

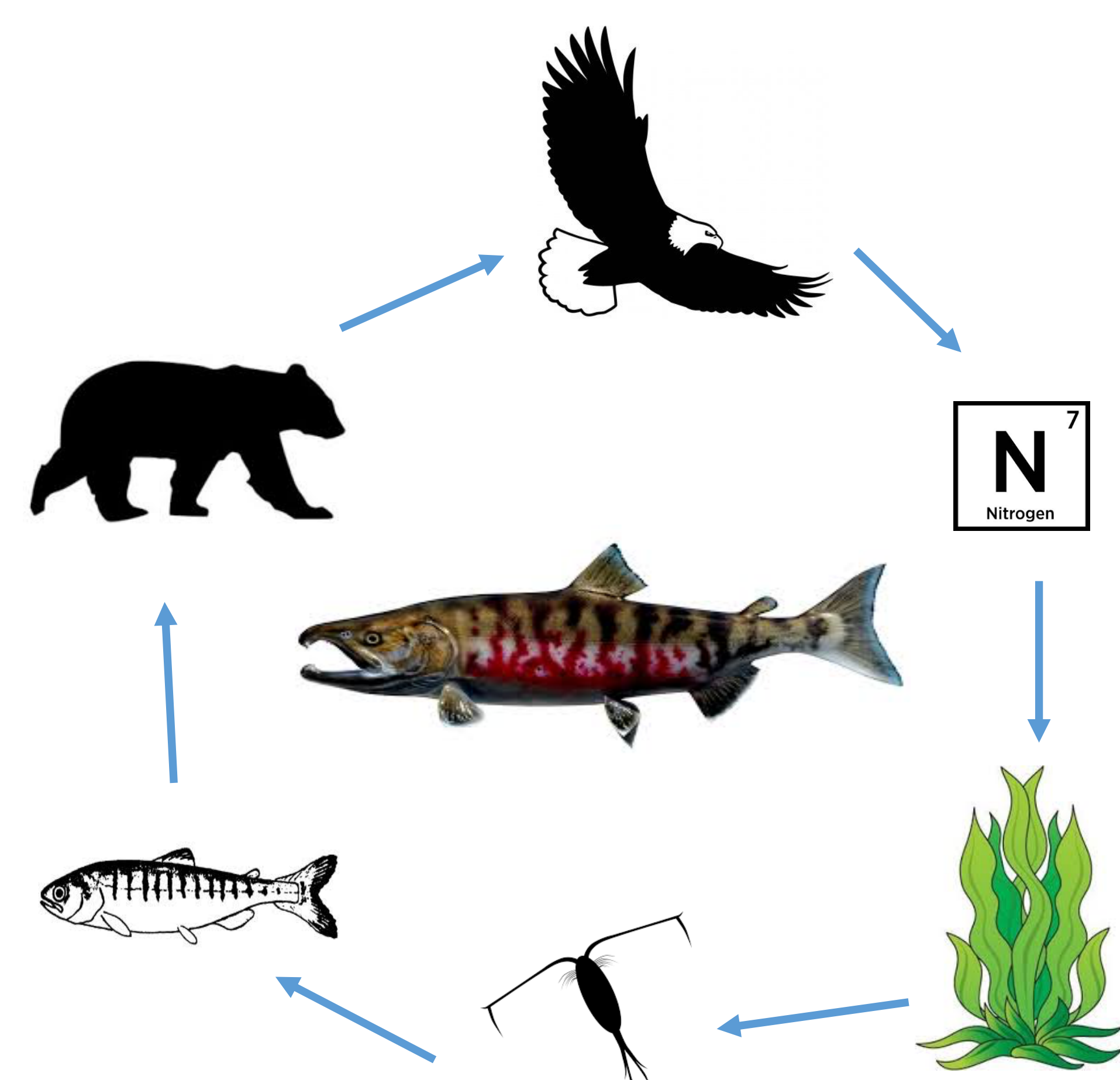
The role of bald eagle foraging behaviour in coastal food webs and nutrient feedback systems in salmon watersheds

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Importance of the Project to Goals of SSMSP

Background: Coastal food webs



Objectives:

- Determine if a decline in salmon populations and carcass abundance will impact eagle foraging behaviour (increase competition and piracy).
- Establish if a change in foraging behaviour will result in a higher waterfowl predation rate.
- Determine if a decline in carcass abundance will cause less nutrients to be transferred into the river.

