



National Standard 1

**Prevent Overfishing
&
Achieve Optimum Yield**

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Presentation Outline

- Basis in MSFCMA
- Current NS1 Guidelines
- Scientific Factors in MSY
- Optimum Yield
- Status Determination
- Rebuilding
- Precautionary Approach

Sustainable Fisheries Act (1996)

- MSFMCA amendment:
 - Revised definitions of “optimum” and “overfishing.”
 - Established requirement for rebuilding overfished stocks
 - Required revised guidelines from NMFS (1998)

National Standard 1

- Conservation and management measures shall ***prevent overfishing*** while achieving, on a continuing basis, the ***optimum yield*** from each fishery for the United States fishing industry.



- Both cannot be achieved without accurate scientific information

NS1 Guidelines Outline

(a) *Standard 1*

(b) General

(c) MSY

(2) Options in Specifying MSY

(3) Alternatives to specifying MSY (data-poor)

(d) Overfishing

(2) Specification of Status Determination Criteria

(3) Relationship of SDC to other National Standards

(4) Relationship of SDC to environmental change

(5) Secretarial approval of SDC

(6) Exceptions (mixed-stock)

NS1 Guidelines Outline (2)

(e) Ending overfishing and rebuilding overfished stocks

- (2) Notification
- (3) Council Action
- (4) Constraints on Council action (time-frame)
- (5) Interim measures

(f) Optimum Yield

- (2) Values in determination
- (3) Factors relevant to OY (social, economic, ecological)
- (4) Specification
- (5) OY and the precautionary approach
- (6) Analysis
- (7) OY and foreign fishing

“Optimum” Yield

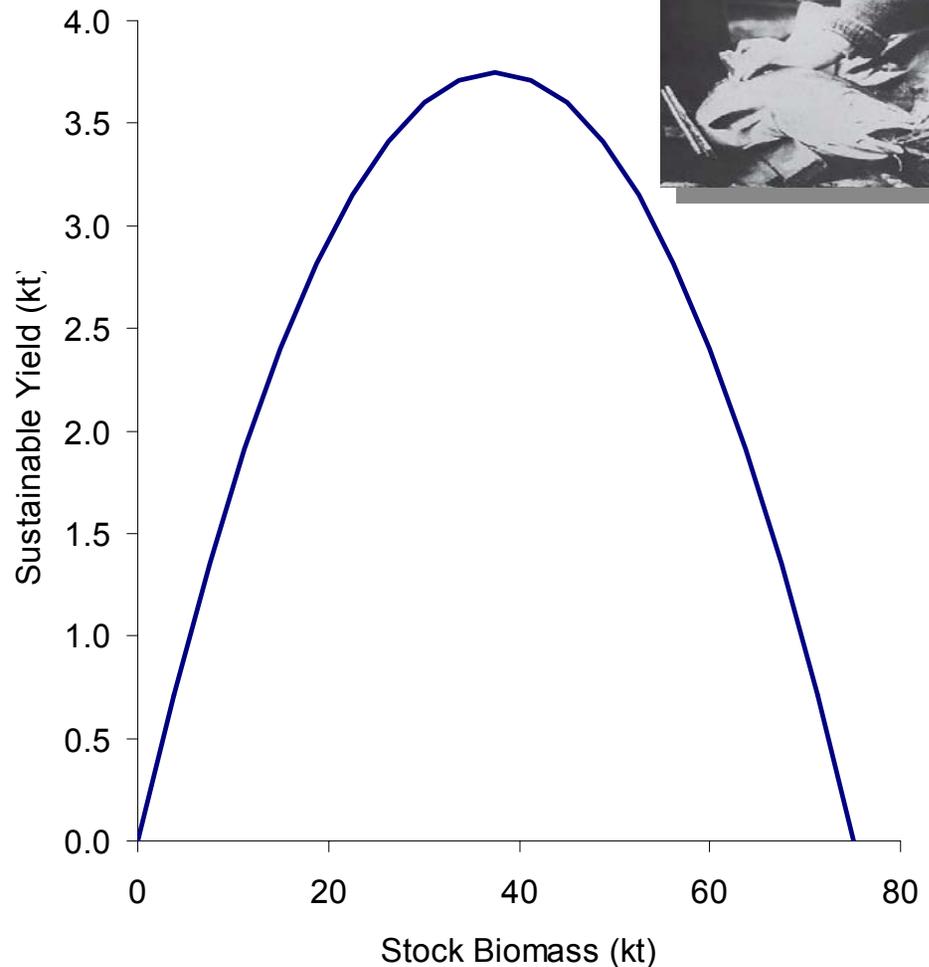
The term "optimum", with respect to the yield from a fishery, means the amount of fish which--

- A. will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and *taking into account the protection of marine ecosystems*;
- B. is prescribed as such on the basis of the maximum sustainable yield from the fishery, **as reduced by** any relevant economic, social, or ecological factor; and
- C. in the case of an overfished fishery, *provides for rebuilding to a level consistent with producing the maximum sustainable yield* in such fishery.



