

The consequences of global climate change for complying with Marine Strategy Framework Directive Indicators: results from DEVOTES project

Angel Borja and Mike Elliott

EUCC-France international conference

European coasts and climate
change: biodiversity response
and new management strategies
in coastal environment

Biarritz: 22-23 June 2015



azti
tecnalia


UNIVERSITY OF Hull
Institute of Estuarine and Coastal Studies



innovative biological experience information
implementation management information
Environmental coastal modelling management information
new DEVOTES
issues national consortium
waters M
Participa



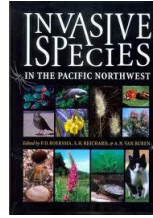
Task changes workshops climate
Partners ecosystem benthic
international partners
pressures international partners
Seas species
European Workplan Management diversity services
levels models
assess monitoring indicators
Ecosystem Research
development researcher ecological dissemination
stakeholders



Eleven Qualitative Descriptors



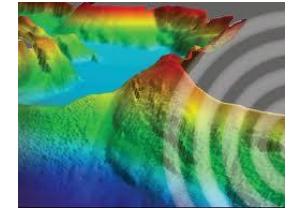
Biodiversity



Alien



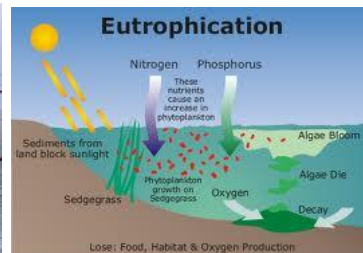
Foodwebs



Seafloor integrity



Fishing



Eutrophication



Hydrography



Pollution



Litter



Committee on Oceanic Biological Organisms
National Research Council
Division on Earth and Life Studies
NATIONAL RESEARCH COUNCIL

