

**NOAA
FISHERIES**

Scientific Perspective on Flexibility in Fishery Management

Bevan Symposium on Sustainable Fisheries

Seattle, WA

April 2014

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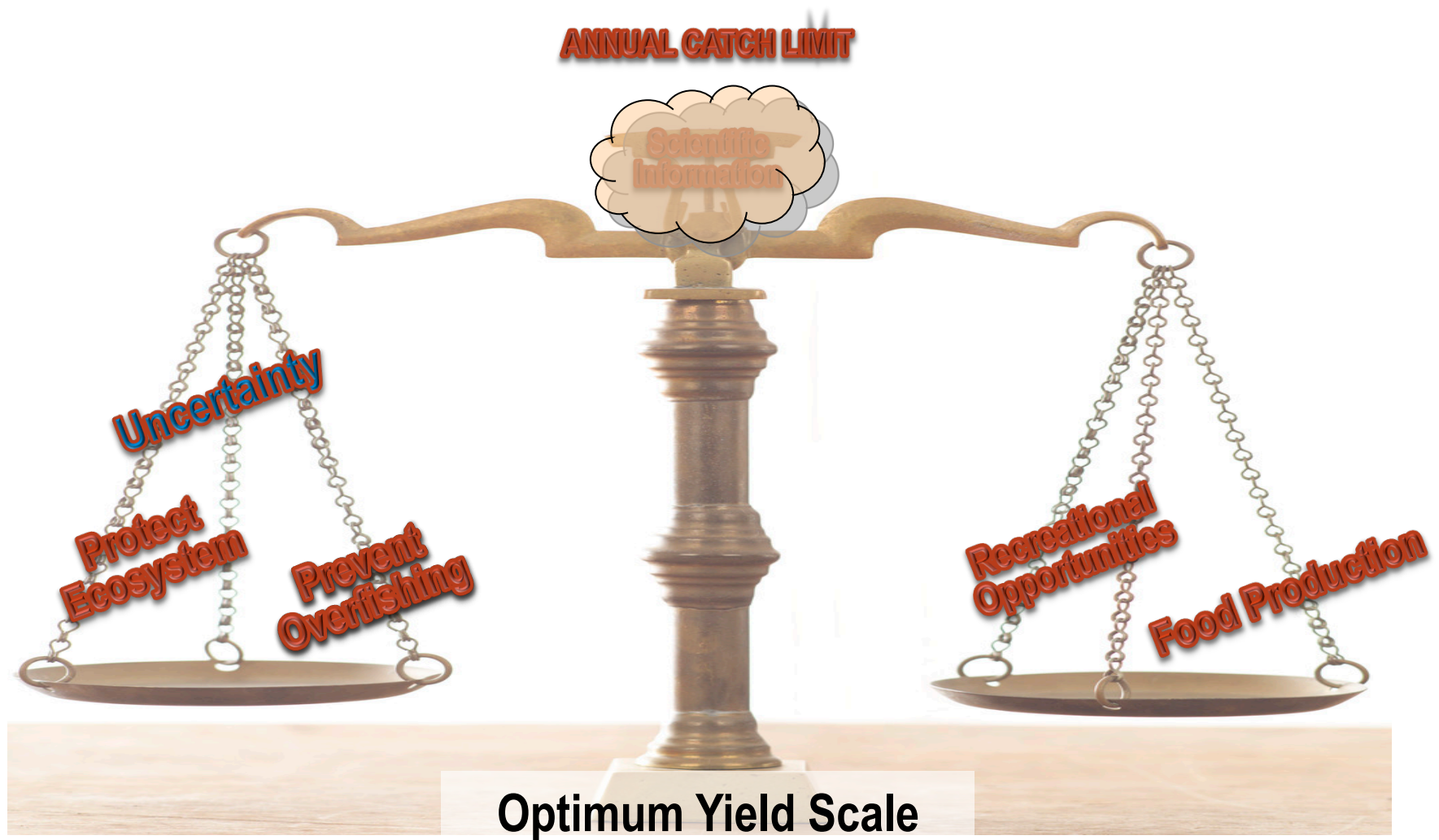
NOAA Science Advisor for Stock Assessments

Seattle, WA

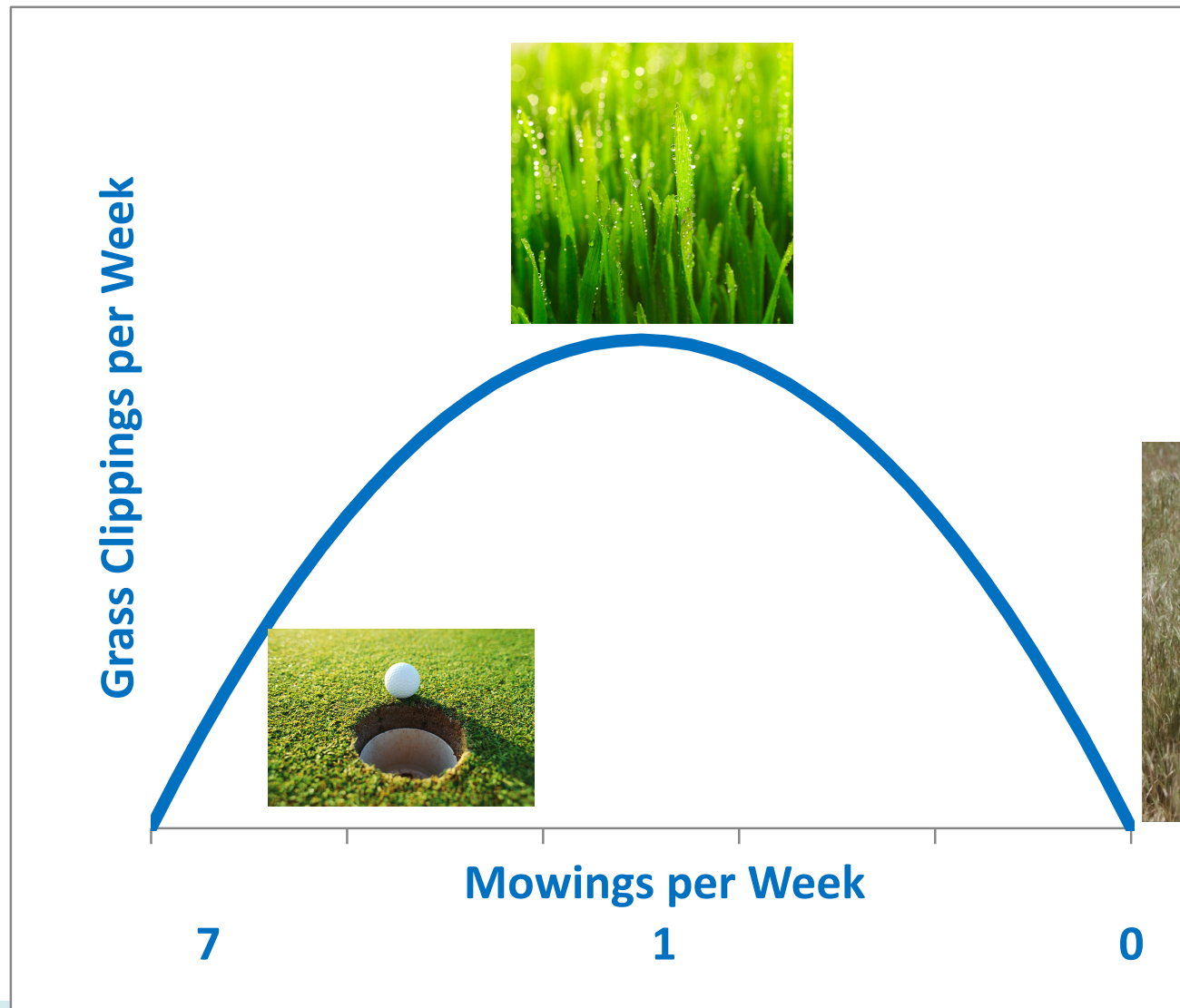
Presentation Outline

- **How intensely can/should stocks be fished?**
- **How can new scientific results be phased into management?**
- **How much conservation and management does each stock need?**
- **Compare management of stock complexes to that of mixed stock fisheries**