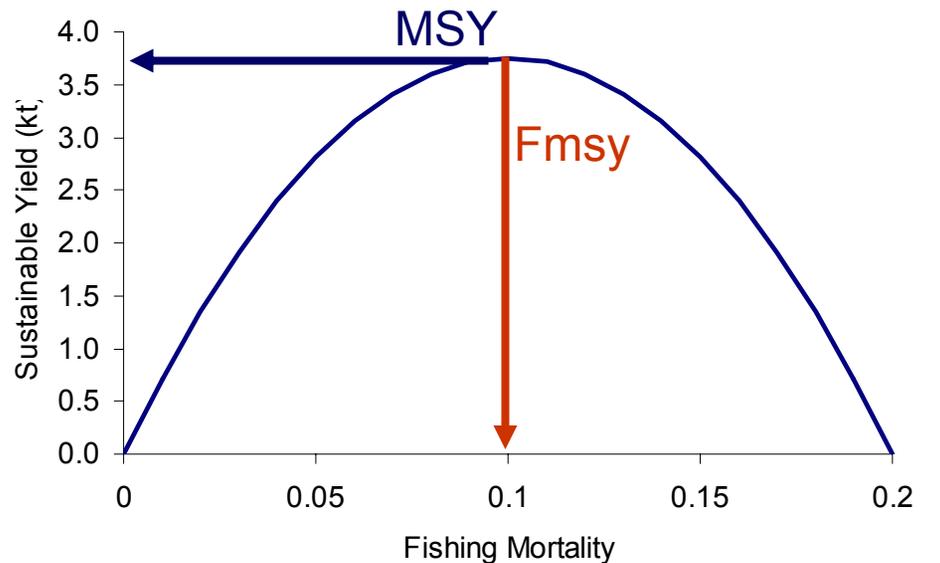
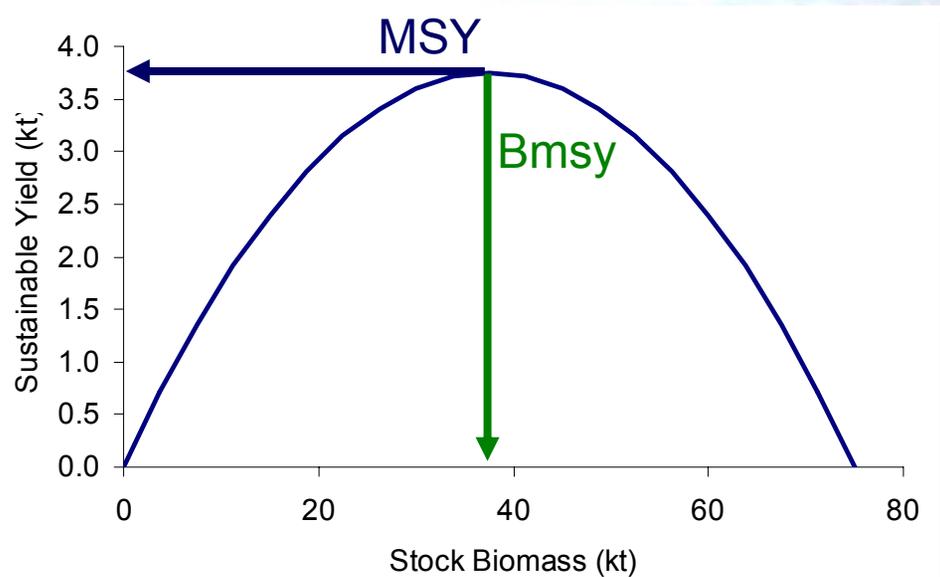
Sustainable Fishing

- Graham's Theory of Sustainable Fishing (1935):
 - If removals can be replaced by stock production each year, the fishery is sustainable.
 - If stock size is maintained at half its carrying capacity, the population growth rate is fastest, and sustainable yield is greatest (*Maximum Sustainable Yield*).



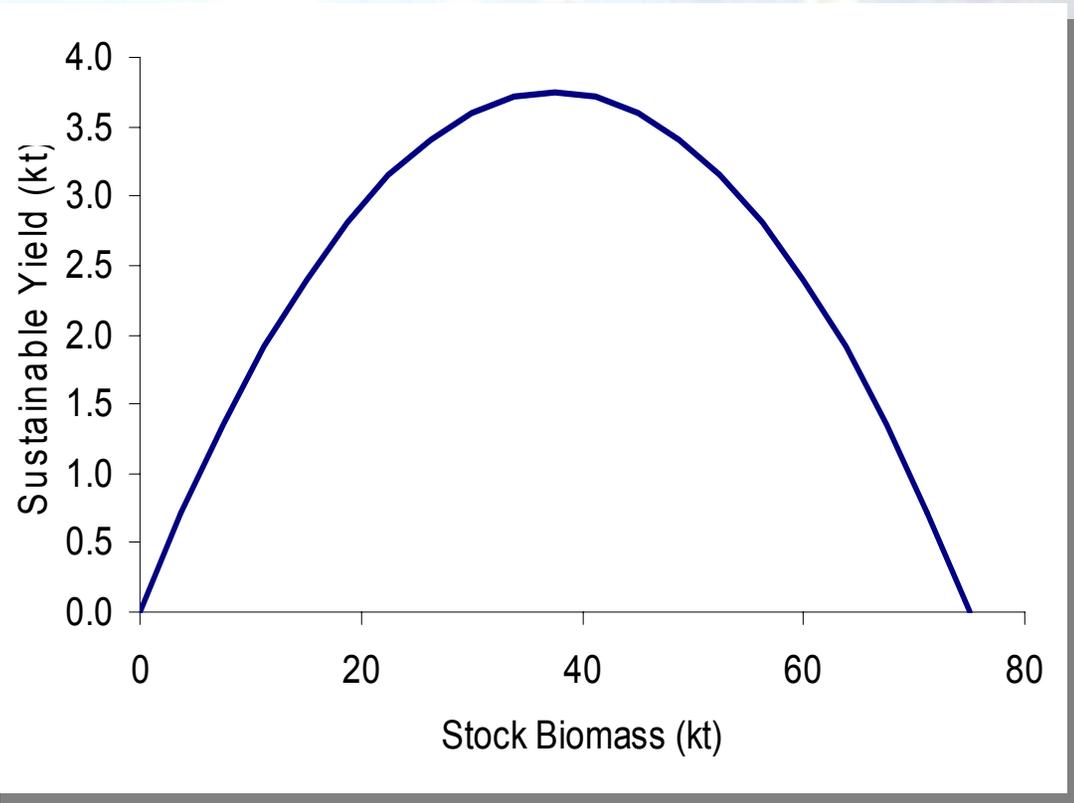
MSY Definitions

- MSY: maximum sustainable Yield
- Bmsy: stock biomass that can produce MSY
- Fmsy: fishing mortality that can produce MSY
- These are “equilibrium” definitions (actual fish populations vary over time)
- Alternative stock models change shape of the curve



