Integration of Ecological Indicators for the North Pacific with Emphasis on the Bering Sea: A Workshop Approach

Report on Two Pre-workshops: 25 January 2006 in Anchorage, Alaska, and 8 February 2006 in Seattle, Washington

Prepared by Gordon H. Kruse

Introduction

In spring 2005, the North Pacific Research Board (NPRB) approved and funded a proposal submitted by the North Pacific Marine Science Organization (PICES) to conduct a workshop on Bering Sea ecosystem indicators. The workshop is scheduled for June 1-3, 2006 in Seattle, Washington. As stated in the proposal, the workshop will involve four activities: (1) involve the Bering Sea and international communities in developing a set of operational objectives for the southeastern Bering Sea ecosystem, (2) evaluate two status reports on the North Pacific marine ecosystem with a goal of integrating results and streamlining the presentation, (3) investigate methodologies that monitor system-wide structural changes within the marine ecosystem, and (4) identify steps in validating indicator performance, improving the monitoring network, and integration of predictive models.

In preparation for this workshop, two pre-workshops were held – one on 25 January 2006 in Anchorage and the other on 8 February 2006 in Seattle. The former was held as an afternoon session at the conclusion of the annual Marine Science in Alaska Symposium and the latter was held as an evening session during the meeting of the North Pacific Fishery Management Council.

The purpose of this report is to summarize the proceedings of these two pre-workshops. Questions and comments were actively sought by the members of the audience. We are very grateful to Bill Bechtol of the University of Alaska Fairbanks for taking notes during the Anchorage workshop. Additional notes were taken by Gordon Kruse during both the Anchorage and Seattle pre-workshops.

Oral Presentations

Both pre-workshops followed the same format. At the Anchorage pre-workshop, Gordon Kruse of the University of Alaska Fairbanks gave an overview of this ecosystem indicators project, as well as a summary of the concepts behind an ecosystem approach to fisheries management. Diana Evans of the North Pacific Fishery Management Council staff gave an overview of the groundfish fishery management policy objectives that were developed by the North Pacific Fishery Management Council through their Programmatic Supplemental Environmental Impact Statement. The Council developed a work plan to monitor progress toward achieving these objectives. Pat Livingston of the National Marine Fisheries Service provided an overview of ecosystem processes that integrate climate and fishing stressors, as well as various indicators of these effects. Jim Overland of the Pacific Marine Environmental Laboratory provided an overview of some major historical and recent changes in climate patterns affecting the Bering Sea. Finally, Gunnar Knapp of the Institute of Social and Economic Research provided insights

into socioeconomic indicators for ecosystem-based management. At the Seattle pre-workshop, all presenters were the same, except that Mark Fina of the North Pacific Fishery Management Council staff kindly agreed to substitute for Gunnar by giving the socioeconomic presentation. Thanks are expressed to all presenters, especially Diana Evans, Gunnar Knapp and Mark Fina, who are not principal investigators for this NPRB-funded project. Copies of all presentations appear in Appendices 1-5.

Comments and Questions

The Anchorage and Seattle pre-workshops were attended by approximately 75 and 20 attendees, respectively. Feedback from these participants is greatly appreciated. Below we summarize the questions and comments offered by participants in both workshops.

Anchorage Pre-workshop

Questions after Kruse presentation:

- How will invited be participants chosen for June workshop?
    - Kruse answer – We would like to be sure that participants represent both system components and geography.
    - Overland add on – we also seek participants with enthusiasm for the project.
- How do you validate ecosystem indicators?
    - Overland answer – Workshop outcomes might be recommendations for ongoing investigations; this workshop will not produce a complete set of indicators, but will likely yield an ongoing process for determining indicators.
- Is the aim of the workshop to move from broad goals to operational objectives and indicators?
    - Kruse – Yes, but there is a tradeoff between scoping all issues (horizontal dimension) and delving into the operational details (vertical dimension). The hope is to get to lower levels and perhaps find the responsible stressors to the system.
- How do you balance economic versus ecological indicators?
    - Kruse – Balancing needs to occur in a public process as a component of management. This is a societal decision.
    - Overland – The final decision on weighting of indicators will lie with the NPFMC and not within the workshop itself; it is easy to make a large list of indicators for the Bering Sea, but the hope of the workshop is to distill the list to a smaller (e.g., <20) group of indicators to present to the Council and perhaps to identify species to use as indicators.
- We know the Bering Sea is a dynamic system and we also know that some reference points (e.g., crab biological reference points) aren't always robust, so how do we manage for performance measures in a dynamic system? The idea to "maintain" might not be the appropriate term.
    - Kruse – The NPFMC has a crab working group looking at overfishing definitions and perhaps reference definitions and this is proving to be a difficult problem. Perhaps there is a need for these definitions to be a dynamic function of the ecosystem.

- Objectives "to maintain" and those dealing with ecosystem structure are slightly on vague side. There is a need to consider ecosystem states that may change over time (multiple states of the system) and there is a need to allow ecosystem indicators to fluctuate over time. There has been considerable intertidal benthic work that indicates the existence of multiple steady states that could contribute to consideration of these concepts for this project.
    - Kruse – agreed.
- The Nature Conservancy (TNC) went through similar exercise in last few years that could serve as possible frame of reference for this project. A draft report from TWC is available.
    - Kruse – we look forward to receiving a copy of this report for consideration.
- How does new information on marine reserves and Marine Protected Areas (MPAs) get into the process and could these address differences in changes from human versus other natural factors?
    - Kruse – Ecosystem-based management is broad and encompasses MPAs, if deemed appropriate for the region. MPAs are an available tool at the disposal of the NPFMC to achieve their objectives, and they have already closed vast areas of the Gulf of Alaska and Bering Sea. MPAs can also be a useful tool to separate natural from human effects on marine systems, if they are part of a monitoring program.

Questions after Livingston Presentation:

- If you choose indicators for certain performance measures, what about potential relationships between indicators? Would you want to focus on particular indicators so that you can monitor cascading effects…e.g., how does a measure of carbon flux across the shelf relate to recruitment of a particular species?
    - Livingston – That is the purpose of putting many indicators in ecosystem chapter because we often do not initially know the relationship between particular indicators.
- You could spend a lot the research budget on just tracking indicators. So, how would you balance the budget for monitoring versus efforts to determine relationships and processes?
    - Livingston – the Alaska Fisheries Science Center will continue to monitor resources, but gaps exist in the monitoring system and there will to be need partners for both monitoring and process determination. We need to identify the gaps.
- Consider other changes in natural communities, such as range extensions.
- There are concerns about ballast water discharges which may affect range of native as well as non-native species.
- When looking at ecosystem protection, how do you define the time range to be considered in establishing indicators? How far back do you go to define your baseline?
    - Livingston – We want to look back as far as possible in time, but the real issue is how to set baseline for indicator comparisons.
- You will have a changing baseline no matter what time period is chosen. The species mix will continue to change, so how would you determine what change is natural and what induced?