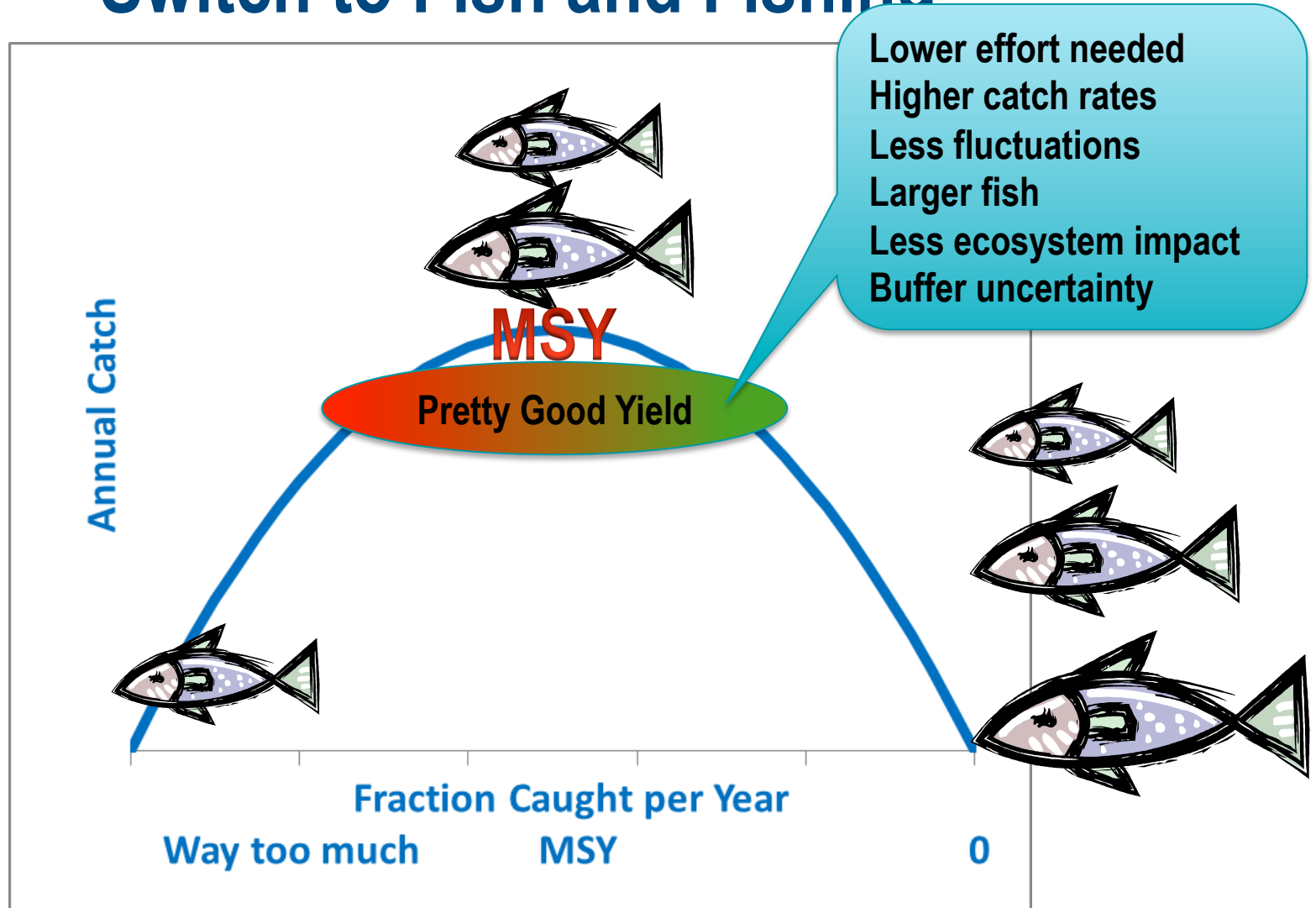
Balance Conservation and Utilization



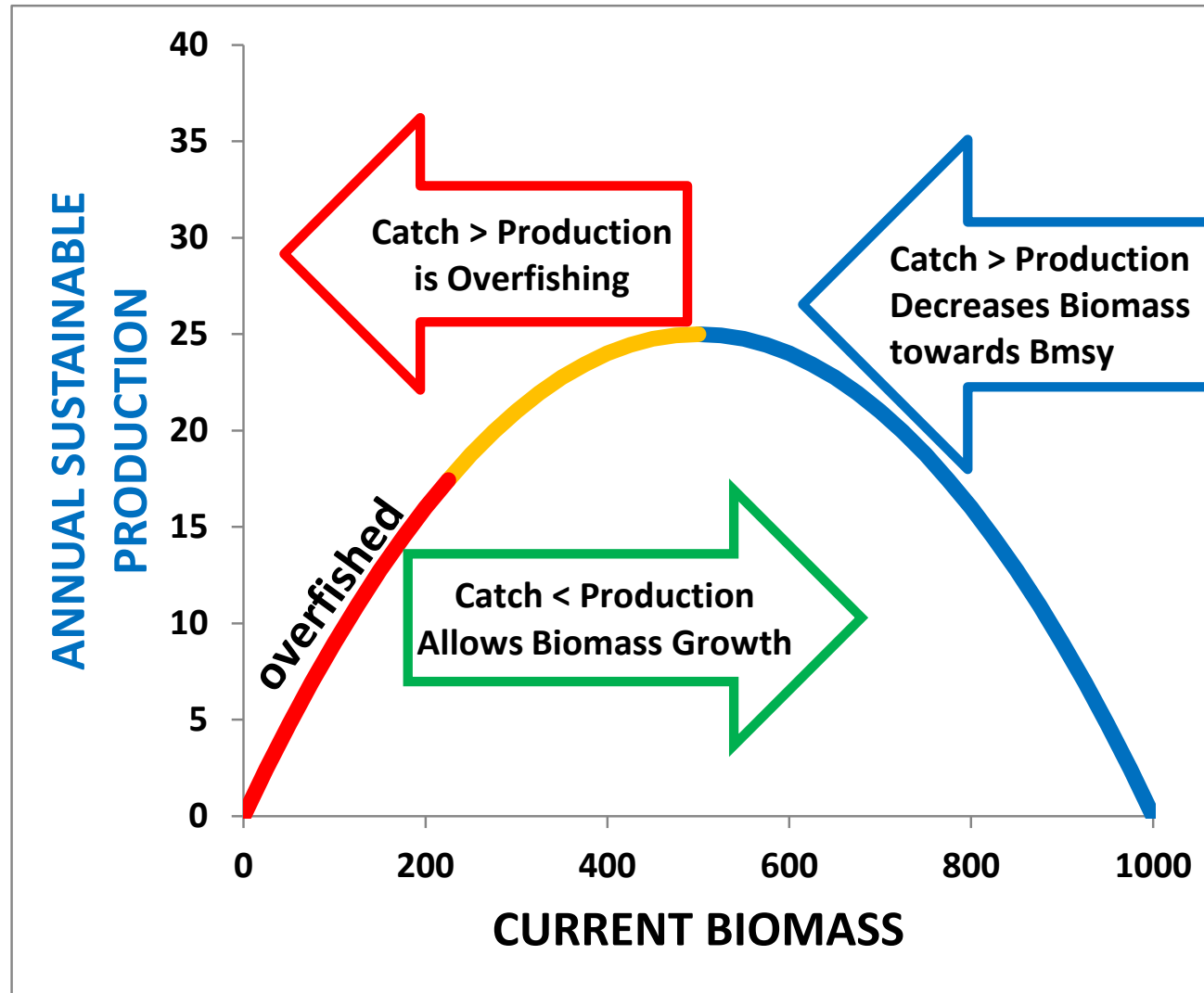
Start with Example Close to Home



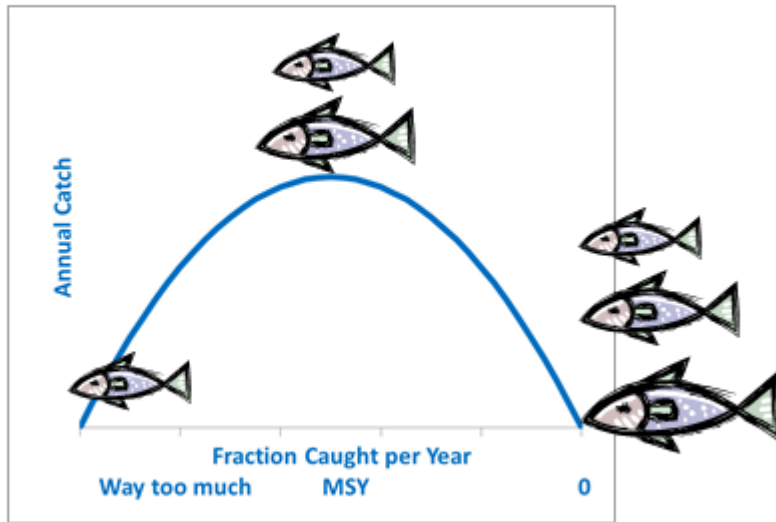
Switch to Fish and Fishing



Fishery Production Concepts



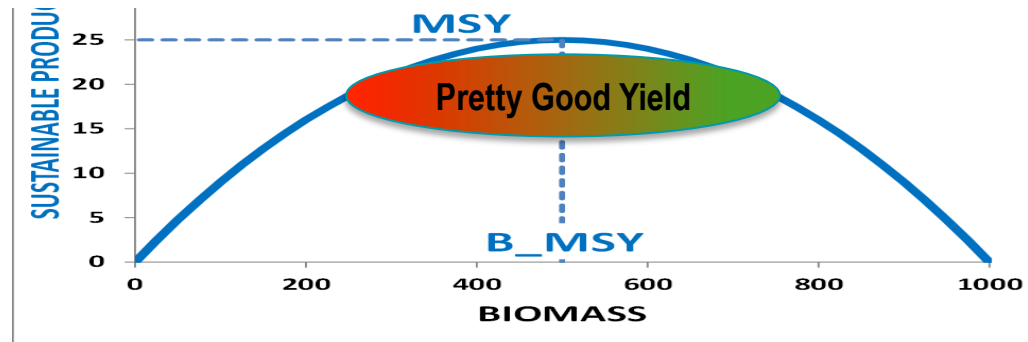
How Hard Can We Fish?



A fish's natural mortality rate and other biology sets scale for how much "interest" can be skimmed off each year sustainably

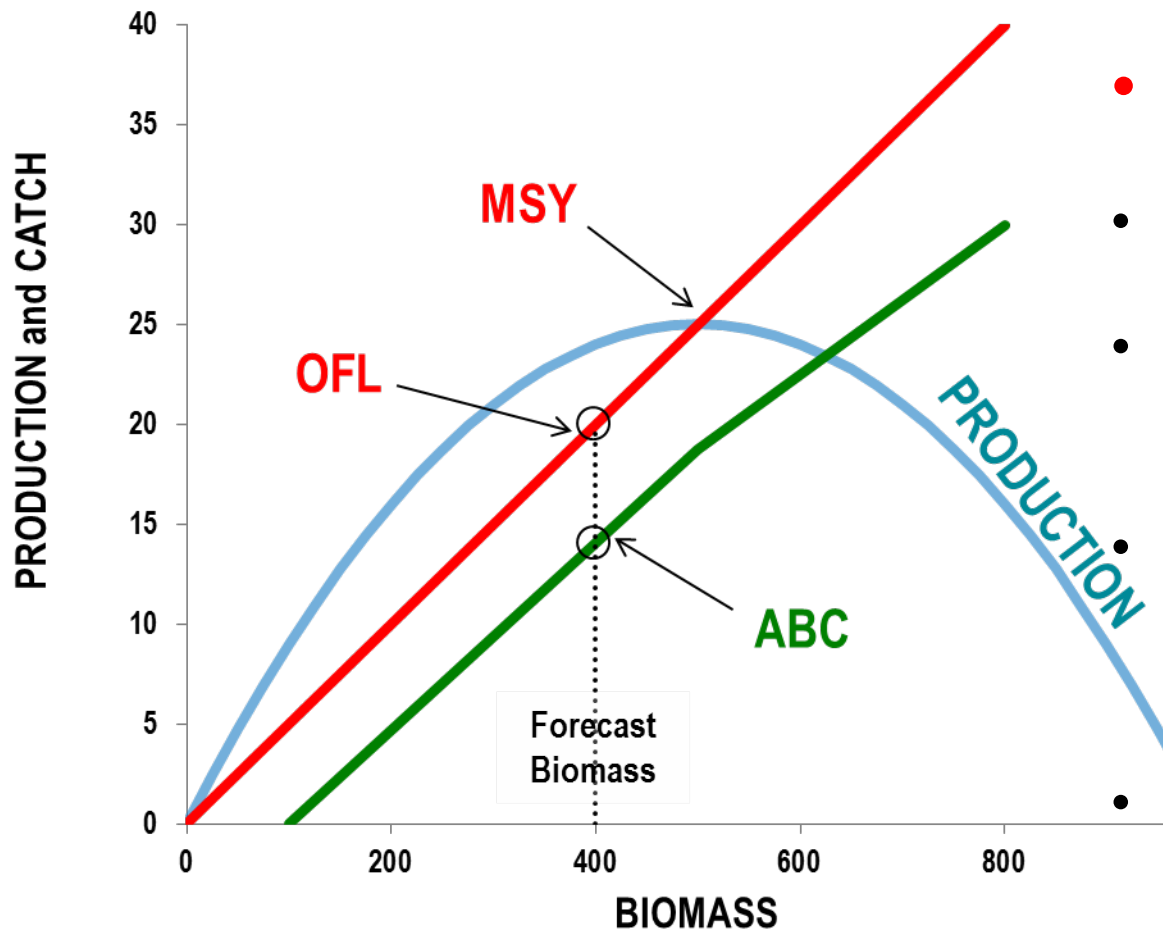
- **Short-lived shrimp, anchovy, salmon can support high rates**
