Marine mammal prey consumption and competition with fisheries in the Northeast Pacific

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Mammals as consumers

- biomass: function of natural trends and exploitation
- metabolic rate: proportional to size and cost of living
- diet: planktivore (blue whale) to top predator (orca)
- high consumption -> potential top-down effects
Then and now

What proportion of prey production did NE Pacific marine mammals consume in:

1) 1900 (before industrial whaling)?
2) 1950 (whaling, pinniped culls)?
3) currently (population recovery)?
Food web modeling

- framework: Ecopath with Ecosim
- fundamental principle: mass balance
- consumption: biomass, metabolism, diet
Food web models

- structure: 80 functional groups (12 mammals)
- study area: N British Columbia, SE Alaska
- ecosystem states: 1900, 1950, current
Estimating consumption

- biomasses: field abundance surveys, mean masses
- metabolic rates: empirical relationships with mass
- diets: stomach contents, field feeding observations
Whales vs. fisheries (1)

![Bar graph showing consumption of whales and fisheries over time.](image-url)

- **Consumption / total annual production (%)**
  - **1900**
  - **1950**
  - **Current**

- **Whales**
- **Fisheries**

*Surma (2019)*
Whales vs. fisheries (2)

1950-2015: Competition limited to Haida Gwaii

Surma (2019)
Whale recovery

- population projections: surplus production models
- output trends used to drive ecosystem simulations
- ecosystem model estimated impacts on food web
- 15 simultaneous primary productivity scenarios
Conclusions

• mammals notable consumers in all periods
• most important for forage fish & groundfish
• pinnipeds more important now than before
• whales slowly recovering past importance
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