Using chemical fingerprints in salmon and whales to infer prey preferences and foraging habitat of SRKWs.

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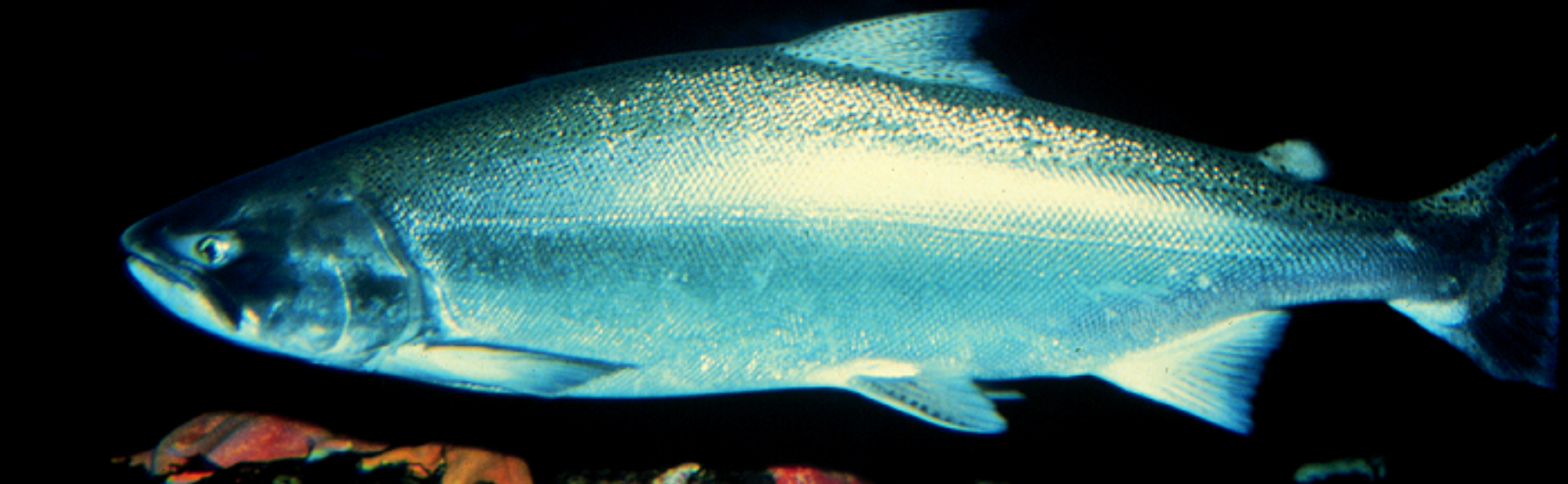
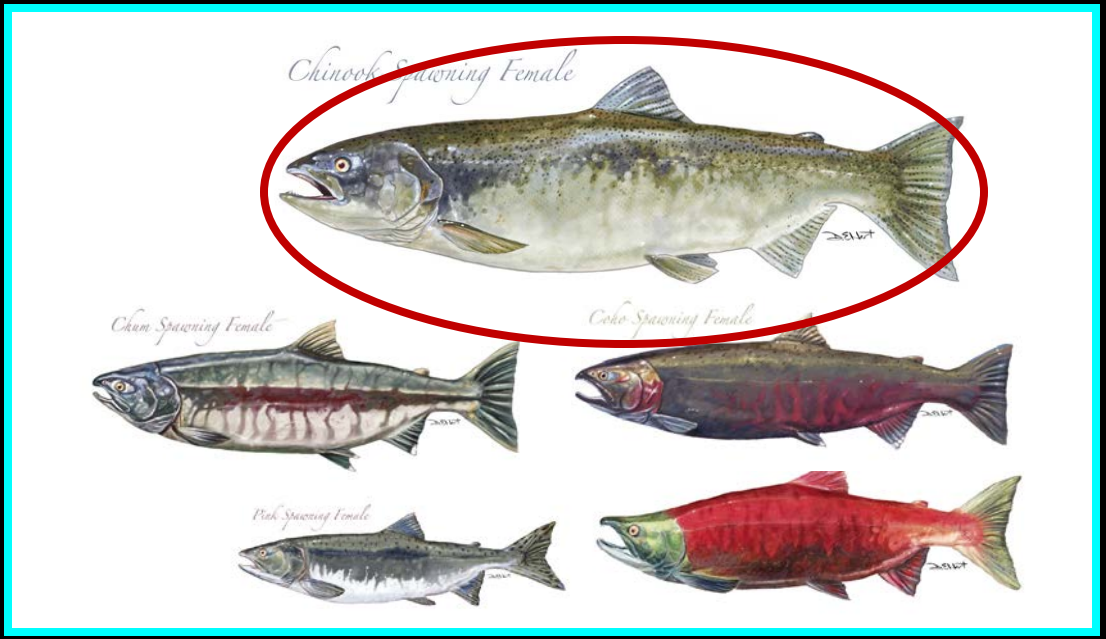


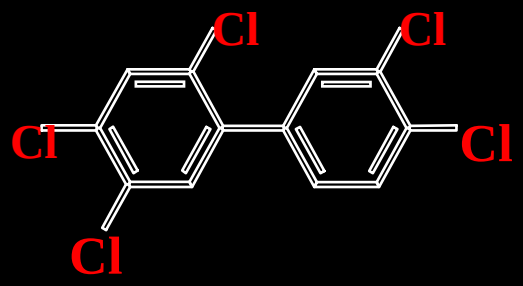
Contaminants levels in fish are determined by…



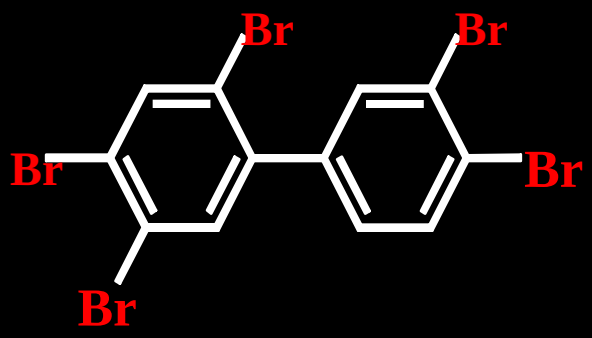
- Where they live
- What they eat
- How long they are exposed
- How fat they are

Persistent Organic Pollutants (POPs)

- Synthetic, industrial compounds
- Highly toxic
- Resistant to biological degradation
- Accumulate w/ age
- Bio-magnify



Polychlorinated Biphenyls (PCBs)



Polybrominated Diphenyl Ethers (PBDES)

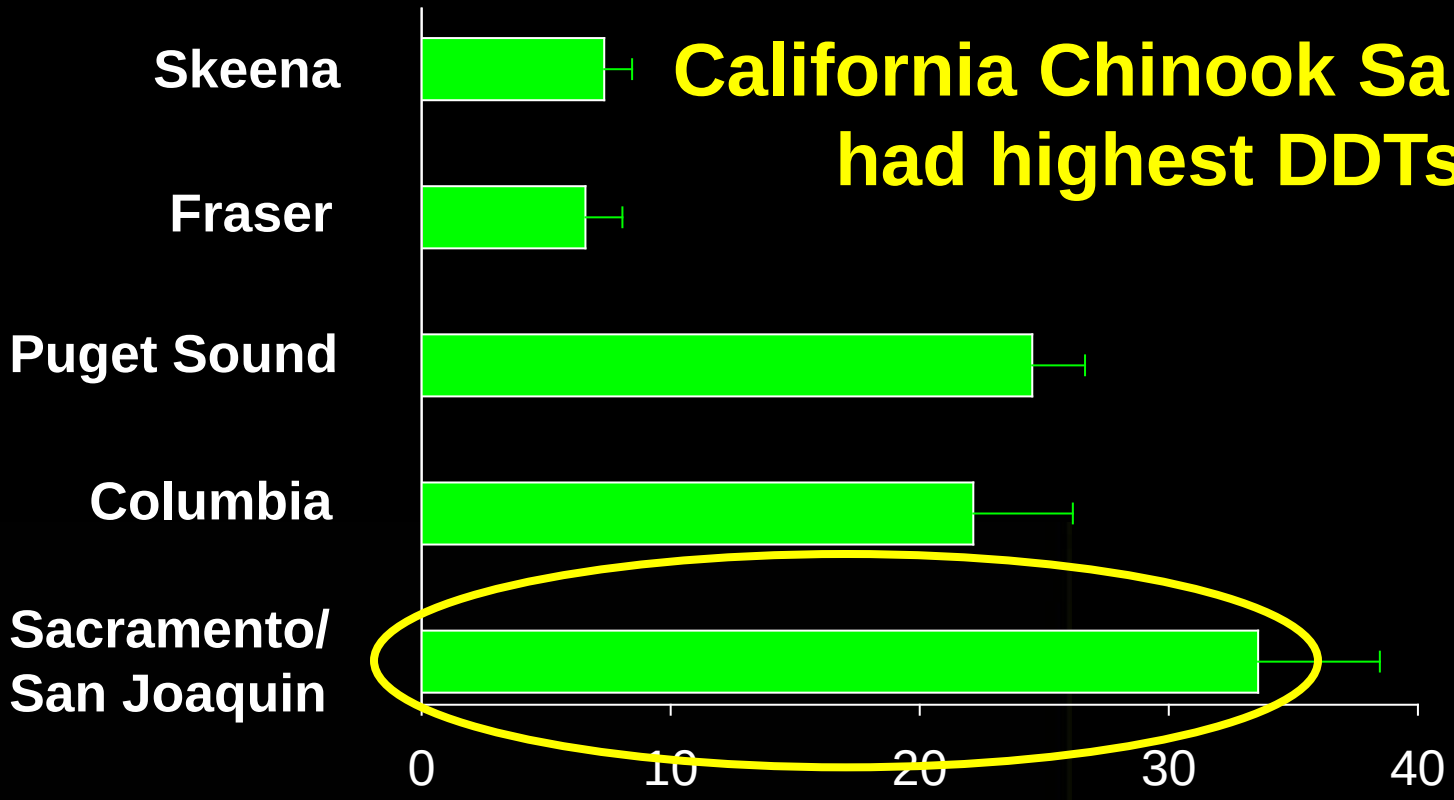
How do west coast Chinook salmon populations differ in POP concentrations?

