Assessing and Managing Biodiversity of Pacific Salmon: Methods for Setting Limit Reference Points in Canada

IYS Symposium 2022

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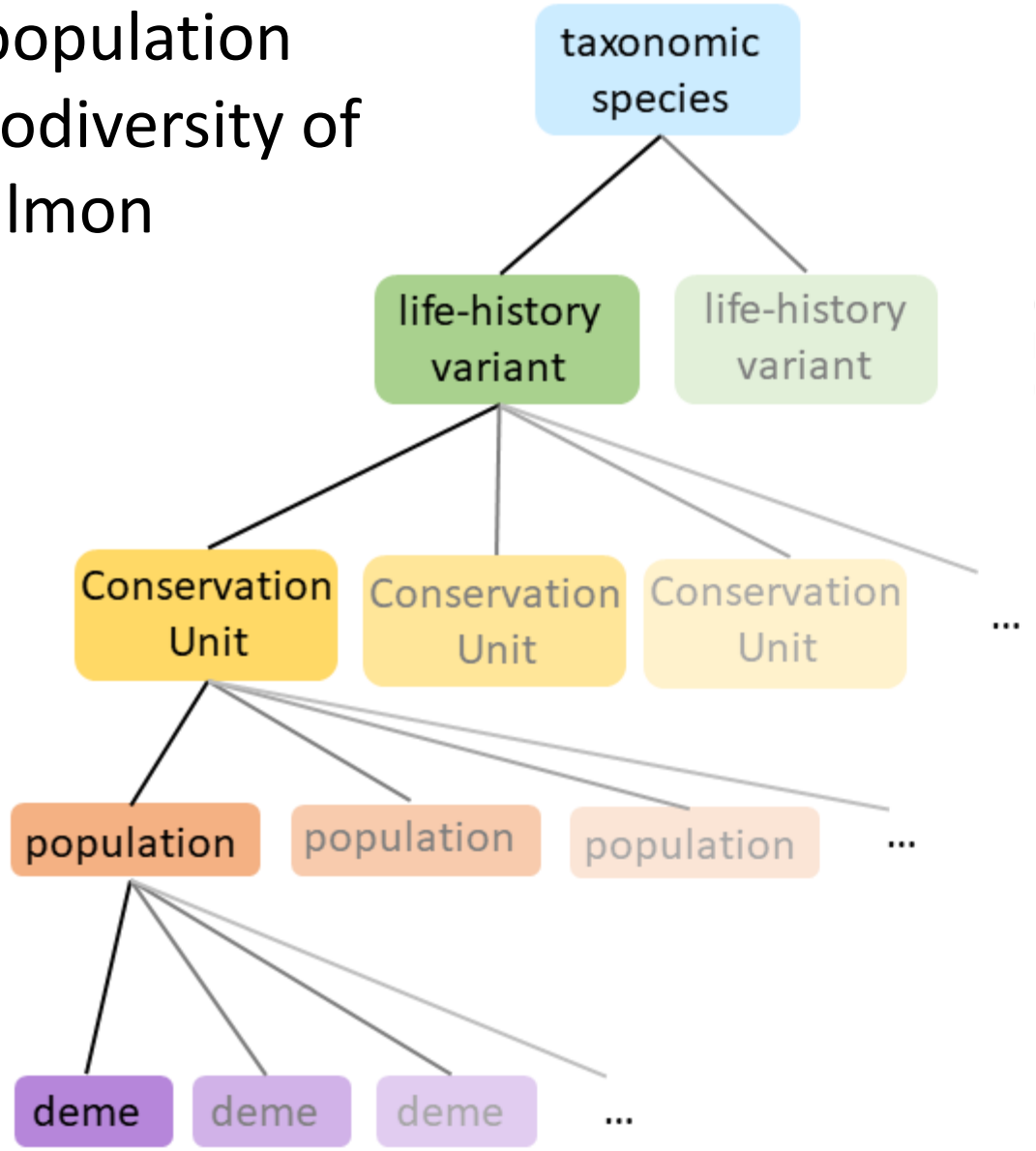
Traditional territory of Snuneymuwx First Nations

