19th POGO Annual Meeting (POGO-19) Minutes

23-25 January 2018

Scripps Institution of Oceanography, La Jolla, CA, USA

Tuesday 23rd January

Inauguration

Margaret Leinen (ML), Director of Scripps Institution of Oceanography, welcomed the participants and provided some background on POGO. The first POGO Annual Meeting had been hosted by Scripps. Charlie Kennel, then Director of Scripps, had met with Bob Gagosian (then Director of WHOI) and Howard Roe (then Director of Southampton Oceanography Centre) and decided that the ocean community needed an equivalent of the Committee on Earth Observation Satellites (CEOS). The first meeting had included 17 institutions from 12 countries. Since then, POGO had made notable achievements, such as the creation of GEO Blue Planet and contributing to the G7 statement on ocean observations. These products were a result of a commitment of institutions to work together on a voluntary basis.

Sophie Seeyave (SS) gave a brief overview of the meeting format for the next three days.

Karen Wiltshire (KW) welcomed the participants and thanked ML and her team for providing such a wonderful venue for this meeting, and for all their hard work in bringing it together.

All the participants then introduced themselves.

Presentations by new/selected members (Chair: Jan Mees)

Short presentations[1] were given by some members on the following topics:

- Introduction of new member –the Marine Institute, Galway, Ireland: Michael Gillooly
- Introduction of new member –Monterey Bay Aquarium Research Institute (MBARI): Chris Scholin
- FIO's deep ocean observation: Zexun Wei
- Introduction to the Center for Ocean Mega-Science, CAS: Chaolun Li
- Innovation: where in marine and earth science can we find a solution? Hide Sakaguchi, JAMSTEC

[1] All presentations have been shared with the delegates via a Dropbox folder, rather than made public via the POGO website.

Showcase of oceanography and observing technology at Scripps (Chair: Margaret Leinen)

- Argo: *Sarah Gille, Professor*
- The Future of Argo: *Dean Roemmich, Professor*
- Biogeochemical Argo: *Todd Martz, Associate Professor*
- Coastal Data Information Program: *Julie Thomas, Co-Manager/Principal Investigator*
- The Wirewalker: Ocean Wave Power for Long Term Vertical Profiling: *Robert Pinkel, Professor Emeritus*
- Frontiers of Using Artificial Intelligence in Marine Ecology: *Jules Jaffe, Research Oceanographer*
- Innovation in Biological Observation Technology: *Stuart Sandin, Associate Professor*

Updates on POGO activities (Chair: Edgar Pavia)

KW provided a presentation on POGO Highlights for 2017, in particular the new member (Marine Institute, Ireland), efforts to enhance African membership (Cape Verde workshop), the achievements of the various POGO Working Groups and Task Forces, the grant obtained from the Lounsbery Foundation, and the launch of the Ocean Training Partnership portal and initiative.

SS followed with a Progress Report, highlighting the progress on Action Items, additional details on the Working Groups and Task Forces, partnerships and funding, the GEO Blue Planet Initiative, various training initiatives funded by POGO, and the improvements made to POGO communications by the new Communications Officer.

Adriana Gonzalez Silvera, NANO alumnus, presented an update on the NANO Global Project that was initiated in 2017. The project aims to coordinate measurements of temperature, salinity, dissolved oxygen and pH at selected sites around the world. A survey was developed to gather information on existing time-series stations in NANO member countries, and to determine which ones could contribute to the project. A workshop was being organised for April 2018 to bring together representatives from these countries/stations.

Kirill Kivva, NANO alumnus, presented an update on another Global Project that was submitted as a proposal to NANO, but funded by POGO as an addition to the NANO Global Project. The project aims to develop an affordable temperature/depth sensor for use in developing countries as part of a citizen science project. Comments were made on the need for strict quality control and open access to data from citizen science projects in general.

Richard Coleman provided an update on the POGO-funded Working Group OASIIS, which held a workshop in June 2017. This was a follow-up to the report "Seeing below the Ice" published in 2012. A publication from the workshop was planned for 2018, and a White Paper will be submitted to Ocean Obs' 19. It was suggested that OASIIS should link to Arctic observing groups/projects and that POGO could play a role in coordinating between the various groups.

