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SCHOOL OF GEOGRAPHY

Governing Ocean Acidification

Addressing an emergent problem under existing multilateral environmental agreements

Ellycia Harrould-Kolieb

Supervisors: Peter Christoff
Rachel Hughes
Ove Hoegh-Guldberg

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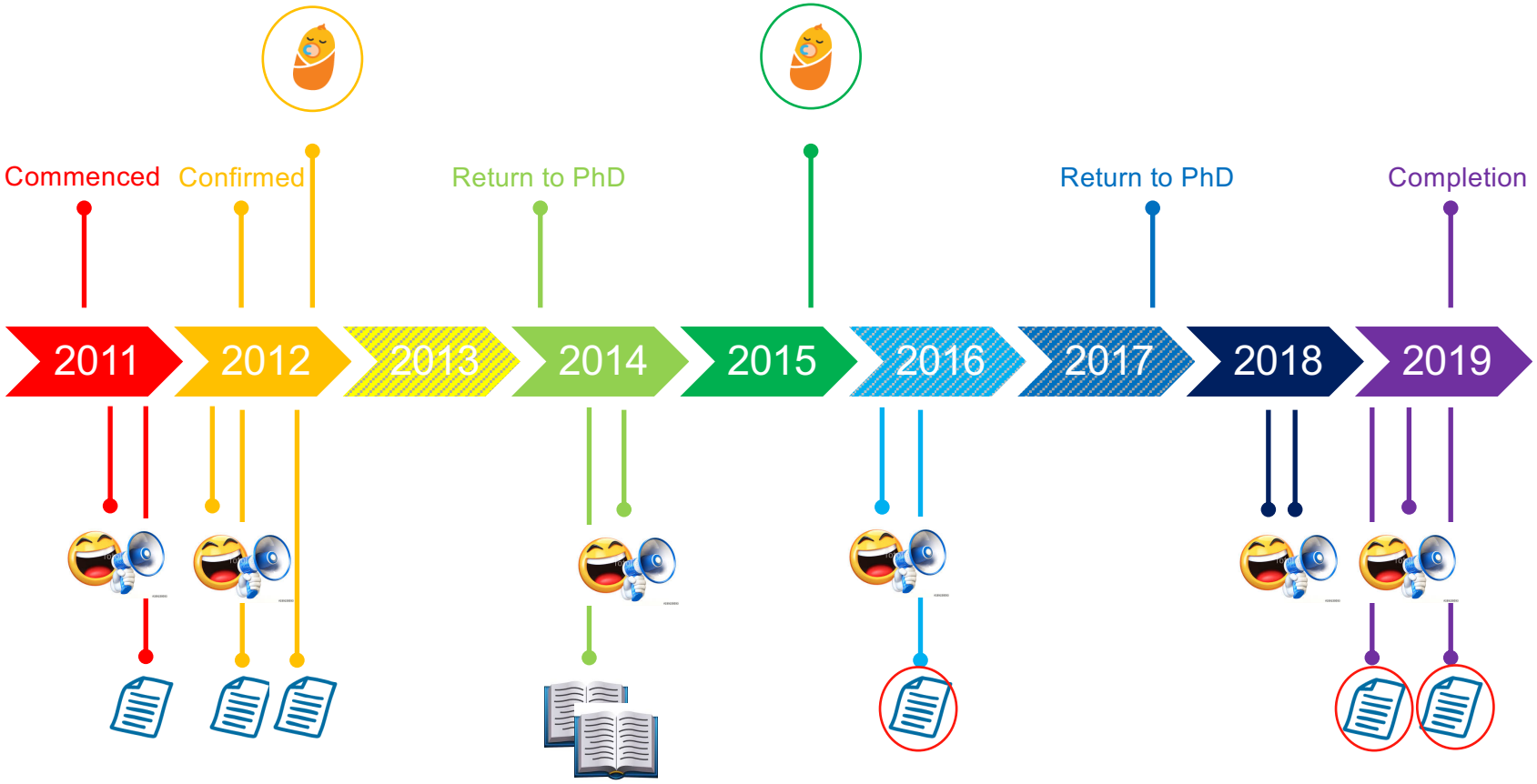
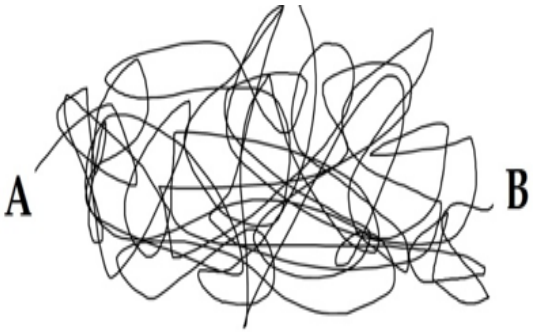
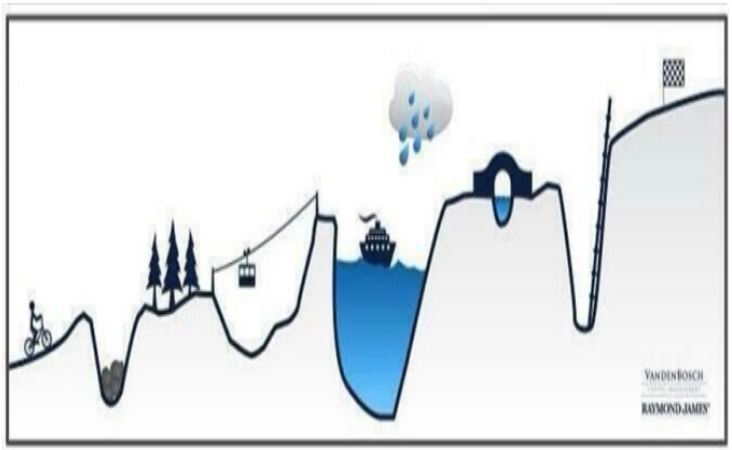
My PhD Journey



