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- NF-POGO Alumni Network for the Ocean -

Going beyond the mainstream

nano news

NF-POGO Alumni E-Newsletter – Volume 24, March 2024

In this issue:

*Would you like to see your photo on the cover of NANO News?
Please send high resolution, ocean-theme photos to
lakrug@ualg.pt*

*Cover photo
View of the Ellen Browning Scripps Memorial Pier from
UC San Diego's Scripps Institution of Oceanography.
Credits: Lilian A. Krug*

From the Editorial Board

The ever-growing challenges facing the World Ocean call for a growing number of enthusiasts to monitor them. As a result, the 14th batch of oceanographers is currently in training at the NF-POGO Centre of Excellence in Observational Oceanography. This issue will introduce you to each of them. Likewise, you will be introduced to Paula Bermejo, a new member of NANO thanks to her participation in the NF-POGO Shipboard Training programme. During the training, Paula had the opportunity to optimise her knowledge on a research cruise and in the laboratory at CSIRO (Australia).

The 24th issue of NANO News includes pieces on five stations belonging to the NANO-DOAP network of coastal monitoring sites. These are located in Nigeria, Colombia, Togo, Peru and Indonesia. From essential ocean variables measurements, establishment of long-term time series and organisation of outreach activities, NANO-DOAP produces impressive results every year, as you will find out.

Constant training for improvement of expertise and skills is a priority for NANO members such as Joana Rejon, who attended a training course in Qingdao (China) and a Workshop in Savannah (United States). Joana and two of her cohort also attended the 25th POGO Annual Meeting in Ensenada (Mexico) this January and shared their impressions as early career researchers surrounded by leaders of world renowned institutions, members of POGO.

Joana is a great example of NANO members, always commited to enhance their habilities. After all, dedication is what makes a scientist great. But not without standing complicated relations and stress, typical of an academic life. What happens when additional stress is added by being a student or researcher living abroad? Fernanda and Lilian conducted a survey with NANO members and reported back to us what are the major challenges faced by NANO members during their time in a foreign country.

We wish you a pleasant reading.

Yours sincerely,

Lazare Akpetou

Editor-in-chief

Meet the new members

POGOnians year 14 (2023-2024)

Profiles available at https://nf-pogo-alumni.org/programs/centre-of-excellence/cofe-2324/

*S*ince 2008, ten young scientists have been selected every year to take part in the 10-month NF-POGO Centre of Excellence in Observational Oceanography. The 2023-2024 cohort began the training in June 2023 at the Alfred Wegener Institute Biological Station in Helgoland, Germany. In this setting, the scholars are trained in core skills and topics which will help to level-up their scientific knowledge and capacity to carry out research on the ocean, its ecosystems, processes, and human-related activities. As their final assignment of the course, they conduct independent research projects guided by mentors from the AWI.
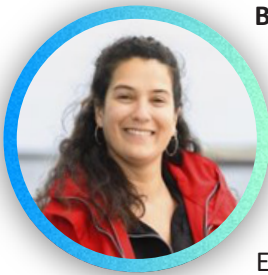
Beatriz Mano (Portugal)

Beatriz has a Bsc degree in Biochemistry and a MSc degree in Applied Biology from the University of Aveiro, where she carried out her master's dissertation in Toxicology. She started her scientific career working at the Laboratory of Ecology, Ecotoxicology and Freshwater Risk. In early 2020, she had the opportunity to work at the multidisciplinary project 'Impacts of human activity on the physiological resilience of Cold-Water Corals in the Azores', from the Instituto do Mar of the University of the Azores. Between 2022 and 2023, during the second phase of the project, she worked with the expression of genes related to CWC stress after deep sea mining and climate change impacts.

Beatriz enjoys outreach activities, having participated in several beach and coastal clean-ups, including while scuba diving, one of her favourite hobbies. She also participated in a project called "Cientista Regressa à Escola" (*Scientist return to school*) where she went to several schools to explain her work and engage in activities with the students.

Beatriz is immensely happy and grateful to have been accepted into the NF-POGO CofE programme and for having this great opportunity to learn and improve her knowledge in oceanography. Her ambition is to do a PhD and she considers this training as a precious help to achieve it, as it will give her the opportunity to have a broader vision and to integrate her knowledge of this field for future research. She expects that the experience of a broad multidisciplinary training in oceanography will contribute a lot to her proficiency and also enhance her knowledge on a personal level, as she is living with people from all over the world with different cultures, religions, ways of living, and thinking.

Bruna de Ramos (Brazil)

Bruna holds a BSc degree in Oceanography from Universidade Federal de Santa Catarina (2013-2018) and a MSc degree in Coastal Management from Universidade Federal do Rio Grande (2018-2020), with an internship at Universidad de Cádiz (UCA). Currently, she is a PhD candidate at the Federal University of Pernambuco.

According to Bruna, one of the highlights of her professional journey was her participation in the Project Orla (2020-2022), a project aimed at evaluating the status and updating governmental guidelines for beach management strategy in Brazil. This experience provided insights into real-world coastal and marine management practices.

Bruna's scientific interests focus on ocean technologies, physics and data science, with applications in coastal and ocean management. Her ongoing research is centered on comprehending the dynamics, characteristics, sources, and distribution of macro marine litter in Northeast Brazil. Developing a beach description tool and a comprehensive database are also key aspects of her work.

Bruna sees her selection for the CofE NF-POGO programme as a unique opportunity to improve her observational oceanography skills, particularly in physical oceanography, data acquisition, and processing. Additionally, she aims to refine her programming abilities in Python and R and gain more field data acquisition experience. One of the standout moments was the expedition onboard the R/V Heincke. Moreover, this programme has given her the opportunity to immerse in different cultures, which has contributed to both her personal and professional growth. She feels privileged to be getting to know inspiring people driven by the shared goal of ocean conservation.

Bruna's ultimate aspiration is to contribute to the creation of a global society that prioritises the well-being of the ocean, recognising it a vital climate regulator full of beautiful creatures and a magnificent mystery.

Fatuma Swedi (Tanzania)

Fatuma was born in Kilimanjaro (Northeast Tanzania), studied in Dar es Salaam, and is now working as a Laboratory Technician in Biological Oceanography at the Institute of Marine Sciences, University of Dares Salaam-Zanzibar. As a Technician, she performs tasks related to laboratory practicals such as the preparation of samples and chemicals, undertaking scientific analysis of samples, supervising students in their projects and laboratory works as well as consultation services. She also assists in field operations for matters like sample collection in both marine and lacustrine environments.

Fatuma has a Bachelor of Science in Molecular Biology and

an Ordinary Diploma in Science and Laboratory Technology, with research on 'Quality assessment of soap with respect to saponification value' and on 'Antimicrobial activity of endophytic fungi isolated from *Plenctrathus barbatus* plant against *E. coli* and *Staphylococcus aureus*'. After graduating she continued participating in marine research projects related to microbial activity and food and cosmetics production in Zanzibar. In addition, she has been assisting in experiments such as the analysis of fish otolith for age determination, fish gonads for maturity or transition stage analysis, sediments analysis for water nutrients, sulfate and carbonate analysis, chlorophyll-a analysis as a proxy indicator of primary productivity in fisheries. Fatuma also has experience with microbiology and molecular analysis techniques as well as in bioinformatics.

To Fatuma, the NF-POGO Centre of Excellence has been great for her career advancement as she is keen to increase her knowledge in marine sciences and oceanography in general. The knowledge gained will help her in linking oceanography and her previous knowledge in molecular biology effectively as well as pass the gained knowledge to students and colleagues in her institute back in Zanzibar. She also wishes to further her studies to a master's degree either in marine biotechnology or microbiology, and later to a PhD. She expects NANO to be a great place for future collaborations and networking with fellow scientists.

Juan I. Vizzo (Argentina)

Juan's studies are based on the effects of global change drivers on phytoplankton communities in Patagonian coastal areas. Specifically, he assesses the ongoing and future increases in extreme events such as rainfall and wind along with the concomitant increases of terrigenous material and nutrients inputs into the South West Atlantic coast of Patagonia (Argentina). For this purpose, he is focusing on the ecology and trophodynamics of plankton, enhancing his knowledge across various disciplines of oceanography.

Juan started his career as an undergraduate student in Biological Sciences, working with the temporal and spatial distribution of freshwater phytoplankton. He measured different physico-chemical and hydrological variables in order to estimate water quality indexes. Due to this experience, he developed a keen interest in this field during his undergraduate thesis. Currently, he is primarily interested in the pelagic dynamics of coastal areas and the effects of natural and anthropogenic variables on the ecology and physiology of phytoplankton.

Juan initiated his PhD studies at Estación de Fotobiología Playa Unión, a pioneering scientific institution in assessing the effects of global change on plankton communities. Juan conducted short- and long-term experiments, as well as monitoring activities, to understand how phytoplankton respond to the ongoing increases in extreme events. He is currently working on scientific publications and expanding his knowledge in areas such as data management and experimental design to further his research career.

Juan feels honoured to be a part of the NF-POGO CofE as it will provide him a unique opportunity to acquire oceanographic knowledge from a multidisciplinary and a global point of view. Beyond skill development, it represents a remarkable opportunity to engage with diverse cultural perspectives and gain insights into the challenges that scientists face across various regions of the world.

Liban Isse Farah (Somalia)

Liban is the first Somali scholar of the NF-POGO CofE. His career is essentially based on marine science and fisheries. Liban is a Marine and Fisheries scientist with a bachelor's and master's degree in marine sciences from City University in Somalia and Çukurova University in Turkey. His focus is mainly on fish population dynamics. For his undergraduate thesis, Liban studied commercial fish species found in Mogadishu (Somalia). The work was presented at the 6th International Student Symposium held at Sakarya University in Turkey and got published in 2021.

In 2014, Liban initiated his own fish data collection programme in Mogadishu and around cities which aimed to document all fish in Somalia. In 2016, he founded "Project Kalluun", a fish database system at City University in Mogadishu. As a result, in 2019, the first report of this work was presented in Seychelles by the Minister of Fisheries of Somalia. Today, the project has been expanded to the main coastal cities of Somalia and created job opportunities for many Somalis. In 2019, with the financial support of Secure Fisheries, Liban published "Guide to Fishes of Somalia" the first ever book concerning Somali fishes issued after the collapse of central government. In September 2018, Liban became the first Somali marine and fisheries science graduate awarded a full Master's scholarship by the Republic of Turkey.

During his MSc studies, he had the opportunity to do voluntary work and join the research team of his department in several operational field research and cruise work including; ichthyoplankton sampling for designing Marine Protected Areas at Yamutalik Bay, Southern Turkish coast of Eastern Mediterranean Sea. For his Master Thesis, he studied the population dynamics of Bogue, economically important fish in Turkey and obtained significant results which are vital for the fisheries management of the species. In 2021, Liban returned to his homeland, and was hired by his undergraduate university as a lecturer of Marine studies.

Currently, Liban is excited to be an intern in Alfred Wegener Institute in Helgoland, Germany. Certainly, Liban is willing to further strengthen his skills to achieve his long-term educational goals which will increase his academic credential. Beside the academics, Liban enjoys scuba diving, travelling and reading of stories.

Najoro Randrianalisoa (Madagascar)

Najoro has a Master's degree in marine science from the Institut Halieutique et des Sciences Marines (IHSM), University of Toliara, Madagascar. During her master studies, she was trained in marine ecology, biology, oceanography, mapping (PS: QGIS is her best friend), and diving (open water and advanced open water by PADI). For her bachelor's degree, she studied the impact of village aquaculture in southwestern Madagascar.

Concerning her master's degree, Najoro did something completely different from her bachelor. Her research was based on the distribution of the demersal fauna of the western Malagasy continental shelf and slope. The data that she analysed for this study were collected during a RV Dr Fridtjof Nansen cruise. For this research, she was supported by a Western Indian Ocean Marine Science Association (WIOMSA) project. As part of the project, they had an online workshop on community analysis using R studio and a workshop in Nairobi on multivariate analyses using Primer v7. Always in the context of her research, Najoro spent one month for an internship at the Oceanographic Research Institute.

As an early career scientist, she had the opportunity to present her work orally at the 12th Scientist Symposium of WIOMSA in South Africa. Apart from that, she is a member of some networks such as Women in Marine Science at the Western Indian Ocean (WIMS/WIOMSA) and Madagascar Oceanographic Data Center (MODC).

Najoro feels that being part of NF-POGO CofE this year is a great opportunity for her. Najoro is really grateful to have all these beautiful people along with her at the programme. She believes that they can work together for our ocean and our planet irrespective of any gender, age, or country barriers.