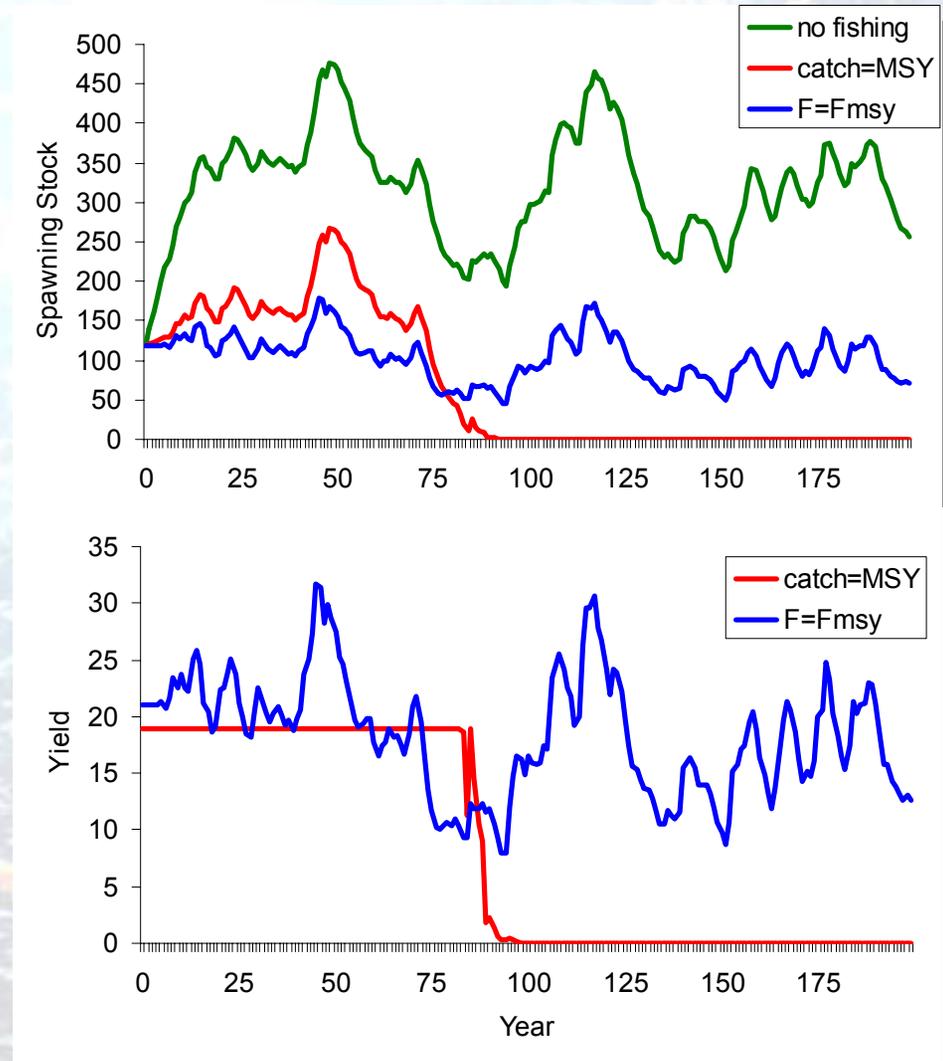
MSY or Fmsy?

- Note that when $B < B_{msy}$, the equilibrium MSY is ***not*** sustainable for long.
- It is better to fish at F_{msy} to allow for fluctuations above and below B_{msy} .
- F_{msy} is the cornerstone of current fishery management (in U.S. and globally).



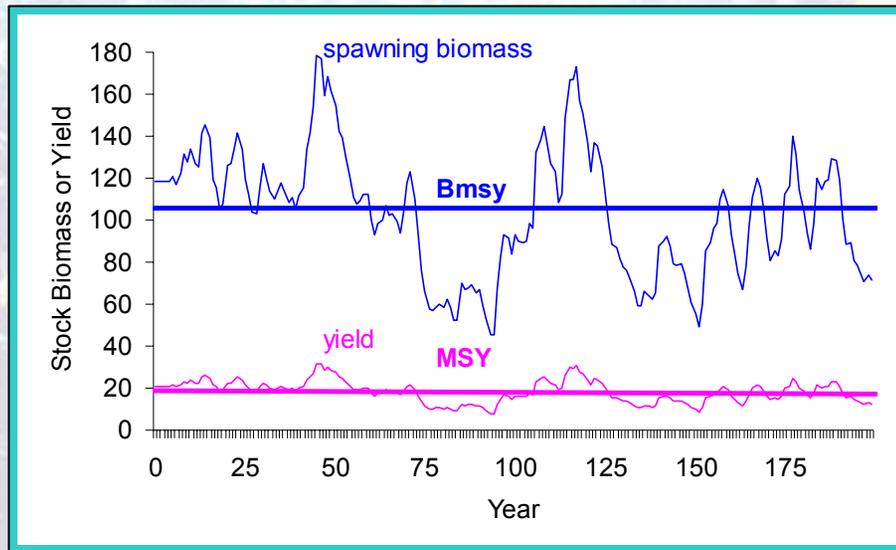
Historical Development of MSY

- Initial management strategies considered MSY to be a target.
 - The strategy contributed to stock collapses, because stocks naturally fluctuated below B_{msy} , causing F to exceed F_{msy} .
 - Note that when $B < B_{msy}$, the equilibrium MSY is **not** sustainable for long.



