PML | Plymouth Marine Laboratory

Listen to the ocean

THE OCEAN CONFERENCE
UNITED NATIONS, NEW YORK, 5-9 JUNE 2017

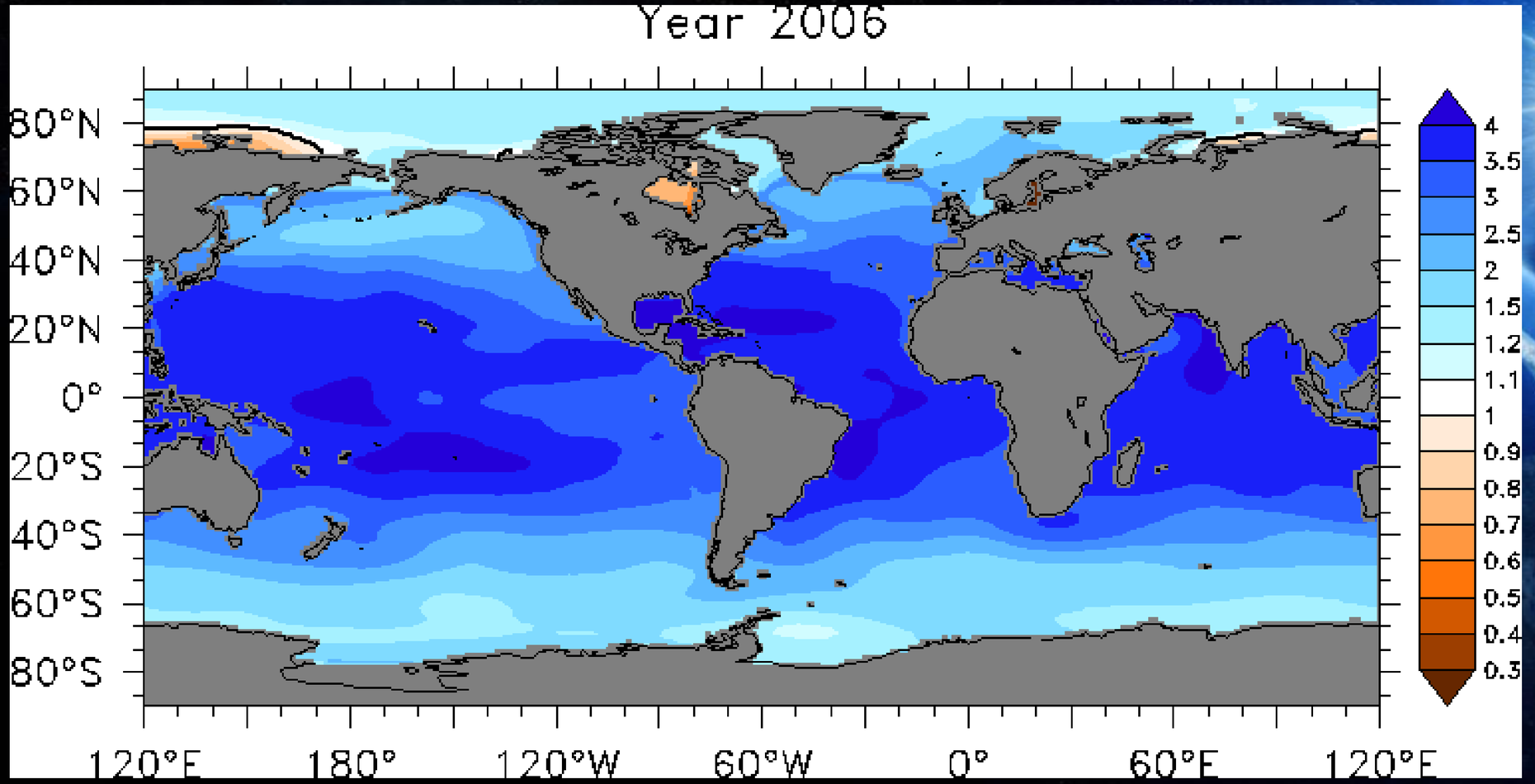
Ocean Acidification: Status, risks and options

