

気候変化と水産業に関する人 間の問題について

Surfclam Dramas and Other
Stories: Human Dimensions of
Climate Change and Fisheries

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Perspectives on “human dimensions” of marine commons

- Anthropogenesis
 - People as threats
 - Overfishing
 - Cumulative effects
- Ecosystem Services
 - People as consumers
 - Valuation/ tradeoffs
- Social & Economic Impacts
 - People as impacttees
 - Victims/ beneficiaries
- **Tragedians of the Commons**
 - **People as self-interested, myopic individual actors**
- **Comedians of the Commons**
 - **People as social, trying to make sense of and correct things**
- **Coping & adaptation...**

“Comedies of the Commons”



“The drama of humans as social rather than private beings, a drama of social actions having a frankly corrective purpose.” (M.E. Smith, 1984; McCay and Acheson 1987).

Acknowledgments

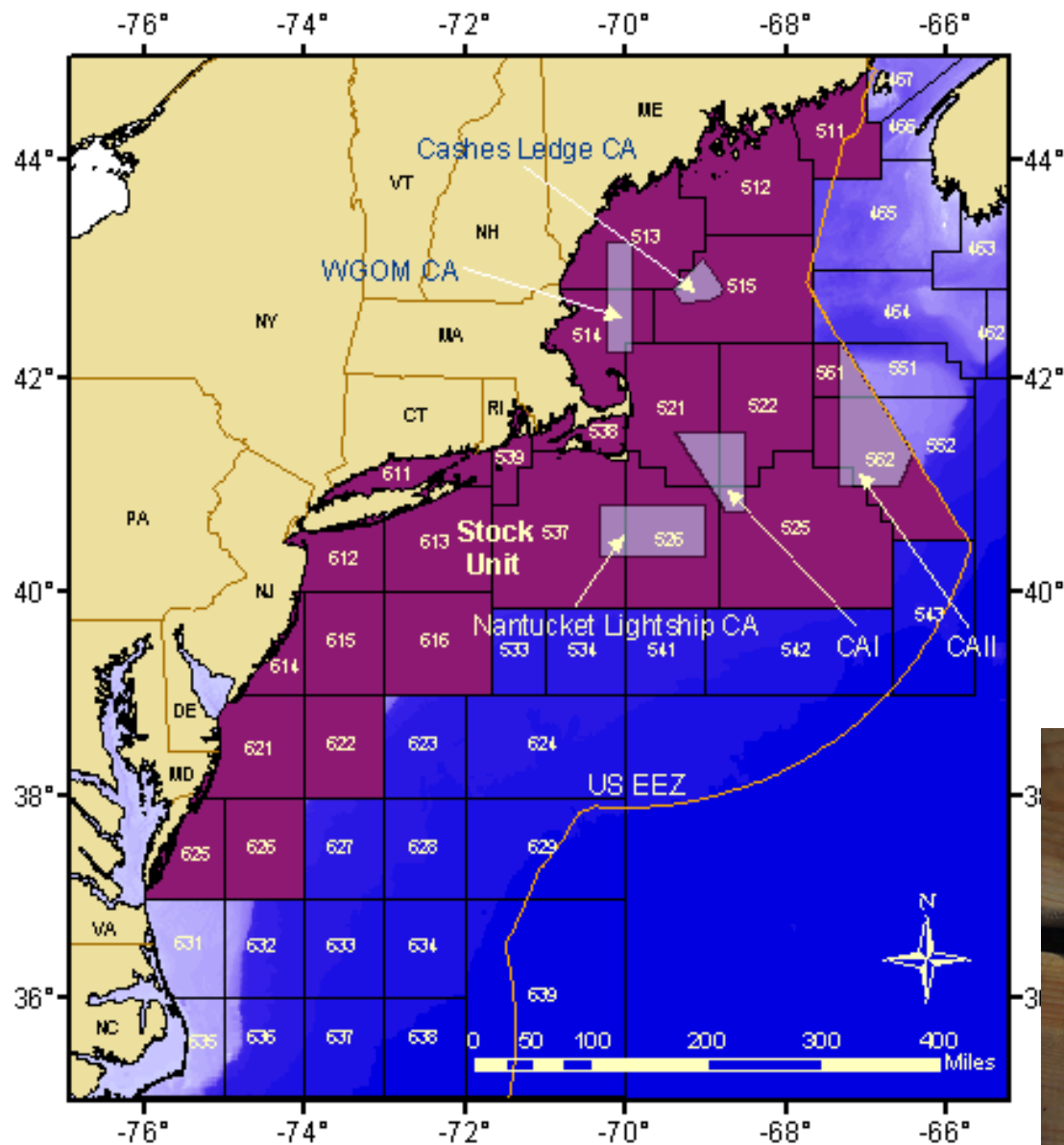


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- *Collaborative Research:
Climate Change and Responses
in a Coupled Marine System.
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Atlantic Surfclam Range



Adaptive Capacity and Co-Management

- Whether and how the socio-economic and regulatory system will adapt to effects of climate change (perceived and documented) in response to environmental signals
 - Mid-Atlantic Fisheries Management Council (MAFMC); National Marine Fisheries Service (NMFS); National Fisheries Institute....
 - Fishing industry
 - Harvesters
 - Owners
 - Processors
 - Govt. & University scientists
- Co-Management: Industry, Scientists, Government

