



**The ecosystem approach to
managing aquatic resources has a
lot to do with management but
little to do with ecology or
ecosystems**

Howard I. Browman
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INSTITUTE OF MARINE RESEARCH
HAVFORSKNINGSINSTITUTTET

Where did the EBAM come from?

What is it and how are we operationalizing it?

Is there any ecology in it? Does there have to be?

Is it really needed to improve the sustainable management of marine resources?



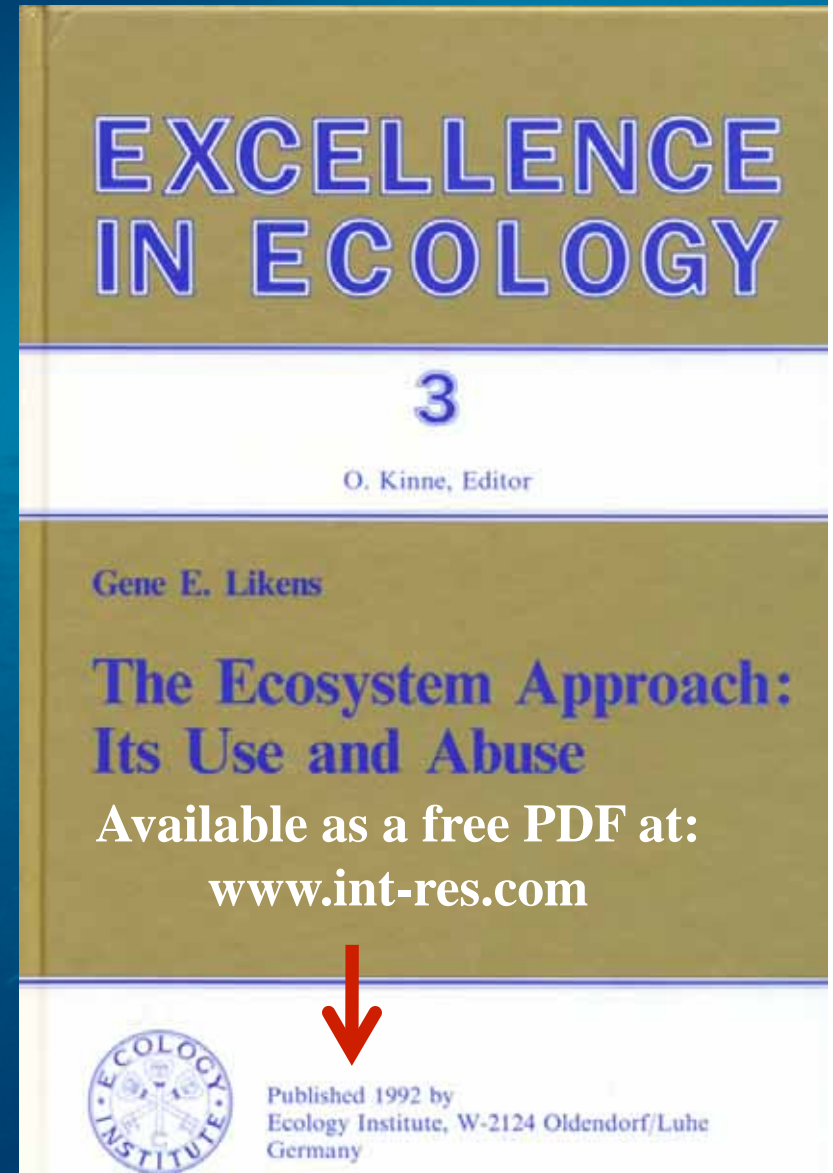
Where did it come from?

Terrestrial EBM began in the USA in 1980s during the conflicts over protection of endangered species, land and water conservation, access rights to grazing and timber land...

Limnetic EBM began about the same time in response to concern over eutrophication (phosphorus from detergent), acid rain, pollution of ground-water...



Do not ignore this history



1945	UNCLOS	United Nations UNCED	FAO
1965	<p>Influences: Arvid Pardo—"the deep sea is the common heritage of mankind", "all aspects of ocean space are interrelated and should be treated as a whole"</p>	Conf. on Envir. & Develop.	UN Food and Agricultural Organisation
1972	<p>UN Conferences on the Law of the Seabed (1958, 1960) International Ocean Institute—Pacem in Maribus Conferences (annually, starting in 1970)</p>	<p>UN Conference on the Human Environment (Stockholm 1972)</p> <p>Stockholm Declaration</p>	FAO Fisheries Committee
1982	UN Convention on the Law of the Sea	<p>Associated Instruments:</p> <ul style="list-style-type: none"> - UN Environment Programme - UNEP Joint Group of Experts on the Scientific Aspects of Marine Environment Protection (GESAMP) 	Cancùn Declaration
1992	<p>Associated Instruments:</p> <ul style="list-style-type: none"> - International Seabed Authority - Commission on Limits of the Continental Shelf - International Tribunal for the LOS - Meeting of the State of the Parties 	<p>UN Conference on Environment and Development (Rio de Janeiro 1992)</p> <p>Rio Declaration</p>	<p>FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas</p>
1995	UN Agreement Relating to Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks	<p>Convention on Biological Diversity</p> <p>Agenda 21</p>	FAO Code of Conduct for Responsible Fisheries
2001		<p>Associated Instruments</p> <ul style="list-style-type: none"> - CBD Conference of the Parties - CBD Jakarta Mandate - CBD Subsidiary Body on Scientific, Technical and Technological Advice - UN Sustainable Development Commission - World Bank Global Environmental Facility 	Reykjavik Conference on Responsible Fisheries in the Marine Ecosystem
2002		<p>World Summit on Sustainable Development (Johannesburg 2002)</p> <p>Johannesburg Declaration</p>	FAO Reykjavik Declaration
Turrell (2004). Eurogoos		<p>Associated Instruments:</p> <ul style="list-style-type: none"> - WSSD Implementation Plan 	

Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem

Recognising that sustainable fisheries management incorporating ecosystem considerations entails taking into account the impacts of fisheries on the marine ecosystem and the impacts of the marine ecosystem on fisheries,

Recognising the complex inter-relationship between fisheries and other components of the marine ecosystems,

Convinced that including ecosystem considerations in fisheries management provides a framework within which States and fisheries management organizations would enhance management performance,

Declare that, in an effort to reinforce responsible and sustainable fisheries in the marine ecosystem, we will individually and collectively work on incorporating ecosystem considerations into that management to that aim.

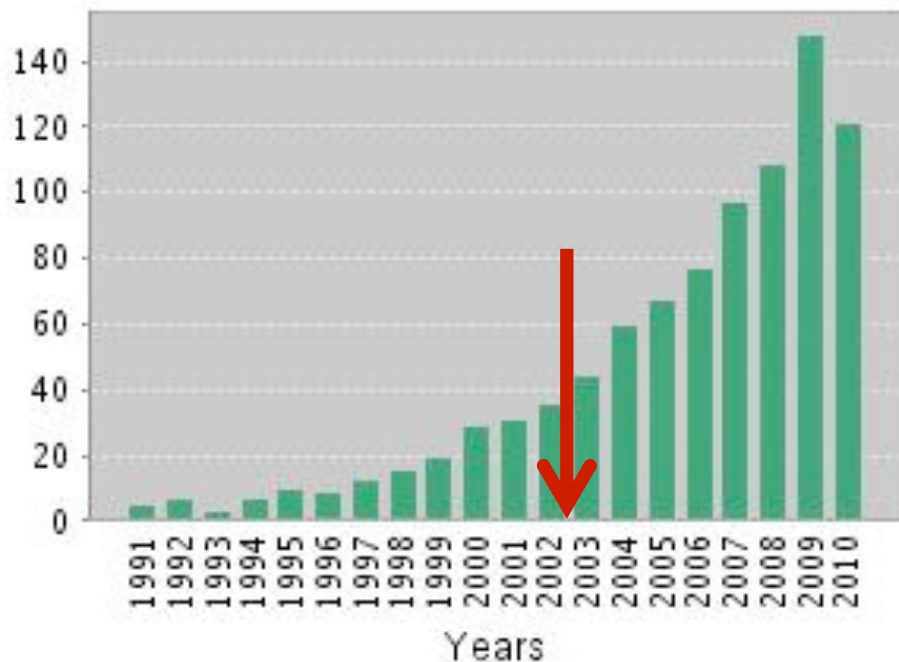


2002

Ecosystem approach + marine

912 hits (there are 6226 hits for EA only)

