INDISEAS 2
Evaluating the status of marine ecosystems in a changing world

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IndiSeas Working Group Background

1. Established in 2005 as an international collaborative program
   - endorsed by IOC/UNESCO
   - co-funded by the NoE EUROCEANS , FP7 MEECE project, IRD, UCT

2. IndiSeas aims to perform comparative analyses of ecosystem indicators from the world's marine ecosystems to quantify the impact of fishing and to provide decision support for fisheries management in a context of climate variability and change.

3. IndiSeas1 (2005–2009) focused on ecological indicators.

4. IndiSeas2 (2010-2014) aims to address issues raised during phase 1 analyses, based on extensive sets of indicators including climate, biodiversity and human dimension indicators.

IOC=International Oceanographic Commission; UNESCO=United Nations Educational, Scientific and Cultural Organization; NoE=European Network of Excellence; EUROCEANS=EURopean research on OCean Ecosystems under Anthropogenic and Natural forcingS; FP7 MEECE=Marine Ecosystem Evolution in a Changing Environment; Institut de Recherche pour le Développement; UCT=University of Cape Town

INDISEAS 1 (2005 - 2009)

OBJECTIVE: Evaluate ecological status of marine ecosystems:

- with respect to fishing activity
- using a set of ecological indicators
- using a comparative approach across marine ecosystems

STRATEGY: Select common list of indicators, with constraints:

- the set of indicators must remain tractable and measurable for an extended range of ecosystems
- must be meaningful to the public at large, and to managers

*ecosystem experts must participate in the diagnosis and comparison across ecosystems to take into account local specifics in the interpretation of indicators –to avoid biases sometimes found in global meta-analysis

Deliverables Indiseas 1

–Special Series of papers for *ICES Journal of Marine Science*

- Online: February 2010
- Published: May 2010

–Website: www.indiseas.org

IndiSeas1 Indicators

Indicators selected from a list of candidates on the basis of:

1. Ecological significance,
2. Sensitivity,
3. Measurability,
4. General public awareness.

Table 3. Summary of ecological indicators selected by the IndiSeas WG and the corresponding management objectives.

Indicators	Headline label	Used for State or Trend	Management objective[a]
Mean length	Fish size	S, T	EF
TL of landings	TL	S, T	EF
Proportion of under- and moderately exploited stocks	% healthy stocks	S	CB
Proportion of predatory fish	% predators	S, T	CB
Mean lifespan	Lifespan	S, T	SR
1/*CV* of total biomass	Biomass stability	S	SR
Total biomass of surveyed species	Biomass	T	RP
1/(landings/biomass)	Inverse fishing pressure	T	RP

[a]CB, conservation of biodiversity; SR, maintaining ecosystem stability and resistance to perturbation; EF, maintaining ecosystem structure and functioning; RP, maintaining resource potential.

Image Source: www.indiSeas.org

Table Source: Shin et al. (2010a)

Indicators for the seas

indiSeas

FRANÇAIS
ESPAÑOL
ENGLISH

STATUS OF MARINE ECOSYSTEMS

To view an ecosystem and a evaluation of its state, click on the corresponding location in the world map or consult the list below.

Ecosystems

COMPARATIVE APPROACH

Select and compare the states and trends of several ecosystems (pie diagrams and time series)

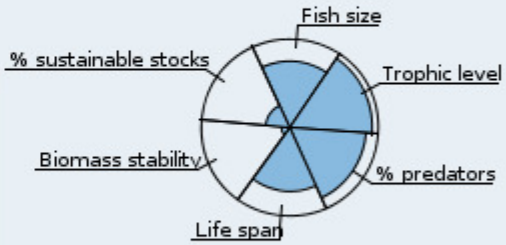
Compare

ABOUT indiSeas

Methods details
About us

to the map

State (2003 - 2005)



Trends (1996 - 2005)

West Coast of Vancouver Island

Description

Key Species

Effort and resulting landings in the demersal fishery built slowly to the 1960s, were maximum but highly variable through the 70s, and have been maintained at moderate levels since the early 80s by active management regulations. Pelagic fisheries landings show a roughly similar pattern, but were almost double demersal landings and peak landings occurred in the early 90s. Landings tend to be dominated by low frequency oscillations of cool and warm water taxa, such as sardine in the early years and Pacific hake in the latter years; Pacific herring are a major component through the time series. Recent (1996 onwards) indicator trends reflect the active management for groundfish and effects of recent warm water conditions which have favoured highly-migratory species such as Pacific hake and sardines.

by *Jennifer Boldt, Caihong Fu, Brenda Waddell, Ian Perry* *DFO*

FS=mean fish size; TL=trophic level landings; P=Proportion predator fish; LS=mean life span; B=surveyed biomass; 1/FP=inverse fishing pressure

IndiSeas 1 Conclusions/Issues

A suite of indicators is required – some redundancy is possible between indicators in some systems, but all 8 are required to ensure impacts are detected if present (Blanchard et al. 2010).