Clammers & Hydraulic Dredge, Atlantic City, NJ

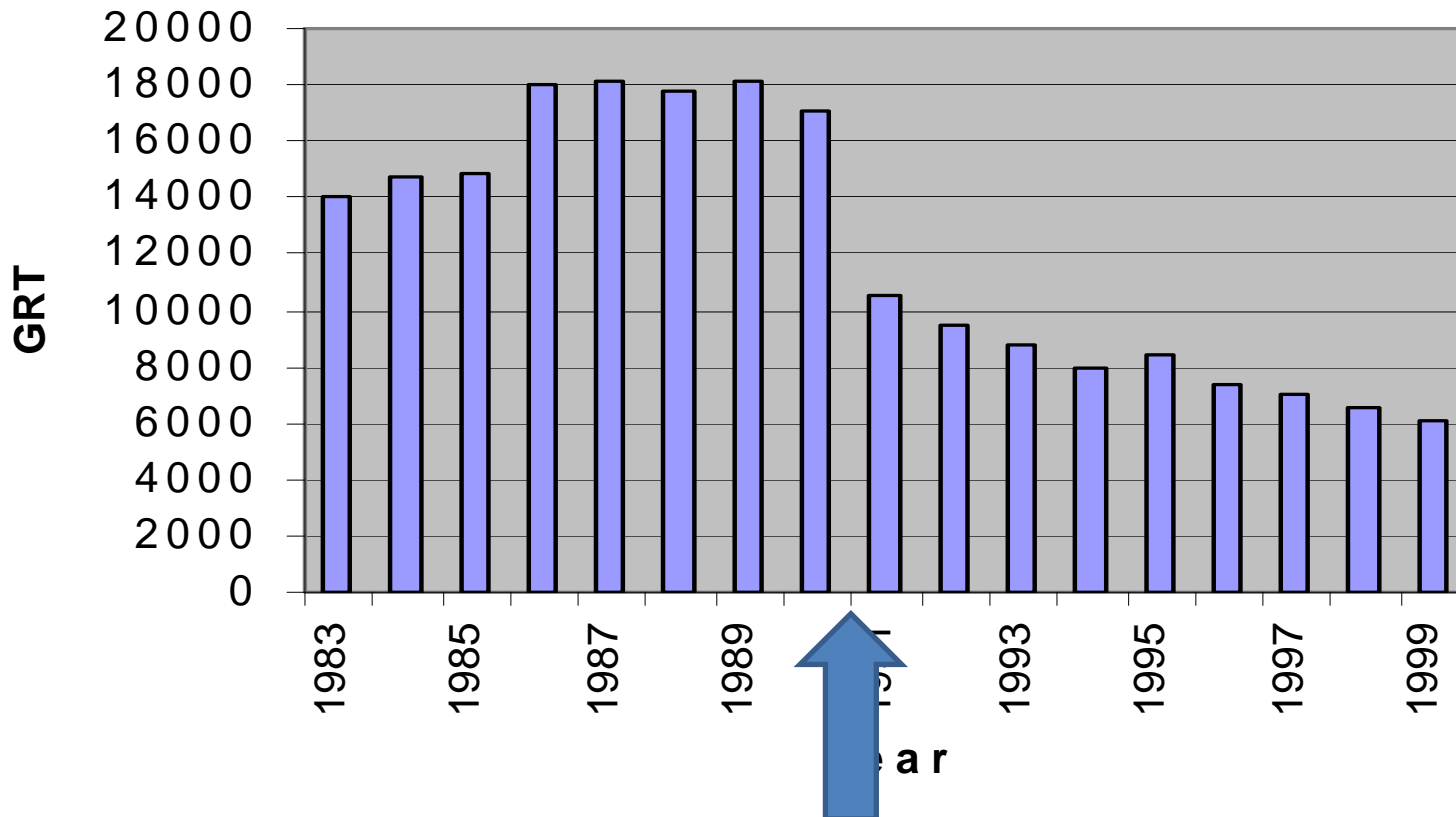


Fishery Management: ITQs

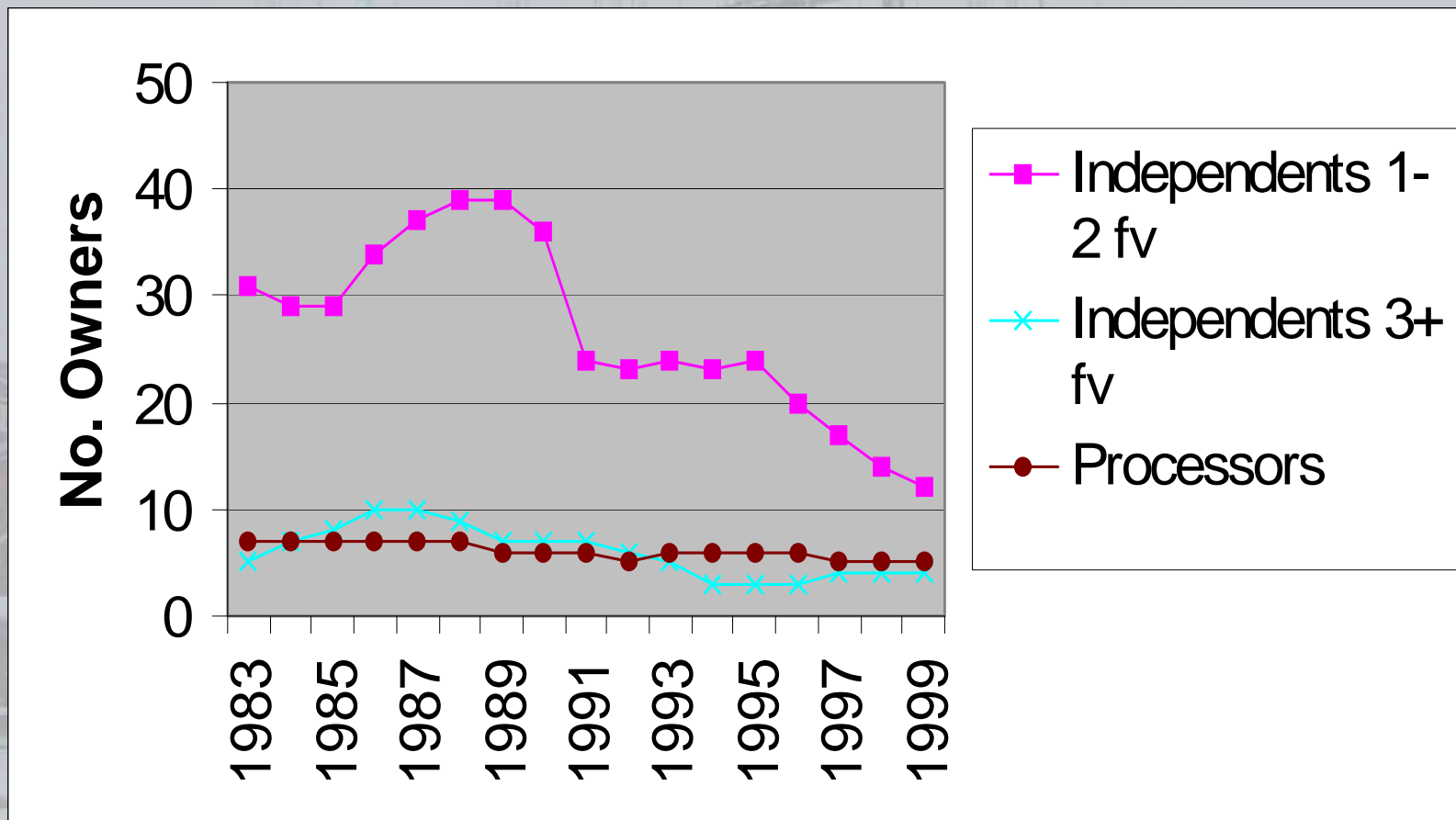
AMENDMENT #8

FISHERY MANAGEMENT PLAN FOR THE ATLANTIC SURF CLAM AND OCEAN QUAHOG FISHERY

Fleet Tonnage 1983-1999



“Consolidation:” SCOQ Owners, 1983-1999

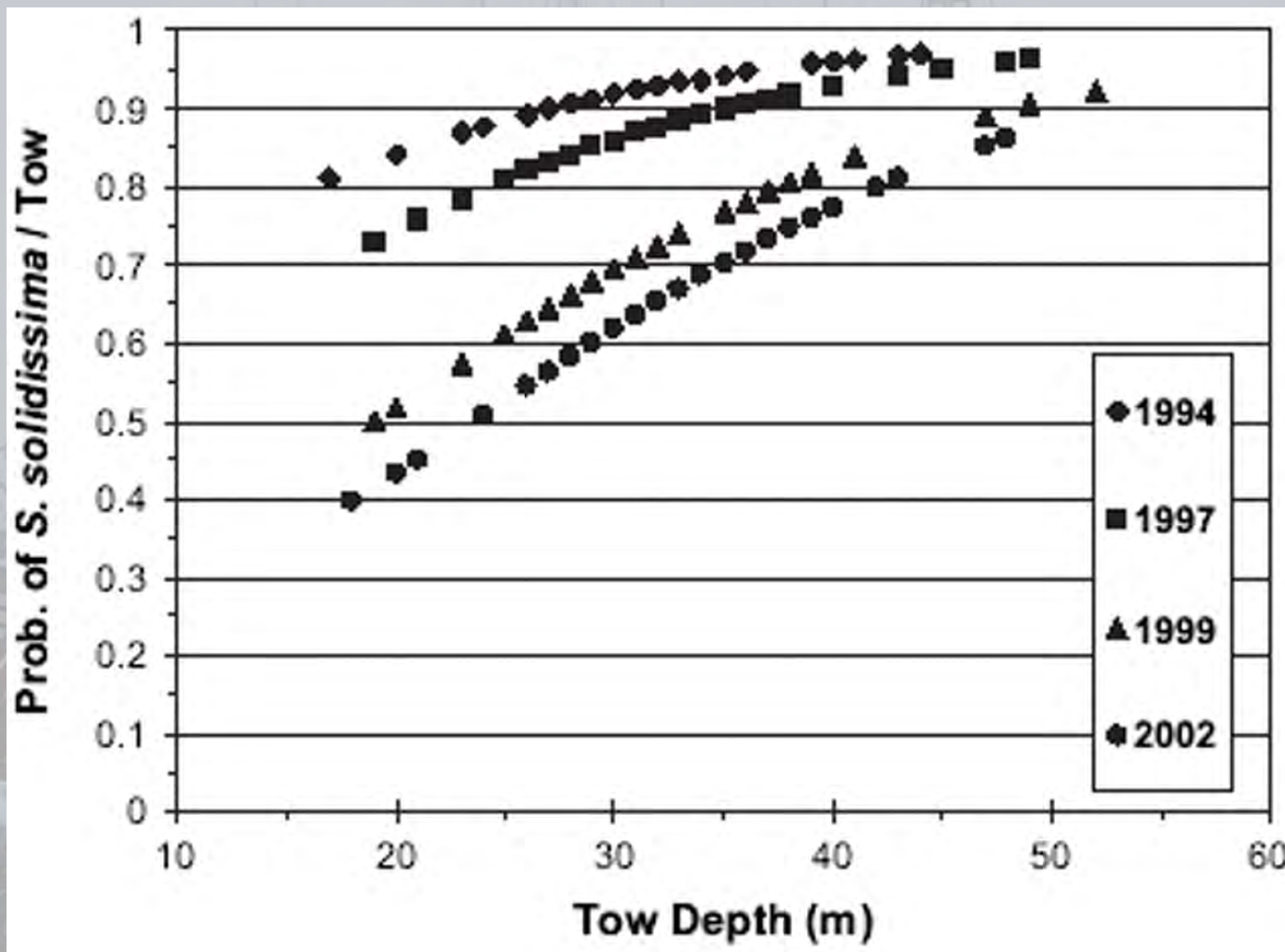


How will a market-based system respond to environmental change?

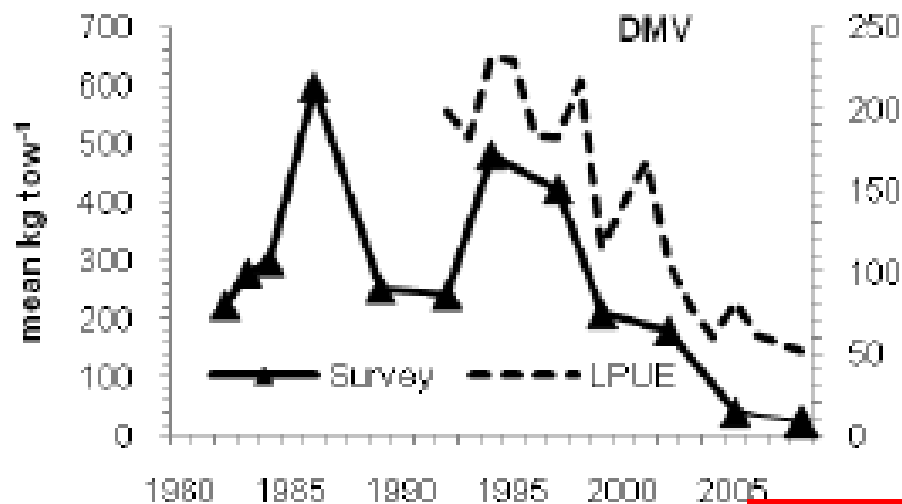
Fewer “foxes” in the “henhouse”, less conflict and lower transactions costs
Good Stewards? Or Just Business?



