Examining stocking options for Lake Michigan salmonines using Decision Analysis

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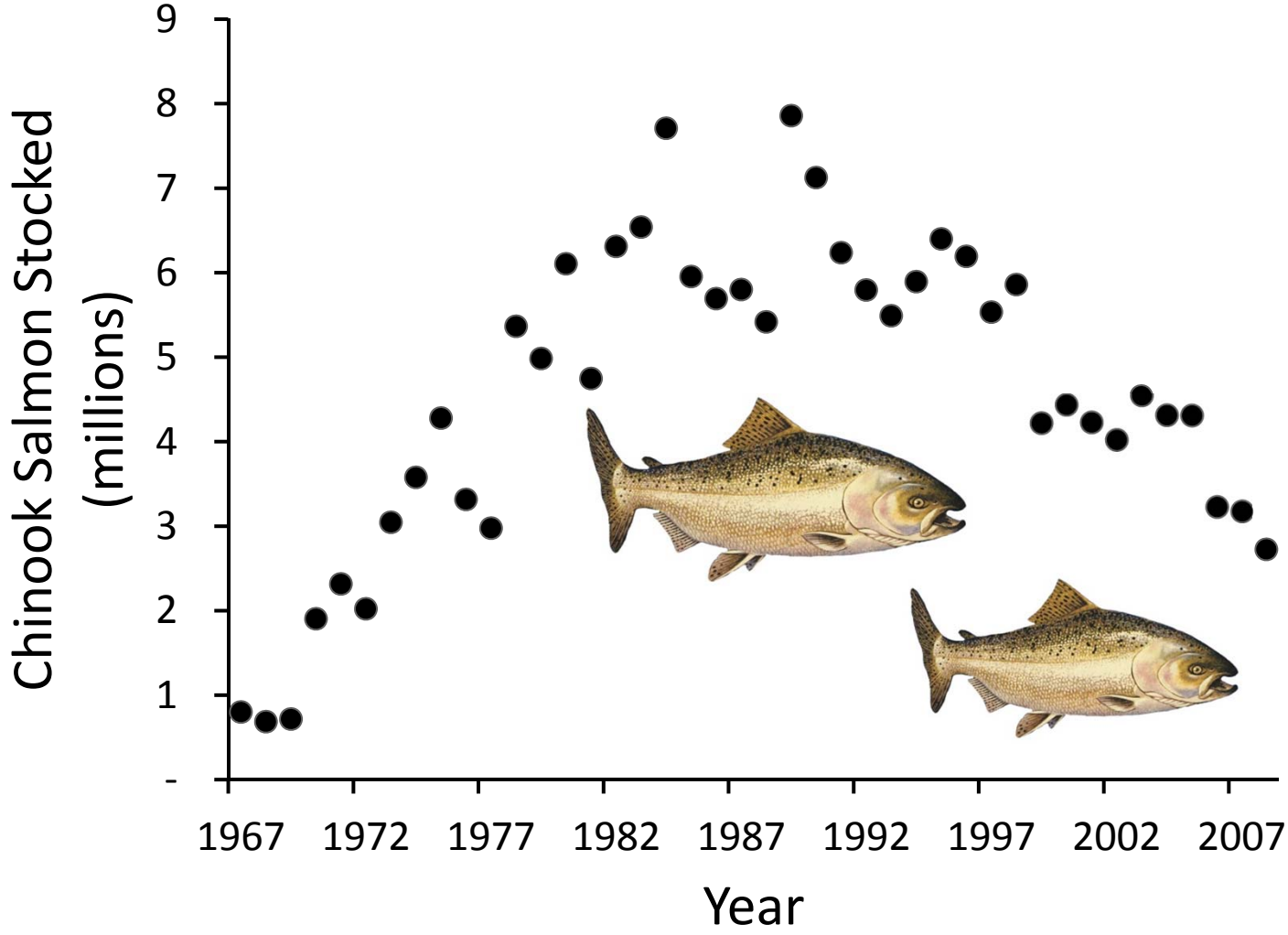
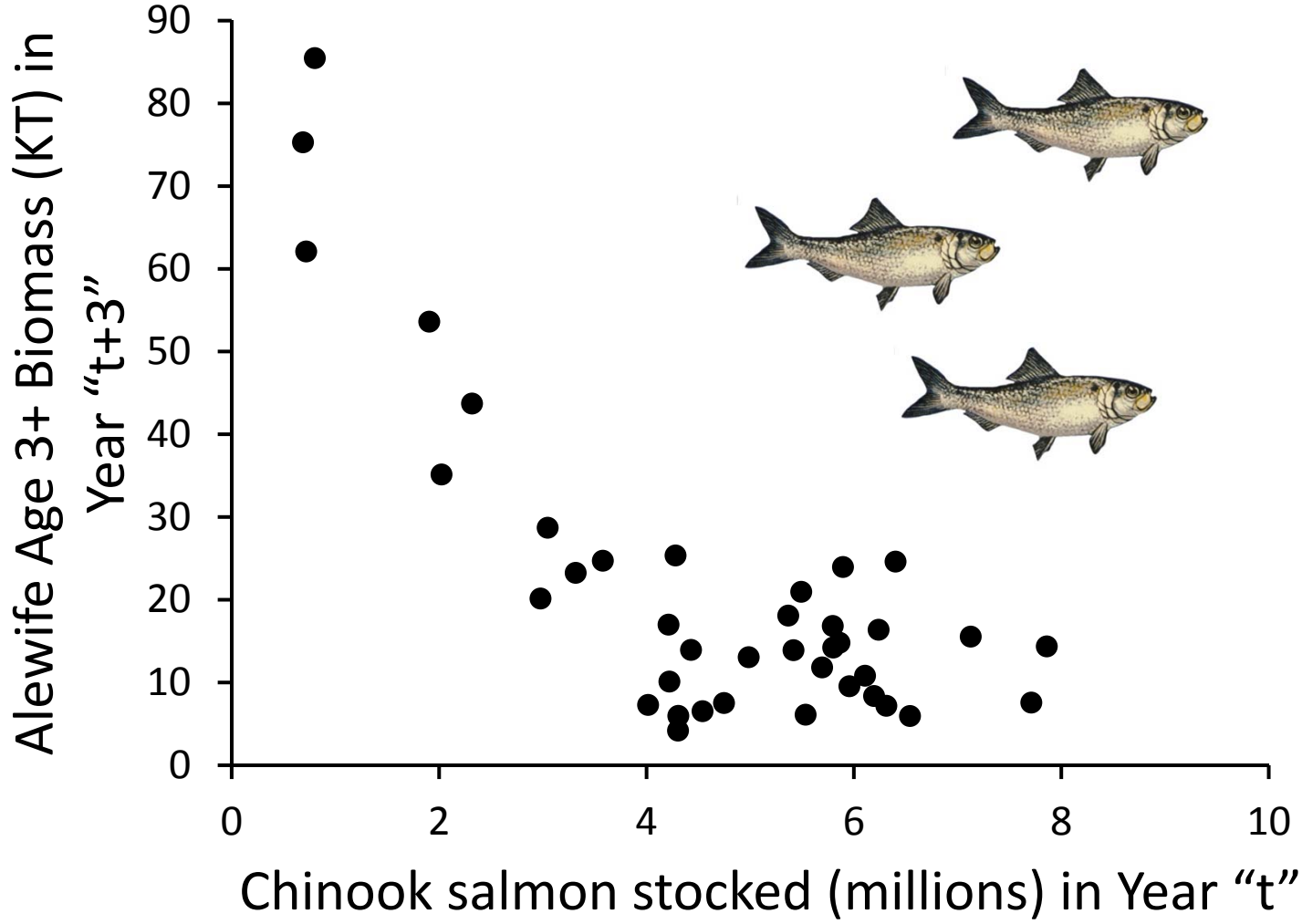
Outline