Published Items in Each Year



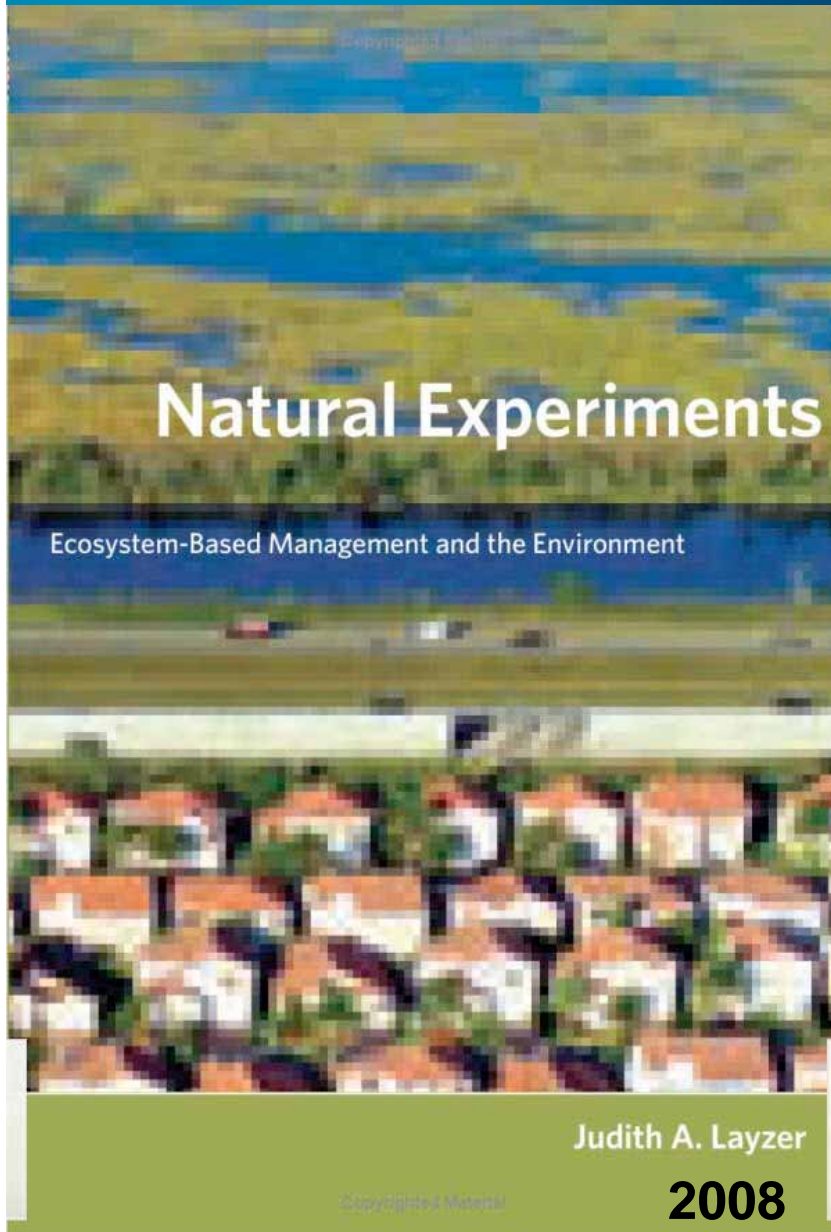
Citations in Each Year



What is it – terrestrial?

Three core attributes of EBM

- Addressing problems at a landscape, or regional, scale
- Collaborative planning
- Flexible, adaptive implementation of planning goals

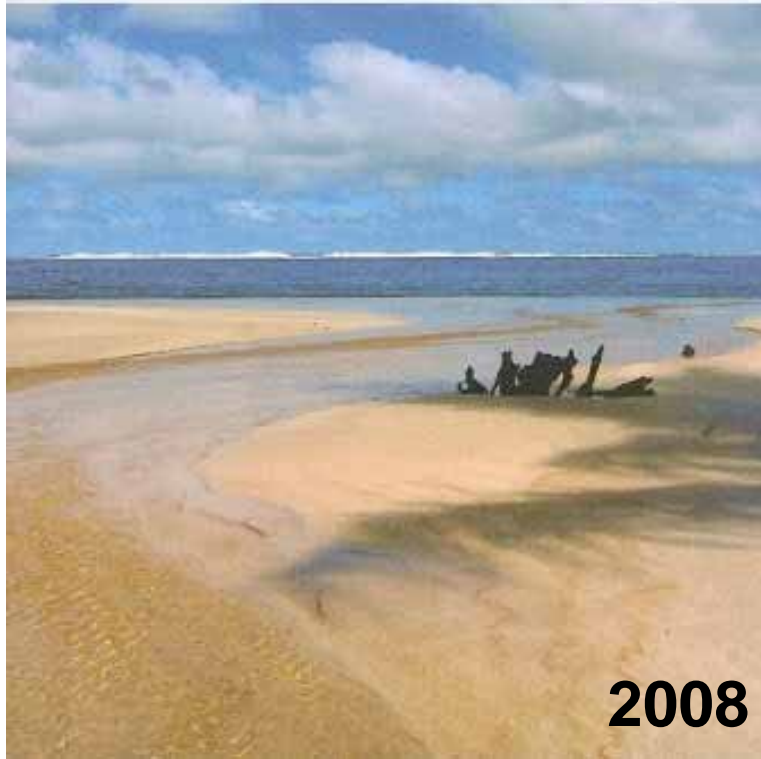


DAVID WALTNER-TOEWS | JAMES J. KAY | NINA-MARIE E. LISTER

EDITORS

THE ECOSYSTEM APPROACH

Complexity, Uncertainty, and Managing for Sustainability



2008

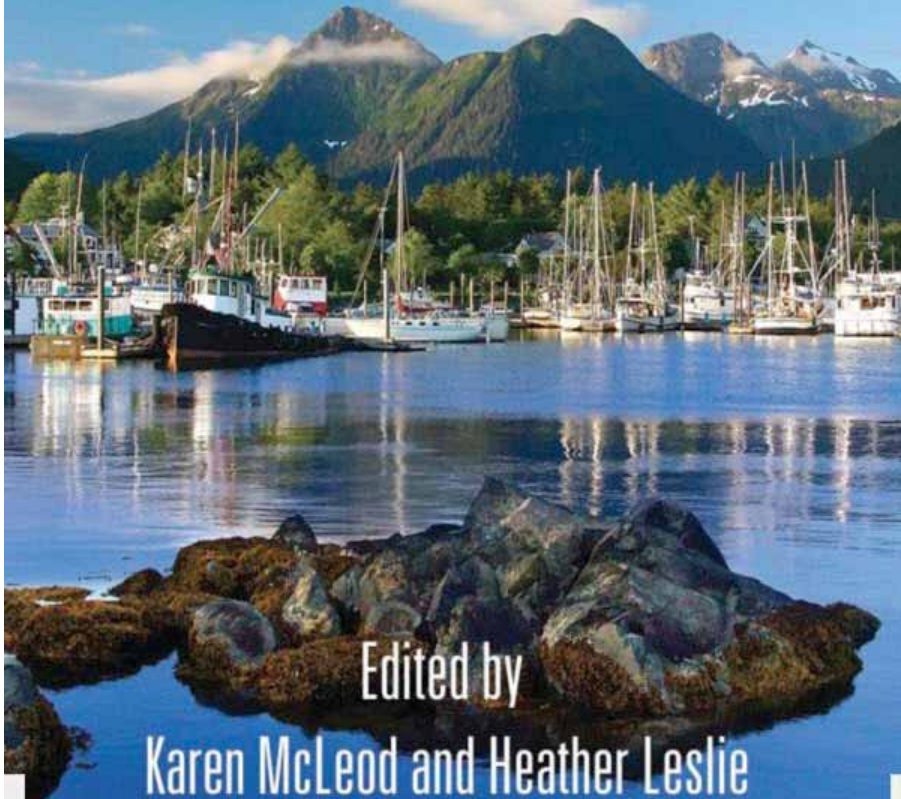
1. An Introduction to **Systems** Thinking
2. Framing the Situation: Developing a **system** description
3. Scale and type: a requirement for addressing complexity with dynamical quality
4. Self-Organizing, by Holarchic
5. So what changes? Implications of complexity for an ecosystem approach to management
6. Bridging Science and Values: The Challenge of Biodiversity
7. The cultural basis for an ecosystem approach
8. A Family of Origin for an Ecosystem Approach to Managing for Sustainability
9. Linking hard and soft systems in local development



