

# The Millstone Coho Project

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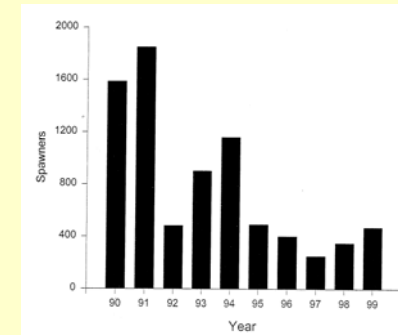
# Topics:

## 1) Coho 101 – Life history and ecology



## 2) Where have all the coho gone?

- decline in SOG coho in the '90s
- some reasons for the decline

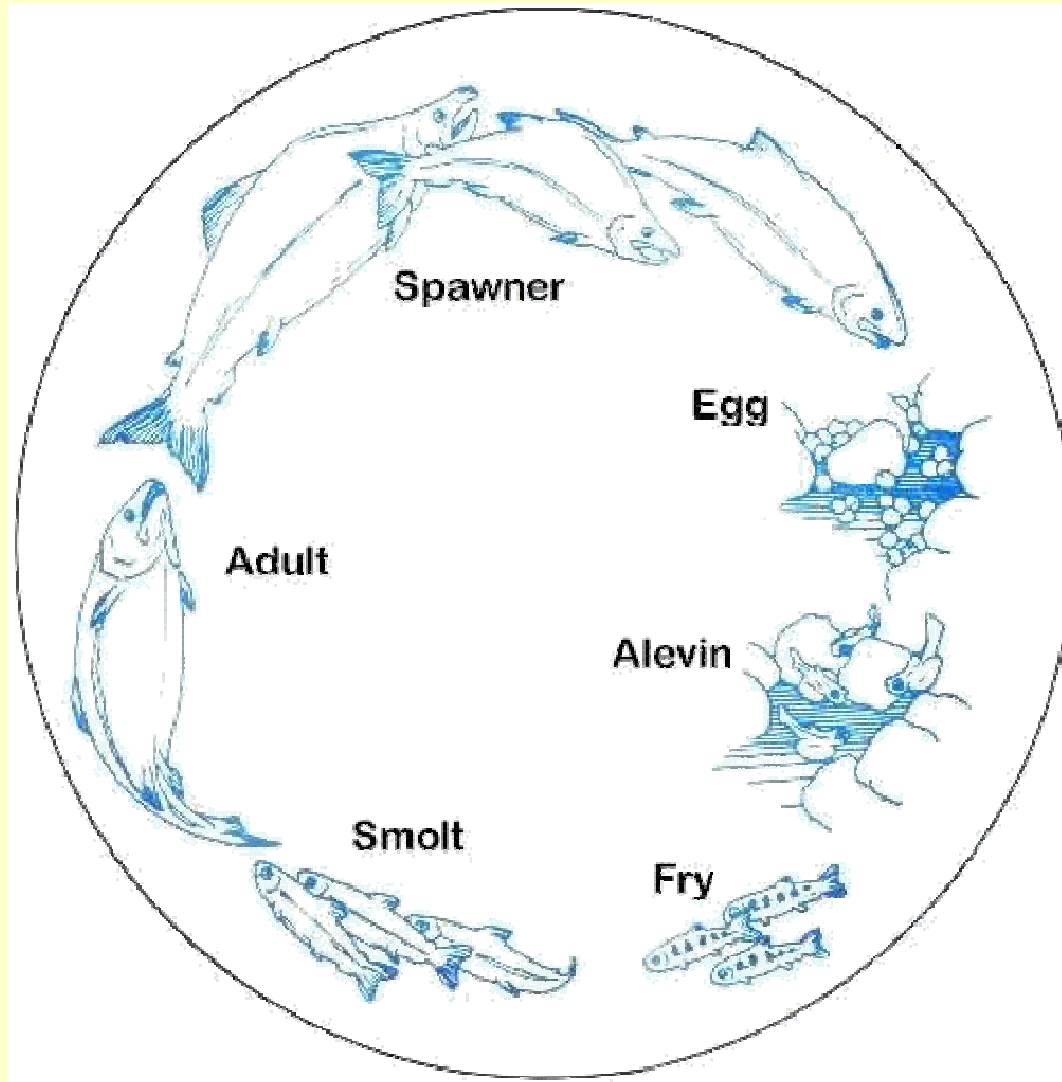


## 3) Bringing them back

- Millstone coho project as an example



# 1) Salmon Life Cycle:



## Coho salmon fry:



### ID features:

- Adipose fin like all salmonids
- Large eyes relative to body
- Large parr marks
- Anal fin is "sickle-shaped",
- The leading edges of the anal and dorsal fins have white followed by black
- No spots on fins
- Orange colour on fins