Partner organisations and projects (Chair: Tony Knap)

Short presentations were given by a selection of organisations of relevance to POGO:

The UN Decade of Ocean Science for Sustainable Development: *Vladimir Ryabinin*

The Decade was formally adopted by the UN General Assembly in December 2017. It will involve a 3-year preparation phase that will determine its governance, structure and strategy, in consultation with the ocean science community. Possible projects may include biological, ecological and biogeochemical observations, marine information, standards, open data and polar observations. The IOC welcomes POGO's intellectual input. This may be implemented via a POGO Task Force.

GOOS Regional Alliances and Capacity Development: *Glenn Nolan*

GOOS has 3 very well developed GRAs (IOOS in the USA, EuroGOOS in Europe, and IMOS in Australia). Through its capacity building efforts, GOOS is helping some more recent GRAs to become established and to contribute to the GRA leadership. A Capacity Development Task Team is helping to embed CD in the new GOOS Strategy. GOOS is using an EMODNet engine to map the GRA "assets", using data and metadata provided by the GRAs. A CD Meeting will be held at IOC in March, which POGO is invited to attend.

SMART Subsea Cables - a New Way to Observe the Oceans: *Bruce Howe*

This initiative aims to make use of the million kms of subsea operational cables and piggyback on the repeaters that are located every 50-100km for both power and communications. SMART sensor modules will measure temperature, pressure and acceleration. Cables are typically replaced every 10-20 years; new cables are being laid in parts of the ocean that are not currently covered. The effort is being led by a Joint ITU-WMO-IOC Task Force comprising 130 members from 80 organisations that is working to raise awareness and source funds, investors and partners. They are developing a 5-year Road Map from proof of concept to wet demos to pilots and eventually global implementation. Initial demos may include high-risk tsunami areas and the Arctic (cables between Norway and Svalbard). Current funding is mainly from NOAA and NASA. The group is asking POGO to endorse and join the JTF, help identify funding opportunities, help develop the science/implementation plan, and connect with stakeholders. An abstract has been submitted to Ocean Obs' 19.

Update from the Scientific Committee on Oceanic Research (SCOR): *Ed Urban*

SCOR Working Group products now take a variety of different forms (websites, manuals etc). New WGs include one on floating litter (FLOTSAM), one on plankton observing (P-Obs) and one on eastern boundary upwelling systems. SCOR co-sponsors 5 projects (GEOTRACES, IIOE-2, IMBER, IQOE and SOLAS) and several "infrastructural" activities (GlobalHAB, IOCCP, SOOS). SCOR continues to fund a Visiting Scholars programme, for which it receives 30 applications per year. Modest additional funding is obtained through crowd-funding (which increased to 850 USD in 2018). A recent ICSU review recommended that SCOR focus more on societal relevance and communications, although SCOR's main remit remains fundamental science. A seat on the ExCom is reserved for an early-career scientist.

Ocean XPrizes –Past, present and future: *Jyotika Virmani*

XPrize is a multi-million dollar competition for technological developments that address societal issues. There have been 3 ocean XPrizes –Ocean Health (pH sensors), Shell Ocean Discovery (high resolution seafloor mapping) and biological sensors on robots launched from shore.

Deep Ocean Observing System (DOOS): *Simone Baumann-Pickering*

There are various motivators for deep ocean observing, both societal and economic. DOOS conducted an inventory in 2016, for which 70 responses were received, and this effort is ongoing. An interactive

map has been developed (see www.deepoceanobserving.org). In 2017, a Scoping Steering Committee was established.

Wednesday 24th January

Report on POGO Industry Liaison Council and discussion on follow-up: *Steve de Mora and Ralph Rayner*

RR introduced the different types of businesses that are either providers or users of ocean observations and information. The "blue tech" business sector focusses on technology development and standards, with an economic value of $7bn/year in the USA and £1.8 bn/year in the UK. The intermediary sector makes use of observations/data to develop models, tools and visualisations that convert data into products for end-users. This group can be a strong advocate for ocean observations. The end-user business community benefits from ocean observations because it is able to conduct its business more effectively as a result of ocean observations. The linkage between users and providers is sometimes via value-added businesses that are often very large businesses and can be very powerful advocates. Due to this complex landscape, the economical value of ocean observations is not well understood and very difficult to quantify. The ocean economy as a whole is however becoming better studied and understood (e.g. OECD report on the Ocean Economy in 2030, country satellite accounts). Ocean observations are currently little used in weather forecasting (although this is different for climate). Fully-coupled ocean-atmosphere models are being developed that will increase the economic value of ocean observations in this area. The Oceans of Knowledge conference, organised by IMarEST and co-sponsored by POGO, showed the results of recent work on assessing skill improvements associated with fully-coupled ocean-atmosphere operational forecast systems, with participation from NOAA, ECMWF, the UK Met Office. Case studies are being written up, to be published in the Blue Planet Supplemental Issue of the Journal of Operational Oceanography.