    - Livingston – We are still determining the natural range of variability for many species and Jim Overland's analyses will help to determine if we are in the same or different regimes.
- Given the concept of decadal changes and examining as steady states, how much of change in abundance can be attributed to decadal change? Also, because there is a focus on organisms of commercial importance, do you anticipate additional data collection on non-commercial species?
    - Livingston – Gordon mentioned the lack of benthic data and NMFS is trying to increase sampling of non-target species, but NMFS also needs to maintain commercial species monitoring.
- The existing 2 reports (PICES and NMFS) have data on potential indicators.
- You might want to select species that are indicators of progressive (constant or gradual) changes and not just species indicating shifts as decadal changes.
- We need clarity what a species are indicating changes in the ecosystem process. We also need to consider both small and large ecosystem scales, as well as effects on humans.
- Consider the possibility that indicators themselves may change.
- Often we can only see shifts in hindsight (i.e., note that we are still arguing over the last El Niño), so it may be naive to say we will see an ecosystem change and respond accordingly.
- There is a focus on the use of sentinel species as indicators, but you should also consider looking at aggregates, such as the biomass of a class of consumers.
    - Livingston – We are looking at community biomass levels and types of consumers.
- We are discussing ecosystem level changes, but we are still considering species-level indicators. So, it may be useful to broaden our consideration to the types of indicators.
- It is important to consider the need to examine aspects of variability over time. Consider focusing on things for which you understand the variance structure well.
- Consider a deeper examination of species richness of existing data (like Overland discussed) to get a solid understanding on spatial and temporal variability before using as a species as indicator.

Questions after Overland Presentation:

- General Comment by Overland: The Bering Sea produces $1 billion in product without the consideration of trickle down effects. Currently, there is worldwide interest in ecosystem indicators and we hope to incorporate expertise in people from other regions to help examine the Bering Sea. The Bering Sea is one of few remaining areas where natural variability is the primary determinant of fishery output. In contrast, most areas of the world are interested in how to facilitate recovery of depressed fisheries. Note that the Bering Sea is also the boundary of arctic versus subarctic system. A significant challenge will be to couple data such as the current meter M2 temperature time series with Pat's ecosystem data on species abundance. Note that with more information, the analyses get more complex (e.g., Arctic Warm environmental cycle).
- Do you see a trend or pattern in pH over time?
    - Overland – Changes in carbon may already be impacting Aleutian corals, but this is part of a long-term process. We are seeing a global warming signal, but the

changes in the Arctic are occurring faster than global warming signal changes. Others may be better able to address changes in pH.

- Temperature has a big influence, but the aspect of acidification may eliminate many life forms (those needing $CaCO_4$), so what would loss of those species imply to the ecosystem?
    - Overland – It is difficult to predict this.

Comments after Knapp Presentation:

- What do you mean by "institution?
    - Kruse – Institutions include NMFS, NPFMC, the courts, the State of Alaska, etc. It includes all institutions that collects fishery information and make management decisions.
- We often define objectives based on negatives, i.e., something that we don't want to happen.

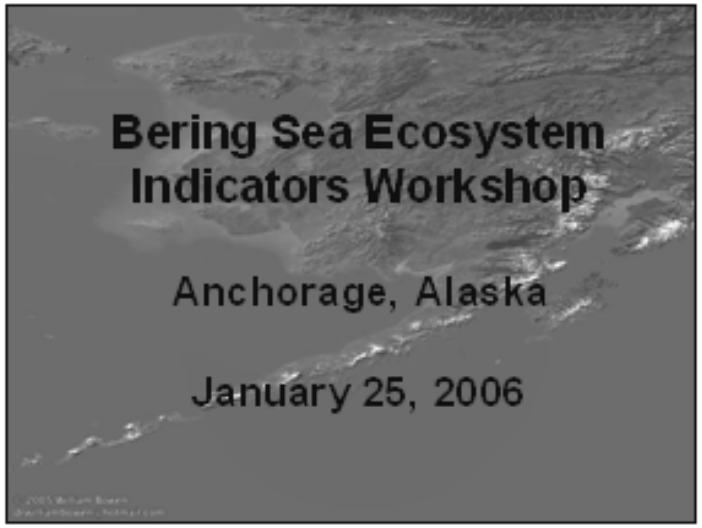
Seattle Pre-workshop

Questions after Oral Presentations:

- What does "maintain" mean?
    - Kruse answer – Maintaining a certain level of biomass for a species is problematic in a changing system, however, society does define thresholds (determinations of overfished stocks) that trigger actions. Maintain may also have some meaning for biodiversity.
- Consider diversity versus richness as an indicator. Also, consider the spatial distribution of biodiversity.
    - Livingston – We expect a latitudinal cline in diversity to change with climate. AFSC staff have been examining such changes.
- Are there desirable upper limits on species, such as particular marine mammal abundances? For example, how high does arrowtooth flounder need to get to trigger a halt to the pollock fishery or to hold the fishery harmless for their crab and halibut bycatch to foster removals of arrowtooth flounder from the system?
- Consider statistical versus functional methods to render indicators. For the latter, consider exploring groupings of species in the system by functional groups, such as winter spawners versus summer spawners, or predators of copepods versus other plankton, etc.
- Recognize that, as humans, we are modifying the system. So, we are doing ecosystem management.
    - Kruse – Humans are certainly applying stressors to the system, but I don't think we are doing ecosystem management – that is, direct manipulations of habitat and populations with a view toward structuring the system in a way that optimizing some return to us. The system is too complex to think that we can knowingly achieve a desired outcome.
- Consider non-threshold-based indicators.
    - Kruse – Given the fact that the system has a capacity to change states, we should probably think about different thresholds for different states or perhaps a rate-based approach.