- Why it's tough to decide what to do
- What is Decision Analysis?
- Discussion of management options and objectives
- Our progress to date
- Future plans

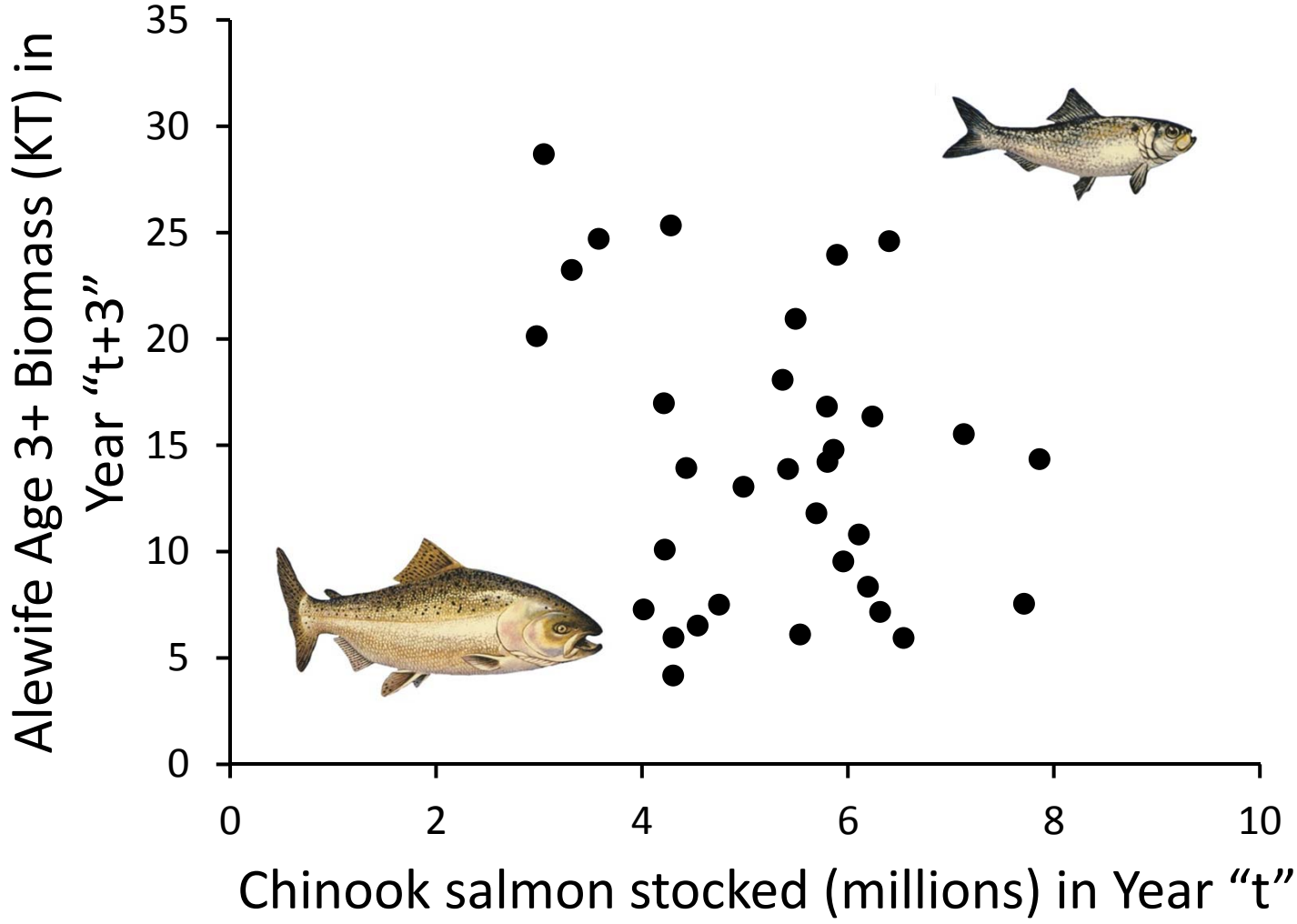
Lake Michigan Chinook salmon stocking: 1967-2008



