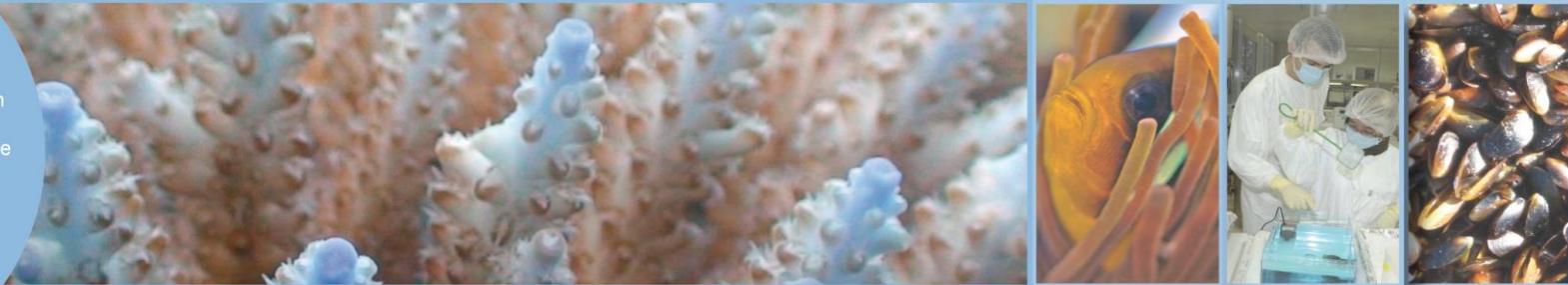




Ocean Acidification  
International  
Coordination Centre  
OA-ICC



# International ocean acidification initiatives and coordination (OA-ICC, GOA-ON, resources, data management)

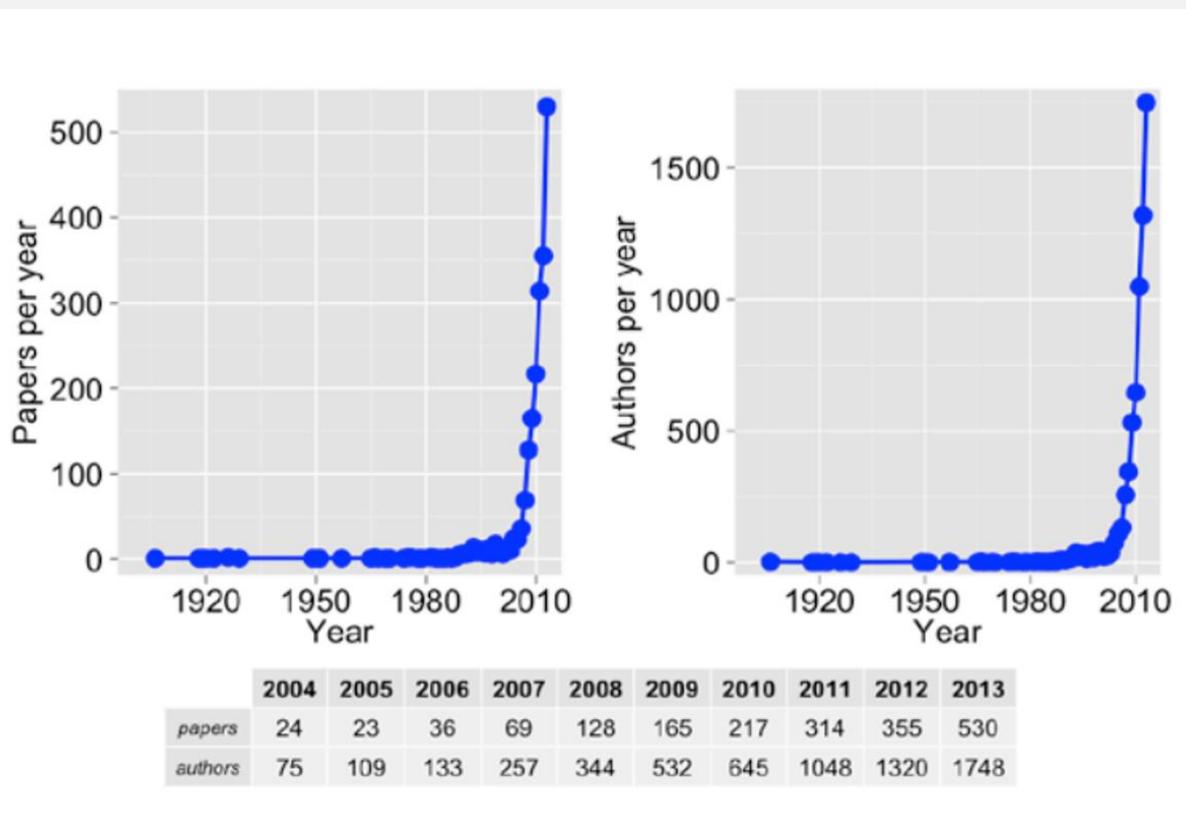
**Lina Hansson**  
OA-ICC Project Officer

IAEA Environment Laboratories  
International Atomic Energy Agency  
Principality of Monaco

[oaicc@iaea.org](mailto:oaicc@iaea.org)  
[www.iaea.org/ocean-acidification](http://www.iaea.org/ocean-acidification)  
<http://news-oceanacidification-icc.org/>

