

UNINTENDED CONSEQUENCES OF SUCCESSFUL NUTRIENT RESTORATION PROJECTS

The Devil is in the Details

SYSTEMS ARE BEING STARVED

- Lake sediment cores
- Stable isotope studies-fish, bears, trees
- Reviews of historic catch levels

VALUE OF CARCASS DERIVED NUTRIENTS

CARCASSES ARE HABITAT

- Directly feed juvenile fish
- Feed aquatic insects
- Directly feed other animals; bears, mustelids, cougar, eagles, gulls, ducks, etc. etc.
- Appears to be not just N and P, but also C and trace minerals
- Act of spawning is a valuable habitat mitigation

MITIGATION

- **Short term** to compensate for lack of escapement
 - Distribute carcasses
 - Distribute analogs
 - Distribute fertilizer
- Ultimately, fish need to accomplish nutrient recycling

“PROBLEMS” BROUGHT ON BY INCREASING ESCAPEMENTS

- Magnification of pathogens to hatcheries
- Delivery of toxic materials
- Selective fisheries
- The increase in salmonid populations will impact other resources

DISEASE PROBLEMS 1

- Similkameen River spring chinook ecosystem goal= approx 8,000 (800+/km)
- Recent years close to a quarter of this
- Spawners concentrated near hatchery (400/km)
- Catastrophic losses at rearing pond

DISEASE PROBLEMS 2

- Minter Creek ecosystem goals approx. 3,600 coho and 13,000 chum
- Recently, huge runs exceeded this for chum
- Low water concentrated even more
- Many disease problems, but treatable so far

OPTIONS

- Since ecosystem goals appear to increase risk to hatcheries on surface water supplies
- Solutions include:
 - Close hatchery
 - Install filtration system
 - Utilize groundwater
 - Do not allow such high levels of spawning
 - Modify rearing/incubation program

TOXIC ACCUMULATION 1

- Salmon accumulate PCBs in the ocean
- Salmon transport these to their spawning watersheds
- Measurements of some Puget Sound chinook show a 6.5kg fish carries 267 μ g PCB
- An escapement of 10,000 puts 2.7g PCB into the watershed
- An escapement of 100,000 puts 27g into the watershed

TOXIC ACCUMULATION 2

– So what?

- A single killer whale can contain 200 g PCB
- What is background level in receiving watershed?
- Where do they go? Sediments? Riparian ecosystem?
- What are the patterns of travel through the food chain?
- Where do they accumulate?
- Studies necessary to answer these questions

SELECTIVE FISHERIES 1

- For Skagit River chinook there are 3 goals identified:
 - WDFW, mid-70s=17,900
 - Michael 121,600
 - Cederholm 270,350

SELECTIVE FISHERY 2

- Assume a 3:1 hatchery to wild in a mixed stock fishery
- Assume a .5% survival of hatchery smolts from release to entry to the fishery
- Assume no hooking mortality

SELECTIVE FISHERY 3

- In order to “cover” each of the escapements you will need:
 - For mid-70s, 10,740,000 smolts
 - For Michael, 72,960,000 smolts
 - For Cederholm, 162,221,000 smolts
 - WDFW releases about 100,000,000 smolts per year

SELECTIVE FISHERY 4

- For Snohomish coho, using WDFW's stream catalog estimate of available habitat at SLF and applying Bilby's 0.15 kg per square metre (bankfull) per spawner, you need about 400,000 coho
- At a 3:1 hatchery wild ratio and 4.75% hatchery fish survival you need 25,263,000 smolts.
- WDFW Puget Sound hatcheries do 10,000,000 per year

SELECTIVE FISHERY SOLUTIONS

- Don't conduct mixed stock fisheries
- Lower escapement goals at the expense of ecosystem productivity.
- Triage

INCREASE IN SALMONID NUMBERS

- As salmonid numbers increase, they exert more predation pressure on other species such as herring, rockfish, etc. Must effectively manage them.
- As salmonid numbers increase, they are preyed on by other species such as pinnipeds, whales, birds, etc. How do we deal with that occurrence?

WHERE DO WE HEAD FROM HERE?



– Not to decide is to decide

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