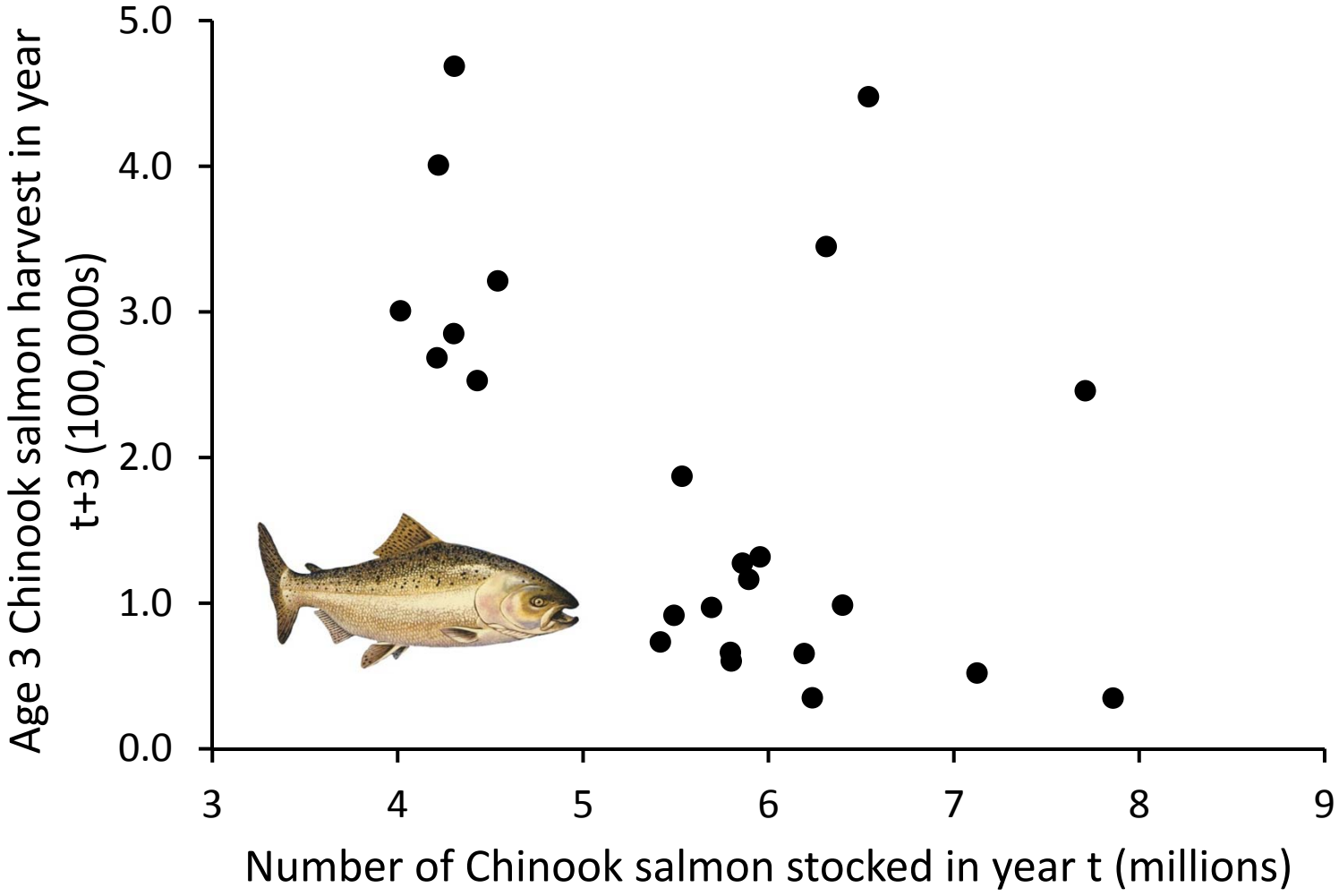
Alewife Biomass: 1967-2008



Alewife Biomass vs Stocking: 1973-2008

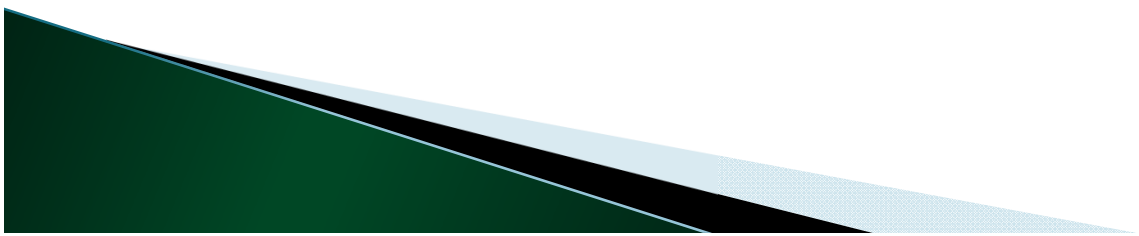


Chinook Harvest versus Stocking: 1982-2005

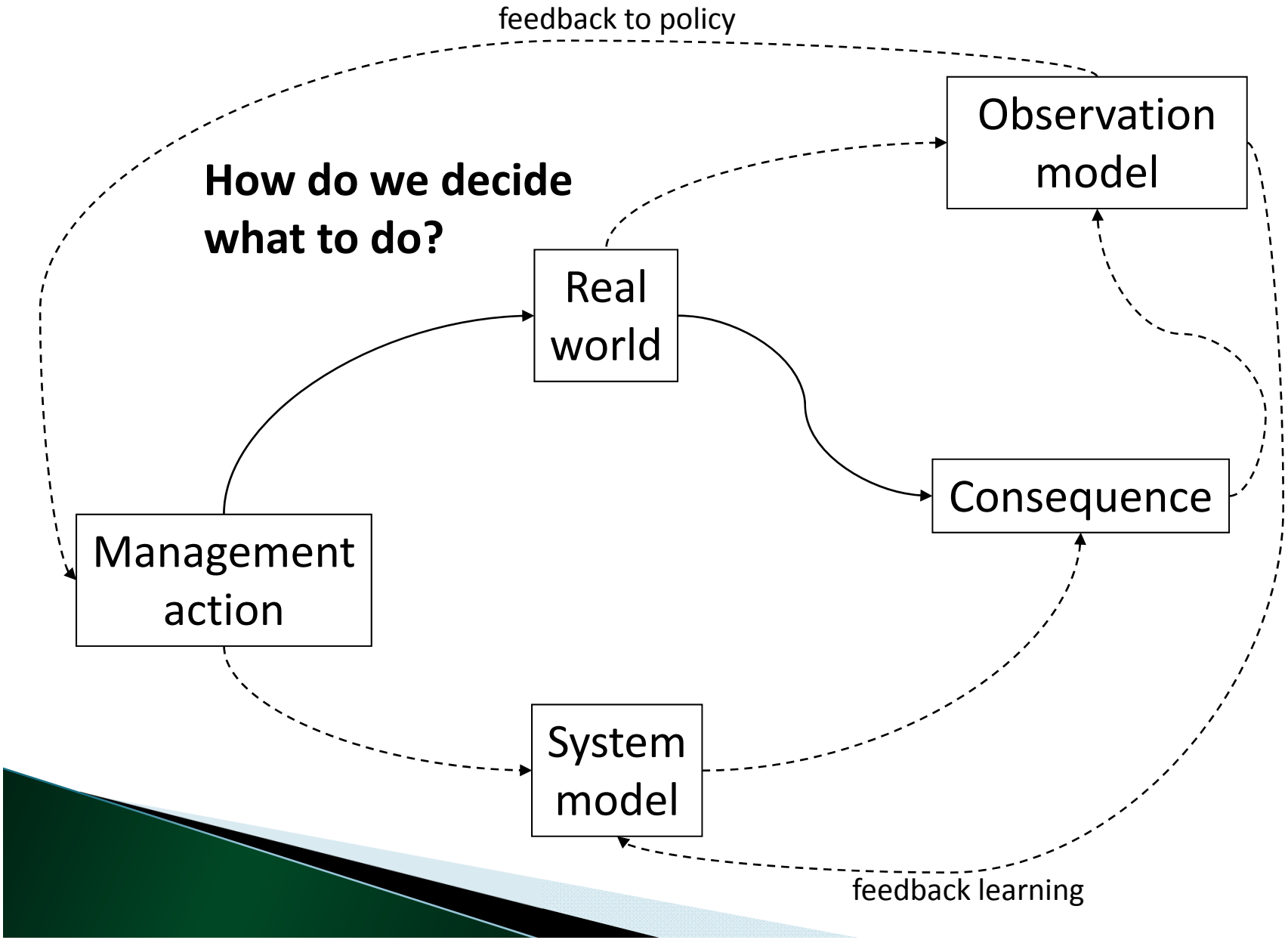


So what's my point?

- Is stocking irrelevant and inconsequential?
  - Of course not
  - If we stopped stocking salmonines altogether, there would be more alewife in Lake Michigan, and there'd be less fish to catch
- The point is…
  - Our management tools are "blunt instruments"
    - factors other than management have important effects
  - We can't easily determine what to do in the future, based on past experience



A Model of the Management Process



How should we make decisions?

- **What do we hope to achieve?**
  - **Objectives**
- **What can we do?**
  - **Options**
- **What is likely to happen?**
  - Predictions (**models**)
- **How certain are we?**
  - Risk (**uncertainty**)
- **Rank options**
  - How well do they meet objectives?
  - Is there much risk? (or what if our prediction is wrong?)