Rafael Junnar P. Dumalan (Philippines)

Rafael is a graduate of The University of the Philippines, Marine Science Institute with a major in Marine Biology and a Master's degree in Marine Science. As a marine scientist, he specialises in studying the biology and ecology of commercially-important marine macroinvertebrates (e.g., sea cucumbers) and macrophytes (e.g., seaweeds) together with other aquaculture-related topics – finding ways for a sustainable and environment-friendly mariculture practice.

Additionally, he worked on understanding the dynamics of toxic Harmful Algal Blooms to develop efficient and cost-effective detection and mitigating measures. He is also an advocate of ecosystem-based management solutions to address societal, economic, and environmental problems. Since he previously worked as a Environment and Natural Resource Officer of Ormoc City, Leyte Province in his country. Also, he acted as the Pollution Control Officer that ensures the local government's compliance with the requirements of basic environmental laws.

Currently, Rafael is a faculty member and researcher at the Department of Biological Sciences-Visayas State University (DBS-VSU), where he teaches future marine biologists with a basic background in Oceanography, Marine Pollution, Marine Microbiology, and Fungi. He is a study leader of a VSU-funded project entitled "Development of a Tropical Ecosystem Health Scorecard". This project involves monitoring and assessment of overall ecosystem health with a focus on water quality monitoring and pollution load estimation of rivers and coastal systems. He is also an active research extensionist managing the "VSU Multispecies Hatchery Project" which enhances hatchery production of "tilapia" and freshwater prawn to support small-scale and backyard fish farmers. In addition, he leads the VSU Waste Management and Pollution Control Committee as co-chairman which helps maintain proper waste management

to protect and enhance the environmental quality of the university.

Rafael's recent research activities have been driven and inspired by sustainable resource utilisation and management of various ecosystems geared towards maintaining ecosystem integrity and ecological balance.

Furthermore, Rafael strongly believes that by participating in the NF-POGO CofE Programme, he can still enhance his knowledge, improve his skills and strengthen his expertise in the various fields of marine science including oceanography and environmental management. This programme will also enable him to appreciate and understand cultural dynamics by interacting with international participants and learning the way of living of the host country, Germany. Additonally, he would like to take this opportunity to exchange ideas, establish collaboration, and build international relations for future collaborative efforts in regional/global oceanographic studies. Ultimately, he wants to inspire future marine biologists, and environmental scientists likewise to share these new learnings and knowledge to contribute to his country's growing scientific community and environmental practitioners.

Salim Kabbara (Lebanon)

Salim hails from the beautiful country of Lebanon and serves as a research assistant at the National Centre for Marine Sciences. He has a bachelor's degree in biology and a master's degree in health and environment. He is already a NF-POGO alumnus, having been awarded the NF-POGO-IEO Shipboard Training Fellowship, during which he spent three months training at the Instituto Español de Oceanografía in Malaga, Spain.

Salim's true passion lies in exploring the fascinating realm of phytoplankton communities, with a specific and profound interest in understanding the consequences of ocean acidification. Beyond his scientific endeavors, Salim finds solace and inspiration in the soothing melodies of the violin and the practice of meditation. He has a deep appreciation for literary marvels and thought-provoking documentaries, especially those that unveil the enigmas of the cosmos.

Furthermore, he believes that he is currently one of the fortunate ten scholars in the latest NF-POGO Centre of Excellence cohort at the Alfred Wegener Institute in Helgoland. This incredible opportunity has left him deeply grateful to POGO, Nippon Foundation, and AWI for making this endeavor a reality. The experience has already equipped him with a wealth of valuable skills. Living amidst a diverse and warm-hearted group, he describes the feeling as akin to being part of a loving family. Currently, he is actively seeking a PhD opportunity to further his academic journey.
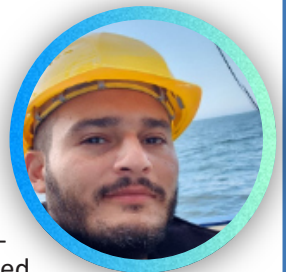
Sreevidhya Rajagopalan (India)

Sreevidhya is a chemical oceanographer from India. Her research interests focus on marine biogeochemical dynamics with a special interest in the aspects of carbon chemistry and coastal ocean

acidification. She holds a master's degree in marine chemistry from the Kerala University of Fisheries and Ocean Studies, India. She gained valuable experience from the shipboard training onboard FORV Sagar Sampada by India's Centre for Marine Living Resources and Ecology (CMLRE) at the Arabian Sea in 2019. She completed a summer internship at the ESSO-Indian National Centre for Ocean Information Services (INCOIS) with a focus on the composition of phytoplankton pigments in different coastal sites of the western Bay of Bengal. Furthermore, she was honored with the Best PG Dissertation Award by the Ocean Society of India for her dissertation project at CSIR-National Institute of Oceanography, RC Visakhapatnam, titled "The Role of Organic Nutrients on the Sustainability of Primary Production in the Bay of Bengal".

Following her Master's degree, she briefly worked as a project scientific associate at CSIR-NEERI before joining CSIR-NIO, RC Visakhapatnam in 2021. There, her research focused on identifying potential mechanisms responsible for coastal ocean acidification by examining modifications in dissolved inorganic carbon concentration and isotopic composition (δ13CDIC) in the upper ocean along the east coast of India and estuaries. Apart from performing various chemical analytical methods, she gained experience in handling basic to advanced instruments such as TOC/TN analysers, elemental analysers, isotopic ratio mass spectrometry, spectroscopic and auto-analysing techniques, and more, from her home institution.

Sreevidhya believes that the NF-POGO CofE programme will provide her with a comprehensive learning experience in multidisciplinary aspects of oceanography which is necessary to excel in marine biogeochemistry. She is also trying to refine her skills in networking, scientific writing, and presentation and sharing a wonderful time with her multicultural family in Helgoland.

Tharaka Dhanushka B. Yapa (Sri Lanka)

Tharaka did his Bachelor's degree in Surveying Sciences focusing on Surveying and Geodesy at Sabaragamuwa University of Sri Lanka and ventured into the professional world as a surveyor. After working in a major construction company, he joined the National Hydrographic Office (NHO) of the National Aquatic Resources Research and Development Agency (NARA) as a hydrographer, and there he honed his expertise in Nautical Charting and Spatial Data Analysis, delving into the depths of the Indian Ocean utilising sonar systems up to the EEZ of Sri Lanka.

While conquering the waters, he embarked on a parallel academic journey, pursuing a Master's degree in Surveying Sciences at the same university and his passion for hydrography led him to delve into a cost-effective seabed classification approach during his master's dissertation. In 2021, he joined a cruise on RV Samudrika for monitoring the impact of the X-PRESS Pearl ship burning incident and mapping the debris along the West coast of Sri Lanka which allowed him to think about the ocean more in an ecological way. In 2022, he joined the prestigious Sri Lanka Survey Department to expand his proficiency in the field of spatial sciences, but his hunger for knowledge knew no bounds, propelling him to apply for the CofE programme.

Now, in Germany, under the roof of AWI, Tharaka is embracing this unparalleled opportunity to deepen his understanding of the ocean while improving his personal skills which will change him to think out of the box to be a true ocean enthusiast. Further, he is forwarding his gratitude to NF, POGO, AWI, and all who helped him to achieve this opportunity, and he is looking forward to making his contribution to make a better world in the future.

The CofE scholars in Helgoland, Germany. Photo credits: Uwe Nettelmann (AWI)

NF-POGO Visiting Fellowship for Shipboard Training

Meet the new members

International Nutrient Inter-Comparison Voyage (2023)

NF-POGO-CSIRO Shipboard Training Fellowship onboard INIV Cruise
(29 May - 14 July 2023)

RV Investigator

Paula Bermejo
Member profile: https://nf-pogo-alumni.org/profile/bermejopaula

My name is Paula Bermejo. I live in Puerto Madryn, Argentina. I'm a Chemist with a PhD in Biology, and now I am working as a research assistant at the Centro para el Estudio de Sistemas Marinos (CESIMAR-CONICET). During my participation in the International Nutrient Inter-Comparison Voyage (INIV) on board the RV Investigator I have been trained and involved in measurements of dissolved inorganic nutrients in seawater. This fellowship gave me the opportunity to work with nutrient analysts and experts from around the world, learning about the methodologies, techniques, and instrumentation used in each laboratory. During the post-cruise training, I was involved in the everyday activities of the Hydrochemistry group at CSIRO, performing salinity and dissolved oxygen measurements, preparing chemical solutions and working with nutrient autoanalysers, treating problems regarding continuous flow analysis operations and on analysis protocols.

Furthermore, this fellowship programme gave me the possibility to be on an oceanographic cruise for the first time in my life. I am very grateful for the NF-POGO programme because this was an excellent opportunity to update and exchange knowledge with colleagues, gain experience, and learn a lot. I was lucky not only to meet excellent professionals but also excellent people, who kindly transferred me their knowledge and listened to my opinions and suggestions.

For me, this training programme not only meant professional but also personal growth, since it allowed me to experience new cultures and improved my oral and written communication of the English language.
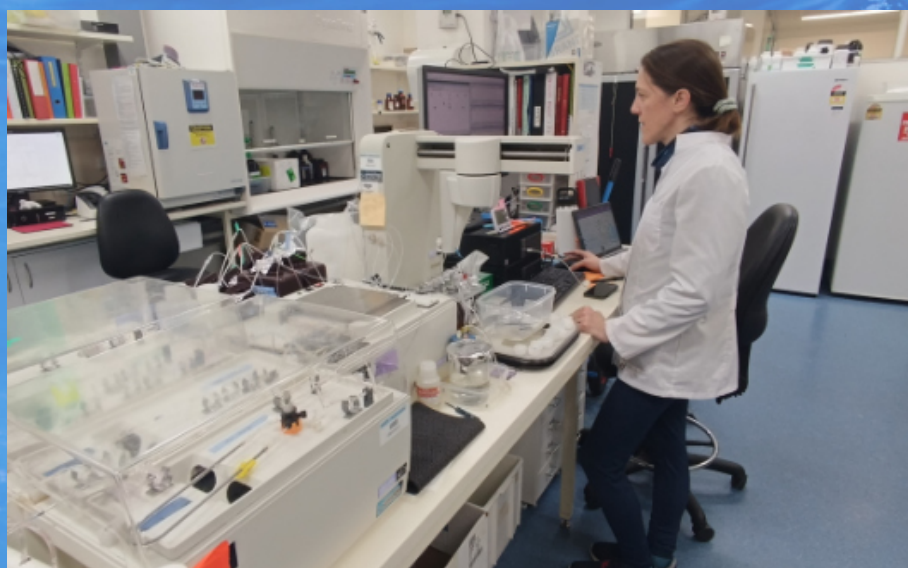
NANO-DOAP RESEARCH PROJECT

The project "A global study of coastal Deoxygenation, Ocean Acidification and Productivity at selected sites (NANO-DOAP)" has been supported by POGO and NANO since 2017. NANO-DOAP aims to: 1) promote in situ and remotely sensed coastal observations; 2) provide opportunities where members can strength their capabilities for monitoring essential ocean variables; and 3) organise activities where members can share experiences and best practices, as well as compare results from local analysis, producing global results. The project currently includes 33 sampling sites in 18 developing countries, all led by NANO members. In this series, NANO-DOAP participants present work that has been done at the stations.

Five Cowries Creek (Nigeria) station

Seasonal variation of the Physico-Chemical Characteristics and Chlorophyll-a concentrations at Five Cowries Creek, Lagos, SW-Nigeria

Akinnigbagbe E. Akintoye[1], Oyatola O. Otolorin[2], Oghenede E. Karo[3], Popoola S. Olatunde and Nubi Olubunmi

Nigerian Institute for Oceanography and Marine Research, Nigeria
Member profile:
[1] https://nf-pogo-alumni.org/profile/aakinni/
[2] https://nf-pogo-alumni.org/profile/blissyem/
[3] https://nf-pogo-alumni.org/profile/esther-oghenede/

Introduction and Aim

In most urban-rural communities in the developing countries, especially the Sub-Saharan Africa, fresh waters (rivers, streams, and lakes) and coastal waters have been the most available sources of water used for domestic purposes and provide breeding habitat for many fish species and aquatic ecosystems. The water from these sources is contaminated with domestic, agricultural, and industrial wastes and likely to cause water related diseases (Ojekunle, 2000 & Ayeni et al., 2009), and further creates adverse effect to the coastal ecosystems and human health at the higher trophic levels of the food chain. Similarly, Bullard (1972) inferred that impaired fresh and coastal water quality always results in an unhealthy socio-economic environment.

