

# Briefing on Cowichan Chinook and water.

Cowichan chinook are a key indicator species. Each species of salmon (chinook fall run, chinook spring/summer run, coho, chum, pink, steelhead) which inhabit the Cowichan watershed have different life histories and slightly different water needs. This presentation will show how key species are vulnerable to water level, flow, temperature, and other critical habitat.

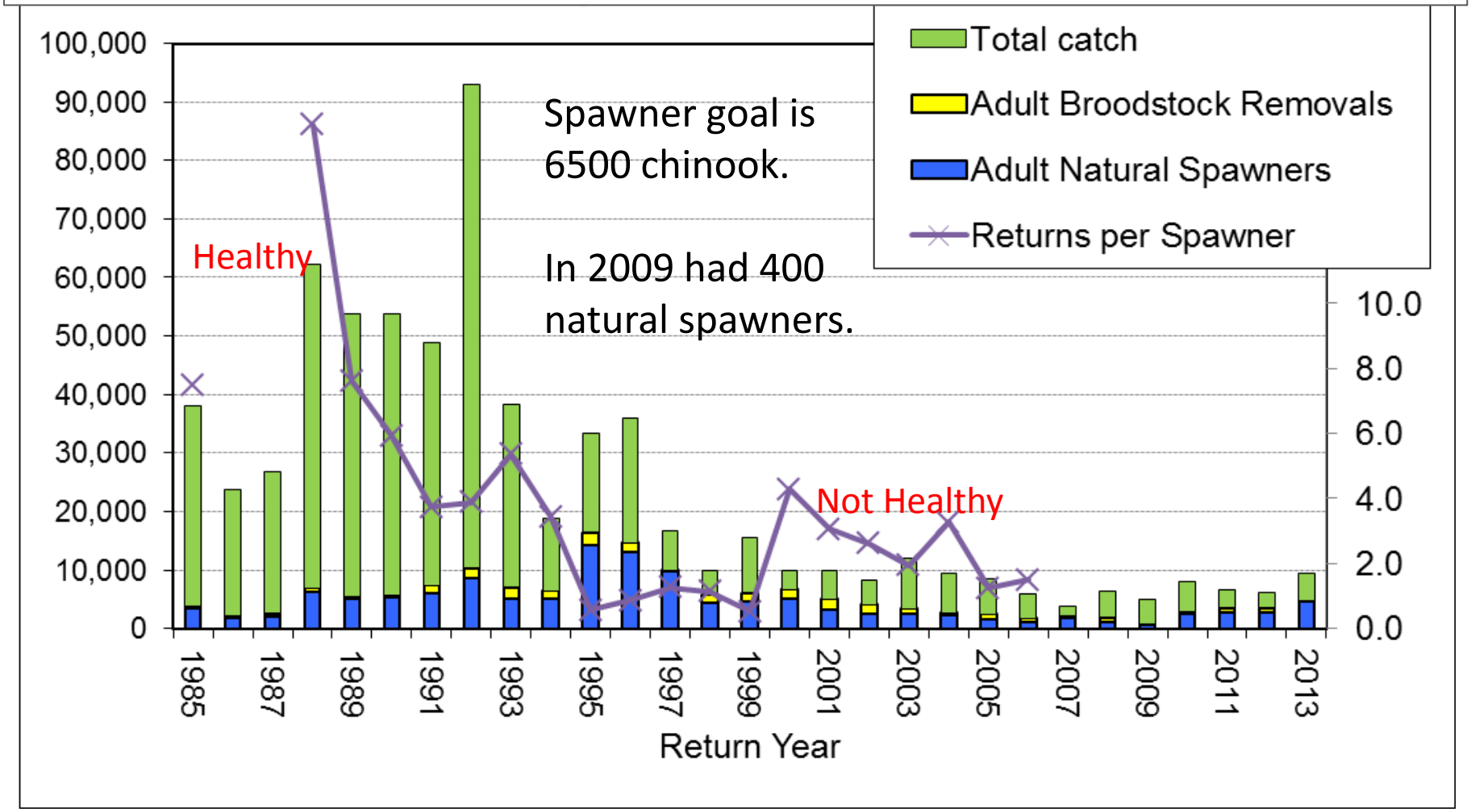
# Do we have a common vision?

- Watershed health …. Also means salmon health.
- Or agree that Salmon are a keystone indicator of watershed (ecosystem) health.
- Picked Cowichan River fall run ocean type Cowichan/Koksilah chinook as main indicator, but also acknowledge spring/summer run chinook, steelhead, coho, chum.

We have winning conditions:

- *common vision,*
- *knowledge & understanding,*
- *community engagement,*
- *good governance,*
- *funding (at least bettter than most areas),*

# The decline in Cowichan fall chinook productivity (Returns per spawner) started in 1994 with all time low in 2009.



# Why the decline in productivity? From 2005-2013 experts identified High Priority Risks

**HIGHEST PRIORITY RISKS…**

1. Poor inriver and estuary rearing habitat creates small weak chinook smolts which do not survive the early marine phase… due to
   - Fine sediment loading reducing productivity of mid to lower river – sluffing of Stoltz bluff
   - Large sediment loading – gravel accumulation in lower river
   - Poor estuary habitat
2. Lack of water for various life history stages → *focus for this talk…*
3. High exploitation in fisheries

**OBJECTIVES….**

1. Reduce sediment load by fixing Stoltz bluff.
2. Reduce channelization due to dykes, increase side channel connection, improve poor flow in side channels, improve stream complexity.
3. Sediment management plan.
4. Connect estuary, habitat restoration, better management.
5. Increase water storage and improve flow management. → *focus for this talk…*
6. Reduce fishery impacts
7. Build a plan to rebuild chinook and improve the watershed health and improve the governance.

# Water: A critical chinook habitat for each life phase of chinook salmon

| | |
|---|---|
| Adult migration up the river | Need sufficient flow to migrate and pool refuge areas for resting and water temperatures generally below 18C. No barriers. |
| Spawning | Chinook have specific velocity and water depth requirements in the spawning area. |

