Influence of incomplete capture on fish monitoring and management: problems and solutions

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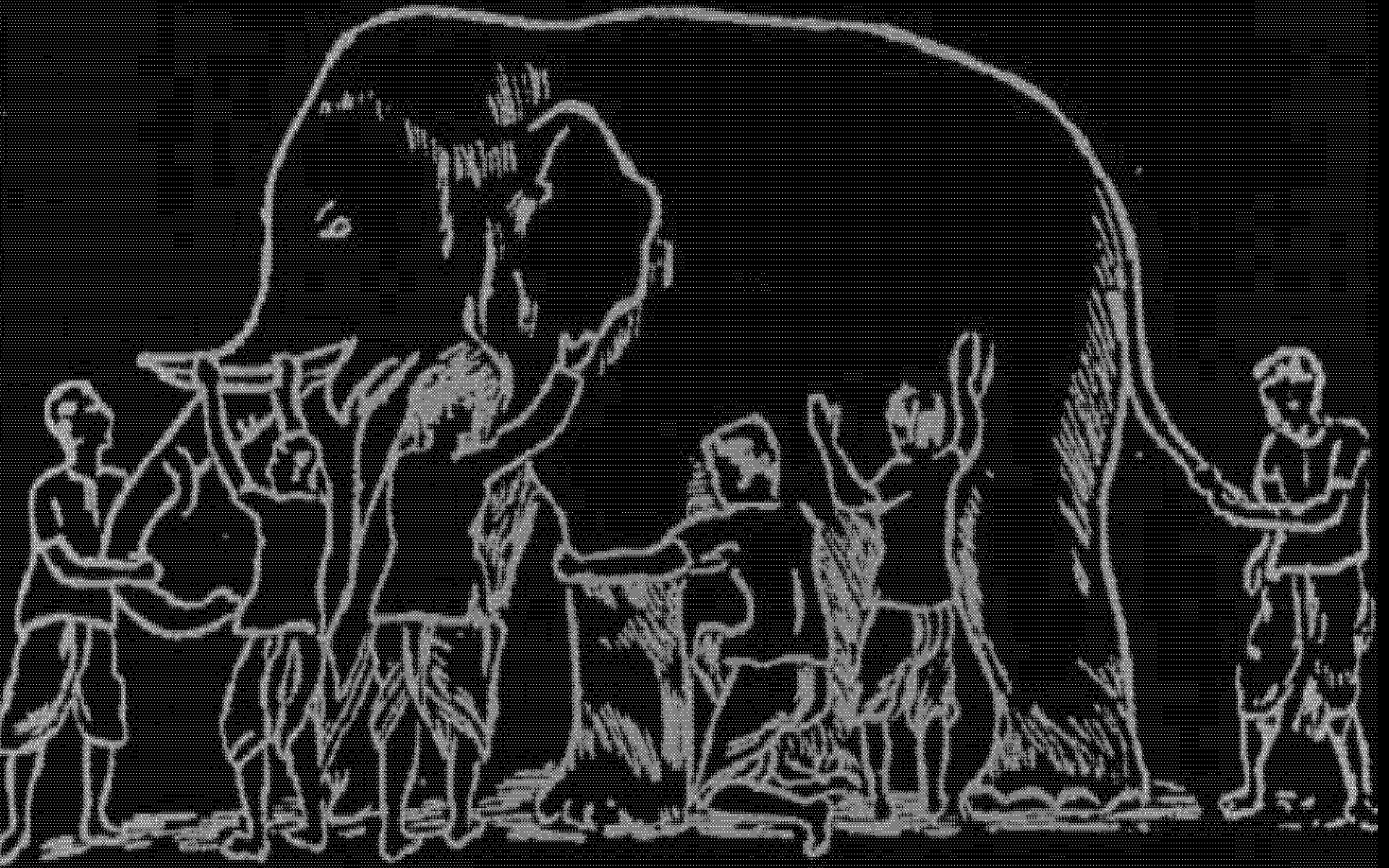