- Consider using species that we do not interact with – e.g., walrus in the Bering Sea that feed on clams – as indicators. Then, use these species to compare to those species that are related to fisheries to try to sort out our effects.
- We state up front that we are not trying to develop an ecosystem-based fishery management plan. Why aren't we trying to do this?
    - Kruse – this is beyond the scope of our project and this task requires a public process that is best served by a group such as the NPFMC.
- We are entrenched in methods that try to maintain the mean but eliminate the variance.
- There are other views of the role of humans in the system, such as Chuck Fowler's approach that argues that humans remove harvests at an order of magnitude too high.
- Some indicators are common across systems. Consider looking at degraded systems to see what indicators may have indicated a change in those systems.
- Consider focusing on indicators that motivate management decisions. Sea ice indicators are nice, but what management decision hinges on this indicator?
    - Kruse – Management of the fishing season for snow crabs hinges on sea ice conditions in extremely cold years. Otherwise, sea ice may act through other direct or indirect mechanisms to affect changes in species that trigger a management response.

Appendix 1. Oral presentation by Gordon Kruse.



Overview of Workshop

What? We seek advice from *you* (the scientific community and public) on priority marine ecosystem objectives, including stressors affecting both ecological and human environments.

How? Following some brief introductory presentations, a short panel session will be used to stimulate your suggestions on priorities, key indicators, and specific operational objectives to be considered by future management of the Bering Sea.

Outline of this Workshop

1. Description of Ecological Indicators project – Gordon
2. Overview of goals and definitions of an Ecosystem Approach to Management (EAM) – Gordon
3. Specific objectives for Ecosystem Approach to Fisheries Management (EAF) in the eastern Bering Sea – Diana
4. Panel discussion highlighting key eastern Bering Sea Influences
   a) Climate Stressors – Jim
   b) Ecological Processes – Pat
   c) Social/Economics – Gunnar
5. Feedback and questions from audience – *you!*

Ecosystem Indicators Project

- Submitted by: North Pacific Marine Science Organization, PICES (Alex Bychkov and Skip McKinnell)
- PIs: Gordon Kruse (UAF), Glen Jamieson (DFO), Pat Livingston (AFSC), and Jim Overland (PMEL)
- Collaborator: Ian Perry (DFO)
- Funded by: NPRB ($100 K)
- Title: *Integration of Ecological Indicators for the North Pacific with emphasis on the Bering Sea: A Workshop Approach*
- Response to NPRB 2005 RFP: *Host a workshop to evaluate the utility of ecosystem indicators*

Project Components

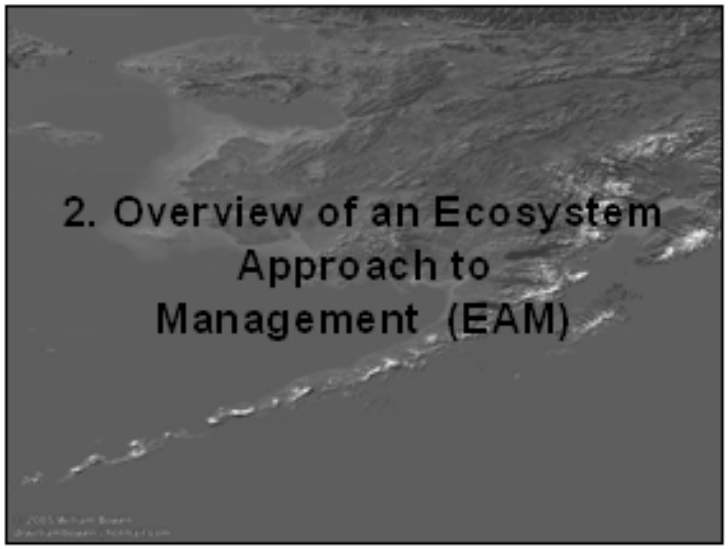
1. **Involve the Bering Sea and international communities in development of a set of operational objectives for the southeast Bering Sea ecosystem**
   a) *pre-Workshop – Marine Science in Alaska Symposium (January 2006)*
   b) *pre-Workshop – North Pacific Fishery Management Council Meeting (February 2006)*
   c) *Workshop – Seattle (June 1-3, 2006) – 40 invited participants*

Project Components (continued)

2. Evaluate two ecosystem status reports with a goal to integrate the results and streamline the presentations:
   a) Ecosystem Considerations Chapter of SAFE
   b) PICES North Pacific Ecosystem Status Report
3. Investigate whole-system methodologies for indicators that monitor structural changes in the marine ecosystem
4. Identify next steps in validating indicator performance, improving the monitoring system to measure key missing indicators, and integration into predictive models

Project Products

1. Pre-workshop activities include drafting three working papers:
   a) development of operational objectives (Gordon)
   b) evaluate two ecosystem status reports (Pat)
   c) investigate whole-ecosystem approaches (Jim)
2. Workshop synthesis report by PIs plus PICES staff to be published in the *PICES Scientific Report Series*
3. Journal article based on our experience with this project



Terminology

Similar Terms:

- Ecosystem Approach to Management (EAM)
- Ecosystem Approach to Fisheries Management (EAF)
- Ecosystem-based Fisheries Management (EBFM)

But not:

- Ecosystem management (EM) – ***direct manipulation of habitat and populations*** in space, structure and time with a view of optimizing long-term returns to humans

EAF Definition

Ecosystem approach to fisheries (EAF) – strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties of biotic, abiotic, and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries.

Adopted by FAO Technical Consultation on Ecosystem-based Fisheries Management.

IM Definition

Integrated management (IM) – comprehensive planning/regulation of human activities towards a complex set of interacting objectives

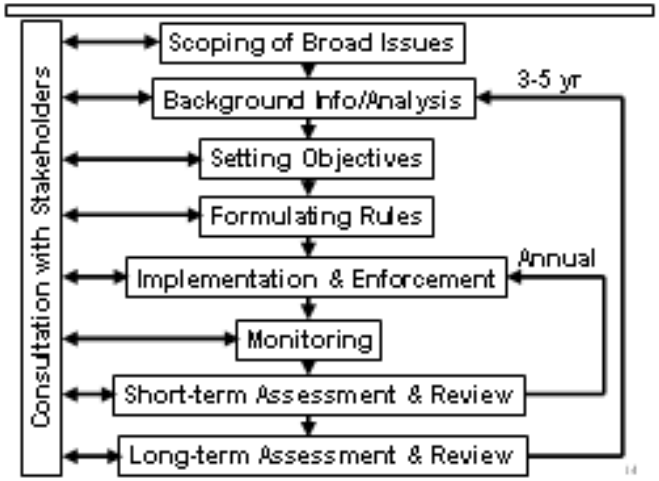
- Aims at minimizing user conflicts while assuring long-term stability
- Uses a collaborative approach involving stakeholders
- Considers cumulative effects of human activities

