



NOAA
FISHERIES

Stock Assessment Methods, Models and Results

Northeast Groundfish Science Forum

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Some Basic Concepts

- Stock assessments are a shared responsibility among industry, scientists and managers.
- Stock assessments are NOT just surveys
- Stock assessments are NOT just landings + discards
- Stock assessments are NOT just basic biology/ecology
- Instead an assessment requires all three components

How many fish?

Various Approaches

Method	Pros/Cons
• Census via capture	• Most captures are terminal encounters
• Mark and Recapture	• Expensive, relies on detection, reporting, monitoring, analyses
• Survey Sampling	• Examples: Bottom Trawl Surveys, Acoustics, Egg/Larvae etc.
• Stock Assessment Model	• Combines Total removals with surveys

All feasible approaches require sampling: A census removes uncertainty but ensures an uneconomic resource or extinction.



Purposes of Stock Assessment

What is the state of the stock?

An evaluation of the current state of the stock and the rate at which it is being exploited.

What has happened to the stock?

A reconstruction of the dynamic history of the stock allowing an evaluation of its response to exploitation.

What will happen to the stock?

Prediction of the response to future exploitation and the risks associated with harvesting strategies.

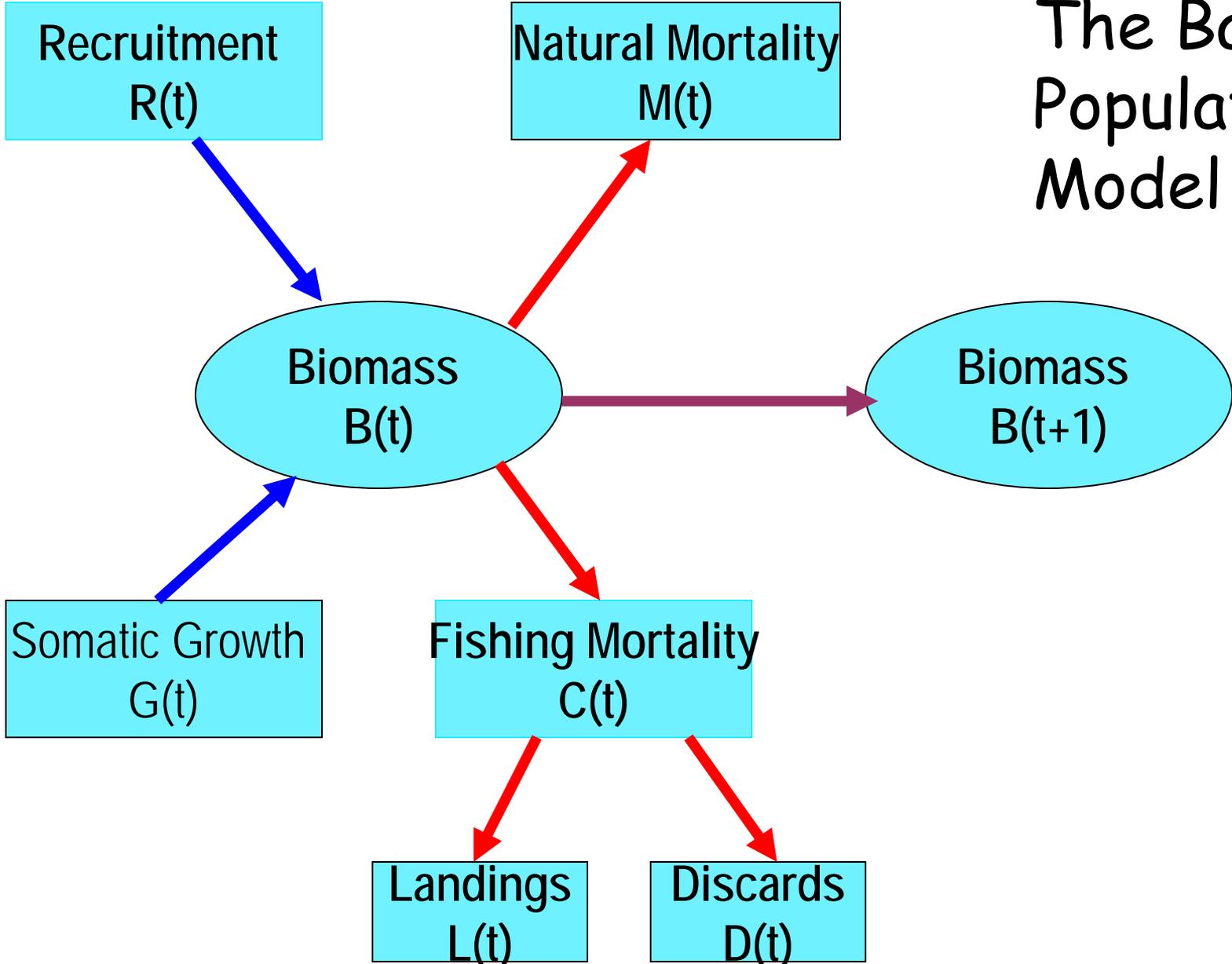


Stock Assessment—an integration of **measures of trend and scale.**

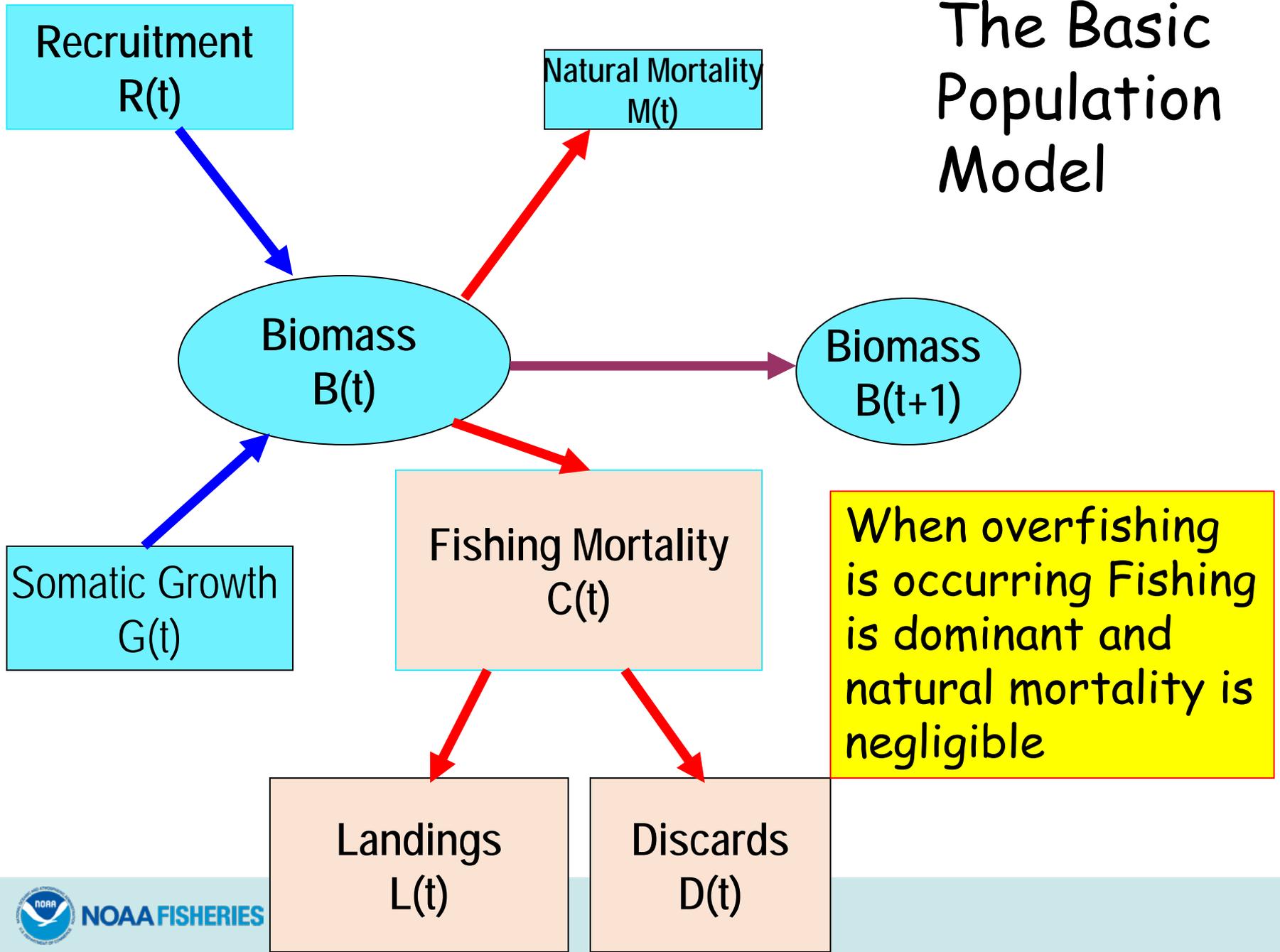
Measure of Scale: $Catch = Landings + Discard$