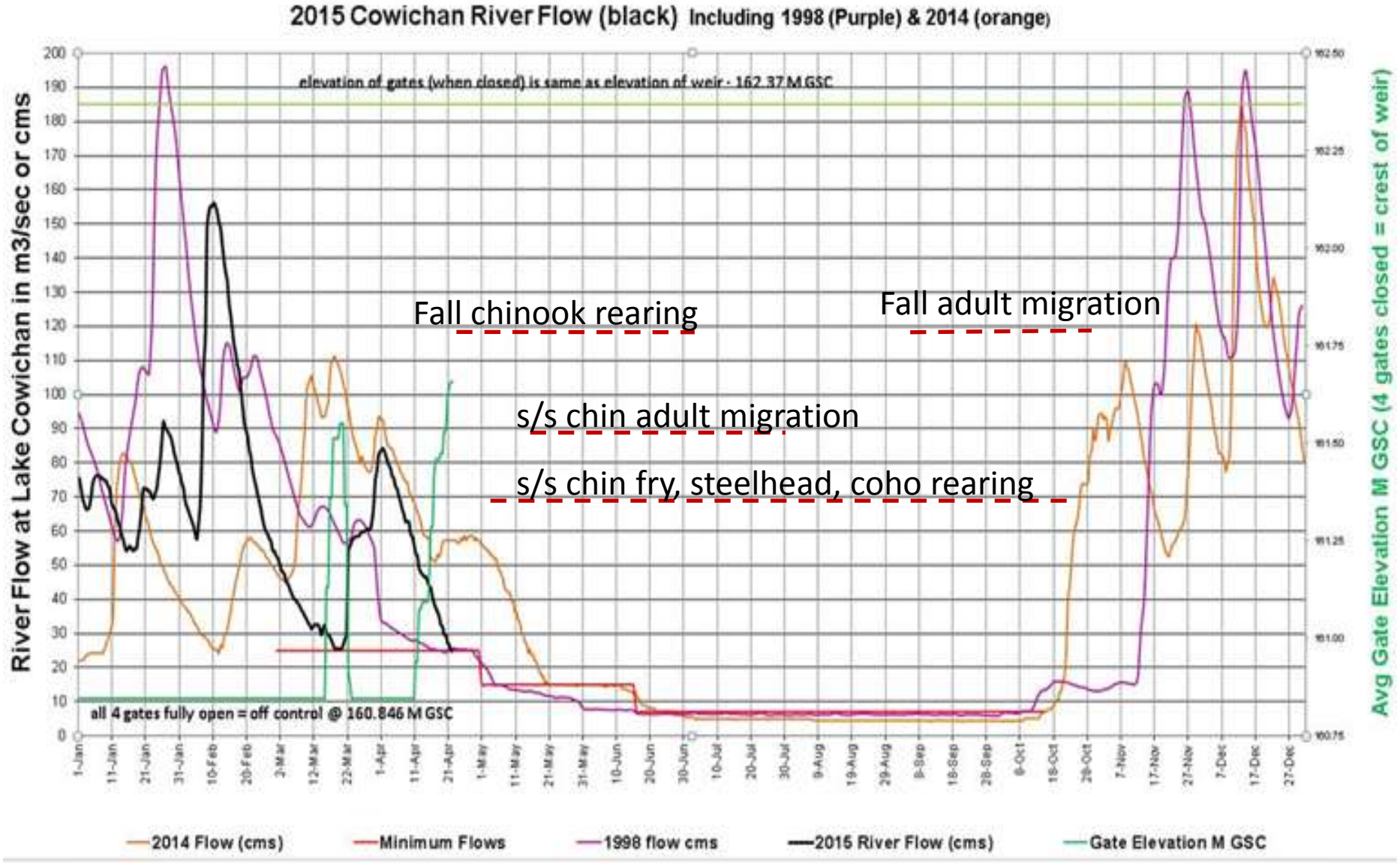
Note that ocean rearing is a major determination of productivity of the stock.

# Water: Chinook Critical Habitat at each life phase

| | |
|---|---|
| Egg Incubation | Need sufficient flow to keep eggs in gravel safe from floods, desiccation, scouring, silting. Temperature is an important factor as well, as the cumulative degree days determines hatch time. |
| Fry rearing | Flow keeps rearing habitat along the margins of the mainstem and keeps side channels connected. |
| Smolting | A robust smolt will have a higher chance of survival in the ocean. |



# Key life history stages (not complete) during periods of low flow.



# Cowichan Fall Run Chinook risks related to water flow only …

- Fall upstream migration. Risk is high.
- Spawning. Risk is low.
- Egg incubation. Risk is low.
- Inriver rearing in edge habitat. Risk is moderate to high and increasing.
- Lower river rearing areas. Risk is high.
- Estuary. Risk is low to high (flow not limiting but sedimentation associated with flow may be).

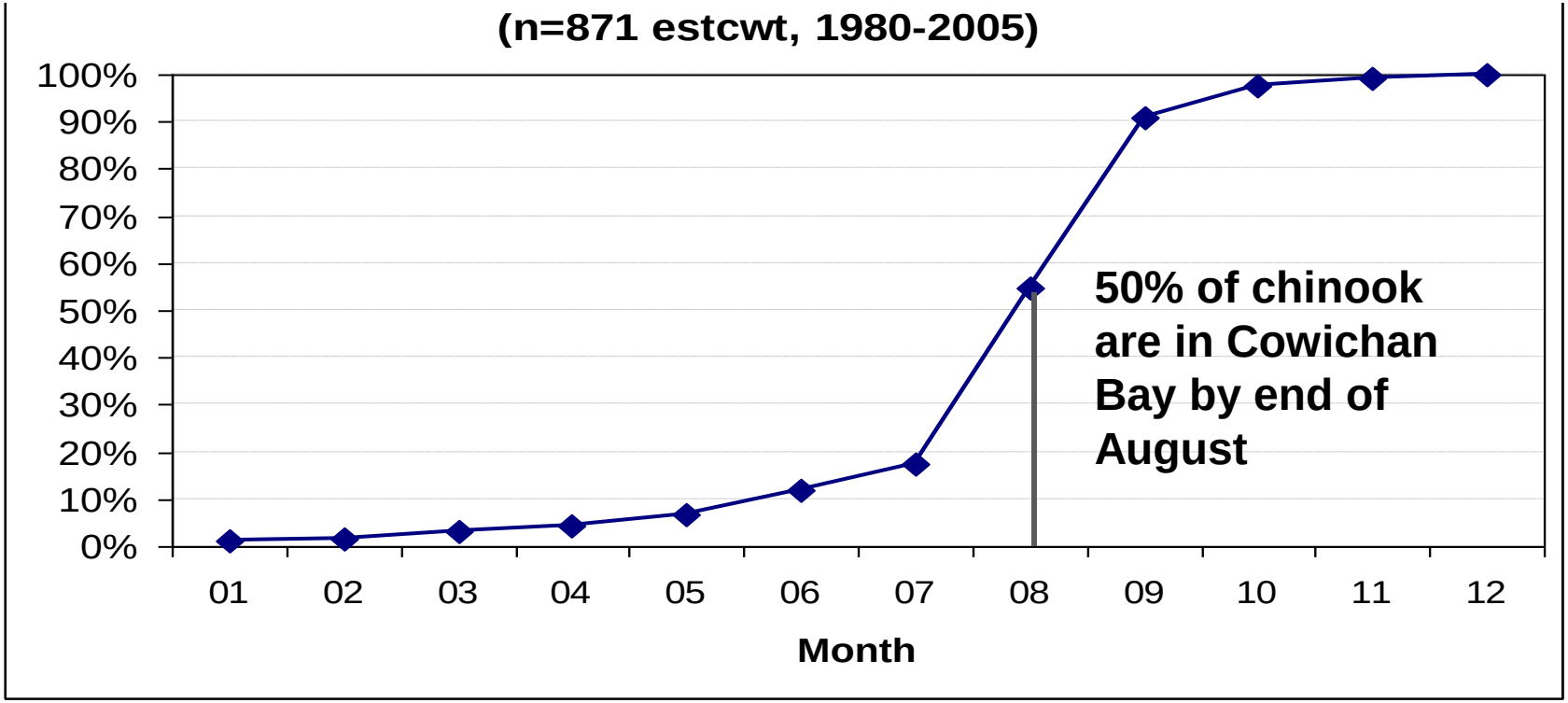
*What do we know? Let's review the info.*

# 1. We know that fall run chinook enter Cowichan Bay in August when water is generally low.

•Based on Coded Wire Tag data recoveries from Cowichan chinook we know the fall chinook arrive in the Cowichan Bay area in July-August, 50% are in the Bay by the end of August, and all are present by mid September.