SdM then followed with a summary of the work undertaken and recommendations from the POGO ILC. Initial discussions had identified that there were too many stakeholders and types of industry, and POGO-18 had recommended that the ILC focus on the benefits of weather forecasting. Nine meetings had been held over 2 years, mostly via teleconference. There had been presentations at Oceanology International 2016, Ocean Business 2017, Oceans of Knowledge and other meetings. Companies had been successfully invited to sponsor POGO-18 and POGO-19. The recommended next steps were:

- Secretariat to assume the networking activities with industry
- Develop a list of relevant meetings attended by POGO members
- Make use of POGO promotional materials
- Encourage industry sponsorship
- Sophie Seeyave or a POGO trustee to join IMarEST Special Interest Group
- Secretariat to maintain a registry of interested companies
- Interact with various industry groupings.

The floor was then open to the participants for discussion. KW commented that POGO needed to carry on this work, because POGO is one of the few organisations that can deal with inter-cultural differences and can make over-arching recommendations on knowledge transfer at the country level. CS commented that there are many different paths for technological development, and that the members could provide "success stories" or "impact stories" for the Secretariat to harmonise. TK

added that we needed better clarity as to what we want out of industry. It was suggested that the main focus should be on getting industry to see the benefits of ocean observing and fund observing programmes, and that for this to work POGO should use some of its reserves to fund someone to work for POGO on this. EH underlined that the final step should be to close the loop back from advocacy to public funding of ocean observations. RR added that this is a virtuous circle, since advocacy for ocean observations can benefit the provider industry, e.g. by increasing the demand for sensors. POGO needs to position itself as a "knowledge partner" with connections at regional and national scales, and the Secretariat should play a mediation/relationship-building role.

Keynote presentation Workshop 1: *Tom Armitage, International Arctic Science Committee Marine Working Group Fellow, Jet Propulsion Laboratory, USA*

Tom Armitage gave an overview of IASC. It is based on voluntary participation, with modest funding for activities and a strong focus on engaging early-career scientists. Allen Pope is the Executive Secretary. Relevant meeting include the Arctic Observing Summit (theme: the business case for a pan-Arctic observing system, with a call for papers and deadline end Feb) and the POLAR18 conference, both held in Davos in June 2018. POGO is welcome to attend the IASC Marine Working Group business meeting that will be held prior to POLAR18.

Yoshihisa Shirayama (YS) highlighted that there was an Arctic Symposium 2 weeks previously and asked if there was any connection with this. Nick Owens (NO) added that the Arctic Science Summit Week was an interesting conference, very broad but with a focus on social science.

Workshop 1: Arctic Observations (Chair: Nick Owens)

NO gave an introduction to the workshop and the speakers.

The first presentation was on Sustaining Arctic Observing Networks (SAON), given remotely by Jan Rene Larsen. SAON is continuing the legacy of the International Polar Year (2007/8). The Arctic Council urged its members to extend long-term monitoring of change in 2006. In this context, SAON aims to serve societal needs. Its goals are to produce a roadmap for an integrated Arctic observing system, to achieve free and open access to data, and sustainability. Implementation will be in open cooperation with all those committed to Arctic observing. The system will include in situ, remotely sensed and community-based, atmospheric, terrestrial, marine and human-based monitoring.

Suggestions for POGO included making data available for AMAP, cooperation on interoperability and making data available to a wider audience, having POGO represented on the SAON Board (this involves monthly telecons). Other items discussed were looking at gaps in observing activities (e.g. inventory), a fellowship programme with an Arctic focus, and an Arctic GEOSS being proposed by SAON to GEO.

INTAROS EU project: Glenn Nolan, EuroGOOS

Glenn Nolan presented this project on behalf of the INTAROS participants. The project started in 2017 and one of the activities ws to develop and distribute a survey (70 respondents to date).

MM highlighted that there are many groups working in the Arctic and that it is not clear who is doing what, or if they all agreed on what they considered as the spatial extent of the Arctic.