The Elephant in the Living Room

Incomplete Capture

Species differences

Habitat effects

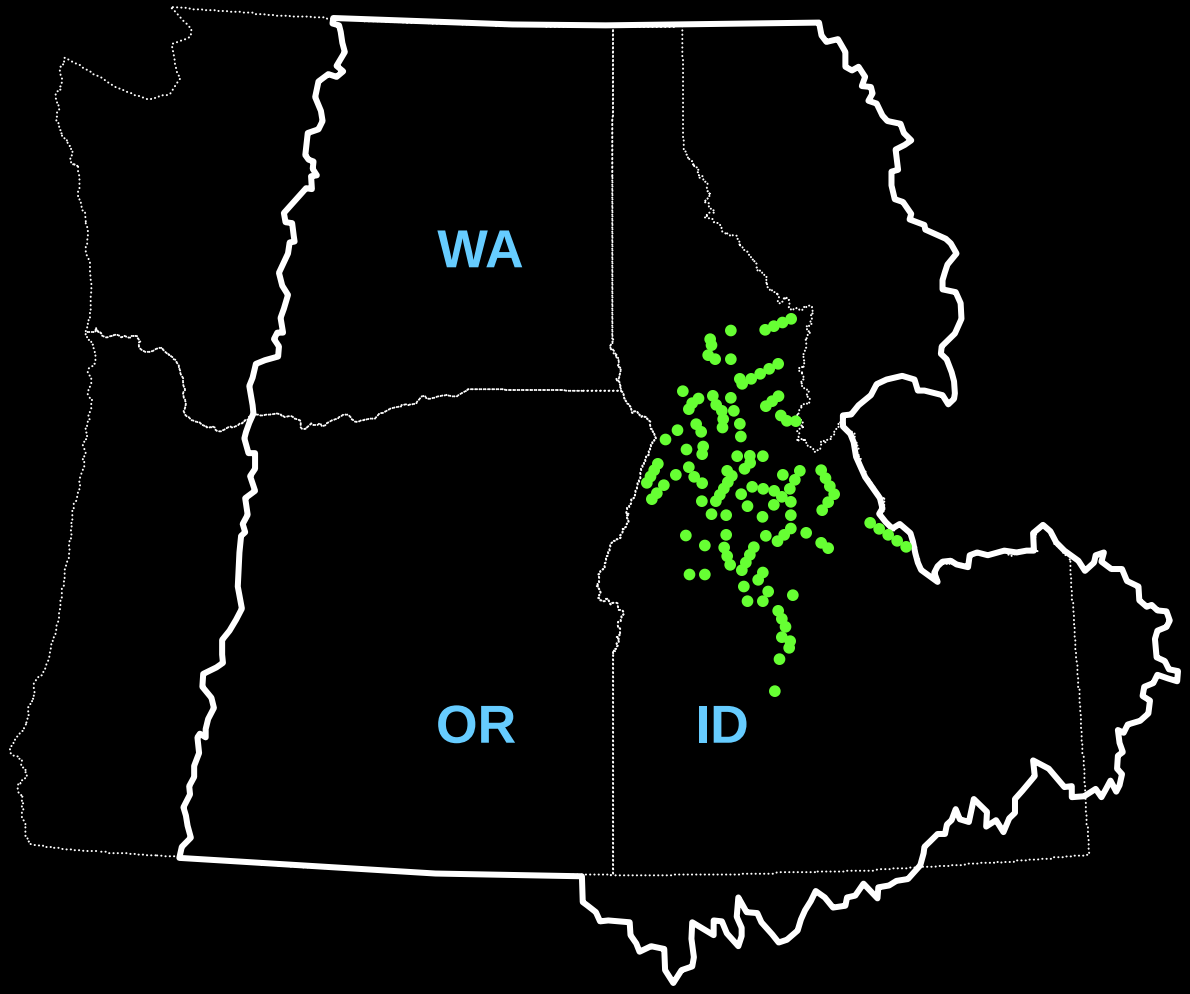
Changes in fisheries

- **New technology**
- **New designs**
- **New objectives**

Systematic bias