My PhD Journey – in reality





2011-2012

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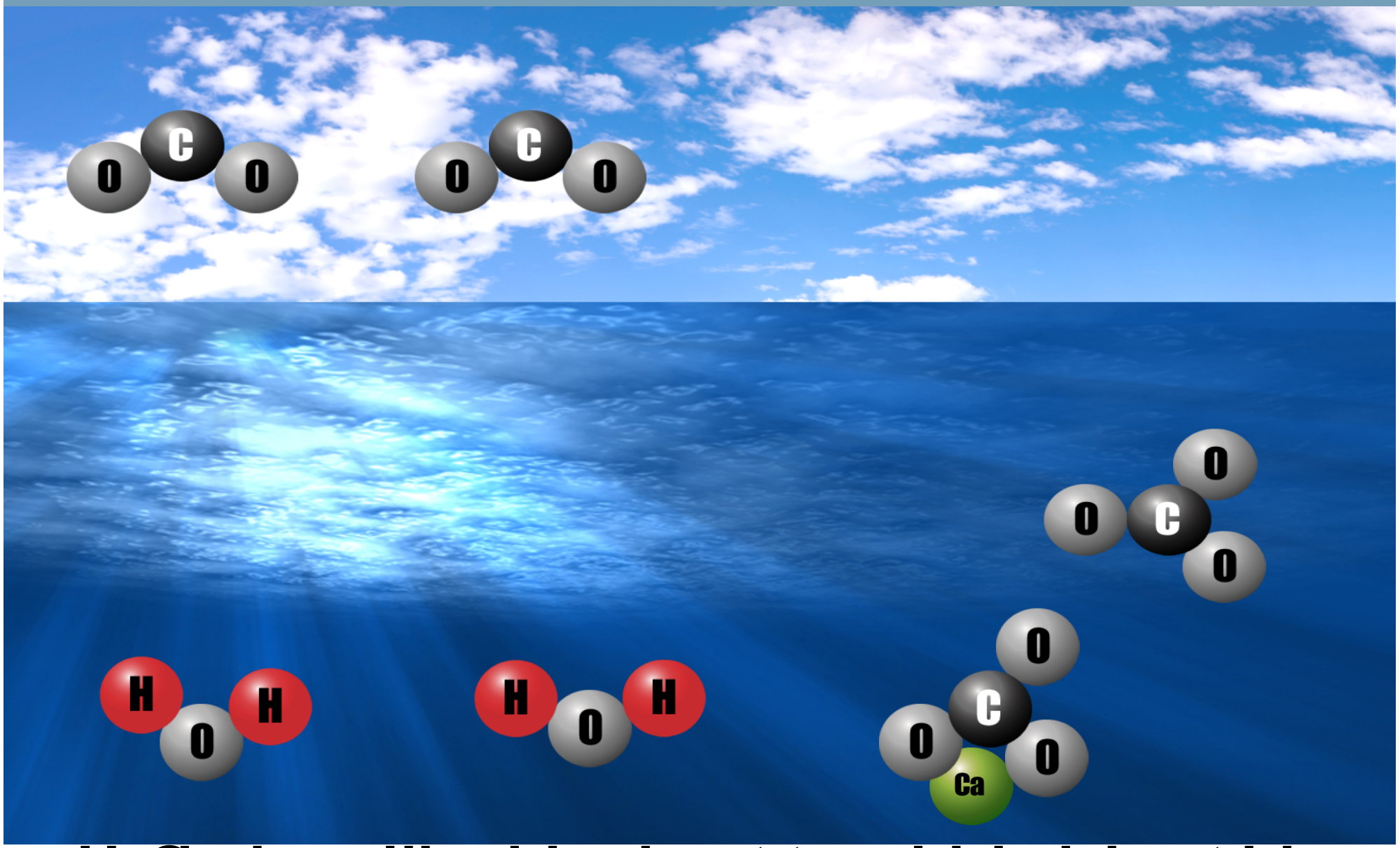
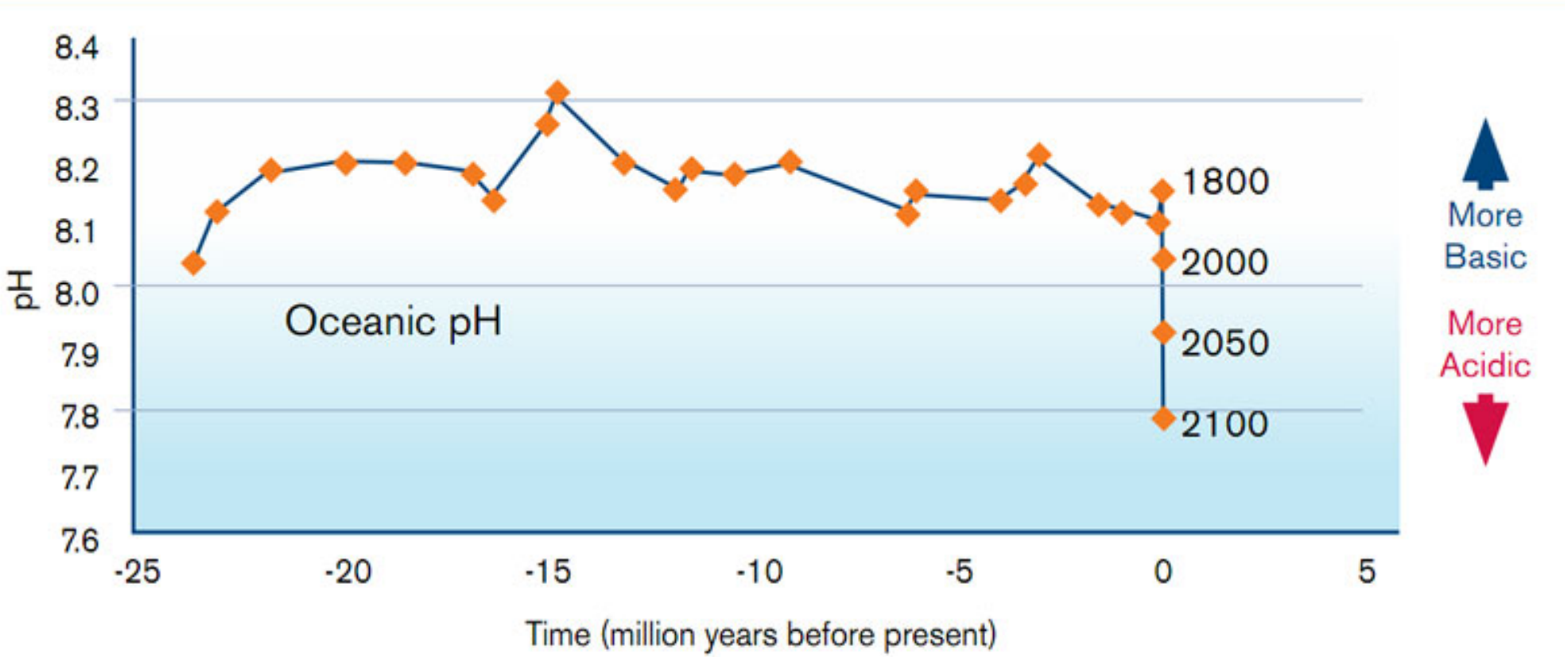
The Process of Ocean Acidification



Carbon dioxide + water → carbonic acid

Carbonic acid + calcium carbonate →

Rate and Magnitude of Change Unparalleled



SOURCE: Turley et al. 2006

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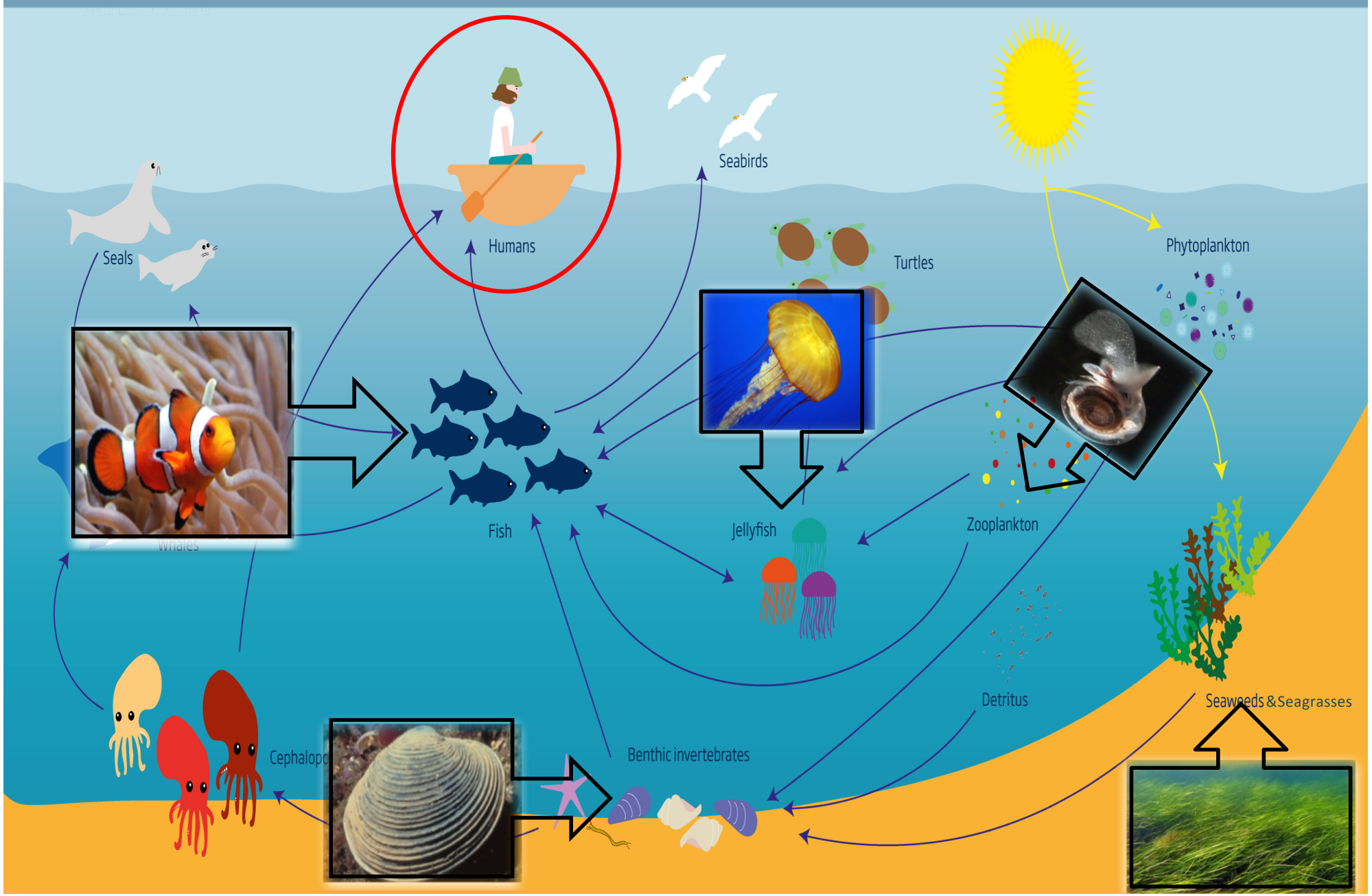
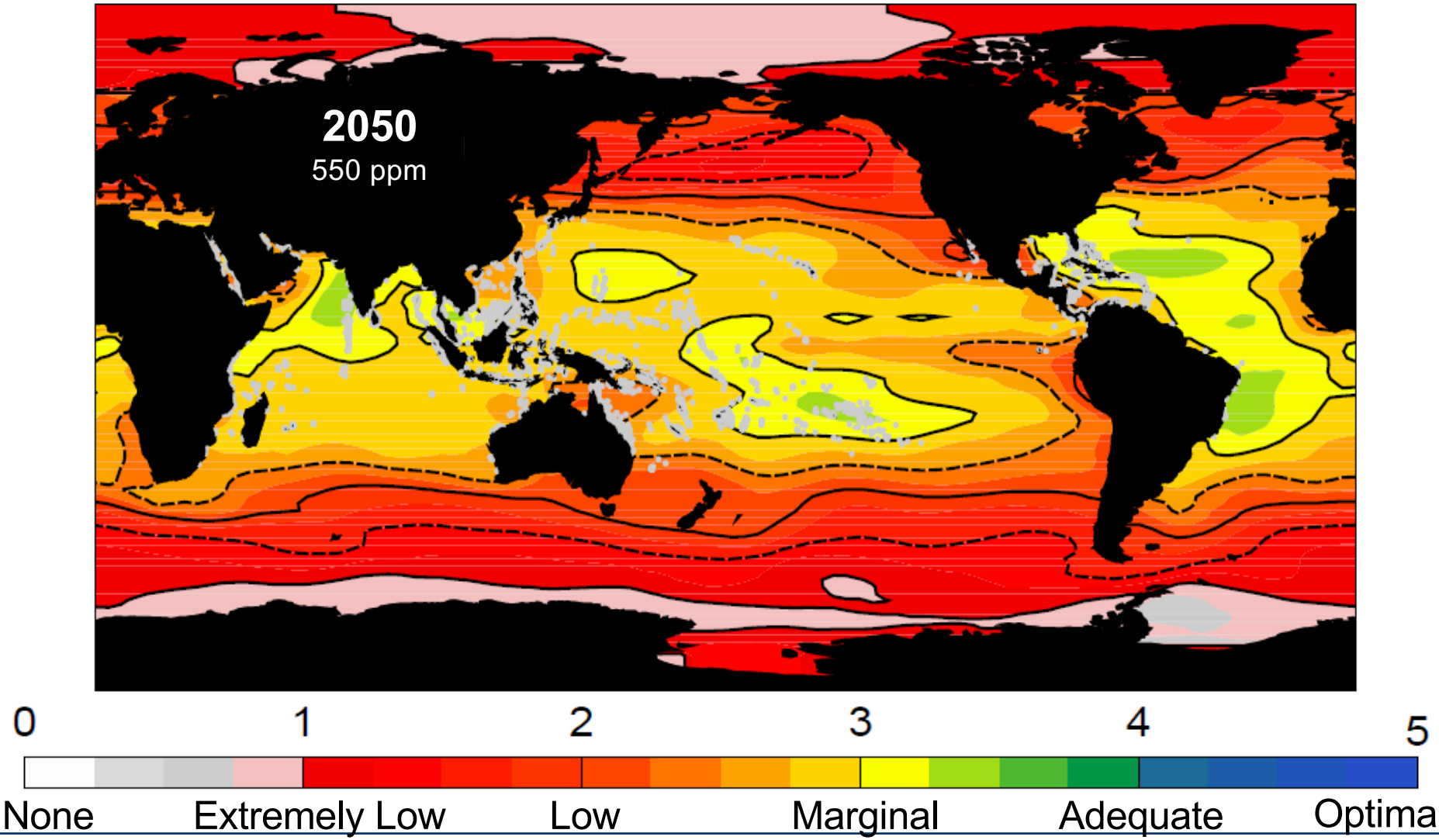
Winners and Losers (but mostly losers)