Relation to SSMSP:

- This study will determine the chemical and biological factors impacting salmon survival.
- Further understanding how changes in coastal food webs and nutrient cycling effect juvenile salmon will facilitate more effective management and larger returns.

Methods and Predictions

Field observations:

- Point-count surveys of spawning salmon, carcasses, and bald eagles.
- Determine the abundance and decomposition of carcasses.
- Determine the competition and piracy rates among groups of scavenging bald eagles as either low, medium or high.

Carcass experiment and Stable isotope sampling:

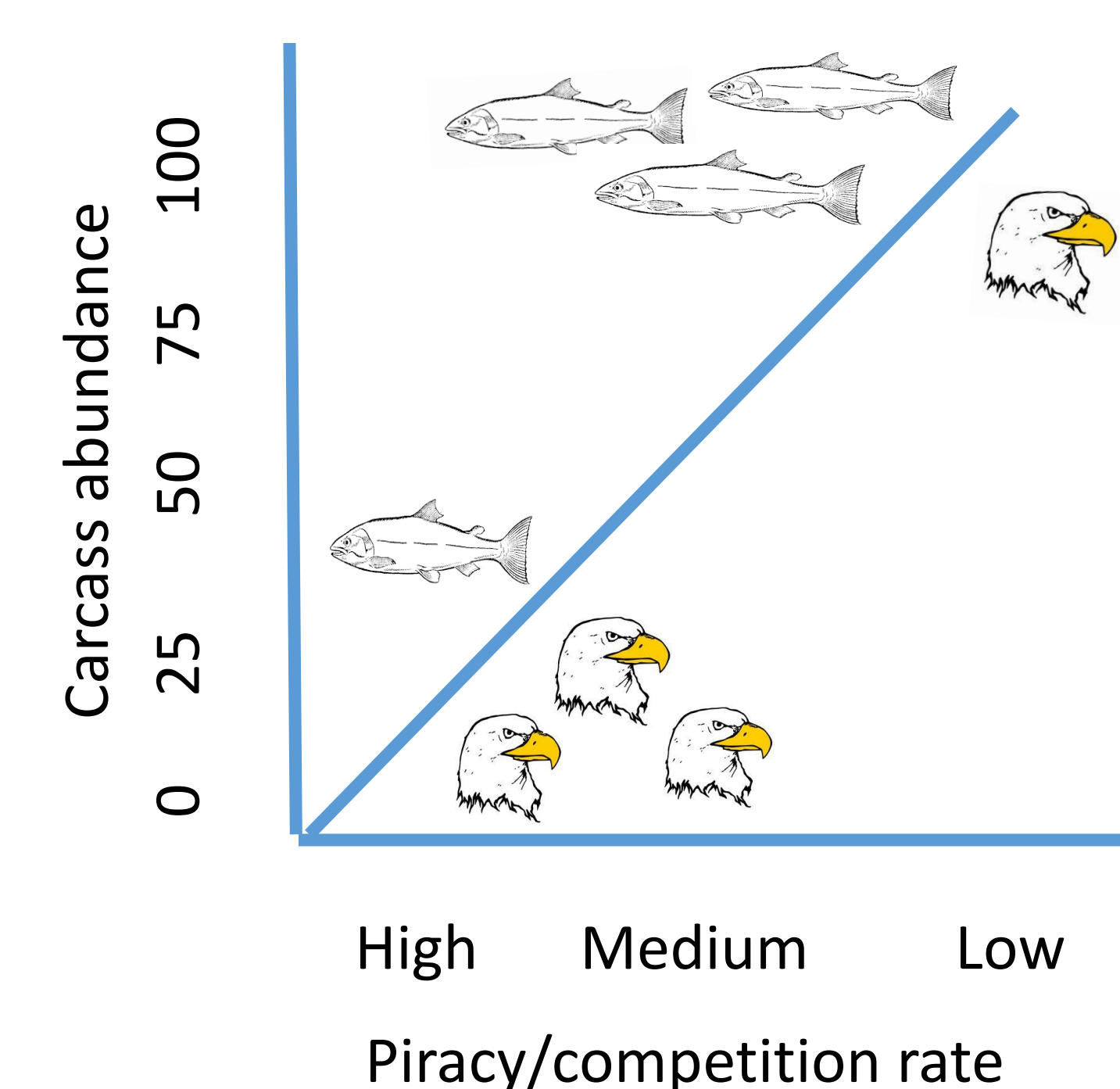
- Measure biomass and zooplankton before and after carcass scavenging for elevated stable isotope levels (δ^{15}) of nitrogen and carbon.

