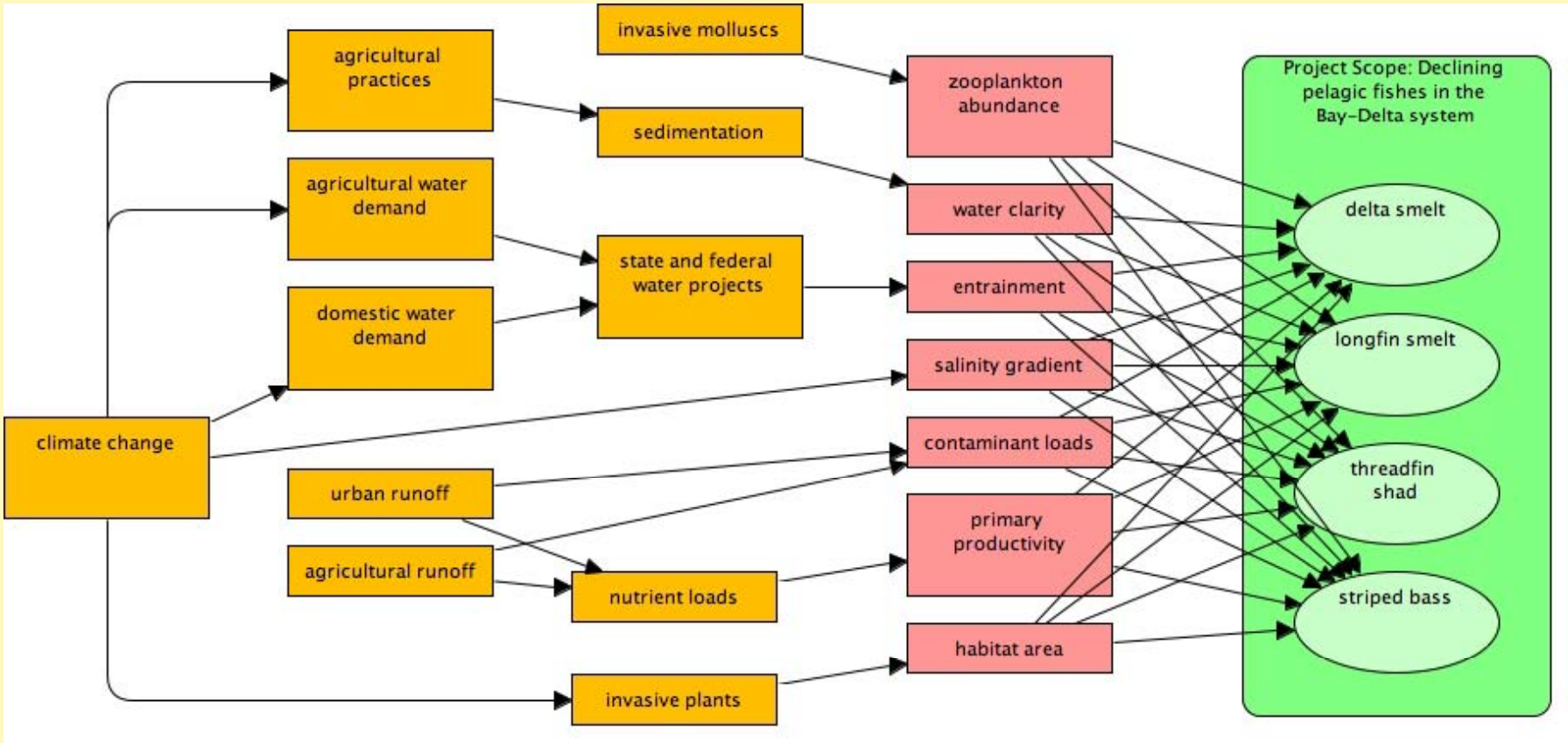
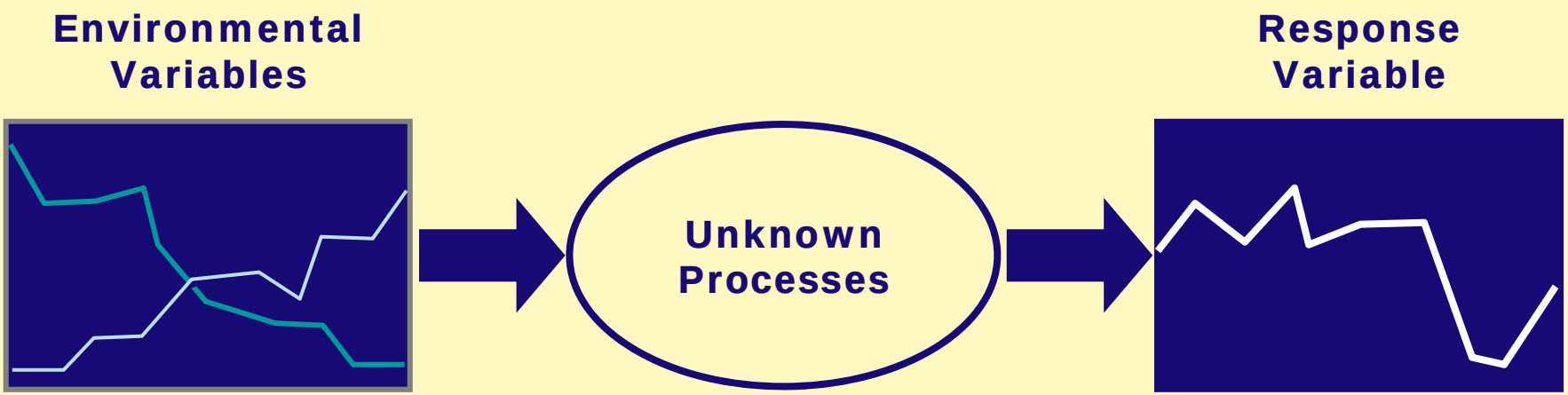

invasive molluscs
agricultural practices
sedimentation
zooplankton abundance
Project Scope: Declining pelagic fishes in the Bay-Delta system
agricultural water demand
water clarity
delta smelt
state and federal water projects
entrainment
domestic water demand
longfin smelt
salinity gradient
climate change
contaminant loads
urban runoff
threadfin shad
primary productivity
agricultural runoff
nutrient loads
striped bass
habitat area
invasive plants

