



Global Ocean Acidification Observing Network (GOA-ON)  
6<sup>th</sup> Annual Executive Council Meeting  
Hangzhou, China, 13 & 18 April 2019



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## 1. Objectives of the meeting

The Global Ocean Acidification Observing Network (GOA-ON) held its 6<sup>th</sup> Annual Executive Council (EC) meeting at the Zhejiang Hotel in Hangzhou, China on the 13. and 18. April 2019. The objectives of this meeting were for the group to provide updates on GOA-ON's activities since the last in-person EC meeting held in Sopot, Poland, 28-30 May 2018, as well as to discuss upcoming activities, current needs for the global ocean acidification community, and future priorities. This meeting was held the day prior to, and the day following the 4<sup>th</sup> GOA-ON International Workshop, where over 250 scientists and industry representatives from more than 60 countries attended, and therefore the GOA-ON EC meeting included discussions on the outcomes from this workshop. The Executive Council also addressed the SDG 14.3.1 data reporting process, advancements of regional hubs, communication products, and the network's participation at upcoming international meetings, including OceanObs'19, Oceans in a High CO<sub>2</sub> World 2020 meeting, and the UNFCCC COP25.

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### DAY 1

## 2. Welcome

Welcome from the local host Fei Chai, director of the State Key Laboratory of Satellite Ocean Environment Dynamics. The GOA-ON co-chairs Libby Jewett and Bronte Tilbrook also welcomed the Executive Council.

## 3. Introductions and welcome to new attendees and Secretariat

Tour de table with all attendees. Two new Executive Council members were introduced, Kim Currie (National Institute of Water and Atmospheric Research, New Zealand) and Abed El Rahman Hassoun (National Council for Scientific Research, Lebanon). Kim Currie is the GOA-ON EC representative for IOCCP, and Abed El Rahman Hassoun is the representative for the new GOA-ON regional hub for the Mediterranean Sea, titled "OA Med-Hub". Maciej Telszewski's role as a GOA-ON EC member changed from being the IOCCP representative to now being the GOOS representative. One new secretariat member was also welcomed, Alicia Cheripka (NOAA Ocean Acidification Program).

## 4. 4th GOA-ON International Workshop overview

The local host Fei Chai provided a progress report on the logistics of the 4<sup>th</sup> GOA-ON International Workshop. Fei Chai went over the structure of the workshop (plenary and parallel sessions with discussions), comprising of 100 oral presentations total, including special event talks, keynote speakers, plenary talks, and session presentations, as well as 76 poster presentations, and 2 workshops on the day prior to the official workshop. The event was supported by 17 co-sponsors, enabling to provide 35 travel

grants and that 50 registration fees for participants were waived. Prior to the meeting session co-conveners were expected to prepare questions to lead the session discussions. In preparation for the workshop, the Executive Council reviewed each session's proposed questions. It was decided that the session discussion notes will be included in the overall GOA-ON workshop report.

## 5. Status of the GOA-ON Distributed Secretariat

The GOA-ON Distributed Secretariat was formed in 2018, and presently consists of three members: Alicia Cheripka (NOAA), Marine Lebrec (IAEA OA-ICC), Katherina Schoo (IOC-UNESCO). Each Secretariat member provided a short update on the status of their positions and their respective roles within the Secretariat; Marine Lebrec will be at the IAEA until May 2020, Katherina Schoo will be with the IOC-UNESCO until April 2020, and Alicia Cheripka will be at NOAA until January 2020 with a new Knauss fellow beginning after Alicia Cheripka. Jan Newton is also involved in the Secretariat through providing technical support to the GOA-ON website and data portal. The University of Washington provides two technical support staff: Emilio Mayorga and Troy Tanner. Overall there is strong interest from the GOA-ON EC to ensure continued support for the Secretariat in the years to come. The roles of the Secretariat are outlined in Table 1, which was presented at the GOA-ON EC meeting.

Table 1. GOA-ON secretariat responsibilities.

	<b>Alicia Cheripka (NOAA OA Program)</b>	<b>Marine Lebrec (IAEA OA-ICC)</b>	<b>Katherina Schoo (IOC-UNESCO)</b>
<b>Communication</b>	Monthly P2P newsletters	Focal point for website development (with UW) Manage OA-ICC news stream and bibliographic database	Presentation slides w/ overview of GOA-ON for GOA-ON members
	<ul style="list-style-type: none"> <li>Review and revise website content (news stories)</li> <li>Communication via social media</li> <li>Quarterly newsletters to all GOA-ON members</li> <li>Produce flyers &amp; new communication tools</li> </ul>		
<b>Regional Hub support</b>	<ul style="list-style-type: none"> <li>North American</li> <li>LAOCA</li> <li>PI-TOA</li> </ul>	<ul style="list-style-type: none"> <li>OA-Africa</li> <li>OA Med-Hub</li> </ul>	<ul style="list-style-type: none"> <li>IOC-WESTPAC</li> <li>North East Atlantic</li> <li>Australia</li> </ul>
<b>Products</b>	New products from GOA-ON China workshop	<ul style="list-style-type: none"> <li>Contacting data providers &amp; updating GOA-ON Data Portal</li> <li>WMO time series plots</li> </ul>	<ul style="list-style-type: none"> <li>GOA-ON Implementation Strategy w/ Jan Newton</li> <li>SDG 14.3.1 Methodology &amp; data files</li> </ul>
<b>Capacity Building</b>	<ul style="list-style-type: none"> <li>Link b/w GOA-ON &amp; NOAA</li> <li>Focal point for Pier2Peer program</li> <li>Liaison with The Ocean Foundation</li> </ul>	<ul style="list-style-type: none"> <li>Link b/w GOA-ON and OA-ICC activities</li> <li>Maintain database of capacity building activities</li> </ul>	<ul style="list-style-type: none"> <li>Link b/w GOA-ON and IOC-UNESCO)</li> <li>Facilitating reporting toward SDG 14.3</li> </ul>

## 6. Updates on GOA-ON's coordination with other networks/initiatives

- Commonwealth Blue Charter OA Action Plan

Kim Currie presented on the Commonwealth Blue Charter OA Action Plan, which New Zealand is leading. The goal of this group is to improve the capacity of Commonwealth countries to address the impact of ocean acidification, particularly in small-island developing states. The Action Group held their first meeting in Dunedin, New Zealand, in February, which was attended by 49 representatives from 19 Commonwealth countries, plus invited experts. The meeting was focused on OA science, the status of OA monitoring, adaptation strategies to OA, and governance and action. A final report from this meeting is under final review and will be shared soon. The commitment of the various Commonwealth countries to the action plan is still to be determined.