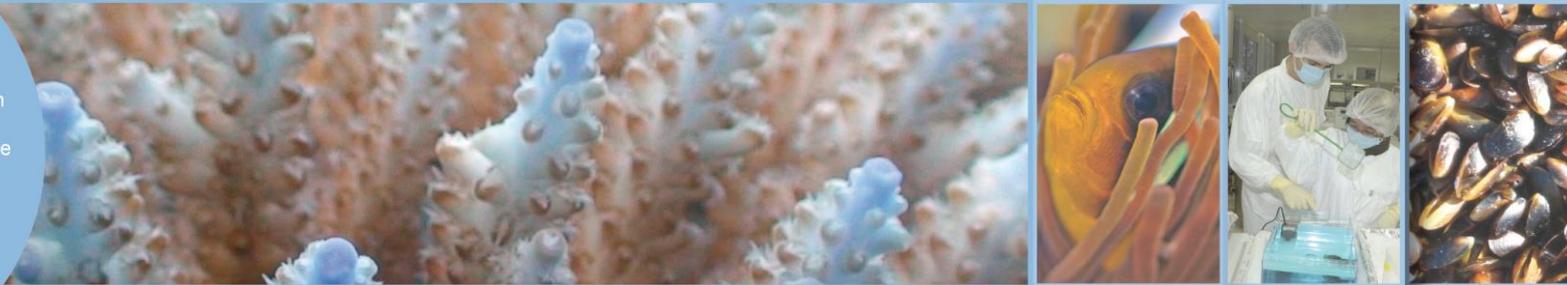


# Ocean acidification – a rapidly growing field



OA-ICC Bibliographic Database,  
modified after Gattuso and Hansson 2010

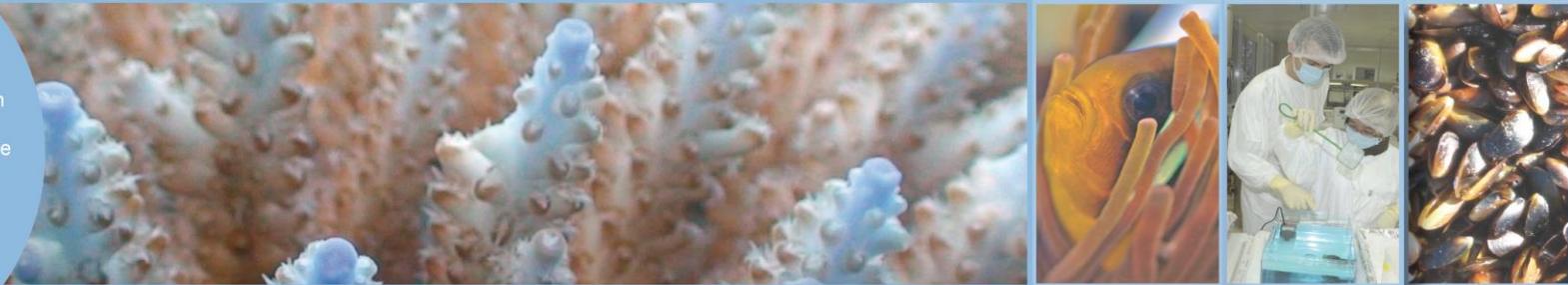




# Ocean acidification – a rapidly growing field

➔ **increasing need for  
international coordination  
and collaboration**

The IAEA launched the OA-ICC in 2012 upon recommendation of the SOLAS IMBER Ocean Acidification Working Group and increasing concern of its Member states



## Why the IAEA?

### Nuclear applications in ocean acidification research

- The IAEA Environment labs are active in any field where isotopic and nuclear applications are relevant to understand environmental issues.
- Isotopic and nuclear techniques are unique tools e.g. to:
  - Study the Impact on primary production, growth and calcification rate, using e.g. Ca-45, C-14
  - Reconstruct past pH, using the isotopic ratio B-11/B-10 as a proxy



## IAEA Environment Laboratories – other projects with OA components

- Coordinated Research Programme: “Ocean Acidification and Economic Impacts on Fisheries”

- Current **IAEA Technical Cooperation projects** with OA component:

National project: Kuwait

National project: Indonesia

Regional project: Africa

Regional project: Latin America

Contacts:

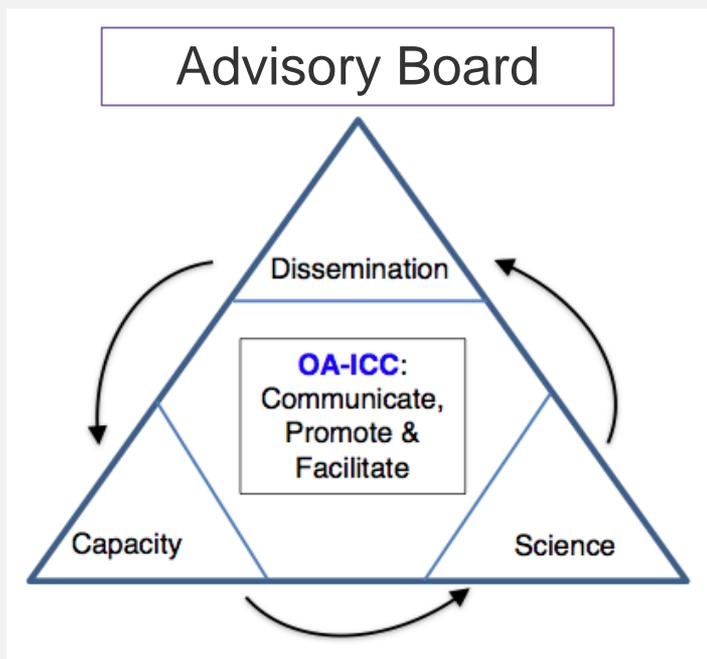
Juan-Carlos Miquel, Yasmine Bottein, Marc Metian

- Proposal:

