Fisheries: from Clockworks to Social-Ecological Systems.

Serge M. Garcia

(Chair IUCN-CEM-FEG)

ICES MSEAS Symposium. Understamding marine socio-ecological systems: including the human dimension in integrated ecosystem assessment. Best, 30 May-3 June 2016.

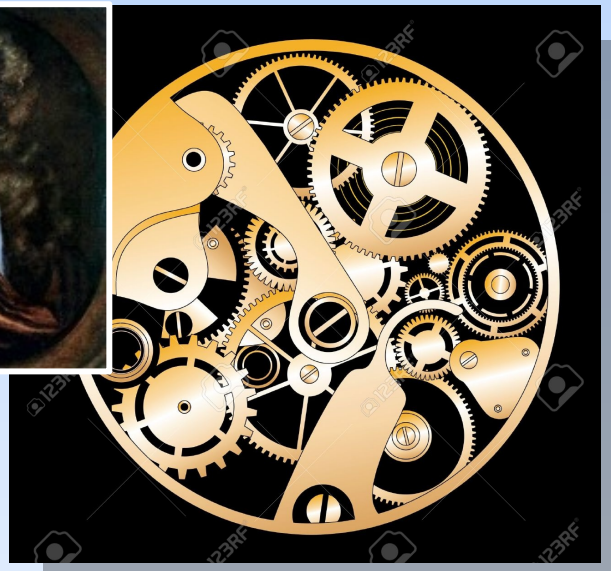
Outline

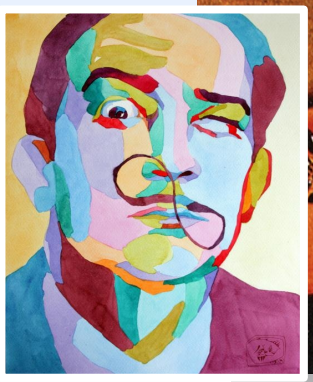
1. Incorporating complexity
2. Social-ecological systems
3. Fisheries, conservation & economics
4. Concluding remarks