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2009

ECOSYSTEM-BASED MANAGEMENT FOR THE OCEANS



Edited by

Karen McLeod and Heather Leslie

2008

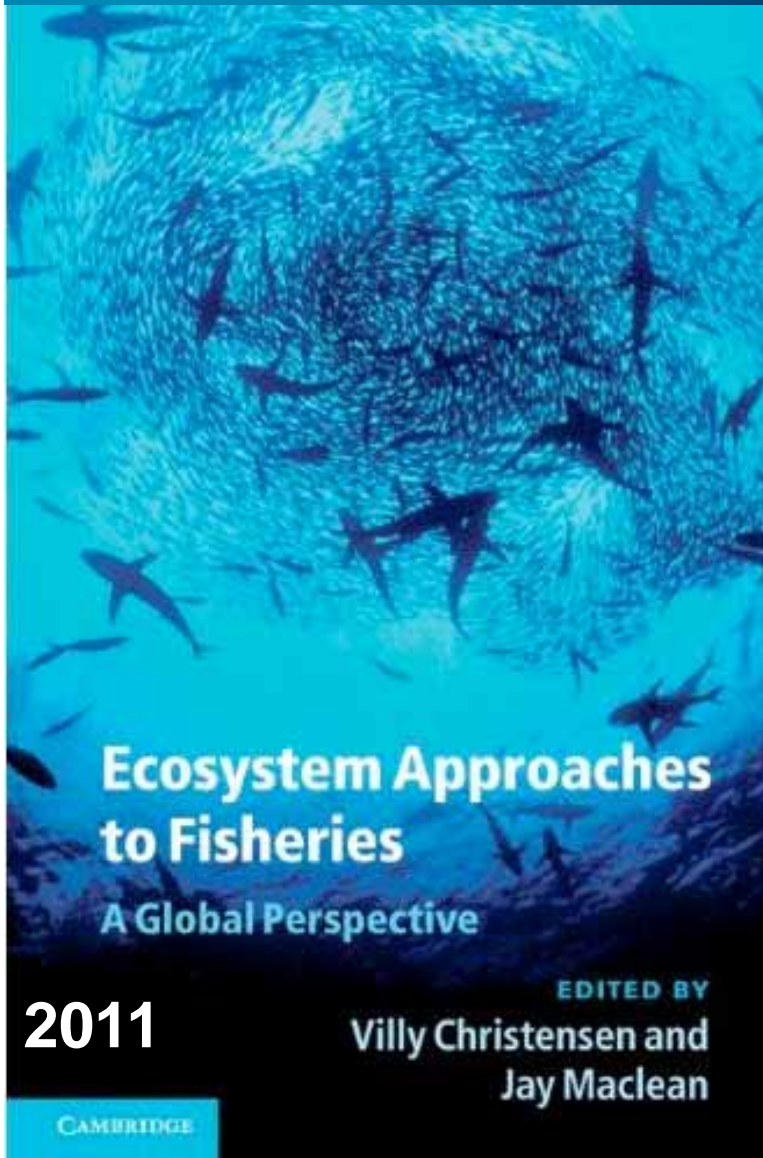
The Ecosystem Approach to Fisheries

Edited by

Gabriella Bianchi & Hein R. Skjoldal



1. Introduction: toward ecosystem-based management of fisheries
2. The oxygen constraint
3. Organizing and disseminating marine biodiversity information: the FishBase and SeaLifeBase story
4. The science in FishBase
5. How much fish is being extracted from the oceans and what is it worth?
6. Fishing down the food web
7. Aquaculture up and down the food web
8. Beyond food: fish in the 21st century
9. The shifting baselines syndrome: perception, deception and the future of our oceans
10. Assessment of exploited stocks of tropical fishes: an overview
11. Ecosystem-based fisheries management in the face of climate change
12. Progress in the use of ecosystem modeling for fisheries management
13. Science and capacity building for sustainable development in fisheries
14. Thinking big on small scale fisheries
15. Coastal-marine resource use in human ecological context
16. Global fisheries economic analysis
17. Linking conservation policy and science
18. Using the science
19. The scientist as communicator
20. Scenario development for decision-making
21. The relationship between science and ocean policy



What is it - marine?

WHAT IS ECOSYSTEM-BASED MANAGEMENT FOR THE OCEANS?

Ecosystem-based management is an integrated approach to management that considers the entire ecosystem, including humans. The goal of ecosystem-based management is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need. Ecosystem-based management differs from current approaches that usually focus on a single species, sector, activity or concern; it considers the cumulative impacts of different sectors. Specifically, ecosystem-based management:

- emphasizes the **protection** of ecosystem structure, functioning, and key processes;
- is place-based in focusing on a specific ecosystem and the range of activities affecting it;
- explicitly accounts for the interconnectedness within systems, recognizing the importance of interactions between many target species or key services and other non-target species;
- acknowledges interconnectedness among systems, such as between air, land and sea; and
- integrates ecological, social, economic, and institutional perspectives, recognizing their strong interdependences.



McLeod et al. 2005. Scientific consensus statement on marine ecosystem-based management.

ECOSYSTEMS MISSION GOAL

OUTCOMES

- Healthy and productive coastal and marine ecosystems that benefit society
- A well informed public that acts as a steward of coastal and marine ecosystems

PERFORMANCE OBJECTIVES

Increase number of fish stocks managed at sustainable levels.

Increase number of protected species that reach stable or increasing population levels.

Increase number of regional coastal and marine ecosystems delineated with approved indicators of ecological health and socio-economic benefits that are monitored and understood.

Increase number of invasive species populations eradicated, contained, or mitigated.

Increase number of habitat acres conserved or restored.

Increase portion of population that is knowledgeable of and acting as stewards for coastal and marine ecosystem issues.

Increase number of coastal communities incorporating ecosystem and sustainable development principles into planning and management.



The marine version of the EBAM is a conservationist policy that came to scientists from the top down (WSSD)

This partly reflects the influence of NGOs in the political process that led to its adoption.

Is this another example of deflecting our attention onto details while minimizing or ignoring the reality of unsustainable exploitation of marine resources that is forced upon us because we are pushing the planet's carrying capacity?



What it is depends on who you are

- For politicians and managers, the EBAM is mainly about meeting international commitments (and/or national directives) and about managing human activity
- For marine scientists, the EBAM is currently mainly about time-series (are things changing?), observations (indicators) and forecasting
- For fisheries scientists, the EBAM is mainly about "maximum sustainable" exploitation (really, no different from their pre-EBAM focus)
- For sociologists it is about managing people
- For economists it is about value (from extraction and services)



How are we operationalizing it?

LMEs/biogeographic zones?

Indicators?

Trophodynamic models?

Etc.



MAP KEY:

- LME Numbers
1. Eastern Bering Sea
 2. Gulf of Mexico
 3. Caribbean Sea
 4. Gulf of California
 5. Gulf of California (Continental Shelf)
 6. Gulf of California (Continental Shelf)
 7. Eastern Tropical Pacific
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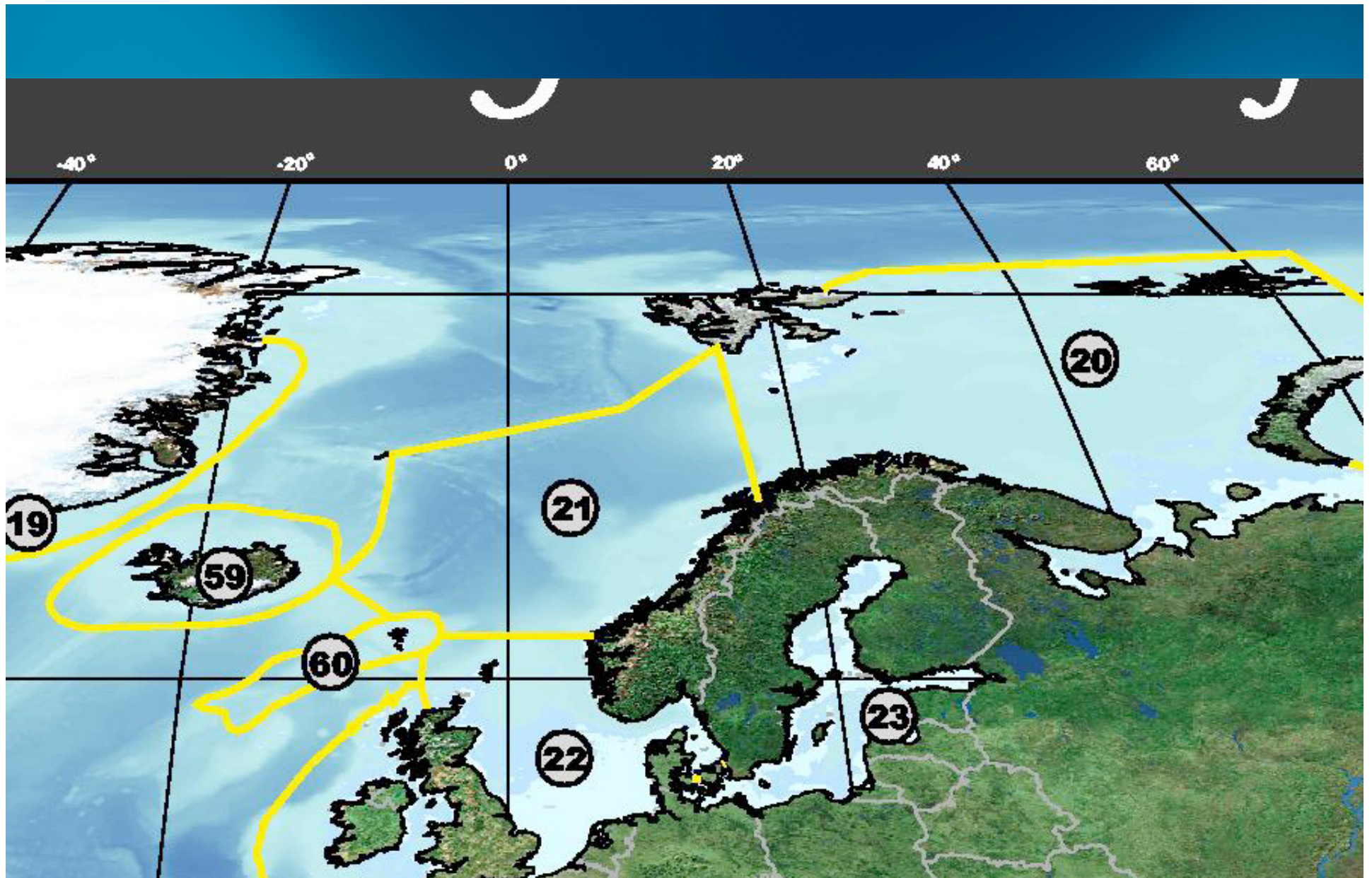
Large Marine Ecosystems of the World