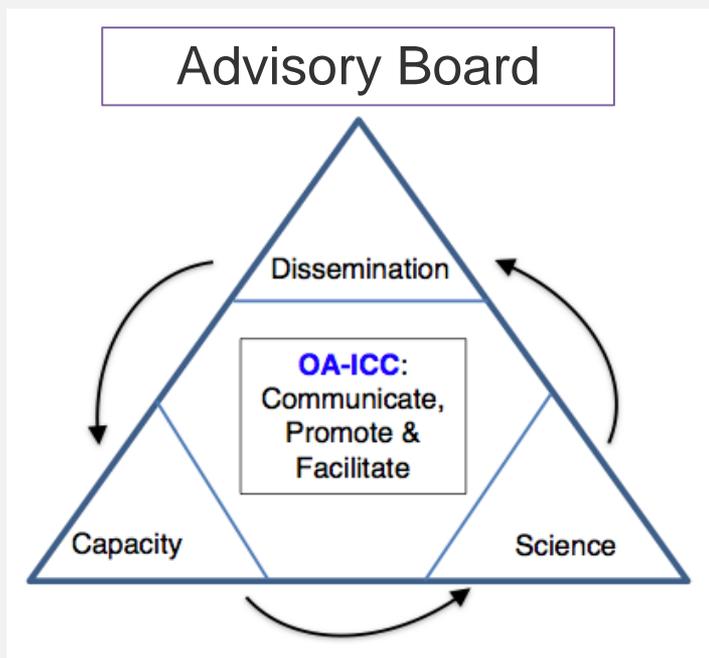
Inter-regional project (Africa, Asia and South America) on OA monitoring



## IAEA Ocean Acidification International Coordination Centre (OA-ICC)



- **Objective:** act as a **hub** to communicate, promote and facilitate international activities on ocean acidification
- **End users:** scientific community and science users (e.g., policy makers, media, general public)



- **Functioning:**

Operated by the IAEA Environment Laboratories in Monaco

Announced in June 2012 at Rio+20 for an initial duration of 3 years

Advisory Board: UN agencies, key institutions and leading scientists in the field



## Funding and support

Supported by the IAEA 'Peaceful Uses Initiative' (PUI) through direct and in-kind contributions from several IAEA Member States and research projects on ocean acidification:

Australia, France, Italy (ENEA), Japan, New Zealand, Norway, Spain, United Kingdom, United States  
NOAA OAP, IMBER, SOLAS, BIOACID, MedSeA, UKOA

Total budget: USD 2.4 M (USD 1.4 M cash and USD 1 M in-kind)



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# SCIENCE

*'Promote activities to help advance ocean acidification research'*



## **Global observing network**

R. Feely, USA & L. Jewett, USA

## **Joint platforms & experiments**

U. Riebesell, Germany & J. Barry, USA

## **The human dimension (socio-economics)**

J. Bijma, Germany & S. Cooley, USA

## **Intercomparison exercises**

M. Dai, China

## **Best practices**

U. Riebesell, Germany & J.-P. Gattuso, France

## **Bibliographic database**

J.-P. Gattuso, France

## **Data management**

J.-P. Gattuso, France



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Coordination Centre  
OA-ICC



# CAPACITY BUILDING

*‘Help train tomorrow’s experts on ocean acidification’*



---

**Regional training courses**

L. Robbins, USA

**Participation of scientists from eligible countries in international meetings**

**Regional coordination meetings**



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# COMMUNICATION

*‘Serve as a hub of information for different audiences (scientists, policy makers, media...)’*



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**Exhibits, side events, publications (in cooperation with the Ocean Acidification International Reference User Group; OA-iRUG)**

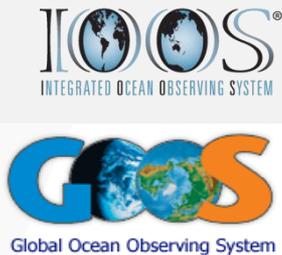
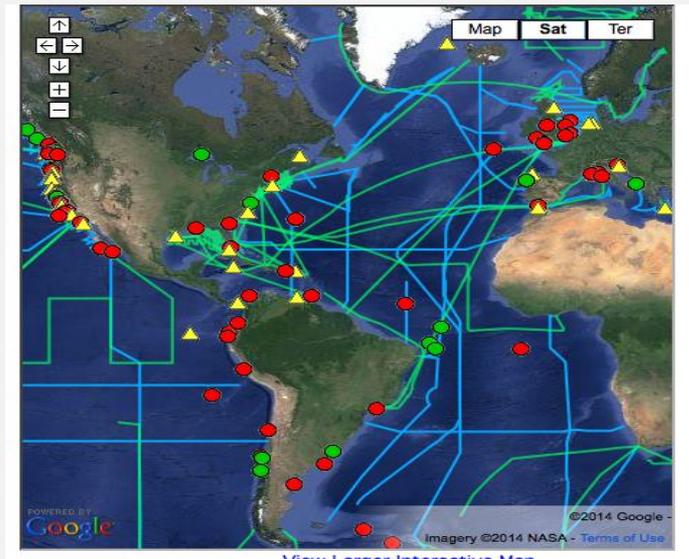
D. Laffoley, UK & C. Turley, UK

**Web site & news stream**

**Distribution of material**



- 2 international workshops (Seattle 2012 and St Andrews 2013)
- 155 members from 30 countries
- Co-chairs: L. Jewett (NOAA OAP, USA) and B. Tilbrook (CSIRO, Australia)
- Strategy outlined in GOA-ON Plan (Goals, Levels)
- Friends of GOA-ON



## Upcoming

- Expert workshops (data portal and synthesis products)
- Defining EOVs, Biology Working Group, fill gaps (e.g. Africa)
- Training course, Mozambique (S. Dupont)
- 3d scientific meeting Hobart, 8-10 May 2016, following the 4<sup>th</sup> Ocean in a High CO<sub>2</sub> World Symposium (focus on biology)