Note: “Fraser” stocks do not include Harrison

4 classes of contaminants were analyzed in 216 whole body salmon samples:

DDTs, HCB, PCBs, PBDEs,

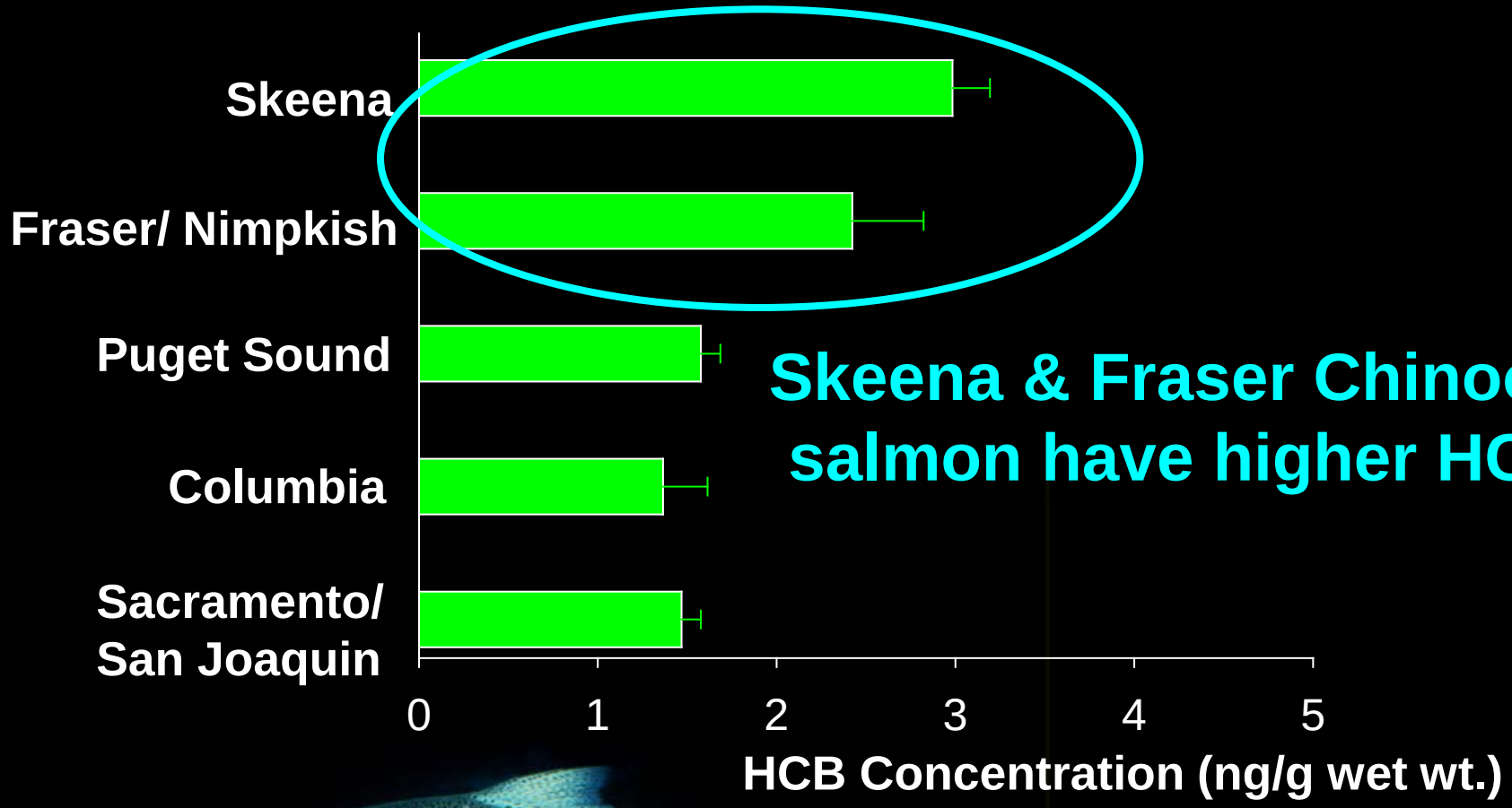
DDTs in Whole-body Chinook Salmon



California Chinook Salmon had highest DDTs

adult fish
summer/ fall run

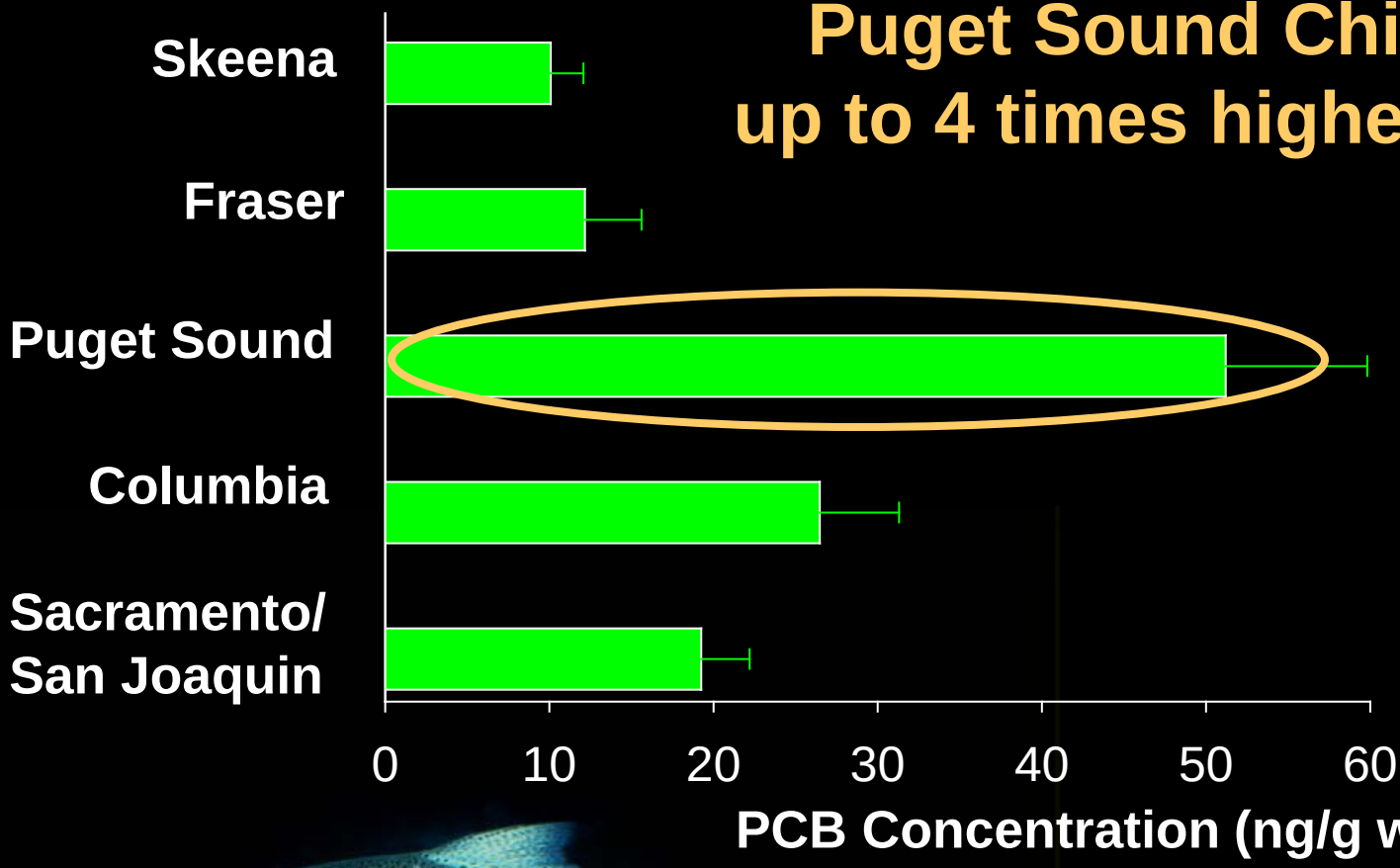
HCB in Whole-body Chinook Salmon