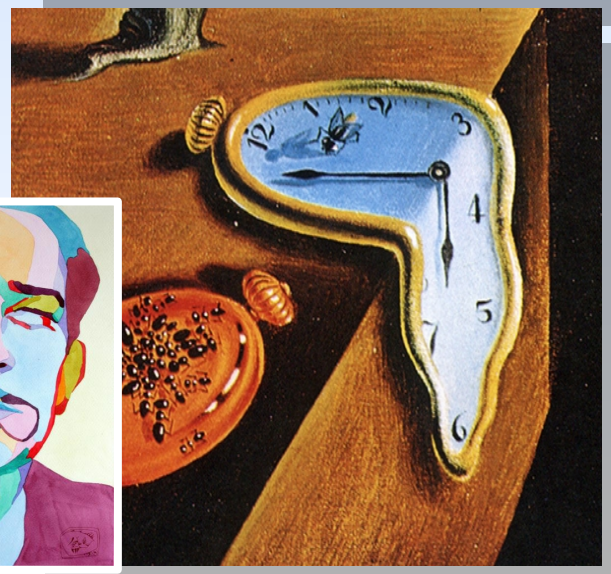
Outline

1. Incorporating complexity

From clockworks to soft watches

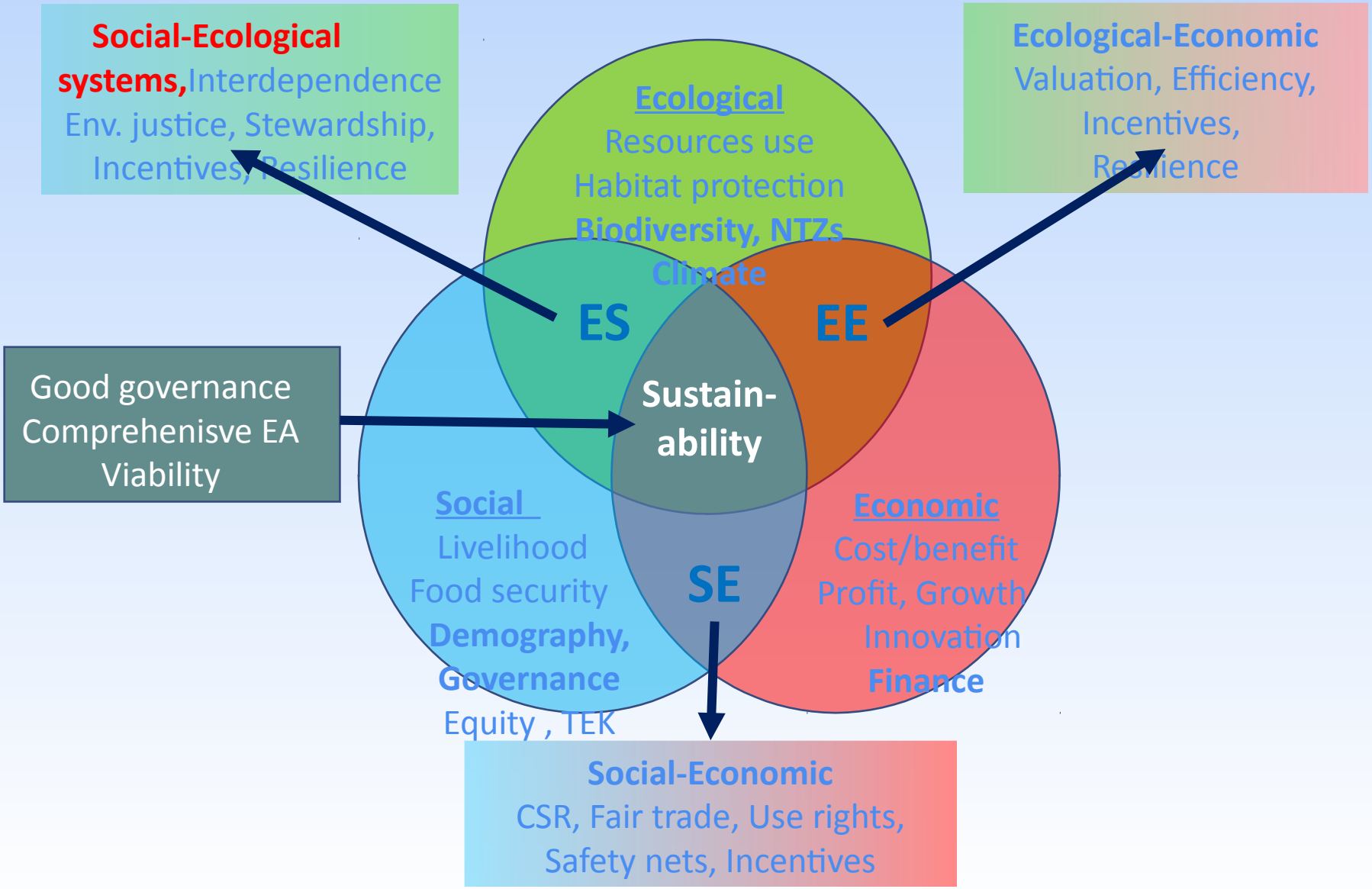






Source: Garcia and Charles, 2006; 2008

SD dimensions



Some precursors

R. Hilborns

P. Allen

J. McGlade

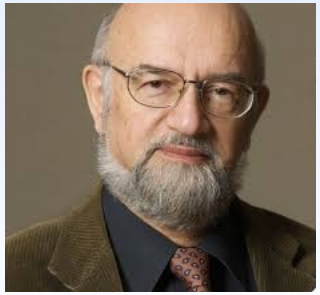
J. Le Fur

C. Walters

C.S. Holling

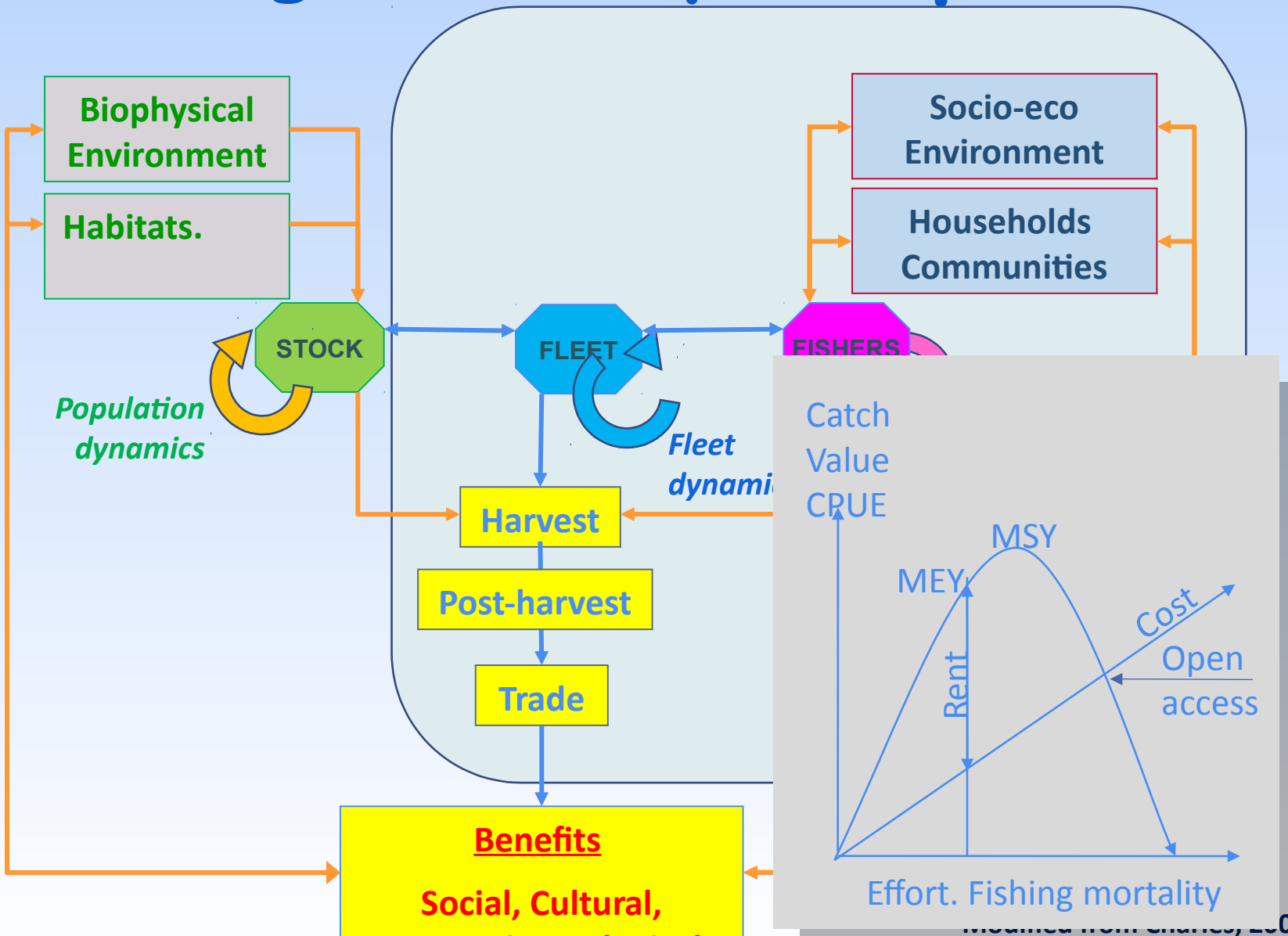
T. Charles

B. Rothschild



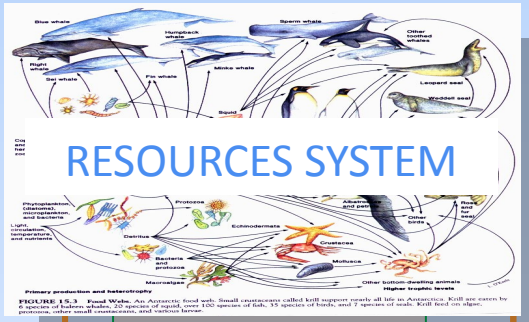
F. Berkes

A single-fishery complex



Modified from Charles, 2005

A complex sectoral system



Communities

STOCK

Population dynamics

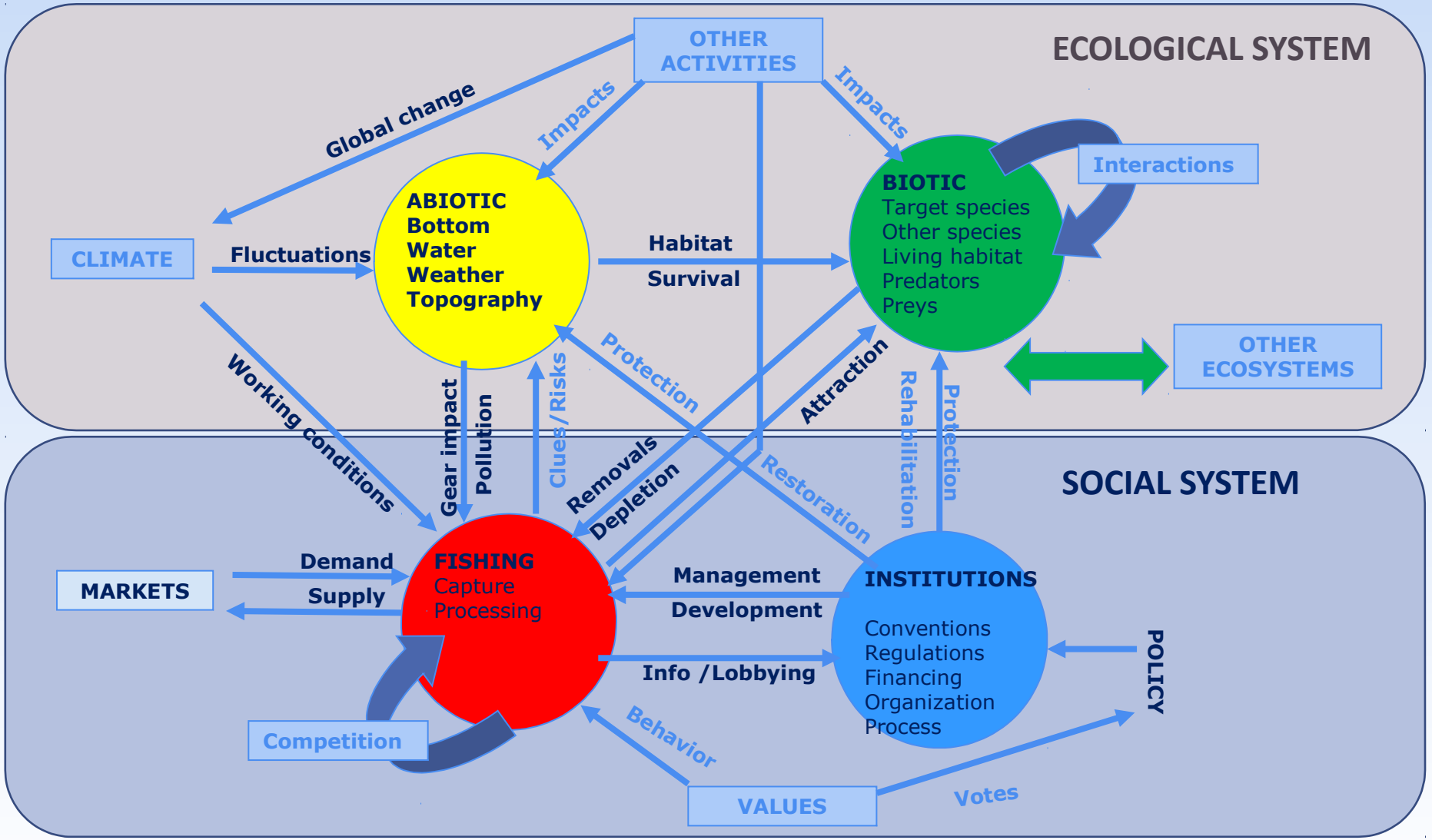
FIS

Benefits

Social, Cultural, Economic, Ecological

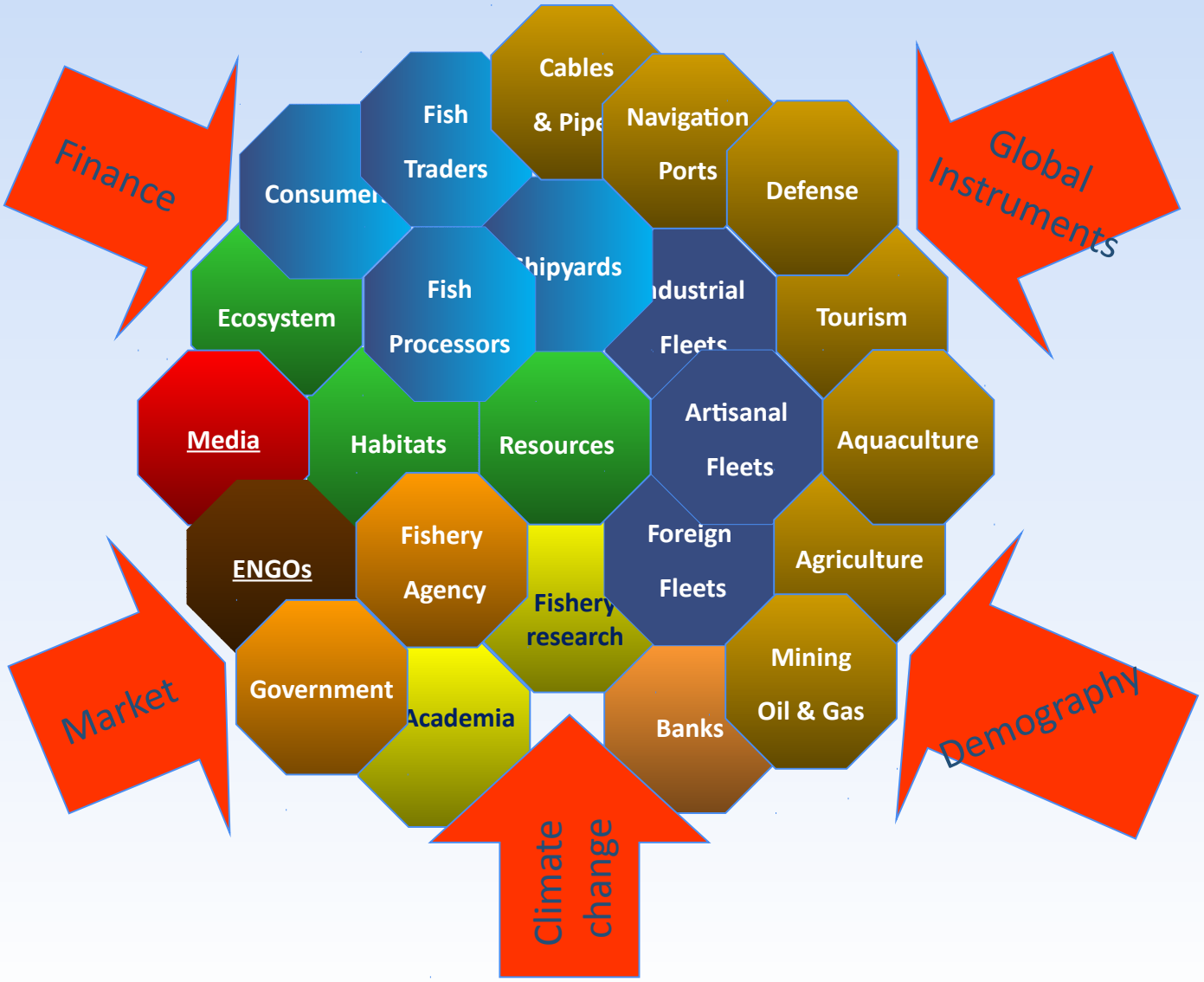
Modified from Charles, 2005

Ecosystemic representation



From Garcia et al. 2003

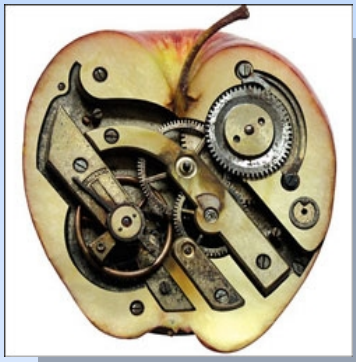
Cross-sectoral complexity



Garcia, 2007

Reflections on complexity

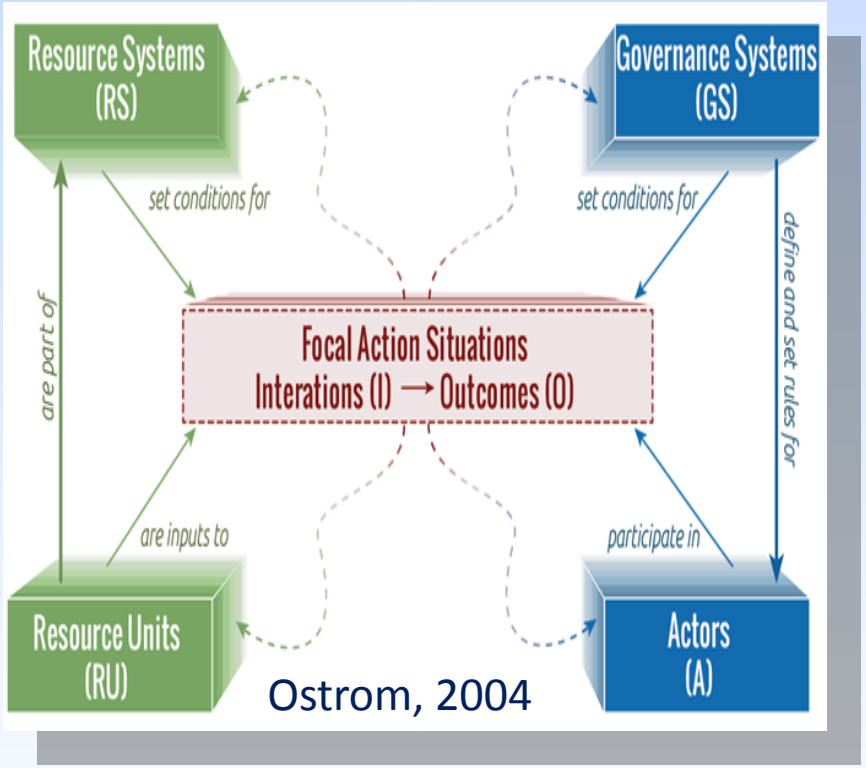
We are seeing the end of reductionism, the fake ideology which promised humans the control on everything
(Robert Laughlin 2005; Nobel laureate in Physics)