Two major challenges highlighted that form the basis of IndiSeas2:

1. Need to consider multiple drivers including humans & climate (e.g. Link et al. 2010; Shannon et al. 2010); and
2. Determine how indicators can be effectively used for improving management and conservation. (e.g. Shin et al. 2010b)

IndiSeas2 Goals

- Update the ecological set of IndiSeas indicators.
- Expand the range of ecosystems included (increased from 19 to 35).
- Address issues from IndiSeas1.

INDISEAS 2 (2010 - 2013)

Key questions IndiSeas 2:

-Which complementary indicators (climate, biodiversity, human dimension indicators) should be used to refine ecosystem status and to inform fisheries decision-makers?

-What methods are most effective for analysis of a broad suite of multidisciplinary indicators?

-How well do indicators reflect change in fishing pressure and provide support for decision making for sustainable fisheries?

-How best can the status of exploited marine ecosystems be assessed under multiple drivers and objectives?

IndiSeas2 Task Groups

Address issues from IndiSeas1 by forming task groups:

1. Climate and Environmental Indicators
2. Biodiversity and Conservation Indicators
3. Human Dimensions Indicators
4. Reference Levels for Indicators
5. Performance of Indicators and links to Management
6. Integration of Indicators

IndiSeas2 Task Groups Aims

TG1 - Climate and Environmental Indicators.

1. Assess the relative importance of fishing and environment for different ecological indicators and across ecosystems.
2. Identify years where the environment was more important than fishing.

