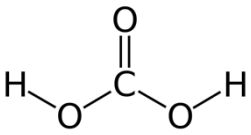

OCEAN ACIDIFICATION: A LITMUS TEST FOR INTERNATIONAL LAW

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Legal Studies Association Conference 2013

INTERNATIONAL ENVIRO. LAW – A PRIMER

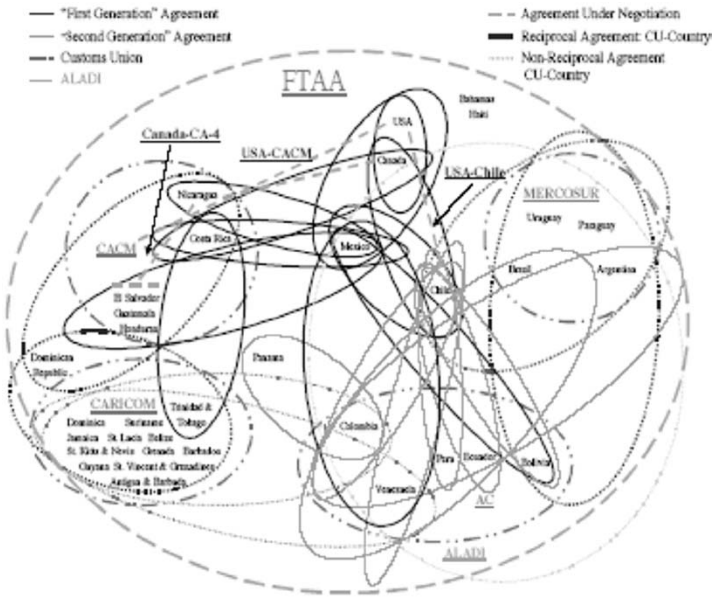
- International enviro. law (IEL) a branch of public international law
- Key sources – treaties, custom, general principles, judicial decisions and academic writings (Statute of the International Court of Justice, Art 38(1)) + 'soft law' (e.g. 1992 Rio Declaration and Agenda 21)
- Multilateral environmental treaties often called treaty 'regimes'
- Some parts of IEL much more detailed and prescriptive than others (e.g. marine pollution vs climate change) (Peel and Stephens, 2013)

OCEAN ACIDIFICATION

- Ocean acidification – 'natural' (passive) and artificial (active) drivers
- Addressing ocean acidification an emerging case study of global environmental governance in era of complexity – there is no 'clean slate', but instead a 'complex' of interrelated regimes.
- Ocean acidification – which treaty regime to apply?
  - Climate change regime (Kyoto etc)?
  - Marine pollution regimes?
  - Biodiversity regimes?
  - Atmospheric pollution regime?