## Coho salmon fry:



### Life History Notes:

- Juvenile coho generally rear in streams for 1-2 years, and prefer pool habitats
- Good coho streams have ~50% pools by area
- Life history is quite variable however, including river, lake and estuarine forms with different colouration and body types
- Stream coho fry are active daytime feeders, specializing mainly on “drift” (e.g. aquatic insects)
- They set up feeding stations and are quite territorial, chasing off competitors
- Over-wintering parr will move into off-channel swamps and sloughs to get out of the mainstems during high flow periods

## Bucket ID – Cutthroat trout vs Coho fry



# Coho smolts



- After 1 or 2 years in FW, coho undergo a parr-smolt transformation where they silver up in colour, pre-adapt for living in SW and begin migrating downstream to live in the ocean
- The spring smolt migration is cued by changes in photoperiod (i.e., increasing light), and rising temperatures and flows
- Coho smolts feed in the estuary on benthic invertebrates and small fish for a few months before moving offshore

## Coho Salmon at Sea



- Coho in the ocean are characterized by their white gums, thick caudals, and tail spots on the upper lobe only.
- BC coho tend to migrate northward after leaving the estuaries
- A coho's ocean diet includes invertebrates (e.g., krill and crab larvae) and "small silvery fish" (e.g., anchovy, smelt, sand lance, herring, sardine)
- Coho typically spend 18 months at sea, and a large part of their growth occurs in the last 4 months on their return trip, where they can more than double their size
- West coast coho are known to grow larger than SOG coho



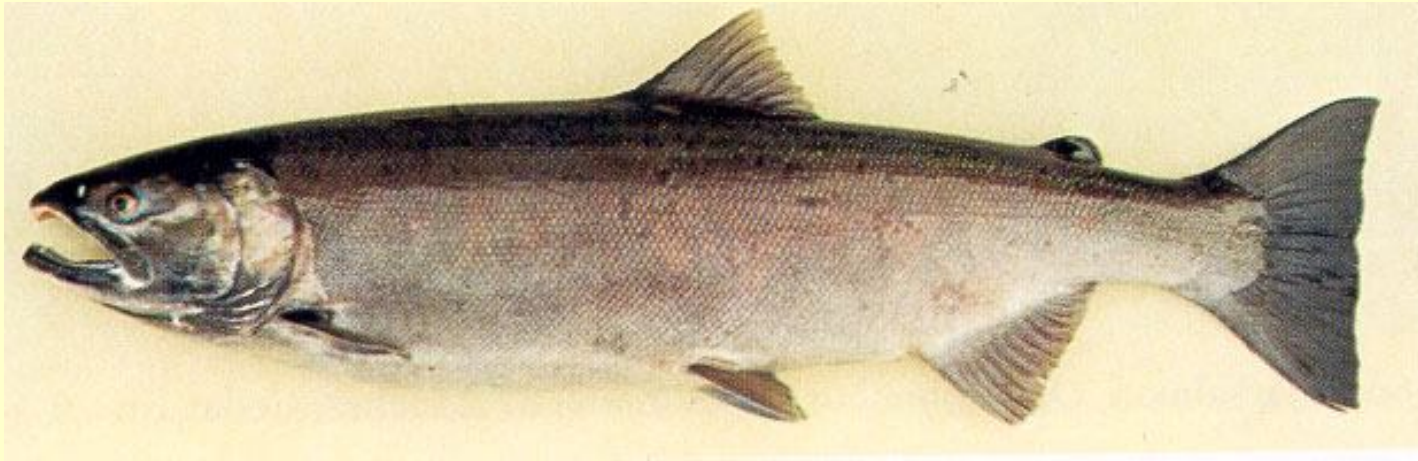
## Coho salmon spawners in FW



- Coho salmon return to their natal streams and rivers to spawn at 3 or 4 years of age; jacks return at age 2 after only 4 months in SW
- Males have a dark green, spotted back and head with red sides
- They also develop a large hook in the upper jaw ("kype") and the nostrils are white