- IOC-UNESCO, UN Decade of Ocean Science for Sustainable Development

Kirsten Isensee updated the EC on the planning phase of the United Nations Decade of Ocean Science for Sustainable Development (2021-2030). As mandated by the UN General Assembly, the Intergovernmental Oceanographic Commission (IOC) of UNESCO will coordinate the Decade's preparatory process, inviting the global ocean community to plan for the next ten years in ocean science and technology. The EC was asked to contribute to the Planning phase by completing a questionnaire and providing input on the proposed Science Plan, ahead of the 1st Global Planning Meeting in Copenhagen, Denmark, from 13-15 May 2019.

- Ocean Acidification International Coordination Centre (OA-ICC)

Lina Hansson provided a more in-depth overview of OA-ICC's activities on day 2 of the EC meeting (see Capacity Building section). The OA-ICC is putting in a proposal for a third phase of the project as this current phase of the project will be finished at the end of 2020. A Phase III would allow for five additional years for the project. The OA-ICC asked the Executive Council for ideas on how this next phase could best support GOA-ON. Potential ideas from the EC include continuing to support the Secretariat after 2020, continue capacity building with more data management workshops, and helping with access to CRMs. The group recommended writing letters of support to the IAEA to strengthen the OA-ICC phase III proposal, which would be much appreciated.

- OceanObs'19 Meeting

Fei Chai and Jan Newton provided an update on the planning of OceanObs'19. The program for Ocean Obs'19, to be held September 16-20 in Honolulu, Hawaii, was recently finalized. The conference is meant to synthesize what has been achieved and get a better idea of what the priorities should be moving forward (at the decadal scale). Many community white papers were submitted and from those some high-level recommendations and priorities have been determined. Concerning the structure of the conference, there will be 22 breakout sessions selected from the 79

proposed and these will be listed soon along with the session leads, though it was mentioned that the session on SDG goals was selected. GOA-ON contributed to a breakout session and responses for these breakout sessions are expected soon. There will also be plenary talks, panels and town hall meetings. The GOA-ON OceanObs white paper is expected to be published soon, Bronte Tilbrook just resubmitted a revised version to the journal based on reviewer comments.

- Input to WMO reporting and the role of GOA-ON

Richard Feely, Marine Lebec, and Dana Greely have been working to produce time-series plots of pCO<sub>2</sub> and pH using consistent calculation methodologies. This has been done for three stations so far: Bermuda Atlantic Time-series Study (BATS), European Station for Time series in the Ocean Canary Islands (ESTOC), and Hawaii Ocean Time-series (HOT). They are working on the newly collected and submitted New Zealand dataset now, and the idea is to continue adding new stations to have a catalogue of time series plots of pH and pCO<sub>2</sub>, all which have been calculated the same way. The three plots that have been produced to date were published in the [WMO Statement on the State of the Global Climate in 2018](#), submitted by the IOC for GOA-ON. The Executive Council sees this as a useful product, and it was decided that the work would be published this year in order to be made available to the GOA-ON community. Such a product would be led by Richard Feely. Richard Feely, Marine Lebec, and Dana Greely will also work on adding new time-series plots and updating the ones that have already been made with the latest available data from the last year.

- UNFCCC COP 25 Meeting

The next UNFCCC COP 25 meeting will be held in Santiago, Chile, and similarly to last year this year's COP will have support from the United Kingdom's Department for Environment, Food and Rural Affairs (DEFRA), which is expected to host a side event / pavilion to highlight OA and specifically GOA-ON, thereby ensuring together with GOA-ON that OA is again recognized at this meeting. There will also be a pre-COP meeting in Costa Rica. GOA-ON could also partner with the Commonwealth Blue Charter, or with SPREP, on a side event to ensure its presence at this important meeting.

- UN Oceans Conference 2020

Bronte Tilbrook is a co-focal point for the [Community of Ocean Action on OA](#) (COA on OA), along with David Osborn, Director at the IAEA Environment Laboratories in Monaco. At the last UN Oceans Conference in New York a total of 240 Voluntary Commitments under SGD 14.3 were submitted. The OA-ICC and GOA-ON ran an analysis of the VCs to assess what the submitted VCs are focused on and what the needs are from the community. Additionally, they have hosted several webinars. It was agreed that GOA-ON regional hubs should be urged to submit Voluntary Commitments for the COA on OA before the next UN Oceans Conference in 2020; GOA-ON has a VC already, which the regional hub VCs could be based on. Submitting a VC is really a very straightforward process.

- 5<sup>th</sup> International Symposium on the Ocean in a High-CO<sub>2</sub> World

This meeting will be held in Lima, Peru, on 7-10 September 2020, and the first announcement has been published by SOLAS-IMBER Working Group on OA (SIOA). The lead organizers are Drs. Wilmer Carbajal (Pedro Ruiz Gallo National University, Peru) and Michelle Graco (Institute of the Sea of Peru, IMARPE) together with their colleagues, who submitted the successful bid to the SIOA. GOA-ON will be involved in this in addition to LAOCA's involvement.

