

TMDL's, Benefits and Costs  
prepared for  
*Innovating Policy for Chesapeake Bay Restoration*  
*March 29*

Ted McConnell  
and  
Doug Parker  
Department of Agricultural and Resource Economics  
University of Maryland  
College Park

# The components

- Why bother estimating the benefits?
  - Appropriate for decisions involving scarce resources
- Benefits and costs as a predictor of attainment of environmental goals
- Current state of the Bay: our ability to assess based on benefits and costs
- What we know about benefits
- Caveats about benefit estimation
  - Uncertainty, limited, statistical issues, scale

## Why should we find out about the benefits from Bay restoration?

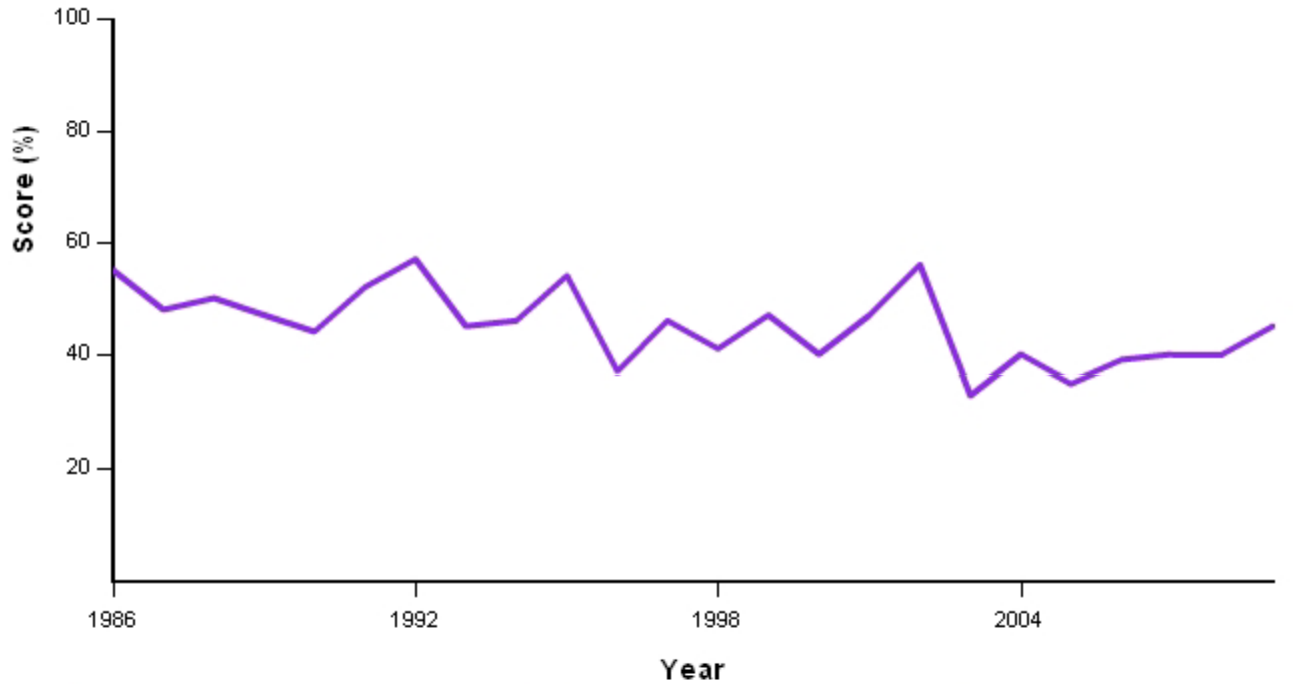
- Expensive—more than \$500 million/year
  - **Prudent to know the benefits**
  - **Compare with Regulatory Impact Analysis**
    - **Circular No. A-94 Revised**
- Deteriorating fiscal situation for all levels of government
- Benefits and costs determine whether attainment achieved.