And the Technical Working Group for defining LRPs for Pacific salmon

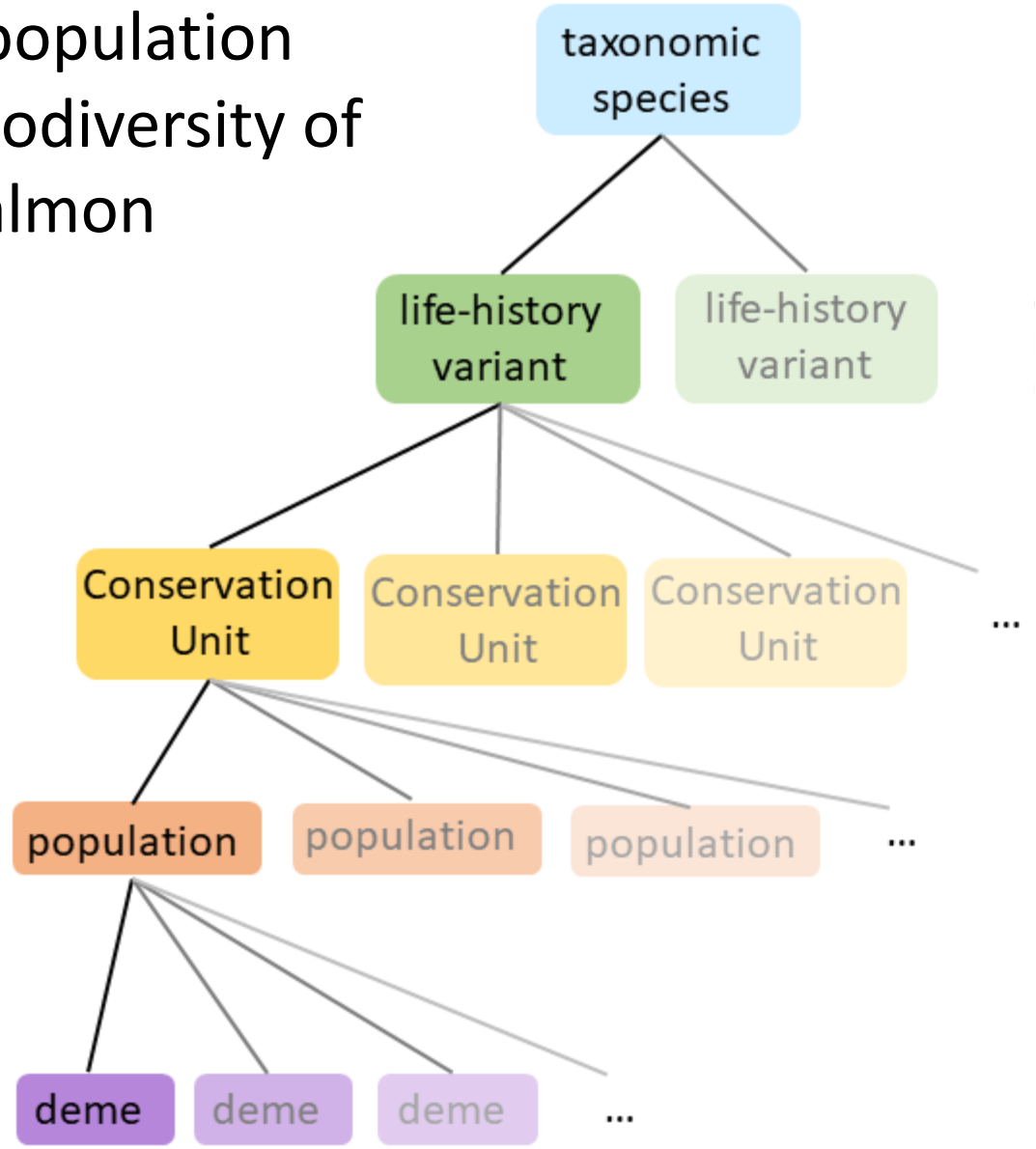
Acknowledgement of the Technical Working Group on LRPs

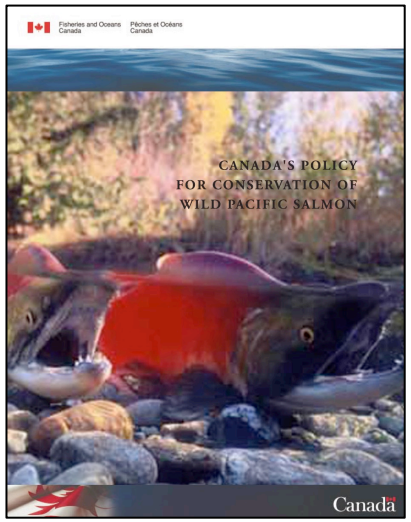
- 29 members from DFO and First Nations
- DFO Science Advisory Report (DFO 2022) and Research Documents (in press)