- Indian subcontinent workshop 2019

Richard Bellerby is organizing a workshop in Goa, India, in late 2019, and The National Institute of Oceanography (NIO) of India has offered to be the host with national support from IISER, Kolkata. Both of these institutes will apply for regional and national co-funding for the workshop, and NIO will be providing the laboratory, meeting rooms, core CO<sub>2</sub> system instrumentation and technical support. Lecturers have been identified, with the hope of expanding the core staff to also including regional lecturers and trainers. It is also their intention to organize this meeting back-to-back with a regional IMBeR-Future Earth Continental Margins Working Group (CMWG) workshop to enable lecturers specialized on the socioecological aspects of OA to join. The GOA-ON Executive Council thinks this course will be very useful and can help in providing logistical support for this. The OA-ICC and IOC-UNESCO could provide funds for this workshop, and The Ocean Foundation have agreed to add their support.

## **7. GOA-ON Implementation Strategy**

The GOA-ON Implementation Strategy has been finalized with input from the EC. The Strategy outlines how to implement the GOA-ON Requirements and Governance Plan, including expanding ocean acidification observations, closing human and technology capacity gaps, connecting scientists regionally and globally, and informing about the impacts of ocean acidification. The aim is to provide guidance that will allow for comparability across the Network, while considering the potentially different requirements and impediments of regions. The Implementation Strategy also offers practical information prompting members to approach GOA-ON's goals. The Strategy was officially launched during the GOA-ON Workshop and [published on the GOA-ON website with community feedback requested by 1 July 2019](#).

## **8. Methodology for OA and reporting to SDG 14.3.1**

Following the last EC Meeting in Sopot, Poland, in 2018, members of the GOA-ON EC submitted their final reviews and comments on the SDG 14.3.1 Indicator Methodology to the IOC. The IOC then presented the Indicator Methodology, for which it is the custodian agency, to the Executive Council of the IOC at its 51st Session in July 2018, where it was welcomed. The EC of the IOC recommended that the SDG 14.3.1 Indicator Methodology be presented to the Inter-agency and Expert Group on SDG Indicators (IAEG-SDG) of the United Nations Statistical Commission for an upgrade from Tier III to Tier II.

The upgrade was granted in November 2018. Tier II classification means that the “Indicator is conceptually clear, has an internationally established methodology and standards are available, but data are not regularly produced by countries.” The next steps will now be to start collecting national data submissions towards the Indicator. In a pilot study carried out by the IOC and the International Oceanographic Data and Information Exchange (IODE) to obtain data from National Oceanographic Data Centres (NODCs) and to ascertain which data centres hosted relevant data, the responses from NODCs to the survey showed a disconnect with the presence of data centres known to have relevant datasets. Furthermore, it became apparent that not all countries undertaking ocean acidification observations possess NODCs or relevant data centres with the capacity to store and share data. To achieve the respective Target 14.3 it will be essential to develop and maintain global data collection, related quality assessments and quality controls capabilities for pH and eventually a suite of carbonate chemistry parameters, as well as related metadata covering the entire Essential Ocean Variables (EOV) system. The IOC has therefore begun the development of a global independent facility for data storage and analysis for the SDG 14.3.1 Indicator data. This data server will be hosted by IODE and is expected to be up and running by June 2019, prior to the first data collection effort towards the SDG 14.3.1 Indicator. The data server will include a web-based interface for data submission, facilitating the process for those countries lacking a NODC. Additionally, IOC will develop a manual to provide instructions and useful information on how to use the SDG 14.3.1 Indicator Methodology and the associated data and metadata files. The manual will be aimed at and written for data originators, data managers, IOC focal points, NSOs (National Statistical organizations) and is, in particular, expected to be useful to those researchers beginning new measurements, including the recipients of the GOA-ON kit and participants in capacity building exercises. The need for such a manual was identified by the community.

## 9. GOA-ON website and data portal

Marine Lebrec reported on some of the progress to the GOA-ON website within the last year, including:

- Web pages were created for two new regional hubs: The [OA Med-Hub](#), and the [Pacific Islands and Territories OA Network \(PI-TOA\)](#)
- The [Resources](#) page was updated and reorganized with new tabs (SDG 14.3.1 documents, Manuals/SOPs, etc).
- The GOA-ON home page is regularly updated with news items on the network’s activities. The Secretariat has published over 25 news items within the last year.
- Social media platforms were set up for GOA-ON (Facebook and Twitter). Both platforms have proven to be successful in increasing GOA-ON’s visibility and have rapidly gained followers.
- Based on Google Analytics, the number of individual users since the launch of the new website has doubled (500 in February 2018, and 1000 users presently). Marine Lebrec also shared some statistics on website usage, such as what pages are being visited the most, the amount of time users are spending on a page, etc.
- A new [landing page](#) for the GOA-ON data portal was created, and a short guide was made for users to see when opening up the portal with information on the main features of the portal.



- There are presently nearly 600 assets on the portal, 45 of which are showing live visualizations, and 208 assets have links to external data (so approximately one third of assets).
- Within the last year, the Secretariat has contacted all data providers to update their assets, and as a result 70 updates have been received in the last year, largely to add links to external data and update metadata information.

There are some assets on the portal, which do not show any OA parameters, and some assets that are inactive. The group recommended that Marine Lebrec work with Cathy Cosca, Emilio Mayorga, Troy Tanner, and others, to create new filters to show for example the number of OA parameters for an asset, or if an asset is still in the water, etc. Marine Lebrec will first outline this idea in a document and share it with the data portal group and co-chairs. Marine Lebrec will also continue organizing calls with the data / website group.

Libby Jewett mentioned that NOAA OAP could pay for the monthly subscription for operation of the GOA-ON Google Suite, currently being run by Cathy Cosca. Cathy Cosca will pass on responsibilities and management of the Google Suite to the Secretariat, giving them access to GOA-ON's google forms, sheets, emails, etc.

There are still several gaps in the GOA-ON Membership (Russia, Poland). Several scientists from these countries attended the 4<sup>th</sup> workshop in China and have been approached to become members. Marine Lebrec showed a map of GOA-ON membership (see below), and the group recommended making population density plots of membership, versus having all countries shaded the same color. Marine Lebrec and the Secretariat will work on this and present their visualizations to the EC to see if they are useful.