## Coho salmon – *Adult female*



- Female coho are not as strongly coloured as males and lack the pronounced hooked snout
- Fecundity for coho females ranges from 2,000-4,000, depending on fish size

## Coho salmon spawning



- Timing of stream entry depends on location and they may spawn anytime between October and March
- Coho prefer small streams for spawning and may travel to headwater tributaries of larger river systems
- Coho on VI typically wait for a storm event to raise water levels and increase turbidity; both provide cover for the migrating adults
- Because of their vulnerability to predation in small streams, coho hide in deep pools and under cutbanks during the day and travel to spawning grounds at night

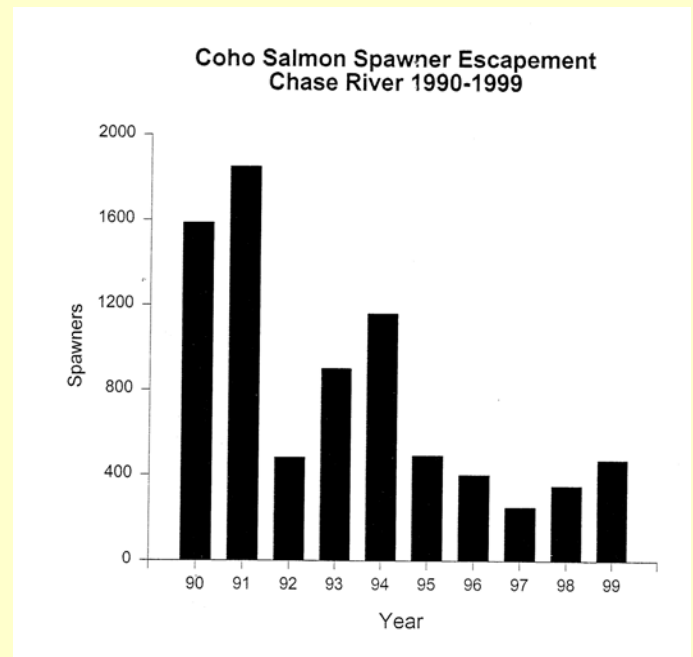
## Coho salmon spawning



- Coho will often choose the interface between pools and riffles (aka Pool tail-outs) to dig their redds
- Cutbanks or logs nearby provide cover between spawnings
- Stream life for coho spawners is about 2 weeks
- The female is the last to die and will sit on the redd and protect it from other spawning females

## 2) **SOG Coho decline** – the Coho crisis of the 90s

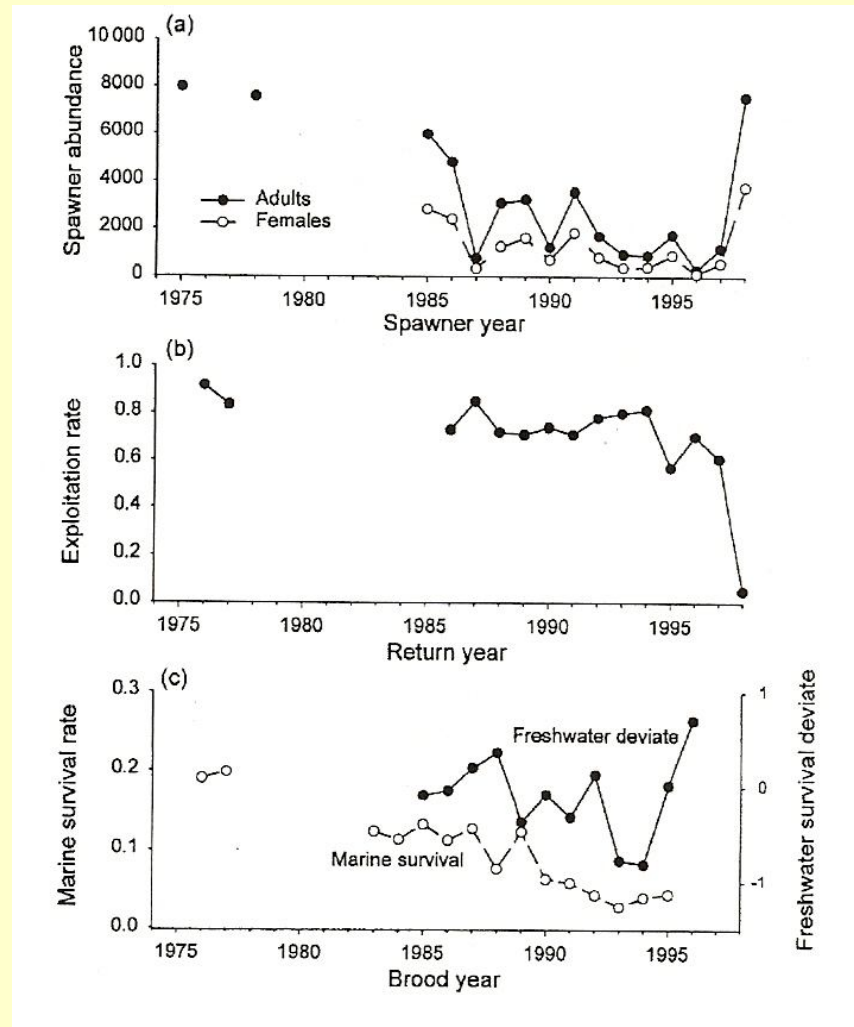
- During the 1960s and 70s, there was a popular coho fishery in the Strait of Georgia
- By the early 1990s however, the returns of coho to our local waters were in decline
- In 1998, coho fishing was closed in the SOG
- What caused these declines?