Hierarchy of population structure and biodiversity of Pacific salmon



Hierarchy of population structure and biodiversity of Pacific salmon

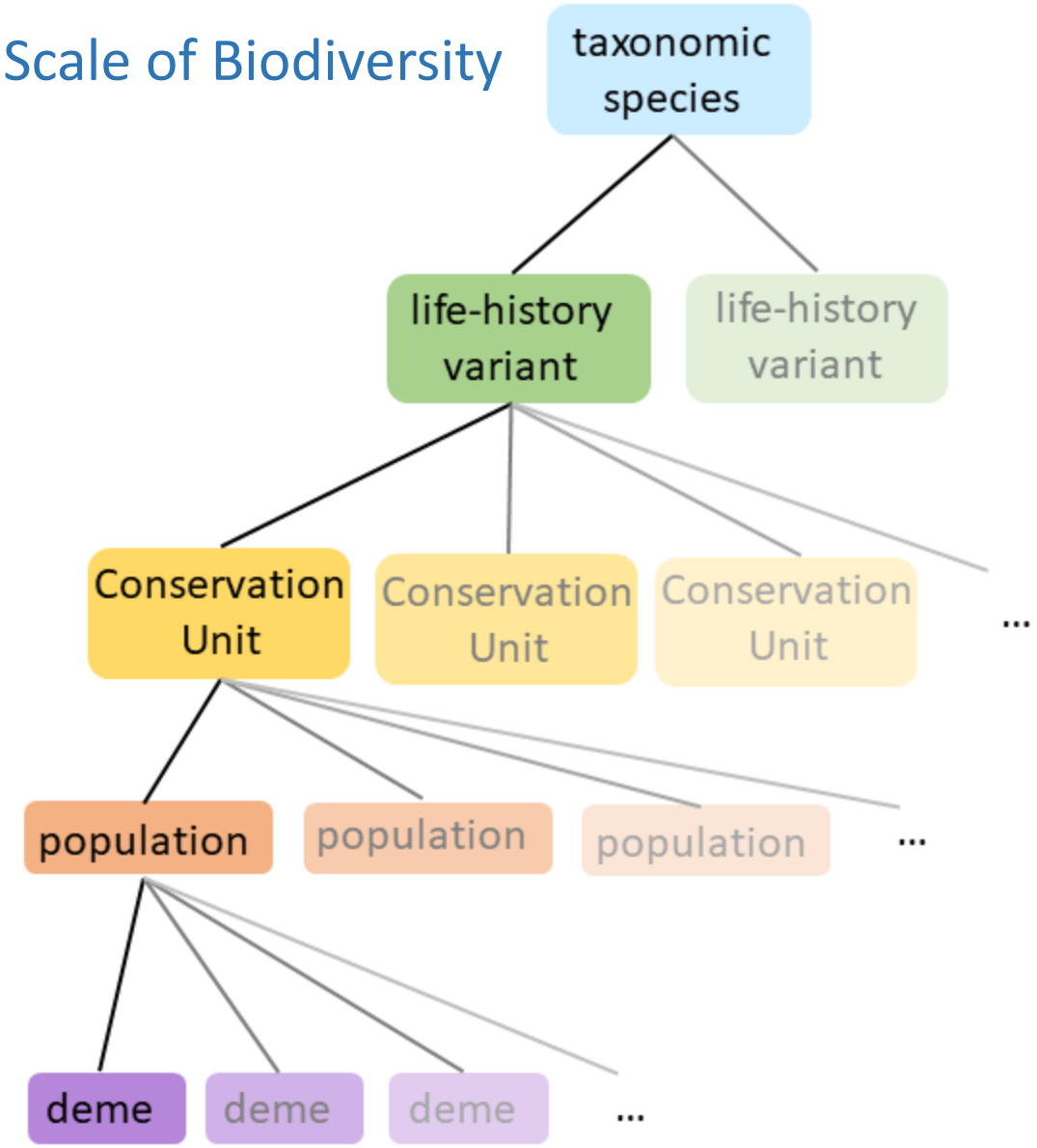




Canada's Wild Salmon Policy, 2005

Conservation Units, "group of wild salmon sufficiently isolated from other groups that, if extirpated is very unlikely to recolonize naturally within an acceptable time frame"

Scale of Biodiversity



CUs nested within SMUs

Scale of Management

Stock Management Unit (SMU)

Food, social and ceremonial fisheries

Hatcheries

Habitat restoration/ stewardship

Local fisheries

Marine, mixed-CU fisheries

Watershed and estuary planning and restoration

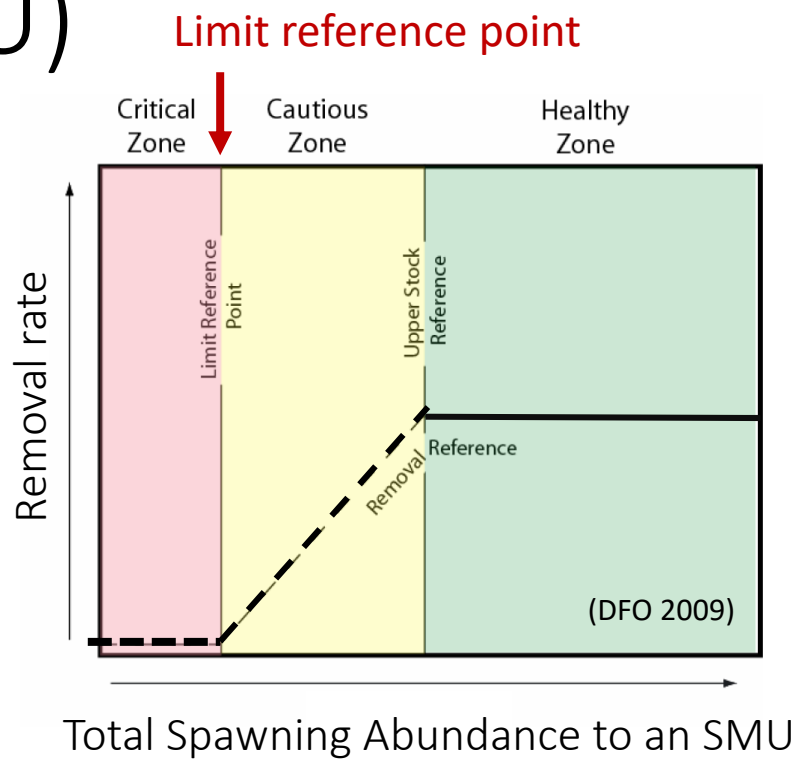
Ocean Management

Stock Management Units (SMU)

→ Require Reference Points for assessment and management

→ Limit Reference Point (LRP): the stock status below which **serious harm** is occurring to the stock.

→ LRPs applied at the scale of SMU, but serious harm occurs when component CUs are depleted below lower conservation benchmarks



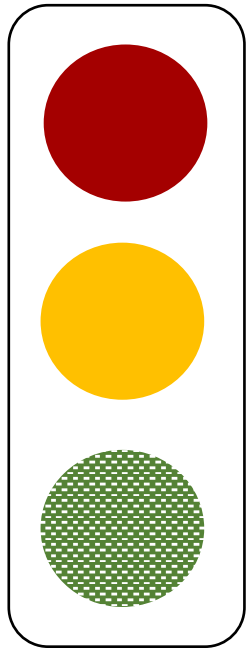
Goal: identify LRPs at the SMU scale that account for component biodiversity of CUs

Two types of LRPs based on two types of metrics:

(1) CU-status based LRP

Metric: Proportion of CUs above their lower benchmark

LRP: Required proportion of CUs above their lower benchmark (e.g., 100%)



