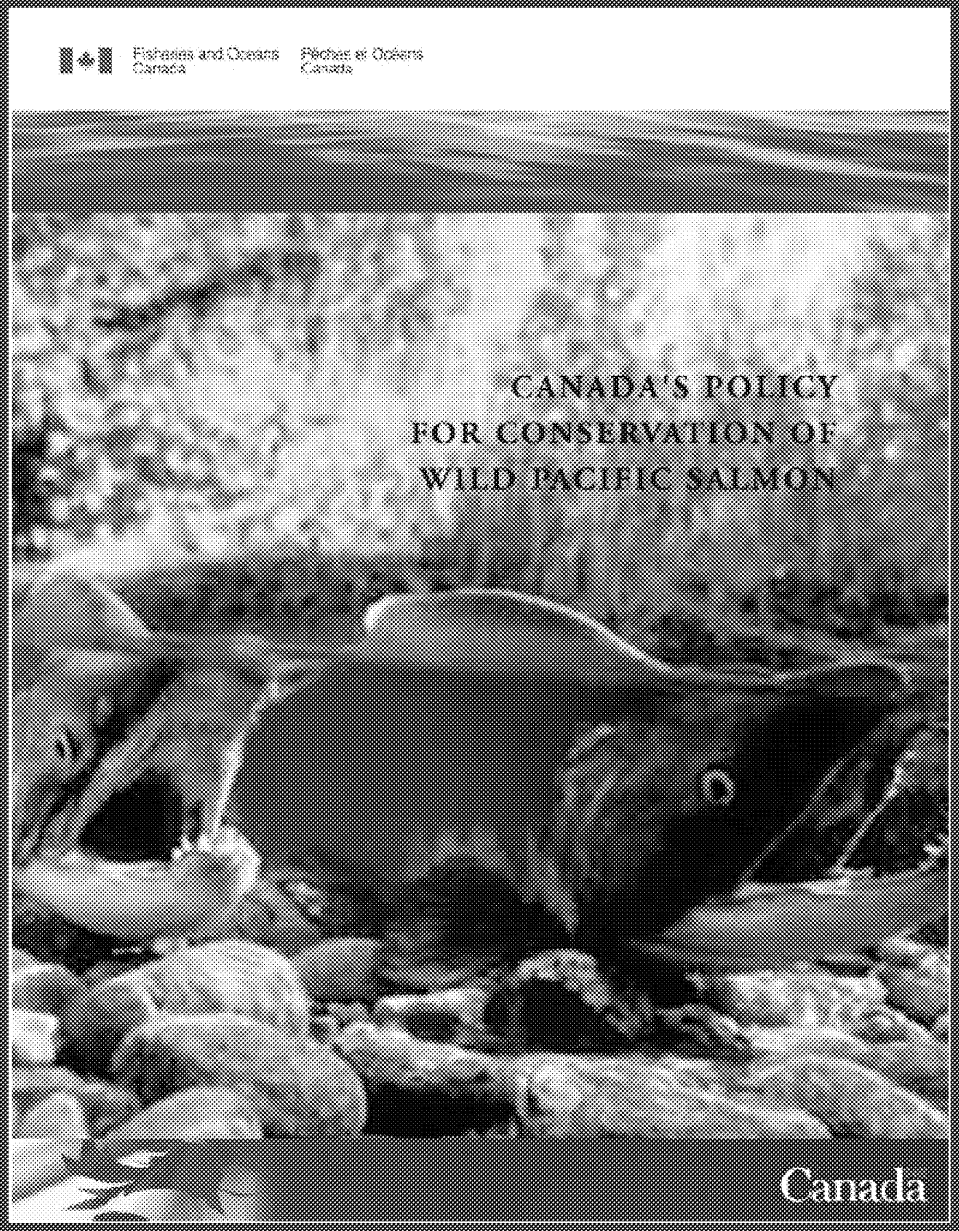
Next Steps in the Implementation of Canada's Policy for Conservation of Wild Pacific Salmon

The Identification of Conservation Units (CUs)

Fall 2006



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Why are we here?

- DFO is in the process of developing a science-based method for identifying salmon CUs
- We clearly heard that First Nations and stakeholders want to be involved in this work
- We need your input, in particular:
  - reaction to the proposed method
  - assistance in refining preliminary list of CUs

Some Background …

- Wild Salmon Policy (WSP) released in June 2005
- WSP incorporated significant input from First Nations, stakeholders, & public. These meetings are a continuation of that process
- WSP resulted from the realization that protecting diversity will enable the continuance of wild salmon, the ecological processes that depend on them, & the cultural, social, & economic benefits drawn from them
- WSP will protect diversity within CUs, their habitats, and ecosystems.

What are Conservation Units?