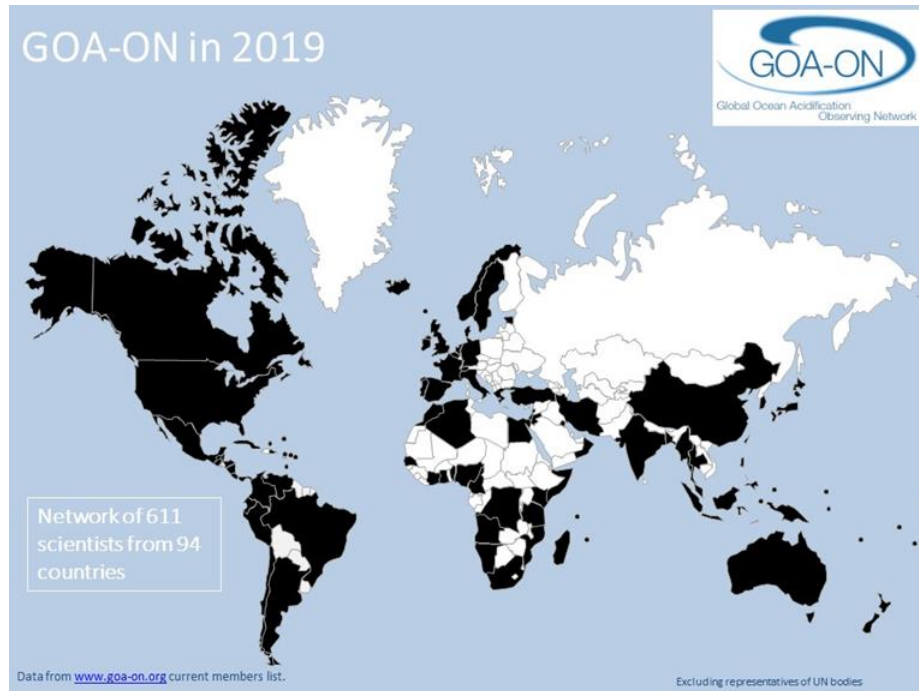


Figure 1. GOA-ON network representatives' county affiliation in 2019.

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## DAY 2

### 10. Regional Hub updates

- OA Med-Hub

A new regional hub for the Mediterranean Sea led by Abed El Rahman Hassoun (EC regional representative) with support from Marine Lebec is in the initial phases. The hub presently includes 42 scientists from nine countries. The hub has a new page on the GOA-ON website (see [here](#)), and has a team on the OA Information Exchange, although there is not much usage of the OAIE. The hub plans to have their first virtual meeting soon to better identify goals and needs from the group, and to establish a Steering Committee with representatives from each country of the hub. Eventually it could be useful to have an in-person meeting, and perhaps this is something the OA-ICC could fund (maybe in 2020). Richard Feely mentioned that it would be good to include Melchor González-Dávila, who manages the ESTOC time series and Med transect through the Strait of Gibraltar.

The connection between the Joint European Research Infrastructure network for Coastal Observatories (JERICO) and Med hub has been integral, and we should “exploit” other pre-established connections.

- OA-Africa

Nayrah Shaltout is the representative of the OA-Africa network. In the last few years there were issues with the communication within the hub, however in September following some reorganization within the OA-Africa Steering Committee, three new co-chairs were appointed: Nayrah Shaltout (Egypt), Roshan Ramessur (Mauritius), and Sheck Sherif (Liberia). Most recently six new OA projects for six countries, funded by WIOMSA supported by IOC and Sam Dupont, were introduced, which are starting this year. The OA-Africa hub held a side-event at the Blue Oceans Conference in Liberia in March 2019, where they presented white papers. Following the Blue Oceans Conference, the Steering Committee met in person to outline needs and responsibilities of the Committee. Both events were supported by OA-ICC and The Ocean Foundation. OA-Africa white papers will also be presented at the WIOMSA Scientific Conference in July 2019. Countries will be asked to report to the SDG 14.3.1 soon and OA-Africa is planning on supporting this as much as possible. Nayrah Shaltout proposed having an OA-Africa, or GOA-ON, side event at the UN Oceans 2020 conference and will follow up with this when more information on the planning of this event is available. The hub would also like to hire a webmaster to keep their website updated; Jan mentioned that Troy Tanner at UW could potentially help with OA-Africa's website. The hub decided in Liberia that they want to build a research center in West Africa to support the scientists of the region, and to move from the basic data collection to more sophisticated projects. The hub is also establishing a Proposal Writing Advisory Committee with several GOA-ON EC members to be involved.

Libby Jewett mentioned that NOAA OAP recently funded two researchers from Africa to carry out OA work, and would be good to link them to OA-Africa, and to find out who from Africa attended the China workshop to make sure they know about OA-Africa. If OA-Africa wants to gain more international visibility and funding sources, it may be useful to liaise with the Commonwealth OA group.

Kirsten Isensee mentioned that there will a series of meetings and workshops following the initial WIOMSA OA meeting in Mombasa, Kenya in February 2019.

- 20-24 May 2019 Biology – South Africa – Dave Pearton, Sam Dupont
- July 2019 Chemistry WS (3 days) – potentially after WIOMSA conference / Yashvin Neehaul & Roshan Ramessur, Jerome Harley
- July 2019 WIOMSA Scientific Conference – Special Session on OA, supported by the 6 projects, Kirsten Isensee and Sam Dupont
- July 2019 (1 day) Communication workshop – potentially before the WIOMSA conference, Sam Dupont, Roshan Ramessur, Mathias Igulu
- End 2019/Early 2020 second Biology workshop – Kenya - Eric Okuku, Sam Dupont
- 2020 OTGA Ocean Acidification data management training/14.3.1 training, Kirsten Isensee, Mathias Igulu

- Arctic Hub

There has been growing interest from scientists studying in the Arctic, and a new regional hub led by Agneta Fransson and Melissa Chierici is being discussed. Neither were able to attend the GOA-ON Workshop, but the next steps are for these co-leads to reach out to colleagues in other Arctic countries. If the hub is formalized, it can then be nominated to have a representative join the GOA-ON EC. Katherina and Alicia are to both act as focal points in the Secretariat for this hub, since both the Northeast Atlantic hub and the North American hub will overlap with Arctic region. Katherina will coordinate the discussions with the North East Atlantic hub. There have also been discussions of an Antarctic / Southern Ocean hub in the past, but nothing has happened yet.