More Definitions

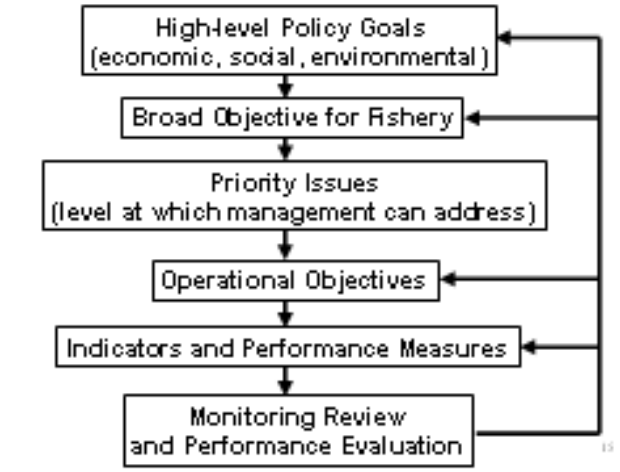
Ecosystem services – benefits that people receive from ecosystems

- Provisioning Services – products obtained: food, water, fuel, fiber, biochemicals, genetic resources
- Regulating Services – benefits from regulation: climate, disease, water purification
- Cultural Services – non-material benefits: spiritual, recreational, ecotourism, aesthetic, educational
- Supporting Services – necessary for production of all other ecosystem services: primary production, nutrient cycling, ecological value, sustaining conditions for life on earth

Developing an EBFM Plan (from ICES)



Setting Objectives



An Example

High-level Policy Goal:

- Maintain ecosystem structure and function

Broad Objective for Fishery:

- Maintain populations of predators and prey within ecologically viable levels

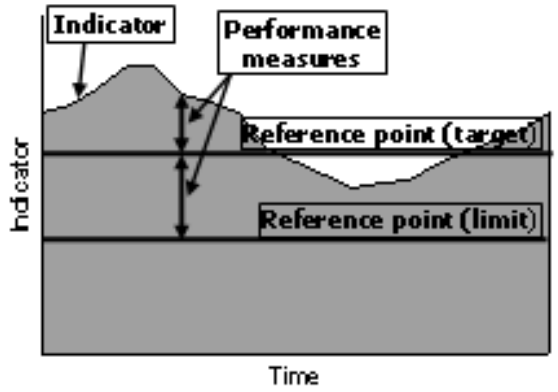
Operational Objectives:

- Reduce harvest rate of large predators by 25%
- Reduce harvest rate of forage fishes by 25%

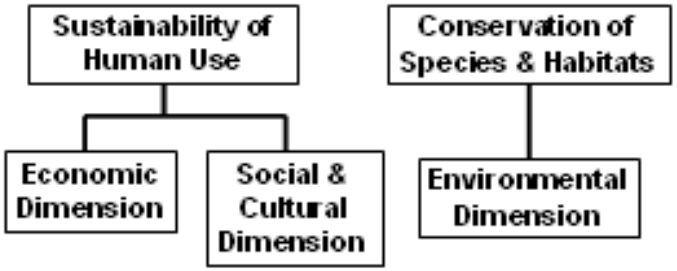
Indicators and Performance Measures:

- Trophic level of the catch
- Size spectrum of the catch

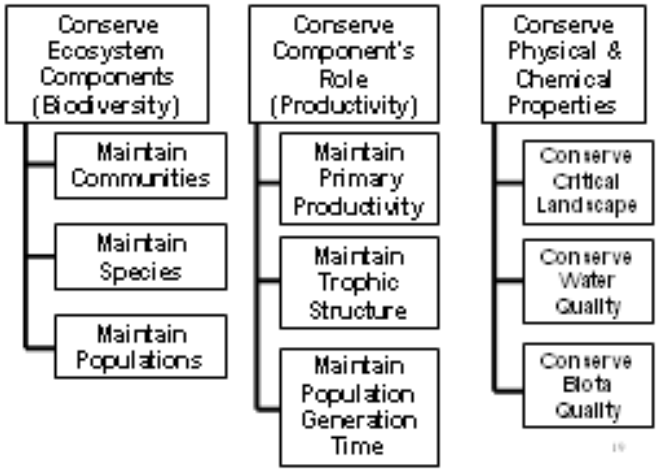
Indicators and Reference Points



Two Broad Overarching Goals (Canada)



Objectives for Conservation (Canada)



Potential NOAA High-level Goals Under Discussion for the U.S.

- Ensure sustainability of resources
- Conserve biodiversity
- Maintain opportunities for economic, social and cultural access to resources

"Unpacking" of Operational Objectives

- High-level policy goal
- Broad objectives for each fishery
- Operational objectives
- Indicators and performance measures

Lessons learned by Canada:

- Unpacking of conceptual objectives needs to occur as part of IM process
- Tendency to use available data to define objectives. Instead it is better to use objectives to guide data collection
- Tendency to focus on one set of objectives as it is difficult to get all relevant expertise together at once

Conclusions

- We seek your input into priorities, specific operational objectives, and key indicators
- We are *not* designing an EAF management plan
- Rather we refer to the selected management alternative from the Alaska Groundfish Fisheries Final Programmatic Supplemental Environmental Impacts Statement (PSEIS) to guide the discussions
- A short panel session will be used to stimulate suggestions on priorities, specific operational objectives, and key indicators to be considered by future management of the Bering Sea using the selected management alternative.

Appendix 2. Oral presentation by Diana Evans.