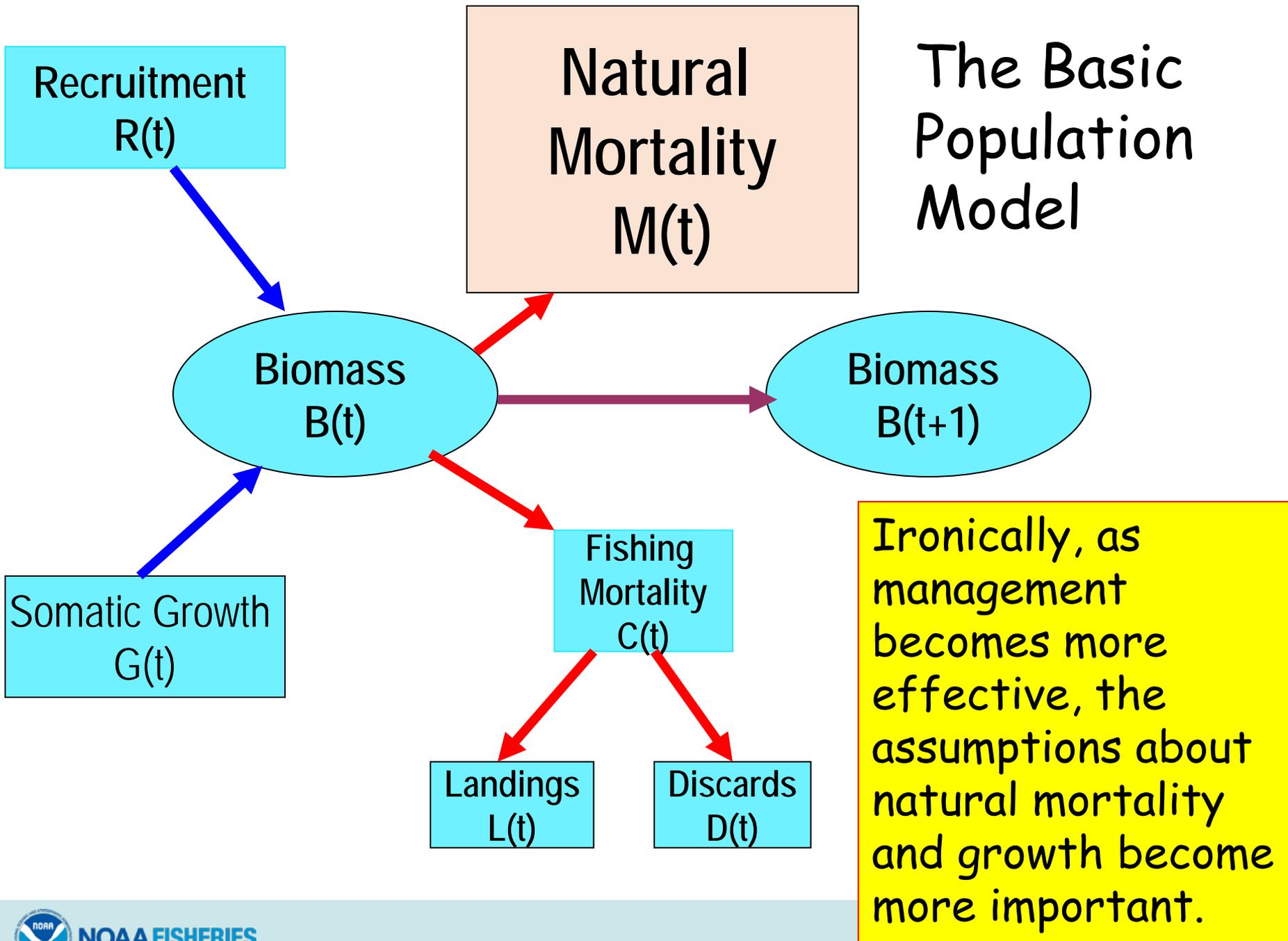
Measure of Trend: Survey Indices

The Basic Population Model



The Basic Population Model

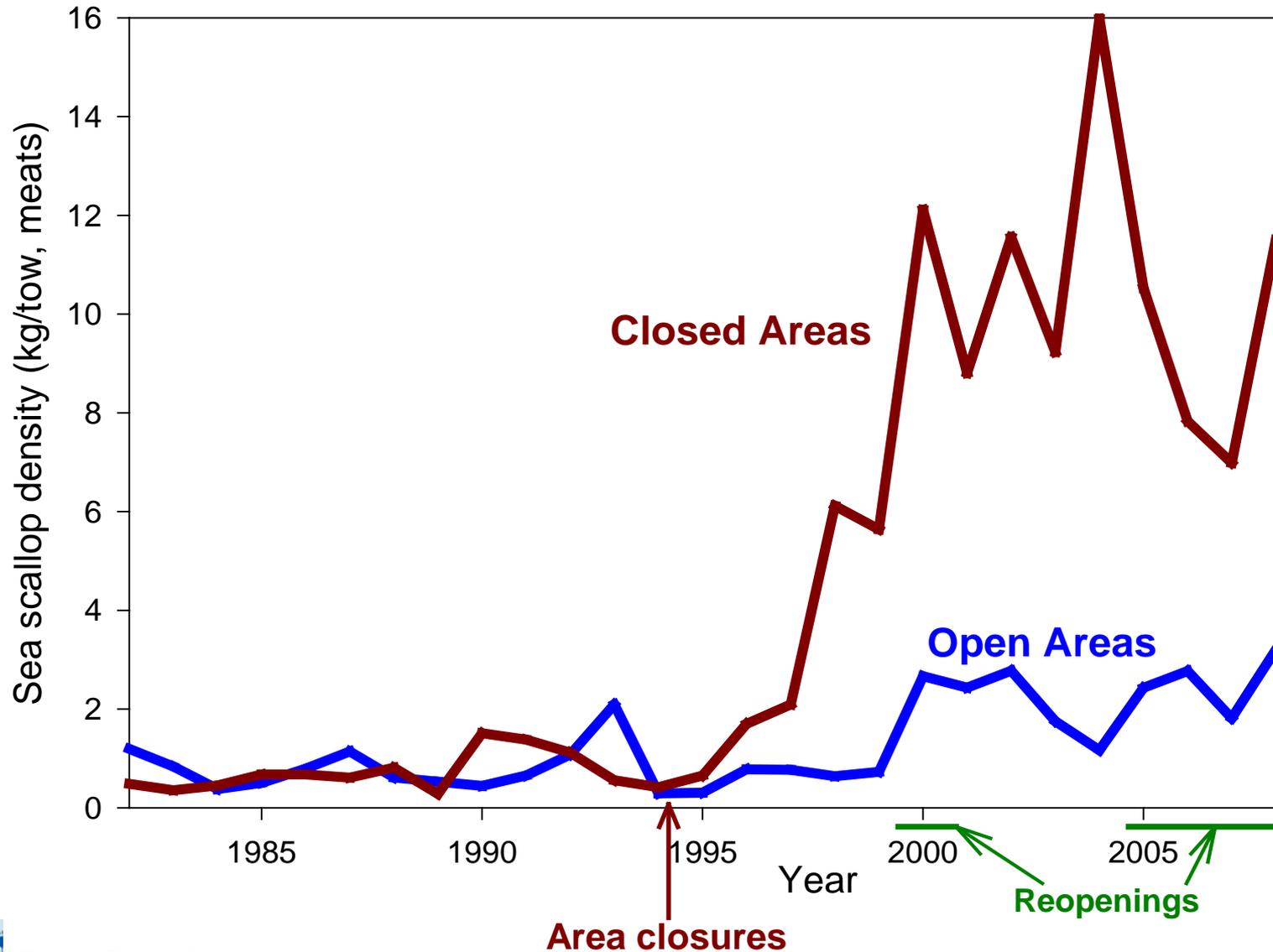




Stock Assessment—An Observational Science

- True experiments rare or impossible
- Lack of experimental control
- Imprecise measurement
 - Measures of Trend