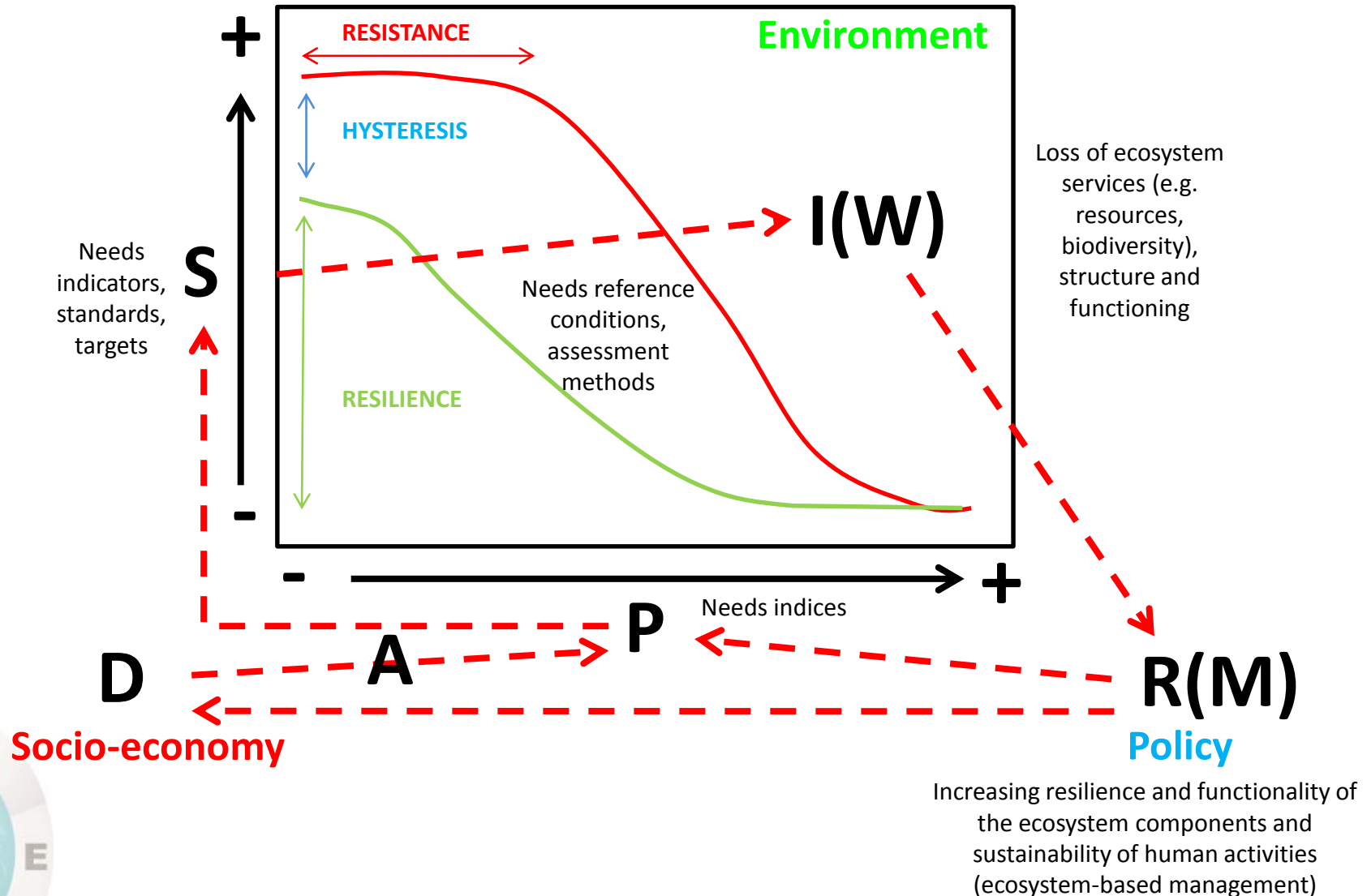
THE NATIONAL ACADEMIES PRESS
Washington, DC
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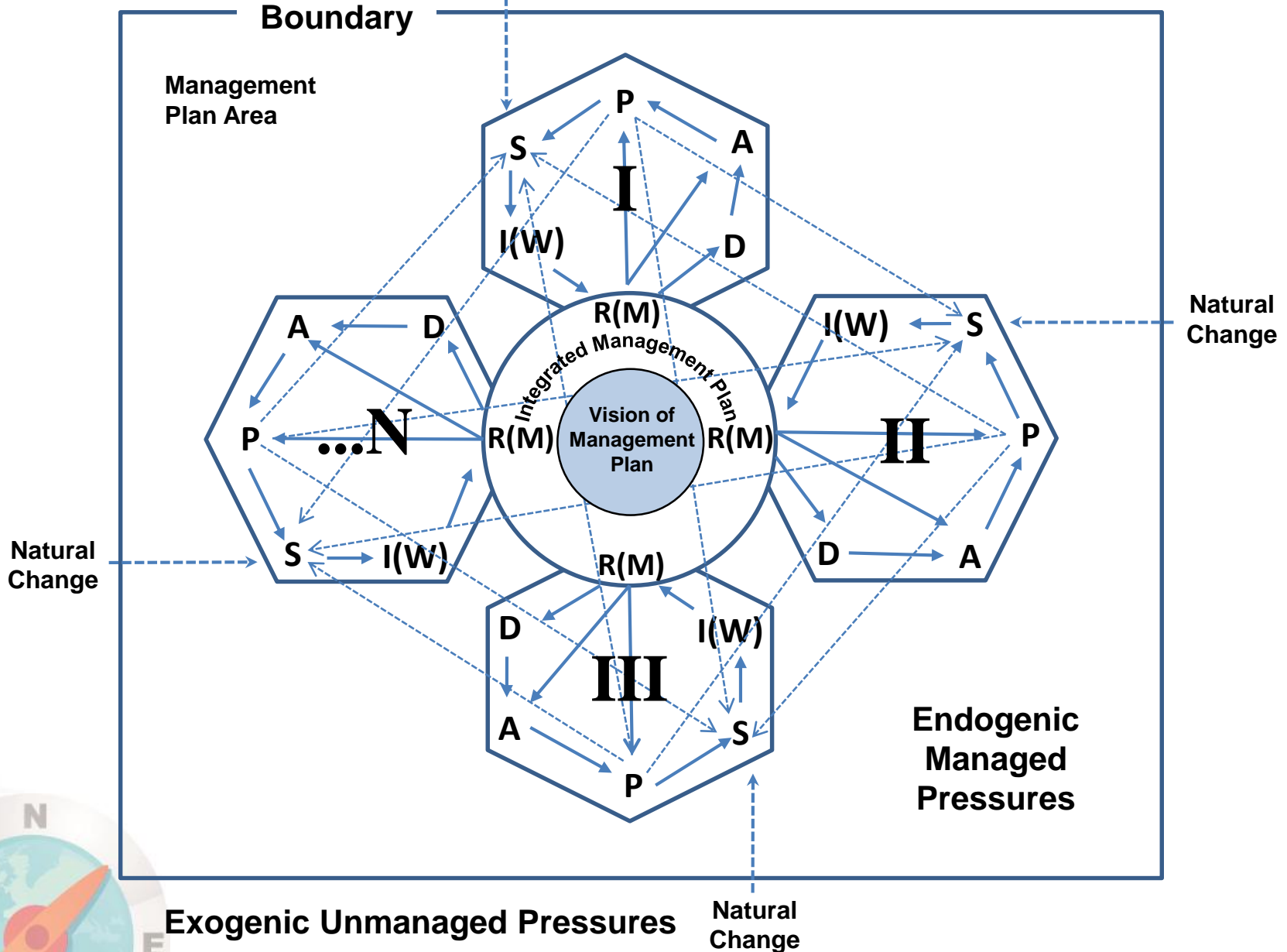
29 criteria
56 indicators

Marine Strategy Framework Directive

Introduction

Modified from: Borja, A., A. Murillas, M. Pascual, M.C. Uyarra, 2015. Marine and coastal ecosystems: delivery of goods and services through conservation. In: Ecosystem Services and River Basin Ecohydrology. Eds. L. Chícharo, F. Muller, N. Fohrer, E. Wolanski. Springer.





Good Environmental Status (GEnS) under the MSFD

It is achieved when **physicochemical** (including contaminants, litter and noise) and **hydrographical** conditions are **maintained** at a level that main **structuring components** of the ecosystem are **present**, allowing the **functionality** of the system to provide **resistance and resilience** (ability to withstand stress and also ability to recover after a stressor) against deleterious effects of human pressures/activities/impacts, **maintaining and delivering the ecosystem services** that provide societal benefits in a **sustainable way** (i.e. pressures associated with uses cumulatively do not hinder the ecosystem components to retain their natural diversity, productivity and dynamic ecological processes, and recovery is rapid and secure if a use ceases)

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Viewpoint

Good Environmental Status of marine ecosystems: What is it and how do we know when we have attained it?