MOSAiC: Karen Wiltshire, on behalf of Markus Rex (AWI)

KW presented this project which is being led by AWI with 15 international partners. It will cost at least 65M EUR on top of the ship operating costs, and it was a very difficult decision for the AWI to commit the Polarstern for such a long period of time and to have to turn away other proposals.

ML commented that it will be a huge process study, but were there any plans to turn some of the measurements into sustained observations? KW responded that the next steps were planned to be more open water, coastal and permafrost measurements, and that a "terrestrial" MOSAiC was already being planned. She added that the AWI already had study sites in the Fram Strait and Lena River Delta, and that there was no funding for an additional site. VR added that this was a once-in-a-lifetime opportunity to measure biogeochemical processes to input into models (sea ice melting/freezing), and that IOC would be happy to endorse this project.

Ed Hill (EH) asked what the role of POGO could be. As agreed at POGO-18, POGO should focus on the interfaces between Arctic and Sub-Arctic, and play a coordinating role (rather than just being an additional player). VR suggested that POGO could help with advocating for the need for an Arctic GOOS. KW added that POGO's role should be to explain who the main players are in the Arctic. SS suggested that this could be integrated in the "ocean observing seascape" that POGO is leading within Blue Planet. GN mentioned that EuroGOOS is doing something similar for the European landscape.

Keynote presentation Workshop 2: *Francisco Chavez, Monterey Bay Aquarium Research Institute (MBARI)*

Francisco Chavez (FC) gave an overview of "observing life in the seas –where are we and what are POGO opportunities?" A comment was made that viruses and funghi were missing from the overview, to which FC responded that it was not meant to cover all types of organism. TK commented that the biological data pipeline will require a lot of work and because of the way genomics is set up there is a place where people can go (libraries).

Workshop 2: Innovative Biological Sampling (Chair: Margaret Leinen)

ML gave an introduction to the workshop and the speakers.

SCOR working group on Integration of Plankton-Observing Sensor Systems to Existing Global Sampling Programs (P-OBS): Emmanuel Boss, University of Maine

This WG is leveraging the work of two large-scale coordination groups –GO-SHIP and OceanSITES. It will add protocols for plankton measurements on-board research vessels to the GO-SHIP manuals, which are currently focussed on biogeochemistry only. There are synergies between this WG and other groups, such as BGC-Argo, CPR etc. POGO is seen as a source of information/expertise for this WG and could help with linking to the materials produced by the WG and with sustainability beyond the 3-year period.

Jules Jaffe (JJ) raised the issue of under-sampling, and whether models can be reconciled with this type of synoptic sampling. EB replied that the use of underway systems on ships is helping with this, and also expeditions such as TARA for "crude" measurements such as fluorometry. AC asked how to reconcile fixed-point variation with transect data, to which EB responded that this could be done using models. Willie Wilson (WW) asked if GO-SHIP used

only research vessels. EB replied that this was currently the case, although it could be expanded to other ships.

General discussion of innovative biological sampling and the role of POGO going forward

A Case Study of Technological Development in Support of Fisheries Management: Chris Scholin

The Nature Conservancy and others came up with a benthic observing system (BOS) to overcome the issue that nets cannot be used in rocky habitats where the fish prefer to live. The system works but does not meet end-user requirements. A workshop was held on visual tools to bring together end-users and address science as well as engineering questions. A NOAA system was compared to BOS and they looked to combine this with acoustic and genomic sensors for potential application to Marine Protected Areas (MPAs).

SdM asked how long it took fish to start ignoring the instrument and CS responded that it is very quick. JJ added that there is a Sea Grant project that came to a similar conclusion. YS asked if the system released lead into the aquatic system and CS responded that the instrument was collected again after use and nothing was left behind.

ML then gave an overview of the history of the Biological Observations Task Force (TF), which had started off looking at conservation issues (MPAs). At POGO-19 it had been agreed to focus on the transition from physical to biological observations. The TF had identified a very broad set of drivers for biological observations and looked at the impacts of biodiversity on ecology and biogeochemistry, as well as the relationships between surface, deep and benthic biology. Some of the policy questions that can be addressed are (1) do MPAs work?, (2) could we sequester carbon in the ocean without harming ecosystems?, and (3) how does marine debris propagate? There are also public concerns, such as "Is the ocean dying?". Currently the scientific community cannot answer these big questions. The TF had asked itself what was the appropriate focus for POGO. The focus should be on large scale, long-term observations, technological developments and biological rather than just biogeochemical observations. The need to partner with other groups to accelerate the process of developing biological observing capabilities was highlighted, and in particular the need to work with management and conservation groups. POGO could play a leadership role in fostering dialogues to increase the pace of technological development (e.g. standards, validation/verification, intercalibration, sampling strategies, development of data repositories). The Argo programme undertook a complex modelling process to determine how many floats would need to be deployed, and BGC-Argo should do the same. There are currently no repositories for many types of biological data, such as flow cytometry data. It was highlighted that it is not POGO's role to determine EOVs. A recommendation was made to establish a longer-term Working Group on this topic, and to work with other organisations such as ICES, PICES, SCOR and GEO.