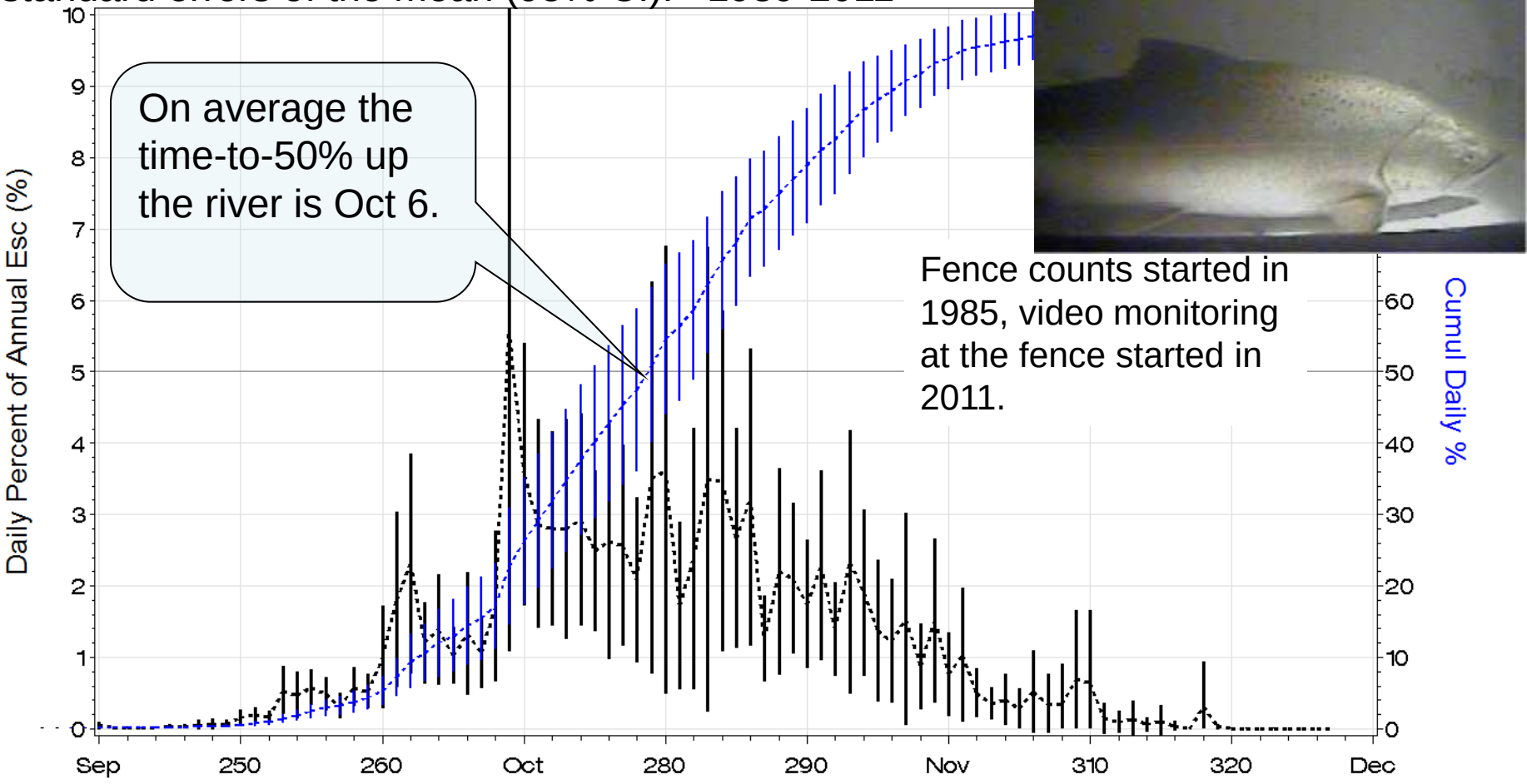
•Chinook prespawn mortality depends on the duration the fish are pooled in the estuary and the abundance of predators such as seals, humans or prevalence of disease.