Groups of wild salmon living in an area sufficiently isolated from other groups that, if they are extirpated, that area is very unlikely to be recolonized naturally within an acceptable time frame (e.g. a human life time)

What are Conservation Unit Attributes?

- Irreplaceable units of salmon diversity
- Provide the current basis of salmon production and evolutionary change
- Can be made up of one or more salmon populations
- Recolonization is possible when populations within a CU are interchangeable, which means they:
  - have similar adaptations
  - are not isolated from each other

How can we tell populations are similarly adapted?

- Can be apparent based on:
  - unique characteristics & life-histories
  - behaviors and appearance with known or likely genetic basis (i.e. phenotypes)
- Can be inferred based on:
  - the similarity of the habitat and ecosystems they occupy
  - genetic information (geographic lineages)

How to Identify CUs?

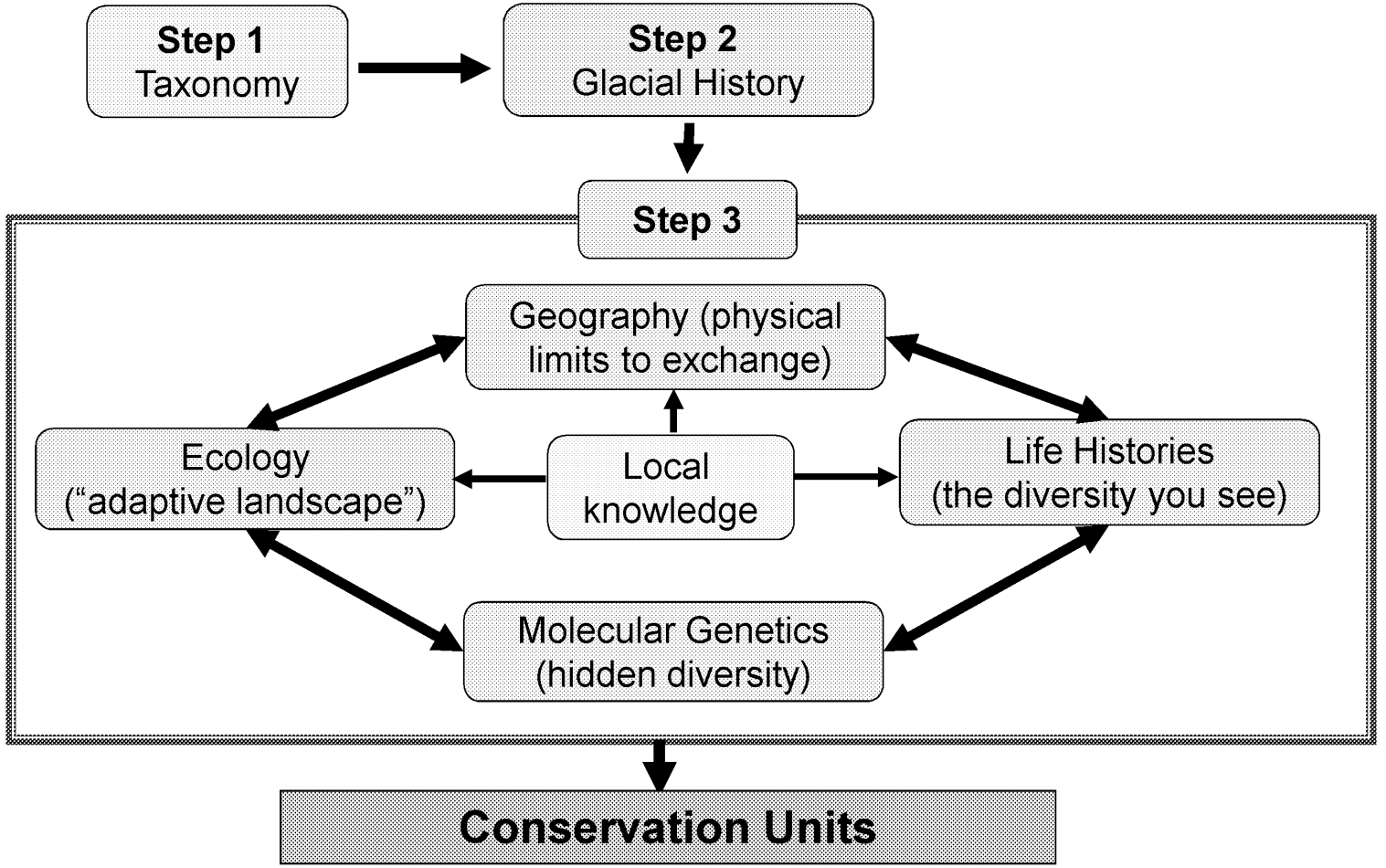
According to the WSP…

- Use scientific, local, and aboriginal knowledge
- Assess various information types including genetic, distribution, life history traits (including run timing)
- Expect CU delineations to change as knowledge base expands

