



Ocean Acidification  
International  
Coordination Centre  
**OA-ICC**



# OCEAN ACIDIFICATION IMPACTS ON COASTAL COMMUNITIES

Summary for policymakers from the Third International Workshop



**“Bridging the Gap between Ocean Acidification and Economic Valuation”**

OCEANOGRAPHIC MUSEUM,  
PRINCIPALITY OF MONACO.

12-14 January 2015

The Third International Workshop on the Socio-Economic Impacts of Ocean Acidification gathered 53 experts from the natural and social sciences from 20 countries. The workshop considered how ocean acidification could affect different coastal communities and identified potential solutions. Despite uncertainties, particularly related to combined effects with other major environmental stressors, we know enough to act, and action should be taken now. This brochure summarizes the main results from the workshop discussions.



HSH Prince Albert II - © Palais Princier

«Ocean acidification is, I believe, one of the greatest scourges resulting from the considerable development of anthropogenic greenhouse gas emissions, to have both concrete and global impact.»

**H.S.H. Prince Albert II of Monaco**

The workshop was organized by the Monaco Scientific Centre (CSM) and the Ocean Acidification International Coordination Centre (OA-ICC) of the International Atomic Energy Agency (IAEA), with the support of:



For list of participants

# SETTING THE SCENE



## Ocean acidification and coastal communities

Ocean acidification is a change in seawater chemistry caused by the absorption of growing atmospheric CO<sub>2</sub> by the ocean. A high-CO<sub>2</sub> ocean is predicted to have effects on marine organisms, including species upon which the economies of coastal communities depend. This could be through direct impacts on commercial species like shellfish, or indirectly via food web interactions and loss of marine habitats, such as coral reefs. These effects are inextricably linked to the impact of other stressors on marine species and ecosystems, such as warming, pollution and overfishing.

**This workshop focused on the socio-economic impacts of ocean acidification on coastal communities. Discussions centered around three main topics:**

- 1) coastal economic activities with an emphasis on fisheries, aquaculture and tourism;
- 2) modelling as a tool to evaluate bio-socio-economic impacts of ocean acidification;
- 3) potential measures to tackle ocean acidification including societal action and adaptation, governance and legislation options.

## KEY MESSAGES

■ Communities and activities most at risk include:

- small scale fisheries and mariculture in developing countries;
- poorer communities and social groups dependent on subsistence fisheries, with potential gender inequalities;
- economies reliant on aquaculture or threatened ecosystems, such as coral reefs;
- poorly diversified local economies.

■ Economic impacts of ocean acidification on tourism may include loss of profits and employment, as well as loss of tourist infrastructure due to decreased storm protection from reefs.

■ Reducing the root cause of ocean acidification – CO<sub>2</sub> emissions – must remain the primary goal, even if adaptation options can be considered to buy time.

■ Adaptation methods include behavioral change, infrastructure investment and building economic resilience through loans, tax credits, taxes, insurance, prizes and risk pooling.

■ Governance reforms should include mitigation and adaptation actions at national and sub-national, as well as multi-lateral collaboration, capacity building and technology transfer.



■ Build capacity and awareness of ocean acidification at influencer-level and to include it in national education agendas.

■ There are significant gaps in our ability to characterize and model the local/regional ocean acidification processes and their impacts on the food supplies and ecosystem.

■ Open-ocean models on ocean acidification are not applicable to coastal assessment and there are currently very few socio-economic models at a relevant scale for use by coastal communities and managers.

■ Ocean acidification impacts need to be assessed in relation to existing trends, e.g. declining labour and incomes in capture fisheries; growth of aquaculture; and the impacts of other environmental stressors.

# THE FIVE THEMATIC AREAS COVERED BY THE WORKSHOP



## Fisheries and aquaculture

About 38% of global marine capture fisheries production is harvested by small-scale fishers. Small-scale producers account for about 88% of the aquaculture and 85% of the capture fisheries workforce (50% are women).

Over 95% of small-scale fishers live in developing countries with an estimated 6 million reef fishers in some 100 countries and territories worldwide.

