

# **The Use of Indicators in International Large Marine Ecosystem Programs and a Baseline for the U.S. Northeast Shelf**

Northeast Coastal Indicators Summit

UNH

6 to 8 January 2004

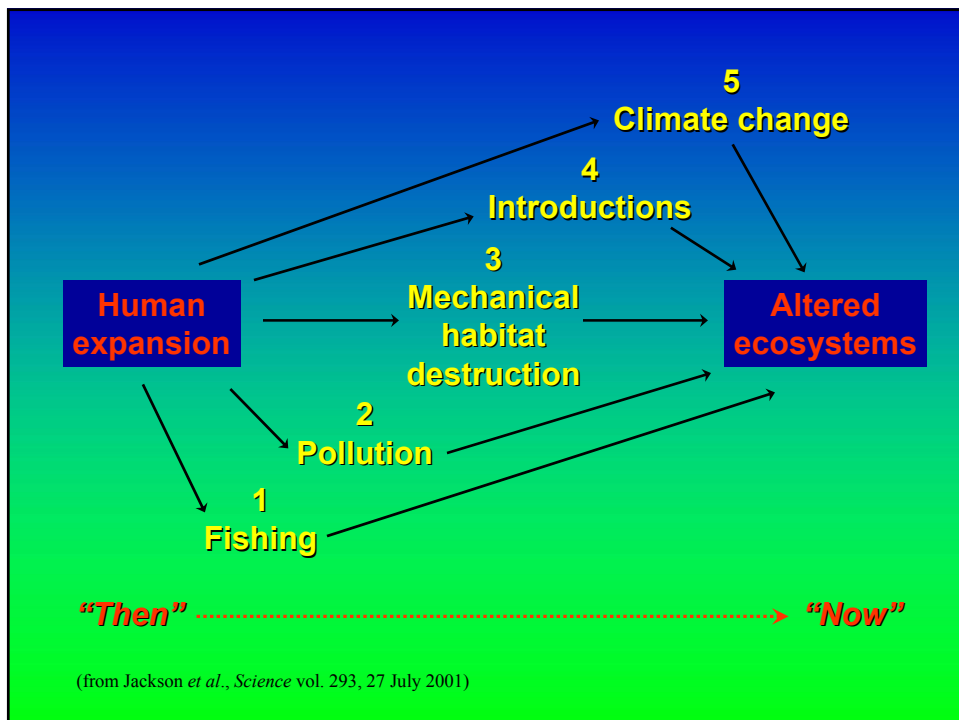
## **WORLD SUMMIT ON SUSTAINABLE DEVELOPMENT: ACTIONS AND TARGETS**

- **Strengthen regional cooperation**
- **Encourage the application of the ecosystem approach-- by 2010**
- **Maintain or restore fish stocks to levels that can produce maximum sustainable yield (MSY)-- on an urgent basis and, where possible, no later than 2015**

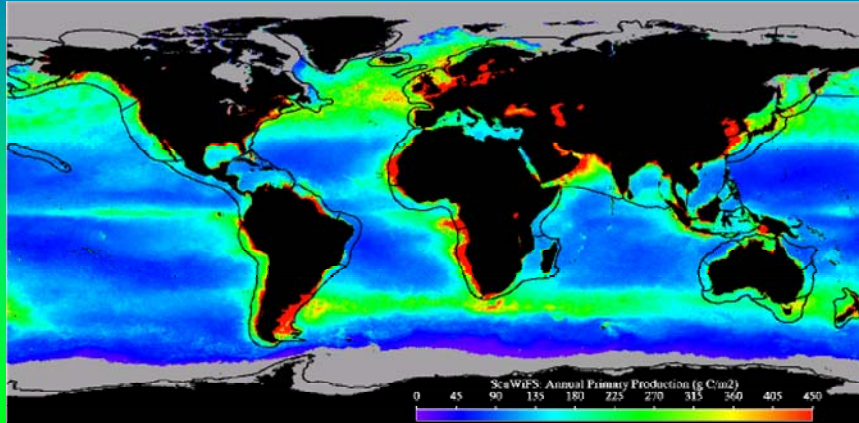
From the Secretariat: "Guide to Oceans, Coasts and Islands at the WSSD and Beyond: Integrated Management from Hilltops to Oceans" Dec. 2002 report

## Selected, Ecosystem Related WSSD Targets and Program of Action (POI)

- Land-based Sources of Pollution  
POI – Substantially reduce by 2006
- Ecosystem-based Approach  
POI – Introduce by 2010
- Marine Protected Areas  
POI - Designated Network by 2012
- Restoration and Sustainability of Fisheries  
POI – On an urgent basis and where possible to MSY by 2015