 - Measures of Scale
- Major interventions
 - Management
 - Environment
- Non stationary Processes—Things Change over time

U.S. Georges Bank scallop indices inside and outside groundfish closed areas



Why don't you use ecological information in stock assessments?

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Ragosaurus Rex

Courtesy Tom Nies

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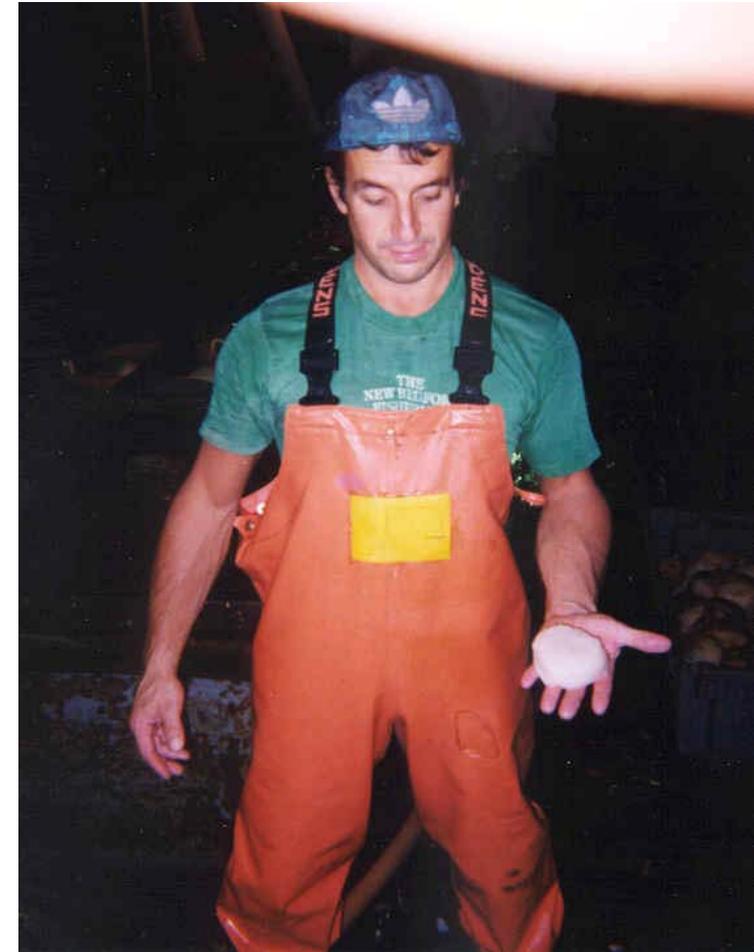
In fact we do.

- Changes in average weight over time
- Changes in maturity
- Changes in selectivity of fleets
- Changes in recruitment patterns
- Importance of stocks
- Recent examples: Herring, SNE yellowtail

How do we harvest a natural Resource?