- **Long-lived rockfish and sharks get MSY at single-digit rates**
- **Over 95% of many rockfish are allowed to "escape" the fishery each year when sustainably fished**

Recreational Fisheries: What's Different?



- Tens to barely thousands of participants per fishery
- Values maximum production, plus:
 - Product quality,
 - Efficiency,
 - safety
- Millions of participants in some fisheries; cannot census the catch
- Value opportunity to fish, plus:
 - Good catch rates,
 - Long, consistent seasons,
 - Trophy fish

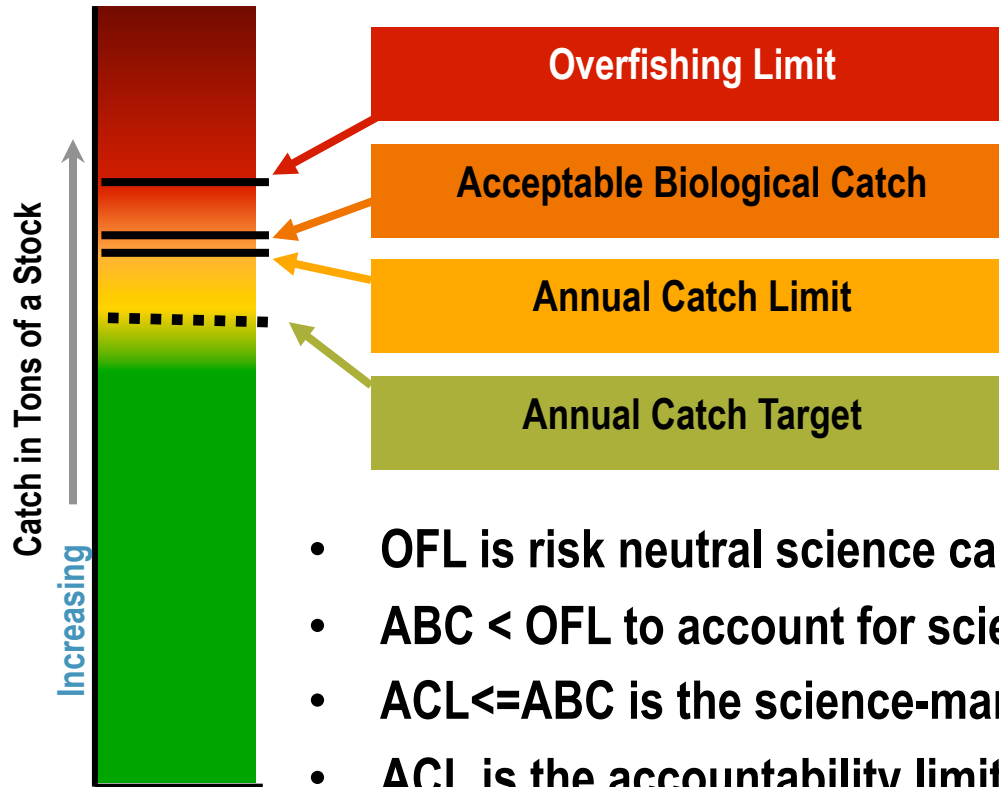
Fishery Control Rules: Limits and Targets