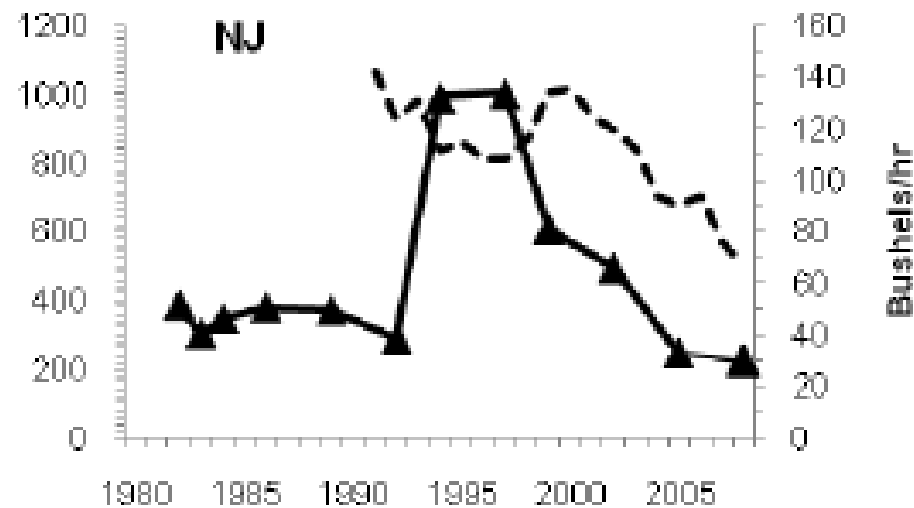
The probability of capturing *Spisula solidissima solidissima* (≥ 88 mm length) in a NMFS research vessel surfclam survey tow as a function of station depth and survey year



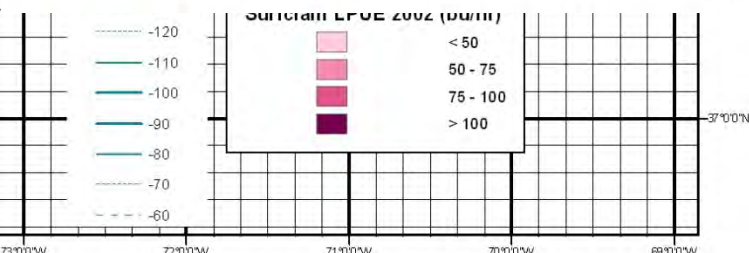
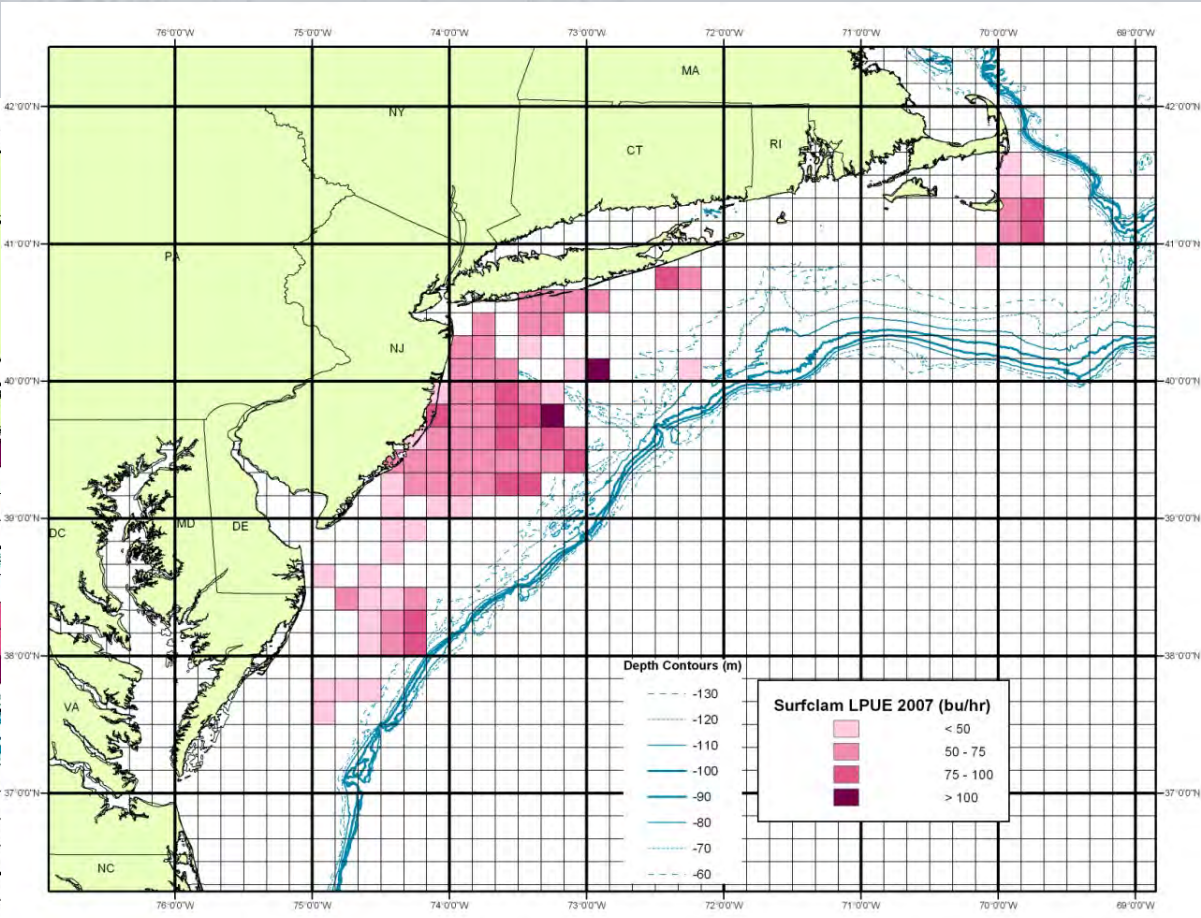
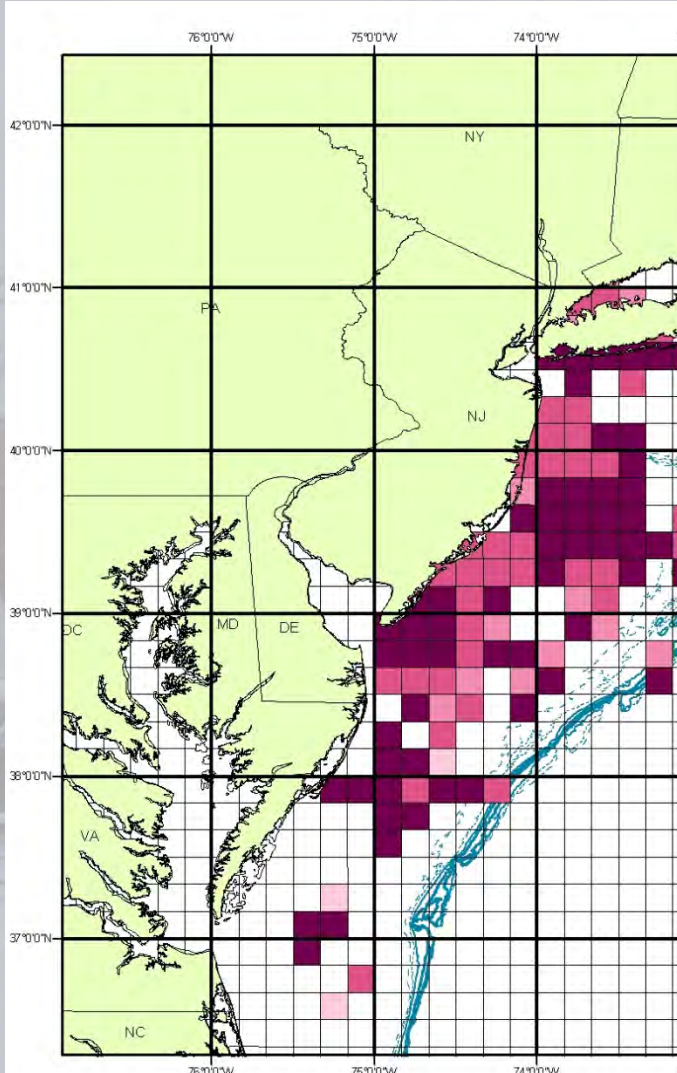
Weinberg, J. R. ICES J. Mar. Sci. 2005 62:1444-1453;
doi:10.1016/j.icesjms.2005.04.020