## 95% of the World's Annual Marine Fishery Catches are Produced in 64 LMEs

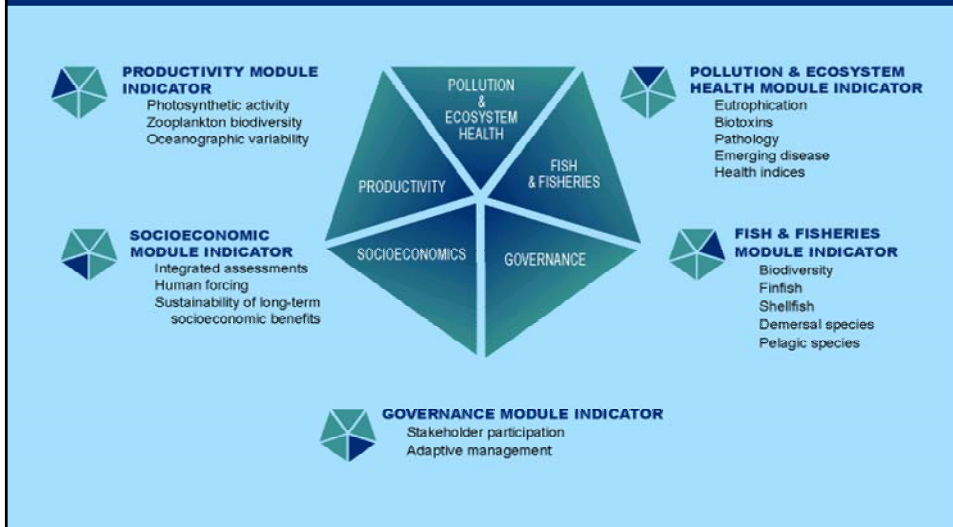


## ECOLOGICAL CRITERIA USED TO DETERMINE AREAL EXTENT OF LMES:

- Bathymetry
- Hydrography
- Productivity
- Trophodynamics

## Modular Assessments

Support LME Restoration and Sustainable Development



## Funding support from the Global Environment Facility, for projects linking environmental protection to resource development and sustainability

First tranche of projects:

Supported at \$2.1 billion funding level, 1994-1998

Second tranche of projects: supported at \$2.7 billion funding level, 1999-2002

Third tranche of projects: supported at \$3.0 billion funding level, 2002-2005

Categories for funding include:

- Global climate change (ozone)
- Biodiversity
- International waters

126 Developing Countries  
Participate in LME Assessment and  
Management Projects in Africa,  
Asia, Latin America and Eastern  
Europe.

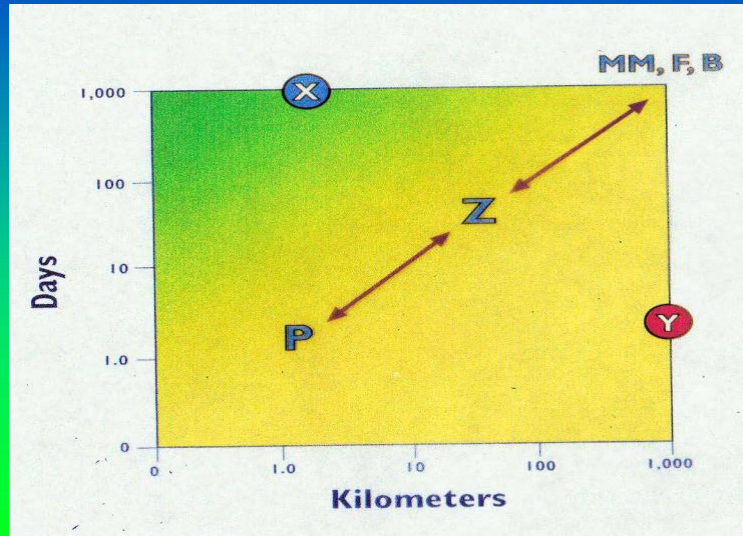
GEF and Country Investment in  
Projects as of January 2004 = \$650  
million.

## LMEs ARE GLOBAL CENTERS OF EFFORTS TO:

- **REDUCE** coastal pollution
- **RESTORE** damaged habitats  
(Coral reefs, mangroves, sea grasses)
- **RECOVER** depleted fishery stocks