## Persistent non-attainment cases for air pollution

- Low level ozone in Los Angeles County
  - Very high costs
- Sulfur dioxide for large power plants in the mid-west—  
Title IV of Clean Air Act Amendments
  - Few local benefits
- Compliance for new carbon dioxide standard
  - No local benefits

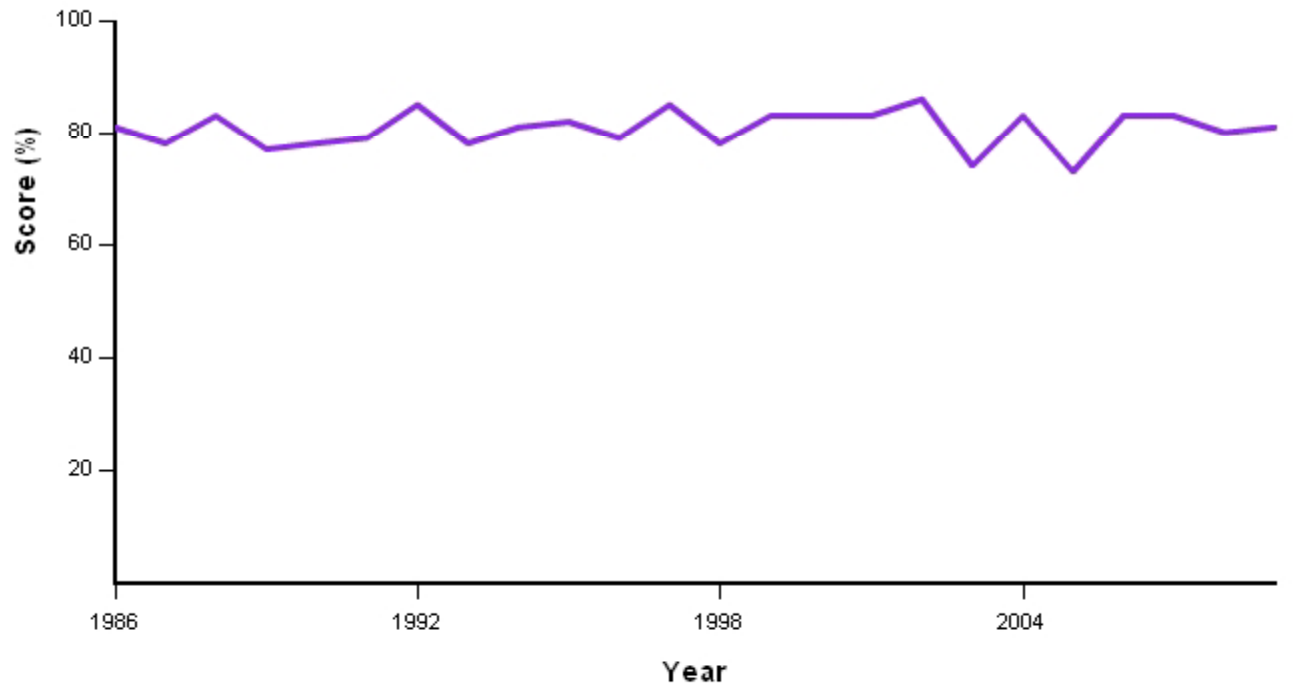
- Bay water quality indicators

# Water Quality Index: 1986-2009



- |                |                               |                          |
|----------------|-------------------------------|--------------------------|
| Choptank River | Elizabeth River               | James River              |
| Lower Bay      | Lower Eastern Shore (Tangier) | Lower Western Shore (MD) |
| Mid Bay        | Overall Bay                   | Patapsco and Back Rivers |
| Patuxent River | Potomac River                 | Rappahannock River       |
| Upper Bay      | Upper Eastern Shore           | Upper Western Shore      |
| York River     |                               |                          |

# Dissolved oxygen, June-September: 1986-2009



- Beyond water quality indicators: assessing the Bay's progress, without benefits and costs



