# Ecosystem-based management and international marine governance

Henrik Österblom
henrik.osterblom@su.se
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Stockholm Resilience Centre
Research for Biosphere Stewardship and Innovation
Stockholm University
A PARTNER WITH
The Beijer Institute of Ecological Economics
Kungl. Vetenskaps-Akademien
The Royal Swedish Academy of Sciences
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# Ecosystem Based Management

- Of CBD-origin (late 1990s)
  - A common international commitment
  - "The primary framework for action"
  - Defined in the 12 Malawi principles

- Bergen Declaration 2002

- Increasingly advocated for
- Few, but increasing number of operational examples

- *In common* is to preserve the structure and function of the ecosystem, balance conservation and use, inclusivity of stakeholders and underlining the importance of adaptive management

# What is adaptive management?

- Requires a management structure that is adaptive to change and integrates a range of different and complementary sources of knowledge and capacity.

# Adaptive management requires

- *Flexible* and *learning-based* collaboration and decision-making processes, involving both state and non-state actors
- A whole landscape- or seascape approach

- Does not exclude more ”traditional” management tools

# Process

- Build knowledge and understanding of ecosystem services and dynamics
- Feed this knowledge into adaptive management processes
- Support flexible institutions and multilevel governance systems
- Deal with external perturbations, uncertainty and surprise

Folke et al. 2005 *Annual Review of Environment and Resources*

# Dealing with complex, multi-scale and interdependent challenges

- From
  - Government
  - Top-down
  - Command and control
  - Blueprint
  - Expert
- To
  - Governance
  - Polycentric
  - Adaptive co-management
  - Experimentation
  - Collaborative learning and stakeholder participation

# Common ingredients in marine ecosystem based approaches

- Mitigating unwanted effects on non-target species and habitats
- MPAs and Marine spatial planning
- Investigating ecosystem boundaries and thresholds
- Regarding humans as part of the system

# Mitigating unwanted effects on non-target species

- Gillnets around Greenland
  - Public awareness and policy has spread all over the world

nature International weekly journal of science

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Letters to Nature

Nature 237, 42-44 (5 May 1972) | doi:10.1038/237042a0

Mortality of Thick-billed Murres in the West Greenland Salmon Fishery

C. ERIC TULL[1], PAUL GERMAIN[2] & ARTHUR W. MAY[2,3]

1. [1]Département de Biologie, Université de Moncton, Moncton, New Brunswick
2. [2]Fisheries Research Board of Canada, Biological Station, St John's, Newfoundland
3. [3]Present address: Fisheries Service, Ottawa, Ontario K1A 0H3.

SINCE its inception in 1965, the drift net fishery for Atlantic salmon (*Salmo salar*) off West Greenland has taken a heavy toll of thick-billed murres (*Uria lomvia*)[1], which are entangled and drowned as they dive for food.

- Top

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- ARTHUR W. MAY

# Mitigating unwanted effects on non-target species

# Seabird distribution

- Karpouzi et al. 2007, *MEPS*

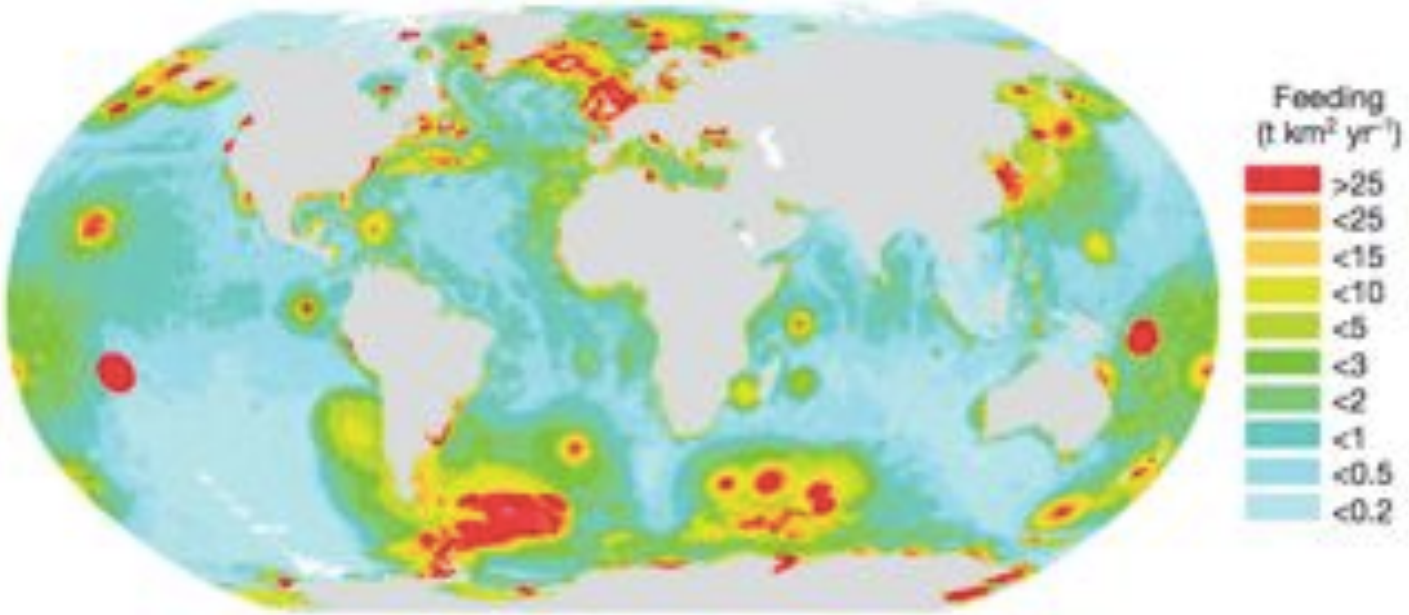



Fig. 3. Predicted global food consumption rate (in tonnes km$^{-2}$ year$^{-1}$) of all sea-birds combined for an average year in the 1990s

CAFF

Conservation of Arctic Flora and Fauna

Supporting Publication to the
Circumpolar Biodiversity Monitoring Program
CAFF CBMP Report No. 13
September 2008

# FRAMEWORK FOR A CIRCUMPOLAR ARCTIC SEABIRD MONITORING NETWORK

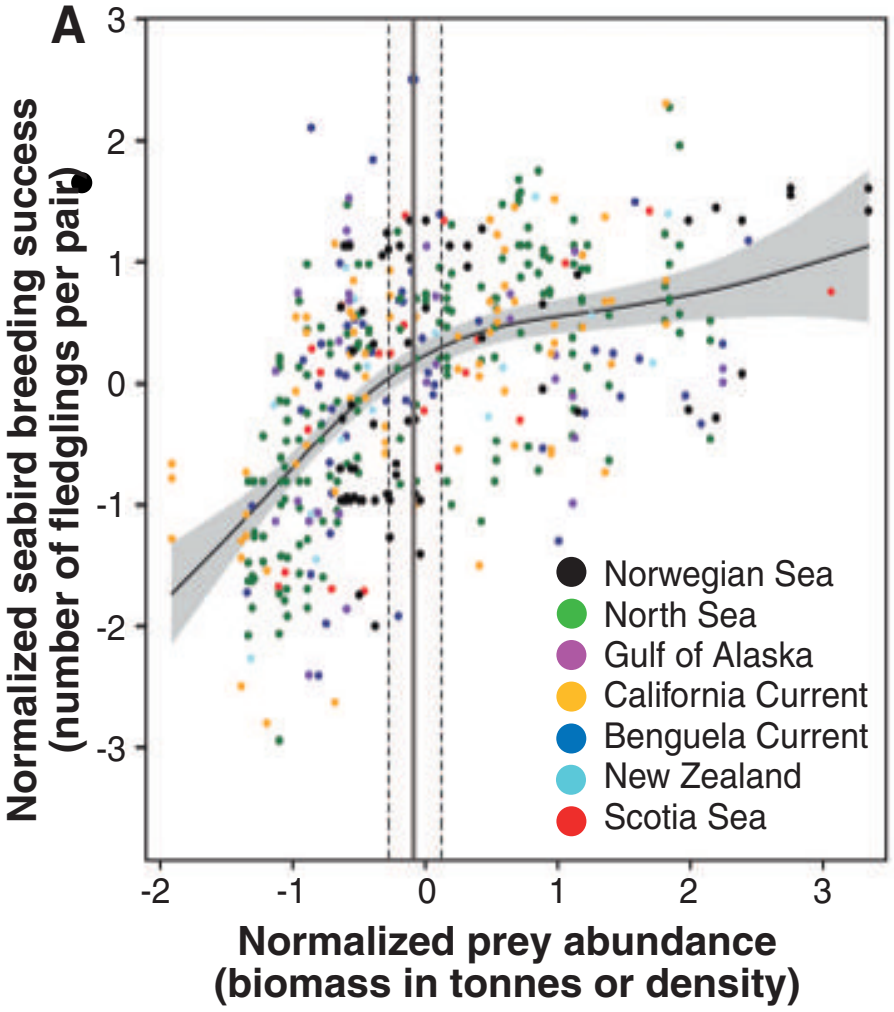
## CAFF's CIRCUMPOLAR SEABIRD GROUP

# Arctic Seabird colony map


Fig. 1 Distribution and size of Thick-billed and Common Murre colonies in the circumpolar countries: Iceland, Greenland, Canada, USA, Russia, Finland, Sweden, Norway, Great Britain, and the Faroe Islands.