Angel Borja ^{a,*}, Mike Elliott ^b, Jesper H. Andersen ^c, Ana C. Cardoso ^g, Jacob Carstensen ^c, João G. Ferreira ^d, Anna-Stiina Heiskanen ^e, João C. Marques ^f, João M. Neto ^f, Heliana Teixeira ^g, Laura Uusitalo ^e, María C. Uyarra ^a, Nikolaos Zampoukas ^g

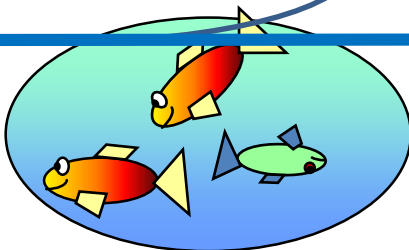


Difference to **reference conditions**

Ecological Status
(Water Framework Directive- WFD)

Environmental Status
(Marine Strategy Framework Directive -MSFD)

None or small

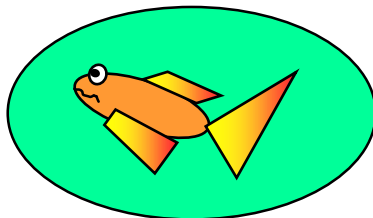


High

Good



Slight



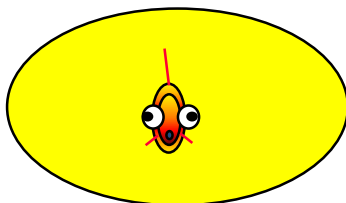
Good

Good



TARGET

Moderate

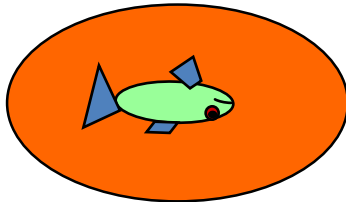


Moderate

Not Good



Important

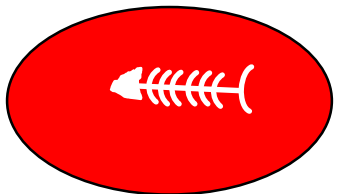


Poor

Not Good