Skeena & Fraser Chinook salmon have higher HCB

adult fish
summer/ fall run

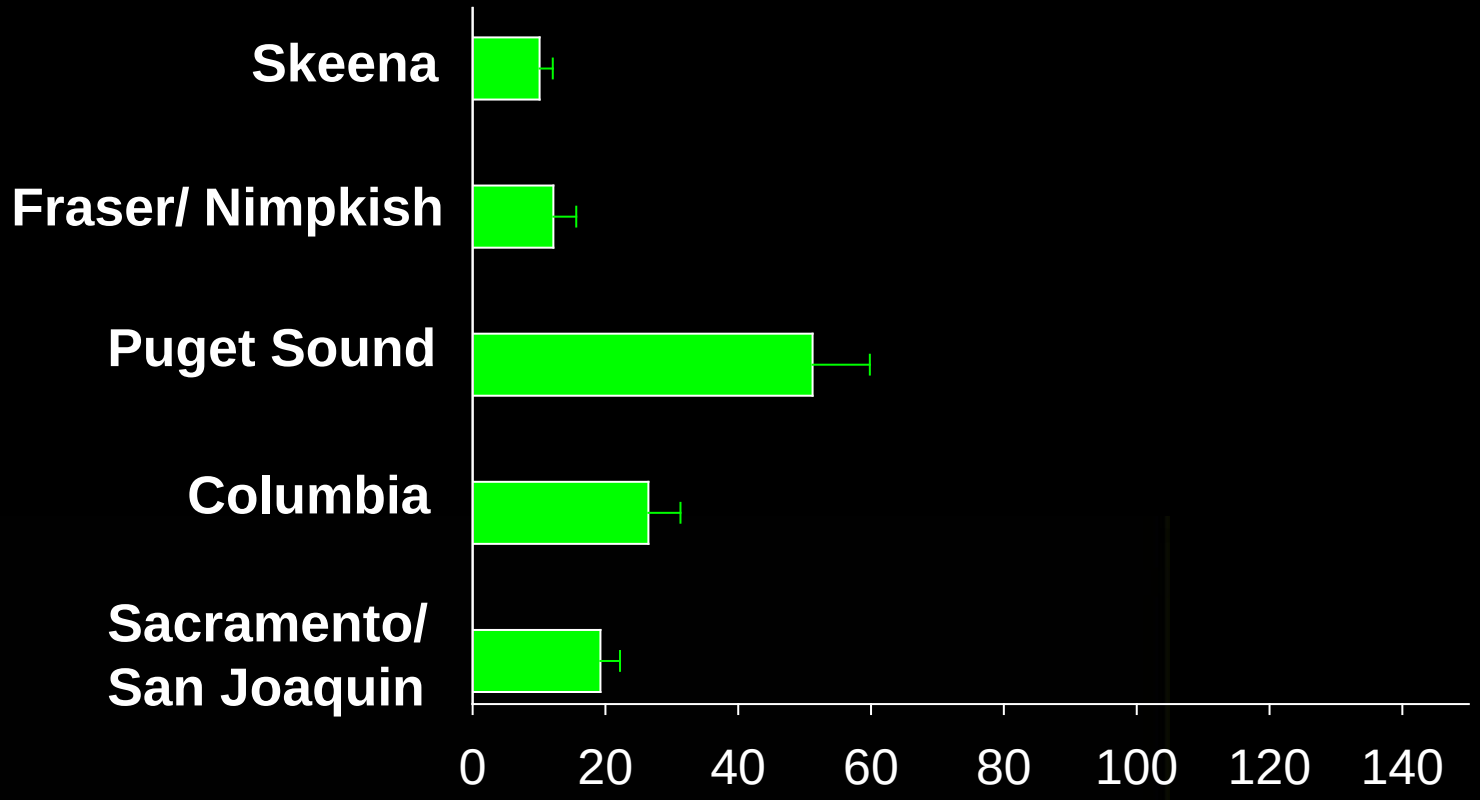
PCBs in Whole-body Chinook Salmon



Puget Sound Chinook up to 4 times higher PCBs

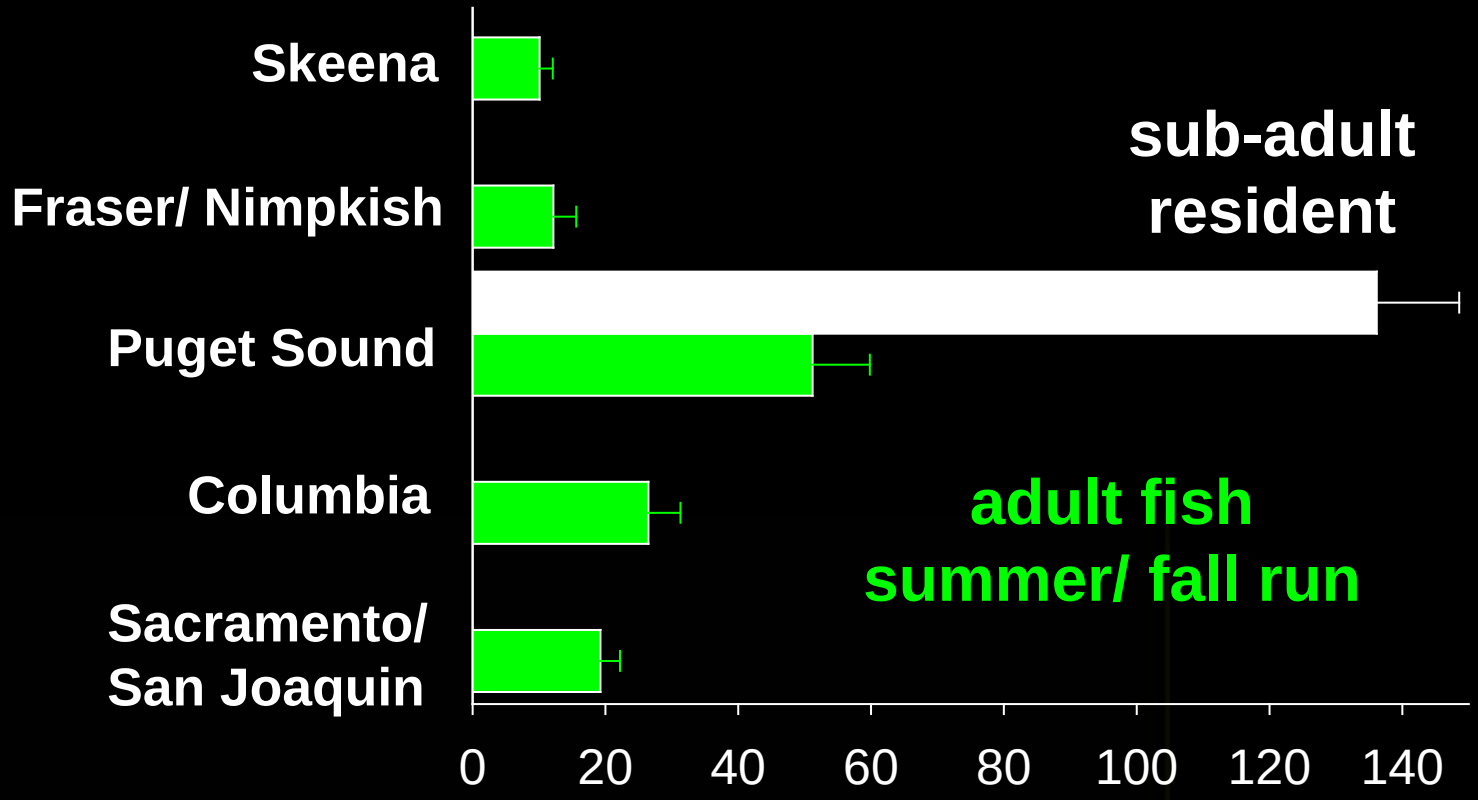
adult fish summer/ fall run

PCBs in Whole-body Chinook Salmon



adult fish
summer/ fall run

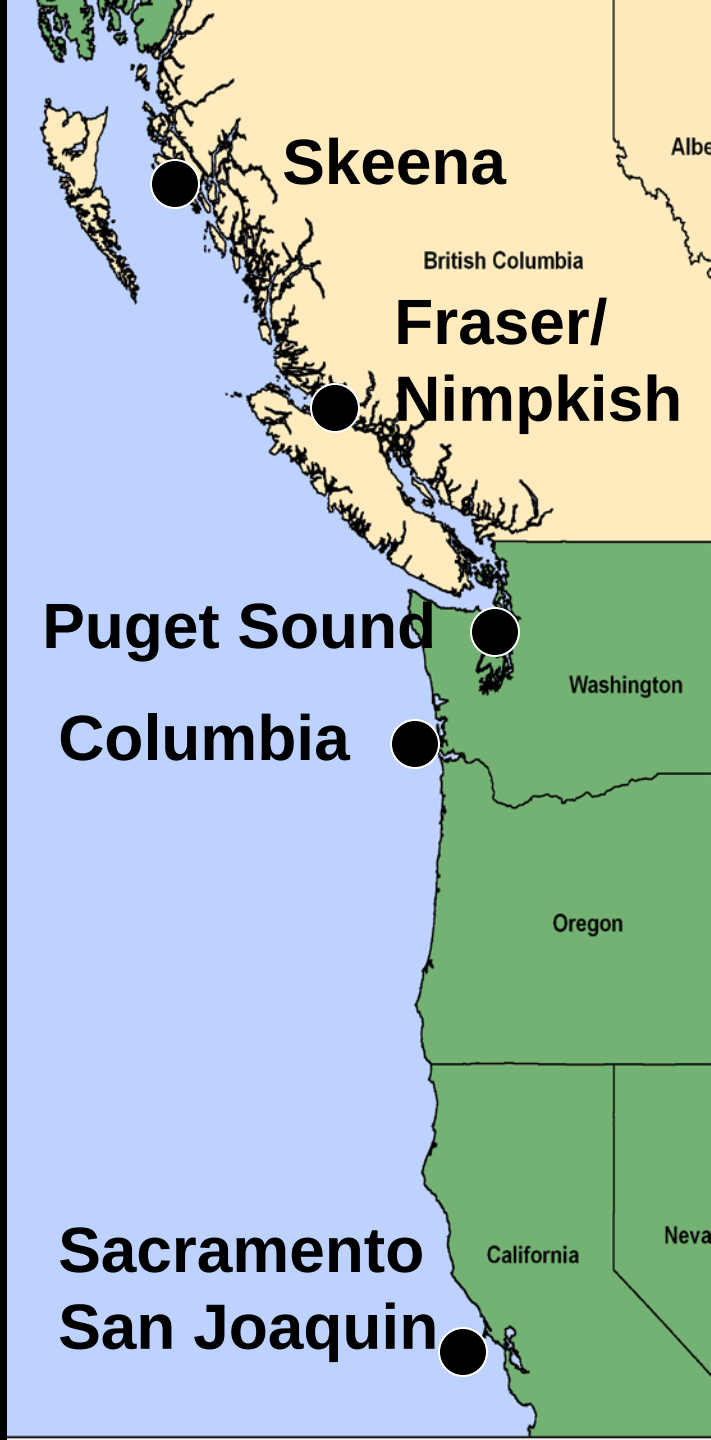