The quality of water is the degree of its potability and is determined by the amount and level of physicochemical, microbial and heavy metals. The coastline of south-west Nigeria is endowed with creeks. The environmental dynamics in these creeks are regulated by rainfall and salinity. Thus, an environmental gradient exists all through the year. Five Cowries Creek drains directly into the Lagos harbor and seasonally into Abule Eledu and Abule Agege creeks which are much further away from the harbor. The Lagos harbor provides the only channel that drains runoffs from creeks, rivers, and lagoons into the sea (Hill and Webb, 1958; Oyenekan 1983; Nwankwo, 1996). Creeks, creeklets and storm water channels are prominent features of low lying coastal zones of south-west Nigeria (Nwankwo et al., 2013). Tidal creeks may originate as storm water channels or creeklets drain into coastal rivers or directly into estuaries or lagoons (Nwankwo et al., 2008).

The coastal water quality changes with seasons and geographic areas, even in the absence of pollution. Water quality guidelines provide basic scientific information about water quality parameters and ecologically relevant toxicological threshold values to protect specific water uses. Important physical and chemical parameters influencing the aquatic environment are temperature, rainfall, pH, salinity, dissolved oxygen (DO), and carbon dioxide (CO_2). Others are total suspended and dissolved solid, total alkalinity and acidity and heavy metal contaminants. These parameters are the limiting factors for aquatic organisms to survive (Lawson, 2011).
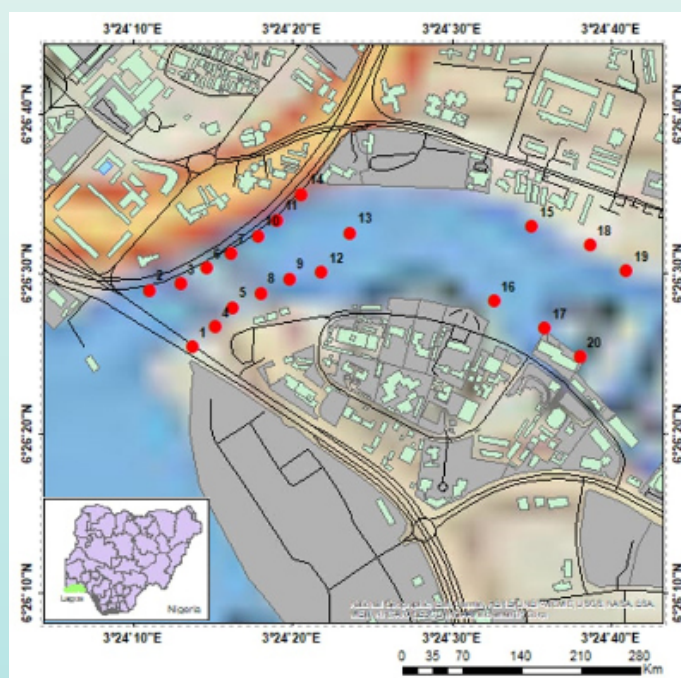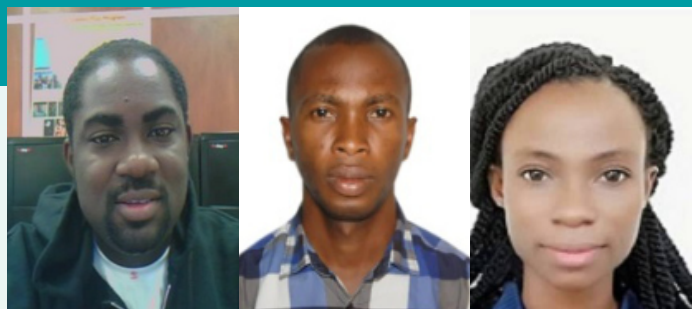

Figure 1 - Five Cowries Creek sampling points.

Previous studies on creeks in southwest Nigeria include Nwankwo et al. (2012), who investigated variations in nutrient and chlorophyll-a (Chl-a) of Light House Creek and Five Cowries Creek, and reported that phytoplankton biomass are most abundant in dry months. Onyena and Okoro in 2019 investigated the spatio-temporal changes in water and sediments of three tidal creeks in southwest Nigeria and reported that creeks in the region are highly impacted with anthropogenic stressors. Despite numerous studies on creeks in this area, the need to continuously monitor the changes in physciochemical parameters and their implication on aquatic life and the environment at large cannot be overemphasised. Hence, the aim of this study was to investigate variations in physico-chemical parameters, nutrient and chlorophyll-a in different sample stations along Five Cowries Creek.

Materials and Methods

Study area

This study was carried out in Five Cowries Creek, South-West Nigeria, as shown in Figure 1. The Creek is one of the numerous adjoining creeks to the Lagos Lagoon. It is connected to the Lagoon at two ends; the Lagos Harbor which opens to the inshore (coastal) waters off Lagos, and at the extreme of the Eastern part of Ikoyi, respectively. The creek has an approximate length of 7 km and is located 6°26'24'' N - 3°24'18'' E. It is deep, tidal and subjected to the same physical conditions, which are regulated by rainfall and salinity variations, as the harbor. Seawater enters into the creek through the Lagos Harbour end at high tide and at low tide; water is drained from the Eastern part of the Lagos Lagoon through the creek to the harbor en-route to the Atlantic Ocean (Fakoya et al., 2014).

Methodology

Surface water samples were collected along Five Cowries creek from 20 sampling points bimonthly between July 2021 and August 2022. Physicochemical parameters such as temperature, pH, DO, and Electrical Conductivity (EC) were measured in situ with a Hanna HI-9828 multi-parameter. Nitrate, ammonium and phosphate were estimated by following standard methods (AFNOR standards ISO 7890-3; T 90015; T 90023 respectively) after filtering the water samples through GF/C whatman filter paper (0.45 µm). Chl-a was analysed by spectrophotometric method according to Lorenzen (1967). For all the spectrophotometric analyses, a double beam UV-Visible Spectrophotometer (SHIMADZU UV/visible-1700 pharma) was used.

Results and discussion

Physicochemical parameters

The results for the physicochemical parameters (temperature, pH, dissolved oxygen, salinity, EC) and nutrients (nitrate, nitrite, ammonia, phosphate, chlorophyll-a) are shown in Figure 2. The temperature of the study area ranged from 27.67 ± 1.30 °C at station 1 to 27.81 ± 1.23 °C at station 20 during the wet season and from 27.62 ± 1.50 °C at station 4 to 29.05 ± 0.94 °C at station 2. Higher temperature noticed in dry season could be as a result of high solar radiation and a clear sky enhances the atmospheric temperature. This result corroborates with Nyantakyi et al. (2020) and Ajani et al. (2021), who also recorded higher temperature in dry season at River Tano in Ghana and tropical Lagoon off the Gulf of Guinea unlike Fatima et al. (2014) who recorded higher temperature value during wet season to dry season. The water temperatures at all the sample stations were within the acceptable range (20 - 33 °C) as recommended by FEPA (1991). The lowest (7.75 ± 0.07) and highest (7.88 ± 0.15) pH mean value was recorded at station 16 and 1 respectively during the wet season and during the dry season, the lowest (7.21 ± 0.33) and highest (7.52 ± 0.58) were recorded at station 11 and 2, respectively. This little variation in pH might have been influenced by a
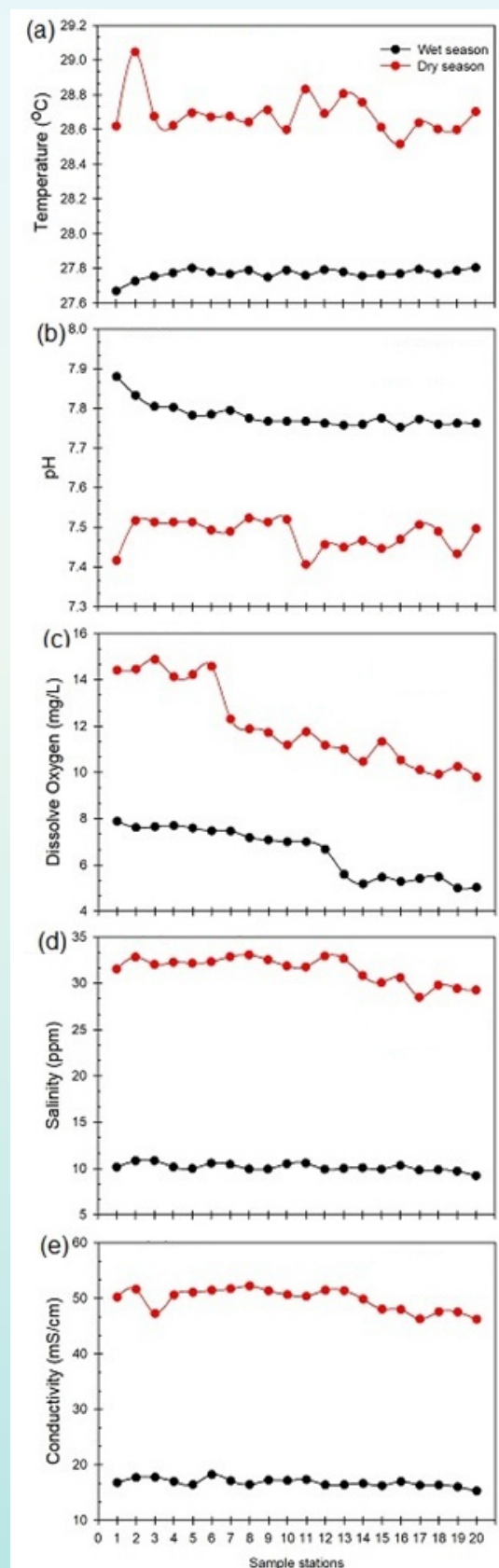

Figure 2 - Seasonal distribution of physicochemical parameters at Five Cowries Creek.

number of factors, such as the deposition of some organic matter into the water from run-off during wet seasons. These pH changes may be conducive for fish since they usually live at pH levels between 6.0 and 9.0, although they may not tolerate a sudden change within this range (Adefemi et al., 2007). The result from this study is consistent with Ogunbanwo (2018) who recorded highest pH value in July (wet season) and the lowest in March (dry season).

The main sources of oxygen in water are atmospheric air and photosynthetic plankton and the concentration of DO affects the growth, survival, distribution, behaviour and physiology of marine organisms. DO values >5 mg/L are considered supportive of marine life, whereas DO values <5 mg/L leads to poor feeding of fish, starvation, reduced growth, survival and population. At Five Cowries Creek, DO ranged from 5.00 ± 2.62 mg/L (station 19) to 7.88 ± 5.24 mg/L (station 1) during the wet season and from 9.80 ± 6.12 mg/L (station 20) to 14.87 ± 11.82 mg/L (station 4). The lower DO values observed during the wet season could be attributed to erosion and transportation of non-biodegradable organic loads that often utilise the available DO for chemical oxidation and microbial decomposition. Nonetheless, the recorded DO values in the study area support marine life.

Salinity ranged from 9.22 ± 8.07 (station 20) to 10.85 ± 9.90 (station 3) during the wet season and from 28.50 ± 0.82 (station 17) to 33.07 ± 7.53 (station 8). Higher concentration of salinity during the dry season could be due to high loss of water by evaporation. The maximum value of EC is recorded in station 6 (18.26 ± 12.03 mS/cm) and station 8 (52.19 ± 8.06 mS/cm) during the wet and dry season respectively. Higher EC values recorded in the entire study area during the dry season than the rainy season could be associated with high evaporation in the dry season.

Nutrients

Nutrient and Chl-a concentrations along the sample stations are reported in Figure 3. Chl-a in terms of phytoplankton biomass generally fluctuates from time to time particularly in coastal waters. Phytoplankton population and growth depends on several factors which are variable with different seasons and regions. Among the factors affecting photosynthesis rates is the concentration of nutrient salts. The variations of phytoplankton growth are complicated due to the interaction between ecological factors and rates of regeneration of nutrients. Chlorophyll-a ranged from 3.05 ± 2.97 mg/L (station 15) to 8.03 ± 3.31 mg/L (station 4) during the wet season and from 2.59 ± 1.81 mg/L (station 15) to 8.48 ± 0.83 mg/L (station 4) in the dry season.