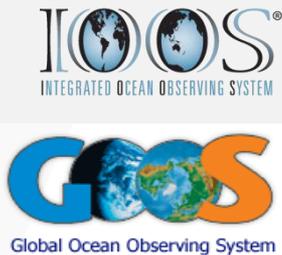
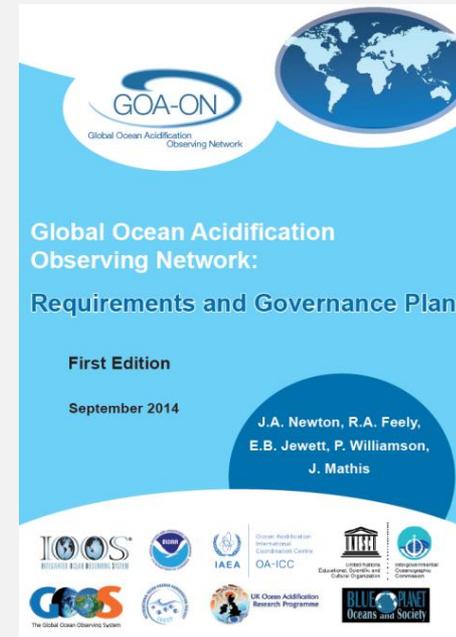
## Get involved

[www.goa-on.org](http://www.goa-on.org)

[info@goa-on.org](mailto:info@goa-on.org)

Newsletter

Next workshop: Hobart, May 2016





## Joint platforms and experiments

### Goal

Promote international collaboration and provide access to “platforms” (lab, ship, experiment, facility...)

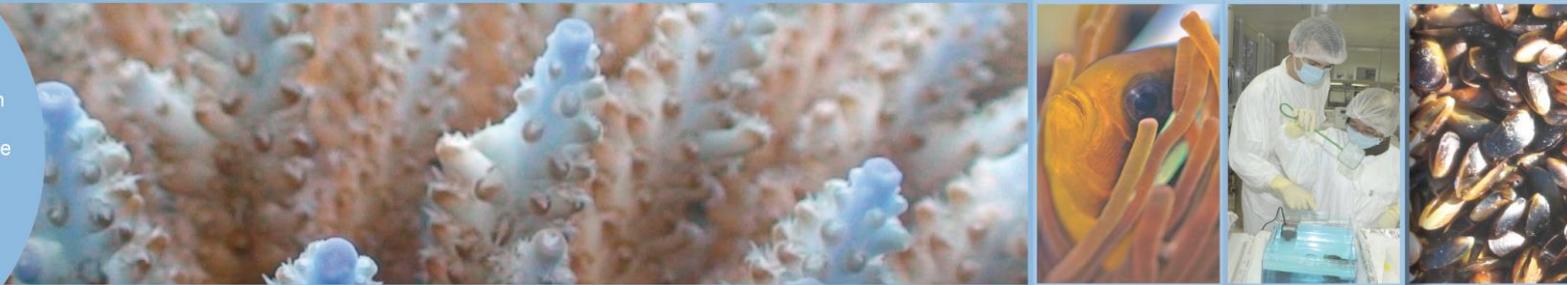
### Approach

- Travel support – challenging to implement
- Information sharing: OA-ICC web site
  - Links to various facilities
  - Short list of collaboration opportunities





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## Human dimension – collaboration between natural and social scientists

### Goal

Facilitate interactions between natural and social sciences to advance understanding of the impacts of ocean acidification on human society

### Approach

International workshops to bridge gap between ocean acidification impacts and socio-economic valuation (CSM & IAEA), recommendations, publications

The brochure cover features the IAEA and OA-ICC logos at the top left, and the Monaco Scientific Centre logo at the top right. The title 'OCEANOGRAPHIC MUSEUM, PRINCIPALITY OF MONACO.' is prominently displayed in blue. Below it, the subtitle 'OCEAN ACIDIFICATION IMPACTS ON COASTAL COMMUNITIES' is followed by 'Summary for policymakers from the Third International Workshop'. A large image of coral reefs is shown with the text 'Bridging the Gap between Ocean Acidification and Economic Valuation'. The date '12-14 January 2015' is listed. A portrait of H.S.H. Prince Albert II of Monaco is included, along with a quote: 'Ocean acidification is, believe it or not, one of the greatest scourges resulting from the considerable development of anthropogenic greenhouse gas emissions, to have both concrete and global impact.' The bottom of the cover lists organizing institutions: Prince Albert II of Monaco Foundation, Gouvernement Princier Principauté de Monaco, Institut océanographique, and IUCN, along with other logos and a link to the list of participants.



## Intercomparison

### Goal

Support intercomparison of key ocean acidification variables and software

### Approach

Support international intercomparison exercises:

- software comparison, extended (error propagation and buffer factors)
- calcification (compare methods)



## Comparison of ten packages that compute ocean carbonate chemistry

J. C. Orr<sup>1</sup>, J.-M. Epitalon<sup>2</sup>, and J.-P. Gattuso<sup>3,4</sup>

<sup>1</sup>LSCE/IPSL, Laboratoire des Sciences du Climat et de l'Environnement, CEA

<sup>2</sup>Geoscientific Programming Services, Fanjeaux, France

<sup>3</sup>CNRS-INSU, Laboratoire d'Océanographie de Villefrance, Villefranche-sur-

<sup>4</sup>Sorbonne Universités, UPMC Univ. Paris 06, Observatoire Océanologique, V