SdM commented that remote sensing was missing from this summary. ML responded that the TF had agreed POGO was better placed to foster intercalibration rather than advocating for sensors, and that there were other groups focussing on remote sensing. Bob Weller (BW)

commented that OceanSITES has been talking for years about adding biological sensors to its moorings, which are turned around regularly, but this has not yet happened because operators are nervous about this. Maybe POGO could help to encourage this. ML responded that this was a great suggestion, and also there was an opportunity with oil rig decommissioning. Henk Brinkhuis (HB) added that POGO should play an advocacy role in addition to making technical recommendations. Vladimir Ryabinin (VR) recommended that POGO also support intergovernmental processes such as the GOOS BioEco Panel and biodiversity in areas beyond national jurisdiction (BBNJ, IPBES). EH added that this is also relevant to the World Ocean Assessment and the European Marine Strategy Framework Directive (MSFD). EBG made a plea for POGO to get more involved with remote sensing, e.g. advocate for ocean sensors to be added to LiDAR. Alessandro Crise (AC) commented that the readiness level is not very advanced, and that there needs to be a foresight effort/roadmap to see what will be available in the future. CS suggested articulating use cases. EH added that there are two types of biological observation: one is monitoring to assess policy/management effects, and the other is to address scientific questions.

Regarding the proposal to the Lounsbery Foundation, the TF had had a lively discussion and come up with a recommendation to bridge the gap between the scientific community and the Artificial Intelligence (AI)/Machine Learning (ML) communities, for both developed and developing countries and for resource management and conservation as well as science. Jyothika Virmani (JV) commented that POGO could define a question to be addressed, and then propose to set up a HeroX challenge for application development. HS commented that there is a need to set standards for AI. MM mentioned a project between the University of Cambridge and Google. KW suggested linking up to the Big Data policies of our nations/regions. Sebastien de Halleux (SdH) stated that the AI community is looking for well-formed questions and encouraged the POGO community to articulate the problems and the solutions that are required, and present these at an AI conference.

Presentations from Sponsors: 'Innovation in Ocean Observations' (Chair: Gwen Nero)

- Saildrone: Sebastien de Halleux, COO
- Teledyne Marine: Peter Spain, Research Scientist
- RBR, Ltd.: Chris Kontoes, Technical Sales
- Ocean Aero, Ltd.: Neil Trenaman, Executive VP Strategic Business Development
- Sea-Bird Scientific: Casey Moore, President
- Sonardyne: Simon Partridge, Engineering Director
- Q&A with all presenters

Wrap-up and recommendations from Workshops 1 & 2

Arctic observations

The group acknowledged that this was a very mature arena with many existing players, and that POGO should be careful about "wading in". POGO should have a representative attend relevant meetings (e.g. IASC and SAON, as per their invitations expressed today). POGO should also think about how to get representatives of other organisations to attend POGO meetings. The idea of

producing an infographic on Arctic organisations was popular. EH commented that we should go one step further and use the advocacy power of POGO to enhance ocean observations in the Arctic and their coordination, as was done with the Southern Ocean, through SOOS. VR commented that this would be very useful for IOC and Mike Meredith (MM) added that such an observing system was needed by society. Despite all the activity that is going on there is no sustained observing system. Support was needed also on the Pacific side (e.g. Japan, China, Korea).

Biological observations

The main recommendations from the Task Force was the creation of a longer-term Working Group and development of a Work Plan to foster the development and deployment of biological sensing and use the advocacy power of POGO to support the development of EOVs, CBD, SDGs, BBNJ, the UN Decade and the World Ocean Assessment; the development of intercalibration and data repositories. It was recognised that the conservation community was mainly coastal and that that it was a different community to the ones we are used to working with, and that we should not "walk away" from remote sensing.