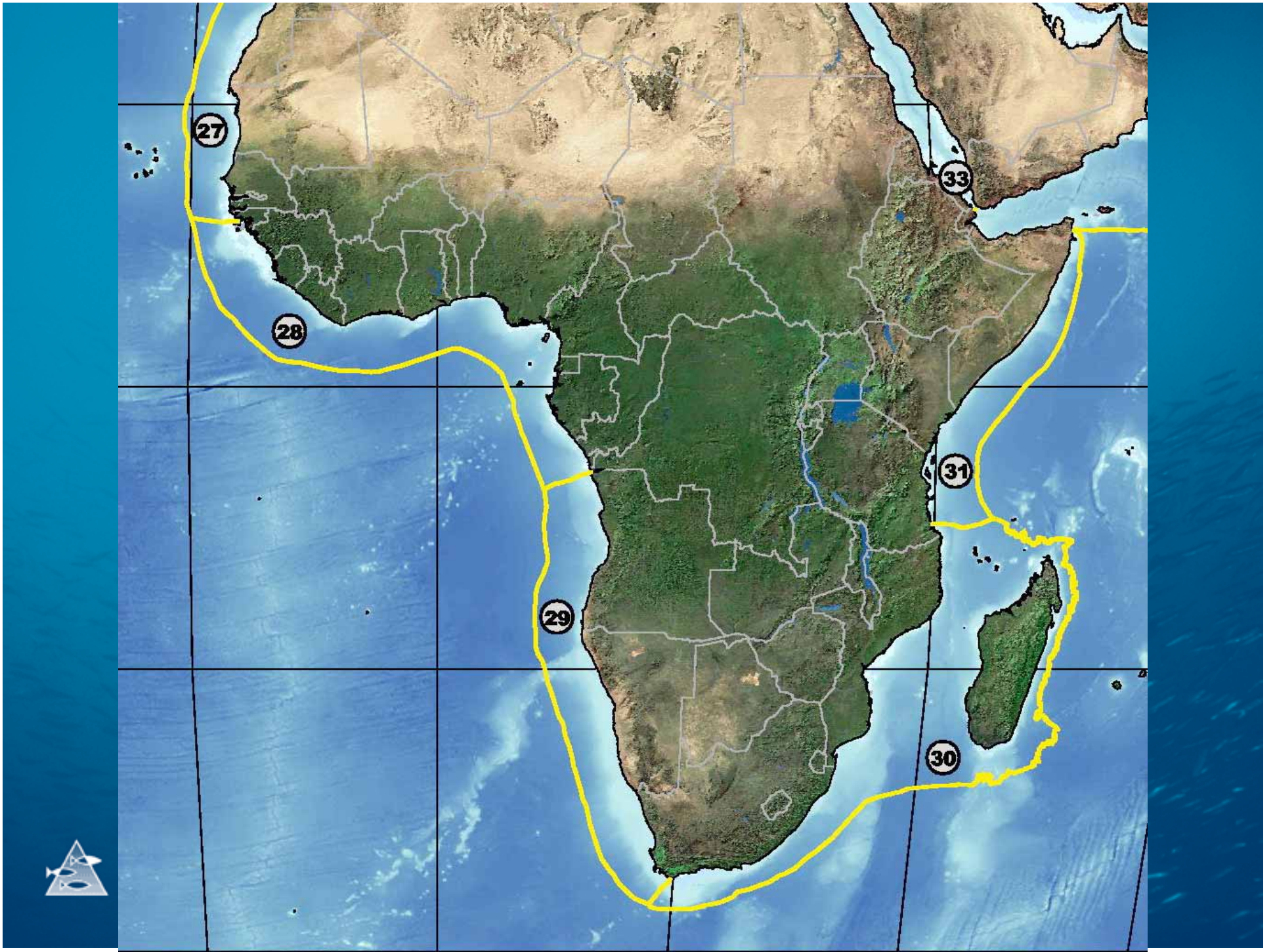


LARGE MARINE ECOSYSTEMS are areas of the ocean characterized by distinct bathymetry, hydrography, productivity, and trophic interactions. They annually produce 95 percent of the world's fish catch. They are national and regional focal areas of a global effort to reduce the degradation of coastal resources and environments from pollution, habitat loss, and over-fishing.

For More Information Visit: <http://www.lme.noaa.gov>







Indicators

Net primary production

Respiration

Mean trophic level

Total biomass

Pacific decadal oscillation

ENSO index

SST

Upwelling

Deep water temperature and salinity

Physical spring transition

Copepod species biodiversity



Indicators

**the new monitoring, but with the
same old problem: insufficient
spatiotemporal coverage with
respect to productivity-determining
processes**





ICES
CIEM

International Council for
the Exploration of the Sea
Conseil International pour
l'Exploration de la Mer