- Pacific Islands & Territories Ocean Acidification (PI-TOA) Network

Duncan McIntosh is the representative of the PI-TOA network in the GOA-ON EC. There are presently GOA-ON Kit recipients in Samoa, Fiji, Papua New Guinea, Tokelau, Palau, and Vanuatu. One of the recurring problems that have come up are that there are few to no laws/procedures governing the disposal of some of the chemicals, and there is a need for basic trainings as well as data management, as well as a high turnover of people. Duncan also mentioned that JCOMM will be producing a report card for the State of Ocean Observing System and would like GOA-ON's input in the new few weeks.

- North American Hub

This hub is being led by Richard Feely and includes scientists from Canada, the United States, and Mexico. The hub held its first in-person meeting in Canada in October 2018 at the Hakai Institute in Victoria, British Columbia, and from that meeting a report was [published on the GOA-ON website](#). Some of the outcomes of this meeting include:

- Writing a synthesis paper, making a website, coordinating cruises, and plan future meetings. There will be a meeting at UW in 2019 bringing together scientists calculating Time of Emergence (ToE). Additionally, there will be an event at OceanObs'19 to discuss ToE.
- Facilitating a handshake of data between GOA-ON data portal and the national data centers. It would be useful to have information on the GOA-ON data portal site with NODC contacts for each country.
- Additionally, there needs to be a long-term strategy for CRMs (including less costly alternatives), and more thought should be put into how to make CRMs more applicable for coastal work.
- There is a need for training and best practices at all levels in the region as well as a need for increasing biological input/inclusion in North America. A lot of capacity building has been devoted to 'developing' countries, but there is also a big need for this in North America.
- There is a need for products with biological indices and indicator species for each region, the hub is looking to work with the Smithsonian on this.
- The hub would like to see more high-quality data analysis with high quality data sets on the portal.

- North East Atlantic Hub

Katherina Schoo, as the Secretariat focal point for this hub, presented the development of this new hub. The NE Atlantic hub is currently chaired by Helen Findlay and Steve Widdicombe from the Plymouth Marine Laboratory, UK. The hub, which has members from Belgium, Denmark, Faroe Islands, France, Germany, Iceland, Ireland, Netherlands, Norway, Poland, Portugal, Spain, Sweden, UK, held its inaugural meeting in Greenwich, London, UK, on 12- 13 March 2019. Members of the hub discussed what the scope and goals of the hub should be. Some of the outcomes and suggestions from the group include:

- Creating maps depicting and synthesizing what has already been done in the region in terms of OA monitoring and observations.
- The possibility of writing a review paper on the status of OA observations in the region was raised.
- Several members of the hub are also involved in the Oslo/Paris convention (for the Protection of the Marine Environment of the North-East Atlantic) Intersessional Correspondence Group on Ocean Acidification (OSPAR ICG-OA) and the hub will explore how to strengthen those links.
- The hub members have decided to include the Baltic Sea in the regional hub and will reach out to researchers from this area. HELCOM is in the process of including carbonate chemistry parameters in its monitoring efforts and the NE Atlantic hub is interested in collaborating with the Baltic region, to exchange expertise and experience.
- The inclusion of policy makers, stakeholders and experts on biological impacts of OA in the hub was discussed and will be pursued.
- Hub members provided updated information on OA monitoring assets in the region, which will be included in the GOA-ON data portal.

## **11. GOA-ON communication efforts**

Based on feedback from recent Regional Hub meetings and conversations with participants at trainings and this China workshop, the Secretariat developed a list of suggested communication materials. These include, but are not limited to, the following:

- A GOA-ON Logo Sticker
- Infographics showing regional impacts of OA on species, similar to those used by NOAA and created by the [Center for Environmental Visualizations](#)
- High resolution maps showing how much pH and saturation state has changed (in the last ~200 years). Richard Feely mentioned there is already such a product for saturation state, in a manuscript submitted to PNAS and that he is working on a similar product on pH now; this should be published and available around June – August 2019.
- A database of recommend OA sensors and instruments for carbonate chemistry measurements; the IOCCP has this exact product on its [website](#), which is kept updated. This will be added to the GOA-ON website.
- Downloadable high-resolution GOA-ON logo on website (for use on posters and in presentations).

- A concise sentence about what OA is should be available soon the About page (above the section outlining the GOA-ON Goals) for use by scientists, policy makers and the general public and ensuring OA is presented understandably and in a scientifically correct way.
- GOA-ON overview slides available online for members.
- Press release “media toolkit” for the regional hubs and others to use for presentations.
- Include information about the GOA-ON kits on GOA-ON website, especially SOPs and information on the equipment provided in the kits - there is already a list that TOF has been updating, which could be used for this.

There is also a clear need for more education products, especially in other languages (Arabic, French, Spanish), which EC members could help in translating, including translations of the GOA-ON flyers as well as general slides about GOA-ON. The Secretariat will work on compiling education products and add an ‘Education’ tab to the Resources page (linking to OA-ICC education webpage). The Secretariat will also check if the IMOS e-lectures are in line with GOA-ON’s goals and if so, will put those on line.

It was recommended that the GOA-ON Secretariat, as well as their affiliations, be made more visible on the GOA-ON website.