Veal vs Beef

Pulp vs Lumber

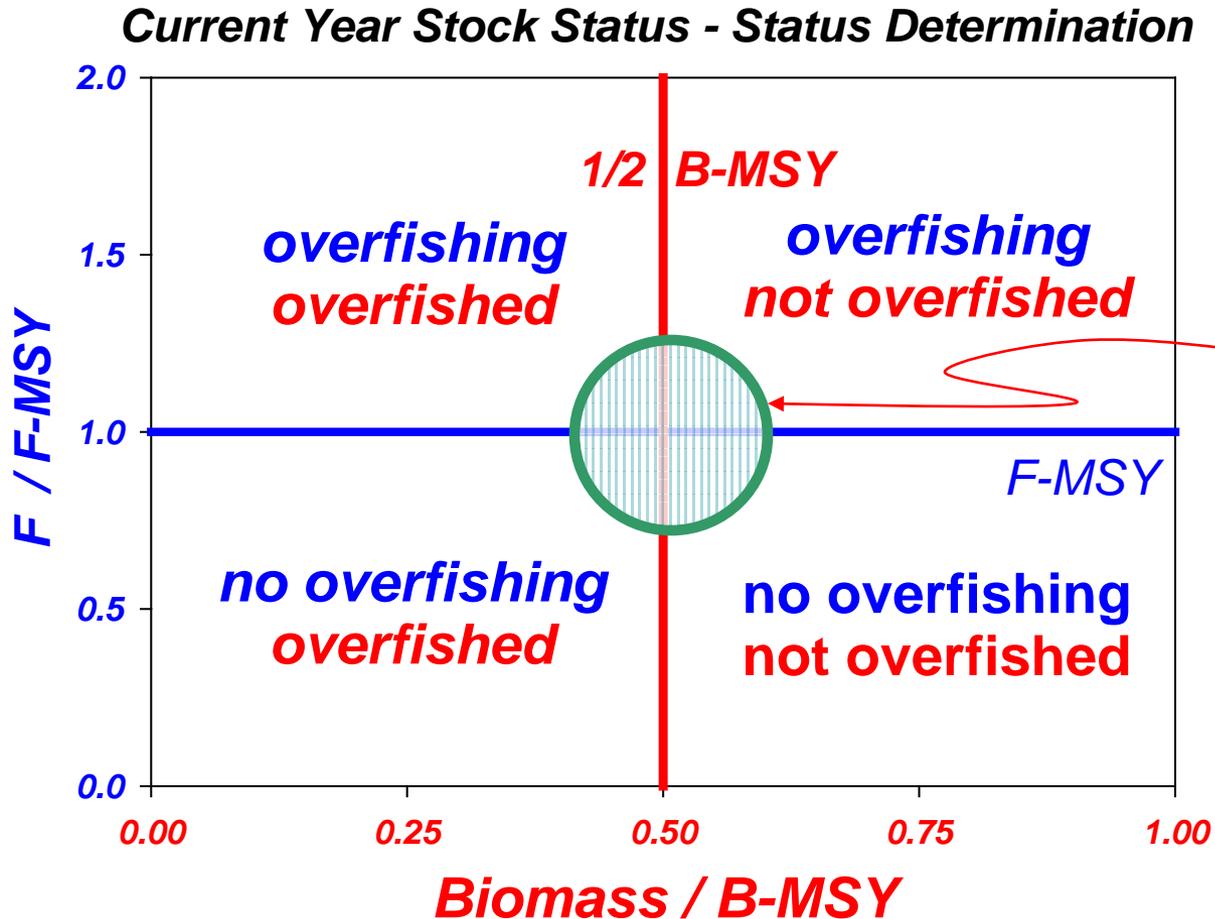


Natura nihil agit frustra
Nature does nothing in vain

Thomas Brown 1605-1682



Where do you want to manage the resource?



Managing at the margin makes changes in stock status very likely given the expected variation in assessments.