- **OFL control rule** sets annual overfishing limit
- Slope of control rule is a fishing rate, F
- Where control rule intersects **PRODUCTION** is long-term **MSY**
- Lower **ABC control rule** accounts for **UNCERTAINTY** in assessment
- Assessment forecasts biomass in next fishing year

Overfishing: $Catch > OFL$ or $F > F_{OFL}$

Know Your Reference Points



- OFL is risk neutral science calculation
- $ABC < OFL$ to account for scientific uncertainty
- $ACL \leq ABC$ is the science-management hand-off
- ACL is the accountability limit for the year
- ACT is optional and can be set below ACL to account for management uncertainty and other factors



Stocks "Subject to Overfishing" (28) – as of December 31, 2013



New England:

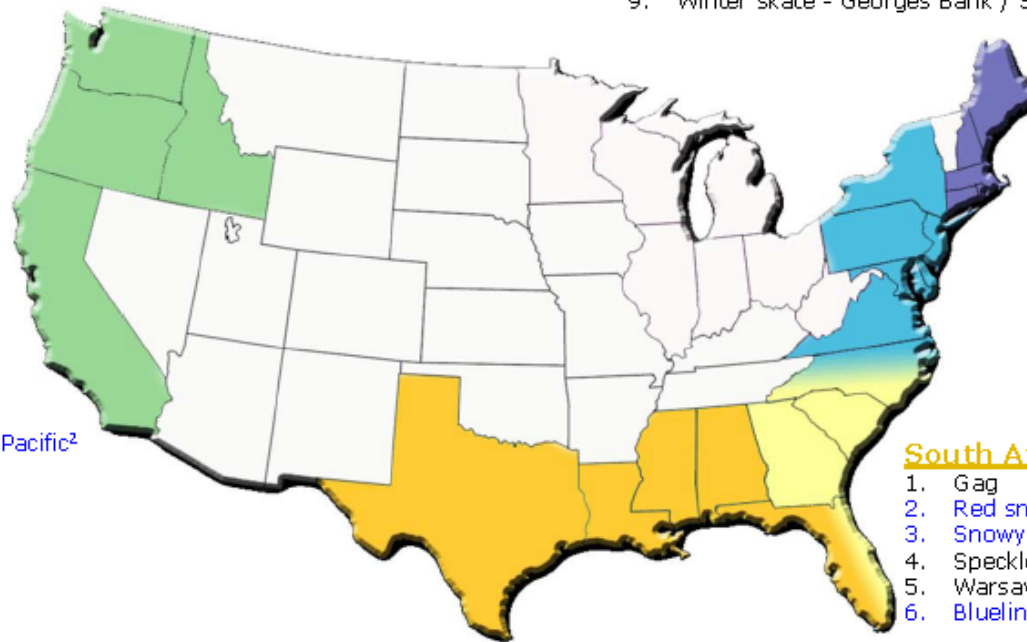
1. Atlantic cod – Georges Bank
2. Atlantic cod – Gulf of Maine
3. Haddock – Gulf of Maine
4. Windowpane – Gulf of Maine / Georges Bank
5. Witch flounder
6. Yellowtail flounder – Cape Cod/Gulf of Maine
7. Yellowtail flounder – Georges Bank
8. Thorny skate – Gulf of Maine
9. Winter skate – Georges Bank / Southern New England

Pacific and Western Pacific

1. Bigeye tuna – Pacific²
2. Pacific bluefin tuna – Pacific²

Western Pacific

1. Striped marlin – Central Western Pacific²



Highly Migratory Species:

1. Albacore – North Atlantic²
2. Blacknose shark – Atlantic
3. Blue marlin – Atlantic²
4. Bluefin tuna – West Atlantic²
5. Dusky shark – Atlantic
6. Sailfish – West Atlantic²
7. White marlin – Atlantic²
8. Scalloped hammerhead – Atlantic¹

South Atlantic:

1. Gag
2. Red snapper
3. Snowy grouper
4. Speckled hind
5. Warsaw grouper
6. Blueline tilefish¹

Gulf of Mexico:

1. Hogfish
2. Jacks Complex¹

1. Non-FSSI stock
2. Stock is fished by U.S. and International fleets.

Blue = Also Overfished



U.S. Department of Commerce
National Oceanic and Atmospheric
Administration
National Marine Fisheries Service
Office of Sustainable Fisheries



How does Overfishing Occur?

Intentional Overfishing
Ended with accountable
ACLs required by MSA

Pre-Fishing Year

Management Uncertainty
In-season controls did not
prevent catch from
exceeding limit

Fishing Year

Scientific Uncertainty
Catch was controlled below
limit, but limit was not
accurate

Few Years Hindsight

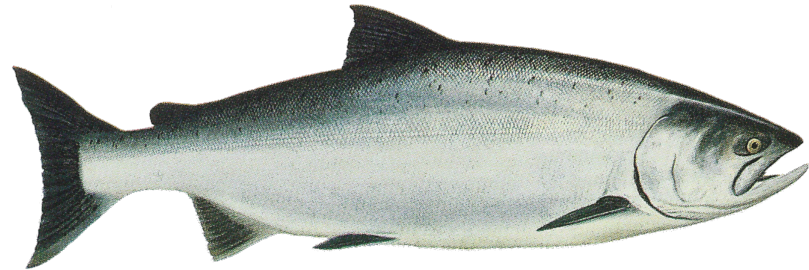
Ecosystem Uncertainty
Assessment missed some
important factor

Decadal Hindsight

Salmon: What's So Different?