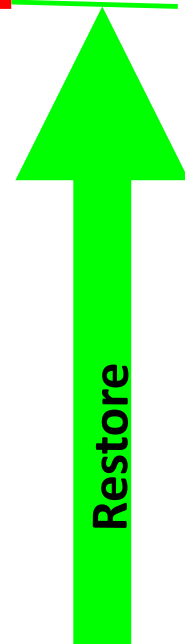
Strong



Bad

Not Good

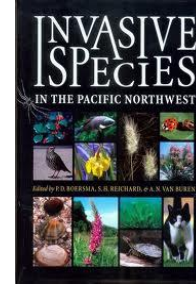
Prevent degradation



11 Qualitative Descriptors



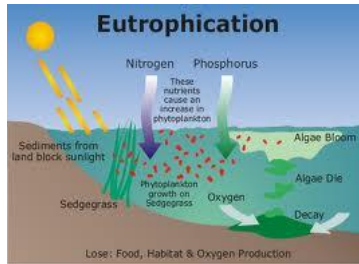
1. Biodiversity



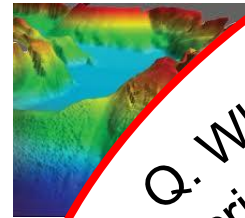
2. NIS



4. Foodwebs



5. Eutrophication



6. S

Q. Which of the descriptors, and their targets and reference conditions, are outside the control of an area manager?



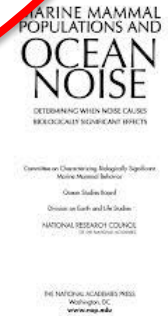
8. Contaminants



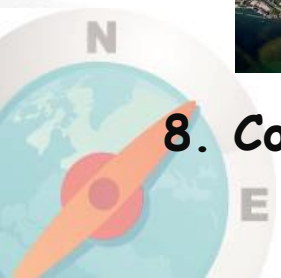
9. Seafood contaminants



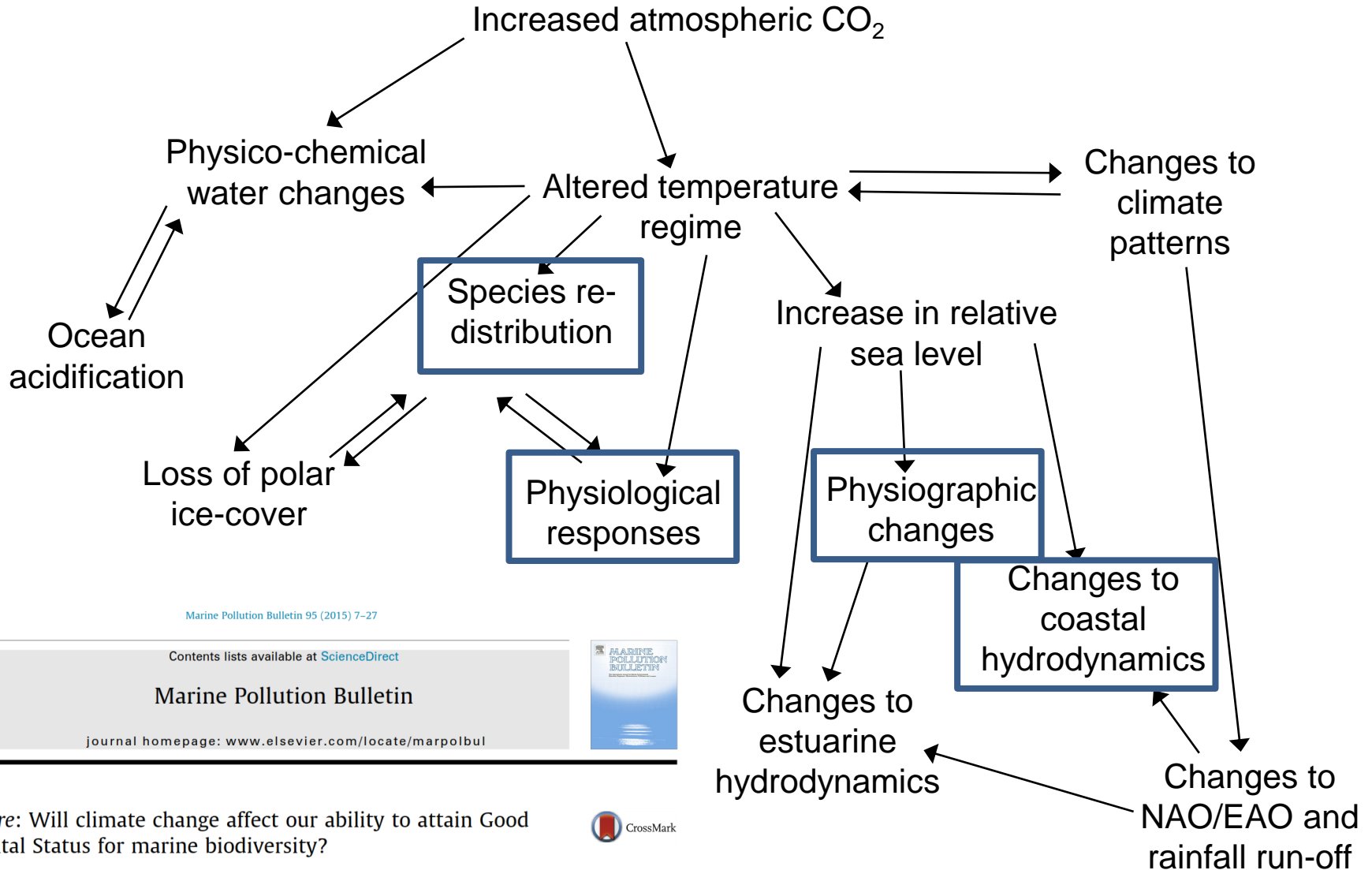
10. Litter



11. Energy



Primary drivers and consequences of marine global climate change



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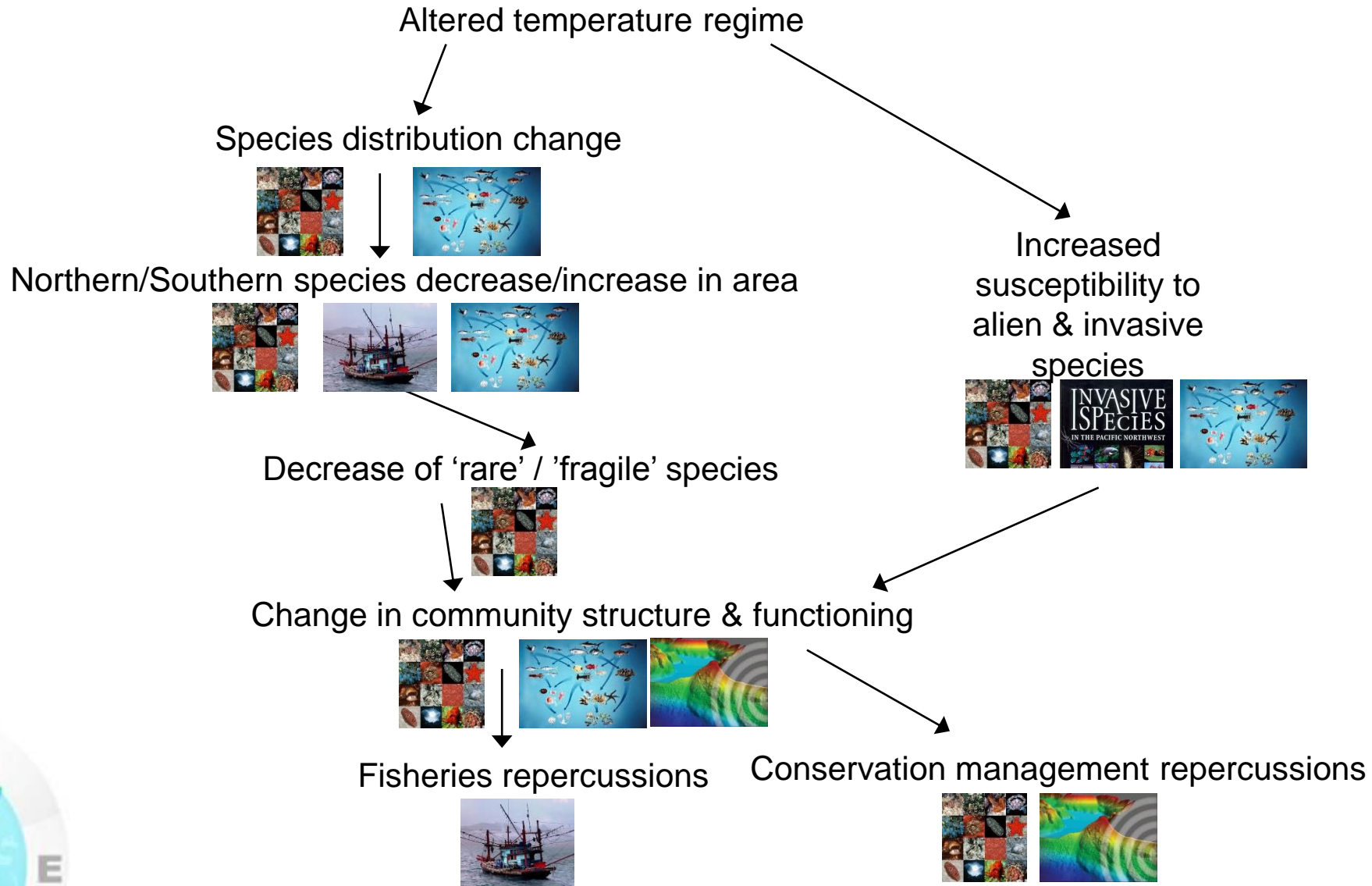