- **Decide on best option**

Decision analysis – a process to guide management

STEPS:

- **Management objectives**
- **Management options**
- **Critical uncertainties**
- **Analysis of uncertainties – probabilities of alternative "states"**
- **Model to forecast outcomes**
- **Decision tree**
- **Ranked outcomes**
- **Sensitivity analysis**

After Peterman and Anderson 1999

Lake Michigan Salmon Stocking Decision Analysis

- Previous DA conducted 2001-2005; informed 2006 stocking decisions
- Lake Michigan Committee asked the Quantitative Fisheries Center to re-visit the DA based on new information collected since early 2000s
- Great Lakes Fishery Trust sponsored a research project to support our work: 2008-2012
- Currently in midst of analysis/model-building phase
- Important to involve stakeholders to extent possible

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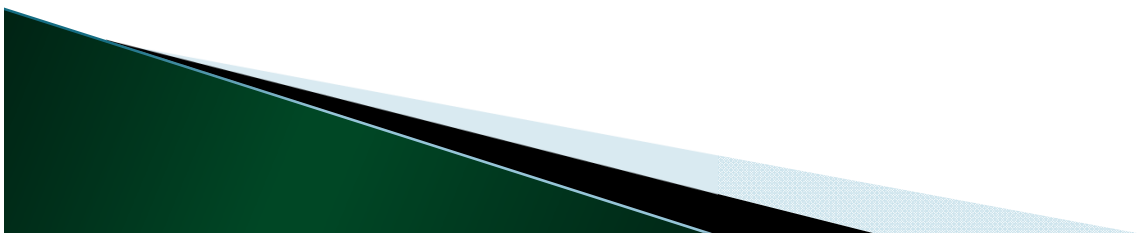
After Peterman and Anderson 1999

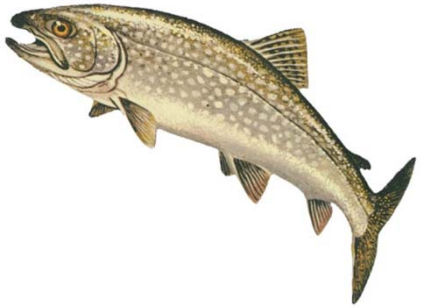
So what do you think?