Average Surface Aragonite Saturation State



Adapted from Cao and Caldeira, 2008

Research Questions

How can the emergent problem of ocean acidification be addressed in the already congested landscape of multilateral environmental agreements?

Supplemental questions:

1. What efforts have already been made under existing multilateral environmental agreements to address ocean acidification and where are the existing gaps in the governance of this issue?

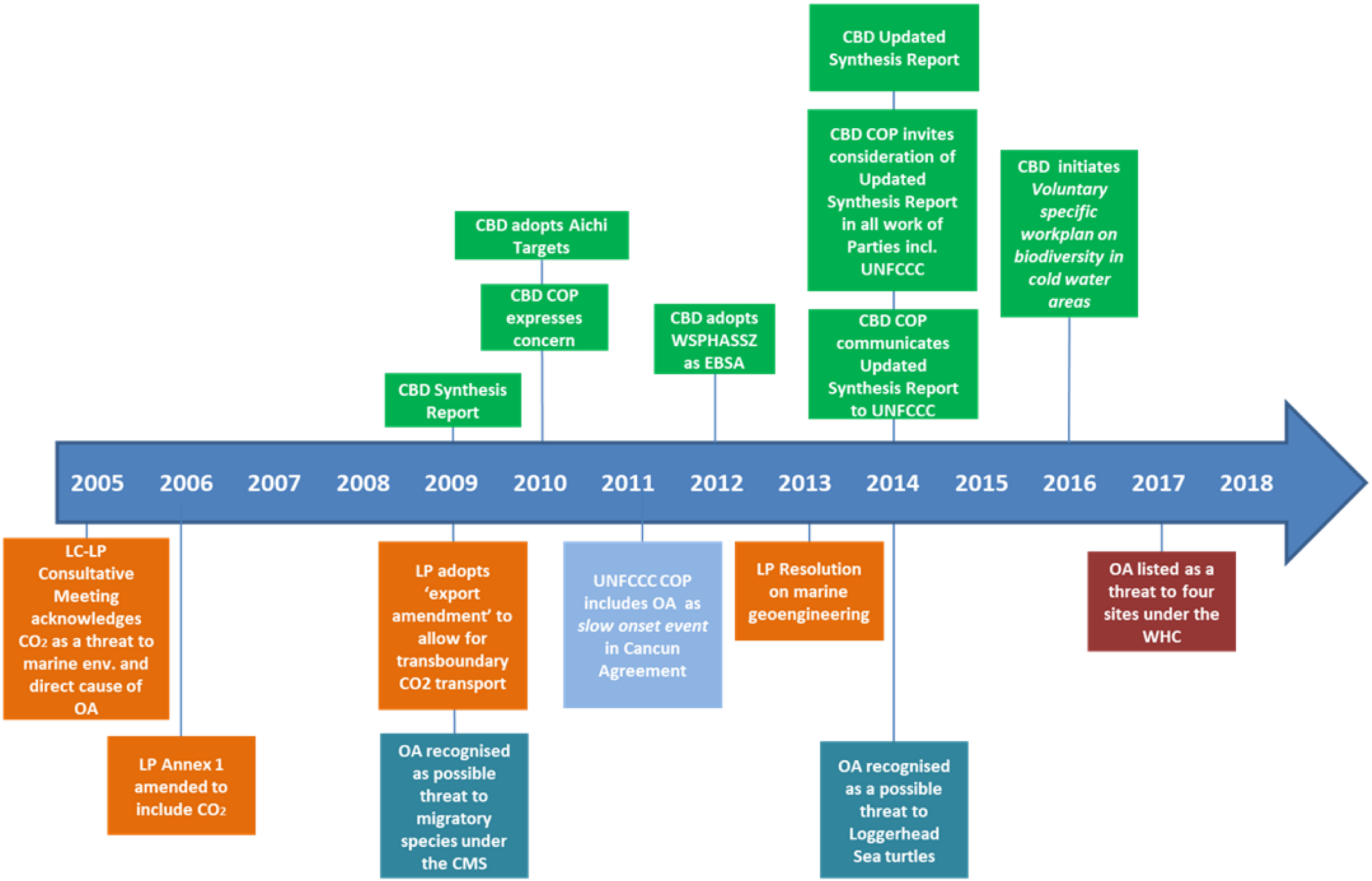
2. Can reframing the problem of ocean acidification play a role in filling the identified gaps in governance?

(a) What are the different ways that ocean acidification can be framed?

(b) Can the use of various frames lead to reinterpretations of existing multilateral environmental agreements that require States to address ocean acidification?

4. Can the reframing of ocean acidification enhance the possibilities of synergistic regime interaction?

Existing MEA responses



A Governing Framework for Action on OA

Marine Policy 102 (2019) 10–20

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A governing framework for international ocean acidification policy

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Keywords:
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ABSTRACT

Ocean acidification (OA) is a major emergent stressor of marine ecosystems with global implications for biodiversity conservation, sustainable development and economic prosperity. International action is imperative for addressing it. This paper builds a science-based governing framework, identifying three overarching policy objectives and six areas for action that should be pursued so as to minimise this global problem. No unifying OA treaty or legal instrument with the explicit task of addressing OA currently exists and it looks highly unlikely that any will eventuate. A more pragmatic approach is to use existing multilateral agreements. However, taking on OA as a unified problem seems to be beyond the scope of existing agreements, due to structural limitations and the willingness of Parties. Given this, it is more likely that OA will be addressed by a network of agreements, each responding to discrete elements of the problem of OA within their capabilities. However, it is unclear how existing MEA capabilities extend to addressing OA. This paper therefore offers an analytical framework through existing governance structures can be explored for their capabilities to respond to OA.