## 12. Status of GOA-ON capacity building activities

- Pier2Peer

Alicia Cheripka reported on the [Pier2Peer program](#). Presently there are 75 mentees and 133 mentors, and 98 active pairs. Alicia presented a poster during the workshop and received some strong interest from several scientists who wanted to sign up to either be a mentor or a mentee. There is a strong need for mentors working on biological responses to ocean acidification, as well as mentors involved in policy / stakeholder engagement. There are small funds given toward the Pier2Peer program (USD 5000 per project) which is usually enough for travel costs to visit a mentor’s institute, however the connection is difficult to sustain with such limited funds. The EC recommended seeking ways to tap into other funds from institutions, universities, and the [Partnership for Observation of the Global Ocean](#) (POGO). As the OA-ICC is developing their proposal for a ‘Phase III’, they could explore including funds toward the P2P program and other fellowships. The P2P newsletter could now also add a section encouraging people to contact Alicia if they know of new scholarship opportunities. Rather than having support only from The Ocean Foundation for P2P scholarships, GOA-ON should start thinking about other sources who could provide resources; this would enable more than just single visits to institutions but rather mentees could work side-by-side at the mentor’s institutions and collaborate. The EC decided that GOA-ON should work on a 5-year plan for growing the P2P program.

- The Ocean Foundation, GOA-ON Kits

Alexis Valauri-Orton, Program Manager at The Ocean Foundation (TOF), presented on the current and upcoming ocean acidification capacity building efforts being carried out by TOF. Through their training courses and providing GOA-ON Kits, TOF has identified common challenges, including extensive customs clearance process and difficulties in procurement of equipment for many countries, limited human resources at particular institutions or in certain regions to sustain OA work, a lack of dedicated lab space and basic equipment at some institutions, and a difficulty in finding a local supply of basic items such as strong rubber bands for DIC/TA bottles, were given as examples of problems researchers in many countries deal with. Sensor maintenance is technically challenging and can be very difficult, so that measurements from sensors can sometimes be unreliable when issues arise; therefore, TOF recommends that the community should focus on non-sensor-based measurements.

Alexis Valauri-Orton also shared TOF's upcoming plans, including several OA trainings: Panama around September - November 2019, and hopefully a follow-up training course in Latin America in 2020 to the one held in Colombia in January 2019. TOF also aims to start capacity building efforts in the Arctic in 2020 / 2021. TOF is involved in several new products, including e-learning videos on sampling in the field as well as on sensor maintenance, and is involved in developing a low-cost shellfish hatchery risk reduction kit. The Ocean Foundation plans to continue international support for the GOA-ON Pier2Peer scholarship fund and plans on collaborating with the Commonwealth Blue Charter for future trainings. TOF also plans on organizing trainings specific to policy makers in Mexico, Fiji, and the Marshall Islands. Presently there is no information about the GOA-ON Kits on the GOA-ON website, so this will be added after the May OA-ICC / GOA-ON meeting in Monaco to assess the kits and identify new 'practical' best practices.

- Ocean Acidification International Coordination Centre (OA-ICC)

Lina Hansson provided an update on the OA-ICC's recent and upcoming activities. Some of the OA-ICC's activities in the last 12 months include:

- June 2018: A 3-week long training course held in Kristineberg, Sweden which involved a joint experiment and has led to high-quality data to hopefully be published in a paper soon.
- October 2018: A data management training / workshop in Monaco focused on QA/QC methods, where participants learned techniques and applied it to their own data sets that they brought with them.
- November 2018: A training course in Kuwait focused on ocean acidification experiments using nuclear and isotopic techniques.
- January 2019: OA-ICC supported the TOF symposium & training course in Colombia.
- March 2019: OA-ICC supported the OA-Africa side-event and in-person Steering Committee meeting in Liberia.

The OA-ICC has many planned activities for the coming year, which are outlined here:

- 23-25 April 2019: OA-ICC is hosting a meeting in Monaco on the human vulnerabilities to OA with a group of social scientists.
- 27-28 May 2019: [The SOLAS-IMBeR OA Working Group](#) meeting followed by the OA-ICC expert group meeting, to discuss the OA-ICC's activities and future directions, particularly with discussions for preparing a Phase III of the OA-ICC.
- 24-28 June 2019: OA-ICC is hosting a training course based on setting up experiments in a multi-stressors context, based on the newly released Best Practices document put out by the SCOR Working Group 149 (more info here: <https://meddle-scor149.org/>).
- August 2019: The OA-ICC will host its first meeting for the Coordinated Research Project (CRP), which will include involvement from approximately 15 countries to study the impacts of OA on commercially important seafood.
- October 2019: The final meeting for the IAEA INT7019 ocean acidification project will be held. Venue is not yet confirmed but it may be in Ecuador.
- December 2019: The OA-ICC will host another basic training course held at the IAEA labs in Monaco.
- 2020: The OA-ICC will help organize a communication training with colleagues in Costa Rica (dates and full scope of the training to be determined). Recommendation from Libby Jewett to include [COMPASS science communication](#) non-profit in this course.
- The OA-ICC plans on supporting several Cooperation meetings in the coming year, including the OA workshop in India that Richard Bellerby is organizing, and perhaps other RUG activities that may come up.

Other ideas for projects and new meetings that the OA-ICC could prioritize for 2020 include doing a modeling training, and a follow-up to the data management workshop that was held in October 2018, supporting the High CO2 Meeting in Chile, continuing to support the GOA-ON Secretariat, and also supporting the SDG process.

- IOC-UNESCO
  - October 2018: IOC-UNESCO introduced the 14.3.1 methodology at the OA-ICC data management training / workshop in Monaco focused on QA/QC methods, where participants learned techniques and applied it to their own data sets that they brought with them.
  - February 2019: IOC supported an Ocean Acidification workshop for Western Indian Ocean (WIO) region hosted by KMFRI, in Mombasa, in February 2019 (more information [here](#)). The three-day workshop was used as an introduction into global ocean acidification resources and networks as well as an introduction to the SDG indicator 14.3.1 methodology, along with the related metadata and data files.

Several capacity building updates from IOC-UNESCO, presented by Kirsten Isensee include:

- IOC-UNESCO will provide expertise and training at an ocean acidification workshop in Iran, scheduled for June 2019. The workshop will be hosted by the Regional Education and Research



Centre on Oceanography for West Asia (RCOWA) and aims to develop regional capacity for ocean observations in support of SDG target 14.3.