Dynamic MSY = ABC

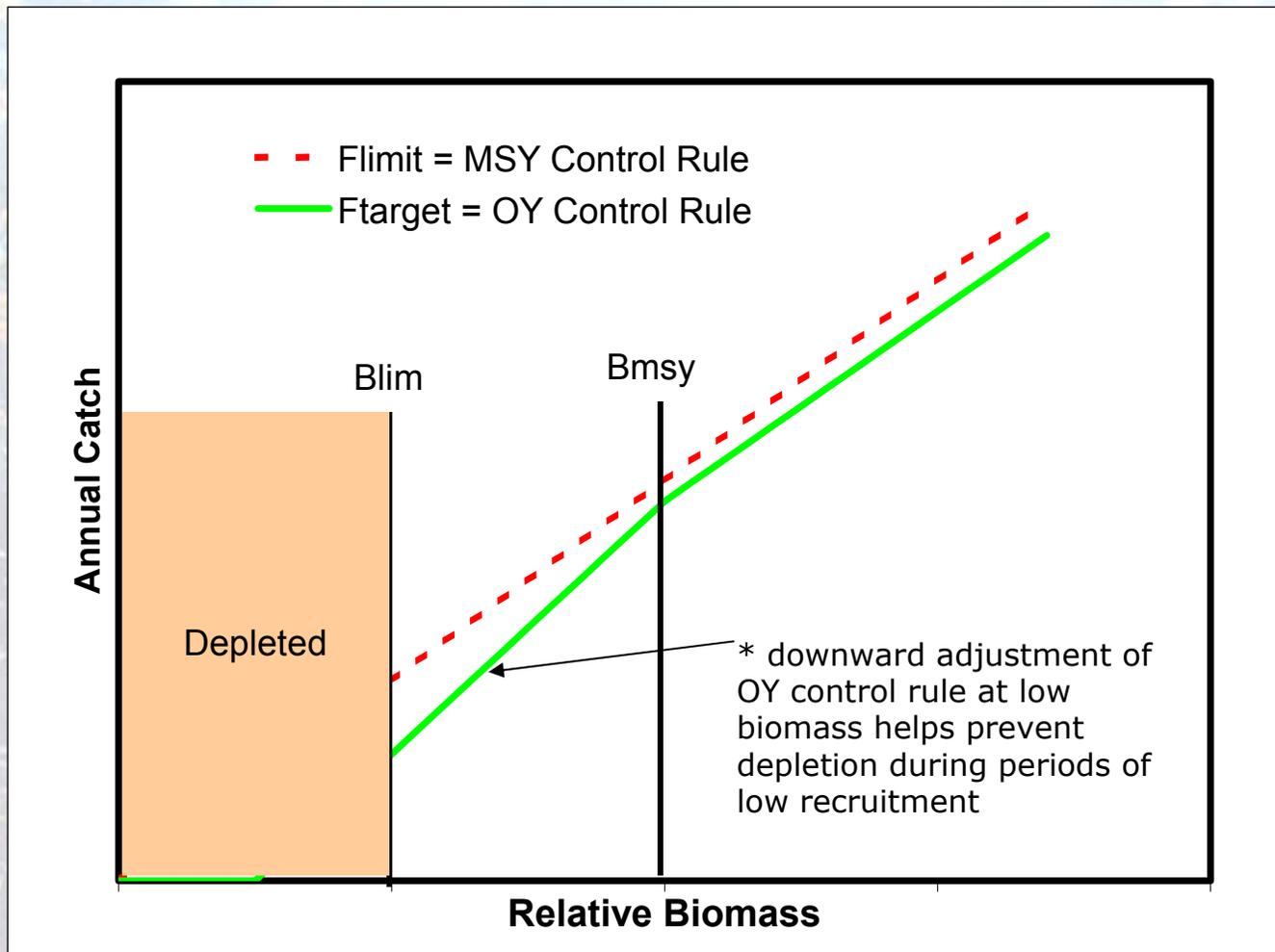
- Fmsy: Fishing mortality that yields maximum average yield over the long term.
- MSY and Bmsy are emergent properties of fishing at Fmsy:
 - MSY is then the long-term result of fishing at Fmsy.
 - Bmsy the average stock biomass that results from fishing at Fmsy.