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## Best Practices

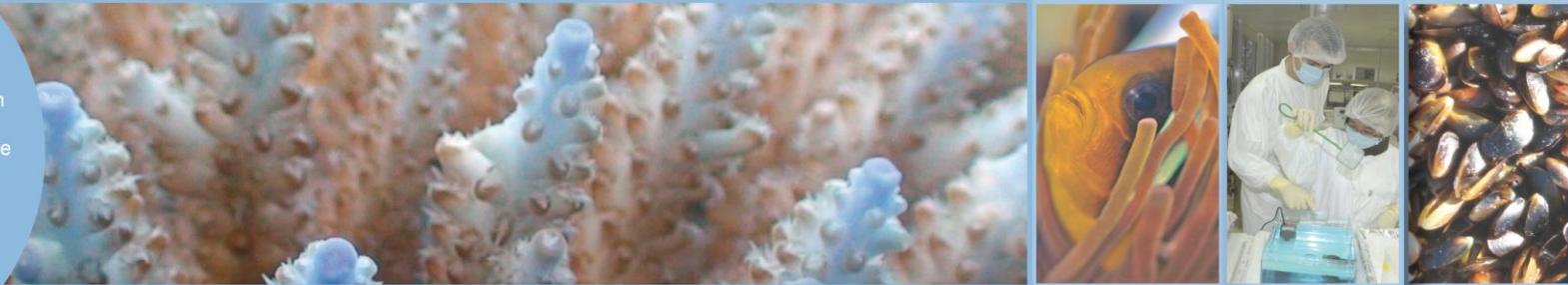
### Goal

Provide access to internationally standardized protocols for observational and experimental approaches and data reporting, to promote quality and comparability of results

### Approach

- Addendum, update not foreseen
- Share information (guide distribution, web site and news centre)





## OA-ICC bibliographic database

### Goal

Provide access to a comprehensive list of bibliographic references on ocean acidification

### Approach

On-line open access searchable bibliographic database on Mendeley (currently more than 2700 references)

#### User instructions



#### Ocean Acidification (OA-ICC)

Owned by Ocean Acidification International Coordination Centre

The OA-ICC bibliographic database is based on a initiative developed by Jean-Pierre Gattuso (CNRS/UPMC) in 1995. The database continued to evolve and was maintained as part of the EU project EPOCA ([www.epoca-project.eu](http://www.epoca-project.eu)) from 2008 to 2012. In July 2012, the maintenance and update of the database became one of the activities of the IAEA Ocean Acidification International Coordination Centre (OA-ICC). More information and user instructions are available at [www.iaea.org/ocean-acidification](http://www.iaea.org/ocean-acidification).

#### Recent papers in this group



**Novel methodology for assessing phytoplankton response to pCO<sub>2</sub> enrichment in fresh and saltwater**

S B Gifford  
, Volume: MSc thesis (2011)



**Swimming performance in Atlantic Cod (*Gadus morhua*) following long-term (4-12 months) acclimation to elevated sea water PCO<sub>2</sub>**

F Meizner, S Göbel, M Langenbuch, M A Gutowska, H-O Pörtner, M Lucassen  
*Aquatic Toxicology*, Volume: 92 (2009)



**Elevated seawater pCO<sub>2</sub> differentially affects branchial acid-base transporters over the course of development in the cephalopod *Sepia officinalis***

M Y-A Hu, Y-C Tseng, M Stumpp, M A Gutowska, R Kiko, M Lucassen,  
*American Journal of Physiology*, Volume: 300, Issue: 5 (2011)



**The effect of ocean acidification on symbiont photorespiration and productivity in *Acropora formosa***

A Crawley, D I Kline, S Dunn, K Anthony, S Dove  
*Global Change Biology*, Volume: 16 (2010)



**Pteropods from the Caribbean Sea: variations in calcification as an indicator of past ocean carbonate saturation**

D Wall-Palmer, M B Hart, C W Smart, R S J Sparks, A Le Friant, G Boudon, et al.  
*Biogeosciences*, Volume: 9 (2012)



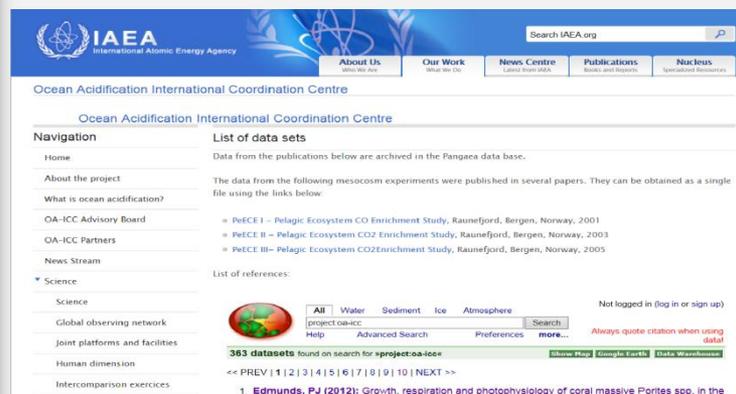
## Data management

### Goal

- Facilitate coordination of OA data archiving efforts and promote data sharing (experimental and GOA-ON).
- Compile published data on the biological impacts of ocean acidification and make openly accessible.

### Approach

- OA-ICC Data compilation
- Expert workshops on international management of ocean acidification data (common metadata templates, vocabularies, ultimately joint data portals)



IAEA International Atomic Energy Agency

Search IAEA.org

Ocean Acidification International Coordination Centre

Ocean Acidification International Coordination Centre

Navigation

- Home
- About the project
- What is ocean acidification?
- OA-ICC Advisory Board
- OA-ICC Partners
- News Stream
- Science
- Global observing network
- Joint platforms and facilities
- Human dimension
- Intercomparison exercises

List of data sets

Data from the publications below are archived in the Pangaea data base.

The data from the following mesocosm experiments were published in several papers. They can be obtained as a single file using the links below.