Irons et al. 2008, Global Change Biology

# Competition for feed: Seabirds



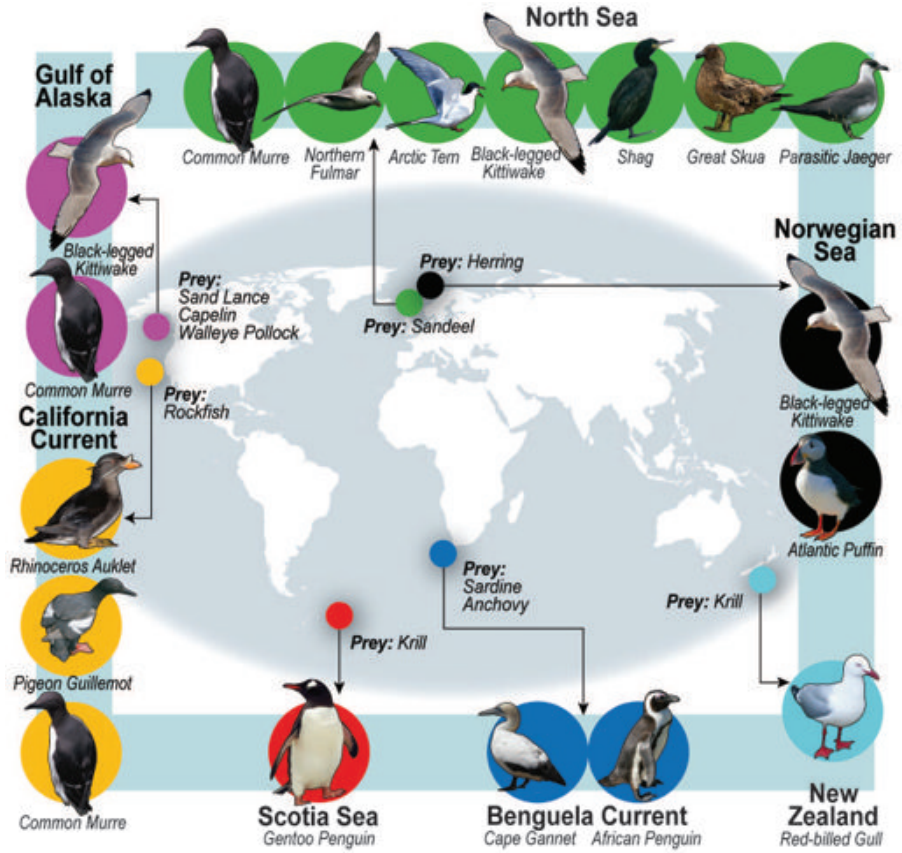
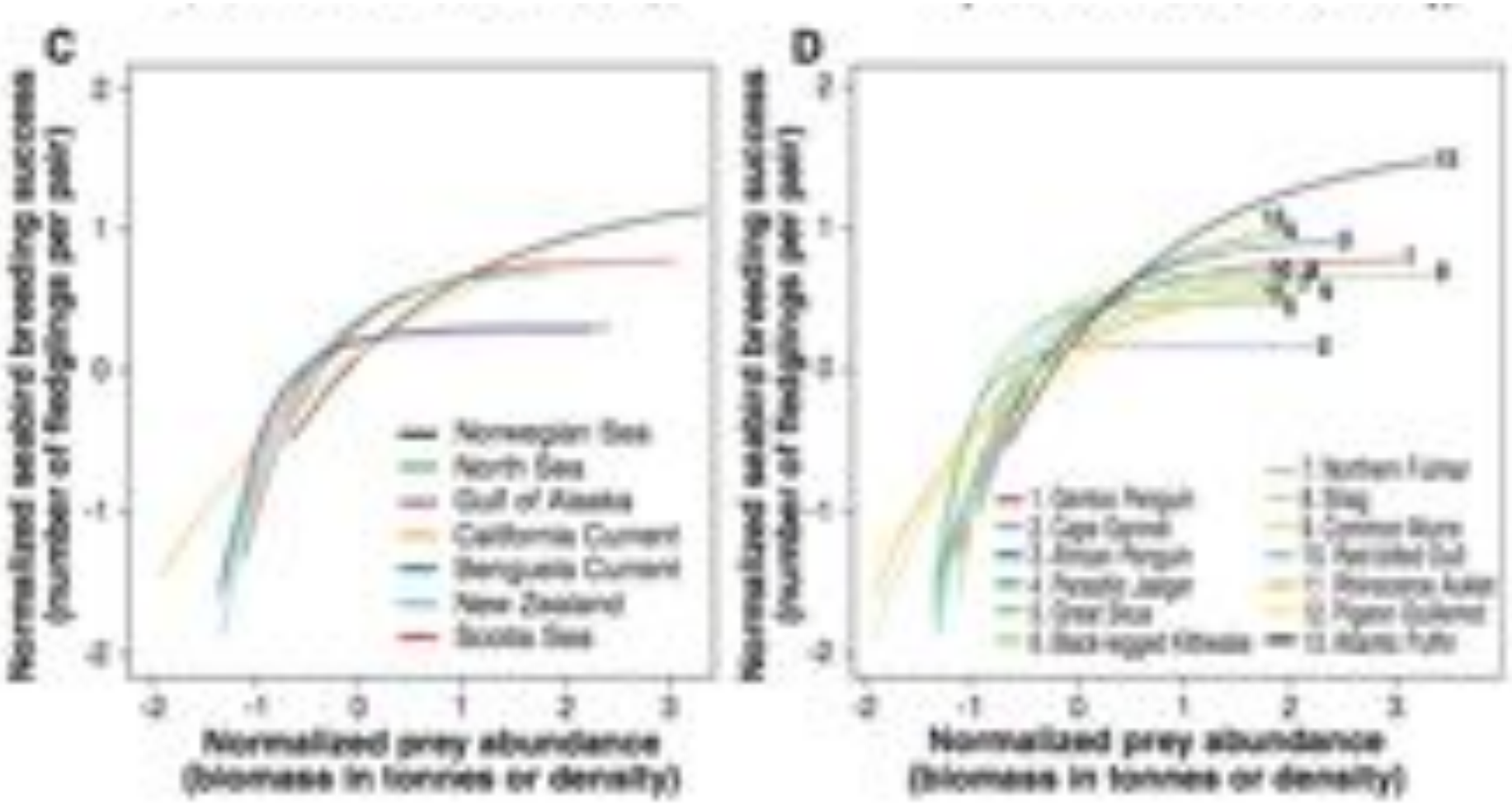
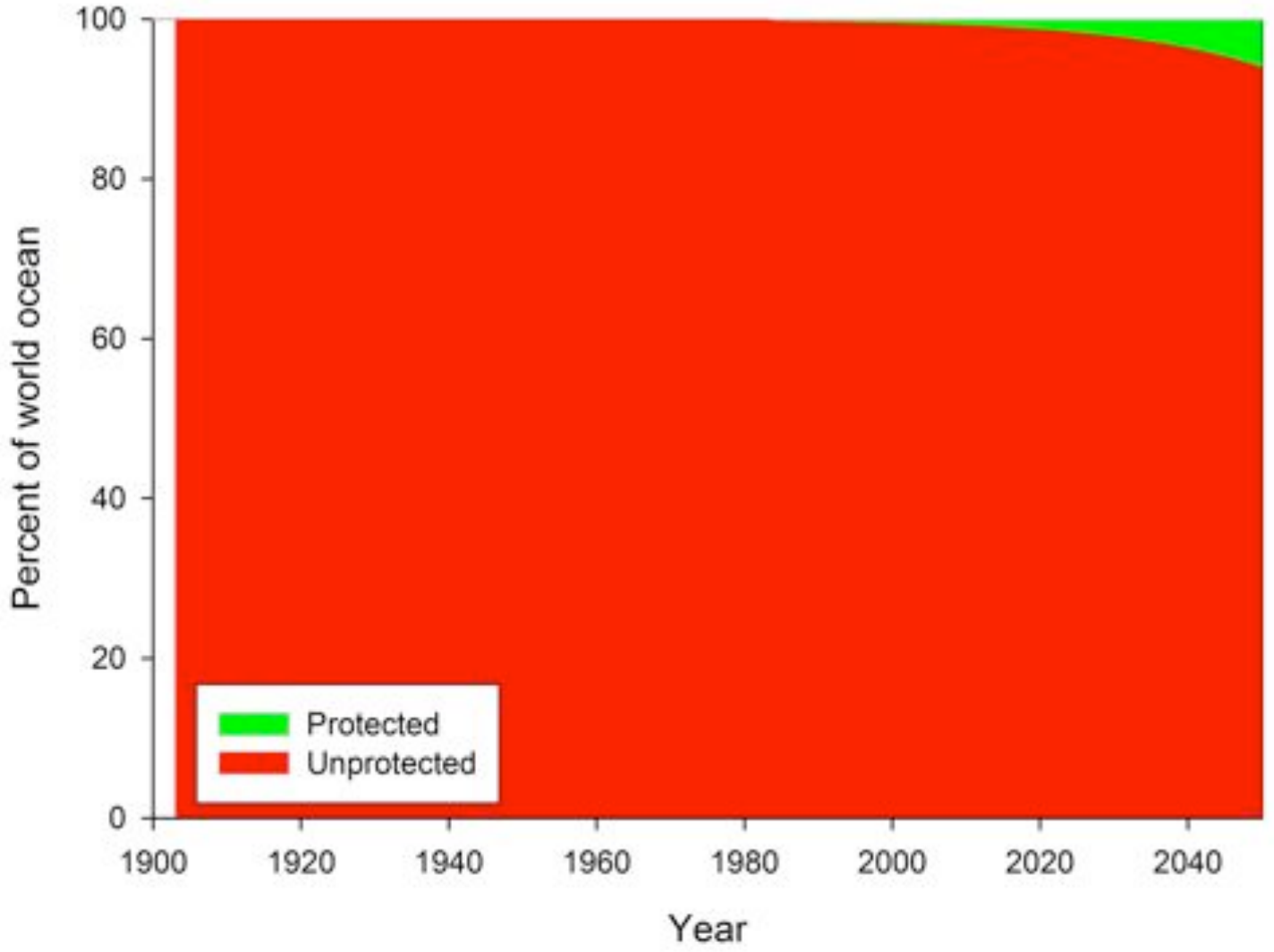




**Fig. 1.** Map of the distribution of seabird and prey species considered in our analysis.

Cury et al. 2011, Science


C
D
Normalized seabird breeding success
(number of fledglings per pair)
Normalized prey abundance
(biomass in tonnes or density)
Norwegian Sea
North Sea
Gulf of Alaska
California Current
Benguela Current
New Zealand
Scotia Sea
1 Northern Fulmar
2 Gentoo Penguin
3 Cape Gannet
4 Adelie Penguin
5 Parasitic Jaeger
6 Great Skua
7 Black-legged Kittiwake
8 Sooty
9 Common Murre
10 Rhinoceros Auklet
11 Pigeon Guillemot
12 Atlantic Puffin
13

# Marine Protected areas




Louisa Woods, UNEP-WCMC

# Marine Protected Areas

Most of the global MPA area is contained within 10 MPAs. Together they encompass 74% of the global marine area protected and 80% of the global reserve area. The table below shows information for the world's 10 largest MPAs.

| Country / location | MPA name | MPA Designation type | Year designated | Total area ($1000km^2$) | Marine area ($1000km^2$) | No-take area ($1000km^2$) | Link |
|---|---|---|---|---|---|---|---|
| Republic of Kiribati[1] | Phoenix Islands | Protected Area | 2008[1] | 410.5 | 410.5 | 0.5 | View |
| Australia | Great Barrier Reef | Marine Park | 1975 | 344.4 | 344.4 | 115.4 | View |
| USA[2] | Papahānaumokuākea | Marine National Monument | 2006 | 341.4 | 341.4 | 3.5 | View |
| Commonwealth of the Northern Mariana (USA) | Marianas Trench | Marine National Monument | 2009 | 246.6 | 246.6 | 3.5 | View |
| USA | Pacific Remote Islands | Marine National Monument | 2009 | 225.6 | 225.6 | 0.5 | View |
| Australia | Ningaloo Marine | Marine Park | 1987 | 183.1 | 183.1 | 88.3 | View |
| Galapagos Islands (Ecuador) | Galapagos | Marine Reserve | 1998 | 133.3 | 133.3 | 1 | View |
| Greenland (Denmark) | Greenland | National Park | 1974 | 972.9 | 113.9 | 1 | View |
| Colombia | Malpelo | Marine Protected Area | 2006 | 90.1 | 89.9 | 2.1 | View |
| Australia (Heard and McDonald Islands) | Heard Island and McDonald Islands | Marine Reserve | 2002 | 64.3 | 64.3 | 64.3 | View |
| TOTAL | | | | 2,990.4 | 2,155.1 | 276.9 | |

[1] Phoenix Islands Protected Area was first designated in 2008 as a size of 185,158km$^2$ a size then enlarged in 2014 to cover 410,500km$^2$.

[2] Papahānaumokuākea Marine National Monument was first designated in 2006 as the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (as per Presidential Bill 13178). It is also only one designated as a Marine National Monument as per Presidential Bill 13196. Although it is not yet active. Two legislation used to redesignate it as a Marine National Monument whether their various restrictions (banning activities such as fishing) is required to have existed within 5 years of designation – as by 2017.

# Spatial management: Dynamic "event-triggered" closure

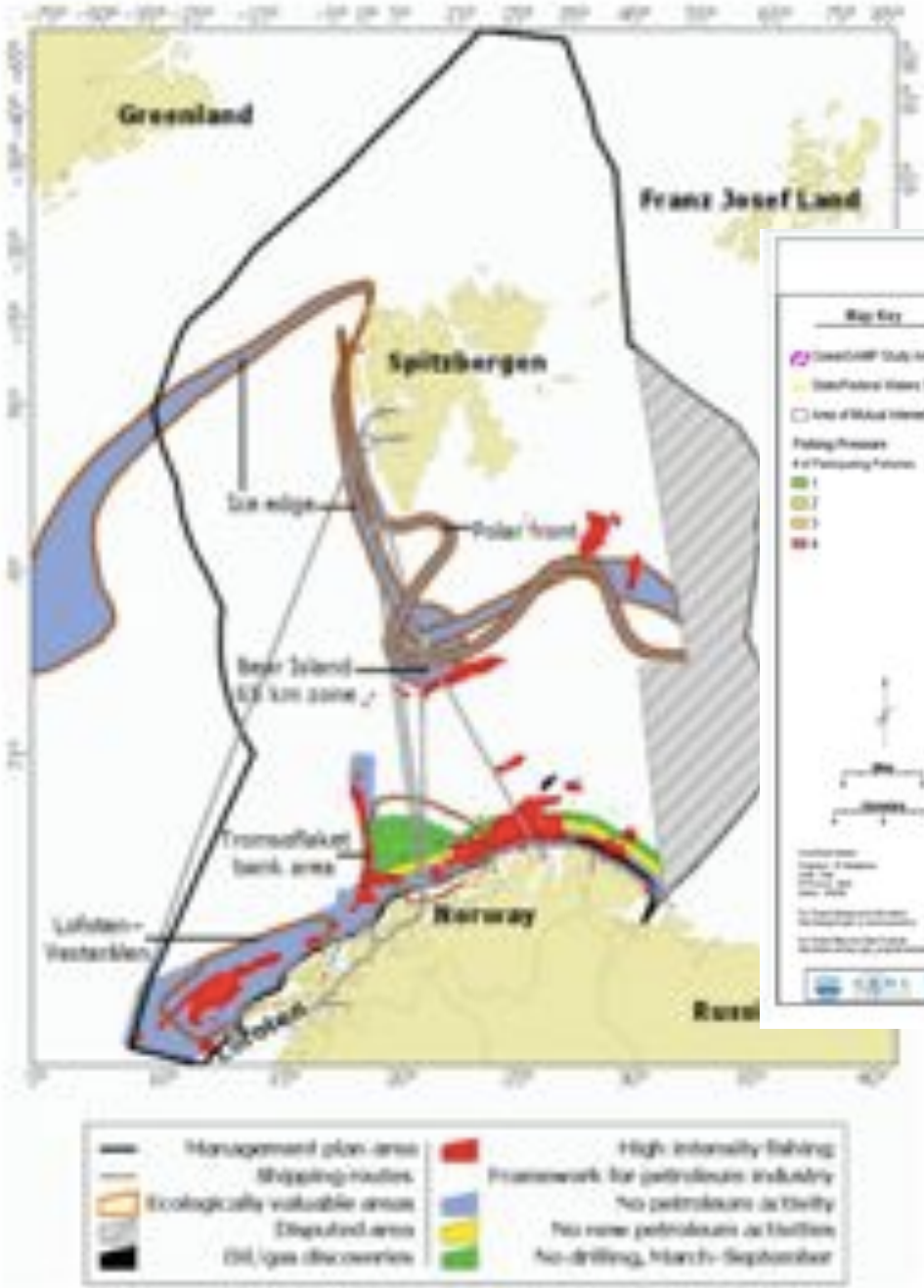
Dunne et al. 2013 Fish and Fisheries

Courtesy of Daniel Dunne, Marine Geospatial Ecology Lab, Duke University

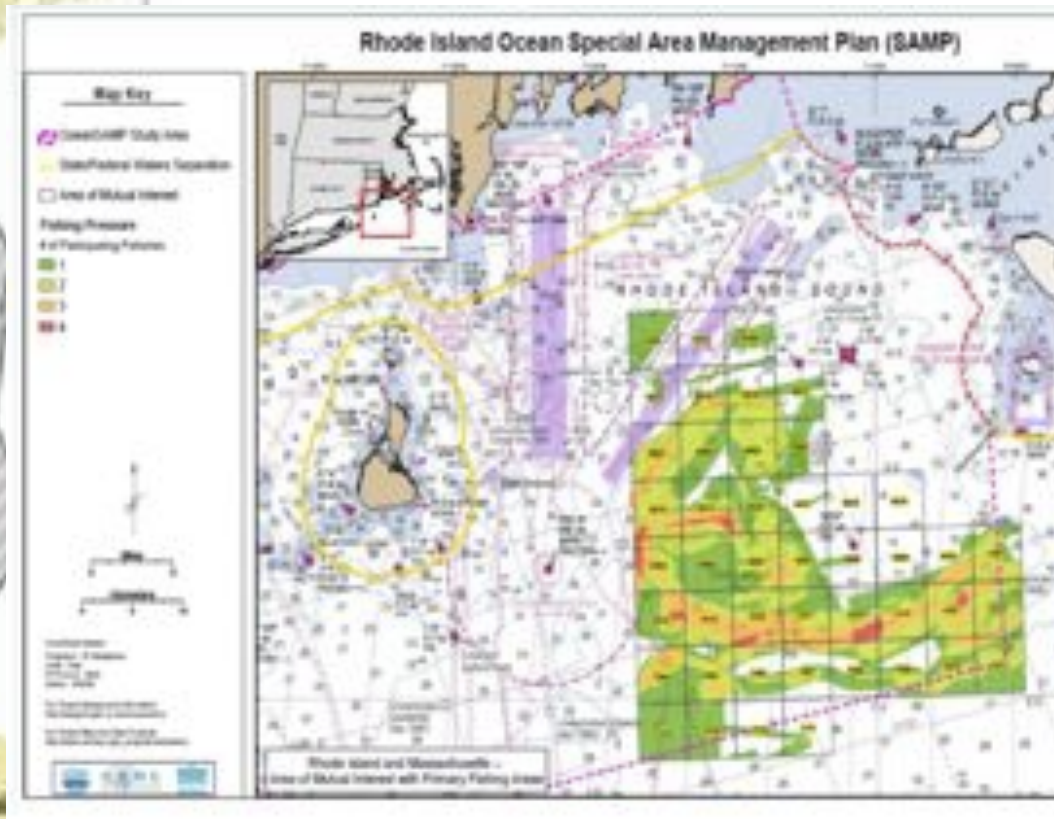
# Beyond MPAs: MSP as a multiple-use and conservation approach to marine space