- An [OceanTeacher](#) Global Academy Course in Santa Marta, Colombia, on SDG 14.3.1 data management and data analysis with the data portal is planned for October 2019. There is currently no link to OceanTeacher on the GOA-ON site, this could be included in the planned new 'Education Resources' Tab. Creating an OA course for OceanTeacher was discussed, a follow-up is needed.

### **13. Debrief of the workshop**

Following the 4 days of the GOA-ON workshop the local host and co-chair Fei Chai's presented some reflections on the workshop. His impressions of the workshop were that the structure worked well, and the audience was very engaged throughout the three days. There was a good balance between Chinese and international participants. In total, there were 270 participants from over 60 countries. While 270 people attended the workshop, 350 had registered online; the discrepancy may be due to about 30 people not being able to attend due to visa issues. Overall, the number of people attending was close to the capacity of the hotel. The workshop organizers tried to make the conference as green as possible, 50 people paid for the carbon offset when registering.

Fei Chai also reflected on the two special events which were held the day prior to Day 1 of the workshop. He thought the events were appreciated, and it will be important for GOA-ON to maintain a connection with the industry specialists who attended the special event. One way to maintain this interest is to put pressure on industry to work with scientists, with help from Minhan Dai and Wei wei You. Richard Feely mentioned that in the Pacific Northwest, there is a Pacific Shellfish Growers Association (non-profit), which holds an annual scientific meeting where scientists and shellfish growers can interact; something similar in China may prove useful. Kirsten Isensee recommended that for future workshops, it would be good to have a day prior to the workshop to have a stakeholder meeting or a 'town hall' to connect with policy makers, stakeholders, and experts from a local institute. Also, in the future it would be useful to include more social scientists studying human vulnerability to OA.

Six news medias picked up this meeting, one top Beijing media piece was published following the workshop ([article in Chinese found here](#)).

Libby Jewett mentioned that she liked the format of the discussions and the sessions. As a session co-convenor she would have preferred to occasionally leave her session in order to participate in other sessions as well, so maybe for the next meeting, session chairs could be switched throughout the workshop. The discussions in session 4 were very organic and she did not rely much on the prepared questions. The panel at the end of the workshop included a lot of the same people who had been on the stage throughout the workshop, so in the future the workshop might benefit from putting some young scientists in the spotlight (this will be done at OceanObs'19).

Richard Feely recommended that there could be three session chairs in the future instead of two, one of which could be a discussion leader for the breakout sessions and that way the chairs can rotate to different sessions. One of the chairs could be a young scientist who would benefit from having a session chair role to gain experience and exposure. Additionally, more participants could have engaged if there was more time for a discussion at the end of the last plenary, maybe the 60-second speeches were not enough. Maciej Telszewski thought there should be more time for discussions in plenary sessions next time, for example by having the session presentations in the breakout rooms but then convening for discussions as a whole group. Samuel Wang also shared his impressions from the workshop. He mentioned that 90 - 100 early career scientists attended the meeting. About 1/10 of the questionnaires about participants' impressions of the workshop were filled out, most of them with positive remarks. Some of the feedback included that the talking time for presentations was too short, that GOA-ON should engage more with industry as well as policy to focus on socio-economic impacts of OA.

One other theme that came out of this workshop is that regional groups need to identify what species / biological response information they should be studying. This will be an important part of the discussions at OceanObs'19. Coordinating bodies should have a meeting together to discuss these things rather than being so separate (for example communicating more with Marine Biodiversity Observation Network (MBON)).

Outcomes from this workshop will include:

- Two reports, one of which will be a long document including notes from note-takers, and one a shortened document with key points from each session (to be compiled by the Secretariat). Session co-chairs are tasked with sending session reports to Samuel and the Secretariat, so they can be compiled into full reports.
- A GOA-ON EC call is to be scheduled ~1 month after China workshop to discuss the workshop report with statistics, concrete outcomes from the workshop, and action items that came out of this meeting, as well as concise plans on the follow-up to these Action items.
- The EC discussed writing an EOS document about the workshop, which needs to be published three months after the workshop ends, with emphasis on integration of all disciplines, actionable recommendations, and also emphasizing the many early career scientists involved. The article would also lay out what the needs are for the community and what GOA-ON will do to address these needs. One of the needs identified will focus on biological responses, and this EOS article can include information about the GOA-ON biological working group meeting in October in Kristineberg, Sweden.

## **14. Discussion of GOA-ON in the next 2 years**

Many topics discussed during the two days of the EC meeting will direct the work of GOA-ON at large and its EC. The results of the discussion and the follow up items are described in detail above. Some additional items which were not addressed to this point were:

A new version of the GOA-ON Terms of Reference was reviewed by the EC ([version April 2019](#) which is now on the GOA-ON website), allowing EC members to have a term of 9 years total, in increments of three years at a time. Members who have reached their six years in 2019 were asked if they would like to extend their membership or step down from the EC, and the EC also assessed all members' ability to contribute to the EC.

Some EC science members were not able to attend the Hangzhou meeting. The in-person EC meetings are important as many have difficulties in connecting to the quarterly teleconferences due to them happening in the middle of the night for some members. The secretariat and co-chairs will contact members who could not attend to see if they are able to continue or if they would like to step down due to other commitments. It was decided that the GOA-ON Executive Council will hold its next annual in-person meeting on 11-12 September 2020 in Lima, Peru, directly following the Oceans in a High CO<sub>2</sub> World meeting, which is being held there 7-10 Sep 2020. EC members have been asked to save the date in their calendars.

In terms of adding new people, the group decided that priority should be given to a new Arctic hub member, and that it could be useful to have someone from PICES included in the GOA-ON EC, potentially a researcher from Japan. Libby Jewett has decided to step down as co-chair in 2019, and therefore a new co-chair needs to be nominated. Nominations are to be sent to Libby by 1 June. The new co-chair can come from either outside of the EC or in the current EC, and a person can self-nominate or be nominated by another EC member.