Illustration of systematic bias: Interagency salmonid monitoring

Sampling via standardized snorkeling protocol, since 1986



Snorkel efficiency

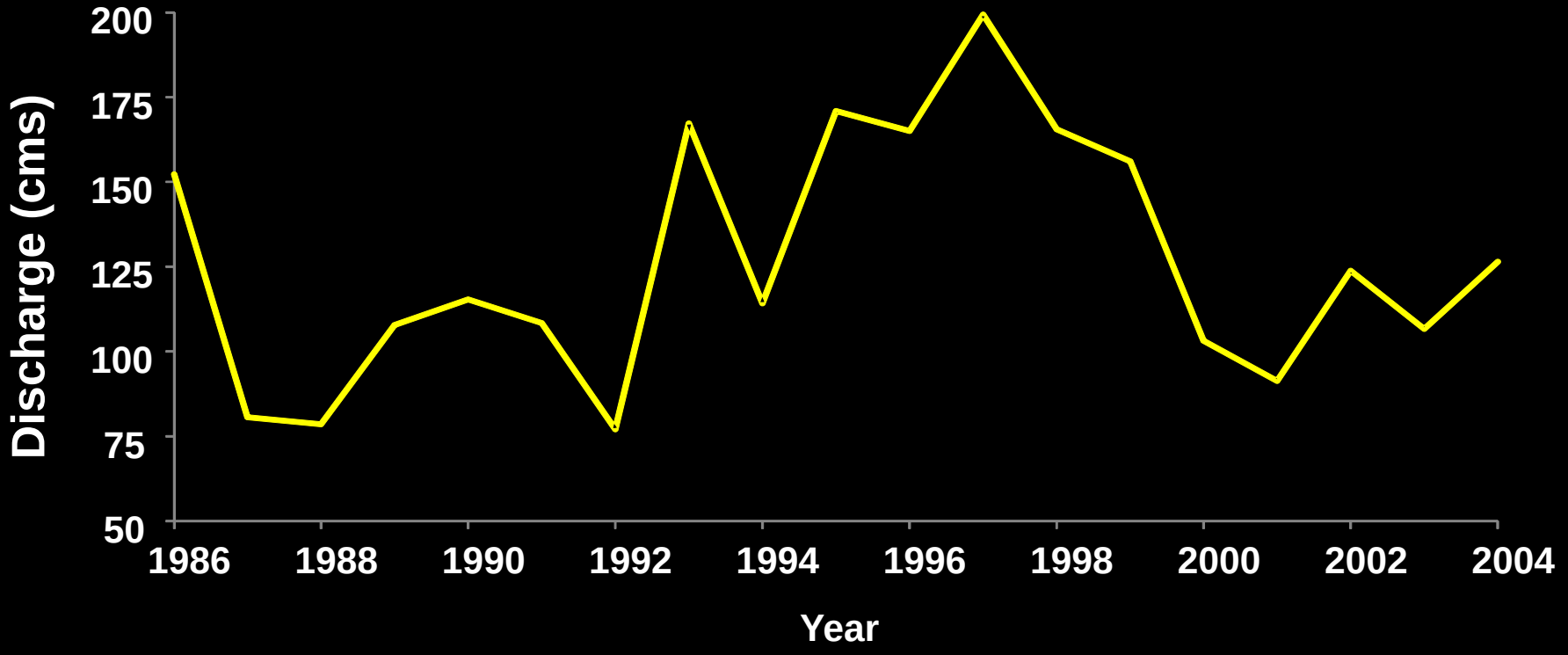
Water temperature (+)
Visibility (-)
Others..

