



# **No-Take Reserves**

And fisheries management.

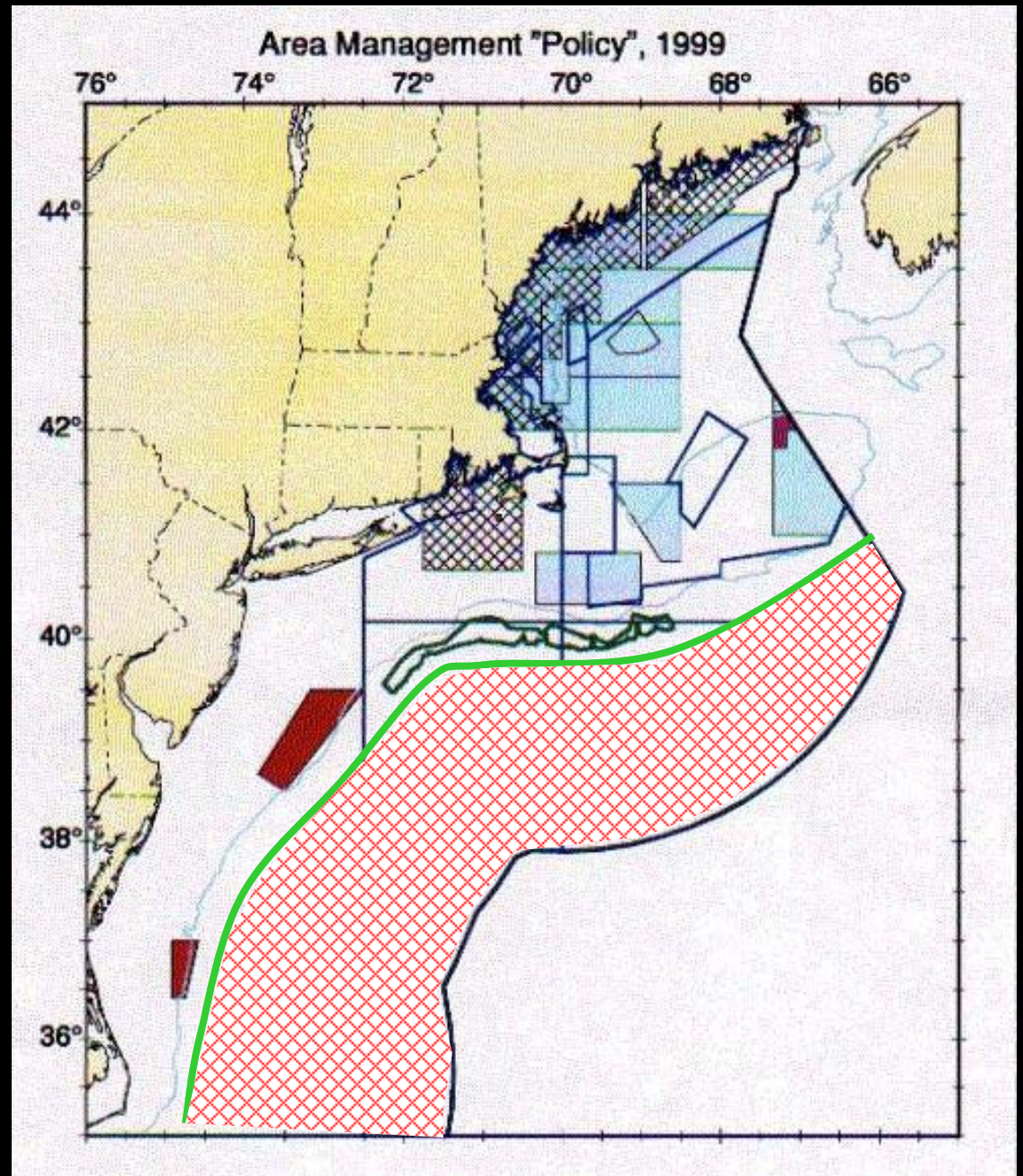
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*“Empowering Fishery Stakeholders with Fishery Science”*

# **This is New England**

- Not depleted coral reef fisheries in impoverished rural communities with no fisheries science or infrastructure
- We have a realistic choice between catch-effort controls and No-Take Reserves

A few of the  
MPAs in the  
Northeastern  
U.S.