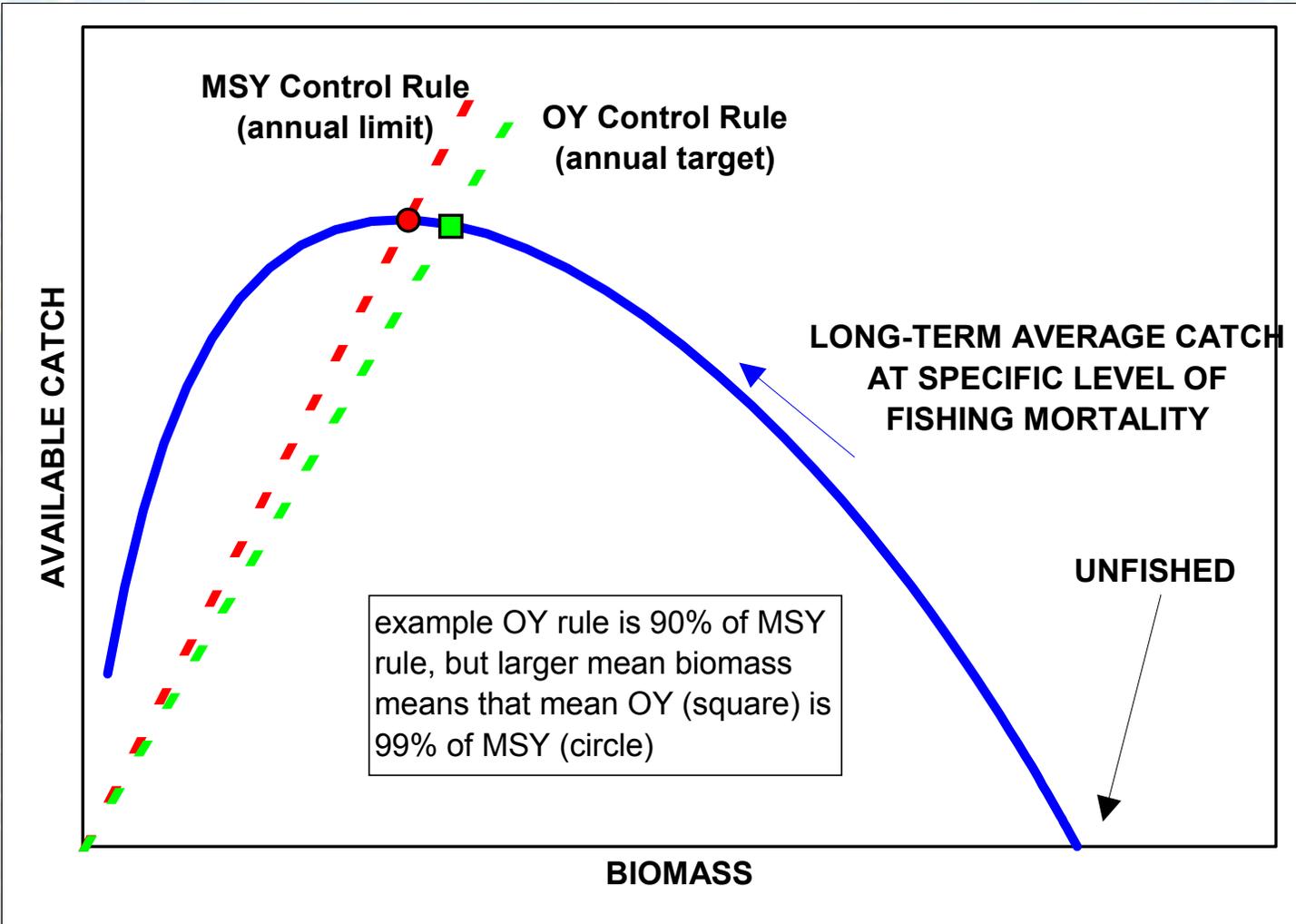
Getting Ahead Of The Curve

- Preventing Overfishing
- Preventing Stock Depletion
- Achieving Optimum Yield

Control Rules



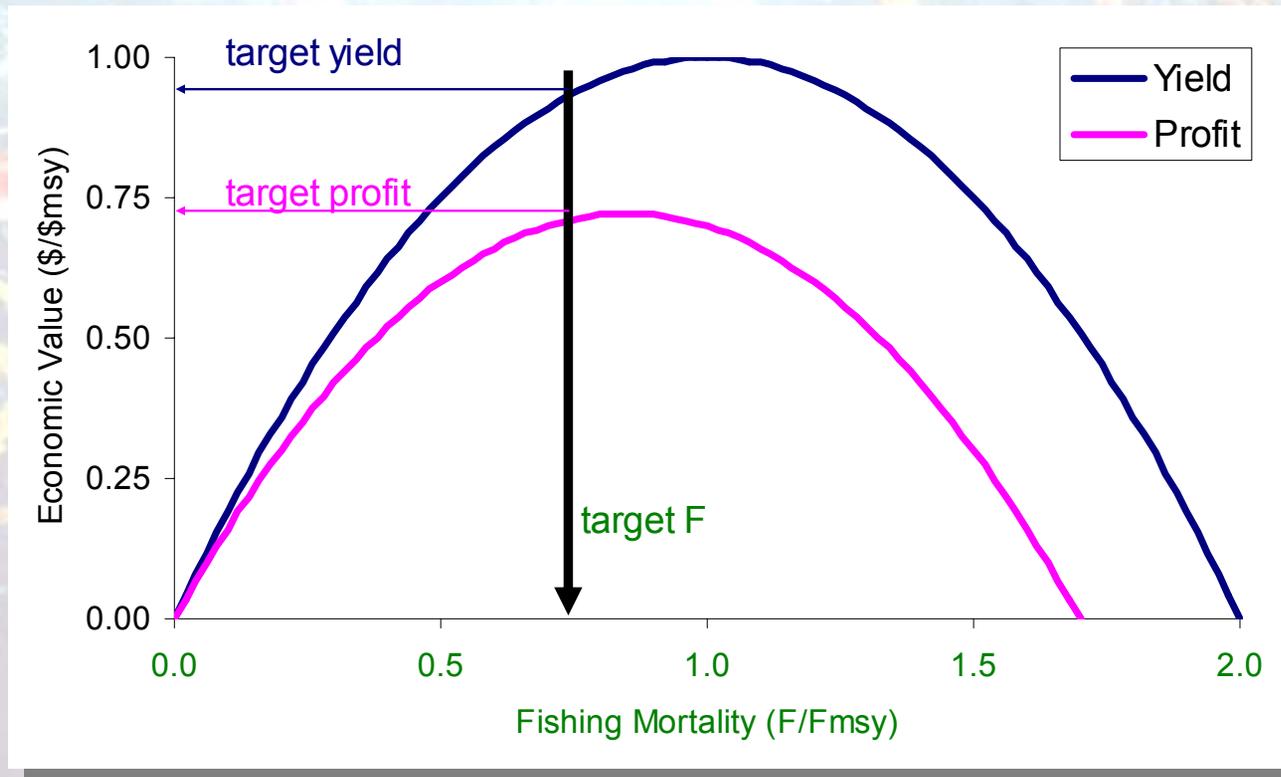
Control Rules



*asymmetric curve due to spawner-recruitment model, rather than simple production model

Economic Theory

- Precautionary F targets are expected to produce slightly lower expected yields, but similar or greater economic yield



“Overfished” & “Overfishing”

- Federal Register 1998
 - To “**overfish**” means to fish at a rate or level that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis.
 - “**Overfishing**” occurs whenever a stock or stock complex is subjected to a rate or level of fishing mortality that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis.



Status Determination Criteria

- The terms "overfishing" and "overfished" mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis.