How to Identify CUs?- Process & Schedule

Activity	Date Completed
DFO to propose a method for CU identification & produce a preliminary list of CUs	Complete
DFO to consult on the method and the list with stakeholders & First Nations through bilateral and community forums	Fall 2006
Refinement of method and revision of list	Early 2007
Scientific review of method by Pacific Scientific Advice Review Committee (PSARC)	Spring 2007
Revision of method and provision of revised list of CUs	Late 2007

How to Identify CUs?- Proposed Approach



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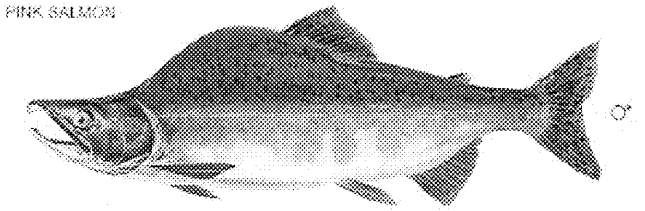
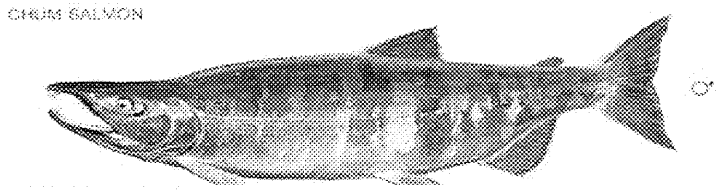
Step 1: Taxonomy

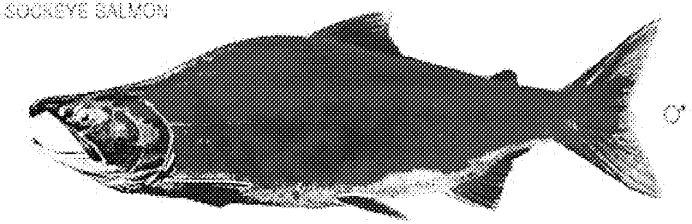
Start with the 5 taxonomic species of Pacific salmon (shown here in spawning colouration)

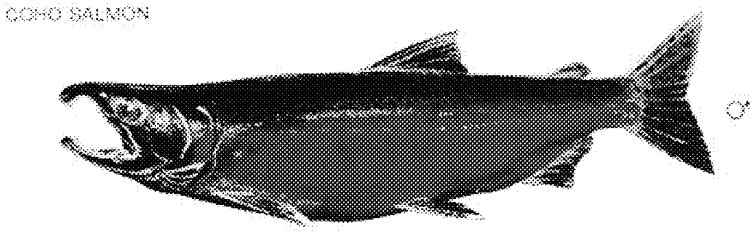
Trout and kokanee excluded because they are under Provincial jurisdiction

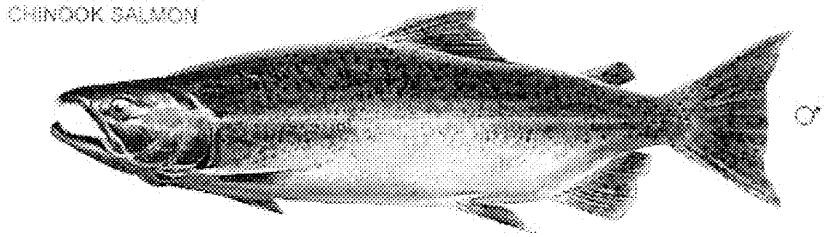
Divide pinks into odd-year & even-year races because they are reproductively isolated











Results in 6 taxonomic groups: chinook, coho, sockeye, chum, odd-year pinks, even-year pinks

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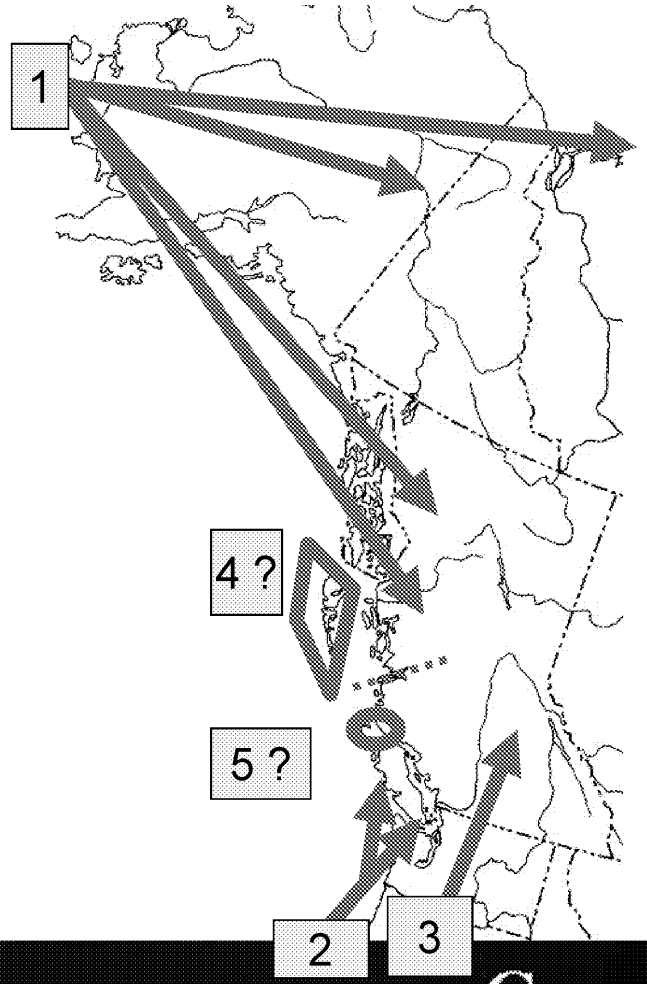
Step 2: Glacial History