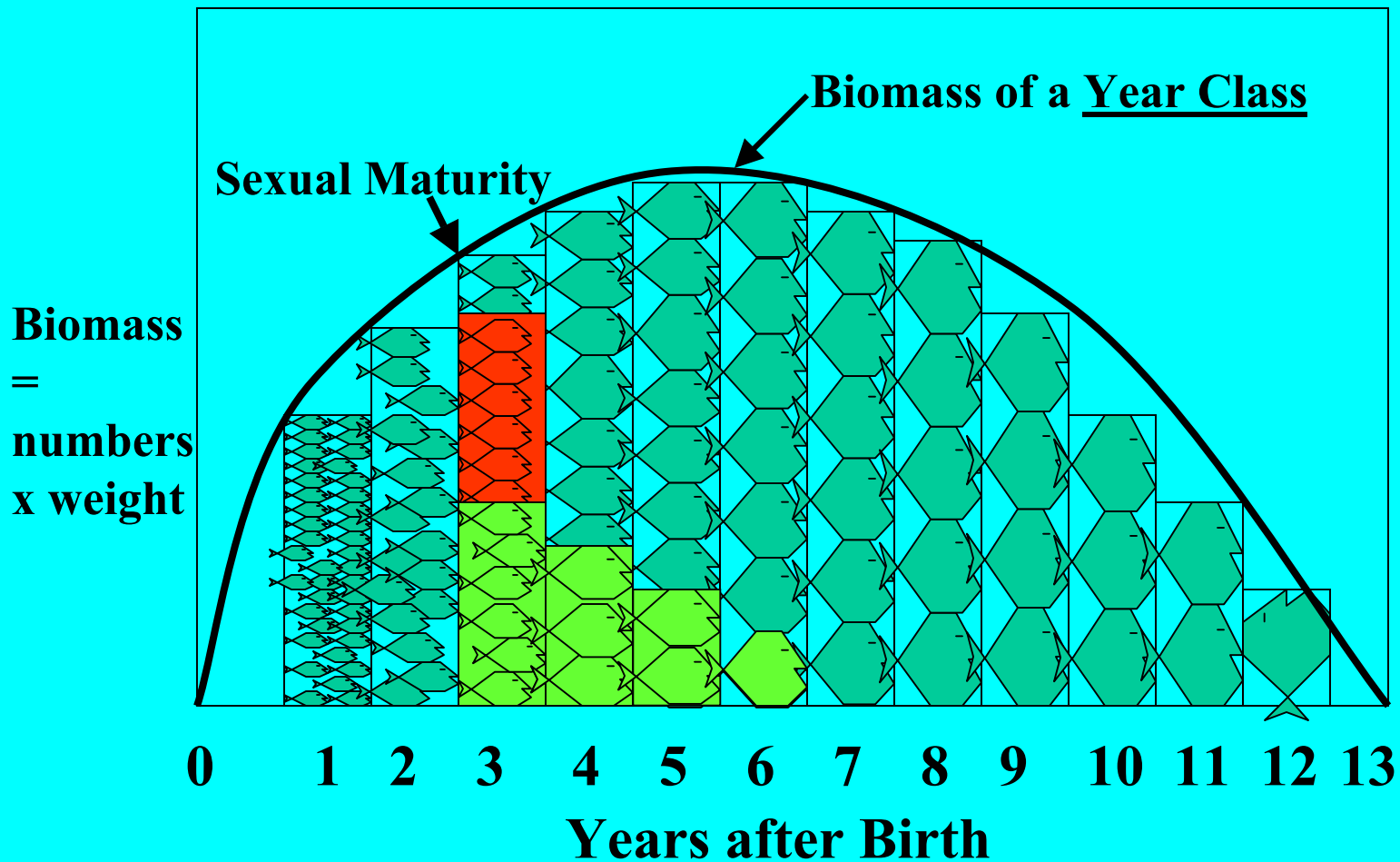
# What Is the Purpose of Fishery Management?

- **“Assuming the goal of resource management is to maximize benefits while sustaining the stock, the appropriate modeling objective is to find the economically optimal level of effort (the MEY solution).”**

*Milon et al, Bioeconomic Models of the Florida Commercial Spiny Lobster Fishery*