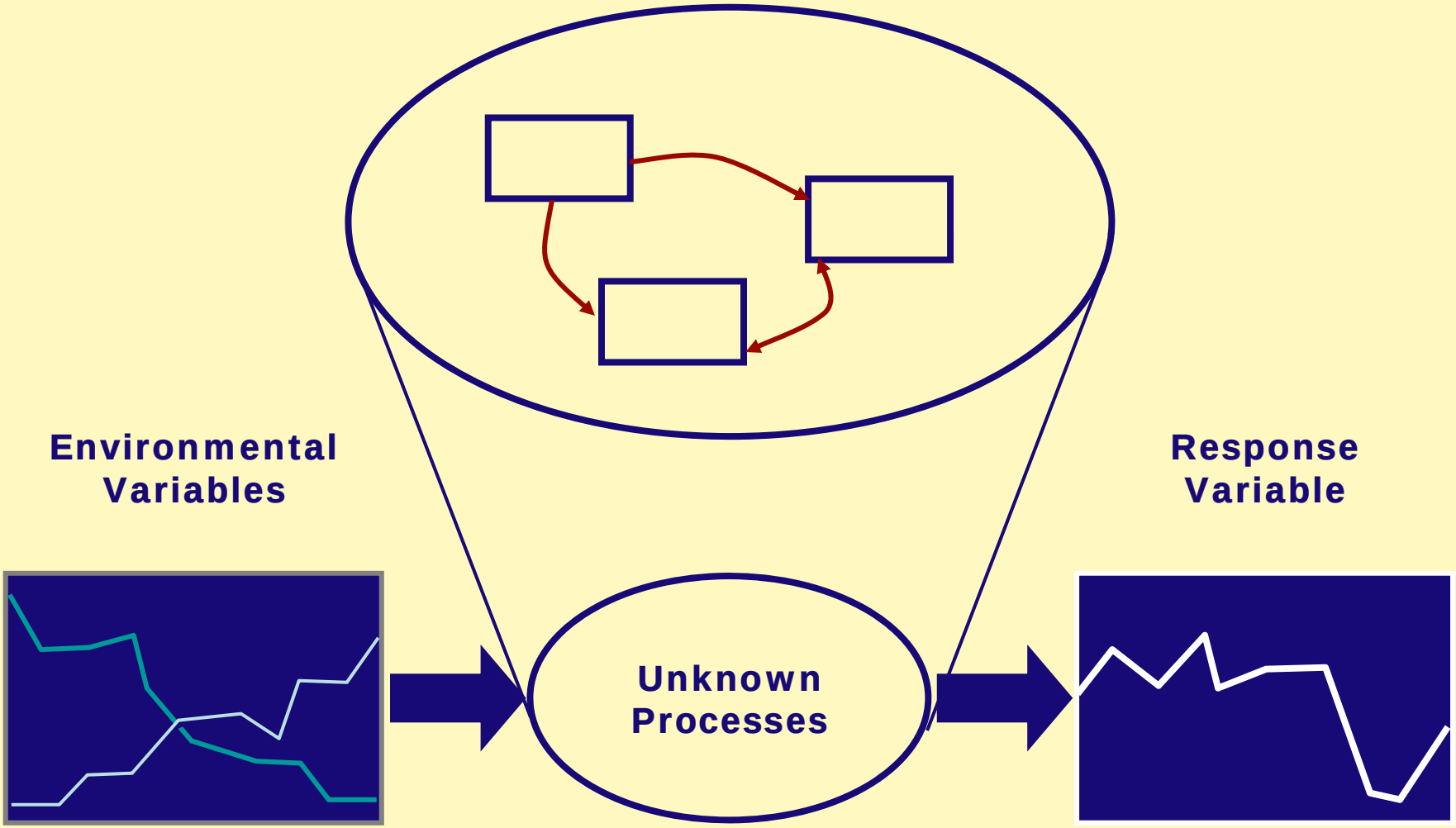
Management Challenges

- Many responses and potential stressors of concern
- Different data sets provide different types of information
- Many alternative theories
- Many approaches to examining different responses



Alternative approaches:

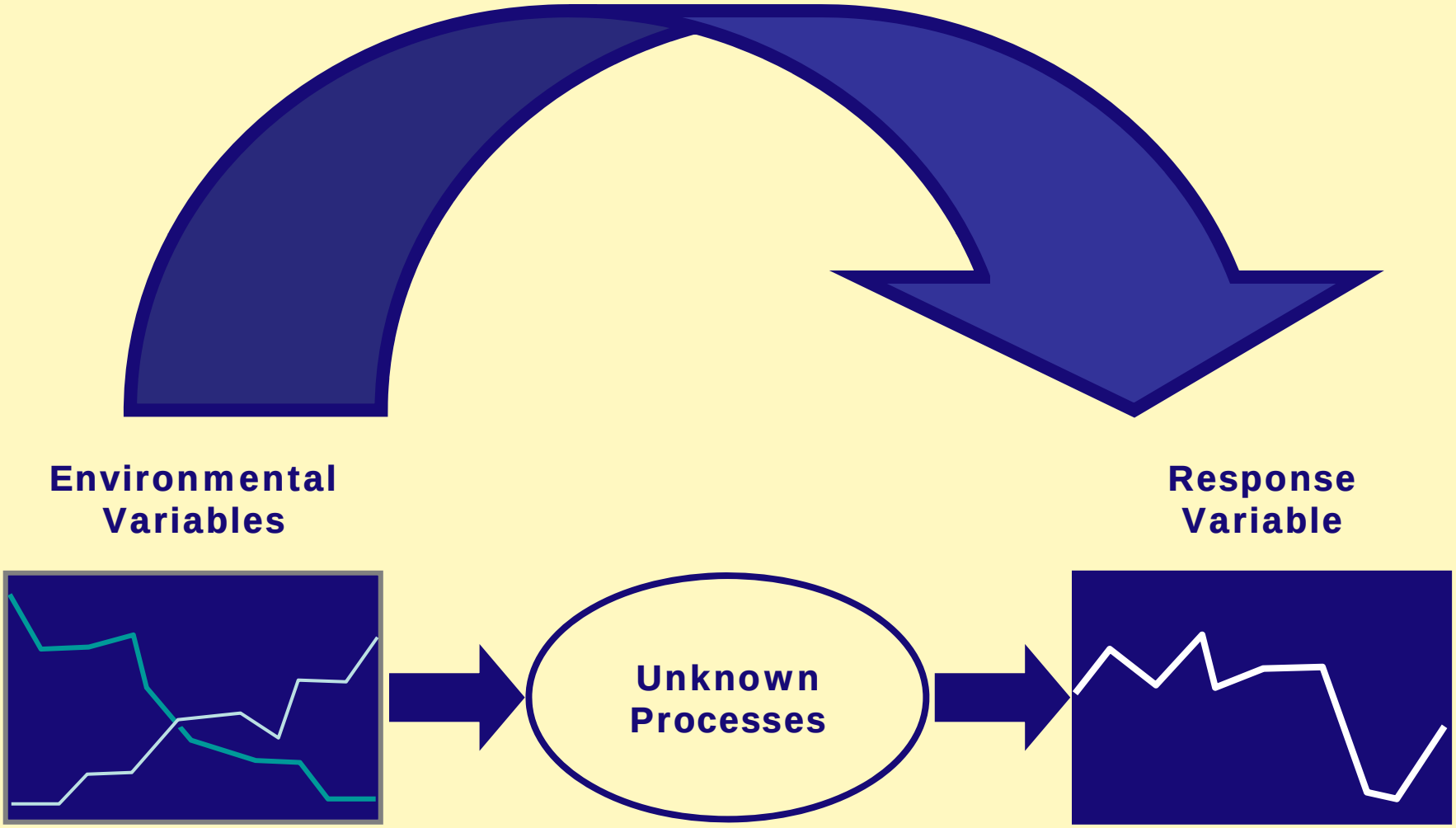
mechanistic experiments to reveal processes