## TEMPORAL AND SPATIAL SCALE RELATIONS FOR SELECTED INDICATORS

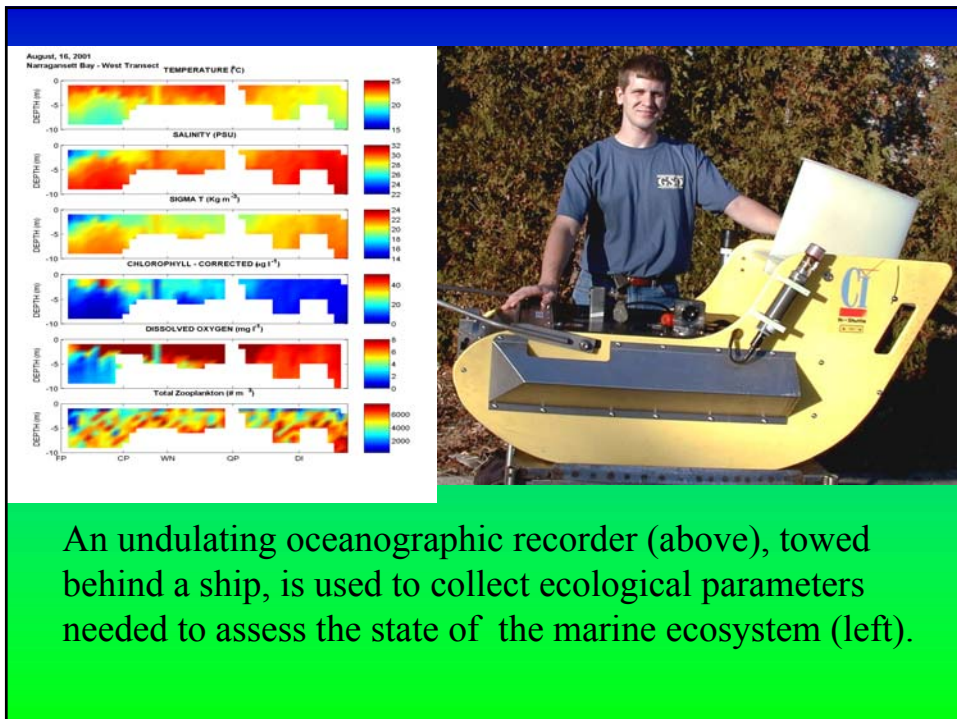


## INDICATORS OF CHANGING ECOSYSTEM STATES:

**Productivity**  
**Fish and Fisheries**  
**Pollution**  
**Socioeconomic**  
**Governance**

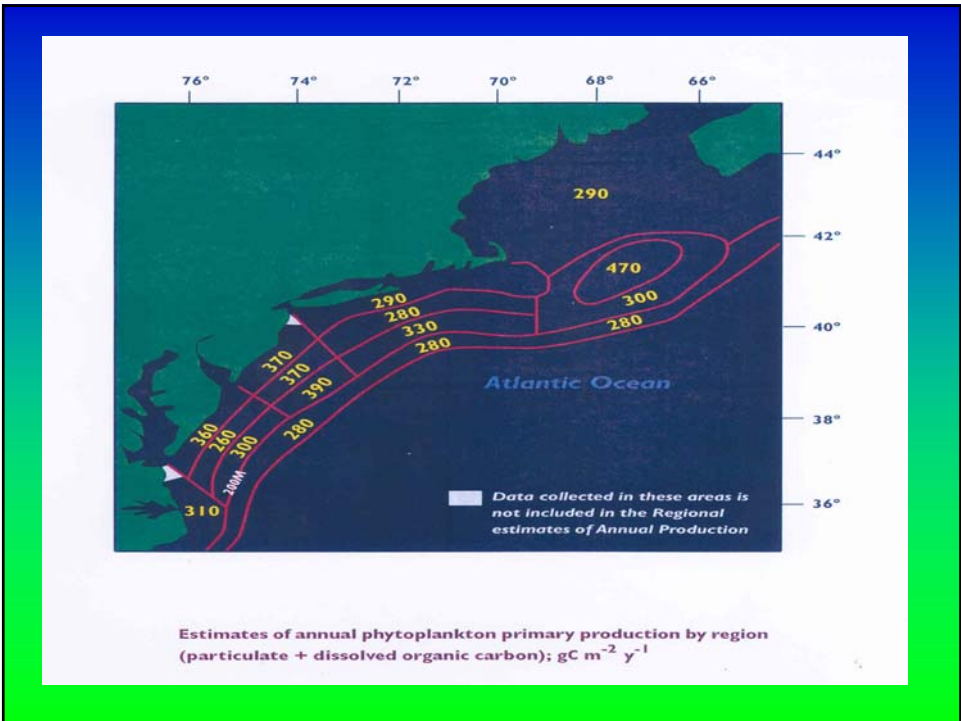
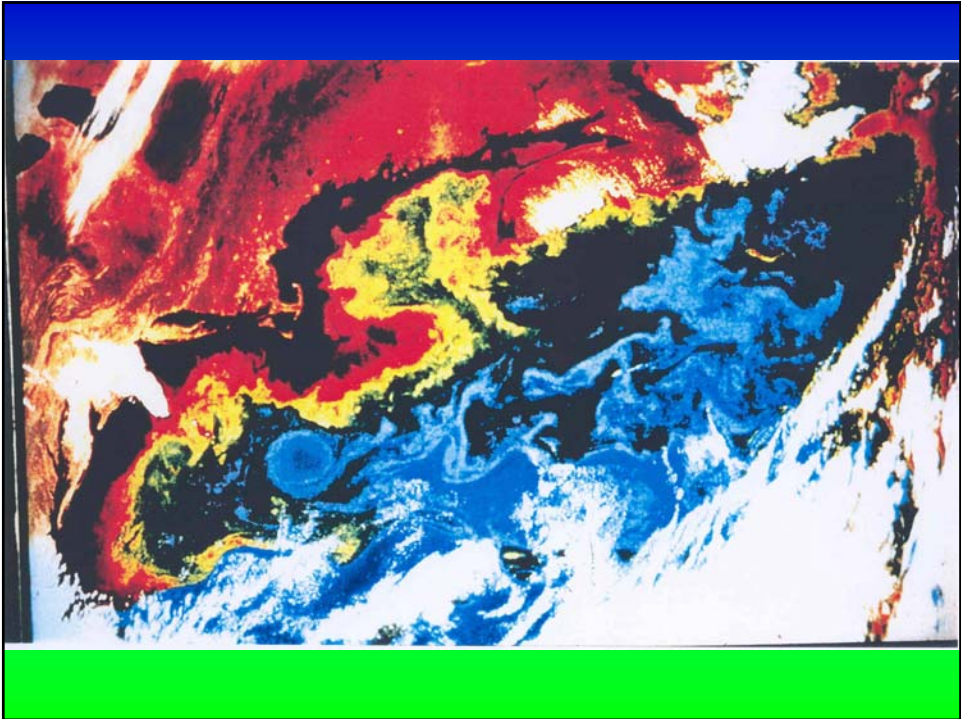
# PRODUCTIVITY INDICATORS:

- Primary productivity ( $gc/m^2/y^1$ )
- Chlorophyll *a* ( $\mu g/l$ )
- SST; water column temperature
- Photosynthetically active radiation (PAR)
- Nitrogen
- Zooplankton biomass ( $cc/100m^3$ )
- Zooplankton biodiversity ( $n/100m^3$ )



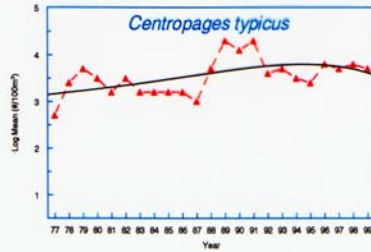
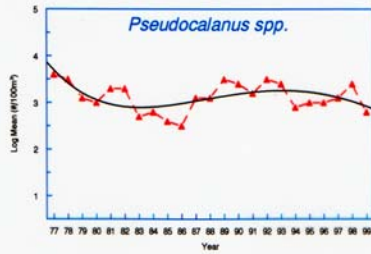
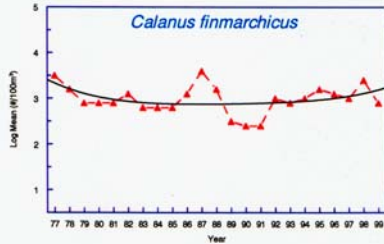
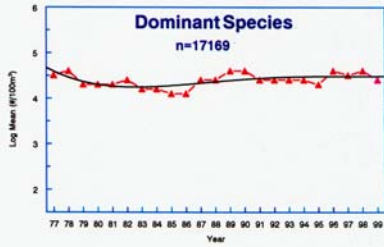
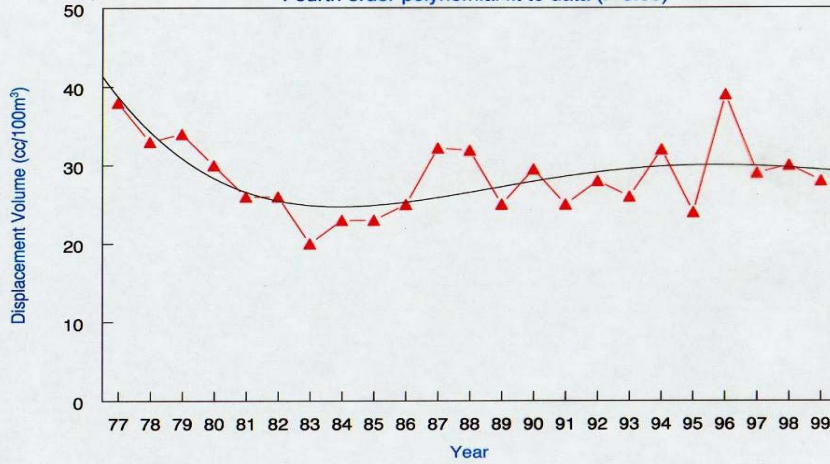
An undulating oceanographic recorder (above), towed behind a ship, is used to collect ecological parameters needed to assess the state of the marine ecosystem (left).

