GOA-ON

Global Ocean Acidification Observing Network

The Global Ocean Acidification Observing Network

CSIRO

IMOS Integrated Marine Observing System

UNESCO United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

IOOS Integrated Ocean Observing System

IAEA Ocean Acidification International Coordination Centre OA-ICC

The Ocean Foundation

International Ocean Carbon Coordination Project IOCCP

GOA-ON:

The **Global Ocean Acidification Observing Network** (GOA-ON) is a **international partnership** to:

1. **Document the status and progress of ocean acidification** in open-ocean, coastal, estuarine, and coral reef environments,

2. **Understand the impacts of ocean acidification on diverse marine ecosystems and societies**, and

3. **Support forecasts of ocean acidification conditions.**

www.goa-on.org

GOA-ON will provide:

Goal 1 An understanding of **<u>global OA conditions</u>**

Identify spatial/temporal patterns and assess generality of response; document and assess variation to infer driving mechanisms; quantify rates of change

Goal 2 An understanding of **<u>ecosystem response to OA</u>**

Track biological responses to physical/ chemical changes; quantify rates of change and identify areas and species of vulnerability or resilience

Goal 3 Data to **<u>optimize modeling for OA & impacts</u>**

Acquire and exchange spatially and temporally-resolved chemical and biological data to be used in developing models for societally-relevant analyses and projections

GOA-ON Plan:

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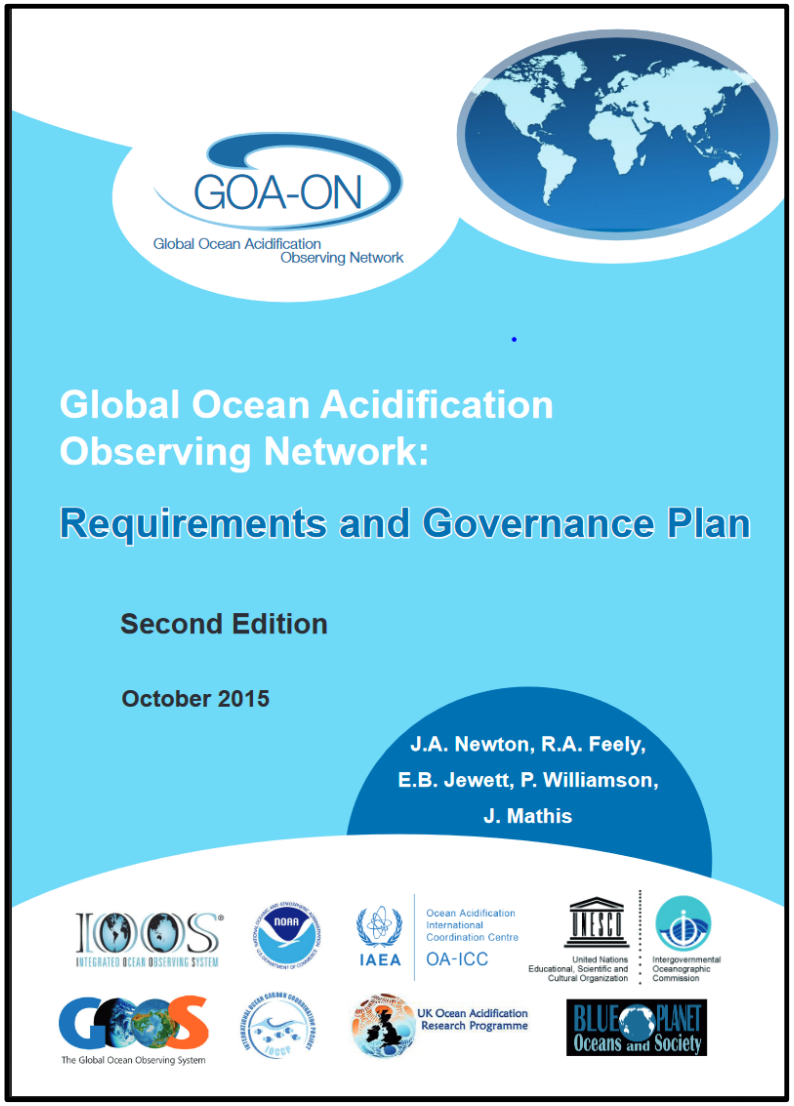