Thurow et al. 2006

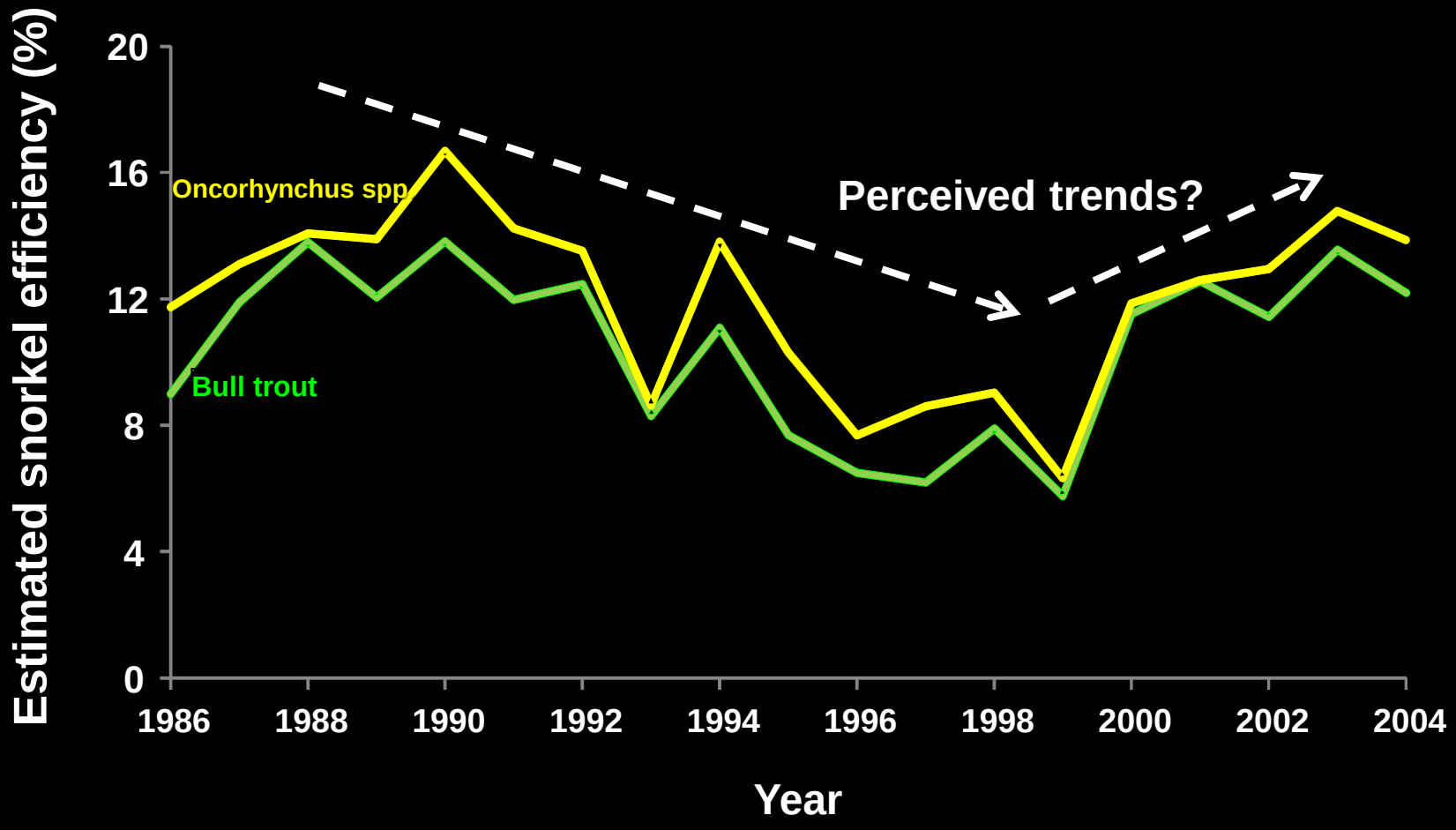
Mean daily discharge during monitoring period in the lower Salmon River, Idaho

