Regional Training on Major Aspects of Marine Sciences for MPA Monitoring and Management (RETMMAM)

1. Introduction

The Partnership for Observation of the Global Ocean (POGO) funded Regional Training on Major Aspects of Marine Sciences for MPA Monitoring and Management (RETMMAM), was successfully organized by the Nigerian Institute for Oceanography and Marine Research (NIOMR), in partnership with Euro-Mediterranean Center on Climate Change (CMCC, Italy), Institut de Recherches Halieutiques et Océanologiques du Bénin (IRHOB, Benin), University of Ghana (UG, Ghana), Centre Universitaire de Recherche et d'Application en Télédétection (CURAT, Côte d'Ivoire), and University of Calabar (UNICAL, Nigeria).

The training held from 19th to 23rd October 2025 brought together early and mid-career marine scientists from across West Africa. It aimed to enhance regional capacity in marine protected area monitoring and management through in-class lecture, hands-on field and laboratory sessions.

The main objectives of the RETMMAM training were to:

- Strengthen the capacity of early- and mid-career scientists in marine sciences, particularly in MPA monitoring and management.
- Enhance understanding of marine ecosystems, pollution processes, and mitigation strategies.
- Promote collaboration among regional marine research institutions and encourage data sharing and ocean stewardship.

The training hosted 21 participants drawn from partner institutions across West Africa, including Nigeria, Ghana, Benin, and Côte d'Ivoire. The participants represented universities and research institutions actively engaged in marine and coastal studies. The gender balance among participants reflected inclusivity and regional representation (Table 1).

Table 1: List of Trainees, Their Affiliations, Countries, and Gender

S/N	NAMES	AFFILIATION / COUNTRY	GENDER
1	COMFORT OPOKU	UNIVERSITY OF GHANA	F
2	DORCAS ANTWI	UNIVERSITY OF GHANA	F

3	OKPEITCHA O. VICTOR	IRHOB (BENIN)	M
4	TOUPE AHOUEFA GERARDA MAIËLLA	IRHOB(BENIN)	F
5	ADJE ADEKOUNLE CHRISTIAN	IRHOB(BENIN)	M
6	DJOHORE E. JUDITH	CURAT (Côte d'Ivoire)	F
7	ABAKA KOUTOUAN JEAN-LOUIS	CURAT (Côte d'Ivoire)	M
8	MICHAEL CHIBUZOR OKERE	UNILAG (Nigeria)	M
9	OKORO CHIDINMA MIRIAN	UNILAG (Nigeria)	F
10	EDAK AGI-ODEY	UNICAL (Nigeria)	F
11	DAVID EDODI	UNICAL (Nigeria)	M
12	MUHAMMAD KACHALLA	NIOMR (Nigeria)	M
13	OBIORA IJEOMA JACINTA	NIOMR (Nigeria)	F
14	OLORUNFEMI IREMIREN	NIOMR (Nigeria)	F
15	GIWA SIKIRAT MAYOWA	NIOMR (Nigeria)	F
16	ODEDERE ADELODUN OMOTAYO	NIOMR (Nigeria)	M
17	OKONKWO EBERE	NIOMR (Nigeria)	F
18	ABDULGANIYU ABDULAFEEZ	NIOMR (Nigeria)	M
19	ACHUMBA GEORGE U.	NIOMR (Nigeria)	M
20	OWULU MAURICE KOSISOCHUKWU	NIOMR (Nigeria)	M
21	ONWUJIARIRI CHINEMEREM EMMANUEL	ARAC (Nigeria)	M

2. Detailed Report of Daily Activities

The Regional Training on Major Aspects of Marine Sciences for MPA Monitoring and Management (RETMMAM) commenced on Sunday, 19 October 2025, with the arrival of participants from across West Africa - Nigeria, Ghana, Benin, and Côte d'Ivoire (e.g. Figure 1 shows Ghanaian trainees arriving at the airport in Lagos).

Fig.1: Ghanaian trainees ready for pick-up at Lagos International Airport.

Upon arrival, participants were warmly received by the organizing team and settled into their accommodation. The day provided an opportunity for informal networking, introductions, and a short pre-training briefing that outlined the objectives and expectations of the training program.

The formal opening ceremony took place on Monday, 20 October 2025, at NIOMR's conference hall. The event began with welcome remarks from the representative of the ED / CEO of NIOMR (Dr Yakubu Ademola – Director of Biological Oceanography Dept), followed by an overview of the training schedule, the introduction of participants, and the taking of group photographs (figure 2).