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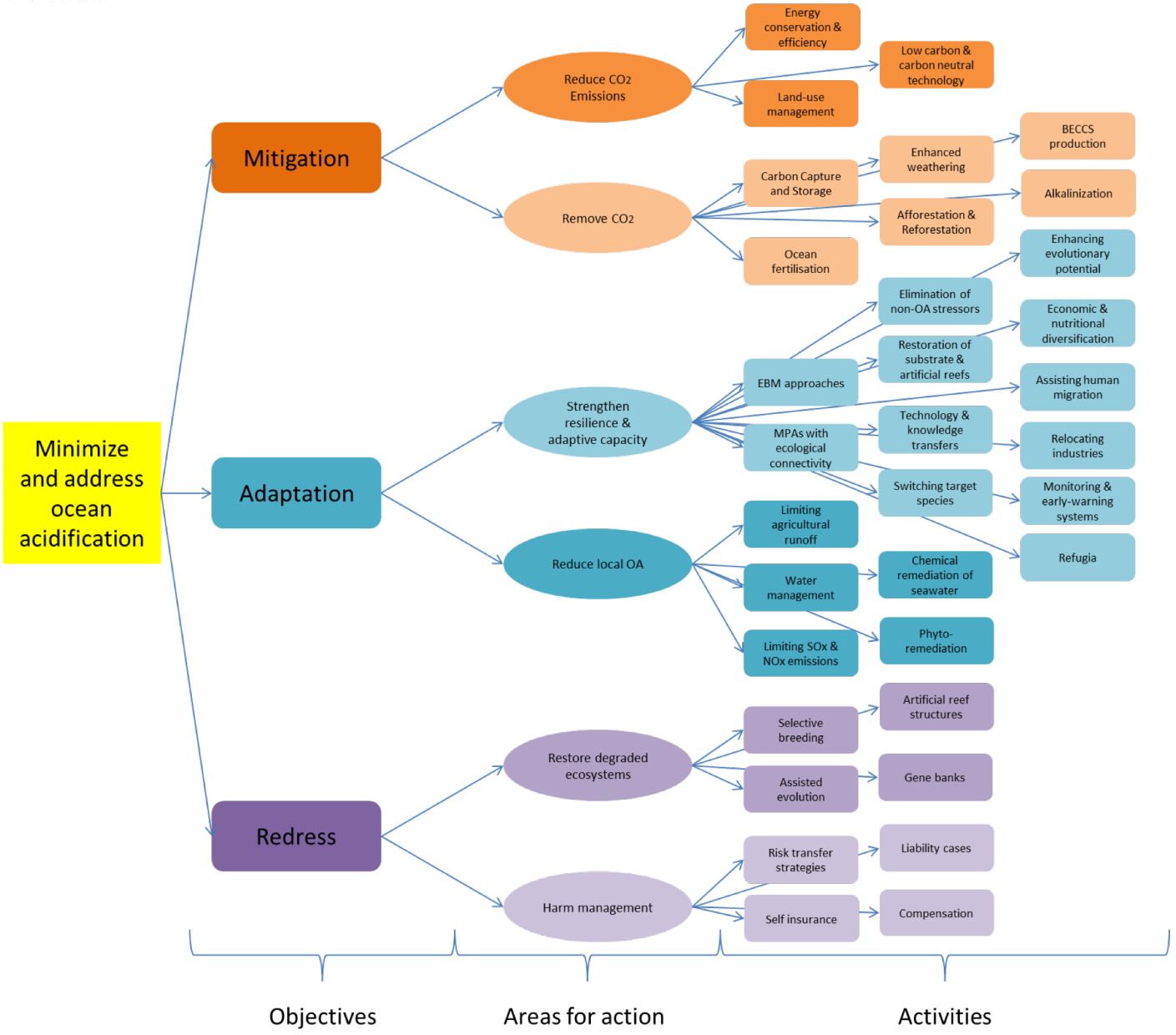
An idealized version of OA governance



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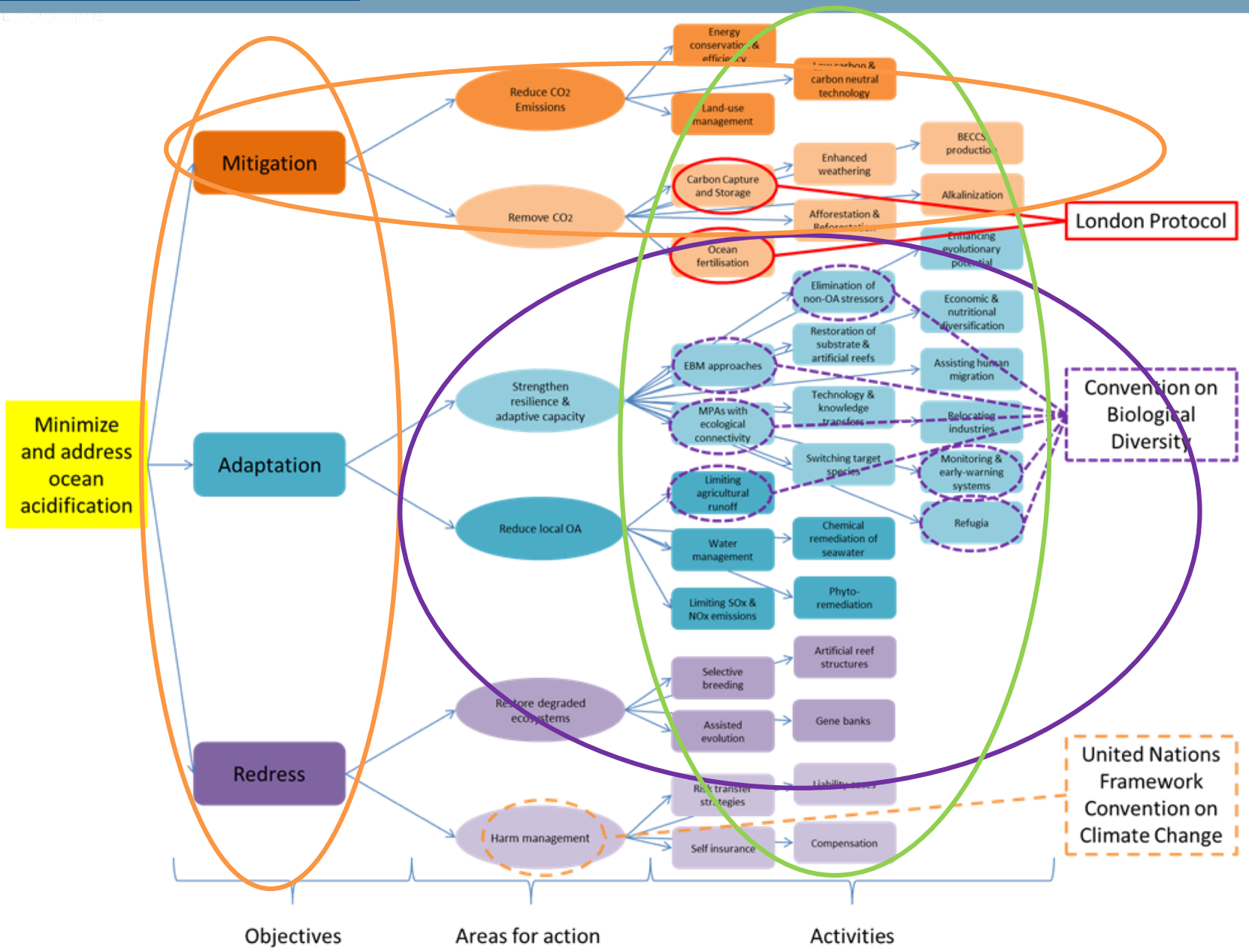
Gaps in OA governance



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The OA Epistemic Community

climate policy

synthesis

Ocean acidification and climate change: synergies and challenges of addressing both under the UNFCCC

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Ocean acidification and climate change are linked by their common driver: CO_2. Climate change is the consequence of a range of GHG emissions, but ocean acidification on a global scale is caused solely by increased concentrations of atmospheric CO_2. Reducing CO_2 emissions is therefore the most effective way to mitigate ocean acidification. Acting to prevent further ocean acidification by reducing CO_2 emissions will also provide simultaneous benefits by alleviating future climate change. Although it is possible that reducing CO_2 emissions to a level low enough to address ocean acidification will simultaneously address climate change, the reverse is unfortunately not necessarily true. Despite the ocean's integral role in the climate system and the potentially wide-ranging impacts on marine life and humans, the problem of ocean acidification is largely absent from most policy discussions pertaining to CO_2 emissions. The linkages between ocean acidification, climate change and the United Nations Framework Convention on Climate Change (UNFCCC) are identified and possible scenarios for developing common solutions to reduce and adapt to ocean acidification and climate change are offered. Areas where the UNFCCC is currently lacking capacity to effectively tackle rising ocean acidity are also highlighted.

Keywords: climate change; climate policy; ocean acidification; oceans; UNFCCC

L'acidification des océans et le changement climatique sont liés par leur cause commune : le CO_2. Alors que le changement climatique est la conséquence d'une série d'émissions de gaz à effet de serre, l'acidification des océans à l'échelle planétaire est causée seulement par l'accroissement des concentrations en CO_2 dans l'atmosphère. La manière la plus efficace pour atténuer l'acidification des océans est de réduire les émissions de CO_2. Agir pour empêcher davantage d'acidification dans les océans en diminuant les émissions de CO_2 entraînera également des avantages simultanés dans l'atténuation de changements climatiques futurs. Alors qu'il est possible de réduire les émissions de CO_2 à un niveau suffisamment bas pour atténuer l'acidification des océans, tout en s'attaquant simultanément au changement climatique, l'inverse n'est malheureusement pas forcement le cas. Malgré le rôle intégral des océans dans le système climatique et les effets potentiels étendus sur la vie marine et les humains, le problème de l'acidification des océans est largement absent de la plupart des discussions politiques liées aux émissions de CO_2. Les liens entre acidification des océans, le changement climatique et la Convention cadre des Nations Unies sur le changement climatique (CCNUCC) sont identifiés et des scénarios possibles pour développer des solutions communes pour réduire et s'adapter à l'acidification des océans et le changement climatique sont proposés. Les domaines où la CCNUCC manque actuellement de capacités pour lutter effectivement contre l'acidité croissante des océans sont aussi mis en valeur.