LRP breached if at least one CU has status below their lower benchmark

Example SMU with 5 component CUs

CU 5 below benchmark

80% CUs with status above lower benchmark, SMU below the LRP of 100%

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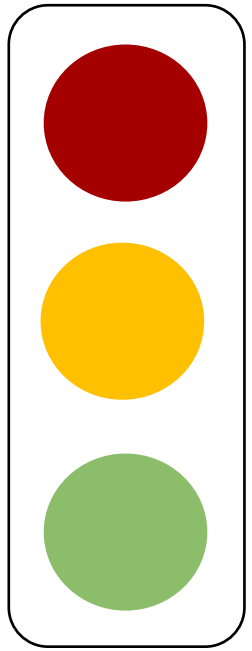
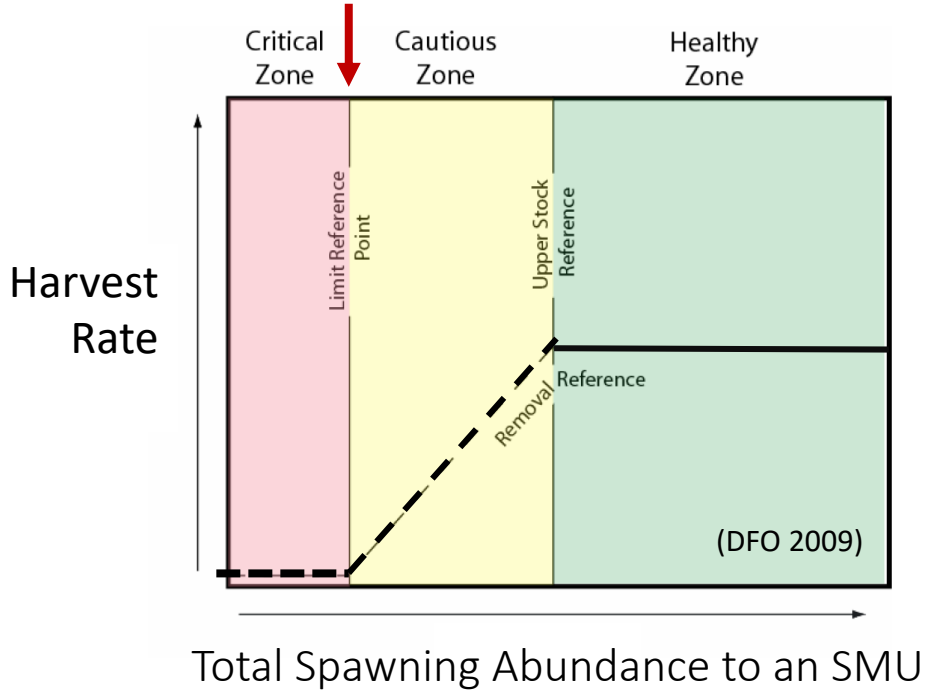


LRP breached if at least one CU has status below their lower benchmark

(2) Aggregate Abundance LRP

Metric: Total SMU-level spawning abundance

LRP: A specific number of spawners (e.g., 20,000 spawners)

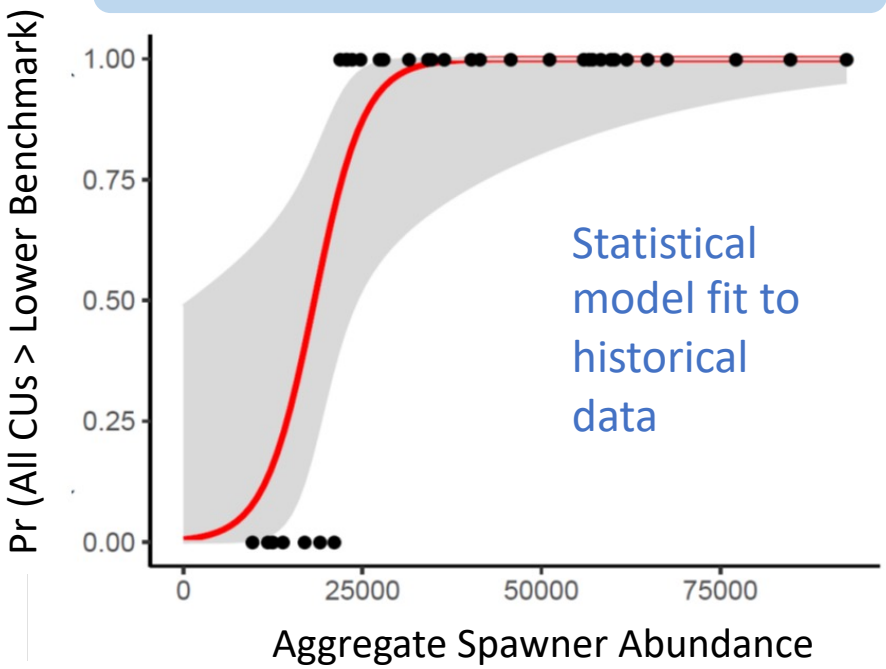


Aggregate Abundance LRPs

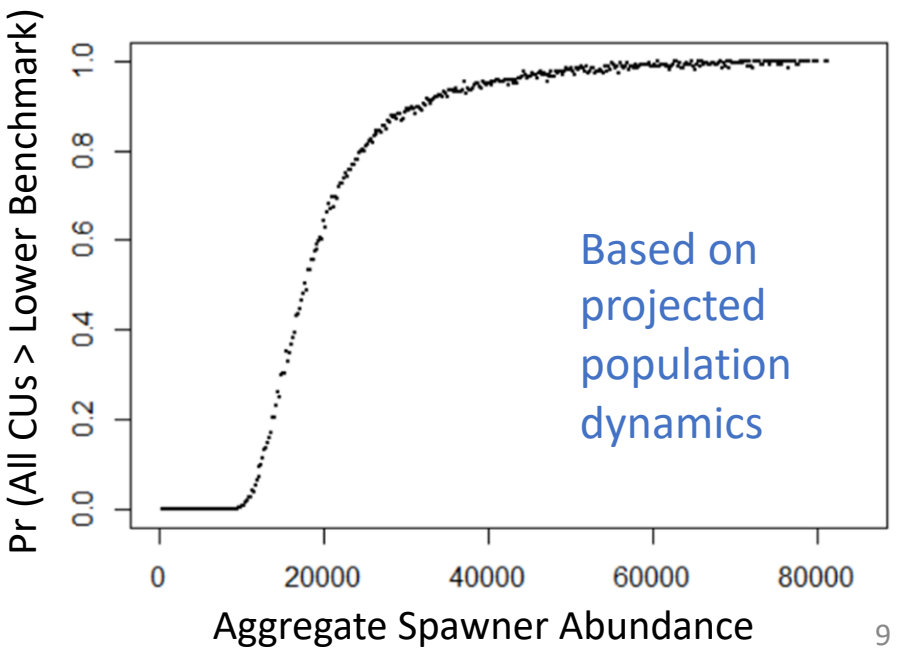
LRPs identified an aggregate abundance associated with **an acceptable probability of all component CUs being above lower benchmarks**