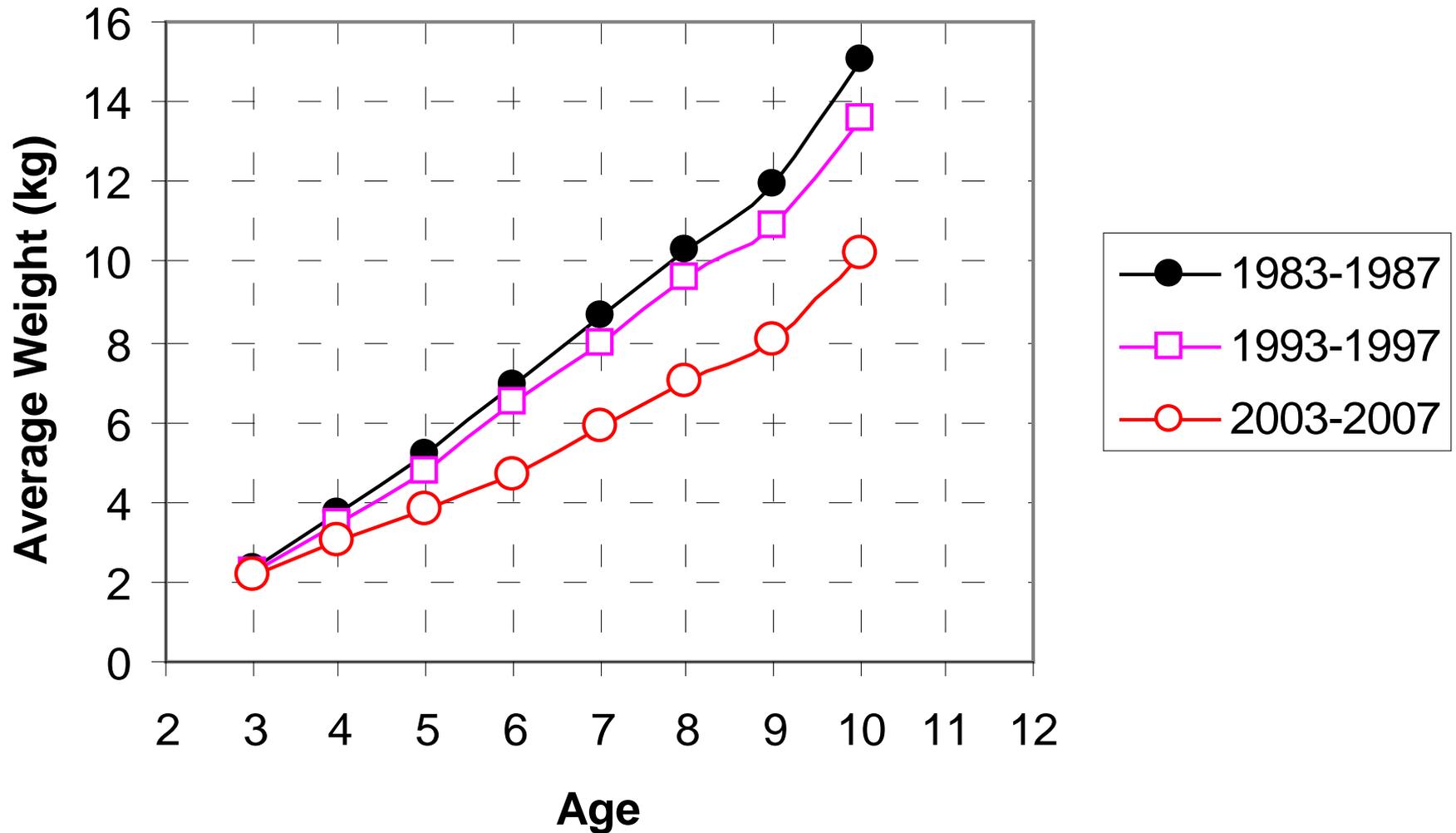
Summary

- Stock assessment is scientific basis for management
- Requires attention to detail at every step: landings, discard estimation, biological sampling and surveys.
- Ecosystem based fisheries management begins with quantification of stock size, rates of change, measures of recruitment, and total removals
- Stock assessment depends on extensive collaboration among all partners
- New demands of ACLs, Sectors, and MSRA will increase interdependencies and need for collaboration.



End

Average Weight at age of Georges Bank Cod in Commercial Catch (Landings + Discards)





Fishery Dependent Sampling: What do we collect?

- Vessel Trip Reports
- Dealer Records
- Port sampling for length, age, weight
- Observer coverage, esp. bycatch, discards
- Vessel Monitoring Systems
- Recreational Surveys



Fishery Dependent Sampling: Why don't we use it as the primary estimate of abundance?

- In fact we do. Most models use total removals of a cohort over time as a way of estimating the initial size of the cohort.
- Catch per unit effort, however, is far more difficult to interpret.
- Major concern—what is the appropriate measure of effort?
- Need to distinguish change in abundance from change in fishing power.

Productivity of Groundfish Stocks

MSY Estimates from GARM III