**MEY = Maximum Economic Yield**

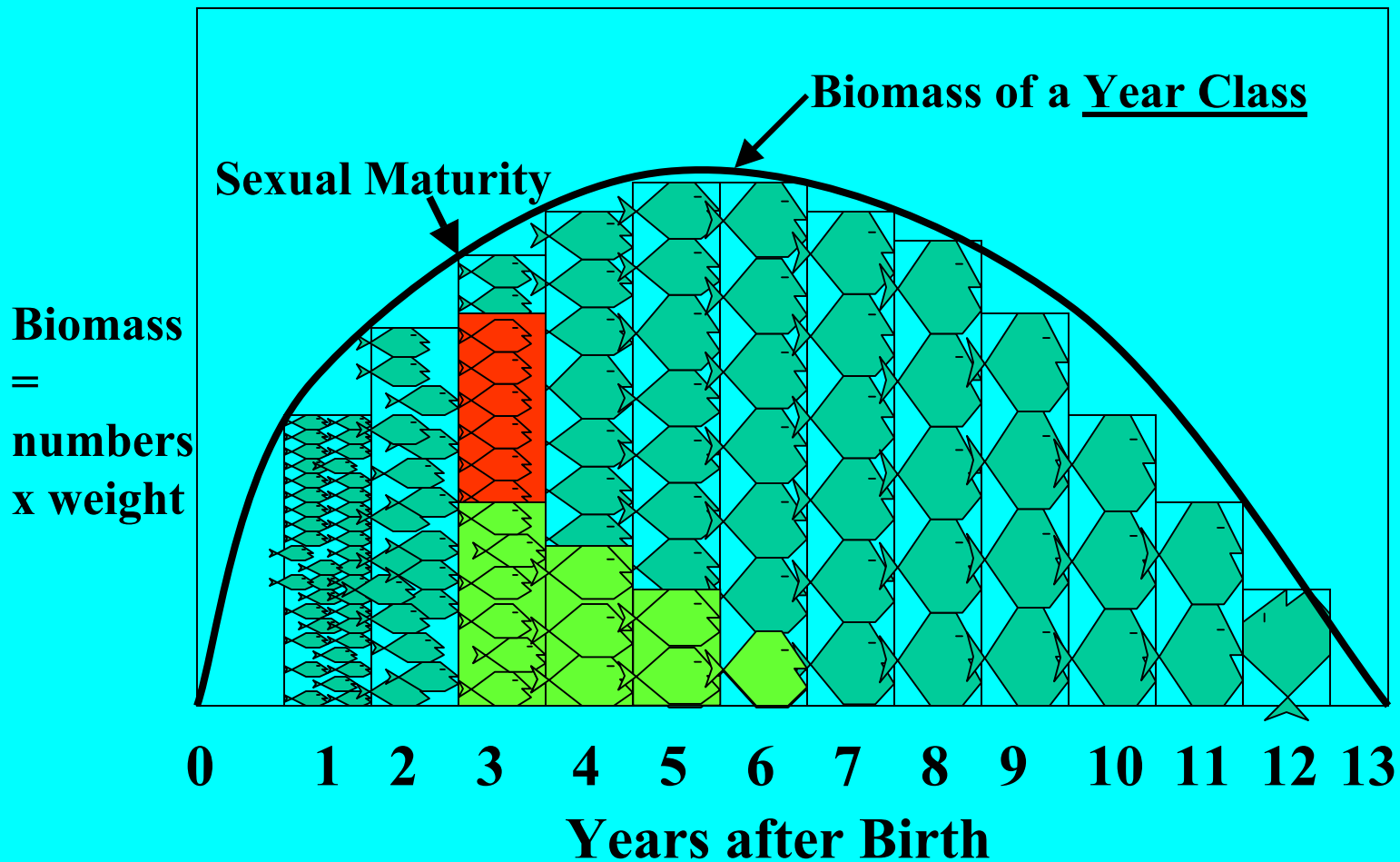
# Growth, Death, and Yield



# Fishery Yield Controls

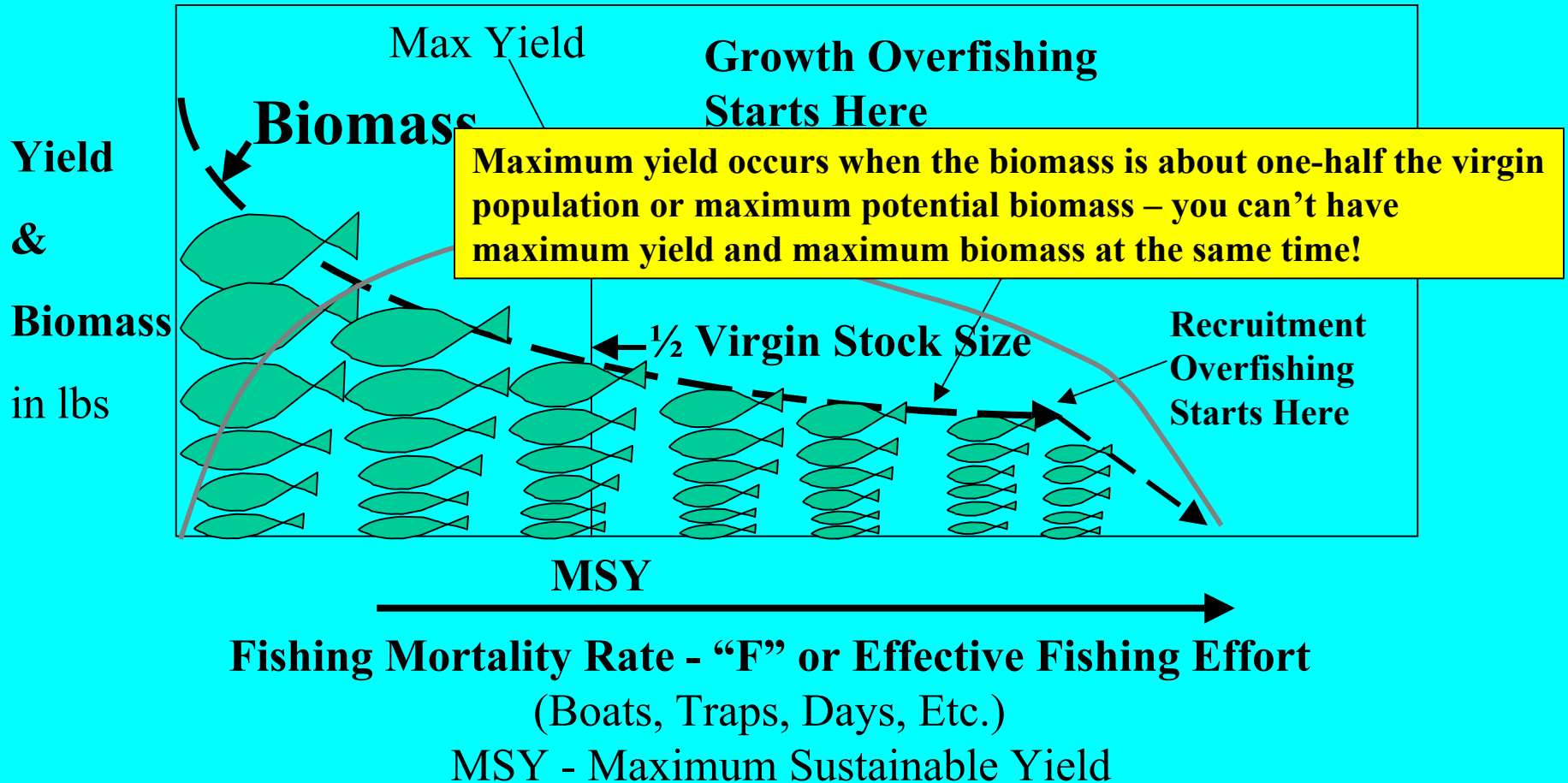
- Egg Production and Recruitment
- The age at entry into the fishery.
- The fishing mortality rate;