•**THEY NEED SUFFICIENT WATER TO MOVE UPSTREAM TO AVOID PREDATORS!**



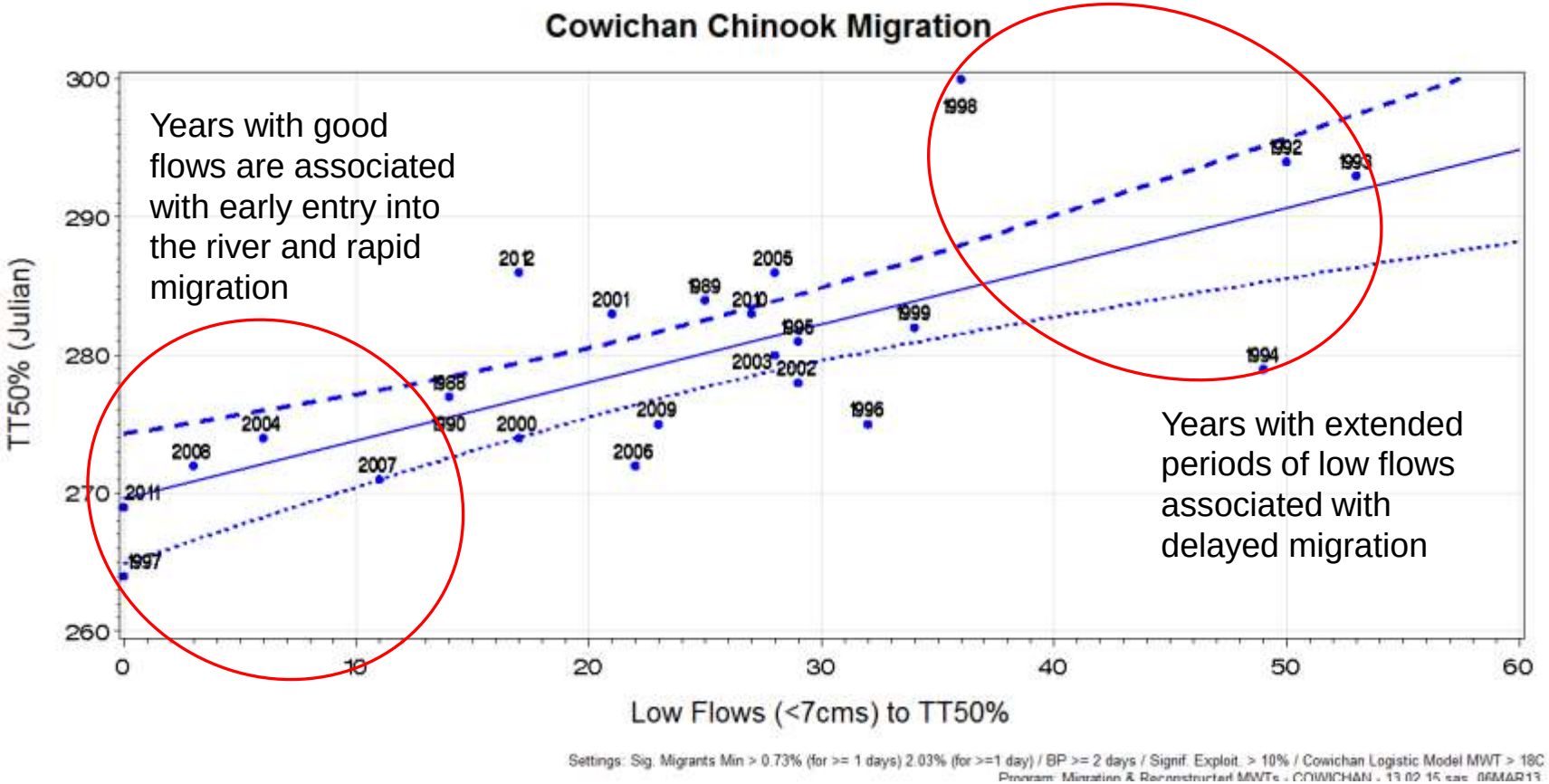
# 2. We know that chinook migrate up the river from mid Sept to mid Nov.

•DFO monitors migration of chinook up the river with peak in early October. This graph shows mean daily and cumulative % of total annual escapement ± 2 standard errors of the mean (95% CI). 1989-2011



# 3. We know that entry into the river and migration rate are affected by river flow.

- In the Cowichan… the more days as 7cms the longer it takes for the migration to reach the 50% mark. In dry years when there are extended periods of 7cms chinook migration up the river can be delayed by 20 days. This delay is associated with significant stress on the fish, increased prespawn mortality, and reduced productivity.



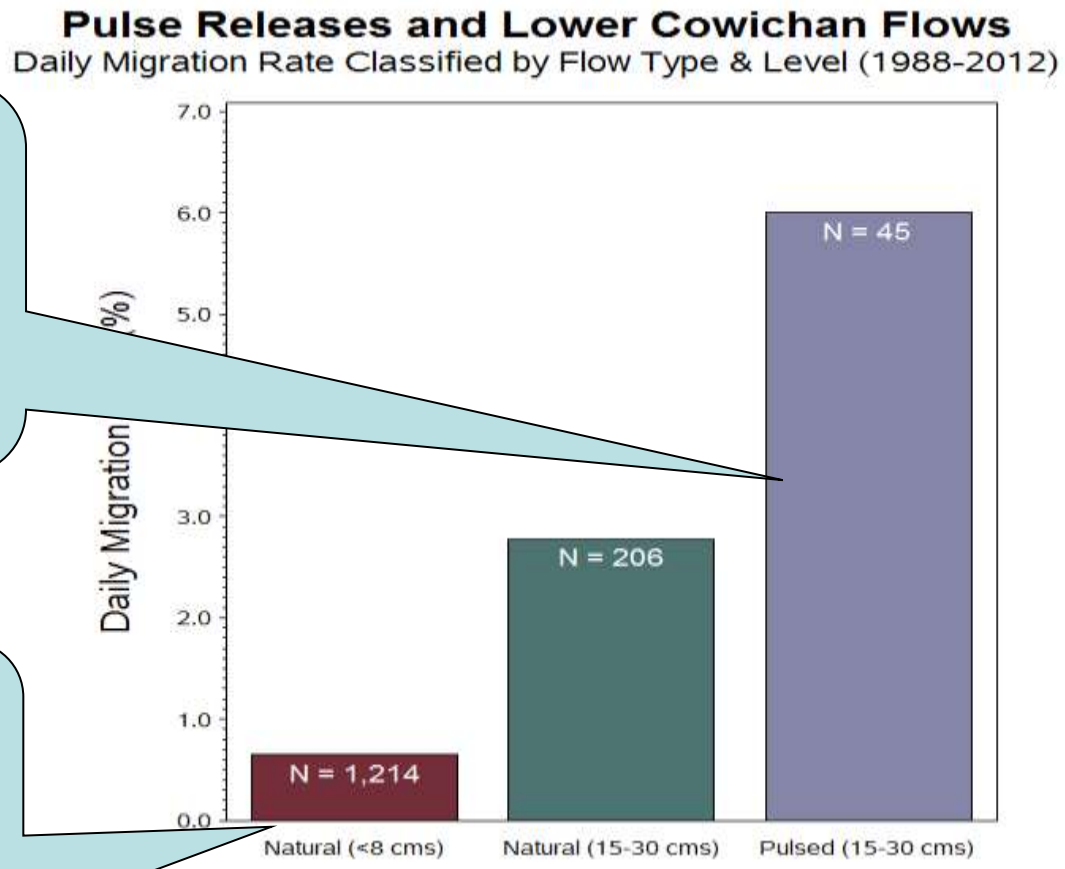
# 4. We have measured the direct effect of river flow on daily migration.

The graph below shows importance of pulse flow to migration.