Viewpoint

Force majeure: Will climate change affect our ability to attain Good Environmental Status for marine biodiversity?

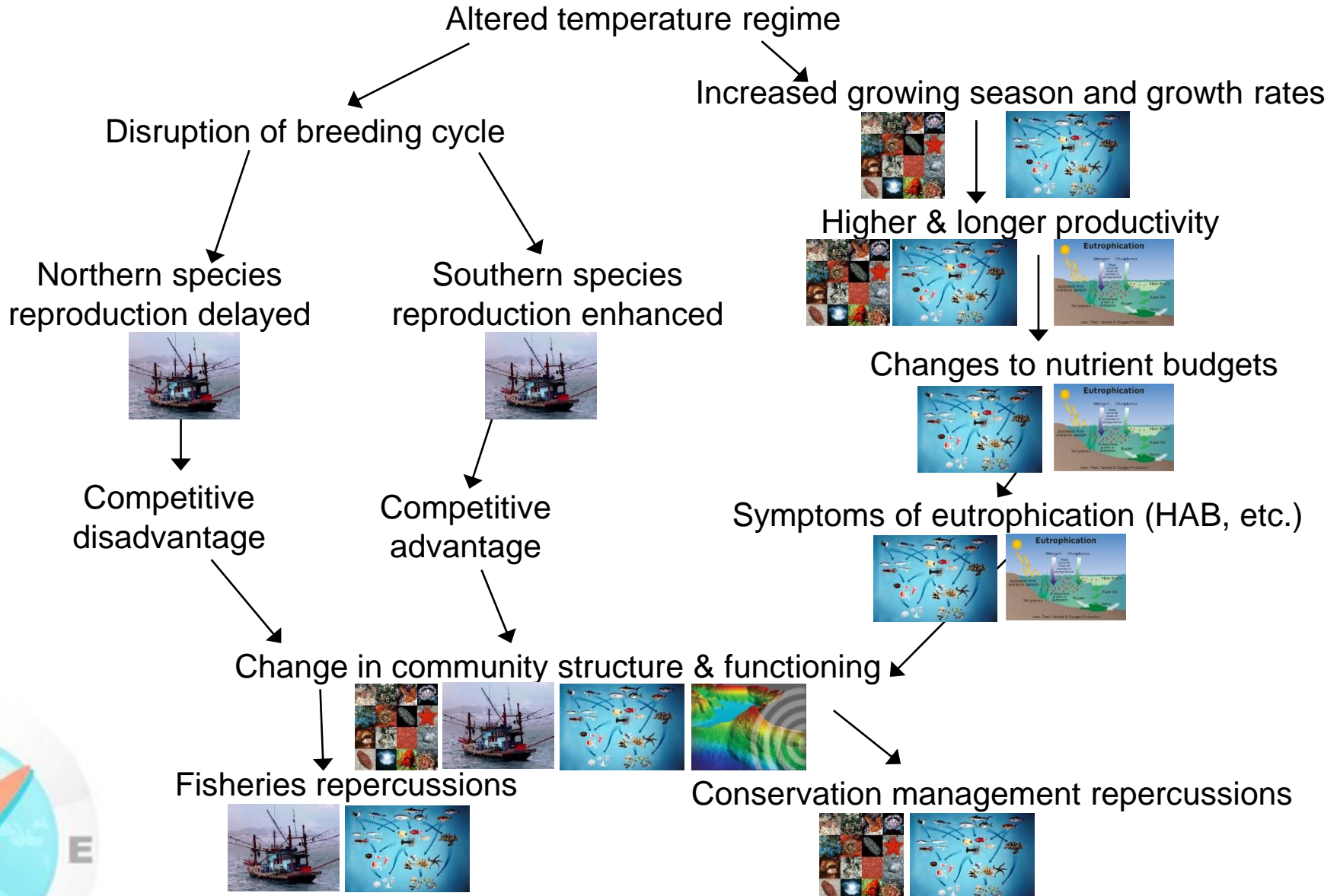
Michael Elliott^{a,*}, Ángel Borja^b, Abigail McQuatters-Gollop^c, Krysia Mazik^a, Silvana Birchenough^d, Jesper H. Andersen^e, Suzanne Painting^d, Myron Peck^f