source: California Academy of Sciences

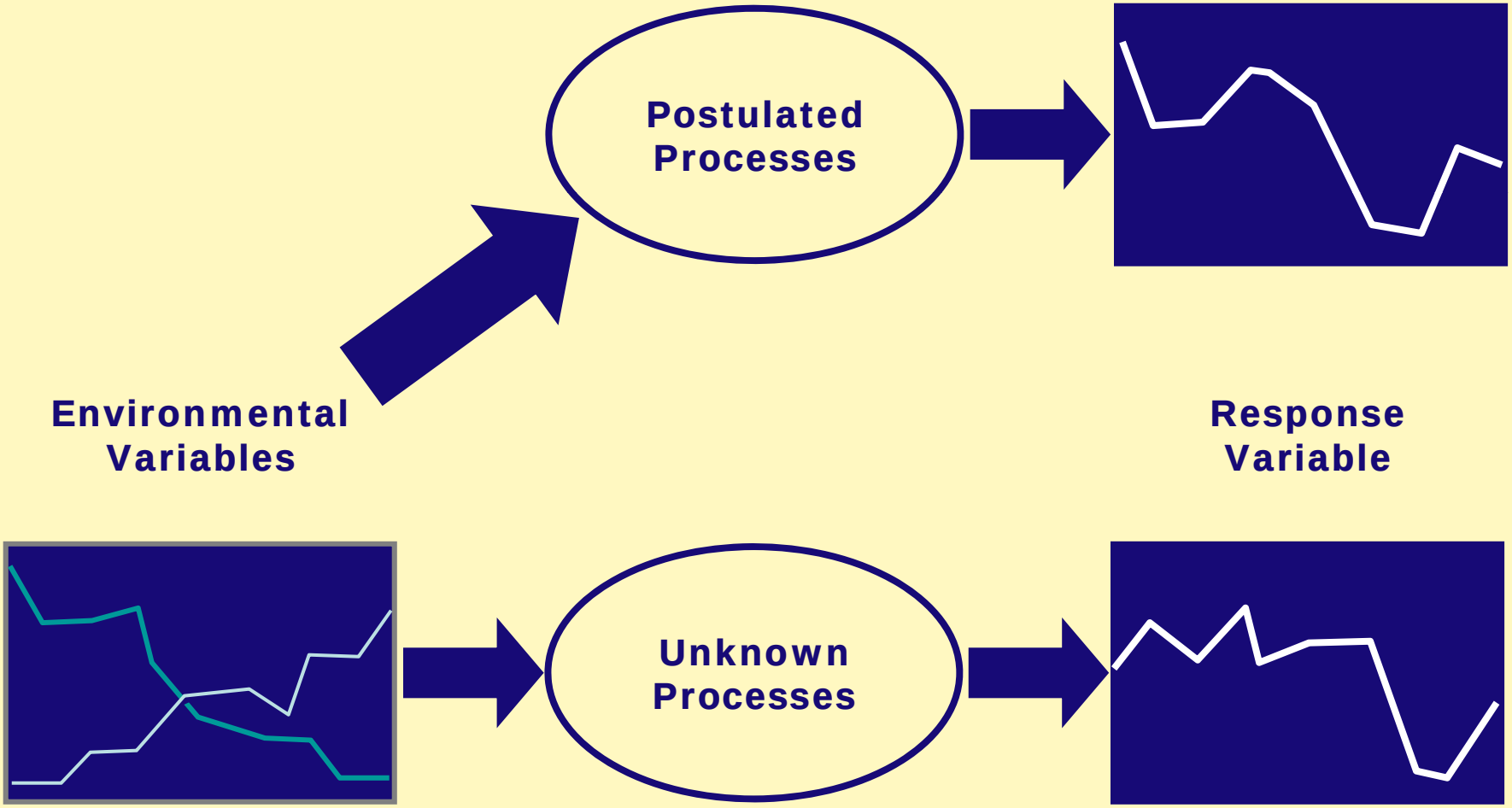
Alternative approaches:

statistical relationships show associations

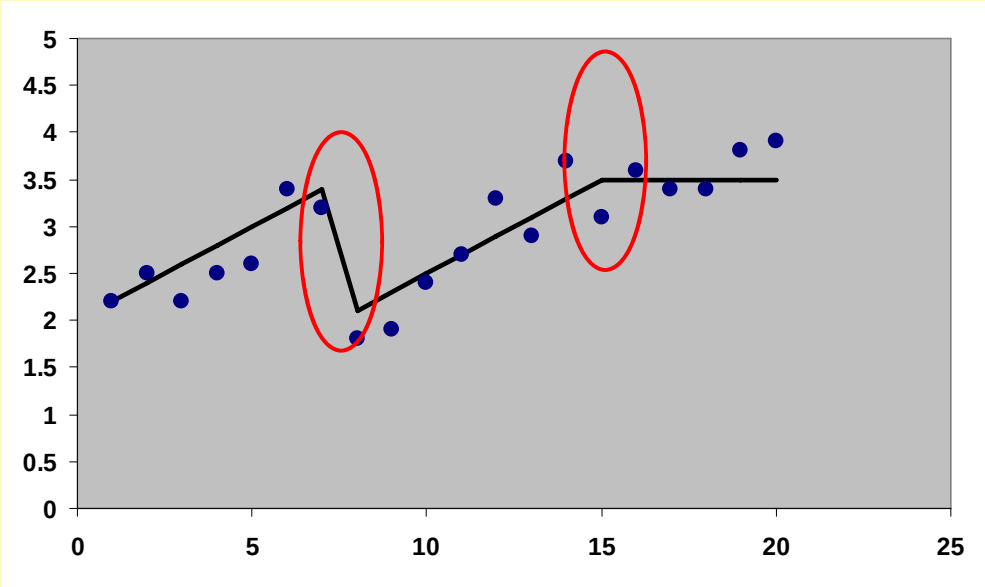


Alternative approaches:

modeling to examine hypotheses and assumptions

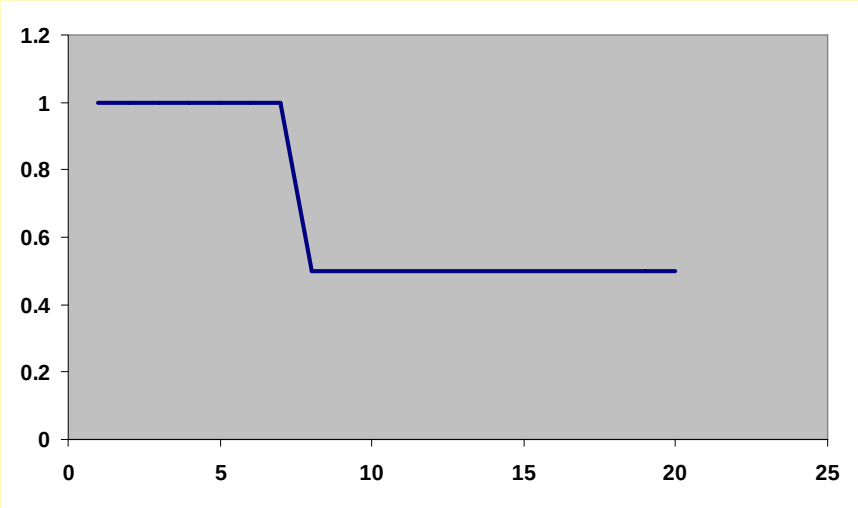


Change-points:
abrupt or unusual changes in absolute abundances (step changes) or rates of change in abundances (trend changes)



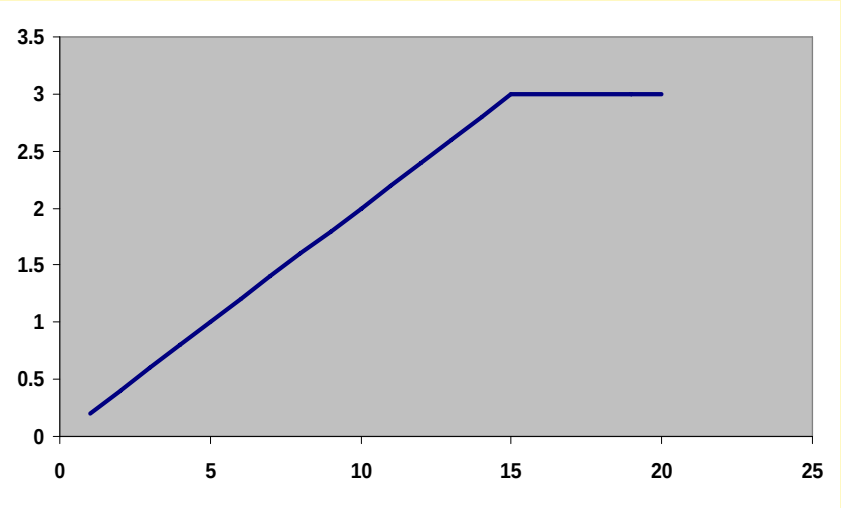
Change-points:
abrupt or unusual changes in absolute abundances (step changes) or rates of change in abundances (trend changes)