TREATY REGIME COMPLEXITY

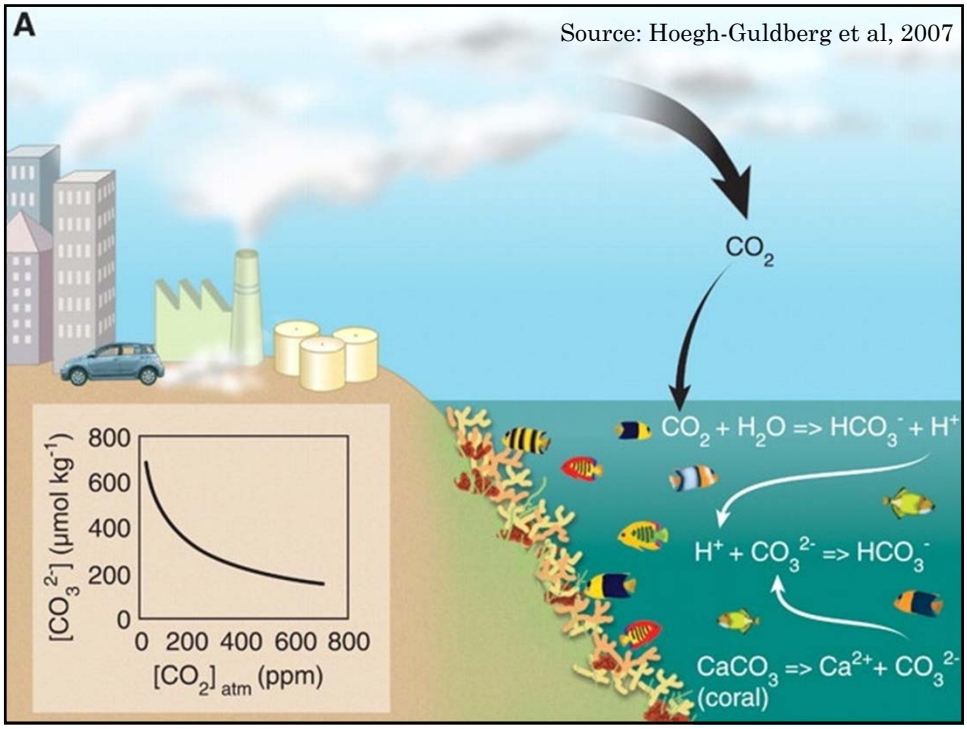
- 'Treaty congestion' – too much rather than too little intl. environmental law
  - Forum 'shopping'
  - The 'fragmentation' of international law - conflicting rules (e.g. WTO obligations vs environmental obligations)
- Difficulties encountered in environmental governance due to ecological interdependence – environmental issues should not really be addressed in isolation (yet IEL has developed in a sectoral fashion)



'Spaghetti Bowl' of trade agreements in the Americas (from Alter and Meunier, 2009, 13)

OCEAN ACIDIFICATION: THE CHEMISTRY

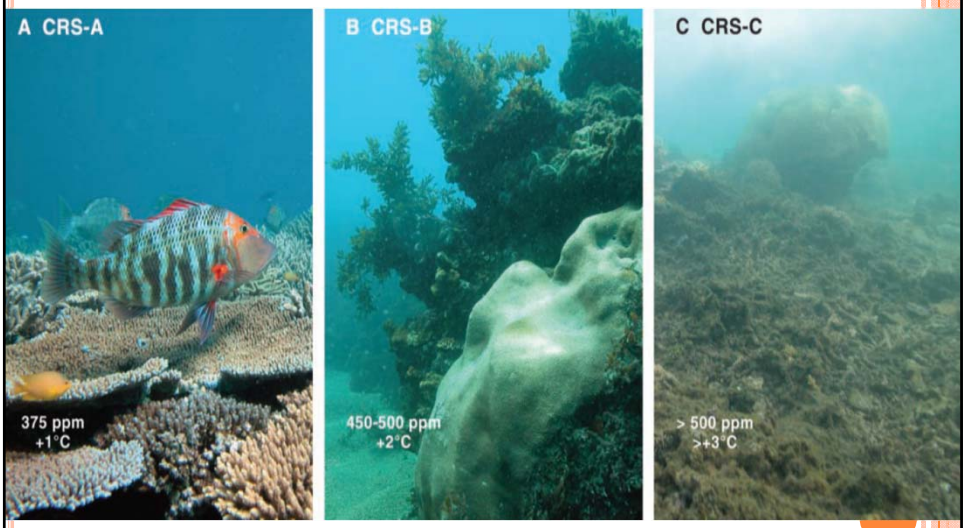
- CO_2 absorbed by seawater
- CO_2 reacts with H_2O, forming **carbonic acid** which dissociates to form **bicarbonate ions** and protons (H ions)
- H ions combine with carbonate (CO_3) ions in seawater to form more bicarbonate ions, **reducing concentration of carbonate ions**
- **Reduced availability of carbonate** for formation of marine calcifying organisms (eg corals, molluscs, crustaceans and planktons)
- **Erosion of calcium carbonate structures** sustaining variety of marine calcifying organisms