Species re-distribution and community response due to altered temperature regime

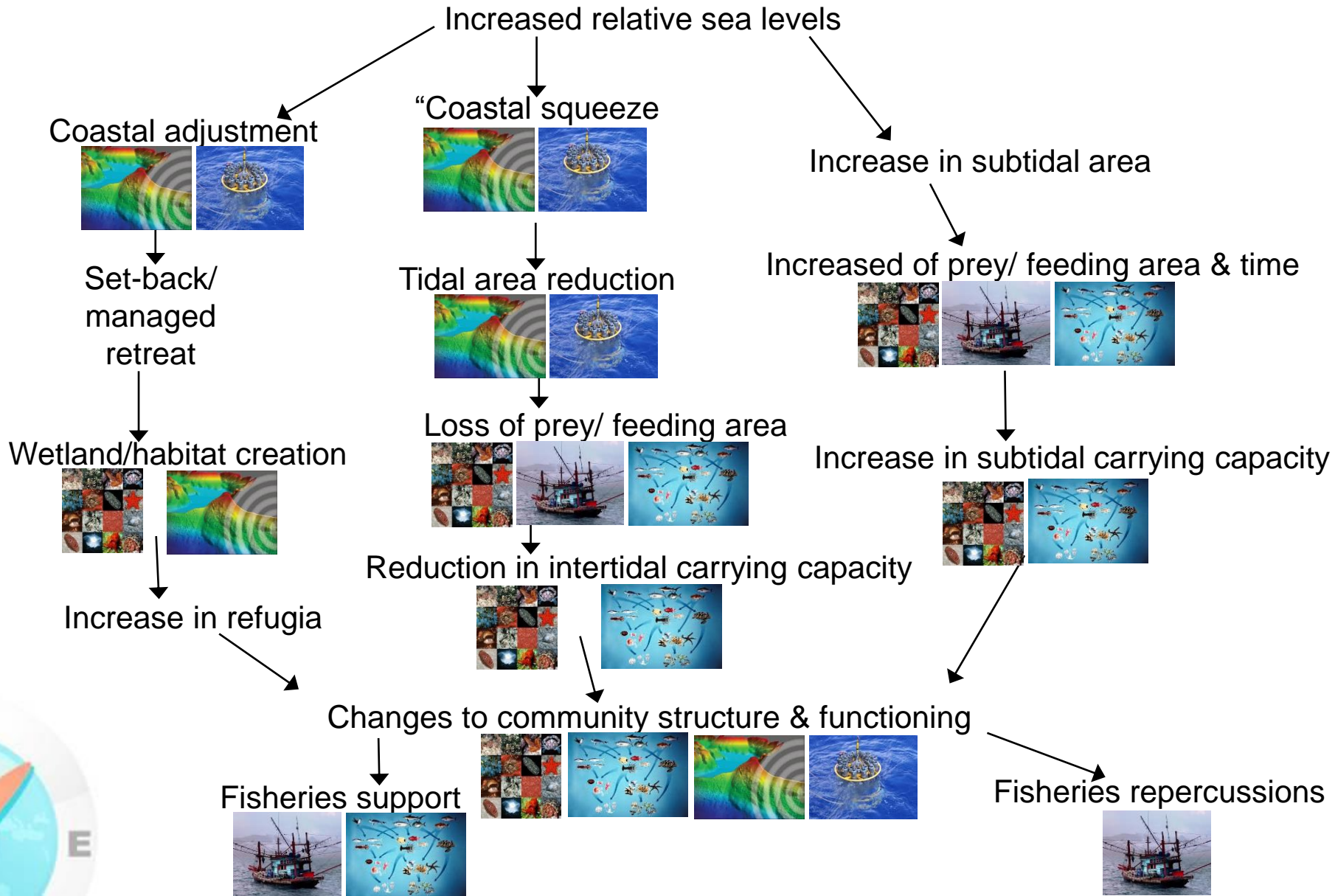


Climate change and MSFD

Physiological and phenological responses due to an altered temperature regime leading to ecosystem effects