- Management objectives
- Management options



Management objectives and options

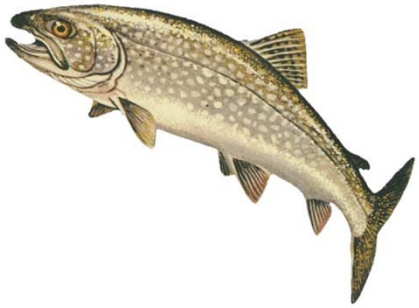
- Management objectives
  - Maintain acceptable catch rates
    - 8-12 fish/100 hrs
  - Maintain diverse fishery
    - > 50% Chinook; > 25% other species
  - Maintain good salmon growth
    - Age 3 Chinook > 7 kg, late summer
  - Maintain alewife at or below undesirable levels
    - Target level not specified
  - Adequate spawning stock biomass for lake trout
    - To support reproductive success, level not specified
- Management options
  - Different stocking rates for salmon and trout



Management Options

- Fixed stocking strategies
  - Status quo
  - 25% increase
  - 25% decrease

- Feedback strategies
  - Based in predicted Chinook weight at age 3
  - If < 7 kg, reduce stocking
  - If > 8 kg, restore stocking



Decision analysis – a process to guide management

STEPS:

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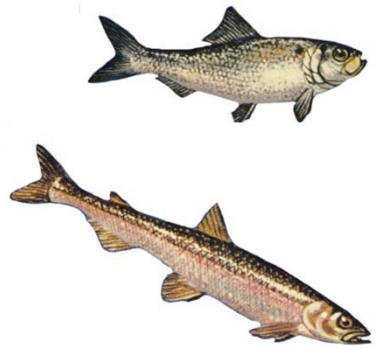
After Peterman and Anderson 1999

Key Uncertainties

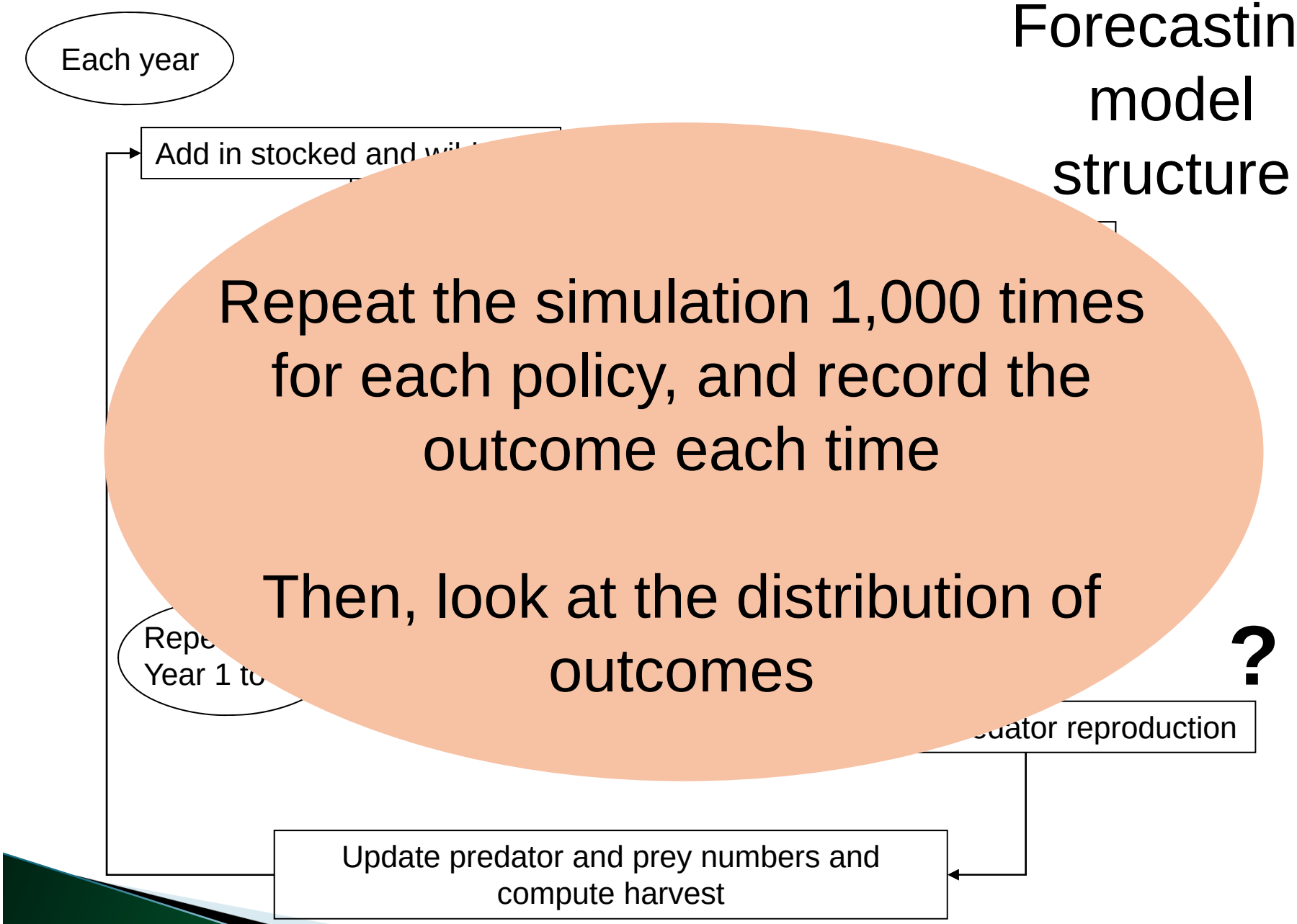
- Prey fish recruitment dynamics (especially alewife)
  - Alewife recruitment has declined in recent years
  - Stock-recruitment relationship is weak and highly variable