step change



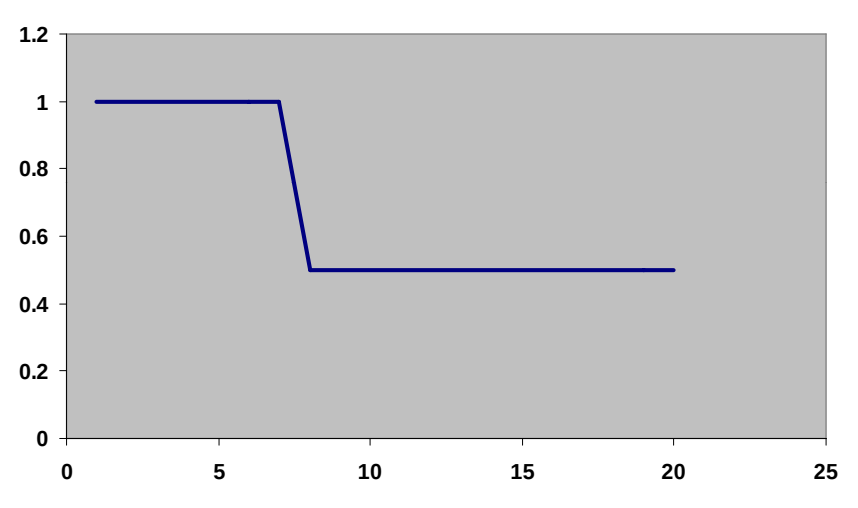
time

trend change



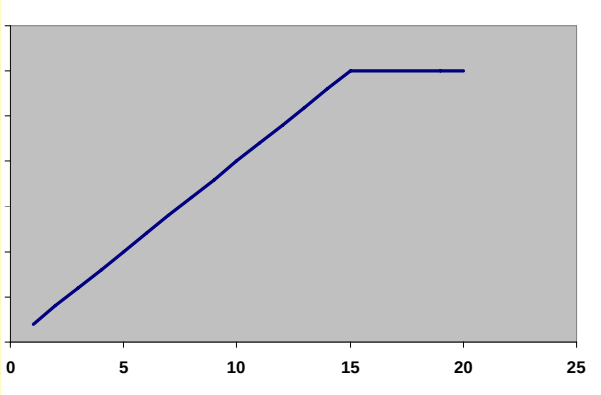
time

step change

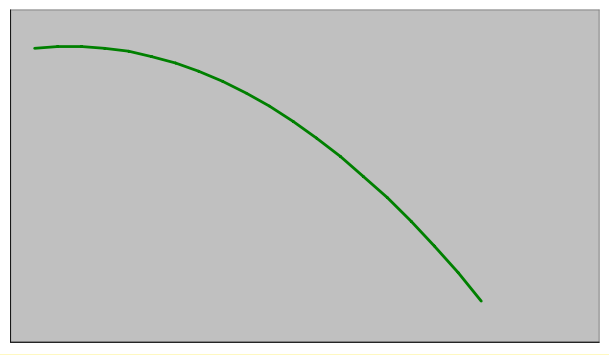


time

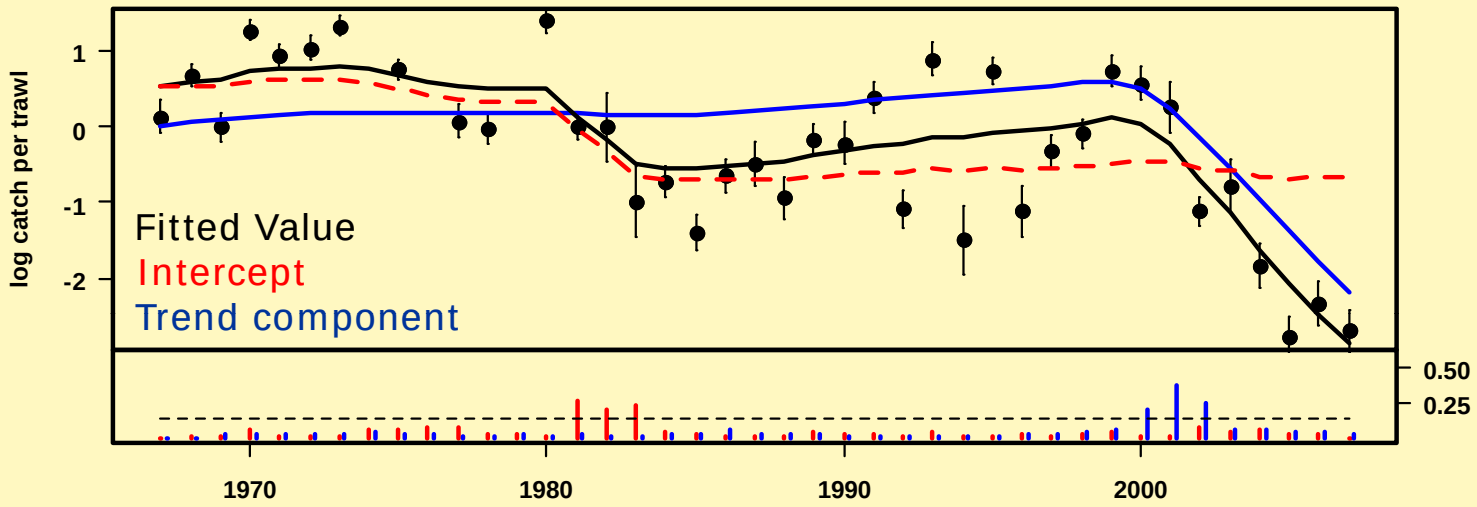
x_1



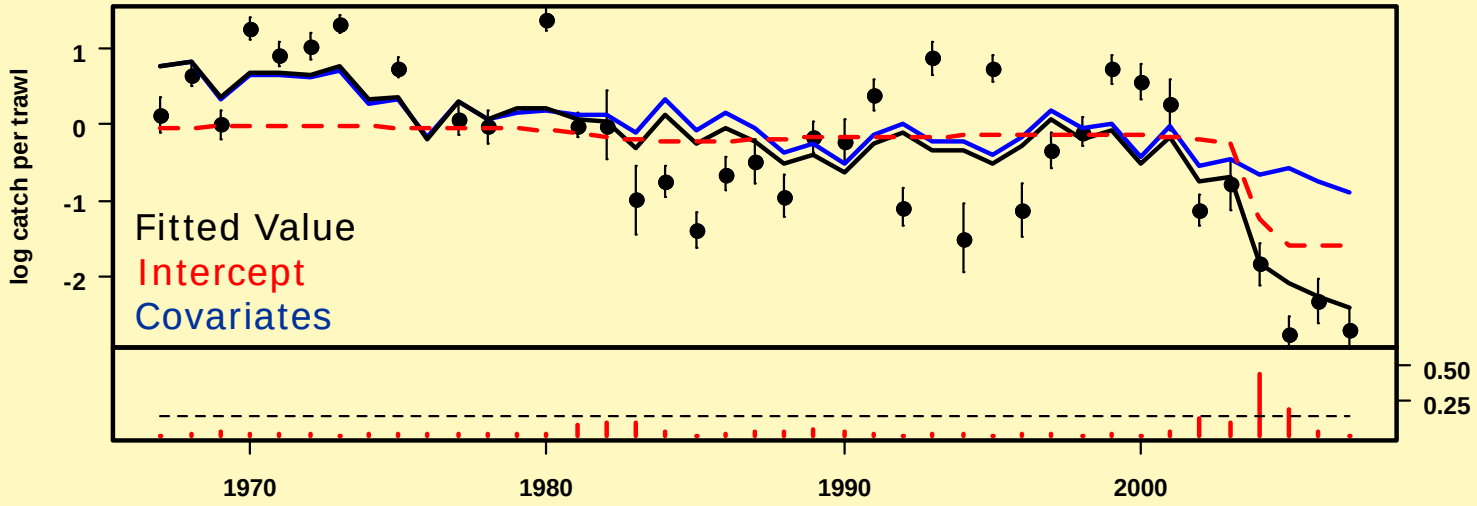
x_2



Delta Smelt

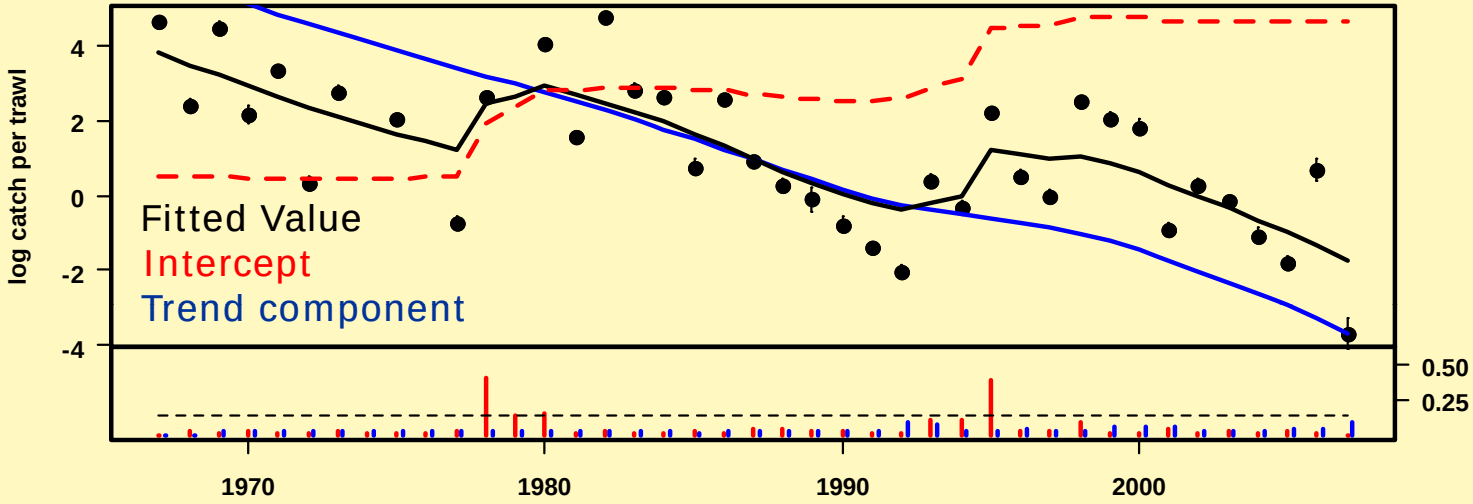


Change-point