Two Types Considered:

(1) Logistic Regression LRPs

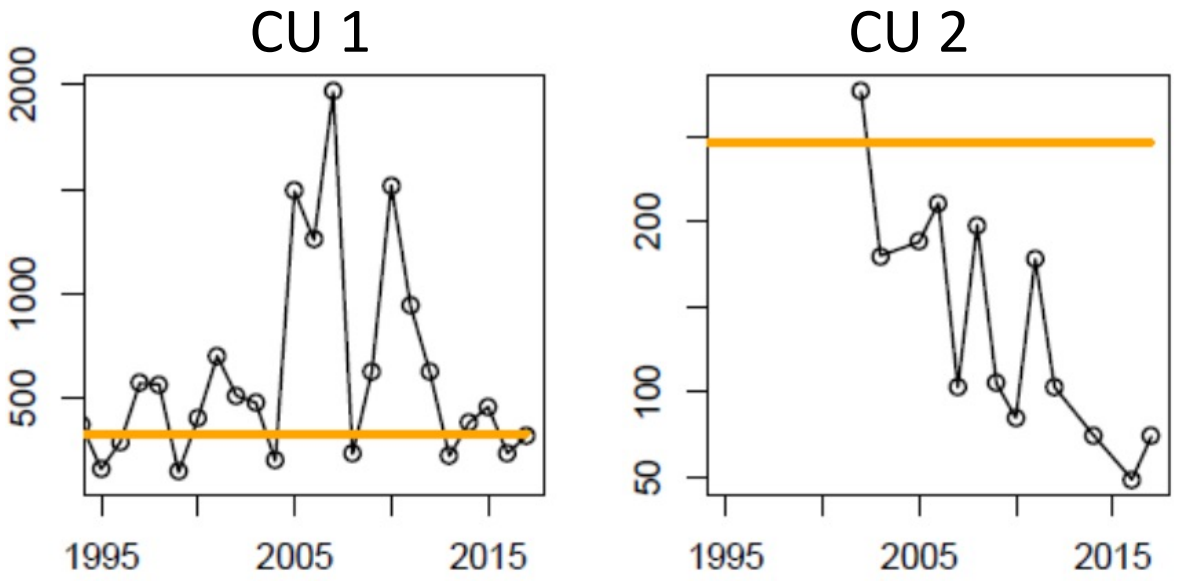


(2) Projection LRPs

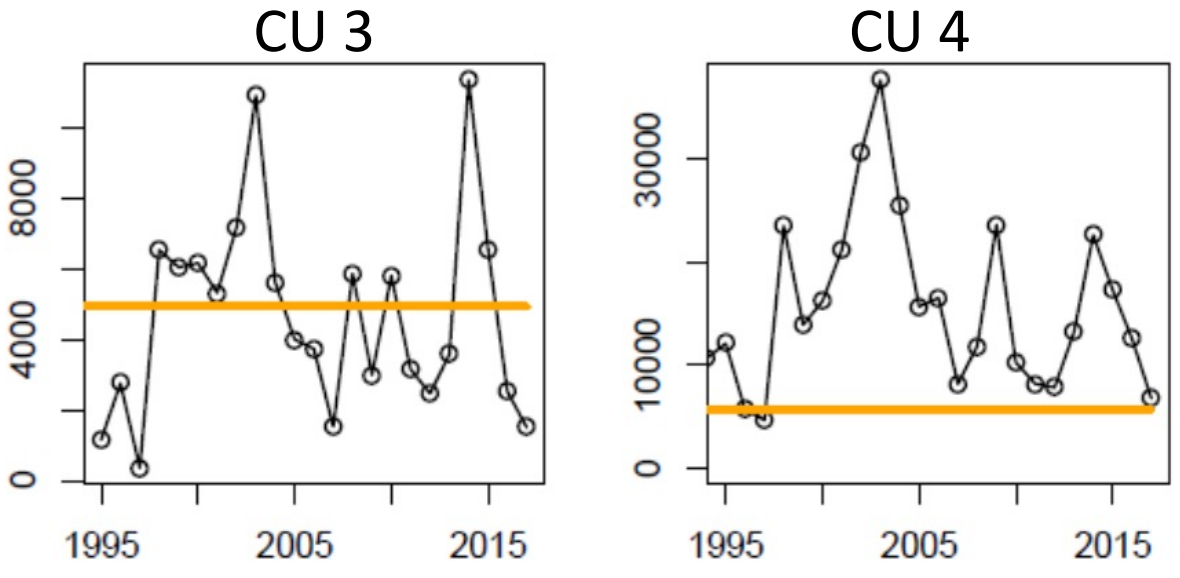


(1) Logistic Regression LRPs

Escapement



Escapement



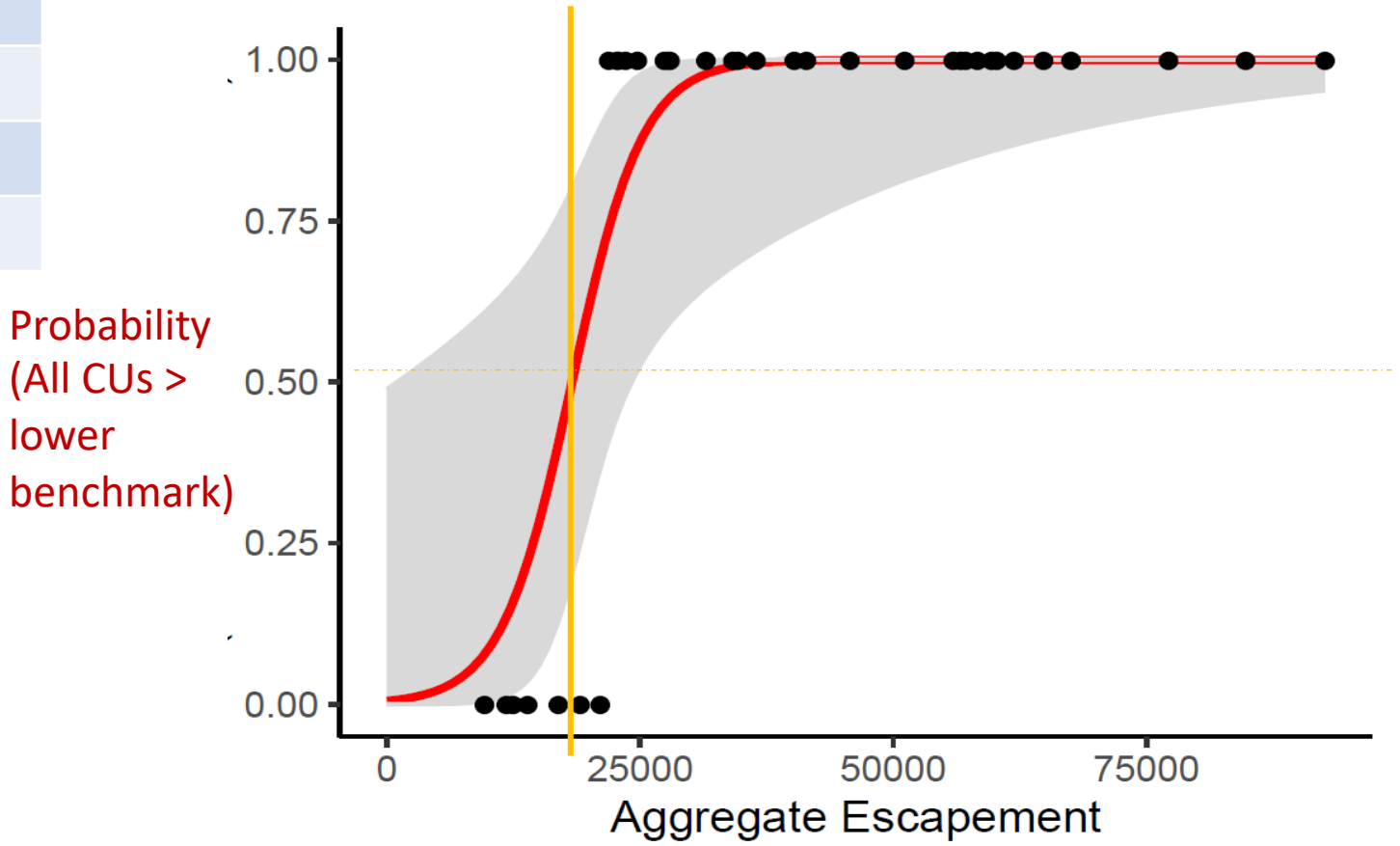