**7cms is the current minimum, migration requires more likely 15cms by late September.**

2. But when flow is 20cms or more… chinook will migrate, especially when a pulse flow is provided.

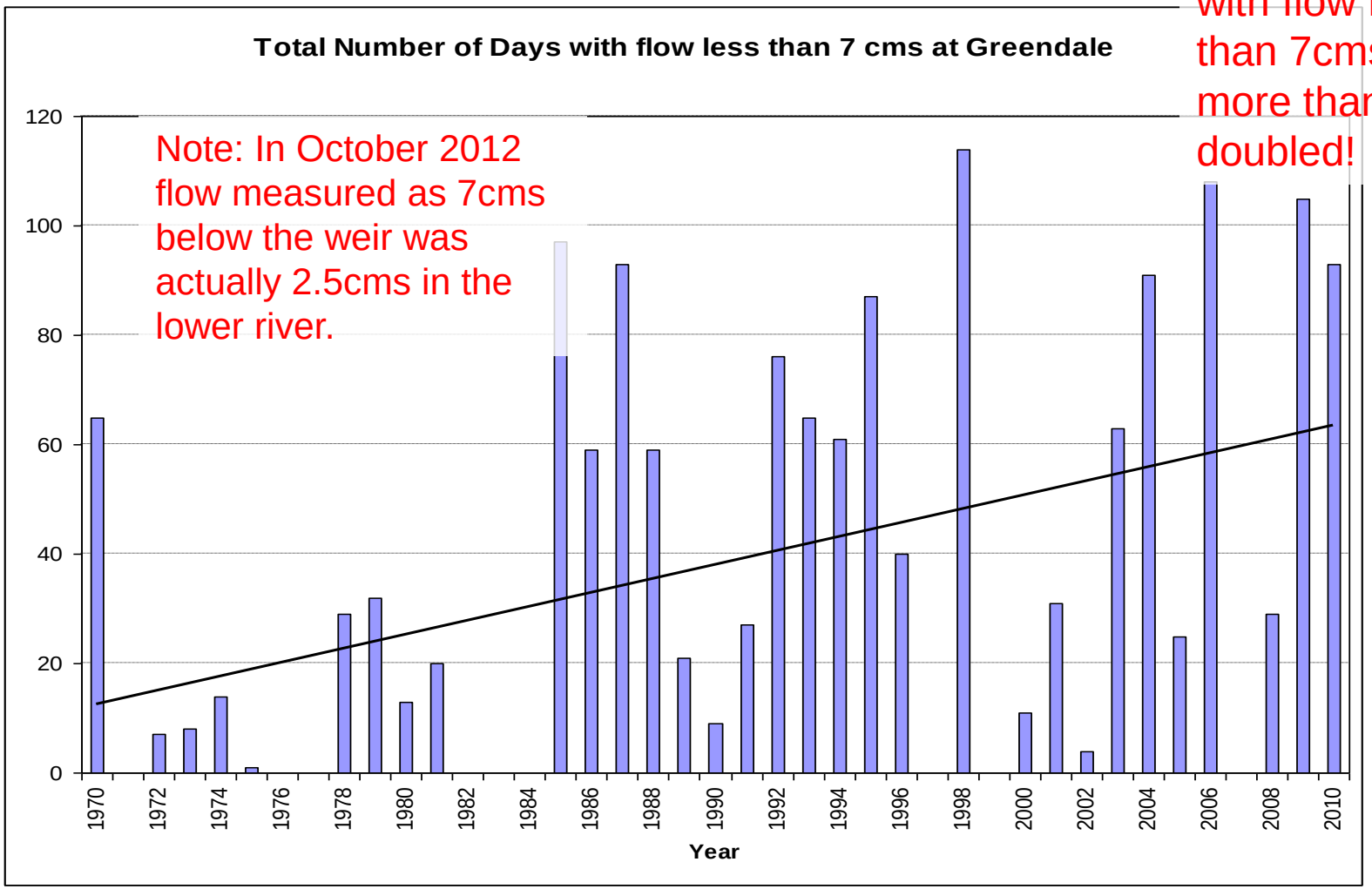
1. When flow is 7cms or less…very few chinook will/can migrate up river.



# 5. The number of days fish migration is delayed is increasing.

periods of low flow are increasing and will likely intensify with climate change.

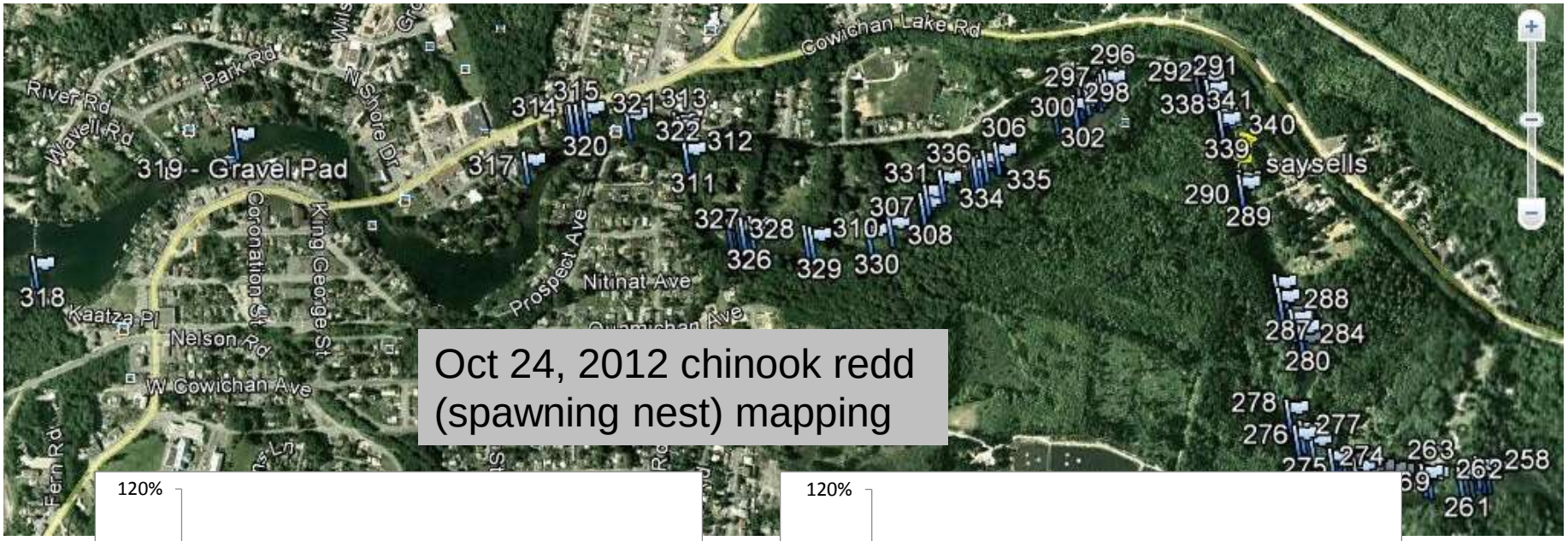
Since 1970 the number of days with flow less than 7cms has more than doubled!



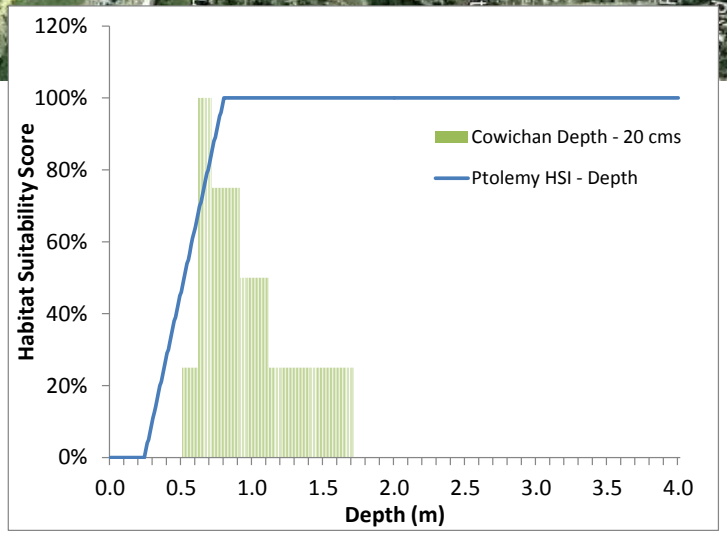
6. Chinook migration and spawning requires refuge pools in the lower and mid river to hold  and rest during migration and prior to spawning.