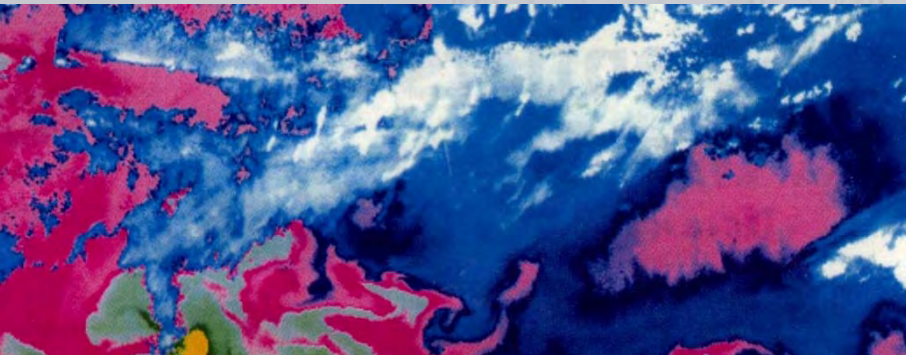
Trends in stock biomass for surfclams (120+ mm SL) based on the NEFSC clam survey and commercial LPUE from logbooks.



Surfclam Landings Per Unit Effort (bu/hr), 2002, 2007



Mid-Atlantic Surfclam Model (MASC)

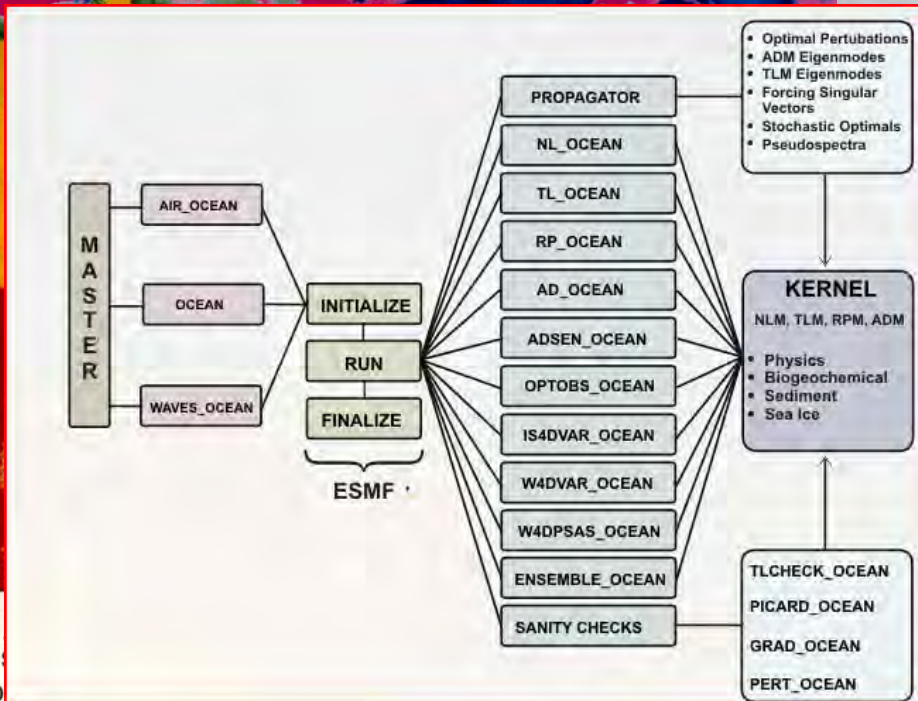


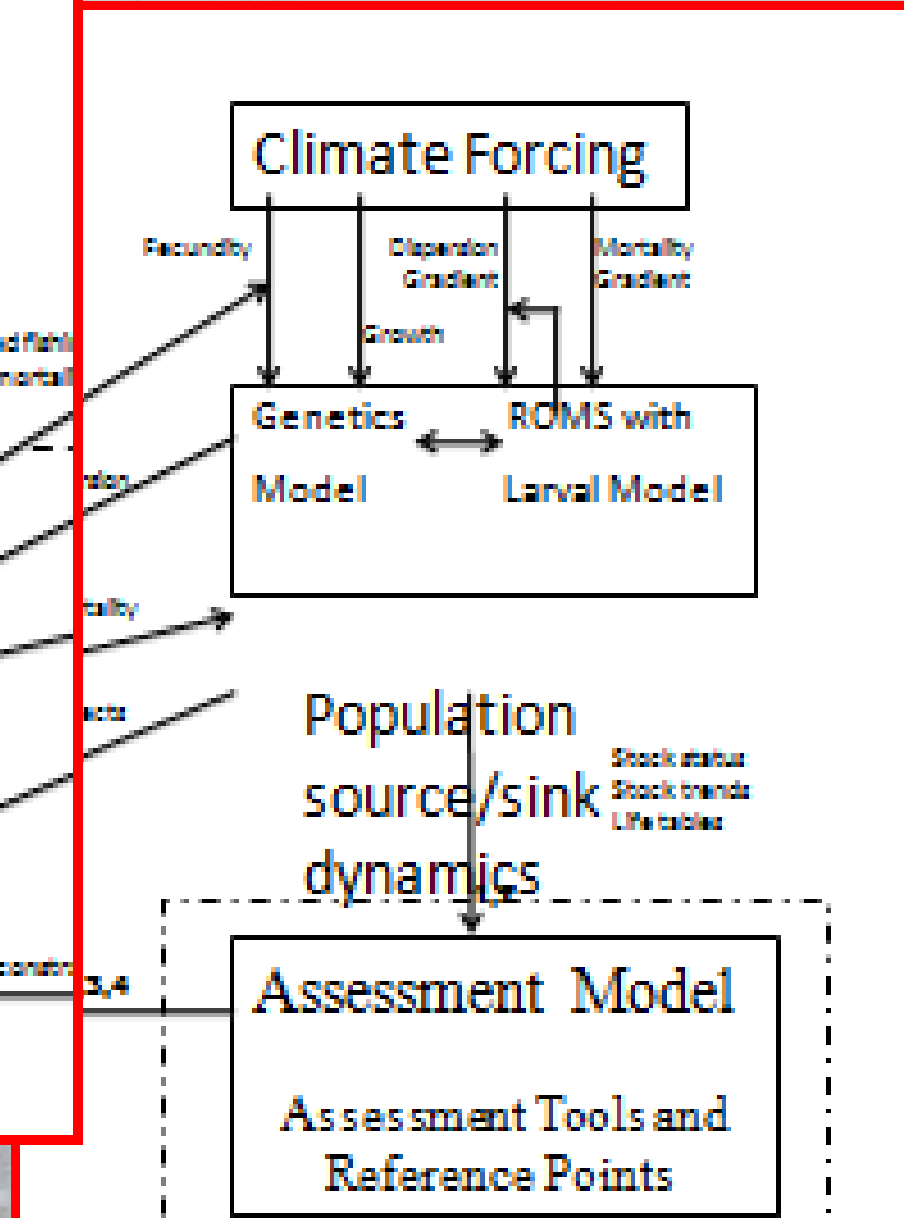
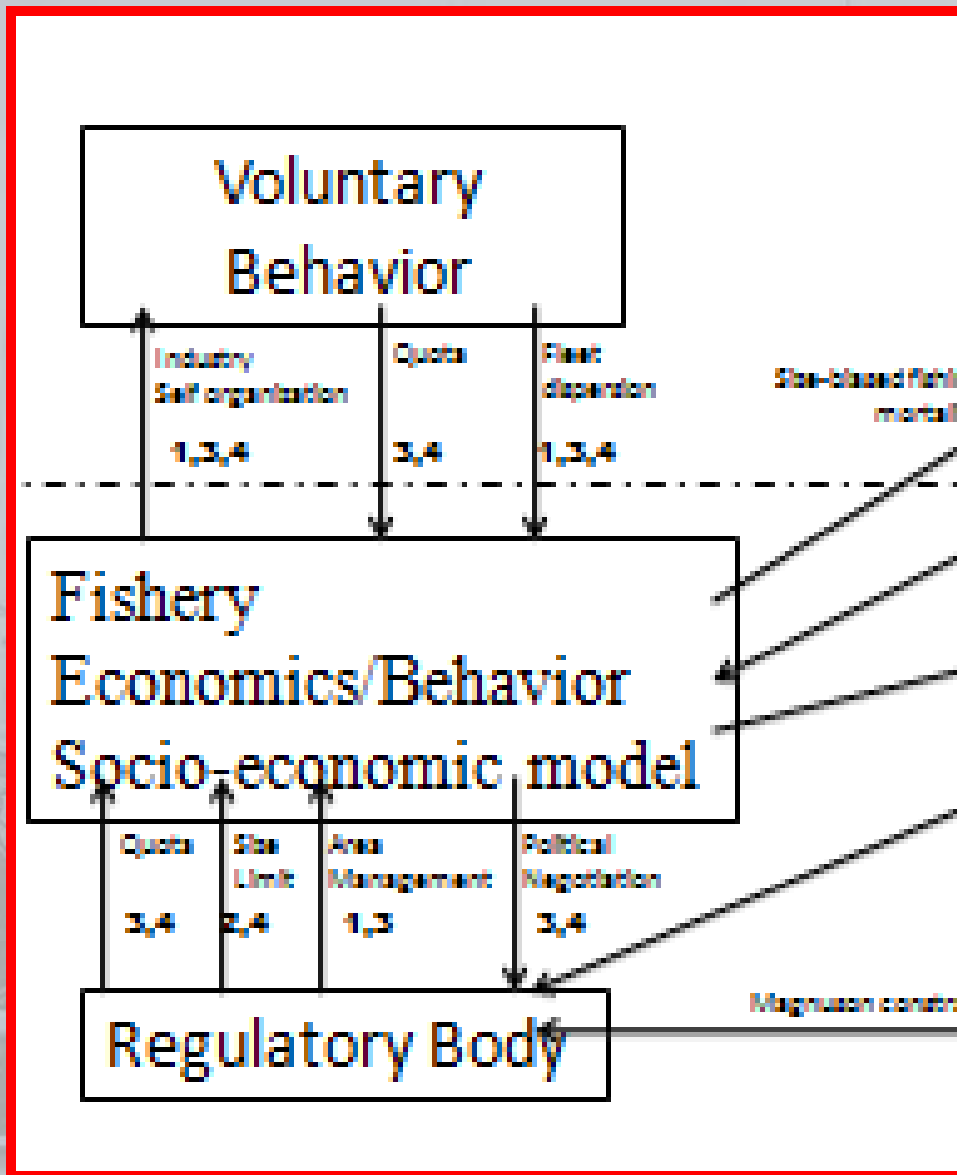
- Regional Ocean Modeling System (ROMS)