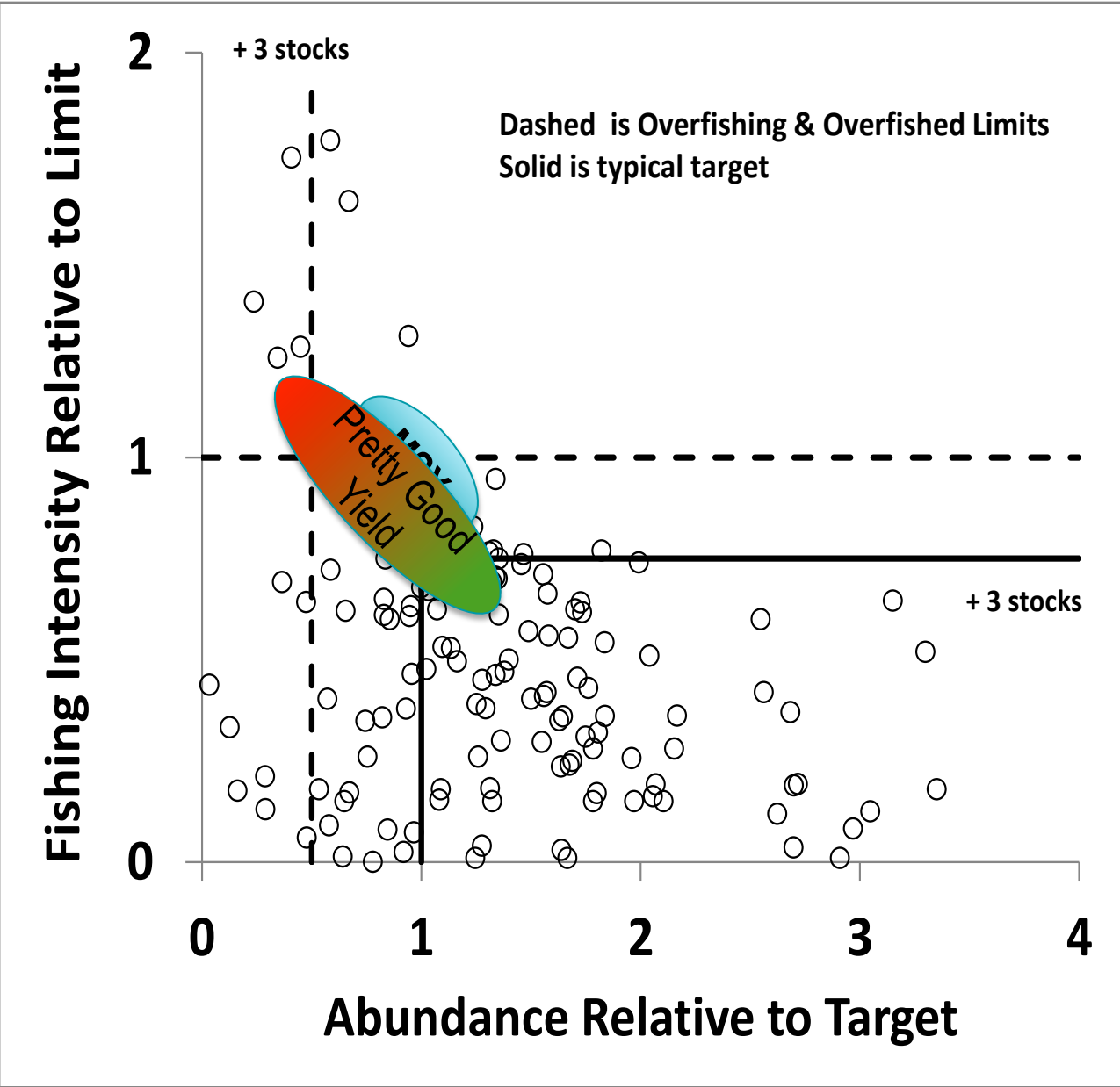
Sablefish
Anoplopoma fimbria



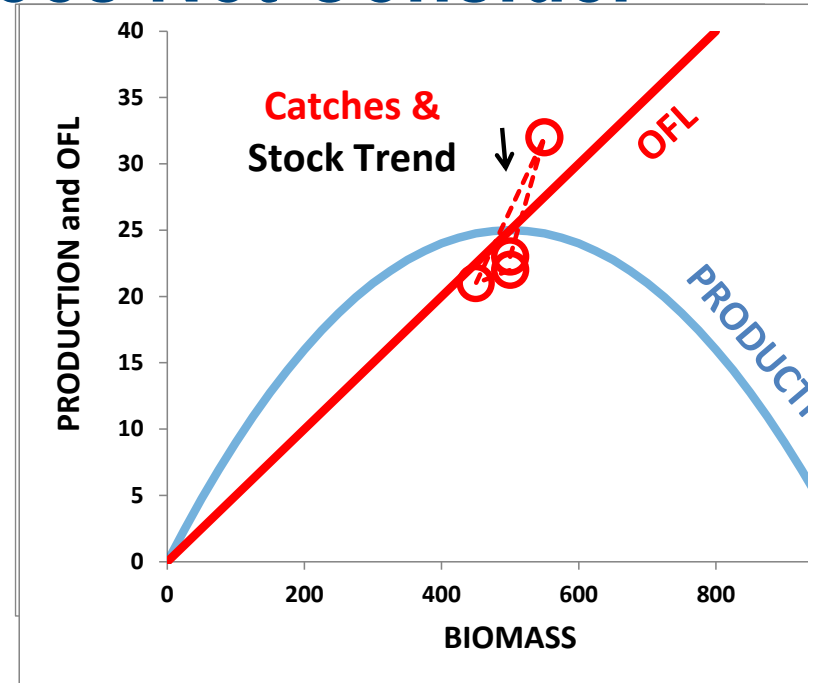
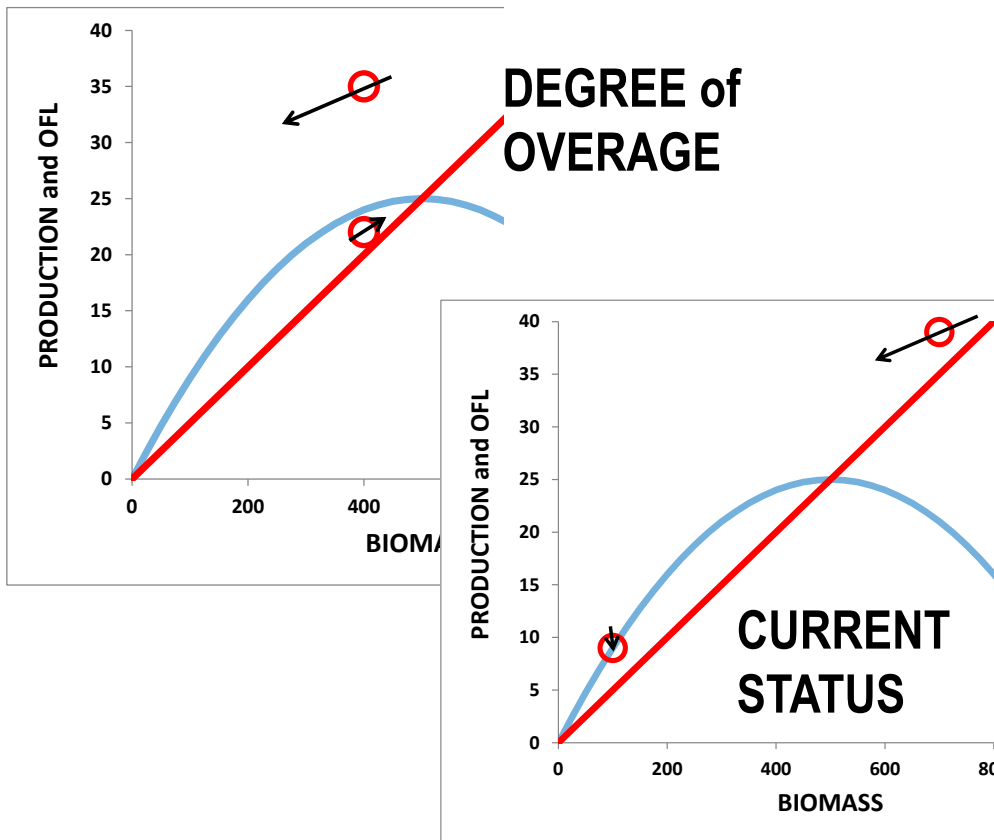
- Few wide-spread ocean stocks
- Long-lived with many ages in fishery and spawning
- “Depletion” is targeted **%reduction** in multi-age spawning biomass

- Many, river-specific stocks; mixed in ocean fisheries
- Short-lived, spawn once and die, fished just in months before spawning
- **“Escapement”** of enough spawners to river is target

