-age (Debertin et al., 2017). A study conducted on chum in Alaska also confirmed that faster juvenile growth and larger body size are positively correlated with survival (Kohan et al., 2019).

A study that examined the relationship between 10 stream habitat characteristics and spawning chum and pink salmon density in 44 streams in British Columbia found that pH was the most positive predictor of spawning densities for Chum Salmon. Low pH suppresses reproductive behavior and increases egg and fry mortality in various salmon species. Newly hatched chum fry are particularly sensitive to this effect (Harding et al., 2015).

Another study showed that spawning salmonids could exhibit an avoidance response when dissolved oxygen levels in a stream are insufficient (Carter, 2005). To this point, survival at many stages of life was greatly diminished when dissolved oxygen was below 3 mg/L (Koski, 1981).

All of this information is significant to this project because it reveals the sensitivity of chum salmon to their environment. DFO has data on historical temperatures in Spanish Bank Creek. Once analyzed, this information will help determine whether the creek's temperature is contributing to the poor returns. Dissolved oxygen and pH are not monitored in Spanish Bank Creek, though dissolved oxygen at saturation is negatively correlated with temperature, and so could be estimated, should the need arise.

Sedimentation

The area surrounding Spanish Bank Creek has been logged extensively, and the area's development is ongoing. These land use changes have allowed for higher rates of runoff, carrying large amounts of sediment. Some of this sediment is deposited in the creek, causing blockages and an overall shallowing of the channel. Both of these conditions are less than optimal for the fish's survival (Reynolds, 2017). Additionally, a study conducted by Birtwell (1999) revealed that salmonid species exhibit an avoidance response to highly turbid waters. The deposition of large amounts of sediment into the creek can also lead to lower levels of dissolved oxygen, consequently reducing the survival of eggs, embryos, and alevins (Birtwell, 1999).

Figure 5. A highly sedimented stretch of Spanish Bank Creek (Reynolds, 2017)

Relevance of project:

The research conducted for this project will help establish guidelines for potential future modification of the creek, so as to increase the likelihood of hosting a successful chum run in the

future. Chum's return to Spanish Bank Creek will enhance the creek's biodiversity and terrestrial and aquatic productivity. Salmon are a keystone species in Pacific Northwest ecosystems, and increase biodiversity by both providing a food source for predators and fertilizing terrestrial organisms once they die. Due to climate change, small water bodies, including creeks, will face changes in their water composition, species biodiversity, and creek morphology. This can also affect the stream's temperature, sediment concentration, pH, and dissolved oxygen, consequently affecting any restoration efforts. As a result, a more comprehensive system of databasing and analysis would be of considerable benefit, both in 2021 and several years beyond.

Finally, the most important impetus for this project is its ability to provide an educational experience for future generations. The experience is maximized when community members are able to see the complete lifecycle of the chum; from the moment the students release the chum in the stream until they return as adults for spawning. It will provide a learning opportunity regarding the time and effort restoration projects take, and will hopefully influence future generations to undertake similar endeavors. Overall, chum's return to the stream will allow elementary students to collaborate in a joint project and witness how collective efforts can achieve a sustainable future.

Methods

This project may be fundamentally divided into two parts. The first, or investigative, aims to answer the fundamental questions underpinning the project: why are chum salmon failing to return to Spanish Bank Creek, and what can be done to remedy this? To answer these questions, the first step is to consult with experts in the field. These experts may possess the requisite experience to identify a set of problems and potential solutions immediately, or they may be able to suggest some parameters of interest, which may warrant more systematic data collection. Either way, the primary goal of expert consultation is to reduce time spent pursuing unproductive leads, and instead target as closely as possible the most likely culprits.

After the expert consultation begins, and we receive feedback on the most important parameters of interest, we will enter the stage of the project in which we collect data to fill those gaps. Already, several collections of data have been assembled, (enumerated below) and more will be added to the database shortly—though the manner and extent of this depends, again, on the judgments of the experts consulted. Three categories of information will be collected during this stage of the project. The first is first-hand, physical data, which will be collected by one or both members of the group living in Vancouver. The second is second- or third-hand data, collected by individuals or agencies before us, which could be recovered by any member—a fair amount of which has already been acquired, in the form of Ron Gruber's field notes & the detailed map of the stream. The third is information in the form of expert opinion. The collection of this information will begin imminently, through both online and in-person communications. Of critical note is the fact that all three forms of information are iterative. The more expert opinions we receive, the more data we will collect, and the more data we collect, the more questions we will pose to the experts.