Moreover there was no significant seasonal variation observed in the course of sampling. Dissolved nutrients showed significant concentrations except phosphate which had a value below 0.5 mg/L. Ammonia values for the study area ranged between 2.12 ± 1.05 mg/L (station 4) and 3.13 ± 1.17 mg/L (station 19) in the wet season and between 1.39 ± 1.01 mg/L (15) and 2.56 ± 1.13 mg/L (station 19) during the dry season. Nitrate ranged between 12.39 ± 11.16 mg/L (station 2) and 20.10 ± 18.56 mg/L (station 6) during the wet season and between 1.50 ± 0.99 mg/L (station 1) and 2.86 ± 1.94 mg/L (station 6). Phosphate ranged from 0.14 ± 0.11 mg/L (station 9) to 0.39 ± 0.22 mg/L (station 16) during the wet season and from 0.07 ± 0.02 mg/L (station 2) to 0.17 ± 0.11 mg/L (station 14). High levels of nitrate found in the sample station during the wet season could be attributed to human contribution which includes runoffs containing fertilisers from agricultural lands, disposal of sewage and other anthropogenic waste added by rainfall and erosion during the wet season.
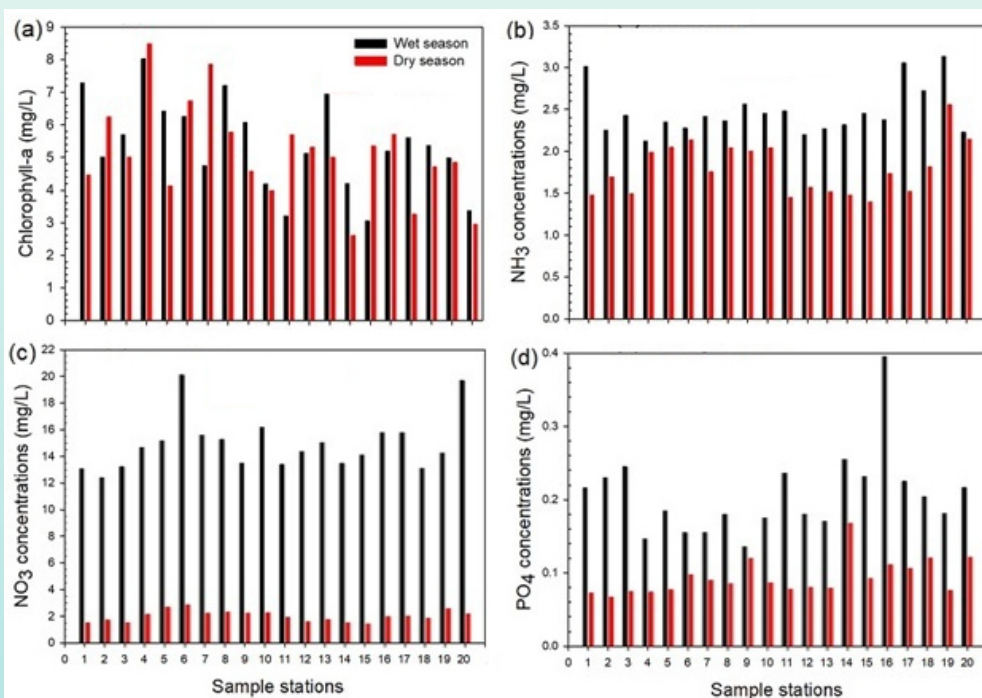

Figure 3 - Seasonal distribution of chlorophyll-a and nutrients concentrations at Five Cowries Creek.

Conclusion

The main objective of this study was to assess the seasonal variations in physico chemical parameters, nutrients and chlorophyll-a in different sample stations along Five Cowries Creek, Nigeria. The physico-chemical properties of water samples from most of the stations studied are within desirable levels and showed high concentrations of temperature, DO, salinity, EC during the dry season, and pH during the wet season. The observed high levels of nitrate during the wet season could be attributed to eroded anthropogenic effluents from lands and disposed sewage in within the study area. There is no significant seasonal variations in

the chlorophyll-a and ammonia concentrations from the study area.

The study is still in progress and has further shown that continuous monitoring of the physicochemical variables along the Five Cowries creek is essential for effective management, and conservation of the aquatic ecosystems in the area.

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NANO-DOAP RESEARCH PROJECT

CIOH Pier (Colombia) station

Variations of salinity and temperature between February and July 2023 at a fixed monitoring station

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Time series focusing on physicochemical aspects of the ocean have become reference data on the ocean's response to climate change, especially ocean warming (Roughan et al., 2022), likewise, they serve as a means to differentiate between environmental changes caused by natural processes and those influenced by human activities (Benway et al., 2019). Various time series projects have been formulated for decades; one of them was CARIACO, which was based at a station located in the Cariaco basin in the southwestern Caribbean Sea. The project was a collaboration between Venezuela and the United States; more than 100 scientists participated during the project between 1995 and 2017, and 130 articles were published (Muller-Karger et al., 2019).

Time series are performed at fixed stations using ships, autonomous surface vehicles, submarines, and sensor-equipped satellite platforms to collect periodic data on physical, chemical, and biological parameters of the marine environment (Benway et al., 2019).Satellite data must be validated and calibrated with in situ observations to eliminate possible biases caused by orbital errors, instrumental errors, and atmospheric effects (Amani et al., 2022). To observe in situ variables, instruments such as CTDs are used, these allow data collection at depths of up to 3000 m in the water column, in contradistinction to satellites that can only measure data in the surface layer (Broekhuizen et al., 2021).

In Cartagena, Colombia, the Centro de Investigaciones Oceanográficas e Hidrográficas del Caribe (CIOH) has monitored the environmental conditions of the Bay of Cartagena since its foundation in 1975, but such monitoring has been discrete. Thus, within the framework of the NANO project Global Study of Deoxygenation, Acidification and Productivity (NANO-DOAP), a continuous in situ monitoring programme was initiated on August 9, 2021, at a fixed station located at the CIOH Pier. The series has been built from measurements made with a CTD RBRconcerto3 with Fluorescence and CDOM sensors, and the data collected to date are particularly robust because the monitoring is done daily, providing a higher temporal resolution, allowing to detect short-term events, such as diurnal variations, extreme events, and subtle fluctuations. Its location also offers the opportunity to detect variations in a highly dynamic coastal environment that is vulnerable to
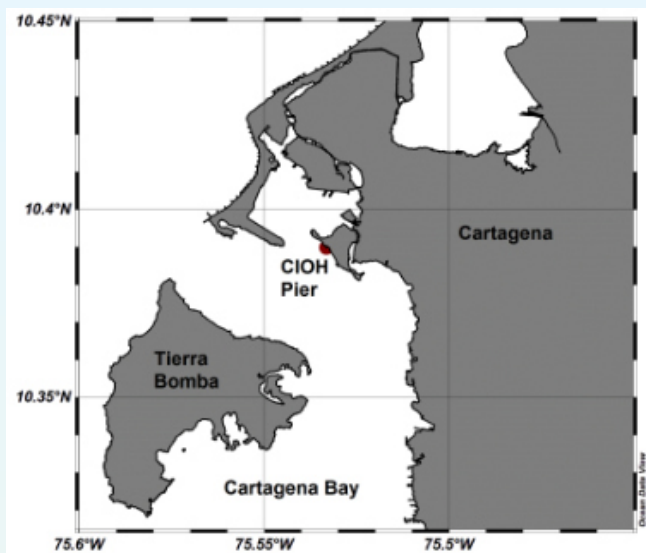
Figure 1 - CIOH Pier location.

human activities (Quartly et al., 2017).

Cartagena Bay is located on the Colombian Caribbean coast, in the department of Bolívar, and covers an area of 82.6 km² with an average depth of 16 m and a maximum depth of approximately 30 m. It is a semi-closed system connected to the Caribbean Sea by several channels that allow water periodicity (CIOH, 2004; Restrepo et al., 2013). The bay is classified as an estuary due to the artificial Dique channel, which supplies fresh water and suspended solids from the Magdalena River (CIOH, 2003; CIOH, 2004). This subjects the bay to three environmental conditions: the tidal cycle, the influence of the winds, and the fluvial contribution of the Dique channel (Cogua et al., 2012). Seasonal conditions in the bay can be divided into three seasons: high winds/low runoff (Jan-Apr), light winds/intermediate runoff (May–Aug), and light winds/high runoff (Sep - Dec) (Tosic et al., 2019). The CIOH pier, situated within the bay's central area on Manzanillo Island (10.390°N; 75.533°W; Figure 1), is strategically advantageous to investigate the seasonal variations in environmental variables and the fluctuations between the influence of the three environmental conditions that the bay is exposed to.

As part of Camila's activities as a Biology intern affiliated to the project, Camila had the opportunity to collect and analyse data from the period between 13 Feb to 14 July 2023, while receiving training on operating CTD and the respective data processing. This equipment contains sensors capable of measuring pressure, depth, salinity, conductivity, sound speed, CDOM, and chlorophyll-a, which allowed her to take daily samples profiling the entire water column with the CTD, following the protocols designed by her predecessors in the project. Furthermore, Camila gained a great knowledge from contributing in this project, and learnt to process this type of data and to construct graphical representations of time series such as the Hovmöller diagrams in Figure 2.

Figure 2 shows that, from February to mid-April, water temperatures varied between 28°C and 30°C and salinities between 35 psu and 31 psu throughout the water column, which can be related to the entry of oceanic waters into the bay pushed by prevailing northerly trade winds and little fluvial discharge from the Canal del Dique (Tosic et al., 2019). During April, small intervals of salinity decrease with values between 19 psu and 26 psu (Figure 2b), as well as increases in water temperature with maximum values of 35 °C (Figure 2a). From the month of May, a gradual decrease in salinity and an increase in temperature can be observed with average values of 30 psu and 30 °C respectively. In the months of June and July, an increase in temperature was observed, with maximum values of 34°C at surface and minimum values of 29°C at the bottom of the water column (Figure 2a). In contrast, during these months, minimum salinity values (14 psu) were observed at surface while maximum values (32 psu) at bottom (Figure 2b). These temperature and salinity records are associated with the inflow of fluvial waters from the dike channel due to increased rainfall along the Magdalena River basin (IDEAM, 2023).

It is highlighted in this data analysis, that the results allow us to demonstrate the flexibility of this fixed monitoring station, identifying the dominance of each seasonal period and the subtle changes experienced by the bay, either by the entry of water from the levee channel or oceanic water.

The NANO-DOAP project involves field observations to evaluate and compare ocean physico-chemical variables at several similar stations around the world, which is important for the CIOH and therefore hopes to maintain the time series for decades and thus provide accurate information on seasonal changes in the bay as well as detect weather patterns, which will be valuable for multiple sectors, from academia and research to governmental decision making and the development of environmental policies for the conservation of the bay.
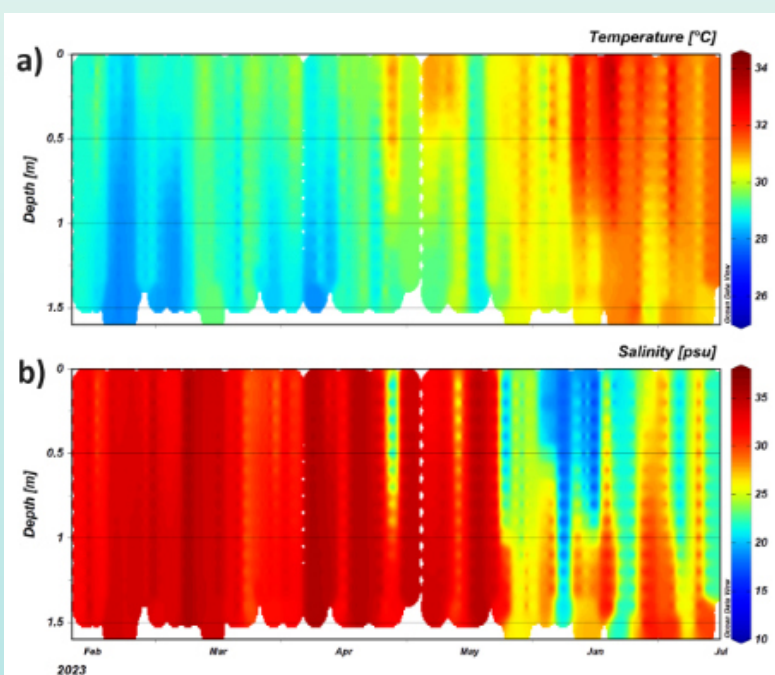

Figure 2 - Hovmöller diagrams of (a) temperature and (b) salinity at the CIOH pier between February and July 2023

Camila Sofia Mercado Molares (Biology intern)

I graduated as a biologist at the University of Cartagena, Colombia. In the last semesters, I studied environmental management and hydrography, which aroused my interest in studying environmental variables in marine ecosystems. However, I encountered a challenge: my undergraduate programme was not focused on marine biology. It was then that the CIOH, a prestigious research center dedicated to studying the Caribbean sea in my country, opened its doors and allowed me to learn the methodologies and management of environmental data in marine ecosystems.