Status of 130 Assessed Stocks



Overfishing Definition Does Not Consider

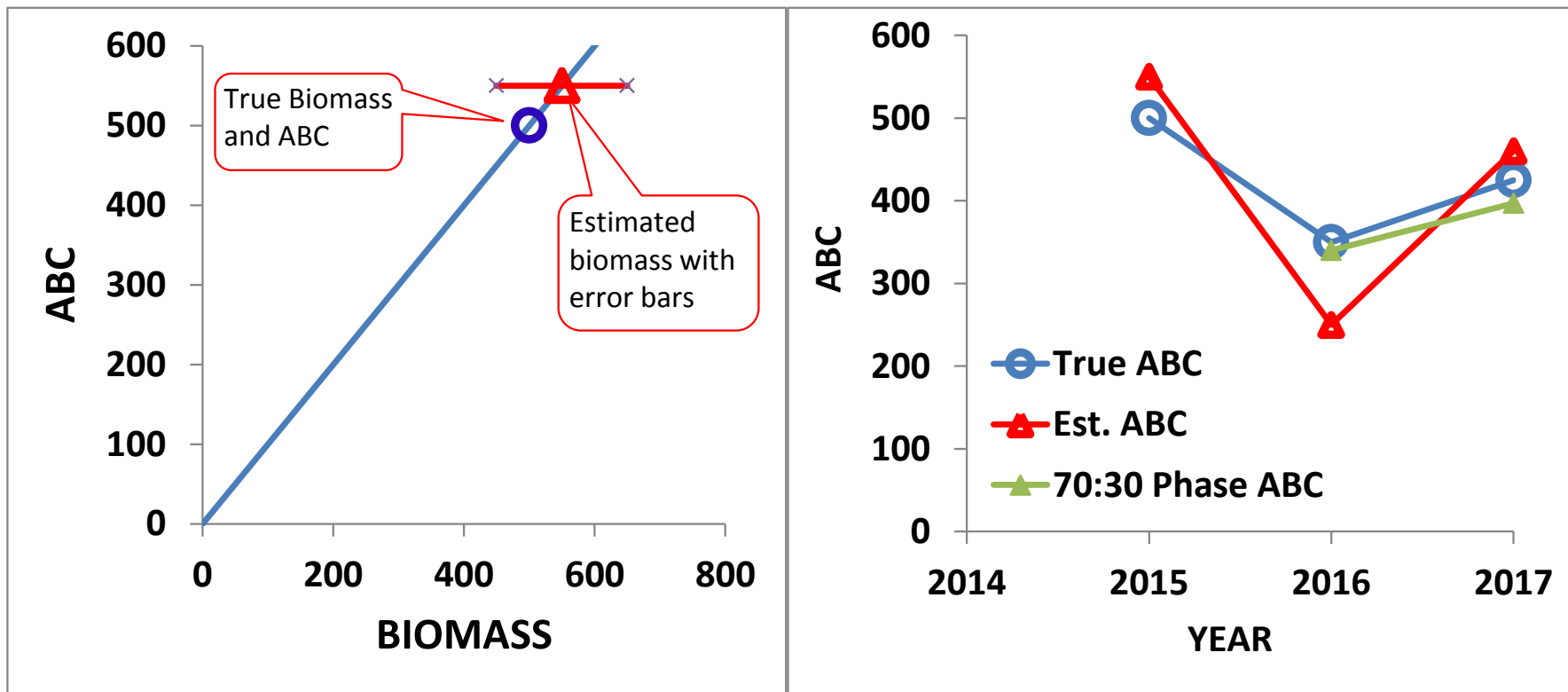


ALTERNATIVE:

ACL is < OFL, so is CATCH < ACL?

Will recent harvest rates leave stock with 50% chance of being above Bmsy in one generation?

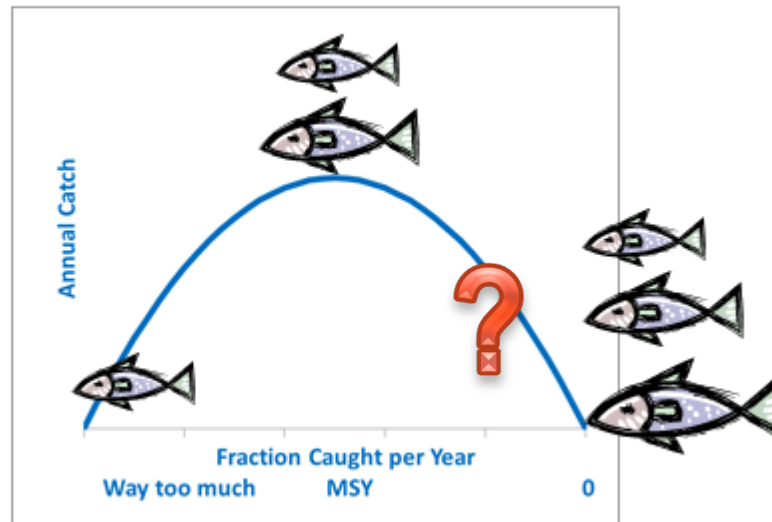
Improve Stability by Phasing-in New Science



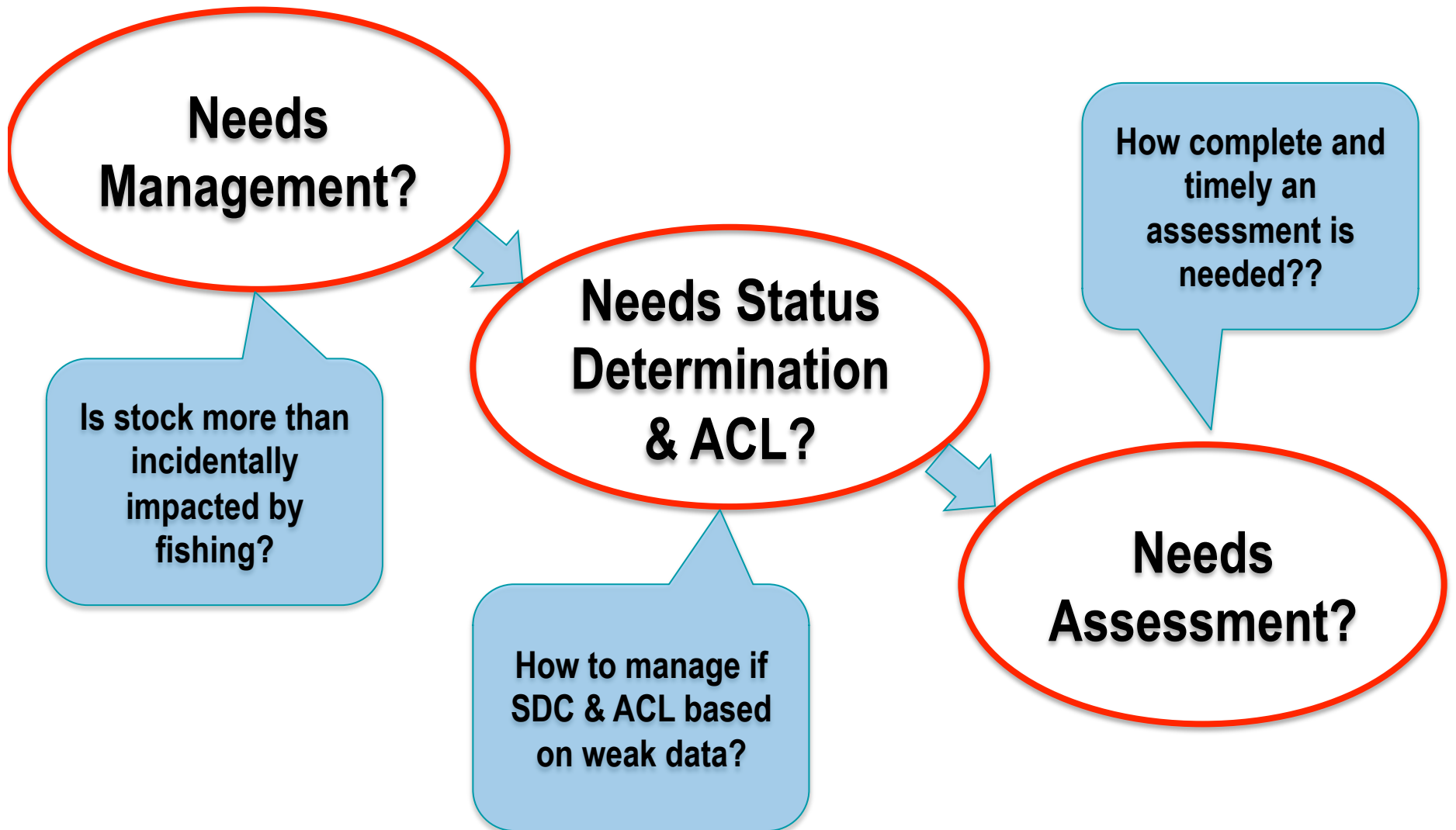
In use today by the EU and the IPHC

Degree of Phase-In depends on factors that can be analyzed with a Management Strategy Evaluation

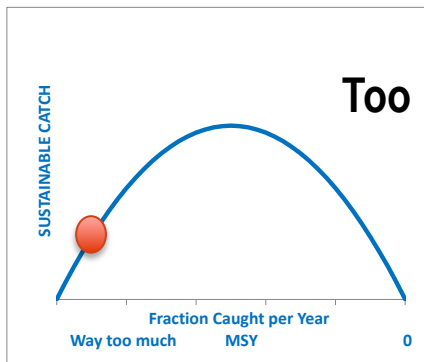
Which Stocks Need Management? How Much?