- Marine spatial planning is increasingly seen as a tool for implementing the ecosystem approach

# . the Barents Sea

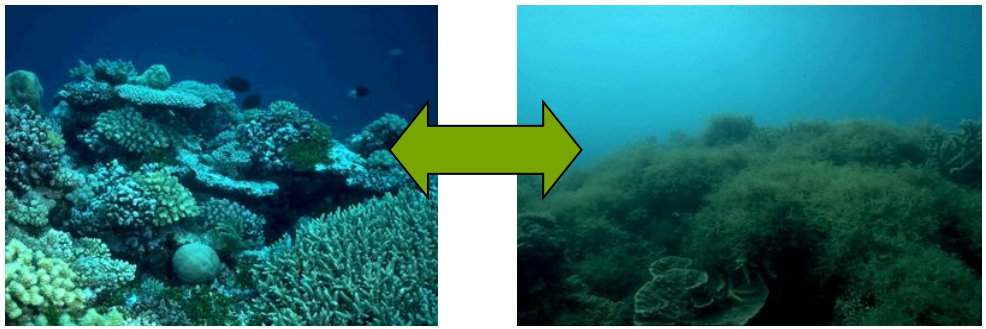



# .. and Rhode Island

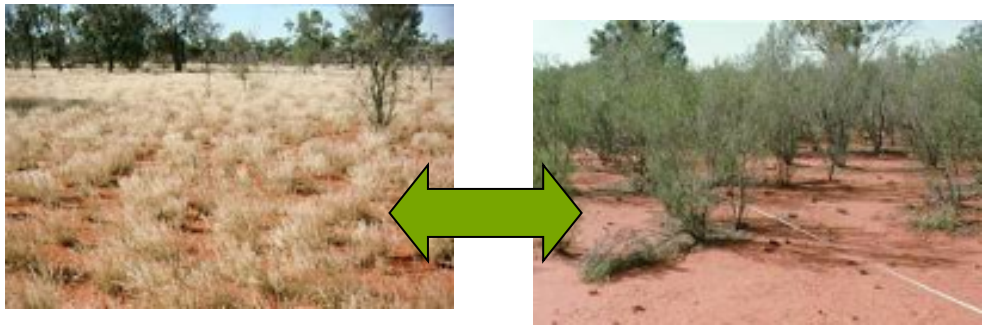



s covered by the ecosystem-based management plan for the Barents Sea, showing the main fishing areas, shipping lanes, and the mework for hydrocarbon extraction (2006–2010), together with the particularly valuable and vulnerable areas.

# THE WORLD IS NOT STATIC



Coral reefs



Grasslands

Tropical forests

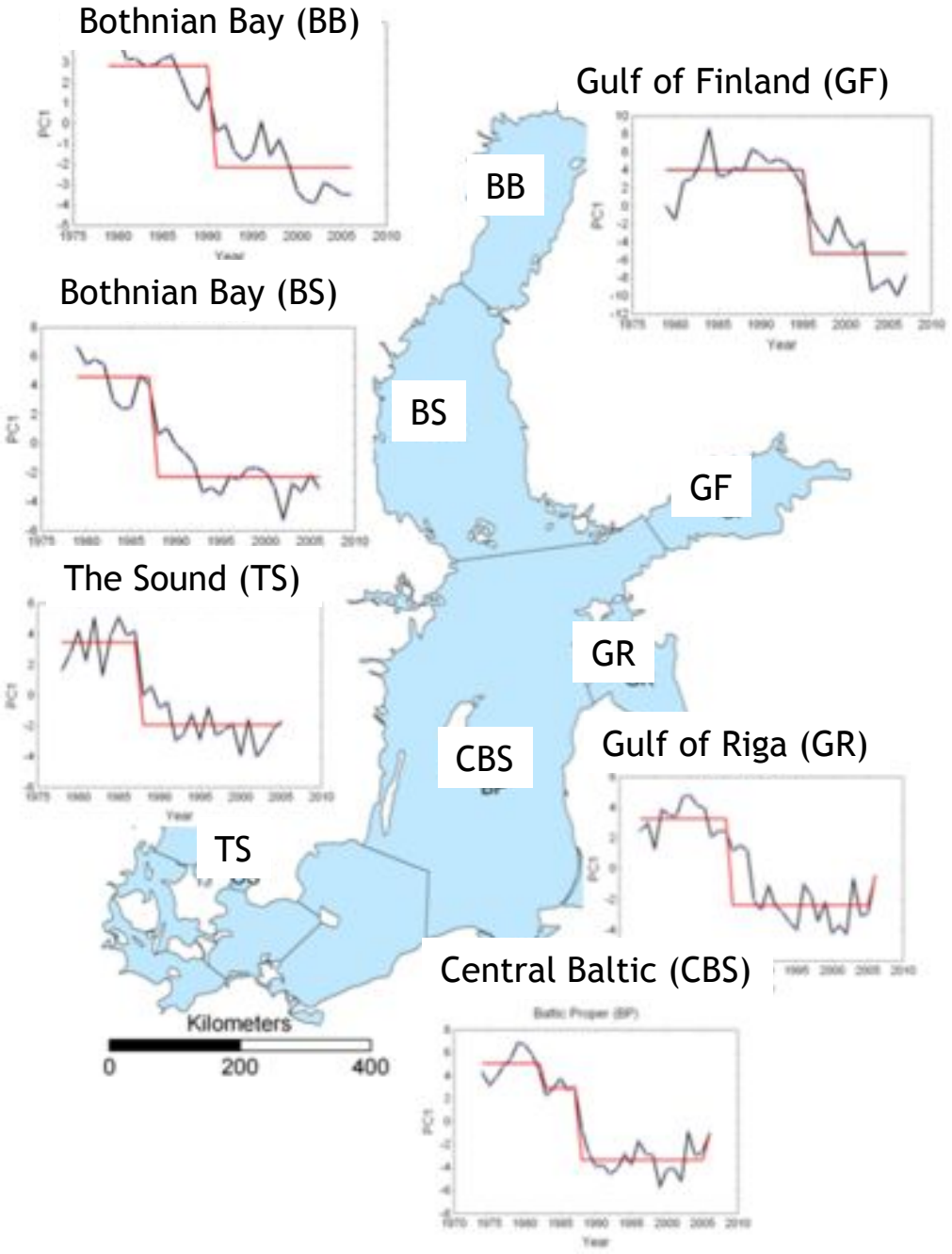
Coral dominance

Phase shift

# Algal dominance

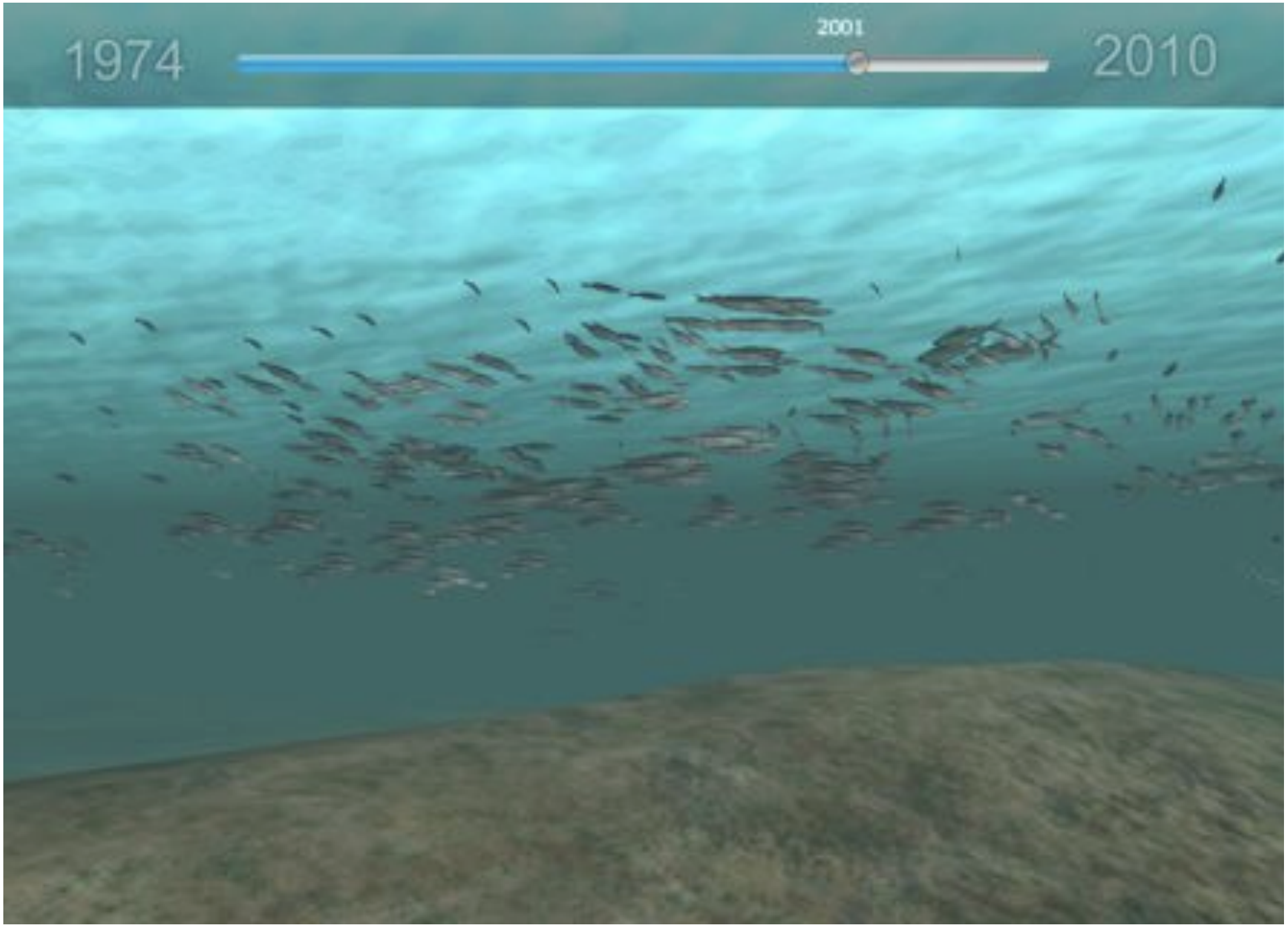
# What drives regime shifts?

- Large scale change in all sub-system
- Simultaneous change
- Climate important driving force, together with basin specific drivers




Blenckner et al, manuscript


1974
1984
2010


1974
2001
2010

# Regime Shift Database

www.regimeshifts.org


AQUATIC SYSTEMS

1. Coral transitions
2. Kelp transitions
3. Bivalve collapse
4. Fisheries collapse
5. Marine food webs
6. Eutrophication
7. Hypoxia
8. Floating plants

CLIMATE SYSTEM

9. Ice sheet collapse
10. Summer Arctic sea ice
11. Thermohaline circulation
12. Monsoon collapse

TERRESTRIAL SYSTEMS

13. Bush encroachment
14. Forest – Savanna
15. Savanna – Desert
16. Tundra – Steppe
17. Tundra - Boreal
18. Soil Salinization
19. Salinization - snow geese

STRONG SOCIAL FEEDBACKS

20. Forest - Cropland
21. Dammed Rivers
22. Locust plagues – outbreaks
23. Development Poverty trap
24. Ecosystem management
25. Urban Sprawl