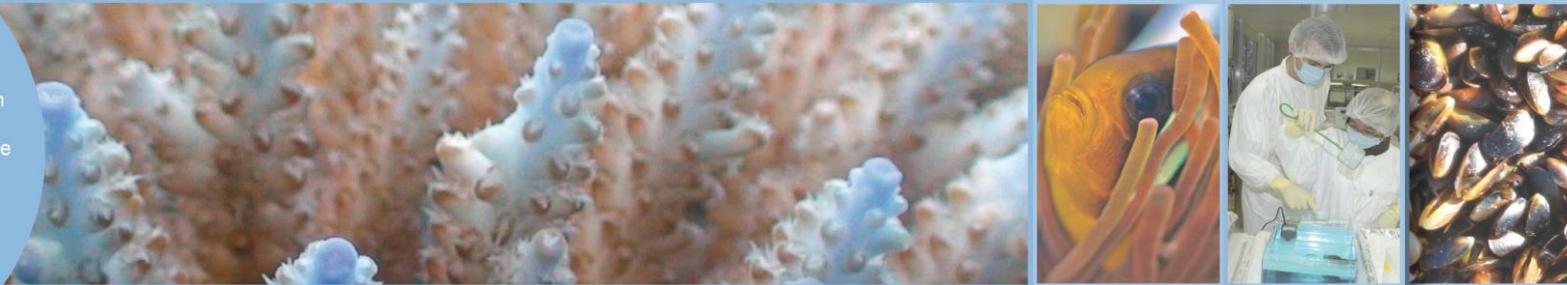
- PECE I – Pelagic Ecosystem CO<sub>2</sub> Enrichment Study, Raunefjord, Bergen, Norway, 2001
- PECE II – Pelagic Ecosystem CO<sub>2</sub> Enrichment Study, Raunefjord, Bergen, Norway, 2003
- PECE III– Pelagic Ecosystem CO<sub>2</sub>Enrichment Study, Raunefjord, Bergen, Norway, 2005

List of references:

1 Edmunds, P.J (2012): Growth, respiration and photophysiology of coral massive *Pocillopora* spp. in the

363 datasets found on search for project-oa-icc

<< PREV | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | NEXT >>



## OA-ICC Data Compilation

<http://tinyurl.com/oaicc-data>

### Background:

Numerous problems for data comparison (pH reported in different scales, carbonate chemistry calculated using different dissolution constants)

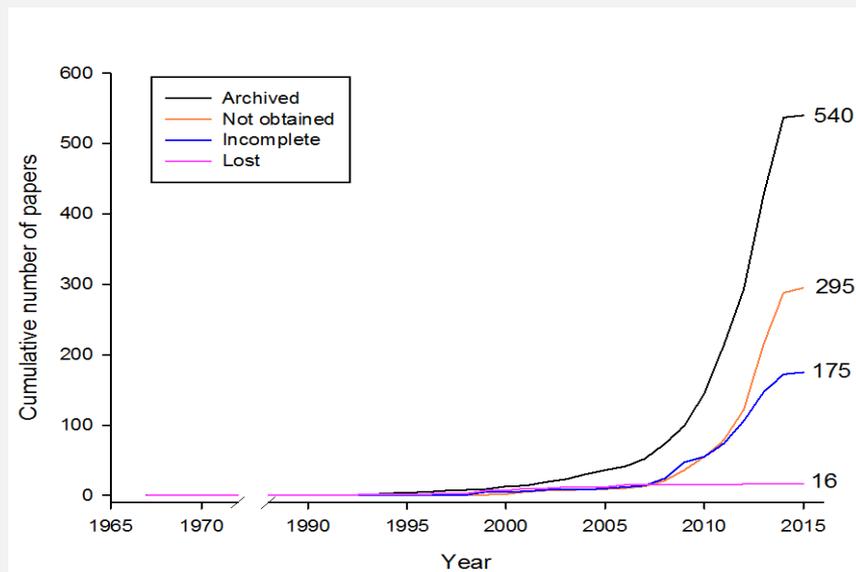
EPOCA/EUR-OCEANS (2007), OA-ICC since 2012, in coop. with Xiamen Univ. and Pangea

Data from 540 papers to date

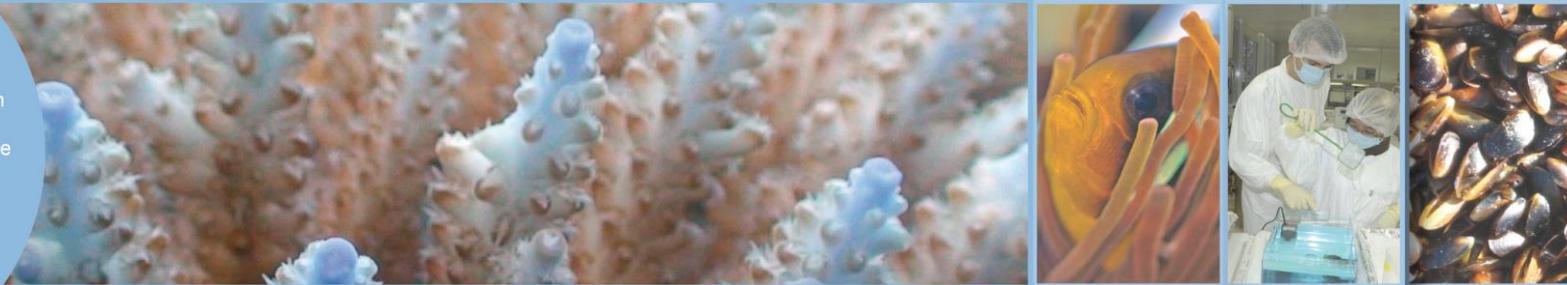
### Challenges:

Slow feedback from authors (50% success rate)

Different names for the same variable (e.g. primary production/carbon fixation/POC production)



Not obtained: papers for which data could not be obtained  
 Incomplete: papers which reported less than two carbonate system parameters  
 Lost: data lost by authors