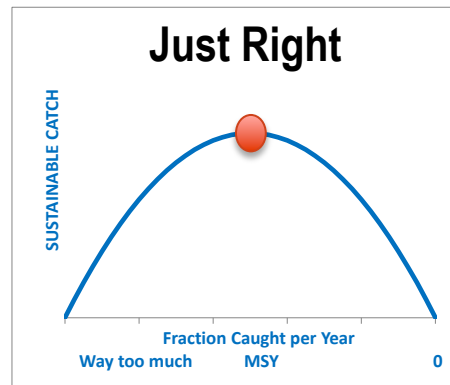
Logical Connections



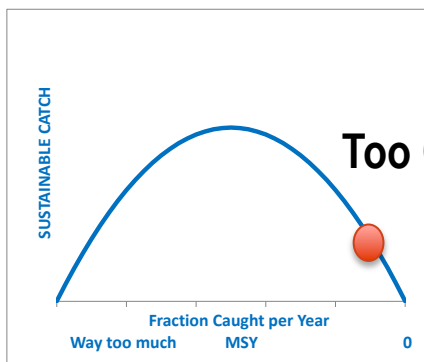
Classifying Data-Limited Stocks



Too Hot!



Just Right



Too Cold

- All we observe is catch
- Is there added evidence as to what fraction is being caught?
- Is there evidence as to how much stock abundance has been reduced?
- Without added evidence, catch alone provides uncertain placement of a stock on a status curve

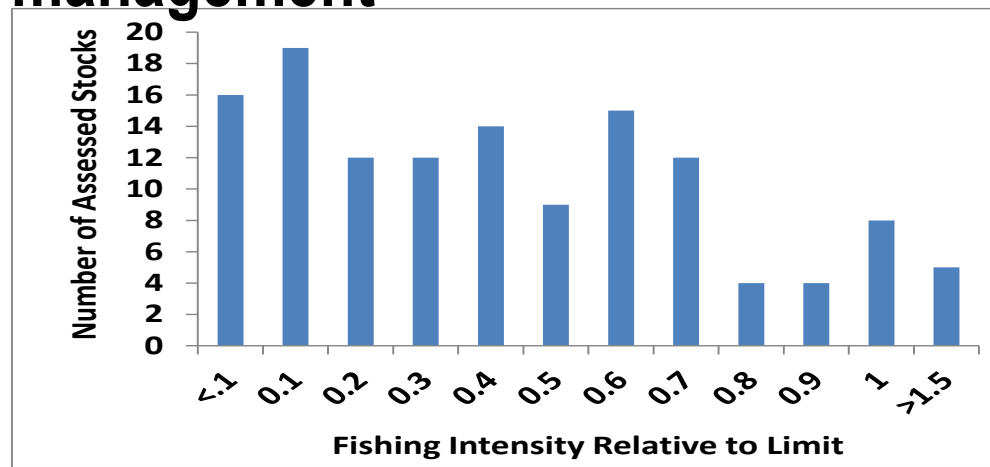
Two Tiers of Managed Stocks in a Fishery

Non-Target Stocks

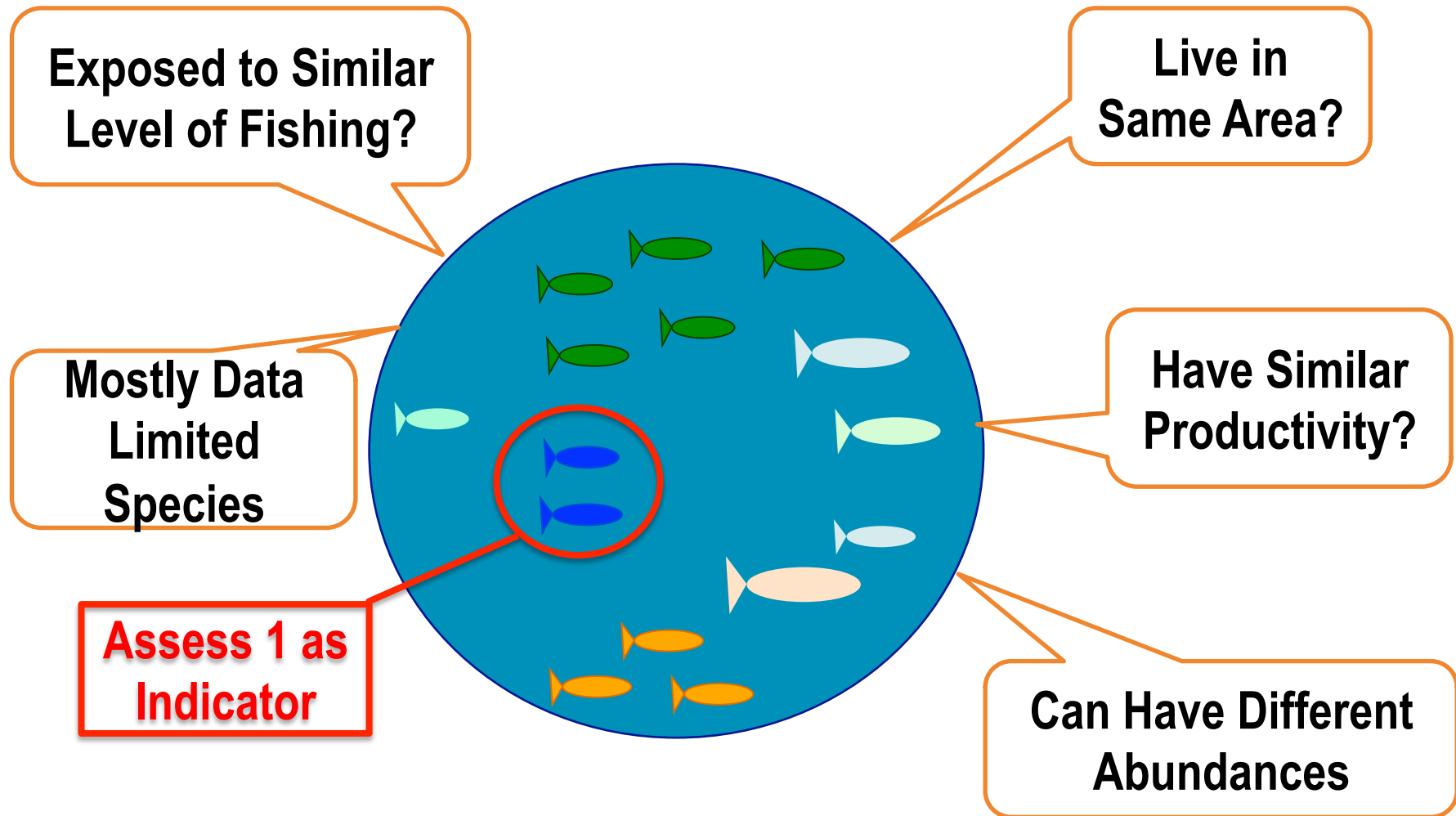
- Less important
- Low F relative to limit
- OK with less complete assessments
- Use annual catch target to monitor fishery, but less intensive management