Fig.2: Left – Representative of the ED/CEO of NIOMR, Dr. Yakubu A. S., delivering the welcome remarks; Right – Group photograph of NIOMR management and staff with the trainees.

The day's sessions focused on the fundamentals of marine and coastal science, emphasizing geochemical and biogeochemical processes relevant to MPA monitoring. Lectures covered topics such as elemental cycling, nutrient dynamics, sources and fate of marine pollutants, and the impacts of ocean acidification (figure 3). Participants engaged in interactive discussions and group exercises, fostering collaboration and an exchange of ideas on effective monitoring strategies for marine and coastal ecosystems.

Fig.3: Some of the pictures taken during the lecture sessions of the regional training - RETMMAM.

We received the tide gauge donated by our technical partner, CMCC Italy, as part of the support from the Coast Predict initiative under the UN Ocean Decade (2021–2030). This contribution aligns with the Ocean Decade African Roadmap and aims to strengthen the capacity of African Early Career Ocean Professionals (ECOPs) - figure 4.

Fig.4: Delivery of the tide gauge donated by CMCC Italy under the UN Ocean Decade Coast Predict initiative.

On Tuesday, 21 October 2025, the focus shifted from in-class lectures to fieldwork as participants embarked on a full-day field excursion to some designated locations in the Lagos lagoon and along the Commodore channel, where the Lagos Lagoon connects to the Gulf of Guinea. Under the supervision of instructors, participants carried out a series of hands-on field demonstrations (figure 5). These included the measurement of physico-chemical parameters such as temperature, salinity, dissolved oxygen, pH, and conductivity using multiparameter probes.

Fig.5: Field activities: Hands-on field demonstrations, *in-situ* data and sample collection.

Microbiology samples were collected, and demonstrations were carried out on the use of a plankton net for plankton collection. Grabbing for sediments and sieving for benthic macro-fauna samples were also demonstrated. Water samples were collected with Niskin bottle, while surface and sub-surface sediments were collected using Van Veen grab and hand corers. The field session gave participants real-world experience in marine sampling and strengthened their understanding of environmental data collection techniques.

Wednesday, 22 October 2025, was dedicated to laboratory and data analysis sessions. Participants processed the collected water and sediment samples to determine nutrient concentrations, chlorophyll-a content, and microbial analysis. The data were then analyzed using statistical tools and visualized with Ocean Data View (ODV) and QGIS software. Facilitators guided participants in interpreting spatial and temporal variations in the data, examining interrelationships between variables, and linking observations to ecosystem health and MPA management goals. The hands-on analytical component of the training was particularly valuable, as it strengthened participants' technical capacity in marine environmental monitoring and data interpretation (figure 6).

Fig.6: Laboratory session demonstrating analytical techniques, operation of equipment, and sample analyses.

An entrepreneurship session was incorporated into the RETMMAM training program to broaden participants' understanding of the economic potential of marine conservation. A lecture titled *"Diving into Prosperity: How Marine Protected Areas Can Boost Local Economies"* was delivered by Dr. Olajuyigbe, Head of the Fish Technology and Product Development Department, NIOMR (figure 7). The session highlighted how sustainable use of marine resources and effective MPA management can drive local entrepreneurship, create jobs, and support community livelihoods, reinforcing the link between ocean conservation and economic development.

Fig.7: Entrepreneurship session during the RETMMAM training program

The final day, Thursday, 23 October 2025, featured data analyses, group discussions, and presentations (figure 8). Each team presented their field and laboratory results, highlighting the key findings, trends, and implications for the sustainable management of Marine Protected Areas.

Fig.8: Data analyses, Group presentations and discussions.

The wrap-up session included reflections from facilitators and participants on the skills gained and the collaborative spirit that characterized the program, marking the successful completion of the training. Participants departed later that day with renewed motivation to apply the knowledge acquired in their respective institutions and to maintain the regional collaboration fostered through the RETMMAM initiative.

3. Some Technical Aspects of the RETMMAM Training

- *Analyses and Interpretation of Physico-chemical Data*

    Participants were trained on the use of Ocean Data View (ODV) software for visualizing oceanographic data, generating Isosurface plots, and applying basic statistical tools such as scatter

plots, regression analysis, and correlation matrices. They analyzed the physico-chemical parameter data to interpret its biogeochemical significance. Working in groups, they examined parameters such as dissolved oxygen, salinity, pH, turbidity, and total dissolved solids, creating visual summaries and discussing their ecological relevance. By the end of the session, participants could independently visualize and interpret physico-chemical data using ODV.

