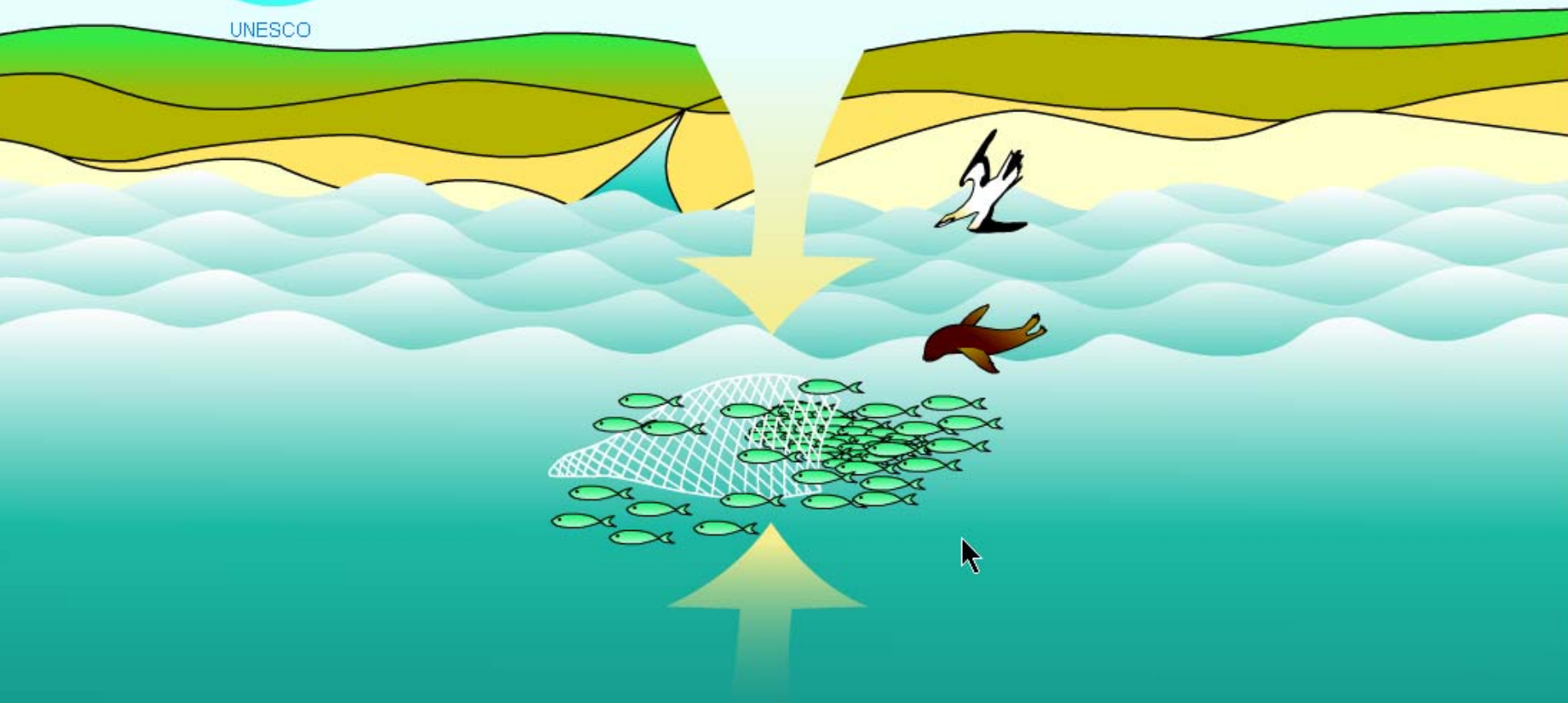
Quantitative Ecosystem Indicators for Fisheries Management