Dr Carol Turley, OBE

Partnership Dialogue 3: Ocean Conference, 5-9 June 2017, New York

Ocean acidification is a global issue experienced locally

.... caused by CO_2 emissions to the atmosphere



Animation: J. Orr

Corrosivity of waters to aragonite (when < 1, aragonite dissolves)

Latest model projections (IPCC AR5 WG1, 2013)

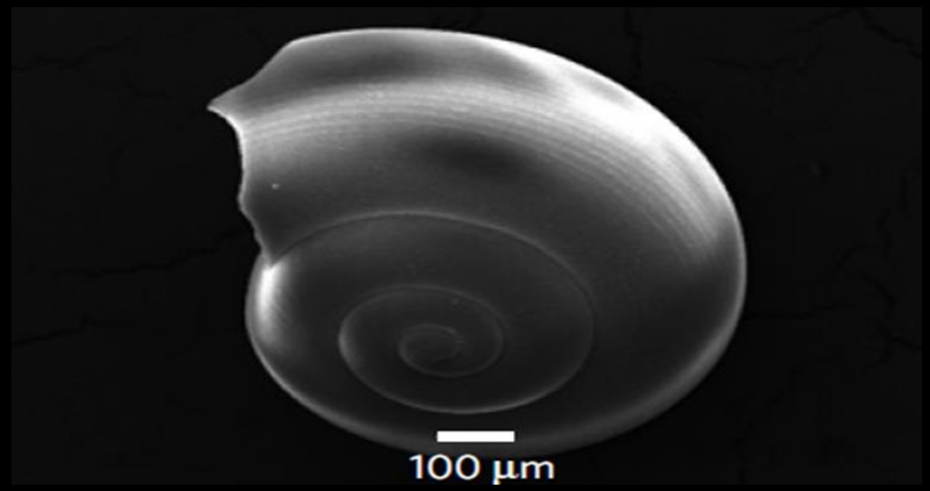
Confirms original findings: Orr et al. (2005, Nature), Calderia & Wickett (2005), Steinacher et al. (2009)

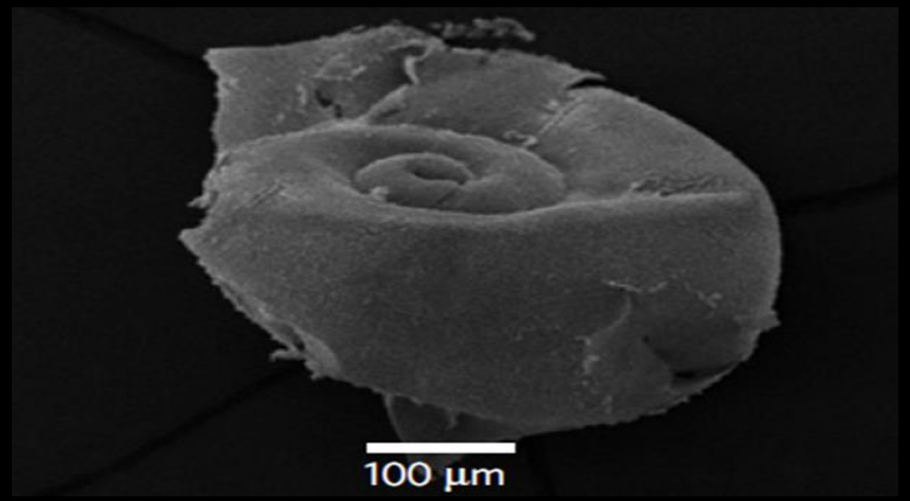
Impacts to key food web components already visible