North Pacific
Fishery Management Council's

Groundfish Management Policy Objectives

Diana Evans
NPFMC staff

Management Policy

- Comprehensive review of groundfish management program (PSEIS)
- Approach statement + 45 objectives
  - organized around 9 ecosystem component 'goal statements'
- Workplan developed June 2004
- Annual review of objectives and workplan

Implementation of Policy

- Objectives fall in one of 4 categories
  - actions already established
  - actions under consideration
  - actions not yet initiated/on hold
  - apply to all management decisions

FOCUS

Prevent Overfishing

(5 objectives)

- F_{40} review recommendations
- Mechanisms for target vs non-target species management

Promote Sustainable Fisheries and Communities

(4 objectives)

- (principles by which to make decisions: fairness, stability, safety, NS1)


Preserve Food Web

(4 objectives)

- Indices for ecosystem health
- Account for uncertainty and ecosystem considerations in ABCs

Manage Incidental Catch and Reduce Bycatch and Waste

(8 objectives)

- Research on non-target species population estimates
- Incentive programs and techniques to reduce bycatch



Avoid Impacts to Seabirds and Marine Mammals

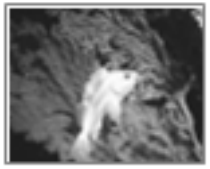
(4 objectives)

- Review marine mammal and fishery interactions




Reduce and Avoid Impacts to Habitat

(5 objectives)



- Review efficacy of existing habitat protection measures
- Research on baseline habitat mapping
- Policy, goals, criteria for MPAs and implement as appropriate

Promote Equitable and Efficient Use of Fishery Resources

(4 objectives)

- Initiate rights-based management programs and periodically evaluate their efficacy

Increase Alaska Native Consultation

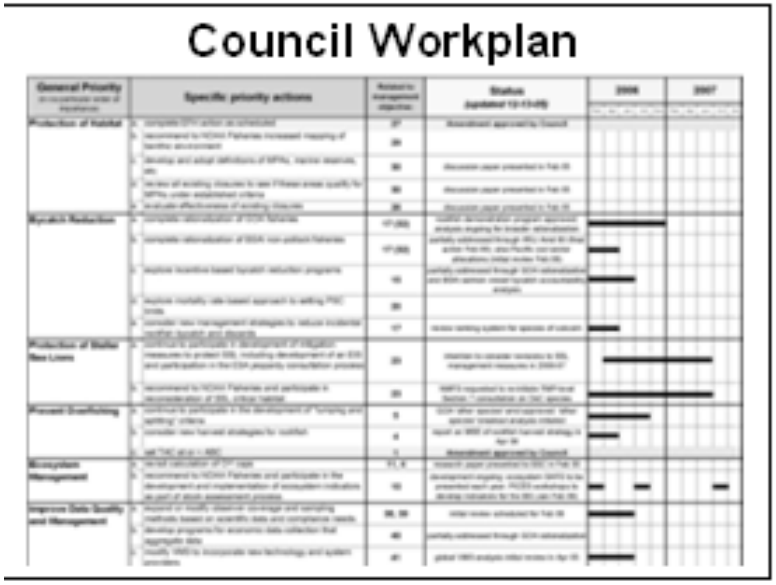
(3 objectives)

- Local and traditional knowledge
- Participation and consultation

Improve Data Quality, Monitoring, and Enforcement

(6 objectives)

- Encourage development of an ecosystem monitoring program
- Enhance utility of observer data
- Increase economic data reporting requirements
- Improve technology for monitoring/enforcement


Council Workplan

Appendix 3. Oral presentation by Pat Livingston.

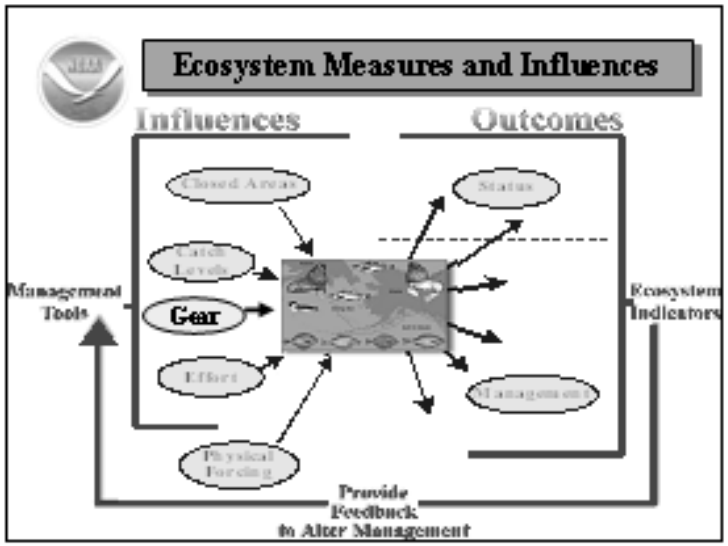
Ecosystem Processes

ECOSYSTEM DEFINITION

- Populations and communities of interacting organisms and physical environment with characteristic trophic structure and material (energy) cycles

OBJECTIVES FOR ECOSYSTEM PROTECTION

- Maintain Predator/prey relationships
- Maintain Energy/flow balance
- Maintain Habitat and Diversity



Objectives for Ecosystem Protection:

- **Maintain predator-prey relationships**
  - pelagic forage availability
  - spatial/temporal conc. of fishery impact on forage fish
  - removals of top predators
  - introduction of non-native species
- **Maintain diversity**
  - species diversity
  - functional (trophic, structural habitat) diversity
  - genetic diversity
- **Maintain energy flow and balance**
  - human-induced energy redirection
  - system impacts attributable to energy removal

CLIMATE and FISHING

Ecosystem Impacts Assessment Framework:

Objectives, sub-objectives, ecosystem indicators

OBJECTIVE: MAINTAIN PREDATOR/PREY RELATIONSHIPS

SUBOBJECTIVE1: Sustain top predator populations

THRESHOLD: Catch level high enough to cause the biomass of one or more top level predator species to fall below minimum biologically acceptable limits

INDICATORS:

- Population status of top predator species
- Bycatch levels of sensitive top predators that lack population estimates (sharks, birds)
- Trophic level of the catch

Effects Analysis

Objective	Subobjective	Significance Threshold	Indicators
Predator-prey relationships	Pelagic forage availability	[illegible]	[illegible]
	Spatial and temporal concentration of fishery impact on forage	[illegible]	[illegible]
	Removal of top predators	[illegible]	[illegible]
	Introduction of nonnative species	[illegible]	[illegible]

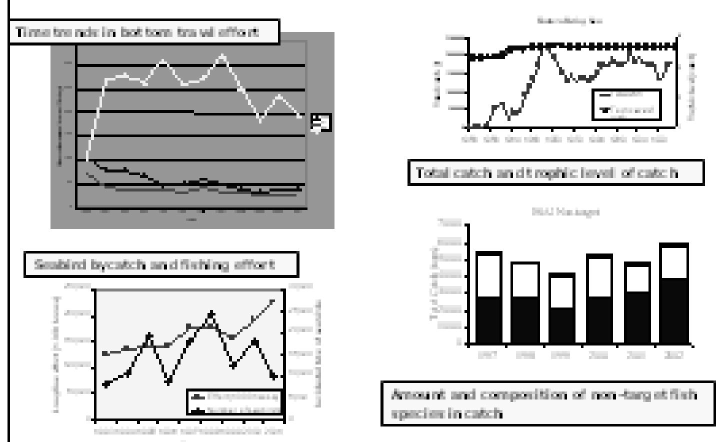
Effects Analysis (cont.)