SCOR-IOC WG 119
2001-2005

UNESCO

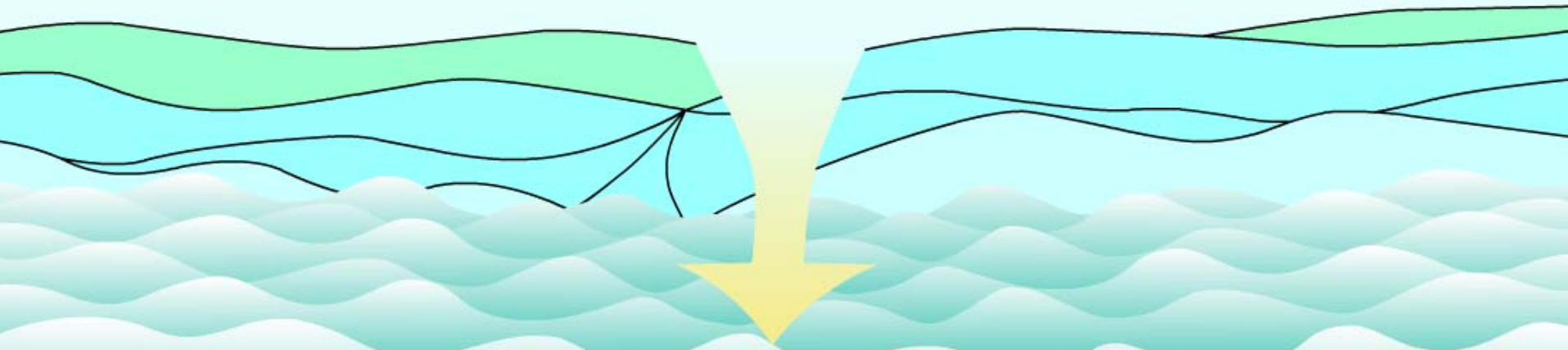
SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH



www.ecosystemindicators.org

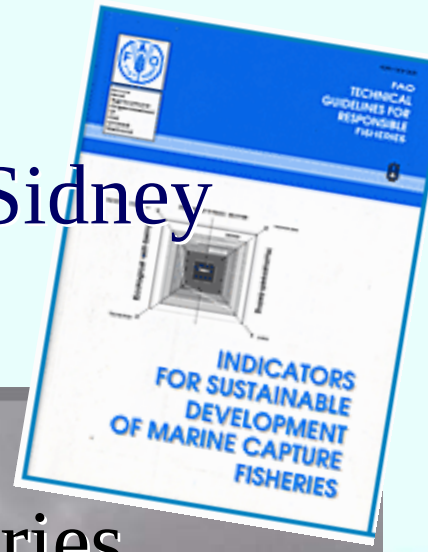
Ecosystem indicators, *oh no!*

We've only just gotten used to:



Y/R, $F_{0.1}$, $F_{0.2}$, F_{max}, B_{msy}, F_{msy}, F_{crash}, S_e, S/R, MSY, MEY, MBAL, q, B_{now}, TRP, LRP, MBP, MAY, CAY, SSB, Z_{mbp}, SPR, B_{msr}, B_0, F_{ref}, F_{low}, F_{med}, F_{high}, F_{target}, E, TC, TR, CPUE, LC_{opt}, SBL, ESB, BYM, MSST, …

Milestone 1



FAO/Australia Technical Consultation, Sidney 1999:

- Guidelines: Indicators for Sustainable Development of Marine Capture Fisheries
  - Development of frameworks;
  - Using indicators in the decision process.
- Marine and Freshwater Research
  - Special issue 51(5), 2000

Milestone 2

- SCOR/IOC WG 119 “Quantitative indicators for fisheries management” was established in 2001 as a follow-up to SCOR WG 105 / Montpellier Symposium 1999;
- The overall objective was to develop, evaluate, and select indicators to characterize processes and changes in marine  ecosystems from environmental, ecological and fisheries perspectives.