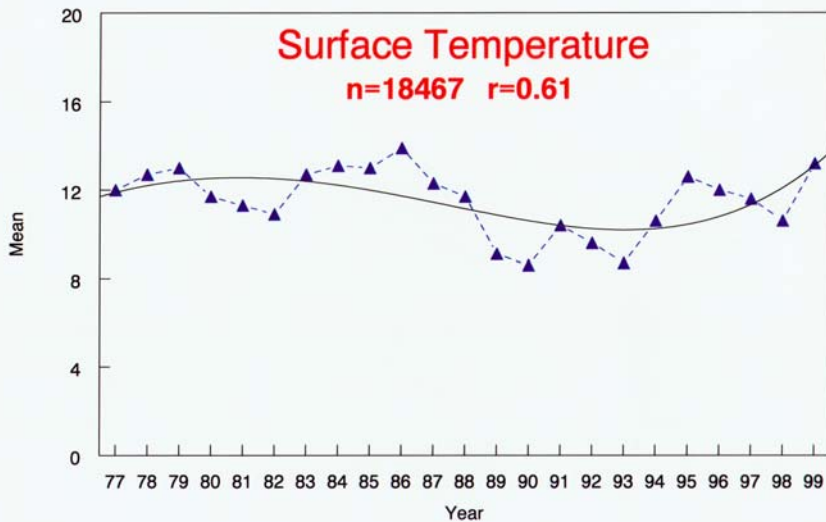




## U.S. Northeast Shelf Ecosystem Annual Median Zooplankton Biomass 1977 - 99

Fourth order polynomial fit to data ( $r=0.68$ )