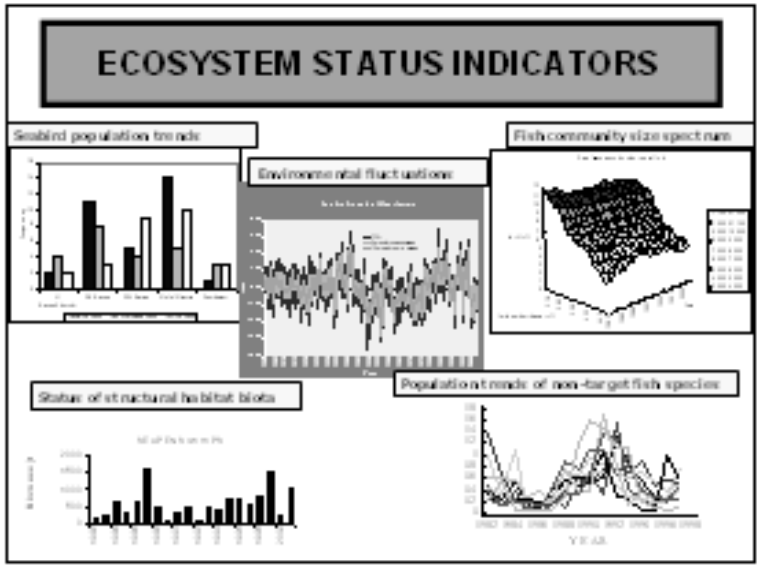
Objective	Subobjective	Significance Threshold	Indicators
Energy flow and balance	Energy re-direction	Long-term changes in system biomass, respiration, production or energy cycling that are outside the range of natural variability due to fishery discarding and offal production practices.	Trends in discard and offal production levels (quantitative for discards) Scavenger population trends relative to discard and offal production levels (qualitative) Bottom gear effort (qualitative measure of unobserved gear mortality particularly on bottom organisms)
	Energy removal	Long-term changes in system-level biomass, respiration, production or energy cycling that are outside the range of natural variability due to fishery removals of energy	Trends in total retained catch levels (quantitative)

Effects Analysis (cont.)

Objective	Subobjective	Significance Threshold	Indicators
Diversity	Species diversity	[illegible]	[illegible]
	Functional (trophic, structural habitat) diversity	[illegible]	[illegible]
	Genetic diversity	[illegible]	[illegible]

MANAGEMENT INDICATORS





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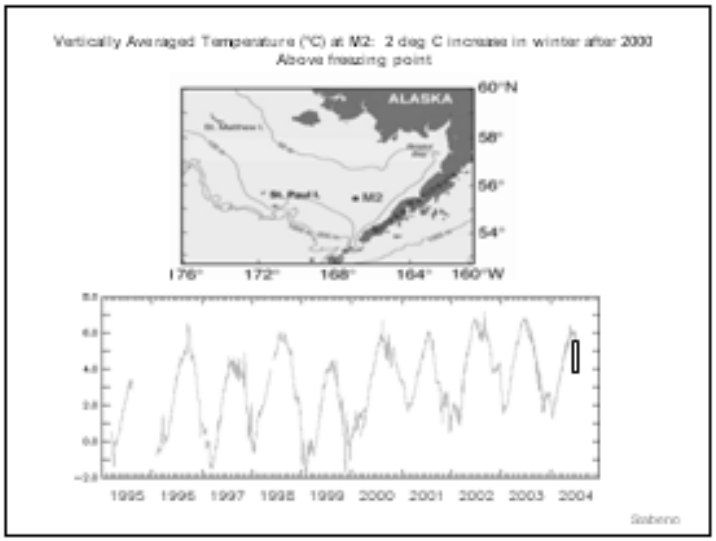
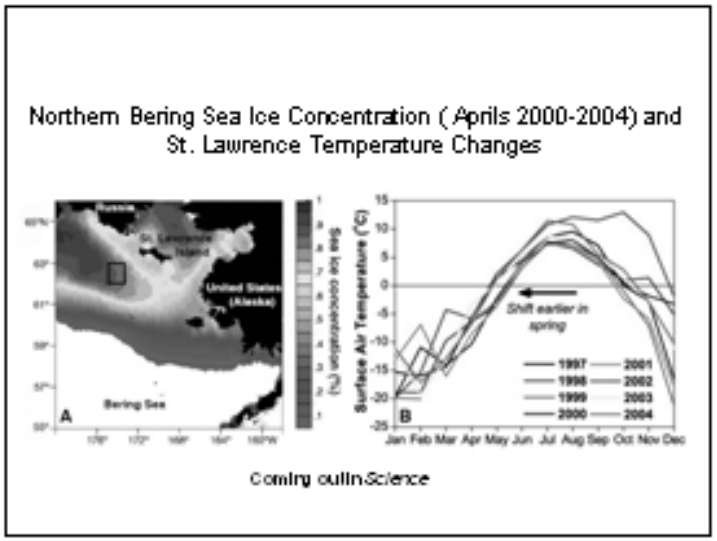
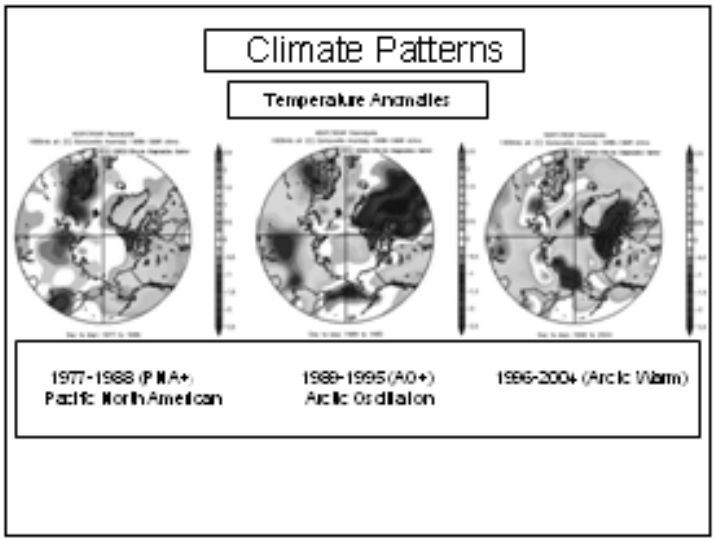
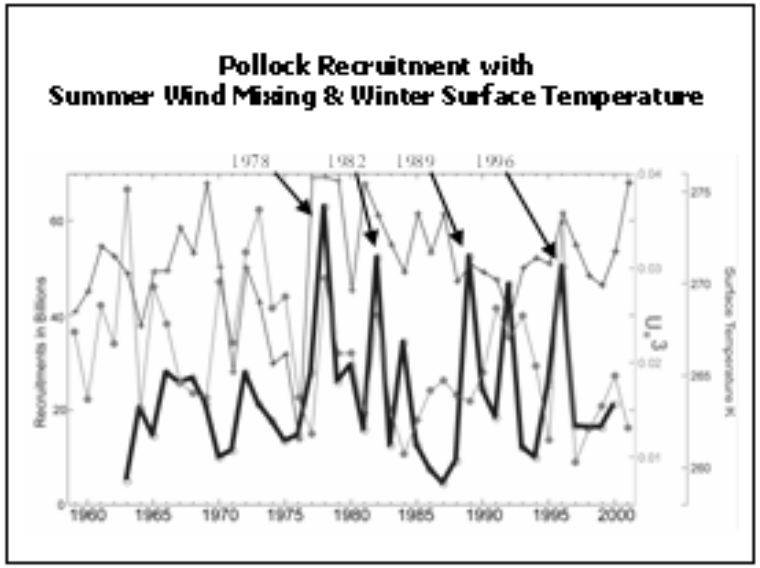
CLIMATE and FISHING