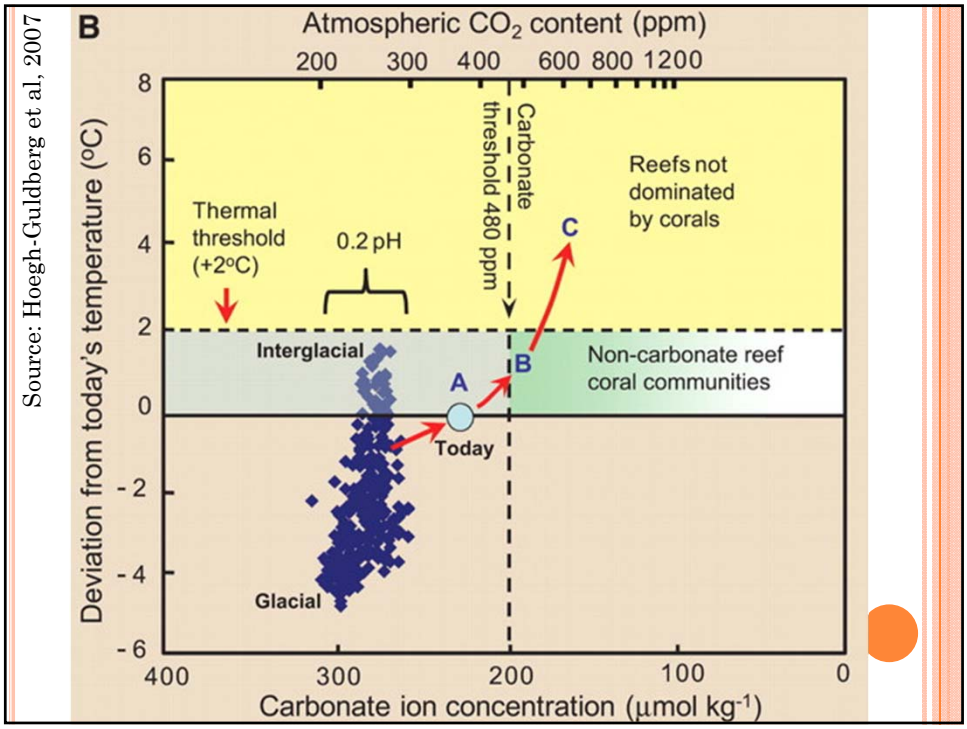
OCEAN ACIDIFICATION: THE IMPACTS

- Ocean uptake of CO_2 slowing climate change
- Oceans absorb around 50 per cent of anthropogenic CO_2 emissions per annum
- Ultimately up 90% of anthropogenic CO_2 emissions will be absorbed by oceans
- Oceans currently slightly alkaline (result of long-term balance) but becoming less so
- Pre-industrial pH of the oceans was around 8.1, but has since declined by 0.1 (nb. not a linear scale, so 0.1 fall in pH ≅ 30% rise in acidity)
- Oceans are more acidic today than at any time in the last 500,000 years

Coral reef structures under different atmospheric CO_2 concentrations and temperature increases



Source: Hoegh-Guldberg et al, 2007



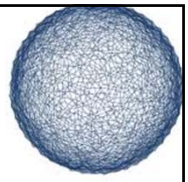
THE POLICY PROBLEM

- **Ocean acidification identified only recently in scientific literature** – see the IPCC's Fourth Assessment Report, 2007, Garnaut (2007, p 96), Stern (2006, p 14)
- Ocean acidification driven **only** by CO_2 (the most voluminous, but not most potent greenhouse gas)
- Ocean acidification sometimes described as climate change's 'evil twin' but is **independent** of climate change (relates to acidic qualities of dissolved CO_2, not its warming potential)