The proposal from the TF to use the Lounsbery Foundation funds to help POGO member institutions move towards AI/ML had been approved by the members.

WW commented that physical as well as data repositories should be considered. TK said there should be a strong emphasis on biology rather than just biogeochemistry. BW added that he would like to see POGO supporting OceanSITES for biological measurements. VR added that POGO should think about how POGO could contribute to Ocean Obs' 19 in this area. ML concluded that the nature of the WG needed to be discussed and further defined.

Action Items from POGO-19

UK Charity:

1. Send latest version of the Constitution to all members and give them 1 week to make any final suggestions. Trustees' institutions (minus OGS) to become first members of the CIO and ratify new version of the Constitution for submission to the Charity Commission. Action: Secretariat and Board of Trustees.

2. Draft Memorandum of Understanding to formalise membership of the new CIO, with the Constitution as an Appendix, then work with the members of the Canadian POGO Society to sign them on as members of the CIO. Action: Secretariat, Board of Trustees, members.

3. Write letters of appointment from POGO Chair to newly elected trustees (Owens, Brinkhuis, Herzig), and request those who are stepping down to submit letters of resignation (Moksness, de Mora, Balguerías-Guerra). Action: Secretariat, Owens, Brinkhuis, Herzig, Moksness, de Mora, Balguerías-Guerra. Owens to provide example/templates.

4. Change Operating Rules so that a trustee (not the Chair) is also a member of the Finance Committee. Action: Secretariat and Board of Trustees.

5. Once all the members have been transferred to the new CIO, wind down Canadian not-for-profit Society and transfer assets from Canada to UK. Action: Secretariat and Board of Directors of Canadian Society.

6. Gradually change organisation's name to Partnership for Observation of the Global Ocean (singular), but no need to change the Charity name for the time being. Action: Secretariat.

Secretariat staffing:

7. Investigate the options of transferring staff from PML to POGO CIO employment, including obtaining legal and financial advice on all the implications and requirements. These will be reviewed at the mid-year Board of Trustees Meeting. If major issues arise, Board of Trustees to decide if this needs to be presented to the members at POGO-20 for decision. If no major issues arise, Board of Trustees to move forward with transferring the staff to POGO CIO. Action: Board of Trustees, Finance Committee and Secretariat.

Finances:

8. Implement new dues structure for low-income countries, as agreed during Partners' Meeting (see Appendix 1). Write to prospective members with dues information and invitation to join POGO. Action: Secretariat and WG on African connections (see #11).

9. Implement 2018 budget as agreed during Partners' Meeting (see Appendix 2). Action: Secretariat.

10. Issue second call for proposals for Working Groups, training initiatives and project funding/endorsement in February. Set up Sub-Committee to evaluate proposals received in first call. Action: Secretariat.

Annual Meetings:

11. POGO-20 to be held in Mindelo, Cape Verde, from 22 to 24 January 2019, with Finance Committee and Board of Trustees Meetings on 21 January and Board of Trustees Meeting on 25 January 2019. Working Group consisting of Balguerías-Guerra, Brinkhuis/ NIOZ nominee, Crise, de Mora, Wilson and Wiltshire, (with open invitation for other members to join), to plan for engagement with this region. Action: WG, Secretariat, Board of Trustees.

12. Offers from First Institute of Oceanography, SOA, China, and CICESE, Ensenada, Mexico, to host POGO-21. Both members to present their formal offers at POGO-20 for the members to decide. Action: Wei Zexun and Edgar Pavia.

POGO Priorities and projects:

13. POGO to fund and implement OpenMODS project. Action: Alessandro Crise, Karen Wiltshire, with support from Secretariat.

14. Develop more detailed proposal on the use of the Lounsbery Foundation funds to lay out the way forward for the scientific/ocean observing community to engage and work with the artificial intelligence/machine learning community to enhance biological observations. Submit proposal to Board of Trustees for review. Action: Margaret Leinen (and previous biological observations Task Force), Board of Trustees, with support from Secretariat.

15. Industry liaison: Secretariat to assume networking activities with industry and maintain a list of relevant meetings that POGO members are attending and ensure that POGO promotional materials are sent to these meetings. Engage with IMarEST Special Interest Group (appoint POGO representative?). Maintain registry of interested companies, trade bodies, clusters and other industry groupings. Action: Secretariat.