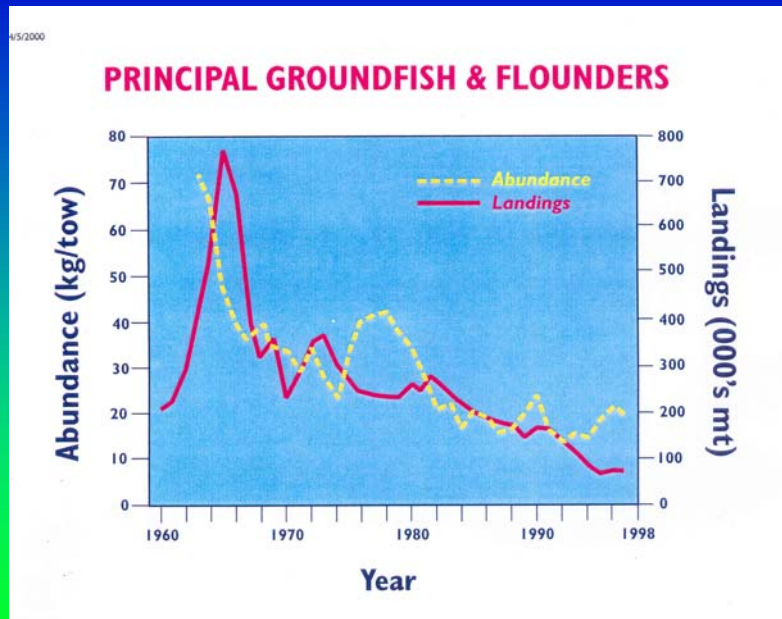


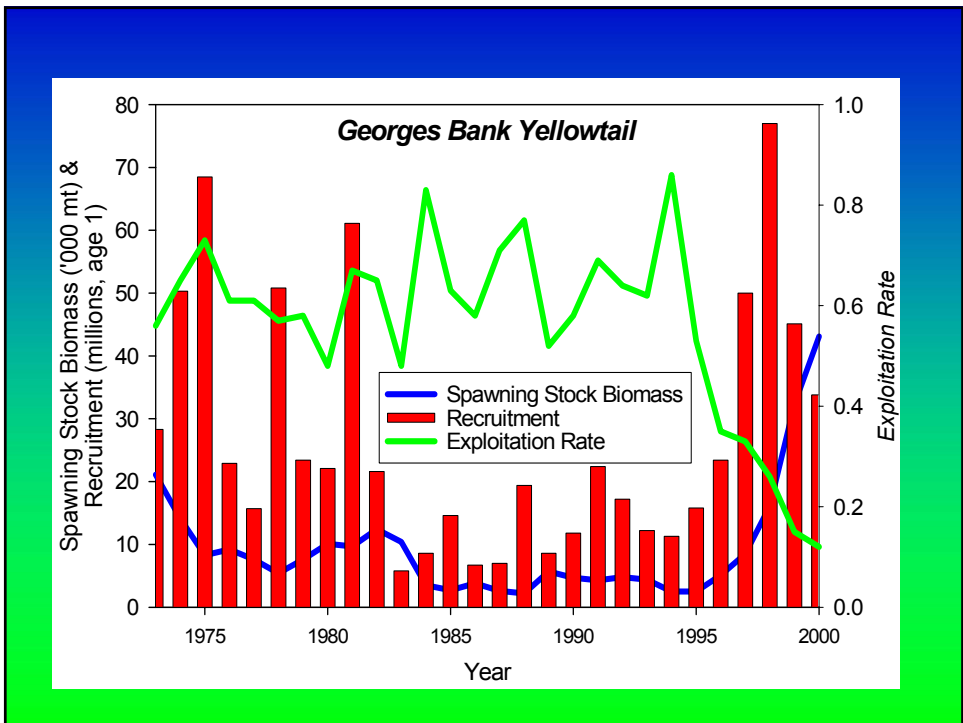
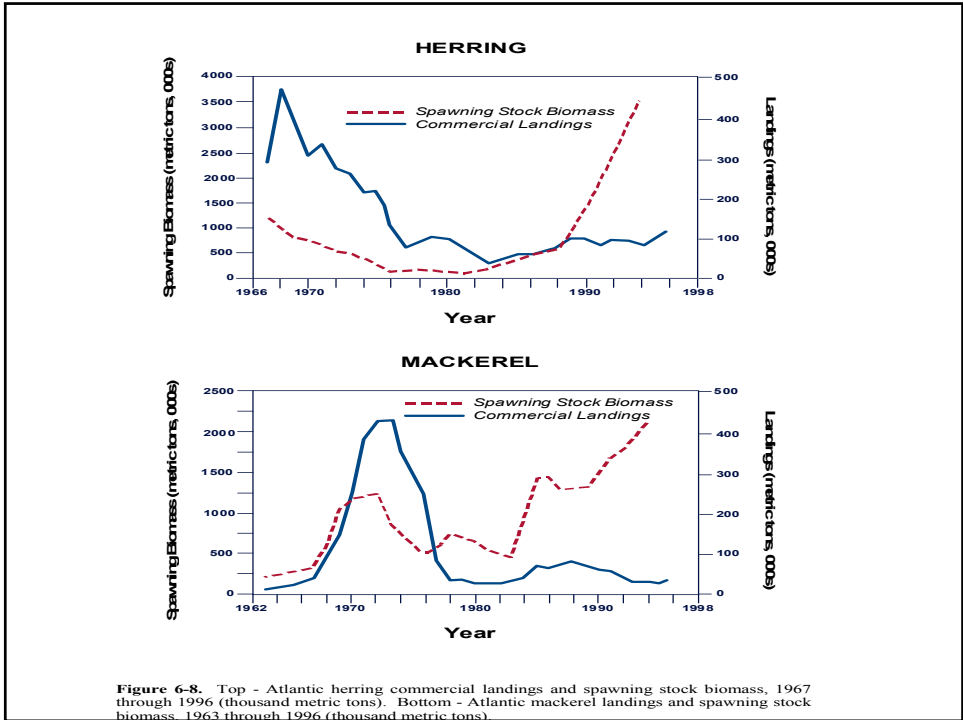
## **FISH AND FISHERIES INDICATORS**