# Reasons behind the decline in SOG Coho

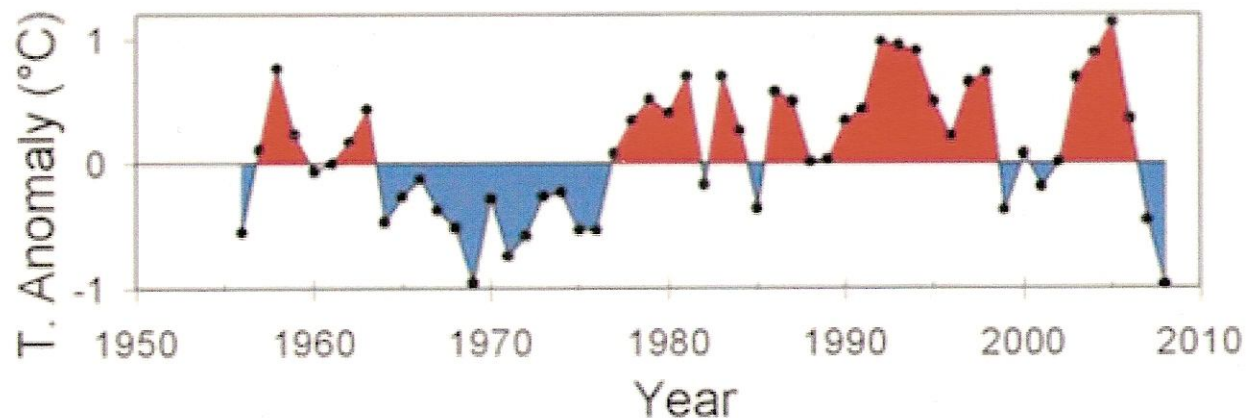
- Exploitation rates for coho in the commercial and sport fisheries were high in the 70s and 80s
- 80-85% of the fish returning to the SOG were harvested
- This was ok as long as marine survival rates were 10-20% (i.e., enough fish came back to spawn)
- But in the late '80s and early '90s, marine survival rates (msr) declined to 2-3% while exploitation rates remained high
- The result was not enough fish came back to spawn to replenish the next generation
- Why did MSR ↓ ?

## Black Creek



# El Nino happened

- El Nino refers to a warmer water current that moves from the southern hemisphere into the northern hemisphere
- El Nino events have become more common in the last few decades



Temperature Changes in the North Pacific Ocean over the past 55 years

# El Nino effects

- El Nino events result in higher surface water temps, lower surface salinities, weaker nutrient upwelling and changes in winds/currents that elevate sea levels (10-20 cm)
- For SOG coho, this meant a less salty and warmer Strait during their first months at sea
- Weaker nutrient upwelling also means less zooplankton and thus less forage fish (e.g., herring) for coho to feed on
- The result of this is lower growth and poorer survival of ocean coho during El Nino years



# El Nino effects

- For west coast Coho, the 1992 El Nino also brought a new predator to the scene
- Chub mackerel feed on salmon smolts, and so have some effect on coho stocks during El Nino events



# El Nino isn't all bad though, depending on what you fish...

- Albacore tuna and sardine populations increase during El Nino years, as they are warmer water species



# For Coho there was a double whammy affecting their recovery in the SOG

- Coho salmon spend the most time in FW as juveniles compared to the other salmon species