The QGIS session was designed to strengthen participants' capacity in spatial visualization and analysis of oceanographic data using field measurements collected during the sea cruise. Focusing on salinity data (figure 9), the training demonstrated geospatial data processing, interpolation, and visualization within the QGIS environment. Participants learned how to import point data, apply coordinate reference systems, and perform spatial interpolation using the Inverse Distance Weighting (IDW) technique to generate salinity distribution maps. The results revealed a gradual decline in salinity from coastal to inland waters. The interactive session encouraged active participation and inquiry, enabling attendees to gain practical experience in converting raw field data into meaningful spatial information for marine resource management and environmental assessment.
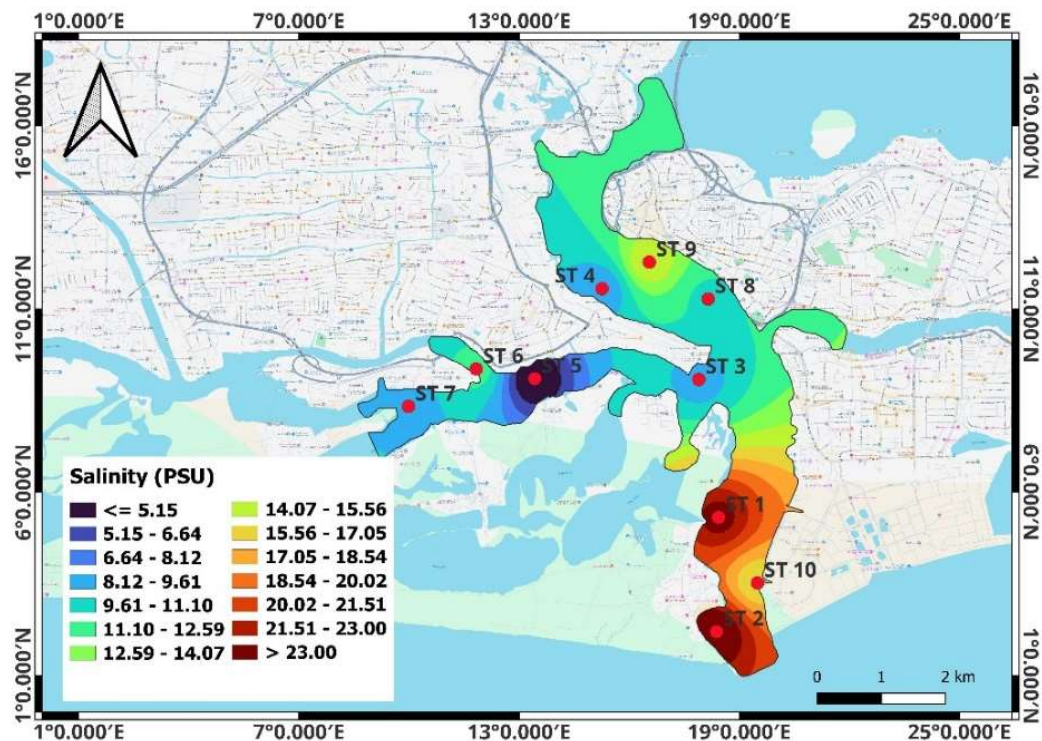

Figure 9: Salinity distribution map generated by one of the participants using QGIS.

- *Geo-Chemical Principles and Sediment Characterization*

  Participants were introduced to key geo-chemical principles and their application in assessing marine pollution and sediment quality. They learned how geochemical signatures distinguish natural from anthropogenic metal sources and how to apply pollution indices such as the Enrichment Factor, Contamination Factor, and Pollution Load Index. The training also covered sediment characterization techniques, including particle size distribution, sorting, and classification using sieving and hydrometer methods. Through these sessions, participants gained practical understanding of how sediment properties and geochemical indicators can be used to evaluate environmental quality, trace pollution sources, and interpret sediment provenance in marine ecosystems.

- *Microbiological analysis of surface water and sediment*

  Participants were introduced to microbiological techniques for assessing water and sediment quality. Surface water samples were collected directly against the current, while sediment samples were obtained using a Van Veen grab and transported on ice to the laboratory. After serial dilutions, total heterotrophic bacteria and fungi were cultured on Nutrient and Potato Dextrose Agar using the spread plate method. Pollution indicator organisms, including total and fecal coliforms, as well as potential pathogens such as *Vibrio* and *Salmonella-Shigella* species, were isolated using membrane filtration on selective media. The session provided participants with hands-on experience in microbial culture, incubation, and enumeration procedures for environmental monitoring.