There was a discussion on the role of GOA-ON and advancements of BGC Argo: GOA-ON can help with informing alkalinity calculations, carbon sensor recommendations, and encouraging for more coastal floats, particularly in the Northeast and Northwest Pacific, as well as the Gulf of Mexico. GOA-ON could also support BGC Argos and suggest including a second OA parameter.

## 15. Meeting participants

### Executive Council Members

- Libby Jewett, GOA-ON co-chair, *NOAA, USA*
- Bronte Tilbrook, *GOA-ON co-chair, CSIRO, Australia*
- Richard Bellerby (Day 1), *East China Normal University & NIVA, Norway*
- Fei Chai, *SOED, Second Institute of Oceanography, SOA, China & University of Maine, USA*
- Richard Feely, *NOAA, USA*
- Abed El Rahman Hassoun, *National Council for Scientific Research, Lebanon*
- Robert Duncan McIntosh, *The Secretariat of the Pacific Regional Environment Programme, Samoa*
- Jan Newton, *University of Washington, IOOS, USA*
- Nayrah Shaltout, *National Institute of Oceanography and Fisheries, Egypt*

### Support / Program Representational members

- Kim Currie, *IOCCP*
- Lina Hansson, *IAEA/OA-ICC, Monaco*
- Kirsten Isensee, *IOC-UNESCO*
- Maciej Telszewski, *GOOS*

### Secretariat

- Alicia Cheripka, *NOAA, USA*
- Marine Lebrec, *IAEA/OA-ICC, Monaco*
- Katherina Schoo, *IOC-UNESCO*

### Other attendees

- Meredith Kurz, *NOAA, USA* (morning of Day 2)
- Alexis Valauri-Orton, *The Ocean Foundation, USA* (morning of Day 2)
- Samuel Wang (mornings of Day 1 & 2)

## 16. Meeting Agenda

### Day 1, 13 April 2019

08:45 Arriving at meeting room

09:00 Welcome (Fei Chai and others from SIO)

09:15 Introductions and welcome to new attendees and Secretariat

Includes Maciej Telszewski (now GOOS rep) and Kim Currie (now IOCCP rep), Duncan McIntosh (PI-TOA), Abed Hassoun (Mediterranean Hub), Alicia Cheripka (NOAA)

09:30 4th GOA-ON workshop overview (Fei Chai and Jan Newton)

- brief summary of attendance
- organization

09:45 Group discussion - what does GOA-ON hope to achieve from workshop, ideas for keynote talks (Fei Chai and Jan Newton)

10:30 Coffee Break

11:00: Status of secretariat – funding for staff so the EC understand needs.

- Brief summary of the roles of each secretariat member (Marine Lebrec, Katherina Schoo and Alicia Cheripka)

11:30 Updates on coordination with other networks and with initiatives.

- Commonwealth Blue Charter OA Action plan (Kim Currie)
- IOC-UNESCO, UN Decade of Ocean Science for Sustainable Development (Kirsten Isensee)
- OA-ICC (Lina Hansson)
- OceanObs'19 - distribute the draft paper and special session status
- Input to WMO reporting – role of GOA-ON (Richard Feely) – distribute the report
- Other key meetings (UNFCCC COP 25 & UN Oceans Conference 2020, 5th Symposium on the Ocean in a High CO2 World, 2020 – and GOA-ON's involvement, Communities of Ocean Action)
- Indian subcontinent workshop (Richard Bellerby)

13:00 Lunch

14:00 GOA-ON implementation strategy (Jan Newton)

- Introduction to finalized Implementation Strategy
- Biological observing – what is it going to look like and are there partner organizations we should engage with?
- Launch and distribution, Implementation how to translate this into action?
- Discussion on implementation plan

15:00 Methodology for OA and reporting to SDG 14.3.1 (Kirsten Isensee)

Expert review of SDG 14.3.1 Indicator manual and portal (Kirsten Isensee, Katherina Schoo)

- Are countries responding the SDG14.3.1.
- How to use the Community of Ocean Action on Ocean Acidification for this?
- How to disseminate and improve the tools, how to connect to exiting efforts and in particular GCOS.

16:00 Coffee break & group picture

16:30 GOA-ON website and data portal (Marine Lebrec)

- Update on status, new developments e.g. new stocktake of observing platforms and next steps to enhance information (Marine Lebec)
- New data portal app for SDG reporting process (Kirsten Isensee, Katherina Schoo)

17:00 Discussion & suggestions for website

17:30 Close day 1

## **Day 2, 18 April 2019**

8:30 Regional Hub updates (Katherina Schoo)

(10-15 min each for new hubs, or those with significant developments –Mediterranean (Abed El Rahman Hassoun), Pacific Islands (Duncan McIntosh), OA-Africa (Nayrah Shaltout), NE-Atlantic (Katherina Schoo))

9:30 Discussion on hubs and needs

(capacity building requirements, new opportunities, impediments to building the hubs (funds, support?), what does success look like).

10:30 Communication efforts (Katherina Schoo)

– Is there a need for more products (e.g. general brochures and synthesis products).

11:00 Coffee

11:30 Capacity building status (Marine Lebec)

- Pier2Peer (Alicia Cheripka)
- Training (past year and future)
- The Ocean Foundation, GOA-ON Kits (Alexis Valauri-Orton)
- OA-ICC (Marine Lebec, Lina Hansson)

12:30 Lunch

13:30 Debrief of the workshop and action items resulting from workshop (Fei Chai and Jan Newton)

Discussion:

- Outcome document, Action items and responsible EC member/group of EC members
- What was good and what went wrong? – Lessons learned

15:00 Coffee break

15:30 Discussion of GOA-ON in next 2 years (Libby Jewett and Bronte Tilbrook)

including membership, what are key objectives to develop/strengthen/reduce and how to support these.

Finalize Terms of Reference based on comments back to Libby Jewett

Plans for 2020 EC in-person meeting (at High-CO2 World Symposium maybe?)

17:00 Close