- Salmon that have been isolated from each for long periods are genetically distinct
- Recolonization following last 2 major ice ages resulted in 3-5 distinct lineages:
  - **1** Bering Strait
  - **2** Southern Coastal
  - **3** Columbia
  - **4** (?) Queen Charlottes
  - **5** (?) North West Vancouver Island



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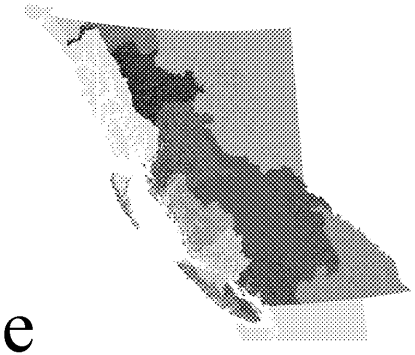
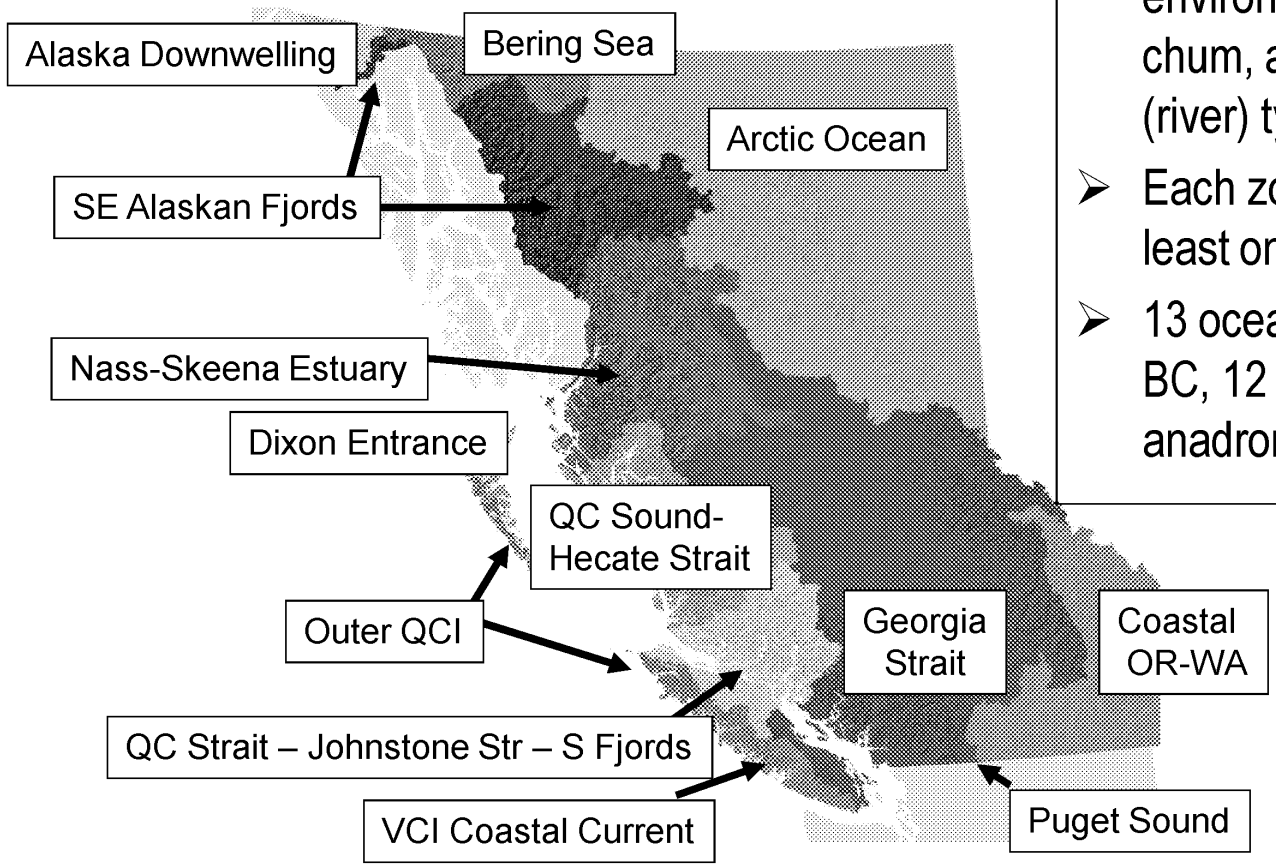
Step 3: Ecology – Ocean Zones