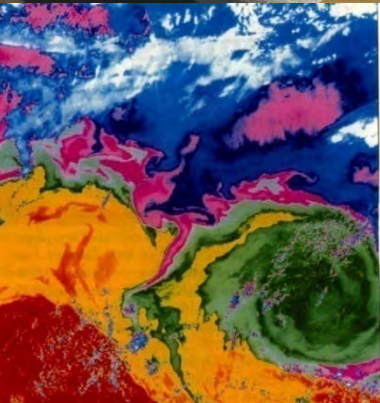
- Regional sub-model; clam larval transport

- Dynamic Population Genetics Engine (DyPoGEn), adult clams

- Responses & adaptations; source-sink issue





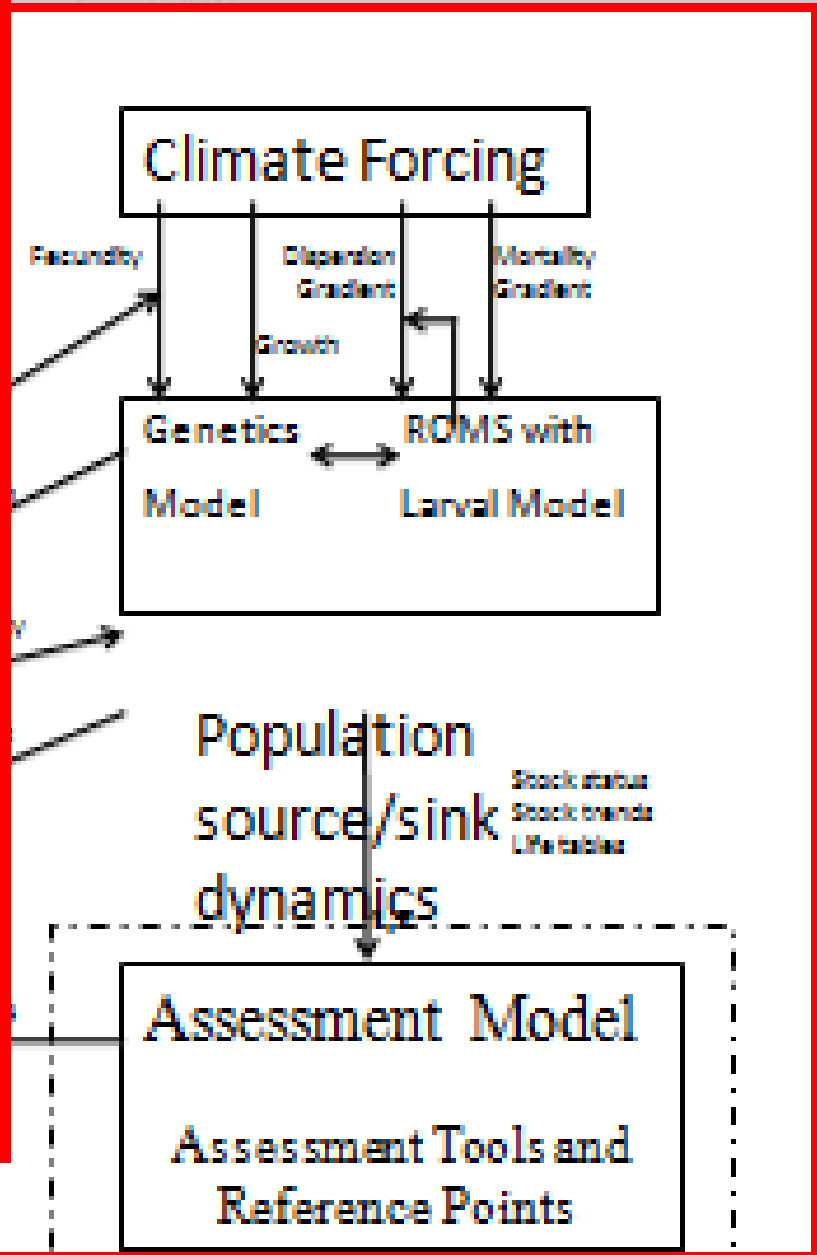
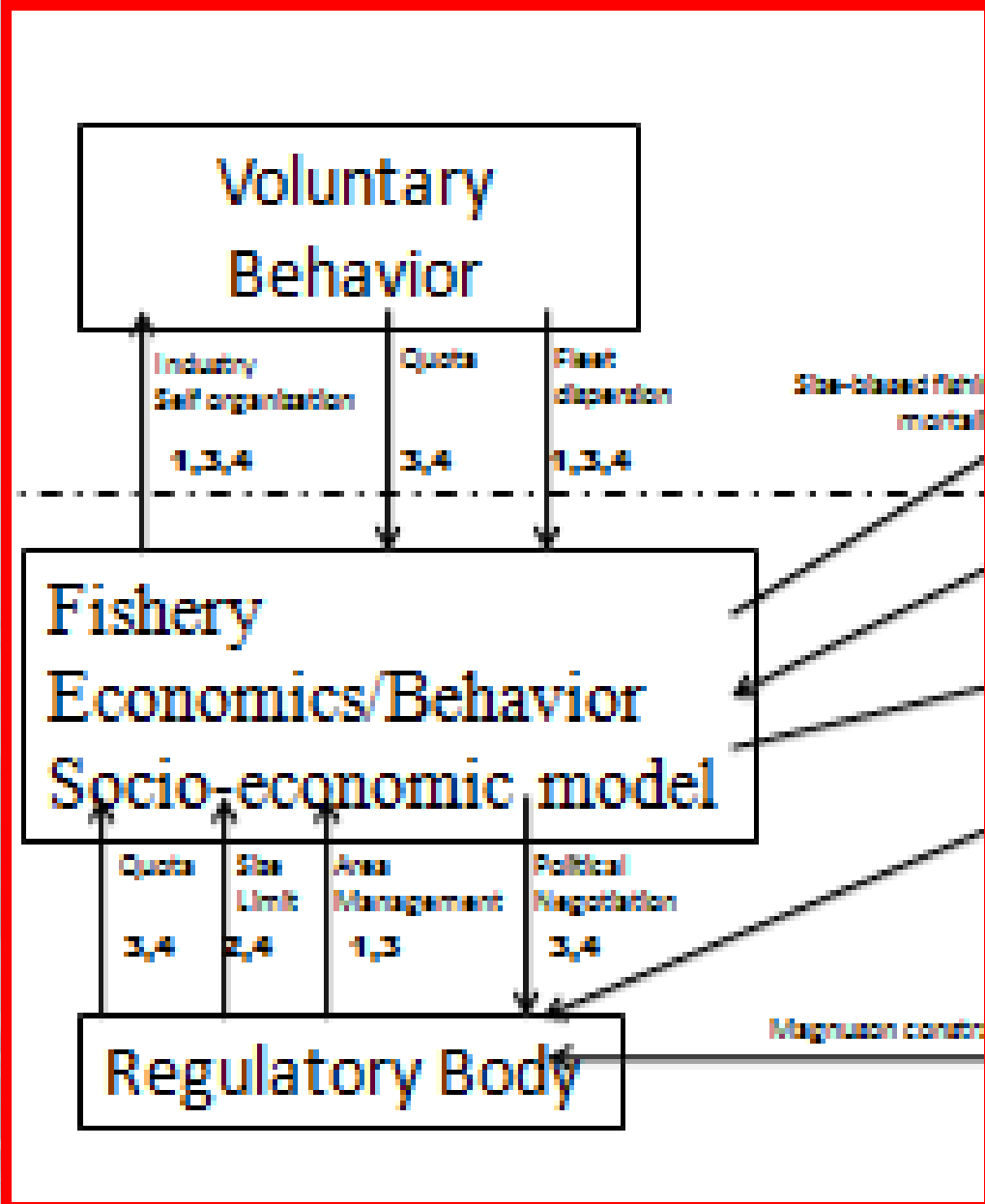


Socio-Ecological System



Co-Managers: The Mid-Atlantic Fishery Management Council





Coupling and Feedback: U.S. surfclam fishery and climate change

- **ITQs embedded in complex hierarchical governance**
- Highly consolidated, pared down industry; well-developed history of industry-sponsored research and “co-management”
- **Clear signals of environmental change**
- Can science-based regulatory system and/or voluntary action of industry adjust?