Mots clés : changement climatique; politique climatique; acidification des océans; océans; CCNUCC

1. Introduction

Since the Industrial Revolution, more than 1.6 trillion tonnes of CO_2 have been emitted into the atmosphere as a result of the burning of fossil fuels, land-use change and other human

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AN ALTERNATIVE APPROACH FOR ADDRESSING CO_2-DRIVEN OCEAN ACIDIFICATION

*by Verónica González**

The oceans have absorbed over twenty-five percent of the anthropogenic carbon dioxide ("CO2") released to the atmosphere since pre-industrial times.[1] As a result, naturally alkaline oceans are becoming more acidic.[2] The projected increase in CO2 emissions absorbed by the oceans will cause changes in water chemistry that may affect "biodiversity, trophic interactions, and other ecosystem processes."[3] Elevated CO2 will lower the

resolve environmental disputes.[72] These mechanisms have been favorably compared with that of the World Trade Organization because of its jurisdiction, authority, and implementing powers.[73]

On the other hand, UNCLOS lacks provisions on how States should fulfill their obligation to protect and preserve the marine environment.[74] The Convention provides a legal basis for marine space protection under Article 207, which emphasizes Parties'

Frequently asked questions about ocean acidification

EPOCA

Is ocean acidification just another name for climate change?

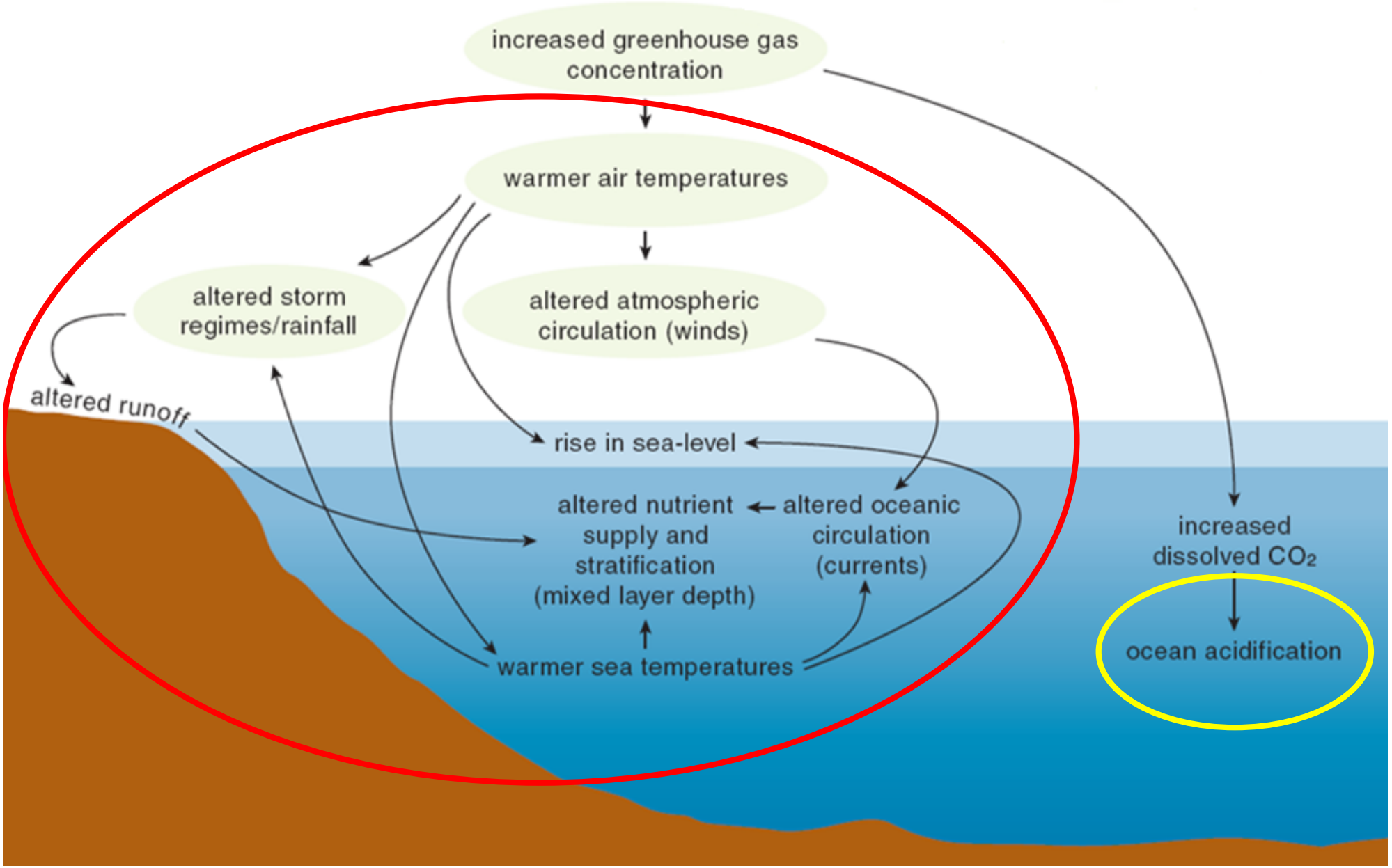
No. While ocean acidification and climate change share a common cause (increases in CO_2 in the atmosphere), climate change encompasses the effects associated with changes in the Earth's heat budget (due to the greenhouse effect of CO_2 and to a lesser extent other climate reactive gases), which cause global warming and changes in weather patterns. Ocean acidification specifically refers to the lowering of ocean pH resulting from its absorption of human-released CO_2 from the atmosphere. Ocean acidification does not include the warming of the ocean. — *C.L. Sabine*

Invitation to attend the side event:

OCEAN ACIDIFICATION – THE OTHER CO_2 PROBLEM

Ocean acidification is an emerging global concern and is a risk to marine

Ocean Acidification: The Other CO_2 Problem



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An Emergent Legal Literature on OA

Ocean Acidification: A Litmus Test for International Law

*Rachel Baird, Meredith Simons and Tim Stephens**

Ocean acidification, the changing chemistry of the oceans as a result of the absorption of carbon dioxide from the atmosphere, is caused by the atmospheric pollutant that is also the main driver of anthropogenic climate change, having effects on the marine environment as serious as other pollutants entering the oceans. However there is no discernible pressure for a new regime to address the problem specifically, given the extensive body of law already in existence that could potentially be applicable. This article assesses the two main environmental regimes that appear to have obvious application – the climate change regime and the marine pollution regime. It is argued that while the phenomenon is partially regulated by both of these regimes, it is addressed wholeheartedly by neither. Ocean acidification therefore exists in an international legal twilight zone, a regrettable position given the serious threat it presents to the ecological integrity of the world's oceans. By reference to international relations scholarship relating to regime complexity, it suggests a possible way forward in addressing ocean acidification as a cross-cutting environmental challenge.

I. Introduction

International environmental law has developed in a mostly sectoral and ad hoc manner. Regimes have been devised to address specific global or regional environmental problems, such as particular sources and types of transboundary pollution, rather than to promote transboundary environmental governance in a holistic and integrated manner.[1] As a consequence there is today an array of international environmental regimes but a lack of coordination among them, and many regimes operate independently, and sometimes even inconsistently, in relation to each another.[2]

Ocean acidification, that is the changing chemistry of the oceans as a result of the uptake of carbon dioxide (CO_2) from the atmosphere, exemplifies the challenges faced in addressing new cross-cutting environmental challenges effectively and expeditiously in an era of environmental regime complexity. Ocean acidification is caused by the atmospheric pollutant that is also the main driver of anthropogenic climate change, having effects on the marine environment as serious as other pollutants entering the oceans. As the phenomenon has only recently been assessed in the scientific literature,[3] and much further research remains to be done, there has been little opportunity for an influential

* Dr Rachel Baird BA, LLB (UQ) LLM (QUT) PhD (Griffith) is a Senior Lecturer at the School of Law, University of Southern Queensland, Meredith Simons BA is an tutor at the Sydney Centre for International Law and a final year LLB student at the Faculty of Law, University of Sydney, and Dr Tim Stephens BA (Hons) Syd LLB (Hons) Syd MPhil Camb PhD Syd is a Senior Lecturer at the Faculty of Law, University of Sydney. Aspects of the research reported in this article were contained in a paper presented by Tim Stephens at a Public Seminar at the Australian National University's Centre for International and Public Law on 3 April 2009, and in an editorial in the Asia Pacific Journal of Environmental Law (Meredith Simons and Tim Stephens, "Ocean Acidification: Addressing the Other CO_2 Problem" 12 Asia Pacific Journal of Environmental Law (2009), 1). The authors gratefully acknowledge the research funding provided by the University of Sydney Law School Small Scholarship Support Fund, the research assistance of Callista Harris, and the comments on an earlier version of the paper by Professor Gillian Triggs.

1 See generally Tim Stephens, International courts and environmental protection (Cambridge: Cambridge University Press, 2009), 2-7 and 304-318.