After the data is collected, we will move into the analysis phase of the project. The two phases may overlap, due to the inherently iterative nature of a question with infinitely many potential solutions; but at the very least, each piece of data will be organized and databased as it is collected. For a similar reason, we cannot be certain precisely what forms of analysis will be done; everything is conditional. However, we can ensure that a digital map of the stream will be made in ArcGIS, that a factor analysis will be conducted on the salmon returns, and that all the miscellaneous observational information on the stream will be logged for potential future reference (presence of mink, for instance). Whatever we will pursue above and beyond this is yet to be determined.

Finally, we move into the second, or communicative part of the project. The primary deliverable will be in the form of a website, which will present our data and the conclusions of the project in a form suitable for both documentation—as work on the stream will certainly continue

beyond the end of this year—and education—as the Scarths have indicated that educating students about salmon is one of, if not the, most important goals of the entire salmon reintroduction project.

Preliminary Data Collection

Current observations of Spanish Bank Creek

Photos and descriptions of stream morphology and the surrounding environment, general observations about water conditions and temperature recordings in 3 locations. Recorded by Mark Pope on 31 October & 13 November 2020, and particularly valuable because not all members are in Vancouver and can view the creek themselves.

Ron Gruber's field notes

Field notes recorded by Ron Gruber from 2004-2014 and meeting minutes from SBSK meetings (refer to Appendix A). Includes observations of salmon and predator sightings, changes in creek morphology, environmental modifications, important weather events, fry release numbers, and meetings with various educational institutions. This is the bulk of data the SBSK has from the past 16 years. The information pertaining to salmon returns has been converted to a spreadsheet.

Detailed stream map

A detailed physical map of the stream, which will be converted into a digital form in ArcGIS. Does not include the most recent alterations to the stream area, but will act as an extremely useful tool for planning, as well as for the conveyance of information to group members & experts who may not be able to see the stream in person.

Minutes from interviews with experts

Ross Davies from Kanaka Education & Environmental Partnership Society (KEEPS) has over 20 years of experience working with chum hatcheries and salmon education programs. He provided valuable insight into potential factors behind the poor chum return, along with information about the hatchery-raised fry released in Spanish Bank creek (as they come

from Kanaka Creek). He will also be providing us with a list of other streams that receive chum fry from Kanaka and data on the water quality at Kanaka.

Sandie Hollick-Kenyon from the DFO was involved in the original daylighting of Spanish Bank Creek and is the individual most directly responsible for the continuing deposition of chum fry into the creek. She provided us with a more complete picture of the history of chum in the stream and suggested potential factors behind the poor returns. She will also be providing us with release and water temperature data for Spanish Bank Creek.

Implications

The overall conclusions regarding which factors are resulting in poor chum returns will be used to either guide modifications to the Spanish Bank Creek ecosystem and the fry release process, or inform the decision to stop expending resources on an issue beyond the SBSK's control. If no significant results are found, suggestions for future data collection will be used to guide the SBSK's future methods and potentially a second project of this type. On a larger scale, the results will be presented on an expanded SBSK website, so that they may be used to further the SBSK's role as educators in the community. Additionally, work to restore Spanish Bank Creek, including lessons learned, can be used to justify and support restoration efforts in other urban streams throughout Metro Vancouver—particularly those of the Jericho Lands, just 2 km to the east.

Team

Sara Alshanteer is a fourth year double major student. Sara's first major is Environmental Sciences with a concentration in land, air, ocean, and freshwater systems, whereas her second is English Literature. She has a background in ArcGIS, freshwater hydrology, and marine biology and microbiology. Sara is currently enrolled in a marine pollution course and aqueous environmental chemistry course.

Jessica Brown is in her fourth year of Environmental Sciences with a concentration on land, air, ocean, and freshwater systems. She has a background in data science with experience using ArcGIS, Python, R and Excel. She has also taken several courses on freshwater hydrology and is currently enrolled in an introductory oceanography course.

Mark Pope is a fourth year Environmental Sciences student with a concentration in land, air, ocean, and freshwater systems. Mark has worked as a nurseryman, stream water quality tester, and data aggregator for various projects. He is especially capable in MATLAB & Excel, and has taken enough hydrology (freshwater, marine, and sub-surface) courses to have a functional understanding of most processes at play in streams such as Spanish Bank Creek.

Joshua Shepherd is a fourth year Environmental Sciences student concentrating on ecology and conservation. Additionally, Josh is pursuing a minor in First Nations and Indigenous studies. Josh has worked for Fisheries and Oceans Canada since September 2019 supporting the development of operational polices and negotiation of Treaty and Reconciliation agreements. Josh has developed his understanding of ecology, including Pacific salmon ecology, through relevant coursework.