During my 6-months internship, I had the opportunity to do field sampling and conduct laboratory analysis. I learnt to calculate the absorption coefficient of particulate matter and Chromophoric Dissolved Organic Matter (CDOM), as well as the use of multiparameter and CTD to measure variables such as pH, temperature, salinity, dissolved oxygen, and conductivity.

In terms of the labor market; I am incredibly proud to have contributed to significant global projects like NANO. Its collaborative approach makes this initiative a valuable platform in the global effort to meet the challenges of climate change and protect our oceans for generations to come. This internship has been an enriching experience that has strengthened my passion for marine biology and has broadened my horizons in contributing towards a more sustainable future for marine ecosystems.

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NANO-DOAP RESEARCH PROJECT

Port of Lomé (Togo) station
Seasonal Variations of Water Quality Parameters at Port of Lomé

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The main objective of the NANO-DOAP project is to monitor the levels of ocean acidification and deoxygenation levels worldwide through the measurement of the Essential Oceanographic Variables (EOVs) at some selected coastal implemented marine stations sites along African, Latin American, and Asian countries. NANO-DOAP also aims to support its representatives to develop outreach activities in their local areas on the importance of ocean observations. These outreach activities will allow NANO-DOAP representatives to create and develop an ocean network taking into consideration all educational programme levels.

One of the NANO-DOAP stations is located in the coastal waters of Togo (6°5'49.90"N; 1°18'47.79"E; Figure 1) within the Gulf of Guinea marine ecosystem. The Togolese coast is an essential part of this ecosystem, supporting various marine species and human activities such as fishing, aquaculture, port activity, and tourism. However, like many other coastal regions, the Togolese coast is subjected to various anthropogenic and natural stressors, which can significantly affect water quality parameters. By setting up a NANO-DOAP coastal station in the fishing zone of the Port of Lomé, we were able to
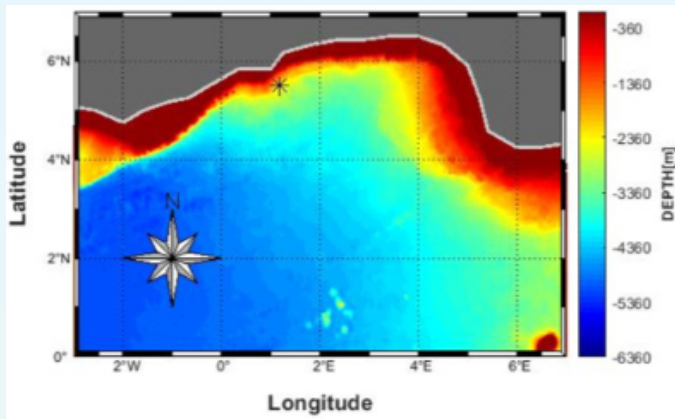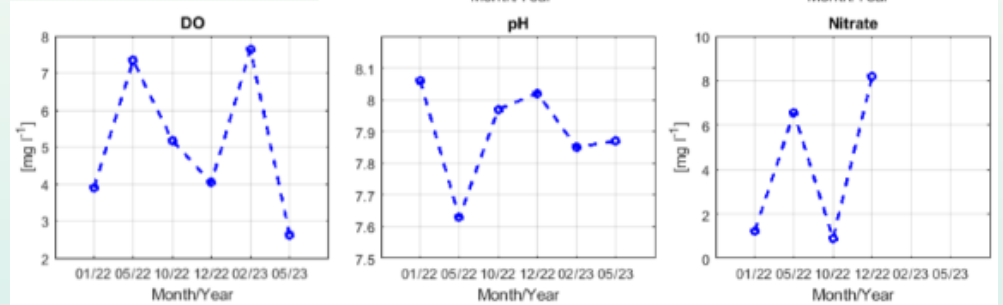
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NANO website: www.nf-pogo-alumni.org

Figure 1 - Location of the sampling station. Black star represents the location of NANO-DOAP Port of Lome station where we collected the water quality parameters.

Figure 2 - Scenes of fieldwork at NANO-DOAP Port of Lomé station. Credit: E. Panassa.

monitor at a bimonthly time scale the seasonal variation of water quality parameters in the surface waters since November 2021 (Figure 2). The essential water quality parameters that are monitored at the station include temperature, salinity, dissolved oxygen (DO), pH, and nutrient (nitrate) concentration.

Here we present the first results from the time series water quality data collected at the Port of Lome station from January 2022 to May 2023 (Figure 3). The data show a significant seasonal variation in water quality parameters, with higher sea surface temperature and salinity recorded during the winter period (January and February). Surface nitrate concentration and pH ranged from 0.9 to 8.17 mg l^{-1} and 7.63 to 8.06, respectively during the sampling period (Figure 3). The variation of pH values indicates a slightly alkaline condition throughout the year in Togolese coastal waters. Surface DO ranged from 2.63 mg l^{-1} to 7.64 mg l^{-1} and was inversely correlated to temperature. In December 2022, a month of rather low DO value, we observed dead animals in the area (Figure 2), which could highlight a relatively severe ocean deoxygenation state in this zone. This probably has a strong impact on the marine life. Further investigation and continuous EOVs long-term monitoring are necessary to better find out the main driver.

Figure 3 - Seasonal variation of waters quality parameters at the NANO-DOAP sampling site of Togolese coast.

First NANO-DOAP Outreach activity in Togo on the Importance of the Ocean and its challenges

In March 2023, during "Student Week 2023" at the University of Kara, we conducted an outreach activity on the importance of the ocean and its challenges. This event took place in room KA A200 of the University of Kara and was organised by students of the bachelor's degree programme in Oceanography and Applications under the supervision of Dr. Panassa Essowe.

The conference was held in the presence of teachers and students from the University of Kara. The objective of this conference was to draw the attention of the public on the one hand to the importance of the Ocean in the life of Man and on the other hand to highlight the impact of human activity on the health of the ocean from the industrial revolution to the present day.

In the first part of the presentation, we evoked the importance of the ocean in the regulation of the climate and the production of oxygen then the implication of the ocean in the West African monsoon, and finally its importance for transportation and food. In the second part, the students highlighted the issues relating to plastic pollution and eutrophication, then to global warming, and ended with coastal erosion and acidification/deoxygenation. In the last part, we gave some simple tips to protect the ocean through good management of plastic bags. This awareness, which began at the university level, will be extended to primary school.

NANO-DOAP RESEARCH PROJECT

Callao (Peru) station
NANO-DOAP time series station in the western Pacific Ocean

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The Callao station has been part of the NANO-DOAP project since 2017. Located off the port of Callao (12°02'S, 77°17'W), on the central coast of Peru, at a distance of 10 nautical miles from the coast and a depth of 90 m (Figure 1). Callao is Peru's main commercial port, where a variety of maritime activities are carried out, including transportation, sports, recreation, and fishing. The oceanographic characteristics of the port of Callao are basically an area influenced by the Peruvian coastal current (Humboldt Current) with cold characteristics and high productivity. These conditions are strongly affected by periodic events such as El Niño and La Niña; mainly by the fall of landslides and the overflowing of some rivers.

The Callao station is part of IMARPE's oceanographic section, where several research vessels are used. The main environmental variables recorded at Callao are temperature, salinity, oxygen, nutrients (phosphates, silicates, nitrates, nitrites), PAR, pH, phytoplankton (with plankton net 75 μm), zooplankton (with bongo net 300 μm), and benthos (with platon and box cores). Recently we have incorporated the use of unmanned remote equipment such as the Glider, which carries out the section up to 200 nautical miles from the coast and samples up to 600 m depth, collecting temperature, salinity, and oxygen (Figure 2). Besides, another tool that we have been using since the 1990s is satellite technology, through the use of satellite image reception stations, which allows us to monitor environmental conditions off the Peruvian coast in real time and publish them on our web portal.

Figure 1 - Callao station (red star) location.

Sea surface temperature and salinity at Callao station. Red dots indicate in situ sampling and blue line is extracted from satellite.
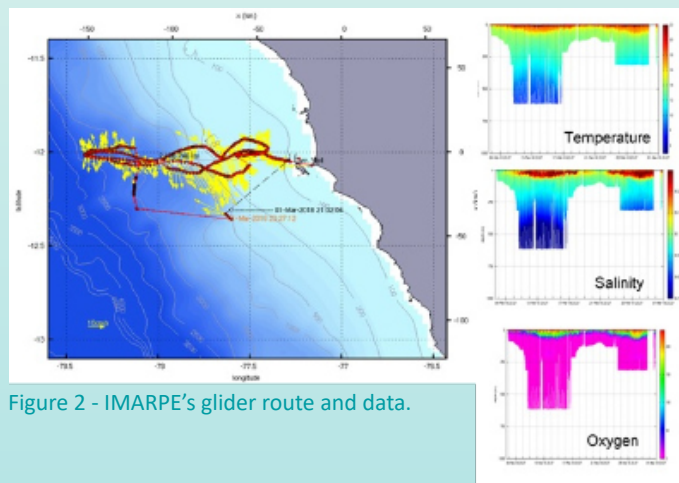
Figure 2 - IMARPE's glider route and data.
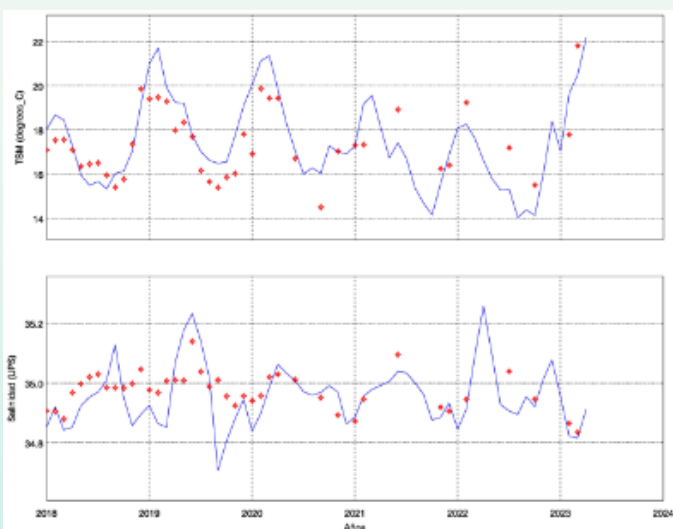
Activities conducted at IMARPE:

Research on marine resources: IMARPE conducts investigations into the abundance, distribution, and behaviour of marine species, such as fish, molluscs, crustaceans, and other organisms important for commercial fishing. This includes population assessment and determination of sustainable catch quotas.

Marine ecosystem monitoring: The institution collects data on oceanographic and biological conditions in the Peruvian sea, aiding in understanding changes in the marine ecosystem and their effects on biodiversity and human activities.

Aquaculture studies: IMARPE researches cultivation techniques for marine and inland species, such as shrimp, trout, and fan mussels. This contributes to the development of aquaculture as a sustainable alternative for food production and the conservation of natural species.

Environmental impact assessment: The institution conducts studies to assess the environmental impact of human activities on the marine and coastal environment, such as mining, infrastructure construction, and pollution.

Tracking climatic events: IMARPE studies climatic and oceanographic phenomena, such as El Niño and La Niña, which have a significant impact on Peru's climate and marine resources. This enables the anticipation and management of potential adverse effects.

Figure 3 - IMARPE's research vessels and oceanographic instruments.

NANO-DOAP RESEARCH PROJECT

Java Sea (Indonesia) station
The Java Sea Station of NANO-DOAP: an initiation of time series observation

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The Java Sea is located in the inner part of the Indonesian archipelago. Shallow (max. depth 50-60m) and relatively turbid, the Java Sea is a basin that holds many river estuaries from Kalimantan Island at the North to the Java Island at the South, with runoff from the Malaka strait (mainly from the Bengal Bay water masses) and Karimata Strait (mainly from the South China Sea). As with any equatorial sea, the Java Sea is warm at the surface, however, surface salinity is low due to estuarine presence and runoff. At the south coast of Java Sea (West Java island), there is a strong influence of anthropogenic activities resulting from artisanal aquaculture, ship traffic to and from the port, industries like Power Plants and Oil company business, and, of course, fisheries.

The activities of the NANO-DOAP Java Sea (JS) station started in November 2021. We chose a point (JS1) offshore Cirebon City (in front of the Pelindo II - Pelabuhan Port). Since January 2022, we added four other data collection points (JS1 to JS5), with approximately 1 km distance from each station (Figure 1). The stations are visited bimonthly due to distance (Cirebon City is approximately a 3.5 hours drive from the main campus in Bandung City). Recently, we also operated a new campus at Cirebon, which is the reason why I chose the Java Sea station location.

Figure 1 - NANO-DOAP Java Sea stations (red dots) and the Copernicus grid cell (yellow dot) with 0.25° resolution.