- Watershed-coastal ecosystems with distinct physical characteristics, including the full sequence of riverine, estuarine, & near-shore marine habitats used by juvenile salmon
- Salmon rearing in an ocean zone will be better adapted to that zone than other salmon and therefore more likely to be ecologically interchangeable



Step 3: Ecology - Ocean Zones (cont'd)

Unique Ocean Zones (boxes) and associated watersheds (coloured)



- Describe the adaptive environment of pink, chum, and ocean (river) type sockeye
- Each zone has at least one CU
- 13 ocean zones in BC, 12 with anadromous salmon

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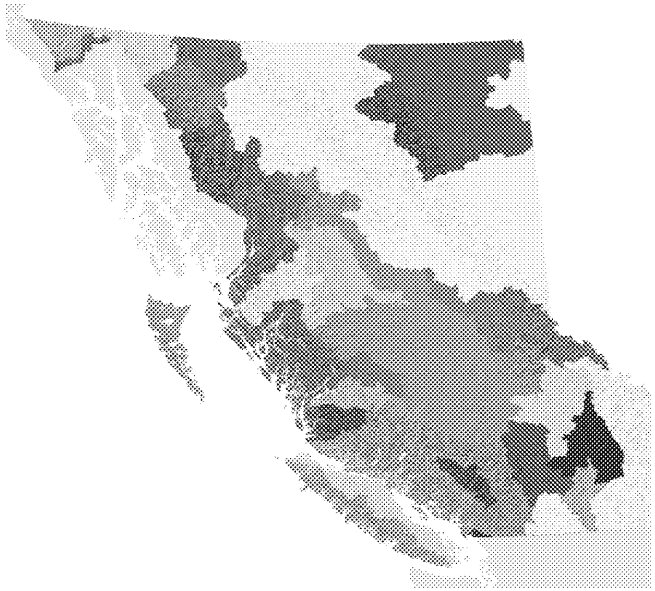
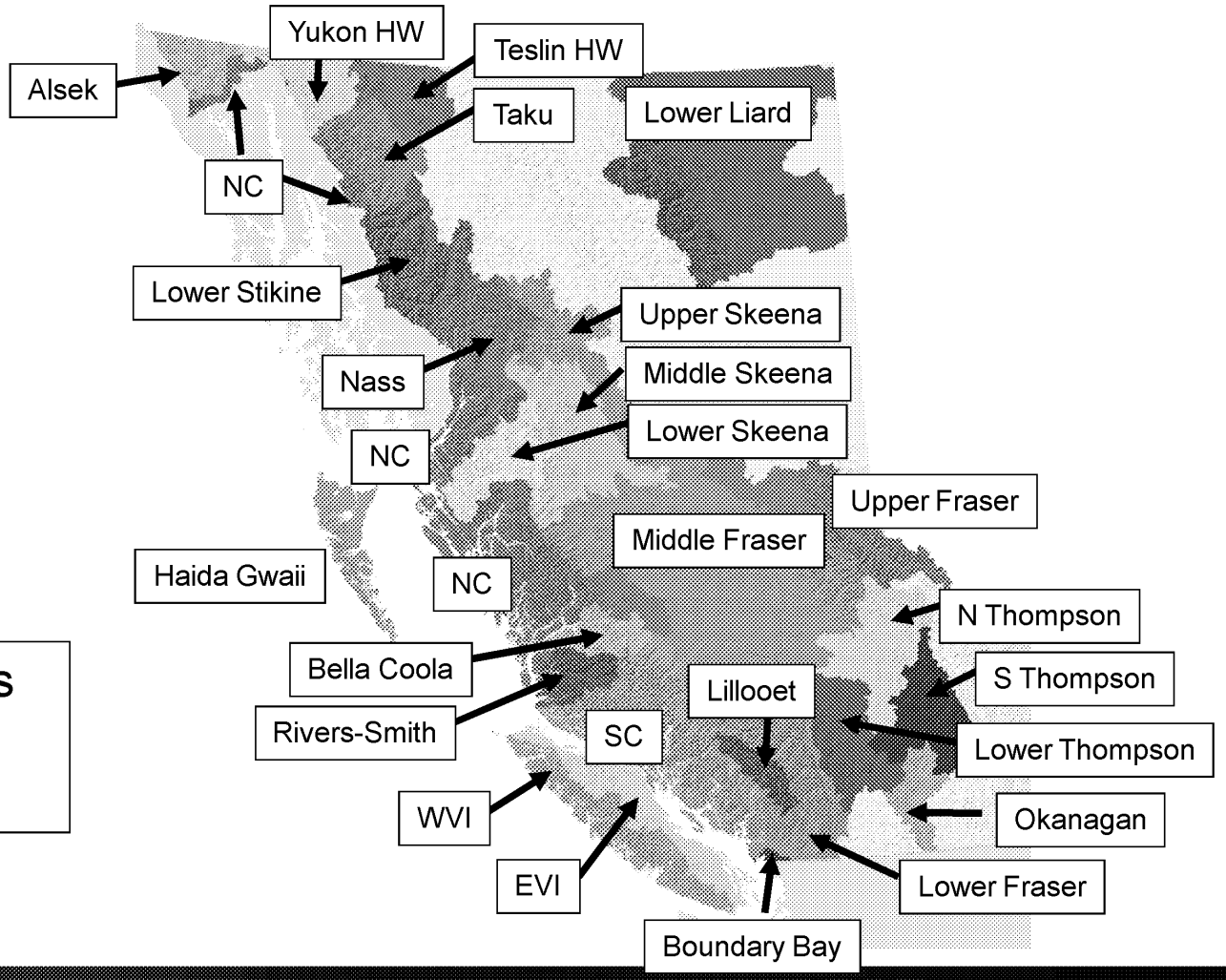
Step 3: Ecology – Freshwater Zones