INSIDE OUT



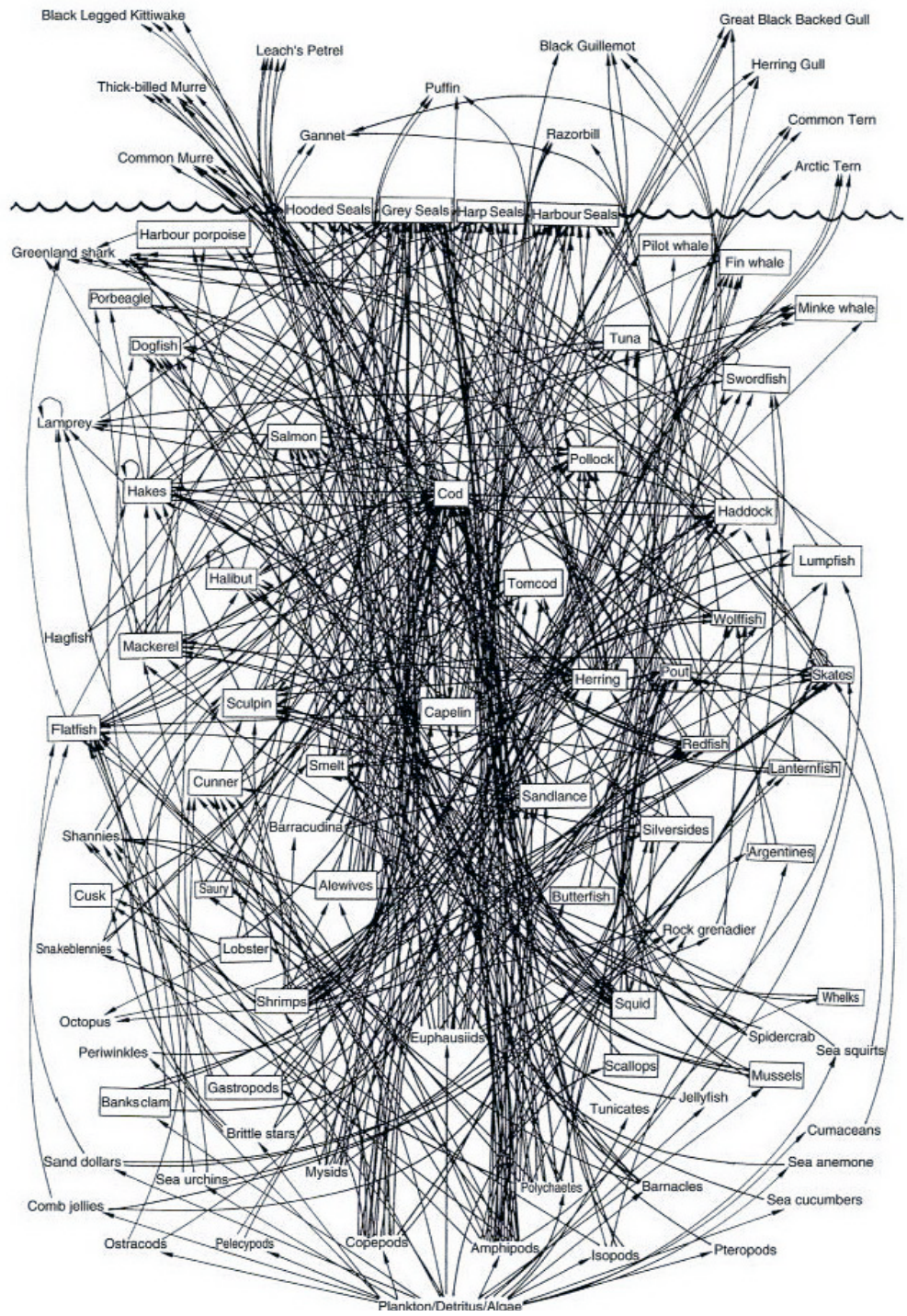
ICES Inside Out, 2010 No. 4

Retiring Head of Advisory Hans Lassen reflects on his long career in marine science

My vision for the future of ICES and its Advisory Services

Under an ecosystem approach we will monitor the status of the marine ecosystem including its fish stocks with an ever-increasing demand for data. This demand I think cannot be met in future because of the costs implied under the present technology. Therefore, we will see new data collection technologies and management that is





Lavigne, 1996.
 Partial food web
 of the Scotian
 shelf



Models and muddles

Some philosophical observations

J. W. HEDGPETH ✓

Santa Rosa, California, USA

ABSTRACT: The first model in marine ecology was that of the biocoenosis by Moebius (1883), conceived as a self-contained box limited by a finite food resource. This box was almost immediately broken down by Dean (1893) and demonstrated to be a bit of a muddle, but the concept and the general term has persisted. Today, the construction of elaborate diagrams and mystico-mathematical representations of assumed relationships powered by selected values is a favorite pastime of many ecologists and "environmental engineers". When taken with a grain of salt (preferably benzoate of soda), such models may stimulate further thought. Fisheries biologists have had some success with single species or paucispecific models, but complex models require simplification and selection of data unrepresentative of nature. A model which is simply an elaborate mathematical summary of a textbook does not tell us much more than we already know, and its formulation involves a questionable diversion of funds.

Operationalizing the EBAM

To achieve the full potential of the ecosystem approach, it is important to train ourselves and our students to do interdisciplinary research. The currently popular terms “interdisciplinary” and “multidisciplinary” are used loosely, in my opinion, by scientists referring to ecological approaches to environmental problems. It seems to me that we approach these complex, “multi” disciplinary problems from the viewpoint of our respective disciplines (e.g. ecology, economics, sociology, hydrology, etc.) rather than at the interstices between our disciplines. It is difficult to think of examples where disciplines brought expertise to bear in an integrated manner to produce a true *inter* (between) disciplinary result for an environmental problem. We may work together or share data for a while, but rapidly retreat to the familiarity and “safety” of our own disciplines when facing extreme complexity. Thus, in my view, interdisciplinary is the goal that we all strive for in ecosystem science, but multidisciplinary is the current status.



**How much ecology is
there in the EBAM?**



Ten Commandments for Ecosystem-Based Fisheries Scientists

ABSTRACT: In an effort to accelerate the ongoing paradigm shift in fisheries science from the traditional single-species mindset toward more ecosystem-based approaches, we offer the following “commandments” as action items for bridging the gap between general principles and specific methodologies.

1. Keep a perspective that is holistic, risk-averse, and adaptive.
2. Question key assumptions, no matter how basic.
3. Maintain old-growth age structure in fish populations.
4. Characterize and maintain the natural spatial structure of fish stocks.
5. Characterize and maintain viable fish habitats.
6. Characterize and maintain ecosystem resilience.
7. Identify and maintain critical food web connections.
8. Account for ecosystem change through time.
9. Account for evolutionary change caused by fishing.
10. Implement an approach that is integrated, interdisciplinary, and inclusive.



“Account for” = mechanisms

Francis et al. (2007). Fisheries

Are there eco-metrics for fisheries?

John H. Steele

Woods Hole Oceanographic Institution, Woods Hole MA 02543, USA

Accepted 3 November 2005

Abstract

Ecosystem-based management of marine resources is a worthy ideal. At present, however, the science is unable to measure and relate the fundamental concepts of diversity, productivity and resilience required for management decisions. Further, we do not have legal or fiscal measures that would allow us to allocate these resources to reserves, fishing quotas or fish farms. A proper appreciation of these shortcomings is needed.

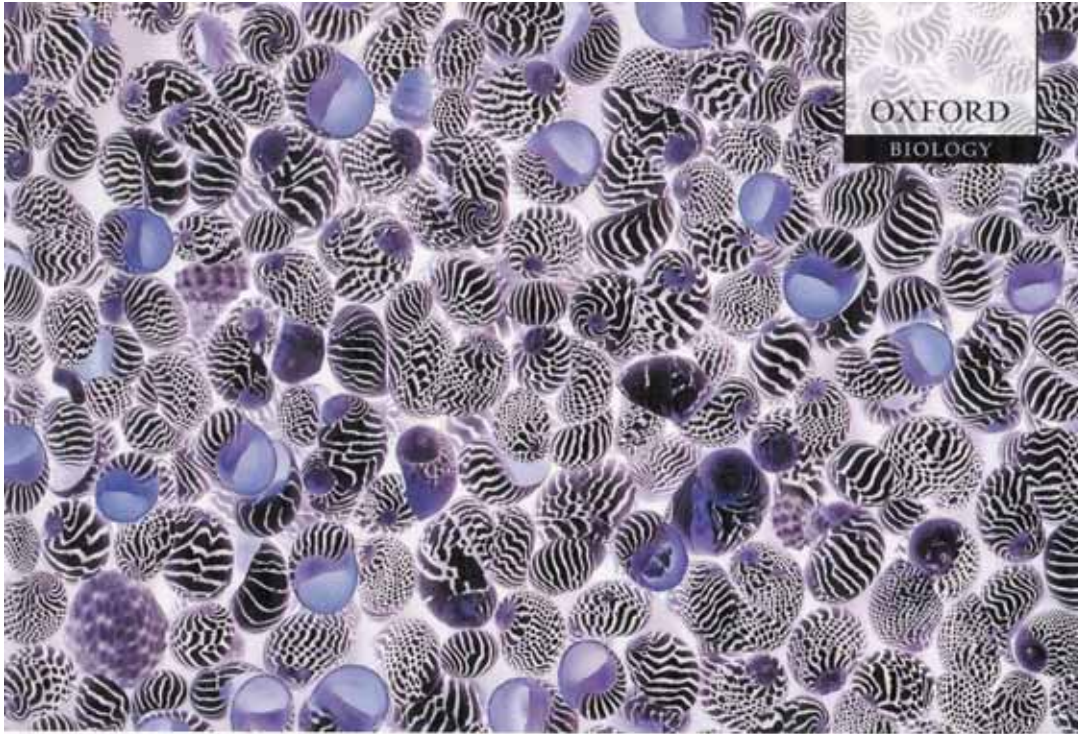


Nonetheless

If we do want to go from *a posteriori* descriptions to predicting changes in productivity-determining processes...