- "Overfished" is also used to describe a stock whose size is sufficiently small that a management change is required to achieve rebuilding. The NS1 Guidelines use "overfished" in this second sense only.

Fishing Mortality Threshold

- The fishing mortality threshold must not exceed the fishing mortality rate or level associated with the relevant MSY control rule (F_{msy}).
- Exceeding the fishing mortality threshold for a period of 1 year or more constitutes ***overfishing***.



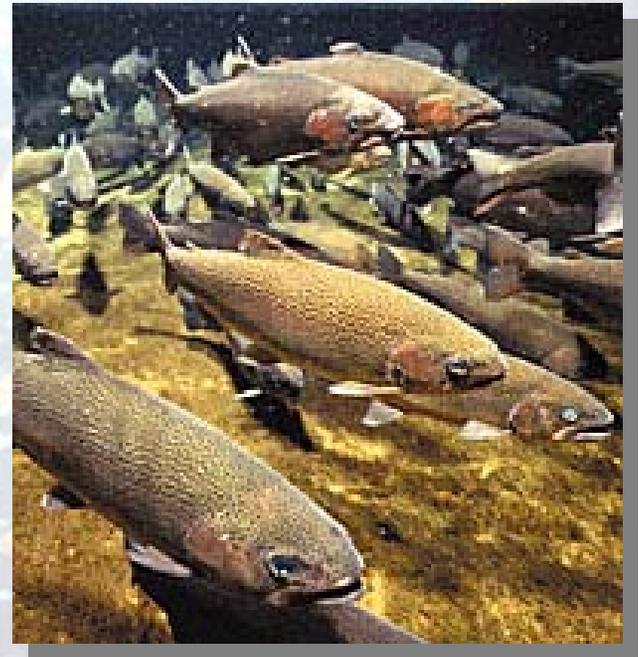
Stock Size Threshold

- To the extent possible, the stock size threshold should equal whichever of the following is greater:
 - One-half the MSY stock size ($1/2 B_{msy}$),
 - or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years if the stock or stock complex were exploited at the maximum fishing mortality threshold.
- Should the actual size of the stock or stock complex in a given year fall below this threshold, the stock or stock complex is considered ***overfished***.