We use our faculty (Earth Science and Technology of Institut Teknologi Bandung, EST-ITB) research boat Ara, in cooperation with the Marine Technology Cooperation Research Center (MTCRC). In this agreement, EST-ITB offers the boat and covers fuel and MTCRC provides the captain and sensor operator with some charges. It is common that going out to sea is quite expensive, therefore whenever we have a chance to share some purposes with another research team, we will cruise together and share some costs (Figure 2).

As part of NANO-DOAP objectives, the JS stations maintain a time series of five Essential Ocean Variables (Temperature, Salinity, Dissolved Oxygen, pH, and Chlorophyll-a concentration). As we have a
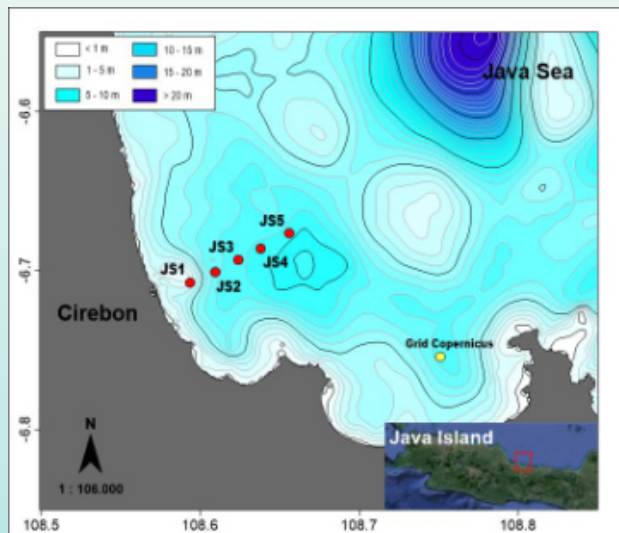
CTD profiler with extra sensors, we also sample for other variables such as pressure, turbidity, PAR, and redox. By now we managed to have 10 datasets from November 2021 to June 2023. Although it is too early to analyse trends in dissolved oxygen (DO), pH, and Chlorophyll-a concentration (Chl-a), we can at least make some comparison to the global data provider like the Copernicus Marine Service (Figure 3).

We could only find one grid cell for the Copernicus data (yellow dot in Figure 1), within approximately 40km distance to JS station. With spatial resolution 0.25°, JS stations are not included but the distance is still within range of open seas observation. The two datasets (*in situ* and Copernicus reanalysis) distribution only presented good agreement for sea surface temperature (SST, Figure 3a). The surface salinity and DO were overestimated while Chl-a seemed underestimated by Copernicus. The alkalinity/acidity indicated by pH was somewhat close in values but all EOVs, with exception of SST, were missing seasonality, a marked characteristic of an area highly influenced by monsoon as the Java Sea.

The reanalysis observation for SST has been well established, while for other EOVs, the algorithm still needs much improvement, especially in this region. The scarcity of observational data to verify the satellite and modeled data is one of the main causes of low confidence for reanalysis data.

With the support of NANO-DOAP, we initiated a time series monitoring at Java Sea and, in time, we are optimistic that these datasets will be very useful for various uses in addition to trend analysis for deoxygenation, acidification, and productivity, NANO-DOAP ultimate goal. Other uses include verification and validation of reanalysis data and monitoring at least seasonal variability of the data. The longer the time series we can provide, the longer time scale analysis will be enabled.
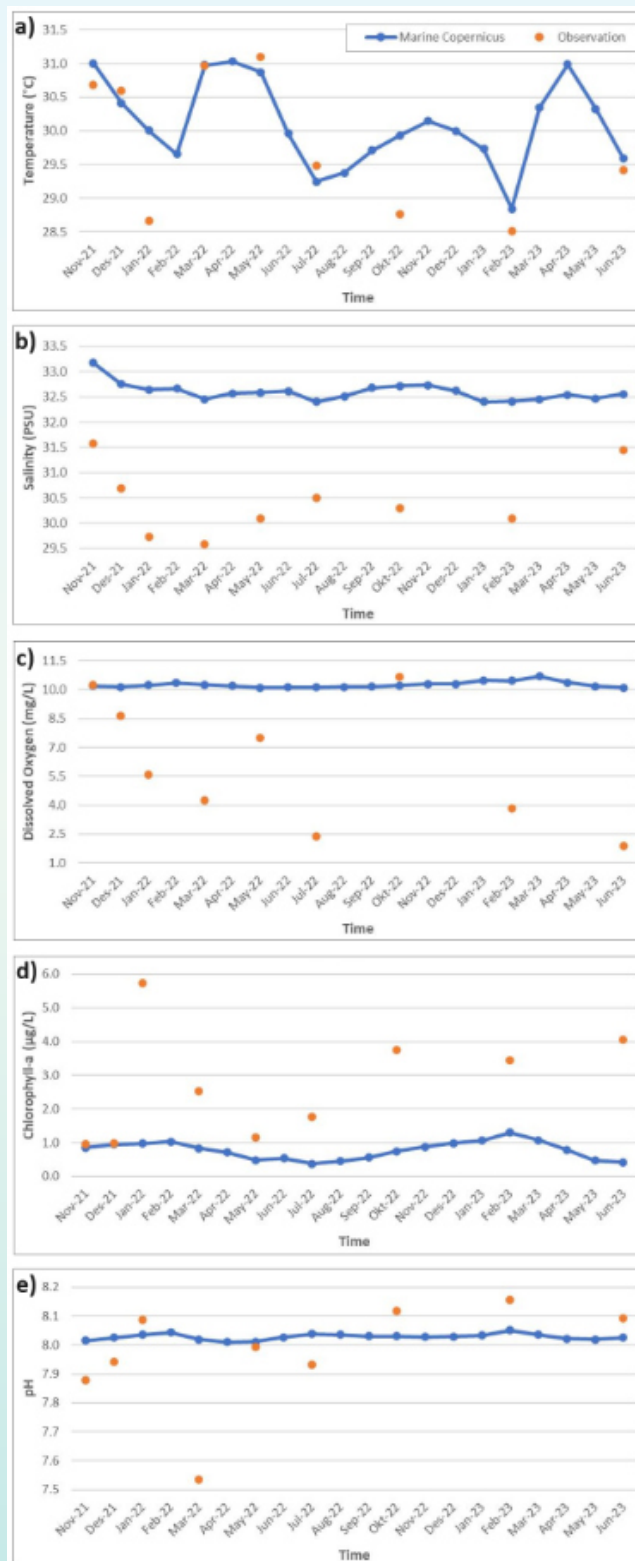

Figure 2 - (Top) The team onboard Ara and (Right) lowering the CTD + sensors.

Figure 3 - *In situ* (yellow dots) and Copernicus (blue line) surface values of Essential Ocean Variables sampled at Java Sea NANO-DOAP station area between November 2021 and June 2023.

The POGO-25 Meeting from NANO members' point of view

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Once again, POGO gave us the opportunity to embark on another adventure of networking. As Latin American NANO members and former NF-POGO Centre of Excellence (CofE) scholars, we were invited to participate and share our work at the 25th POGO Annual Meeting (POGO-25). This year, the meeting that gathers POGO member institutes was held between 22 and 25 January in Ensenada (Mexico), hosted by the Center for Scientific Research and Higher Education in Ensenada (CICESE). This event promised remarkable encounters, stories and discoveries, and it certainly delivered.

Jorvin and Roger were very happy to finally visit Joana (friend and CofE classmate) in her country and at the institute where she received her Master's degree. Joana was happy and proud to welcome POGO member institutes from different parts of the world at CICESE. The city of Ensenada welcomed us all with very peculiar weather, although typical of winter in the region: we arrived with torrential rain and cold, and left with sunny and warm days at the end of the week. The weather did not prevent us from having a great stay. Through various oral and poster sessions, we were able to learn more about the diversity of scientific work being done by POGO members around the world. It was particularly invigorating to get an overview of the issues and challenges we face and will face in ocean science and observation, and to be part of the active discussion during the networking spaces.

It is worth noting that in about three days, surrounded by the warm and welcoming people of Ensenada, delicious Mexican food, vineyards, and colourful landscapes, it was possible to summarise the significant contributions of POGO at the past 25 years to the comprehensive study and observation of the ocean. We witnessed historic events like the signing of the POGO Western Pacific Regional Node Agreement, which will help promote the objectives of POGO at the region, and the official introduction of the new NF-POGO Centre of Excellence, now hosted by OFI and partners in Canada. But one, in particular, filled us with pride and joy: at this meeting, Captain Francisco Arias, director of INVEMAR, assumed the position of POGO chair. Captain Arias is the first Latino Chair of POGO, and proudly Colombian, as Jorvin.

If we could define what POGO-25 meant to us in one word, it would be "rewarding". What we, as NANO guests, liked and enjoyed most about POGO-25 was undoubtedly the networking and the opportunity to meet the people behind the creation and implementation of great ideas and programmes such as the NF-POGO CofE. We were very fortunate to share thoughts, discussions, and dinner (even mariachi!) with POGO pioneers who had a vision and worked for years (and are still working on it) to see it through, which was very moving, inspiring and encouraging for us.

As former POGO scholars, we felt strongly motivated to continue working in science, and deeply inspired after meeting the people who have worked to keep ocean observing a priority over time. At the end of this meeting, we not only expanded our horizons on what a comprehensive study of the ocean means, but also our culinary horizons on the monumental Mexican food.

We are very grateful to NANO and POGO for inviting us to participate at this event. As early career scientists, being part of a POGO meeting helped us understand how much effort and work is behind the opportunities we have had and what we can do to continue and expand them. We would like to thank all the scientists who welcomed us with big smiles, answered our questions and offered their support to do research abroad. We hope these spaces will continue to be created and bear good fruit over time. To all of you, THANK YOU! And we hope to meet you again somewhere in the world.

Joana, Jorvin and Roger at various moments during the 25th POGO Annual Meeting, in Ensenada (Mexico).

Career insights survey

The science exodus conundrum: insights from the 1st NANO Career Survey

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Introduction

Is a science career truly accessible to everyone? This question might seem a bit too general to begin addressing a complex subject, but it has been at the center of numerous recent discussions due to the growing number of scientists who decide to leave academia (Heffernan and Heffernan, 2018). There is still ample room for further research, to collect more information about the challenges that academics are facing nowadays, and even to attempt to understand how the landscape has evolved over the years across various contexts. There is evidence that more scientists from developing (developed) countries, often referred to as the "Global South (Global North)", are publishing in high-impact peer-reviewed journals, yet the bias in terms of publication volume and quality, attendance to conferences, and proficiency in scientific writing is still evident (Khelifa and Mahdjoub, 2022; Nakamura et al., 2023).

This bias becomes even more pronounced when one investigates not only the country of origin of the main author, but of the co-authors and their affiliations. Such investigation might lead to the discovery that the majority of scientists from the developing countries are employed or have spent a period of their careers in developed country institutions.

Thus, the general impression is that only those groups with more resources are capable of conducting science without encountering more than the default issues a research group might face (e.g., dealing with different personalities, time management issues, pressure for academic output), and that chances of becoming successful in academia grows when affiliated to universities and research institutes in developed countries.

For many, however, such a scenario is regarded as positive. When one manages to leave their home country and demonstrate excellence elsewhere, their career as an academic is secured and everything will go smoothly, much like what we picture in our dreams once we decide to become a scientist. The reality, however, can be quite different. Many of those scientists can be actually struggling with an academic life abroad, far from their aspirations. Engaging in discussions and bringing awareness are essential for addressing the underlying roots of this issue.

The NF-POGO Alumni Network for the Ocean (NANO) currently numbers nearly 400 members from 68 countries, mostly developing or with economies in transition. A large percentage of NANO members have spent at least a few weeks in contact with a developed country institution as part of their NF-POGO training, either onboard a Research Vessel during the NF-POGO Shipboard Training Programme or during the 10-month NF-POGO Centre of Excellence. We decided to take advantage of this large poll of members and collect their perspectives and insights. In the previous issue of NANO News, we launched a survey and invited members to collaborate. A total of 30 responses were gathered and, even though this is ~8% of the total number of NANO members, it has revealed intriguing patterns within the academic scenario faced by members at some point of their academic careers.

Who are the survey participants?