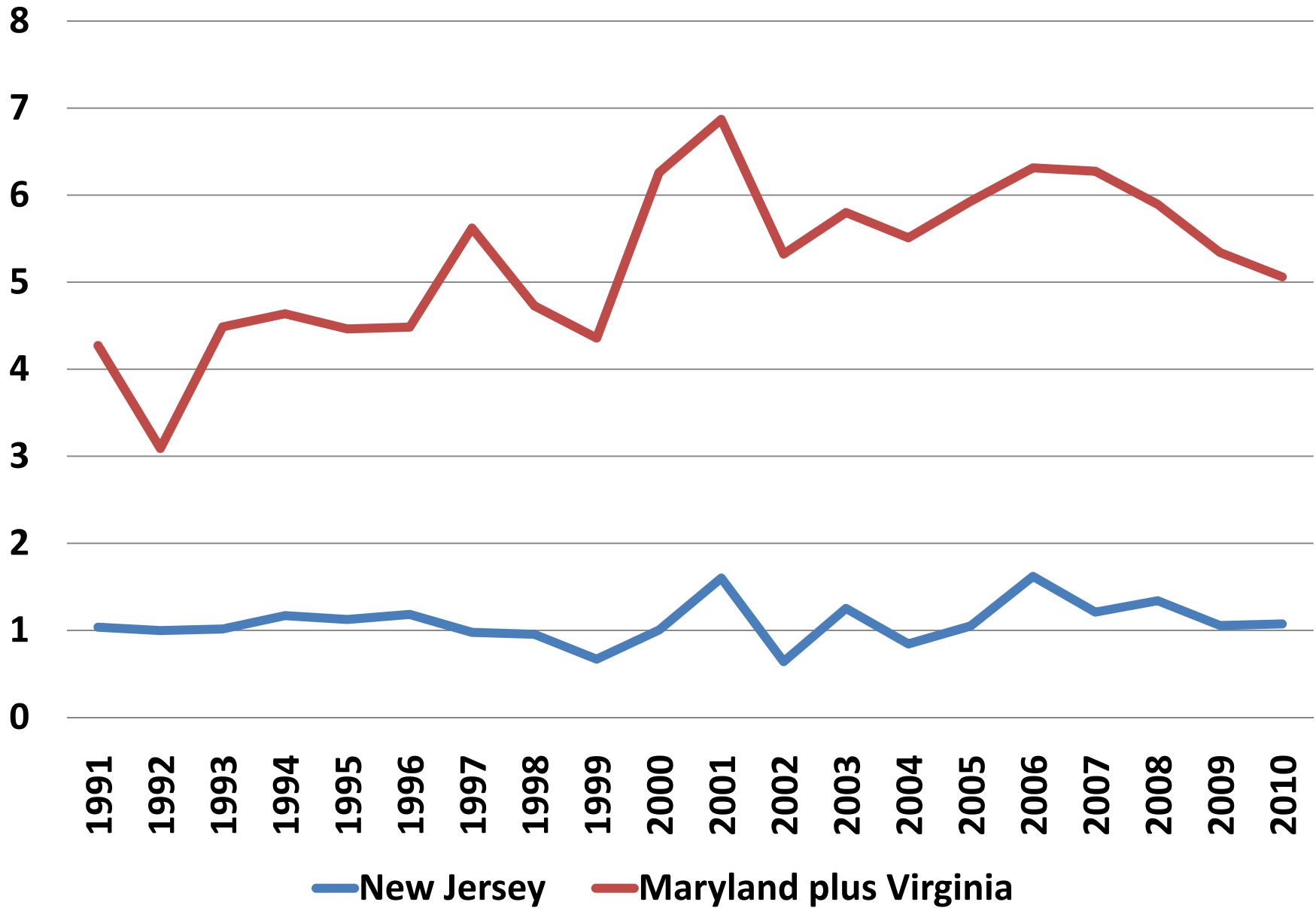
## The Bay restoration:

- Success in preventing a decline in water quality

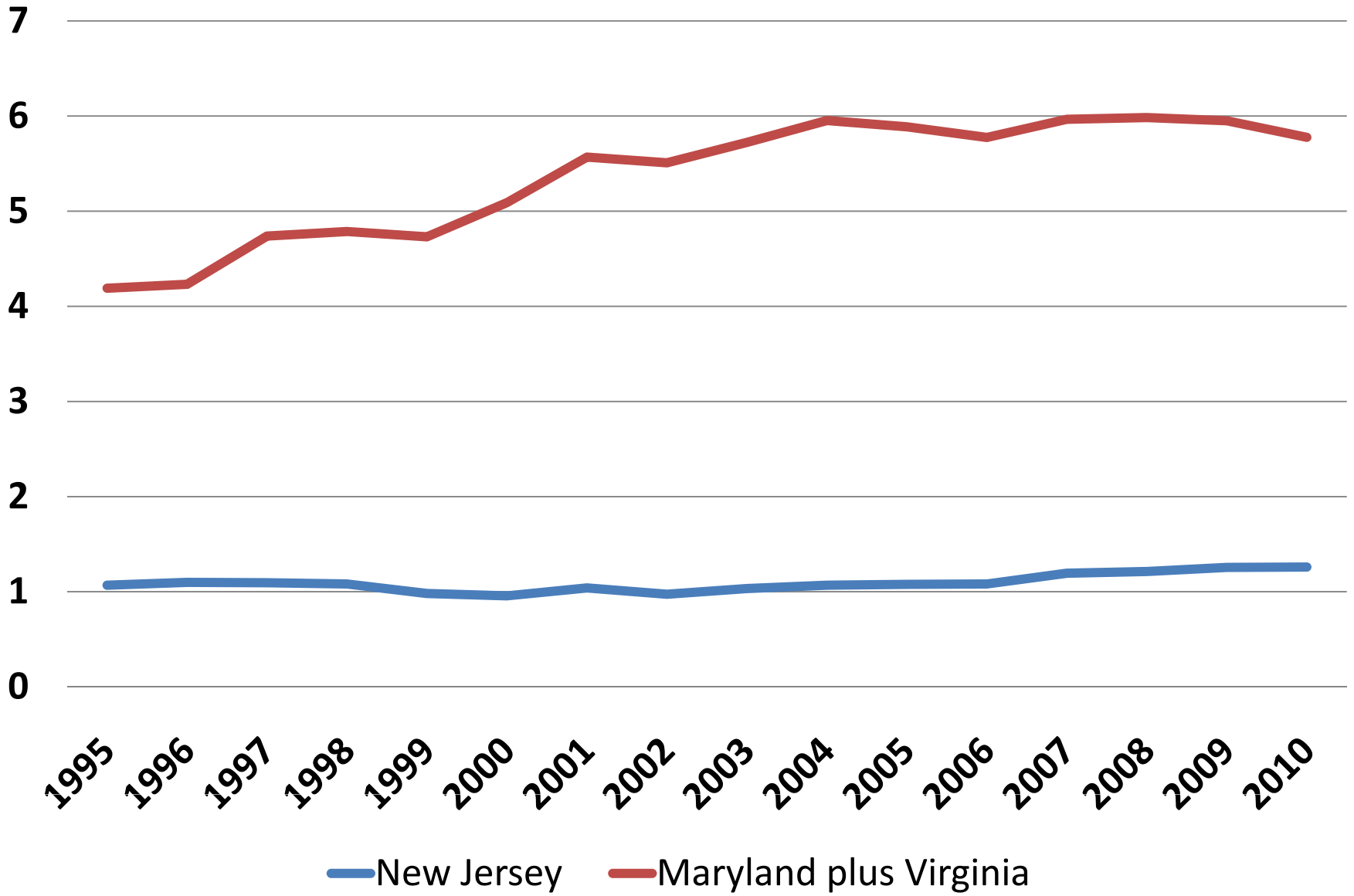
Year	P loads/Population	N loads/Population	N loads /GDP
1986	1.2 lbs	15.3 lbs	2.1 lbs
2009	0.66	9.6	0.72