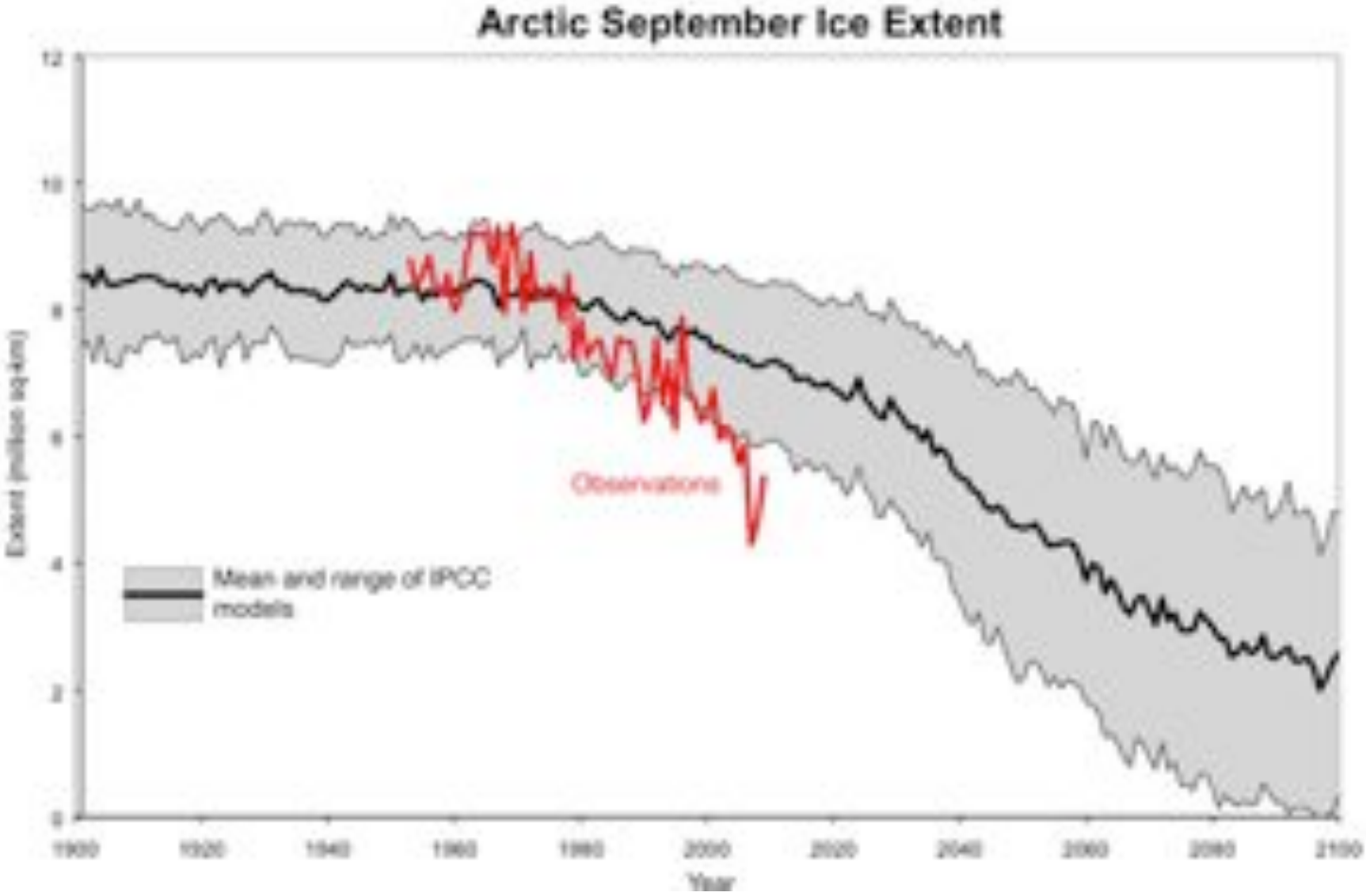

b

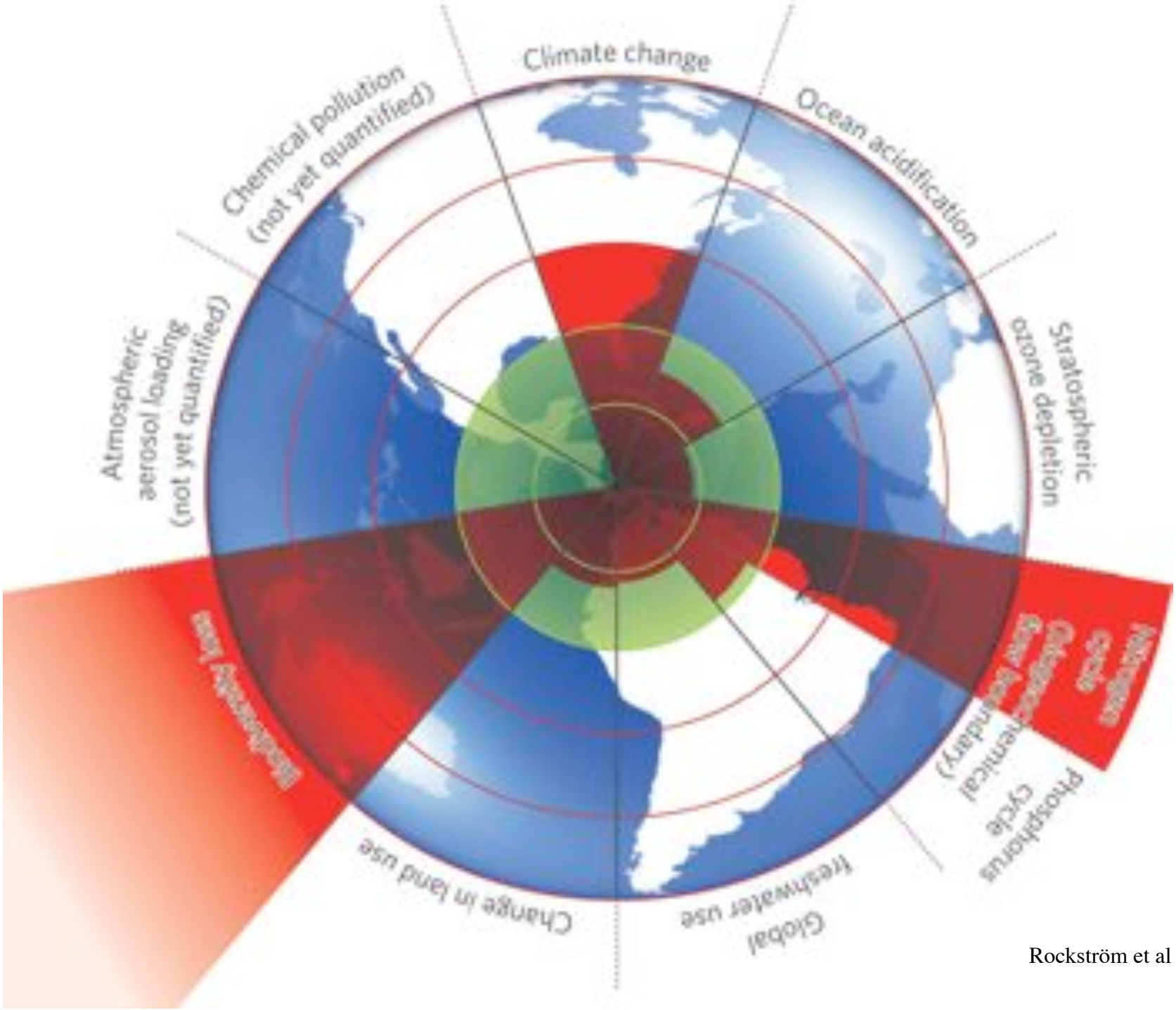
| Location | Type of regime shift | Identified drivers | Potential feedback |
|---|---|---|---|
| 1 Baltic Sea | Cod to sprat | Eutrophication, Fishing, Climate | A, AP and PP |
| 2 Benguela upwelling | Sardine to jellyfish | Fishing, Climate | J |
| 3 Black Sea | Anchovy to jellyfish | Eutrophication, Fishing, Invasive sp. | PP and J |
| 4 Gulf of Alaska | Forage fish to groundfish | Climate | PP |
| 5 Humboldt current | Anchovy to sardine | Climate | PP |
| 6 Japan/East Sea | Sardine to jellyfish | Climate | PP and J |
| 7 North Pacific/Bering Sea | Herring to jellyfish | Climate | PP and J |
| 8 North Sea | Cod to herring/jellfish | Salinity, Climate | PP |
| 9 North West Atlantic | Groundfish to shrimp/crab | Fishing, Climate | PP |

c


Nyström et al, 2012 *Ecosystems*

# Crossing unexpected tipping points?

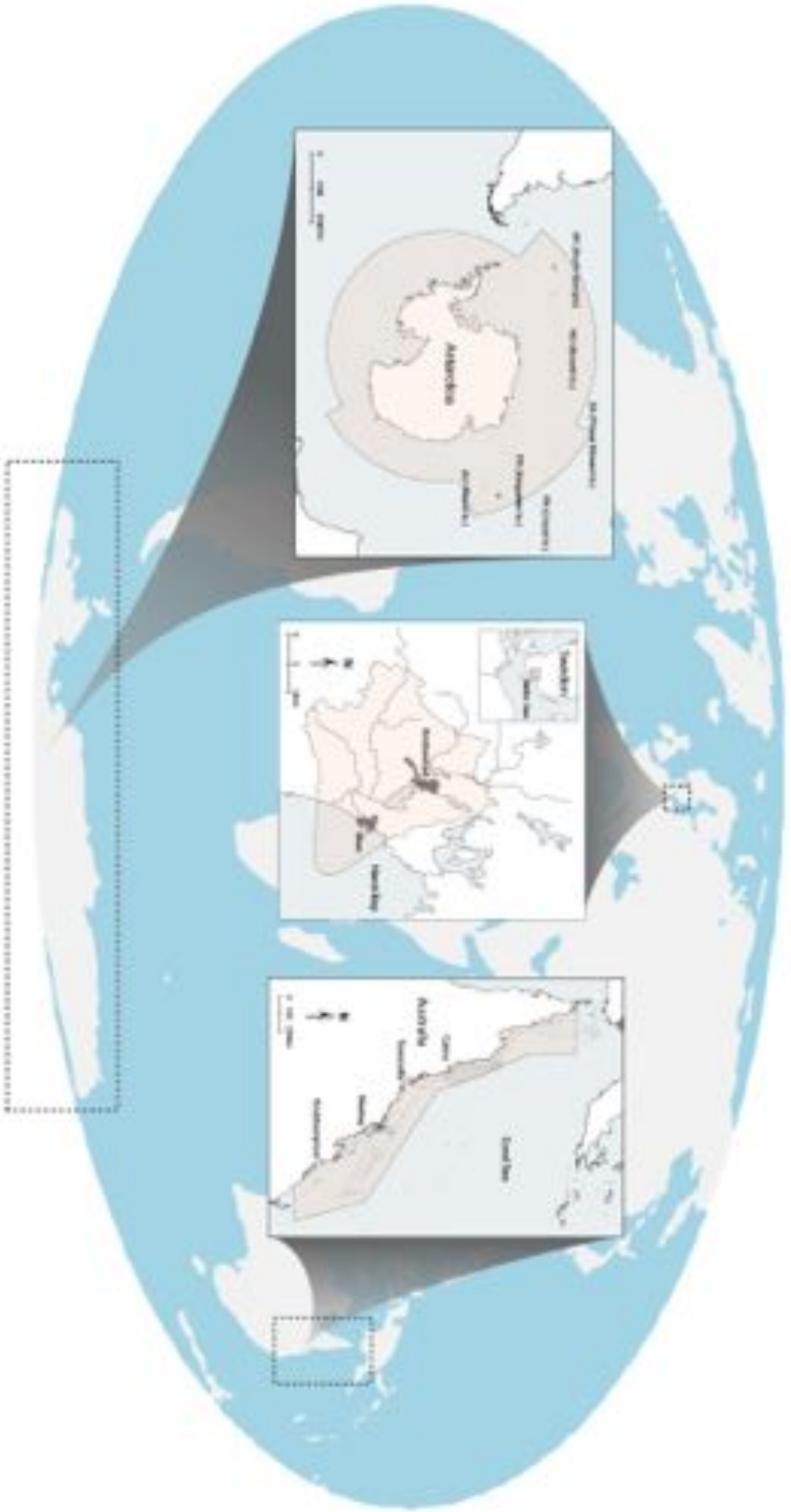





Rockström et al 2009, *Nature*

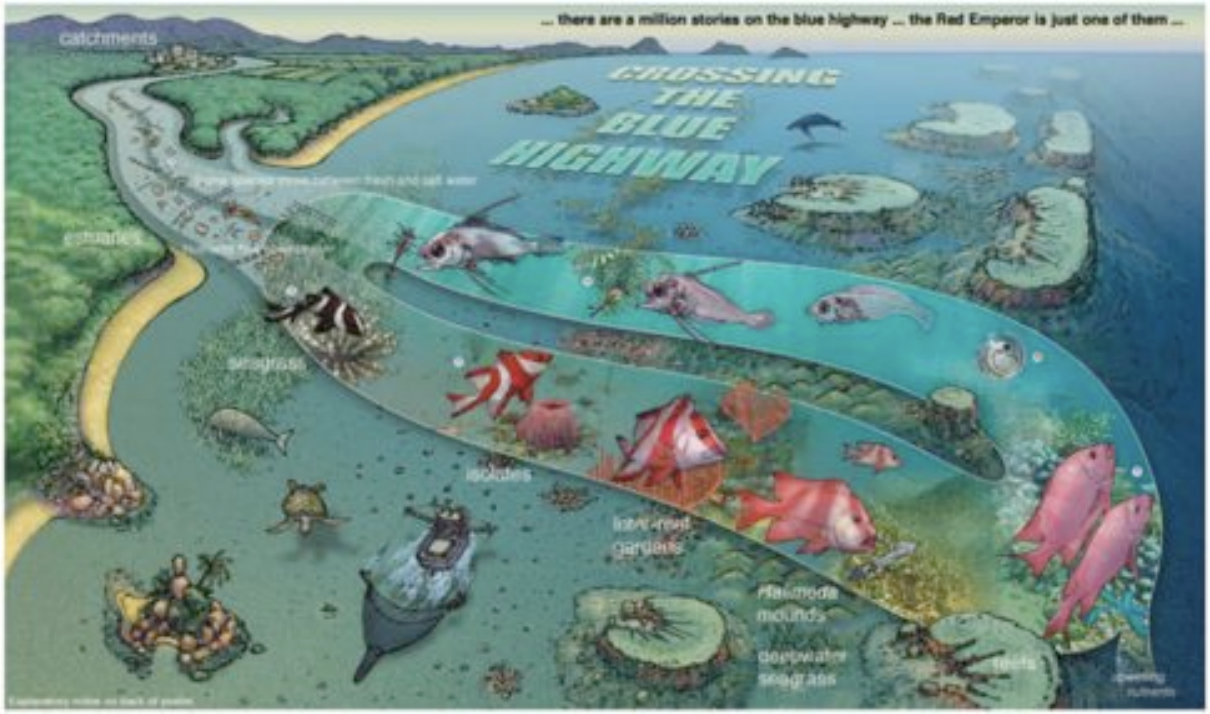
# Three examples of ecosystem based management

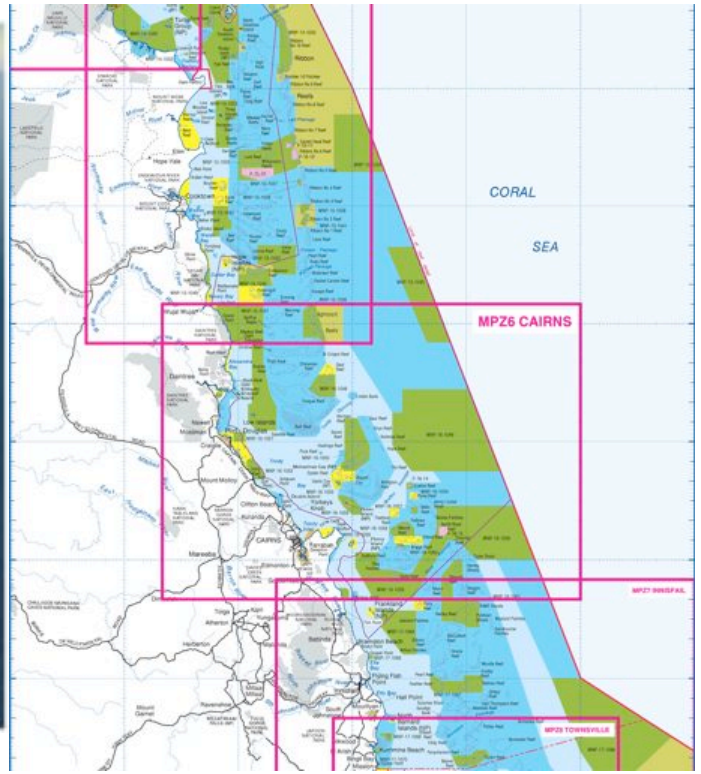
- Addressing local and global drivers of change
- Addressing the risk of tipping points
- Balancing conservation and use
- Including stakeholders