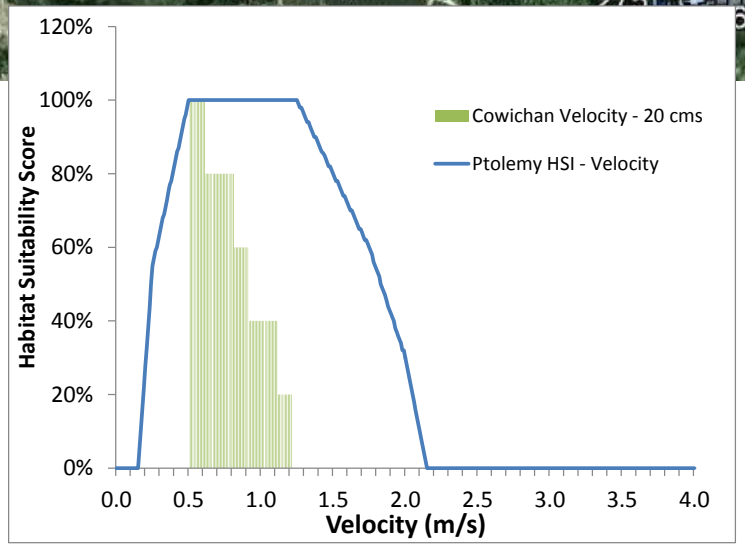
# 7. Chinook spawn in specific flow velocity and depth.

The map shows spawning locations and the graphs show actual water velocity and depth of this spawning (in relation to observed suitable habitat in other rivers). Expert opinion suggests the condition of these upper reaches is good and not limiting the overall productivity of chinook.




Oct 24, 2012 chinook redd (spawning nest) mapping



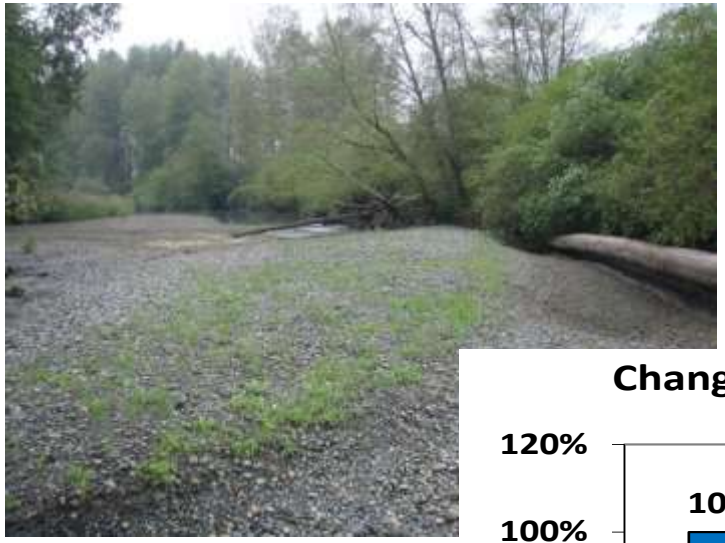
8. Egg incubation requirements late October through early spring:  keep the channel wetted and stable, water needs to be clear and clean.  E.g. sediment loading should be low.

- Generally, the spawning areas are thought to be in good shape with good flows and plenty of habitat.

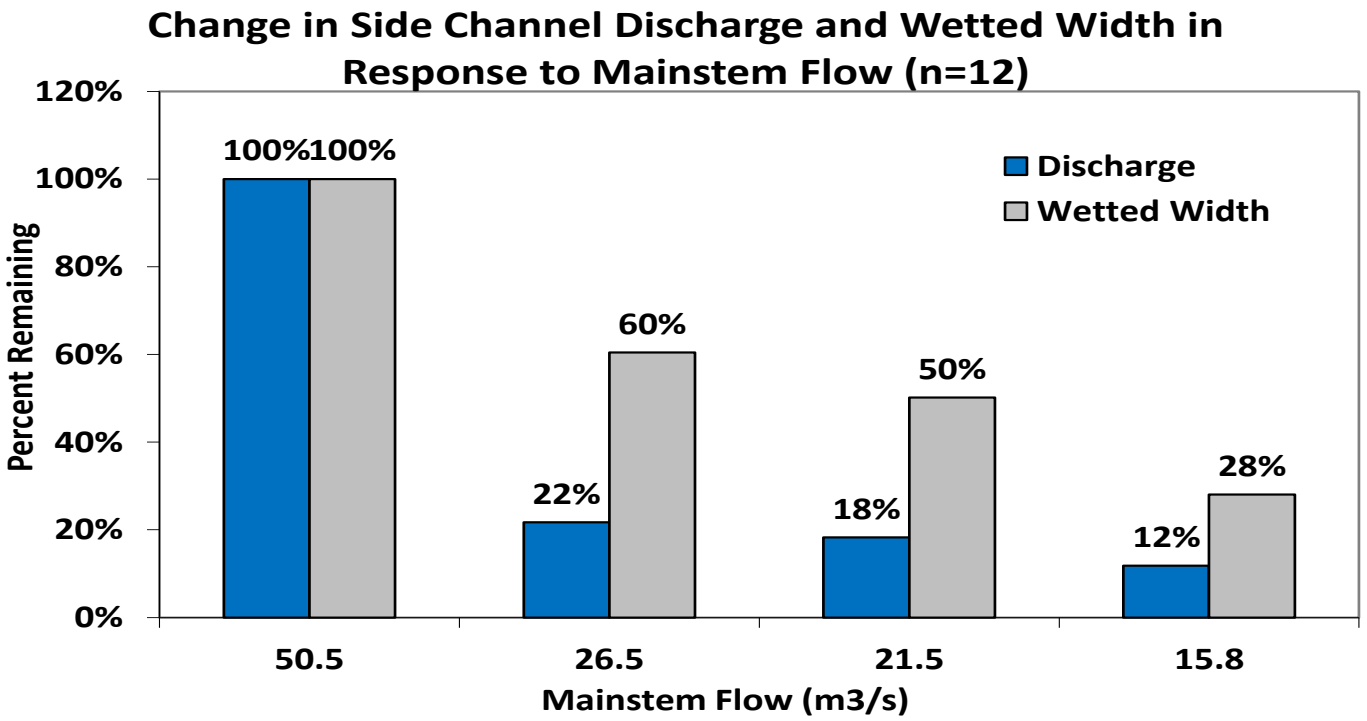
Keep water quality clear.  Sediment loading will reduce salmon productivity (spawning, incubation and rearing.