2 See Rüdiger Wolfrum and Nele Matz, Conflicts in International Environmental Law (Berlin: Springer, 2003).

FROM SEA TO CARBON CESSPOOL: PREVENTING THE WORLD'S MARINE ECOSYSTEMS FROM FALLING VICTIM TO OCEAN ACIDIFICATION

I. Introduction

Each year, the oceans absorb up to one ton of CO_2 per each person on the planet.[1] Although beneficial, this undertaking is cause for alarm because the current amount of CO_2 in the atmosphere has not been experienced on Earth for at least 800,000 years.[2] While steps have been taken to reduce the amount of CO_2 emissions, CO_2 released by human activities has increased by nearly 40% from pre-industrial levels.[3] Since that time, the oceans have absorbed almost half of all CO_2 emissions, decreasing levels of potential of hydrogen (pH) and making them more acidic.[4] This process, now known as ocean acidification, is rapidly increasing and has shrewdly been dubbed the "other CO_2 problem."[5] Unless ocean acidification becomes part

1. The Royal Society, Ocean Acidification Due to Increasing Atmospheric Carbon Dioxide 13 (2005) [hereinafter Royal Society Report], *available at* http://royalsociety.org/workArea/DownloadAsset.aspx?id=5708 (last visited Nov. 5, 2010) (describing effects of atmospheric CO_2 on ocean chemistry); *see also* Scott C. Doney et al., *Ocean Acidification: The Other CO_2 Problem*, 1 Ann. Rev. Marine Sci. 169-92, 170 (2009) (detailing human fossil fuel emissions as significantly affecting oceanic chemistry). Ocean acidification is a predictable consequence of rising CO_2 levels, just like climate change. Doney et al., *supra*, at 170. Unlike climate change in general, however, ocean acidification does not suffer from uncertainties. *Id.* The absorption of CO_2 with seawater is well documented in data, surveys, and other models. *Id.*

2. Doney, et al., *supra* note 1, at 170; *see also* Royal Society Report, *supra* note 1, at 5 (noting changes in atmospheric CO_2 higher today than for at least 420 thousand years).

3. Doney et al., *supra* note 1, at 170; *see also* Royal Society Report, *supra* note 1, at 9 (explaining ocean absorbed nearly 48% total CO_2 from 1800-1994); Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, 37 I.L.M. 22 (1998) (entered into force Feb. 15, 2005) [hereinafter Kyoto Protocol] (outlining emission standards for reducing greenhouse gases).

4. Royal Society Report, *supra* note 1, at 5. The oceans cover roughly 70% of the planet, and the unprecedented increase in CO_2 is chemically changing the oceans and its acidity. *Id.* Because the oceans act as substantial carbon reservoirs, cycling CO_2 from the atmosphere, any increase in the amount of CO_2 in the atmosphere directly affects the amount of CO_2 in the oceans. *Id.* at 5-6.

5. Doney et al., *supra* note 1, at 170 (describing similarities between ocean acidification and climate change); *see also* Royal Society Report, *supra* note 1, at 9 (detailing critical increase in ocean chemistry change caused by CO_2 emissions).

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Is a New Multilateral Environmental Agreement on Ocean Acidification Necessary?

Rakhyun E. Kim

No multilateral environmental agreement (MEA) has so far been concluded with a view to addressing the problem of ocean acidification. The United Nations Framework Convention on Climate Change (UNFCCC) is considered by many as being capable of addressing ocean acidification as it regulates carbon dioxide emissions – the root cause of the problem. In this article it is argued that, on the contrary, the UNFCCC does not provide an adequate legal framework for the problem because ocean acidification is not an effect of 'climate change', meaning that it is outside the UNFCCC's jurisdiction. The article provides a critical examination of whether ocean acidification is likely to be addressed through the self-organization of existing MEAs or whether a new MEA is necessary. Specifically, it considers the extent to which the provisions of relevant MEAs are applicable to ocean acidification and how their decision-making bodies have responded to the problem. This article observes inherent weaknesses in the emerging polycentric order and reaches the conclusion that a new MEA on ocean acidification is necessary to fill the regulatory gap. The article concludes by outlining two hypothetical candidates as a way of discussing key considerations informing the choice of an appropriate form and forum for an MEA on ocean acidification.

INTRODUCTION

Ocean acidification poses a serious global environmental challenge, but only recently has it caught the attention of the international community, having been overshadowed by the climate change problem. Ocean acidification is a direct consequence of the increased concentration of carbon dioxide (CO_2) in the atmosphere due to anthropogenic activity, and has been dubbed 'the other CO_2 problem'.[1] Oceans naturally exchange CO_2 with the atmosphere, and constitute a significant carbon reservoir in the global carbon cycle.[2]

Over the past 200 years, the oceans have absorbed about 40% of the excess CO_2 that humans have emitted into the atmosphere.[3] Although this natural buffering effect has helped to mitigate anthropogenic climate change, the extra carbon taken up by the oceans is decreasing their pH and making them more acidic.[4] The increasing acidity is predicted to have dire consequences for many marine ecosystems and species – especially those organisms which form shells and plates out of calcium carbonate, such as coral reefs.[5] Ocean acidification is now widely recognized as being among the most pressing global environmental challenges that humanity faces in the years to come.[6]

Despite the significance of the problem, no multilateral environmental agreement (MEA) has so far been concluded with a view to addressing it. As a newly emerging global environmental problem, ocean acidification exists in an 'international legal twilight zone'.[7] This article explores whether a separate MEA on ocean acidification is necessary to bring light to twilight and fully address the problem. This question is particularly relevant in the context of ocean acidification because the United Nations Framework Convention on Climate Change (UNFCCC)[8] and its Kyoto Protocol[9] could be considered as being responsible for, and capable of, addressing the problem. Indeed, these MEAs regulate CO_2 emissions, the root cause of ocean acidification.[10]

1 S.C. Doney *et al.*, 'Ocean Acidification: The Other CO_2 Problem', 1 *Annual Review of Marine Science* (2009), 169, at 169.
2 D. Archer *et al.*, 'Atmospheric Lifetime of Fossil Fuel Carbon Dioxide', 37 *Annual Review of Earth and Planetary Sciences* (2009), 117.
3 R.E. Zeebe *et al.*, 'Carbon Emissions and Acidification', 321:5885 *Science* (2008), 51.
4 K. Caldeira and M.E. Wickett, 'Anthropogenic Carbon and Ocean pH', 425:6956 *Nature* (2003), 365.
5 J.-P. Gattuso *et al.*, 'Ocean Acidification: Knowns, Unknowns and Perspectives', in: J.-P. Gattuso and L. Hansson (eds.), *Ocean Acidification* (Oxford University Press, 2011), 291.
6 J. Rockström *et al.*, 'A Safe Operating Space for Humanity', 461:7263 *Nature* (2009), 472.
7 R. Baird, M. Simons and T. Stephens, 'Ocean Acidification: A Litmus Test for International Law', 3:4 *Carbon and Climate Law Review* (2009), 459, at 460.
8 United Nations Framework Convention on Climate Change (New York, 9 May 1992; in force 21 March 1994) ('UNFCCC').
9 Kyoto Protocol to the United Nations Framework Convention on Climate Change (Kyoto, 11 December 1997; in force 16 February 2005) ('Kyoto Protocol').
10 E.R. Harrould-Kolieb and D. Herr, 'Ocean Acidification and Climate Change: Synergies and Challenges of Addressing Both under the UNFCCC', 12:3 *Climate Policy* (2012), 378.

Research Questions

How can the emergent problem of ocean acidification be addressed in the already congested landscape of multilateral environmental agreements?

Supplemental questions:

1. What efforts have already been made under existing multilateral environmental agreements to address ocean acidification and where are the existing gaps in the governance of this issue?

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4. Can the reframing of ocean acidification enhance the possibilities of synergistic regime interaction?

Does the UNFCCC carry an obligation to address OA?

Article 2

OBJECTIVE

The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

Article 3

PRINCIPLES

3. "Climate system" means the totality of the atmosphere, hydrosphere, biosphere and geosphere and their interactions.

1. The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof.

OA as an 'effect of climate change'?

Article 1

DEFINITIONS*

For the purposes of this Convention:

1. "Adverse effects of climate change" means changes in the physical environment or biota resulting from climate change which have significant deleterious effects on the composition, resilience or productivity of natural and managed ecosystems or on the operation of socio-economic systems or on human health and welfare.

2. "Climate change" means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

3. "Climate system" means the totality of the atmosphere, hydrosphere, biosphere and geosphere and their interactions.

What is the 'Climate'?

The average weather

- "Climate change" means a change of average weather which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere…
- "Adverse effects of climate change" means changes in the physical environment or biota resulting from a change in average weather…

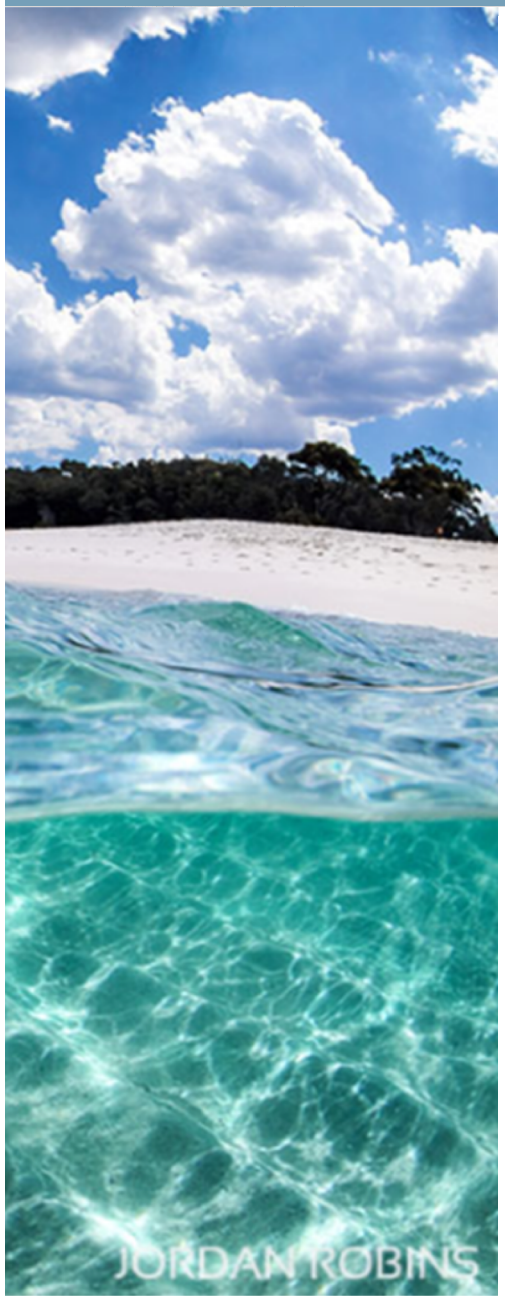
Climate ?