Timeline

The timeline for this project is visible in the attached PDF. Some task assignments and dates are subject to reasonable change. Note, the full chart is not shown for clarity, but all key tasks and dates are listed.

Budget

The budget for this project will be negligible. To the extent that any equipment or resources are required, all will either be of insignificant cost, or will be acquirable from the University or from Fisheries & Oceans Canada. Of particular note is a datalogger, which may be requested if expert opinion deems its information necessary, either through DFO's datalogger request process or through UBC's EOAS or Hydrology departments.

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Appendix

A sample of Ron Gruber's field notes:

June 19 2002

d) Water sampling at Chancellor Blvd: Bob reported on the results of water samples collected by Sandie and Ron, that he had analysed. The results did not disclose anything unusual other than a higher than normal iron content, probably coming from the culvert pipe and fill under Chancellor Blvd.

e) Fry trapping: May 28 - 29/02 six 1/8" mesh net traps were used. 111 coho fry were captured with an average size of 5.2cm to 5.6cm. As a number of fry were captured above, what was thought to be an impassible cascade, there was discussion/speculation that one or more adult pairs had spawned above the cascade.

3) The third order of business was the treasurer's report: As Maurice had only just been appointed, he advised that the bank account had been set up and that he was working on budgetary matters, such as source and application of funds.
Account balance: $260.96 @ June 19/02

4) The fourth order of business was a review of proposed in-stream work projects for the Aug/Sept work window:
a) Ron reported on his on-site consultation with Scott Ducharme in regards to 5 spots needing habitat improvement/enhancement:
i) Pool immediately below the bridge: Action, dig out silt from around existing habitat log.
ii) Pool above the bridge: Action, dig out silt to deepen existing channels.

MEETING OF THE SPANISH BANK STREAMKEEPERS GROUP
Held at Aberthau on Jan.20/04 at 1 pm.

Present: Dick and Jilian Scarth, Maurice LeGallais, Ron Gruber, Sandie Hollick-Kenyon, Cal Easter, ZoAnn Marten, Ken Fowler; arriving later: Kathy Chambers, Bob Seraphim. Dick chaired the meeting.

1. The first order of business was a review of events, by Dick, since the last meeting Nov.22/02.
   a) Trapping for fish presence: Ron reported trapping 51 pre-smolt (7.5 to 10.5 cm) over Mar. 11-12/03. Six traps were used with 32 Coho caught in one trap.
   b) Chum drop: On Apr.15 & 22, & May 5, 32000 Chum fry provided by Federal Fisheries were released by several volunteers. Sandie reported that the same program will be done in 2004. Around Apr.4-5 Dick and Norm were involved with the set up of the Chum Drop Platform for Chum release by the school classes. The platform was taken out in June and stored at the GVRD Works yard.
   c) In May/03 there was trapping for emergent Coho fry from the natural spawn from Fall 2002. Result: 3 Coho, 3 large sculpins.
   d) On Aug.14/03 2000 Coho, with adipose fin clipped, were released below Belmont. Sandie advised that they came from Capilano hatchery.
   e) Catching the Spirit kids worked on two projects: Firstly, on July 19/03, under the direction of Ron in-stream habitat improvements were made. Secondly, on Aug.20/03 a fence was constructed blocking off the illegal trail that runs parallel to the stream south of the Chum drop area. (see Fig.1) Dick reported that the GVRD had closed off the top end of that trail. There was some discussion as to whether further closure of the trail was needed. Decided not to do more at this time.
2. Maurice gave the Treasurer's report: He reported that there is $205 in the bank account and very little activity over the past year. Under budget for 2004. Money for Streamkeeper courses, making copies of Bob" map, and signage/art design for information posters are to be included in the 2004 Budget request.
3. Ron gave a chronological report on the Lower Watershed:
   a) Dec.28/02 Ron saw one adult Coho carcass.
   b) Mar./03 through Aug./03 reported under 1 (a) to 1 (e) above.
   c) Sep.30/03 Ron observed that most of the Coho fry from the Aug.14/03 drop had moved downstream above and below the road.
   d) Oct.15-16/03 Extreme high water flow. Ron believes all the Coho fry were blown out of the stream.
   e) Oct. 23/03 One dead Coho adult approx 5 pounds observed.
   f) Oct. 24/03 Two dead Chum adults observed.
   g) Oct. 26/03 One dead Chum adult male observed in the Creek near the bridge, approx. 11-12 pounds. (see Fig.2)
   h) Nov.25/03 One live Jack Coho observed.
   i) Nov. 28/03 A big flood resulting in a lot of silting.