Individual-Based Model:

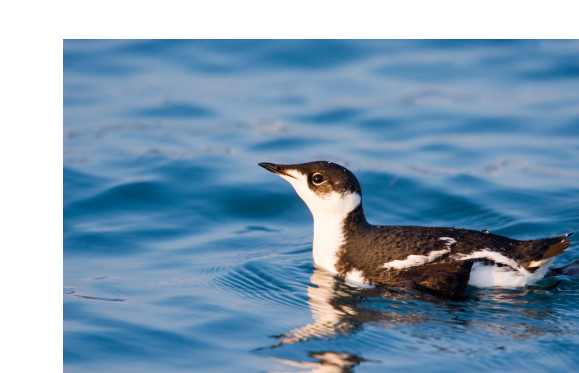
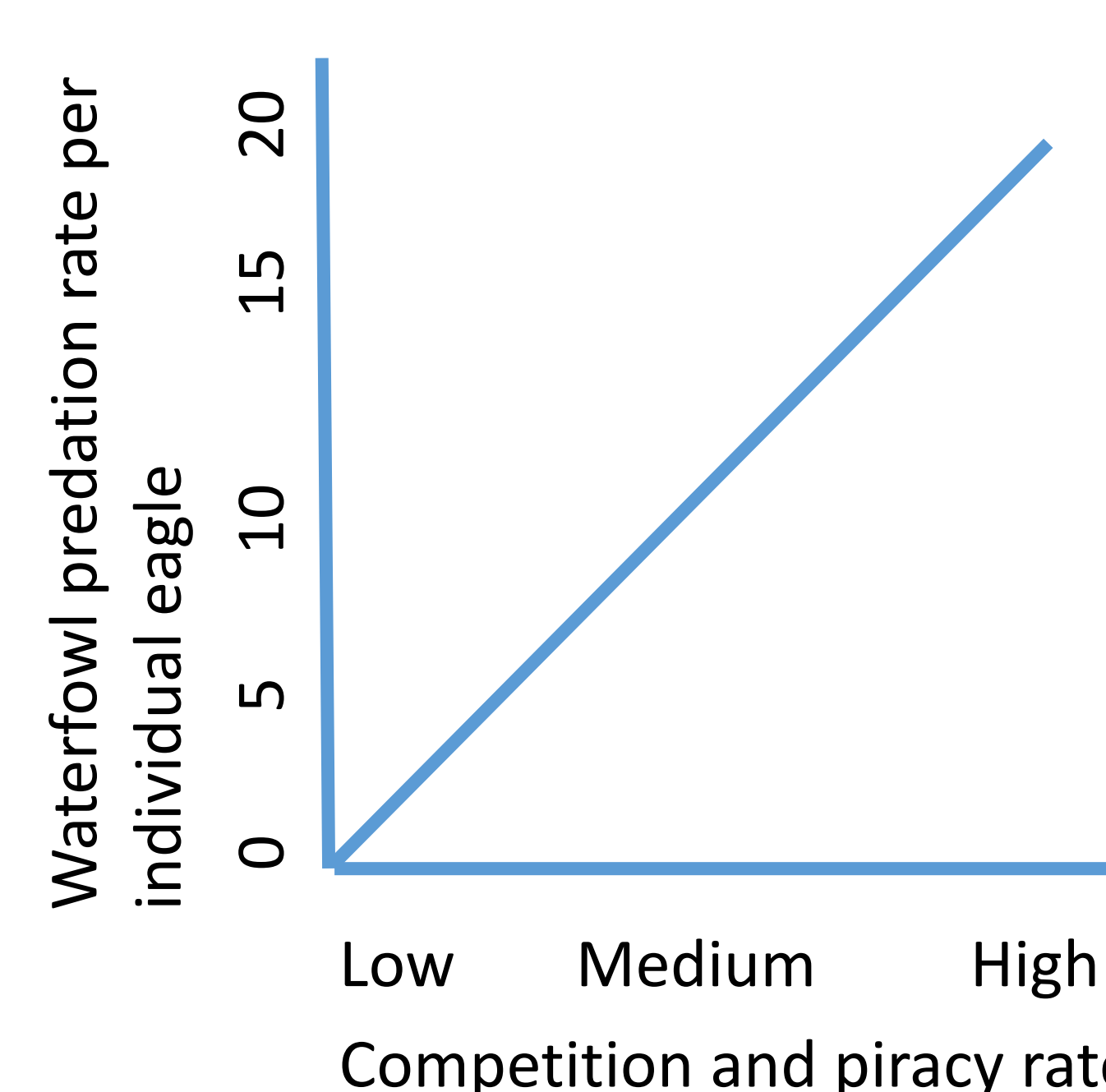
- Simulate a crash in salmon populations to determine if a decrease in carcass abundance will effect the competition/piracy rate among foraging eagles.
- Determine if a change in competition will increase the waterfowl predation rate, which could threaten endangered species.
- Run simulations of altered foraging behaviour to determine if it will decrease the amount of marine-derived nutrients transferred into watersheds.