THE POLICY PROBLEM

- **Ocean acidification could be accelerated by some mitigation policies** – active ocean sequestration of CO_2 (1) undersea geological storage, (2) deep sea injection, (3) biosequestration (ocean fertilization)
- Can only be addressed by reducing emissions of CO_2 (buffering oceans impractical and damaging; ≥13 bn tonnes pa of limestone would be required); adaptation strategies constrained
- For climate change there are winners and losers, for ocean acidification only losers (though extent of loss varies – eg Southern Ocean a 'biogeochemical harbinger')

CLIMATE CHANGE REGIME



- **1992 UN Framework Convention on Clima Change (UNFCCC)**
  - Atmospheric focus, **but not constitution for the atmosphere** (cf. UNCLOS), **or for the carbon cycle**
  - 'Climate change' – change of climate attributed to human activity that alters composition of global atmosphere (Art 1(2)) – **does not encompass ocean acidification**
  - 'Climate system' – totality of atmosphere, hydrosphere, biosphere and geosphere and their interactions (Art 1(3)) – **encompasses oceans, but only in role as component of climate** (eg thermohaline circulation)

CLIMATE CHANGE REGIME

- **1992 UN Framework Convention**
  - 'Adverse effects' – changes in the physical environment or biota resulting from climate change which have significant deleterious effects on composition, resilience or productivity of natural and managed ecosystems… (Art 1(1)) – **does not encompass ocean acidification**
  - 'Greenhouse gases' – gaseous constituents of the atmosphere that absorb and re-emit infrared radiation (Art 1(5)) – **concerned with warming potential of CO_2, not acidification effect**

CLIMATE CHANGE REGIME

- **1992 UN Framework Convention – obligations**
  - Objective of UNFCCC and related agreements is to achieve stabilization of GHG concentrations in the atmosphere at level that would prevent dangerous anthropogenic interference with climate system (Art 2) – ┐ **change in ocean pH not relevant metric**
  - Parties to protect climate system and limit adverse effects (Art 3) – **ocean acidification not an adverse effect of climate change**
  - Parties to promote and cooperate in the conservation and enhancement of sinks of greenhouse gases including oceans (Art 4(d)) – **including the oceans**

CLIMATE CHANGE REGIME

- **1997 Kyoto Protocol**
  - Sets emission reduction and limitation targets for industrialised state parties for six greenhouse gases (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6)
  - To meet commitments, parties may count removals by terrestrial sinks only (afforestation, reforestation and deforestation) (Art 3.3) – **oceans not recognised as sink for meeting commitments** (for pragmatic reasons), and hence cannot be basis for generating CERs (CDM), ERUs (Joint Implementation) or AAUs (Emissions Trading) – **nb. does not rule out voluntary market for credits from ocean sinks**

MARINE POLLUTION REGIMES

- **1982 UN Convention on the Law of the Sea (UNCLOS)**
  - Pollution – 'introduction by man, directly or indirectly, of substances or energy into the marine environment…which results or is likely to result in such deleterious effects as harm to living resources' (Art 1(4)) – **CO_2 clearly pollution under this definition**
  - General obligation to protect and preserve the marine environment (Art 192)
  - States shall take all measures necessary to prevent, reduce and control pollution of the marine environment from any source (Art 194(1))
  - States shall adopt laws and regulations to prevent, reduce and control pollution of the marine environment from or through the atmosphere (Art 212)

MARINE POLLUTION REGIMES

- **Vessel source pollution** – MARPOL 73/78 – no atmospheric focus (but note Annex VI on Prevention of Air Pollution from Ships, applies to SO_2 and NO_x and CO_2 (as of 1 January 2013) – first ever mandatory global GHG reduction regime for entire industry sector (cf. aviation emissions)
- **Dumping at sea** – 1972 London Convention and 1996 London Protocol
- **Land and atmospheric source marine pollution** – 1995 Global Programme of Action; UNEP Regional Seas Conventions