Pearson correlation

Mean water temperature	-0.77
Mean visibility	-0.57



Mean estimated snorkel efficiency during monitoring



Approaches to minimize the influence of incomplete capture

Develop capture/detection probability models

- Mark-recapture
- Dual gear

Closed population

Number fish captured, *C*

Known number of fish present, *N*

$$P(\text{capture}) = \frac{C}{N}$$

Subset of sites, sample using different or same method and

fish abundance is estimated using unbiased estimator

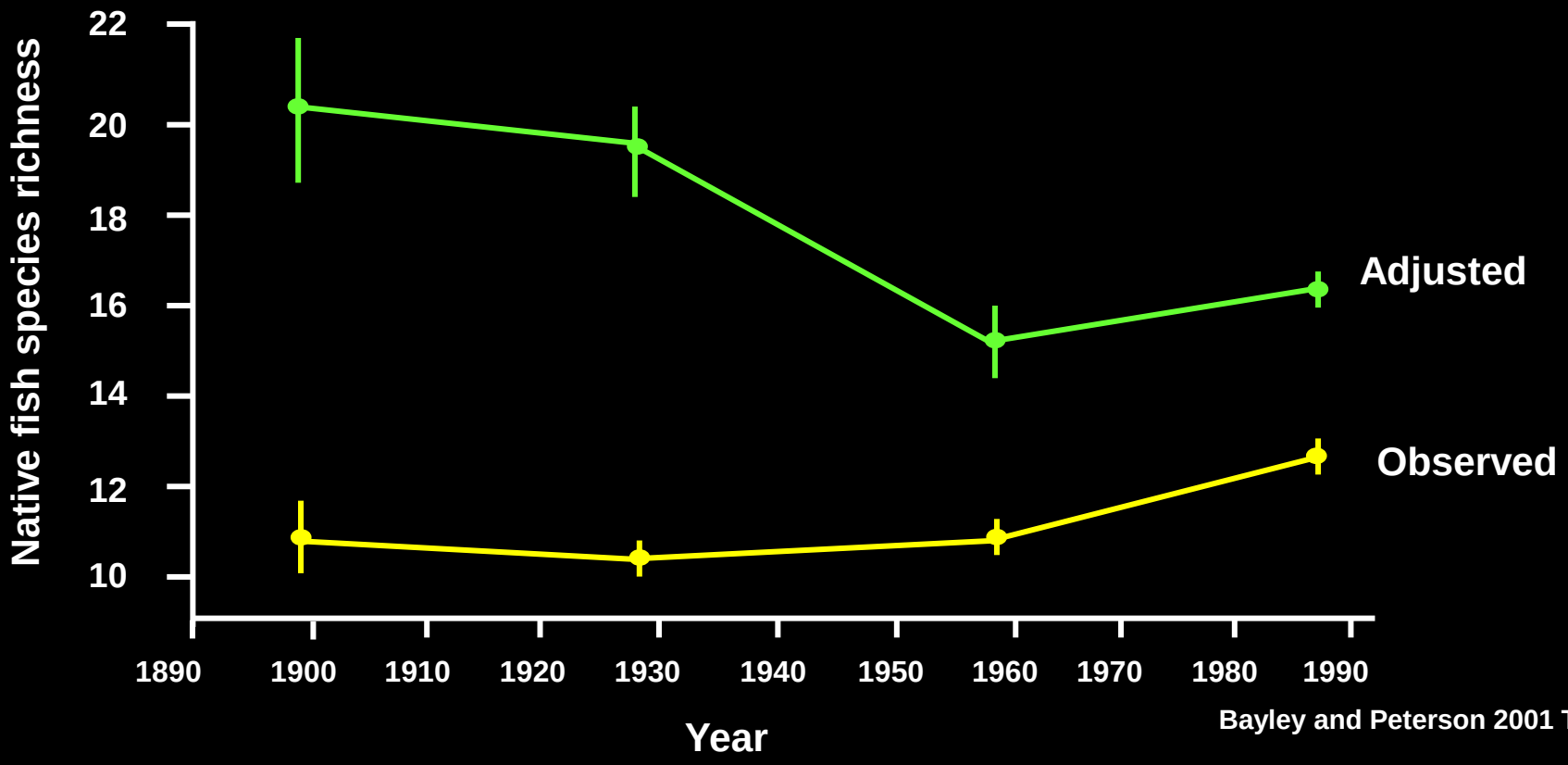
Dual gear example

Fishes of Champaign County, Illinois: 1900 - 1990

- 100's locations sampled every 30 years-
- New technology – new sampling methods
- Changes in habitat- channelization

Calibrated each method using rotenone as secondary gear

Adjusted historic data using capture probability models



Bayley and Peterson 2001 TAFS

Approaches to minimize the influence of incomplete capture

- Develop capture/detection probability models
  - Mark-recapture
  - Dual gear

- Employ statistical population estimators
  - Capture-recapture
  - Distance sampling
  - Occupancy

Population estimator example

Freshwater mussel population dynamics and management in the Flint Basin, GA

20 years mussel catch data collected 100+ sites throughout

- Different levels of effort: quantitative, complete search, qualitative
- Different crews - misidentification of mussels likely