Target Stocks

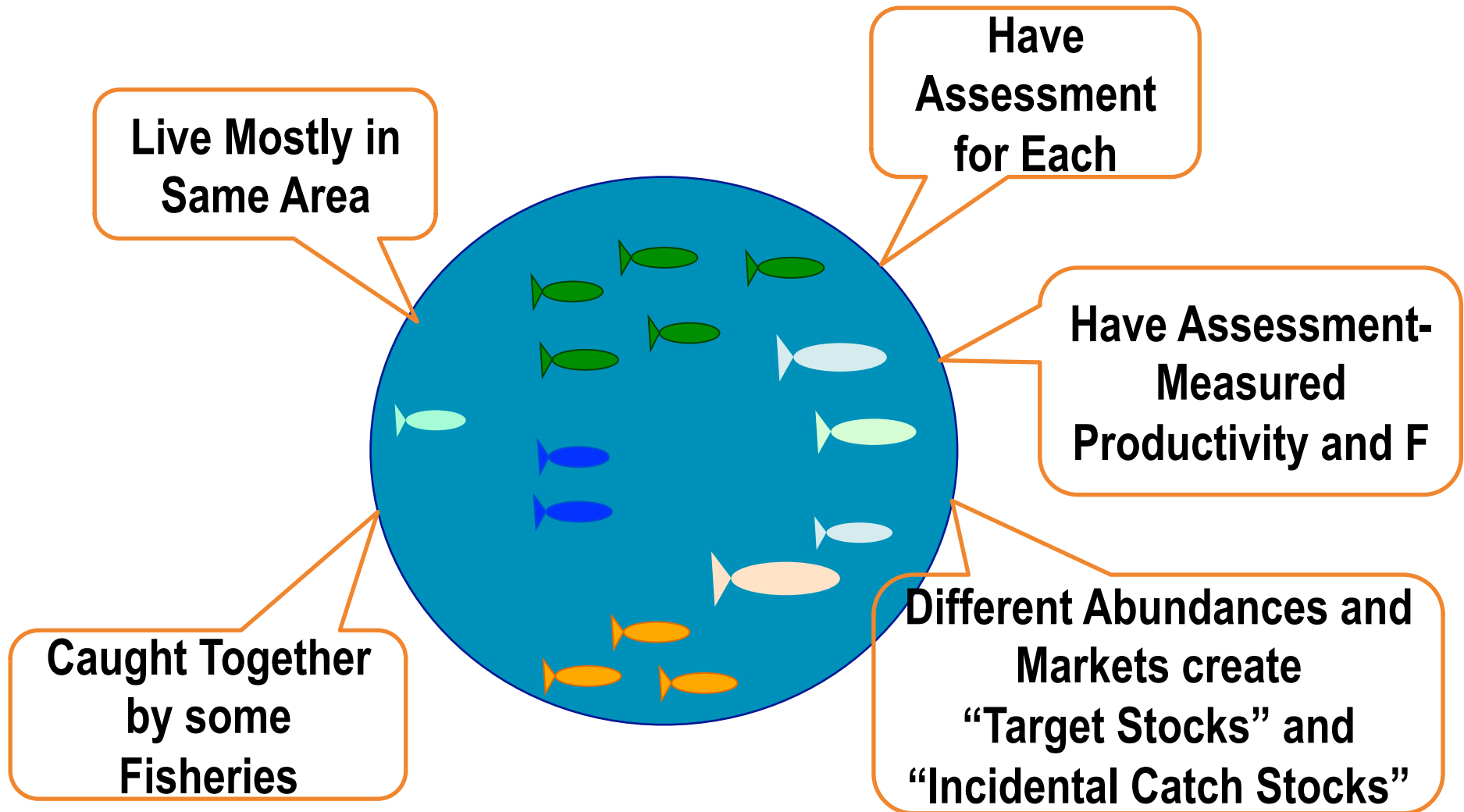
- Most important for OY
- F often near limit
- Need most complete and timely assessments
- ACLs with strict in-season accountability



Stock Complex



Mixed Stock Fishery



Aligning Complex and Mixed-Stock Management

COMPLEXES

- Try to assess more stocks in the complex and use ALL as a ensemble of indicators, rather than removing assessed stocks from the complex

MIXED-STOCKS

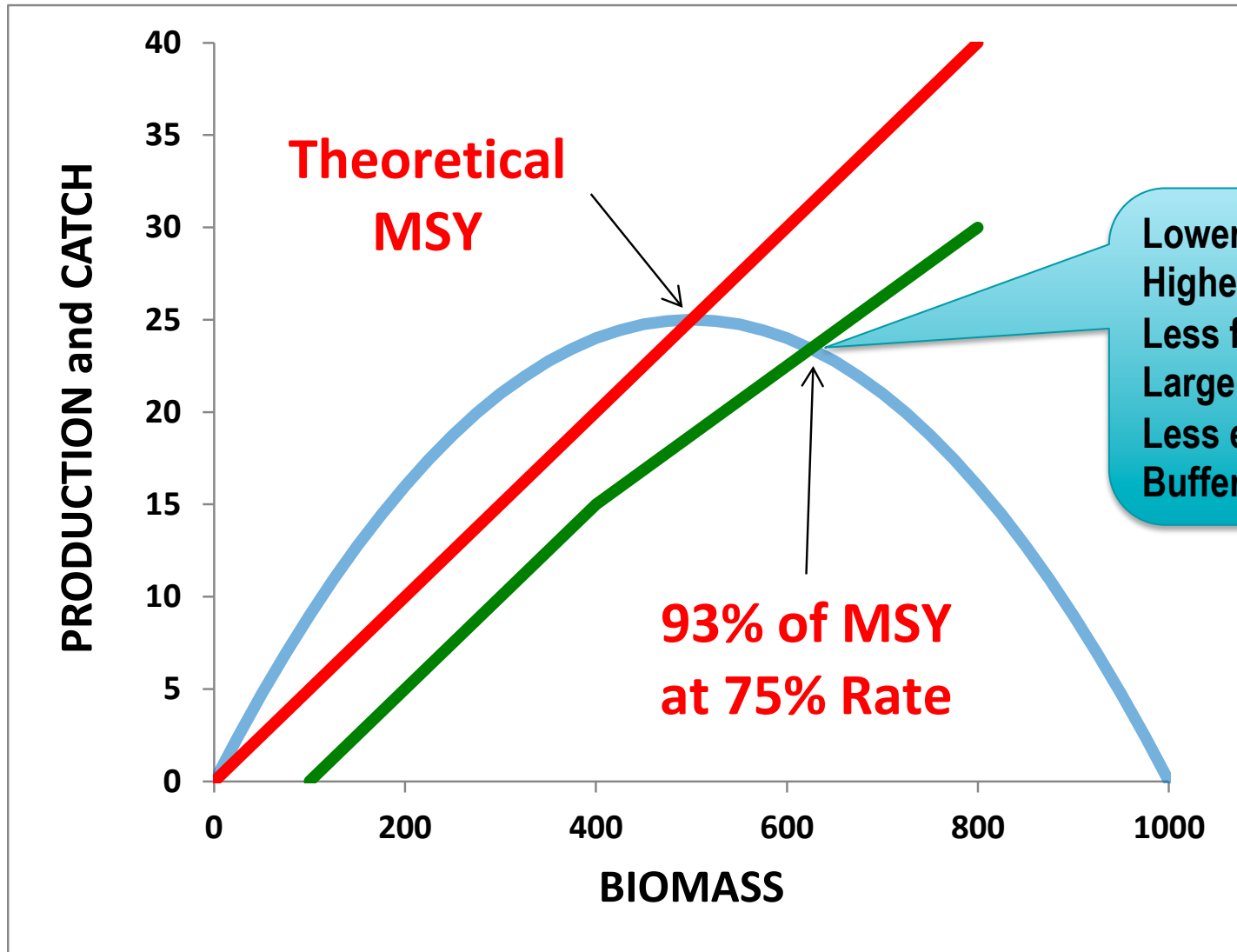
- Strive to achieve species-specific F
- Use fishery-wide OY and economic analysis to examine achievable spread of F rates across stocks that provides best overall OY and sufficient protection for less productive stocks

Merits of Fishery-Wide Optimum Yield (OY)

The collage features several elements:

- Top left: A photograph of fishing boats docked at a pier.
- Top center: A photograph of a school of fish swimming underwater.
- Top right: A photograph of fish hanging on a rack and a cartoon illustration of a fisherman in a green shirt and blue cap.
- Middle right: A photograph of stacks of US dollar bills.
- Bottom right: A photograph of a fishing boat on the open sea.
- Bottom left: A photograph of a large red crab on a wooden deck.
- Center: A diagram with 'directed catches' and 'bycatch' at the top. Lines connect these to images of fish. Labels include 'myctophids', 'salmon', 'herring', 'capelin', 'eulachon', 'sandlance', 'squids', 'shrimp', 'epifauna', 'crabs', 'benthos', and 'copepods & euphausiids'.

The ~75% Solution



Summary

- I have presented the scientific basis for guiding sustainable fisheries, and some ideas for improvement
- Despite best intentions, some types of overfishing will continue to occur
- Development of phase-in control rules, tested with M.S.E., seems feasible within our current guidelines
- Prioritization of assessments and management is dependent on recognition that many stocks are not-targeted or are lightly fished for other reasons
- Concepts of target stocks, non-targets, complexes, mixed-stocks, bycatch need holistic alignment of terminology and coordination of assessment and management. Broader definition of OY is a useful step
- I have not directly addressed ecosystem and environmental factors, but keeping fisheries sustainable depends upon taking more direct account of these factors, as you will hear in a later session