# Growth, Death, and Yield

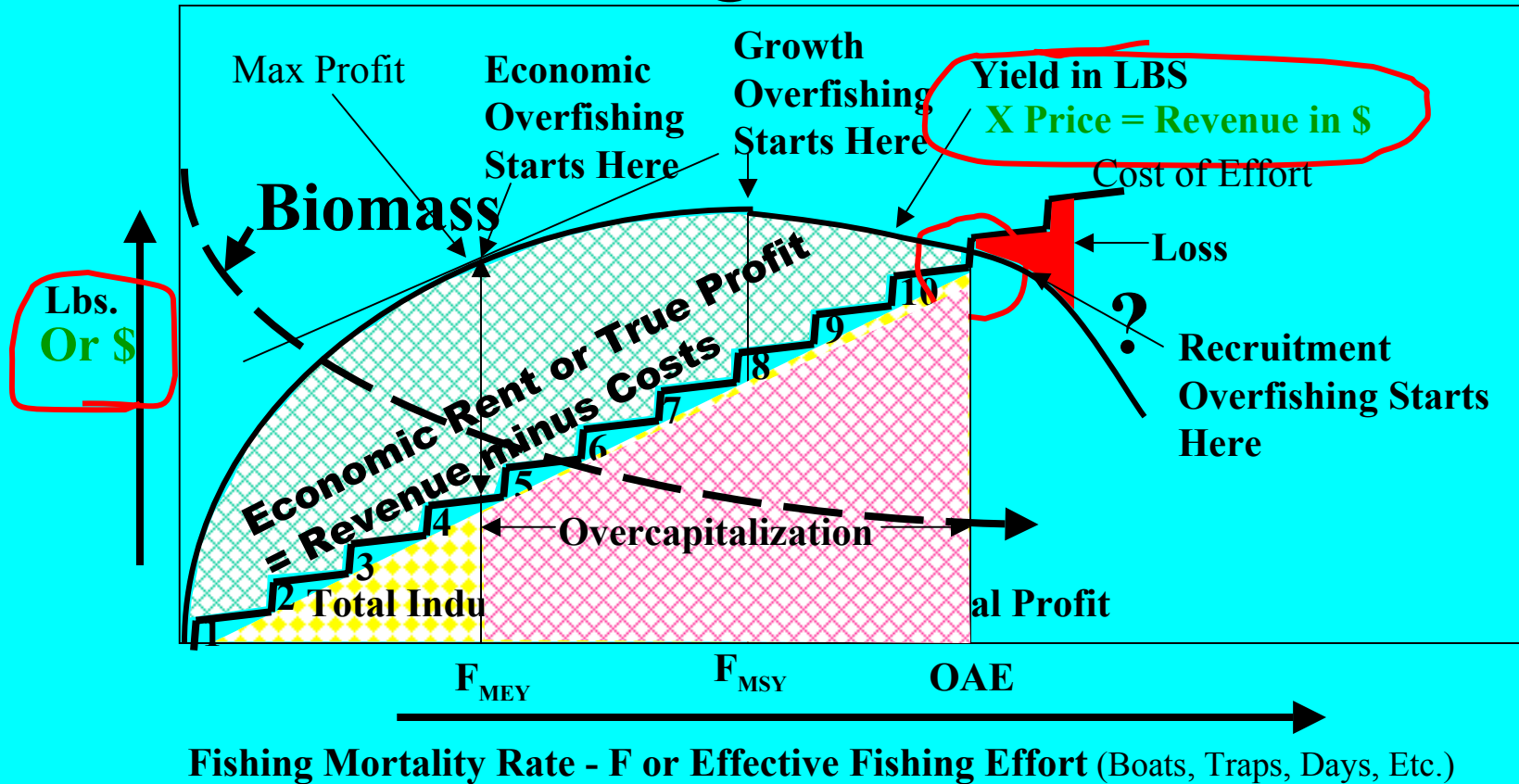




# Biomass vs Yield

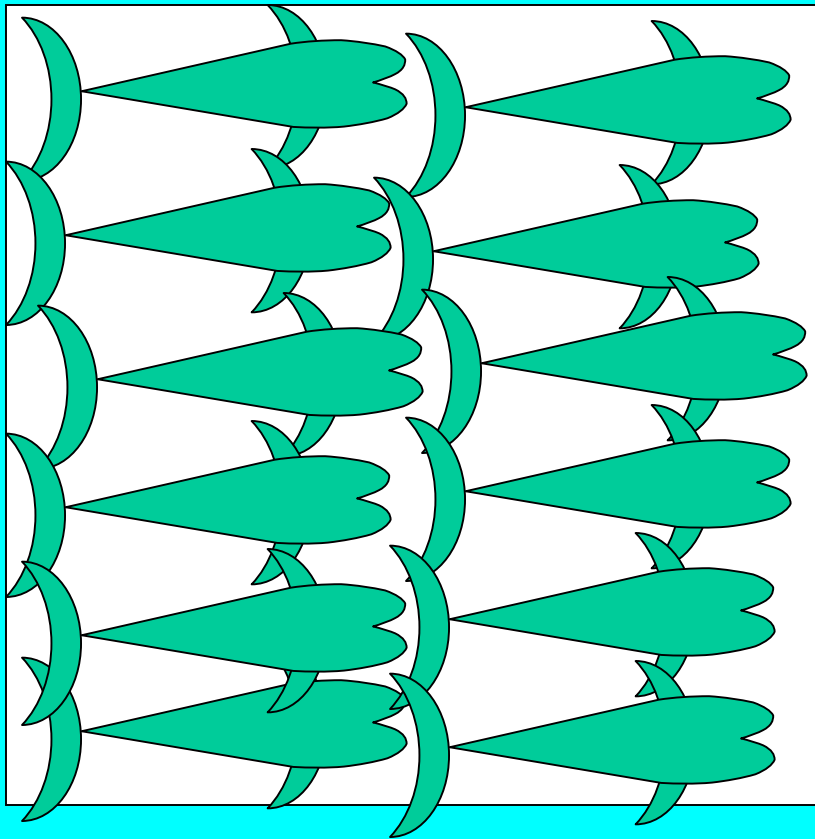


# Adding Economics

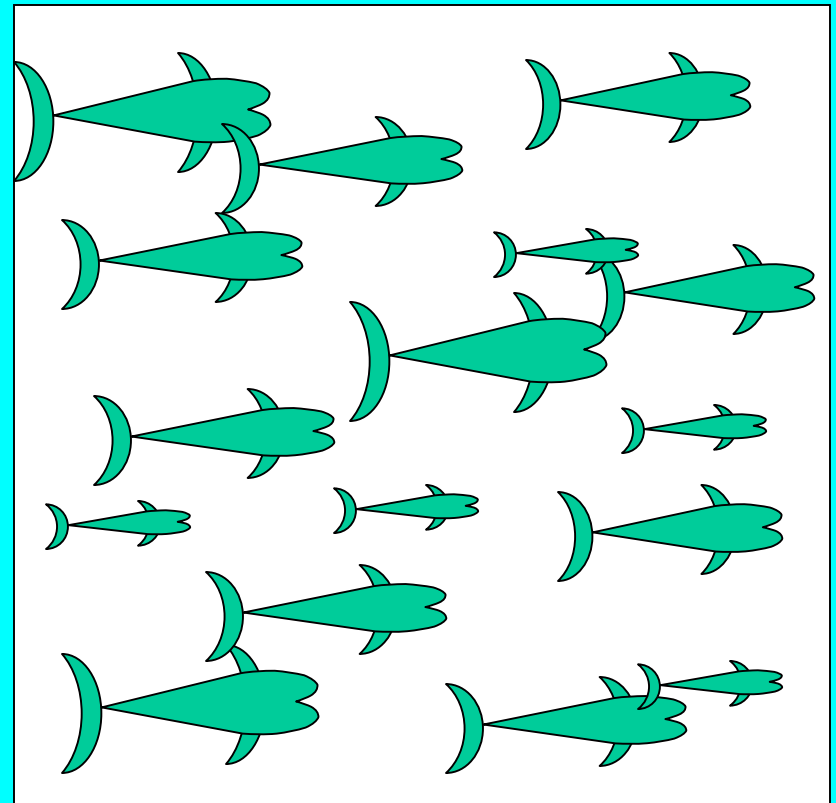


If you average no yield with low yield, you don't get maximum yield.