31 Members from 19 countries

1. Villy Christensen, co-chair Canada
2. Philippe Cury, co-chair France
3. Keith Brander Denmark
4. Ratana Chuenpagdee Thailande/USA
5. Kevern Cochrane Italy
6. Robert Costanza USA
7. Steven Cousins UK
8. Henrik Gislason Denmark
9. Sherry Heileman Kenya
10. Simon Jennings UK
11. Renato Quinones Chile
12. Mike Sissenwine IOC
13. Lynne Shannon South Africa
14. Tony Smith Australia
15. John Steele USA

1. Gabriela Bianchi Norway
2. Pierre Chavance Sénégal
3. Gueorgi Daskalov Bulgaria
4. Serge Garcia Italy
5. Astrid Jarre Greenland
6. Kwame Koranteng Ghana
7. Raymond Lae Sénégal
8. Steven Murawski USA
9. Daniel Pauly Canada
10. Tony Pitcher Canada
11. Jake Rice Canada
12. Marie Joelle Rochet France
13. Keith Sainsbury Australia
14. Patricia Sunye Brazil
15. Shin Yunne France
16. Kees Zwanenburg Canada

Milestone 3:
Reykjavik ‘01, Outlining the work

SCOR-IOC WG 119 activities:

- develop a multidisciplinary approach for using indicators;
- quantify ecosystem status, functioning and changes;
- define framework for implementation of indicators for fisheries management;
- assess and evaluate performance of selected indicators for fisheries management.

WG119 Taskforces

- Environmental indicators & habitat changes;
- Species-based indicators;
- Size-based indicators;
- Trophodynamic indicators;
- Integrated indicators;
- Selection criteria;
- Data sets and reviews;
- Frameworks & use of indicators.

Milestone 4:

Cape Town ‘02: preparing for Paris

www.ecosystemindicators.org

Twelve sponsors

Special Issue
of the
ICES Journal of Marine Science
Vol. 62(3), 2005
(Daan, Cury, Christensen)

Quantitative Ecosystem Indicators for Fisheries Management

International Symposium

31 March - 3 April 2004
Paris, France

UNESCO

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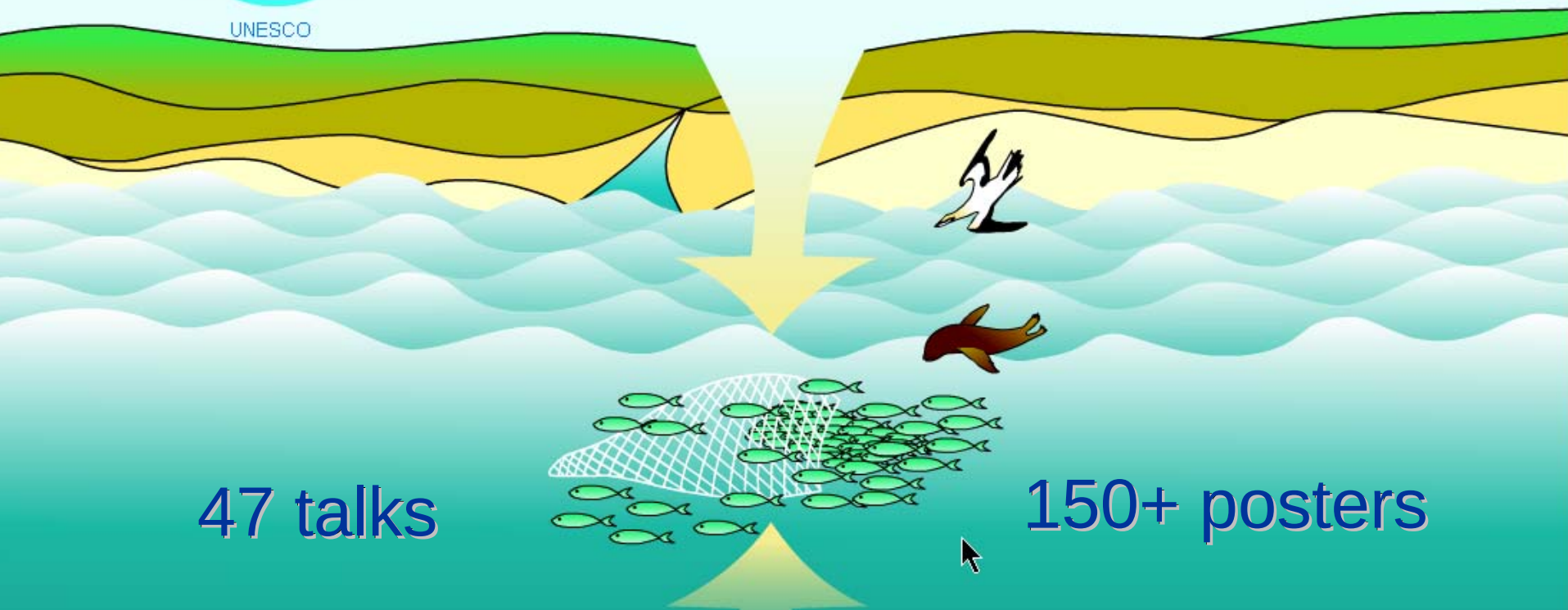