Causality: proximate and ultimate mechanisms (population and community ecology)





Ecological stoichiometry

**Network analysis/Neural networks/
Web page weighting factors**

Information theoretic metrics

Size spectrum analysis

Productivity

Diversity/Stability/Resilience

Succession

Connectedness

Coherence

Food webs

Competition

Aquatic Food Webs

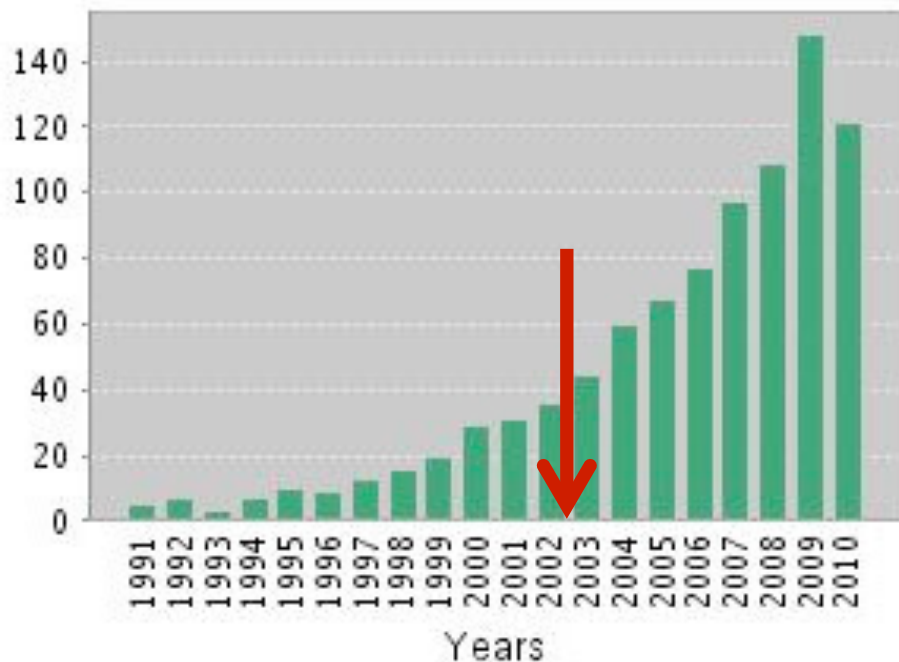
an ecosystem approach

Edited by
Andrea Belgrano,
Ursula M. Scharler,
Jennifer Dunne, and
Robert E. Ulanowicz

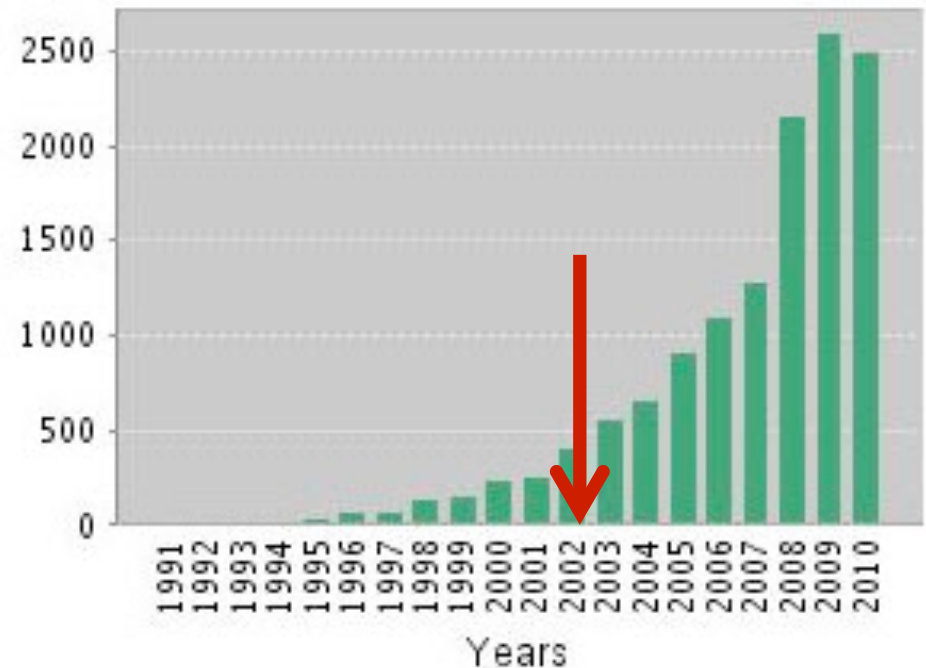
Ecosystem approach + marine

912 hits (but there are 6226 hits for EA only)

Published Items in Each Year



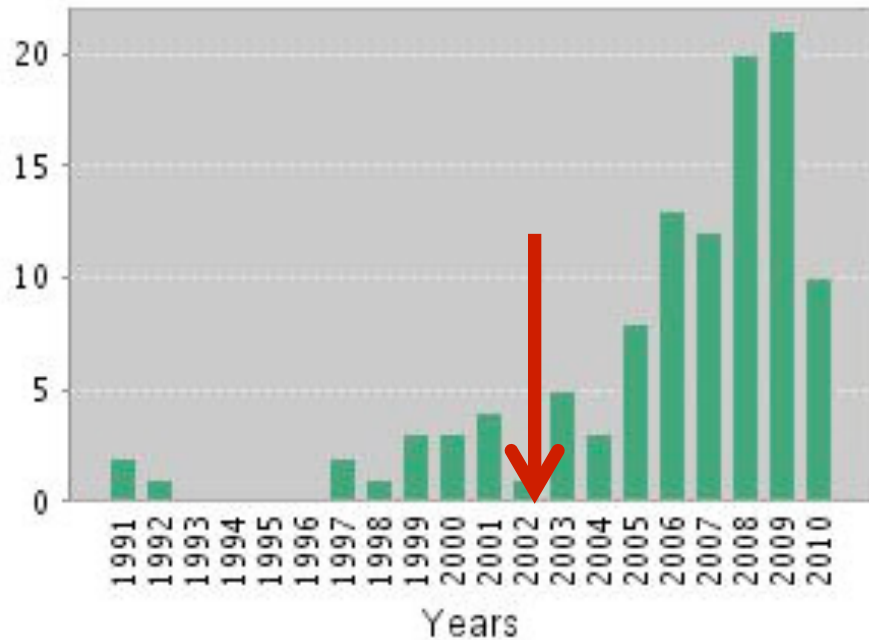
Citations in Each Year



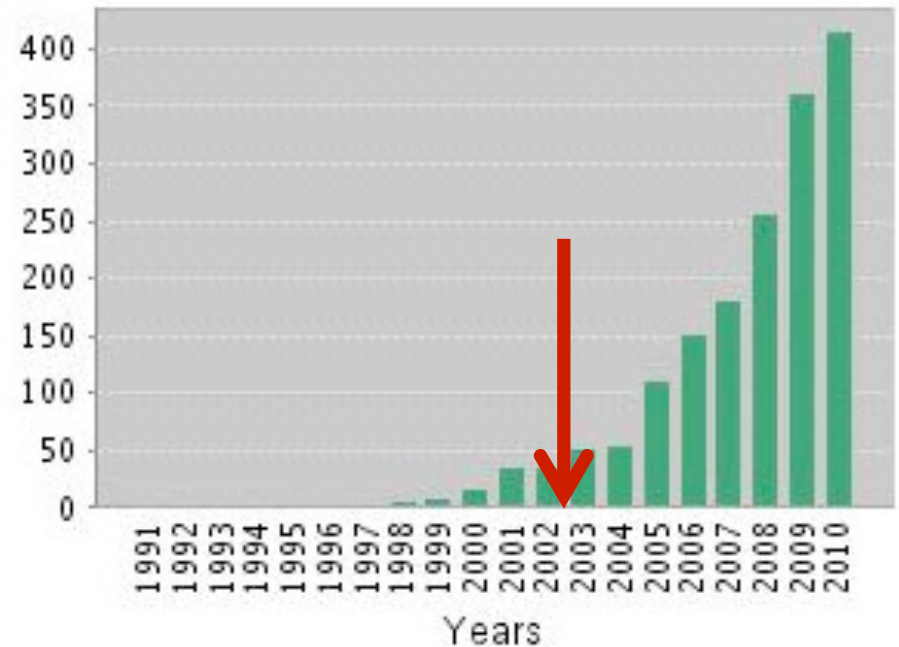
Ecosystem approach + marine + ecology

109 hits (879 for EA + ecology)

Published Items in Each Year



Citations in Each Year



**Do we really need alot more
ecological research to
achieve the “sustainability”
objective of the EBAM?**



Responsible Fisheries in the Marine Ecosystem (2002)

M. Sinclair, R. Arnason, J. Csirke, Z. Karnicki, J. Sigurjonsson,
H. Rune Skjoldal and G. Valdimarsson

*“It is human activities that are being managed,
not the ecosystem.”*

Managing fisheries is managing people: what has been learned?

Ray Hilborn

Fish and Fisheries 2007, 8, 285-296.