Shultz., L., Folke, C., Österblom, H. Olsson, P. *in review*

# Marine spatial planning and rezoning of the GBR



# The Great Barrier Reef

- Existing zoning could not fully protect biodiversity and could thus not protect the resilience of the reefs
  - Especially in light of recurrent disturbances
- A perceived crises following bleaching, crown of thorn outbreaks, overfishing, eutrophication
  - An iconic reef under severe pressure from local and global drivers of change

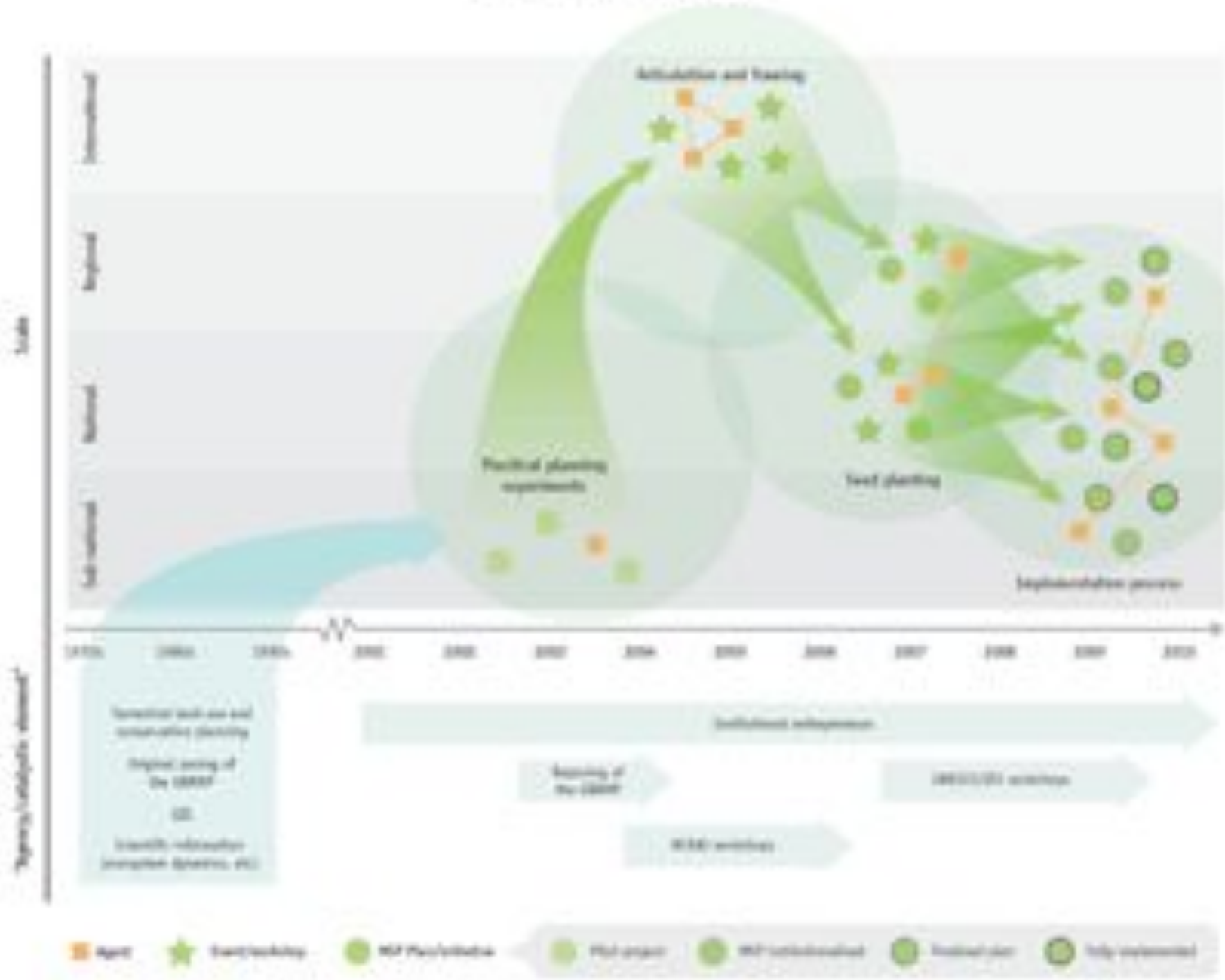
# GBRMPA response

- Produced a “reef under pressure” information campaign
  - Raise public awareness
  - Built support for a re-zoning of the reef
- Massive stakeholder consultations

# GBR Outcomes

- Rezoning of the GBR has resulted in an increase in no-take areas from 5 – 33 %, combined with changes in fisheries management and new monitoring programs
- But many issues remains to be addressed

- GBRMPA serves as an important source of inspiration for MSP around the world


Emergence and Spread of MSP
Articulation and framing
Practical planning experiments
Seed planting
Implementation process

# Kristianstad – the case

- Wetlands management in the south of Sweden
- Environmental degradation connected to land abandonment, eutrophication and pollution
  - Deteriorating water quality
  - Decreasing bird populations

# Framing the Kristianstad Water Realm

- Creation of Ecomuseum Kristianstad
- Brought together five relevant sectors
  - Education, cultural heritage (agriculture), nature conservation, tourism, research
- Mobilized a broad knowledge base
- Connected previously disconnected actors
- Designated a UNESCO Biosphere Reserve in 2005

# Outcomes in the Water Realm

- An active management of grasslands and wetlands
- Improved nutrient cycling, flood protection, aesthetic value and habitats (e.g. for birds).
- Improved recreation and education
- A visitor centre attracting > 100 000 visitors annually

Photo: Dr Stuart Hanchet, NIWA.

# CCAMLR and IUU fishing

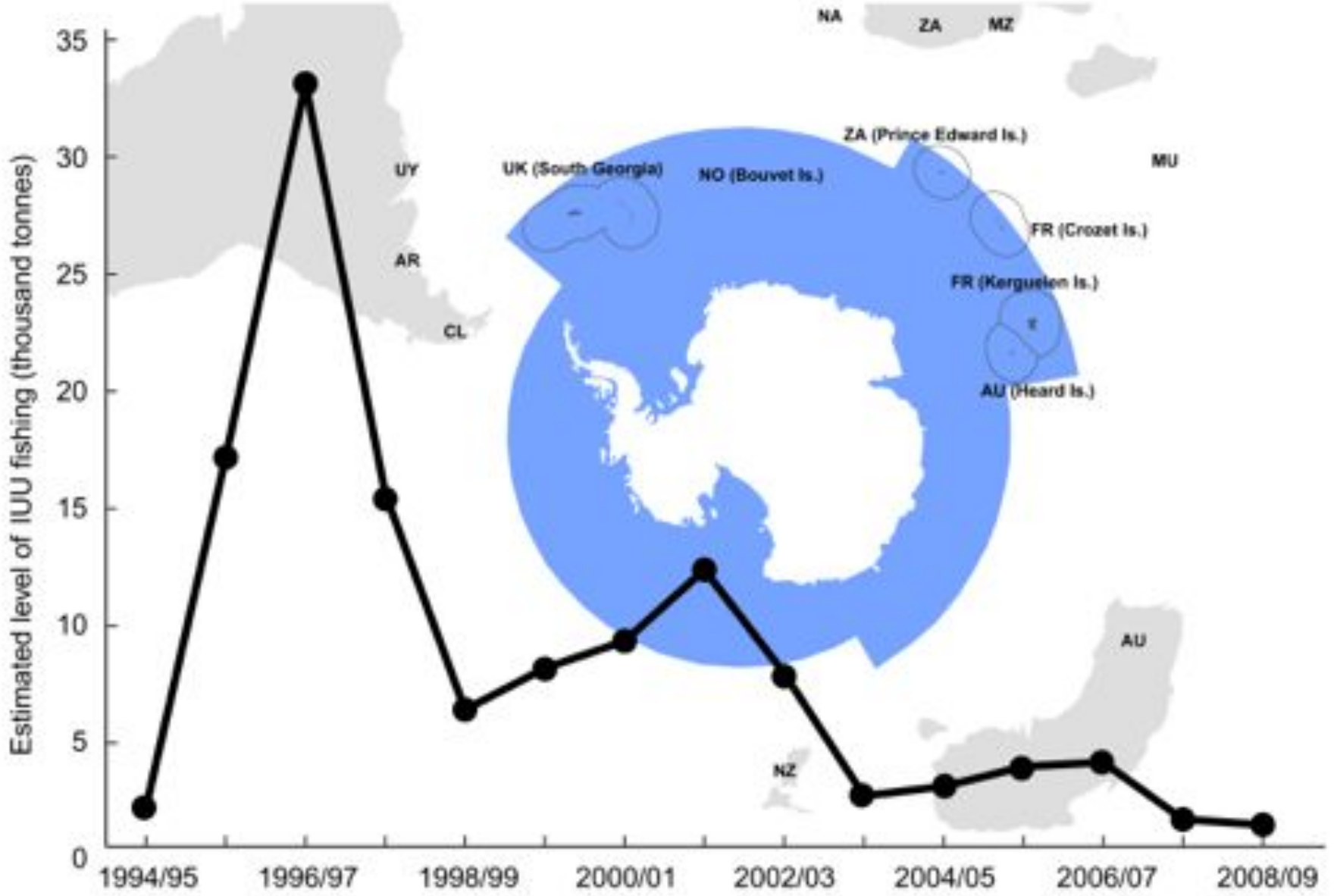
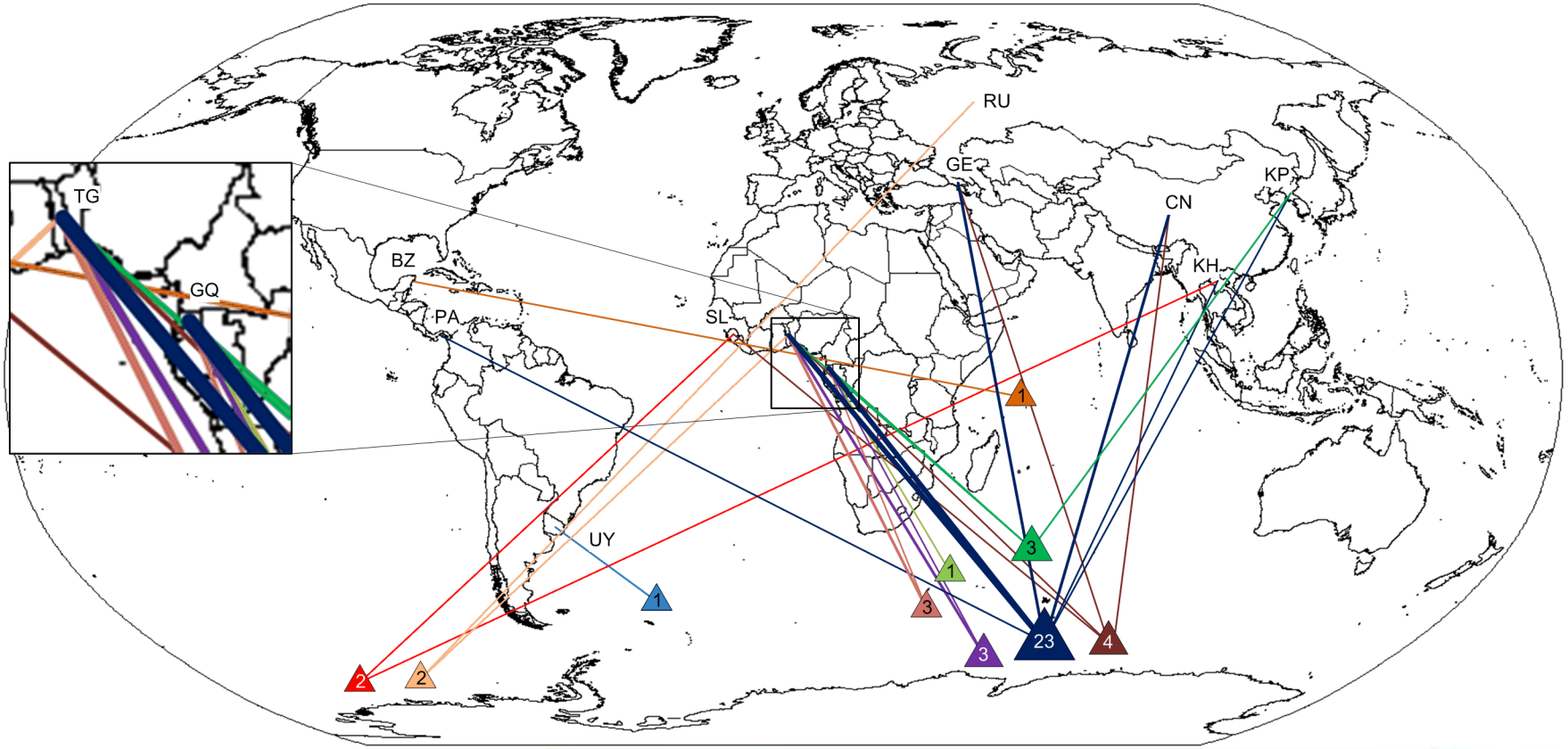
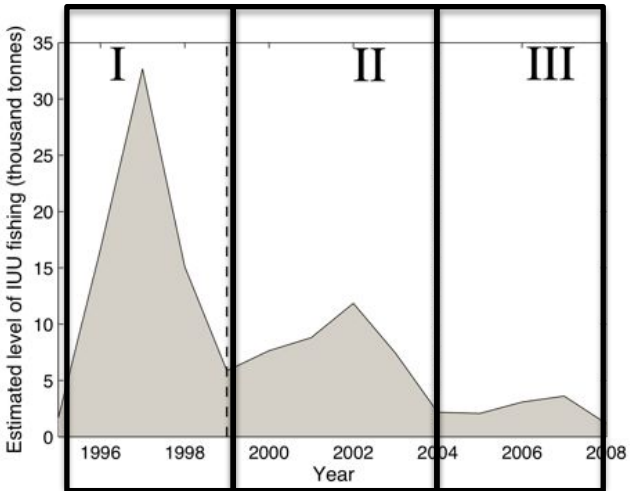


Photo: Rowan Trebilco/Azote

"..causing the likely collapse of the populations of several species of albatross and of white-chinned petrels, as well as the potential collapse of the *Dissostichus* stocks" (SC-CAMLR 1997).