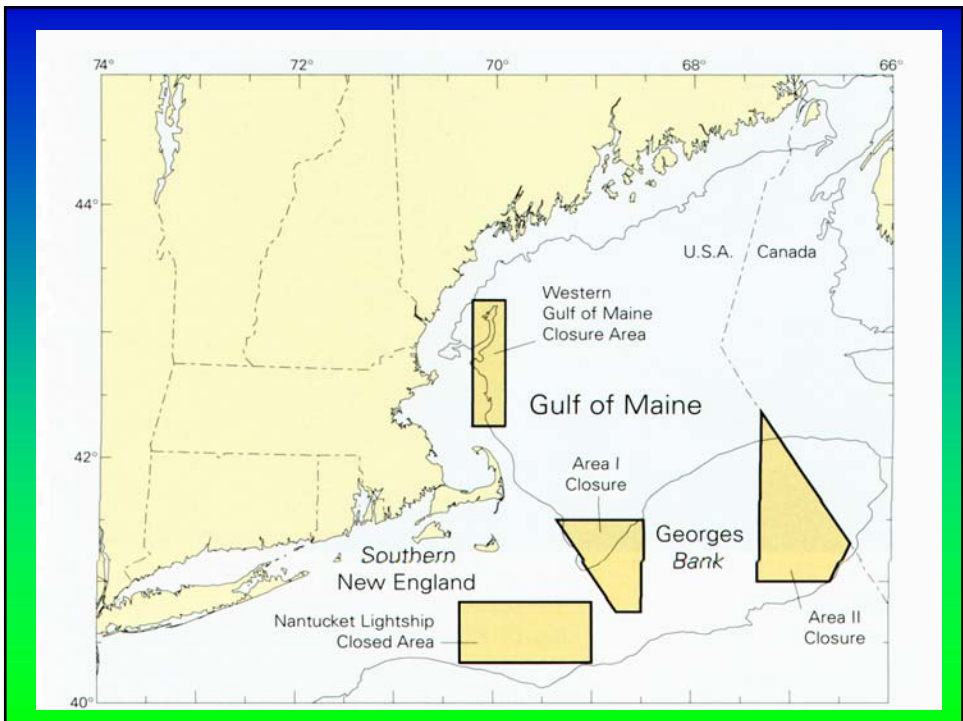
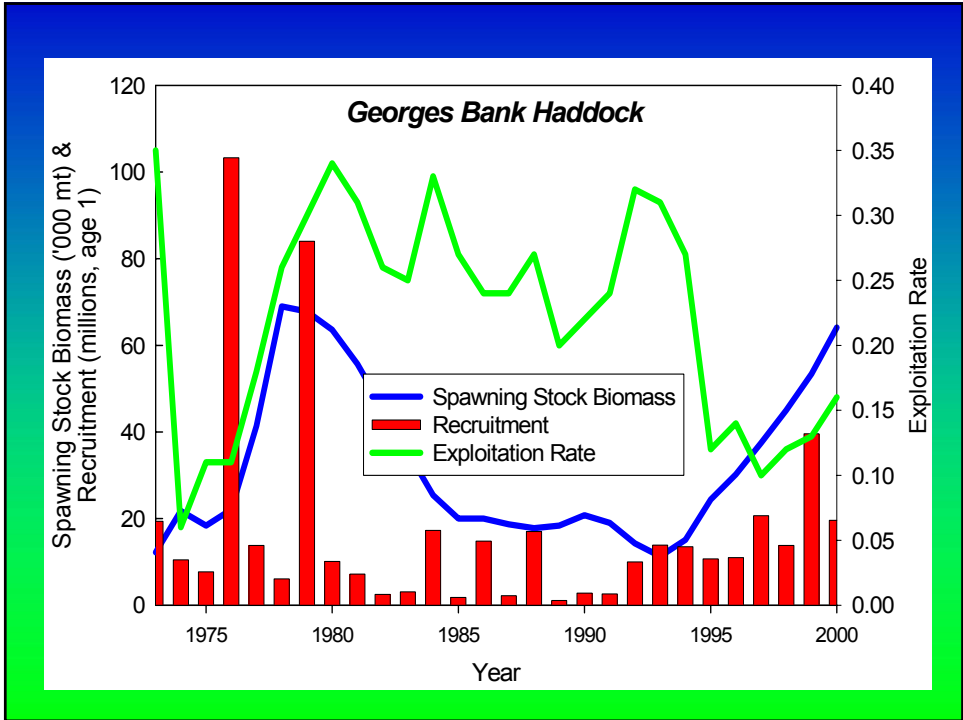
- **Demersal species surveys**
- **Pelagic species surveys**
- **Ichthyoplankton surveys**
- **Invertebrate surveys (clams, scallops, shrimp, lobster, squid)**
- **Essential fish habitat**
- **Marine protected areas**

## COMMON TERMS from Our Living Oceans Report

- Recent average yield (RAY)
- Current potential yield (CPY)
- Long term potential yield (LTPY)
- Stock level relative to LTPY
- Status of resource utilization
- Threatened or endangered
- Potential biological removal (PBR / MMPA)