Using the conventional physics to improve one's understanding of complex systems is like climbing a taller tree (to grab the moon)
(John Casti 2004, in Ulanowicz 2005)

Outline

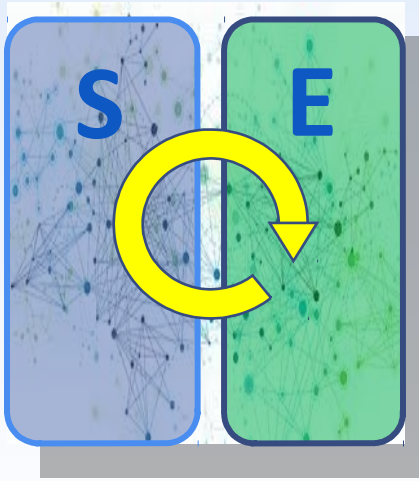
3. Social Ecological Systems



Ostrom, 2004

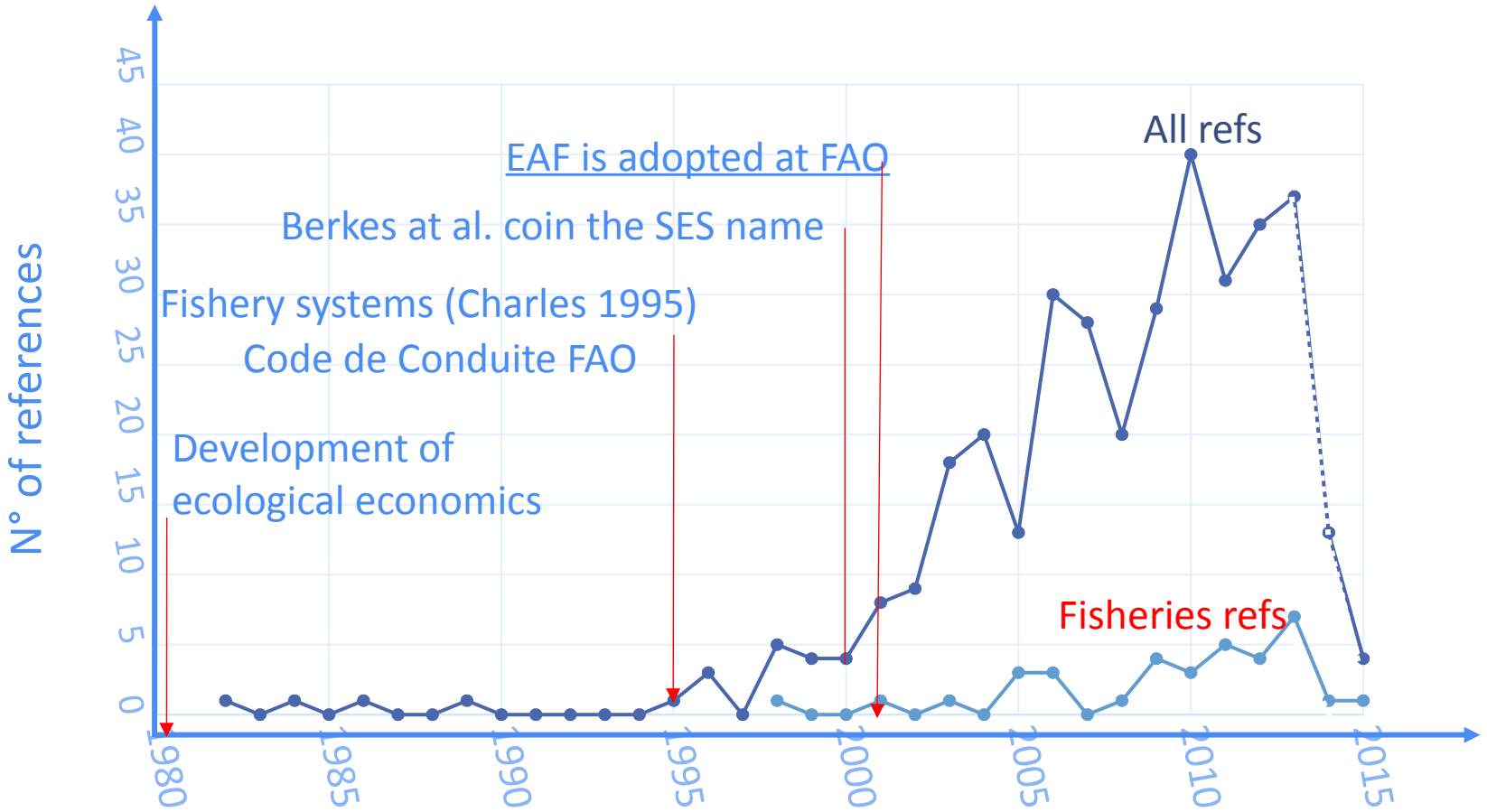
Pseudo-Definitions

Complex adaptive systems are systems in which a large number of interacting components (objects, agents) with no central control and simple rules of operation give rise to complex collective behaviour, sophisticated information processing and adaptation via learning or evolution. They exhibit non-trivial emergent and self-organizing behaviour and surprises. They have memory and generate feed-back reactions. Their outcomes may reflect order or disorder. (Mitchell, 2009: Johnson, 2007).



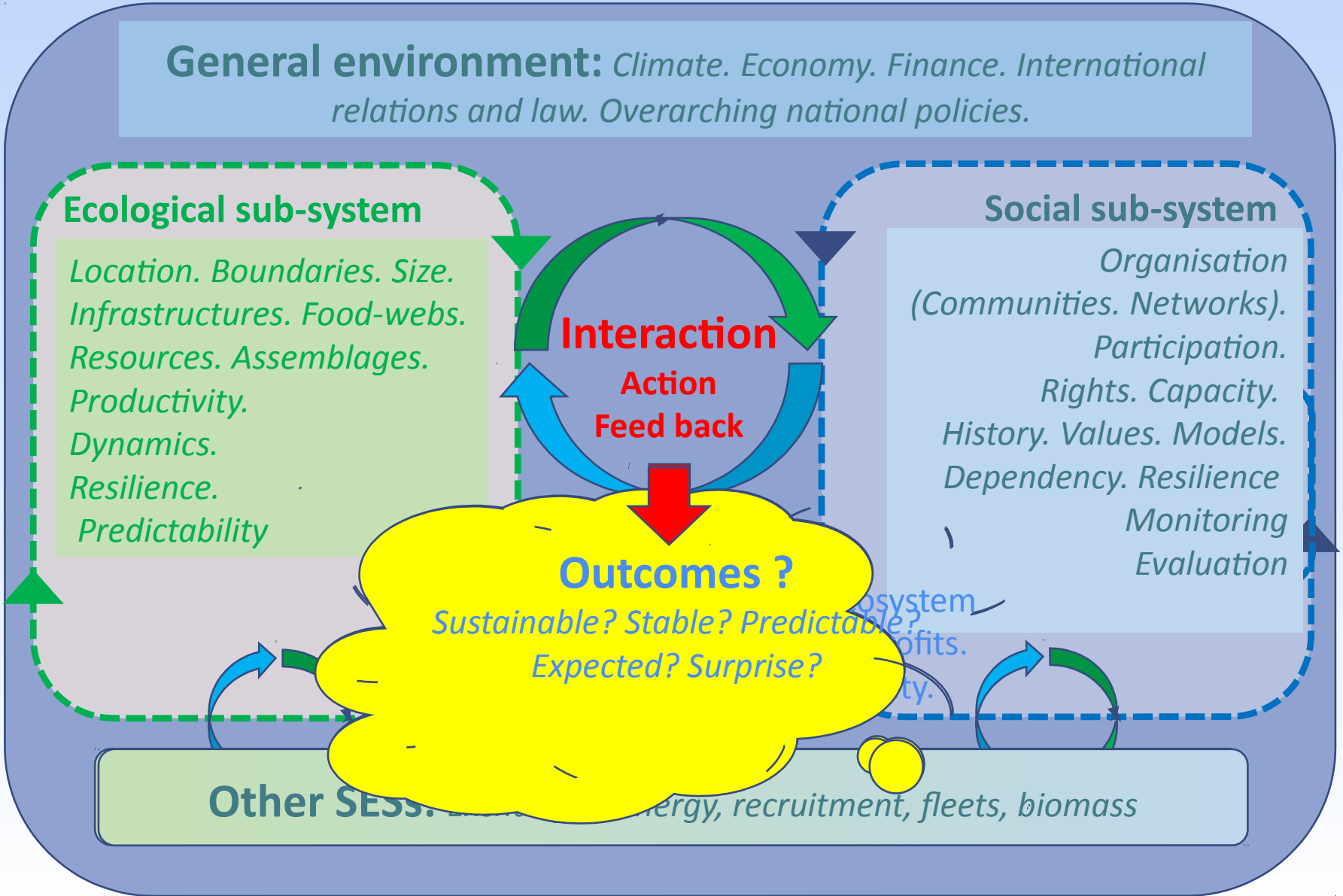
Social-ecological systems are **complex**, integrated, adaptive and resilient systems, defined at several spatial, temporal, and organizational scales which may be hierarchically linked. Their social and ecological sub-systems are dynamic, interdependent, of equal weight and they co-evolve as a result of their interaction [and converge in response to common external drivers] (Gual & Norgaard, 2008; Haliday & Glaser,