…. pteropods shells already dissolving in the Southern Ocean and off California

Movie: Brad Seibel, University of Rhode Island

Important food for fish

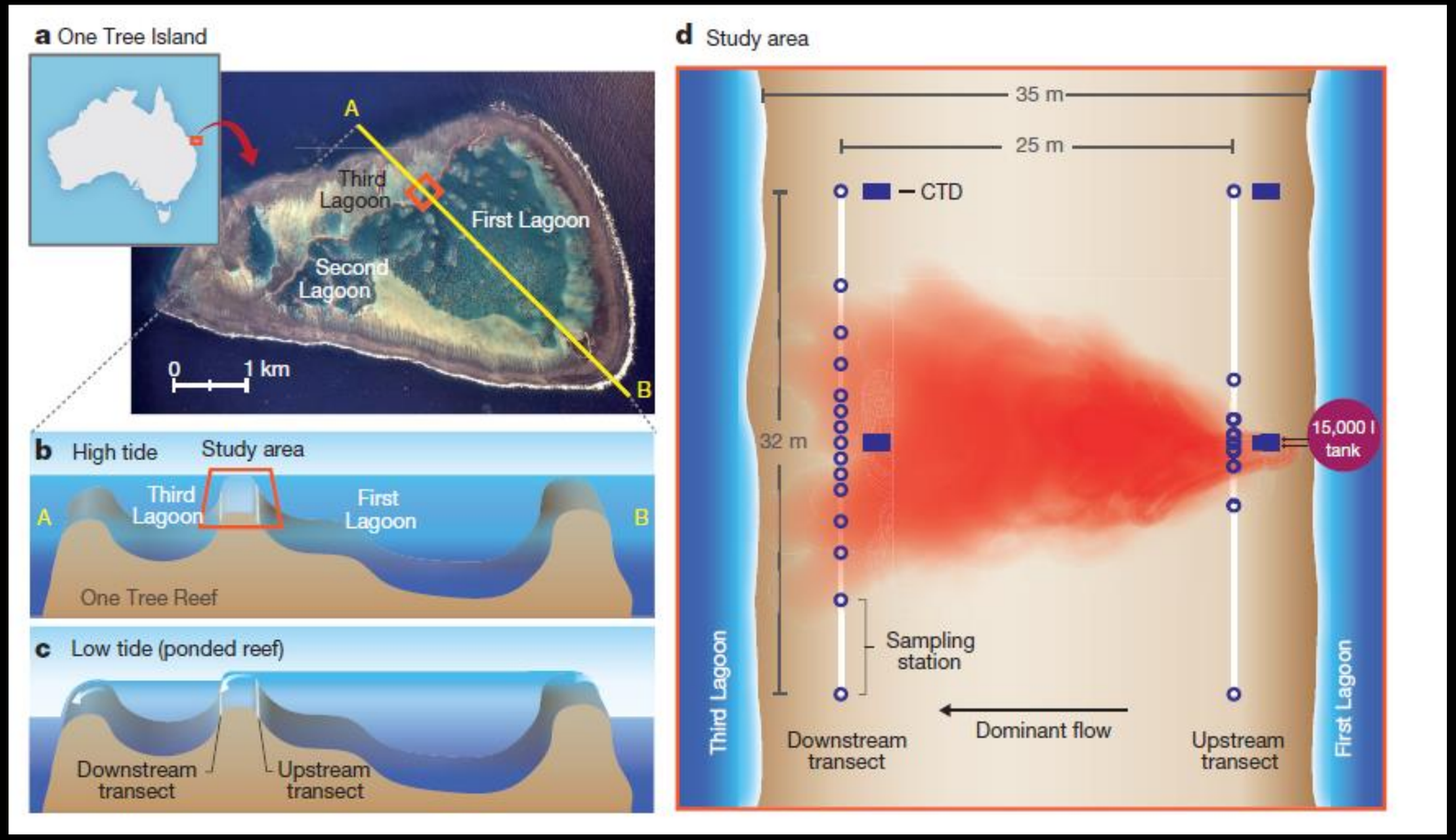


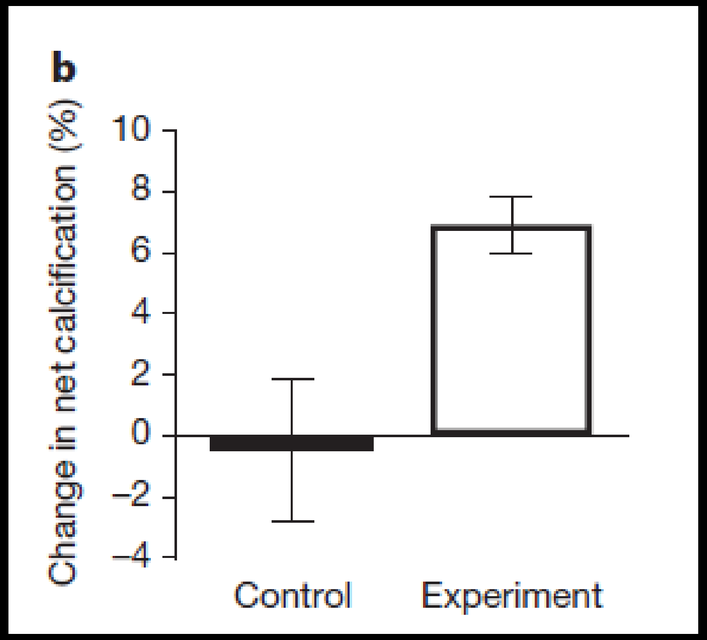


Bednaršek et al. 2012

Coral reef calcification already less, impairing reef growth

… when ocean chemistry is restored to pre-industrial conditions calcification increases by 6.9+/- 0.9%





Albright et al. 2016 Nature

Economic impacts are still very uncertain

..... but already occurring in some regions

Pacific NW 80% mortality oyster hatcheries by 2008

Caused by upwelled low pH waters, further impacted by ocean acidification

Adaptation measures in place but these are a temporary solution

Monitoring system installed but at a cost of US$500k

Barros et al. (2013)

Photo: Mike UIrban Elliott's Oyster House

The ocean is at the frontline of multiple stressors

… often occurring at the same time and place but cumulative effects poorly understood