→ Start with CU-level escapement series relative to lower benchmarks

Lower Benchmark

(1) Logistic Regression LRPs

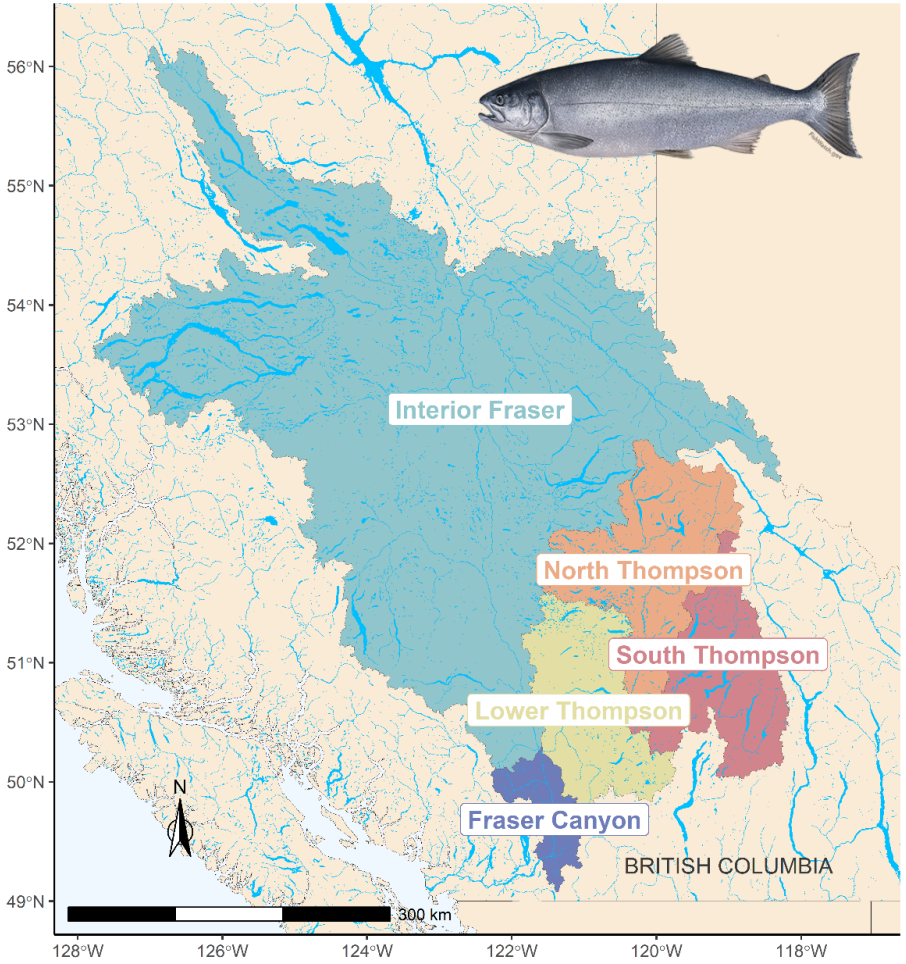
Year	Aggregate Esc.	All CUs above?
1984	22,000	0 (No)
1985	60,000	1 (Yes)
1986	20,000	0 (No)
…	…	…