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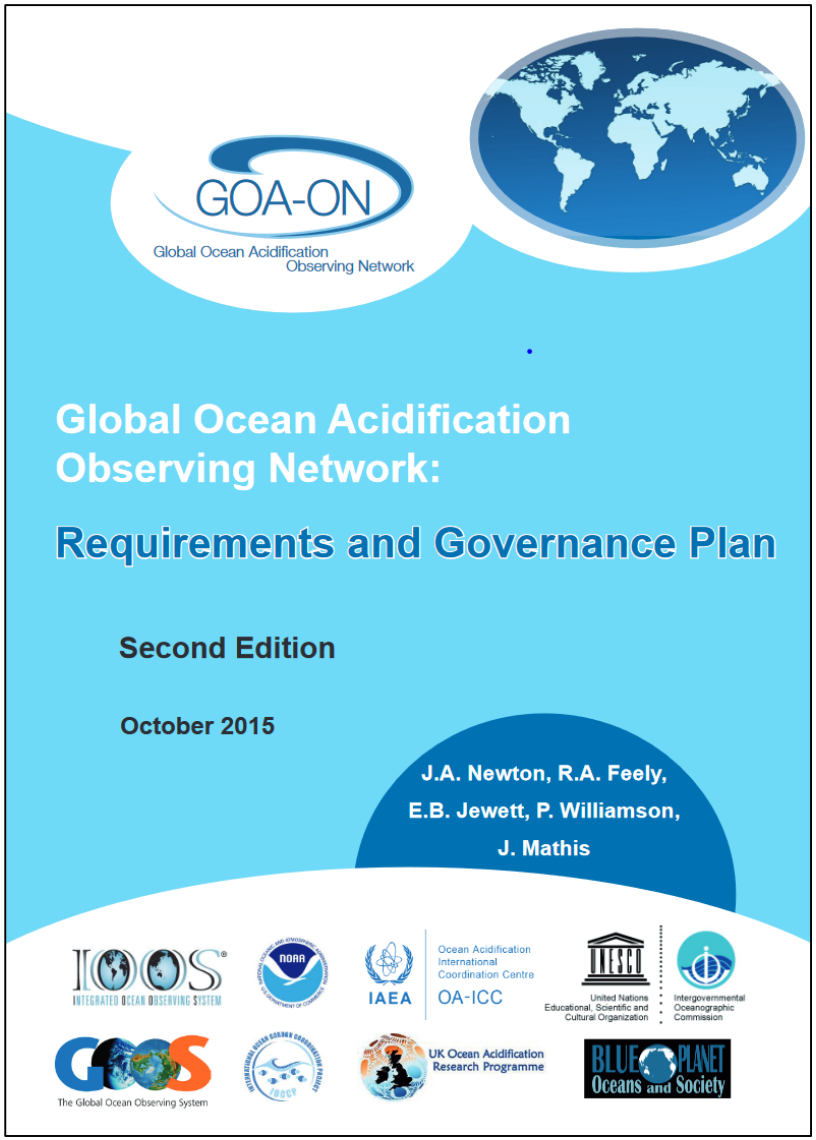
Requirements and Governance Plan:

- *Rationale*
- *Goals*
- *Design*
- *Suite of measurement parameters*
- *Data quality and data distribution strategies*
- *International program integration*

Draft in review as of Dec 2017



GOA-ON has a nested system design

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Coral reefs

Coasts & shelf seas

Open ocean

Goal 1 OA conditions	Goal 2 Ecosystem response	Goal 3 OA modeling
Level 1	*Level 1*	Inputs to models
Level 2	*Level 2*	
Level 3	*Level 3*	