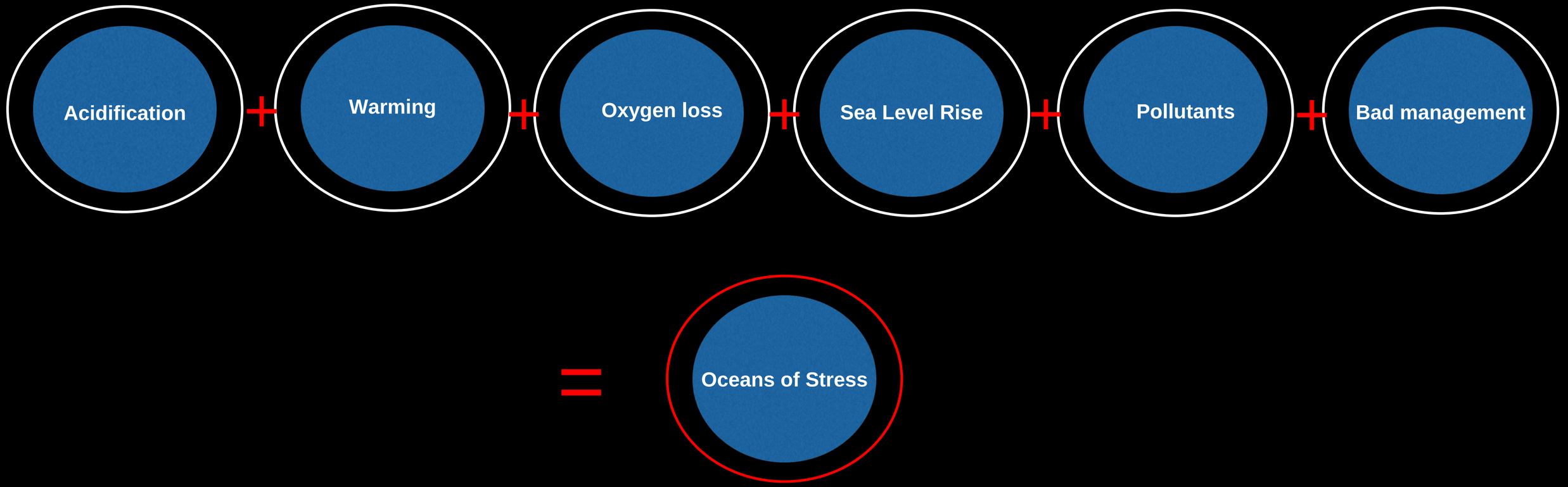


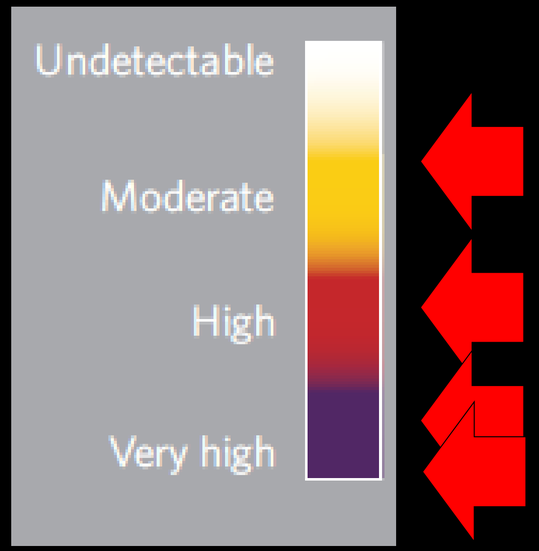
Image credit: UKOA, Sea Surface Consortium


Mitigate
Reduce CO_2 and other GHG emissions
Reduce coastal sources of CO_2
Increase carbon sinks
Remove greenhouse gases from the atmosphere
Protect
Reduce other environmental stressors
Develop MPA networks
Identify and protect ecological refugia
Plan ahead for future change
Restore
Control chemistry
Build resilience in species and ecosystems
Restore degraded ecosystems
Adapt
Sustainable practices
Migrate vulnerable people and industries
Relocate activities/species
Build infrastructure to protect ecosystem assets
Use ecosystems to protect infrastructure
Options for sustainable development

Mitigate: Reduce CO_2 emissions

…. Coral reef ecosystems at very high risk from current NDCs from acidification, warming and oxygen loss