MARINE POLLUTION REGIMES

- **1972 London Convention and 1996 London Protocol**
  - Objective is to prevent pollution of the sea by **dumping** of waste or other mater liable to create hazards to human health, harm living resources and marine life (Convention, Art I)
  - Applies to **active** not **passive** sequestration of CO_2
  - Amendments to 1996 London Protocol to permit CO_2 storage under seabed – adopted November 2006 at MOP1, in force February 2007
    - CO_2 streams from CO_2 capture processes added to Annex as waste or other matter which may be considered for dumping
    - Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth) (amended pursuant to Offshore Petroleum Amendment (Greenhouse Gas Storage Act 2008 (Cth))

MARINE POLLUTION REGIMES

- **1972 London Convention and 1996 London Protocol**
  - Scientific Working Groups Statement of Concern re Ocean Fertilisation – June 2007
  - Resolution LC-LP 1 on the Regulation of Ocean Fertilization – October 2008
    - 'NOTING decision IX/16 on 30 May 2008 of [COP 9 of the CBD which called for moratorium on ocean fertilization]'
    - '1. AGREE that the scope of the London Convention and Protocol includes ocean fertilization activities'
    - '8. AGREE that, given the present state of knowledge, ocean fertilization activities other than legitimate scientific research should not be allowed.'

MARINE POLLUTION REGIMES

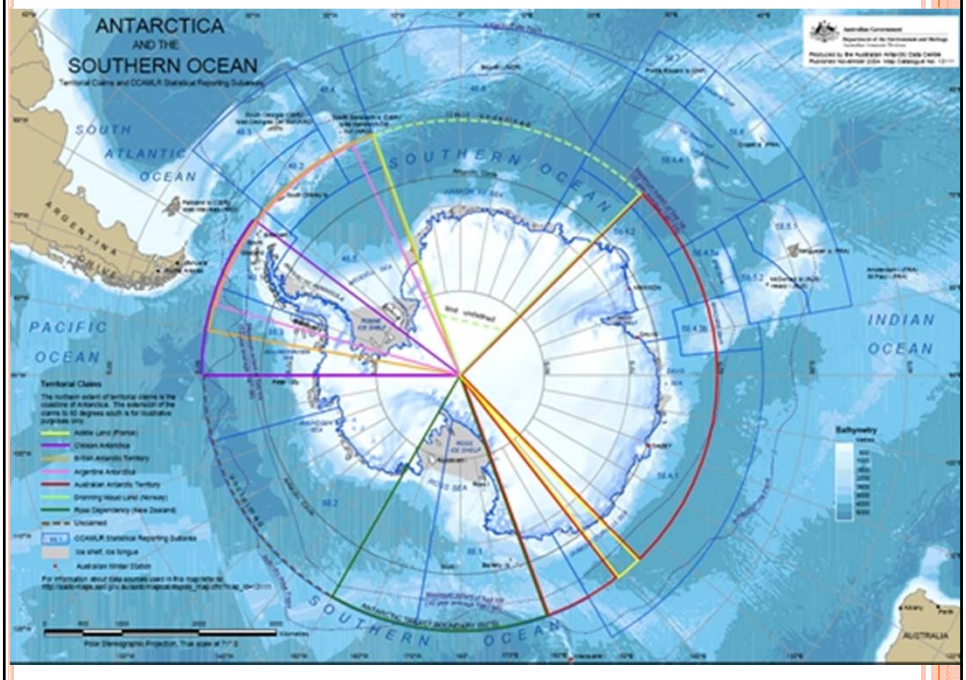
- **1995 Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA)**
  - Although accounts for ≥ 80% of marine pollution, land-based and atmospheric marine pollution under regulated globally, and in many regions
  - GPA a soft law instrument, adopted by 109 states
  - States to develop national programmes of action to address marine pollution from terrestrial sources, and to set specific targets for nine source categories (sewage, persistent organic pollutants, radioactive substances, heavy metals, oils, nutrients, sediments, litter and physical alterations and destruction of habitats)