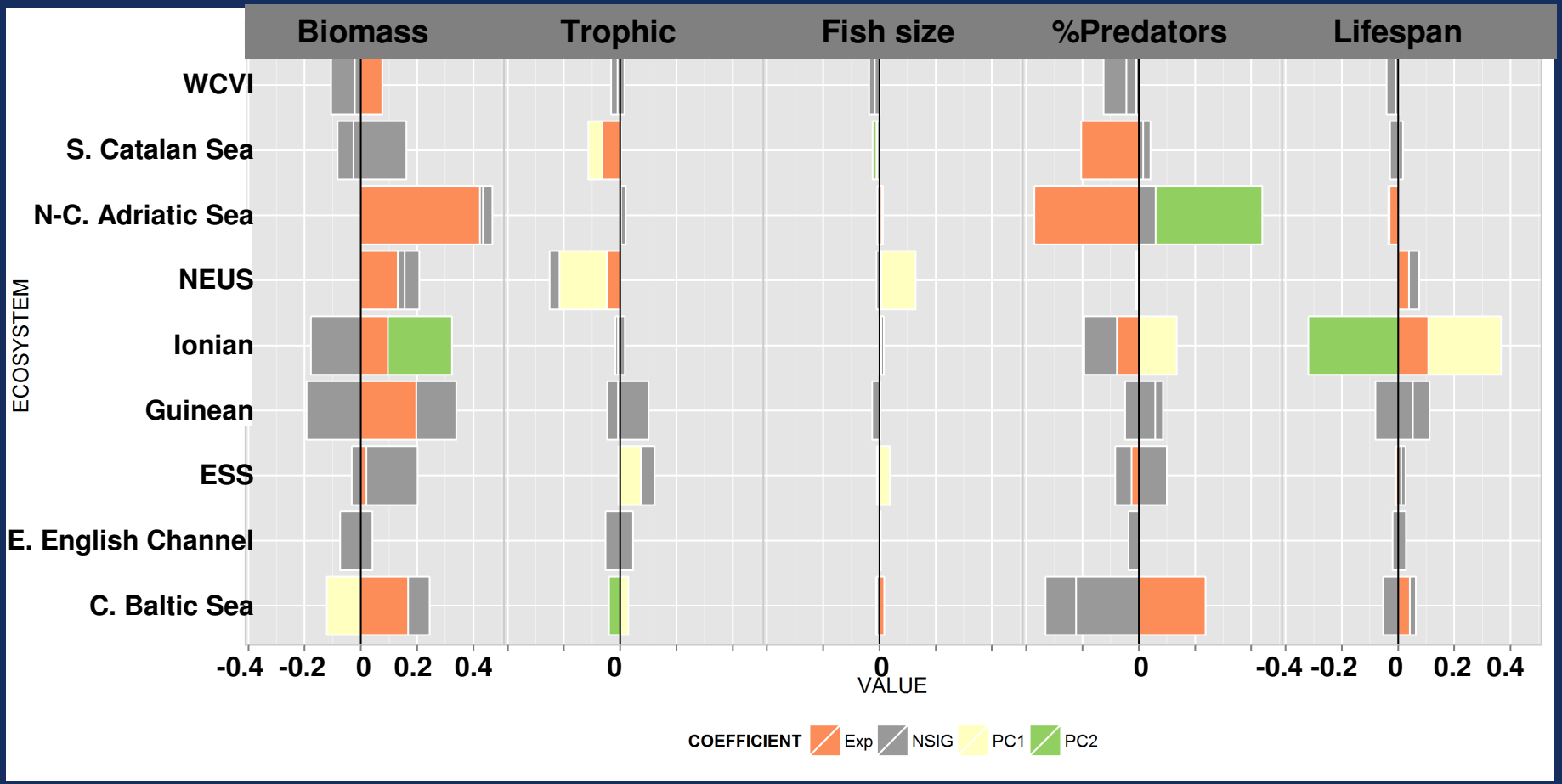


Image Source: IndiSeas TG1, Preliminary GLM Results, Large et al. 2012. WFC

IndiSeas2 Task Groups Aims

TG2 - Biodiversity and Conservation Indicators.

Select & test new ecological indicators that emphasize biodiversity & conservation-based issues in the diagnosis of ecosystem state & trends in response to fishing.

Newly selected indicators:

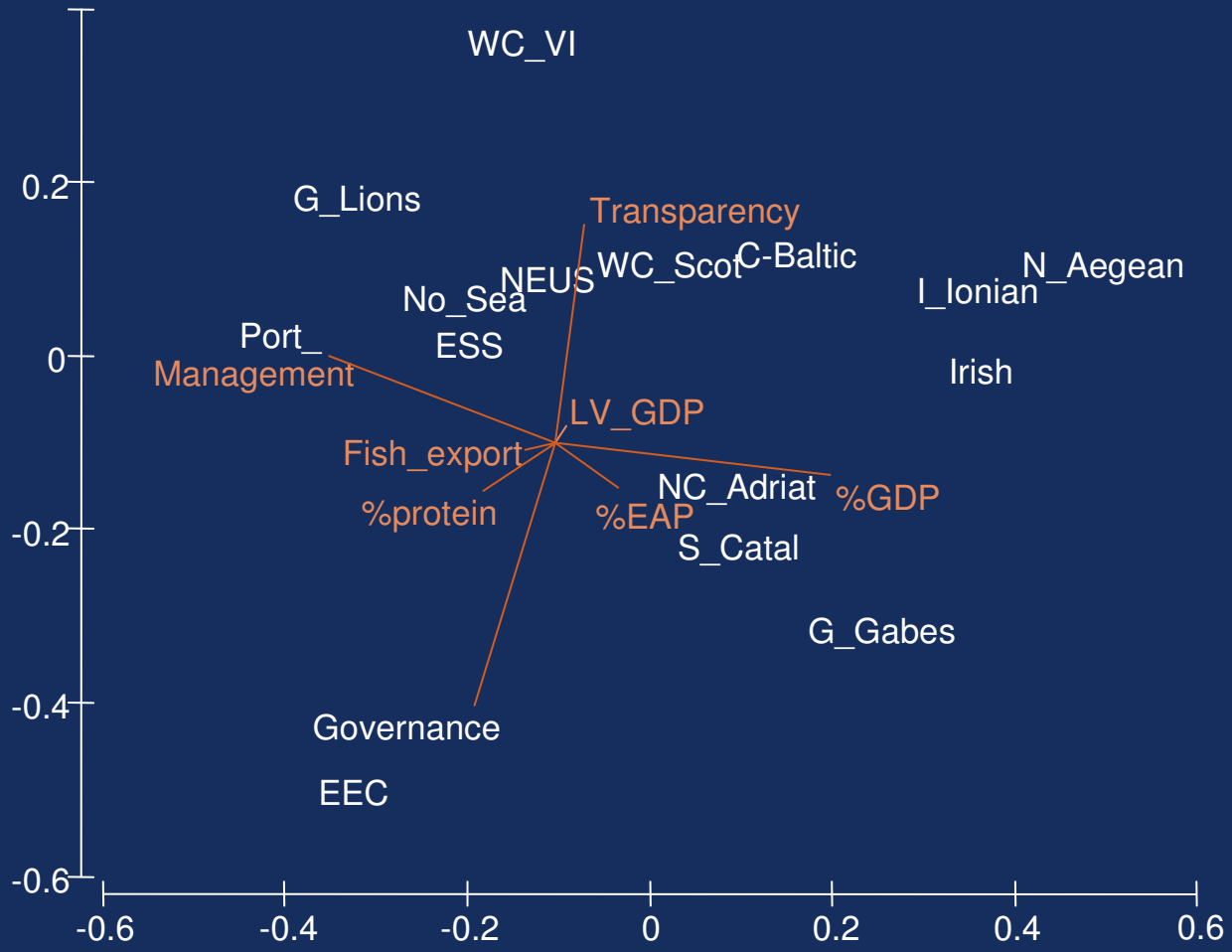
- Proportion of exploited species with declining biomass
- Intrinsic vulnerability index of the catch (Cheung et al. 2007)
- Marine Trophic Index (Pauly and Watson 2005)
- Trophic level (TL) of surveyed and modelled community
- Abundance of flagship species
- Discard rate