- Freshwater systems with similar climate, geography and ecosystems
- Salmon living in a freshwater zone will be better adapted to that zone than other salmon and therefore more likely to be ecologically interchangeable



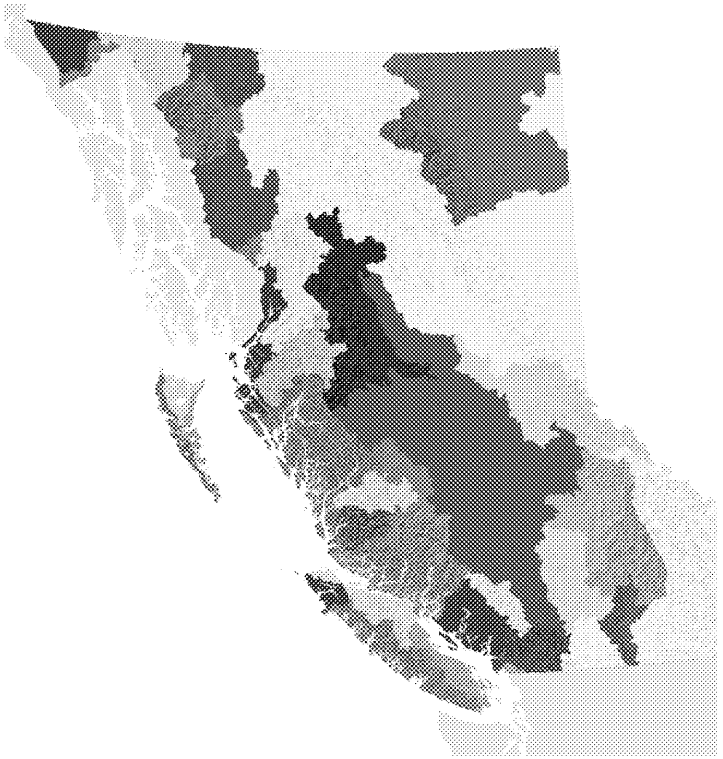
Step 3: Ecology – Freshwater Zones (cont'd)



26 freshwater zones with anadromous salmon in BC

Step 3: Ecology – Joint Adaptive Zones

- The areas of overlapping freshwater and marine ecological zones result in 33 Joint Ecological Adaptive Zones
- Joint zones describe the adaptive environments of coho and chinook