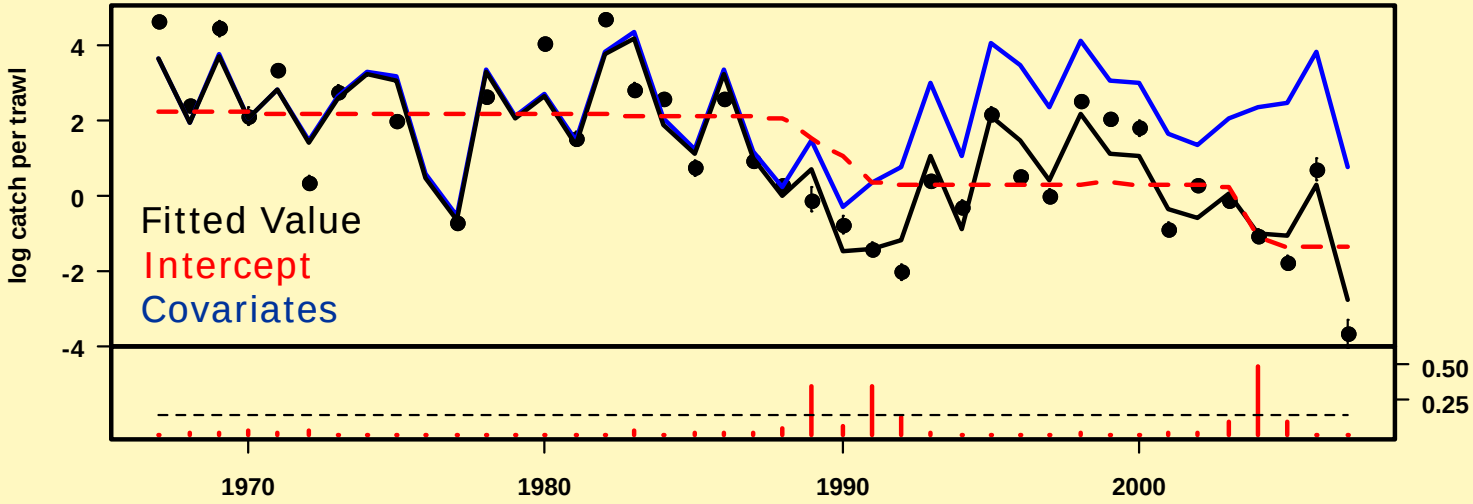


Change-point with covariates

Longfin Smelt



Change-point

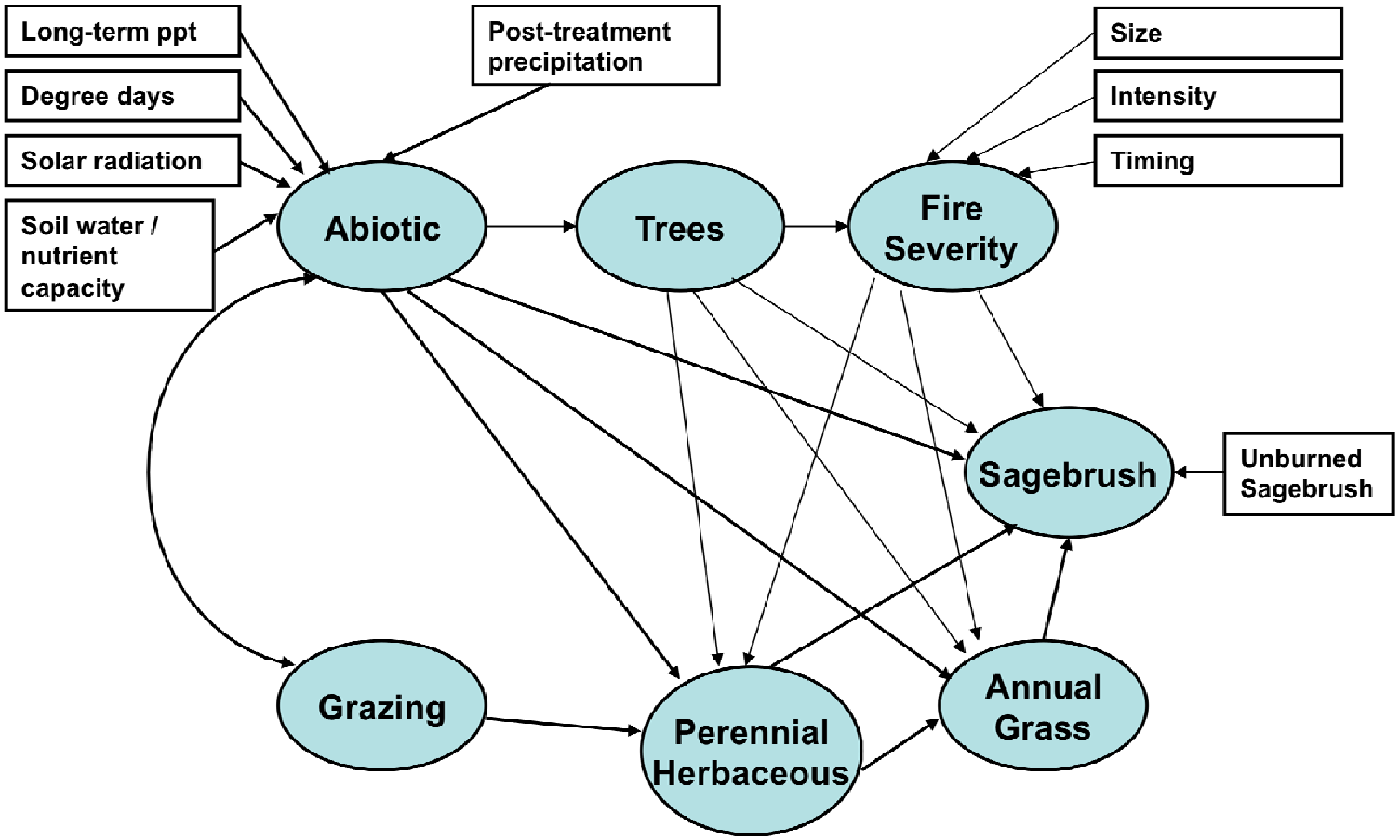


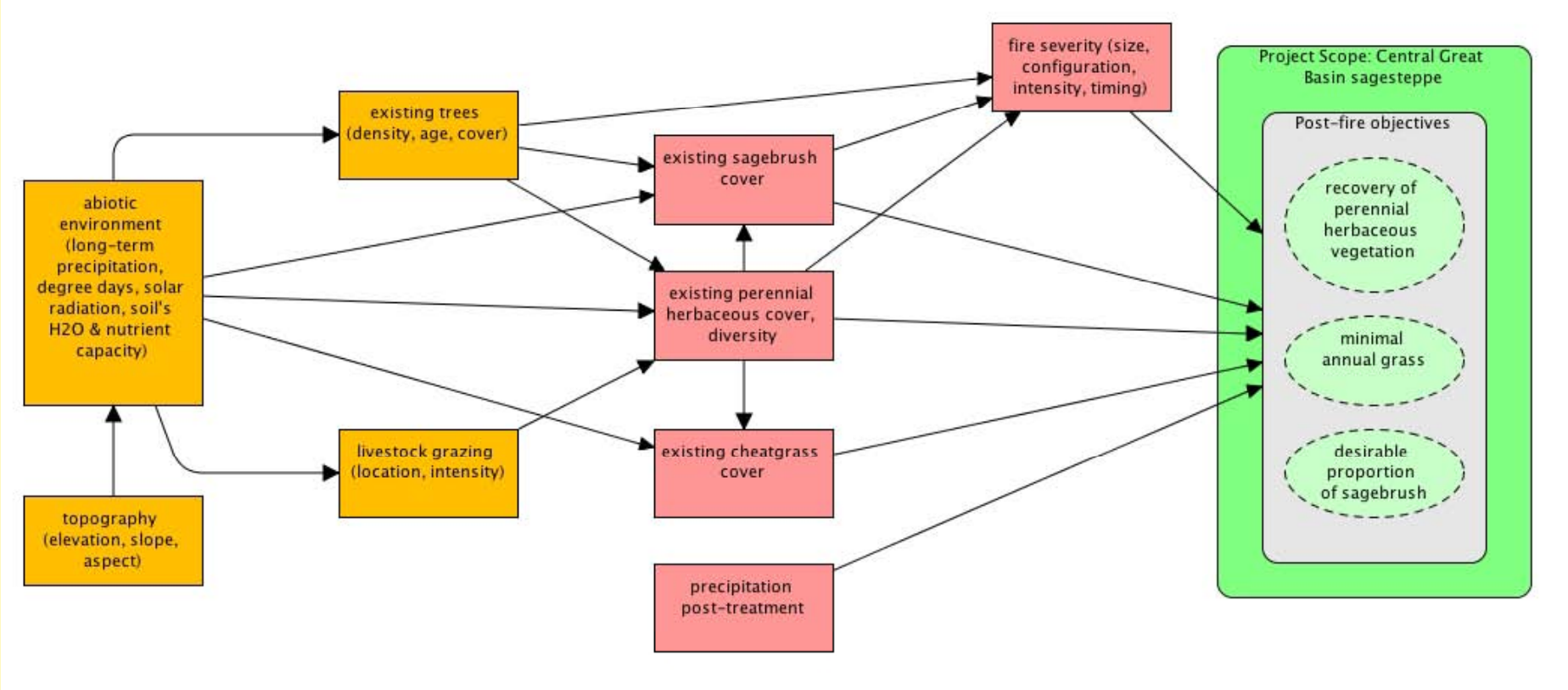
Change-point with covariates

Application of Science

"No, a thousand times no; there does not exist a category of science to which one can give the name applied science. There are science and the applications of science, bound together as the fruit to the tree which bears it."

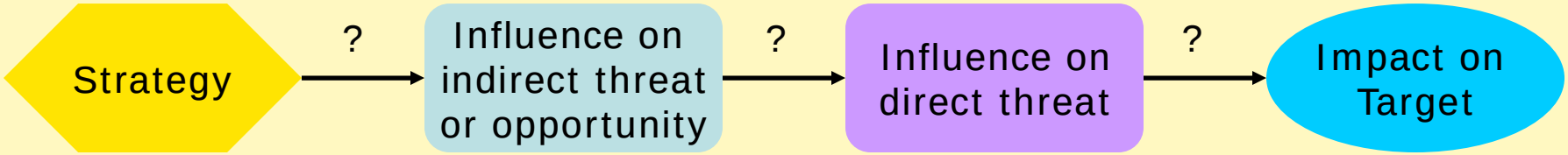
Louis Pasteur, 1871


Long-term ppt
Degree days
Solar radiation
Soil water / nutrient capacity
Post-treatment precipitation
Abiotic
Trees
Fire Severity
Size
Intensity
Timing
Sagebrush
Unburned Sagebrush
Grazing
Perennial Herbaceous
Annual Grass