16. Develop ideas for dialogue and collaboration with XPrize. Action: Board of Trustees, Secretariat.

17. Arctic: Working group to keep a watching brief on activities and organisations relevant to Arctic observations. Nominate POGO representative to attend relevant meetings (as invited by IASC and SAON), and invite representatives to attend our meetings. Develop infographic to clarify the "seascape" of Arctic observing/science organisations. Issue statement on the need for an Arctic GOOS Regional Alliance Action: Secretariat, Nick Owens, Karen Wiltshire.

18. Biological sampling: Establish longer-term Working Group to foster the development and deployment of biological sensing. Use advocacy power of POGO to support the development of EOVs, policy frameworks such as CBD, SDGs and BBNJ, WOA and other high-level global initiatives such as the UN Decade of Ocean Science for Sustainable Development. Nature and modus operandi of WG to be agreed with the Board of Trustees. Establish links to OpenMODS and other relevant activities. Action: Margaret Leinen and WG, Alessandro Crise, with support from Secretariat.

19. Nature Partner Journal: Issue another call to POGO members for Editor-in-Chief and Associate Editors, with deadline of 2 weeks. Confirm with Nature that POGO agrees to the revised scope and

title. Obtain legal advice for negotiations with Nature. Meet with NPJ before and during Board of Trustees Meeting in the summer. Action: Shirayama, de Mora, Board of Trustees and Secretariat.

20. Request final comments from members on draft document on the importance of WOA and GOOS for the goals of the G7 initiative on the future of seas and oceans, and for SDGs. Continue to liaise with IOC, GOOS and WOA about the wording and relevant UN groups/contacts to send the statement to (FAO, IMO, UNEP, UNDP, IAEA, UN Scientific Advisory Board). Action: Secretariat and members.

21. POGO to be bronze sponsor for Ocean Obs' 19. Submit White Paper for Ocean Obs' 19 (using key information from POGO Strategy, statement on GOOS etc). Explore possibility of organising a POGO lunch/reception/meeting in addition. Submit one or more abstracts (deadline 15th March 2018), e.g. on biological observations, private sector engagement, Arctic, G7 etc. Action: Secretariat, Board of Trustees and members.

22. Continue to engage with G7 experts' group; members to stimulate support through their national governments. Write to colleagues in Canada to express POGO's support for the continued inclusion of ocean observations in the G7 remit. Action: Secretariat and Board of Trustees.

23. Blue Planet: request from members to nominate representatives who might attend the 4th Symposium to coordinate POGO presence, and present POGO perspective (biological obs, industry, Arctic). Look into hosting a town hall/lunch side event to inform about POGO and solicit new members. Action: Secretariat, Board of Trustees and members.

24. Launch Graham Shimmield Award (for up-and-coming leaders in marine science/observations) as a joint initiative with SAMS and Bigelow. Action: Secretariat, Nick Owens.

Professional training:

25. Continue joint POGO-SCOR Visiting Fellowship programme. Action: Secretariat.

26. Finalise and submit article on evaluation of POGO training programmes. Action: Secretariat, Board of Trustees.

Partnership for Observation of the Global Oceans

POGO-19 List of Participants

Organisation	Position	Country	Surname	First name
Members				
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Research Director	Australia	Worby	Tony
Institute for Marine and Antarctic Studies (IMAS)	Executive Director	Australia	Coleman	Richard
Flanders Marine Institute (VLIZ)	General Director	Belgium	Mees	Jan
First Institute of Oceanology, SOA	Deputy Director	China	Wei	Zexun
Institute of Oceanology Chinese Academy of Sciences	Deputy Director	China	Li	Chaolun
Alfred Wegener Institute (AWI)	Vice-Director	Germany	Wiltshire	Karen
Marine Institute	Director, Ocean Science and Information Services	Ireland	Gillooly	Michael
Istituto Nazionale di Oceanografia e di Geofisica Sperimentale	Senior Scientist	Italy	Crise	Alessandro
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)	Executive Director	Japan	Shirayama	Yoshihisa
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)	Assistant Executive Director	Japan	Sakaguchi	Hide
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)	Administrative Staff	Japan	Inoue	Yuki
Oceanology Division of The Center for Scientific Research and Higher Education at Ensenada (CICESE)	Director	Mexico	Pavia	Edgar
The Royal Netherlands Institute for Sea Research (NIOZ)	Director	Netherlands	Brinkhuis	Henk
The Royal Netherlands Institute for Sea Research (NIOZ)	Senior Scientist/Former Director	Netherlands	de Leeuw	Jan
Instituto Espanol de Oceanografia (IEO)	Director	Spain	Balguerias	Eduardo
British Antarctic Survey (BAS)	Science Leader	United Kingdom	Meredith	Mike
National Oceanography Centre (NOC)	Executive Director	United Kingdom	Hill	Ed
Plymouth Marine Laboratory (PML)	Chief Executive	United Kingdom	de Mora	Steve