Hypotheses:

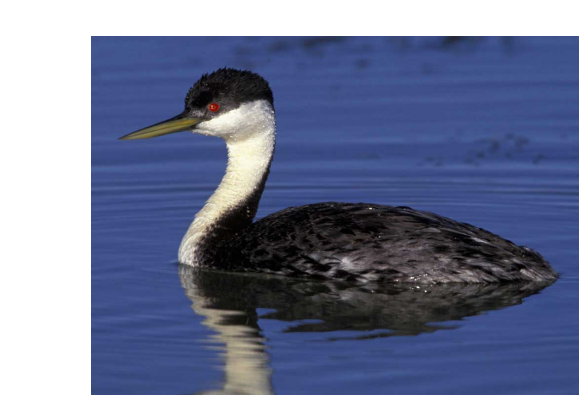
The competition rate in relation to carcass abundance



The waterfowl predation rate in relation to competition levels



Marbled murrelet
(*Brachyramphus marmoratus*)



Western grebe
(*Aechmophorus occidentalis*)

Acknowledgements:



Significance of the Project

Discussion/Conclusion:

- The results will indicate how a change in eagle foraging behaviour due to declining salmon populations will impact coastal food webs (waterfowl predation), nutrient cycling, and the survival rate of juvenile salmon.
- Results will be used in ecosystem-based management strategies of salmon populations and fisheries.

SSMSP:

- The results will inform the predation and modeling research of SSMSP by exploring the relationship of salmon and their ecosystem.
- Fulfill the SSMSP's objective of determining factors that influence salmon survival and mortality in the Salish Sea.