Each joint adaptive zone has at least 1 CU

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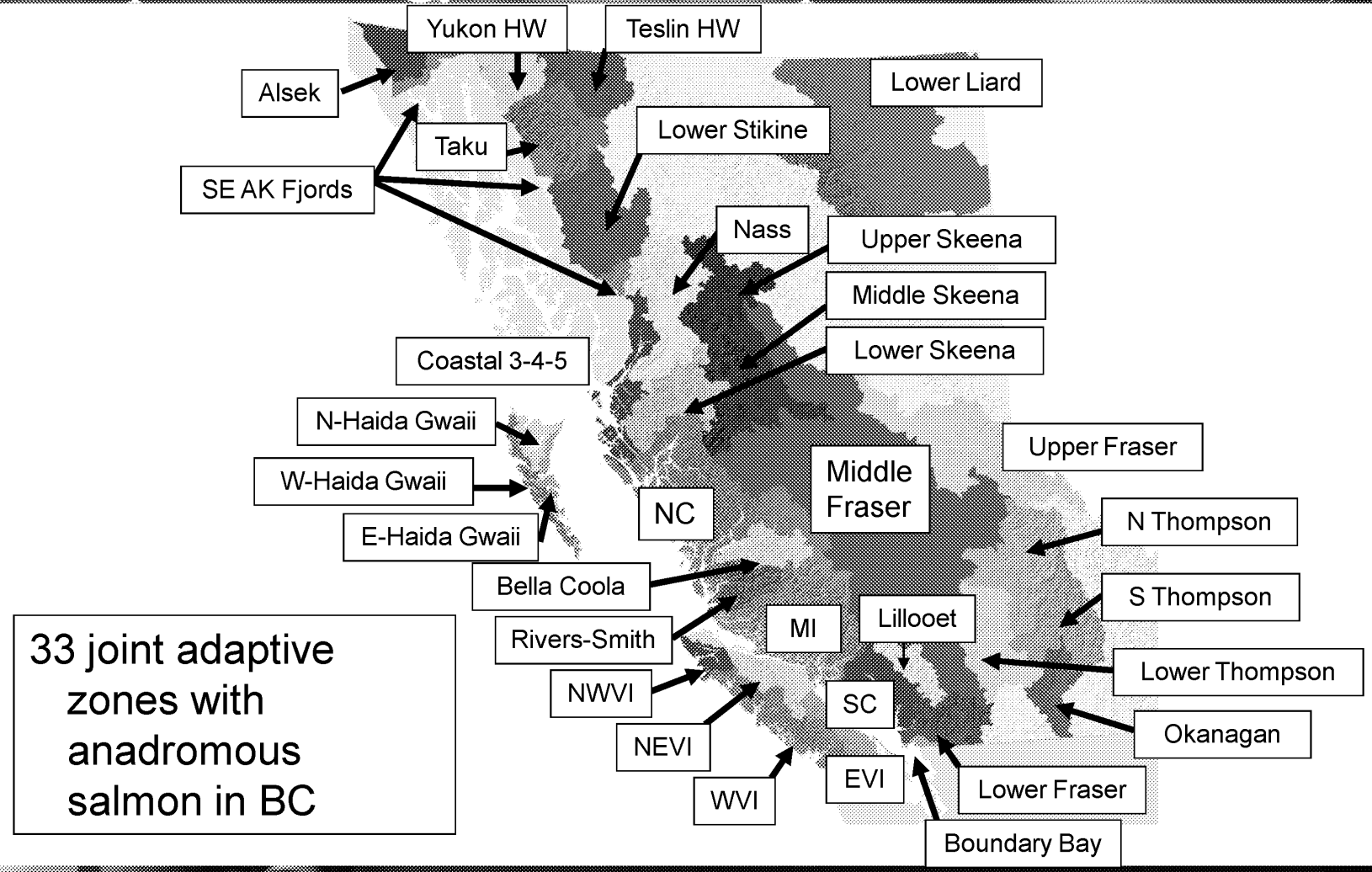
Step 3: Ecology – Joint Adaptive Zones (cont'd)



33 joint adaptive zones with anadromous salmon in BC

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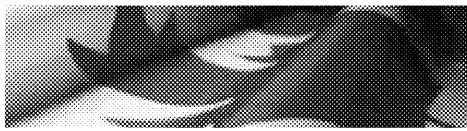
Step 3: Geography – Isolation

- Populations that are geographically isolated will become distinct over time
- Upper reaches of river systems can be in the same ecological zones but salmon in them are geographically isolated from each other (e.g. partition upper Fraser and Bulkley rivers along drainage boundaries)

Step 3: Life Histories – Diversity You Can See

Life history traits also reveal how salmon are adapted to their environments

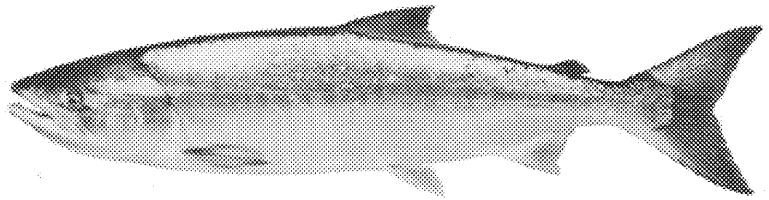
- Adult migration timing [chinook & sockeye]
- Spawn timing [all species]
- Age at maturity [sockeye, chinook]
- Ecotype (e.g. lake vs. ocean (river) type sockeye) [sockeye, chinook, coho]