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Goal 1 OA conditions	Goal 2 Ecosystem response	Goal 3 OA modeling
L1: carbonate-system constraint, T, S, O, *fluorescence, irradiance* *L2:* nutrients, bio-optics, transport, meteorology, trace metals... *L3:* capability-specific	*L1:* biomass of functional groups (phytoplankton, zoo-plankton & microbes) *L2:* species; processes incl. growth, grazing & respiration *L3:* capability-specific	Inputs to models

GOA-ON Goal 1 Level 1

The following five parameters were considered to be the minimum suite of Goal 1 Level 1 measurements (in addition to time and space coordinates, as detailed as practically feasible), applicable to all marine environments:

- Temperature
- Salinity
- Pressure (water depth at which measurement is made)
- Oxygen concentration
- Carbon-system constraint, achievable in a number of ways, including combinations of direct measurements and estimates of other parameters, such as nutrients or alkalinity (see Box 3).

Two further parameters were considered necessary, except where the platform is not appropriate or available for such measurements:

- Fluorescence
- Irradiance

GOA-ON defined two data quality objectives:

- '**Climate data**': of sufficient and defined quality to assess long term trends with defined level of confidence

  Detection of changes in OA state over multi-decadal timescales

- '**Weather data**': of sufficient and defined quality to identify relative spatial patterns and short-term changes

  Mechanistic interpretation of the ecosystem response to local, immediate OA dynamics

From GOA-ON Implemen. Strategy Draft

Measuring Climate and Weather

- The climate objective requires an uncertainty of approximately ±2 µmol kg–1 in measurements of total alkalinity (TA) and total dissolved inorganic carbon (DIC); and a relative uncertainty of about 0.5% in the partial pressure of carbon dioxide (pCO_2). Such precision is only currently achievable by a very limited number of laboratories.
- The weather objective requires the carbonate ion concentration (used to calculate saturation state) to have a relative standard uncertainty of 10%. This implies an uncertainty of approximately 0.02 in pH; of 10 µmol kg–1 in measurements of TA and DIC; and a relative uncertainty of about 2.5% in pCO_2. Such precision should be achievable in competent laboratories, and is also achievable with the best autonomous sensors.

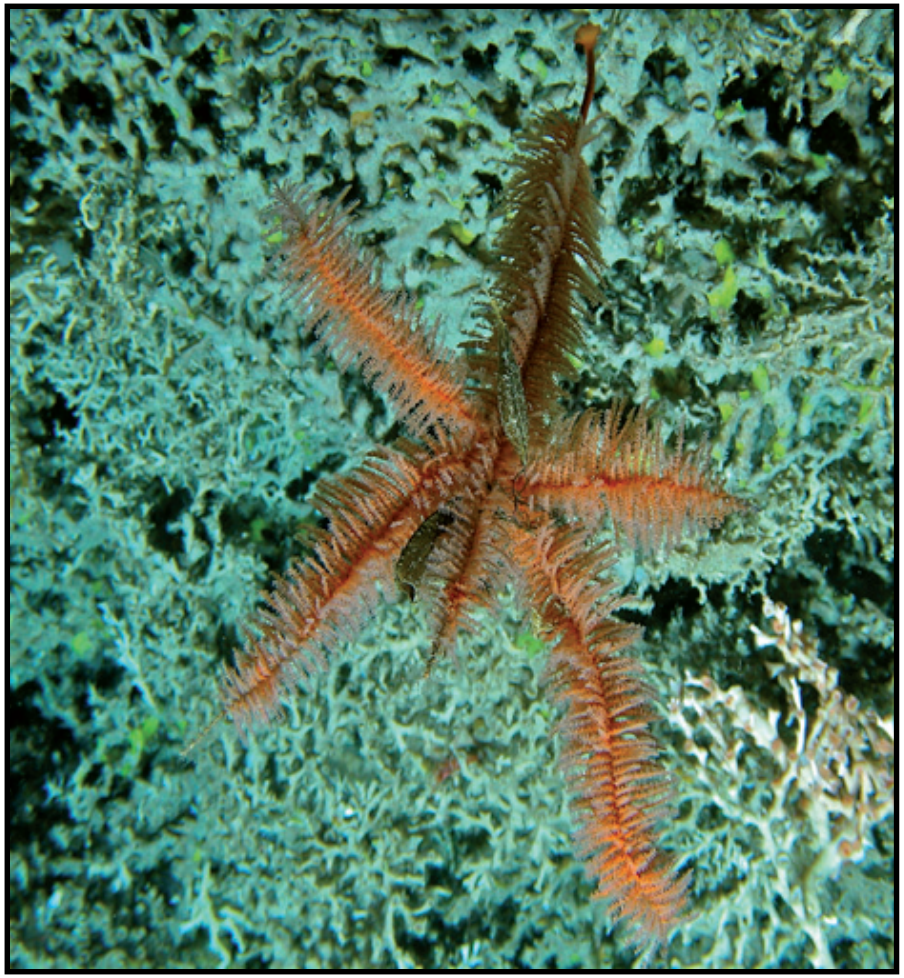
GOA-ON requirements:

Capacity for

- Physical infrastructure
- Intellectual infrastructure
- Operations and maintenance
- Data QA/QC
- Analytical and synthesis activities

Observations across various ecosystems:

- Open ocean: polar, temperate, tropical
- Coasts and estuaries
- Coral reefs



Utilizing various platforms:

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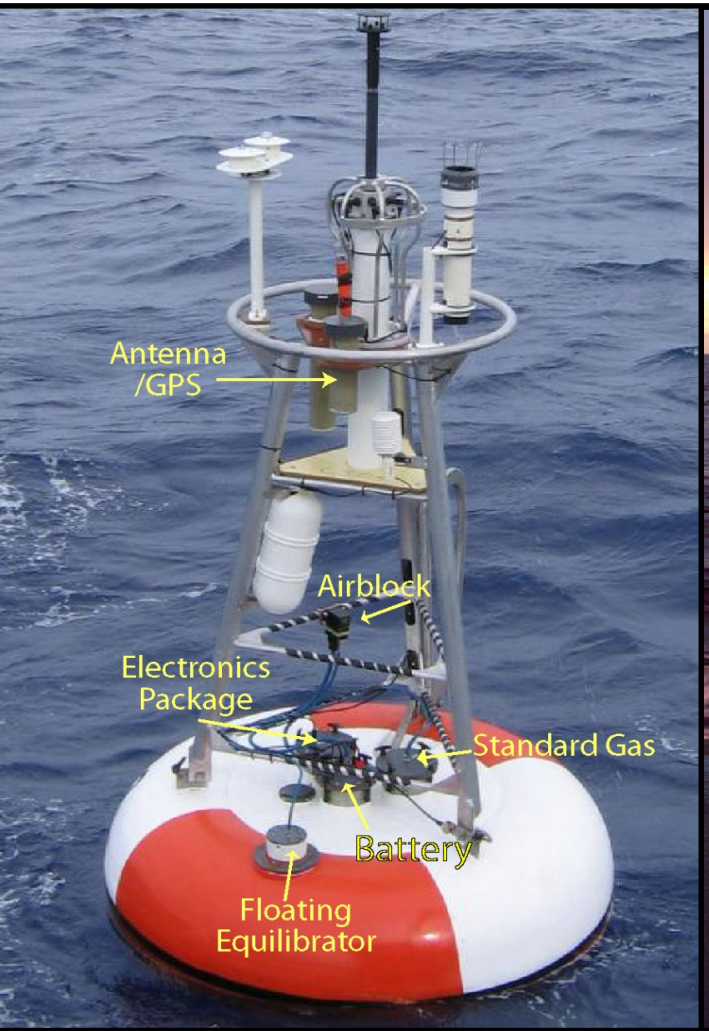
– Ship-based surveys & volunteer observing ships
– Moorings & piers
– Gliders & floats



100 m ↑ ↓ 2 m

End-uses of GOA-ON information:

- **International policy** including carbon emission policies
- **Food security and livelihoods**
  - **Fisheries**
  - **Shellfish aquaculture**
  - **Coral reefs**
- **Shore protection, tsunami protection** from coral reefs
- **Cultural identity**
- **Tourism**