PCBs in Whole-body Chinook Salmon



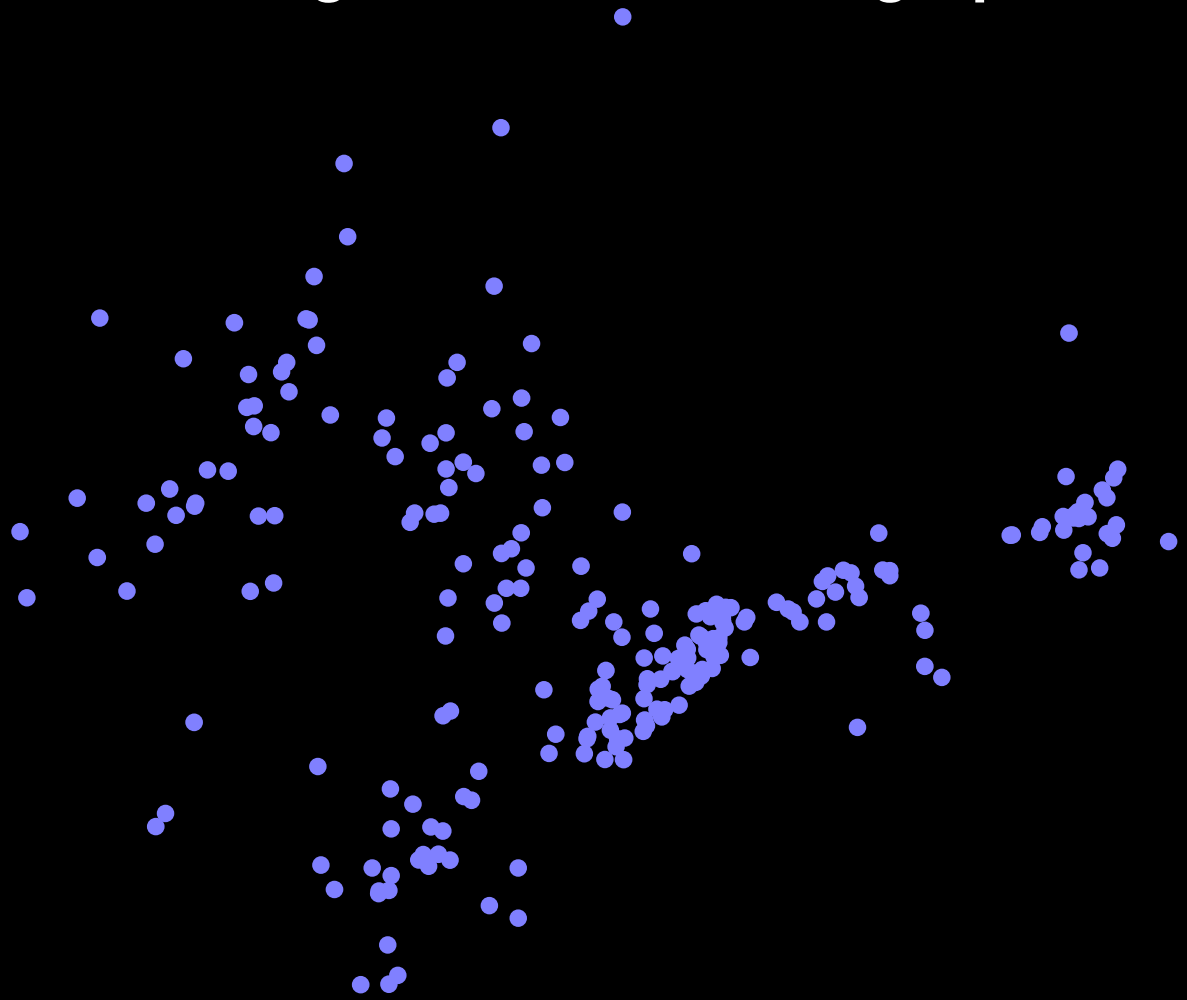
Salmon have chemical fingerprints

PCBs, PBDEs, DDTs, HCB,

Contaminant patterns vary by Chinook population reflecting difference in their marine distribution.



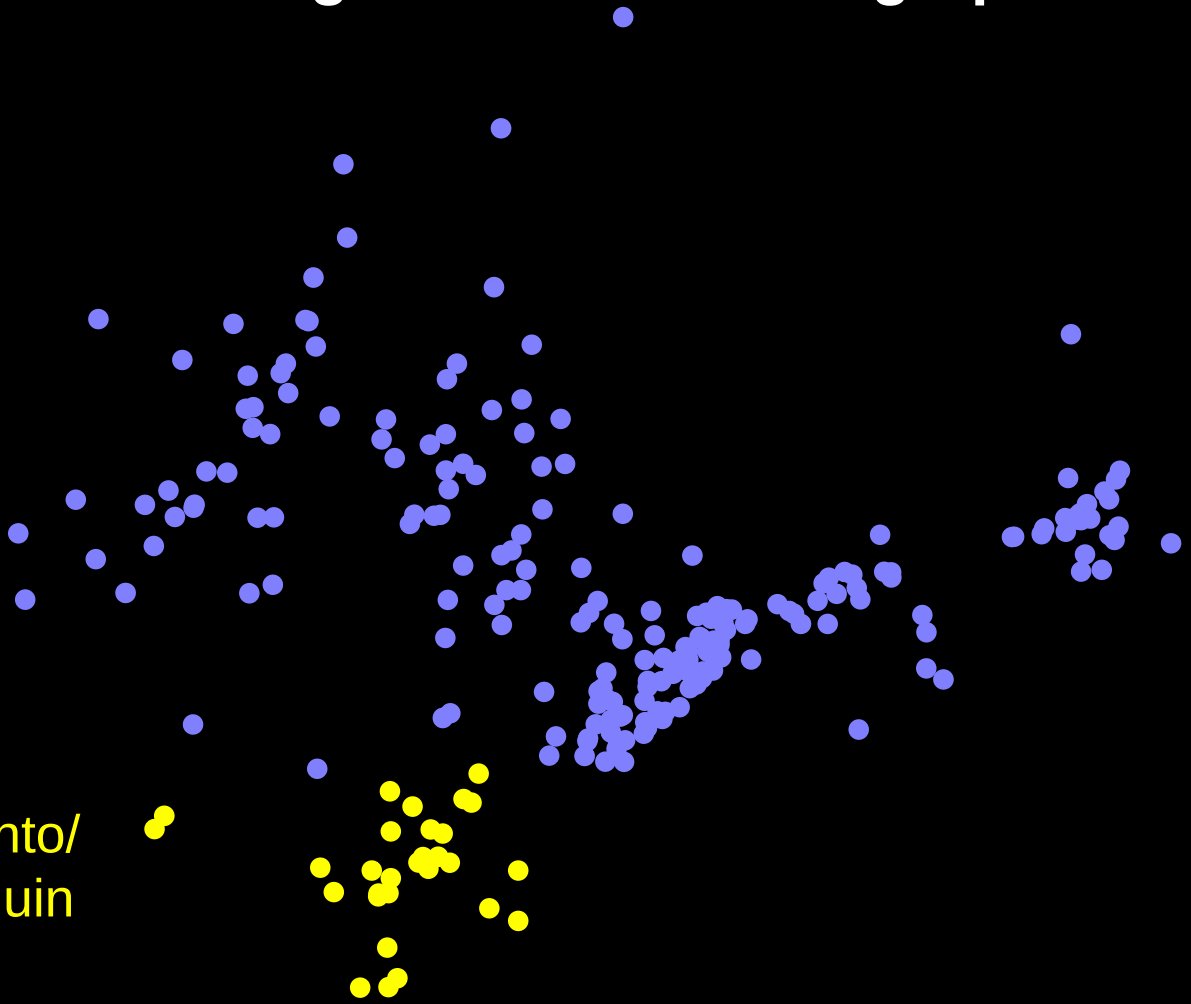
Segregation of Chinook Populations Using Contaminant Fingerprint