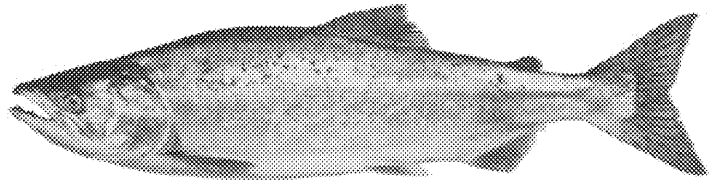
Step 3: Molecular Genetics – Hidden Diversity

- Ancestry considered in Step 2 (Glacial History), but genetics also used to better define population structure
- Genetic evidence indicates that each sockeye lake population is distinct (many studies corroborate)
- Genetic studies that demonstrate strong reproductive isolation sometimes used to refine CUs (e.g. Thompson coho)
- Genetic information is not available for all populations - the absence of genetic evidence does not lead to combining CUs

What did we find for CHUM & PINK?



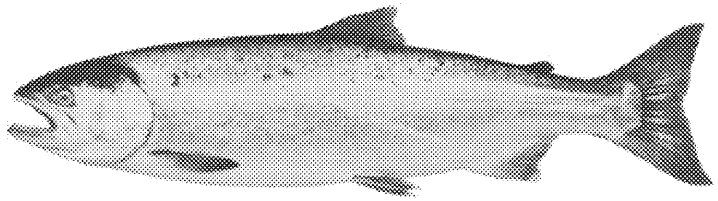
Ocean caught chum



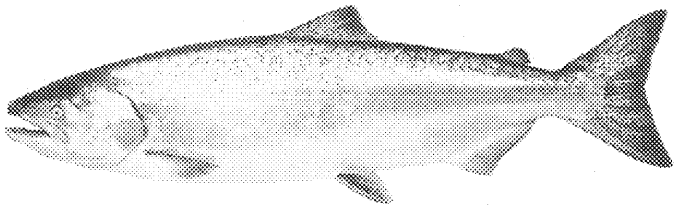
Ocean caught pink

- Presently have 16 CUs for CHUM and 21 for PINK (odd and even year runs are separate CUs)
- Relatively few CUs for Pink and Chum because:
  - Chum and pinks are more likely to return to a stream other than where they were born than other species
  - Since most chum and pinks (and ocean type sockeye) spend relatively little time in freshwater, their adaptive environments were defined only by the ocean zones

What did we find for COHO &CHINOOK?



Ocean caught coho



Ocean caught chinook

- Presently have 28 CUs for COHO and 33 for CHINOOK
- More CUs than for chum and pinks reflects the need to consider Joint Adaptive Zones since coho and chinook spend substantial time spent in both freshwater & and marine environments

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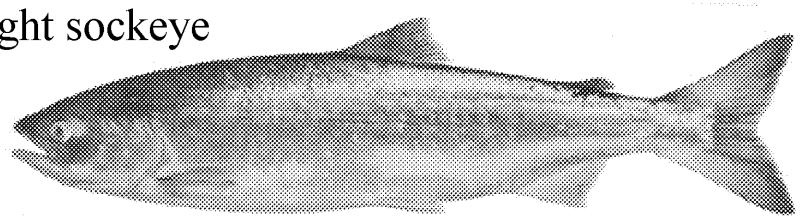
What did we find for SOCKEYE?

Ocean caught sockeye



- Presently have 268 CUs

  (lake & ocean types combined)
- Sockeye lake populations rarely mix and are therefore separate CUs (supported by genetic evidence & the fact that transplants generally fail)
- CU numbers higher than originally thought due to increased emphasis of certain traits like run timing for Fraser sockeye, & more knowledge about small coastal lakes with sockeye

Implications

Although CU numbers for some species may end up higher than were originally estimated, WSP implications remains as outlined in the policy. For sockeye, it is important to consider that:

- DFO has demonstrated an ability to manage weak populations (e.g. Cultus) using a collaborative planning approach that considers social and economic impacts
- A large number of proposed CUs are coastal lake populations that are not significantly impacted by current mixed stock fisheries
- Additional CUs resulting from separation of Fraser run-timing units within lakes are already considered in the management of major run timing units

What are the Next Steps?

- Compile information so that similar analyses can be completed the Yukon Territory
- Gather local and aboriginal knowledge to improve the accuracy and utility of our description of diversity in Pacific salmon
- Consider input, amend as necessary, and re-distribute list of CUs
- Scientific peer review of methodology in 2007

How Can You Help?

- What are your thoughts on the process DFO is using to identify CUs?
- In the lists provided are there:
  - locations listed that are not used by salmon?
  - locations used by salmon not in the lists?
- Are the population characteristics listed correct?
- Are there unusual characteristics about specific groups of fish that we are unaware of ?