E.g.  Stoltz Bluff

# 9. Rearing. Water levels affect connectivity of function of side channels important to rearing.



- lack of adequate habitat (water discharge and wetted width) in the spring period is affecting overall productivity by precluding small young of year chinook require access to side channels where food and rearing habitat are prevalent.



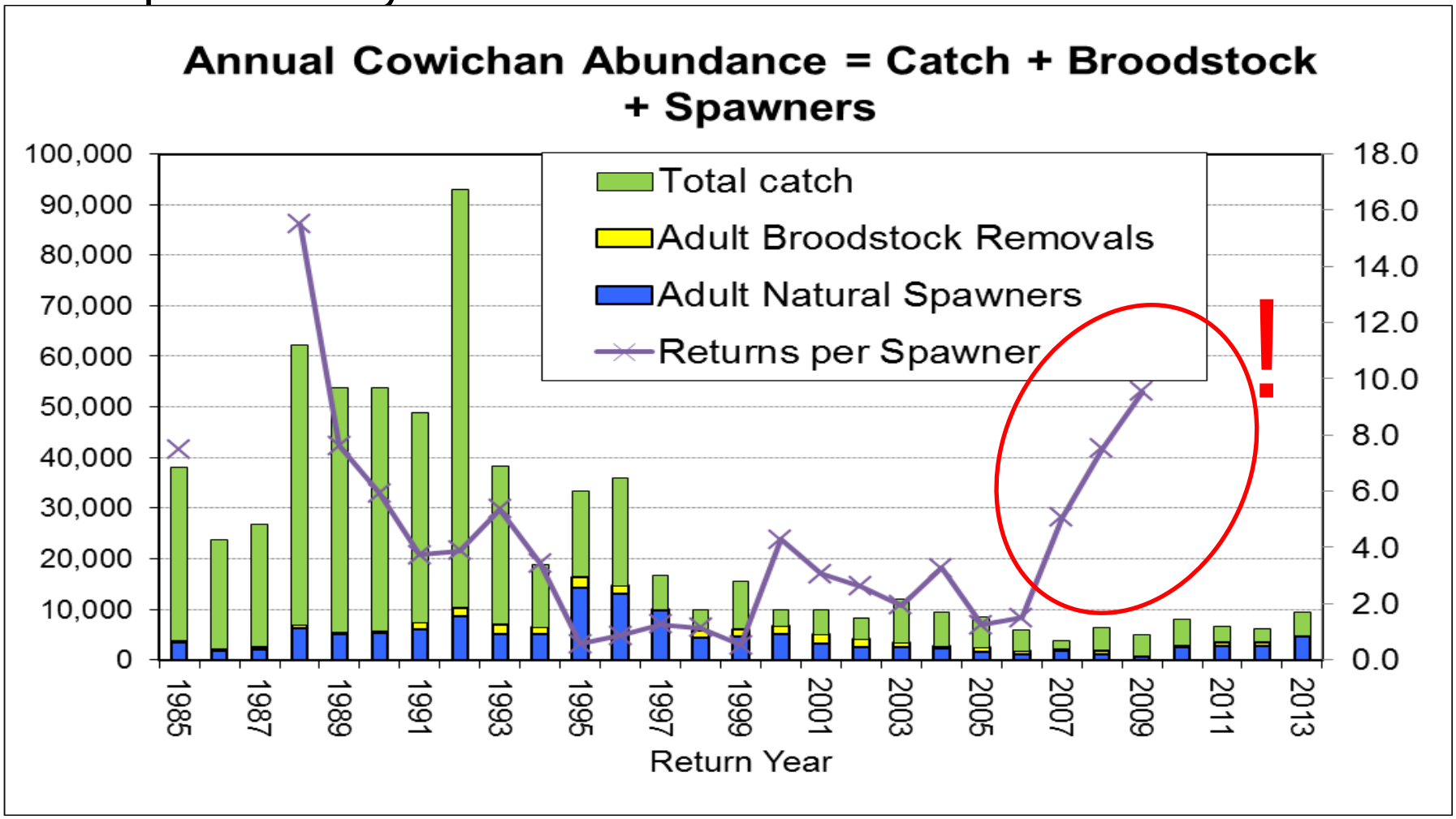
# 10. Water levels affect edge habitat complexity important to juvenile chinook rearing

# Water requirement considerations

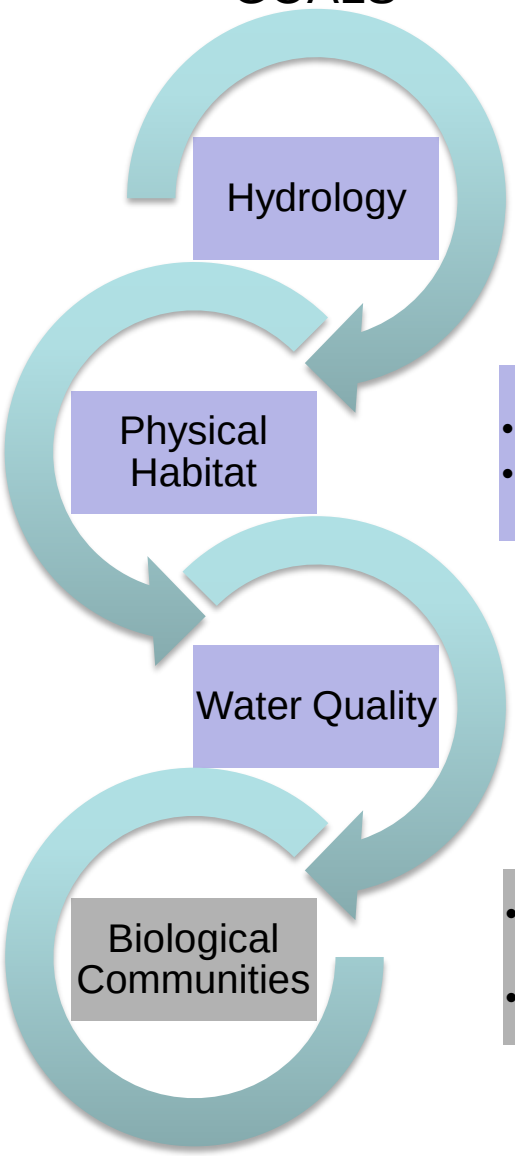
- Rearing chinook require river edge habitat to be complex and connected to riparian.  BCCF work suggests 50cms from late Feb to late June for 100% wetted width and discharge.
- Note that we actually manage to 25cms in late March to early April and then 15cms into June.
- Coho have similar requirements for off channel habitat so are not included.
- Early chinook upstream migration requires 10cms maybe with pulse flows in July.
- Minimum requirements of 7cms during summer to protect rearing steelhead.
- 15cms pulse flows during upstream chinook migration in the fall. There is a protocol on how to ramp up and ramp down the pulse.