Appendix 4. Oral presentation by Jim Overland.








Pollock Recruitment with
Summer Wind Mixing & Winter Surface Temperature
1978
1982
1989
1996
Recruitments in Billions
Surface Temperature K
U_*^3
1960
1965
1970
1975
1980
1985
1990
1995
2000


Bering Climate
Bering Climate
www.beringclimate.noaa.gov

Appendix 5. Oral presentation by Gunnar Knapp.

SOCIOECONOMIC OBJECTIVES AND INDICATORS FOR ECOSYSTEM-BASED FISHERY MANAGEMENT

Bering Sea Ecosystem Indicators Workshop
Marine Science in Alaska 2006 Symposium
Anchorage, Alaska
January 25, 2006

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What I mean by "objectives" and "indicators"

	Definition	Biological example	Socioeconomic example	Socioeconomic example
OBJECTIVE	What you are trying to achieve	Maintain predator-prey relationships	Maintain fishing communities	Safety of human life at sea
INDICATOR	Measure of how well you are doing at achieving your objective	Population status of top predator species Trophic level of the catch	Community residents' share of catches Community residents' share of fishing privileges (quotas, permits, etc.)	Fishing fatalities Vessel losses

Outline

1. A simple conceptual framework
2. Challenges in developing socioeconomic objectives and indicators for ecosystem-based fishery management
3. What are our current socioeconomic objectives and indicators for ecosystem-based fishery management?
4. Recommendations

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Conceptual Framework: The Ecosystem and the "Human System"

ECOSYSTEM

- Physical environment
- Species
- Relationships between different species
- Relationships between species and the physical environment
- Human effects on species and the physical environment

EXAMPLES OF FISHERIES-RELATED COMPONENTS

- Target fish stocks
- Stocks of predator and prey species for targeted fish stocks (including birds and mammals)
- Commercial harvests

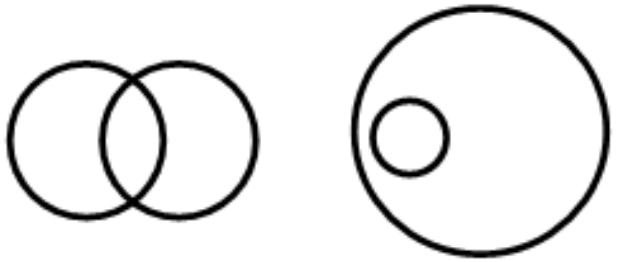
HUMAN SYSTEM

- Economic systems
- Political systems
- Cultural systems
- Population and demographics
- Communities
- Science and technology
- Uses of natural resources

EXAMPLES OF FISHERIES-RELATED COMPONENTS

- *Commercial fishing industry*
- *World fish markets*
- *Fishing technologies*
- *Subsistence traditions*
- *Fishing communities*
- *North Pacific Fishery Management Council*

Potential perspectives on the relationship between the **ECOSYSTEM** and the **HUMAN SYSTEM**



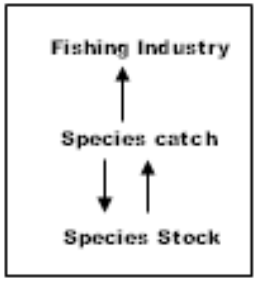
Regardless of your perspective:
The ecosystem affects the human system.
The human system affects the ecosystem.

Analogies between the ECOSYSTEM and the HUMAN SYSTEM

- Both systems are very complex
- Interactions between different parts of both systems occur on widely varying geographic and time scales
- Both systems are continuously changing--on many different time scales
- Parts of the both systems are "stable" and parts are "unstable"
- Our understanding of both systems is very limited
- Our ability to measure both systems is very limited
- Our ability to control both systems is very limited
- What is "good" for an individual is not necessarily "good" for a group or for the system

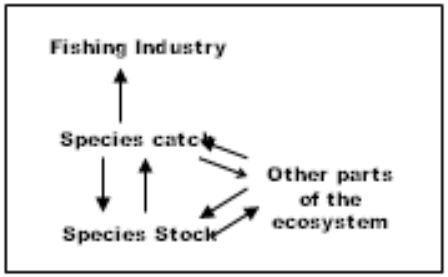
NAÏVE FISHERIES MANAGEMENT

Objective: Maximize benefits to fishing industry
Objective: Keep stock at level which maximizes benefits to fishing industry



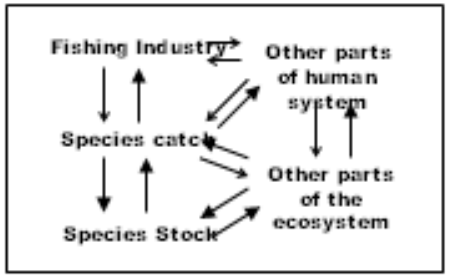
NAÏVE ECOSYSTEM-BASED FISHERIES MANAGEMENT

Objective: Maximize benefits to fishing industry
Objective: Use ecosystem to maximize benefits to fishing industry



ECOSYSTEM-BASED FISHERIES MANAGEMENT

Objective: Maximize human benefits
Objective: Use ecosystem to maximize human benefits



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Biological objectives may conflict with socioeconomic objectives.