Collaborative and Industry-Funded Research

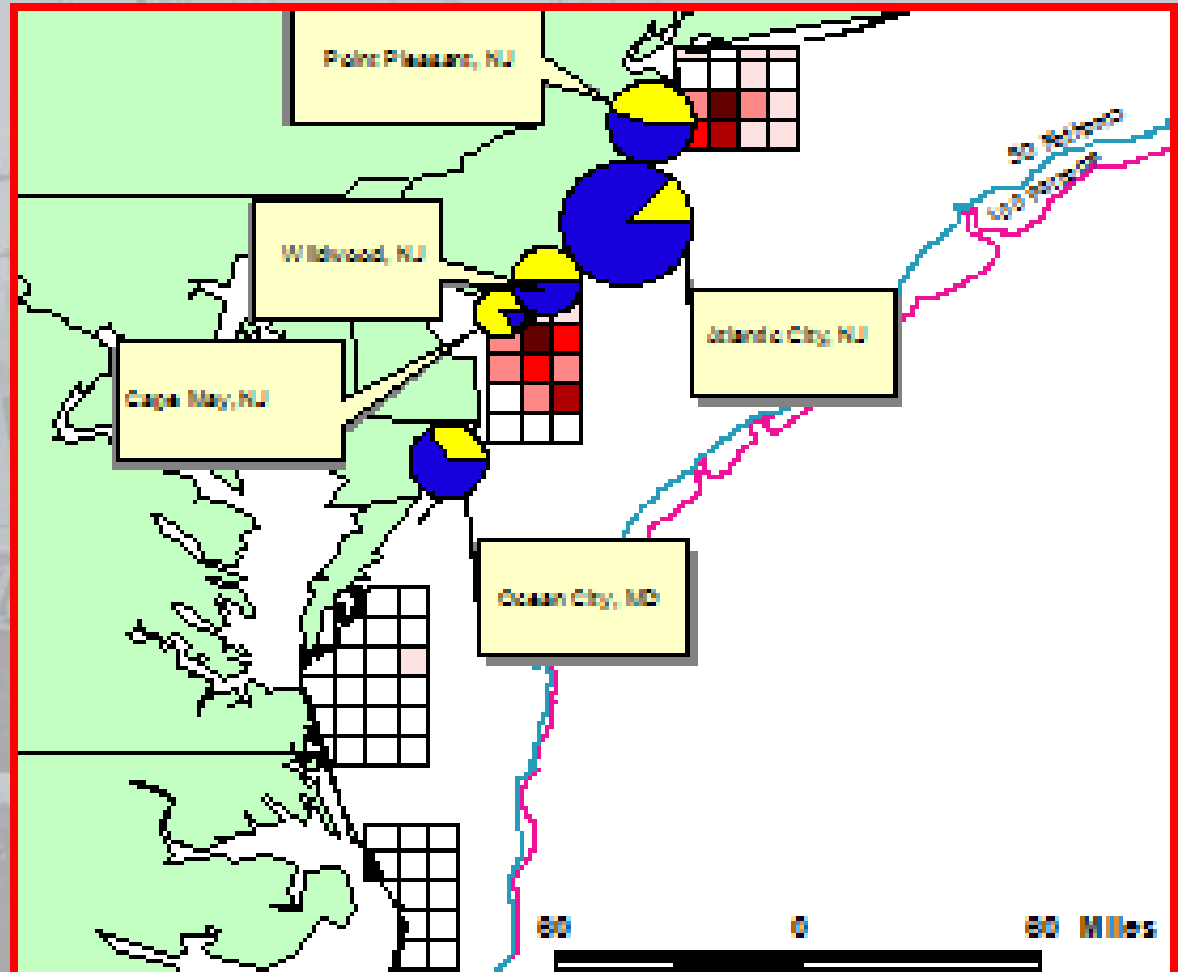
- Catching Efficiency of Survey Dredges; broader surveys



Vulnerability

- Individual units
- Exposure
- Dependency (see map)
- Resources/ Assets
- Example from 2000

GIS on differential
Effects of proposed
Inshore closures





Adaptive Capacity

- Emergent property
 - Aggregate behaviors
 - Collective action
- Ability to respond to change in ways that protect essential components of the fishery system (**industry & community viability; resource productivity**)
 - > diminish, protect, or enhance
 - > negative or positive feedback