# Max Biomass vs. Max Yield

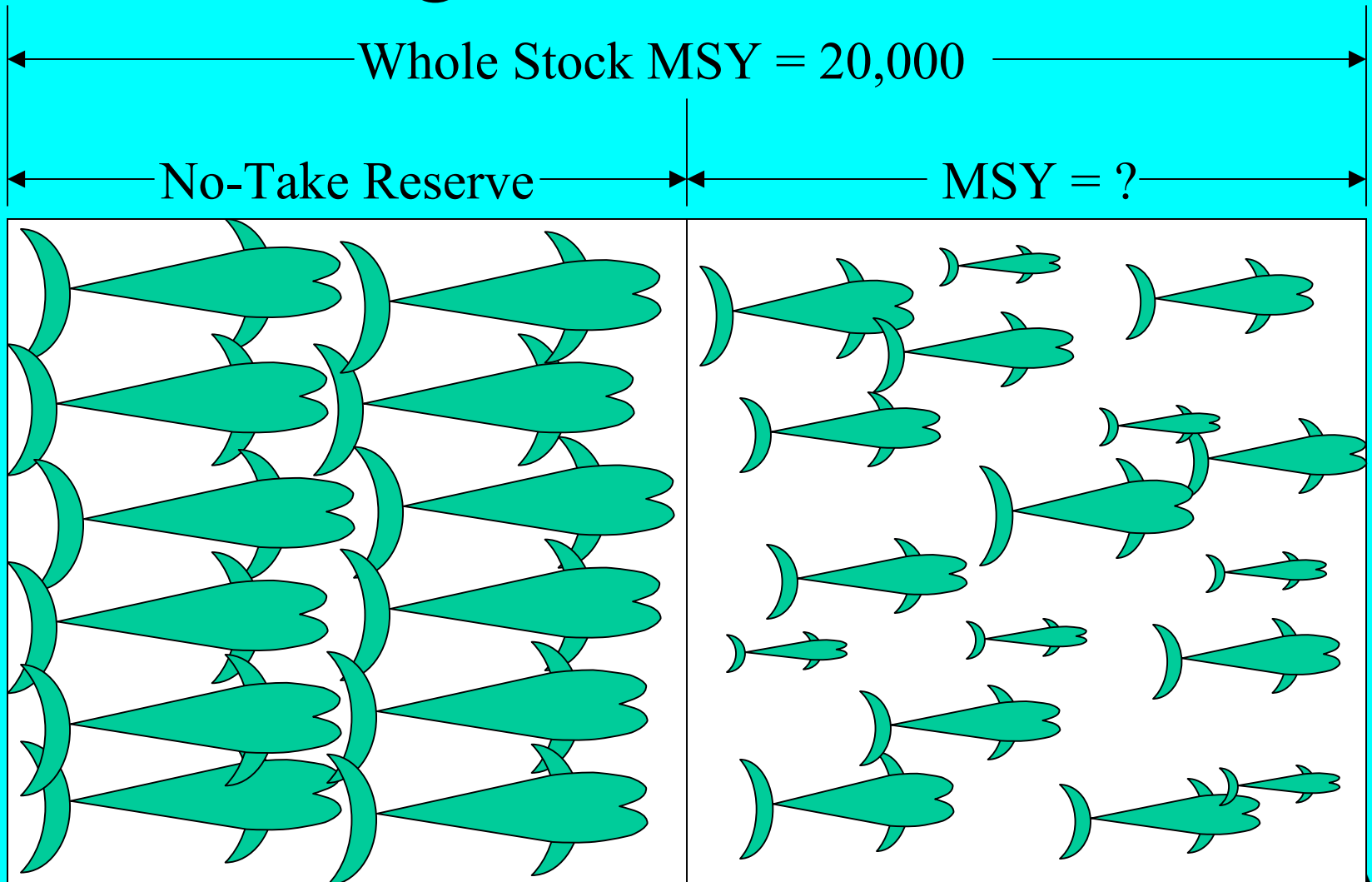


$B_{\max}$

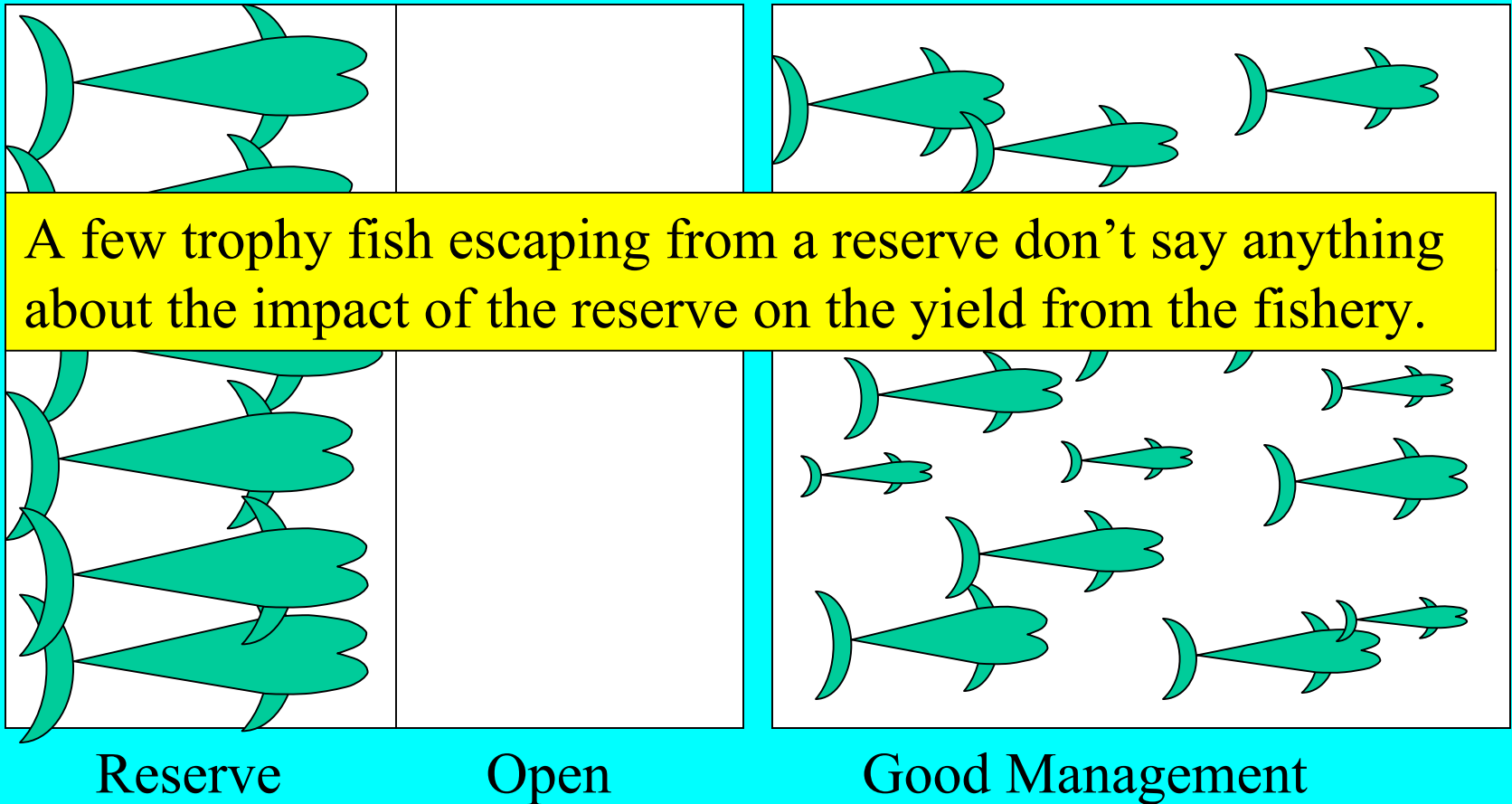


$Y_{\max}$

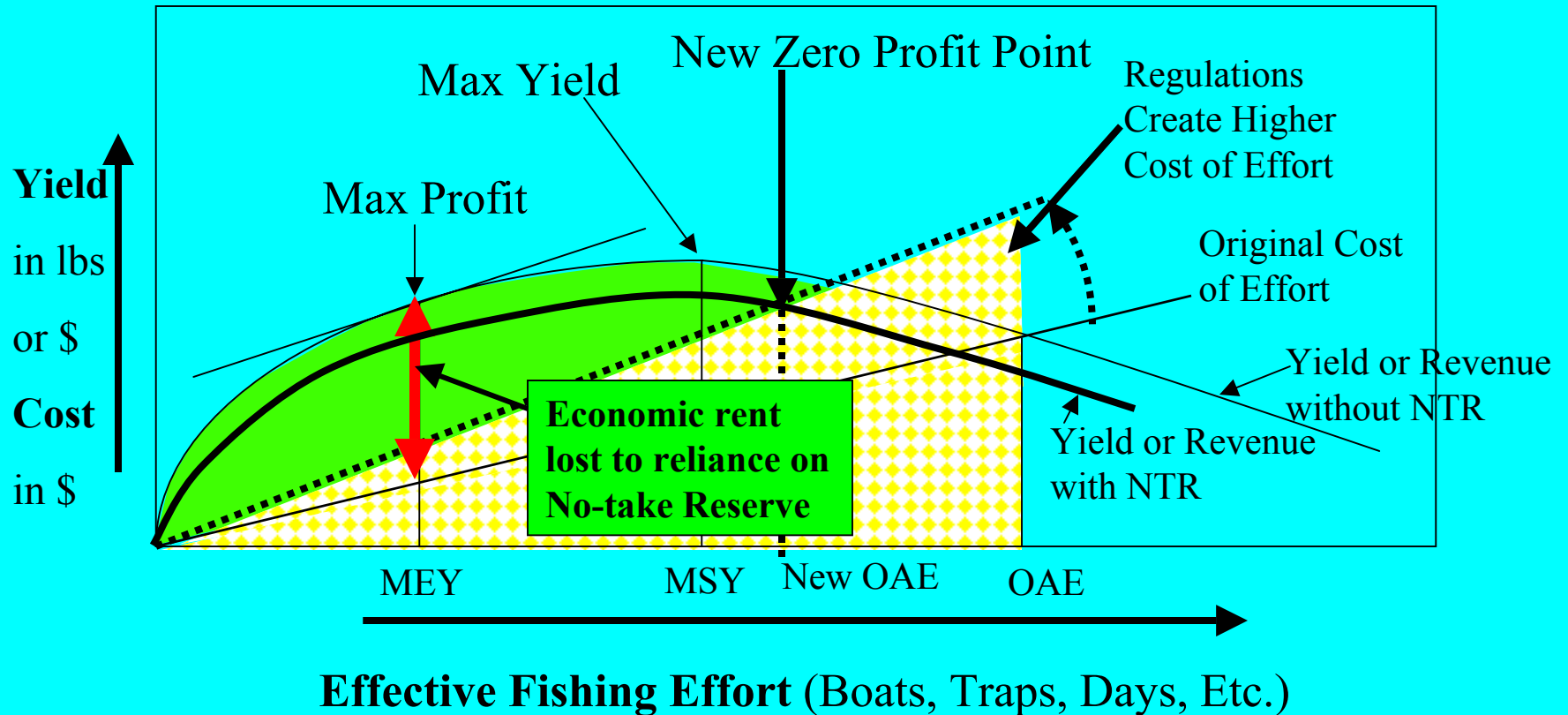
# Losing Yield to an MPA



# Equivalent Ecosystems?



# The Bio-economic Effect of Marine Reserves



<b>MEY</b> - Maximum Economic Yield	<b>MSY</b> - Maximum Sustainable Yield
<b>OAE</b> - Open Access Equilibrium	

# Increasing Fishery Yields?

- 1) Can we achieve MSY using traditional fishery management measures?
- 2) Can we get more than MSY with marine reserves?
- If the answer to 1) is yes, and the answer to 2) is no, marine reserves can not increase yields compared to traditional fishery management measures.

# Can No-Take Reserves Produce Yields Comparable to an Optimum Management System?

- The only situation in which a no-take reserve can produce fishery yields (biological) comparable to an optimal