- *Plankton Sampling and Analysis*

  Participants were trained on plankton sampling techniques involving both phytoplankton and zooplankton collection across ten stations. Standard plankton nets with a 25 μm mesh size were used for horizontal and vertical tows at low speed, and samples were preserved in 10% buffered formalin. In the laboratory, samples were concentrated by decantation and analyzed under an Olympus binocular microscope at varying magnifications (50x–400x). Species identification and abundance were determined using standard counting procedures, expressed as the number of organisms per millilitre. Through this session, participants gained hands-on experience in plankton sampling, concentration, identification, and quantitative analysis essential for ecological and productivity studies.

- *Study of Benthic Macrofauna*

  As part of the practical training, participants examined benthic macrofauna to understand how sediment-dwelling organisms serve as indicators of environmental quality. Sediment samples were

collected across ten stations using a 0.1 m² Van Veen grab and washed through a 0.5 mm mesh sieve to retain macrobenthic organisms. The samples were preserved in 10% formalin and later processed in the laboratory, where participants washed, sorted, and identified organisms to the species level. Trainees were also introduced to and trained on the use of AZTI's Marine Biotic Index (AMBI) software for assessing the ecological status of marine environments. The analysis identified sixteen taxa belonging to three phyla - Mollusca, Annelida, and Arthropoda; with Mollusca as the dominant group (92.31%). The AMBI results indicated that the Lagos Harbour is undisturbed to slightly disturbed (table 2), supporting a community largely sensitive to organic pollution.

Table 2: Ecological quality status of the Lagos Harbour

Stations	AMBI	Disturbance Classification	Diversity	Richness	M-AMBI	Status
ST 1	1.00	Undisturbed	2.73	7.00	0.94	High
ST 2	0.00	Undisturbed	1.00	2.00	0.56	Good
ST 3	0.00	Undisturbed	0.00	1.00	0.40	Moderate
ST 4	2.29	Slightly disturbed	2.04	6.00	0.74	Good
ST 5	2.25	Slightly disturbed	1.50	3.00	0.53	Good
ST 6	1.26	Slightly disturbed	2.06	5.00	0.75	Good
ST 7	1.50	Slightly disturbed	0.00	1.00	0.31	Poor
ST 8	2.58	Slightly disturbed	1.97	5.00	0.67	Good
ST 9	3.00	Slightly disturbed	0.00	1.00	0.22	Poor
ST 10	0.00	Undisturbed	0.00	1.00	0.40	Moderate

4. Future Plans and Next Steps

This report serves as a detailed account of the RETMMAM training activities. Final analyses of the samples collected during the fieldwork are planned, and the results will form the basis of a scientific paper to be published. All RETMMAM contributors, including the 21 trainees, will be listed as co-authors in recognition of their active participation and input. In addition, plans are underway to install and operationalize the tide gauge donated by CMCC. The data generated from this equipment will contribute significantly to both regional and global oceanographic research efforts.

5. Appreciation

The success of the Regional Training on Major Aspects of Marine Sciences for MPA Monitoring and Management (RETMMAM) would not have been possible without the collective efforts and support of our partners, facilitators, and participants.

We extend our heartfelt gratitude to the Partnership for Observation of the Global Ocean (POGO) for funding and providing continuous support throughout the planning and implementation of the training.

Special appreciation goes to all RETMMAM partner institutions for their invaluable collaboration and contribution to the program's success:

- Nigerian Institute for Oceanography and Marine Research (NIOMR, Nigeria)
- Institut de Recherches Halieutiques et Océanologiques du Bénin (IRHOB, Benin)
- University of Ghana (UG, Ghana)
- Centre Universitaire de Recherche et d'Application en Télédétection (CURAT, Côte d'Ivoire)
- University of Calabar (UNICAL, Nigeria)
- Euro-Mediterranean Center on Climate Change (CMCC, Italy)

We also acknowledge with deep appreciation the Management and Staff of NIOMR for their leadership, logistical support, and dedication toward the smooth organization of the training.

Finally, we sincerely thank all the trainees for their active participation, commitment, and enthusiasm throughout the program. Their engagement and collaborative spirit played a vital role in making RETMMAM a truly impactful and memorable regional capacity-building initiative.

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