SESs in literature

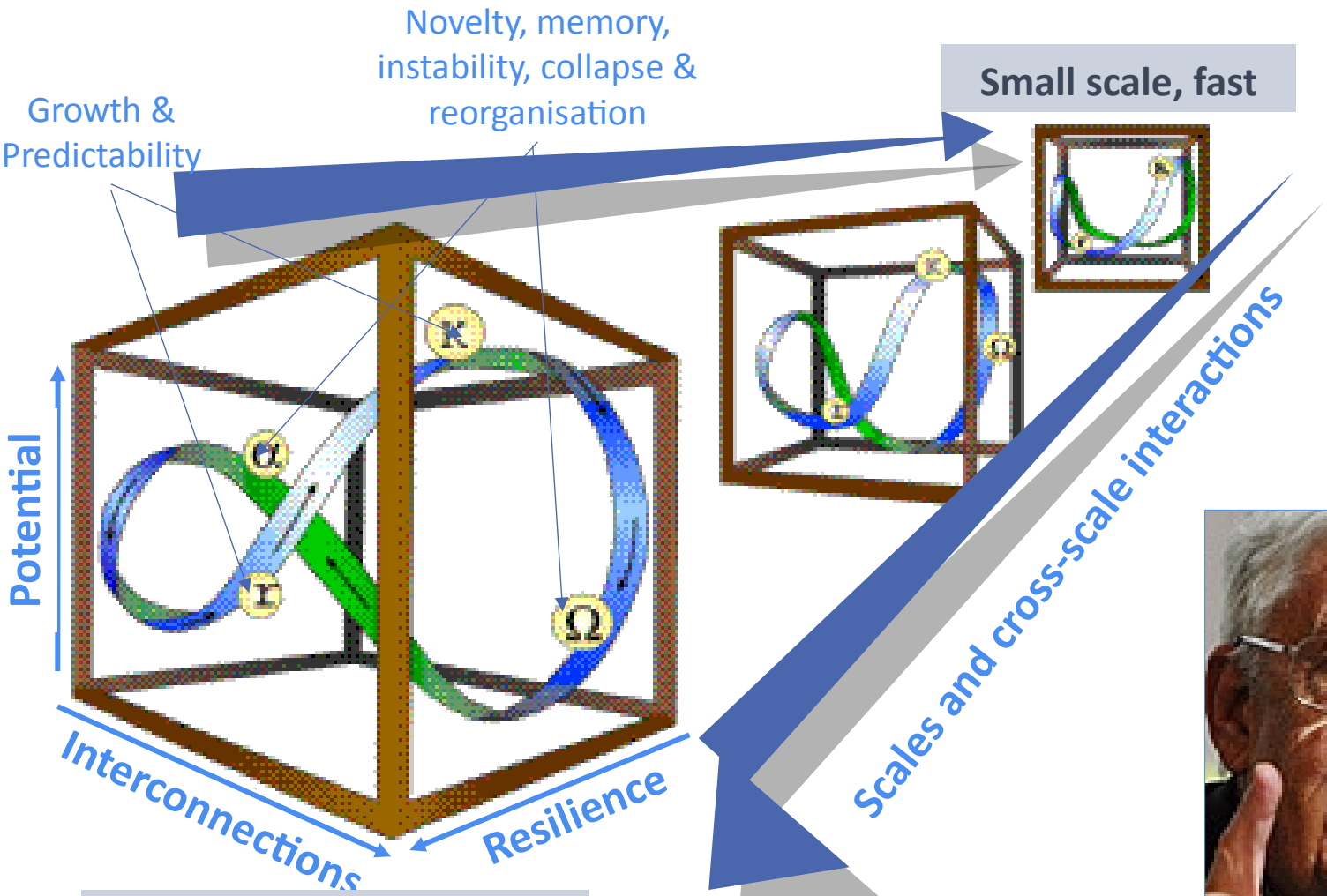


Google scholar hits on (1) social-Ecological systems; and linked social and ecological systems. Papes on or referring to SES. Search conducted on 2 April 2016

Social-ecological systems



SESs adaptive cycle



From Holling, 2004

From Holling, 2004

In a nutshell…

- SES are complex adaptive systems, obviously.
- The concept stresses the role of social drivers and governance on resilience
- It carries the humanist view that Nature includes people
- The S & E dichotomy is arbitrary but reinforces the humanist view
- The S & E are interdependent & coevolve
- SESs exist at numerous nested scales across which they interact
- The evolution patterns of E is similar to that of its governance (Panarchy)

SES "pathology"

Conventionally managed, SESs will tend to show:

- Modification of ecosystem structure & function
- Resources decline and collapse
- Related crises in dependent human communities
- Perverse evolution of practices
- Hardly reversible situations. Lost resilience
- Institutional traps (blocking corrections)

Disciplinary panaceas do not work well or for long and often amount to "*painting with a hammer.* Dengbol et al. 2006)

Adapted from Gunderson & Holling Eds. Panarchy; Dengbol et al., 2006)

Implications for science

- Information shortfall: costs, priorities
- Loss of equilibrium and reversibility
- Loss of universality of results.
- Critical tipping points and thresholds
- Blurred cause-effect relations
- Multiple sources of errors
- Need for risk assessment and precaution
- Hard trade-offs in modelling
- Modelling across nested interacting scales
- Combination of quantitative & qualitative info
- Use of multiple sources of knowledge
- Challenge to design adaptive solutions
- Use scientists as facilitators and stakeholders
- Interdisciplinary science & Integrated assessment

The implications for the sector technological innovation would benefit from a distinct analysis

Implications for governance

- More stakeholders and diverse points of view
- More goals, limits & indicators
- Diversified policies and instruments
- Harder trade-offs; sub-optimal solutions
- Precaution. Contingency planning
- Resilience and adaptive approaches
- "Good governance"
- Nest operational and strategic planning
- Institutionalize performance assessment.
- Ensure coherence across scales
- Avoid *a priori* non-reversible solutions
- Beware of apparent win-win solutions
- Accept uncertainty and partial controllability
- Replace output maximization by risk minimization

Maintain system's resilience.

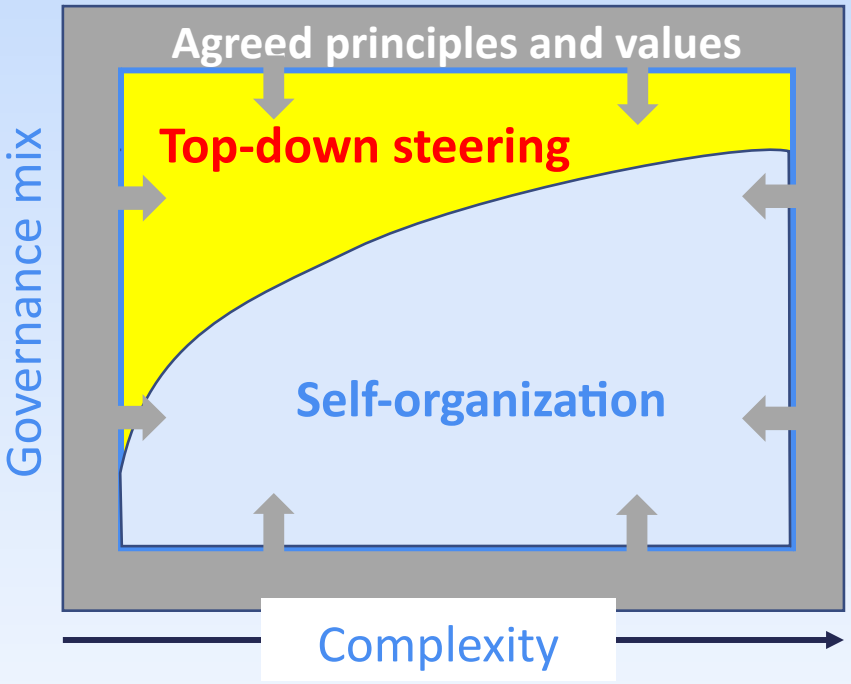
Develop actors' adaptability

Assess how much complexity needs to be addressed: Cost/Benefit analyses

Beware of exponentially escalating complexity in intersectoral governance

Enabling governance

- Effectively connects its components within and across organizational levels
- Provides leadership, trust, vision and meaning
- Provides a learning environment
- Fosters/mobilizes social networks
- Develop bridges between organizations
- Adopt enabling legislation and policies
- Mixes top-down steering and self-

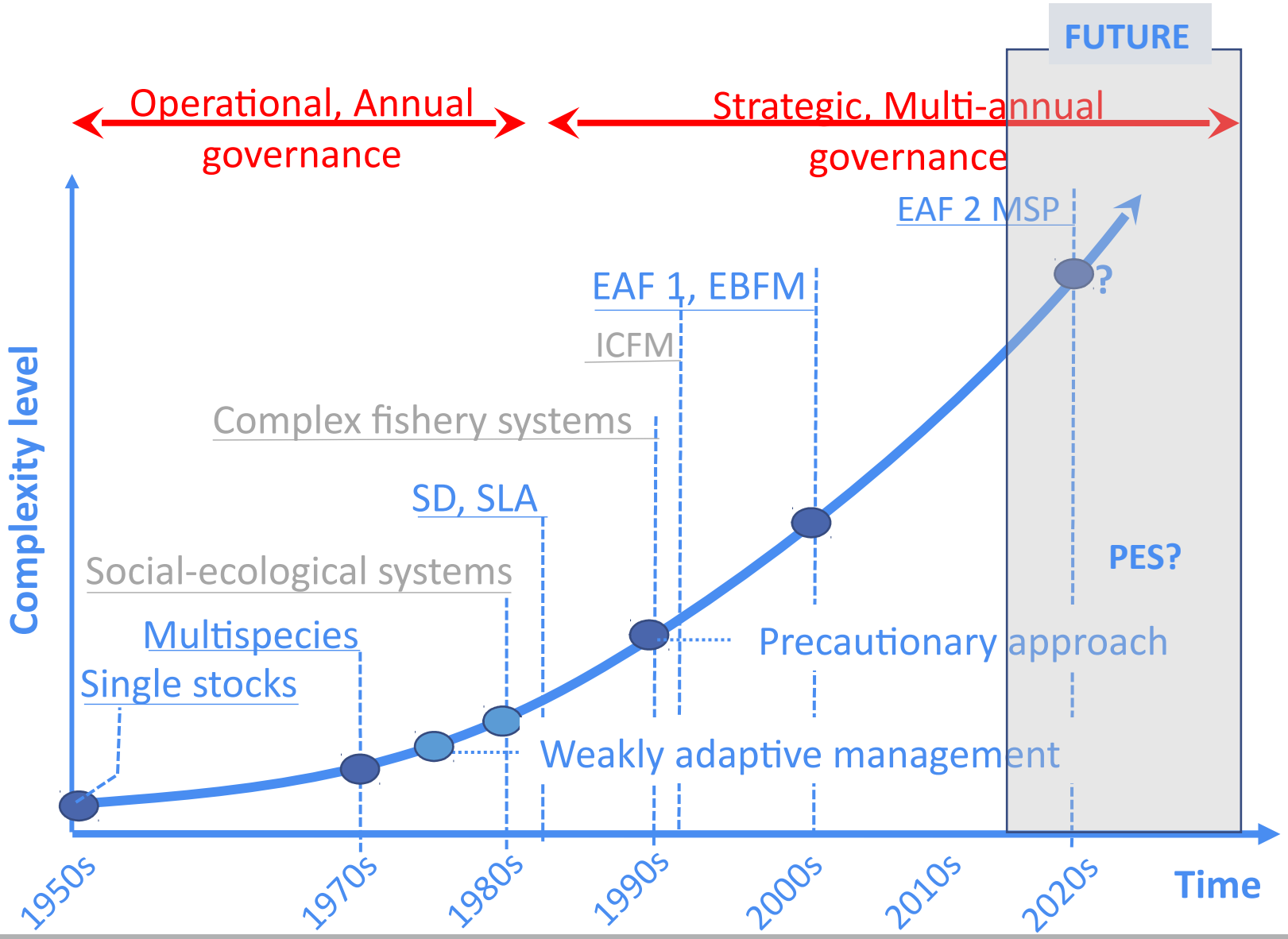


Implies anticipative **institutional capacity-building** and **prioritization** based on **risk assessment** and **cost/benefit analyses**