The best that marine reserve management can do, with a magical coincidence of biological characteristics, is to equal the biological yield from good management but without the economic benefits.

- Economic results will definitely not be optimum.

# The “Double Dividend”

- The “double dividend” of higher biomass and higher yield that is claimed for some no-take reserve situations compares to a triple or quadruple dividend with reductions in fishing effort.
- Reducing fishing effort gives higher biomass, higher yield, less cost, less fuel, less total by-catch, less habitat damage, less redundant labor and capital, more profit.

# Biomass Reserves

## A Better Alternative for Fishery Management

- Inherent in Maximum Economic Yield
- Resolves many NTR circular arguments
- Follow the stock wherever it goes
- Doesn't create boundary problems
  - Negotiating exclusion
  - Enforcement
  - Boundary congestion

# Another Review of the Literature

- **“If effort can be controlled, marine reserves provide little or negative benefit.” (Holland 1996)**

# Another Review of the Literature

- **“Our maximal reserve size will generally not be the economic optimum.” (Pezzey et al. 1999)**

# Another Review of the Literature

- **“In all cases, the potential sustainable harvest from any given total stock size is reduced for any marine reserve, and the larger the reserve the larger is the reduction.”  
(Anderson forthcoming)**

# Another Review of the Literature

- **“A marine reserve will increase fishing costs and overcapitalization in the fishing industry, to the extent it has any conservation effect on the stock, and in a seasonal fishery it will shorten the fishing season.”  
(Hannesson 1998)**

# A Fishery Management Choice

- Society makes an investment in fishery conservation.
  - Foregone catch
  - Labor & capital productivity impacts
  - Administrative resources
  - Enforcement resources
- Which produces the better cost-benefit ratio
  - Locking up small areas?
  - Managing all areas well?