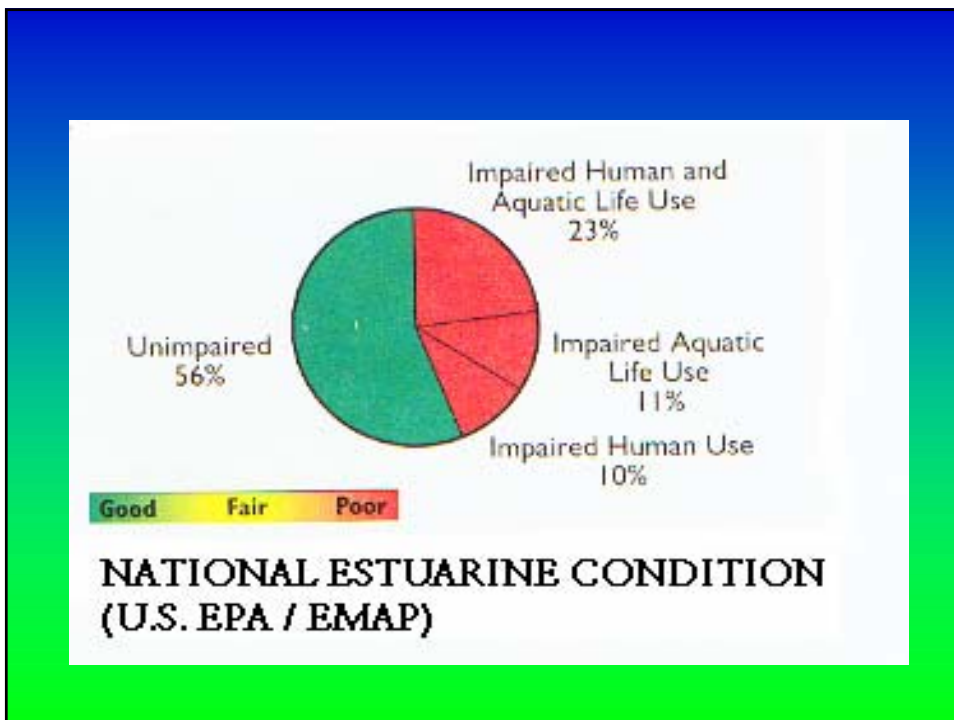
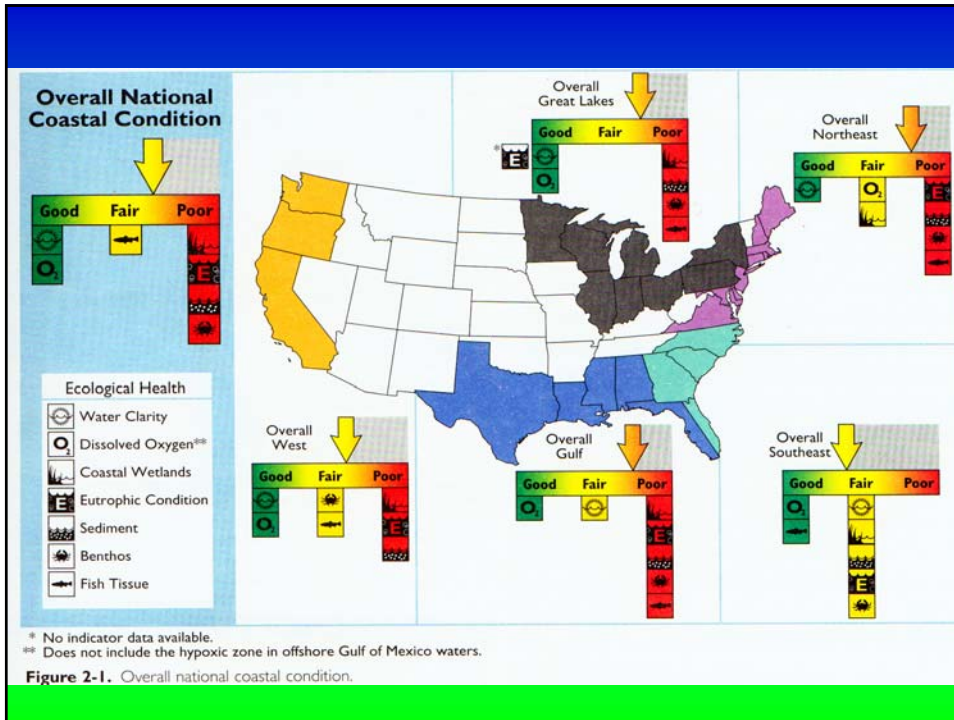
# EPA's 2001 Coastal Condition Report Pollution and ecosystem health indicators

- National Coastal Condition Report
  - EPA
  - NOAA
  - US Dept. of Interior
  - USD
- 2004 NCCR2 and OLO

## How the Indicators Are Calculated

Overall condition for each coastal area was calculated by summing the scores for the seven indicators and dividing by 7, where good = 5, fair = 3, and poor = 1. The Gulf Coast, for example, received the following scores:

	Indicator	Score
	Water Clarity	3
	Dissolved Oxygen	5
	Coastal Wetland Loss	1
	Eutrophic Condition	1
	Sediment Contamination	1
	Benthic Index	1
	Fish Tissue Contaminants	1
	<b>Total Score Divided by 7 = Overall Score</b>	13/7 = 1.86





## Volumes of Peer Reviewed Published LME Case Studies

<b>AAAS</b>	<b>5</b>
<b>Blackwell Science</b>	<b>4</b>
<b>Elsevier Science</b>	<b>3</b>

## ECOSYSTEM MANAGEMENT: A PARADIGM SHIFT

FROM	TO
Individual species	Ecosystems
Small spatial scale	Multiple scales
Short-term perspective	Long-term perspective
Humans: independent of ecosystems	Humans: integral part of ecosystems
Management divorced from research	Adaptive management
Managing commodities	Sustaining production potential for goods and services

NOTE: Some of the substantive changes between traditional resource management and ecosystem management.