

# Summary of Outcomes: POGO's Role in Fostering, Promoting, and Adopting Emerging Technologies

*Session Co-leads: Fei Chai and Tony Knap*

## **Executive Summary**

*Ocean Observations: Emerging Technologies and Strategies – Leveraging Innovation for Global Impact*

The discussion highlighted rapid advances in ocean observing technologies and strategies that could significantly enhance global-scale monitoring over the next decade, with a strong emphasis on biological and ecosystem variables to complement established physical and chemical observations.

## **Emerging Variables and Technologies**

Participants emphasized the growing maturity of biological imaging and AI-enabled analysis, including Imaging FlowCytobots (IFCBs), Underwater Vision Profilers (UVPs), and low-cost tools such as PlanktoScope. When combined with machine learning, these systems enable scalable, automated plankton and ecosystem monitoring across autonomous platforms (floats, gliders, moorings, USVs, UAVs).

Environmental DNA (eDNA) was identified as a particularly promising tool, with potential for autonomous deployment, simultaneous sampling, and near-real-time biodiversity assessment. eDNA offers a powerful new pathway for monitoring ecosystem change and biodiversity at scale.

## **Technologies with Global Deployment Potential (5–10 years)**

Several technology families were seen as likely to achieve global relevance in the next decade:

- Advanced and quantum sensors, including genetically engineered organism-based sensors, smart cables, mooring-based sensors, and distributed acoustic sensing (DAS), enabling transformative real-time measurements.
- Next-generation AUVs, driven by AI-enabled autonomy, improved batteries, and advances in underwater communications.
- Innovations in remote sensing, leveraging high-resolution Earth observation and commercial satellites, alongside improved algorithms for detecting harmful algal blooms, biotoxins, plastics, and other ecosystem stressors.

## **Challenges and Opportunities**

Key challenges include growing demands for computing power, data storage, and data integration, alongside the need for more purposeful and coordinated observing strategies. Observing harsh

environments (deep ocean, under-ice regions) remains difficult but presents opportunities through animal-borne sensors, novel bio-engineered approaches, and regional resource sharing.

Additional cross-cutting issues include cost-efficiency (e.g. Coastal Argo), biofouling management, regulatory barriers for autonomous platforms (especially USVs), and the need for coherent global integration of emerging technologies such as quantum sea-level sensors.

### **Role of POGO**

Participants identified several actions for POGO to accelerate progress:

- Strengthen coordination and community-building, clarifying roles with GOOS (standard-setting) and positioning POGO as a facilitator of implementation and innovation.
- Establish global Communities of Practice and improve information sharing, including dedicated forums to connect innovators, manufacturers, and funders.
- Expand capacity building and training, particularly in developing regions, through sustainable programs and POGO-led guidance to industry and funding agencies.
- Promote equitable global participation in next-generation ocean observing systems.

### **Conclusion**

The session concluded that future global observing systems must prioritize AI integration, scalable biological and ecosystem measurements, and technologies adaptable to diverse and extreme ocean environments. Success will depend on sustained investment in training, international collaboration, and coordinated implementation, with POGO playing a central enabling role.