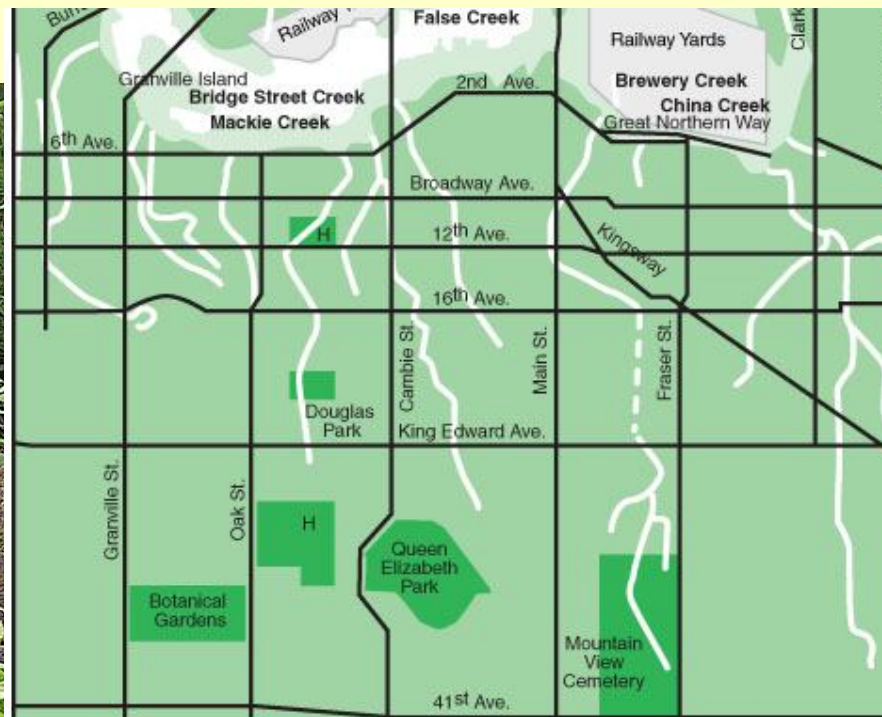


- And they rely on small streams to spawn and rear in on VI
- Increased urbanization has had a negative effect on coho streams on the east coast of VI and the lower mainland



# The Lost Streams of Vancouver

- Smaller streams have been “culverted over” or filled in completely during urban development. These were often important coho and resident trout streams. Impacts are cumulative – a death by a thousand cuts.
- Efforts have been made to “daylight” some of these streams (e.g., Still Creek, Spanish Banks Creek)



# The LA River – an Engineers Dream, An Anglers Nightmare



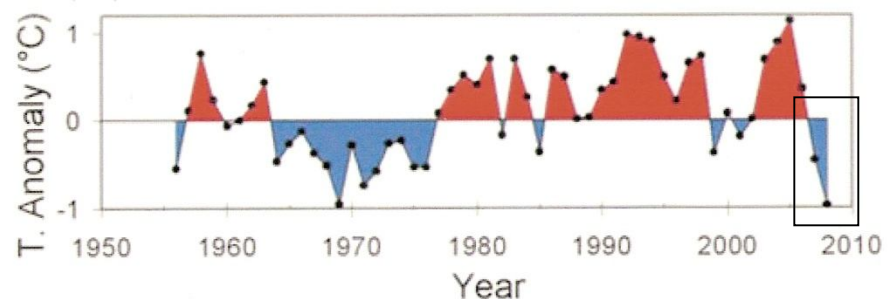
# SOG Coho

- The combined effects of climate change on ocean conditions and freshwater habitat damage resulted in the decline of coho stocks in the SOG and many other BC river systems such as the Thompson
- But salmon are a resilient species and recovery is possible!