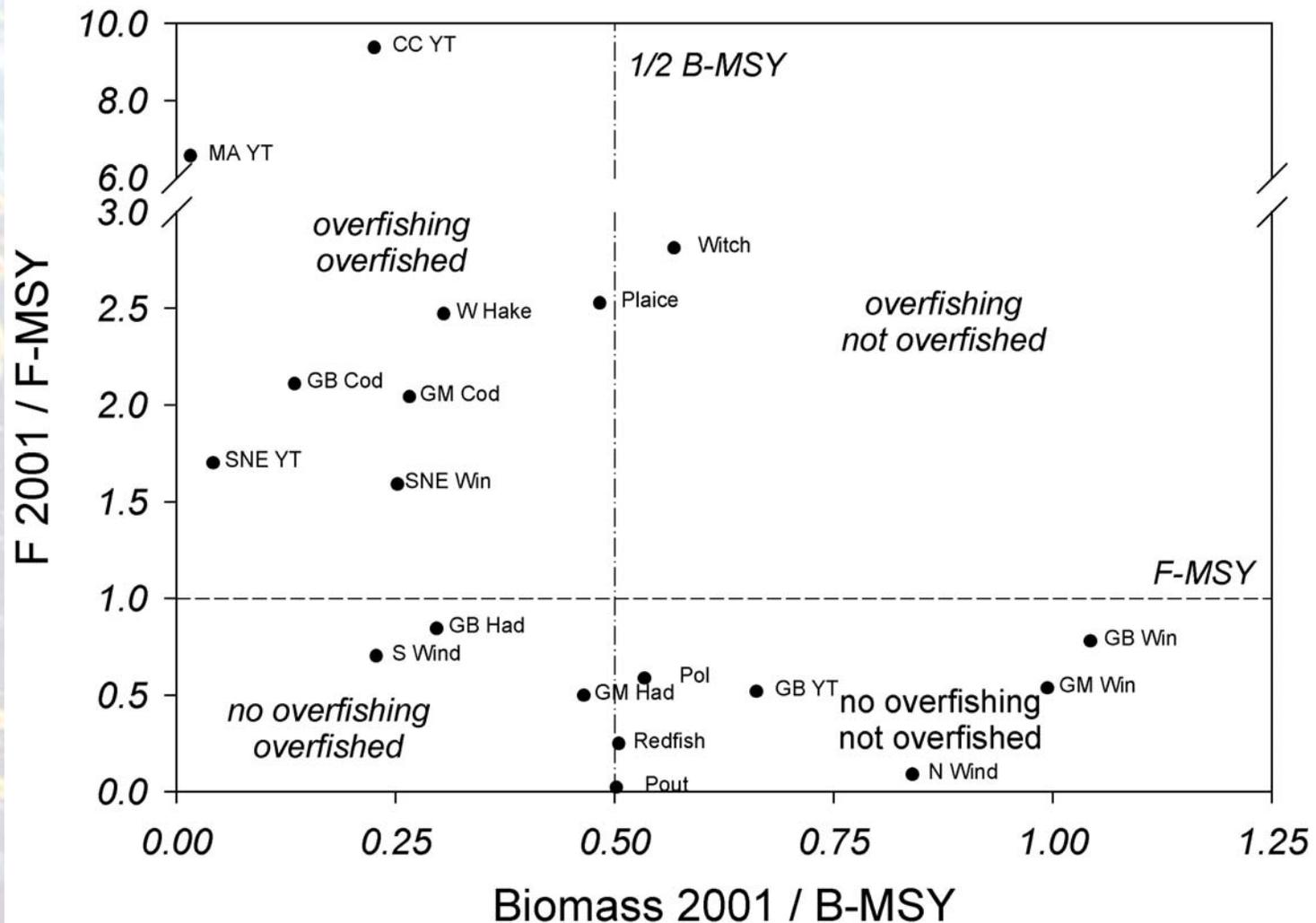
NS1-Based Management Strategy

- 1st line of defense: Fmsy is a ***limit fishing mortality*** which should not be exceeded.
 - If a stock fluctuates to slightly less than Bmsy, fishing at Fmsy allows rebuilding to Bmsy.
- 2nd line of defense: If stock falls to much less than Bmsy, fishing must be sufficiently limited to allow rebuilding to Bmsy in a specified time period.



Stock Status Determination

Groundfish Stock Status - 2001



Fishery Management Plans

- Specify objective and measurable criteria for identifying when the fishery is overfished.
- Contain conservation and management measures to *prevent overfishing, rebuild the fishery and achieve optimum yield.*



Action by the Secretary

- Annual report to Congress & the Councils on the status of fisheries
 - Relative to NS1 criteria for overfishing and overfished conditions.
- Within one year Councils shall prepare a management plan to:
 - End overfishing and rebuild the fishery in as short a time as possible
- Secretary will review progress of the plan regularly to evaluate progress.

Council Action



- Within 1 year of such time as the Secretary may identify that overfishing is occurring, that a stock or stock complex is overfished, that a threshold is being approached, the Council must take remedial action by preparing an FMP, FMP amendment, or proposed regulations.
- This remedial action must be designed to accomplish all of the following purposes that apply:
 - If overfishing is occurring, Council action must be sufficient to end overfishing (time period not re-stated in NS1 Guidelines (1998))
 - If the stock or stock complex is overfished, the purpose of the action to rebuild the stock or stock complex to the MSY level in as short a time as possible.
 - If the rate or level of fishing mortality is approaching the maximum fishing mortality threshold (from below), the purpose of the action is to prevent this threshold from being reached.
 - If the stock or stock complex is approaching the minimum stock size threshold (from above), the purpose of the action is to prevent this threshold from being reached.

Rebuilding Period – MSA Language



- (A) specify a time period for ending overfishing and rebuilding the fishery that shall—
 - (i) be as short as possible, taking into account the status and biology of any overfished stocks of fish, the needs of fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock of fish within the marine ecosystem; and
 - (ii) not exceed 10 years, except in cases where the biology of the stock of fish, other environmental conditions, or management measures under an international agreement in which the United States participates dictate otherwise;
- (B) allocate both overfishing restrictions and recovery benefits fairly and equitably among sectors of the fishery;
- (C) for fisheries managed under an international agreement, reflect traditional participation in the fishery, relative to other nations, by fishermen of the United States.