Projected decrease in carcasses and corresponding nutrient transfer

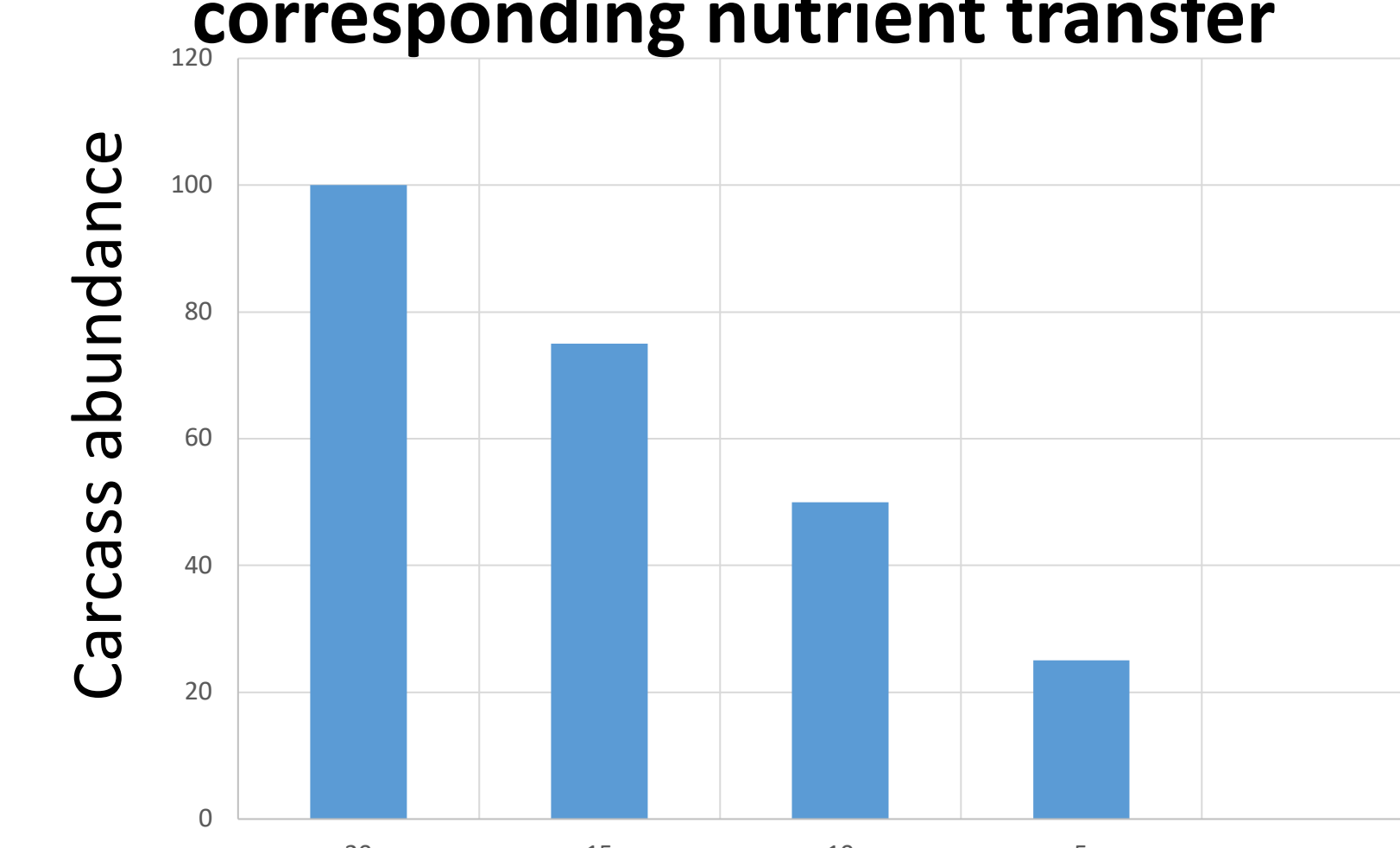


Figure 1: As carcass abundance decreases with declining salmon populations, marine-derived nutrients decline.