Plymouth Marine Laboratory (PML)	Trustee	United Kingdom	Rayner	Ralph
Scottish Association for Marine Science (SAMS)	Director	United Kingdom	Owens	Nick
Sir Alister Hardy Foundation for Ocean Science (SAHFOS)	Director	United Kingdom	Wilson	Willie
Monterey Bay Aquarium Research Institute	President	United States	Scholin	Chris
Scripps Institution of Oceanography	Director	United States	Leinen	Margaret
Scripps Institution of Oceanography	Head, Acoustic Ecology Laboratory	United States	Bauman-Pickering	Simone
Scripps Institution of Oceanography	Professor	United States	Gille	Sarah
Scripps Institution of Oceanography	Senior Scientist	United States	Jaffe	Jules
Scripps Institution of Oceanography	Professor	United States	Martz	Todd
Scripps Institution of Oceanography	Professor	United States	Roemmich	Dean
Scripps Institution of Oceanography	Associate Professor	United States	Sandin	Stuart
Scripps Institution of Oceanography	Consultant	United States	Shaffer	Lisa
Scripps Institution of Oceanography	Coastal Data Information Program, Co-Manager/Principal Investigator	United States	Thomas	Julie
Texas A&M University Geochemical Environmental Research Group (GERG)	Director	United States	Knap	Antony
Florida Atlantic University, Harbor Branch Oceanographic Institute	Executive Director	United States	Post	Anton
Florida Atlantic University, Harbor Branch Oceanographic Institute	Associate Executive Director for Academic Affairs & Economic Development	United States	Davis	Megan
Woods Hole Oceanographic Institution (WHOI)	Senior Scientist	United States	Weller	Bob
Partners/observers				
EuroGOOS/ GOOS Regional Alliances	Secretary General	Belgium	Nolan	Glenn
Intergovernmental Oceanographic Commission (IOC)	Executive Secretary of IOC/Assistant Director General of UNESCO	France	Ryabinin	Vladimir
Jet Propulsion Laboratory (JPL)	International Arctic Science Committee Marine Working Group	United States	Armitage	Tom

Scientific Committee for Oceanic Research (SCOR)	Executive Director	United States	Urban	Ed
SMART Cables		United States	Thomas	Preston
The Maritime Alliance	Executive Director	United States	Murphy	Greg
The Maritime Alliance	President	United States	Jones	Michael
University of Hawaii at Manoa, USA	Professor	United States	Howe	Bruce
University of Maine	Professor of Oceanography	United States	Boss	Emmanuel
XPrize	Senior Director	United States	Virmani	Jyotika
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Ocean Aero		United States	Peterson	Brian
Ocean Aero	Executive VP, Strategic Business Development	United States	Trenaman	Neil
RBR, Ltd.	Technical Sales Manager	United States	Kontoes	Chris
Saildrone, Inc.	COO	United States	de Halleux	Sebastien
Saildrone, Inc.	Business Development	United States	Cohen	Nora
SeaBird Scientific	President	United States	Moore	Casey
Sirenas MD	Director of Operations	United States	Schwent	Tamara
Sonardyne	Engineering Director	United States	Partridge	Simon
Teledyne RD Instruments	Independent Sales Representative	United States	Gloor	Steven
Teledyne RD Instruments	Technical Marketing	United States	Spain	Peter
Teledyne RD Instruments	Director of Marine Measurements Product Lines	United States	Symonds	Darryl
Teledyne RD Instruments	Coastal and Oceanographic Sales Manager	United States	Devine	Paul
NANO members				
Russian Federal Research Institute of Fisheries and Oceanography (VNIRO)	Researcher	Russia	Kivva	Kirill
University of Baja California	Professor	Mexico	Gonzalez	Adriana

Secretariat				
POGO Secretariat	POGO Executive Director	United Kingdom	Seeyave	Sophie
POGO Secretariat	POGO Communications Officer	United Kingdom	Beckman	Fiona