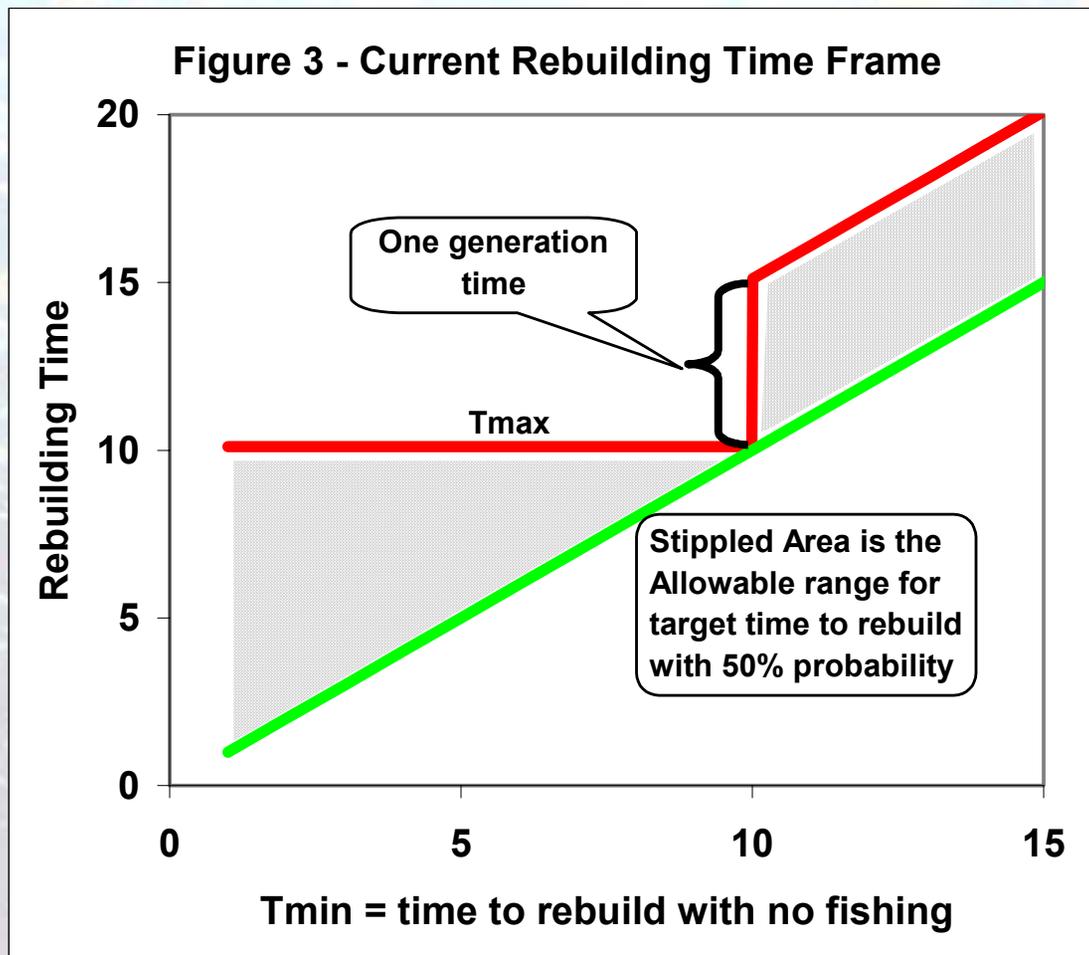
Rebuilding Period in NS1 Guidelines



These factors enter into the specification of the time period for rebuilding as follows:

- The lower limit of the specified time period for rebuilding is determined by the status and biology of the stock or stock complex and its interactions with other components of the marine ecosystem, and is defined as the amount of time that would be required for rebuilding if fishing mortality were eliminated entirely.
- If the lower limit is less than 10 years, then the specified time period for rebuilding may be adjusted upward, except that no such upward adjustment can result in the specified time period exceeding 10 years.
- If the lower limit is 10 years or greater, then the specified time period for rebuilding may be adjusted upward, except that no such upward adjustment can exceed the rebuilding period calculated in the absence of fishing mortality, plus one mean generation time or equivalent period based on the species' life-history characteristics.
- For example, suppose a stock could be rebuilt within 12 years in the absence of any fishing mortality, and has a mean generation time of 8 years. The rebuilding period, in this case, could be as long as 20 years.

Rebuilding Period



MIXED-STOCK EXCEPTION

- There are certain limited exceptions to the requirement to prevent overfishing.
- Harvesting one species of a mixed-stock complex at its optimum level may result in the overfishing of another stock component in the complex. A Council may decide to permit this type of overfishing only if all of the following conditions are satisfied:
 - (i) It is demonstrated by analysis that such action will result in long-term net benefits to the Nation.
 - (ii) It is demonstrated by analysis that mitigating measures have been considered and that a similar level of long-term net benefits cannot be achieved by modifying fleet behavior, gear selection/configuration, or other technical characteristic in a manner such that no overfishing would occur.
 - (iii) The resulting rate or level of fishing mortality will not cause any species or evolutionarily significant unit thereof to require protection under the ESA.

Precautionary Approach



- In general, Councils should adopt a precautionary approach to specification of optimum yield. A precautionary approach is characterized by three features:
 1. Target reference points, such as optimum yield, should be set safely below limit reference points, such as the catch level associated with the fishing mortality rate or level defined by the status determination criteria.
 2. A stock or stock complex that is below the size that would produce MSY should be harvested at a lower rate or level of fishing mortality than if the stock or stock complex were above the size that would produce MSY.
 3. Criteria used to set target catch levels should be explicitly risk averse, so that greater uncertainty regarding the status or productive capacity of a stock or stock complex corresponds to greater caution in setting target catch levels.

Food & Agriculture Organization (1995) Conduct for Responsible Fisheries

- Principles
 - consideration of future generations.
 - identification of undesirable outcomes.
 - quick corrective action.
 - priority to conservation when impacts are uncertain.
 - sustainable harvests.
 - periodic review of fisheries.
 - management plans.
 - appropriate placement of the burden of proof.
- The Code of Conduct was a voluntary agreement, but formed an international standard:
 - Straddling Fish Stocks and Highly Migratory Fish Stocks Agreement (UN 1995): “The fishing mortality rate which generates maximum sustainable yield should be regarded as a minimum standard for **limit reference points**.”
 - Fishing Vessels on the High Seas Agreement (UN 1995) adherence to PA management.
 - International Council for the Exploration of the Sea adopted PA as a management strategy (ICES 1997).
 - Northwest Atlantic Fishing Organization - also adopted PA (NAFO 1997)
 - U.S. National Standard 1 Guidelines (1998)

Target Control Rules

- Target fishing mortality is safely below the limit to account for uncertainty in science and management.
- A rebuilding plan is a temporary adjustment to the Target control rule.