Multi-dimensional Scaling Plot of Four POPs

Stress=0.05

Segregation of Chinook Populations Using Contaminant Fingerprint



Multi-dimensional Scaling Plot of Four POPs Stress=0.05

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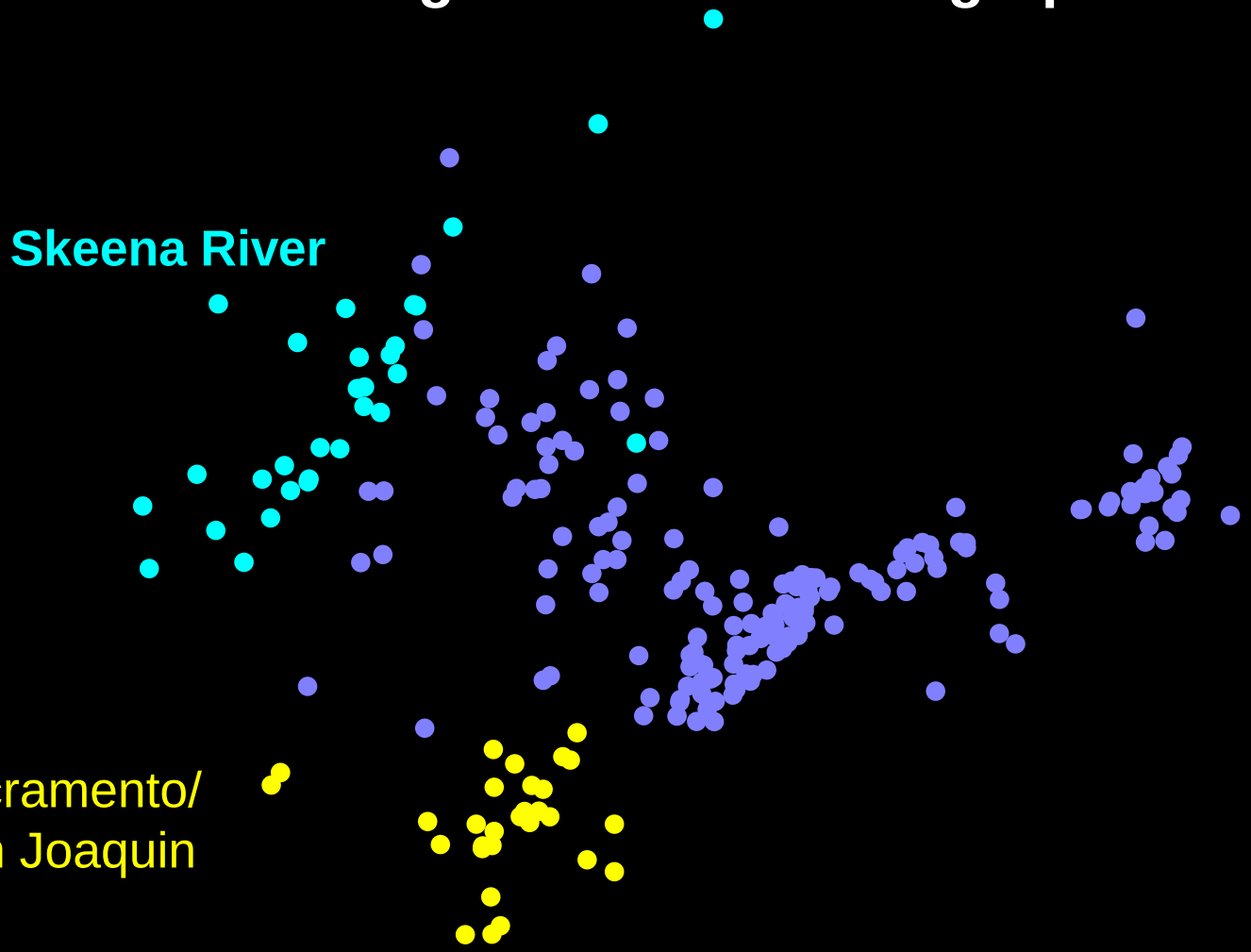

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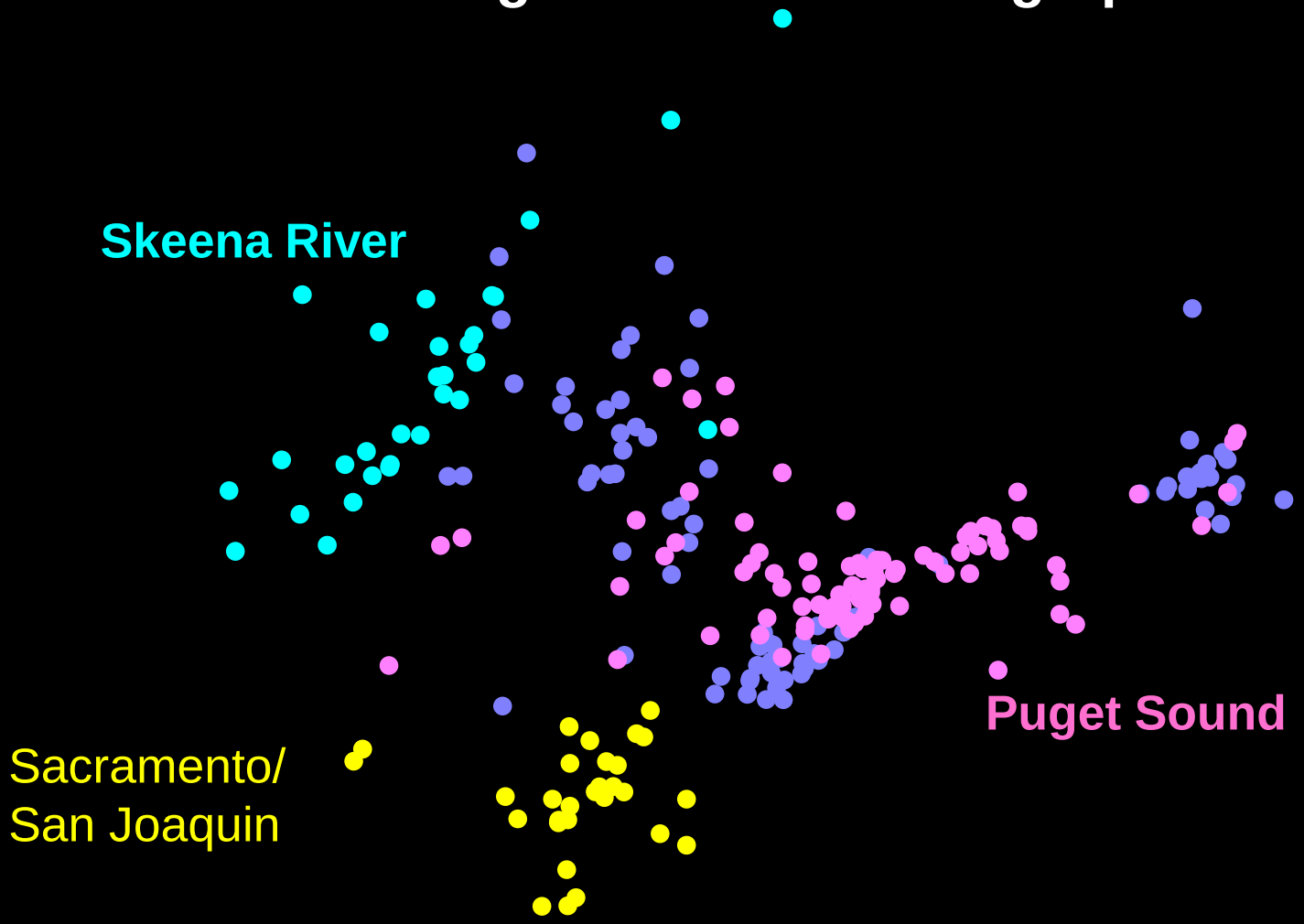

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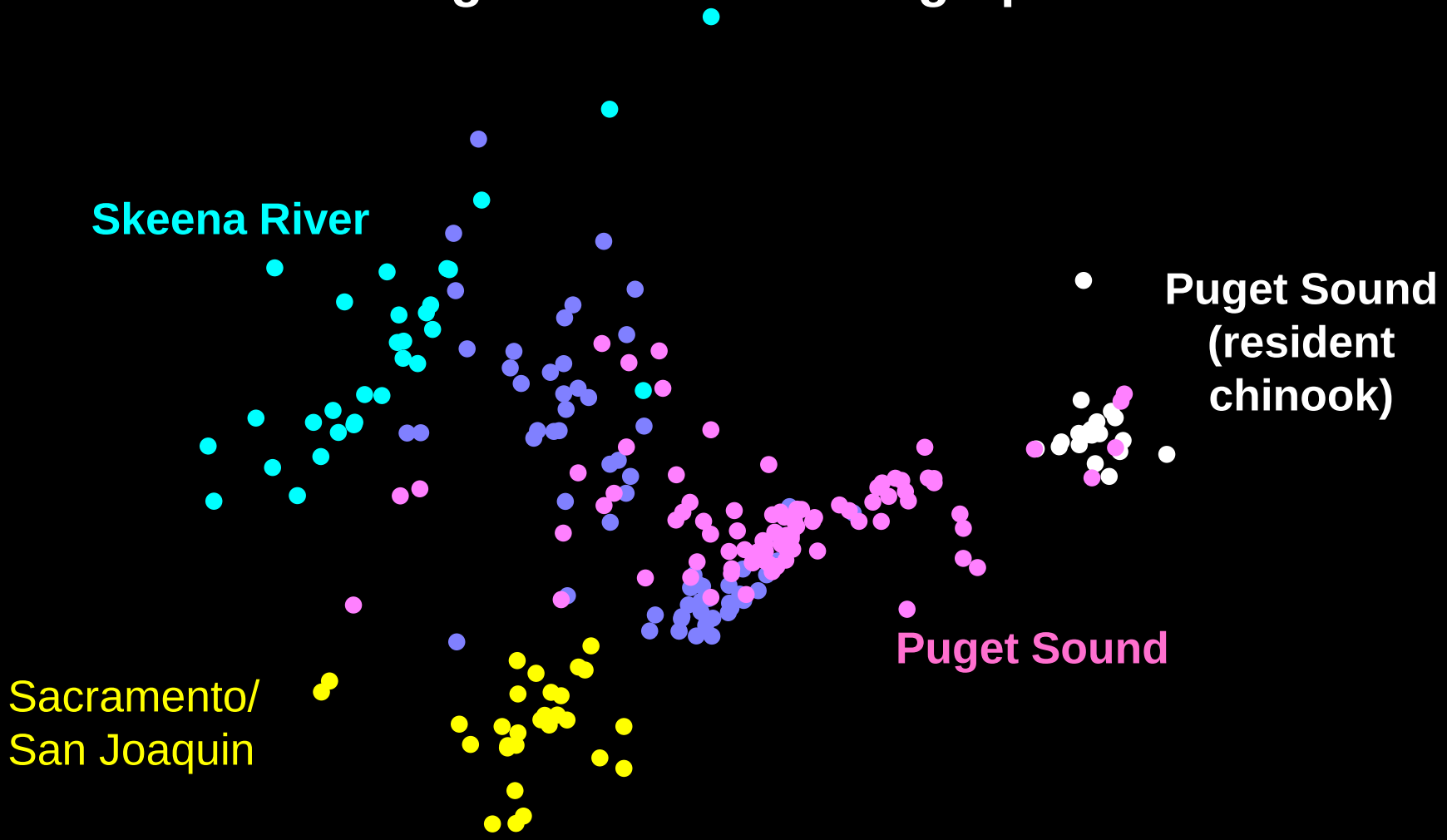