- Per capita load down
- Load per \$GDP down
- Shows in the Bay scorecards

## Saltwater Recreational Fishing Trips, Inland (Millions)



## Saltwater Recreational Fishing Trips, Inland (Millions, 3 Year Moving Average)



## What are benefits? Monetary measure of the gains from a policy decision

- Dollar value of all net gains, from a project or program, added up over all people who gain
- OMB Circular A-94 revised : **Measuring Benefits and Costs.** “The principle of *willingness-to-pay* provides an aggregate measure of what individuals are willing to forego to obtain a given benefit. “
- Relevant value is incremental—willingness to pay for *additional* services
- Key: benefits are the *consequence* of a policy or program.
- Not* total values
  - no event that leads to complete loss of resource

Benefits: willingness to pay – actual amount paid:  
appropriate for decisions

- OMB guidelines
- Court cases involving natural resource damages—oil spills etc.
- Anti-trust cases
- A little illustration: net gains versus impacts

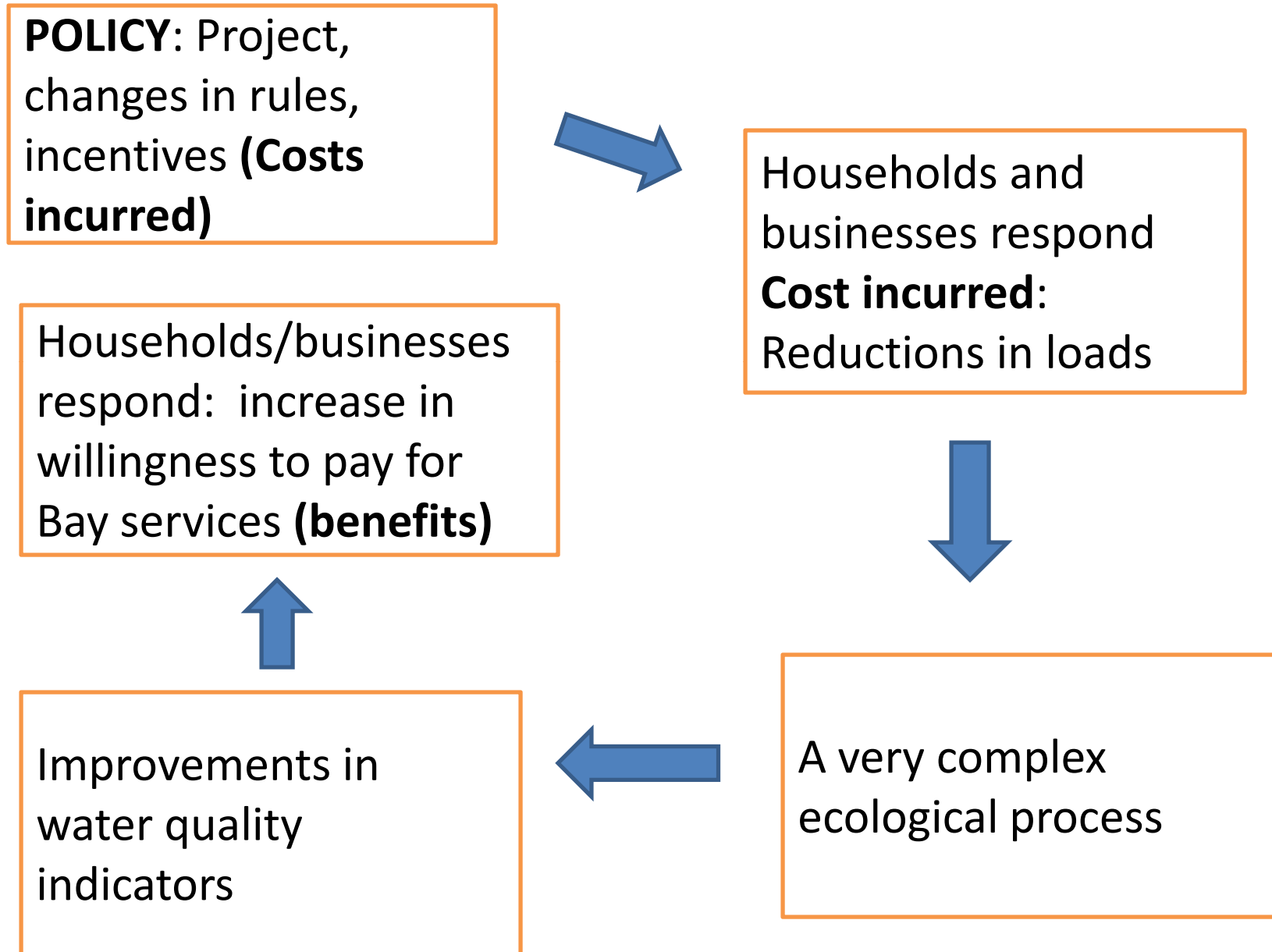
# Net benefits versus Economic Impact

- Benefits and Costs
  - Means of assessment
  - Decision criterion
- Economic Impact
  - Political rhetoric

## Main sources of benefits

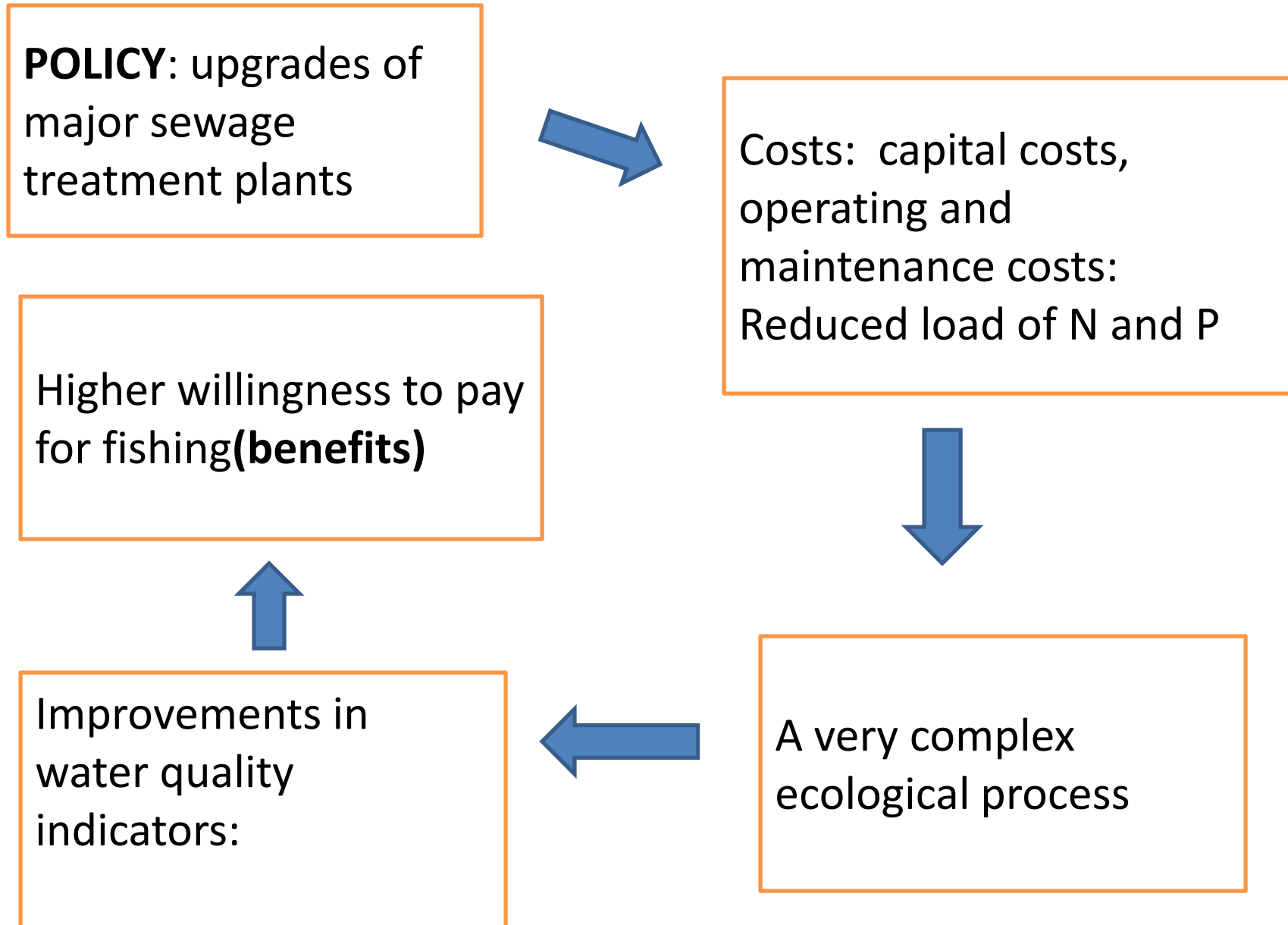
- Recreation
  - Fishing
  - Boating
  - Swimming
  - Crabbing etc
- Aesthetics
- Non-use values
- Net values from commercial harvesting
  - Producer plus consumer willingness to pay