Climate

Climate in a narrow sense is usually defined as the "average weather" or more rigorously as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These relevant quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the *climate system*.

IPCC TAR 2001

Rules of Treaty Interpretation



SECTION 3. INTERPRETATION OF TREATIES

Article 31. GENERAL RULE OF INTERPRETATION

1. A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose.

2. The context for the purpose of the interpretation of a treaty shall comprise, in addition to the text, including its preamble and annexes:

(*a*) Any agreement relating to the treaty which was made between all the parties in connexion with the conclusion of the treaty;

(*b*) Any instrument which was made by one or more parties in connexion with the conclusion of the treaty and accepted by the other parties as an instrument related to the treaty.

3. There shall be taken into account, together with the context:

(*a*) Any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions;

(*b*) Any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation;

(*c*) Any relevant rules of international law applicable in the relations between the parties.

4. A special meaning shall be given to a term if it is established that the parties so intended.

Article 32. SUPPLEMENTARY MEANS OF INTERPRETATION

Recourse may be had to supplementary means of interpretation, including the preparatory work of the treaty and the circumstances of its conclusion, in order to confirm the meaning resulting from the application of article 31, or to determine the meaning when the interpretation according to article 31:

(*a*) Leaves the meaning ambiguous or obscure; or

(*b*) Leads to a result which is manifestly absurd or unreasonable.

In their context and in light of the object and purpose

Determined to protect the climate system for present and future generations,

Article 2

OBJECTIVE

The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

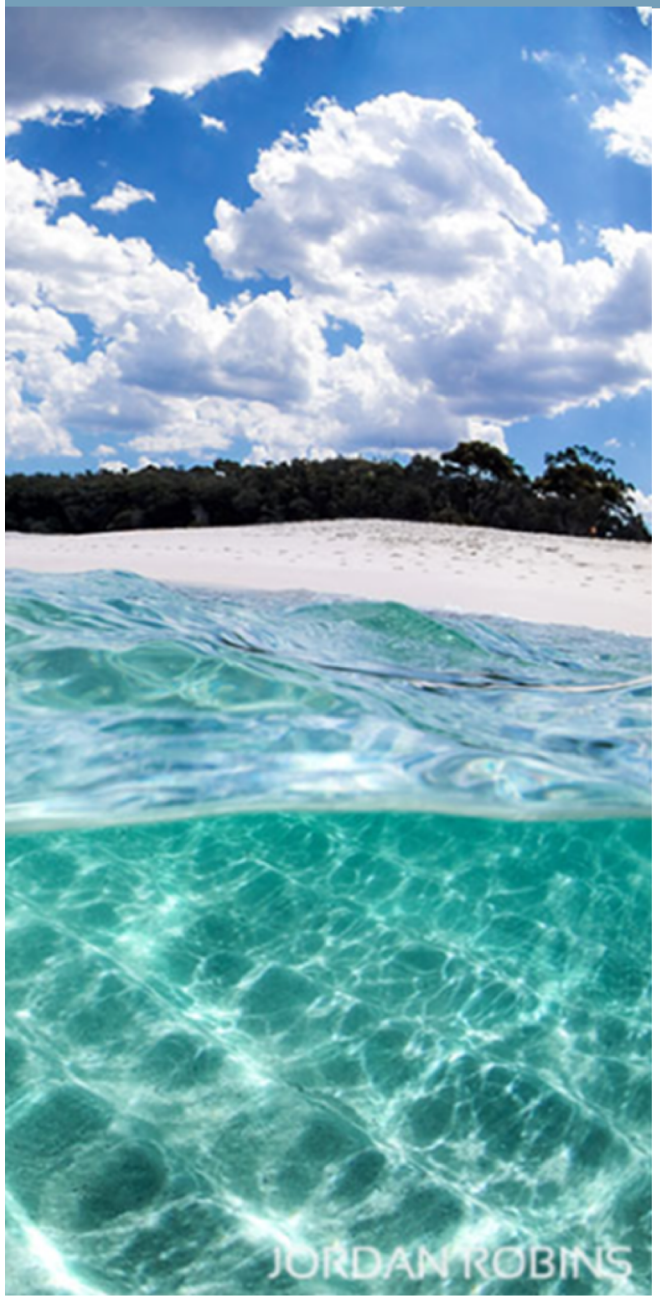
Article 3

PRINCIPLES

In their actions to achieve the objective of the Convention and to implement its provisions, the Parties shall be guided, inter alia, by the following:

1. The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof.

Reframing OA in the context of the UNFCCC



- Scientifically defensible to describe ocean acidification as an effect of climate change
- Given that the UNFCCC doesn't define 'climate' the broader description, as the 'state of the climate system' can be used.
- This description is consistent with coth the object and purpose of the Convention and its negotiating history.
- Describing ocean acidification as an effect of climate change would overcome the structural limitations that that have been identified within the UNFCCC when ocean acidification is framed as a problem concurrent to climate change.