Photo: AFMA

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# Adapting to Regional Enforcement: Fishing Down the Governance Index

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**Henrik Österblom[1,2*], U. Rashid Sumaila[2], Örjan Bodin[3,4], Jonas Hentati Sundberg[3], Anthony J. Press[5]**

**1** Fisheries Centre, The University of British Columbia, Vancouver, Canada, **2** Baltic Nest Institute, Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden, **3** Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden, **4** Department of Systems Ecology, Stockholm University, Stockholm, Sweden, **5** Antarctic Climate and Ecosystems Cooperative Research Centre, Hobart, Tasmania, Australia



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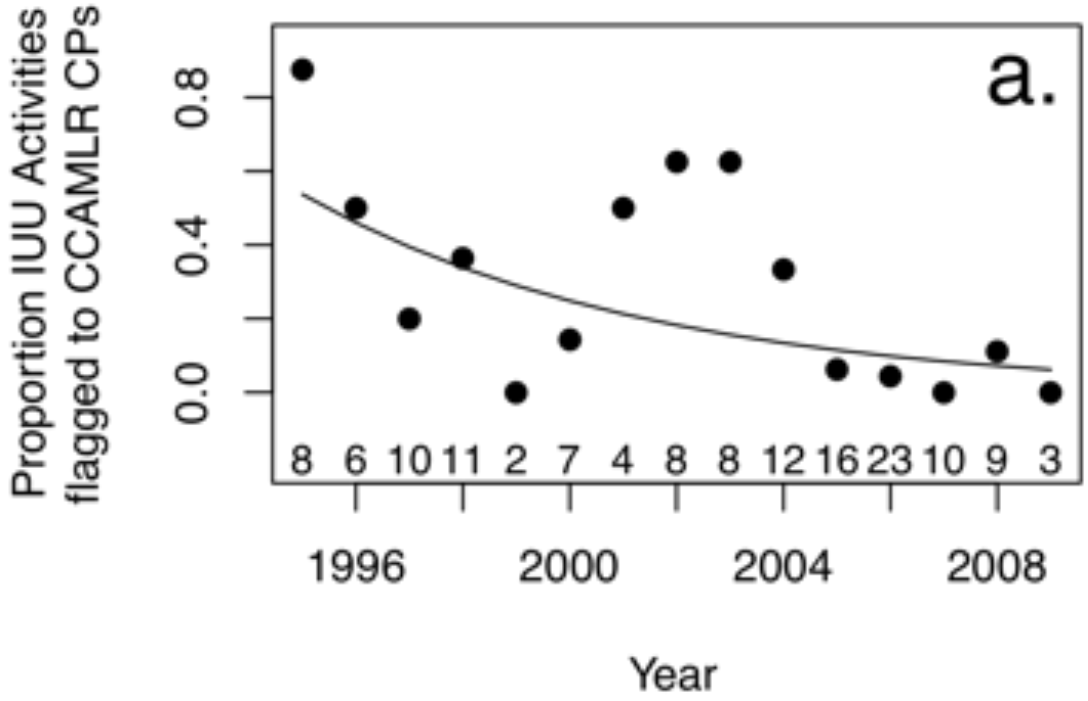
Introduction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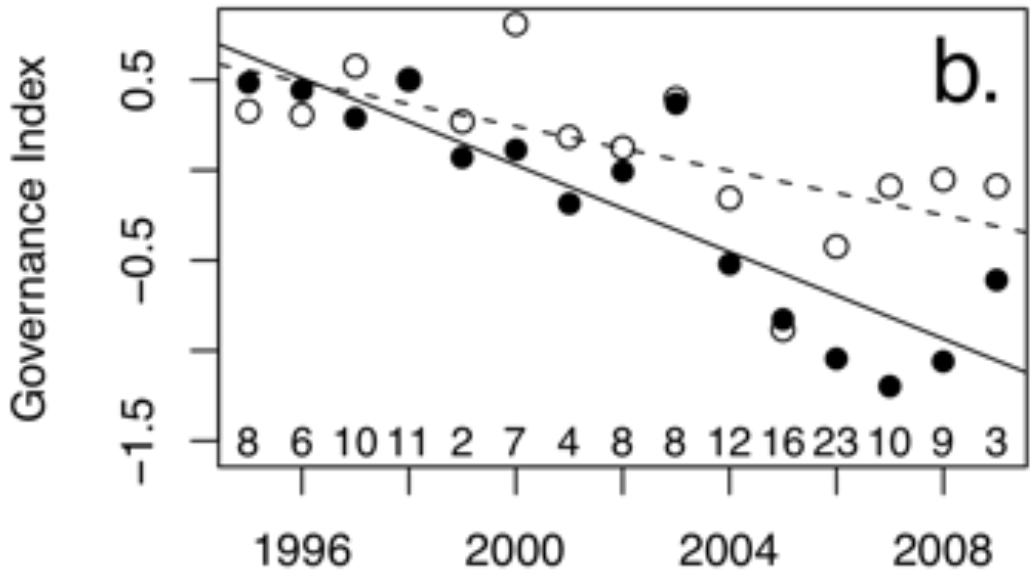
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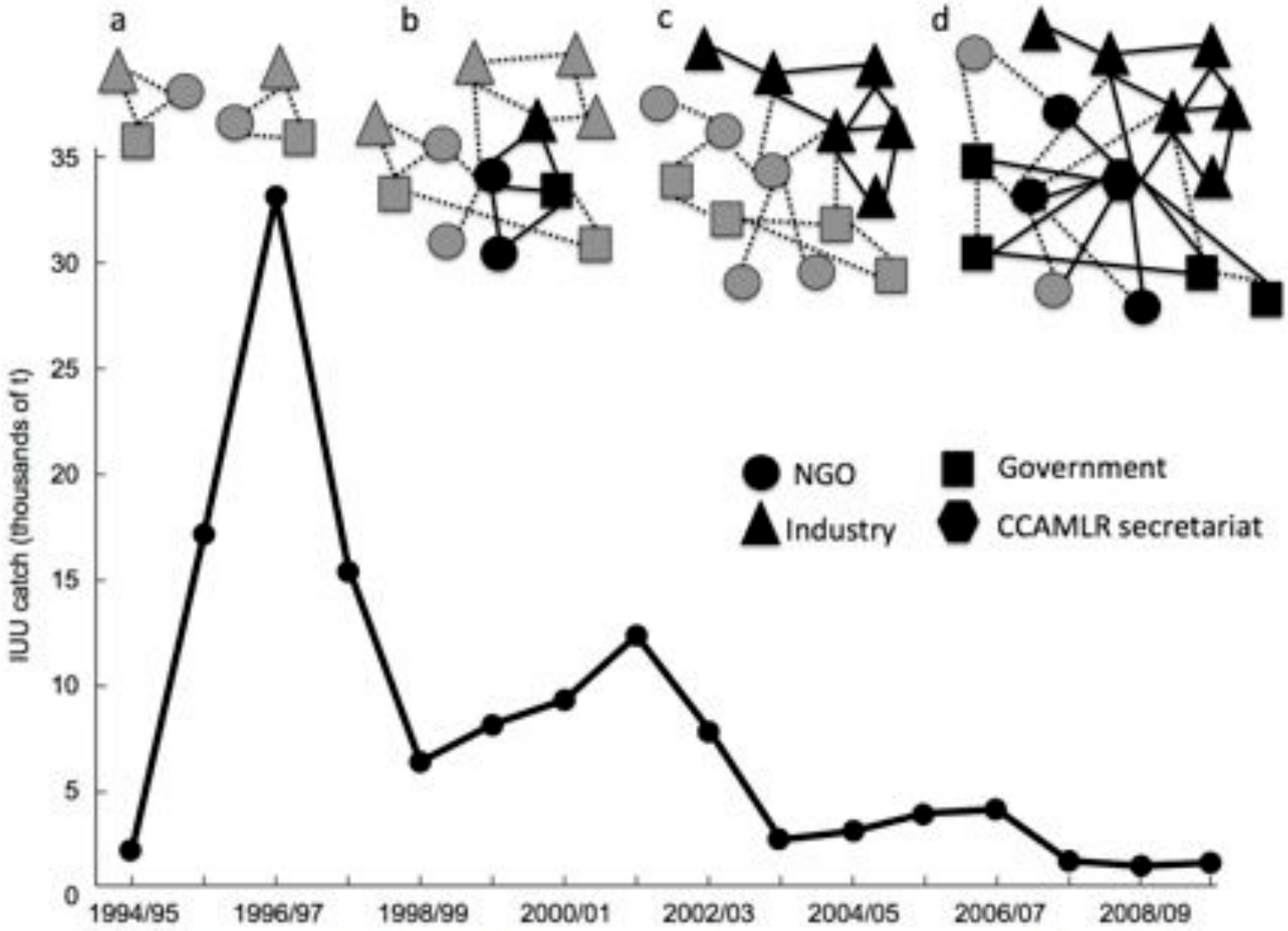




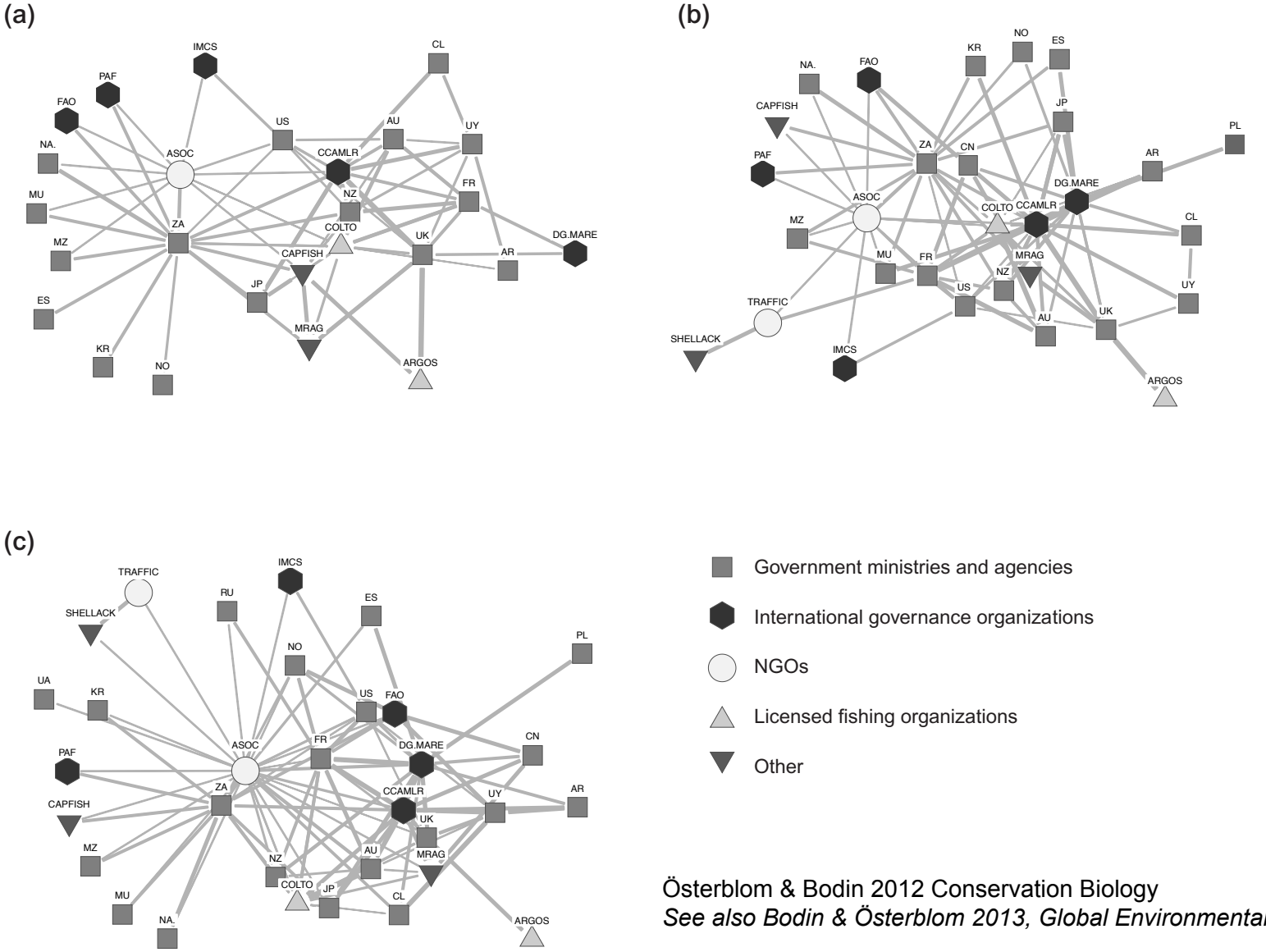
Österblom, H., and C. Folke. 2013. Emergence of global adaptive governance for stewardship of regional marine resources. *Ecology and Society* **18**(2): 4. http://dx.doi.org/10.5751/ES-05373-180204