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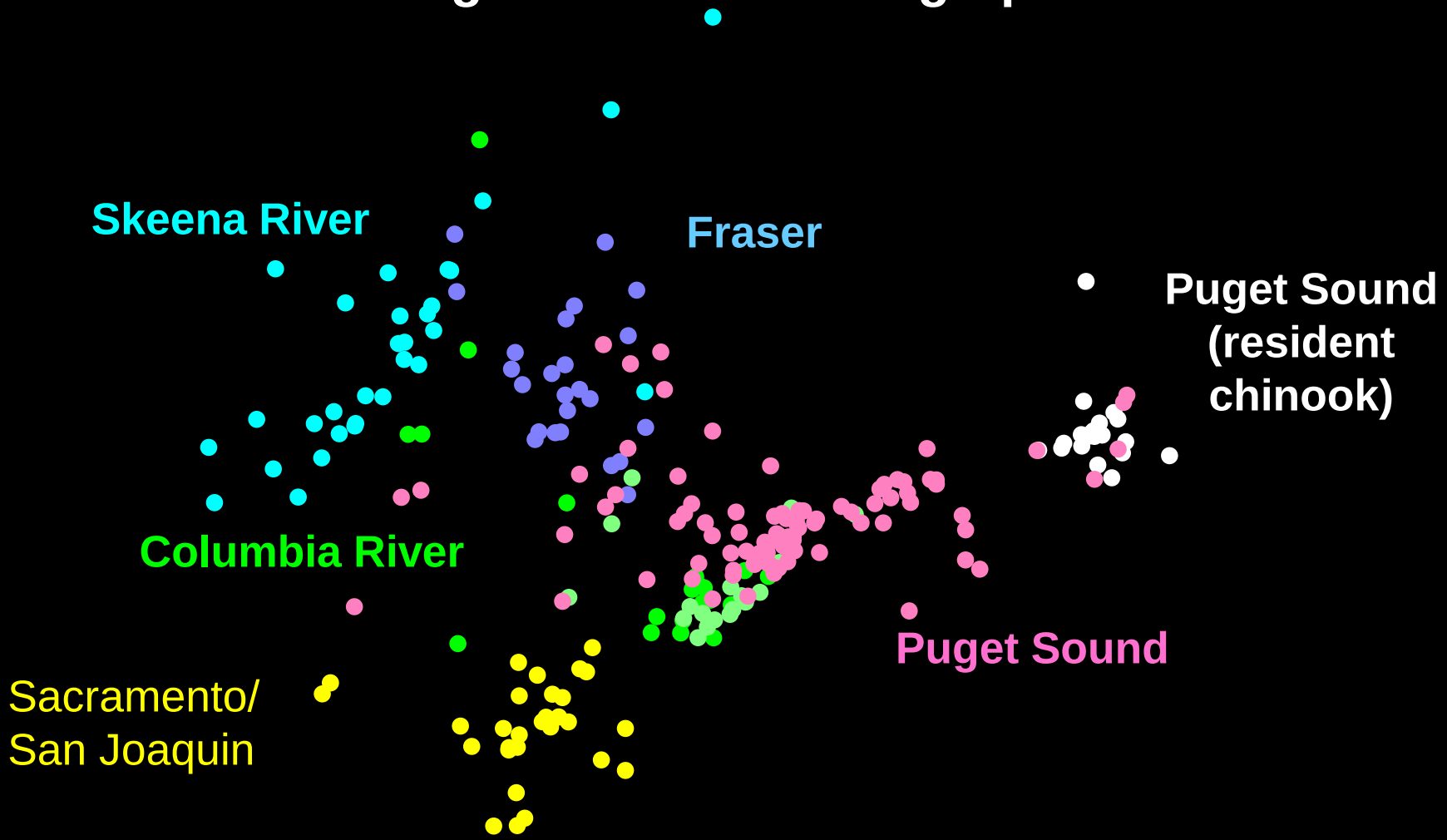
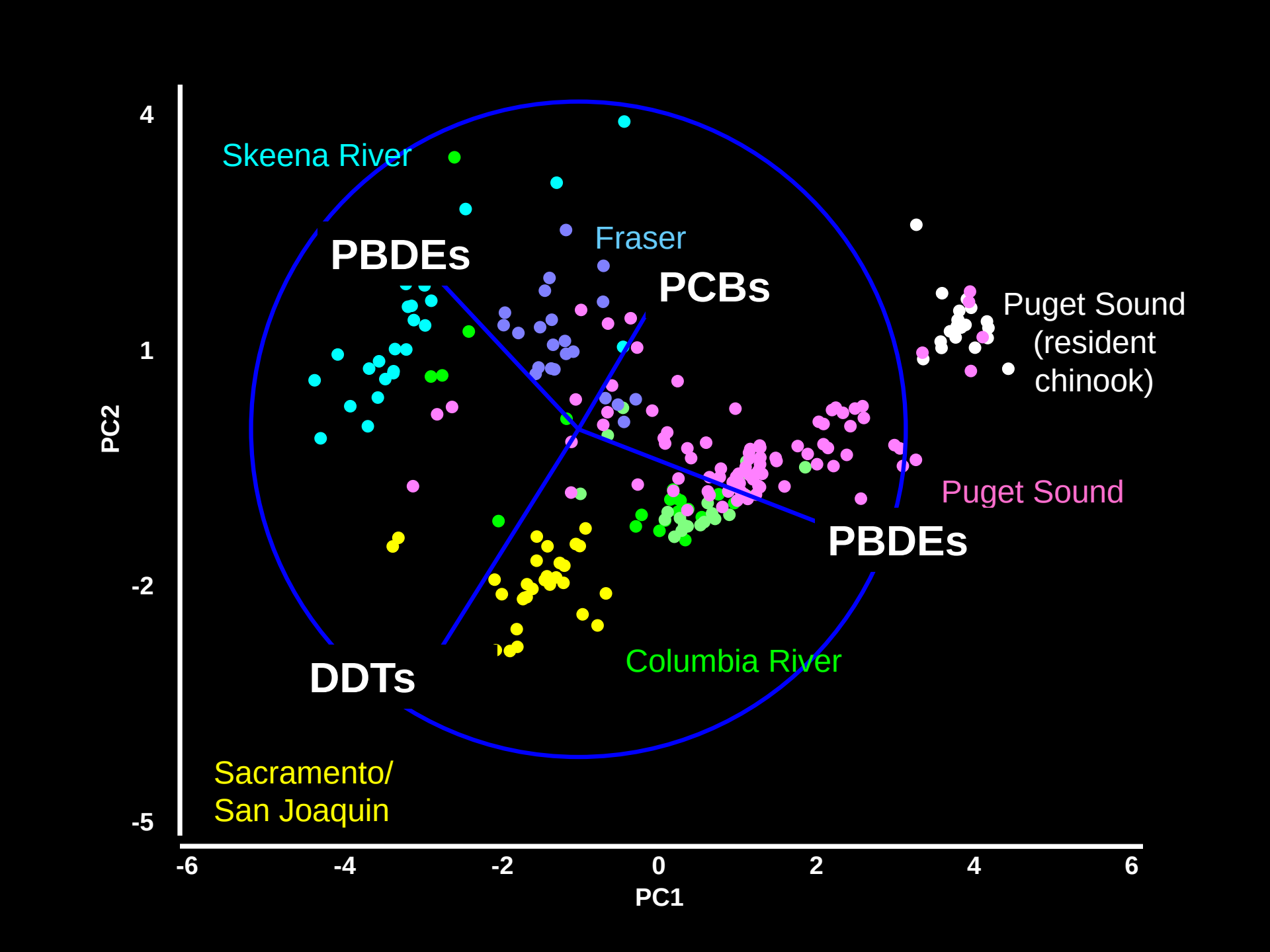
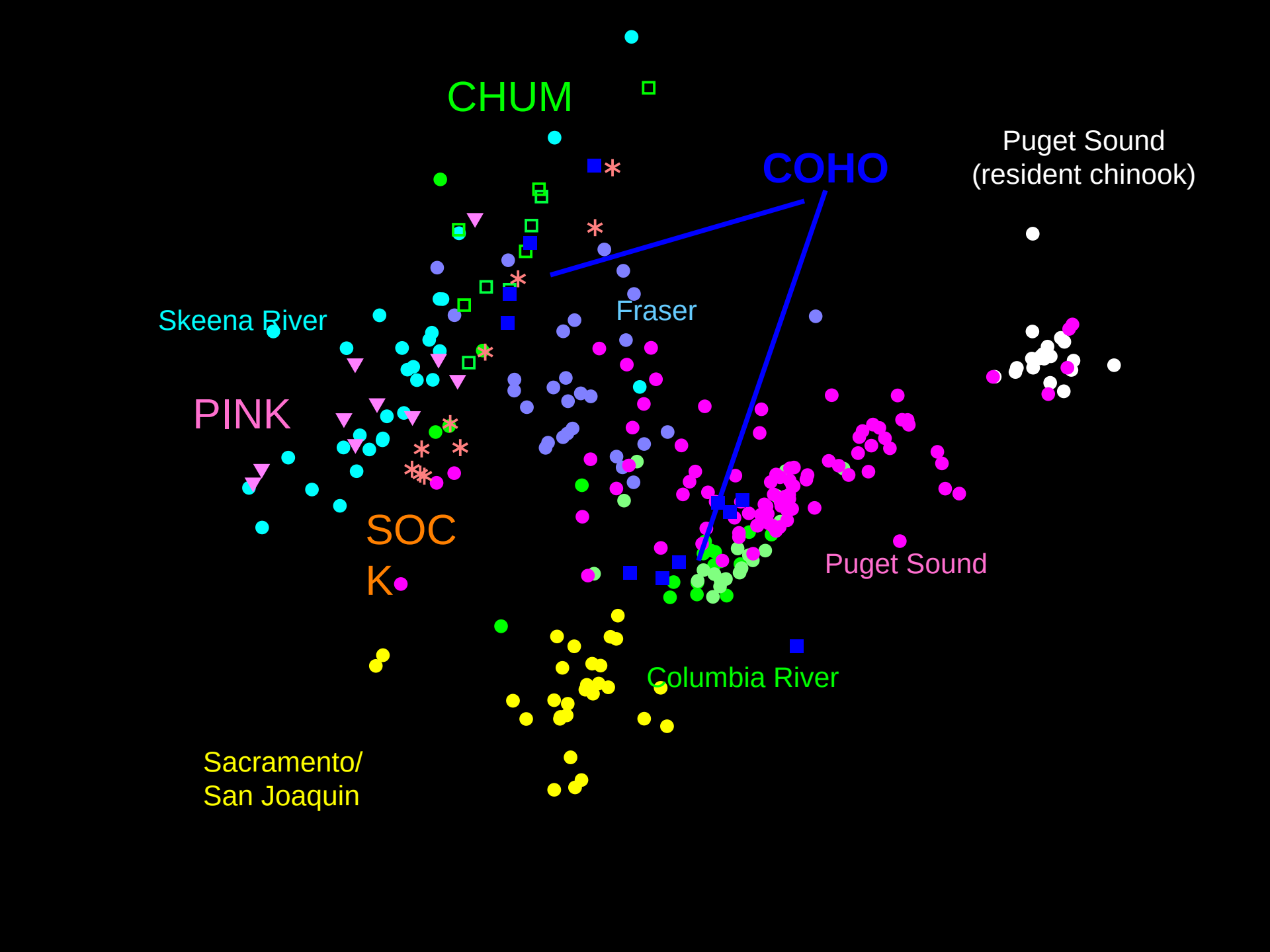
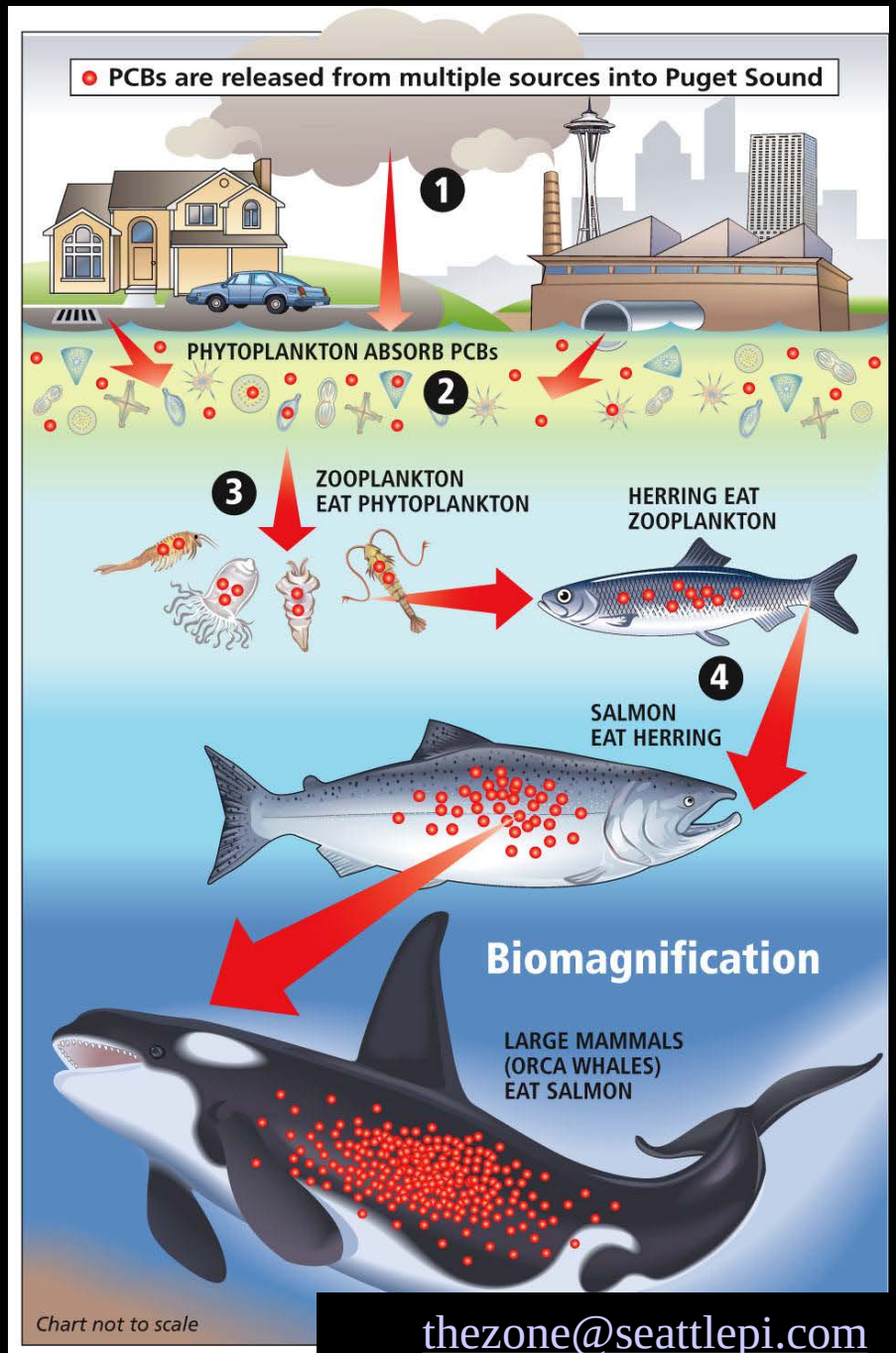