- Predator search rates
  - Appear to be lower than previous estimates
  - Predation mortality estimated to be increasing



- Dependence of predator production on feeding success
  - Very limited evidence for density dependent Chinook production

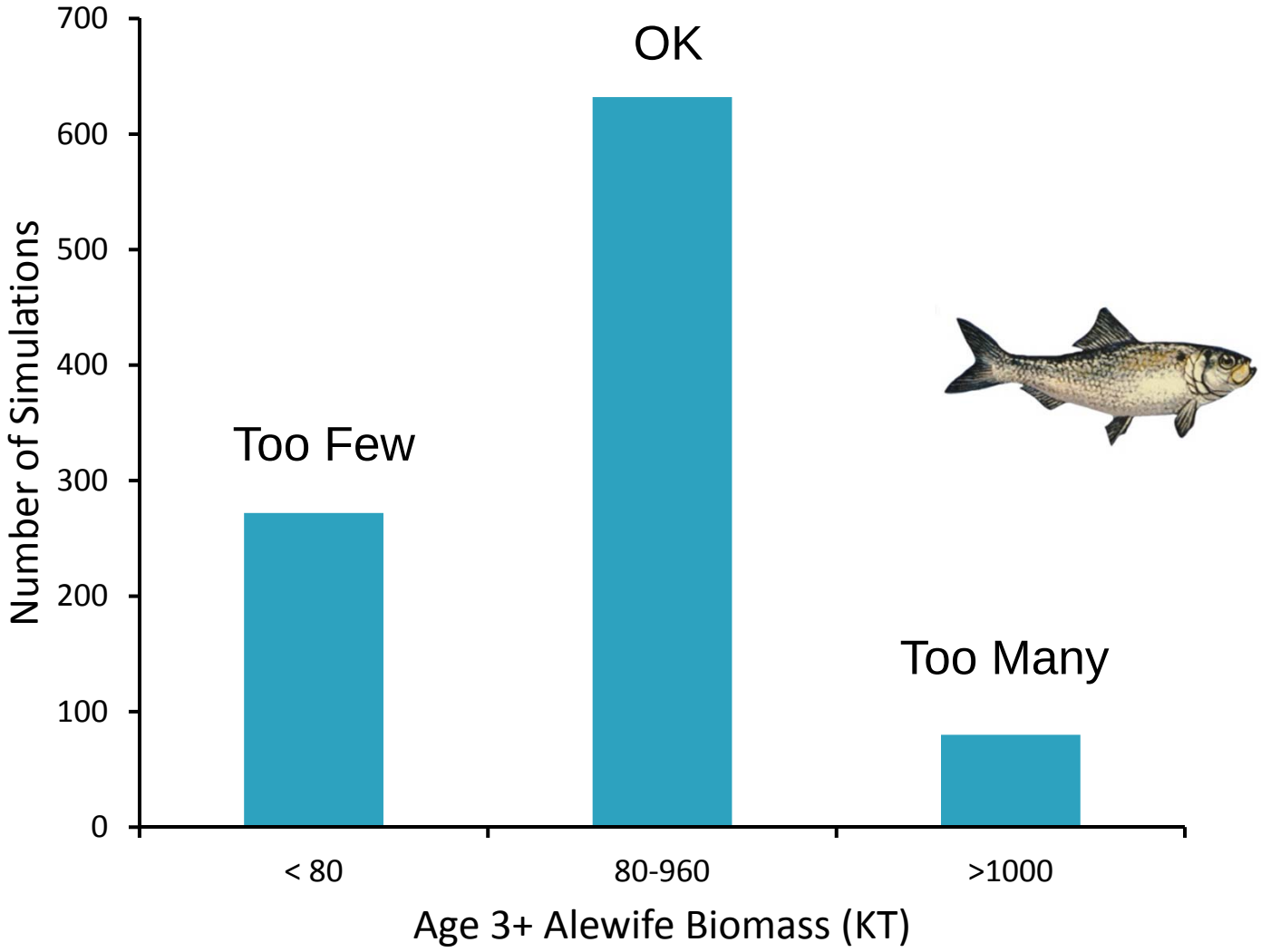
Forecasting model structure



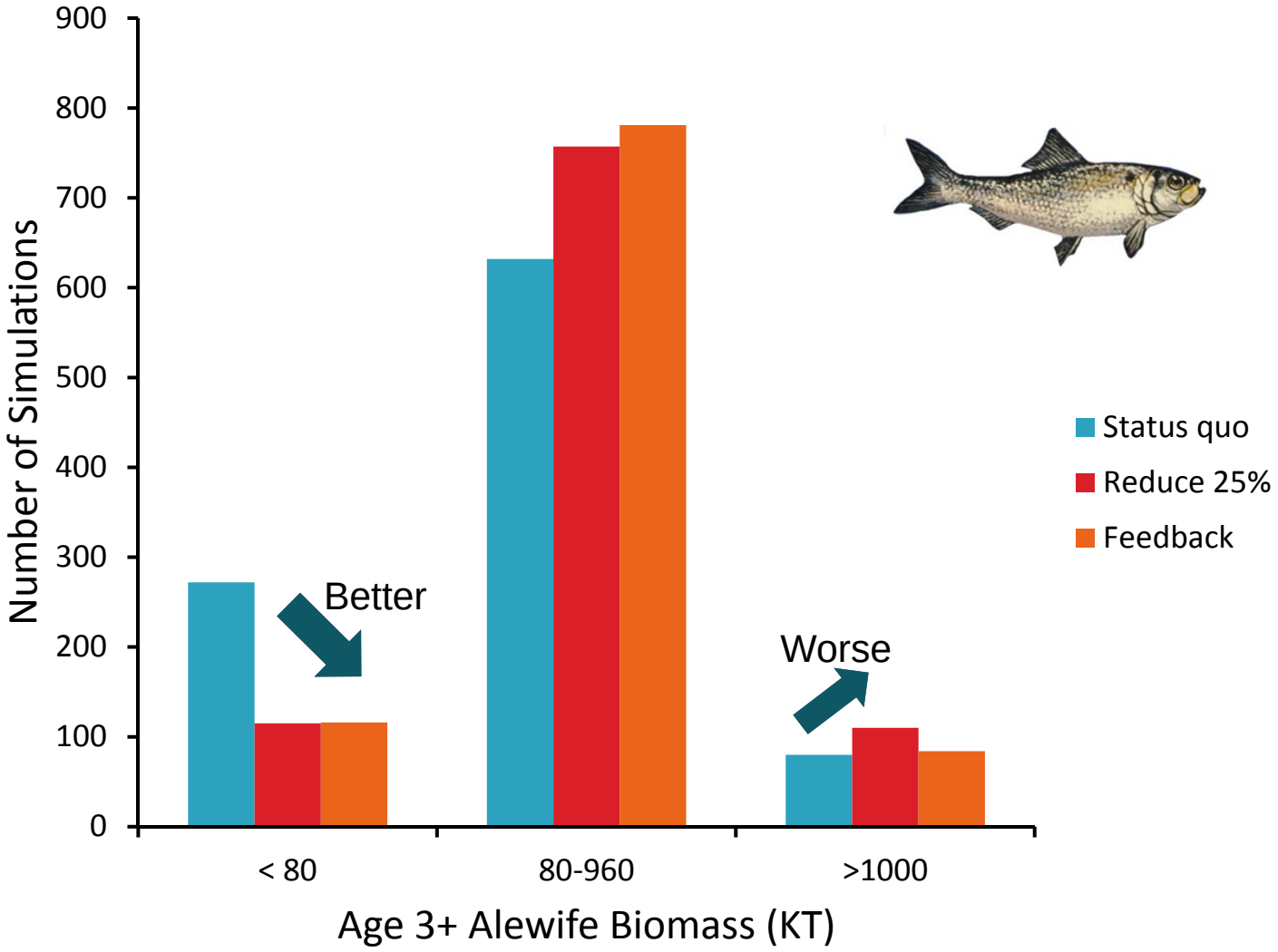
Repeat the simulation 1,000 times for each policy, and record the outcome each time

Then, look at the distribution of outcomes

Status quo policy – forecasted Alewife biomass



Policy comparison – forecasted Alewife biomass



Future plans

- Continuing forecasting model development and analysis

- Engagement with managers and stakeholders
  - Inform about our analysis
  - Use model to evaluate options
  - Advise decision makers