LRP with 50% probability of all CUs > lower benchmark

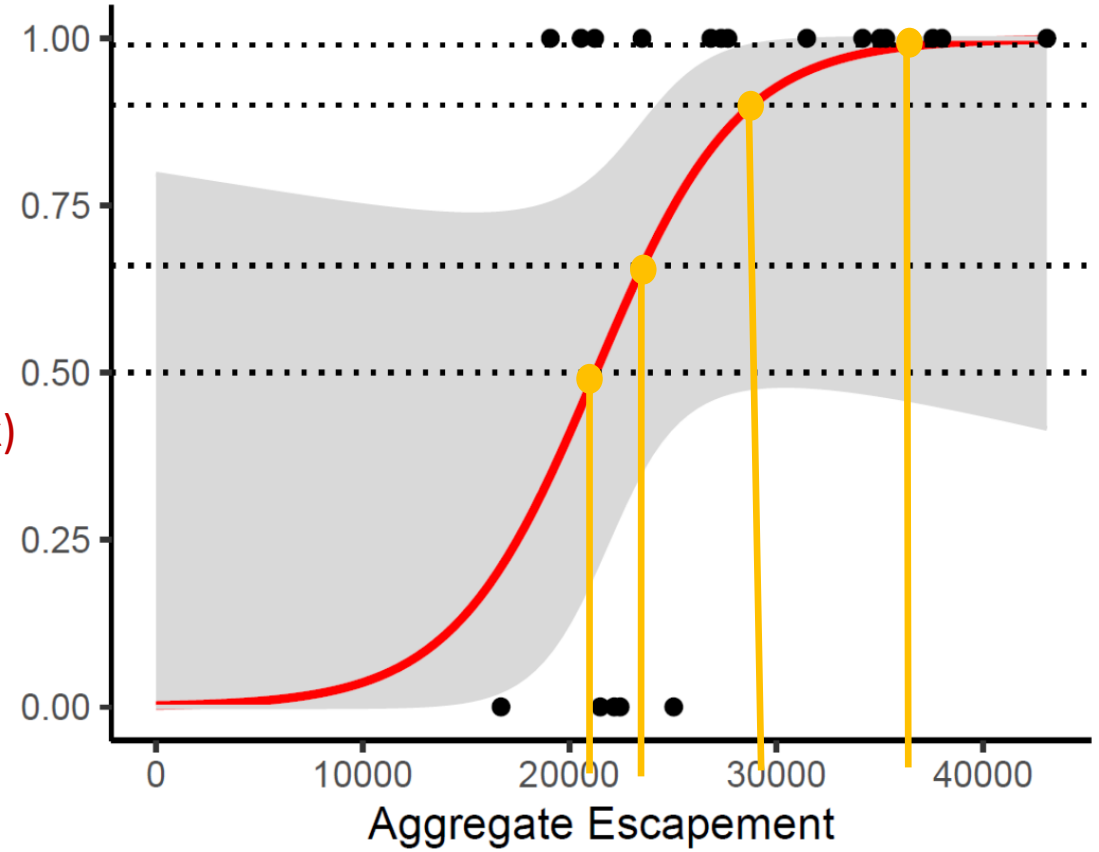


(1) Logistic Regression LRPs

Interior Fraser River Coho Salmon (1998 – 2018)