Resampled each site using historic protocols

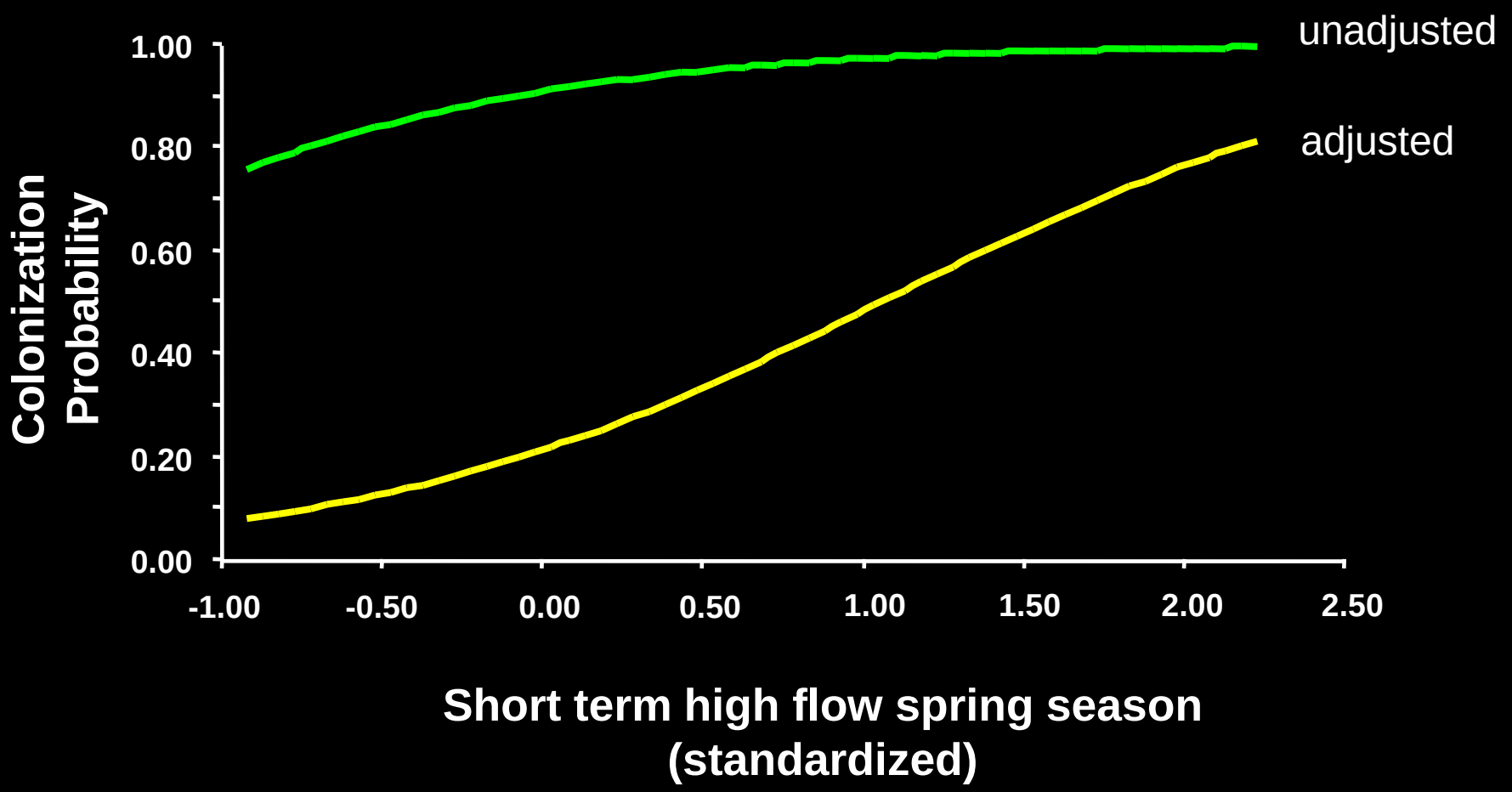
- Occupancy design, crews with various levels experience