Factors that contribute to making fisheries unsustainable (Gréboval, 2002)

Factor	Type of effects and contributing factors	Tools that address (from Table 2)
1 Inappropriate incentives	Promote short-term choices, overcapitalisation of fleets	1,2,4,5,8
2 High demand for limited resources	Too much price elasticity, Costs to fish subsidized	2,8
3 Poverty and lack of alternatives	Regional disparity, subsistence Regional economic dependency	4,5
4 Complexity and lack of knowledge	Unreliable commercial data, Insufficient surveys, too little knowledge of human and ecological system dynamics	3,6
5 Ineffective governance	Conflicting policy/ management objectives, Lack of will or authority of government to act	2,3,7
6 Interactions of fisheries sector with other sectors and the environment	Beyond control of the sector but affect success of management and require robust or reactive strategies	6





The Sunken Billions

THE ECONOMIC JUSTIFICATION
FOR FISHERIES REFORM



The World Bank & FAO, 2009

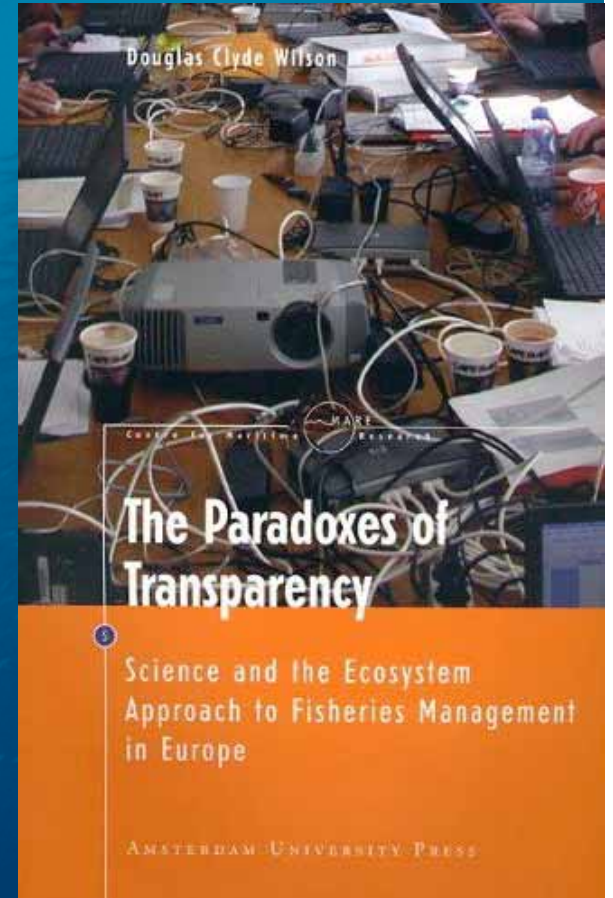


“This study and previous studies indicate that the current marine catch could be achieved with approximately half of the current global fishing effort. In other words, there is massive overcapacity in the global fleet.”

”...successful reforms should take the time to build consensus among fishers on the transition pathways, make provisions for creating alternative economic opportunities, establish social safety nets for affected fishers, and generally manage transition in an equitable manner....”

”Science does matter, but it is not decisive because fisheries management in a democracy is fundamentally a political activity rather than a technical one.”

**p. 29, Douglas Clyde Wilson.
2009. The Paradoxes of
Transparency. Science and the
Ecosystem Approach to Fisheries
Management in Europe**



PROC. N.S. INST. SCI. (1980)
Volume 30, pp. 3-19

THE NATURAL HISTORY OF FISHERIES MANAGEMENT

T.D. ILES

*Marine Fish Division, Research Branch
Department of Fisheries and Oceans, Biological Station
St. Andrews, N.B. E0G 2X0*

The history of attempts at management of fisheries is presented. Current knowledge of the biology of fish populations is critically reviewed as such data have been the basis of schemes of management in the past. It is concluded that social, political, and economic factors are at least as important in fisheries management as the scientific knowledge of the resource.



”...including ecosystem considerations in fisheries management provides a framework within which States and fisheries management organizations would *enhance* management performance.”

Is there any evidence (as yet) to support this?



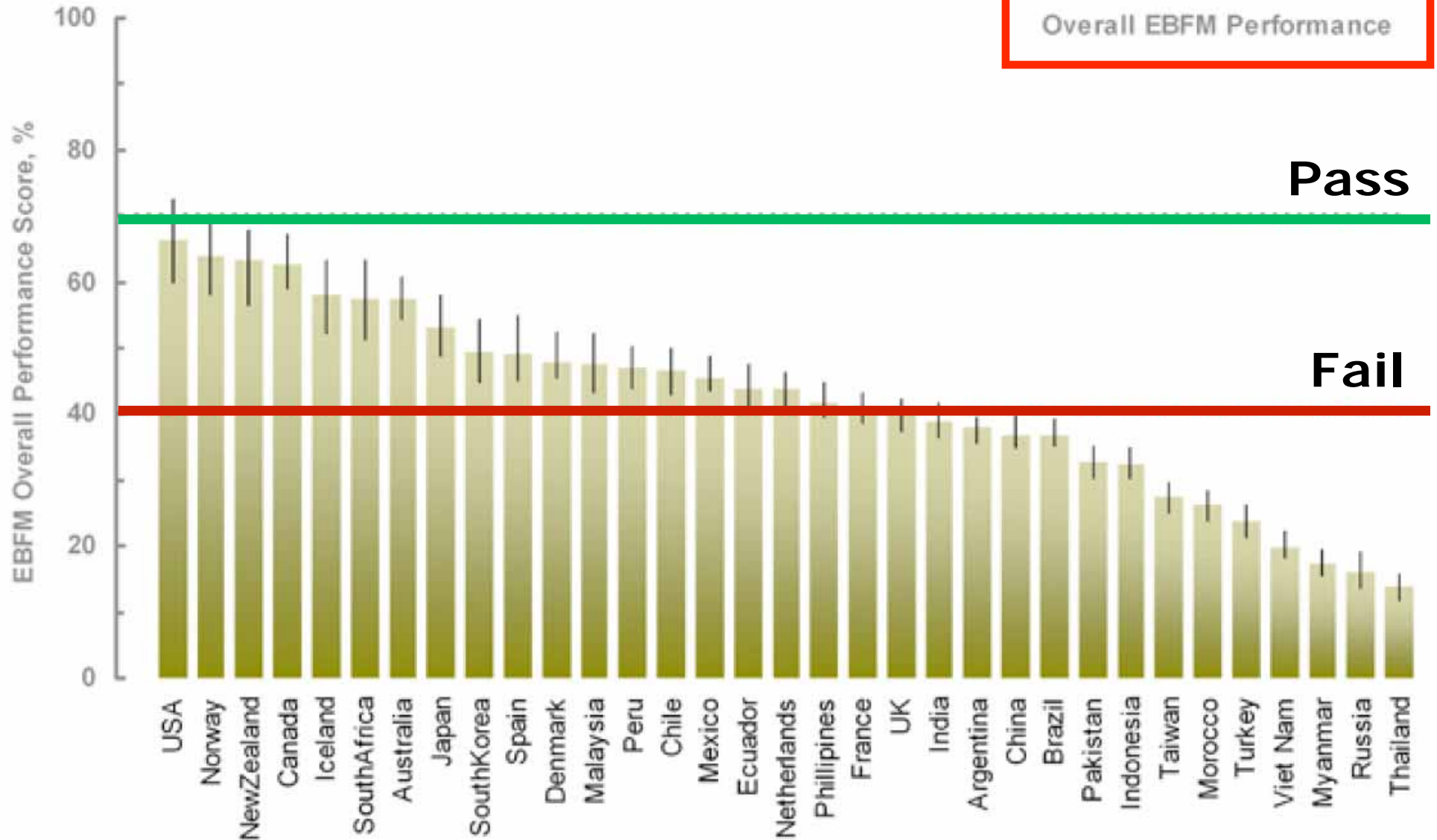
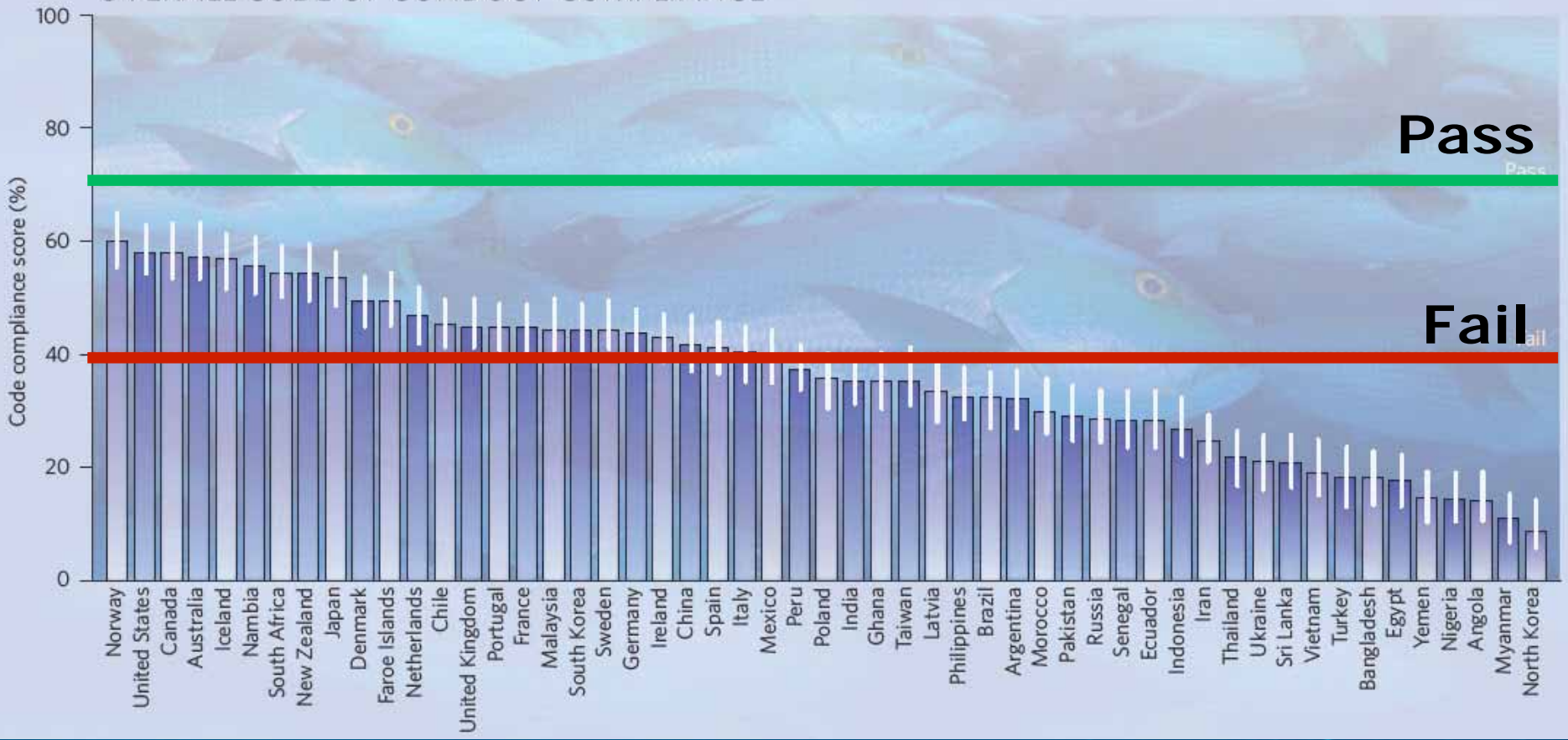