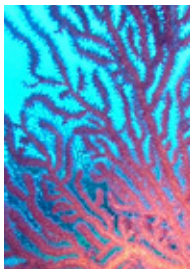
Small-scale producers, subsistence fisheries, poorer fishing communities and populations that are heavily dependent on fisheries and aquaculture for their food and revenues (from seafood production, trade and/or tourism) are potentially more vulnerable to ocean acidification.



## Marine-based tourism

Tourism is a primary source of revenues in 46 out of 50 of the world's least developed countries. The global value of coral reef-based tourism was estimated at 11.5 billion USD in 2010 and diving tourism is increasing by 20% a year, four times faster than global tourism. More than 100 countries benefit from tourism associated with coral reefs, many of which are Small Island Developing States (SIDS).

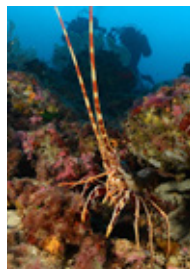
About 60% of the world's coral reefs are threatened by various environmental stressors, including ocean acidification. This is expected to increase to 90% in 2030, and nearly 100% by 2050.



## Modelling as a tool to evaluate bio-socio-economic impacts

While modelling of the chemistry of ocean acidification and of the direct effects on some key habitats and commercial species is reasonably well advanced, modelling of impacts on other components of marine socio-ecological systems and processes is very limited due to a lack of knowledge on the general principles and mechanisms behind biological and human response.

Improving models of the biophysical, economic and social impacts of ocean acidification on coastal systems will provide essential input to policy development and decision-making in local resource and environmental management.



## Societal action and adaptation

Societal action to tackle ocean acidification includes mitigation, adaptation or a mix of both. Human adaptation is necessary but may be difficult, costly, and economically and culturally disruptive. Current geoengineering methods may be feasible locally, but not cost-efficient, practical or ethical.

Poorly planned adaptive measures have the potential to create inequalities between populations that can adapt (large, well-financed industries or countries) and those that cannot (subsistence fishermen, poorer countries). Examples of local adaptation actions to improve ecosystem health and resilience include reducing fishing pressures, establishment of marine protected areas and reduction in nutrient inputs.



## Governance, governments and legislation

Governance tools and legislation can help in limiting the source of ocean acidification (CO<sub>2</sub> emissions), reducing its impacts and protecting coastal environments and communities.

Positive examples of successful management of other ocean pollutants have demonstrated how, through appropriate policies, legal framework and international agreements, transboundary issues such as ocean acidification can be addressed.

# WHAT CAN COMMUNITIES DO?

## RESEARCH NEEDS



### Information for Decision-making

- Improve awareness and knowledge at all levels, including on ocean acidification science, on the costs and effectiveness of adaptation and mitigation actions, and disseminate knowledge of lessons learnt and best practices.
- Support and extend research initiatives on ocean acidification and linked stressors, including monitoring, particularly for vulnerable coastal communities.
- Develop transdisciplinary food-web models for species of interest (capture and cultural) that begin to address the complexities of the coastal system and the potential impact on human well-being.
- Develop good practice two-way communication between scientists and end users.

## LOCAL & NATIONAL MANAGEMENT



### Adaptive Management to Address Complexity

- Improve coastal ecosystem resilience through effective fisheries and aquaculture management, restoration of fish stocks and biodiversity.
- Build community resilience by supporting diversified coastal community economies and increasing community engagement in co-management, e.g. fisheries.
- Explore innovative financing for adaptation (tourist taxes, user fees, public-private partnerships).
- Build ecosystem resilience by reducing local stress factors and creating marine protected areas.
- Broaden opportunities for coastal communities by developing tourism attractions based on healthy reef systems and potential alternative leisure activities.

## INTERNATIONAL POLICY



### Dynamic Leadership to Facilitate Change

- Work to achieve urgent reduction in CO<sub>2</sub> emissions. We have very little time to reach substantial cuts in emissions and avoid tipping into dangerous zones.
- Place ocean acidification, along with other climate change drivers, as a high priority for more countries.
- Mainstream ocean acidification into global, regional and national policies, plans and investment strategies for climate change, for oceans, and in fisheries and coastal management.
- Foster public and private investment in social, economic and environmental capital in communities and regions considered most vulnerable.
- Protect blue carbon sinks and design tools to include them in carbon trading.
- Make ocean acidification projects eligible to the Green Climate Fund.