77% of respondents attended one NF-POGO Training, with most answers indicating participation at the NF-POGO Centre of Excellence (38%) or the NF-POGO Shipboard Training (35%; Figure 1). In terms of gender, 53% of respondents identified as male and 43% as female, which resembles the gender distribution among all NANO. The survey was answered by past scholars from 20 countries, mainly in Latin America (40%), Asia (30%) and Africa (23%), and, considering age, 63% of respondents were between 26 and 35 years old during their NF-POGO training (Figure 1).
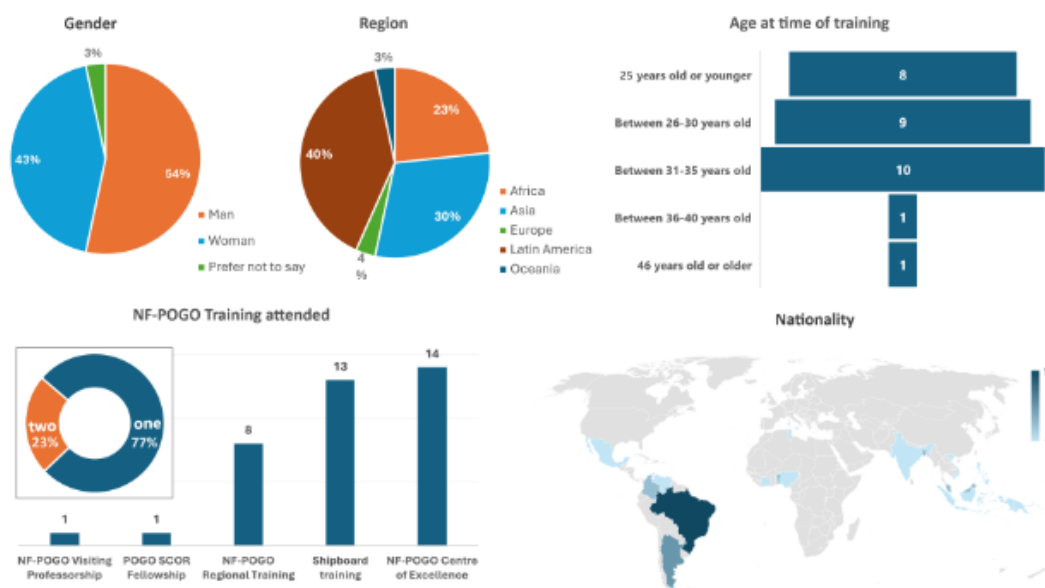

Figure 1 - Demographics of survey respondents (n:30).

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In terms of professional stage during the training period, 63% were graduate (Master or Doctoral) students (Figure 2). Participants were also asked about their current position. 24% are post doctoral fellows while 18% are junior researchers and other 12% are senior researchers. In terms of career progression (Figure 2), the most frequent answers indicated that participants that were MSc student at time of training are now Junior Researcher (13%) or PhD students (10%).
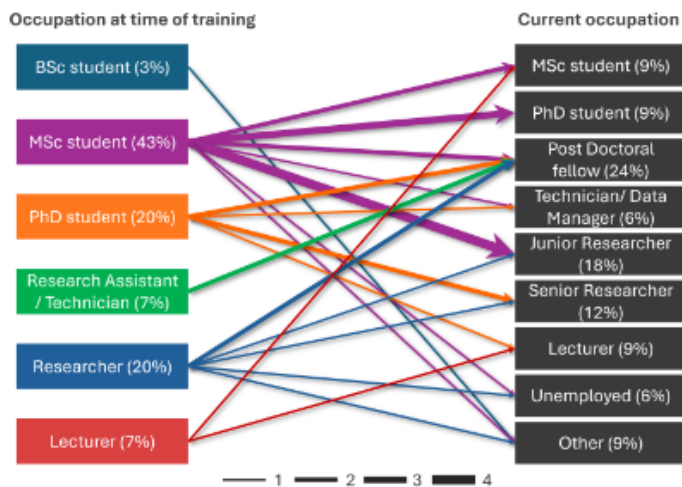

Figure 2 - Occupation of survey respondents (left) during training and (right) currently. Connection line thickness indicates the number of responses with similar career progression.

Eight in every 10 survey participants are still in academia. The remaining indicated to be working in industry roles related to the environmental sector (Technician/Data Manager, Data Scientist, Junior Researcher, Environment Consultant or Geoscientist).

Survey responders seemed mostly content with their decision to become scientists. The majority (70%) indicated they would still choose to work in science if they were to start today, and would recommend a career in science to others (66%; Figure 3). However, in 16% of the cases, those who responded "definitely yes" or "likely yes" to "If you were to start today, would you still choose to work in science?" provided a less positive statement for "Would you recommend a career in science to someone?" (Figure 3). This indicates that, although a preference for the scientific field is prevalent among respondents, some may not believe that others would agree to the same extent.

What is hidden under the table?

As other POGO alumni (see Urban and Seeyave, 2021), it is likely that some of NF-POGO former trainees remain abroad for part of their career as scientists. In fact, 43% of survey respondents are current living abroad, mostly in Europe (30%) and North America (10%). This pattern, of course, is affected by the elevated participation of NF-POGO Centre of Excellence at the Alfred Wegener Institute. The first author of this article, for example, as many former scholars of NF-POGO-AWI CofE, remained in Germany for her PhD studies.

Overall, most survey respondents were immigrants at some point of their academic studies, even if only during the time of their NF-POGO training. And being an immigrant imposes new challenges that impact the quality of life as an academic. From the perspective of NANO members, this intersects with dealing with very different socio-economic and behavioural contexts compared to those in which they grew up. The primary aim of this survey was to gain a

holistic understanding of what is involved in a career as a scientist, especially from a less privileged background.

Figure 4 unveils a much more complex scenario than the simple notion of "I decided to be a scientist elsewhere and it is great" detail. The majority have identified the lack of support from the Institution secretariat as one of the most common issues faced. The findings of Heffernan and Heffernan (2018) corroborate our results. According to their work, it is likely that higher education loses a significant amount of academics within five years not only due to retirement, but also due to the lack of instituuional support that could help reduce job dissatisfaction and/or burnout. These two would be associated with the extra and hidden accumulated work required to solve issues that should not normally be the responsibility of the academics, but of the staff working in institutions.

The reality is that these specific circumstances are usually coupled with others also mentioned, such as the inability of some staff members to speak English and difficulties in obtaining a visa. The NF-POGO trainings which are supported by a host institute require that the participants speak English, as these research centres are characterised as international. However, depending on the host country, in our daily interactions, we often encounter staff who are unable to provide sufficient information, not only due to language barriers but also from lack of willingness to assist and/or limited knowledge of situations that might only affect international students/researchers. When it comes to acquiring a visa, each host country has its own regulations for various nationalities, and proper documentation from the personnel who often deal with internationals could aid in a faster and more efficient visa application and extension process.

The inability to communicate effectively may seem like a matter of just learning a new language, but involves several other factors and that can lead to heightened pressure for scientists living abroad. The scientific community must acknowledge that individuals have their native language (or dialects), need to be proficient in English, and frequently have to deal with a completely different third language, such as French, Italian, or German. Amano et al. (2023) argue that not working in our native language and not being
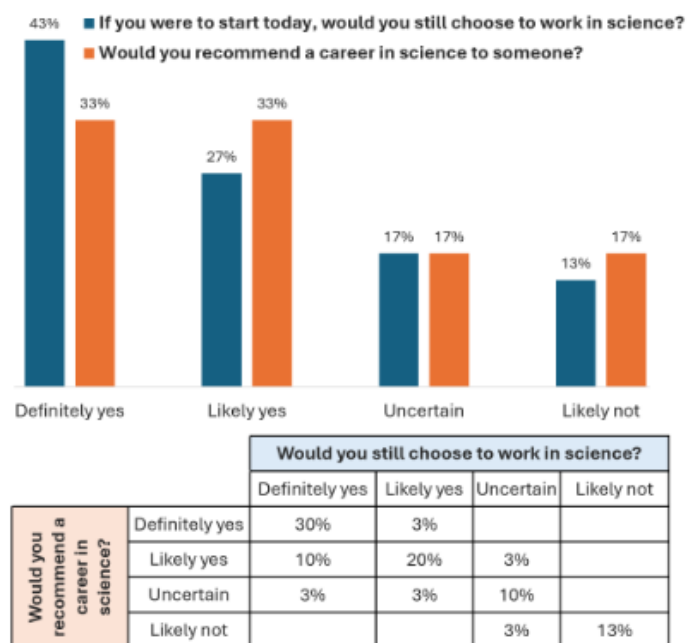

Figure 3 - Satisfaction level in choosing or recommending a career in science.

familiar with different cultural communication styles can substantially hinder our ability to conduct research.

The consequences range from more time spent on reading and writing papers, insecurities to present our work in front of native speakers, reluctance to apply for international events and funding, to having papers rejected by peer-reviewed journals based on writing issues arising from less familiarity with scientific vocabulary. This not only hampers academic careers but also imposes additional strains on daily lives that native speakers can never truly grasp.

Another overlooked point is that, in addition to struggles to conduct science in a foreign language, in a different cultural environment, international researchers findings might not be recognised or understood by peers who are not integrated into an international background.

Moreover, the "internationalisation" of science, as pointed out by Collyer (2018) can increase the barrier between the research conducted and the non-English speaker society, hampering science and innovation development in other countries (Agrawal et al., 2011). This issue can lead to a fear of returning home after concluding a certain academic stage. Additionally, being from a developing country also increases the chances of having to personally cover costs for publications and international events (e.g., conferences) participation (Ramírez-Castañeda, 2020). Being a scientist also often means to be highly qualified and yet often not appreciated. For developing country researchers, lack of appreciation can also happen abroad due to their origins.

Furthermore, a proportion of researchers are often not seen, or cannot see themselves in academia. While science praises itself to be democratic and inclusive, Black, Indigenous, and People of Colour (BIPoC) are still underrepresented in the most renowned research institutions, for example. And when the term "BIPoC" is used, it encompasses not only the lack of diverse research institutes but also the fact that researchers can suffer from discrimination, racism, and xenophobia while abroad (Evangelista et al., 2020; Tseng et al., 2020; Behre et al., 2022).

The term diversity, however, extends beyond issues of discrimination based on origin or ethnicity. Queer, neurodivergent, disabled individuals and other minorities are very often overlooked in the rounds of discussion about building a more inclusive and diverse academic environment (Lewis and Arday, 2023; Silverschanz et al., 2008).

The absence of representation also impacts the perception

of self-worth. If no one around looks like us, is it because we are not good enough or inadequate? Impostor syndrome is a reality and widely affects internationals in academia, particularly those from the developing countries working in research centres in the developed world.

On top of the aforementioned topics raised by participants, the academic environment can sometimes be a toxic place. Luckily, there has been improvement in implementing regulations concerning behaviour in the workplace to address issues of harassment, equality, diversity and inclusion. However, instances of power abuse, also in the form of violent communication, still persist and are reported regularly (Marín-Spiotta et al., 2020; Cohen et al., 2022), even daily. During the 10 years in academia of the first author, she has not only been a victim of different kinds of harassment but also encountered many colleagues who have faced them, often more than once.

Additionally, there is a growing push for publications that concern at least half of the survey participants. Being a successful scientist has become less about publishing well-prepared meaningful research and more about the number of papers a research group publishes per year. This can lead to a decline in research quality and an inability to meet expectations, negatively affecting the career of any scientist or their desire to remain in high-pressure, toxic, low work-life balance academic positions which often do not offer real possibilities of a stable career perspective (Sarewitz, 2016).

Delving deeper into the career perspective theme and connecting it with visa issues, a conundrum is raised. Scientists living abroad typically rely on study or work visas. Many also have families who depend on their visas for immigration and are often unable to find employment in their fields. However, to be granted a visa, one needs a work contract. Yet, to have a work contract, one needs a visa. The impracticality of the visa application systems remains an enigma that is far from being resolved and is often a barrier for scientists worldwide, particularly for those from underdeveloped countries applying for positions in developed countries (Dixit, 2021). Additionally, a bachelor's degree usually takes 3 to 4 years, a master's degree about 2 years, and a doctoral degree 3 to 6 years. For each of these academic stages, a student visa is required.