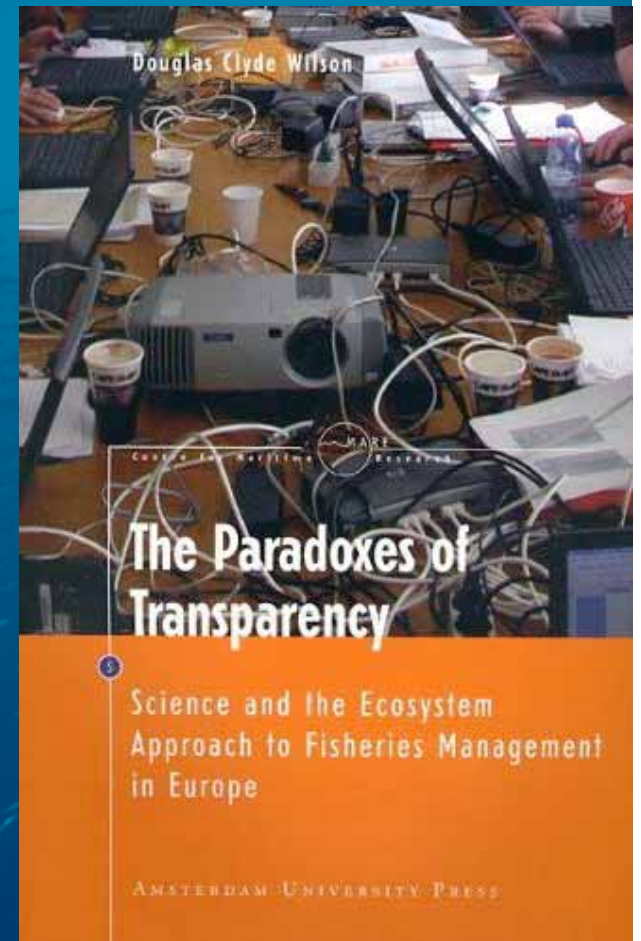
Figure 1
OVERALL CODE OF CONDUCT COMPLIANCE



Pitcher et al. (2009). Not honouring the code. Nature 457: 658-659.

”The CFP has failed in terms of sustainability.... The implementation of the CFP has had no real impact on the condition of fish stocks”

**p. 30, Douglas Clyde Wilson.
2009. The Paradoxes of
Transparency. Science and the
Ecosystem Approach to Fisheries
Management in Europe**



Reduced fleet capacity
Ecological risk assessment
Precautionary approach
Adaptive management
No-fish zones
No-exploitation zones
Exploitation zones
VERY large MPAs



- At present, the EBAM is not mainly about ecology. Further, how much ecology ends up being included is probably not the major determinant of EBM's success (MPAs may be an exception)

- The EBAM is about managing human activity, not about managing ecosystems (which is clearly impossible). That means that, even if we deliver "perfect" scientific information, what is done with it down the EBAM line is out of our hands

- The cost of implementing a truly EBAM – worldwide - is in the 100s of billions of USD. Nothing close to this is (nor will be) available

- Therefore, we must be realistic about what the EBAM can deliver. Failure to do so will undermine our credibility*



Can we manage ecosystems in a sustainable way?

Jake Rice*
Journal of Sea Research (2008) 60: 8-20.

The ecosystem approach may be a necessary step to take, because the problem of sustainable use of fish stocks may not be solvable at the scale it has been defined historically. However these results imply that moving to an ecosystem scale of considerations is going to make the search for sustainability even more difficult. Moreover there is still no guarantee that a solution can be found — at least not any solution without major reductions in social and economic expectations.



**“With man,
most of his
misfortunes
are
occasioned
by man.”**

**Pliny the Elder, 23-79
A.D.**

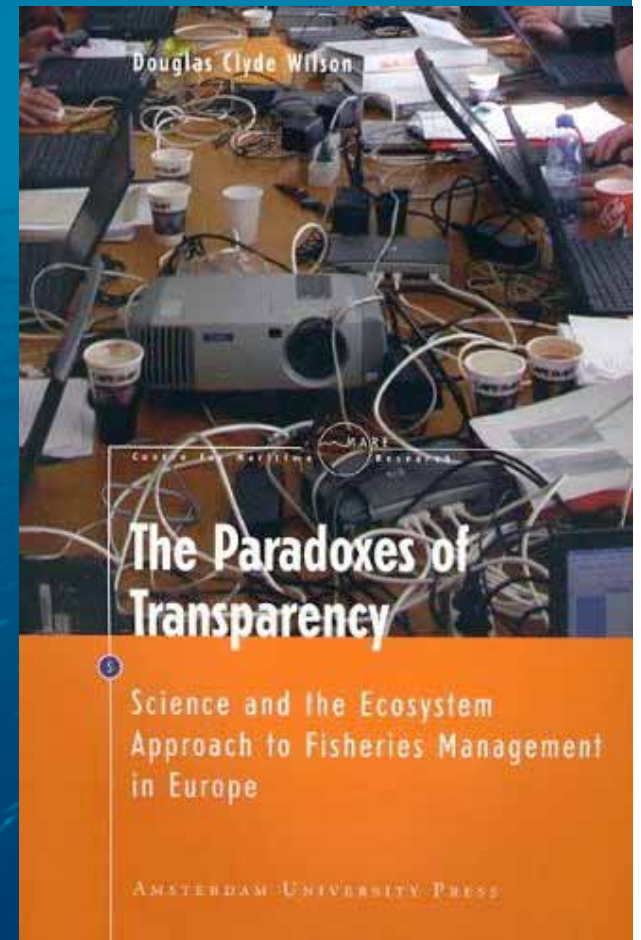


Ray Troll



Inflating the science boundary: "Habermas (1984) warns against a tendency, rooted in a desire for control, to try to redefine cultural phenomena into technical ones. When this happens, social relationships are made to appear as natural and inevitable, rather than as the concrete results of real decisions made by real people who could have chosen another route."

**p. 36, Douglas Clyde Wilson.
2009. The Paradoxes of
Transparency. Science and the
Ecosystem Approach to Fisheries
Management in Europe**



Is our science objective?