Fit dynamic multi-state occupancy models with incomplete identification

- Historic and new data
- meta-demographic rates, identification error

Systematic bias in estimated mussel meta-demographic rates

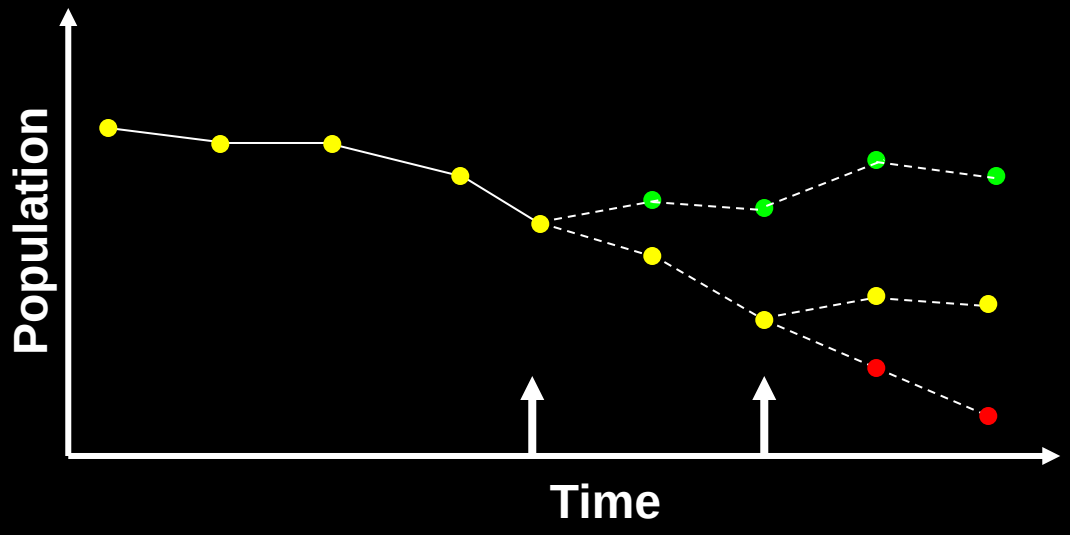
Shinyrayed Pocketbook, *Hamiota subangulata*

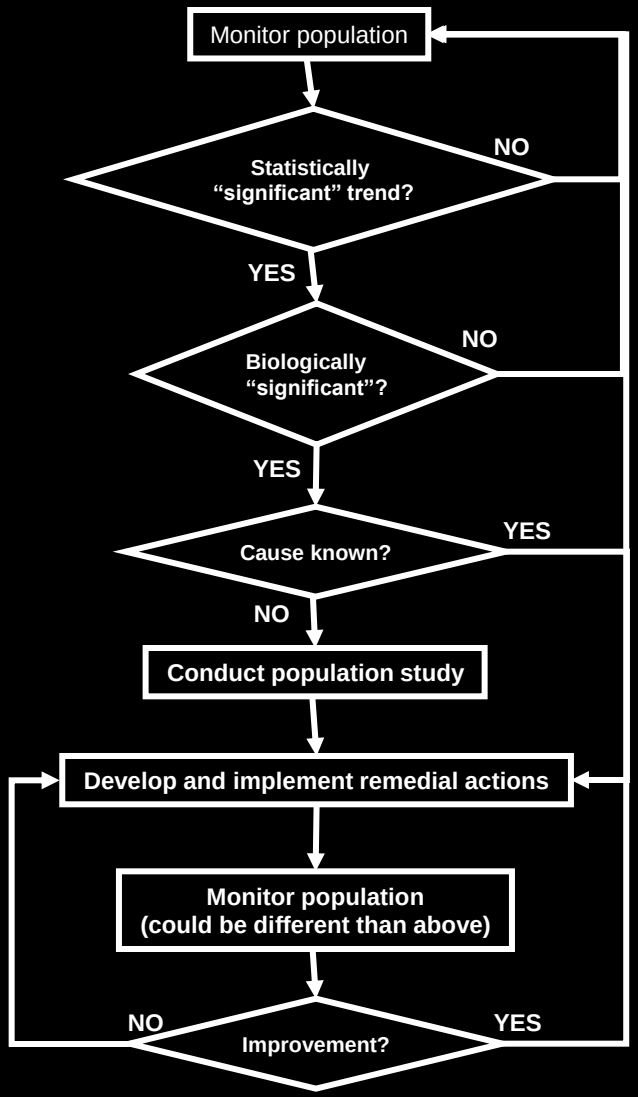


Shea et al. 2013

Important consideration: how will the data be used?