Multi-dimensional Scaling Plot of Four POPs

Stress=0.05


Skeena River
Fraser
PBDEs
PCBs
Puget Sound
(resident
chinook)
Puget Sound
PBDEs
Columbia River
DDTs
Sacramento/
San Joaquin
4
1
-2
-5
PC2
-6
-4
-2
0
2
4
6
PC1


CHUM
COHO
Puget Sound
(resident chinook)
Skeena River
Fraser
PINK
SOCK
Puget Sound
Columbia River
Sacramento/
San Joaquin



Chinook salmon populations distributed near land-based sources of contaminants have elevated POPs.

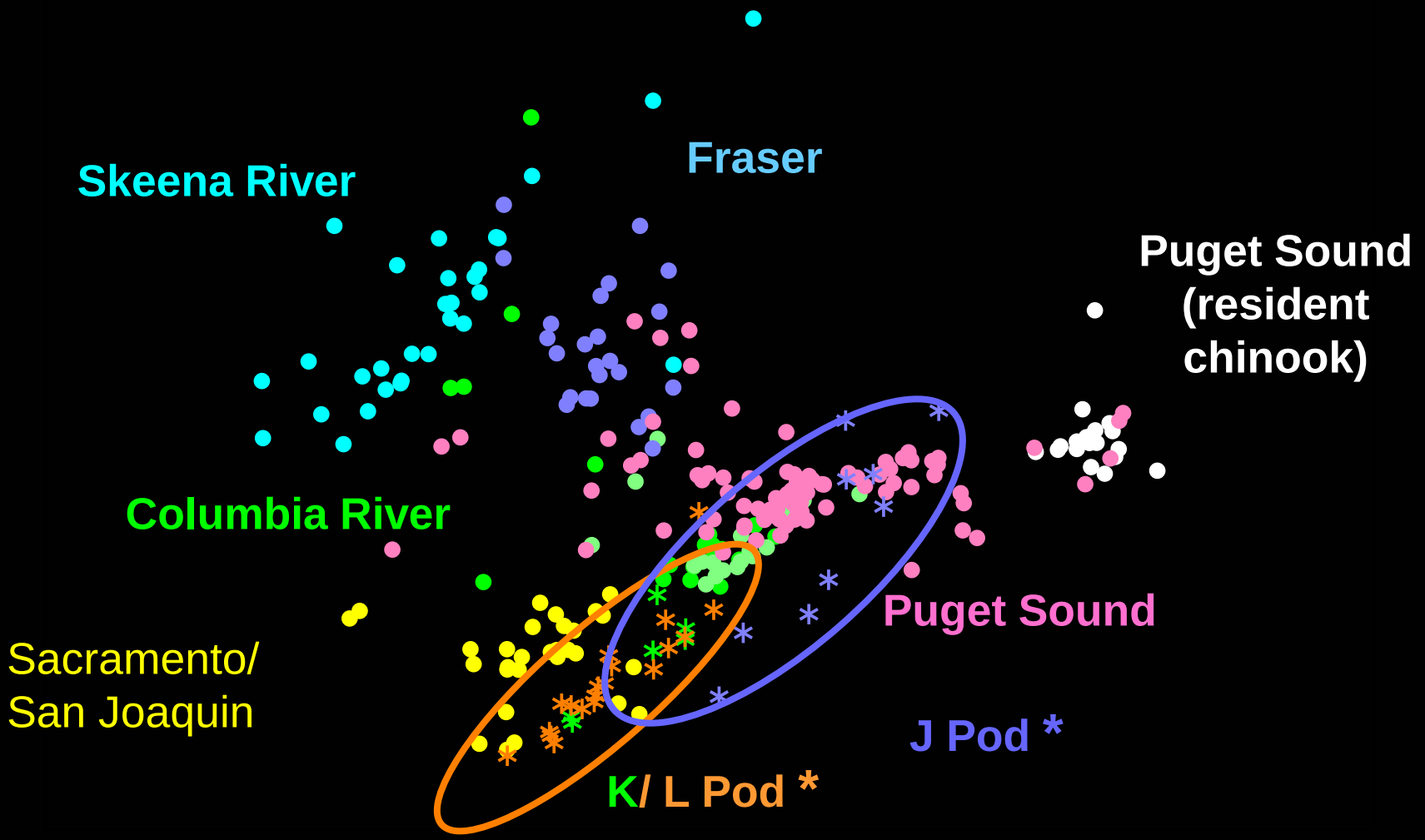
POP concentrations in Chinook salmon vary regionally with distinct chemical fingerprints associated with each population.