Risk of impact to warm water corals



Today

PA Goal of 1.5°C

NDCs National Determined Contributions (2.7 – 3.5°C)

BAU Business as Usual RCP8.5

CO_2 Seeps in Coral Reefs off Papua New Guinea

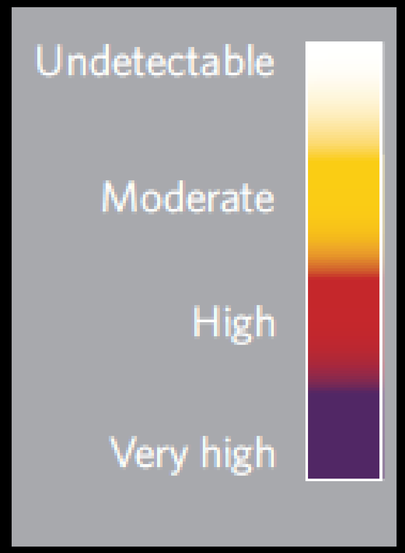
A vision of the future of **coral reefs in a high CO_2 world?**

Ocean acidification leads to loss in diversity, structural complexity. No reef development at <7.8 pH.

Mitigate: Reduce CO_2 emissions

… Finfish at very high risk from current NDCs from warming, acidification and oxygen loss impact directly and through food webs

Risk of impact to finfish



Today

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Protect – blue carbon stores

Dr Ana Queiros
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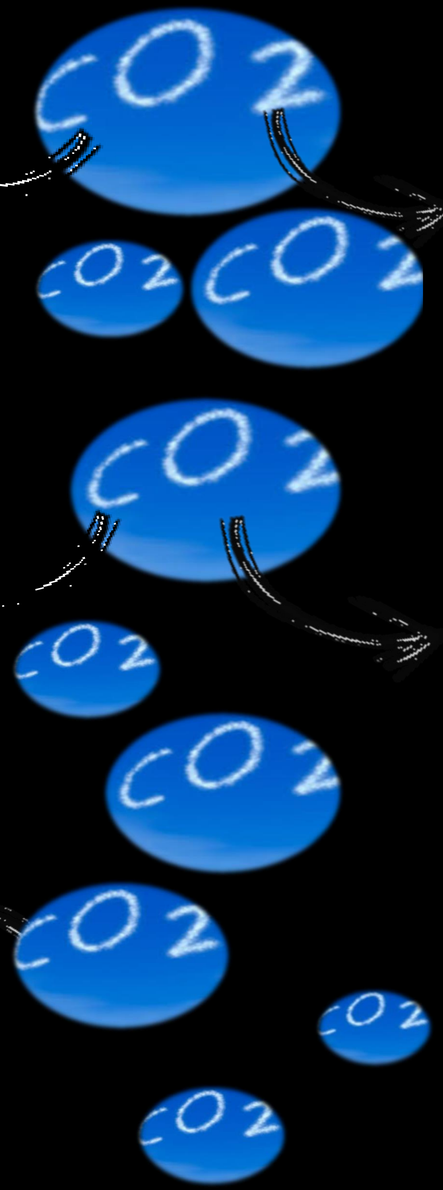
Marine Ecosystems Research Programme