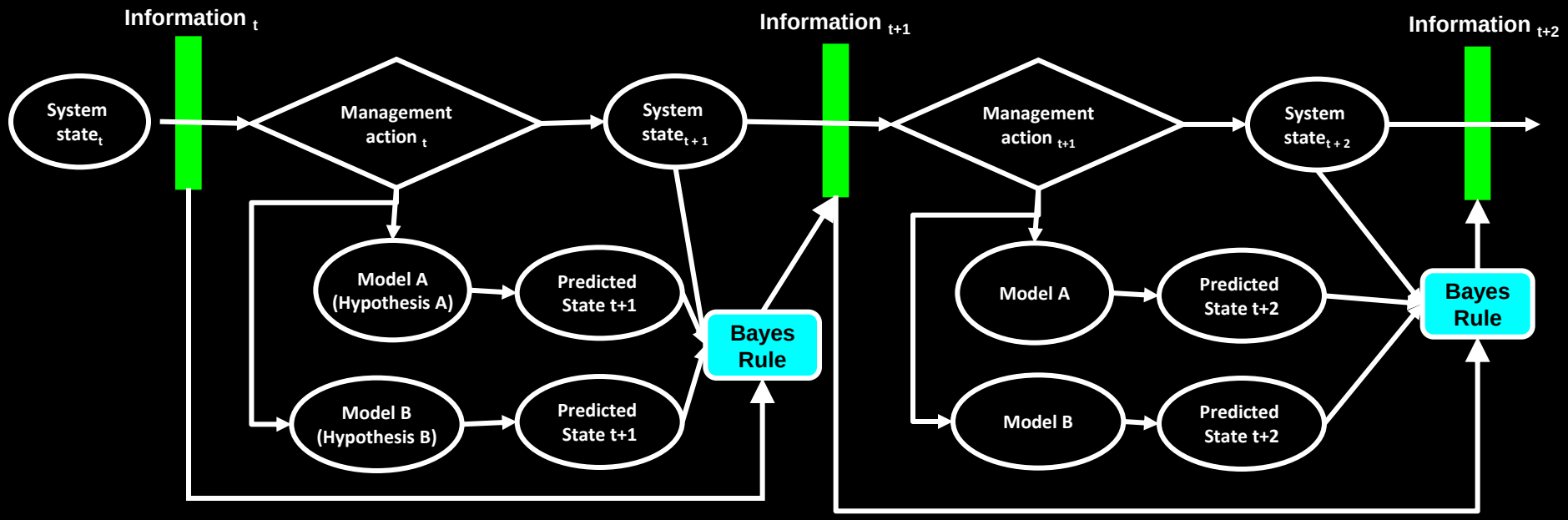
‘Traditional’ approach to using monitoring data





Adaptive Resource Management

Monitoring data are directly compared to predictions under alternative hypotheses

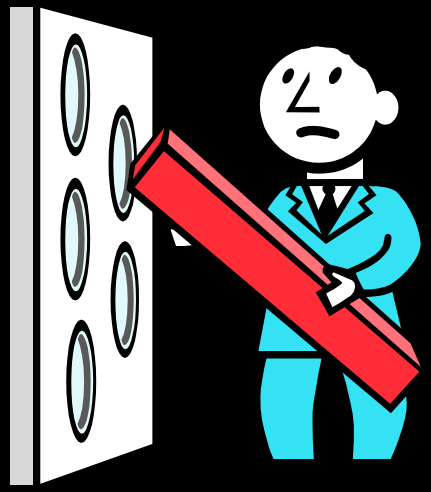


Monitoring and Adaptive Resource Management

Monitoring variables *must* match model predictions

weights updated using monitoring data and predicted responses

Model prediction	Monitoring variable
Population size	Abundance
Species richness	Number of species
Species occupancy/distribution	Number or proportion of areas occupied
Area burned	Amount of area burned



Avoid biased measures

e.g., population indices, catch-effort indices

Misleading information = bad management decisions

Seeing the Elephant

Recognize detectability is important

Greater use of population estimation methods

Develop and employ methods for adjusting historic data

Greater emphasis on validating methods