Folke, et al. 2005

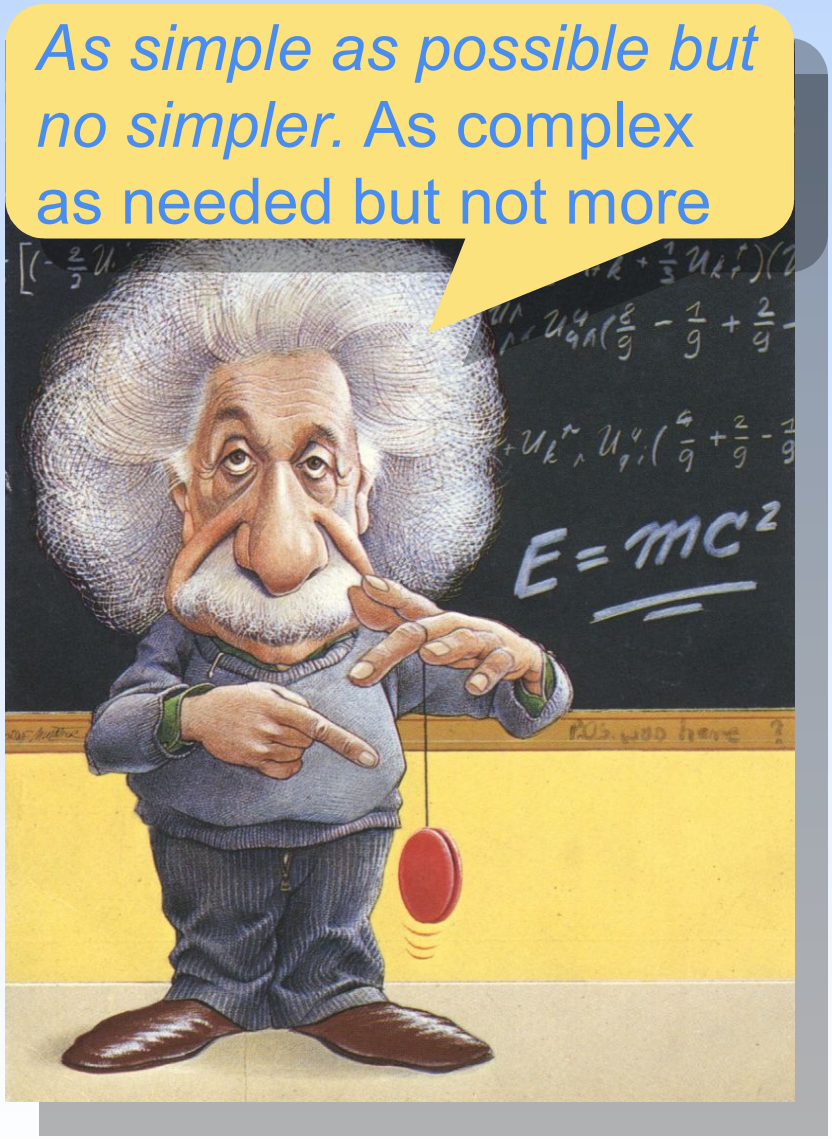
Modified from Mahon et al. 2008.

Where do we stand?



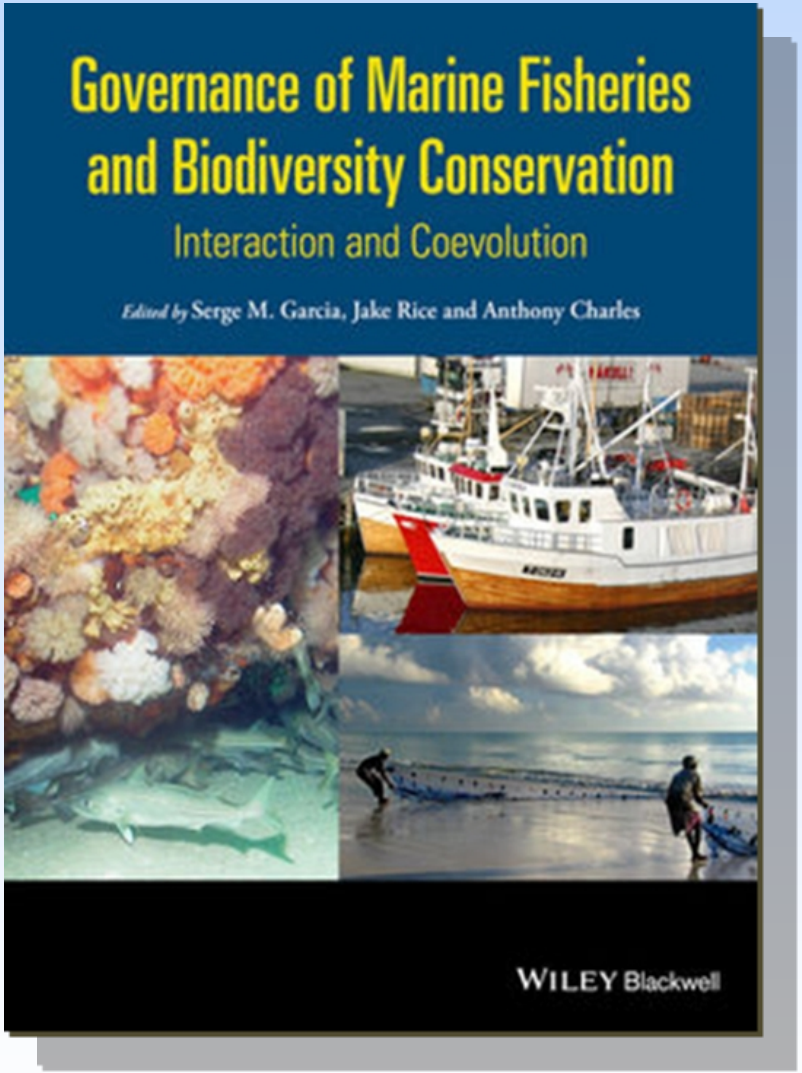
Two problems

1. A chronically insufficient scientific and institutional capacity, and
2. finding the right balance between naive simplisticity and masochistic complexity?



Outline

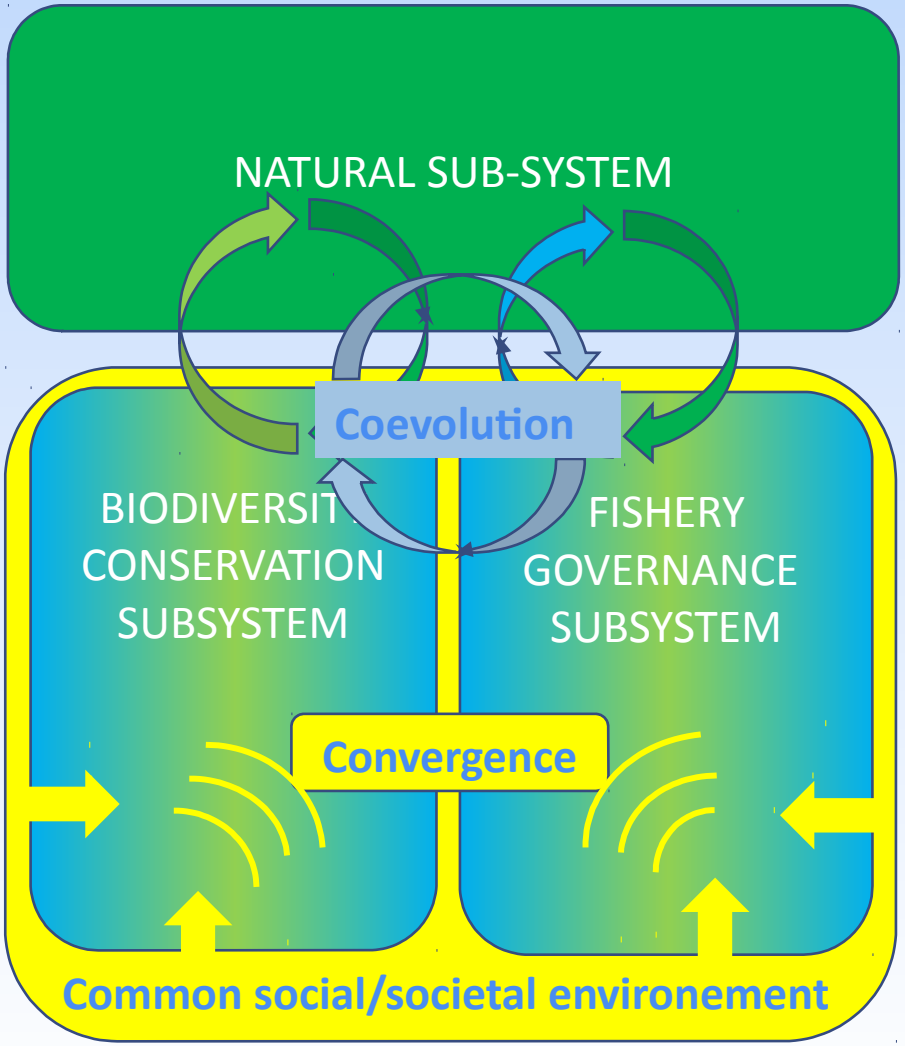
4. Fisheries, conservation and economics



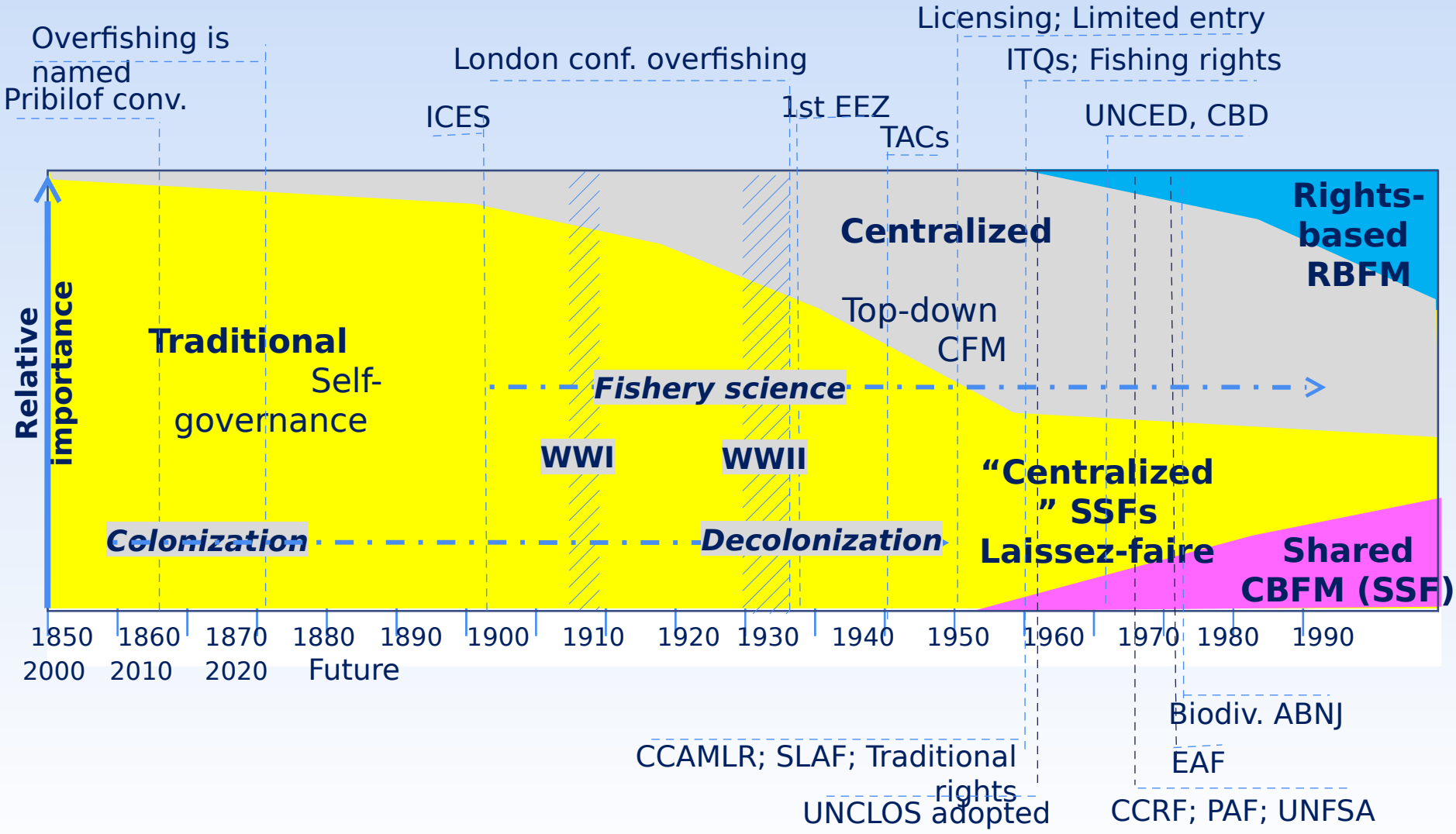
Coevolution and convergence

Coevolution: coadaptation. Two social subsystems react/adapt to each other's actions/changes.