# Result of several years of restoration: Improved biological productivity

where productivity is measured as Returns per Spawner and productivity means watershed health



# Build a plan for WATERSHED HEALTH




| WATERSHED GOALS | OBJECTIVES | LIMITING FACTORS | CHINOOK OBJECTIVES |
|---|---|---|---|
| Hydrology | • stream flow for…<br>• channel function floodplain function<br>• storm water<br>• ground water recharge | High/Low Flows<br>Limitations to Fish Passage | • Adequate flows<br>• Flow for migration<br>• Access to side channels |
| Physical Habitat | • aquatic habitat<br>• terrestrial habitat | Loss of Habitat Quality and Quantity | • Complex Rearing Habitat<br>• Healthy Riparian<br>• Sufficient spawning flow<br>• Complex Edge habitat |
| Water Quality | • stream temperature<br>• human pathogens<br>• urban pollutants<br>• total suspended solids | Poor Water Quality | • Cool Summer Temperatu<br>• Oxygenated, Balanced P<br>• Free of Contaminates<br>• Low Turbidity |
| Biological Communities | • Fish and other organisms<br>• Terrestrial Wildlife | Increased predation & Mortality<br>Lack of Critical Data | • Healthy abundant Chinook pop'n<br>• Healthy insect pop'n<br>• Data Gaps resolved |

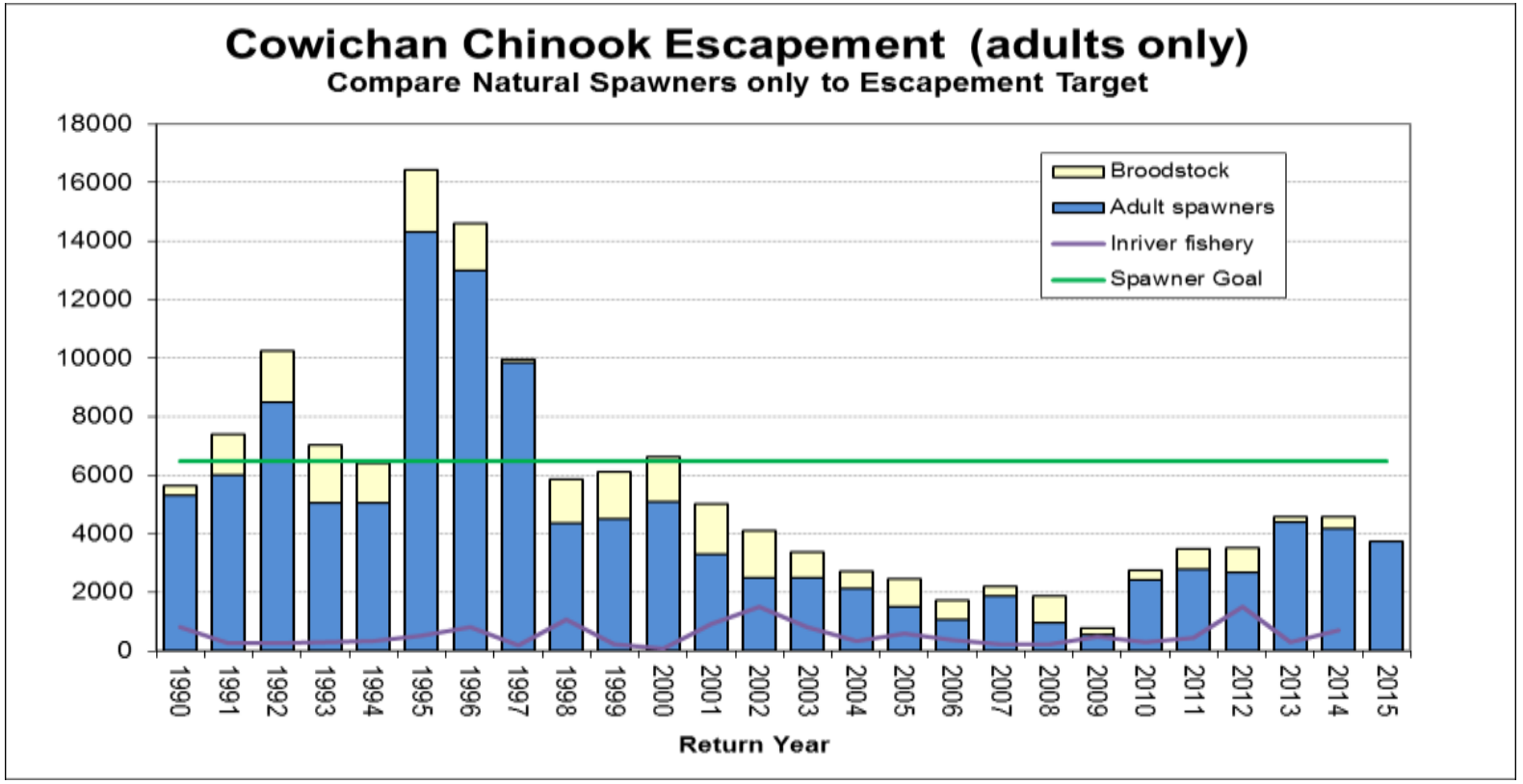
# Summary of flow requirements for fall run chinook

- Fall migration:
  - 7cms minimum flow for short periods,
  - 10-15cms goal for migration depending on access to pool refugia.
- Fry rearing.
  - Available info suggests that 50cms are required to keep side channels fully connected and functioning, but the actual flow target will depend on what level of habitat we want to maintain relative to costs of providing that flow.
  - Less than 50cms is required to maintain edge cover habitat in the mainstem.

# Outlook for 2015 chinook

- Low numbers of age 2 jacks in 2014 suggest poor return of adults in 2015.
- Poor ocean conditions may suggest entering period of lower returns.
- Low snow pack (<10% normal) will reduce spring flows and reduce rearing success.
- Outlook for dry hot summer will cause delays and prespawn mortality of chinook.

# Cowichan chinook jacks were poor in 2014 means lower returns in 2015.




2015 forecast.
Poor age2 'jacks' was

| | Age2 | Age3 | Age4 | Age5 | Adults |
|---|---|---|---|---|---|
| 2012 | 1,322 | 2,052 | 2,869 | 87 | 5,008 |
| 2013 | 2,319 | 3,189 | 1,957 | 138 | 5,285 |
| 2014 | 583 | 3,539 | 1,018 | 34 | 4,590 |
| 2015 | - | 1,374 | 1,671 | 95 | 3,141 |

# Summary for spring/summer run chinook, coho, steelhead

- Upstream migration of summer run chinook in June-July. Risk is high.
- Coho juvenile rearing full year in fresh water. Risk of stranding in off-channel habitat is high. Draw down of lake reduces edge habitat in the lake.
- Steelhead, risk of egg desiccation and reduced rearing habitat in mainstem is moderate.