## Recommendations/guidelines (Gattuso et al.)

---

At least two of the carbonate system parameters, + S, t, hydrostatic pressure :

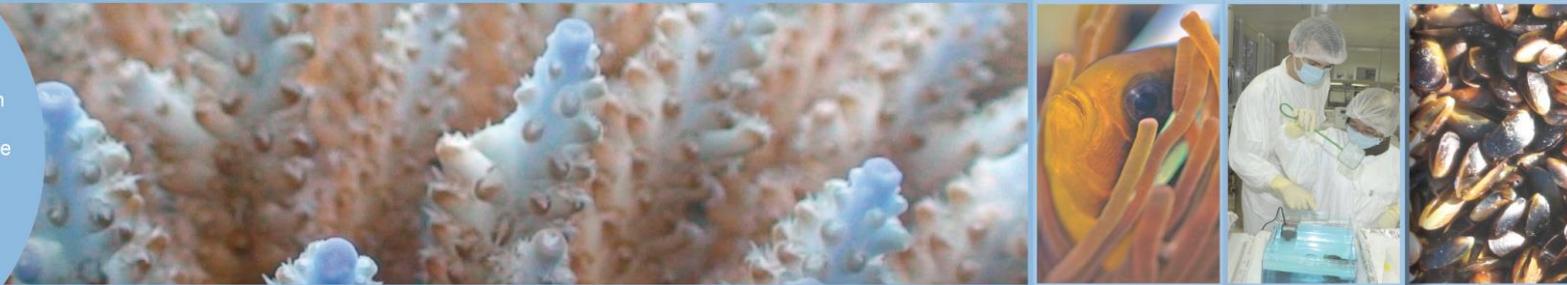
- Dissolved inorganic carbon (CT;  $\mu\text{mol kg}^{-1}$ )
- Total alkalinity (AT;  $\mu\text{mol kg}^{-1}$ )
- pH (it is critical to mention its scale; see below)
- Partial pressure of carbon dioxide ( $p\text{CO}_2$ ;  $\mu\text{atm}$ )
- Fugacity of carbon dioxide ( $f\text{CO}_2$ ;  $\mu\text{atm}$ )
- Carbonate ion concentration ( $\text{CO}_3^{2-}$ ;  $\mu\text{mol kg}^{-1}$ )

Concentrations of total dissolved inorganic phosphorus and total dissolved inorganic silicon (in  $\mu\text{mol kg}^{-1}$ ) whenever possible

How the parameters were measured and protocol followed.

Certified Reference Materials, source, and batch numbers

pH scale (NBS, free, total, or seawater)



## Recommendations/guidelines (Gattuso et al.)

---

Temperature at the time of sampling and at the time of measurement, if different.

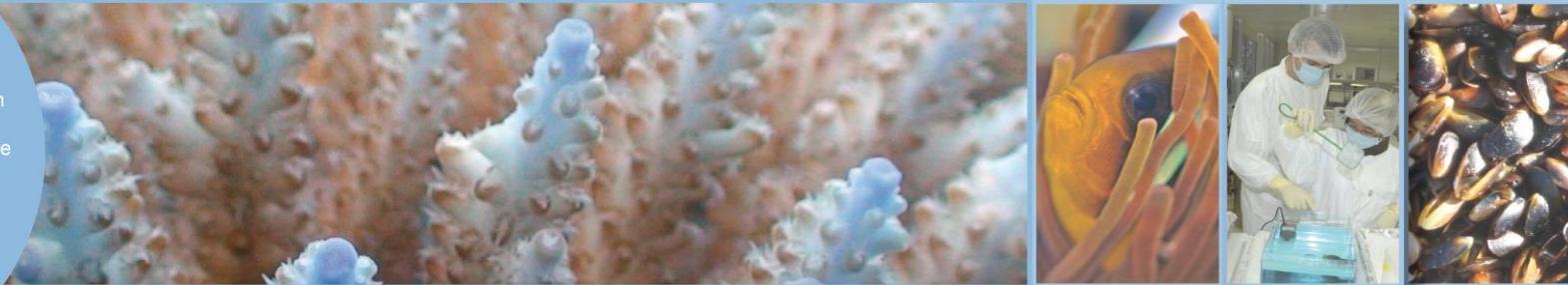
Formulations used to calculate:

- Concentrations of total boron
- CO<sub>2</sub> solubility ( $K_0$ )
- Dissociation constants of carbonic acid ( $K_1$  and  $K_2$ ), boric acid ( $K_b$ ), water ( $K_w$ ), phosphoric acid ( $K_{p1}$ ,  $K_{p2}$ ,  $K_{p3}$ ), silicic acid ( $K_{si}$ ), hydrogen fluoride ( $K_f$ ), and bisulfate ( $K_s$ )
- Solubility products of calcite ( $K_{spc}$ ) and aragonite ( $K_{spa}$ )

Software package used to calculate the carbonate chemistry, version number, and any associated options.

Average reproducibility of the performed measurements (with number of measurements)

Strongly recommended that the chemistry and biological data are either archived in an on-line database (preferred) or provided along with the paper as supplementary information.