Convergence: Two social subsystems are driven in the same general direction by common drivers of their general environment

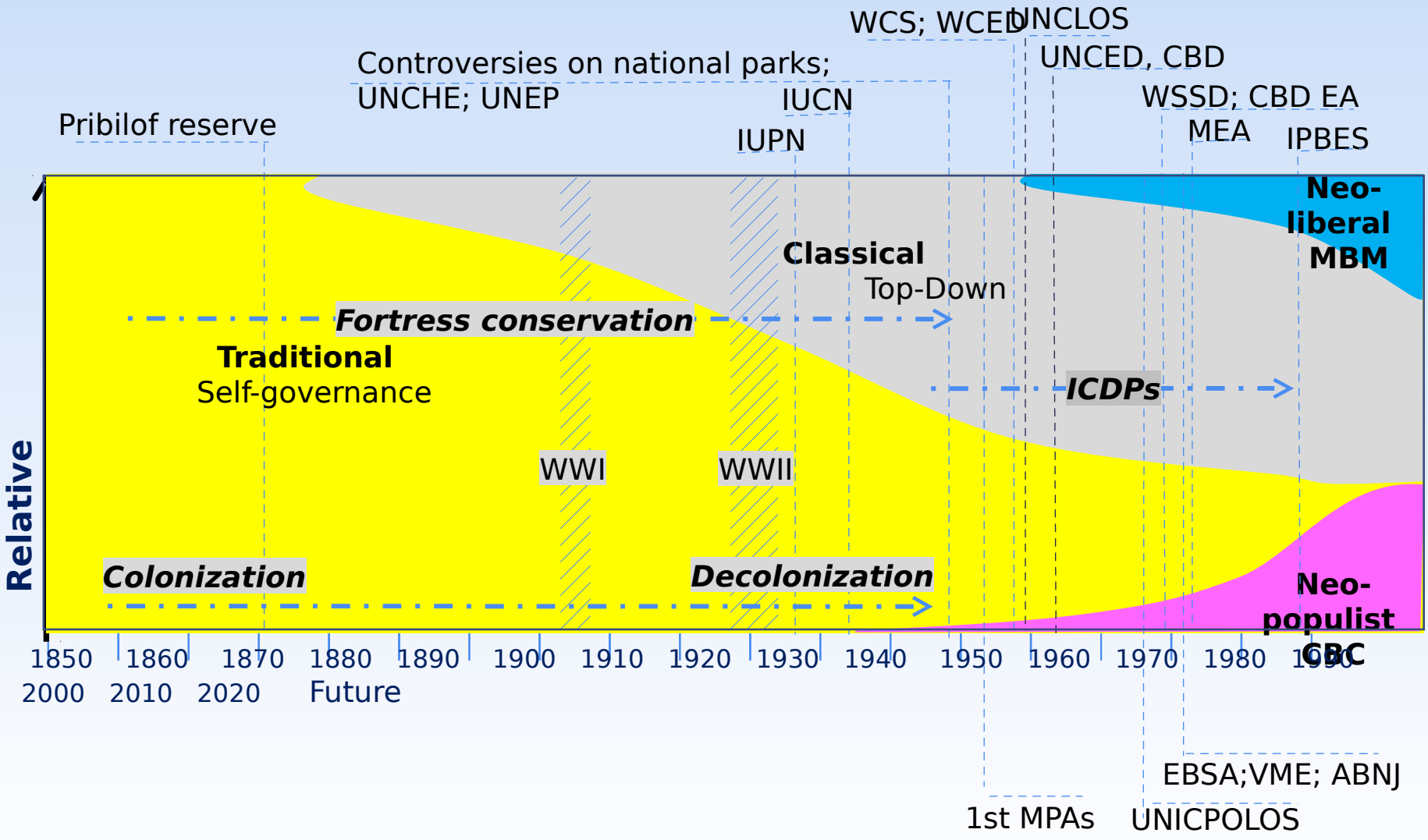


Fishery governance trends



Garcia, Rice & Charles, 2014

Biodiversity governance trends



Garcia, Rice & Charles, 2014

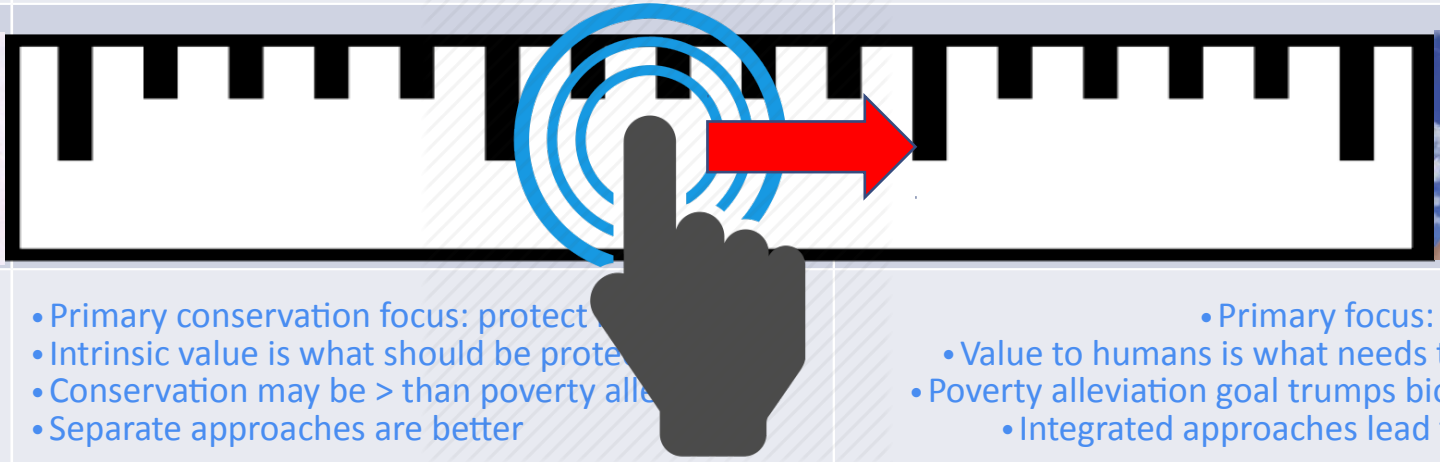
CBD Biodiversity Target 6

Sustainable management of marine living resources

By 2020, all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably…

Social and economic implications are not addressed !!

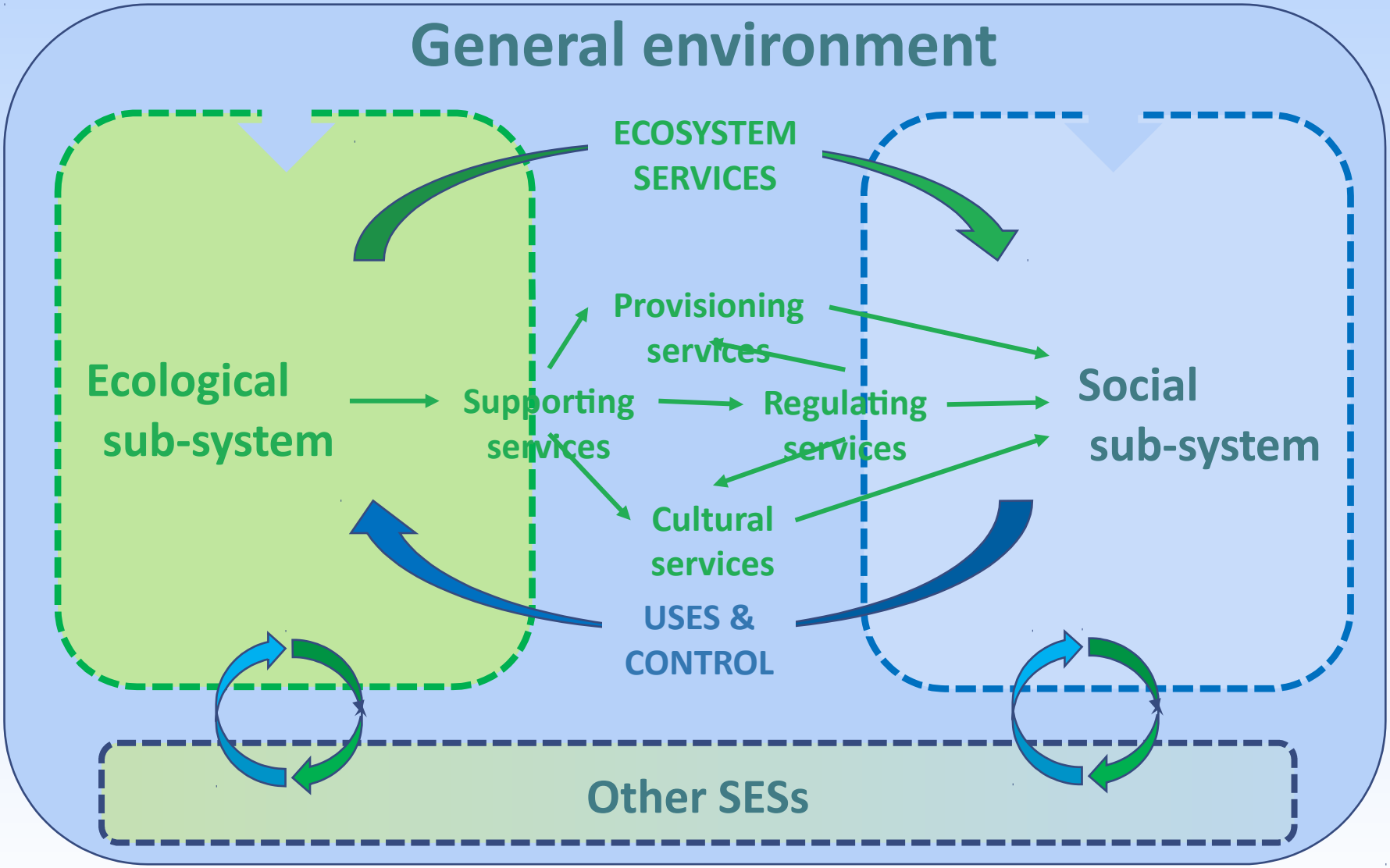
The New Conservation debate

	Nature protection	Social conservation
Policy goal	Protection of biodiversity. Nature centered	SD/SU/conservation & livelihoods. People centered
Instruments	NTZs. Red Listings. Top-down decisions. Weak or zero participation. Fotress conservation. Universal panaceas	Conventional + (MU-MPAs, LMMAs), ICDPs, SLA. Democratic. Participative, PES. Context-based utility. Market-based approaches
		 
Normative claims	• Primary conservation focus: protect • Intrinsic value is what should be prote • Conservation may be > than poverty alle • Separate approaches are better	• Primary focus: human welfare • Value to humans is what needs to be protected • Poverty alleviation goal trumps biodiv. Protection • Integrated approaches lead to convergence
Ethical foundations	• Ecocentrism, preservationism, animals' rights, Ethical «purity»	• Antropocentrism, utilitarism, social justice, traditional rights. Ethical pluralism, Pragmatism
Primary disciplines	Conservation biology, environmental philosophy	Anthropology, political ecology, development economics, fishery, forestry applied sciences
Supporters (Tentative)	IUCN, Many traditional ENGOs	FAO, CBD, IUCN, TNC, WWF (?), Gordon and Betty Moore Foundation, Breakthrough institute, Others?