### 3) Bringing them back -

- Short of ending global warming (any ideas?), it is difficult to make significant changes in ocean conditions
- The NPO has been a been cooler in the last few years, which is good for salmon productivity
- Changes in fisheries have taken place in the last decade (e.g., re-allocation, hatchery only) to regulate harvest



Temperature Changes in the North Pacific Ocean over the past 55 years

# Habitat Restoration

- A lot of effort has gone into restoring in-stream and riparian habitat in the last decade
- For coho in particular, the focus has been on creating pool habitats, providing in-stream cover (e.g., LWD, Boulders) and adding spawning gravel





# Millstone Coho Side-Channel Project

- The Millstone River in Nanaimo supports a spawning run of pink and chum salmon in its lower reaches but, until recently, coho salmon returning to the river have had their access blocked by an impassable water fall located within Bowen Park



# Millstone Side-Channel Project

- In Oct 2007, DFO in partnership with the City of Nanaimo, IWFF, NFGC and others, completed construction of an 800-m bypass channel around the falls
- Returning adult coho now have access to the upper Millstone watershed for spawning and rearing, as well as in the channel itself



# RMOT and the Millstone

- Students and faculty from the Resource Management Officer Technology (RMOT) Diploma and Bachelor of Natural Resource Protection (BNRP) Degree programs at Vancouver Island University (VIU) are using the Millstone side channel in Bowen Park as an Outdoor Classroom
- Over 50 students have carried out water quality, benthic invertebrate and fish monitoring projects in the side channel since it was constructed in 2007 to provide upstream access for fish past the falls in the park



# RMOT and the Millstone

- The RMOT students have worked hand in hand with organizations such as the City of Nanaimo, DFO, the Nanaimo Fish and Game Club, Island Water Fly Fishers, the Nanaimo River Hatchery and Friends of the Millstone to turn the Millstone into a successful coho salmon river



# RMOT and the Millstone

- The Millstone channel has provided an excellent opportunity for students to learn hands on skills in fisheries management and community stewardship, right in the heart of Nanaimo



# RMOT and the Millstone

- Each fall, the RMOT students have been walking the side channel to count returning coho salmon spawners, observing them on a digital video recorder system installed in the channel, and more recently have been following their migration upstream using radio-telemetry (i.e., tag and track)



## Recent Project Highlights – Coho count

- During the fall of 2010, almost 450 coho were counted in the Millstone system – ~60 spawning in the side-channel and the rest moving upstream past the camera