Voluntary Behavior

Industry Self organization

Quota

Fleet dispersion

1,3,4

3,4

1,3,4

Size-biased fish mortality

Fishery

Economics/Behavior

Socio-economic model

Quota

Size Limit

Area Management

Political Negotiation

3,4

2,4

1,3

3,4

Regulatory Body

Magnuson control

Climate Forcing

Fecundity

Dispersion Gradient

Mortality Gradient

Growth

Genetics

ROMS with

Model

Larval Model

Recruitment

Mortality

Stock

Population

source/sink

dynamics

Stock status
Stock trends
Life tables

Assessment Model

Assessment Tools and Reference Points

Signals of change in the system

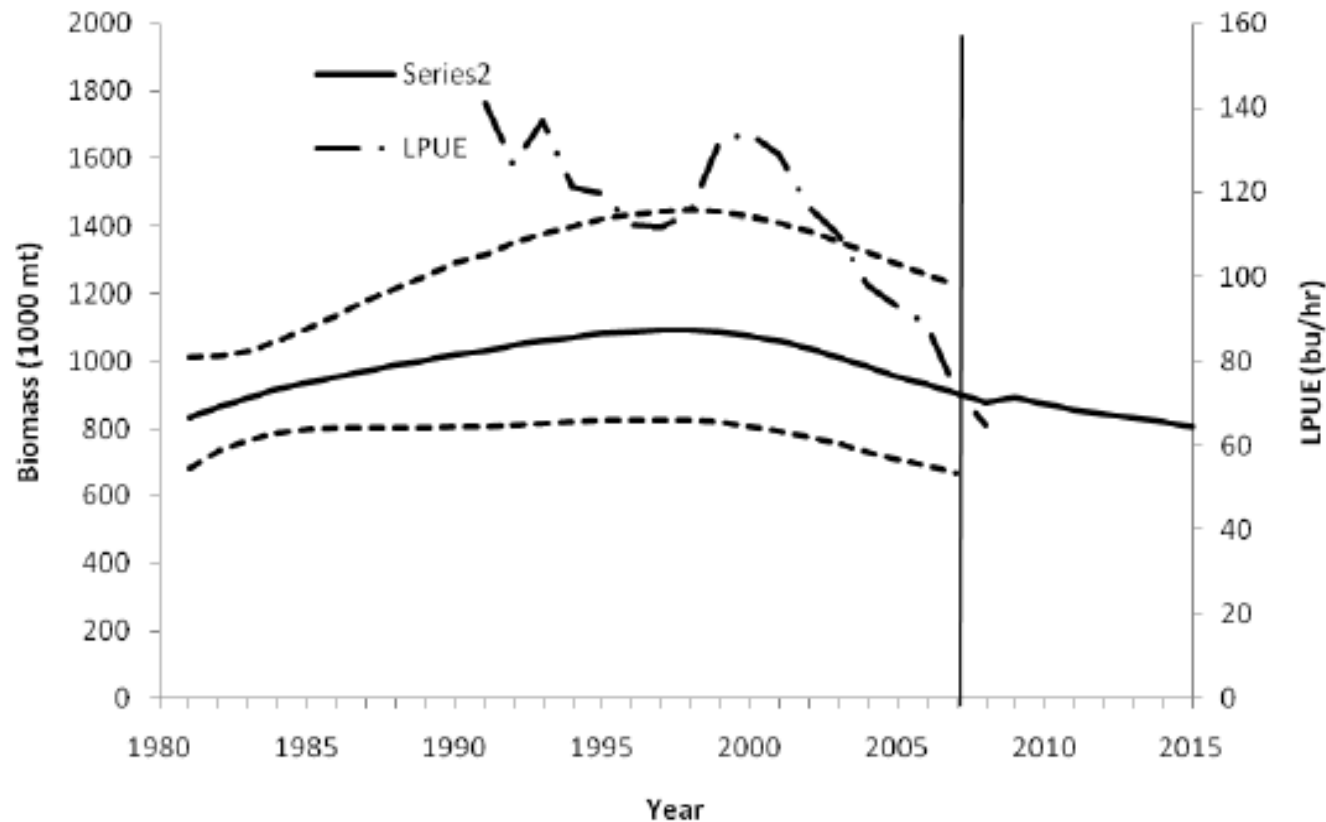
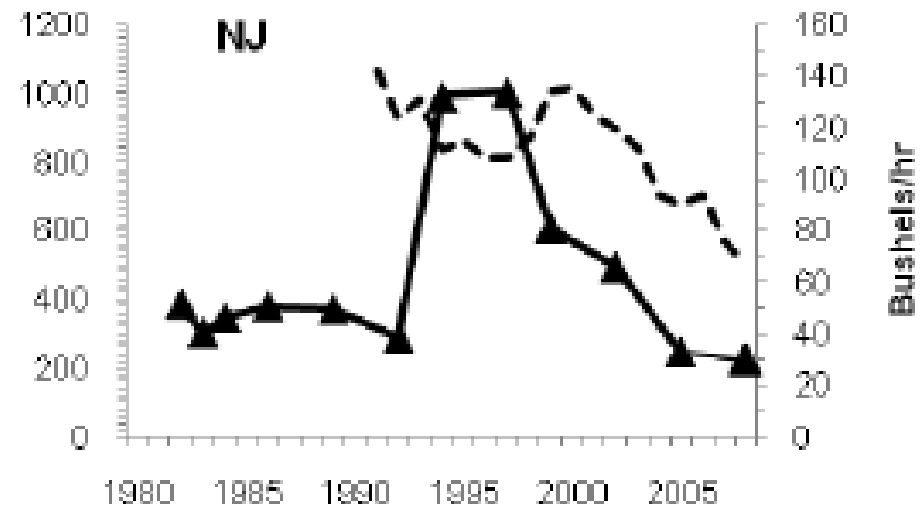
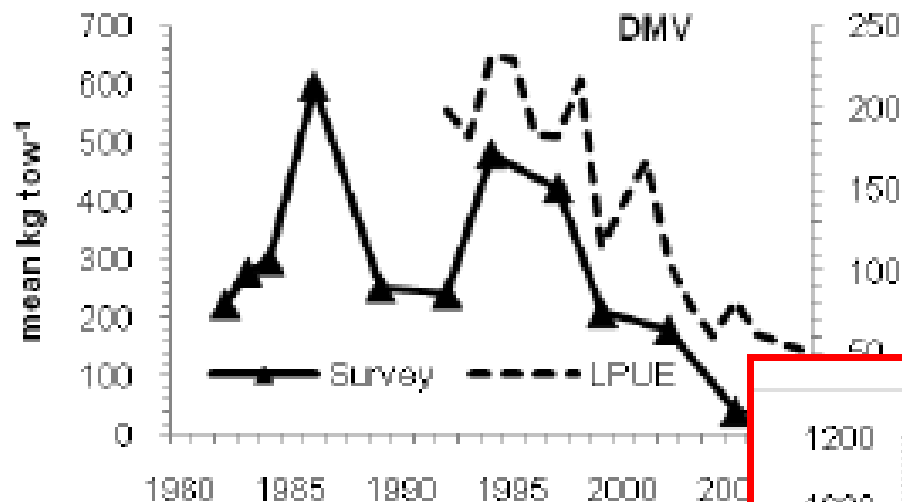


Figure A10. Surfclam biomass estimates (labeled “Series2”) with approximate 80% confidence intervals. Nominal commercial LPUE from logbooks (total reported landings / total reported hours fished, all vessels and all trips) for the entire fishery (not including GBK where fishing did not occur) are shown for comparison. LPUE data were not used in estimating biomass. Projections to 2015, based on industry estimates of landings, are also shown.

Sub-regional Signals: the problem in southern areas of the range



Trends in stock biomass for surfclams (120+ mm SL) based on the NEFSC clam survey and commercial LPUE from logbooks.

responses

- None; absorb losses or compensate internally
- Change fishing behavior;
 - Move to more abundant clam beds
 - Fish more intensively in more abundant clam beds
 - Switch to ocean quahogs, other species
- Effort to reopen Georges Bank (PSP problem)
- Industry reorganization
 - Shift processing northward
 - Buy-outs and consolidation
- Consider voluntary or government management measures

Behavioral Responses: shifting and intensified effort, targeting NJ region

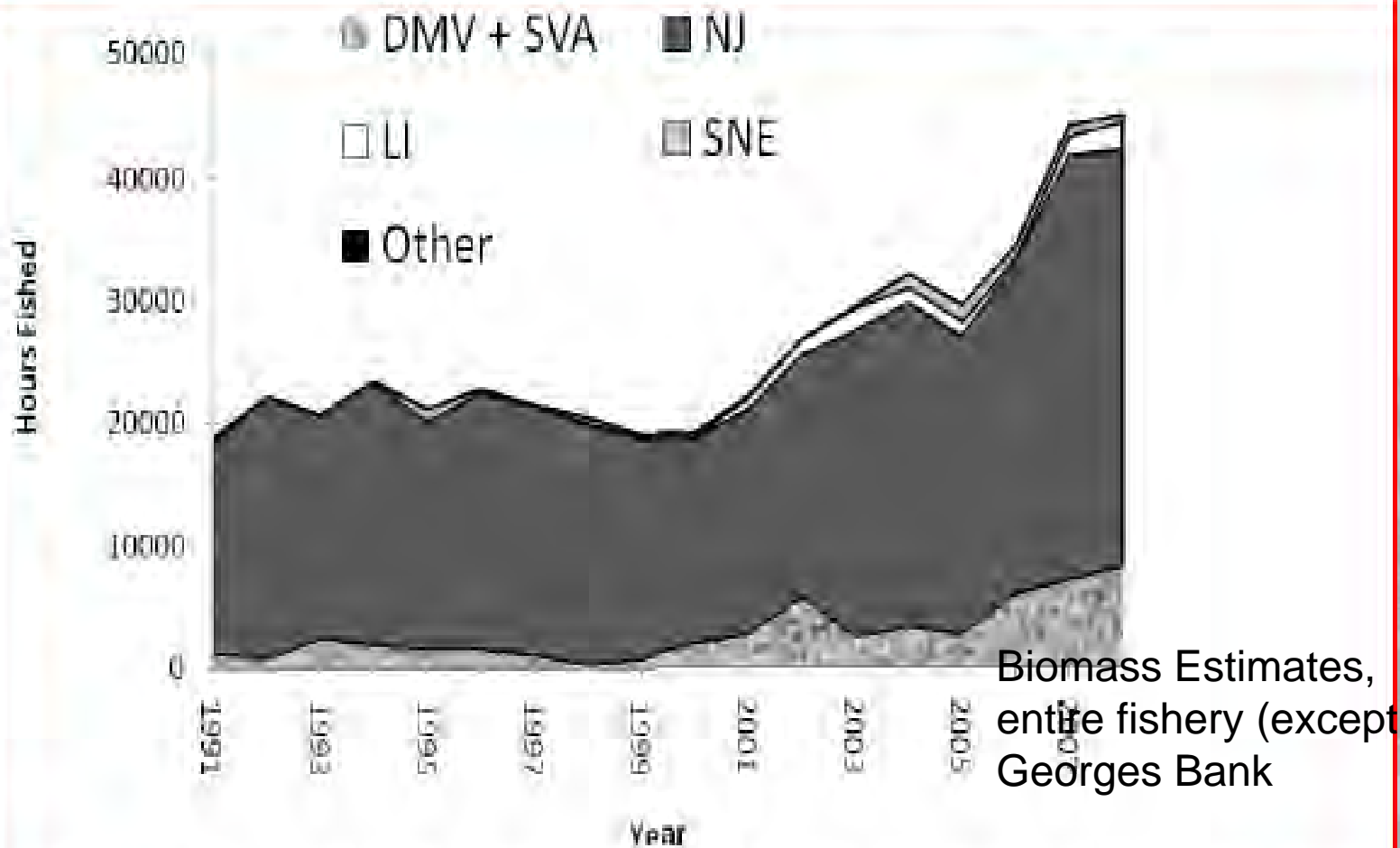
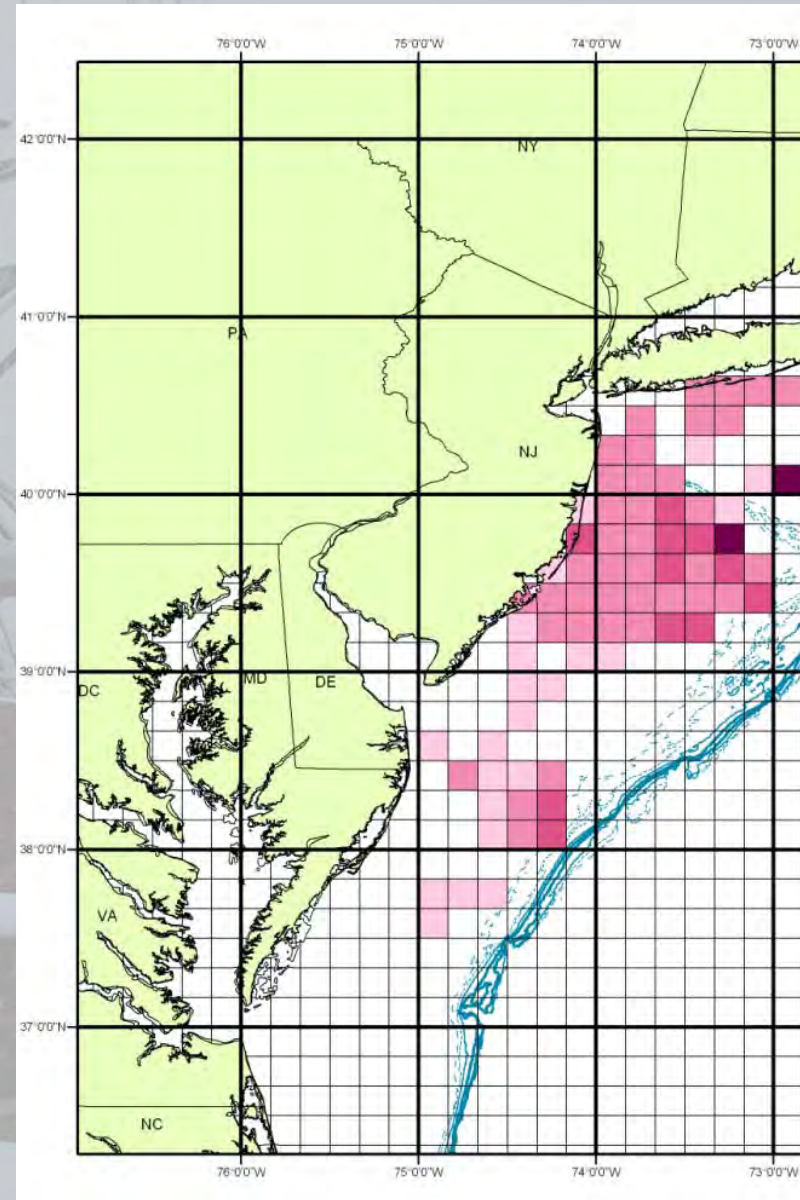