Many individual and institutions mix elements from both ideologies.

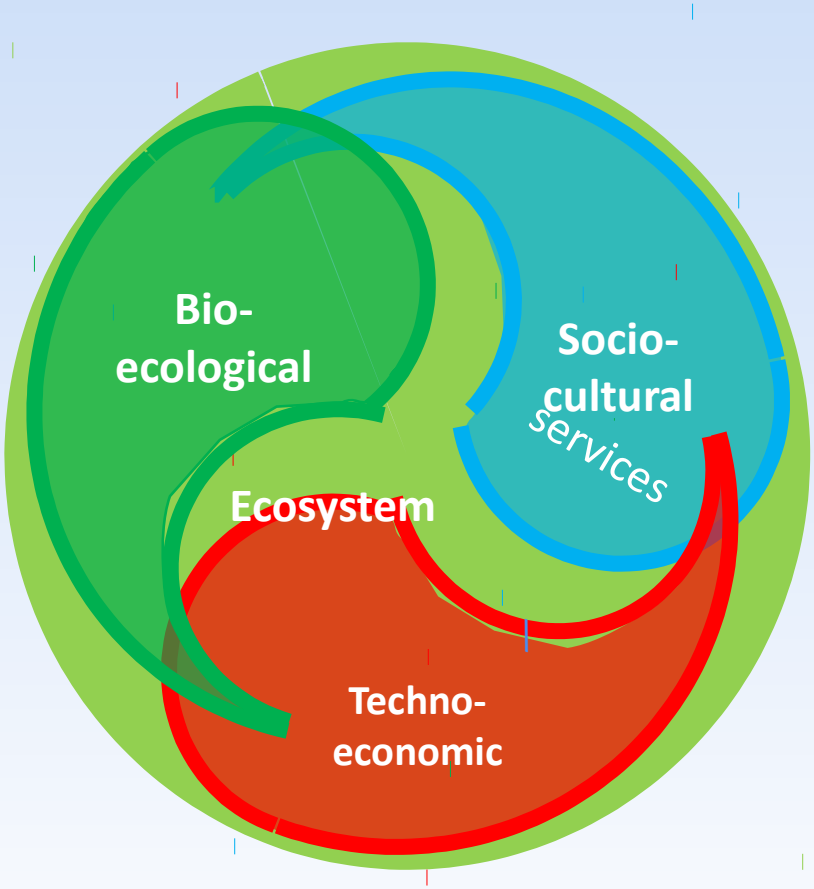
Slightly modified from Miller et al., 2011; Minteer & Miller, 2011

SES and Ecosystem Services



Modified from Bennet, Peterson and gordon. 2009. Ecological letters

ES as a common curency?

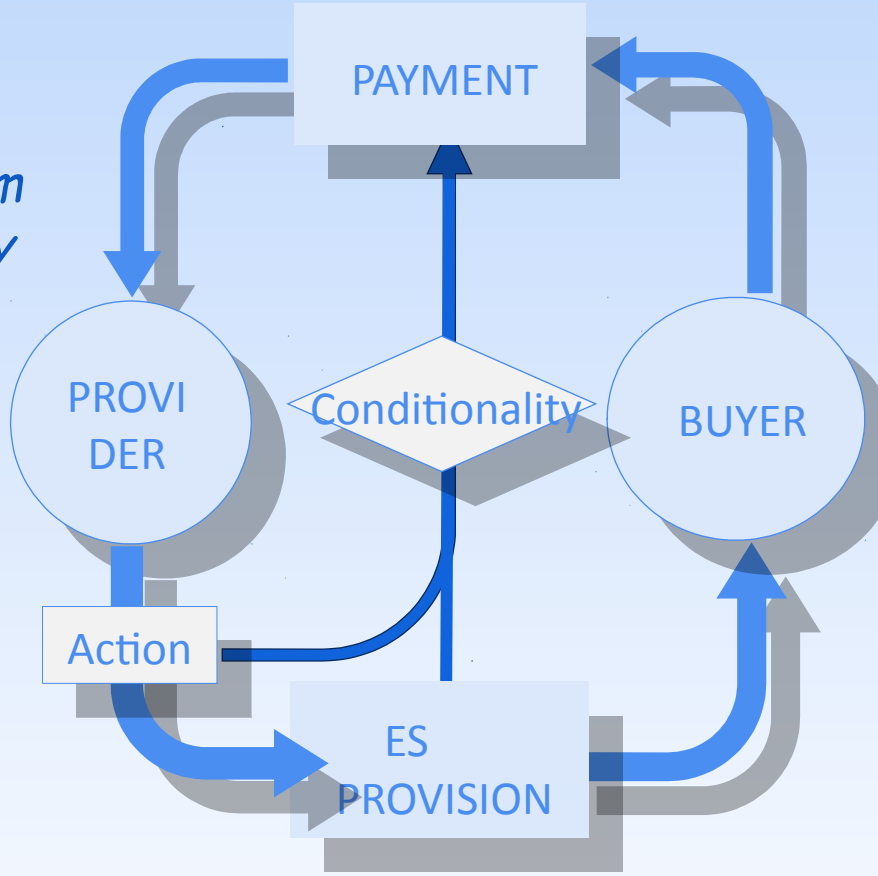


1. ES interconnects the three dimensions of sustainability through a common monetary «Value».
2. They may underplay non-monetary values.
3. Their trade faces issues of cost and benefits, equity, free riding,etc.
4. They are subject to trade-offs
5. Being ecological they are variable

They require integrative policy, legal and operational frameworks

Payments for Ecosystem $ervices

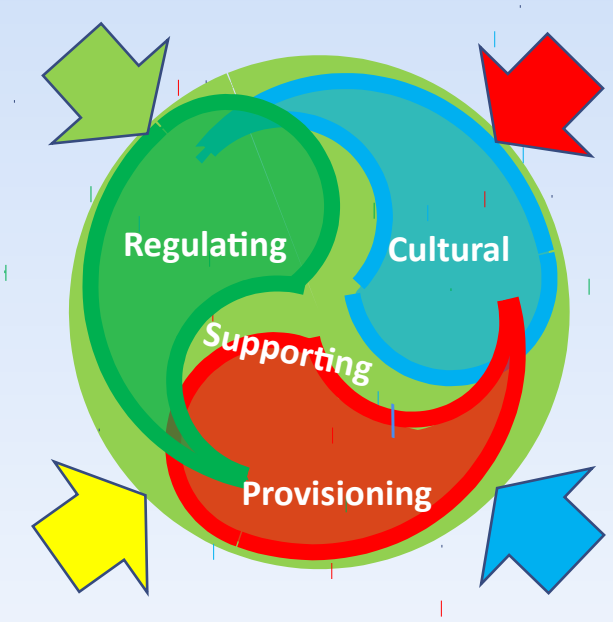
1. *A voluntary transaction in which a well-defined ecosystem service (ES) …is bought by at least one buyer from a minimum of one provider if and only if the provider continues to supply that service* (conditionality) (1)
2. Widely advocated in biodiversity conservation, PES start being used also in fisheries (2)
3. Good example of coevolution between fisheries and conservation, they face significant complexity issues



PES reflect the User Pays Principle

(1) Wunder,2005; Engel et al. 2008; Sommerville et al. 2009; Kinzig et al. 2011. (2) Squires & Garcia, in Press.

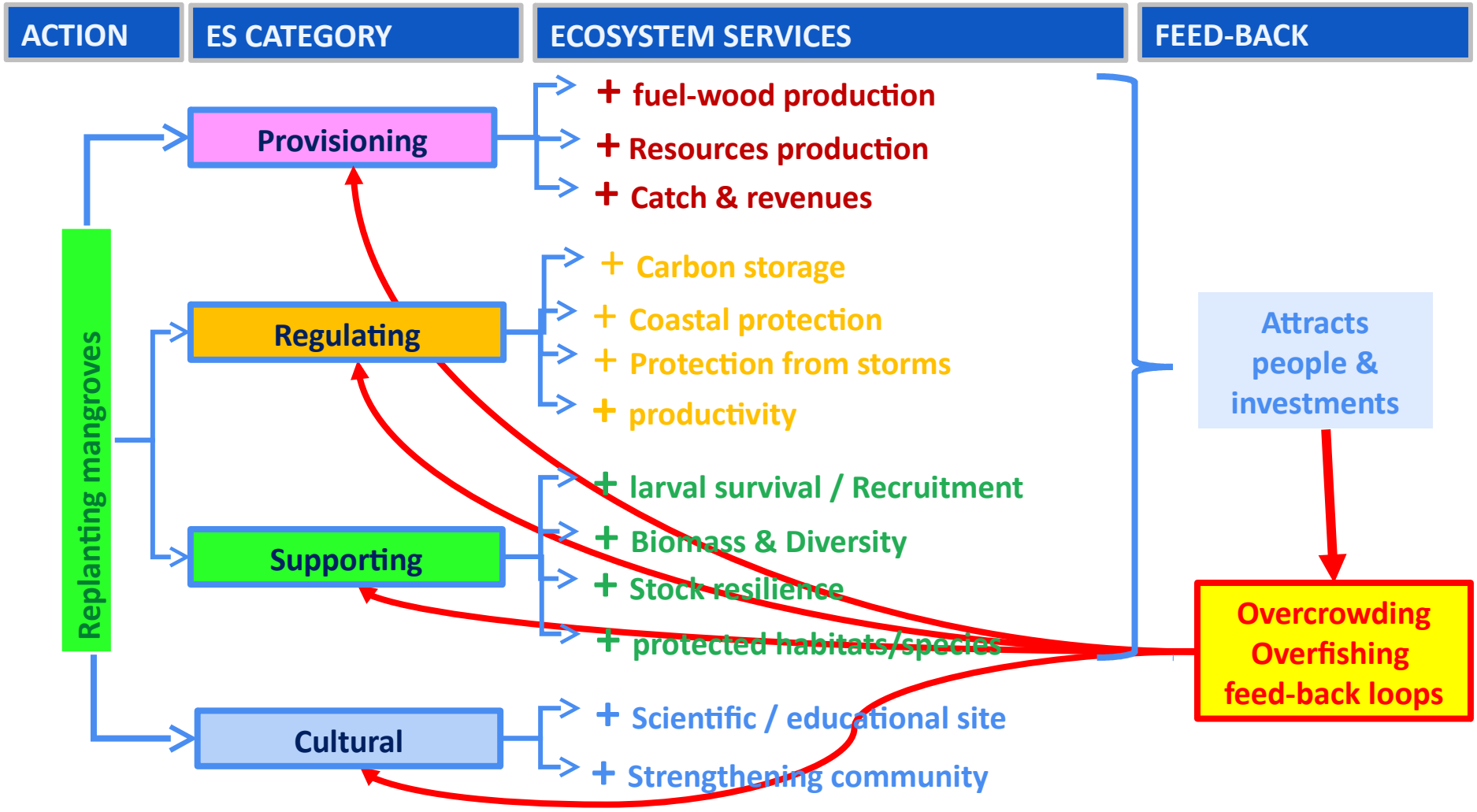
PES and complexity



- One action may provide many ESs for different buyers (stacking and bundling ESs).
- Enhancing one ES may affect provision of other ESs at the same scale or at adifferent one
- Information shortfall or assymetry may create risk and equity problems (for providers and buyers)
- ES flow may be instable because of feed-back loops, delayed response, etc.
- Their inpure public goods nature leads to risks of leakage and free-riding
- But ES are flexible and dynamic. They can be adjusted) as needed
- But who covers the risk? Insurance companies? The State (trade externality)?