Protect – reduce other stressors

Photo credits: NOAA's National Ocean Service, Flickr

Restore - develop resilient species

Photo credits: S. Eklund, Red Box photos

Adapt – use sustainable practices

Photo credits: Quentin Hanich, University of Wollongong

Adapt - use ecosystems to protect

Photo credits: T. Young

Societal impacts

- **Impacts will be strongest in coastal communities** relying on marine productivity and coastal protection
- Many of these are **highly vulnerable and less able to adapt**

Science for sustainable development

...working across disciplines

Assessing risk to societies

Field data

Experiments

Observations from sea and space

Social and economic factors

Analysis

Models and validation

Facilitates evaluation

Informs risk assessment

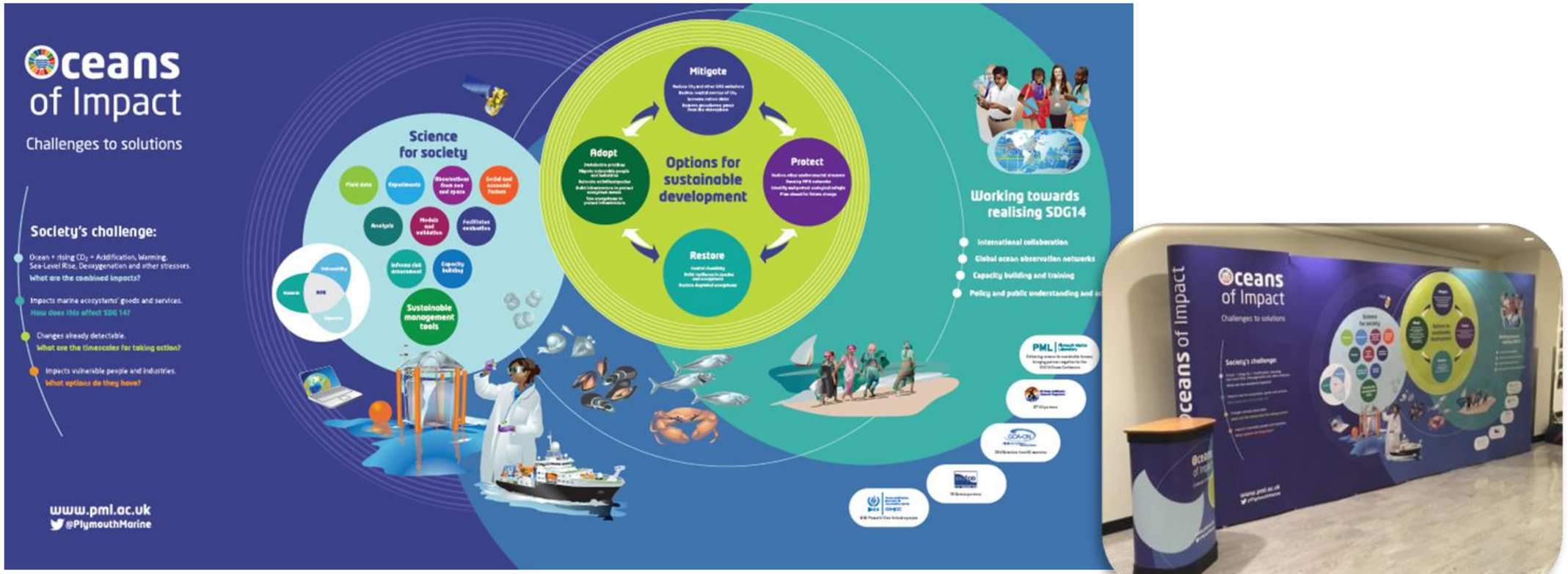
Capacity building

Sustainable management tools

International collaboration, capacity building and financing is essential

Thank you and to all the scientists that have contributed their work

ct@pml.ac.uk



Exhibition stand: "Oceans of Impact: Challenges to solutions"
Outside Conference Room 11