# Reality

- There may be legitimate reasons to establish no-take reserves other than increases in fishery yields.
- It may be in the best interest of the fishing industry to cooperate in the establishment of a limited number of no-take reserves.
- No-take reserves will not be the basis for an optimum fishery management strategy.
- Control over fishing effort will continue to be the primary objective of fishery management.

# Conclusion

The widespread establishment of no-take reserves poses more of a threat to the productivity of marine fisheries than does overfishing.

The need to be part of a group has biological, evolutionary roots traceable to that period in human history when to be banned from the dominant hunter-gatherer group meant almost certain death.

# Another Review of the Literature

- **“It is important to point out that the status quo under consideration here is non-optimal and hence we are comparing various second-best alternatives.”  
(Sanchirico and Wilen 1998)**

# Another Review of the Literature

- **“Protected areas do not address the causes of excess effort that trouble many fisheries.” (Sanchirico, Cochran, and Emerson 2001)**

# Another Review of the Literature

- **“And there is some empirical evidence for the increase in effort compared to the no-reserve, open-access equilibrium, for Goodridge et al. (in press) observed an increase in effort following the creation of reserves in St. Lucia, though this was before final equilibrium had been reached.” (Pezzey et al. 1999)**

# Another Review of the Literature

- **“The models predict that harvesting pressure outside and especially along the boundaries of the MPA will increase (Sanchirico 1998; Walters 1999).**
- **There is some anecdotal evidence that this has occurred outside an MPA located off the coast of Kenya ... (McClanahan and Kaunda-Aara 1996).**
- **This increase in effort along the edge of the MPA led the authors to conclude that the spillover benefits have been quickly dissipated.**
- **Additionally, the costs associated with increased competition could induce fishermen to adopt fishing practices that yield the highest private return subject to the new MPA constraint, but also could increase the amount of habitat destruction in the remaining fishable water.” (Sanchirico, Cochran, and Emerson 2001)**

# Another Review of the Literature

- **“The variables are the number of times the stock falls below the SMBL (safe minimum biomass level), the average annual harvest, and the average annual stock size. ... The pure status quo TAC (Total Allowable Catch) policy out-performed the pure MR (Marine Reserve) policy on all counts.” (Anderson forthcoming)**

# Another Review of the Literature

- “We thus conclude that a system based on reserves may simultaneously provide protection of the stock and a higher long-term catch by allowing greater intensity of fishing in the fraction of the potential fishing ground in which fishing is allowed.”  
(Lauck *et al* 1998)

# Another Review of the Literature

- “The maximal reserve enables a greater catch than the static optimum, but using proportionally more effort and with a lower overall stock density.” (Pezzey *et al* 1999)

# Another Review of the Literature

- “Marine reserves, as an alternative to conventional management, also have uncertainties associated with their performance.” (National Research Council, 2001)

# Another Review of the Literature

- “For fisheries that are sustainable under conventional management, switching to marine reserves as the primary management approach will essentially substitute one effort control measure for another.”  
(National Research Council, 2001)

# Another Review of the Literature

- “For species with low adult mobility, individual size and population abundance should increase within the reserve, but with minimum spillover to adjacent areas.... At the other extreme, high rates of adult mobility between reserves and unprotected areas may drain the reserve population.... Fisheries for species with moderate rates of dispersal are predicted to benefit most from the establishment of reserves.” (National Research Council, 2001)

# Should we give up on fishery management?

- If fishery management is hopeless without marine reserves – “Given the large uncertainties and biases of management, overfishing of every stock seems almost predetermined.” (Lauck et al. 1998)
- How is it that the Marine Stewardship Council is going around the world certifying fisheries as sustainable?

# Should we give up on fishery management?

- Are we really seeing “valuable fish populations continue to disappear at an alarming rate?” (Lauck et al. 1998)
- Or, are we seeing more and more examples of successful fishery management based on control over fishing mortality rates?
- Shouldn't fishery management be based on sound economic principles if we hope to maximize the benefits to society from our fisheries?

# Looking for the Logic

- “MRs do not require expensive annual data collection and assessment efforts ...Elaborate models and extensive knowledge about each species and fishery also are not essential... determining the proper gear, size, or species is not necessary.” (Bohnsack 1996)
- In practice, ecosystem management requires expanded monitoring of populations, habitat, physical factors, and the human dimension to assess the dynamics, interactions, and performance of key ecosystem components (Bohnsack, in press).

# Looking for the Logic

- “Unlike the use of quotas and bag limits, MRs do not require expensive annual data collection and assessment efforts after initially determining their success, especially if the objective is conservation. Elaborate models and extensive knowledge about each species and fishery also are not essential. Some users like the fact that restrictions apply equally to all fishers and that conservation does not mean allocating resources from one group to another. At-sea enforcement is relatively simple because a person is either fishing or not; determining the proper gear, size, or species is not necessary.”  
(Bohnsack 1996)

# Looking for the Logic

- “It is essential that NTRs be complemented by other appropriate management practices, such as size limits, bag limits, quotas, limited entry, closed seasons, gear restrictions, and closed areas for specific fisheries (Bohnsack, in press).”

# Looking for the Logic

- “NTRs will most likely benefit sessile and sedentary species (Bohnsack in press).”
- “They can support sustainable fisheries by supplying adults to fished areas (Bohnsack in press).”

# Compared to What?

- Proponents compare biomass and fish sizes in marine reserves to over-fished, depleted stocks.
  - Zero fishing mortality compared to excessive fishing mortality.
- The more valid comparison is between marine reserves and an overall program of appropriate fishing mortality levels.

# Giving up on fishery management.

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