47 talks

150+ posters

250 participants from 53 countries

Paris Symposium
31 March -3 April 2004

- Indicators for EAF
  - Environmental indicators;
  - Diversity & species-based indicators;
  - Size-based indicators;
  - Trophodynamic indicators;
  - Spatial indicators
- Evaluating, implementing, communicating & using
  - Selecting and evaluating indictors;
  - Integrated indicators;
  - Frameworks for sustainable development;
  - Implementing schemes;
  - Global implementation.

Environmental Indicators

Plankton species as indicators

- Species' distributions shift at different time scales; shifts are important for exploitation and conservation (use of indicator species) & Abundance and species richness are affected to varying degrees by dredging *by K. Brander*
- Plankton species as indicators of environmental shifts (CPR) *By G. Beaugrand*
- Primary productivity at  different time scales based on remote sensing *By J. Polovina*
- Different indicators capture different time scales of ocean variability: Zooplankton monthly changes, fish-birds & mammals longer time periods *by M.Ohman and B. Lavaniegos*

Diversity & species indicators

top predators (seabirds and marine mammals) as indicators

- Indicators of species spatial overlap using GIS to quantify potential competition between fishers and top predators *by Freon, Drapeau et al*
- Seabirds and mammals as indirect means to detect ecosystem effects of Antarctic krill fishing *by Reid and Croxall*
- 'Happiness Index' derived from a composite index of seabird abundance *by Underhill and Crawford*
- World seabirds population trends over the past 30 years (reconstruction); correlates with fish catches *by Karpouzi et al.*
- Marine mammal abundance as  indicators of ecosystem state (W&E Gulf of Alaska) *by Trites and Rosen*
- Catch diversity index (#species in statistics / #exploitable species) *by Palomares and Pauly*
- FEB (Fisheries Ecosystem Balance) indicator of sustainable exploitation rates without loss in species richness *by Bundy et al.*

Spatial indicators

top predators (seabirds and marine mammals) as indicators

- Seabirds are indicators of environmental change in the North Sea *by Scott et al.*
- MPAs and spatial zoning was reviewed by considering spatialized indicators (size spectra, mean trophic levels) & empirical and model-based assessments *by Babcock et al. and by Pelletier et al.*

Integrated indicators

- Economic indicators that mirror changes in stocks and ecosystem (such as prices) *by Perrings*

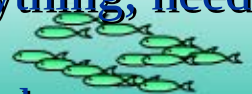
- ‘Public sentiment index’ in the Chesapeake Bay, consensus found by asking a variety of stakeholders about  preferences for protective measures *by Chuenpagdee and Pauly*

Frameworks

- Framework to define ecosystem overfishing *by Sainsbury and Sissenwine*
- Framework for selecting indicators *by Rice and by Rochet*
- Ecosystem indicators translated into decision criteria using T&LRPs: 'ecosystem overfishing' *by Link et al.*
- Viability theory and how to incorporate T&LRPs into a single model *by Cury et al.*
- Indicators and communication *by Degnbol and by Lefur*
- Geographical mapping of indicators for communicating changes *by Pauly*

Indicators: what have we learned?