Other salmon species were seen as well

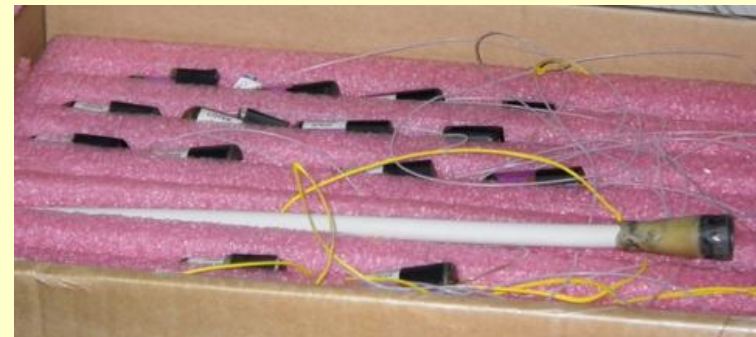


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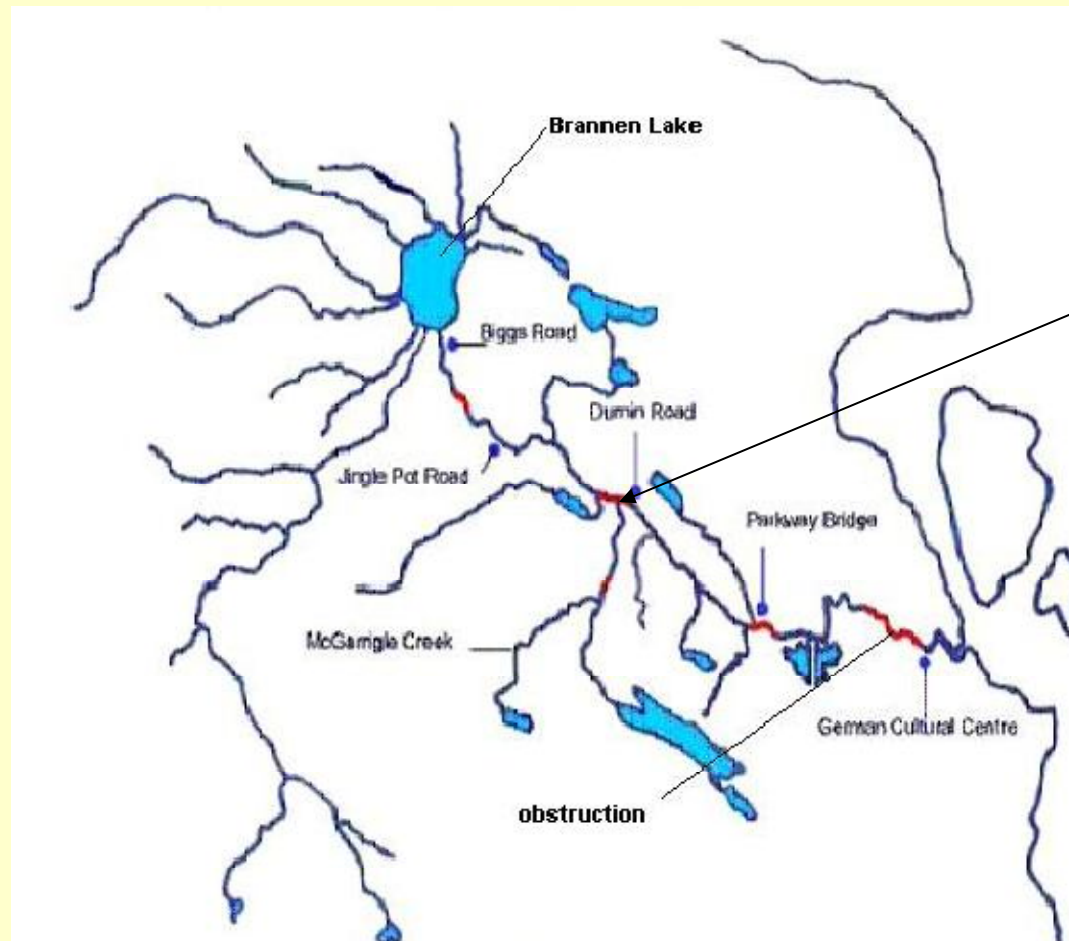
# Radio-tagging Project

- During the fall of 2010, 4 coho adults were captured by beach seining the settling pond at the top end of the side-channel, fitted with radio-transmitters and manually tracked to monitor their movements
- IWFF members helped out with this project well into December



# Radio-tagging Project

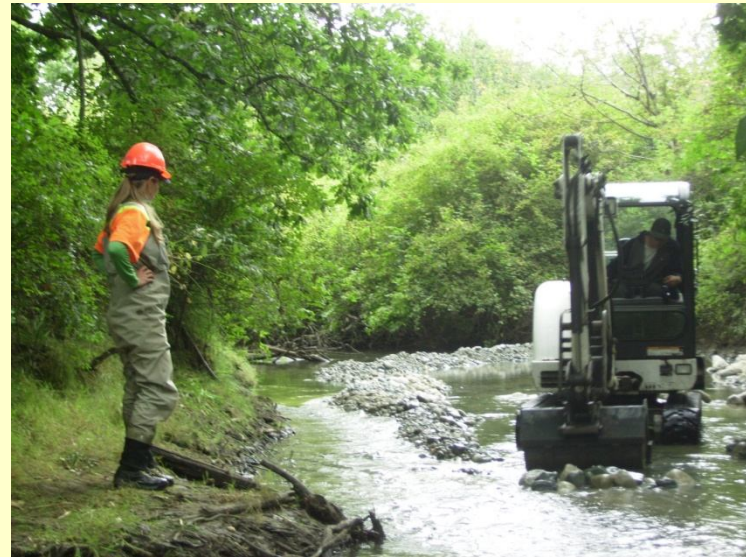
- 3 of the tagged fish remained in the side-channel to spawn, while 1 moved up to spawn in the Millstone mainstem near Maxey and Newfield Roads in the East Wellington area



Location  
of tagged  
coho

# Millstone Gravel Placements

- During the summer of 2011, spawning gravel was placed in the side-channel as well as the Millstone mainstem near the Pryde Vista Golf course
- The work was completed by C Thirkill and BCCF and both projects were funded by PSF
- The gravel placements will be monitored this fall to see if they are used by coho spawners



# Future Millstone Projects

- Funds have been obtained from VIU to design and install a trap in the fishway; this should make it easier to capture the coho for further tagging and tracking studies
- Habitat surveys of tributary streams will be conducted to assess rearing and spawning habitat; Darough Creek will be surveyed this fall
- Several other fish species besides coho now have access to the upper Millstone watershed, e.g., cutthroat trout, lamprey, etc. Monitoring of cutthroat trout may be conducted in the future



# Future Millstone Projects

- VIU may host a Millstone Symposium in 2013
- The long-term goal of the project is to establish a beach fishery for coho in the Nanaimo area