Projected rate of nutrient transfer over time

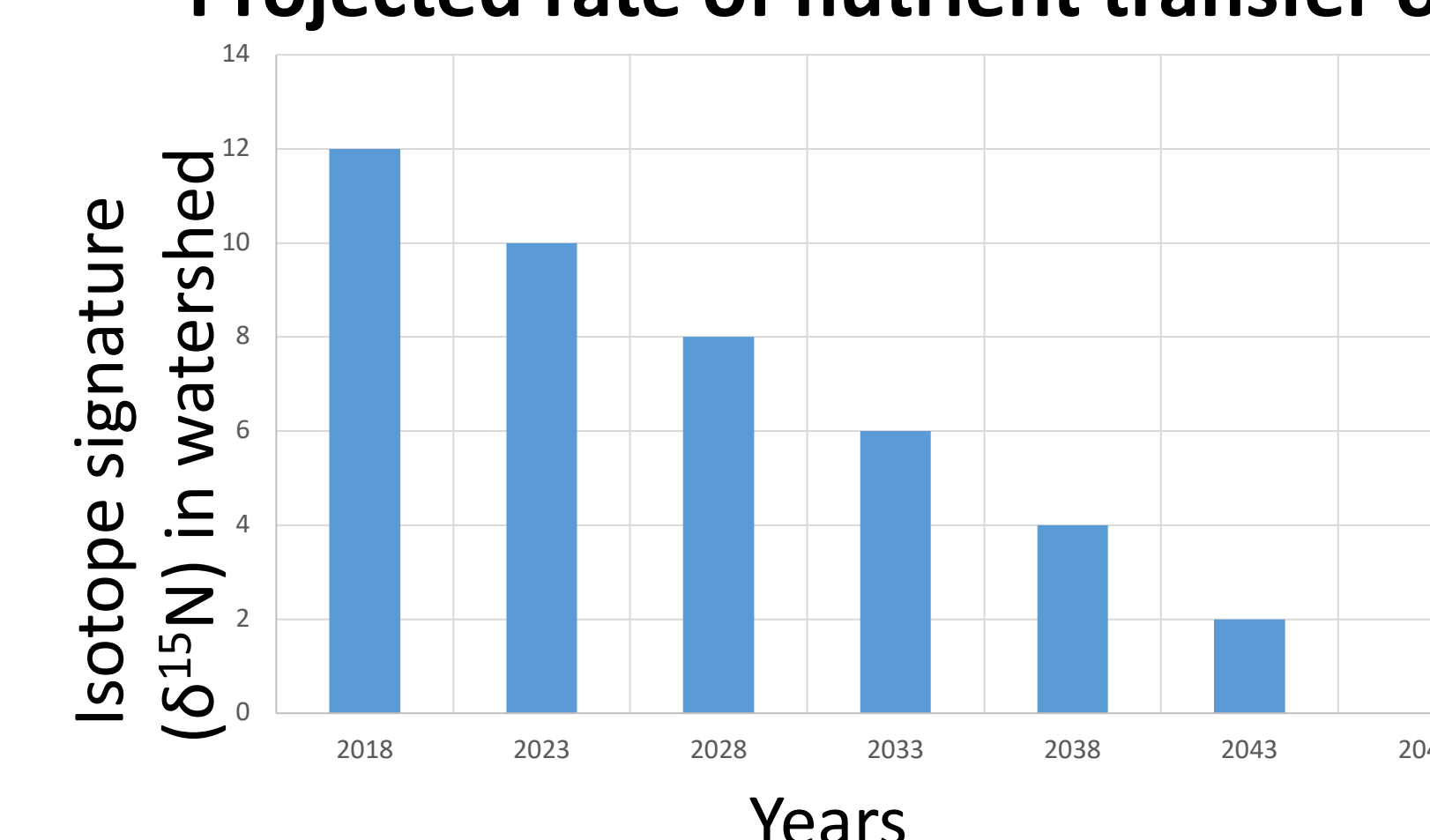


Figure 2: In a IBM simulation, the amount of marine—derived nutrients in the watershed will decline, due to a crash in salmon populations and altered eagle foraging behaviour.