Nature is not a simple supermarket. There is a risk that PES reinforces the simplistic Cartesian approach to fisheries.

ES and complexity (2)

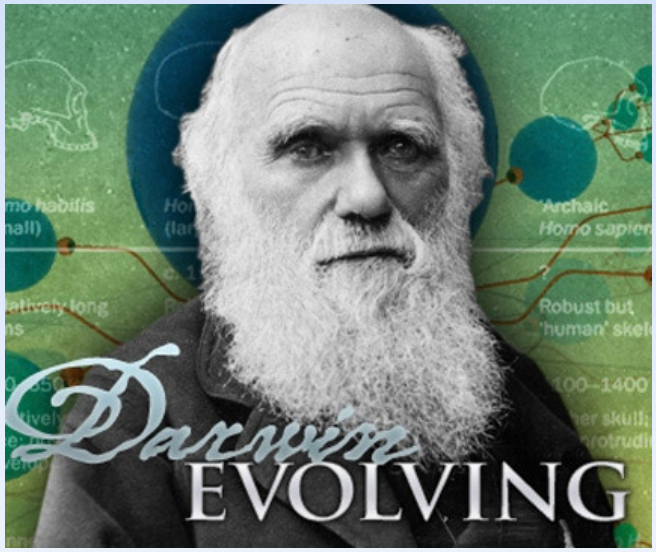


Outline

5. Concluding remarks

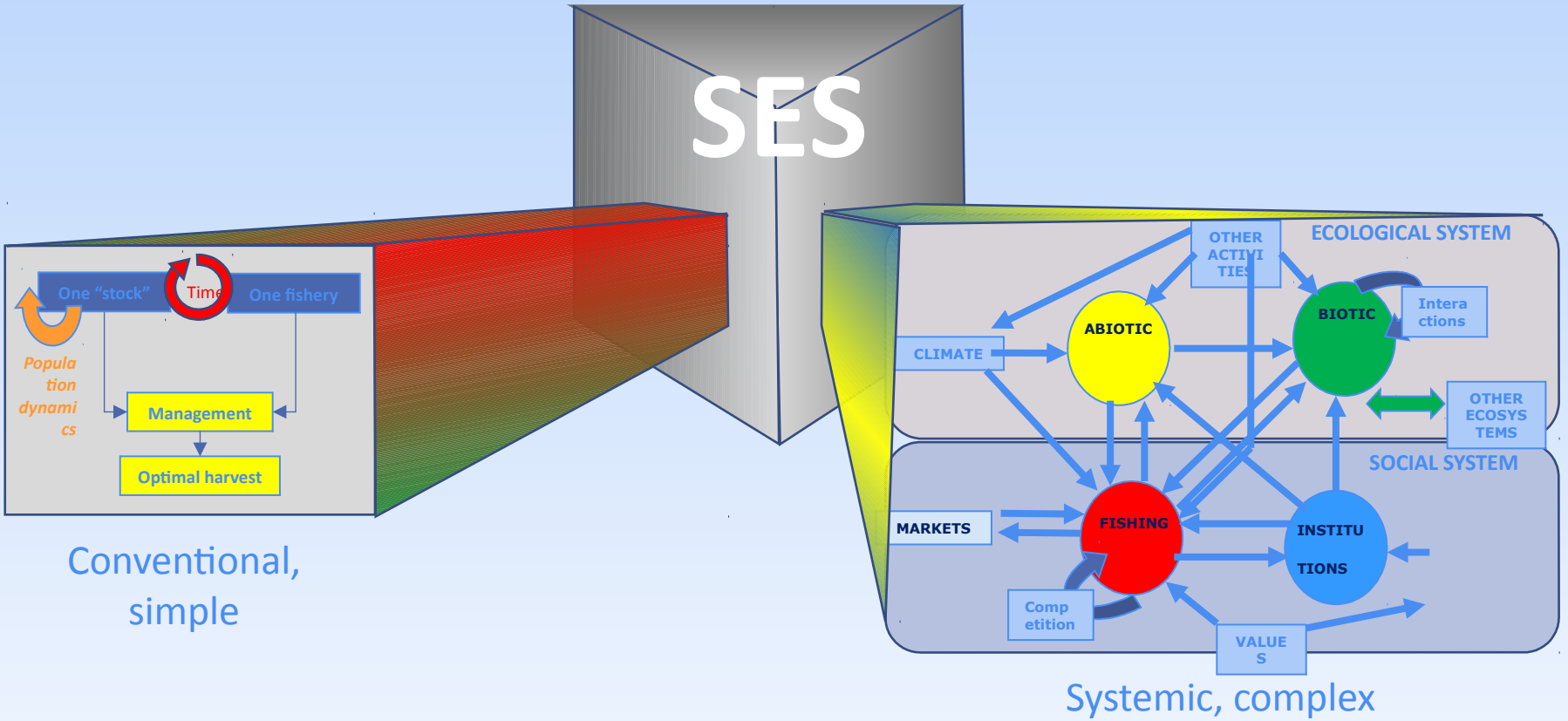
Reflections on SES

- The SES concept relates to the long-standing quest for **Humans living in hamony with Nature**
- It joins natural and social evolutionary theories using a Darwinian metaphor: **coevolution**
- Not yet recognized in legal/policy texts, but consonant principles have been adopted.
- SESs integrate two streams of thoughts:
  - **The complex systems theory** consequences on **the object of management;**
  - **The social ecology** etc. implications for **the management process**



Because of the SES focus on governance, the position of «complexity» changes from an academic «curiosity» to a major factor of performance for managers and policy-makers

SES concept as a prism



A prism through which past experiences may be recast and a unifying framework for both fisheries and conservation to better explain past failures and successes

3 key trends

The SES concept should draw our attention on what happens in the social-subsystem, and particularly on governance, e.g.:

- **The growing empowerment of ENGOs**,
- **The strategic alliance** between large ENGOs and international finance.
- **The challenge of Marine Spatial Planning**

The ENGO network

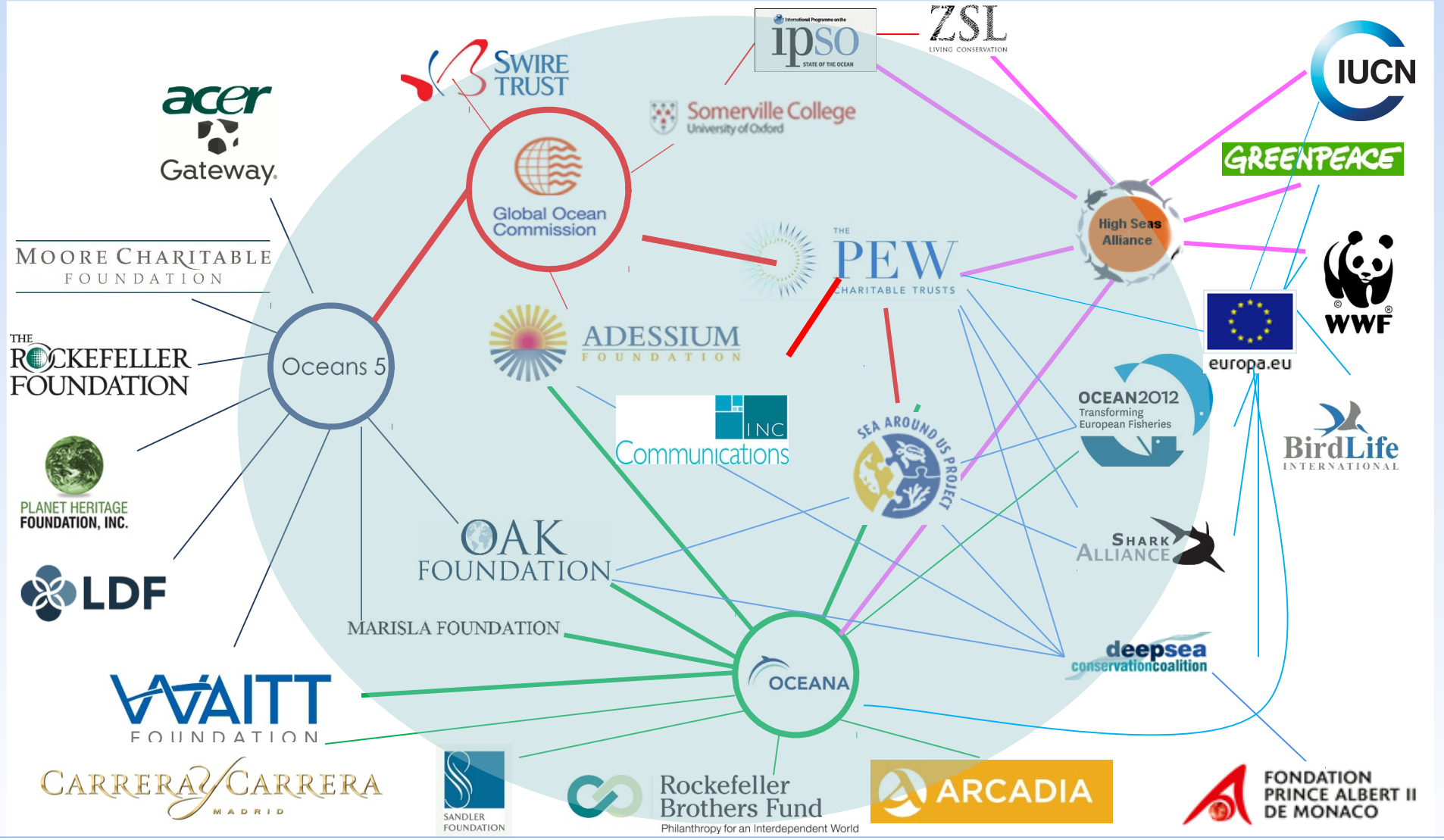
Adapted from Yan Giron. 2014. Les trusts caritatifs anglo-saxons comme instruments de pouvoir dans les espaces maritimes. https://www.youtube.com/watch?v=ZPFdYwjLh8

The NGO/Finance Alliance

Blue Growth - PES

Intersectoral challenge

The ENGO empowerment



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https://www.youtube.com/watch?v=ZPFdYiejLh8

The ENGO-Big Finance Alliance

Blue Growth - PES

MSP integration challenge

Thank you for your attention

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