IndiSeas2 Task Groups Aims

TG3 - Human Dimensions Indicators

To select a suite of indicators to evaluate:

1. effectiveness, efficiency and fairness of fisheries management;
2. contribution of fisheries to the broader society; and
3. wellbeing and resilience of fishing communities.



IndiSeas2 Task Groups Aims

TG4 - Reference Levels for Indicators.

Explore and determine reference levels for ecosystem indicators to:

1. standardise indicators to compare the status of exploited marine ecosystems (ecosystem models); and
2. propose a control rule framework for EAF.

TG5 - Performance of Indicators and links to Management.

To advance understanding of how ecosystem indicators can be used in management by:

1. empirically testing how particular indicators might signal deteriorations and thresholds in ecosystem state through time;
2. developing decision rules that account for different environmental conditions;
3. simulation-testing the performance of a range of indicator and decision rules.

Future deliverables for TG4 and TG5

SIMULATIONS:

Results will be presented at Paris meeting (Unesco, December 2012) and provide advice for the Marine Strategy Framework Directive (MSFD).

A set of ecosystem models (EwE, Osmose, Atlantis, size spectra) will be used to test:

- indicators sensitivity, specificity & responsiveness in different fishing scenarios (TG4)
- indicators response to changing environmental forcing (TG5)
- indicators reference levels & performance for fisheries management (TG5)

IndiSeas2 Task Groups Aims

TG6 - Integration of Indicators.

Explore techniques to allow the integration of multiple and multi-disciplinary indicators to compare and evaluate ecosystem status for an EAF.

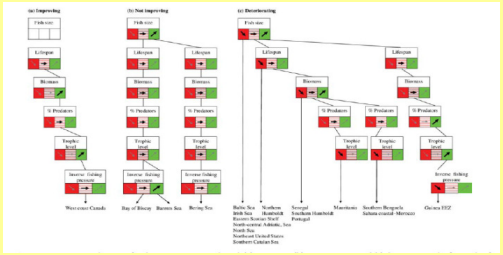
Drivers

(a) Management and governance

(b) Climate change and environmental variability

Assessments

(c) Ecological status of the exploited ecosystem



(d) Wellbeing of fisheries dependent peoples

(e) Integrative global analysis for EAF

Dec. 2011 Workshop Conclusions for EAF

1. ***Combining and integrating multi-disciplinary indicators.***
    1. Important to include main drivers of ecosystem changes & should be quantitative to compare, classify and rank ecosystem status.
    2. Need to display this information in a way that is objective and easily communicated (graph).

2. ***Developing a synergy between model- and data-based approaches.***
    1. Important to use models to test the sensitivity and specificity of indicators under various scenarios of climate and management.
    2. Models can also be used to hindcast “what-if” management scenarios for refining the application and derivation of reference points.

Dec 2011 Workshop Conclusions for EAF

3. ***Using research survey data***
    1. Important that data can be trusted; biases are inherent in catch data.
    2. Currently limited availability/accessibility of survey data, but IndiSeas attempts to plug this gap.

4. ***Being global in scope and regionally rich.***
    1. Enables investigations of common global patterns of fishing effects; successful management strategies can be identified and communicated to other systems.
    2. Inclusion of ecosystem experts enables informed interpretation of results and avoids mid-diagnosis.
    3. Inclusion and integration of multiple ecosystems ensures that contributing ecosystems have access to analyses and comparison to other systems. By combining analyses from many systems IndiSeas can ensure the whole is greater than the sum of the parts.

Note: Recently published paper, Shin et al. (2012), has detailed summary of workshop outcomes.

General progress

- Most ecosystems have submitted final time series.
- Steady progress on statistical analyses of environmental drivers; 2 papers *in prep*.
- Preliminary evaluation of ecological and biodiversity indicators (presentation at World Fisheries Congress by Marta Coll, and at SA Biodiversity Information Forum by Lynne Shannon); 2 papers *in prep*.
- Human dimension indicators – data collation complete
- Publication of 2 papers since 2011 IndiSeas meeting:
  - Report paper Indiseas2: Shin et al. 2012. *Rev Fish Biol Fisheries*
  - Review on global approaches including IndiSeas1: Bundy et al. 2012. *COSUST*