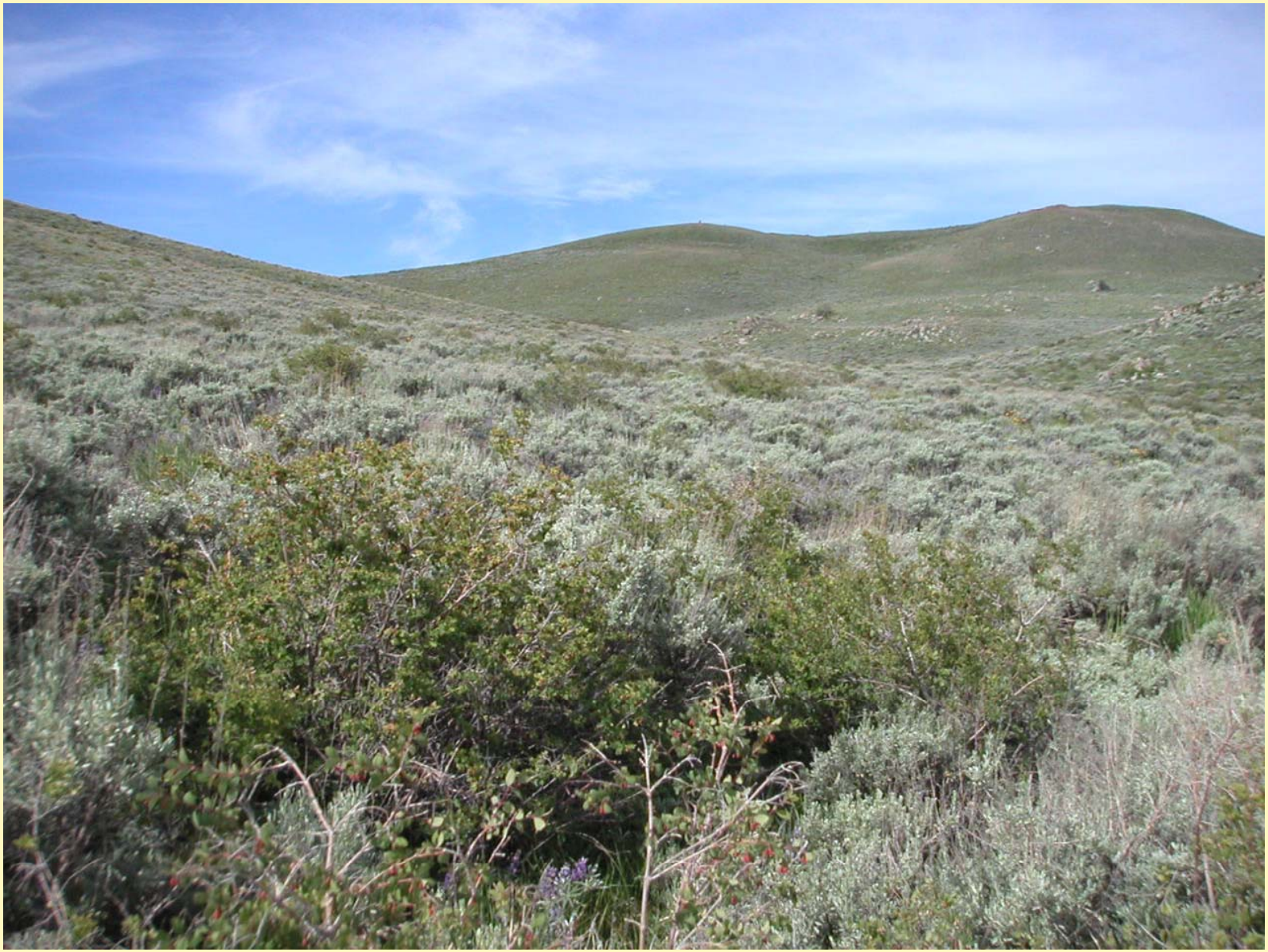

abiotic environment (long-term precipitation, degree days, solar radiation, soil's H2O & nutrient capacity)
topography (elevation, slope, aspect)
existing trees (density, age, cover)
livestock grazing (location, intensity)
existing sagebrush cover
existing perennial herbaceous cover, diversity
existing cheatgrass cover
precipitation post-treatment
fire severity (size, configuration, intensity, timing)
Project Scope: Central Great Basin sagesteppe
Post-fire objectives
recovery of perennial herbaceous vegetation
minimal annual grass
desirable proportion of sagebrush

Results Chain

- Illustrates assumptions of how actions will lead to results
- How will strategies influence threats and opportunities affecting conservation targets?

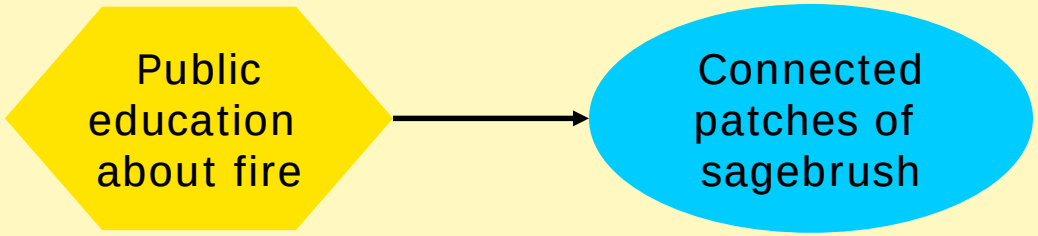


- Link strategy, expected outcomes, desired impact using "if . . . then" format

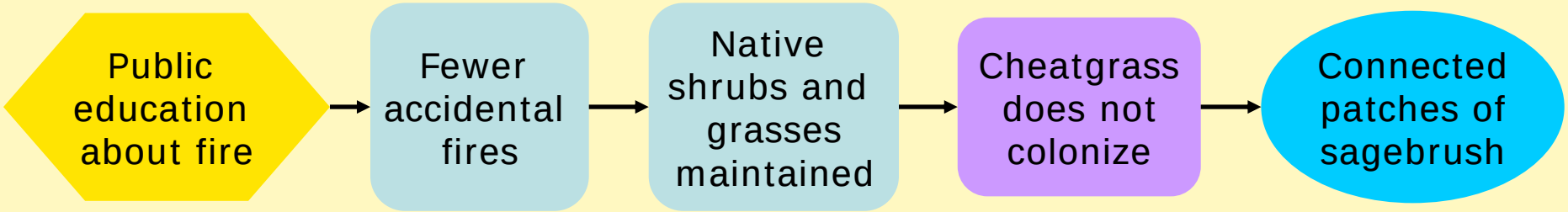


Refine Theory of Change

- Formally state assumptions about how strategies will achieve desired outcomes



- Make assumptions explicit to assess validity



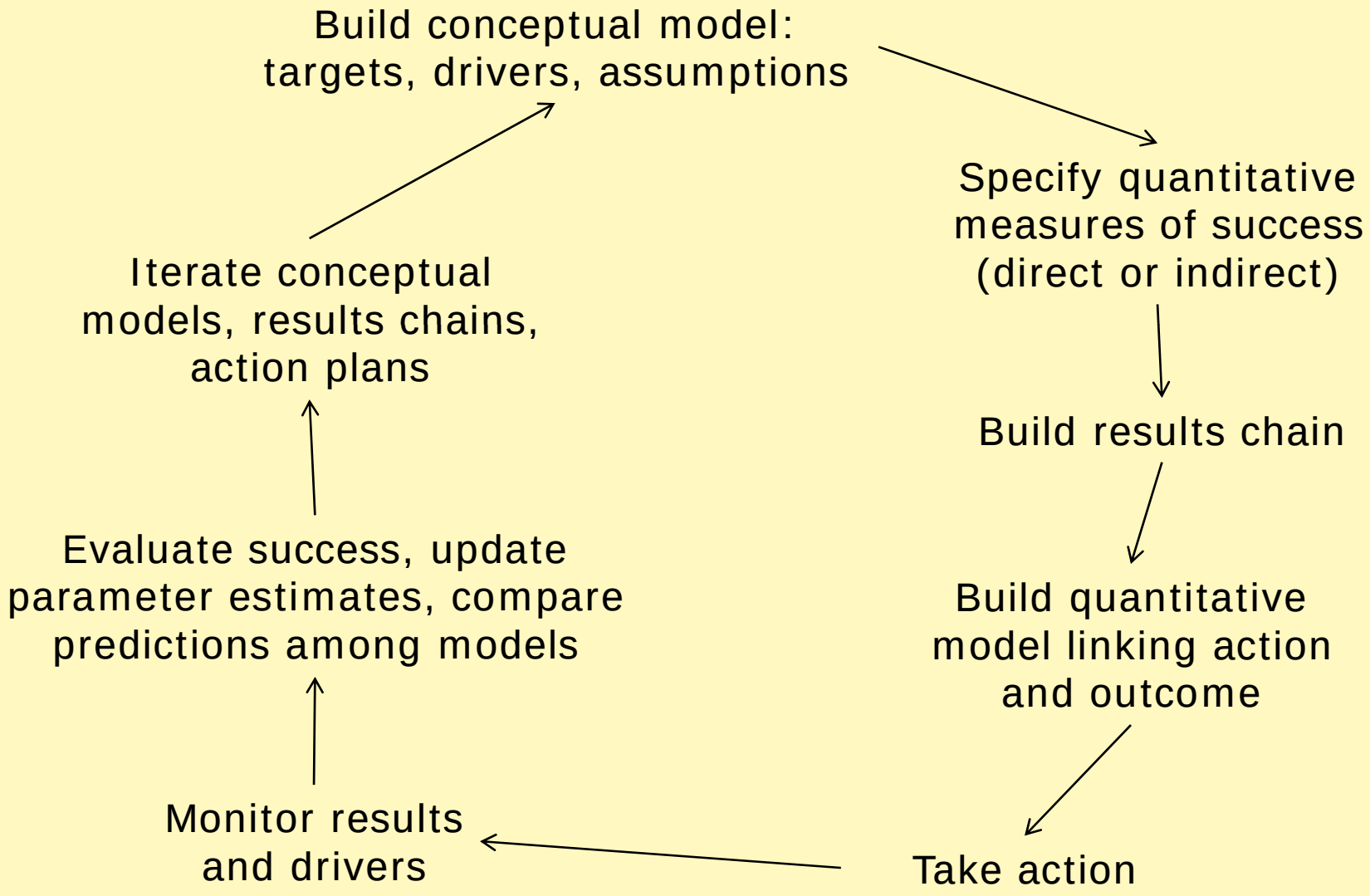
Success

Erroneous theory

Unsuccessful implementation

Failure

Adaptive Management Process



Is Adaptive Management Realistic?