- Stock rebuilding vs. maintaining a fishery-dependent community
- Protecting "bycatch" species vs. valuable catches of target species

Socio-economic objectives may conflict with each other

- Employment conflicts with profitability
- Some peoples' "costs" are other peoples' livelihoods
  - Effects of crab rationalization on fishing jobs
  - Effects of crab rationalization on fuel dealers
- Protecting current users against effects of change vs. allowing the system to become stronger by changing

Every part of the fishery management process is inherently political.

- Different groups have different interests
  - Allocation between different user groups
  - Consumers (cheaper prices) vs. producers (higher prices)
  - Commercial fishery participants vs. other
- Different people have different personal values about what objectives are important
- The current generation has different interests than future generations
- People have an interest in influencing the management process at every level in any way they can—including the definition of objectives and indicators

Just as we have a limited ability to control the ecosystem,
we have a limited ability to control the human system.

- We may not be able to sustain all fishing communities
- We may not be able to make all fisheries or fishermen economically successful
- The human system—and our ability to achieve socioeconomic objectives—is affected by many factors beyond our control
  - Market forces
  - Political forces
  - Demographic change
  - Cultural change

We don't have good data to measure many objectives

- People are difficult to measure
- People don't like to be measured
- Collecting data costs money
- We don't have a tradition of collecting socioeconomic data for fisheries

Relationships within the human system are not necessarily geographically adjacent

- The people affected by fisheries management decisions do not necessarily live or work near those fisheries
  - Non-local fishermen and processing workers
  - Fisheries transportation and distribution
  - Fish consumers
- Market effects are transmitted and experienced world-wide
- We do not agree as a society about where we should draw the geographic lines about who matters and who doesn't matter
  - Locally? Regionally? Nationally? Globally?

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There is no clear national consensus on socioeconomic objectives for fisheries management—or the relative importance of different objectives.

- The national standards of the Magnuson-Stevens Act provide a start at defining some objectives
- The Alaska Groundfish Fisheries Final Programmatic Supplemental Environmental Impact Statement (June 2004) takes us futher towards defining socioeconomic objectives—but doesn't provide a clear guide for some of the most difficult socioeconomic choices we face

Socioeconomic objectives implicit in the Magnuson-Stevens Act National Standards

- Fair and equitable allocation of fishing privileges
- Consider efficiency in the utilization of fishery resources
- Minimize costs and avoid unnecessary duplication.
- Encourage sustained participation of fishing communities
- Minimize adverse economic impacts on fishing communities
- Promote safety of human life at sea
- No discrimination between residents of different States
- No excessive shares of fishing privileges
- No measure shall have economic allocation as its sole purpose.

Socioeconomic objectives in the Groundfish SEIS . . .

To meet the goals of this overall management approach, the NPFMC and NOAA Fisheries will use the PSEIS as a planning document. To help focus its consideration of potential management measures, it will use the following objectives as guideposts to be re-evaluated as amendments to the FMP are considered over the life of the PSEIS.

. .

Socioeconomic objectives in the Groundfish SEIS . . .

Promote Sustainable Fisheries and Communities:

6. Promote conservation while providing for optimum yield in terms of providing the greatest overall benefit to the nation with particular reference to food production, and sustainable opportunities for recreational, subsistence and commercial fishing participants and fishing communities.

7. Promote management measures that, while meeting conservation objectives, are also designed to avoid significant disruption of existing social and economic structures.

8. Promote fair and equitable allocation of identified available resources in a manner such that no particular sector, group or entity acquires an excessive share of the privileges.

9. Promote increased safety at sea.

Socioeconomic objectives in the Groundfish SEIS . . .

Promote Equitable and Efficient Use of Fishery Resources:

31. Provide economic and community stability to harvesting and processing sectors through fair allocation of fishery resources.

32. Maintain LLP program and modify as necessary, and further decrease excess fishing capacity and overcapitalization by eliminating latent licences and extending programs such as community or rights-based management to some or all groundfish fisheries.

33. Provide for adaptive management by periodically evaluating the effectiveness of rationalization programs and the allocation of access rights based on performance.

34. Develop management measures that, when practicable, consider the efficient use of fishery resources taking into account the interest of harvesters, processors, and communities.

Selective Groundfish SEIS objectives

- Provide economic and community stability to harvesting and processing sectors through fair allocation of fishery resources.
  - *How do you measure what is "fair"?*
- Develop management measures that, when practicable, consider the efficient use of fishery resources taking into account the interest of harvesters, processors, and communities.
  - *How do you measure "the interests of communities"*

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Socioeconomic objectives and indicators are important.

- Even though it's difficult, we really should try to think carefully about and define—as best possible—what are objectives are and what indicators we can use to measure how well we are doing.
- Even though it's difficult, we should try to collect useful data for these indicators.

We should not pretend that inherently political choices—including choosing socieconomic objectives for fisheries--can be made "scientifically"

- Scientists should carefully draw the line between their scientific expertise and their political value judgments
  - Scientists can tell us the implications of our management choices
  - Scientists cannot tell us what choices are best
  - When they attempt to do so they risk their credibility as scientists
- Economists do not have a "correct" answer about what our socioeconomic objectives should be
  - Economists tend to believe in"efficiency" and "maximizing net value"
  - Efficiency and maximizing net value don't not necessarily trump other socio-economic objectives (for example, fairness)

What really matters—more than objectives and indicators—are the institutions which establish the objectives, interpret the indicators, and make the management decisions.

- We need institutions which have the ability to make difficult decisions about socioeconomic tradeoffs
  - Based on good information and analysis
  - In a timely way
  - Cost-effectively
  - Fairly
  - Constitutionally and legally