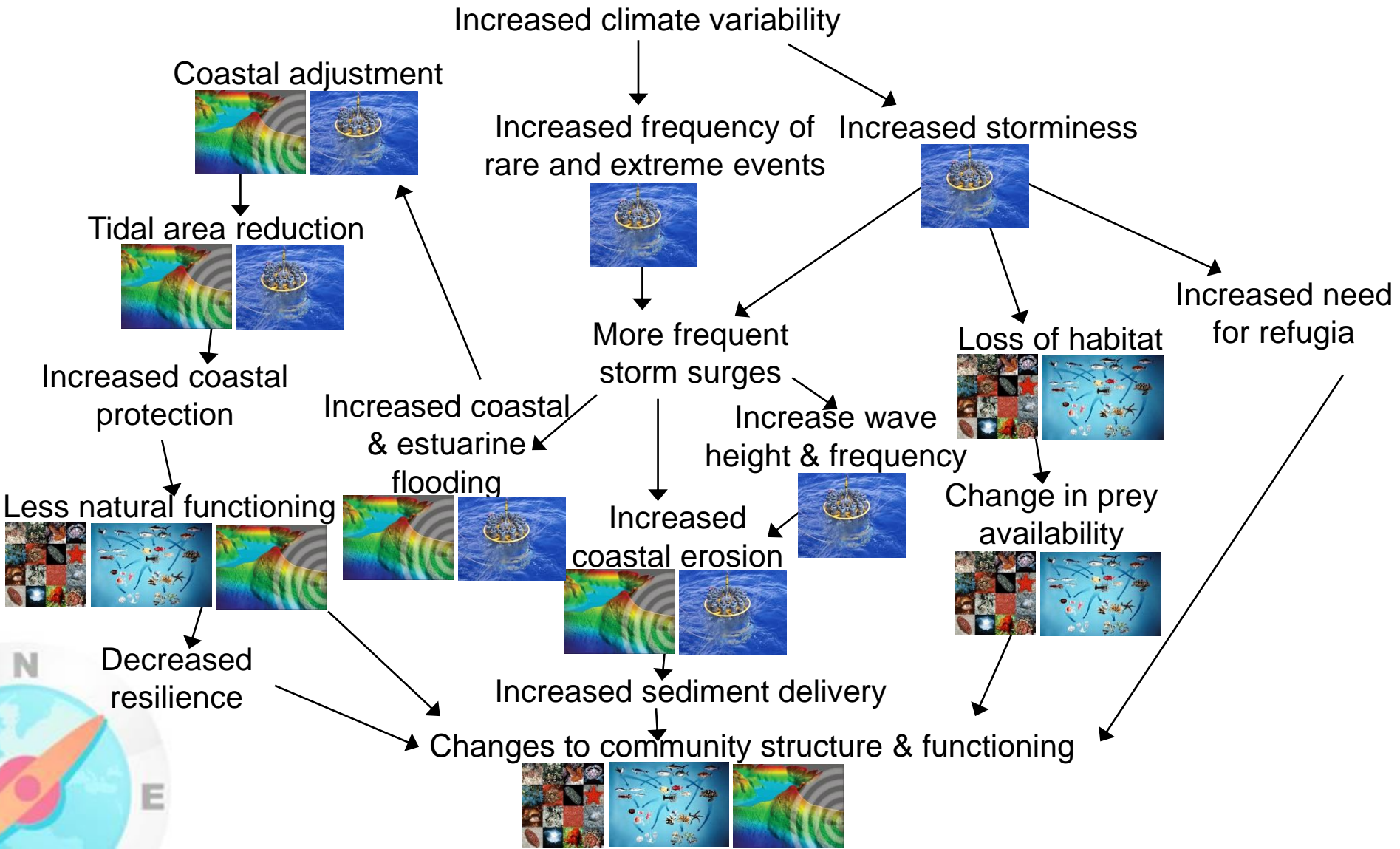


Physiographic changes due to increased relative sea level leading to ecosystem effects



Climate change and MSFD

Coastal hydrodynamic changes due to increased climate variability leading to ecosystem effects



Climate change and MSFD



Topics	Descriptor	1	2	3	4	5	6	7	8	9	10	11
I	Altered temperature regime – species re-distribution and community response	✓	✓	✓	✓		✓					
II	Altered temperature regime – individual physiological/phenological response	✓	✓	✓	✓	✓	✓					
III	Increased relative sea-level rise - physiographic changes	✓		✓	✓		✓	✓				
IV	Increased climate variability effects on coastal hydrodynamics	✓			✓		✓	✓				
V	Changes to large scale climatic patterns due to land run-off	✓		✓	✓	✓	✓	✓	✓	✓		
VI	Increased relative sea-level rise changing estuarine hydrodynamics	✓			✓		✓	✓				
VII	Increased ocean acidification and seawater physico-chemical changes	✓		✓	✓		✓		✓	✓		
VIII	Loss of polar ice cover and global transport repercussions	✓	✓	✓	✓	✓		✓			✓	✓
Sum categories		8	3	6	8	3	7	5	2	2	1	1