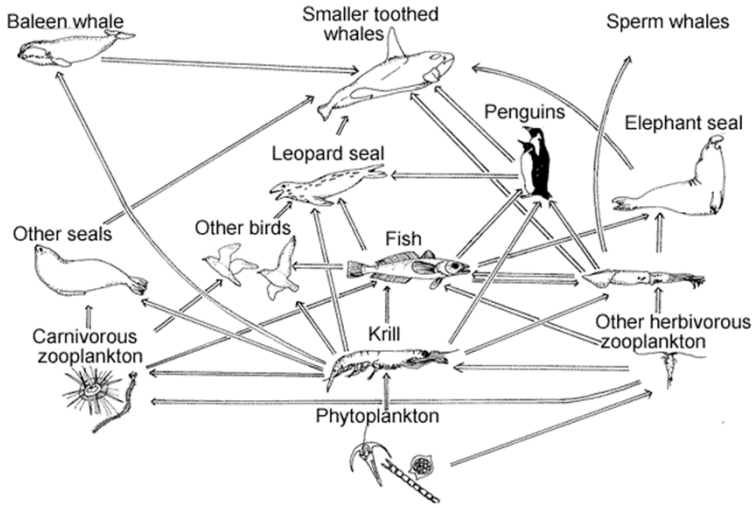
MARINE POLLUTION REGIMES

- **1995 GPA**
  - Greenhouse gases are not included as a pollutant category, and only passing mention made of the UNFCCC as one among several conventions relevant to the protection of the marine environment
  - 2006 Beijing Declaration on Furthering the Implementation of the GPA – notes that many coastal areas and small island developing states are 'vulnerable to the rise in the sea level…as well as the effects on the marine environment of ocean acidification resulting from land-based activities'

BIODIVERSITY TREATY REGIMES

- **1980 Convention on the Conservation of Antarctic Marine Living Resources**
  - Objective of CCAMLR: 'the conservation of Antarctic marine living resources' (Art 2(1)), that is 'the populations of fin fish, molluscs, crustaceans and all other species of living organisms' (Art 1(2))
  - Original focus the conservation of krill, a key shell forming organism in Southern Ocean at basis of food chain
  - Ocean acidification considered by Scientific Committee; could prompt new conservation measures (but has not yet done so)





AIR POLLUTION

- **Ocean acidification not the first litmus test for international law**
  - Acid raid (caused by SO_2 deposition, directly or via acid rain) – more intense locally than CO_2 acidification – technological solutions – SO_2 less persistent in atmosphere
- Long history of international regulation (starting with *Trail Smelter Case* (1938/1941))
  - Acidification damage to land in Washington State, United States, from sulphur fumes from smelter in Trail, British Columbia, Canada
  - Case supplies general rules concerning responsibility of states for harm across borders, and to commons

AIR POLLUTION

- **1979 Geneva Convention on Long-Range Transboundary Air Pollution**
  - Negotiated within UN Economic Commission for Europe, primarily to address acid precipitation
  - Pan-European and North American membership
  - A framework convention supplemented by eight protocols
  - 1985 Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per (23 parties (excluding Canada and United States), EIF 2 September 1987.
  - 1994 Protocol on Further Reduction of Sulphur Emissions (EIF 5 August 1998)

AIR POLLUTION

- **1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (25 Parties (inc. United States)), EIF 17 May 2005**
  - 2010 ceilings and emissions standards – for four pollutants: sulphur, NO_x, VOCs and ammonia
  - Objective (Article 2) – ensuring critical load of acidity not exceeded
  - Once fully implemented, Europe's sulphur emissions should be cut by ≥ 63% and area in Europe with excessive levels of acidification will be reduced from 93 m hectares (in 1990) to 15 m hectares – including marine and coastal zones

WHERE TO FROM HERE?

- Ocean acidification in an international legal twilight zone – peripherally regulated by multiple regimes
- No omnibus regime to address human impact on carbon cycle – partial regulation through climate regime, and through rules for geological sequestration
- Prospects for new sectoral regime crowded out (notwithstanding issue-area ripe for specialised treatment, as for acid rain)
- A case study of difficulty in regulating critical earth systems with a holistic, earth systems approach