Marine distribution is the main factor affecting POP levels in Chinook salmon.

What does this mean for SRKW?

thezone@seattlepi.com

Segregation of Chinook Populations Using Contaminant Fingerprint



Multi-dimensional Scaling Plot of Four POPs

Stress=0.07

Fingerprint Summary

- J Pod killer whales fingerprint overlap with Puget Sound (Harrison) and Columbia River, suggesting substantial portion of their contaminants originate from those source – a more “Salish Sea signal” + Columbia

- K and K Pod killer whales fingerprint overlap more with Sacramento/ San Joaquin and Columbia River – a more “California signal”

Other factor affecting fingerprints

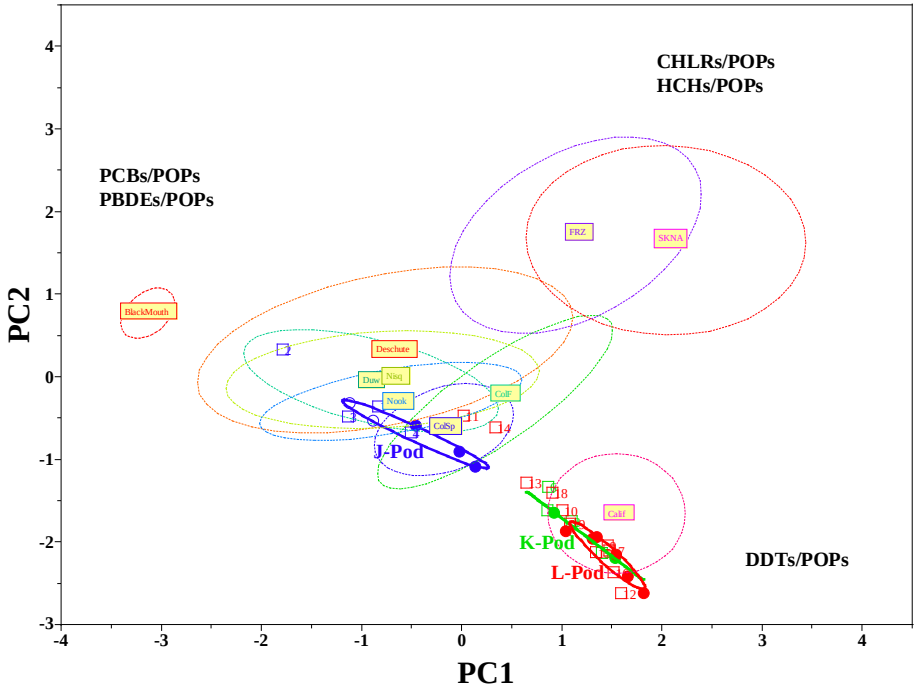
1. Contaminant fingerprints in whales and salmon reflect different time scales.
    - Long-term trends in PBDE alter fingerprints over time
    - BUT, fingerprints with and without PBDEs are similar.

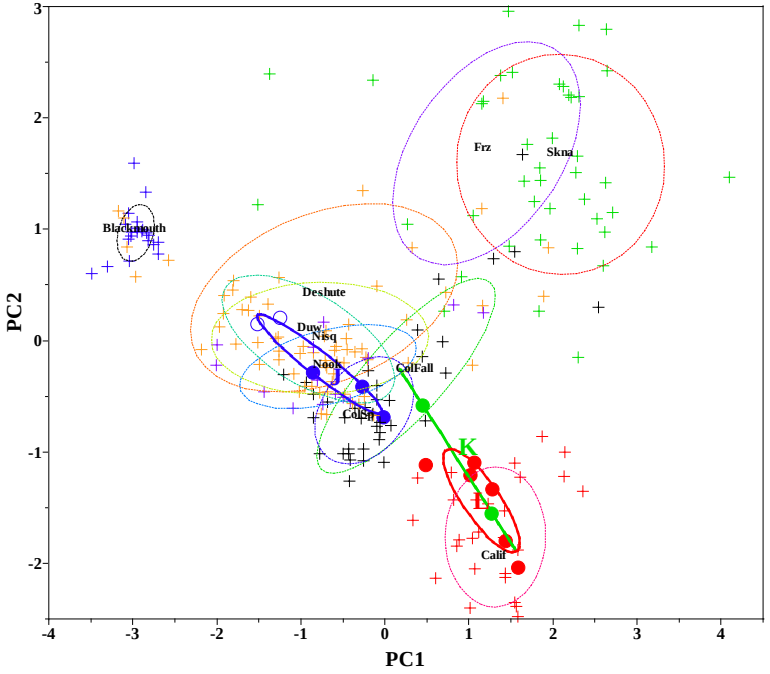
2. Contaminant bioaccumulation factors for individual contaminants differ between whales and fish, altering fingerprints.
    - Preliminary corrections for bioaccumlation factors
        - dampens “California signal” for K and L pods
        - enhances “Salish Sea” signal for J pod

3. Contaminant fingerprints reflect qualitative differences in source of contaminants in diet
    - Quantitative assessment require mass-balance bioconcentration models.

END

Correction for bioaccumaltion rates shifts whales' fingerprint toward Columbia River populations



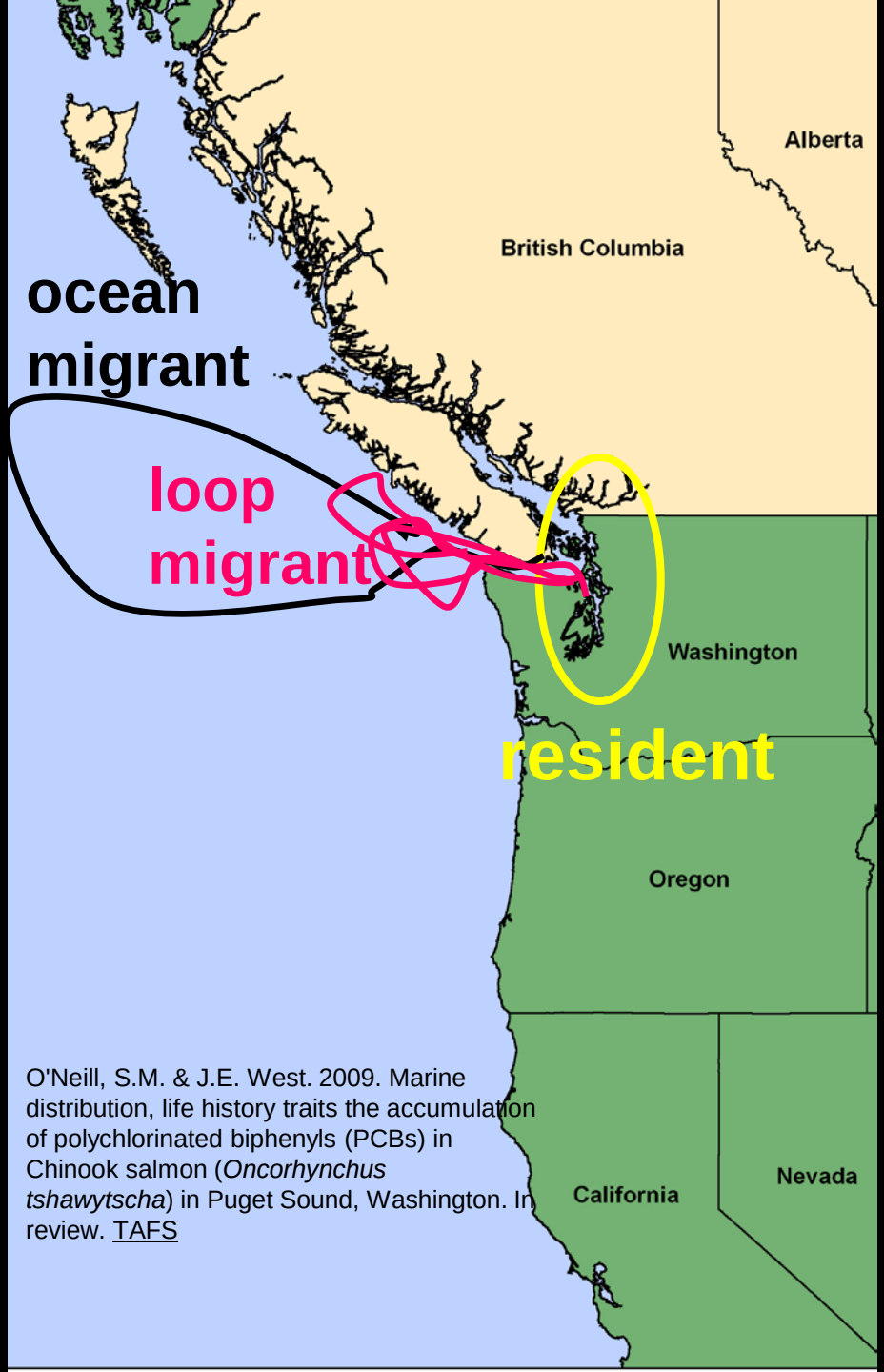


Migration patterns of Puget Sound Chinook salmon

Percent of recreational and commercial catch of Puget Sound Chinook salmon displaying resident behavior

29 % of sub-yearling smolts

45 % of yearling smolts



O'Neill, S.M. & J.E. West. 2009. Marine distribution, life history traits the accumulation of polychlorinated biphenyls (PCBs) in Chinook salmon (*Oncorhynchus tshawytscha*) in Puget Sound, Washington. In review. TAFS

POP Fingerprints

Chemical Fingerprints of Chinook salmon & Pacific herring are similar in regions where their distribution overlaps