Figure A7. Total fishing effort (hours fished during all trips by all vessels) for surfclam during 1991-2008 in the US EEZ, by stock assessment region.

Feedback of Fleet Behavior to Clams

- Amplifying ?
 - Dampening?
 - Neutral?
 - “sources” versus “sinks”
- Focus on 10-minute square #3973, an “abundance high”



Deviation-mitigating responses [‘adaptation’]?

- Research
- Changes in carrying capacity? Genotypic diversity?
- Implications for stock assessments, if accepted by scientific community.
- Management council responses:
 - Co-management context
 - Closed areas? Size limits? Reduced allowable catches?
- Industry responses:
 - Above (co-management)
 - Voluntary agreements?
 - Or amplify and move to something else?

Institutional Challenges to Adaptive Response

Magnuson-Stevens Act

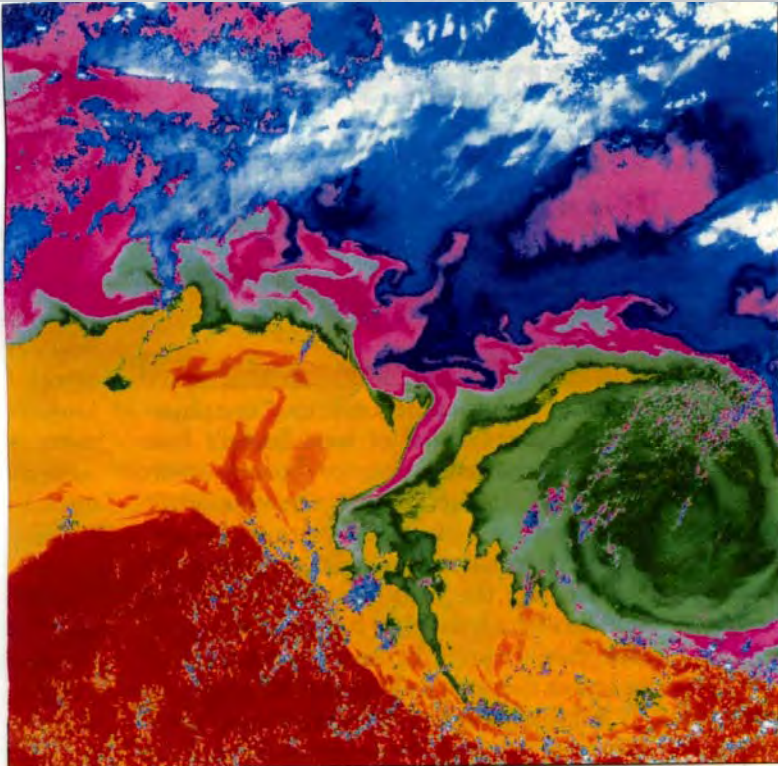
- “overfishing” and “overfished” signals for action, using existing stock assessment models; ...versus other causes of fish stock depletion (now treated vaguely as “e”)
- Overburdened scientific and management organizations
- Recent more precautionary approach; elevating scientific uncertainty
- Quota-setting process; 3 year framework
- Spatial homogeneity assumption: “stock throughout its range”
- ITQs, history of stable quotas, & status quo incentives
- Lag in survey data; possible drop of survey

competing paradigms?

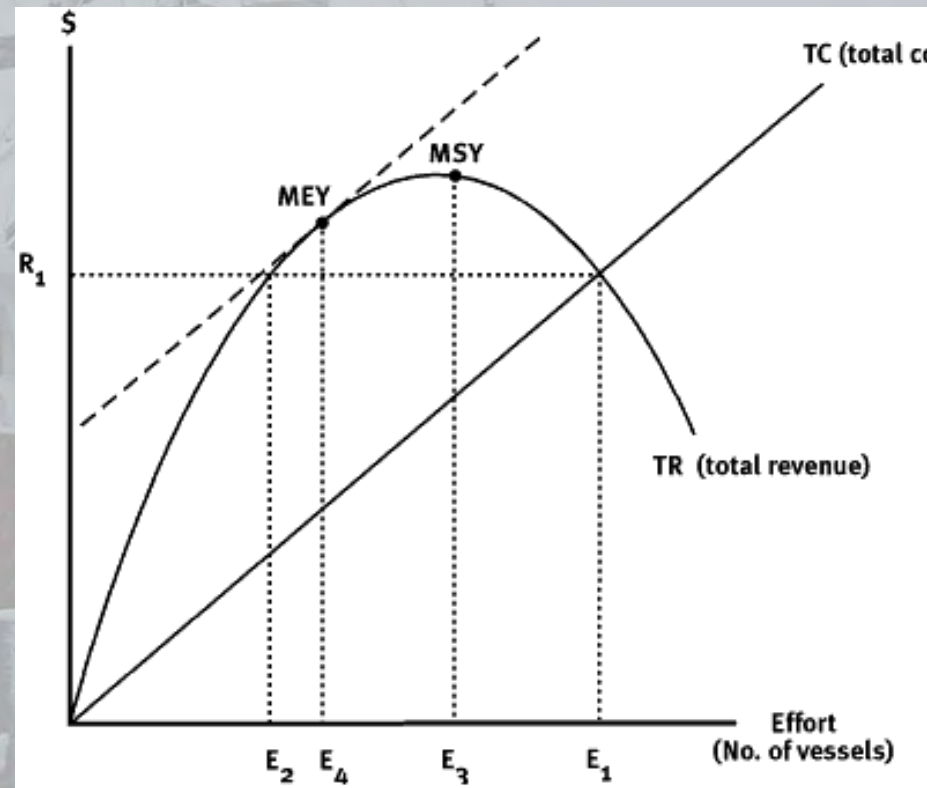
Dynamic & unpredictable

Marine ecosystems: flexibility imperative

Market-based management for greater profitability; predictability imperative



Atlantic jacuzzi. ERS-1's infrared radiometer captured this 200-kilometer-wide swirl of warm water (shown in green in lower right) southeast of Cape Cod, where the Gulf Stream and Labrador current meet, in 1991.



Graph 2 : Relationship between fishing effort and total revenue and total cost

“Comedies of the Commons”



“The drama of humans as social rather than private beings, a drama of social actions having a frankly corrective purpose.” (M.E. Smith, 1984; McCay and Acheson 1987).

Conclusions

- Despite rhetoric, people have not been treated as truly part of marine ecosystems in much research and policy.
- Overemphasis on anthropogenesis of problems, and not of solutions
- Coupled systems analysis: people as active in both positive and negative interaction with other aspects of the ecosystem.
- Else, caught ...

BETWEEN THE DEVIL AND THE DEEP BLUE SEA