*Insight*

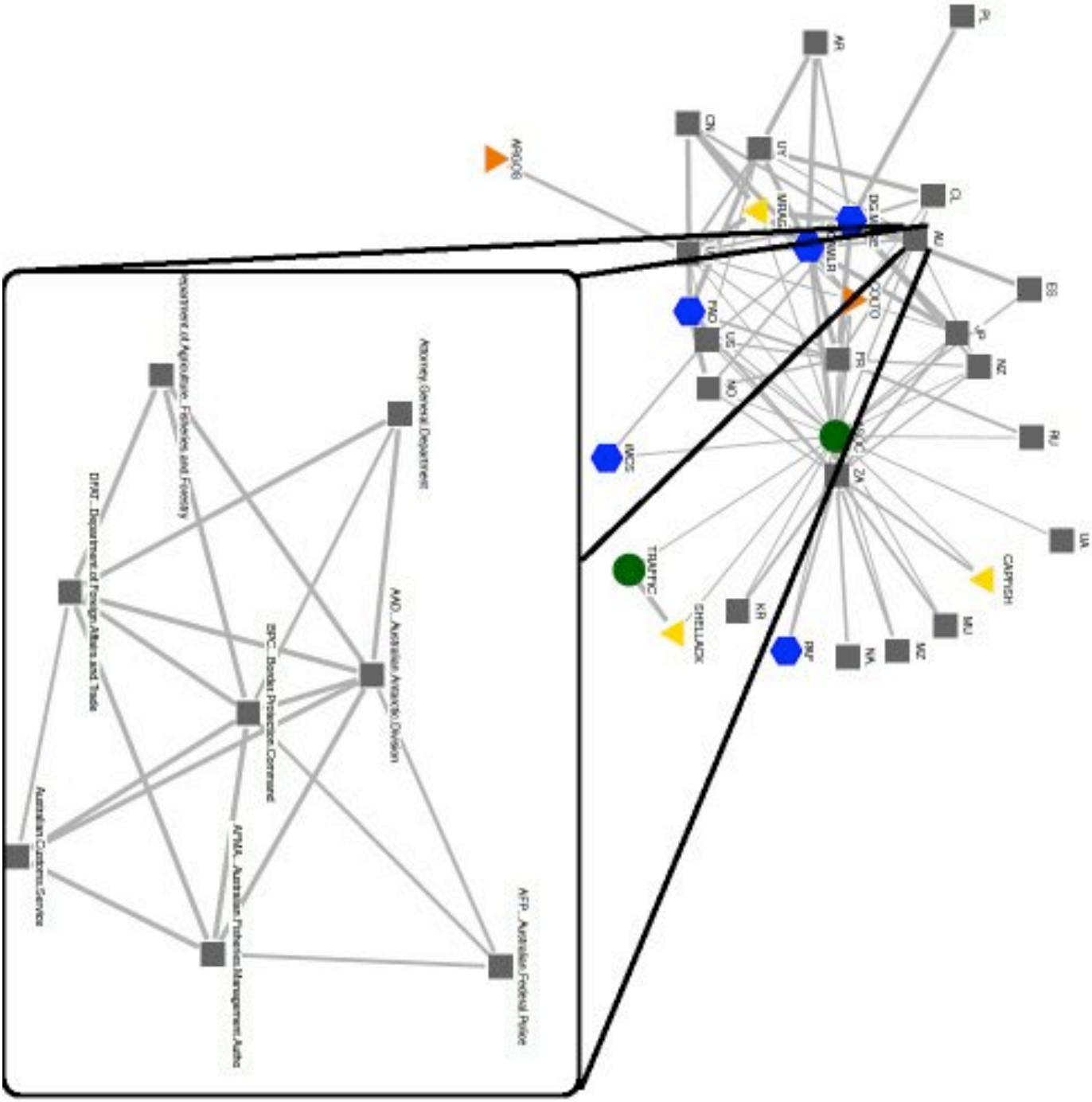
# Emergence of Global Adaptive Governance for Stewardship of Regional Marine Resources

*Henrik Österblom*[1] *and Carl Folke*[1,2]

# Social networks – connecting groups with complementary capacities




Österblom & Bodin 2012 Conservation Biology
*See also Bodin & Österblom 2013, Global Environmental Change*




Henrik Österblom, Stockholm Resilience Centre

# Who is important?

**Table 2. The 20 organizations perceived by respondents as the most important for adressing illegal, unreported, and unregulated fishing in the Southern Ocean.**

| *Organization* | *Total score** |
|---|---|
| Commission for the Conservation of Antarctic Marine Living Resources Secretariat | 102 |
| Coalition Of Legal Toothfish Operators (COLTO) | 65 |
| Australian Fisheries Management Authority (AFMA) | 64 |
| Australian Antarctic Division (AAD) | 55 |
| Antarctic Southern Ocean Coalition (ASOC) | 50 |
| New Zealand Ministry of Fisheries | 50 |
| Directorate-General for Maritime Affairs and Fisheries of the European Commission | 49 |
| U.S. National Oceanic and Atmospheric Administration (NOAA) | 47 |
| Australian Department of Agriculture, Fisheries and Forestry (DAFF) | 43 |
| United Kingdom Foreign and Commonwealth Office | 42 |
| TRAFFIC | 41 |
| New Zealand Ministry of Foreign Affairs and Trade | 41 |
| Marine Resources Assessment Group (MRAG) | 40 |
| Australian Customs Service | 40 |
| Australian Department of Foreign Affairs and Trade | 40 |
| Government of South Georgia and South Sandwich Islands | 40 |
| French Navy | 39 |
| French Southern and Antarctic Lands | 38 |
| U.S. Department of State | 37 |
| UN FAO Food and Agriculture Organization | 37 |

**The responding organizations scored each organization's level of importance (high, 3; medium, 2, or low, 0) in terms of how active and useful they are in addressing illegal, unreported, and unregulated fishing for toothfish. Values correspond to the sum of scores for each organization.*



Österblom & Bodin 2012 *Conservation Biology*

# Any relevance for the Arctic?

nature International weekly journal of science

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Brief Communications

*Nature* **421**, 599 (6 February 2003) | doi:10.1038/421599a

## Fish migration: Patagonian toothfish found off Greenland

Peter Rask Møller[1], Jørgen G. Nielsen[1] & Inge Fossen[1]

**This catch is evidence of transequatorial migration by a cold-water Antarctic fish.**

**A large (1.80 metres in length and weighing 70 kg) Patagonian toothfish (*Dissostichus eleginoides* Smitt, 1898) has been caught in the northwest Atlantic, representing the first Northern Hemisphere record of the diverse, abundant and mainly Antarctic suborder Notothenioidei. This extraordinary catch indicates that large, cold-temperate fishes may occasionally migrate from sub-Antarctic to sub-Arctic waters by using deep, cold water, supporting a widely accepted but unproven proposal that the anti-tropical distribution patterns of many marine biota could be explained by transequatorial migration[1, 2, 3].**

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- Peter Rask Møller
- Jørgen G. Nielsen
- Inge Fossen

open innovation

# Problems move across scales…

- Mobile actors, outsourcing of problems…
- Some of these vessels have moved to deep sea gillnetting of sharks of the coast of Madagascar
- And… to the Arctic

# Evolution of institutions across scales

- Globalized problem of IUU fishing
- Towards global coordination
  - Early 2000s: Increased collaboration between compliance officers in RFMOs (including CCAMLR)
  - Mid 2000s: Rapid growth of the IMCS network
  - Late 2000s: Growing pains and coordination problems
  - Early 2010s: Interpol initiate work on ”fisheries crimes”
  - 2014: IMCS and Interpol increase collaboration

Get in Touch!

The Trygg Mat Foundation is a Norwegian foundation working on sustainable food production. Our main focus over the past years has been sustainable fisheries and illegal fishing. The foundation is doing work for clients as well as conducting independent projects.

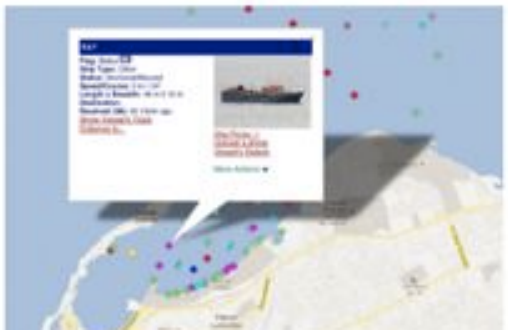
## Poacher Ray in Luanda for 12 days 0

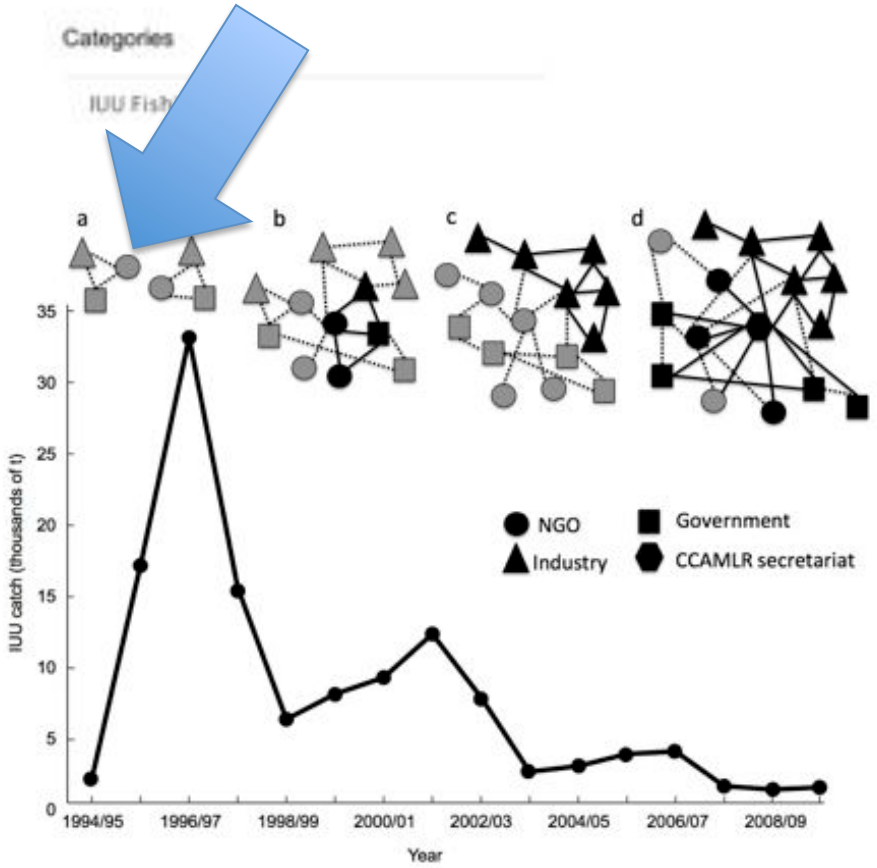
Posted on May 4th, 2012 in Uncategorized

The toothfish poacher RAY, ex Kily, Constant and Tropic is in Luanda and has been there for the past 12 days. In March, the TM Foundation noted that the IUU listed vessel "Kily" had changed name, flag and owner. The vessel transmitted the name "Ray" and flag "Belize" from its AIS in Singapore harbour.

The vessel is IUU listed by CCAMLR, therefore also IUU listed by SEAFO. Since Angola is a member of SEAFO, the country is obliged to take action.

To see the vessel's history of name, flag and owner changes see the **vessel sheet in the TM combined IUU vessel list.**





# Development of adaptive management approaches

- the move from uncoordinated, sectorial management to holistic, flexible collaborations was **triggered by a crisis**
- Small number of **"key individuals"** instrumental for initiating and developing novel approach
- ***umbrella concepts*** were crucial for stimulating cooperation.
- A broad **mobilization of ecological knowledge**, connecting previously disconnected actor
- A **bridging organization** connected scales

Figure 1 | Map of Arctic indigenous peoples

# All three initiatives

- Use the concept of ecosystem services
  - Help clarify the values of natural capital and necessary trade offs/synergies between users
- Provides the coordination and the context for choosing between different tools, and monitor their effects

# Capacity development (inside and outside)

- Capacity to deal with new challenges
  - Increasing in KV, unclear in GBR and SO
- All initiative were highly ***contagious***
  - KV national and European show case, source of inspiration for integrated management approach
  - CCAMLR management tools (e.g. CDS and IUU list) major source of inspiration for other RFMOs