Last meeting November 25, 2004

June 9, 2005

Returning adult salmon fall 2004:

First chum arrived October 18th, last chum arrived November 14th;
59 chum in stream; 6 chum died on beach – total 65.
Put 7 chum carcasses in creek above OCH pond;
First coho arrived November 18th; last coho November 30th (male);
Large female spawned at the mouth of the culvert – eaten by otters Dec. 2nd.

January 16, 2005 - heavy rains for 48 hrs. – historical records broken.
Spanish Bank Creek in flood for 4 days (water temp. 5 – 5.5 degrees C.)
January 18th – washouts on Marine Drive which was closed for 9 days.

February 8, 2005 saw first chum fry at the bridge.
February 14th saw 4 chum fry below culvert.
February 16th arrived to heavy silt in stream from west ditch on Marine Dr.
February 17th Sandie and I found 1 chum fry.

March 4, 2005 saw 8 chum fry at the culvert;
March 7th Norm, Dick and I installed the chum release platform.
March 9th met Matt Foy at the creek and talked of the new culvert and potential new pool on the south side of Marine Drive.
March 10th dug out sand bar cutting off OCH pond;
March 12th replanted salmon berry plants and assorted evergreens salvaged from O.C. Habitat dig in September 2004.
March 18th & 19th Sandie and Scott set traps in O.C.H. and adjoining creek:
caught 9 pre-smolt cohos;
caught 2 salamanders in O.C.H.;
caught 2 chum fry in creek.
March 23rd saw 6 coho fry below "rock pool" 100 metres above twin stumps;
total of 50+ chum fry.
March 23rd took photos of mink sleeping in the sun on stump near the bridge.

April 5, 2005 the beaver arrived (witnessed by a neighbour whose dog got into a "fracas" with same).
April 21st planted 10,000 chum fry; beaver cuttings stopped (believe to have moved on).
April 26th planted 10,000 chum fry.

May 5, 2005 planted 10,000 chum fry; (found dead oolichan at O.C.H. pond).
May 7th saw oolichans being fed on by birds near the anchor.
May 10th oolichans trapped at the mouth of the creek by the dropping tide.

Last meeting → June 20/08 ATT "B"

June 28/08 Norm Walker + R Gruber went to "Ugly Bug Ball" in Surrey
Met many interesting People including Eric Olsen from Noons Creek (end of Burrard Inlet), Fish Hatchery – Took Courses of Salmon – Coho – smolt Trout

July 17/08 I Met Prof. Barry Bond + His UBC. Science Class @ Spanish Bank Creek Gave 45 min. Talk on Hist. of Stream & our endeavours to re-establish Run of Salmon ("4th year") – Talks

July 18/08 Spoke To Rob Knight – "Dept of the Environment – Re Cutthroat Trout + Our Stream – had positive views on Transfer of Trout from Possibly Noons Creek – as" is in Burrard Inlet

July 28th/08 Met Mel Lehan – Tara Gallis + 2 others Suzuki Foundation members @ Spanish Bank Creek – Had Walkabout – Told them of our History – They've interest in Possibilities of Tatlow Creek Restoration

SPANISH BANK STREAMKEEPERS SPRING 2010 MEETING

AGENDA

Date: **Wednesday, February 3rd, 2010**
Time: **1:00 p.m. – 3:00 p.m.**

Place: **Library at Aberthau, WPGCA, cnr. 2nd Ave & Trimble**

1.0 Treasurer's Report (Maurice) $629.50 in bank.

2.0 Field Reports

a) Department of Fisheries & Oceans (Sandie) → no RN's [illegible] at Ck. ; → service awards to Directors
b) Upper Watershed (Maurice) → [illegible] survey.
c) Lower Watershed (Ron) → beaver rectified

3.0 Business Arising from Fall '08 Meeting (Nov.25th)

a) Membership in Musqueam Creek Ecosystem Society

4.0 New Business

UBC program (
a) Salish Creek feasibility study → Ron:
b) Trap Coho Pre-Smolts (Sandie) → march
c) Chum & Coho Drops (Sandie) → 2 x 20,000 chum
d) Invertebrate Count (Richard) Sandie
e) Ivy pull with CtS (Dick) ok
f) Stream rehabilitation with CtS (Ron) ok.

5.0 Next Meeting

Ron's LW Repr.
* from Nov 25/08

(1) small salmon off-shore fall → spring
(2) swiss lecturer: climate change re brown trout > water temp, glacier retreat. climate ch. start '87-'88.
(3) Conference in [illegible]/09: emphasis on wild salmon – [illegible] be [illegible] "ranch" salmon vs farm salmon; salmon moving North because of warm water, withdrawing [illegible] from southern rivers (in US).