Early careers scientists everywhere, even after obtaining PhDs, still do not have any perspective of a permanent position. They are scarce and often depend on being lucky that someone retires or navigating through a complicated process of grant applications and bureaucracy hurdles. The common route to follow after a PhD is to become a
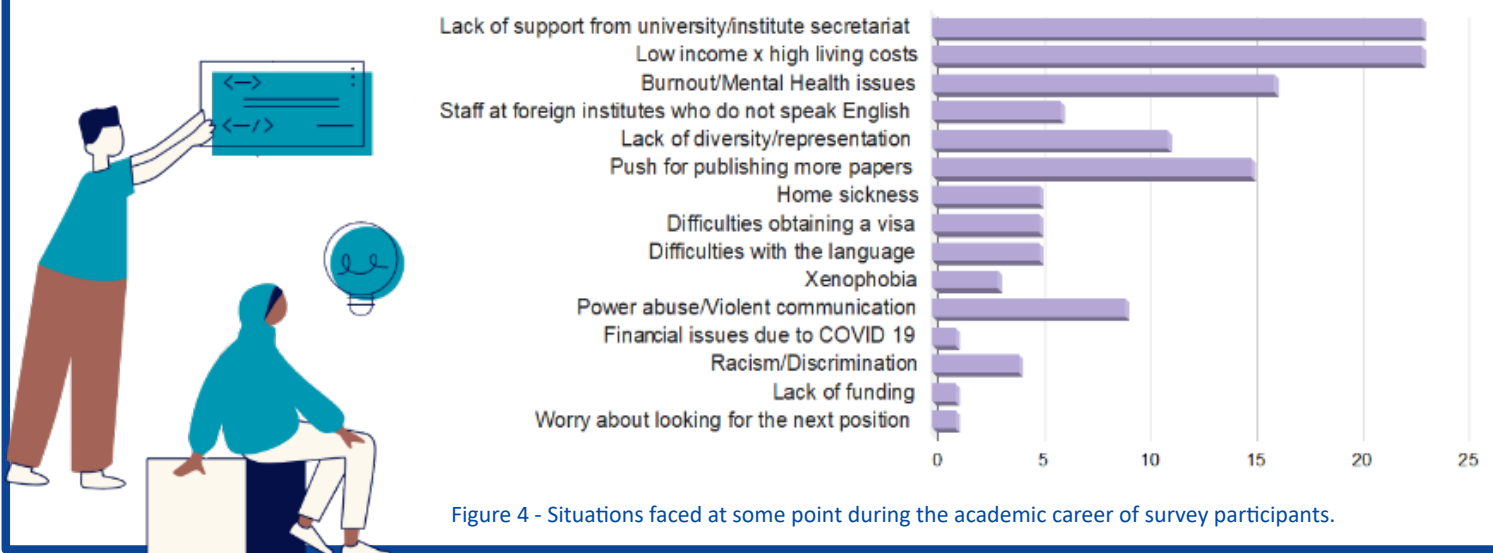

Figure 4 - Situations faced at some point during the academic career of survey participants.

postdoctoral researcher. However, postdoctoral employment lasts only as long as the funding, which can be as short as 6 months. As opportunities available are not frequent, the alternative is to apply for positions in different countries.

How, then, can one achieve any sort of stability? To delve even deeper: how can one achieve any sort of financial stability? How can one ensure that living costs are covered when often one faces expenses that exceed income? Lack of stability, financial uncertainty, limited career prospects, discrimination, mistreatment and pressure all contribute to the alarming number of academics who experience burnout, depression, anxiety and other mental health issues during their academic journeys (Eleftheriades et al., 2020; Moulin, 2020; Curran et al., 2021).

For international researchers, the weight of these feelings is combined with the feeling of home sickness (e.g., familiarity of being understood, traditional food, family members and friends), which also appears in the survey results. Even thought is often neglected, homesickness can affect productivity at any stage of academic careers (Burt, 1993).

As shown by the participants of this survey, with all the issues discussed above, there is still a strong desire to do science. However, a better environment is needed. External stressors, unnecessarily and unfairly imposed, must be mitigated. If these conditions are achieved, researchers can focus on delivering knowledge, forging new realities, improving the quality of life for others through their findings, and being happier overall.

Based on the answers of this survey, a deeper understanding of the complexities of this science exodus conundrum was gained. However, this is just the tip of the iceberg. There is much more that can be discussed, and hopefully more progress will be made.

We would like to thank the 30 scientists who participated in the survey. Next, we share some of their testimonies, which provided inspiration to Fernanda write this text.

"Science is fascinating, especially because it's mostly driven by our own curiosity and desire to be at the boundary of knowledge. On the other hand, academia puts so much pressure for publications and competition for limited funding resources that many people develop mental health issues, or give up. I still enjoy science and I wish I could be more involved with it. In my particular experience and looking in retrospect, I realised that most of my issues were related to funding and low income, and dealing with other people's egos. Sometimes there was also pressure to getting involved in other projects within the same research group, which led to my own research goals becoming lower priority."
- Survey participant

"Science is a lovely job, it encourages you to use your mind, be collaborative and meet new people. But it is utterly unsustainable. Firstly, you are always paid in scholarships - if you are lucky (and you need to be happy that you were "lucky" enough to get it), there is no pension plan and usually no health insurance. For your career, you are required to move to other countries every few years, which does not give you any stability, and the standards change so much between countries. You are not eligible for a bank loan because you don't have a stable job. But at the same time, you are also required to pay publication fees to fulfil open access requirements that can be as much as your yearly income. So, ultimately, if you want to have a family and some stability, science is not a good option."
- Survey participant

"It's a beautiful and rewarding career. You have work freedoms, promote cultural and scientific exchange, while getting to know places and people that you normally wouldn't know. However, especially in recent years, it has been intentionally undervalued. The lack of resources, equipment and working conditions were already unfavourable in developing countries, now they have reached almost irreversible conditions. This increases the gap in the quality of scientific output between countries with greater support."
- Survey participant

"Science is an adventure, the most powerful way to discover the mystery of the nature around us, worldwide, and beyond the universe. I am a lover of knowledge, getting to understand the laws of nature, learn the societal needs and work for human wellbeing are my passion. I stand with science, especially Ocean physics (and connected sciences). Being a scientist is my way to contribute to knowledge building and to participate into a better world for human living (and all living beings) with respect of natural order."
- Survey participant

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Members of NANO-DOAP station Five Cowries Creek in Nigeria monitor Essential Ocean Variables in the Lagos region and conduct outreach activities with school students. Read more about the station activities at page 7.

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A dip in the yellow sea, learning how to design, deploy and recover subsurface moorings in China

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My name is Joana Gonzalez. I am an Oceanographer from Mexico and graduated from the NF-POGO Centre of Excellence 2022 held in Helgoland, Germany. I am very passionate about fieldwork and observational oceanography aboard research vessels. As part of my interests and professional goals, I like to be in constant technical training, and this time I would like to tell you about my participation in a training course in Qingdao, China. In July 2023, I had the opportunity to attend a 7-day training course on the design, deployment, and recovery of subsurface moorings conducted by the Institute of Oceanology of the Chinese Academy of Sciences (IOCAS) and the Northwestern Pacific Ocean Circulation and Climate Experiment (NPOCE) in collaboration with JAMSTEC, SCRIPPS, and supported by POGO.

With circa of 50 colleagues from different countries, I learned different skills through lectures and discussions with IOCAS experts who taught us even the very fine details about moorings, from design to ship operations. The workshop included practical work aboard the R/V Chuang Xin Er in the Yellow Sea, where I witnessed the great capacity and experience of marine technicians and researchers on board, and was able to learn hands-on. I was surprised by the experience, the quality of work and the applied technology for research conducted by IOCAS.

Additionally, the training participants had the opportunity to visit IOCAS warehouse where they test and prepare moorings, instruments, and other equipment like Remote Operated Vehicles (ROVs).

I am infinitely grateful for the opportunity given to me. I was also able to do some short interviews with my colleagues for outreach purposes and we had a lot of fun. I must mention that the training environment was so enjoyable; our friendly and welcoming Chinese colleagues were always willing to answer all our (numerous) questions, sharing all their expertise with great enthusiasm, which made us feel really motivated.

Besides the close contact with IOCAS experts and brainstorming over principal research areas, this workshop contributed to pacing the first step towards the cooperation between China and Mexico for future long-term collaborative ocean observing networks. Likewise, with my colleagues in the course, we established a great relationship and synergy that will bear fruit in our trajectories. I am sure this training will strengthen observational oceanography in my country as it gave me the tools and professional network to bring this knowledge back home. If you have a passion for observational oceanography and are looking for ways to stay updated and educated, don't hesitate to visit China, look for the IOCAS experts, and keep an eye open for future training opportunities.

Practicals happened on board the RV Chuang Xin Er. Photo credit: IOCAS

Testing of equipment at IOCAS warehouse

All participants actively engaged asking questions and making comments. Photo credit: IOCAS

Interviewing colleagues for an outreach activity. Photo credit: IOCAS

Joana received the certificate from IOCAS Director Prof Wang Fang. Photo credit: IOCAS

Join the community studying the Western Boundary Current – Subtropical Continental Shelf Interactions

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The Western Boundary Current systems are harsh regions of the oceans for observation; the fast currents make it difficult to place moorings and deploy instruments on board, so their study is not yet very detailed. During a 3-day international workshop hosted by the Skidaway Institute of Oceanography at the University of Georgia in Savannah, GA, from 22 - 24 May 2023, we discussed the main characteristics and challenges of the Western Boundary current systems.

Some of the most controversial issues that required special attention were those related to heat, nutrient, and especially carbon budgets and their export through cross-shelf transport and exchange between boundary currents. However, measuring and quantifying these quantities is not an easy task.

Of course, in this meeting, we reaffirmed that we are dealing with quite complex systems that we must approach piece by piece in order to make significant progress. We look forward to meeting again to continue studying and collaborating, and we invite you to join us in the adventure of trying to solve these systems. If you are curious, you can still find the general information about the workshop on the event website.

The next opportunity to meet will be during the Ocean Sciences Meeting in February 2024 in the special session "The influence of boundary currents on exchange processes between continental margins and the Open Ocean and biogeochemical consequences". If you are working on a topic related to this session, we strongly encourage you to register and attend the session and, if possible, meet for future collaborations. Either way, you can contact us to start working together and strengthen this nascent network. We hope to see you all soon!
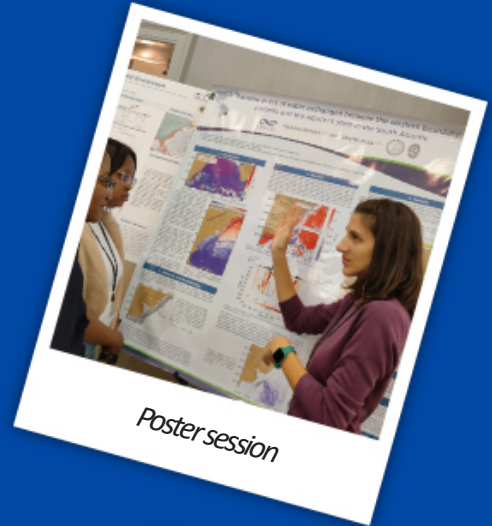
Poster session

International Workshop on Western Boundary Current – Subtropical Continental Shelf Interactions

Discussions and networking

International students

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Scientific events announcements

IOC Training Course and Identification Qualification in Harmful Marine Microalgae 2024 – 'Brush-up'
Online (1st phase) and Copenhagen, Denmark (2nd phase)
1 July - 20 September 2024

Limited to 16 participants, the course includes 60 hours of teaching and is divided into two parts. 1) The first part of the course is an internet teaching programme on the Ocean Teacher platform with up-dated information on recent advances and developments in taxonomy of HAB species. This part of the course is mainly for self-study and estimated to 30 hours of reading. 2) The second part is a practical course in species identification, which includes 30 hours of teaching and a microscope will be available to each participant during the entire period. An exam qualifying for the 'IOC Certificate of Proficiency in Identification of Harmful Algae' will be organised on demand at the end of the course, and participation in this exam is optional.

Deadline for registration
31 March 2024   **https://shorturl.at/nsX17**

Mallorca Science School 2024: Interdisciplinary Science for Marine and Coastal Conservation in a Changing World
Mallorca, Spain
20-26 October 2024

The school places special emphasis on interdisciplinary research introducing state-of-the-art methodologies. Using a hybrid approach, the Mallorca Science School will integrate practical research with theoretical foundations from various disciplines, including oceanography, marine and coastal ecology, social sciences, and marine governance. Participants will employ advanced techniques such as satellite data and tracking systems to study complex coastal ecosystems. The course is specifically designed for PhD students, as well as postdoctoral and other early-career researchers from all fields deeply committed to advancing scientific knowledge in support of the conservation of marine and coastal systems. Applications from motivated Master students are also encouraged and will be evaluated based on CVs and career progress.

Deadline for abstracts
31 March 2024   **https://shorturl.at/tKRV8**

7th International Marine Conservation Congress
Cape Town, South Africa
13-18 October 2024

The overall theme of IMCCs is Making Marine Science Matter. For marine conservation to be effective, marine conservation science must matter to stakeholders, policy makers, and practitioners. IMCC seeks to engage everyone involved in marine conservation to share ideas and promote action for the long term health of our oceans!

Deadline for abstracts
30 March 2024   **https://icriforum.org/events/imcc7-2024/**

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