## From Start to Benefits





## Example: Enhanced Nutrient Reduction



# Research on benefits of restoring the Bay



- Kahn and Kemp, 1985--equilibrium model
  - Bockstael McConnell Strand, 1988, 1989
  - Anderson 1989—equilibrium model
- 

- Leggett and Bockstael 2000
  - housing prices depend on coliform counts
- Lipton and Hicks 2001
  - striped bass catch rates as a function of DO
- Mistiean Strand and Lipton 2003
  - bioeconomic model of crab harvest and growth, function of DO
- Morgan and Owen 2003—Clean Water Act evaluation—with and without CWA N and P loads
  - uses Bockstael et al results

# Research on benefits of restoring the Bay continued

- Von Haefen 2003
  - Recreational use
  - Susquehanna flats only—uses Trophic State Index
- Lipton 2004
  - Boating
  - hypothetical valuation—five states of water quality
- Poor Pessagno and Paul 2007
  - Housing prices depend on TSS, DIN
  - St Mary's county
- Van Houtven and Clayton 2008—nitrogen deposition
  - assumed a 2.1 mg/L increase in DO throughout the Bay
  - used Lipton and Hicks 2003, Bockstael et al. 1985

# Characteristics of these studies

1. All studies prior to 1990 should be regarded as experimental
2. Focus on program, policy or scenario  
i.e. incremental values
3. Look at net benefits—i.e. value added to households
4. Water quality changes  behavior changes  benefit changes
5. **No non-use values!**
6. Aesthetic values—Poor et al?, Leggett and Bockstael
7. Partial measures—particular species or areas of Bay, exploratory rather than evaluative
  - Van Houtven, Morgan and Owen exceptions

# What to do about increasing benefits and reducing costs?

- To estimate Bay benefits,
  - Program, five year horizon
  - Like the Delaware Bay water quality program of the 60's.
  - Suppose we achieve TMDL goals—what do we gain in benefits?
- Local areas—target reductions in fecal coliforms
- Reducing costs:
  - Experiment
  - Use incentives