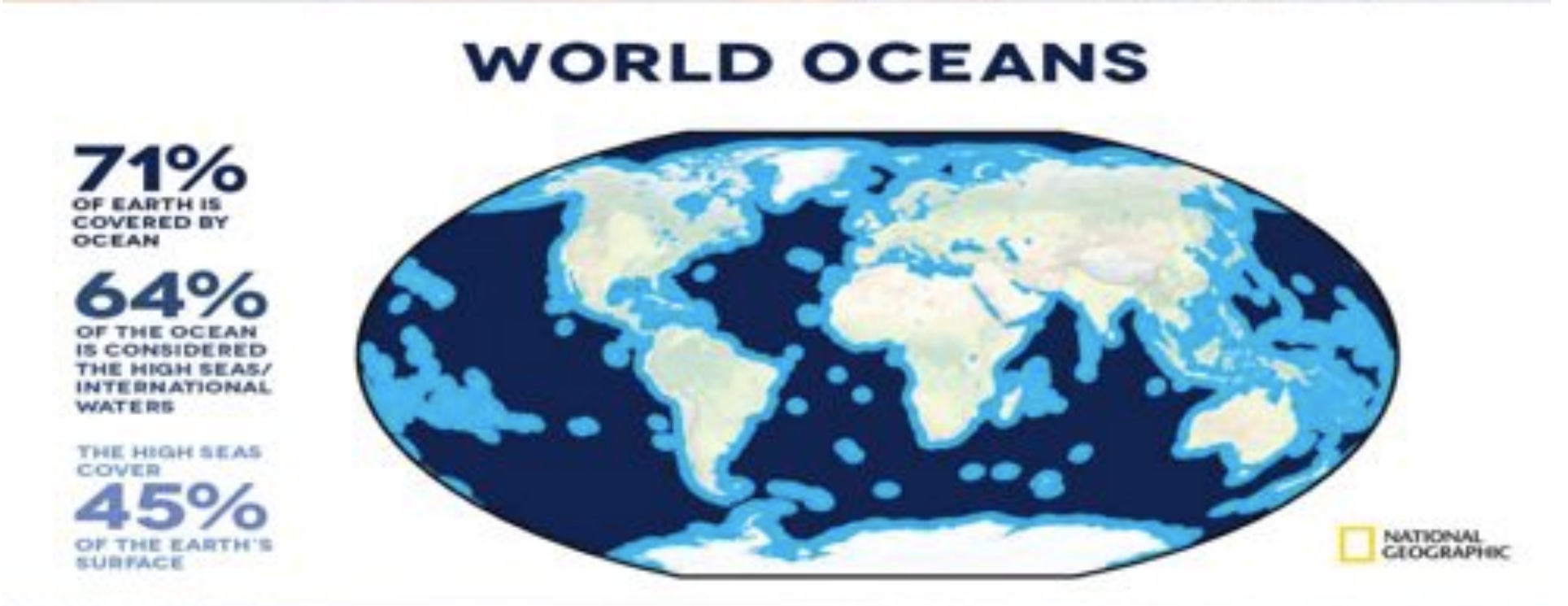
# Global dynamics operate across scales

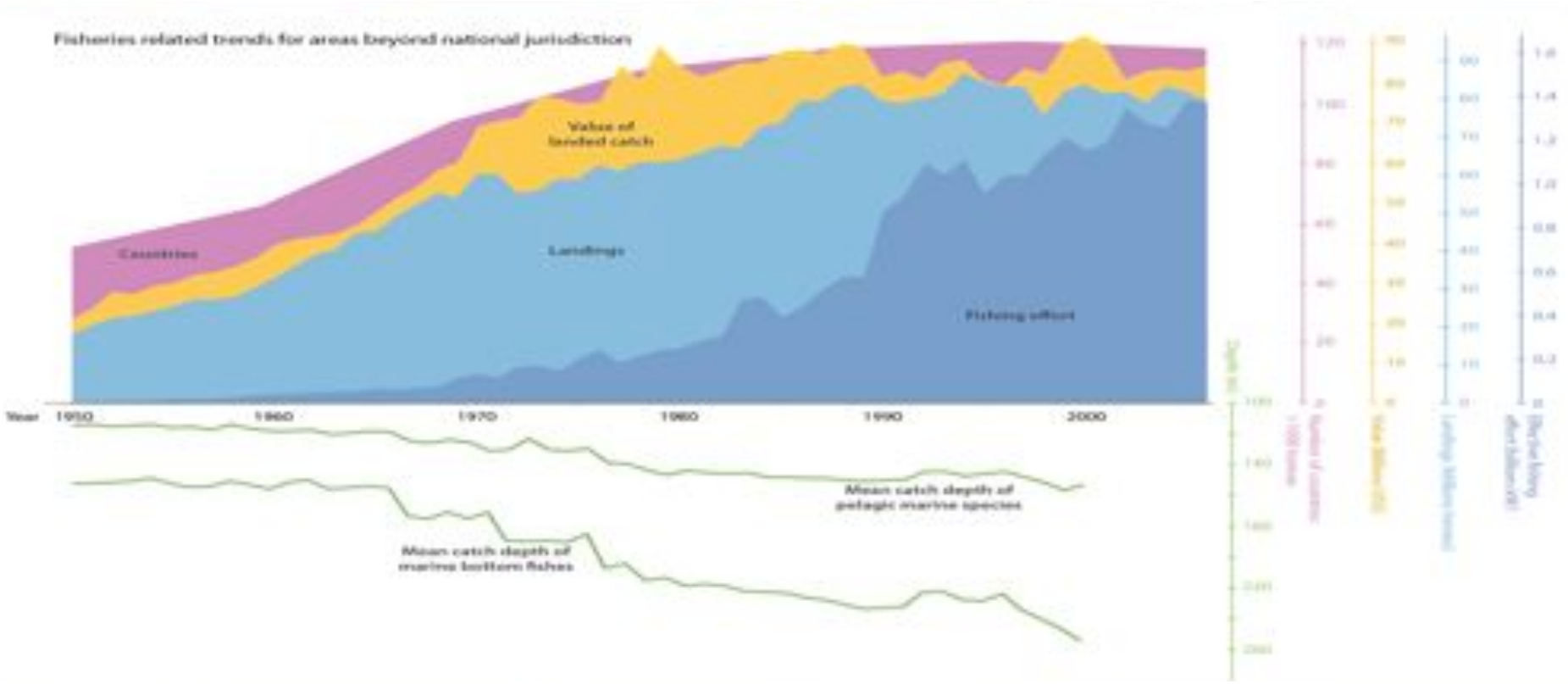
- Trade
- Increasing demand for marine protein (e.g. for aquaculture)
- Global industry actors
- Technological advances
- Shifting species distribution
- ..

# Get ready for surprise

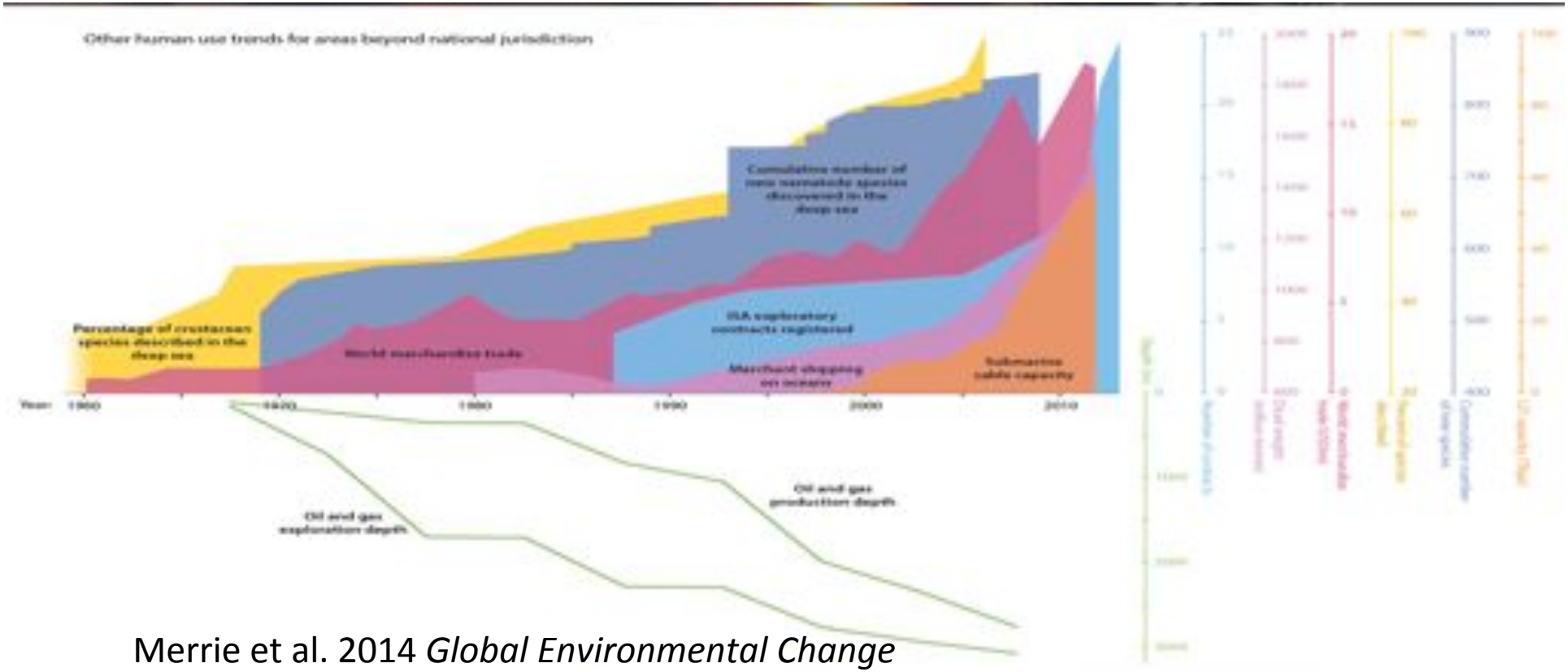
- What happens in places with unclear boundaries and rules?

# Dynamics of the high seas



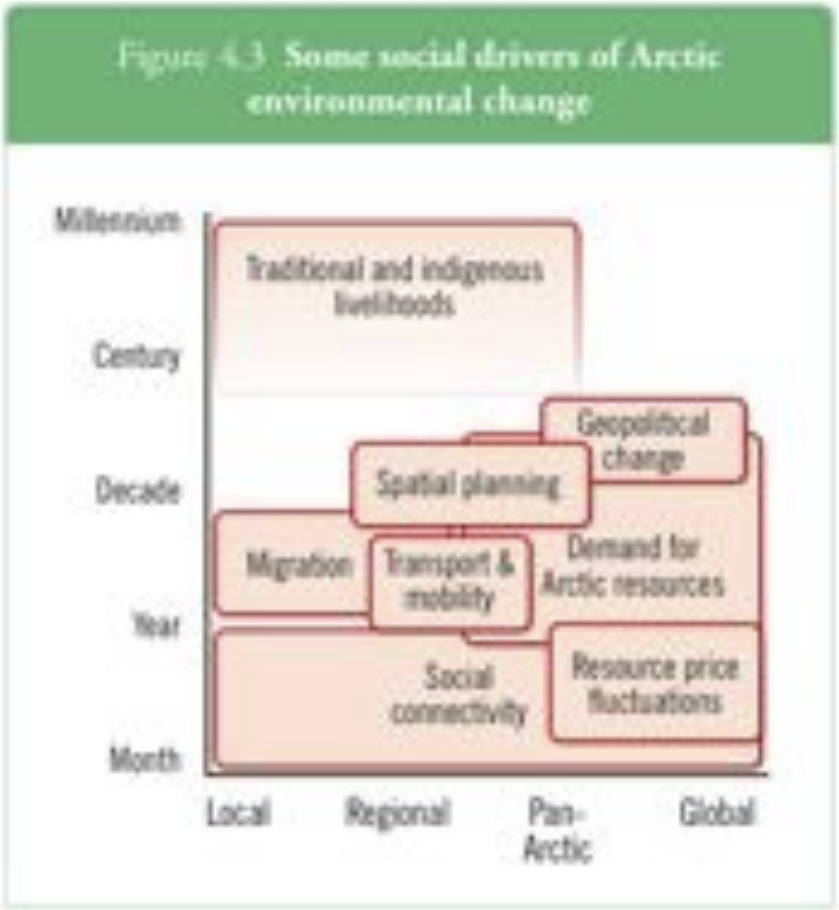


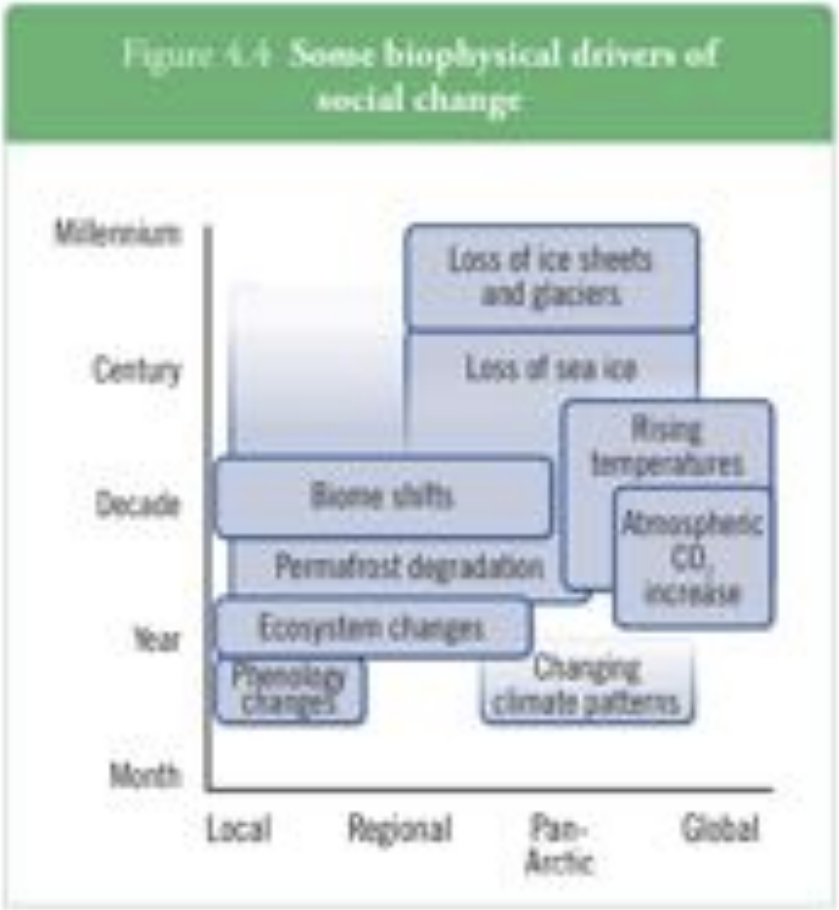

Merrie et al. 2014 *Global Environmental Change*




Merrie et al. 2014 *Global Environmental Change*

# Drivers of Arctic change



# How to design institutions?

- Pioneering work by Elinor Ostrom and colleagues
- But primarily at the local level

Dietz et al. 2003 *Science*


**Fig. 3.** General principles for robust governance of environmental resources (green, left and right columns) and the governance requirements they help meet (yellow, center column) (13, 158). Each principle is relevant for meeting several requirements. Arrows indicate some of the most likely connections between principles and requirements. Principles in the right column may be particularly relevant for global and regional problems.

Table 1. Indicators derived from the links between the design principles and the governance requirements

| Link | Indicator |
|---|---|
| Involve all interested parties to provide necessary information | Who provides information?<br>What type of information is shared?<br>Is the information process transparent? |
| Involve all interested parties to induce compliance | How are decisions made?<br>How are rules monitored?<br>How are rules enforced? |
| Involve all interested parties to encourage adaptation and change | Which tools are used?<br>How are rules revised?<br>Are there any strategies for dealing with change? |
| Allocate authority to provide infrastructure | Who provides physical infrastructure?<br>Who provides technical infrastructure?<br>Who provides institutional infrastructure? |
| Allocate authority to encourage adaptation and change | How are decisions delegated?<br>Are there any links between administrative levels? |
| Employ a mixture of institutional types to deal with conflicts | How are conflicts dealt with within the organization?<br>How are conflicts dealt with between different sectors? |
| Employ a mixture of institutional types to provide infrastructure | How is institutional diversity being used? |
| Employ a mixture of institutional types to encourage adaptation and change | What institutional alternatives exist? |

Valman, Österblom and Olsson, in revision

| Link | CTI-CFF | HELCOM | CCAMLR |
|---|---|---|---|
| Involve all parties in information sharing, compliance and adaptation | NGOs dominate<br>State level compliance<br>Adaptation plans | Govs and science<br>State level compliance<br>No adaptation plans. | Gos, NGOs, industry<br>International<br>Continuous adaptation |
| Allocate authority to provide infrastructure and encourage adaptation | Infrastructure: NGOs<br>Adaptation: Non-state. | National, bilateral, and regional infrastructure.<br>Adaptation: State level. | Member states and secretariat<br>Adaptation: Int-ntl |
| Employ a mixture of institutions to deal with conflicts, to provide infrastructure and to encourage adaptation | No conflict resolution mechanisms. | No conflict resolution mechanisms | Conflict resolution mechanisms. |

Valman, Österblom and Olsson, in revision

# “Evaluating” Helcom

- Information sharing: Limited involvement of stakeholders
- Decision making: Limited involvement of stakeholders
- No forums for evaluating compliance
- No sanctioning mechanisms
- No conflict solving mechanisms
- No performance evaluation
- No mechanism for burden and benefit sharing
- Weak links between levels of authority

# Conclusion

- Ecosystem based management requires diverse capacity, competence and coordination
- Integration of diverse knowledge sources improves the capacity to address complex challenges

- *Adaptive management is never achieved but will always involve a continuous learning process, nurturing of trust, reflection of procedures and structures, and developing collaboration towards a common goal*

# Conclusions

**Individuals, and their networks – makes a difference**

# Thanks!

- *Co-authors:* R. Sumaila, A. Press, Ö. Bodin, J. Hentati-Sundberg, A. Constable, C. Folke, S. Fukumi, L. Schultz, P. Olsson.
- *Funders*: FORMAS, MISTRA and the Nippon Foundation