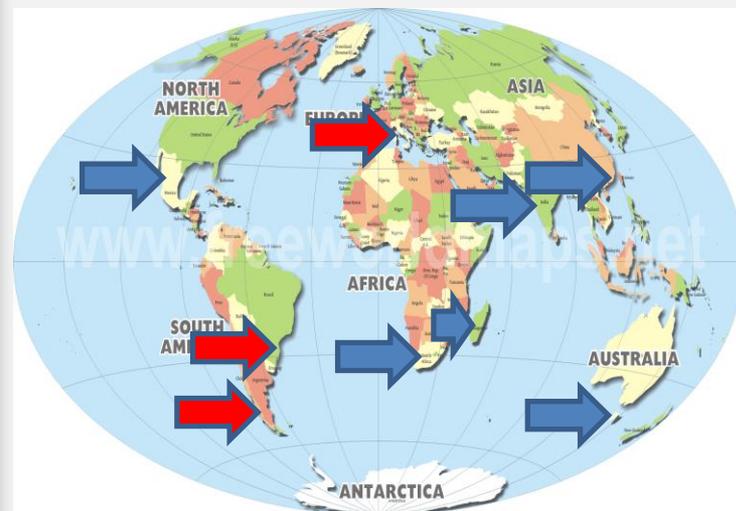
## Capacity building

### Goal

Provide scientists entering the field access to training to be able to set up pertinent experiments, avoid typical pitfalls and ensure comparability with other studies.

### Approach

- Training courses (Latin America, Asia, Africa)
- Information sharing and networking (web site and news centre)
- Regional coordination meetings
- Support to present results at conferences





## Communication and knowledge exchange

### Goal

To ensure that information on ocean acidification is communicated to key end users in an effective way.

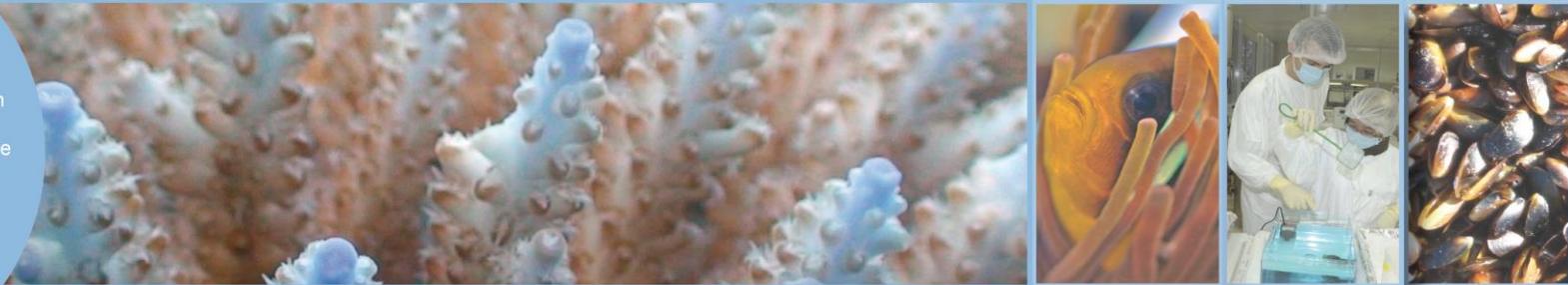
### Approach

- Web site and news stream
- Brochures (close collaboration with OA-iRUG)
- Side events, exhibit stands (e.g. at UNFCCC COPs), in coop. with many partners (UKOA, IOC...)





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## OA-ICC key online resources

### OA-ICC web site

[iaea.org/ocean-acidification](http://iaea.org/ocean-acidification)

### OA-ICC news stream

[news-oceanacidification-icc.org](http://news-oceanacidification-icc.org)

### OA-ICC data compilation

<http://tinyurl.com/oaicc-data>

### OA-ICC bibliographic database

<http://tinyurl.com/oaicc-biblio>

The image shows two screenshots of the OA-ICC website. The top screenshot is the main website page, featuring the IAEA logo, navigation tabs (About Us, Our Work, News Centre, Publications, Nucleus), and a banner with the text "PROMOTING GLOBAL COOPERATION IN A CHANGING OCEAN WORLD". The bottom screenshot is a news stream article titled "Seagrass ecosystem response to long-term high CO2 in a Mediterranean volcanic vent". The article text includes: "We examined the long-term effect of naturally acidified water on a *Cymodocea nodosa* meadow growing at a shallow volcanic CO2 vent in Vulcano Island (Italy). Seagrass and adjacent unvegetated habitats growing at a low pH station (pH = 7.65 ± 0.02) were compared with corresponding habitats at a control station (pH = 8.21 ± 0.01). Density and biomass showed a clear decreasing trend at the low pH station and the below- to above-ground biomass ratio was more than 10 times lower compared to the control. C content and δ13C of leaves and epiphytes were significantly lower at the low pH station. Photosynthetic activity of *C. nodosa* was stimulated by low pH as seen by the significant increase in Chla content of leaves, maximum electron transport rate and compensation irradiance. Seagrass community metabolism was intense at the low pH station, with significantly higher net community production, respiration and gross primary production than the control community, whereas metabolism of the unvegetated community did not differ between stations. Productivity was promoted by the low pH, but this was not translated into biomass, probably due to nutrient limitation, grazing or poor environmental conditions. The results indicate that seagrass response in naturally acidified conditions is dependant upon species and geochemical characteristics of the site and highlight the need for a better understanding of complex interactions in these environments." The article also includes a "Share this post!" section with social media icons and a "Mendeley" link.



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## **More great OA resources!**

**BIOACID web site and Facebook page**

**NOAA OAP web site and Twitter**

**UK Ocean Acidification Research Programme web site**

**[www.ocean-acidification.net](http://www.ocean-acidification.net) (IGBP/IOC/SCOR)**

**MedSeA, EPOCA legacy**

**OCB Ocean Acidification page**



## Don't be strangers! 😊

- Let us know about your projects/progress
- Participate in community efforts
- Make use of resources and provide feedback
- Look out for opportunities



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# Thank you!

## **Web site**

*[iaea.org/ocean-acidification](http://iaea.org/ocean-acidification)*

## **News stream**

*[news-oceanacidification-icc.org](http://news-oceanacidification-icc.org)*

## **Data compilation**

*<http://tinyurl.com/oaicc-data>*

## **Bibliographic database**

*<http://tinyurl.com/oaicc-biblio>*