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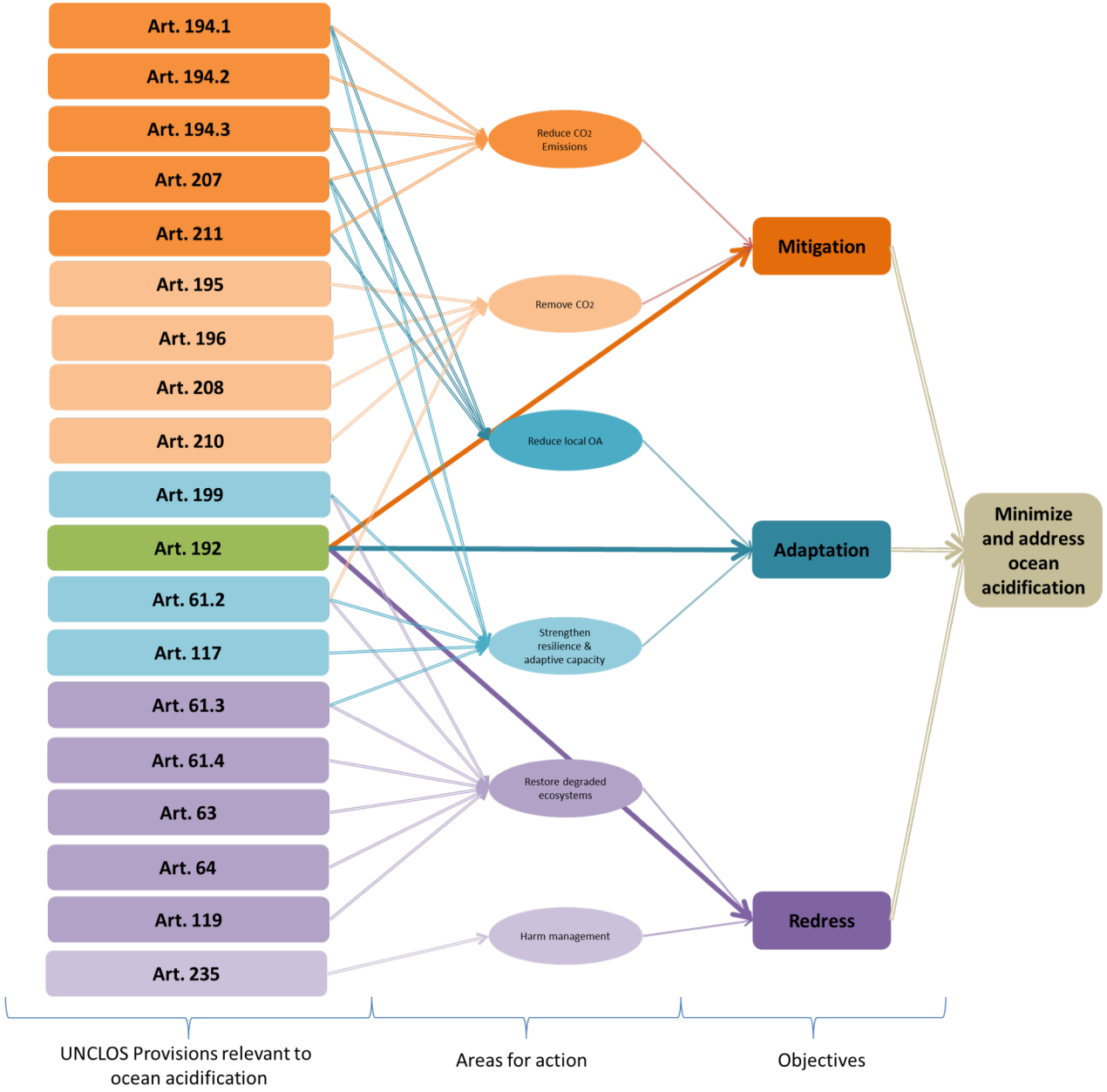
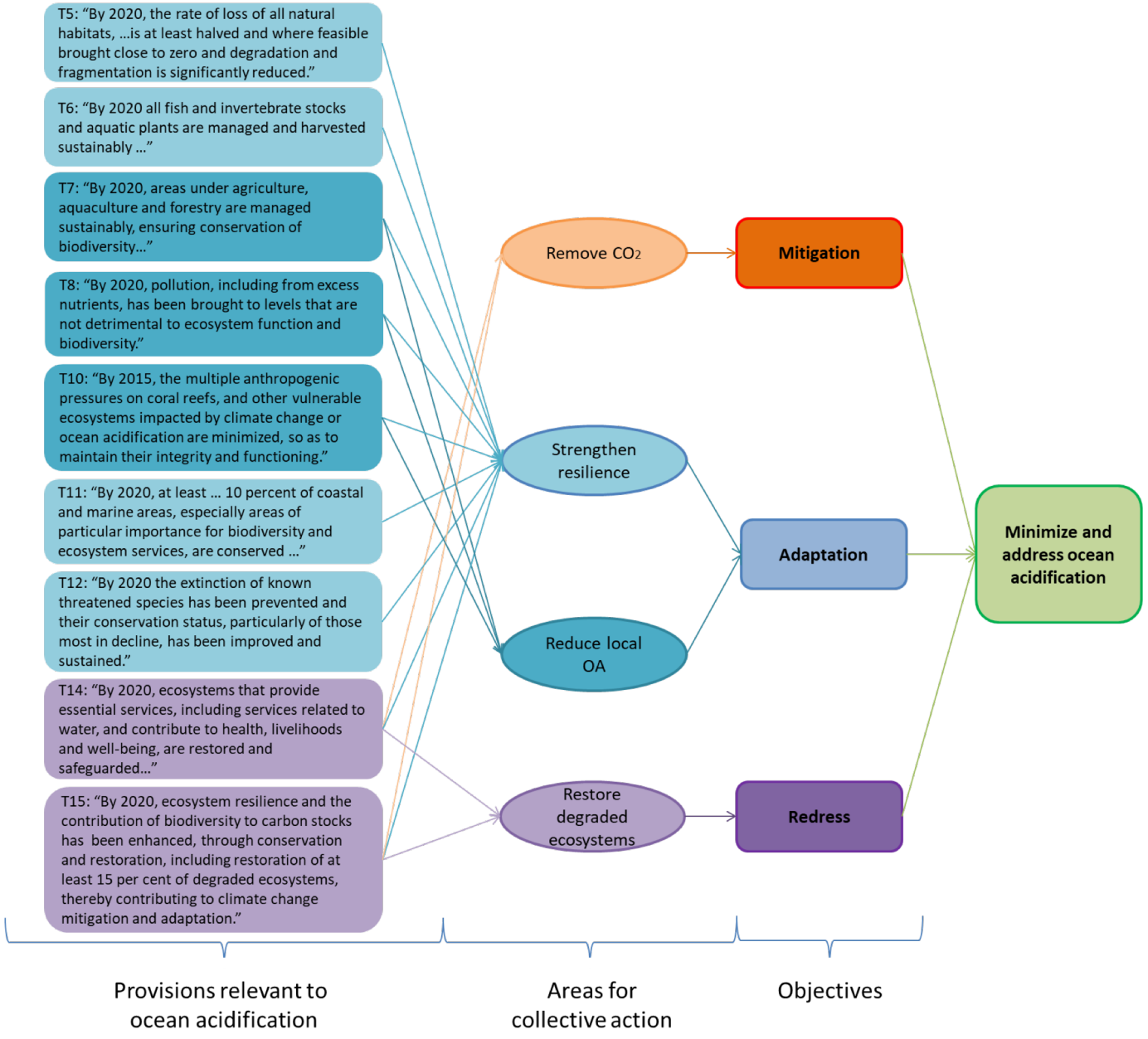
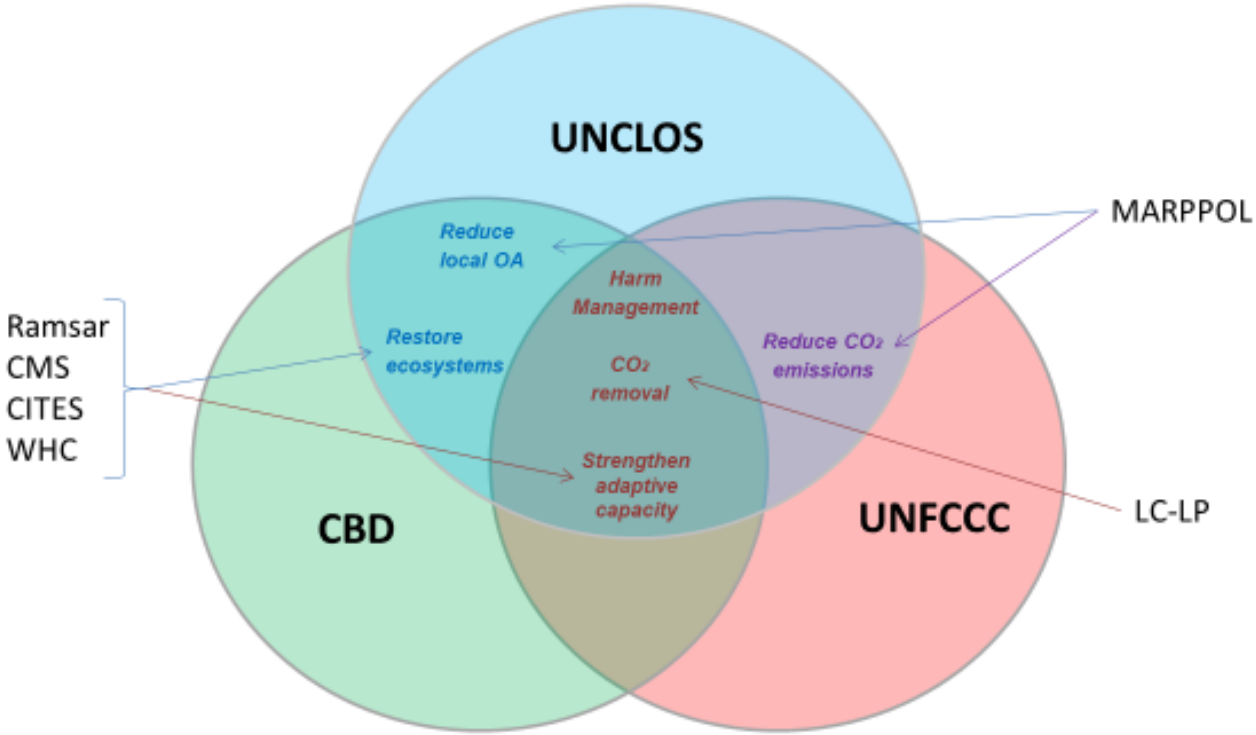
UNCLOS as a framework agreement for OA



CBD and the post-2020 biodiversity agenda



A patchwork of governance



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Thank you!

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Publications produced during candidature

Peer reviewed papers

Harrould-Kolieb, E.R. (in press) (Re)Framing ocean acidification in the context of the United Framework Convention on Climate Change. *Climate Policy XXXX*

Harrould-Kolieb, E.R. and Hoegh-Guldberg, O. (2019) A governing framework for internatior ocean acidification policy. *Marine Policy*, 102:10-20

Harrould-Kolieb, E.R., (2016) Acidification and the UNFCCC: Finding Legal Clarity in the T Zone. Wash*ington Journal of Environmental Law & Policy,* 6(2):612-632

Billé, R., Kelly, R., Biastoch, A., Harrould-Kolieb, E., Herr, D., Joos, F., Kroeker, K., Laffole Oschlies, A., Gattuso, J.-P. (2012) Taking Action against Ocean Acidification: A Review of Management and Policy Options. *Environmental Management*, 52:761-779

Harrould-Kolieb, E.R. and Herr, D. (2012) Ocean acidification and climate change: synergies challenges of addressing both under the UNFCCC. *Climate Policy*, 12(3):378-389

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Book Chapters

Harrould-Kolieb. E.R. and Kolieb, J.A. (2014) Marine and Coastal Resources and Conflict in a CO_2 World, in U. Bob and S. Bronkhorst (eds) *Conflict-sensitive adaptation to climate change Africa.* Berlin: Berliner Wissenschafts-Verlag

Kolieb, J.A. and Harrould-Kolieb, E.R., (2014) Corporations, Climate Change and Conflict Resolution in Africa, in U. Bob and S. Bronkhorst (eds) *Conflict-sensitive adaptation to clima change in Africa.* Berlin: Berliner Wissenschafts-Verlag