Estuaries and Coasts (2009) 32:29–36
 DOI 10.1007/s12237-008-9111-2

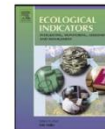
Ecological Indicators 12 (2012) 58–71



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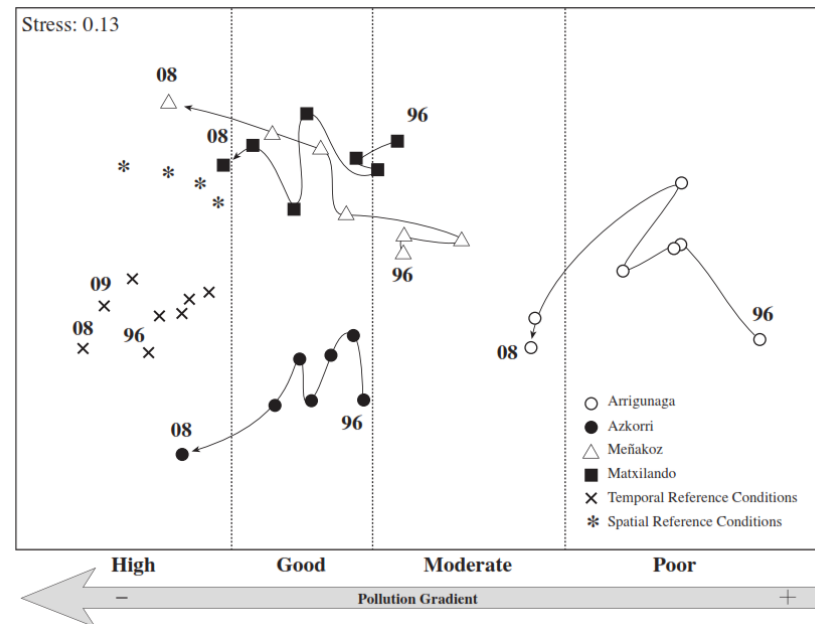
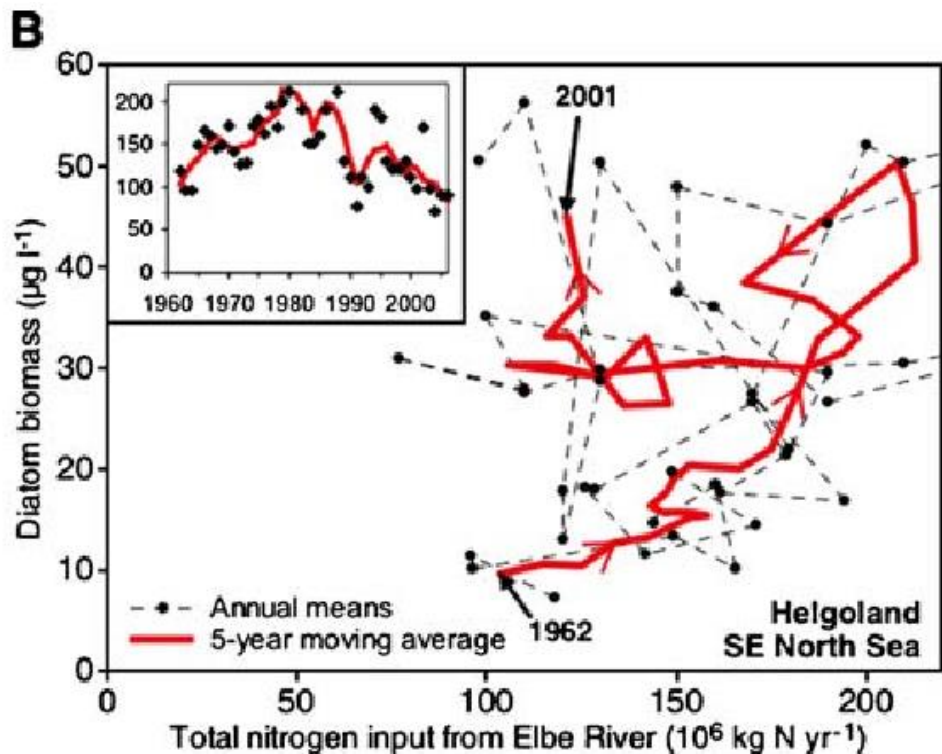


Return to *Neverland*: Shifting Baselines Affect Eutrophication Restoration Targets

Carlos M. Duarte • Daniel J. Conley •
 Jacob Carstensen • María Sánchez-Camacho

Development of a tool for assessing the ecological quality status of intertidal coastal rocky assemblages, within Atlantic Iberian coasts

I. Díez^{a,*}, M. Bustamante^b, A. Santolaria^a, J. Tajadura^b, N. Muguerza^a, A. Borja^c, I. Muxika^c,
 J.I. Saiz-Salinas^b, J.M. Gorostiaga^a



- **Impediments to implementing MSFD and achieving GEnS as result of climate change:**
 - **Poor precise links between changes in biota and climate features** (e.g. how abiotic factors control the vital processes; cause-and-effect understanding is needed; etc.).
 - Climate change produces **'shifting baselines'** which need to be accommodated in monitoring
 - This can result in **changes in reference conditions and impossibility to achieve targets and GEnS**
 - **More cost-effective spatial and temporal monitoring is required** at the ecohydrodynamic rather than geographic scale (...but monitoring budgets are being reduced...).
 - **Interactions amongst Descriptors** and their changes due to climate change need addressing.
 - **Challenges for marine monitoring and management** by climate change superimposed on local activities; climate change may either exacerbate, mask anthropogenic changes or cause failure to achieve GEnS.
 - **Need to determine potential geographic disparity to achieving GEnS**; hence, baselines need revising on a site-specific basis although the evidence needs to be extrapolated to show the short, medium and long-term effects and the speed of environmental response
 - **Society will place emphasis on the repercussions of non-achieving GEnS for the Ecosystem Services and Societal Benefits.**
 - **Failure to meet GEnS because of climate change has wide-ranging legal repercussions** and could lead to a Member State being placed in infraction proceedings; legal challenge not because of Endogenic managed activities but because of Exogenic unmanaged pressures; the legal defence, that the failure was the result of third-party actions, natural causes or force majeure, needs supporting by robust science.

“...changing systems are not a problem for the ecology, as it will adjust to any new situation and create a new equilibrium, they are only a problem for society, i.e. we might not be able to obtain the societal benefits from ecosystem services that we wish to and we may not like the new ecology but eventually we will have to accept it...”





Thank You



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www.devotes-project.eu

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22-23 June 2015, EUCC conference, Biarritz