- We are not managing adaptively now--maybe we can in the future
- Not simply trial and error
- Develop models based on mechanisms and life history
- Test hypotheses about alternative management actions
- Apply to multiple species and ecosystems

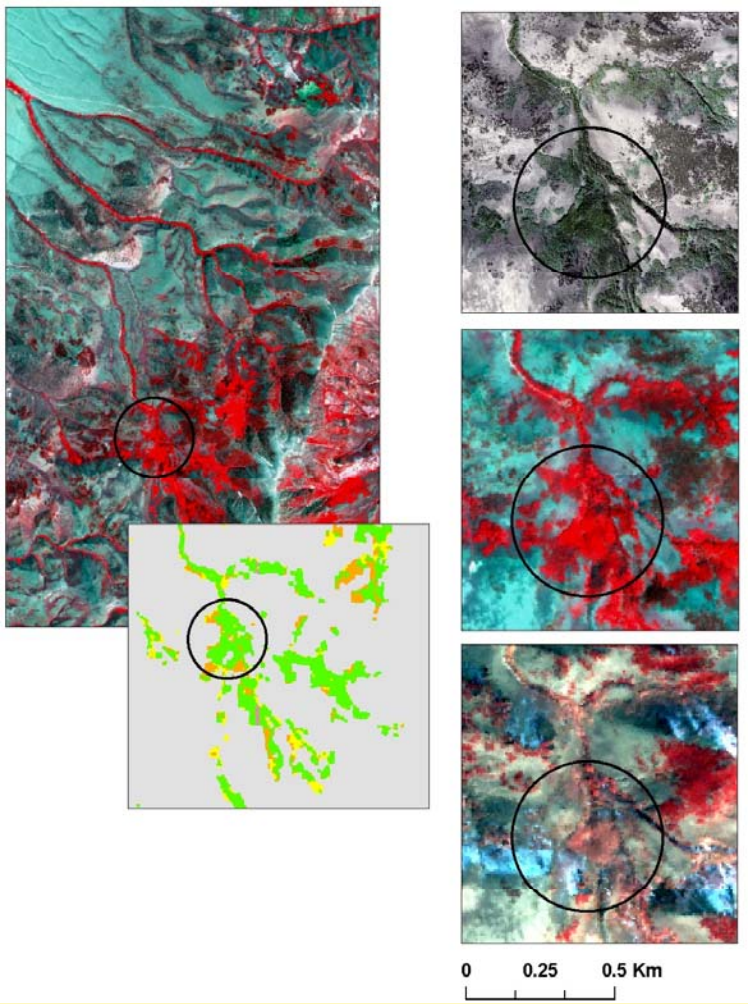
Potential Monitoring Refinements

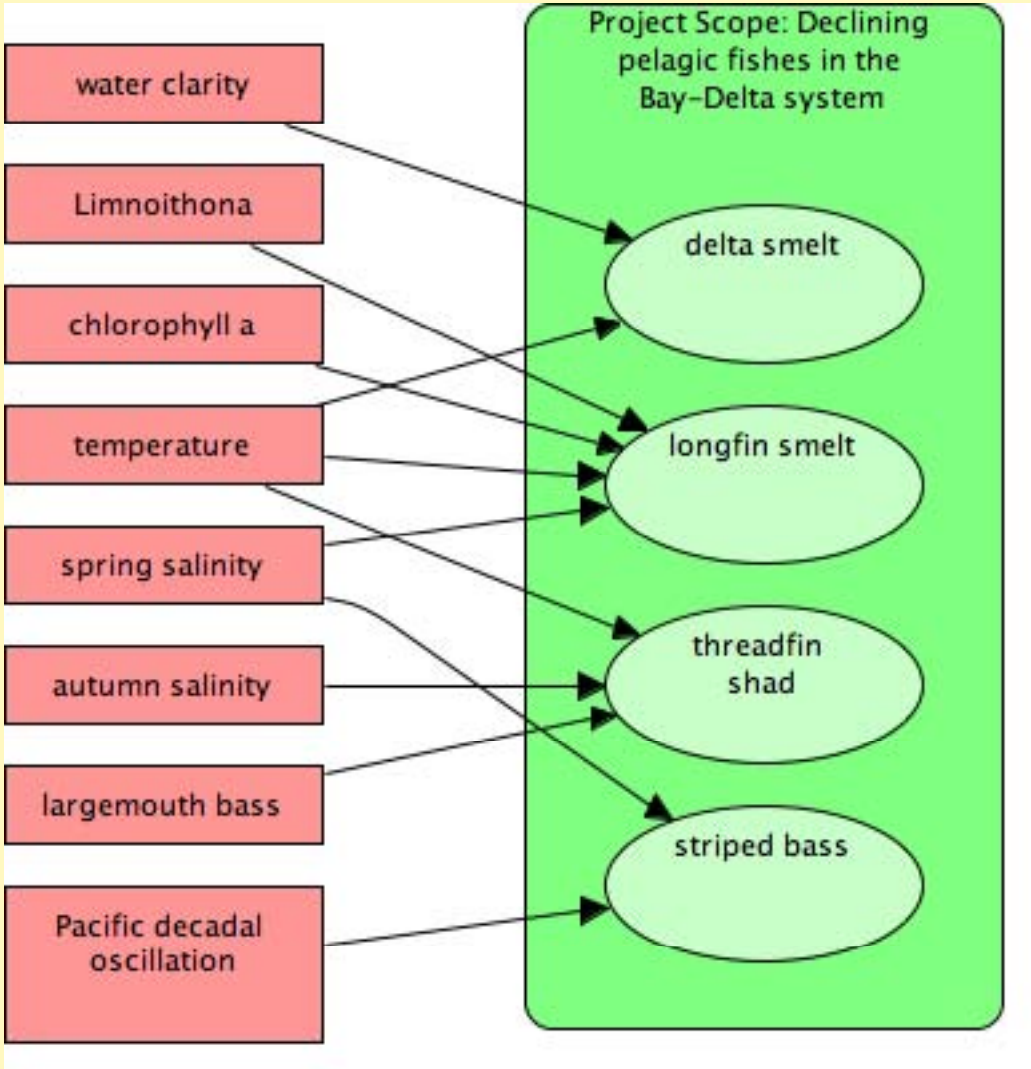
- Measure both static quantities and rates
  - Chlorophyll-a & primary production
  - Zooplankton abundance & reproductive rates
  - Fish abundance & growth rates and measures of condition
- Measure a few new quantities (e.g., ciliates that are zooplankton food)
- Focus more what and why before how

Nuts and Bolts

- Avoid tracking a laundry list of variables: adding or deleting must be justified
- Incorporate gear efficiencies into statistical models that account for process and observation error

Challenges to Change



- Desire for continuous record
- Advanced modeling requires data we are not collecting
- Who decides, what are the criteria?
- Logistical challenges
- Who pays?

One strategy doesn't fit all