- Environmental and low-trophic level indicators can capture environmental changes (bottom-up effects);
- Top predators or high trophic indicators can capture changes in the fish communities/fisheries (top-down effects);
- In general more suited for monitoring than for predictions;
- 'the devil is in the details': interpretation can be delicate;
- Indicators are often conservative (not very sensitive): this must be acknowledged despite lack of reference points (trends and rapid changes should be carefully considered)
- No single indicator is good for everything; need a suite (covering different data, groups and processes) as indicator performance may differ (with ecosystem, history of exploitation, other pressures, [e.g., pollution], quality of sample collection)
- Rather than holding different ecosystem indicators up against each other, one should compare their characteristics and gain knowledge on the status of the ecosystem by interpreting agreement and disagreement between them

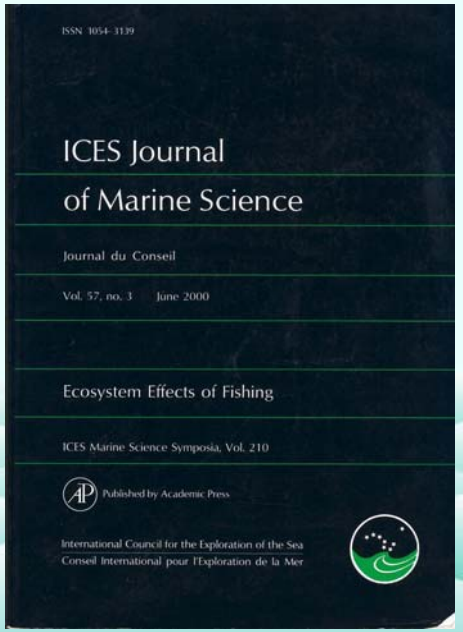


Conclusion

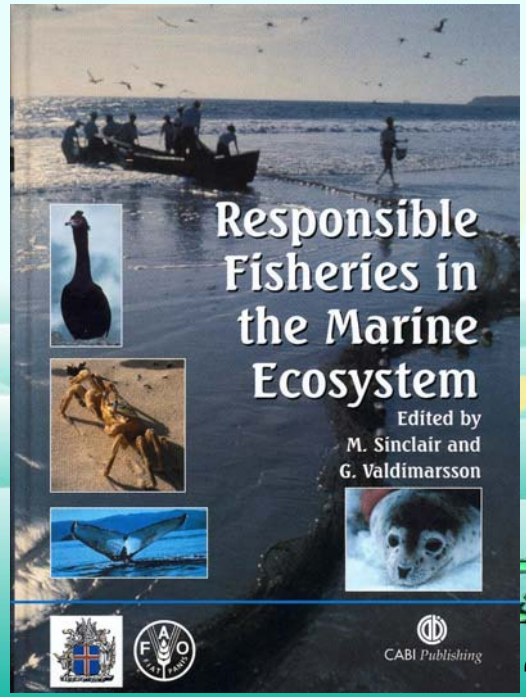
Knowledge, data & frameworks exist for:
Defining, selecting, evaluating & implementing indicators;

No free lunch

Next step?



Montpellier Symposium 'Ecosystem Effect of Fishing' 1999 SCOR-WG105



Reykjavik Conference 'Responsible Fisheries in the Marine Ecosystem' 2001

Paris Symposium 'Quantitative Ecosystem Indicators for Fisheries Management' 2004 SCOR-IOC WG 119

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Implementing EAF & Operationali-zing the use of indicators