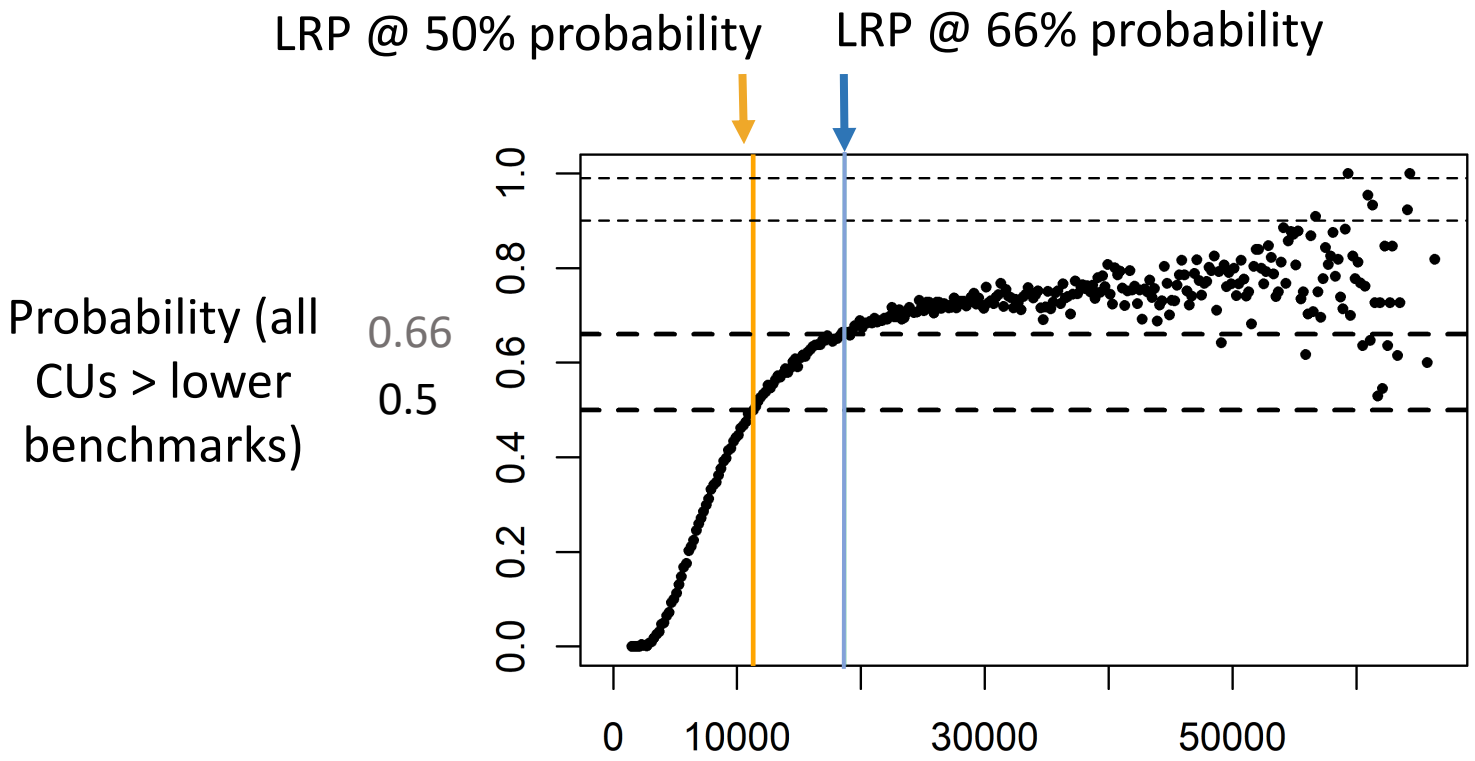


Probability (All CUs > lower benchmark)



(2) Projection LRPs

West Coast Vancouver Island Chinook



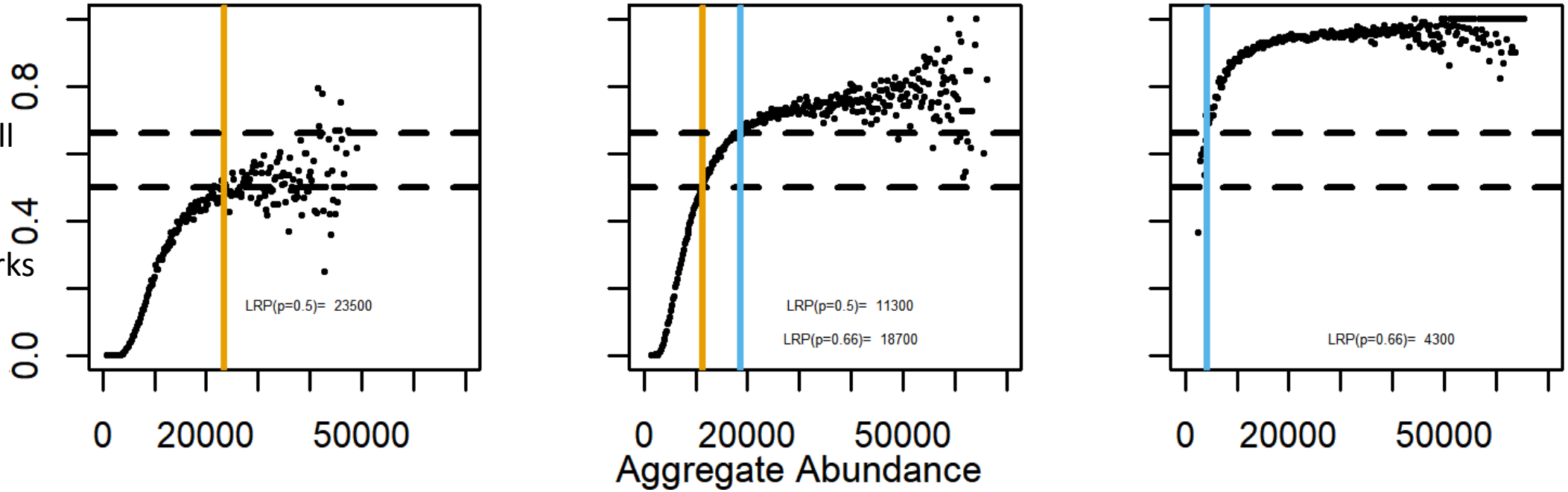
Projection LRP: sensitivity to productivity

0.75 x current productivity

current productivity

1.5 x productivity

Prob. of all CUs > lower benchmarks



- DFO has developed methods for estimating Limit Reference Points that **account for component biodiversity**
- Recommendation to apply LRPs based on the **status of component CUs** for reporting on SMU status and trigger rebuilding efforts under Canada's *Fisheries Act*
- Aggregate-abundance reference points may be useful for harvest management in some cases, though **climate-driven changes in productivity** may require adjusting those reference points to achieve biodiversity objectives

Future research on salmon LRPs

- Simulation evaluation of LRP methods over key sources of uncertainty
- Further exploration of the interaction between climate-driven changes in productivity and stock structure

Thank you

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DFO 2022. Methodologies and Guidelines for Defining Limit Reference Points for Pacific Salmon. Canadian Science Advisory Secretariat Science Advisory Report 2022/030

Holt, C. et al. (in press) Guidelines for Defining Limit Reference Points for Pacific Salmon Stock Management Units Canadian Science Advisory Secretariat Research Document

Holt, K. et al. (in press) Case Study Applications of LRP Estimation Methods to Pacific Salmon Stock Management Units Canadian Science Advisory Secretariat Research Document